

THE EDGE HOUSE, BLACKSTONE EDGE OLD ROAD, ROCHDALE

SUSTAINABLE DRAINAGE STRATEGY

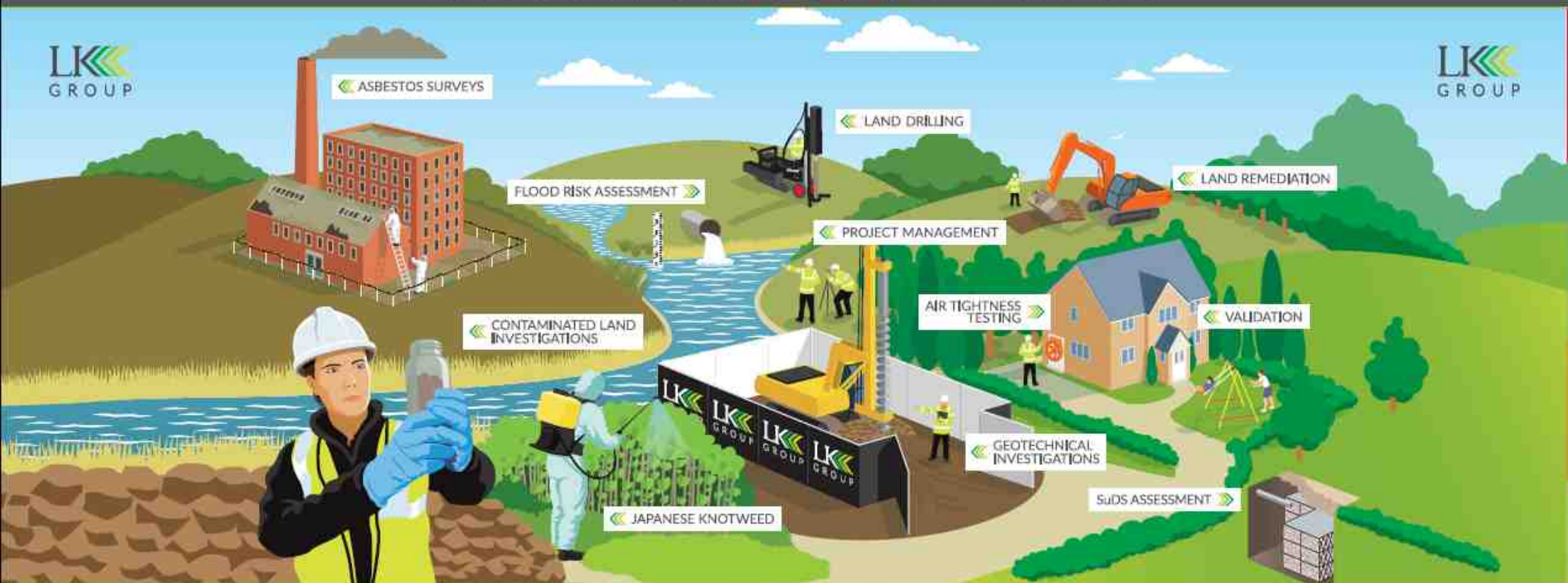
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Date: September 2022
Client: Martin Muldowney



INCREASING LAND VALUE

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GROUP

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LK Consult			
Document Verification			
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EXECUTIVE SUMMARY

Scope and Background

This Sustainable Drainage (SuDS) Strategy has been undertaken by LK Consult Ltd (LKC) to support a planning application for the development of land off Blackstone Edge Old Road, Littleborough, Rochdale. The development comprises the construction of a residential property.

LKC has prepared this SuDS Strategy in line with the NPPF and Technical Guidance where appropriate.

Consultations

Rochdale Borough Council – Lead Local Flood Authority (LLFA) and United Utilities (UU) have been contacted during preparation of this report.

The Environment Agency (EA) website has been utilised to assess if there are any limitations that may affect the form of SuDS that may be appropriate to this site. The records show that the site is within Flood Zone 1.

Drainage Strategy

The underlying natural soils are clay based. In considering the potential drainage options for the site at present, it is assumed that surface water runoff arising from the development will discharge into the existing private sewer that discharges to the combined sewer in Halifax Road, subject to confirmation by United Utilities. The sewer pipe runs down the adjacent track taking the flow from Tall Trees (house) but was extended uphill towards the development site for future potential development when Tall Trees was constructed. A strip of land was retained to allow for the future connection. If this connection proves impractical, then a pumped system for surface water and foul flows would be required. There is a slope towards the northwest.

The outline drainage strategy considers the use of attenuation-based SuDS to be feasible with a discharge to the existing private drain to the north of the site. Therefore, the most effective strategy, in line with the SuDS management train, would be to have a detention facility to the north of the proposed house. The required detention basin or similar has been estimated to be **5.3m³** for the 5l/s flow restriction for the 30-year event.

Similarly, the estimated volume to be retained on site for the 1 in 100-year storm event including the allowance for climate change is between **12.7m³** and **16.88m³** for the 5l/s discharge rate.

The flows from the site should be restricted to an acceptable level to the Lead Local Flood Authority and UU.

The proposed development will increase the proportion of the site covered by impermeable surfaces and will therefore generate more runoff. Attenuation will be required to allow for climate change.

The estimated volume can be stored within the site boundary.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) were commissioned by Martin Muldowney to carry out a Sustainable Drainage Strategy for land off Blackstone Edge Old Road, Littleborough, Rochdale. The report was undertaken in support of a future planning application to redevelop the site for residential use.

The report will consider the impact of the development on surface water runoff accounting for climate change. The sustainable drainage assessment in Section 4 will provide an overview of the SuDS techniques which could be considered on the site.

This preliminary SuDS assessment complies with the principles presented in the Draft National Standards for Sustainable Drainage Systems (Defra, 2015)¹ and the Planning Practice Guidance (PPG) March 2014². The sustainable drainage assessment is presented with reference to the hydrological and hydrogeological context of the development.

The report findings are based upon professional judgement and are summarised below. The report includes baseline data from the Environment Agency (EA), rainfall data from the Wallingford Studies and Hydrogeological information from the British Geological Survey (BGS). The assessment will summarise and refer to these datasets in the text.

Drainage on the site has been assessed by considering the following key constraints:

- » Topography of the site.
- » Local water features and hydrological context.
- » Underlying geology, soil types and permeability.
- » Layout and geometry of the proposed development.

¹ Non-statutory Technical Standards for Sustainable Drainage Systems – DEFRA March 2015

² Planning Practice Guidance – Department for Communities and Local Government July 2021

1.2 Site Details

A summary of the general site details is presented in Table 1-1. Plans, Drawings and Figures are provided in Appendix A. Figure 1 indicates the site location and boundary. Figure 2 indicates the proposed development.

Site Details	
Location	Located off Blackstone Edge Old Road, Littleborough, Rochdale, OL15 0JJ. Centred at approximate National Grid Reference 394705E, 416745N.
Area	Approximately 0.68 Ha.
Topography	183.67 metres above ordnance datum (AOD) in the northwest and 196.72m AOD in the southwest of the site. 188.23m AOD in the west and 194.98m AOD in the east. The site is falling steeply towards the northwest.
Current Land Use	<u>Site</u> Pastureland with some trees to the northeast boundary. Blackstone Edge Old Road boundary is a stone wall. The remaining boundaries are post and wire fencing. <u>Surrounding Area/ Boundary Treatment</u> North: Tall Trees and residential properties. East: Access track with footpath and field. South: Blackstone Edge Old Road and residential properties. West: Residential properties.
Proposed Development	Eco-house with car parking and a garage.

Table 1-1: Summary of site details.

2 Site Setting

2.1 Environmental Setting

LKC has undertaken a review of public domain information including British Geological Survey data, Environment Agency data, historical mapping, and aerial photography to provide a summary of the environmental setting of the site. This is summarised in Table 2-1 below.

Summary of the Environmental Setting			
Geology	Superficial		None recorded.
	Bedrock		Pennine Lower Coal Measures Formation (Mudstone, Siltstone and Sandstone) for the majority of the site. Darwen Flags (Sandstone) towards the southeastern corner.
	BGS Boreholes		BH Ref: SD91SE51a, 200m north: Topsoil and Clay to 3.0m, Shales between 3.0m and 12.0m, Coal between 12.0m and 14.0m, Fireclay between 14.0m and 15.5m and Shale below 15.5m. BH Ref: SD91NW182, 480m west: Brown clayey sand and gravel to 0.2m, brown to dark brown clayey gravelly Sand with roots to 0.8m, firm becoming soft to firm dark grey brown slightly clayey fine sandy Silt to 1.6m, soft light brown and grey slightly clayey slightly fine and medium sandy Silt with pockets of light brown clayey Peat and very oily Clay to 2.2m, light brown clayey Peat to 2.8m, soft grey and light brown peaty Clay to 3.1m and slightly silty subrounded Sand and Gravel to 4.3m (water struck at 4.3mbgl).
	Defra Soilscape Mapping		Type 6 – Freely draining slightly acid loamy soils.
	Hydrogeology	Aquifer	Superficial
Designation		Bedrock	Secondary A Aquifer.
Source Protection Zone (SPZ)		Site not within an SPZ.	
Flood Zone (EA)	The site is within Fluvial Flood Zone 1. Very Low risk, with annual probability of flooding from rivers and the sea of less than 0.1% (1 in 1000).		
Hydrology	All adjacent and internal surface water		There is a private drain running along part of the adjacent track towards Halifax Road. The Rochdale Canal is located approximately 300m to the west of the site. The River Roch is located approximately 500m to the east of the site.
Site History			The site has not been developed previously.

Table 2-1: Summary of the Environmental Setting.

2.2 Site Reconnaissance

A site reconnaissance was undertaken, and further photographs are below.

Relevant features identified on site are summarised below:

- Pastureland falling steeply towards the north and west.
- Existing housing to 3 sides of the site.
- Track with footpath bounds the northeast boundary.
- Combined sewer connecting manhole within the back of the footway and adjacent track off Halifax Road.
- No details of the reported private drain within the track observed during the walkover.
- There were no open water drainage features observed.
- From the site reconnaissance, it was observed that the surrounding area comprises a mix of residential buildings and commercial premises.

Relevant photographs are provided in Plate 2-1.



Photograph 1: View of Blackstone Edge Old Road adjacent to proposed house entrance.



Photograph 2: Footpath route adjacent to the eastern boundary from the southern end.



Photograph 3: View from the eastern boundary towards the southwest corner.



Photograph 4: View along the footpath adjacent to the eastern boundary.



Photograph 5: View across the proposed house location towards Blackstone Edge Old Road.



Photograph 6: View across the proposed house location towards northwest corner.

Plate 2-1: Site photographs.



Photograph 7: View of entrance to Tall Trees from the southern end of access track.



Photograph 8: View of Halifax Road showing manholes on combined drainage system.



Photograph 9: View of Halifax Road showing manhole and existing access track.



Photograph 10: View from proposed entrance towards the northern boundary.



Photograph 11: View from proposed entrance towards the southern boundary.



Photograph 12: View towards NW corner of the site.

Plate 2-1 (continued): Site photographs.

	
Photograph 13: View to the SW corner of the site.	Photograph 14: View towards NE corner along northern boundary.
	
Photograph 15: Eastern boundary from the NE corner.	Photograph 16: View of northern boundary from NE corner.

Plate 2-1 (continued): Site photographs.

2.3 Site Levels

A topographic survey of the site has been undertaken to OS GPS datum, and information is included on the drawings in Appendix B. The site falls from the southwest towards the northwest. The elevation ranges from 188.23mAOD to 194.98m AOD. The proposed access would join Blackstone Edge Old Road to the southwest.

3 Consultation

Information from consultees is summarised in Table 3-1 below.

Relevant correspondence is provided in Appendix C.

Source	Details	
Rochdale Borough Council (LLFA)	Correspondence with the LLFA confirmed that the site is not located within a Critical Drainage Area. For greenfield sites rainfall runoff should be attenuated such that any rainfall discharges from the developed site are not increased. Greenfield runoff rate of 5l/s shall be applied unless an assessment conclusively demonstrates greenfield runoff to be greater than this.	
United Utilities (UU)	Sewer Map	There are no public surface water sewers within or adjacent to the site boundary. There is a 225mm diameter combined drain within Blackstone Edge Old Road. There is an existing short length of combined drain that connects to the 300mm diameter combined in Halifax Road. This appears to be an outfall from the private drain that serves Tall Trees. It is believed that the private drain is 150mm diameter and continues up the track.
	Likely conditions for connecting into their sewerage system	UU would request conditions for a separate system with only foul draining to foul / combined sewers and surface water draining to soakaway/SuDS, watercourse or surface water sewer. All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80 of the National Planning Practice Guidance. Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible. If not feasible, UU will consider a connection to the 225mm diameter public combined sewer located in Blackstone Edge Old Road at a pass forward flow to be agreed by the Lead Local Flood Authority. UU request that any agreed rate does not exceed 5l/s. Foul flow from this site will be allowed to drain into the public combined sewer system. UU's preferred point of discharge would be to the 225mm diameter public combined sewer within Blackstone Edge Old Road at an unrestricted rate. UU Developer Services was contacted regarding sewer flooding history for the site. UU confirmed that they did not have any record of internal or external sewer flooding of properties in the vicinity of the site as a result of overloaded sewers.

Table 3-1: Summary of Consultee Information.

4 Sustainable Drainage Strategy

4.1 Introduction

The NPPF recognises that flood risk and other environmental damage can be managed by minimising changes in the volume and rate of surface run-off from development sites through the use of Sustainable Drainage Systems (SuDS), this being complementary to the control of development within the floodplain.

SuDS will not alleviate flooding in an area prone to flooding; however, properly designed SuDS have the potential to prevent the surface water runoff from new development worsening the flood risk. The effective disposal of surface water from development is a material planning consideration in determining proposals for the development and use of land.

The accepted principles are that surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the site prior to the proposed development, while reducing the flood risk to the site itself and elsewhere, taking climate change into account.

The Building Regulations Requirement H3³ stipulates that rainwater from roofs and paved areas is carried away from the surface to discharge to one of the following, listed in order of priority:

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

The concept of a sustainable drainage system has been incorporated into the outline drainage strategy for the study area in order to comply with the Flood and Water Management Act 2010⁴.

Suitability of different SuDS will be governed by prevailing site conditions, such as the type and scale of development, topography, ground conditions (soil permeability, ground stability, depth to water table), local hydrogeology and risk of groundwater contamination (presence of sensitive aquifers and source protection zones) etc.

³ Building Regulations part H3 2010: Approved Document, Drainage and Waste Disposal.

⁴ Flood and Water Management Act 2010: UK Government.

4.2 Sustainable Drainage Hierarchy

4.2.1 Infiltration

The Groundwater Source Protection Zone mapping from the EA website shows that the site is not within any identified protection zones. A summary of the British Geological Survey superficial and bedrock aquifer descriptions and classifications supplemented by local records is shown in Table 4-1 below:

Classification	Description	Aquifer Classification	Recorded Water Table Depth	Soakaway Potential
None recorded on BGS mapping. Boulder Clay is recorded in the nearest borehole to the north.	Clay to a depth of 3m	None recorded	N/A	Poor
Pennine Lower Coal Measures Formation	Shale, Coal and Fireclay	Secondary A	N/A	Low

Table 4-1: Geological and Hydrogeological Setting.

Infiltration methods such as soakaways are unlikely to be feasible, but this may be investigated further at the detailed design stage, if required.

There is a slope over the site and surrounding area which indicates that groundwater in the vicinity of the site would likely drain towards the northwest.

4.2.2 Watercourses

There are no observable watercourses within or near the boundary of the site.

The Rochdale Canal is located approximately 300m to the west of the site and the River Roch is located approximately 500m to the east of the site.

Access to the watercourses would cause significant disruption and would be across 3rd party land.

Currently surface water from the site runs overland to the northwest.

4.2.3 Public Sewer

There is a 225mm diameter combined sewer within Blackstone Edge Old Road. There is also a combined sewer stub at the northern end of the adjacent track that connects into the 300mm diameter combined drain in Halifax Road.

4.2.4 Other Sewers

There is a private drainage pipe flowing to the north towards Halifax Road. This appears to collect the surface water that flows overland towards Tall Trees. This connects to the stub of a combined drain at the north end of the track.

4.3 Surface Water Drainage Strategy

Following the assessment of the site settings and existing constraints to the development. The drainage options relating to the final discharge of surface water for this section of the site are listed in Table 4-2 in order of priority within the NPPF:

Option No:	Drainage Solution	Most feasible solution	Reasoning
a	Soakaway/Infiltration	N/A	The low permeability soils would restrict the use of soakaways in this area.
b	Connection to Watercourse	N/A	There are no accessible open watercourses within the vicinity of the site.
c	Discharge into a sewer	1	There is a private sewer adjacent to the track towards Halifax Road. This was extended to take the flows from the future development higher up the track when Tall Trees was constructed. The alternative is to have a pumped connection to the sewer in Blackstone Edge Old Road. Any further formal connections to this public combined sewer would need to be approved and confirmed with United Utilities.

Table 4-2: Drainage options.

Table 4-3 provides a summary of the SuDS options appraisal with consideration of CIRIA C697 (The SUDS Manual)⁵ for the development:

SuDS Option	Appropriate to Development	Comments
Soakaways	X	Due to the nature of the ground conditions, the use of infiltration systems may not be feasible.
Infiltration basin	X	Depressions that store and dispose of water via infiltration. May not be appropriate given the ground conditions.
Sand filter	X	Treatment devices using sand beds as filter media.
Filter drains	✓	Linear trenches filled with a permeable granular material, often with a perforated pipe in the base of the trench.
Detention basin	*	Dry depressions designed to hold water for a specific retention time.
Swales	X	Swales are shallow grass-lined channels that provide capacity for conveying flows at a controlled rate into ponds and watercourses.
Rainwater harvesting	*	Rainwater harvesting collects the rain which falls onto roofs, then stores it in a tank until required for a non-potable use. In the process, a volume of water is kept out of the storm-water management system, thereby helping to reduce flooding risks.
Green roofs	*	Green roof installations can help to reduce surface water runoff from roof areas depending on the system specified. Green roofs are not currently included in the development proposals.
Geo-cellular storage systems	*	Modular block systems can be used to provide an underground storage facility. Any geo-cellular storage systems should be lined with a geo-membrane to provide attenuation storage.
Permeable Pavements – with granular and geo-cellular storage systems	✓	Permeable pavements allow inflow of rainwater into underlying construction. Any geo-cellular storage systems would have to be lined with an impermeable membrane to provide storage rather than infiltration for runoff from highways.
Ponds	*	Attenuation ponds can be used to offset the increase in surface water flows attributable to increased area of hard standing, in order to minimise the risk of flooding to and from the proposed development. Ponds will attenuate the surface water flow prior to discharging to the public surface water sewers. The storage volume afforded by these features should not include any permanent water in the pond.
Oversized Pipes	✓	Oversizing the pipes that make up the on-site drainage network is a cost-effective method for providing attenuation storage within the network. Such systems could be considered on the parts of the development where gradients are relatively flat.
Tanks	✓	Prefabricated underground tanks could be considered at the detailed design stage in order to provide storage to attenuate surface water runoff.
Flow control devices	✓	The peak flow rates will be controlled by flow control devices e.g. hydrobrake style flow control systems, and restricted orifices. Flow control devices enable the discharge to be restricted to a constant rate from the development.

Table 4-3: Summary of the SuDS options appraisal.

Notes

✓ Suitable for use given the nature and scale of the development

* Possibly suitable for use – not included in the client and architect design proposal at present

X Not suitable

⁵ CIRIA C697 - The SUDS Manual. London 2015

4.4 Surface Water Attenuation Requirements

In line with the local guidance, the flow for an undeveloped site should be restricted to the greenfield runoff equivalent flows but as the flow is eventually connecting to a combined sewer there may be further restrictions due to the sewer capacity downstream. A pre-development enquiry received from United Utilities stated that the minimum practical flow of 5l/s would be acceptable. It is estimated from the supplied plan (see Appendix A) that the site will have the following designated areas (Table 4-4).

Designated Areas	Plot Area
Total area (ha)	0.680
Catchment Area	
Catchment Area (ha)	0.078
Impermeable Area (ha)	0.074
Permeable Area (ha)	0.004

Table 4-4: Assumed plot areas.

Table 4-4 shows the assumed areas included within the calculations.

It can be seen that there is an increase in impermeable area from the existing usage to the proposed. This is likely to require attenuation to reduce the proposed flow off site to a level which is acceptable to the LLFA and to UU, including an allowance for climate change.

4.4.1 Attenuation Estimate

Surface water storage and greenfield runoff estimations based on the HR Wallingford procedure IH 124⁶ have been undertaken for the development and the output report is presented in Appendix D.

For the contributing catchment an estimate has been produced assuming a catchment area of 0.078ha from the 0.680ha plot. The resulting impermeable area would be 0.074ha. This gives the following runoff rates and attenuation requirements for this section based on the Wallingford IH 124 method:

» Q_{bar} :	0.800 l/s
» 1 in 1-year greenfield runoff rate:	0.681 l/s
» 1 in 30-year greenfield runoff rate:	1.346 l/s
» 1 in 100-year greenfield runoff rate:	1.683 l/s

The allowable outflow will be determined by the capacity available within the combined sewer. A pre-development enquiry has been made to United Utilities to determine the acceptable flow rate. United Utilities has specified an allowable discharge rate of 5l/s.

The following attenuation has been estimated for the development using 5l/s runoff rates and utilises the FSR methodology⁷ as:

- » Attenuation storage volume: **5.3 m³** (1 in 30-year event)
- » Retention on site volume: **12.7 m³** (1 in 100 year + 20% Climate Change)
- » Retention on site volume: **16.88 m³** (1 in 100 year + 40% Climate Change)

⁶ IH124 Flood Estimation of Small Catchments.

⁷ Flood Studies Report Wallingford NERC 1975.

Attenuation storage aims to limit the peak rate of runoff from the development to the 5l/s rates before discharging to the public sewer. As the flow from the development would be reduced there should be little change in the flows that enter the public sewer and thus the risk of flooding as a result from the development should be negligible.

The attenuation required for a 1 in 30-year storm event, requires a storage volume of **5.3 m³** and for the 1 in 100-year event, a storage capacity of between **12.7 m³** and **16.88 m³** will be required from on-site storage as well as SuDS systems. All volumes can be stored within the site boundary and discharges will be limited by flow control devices to the adjacent sewer.

4.5 Site Specific SuDS

The use of attenuation SuDS are deemed to be the most feasible and practical option for the development. The attenuation tank or similar will provide the required storage volume to limit peak runoff arising from the development.

Utilisation of a flow control device at the end of the system will control the peak flow rates.

The use of permeable paving may be viable dependant on the detailed design of the proposed development. If this drainage technique is considered to be feasible then it will reduce the requirement for attenuation as it will reduce the contributing impermeable area. The permeable paving will also provide some level of water treatment reducing effects of pollution in runoff on the environment.

Assuming that the outline drainage strategy is acceptable to the Local Authority, a more detailed design can be presented and agreed with the appropriate regulatory bodies during the detailed design phase.

5 Conclusion

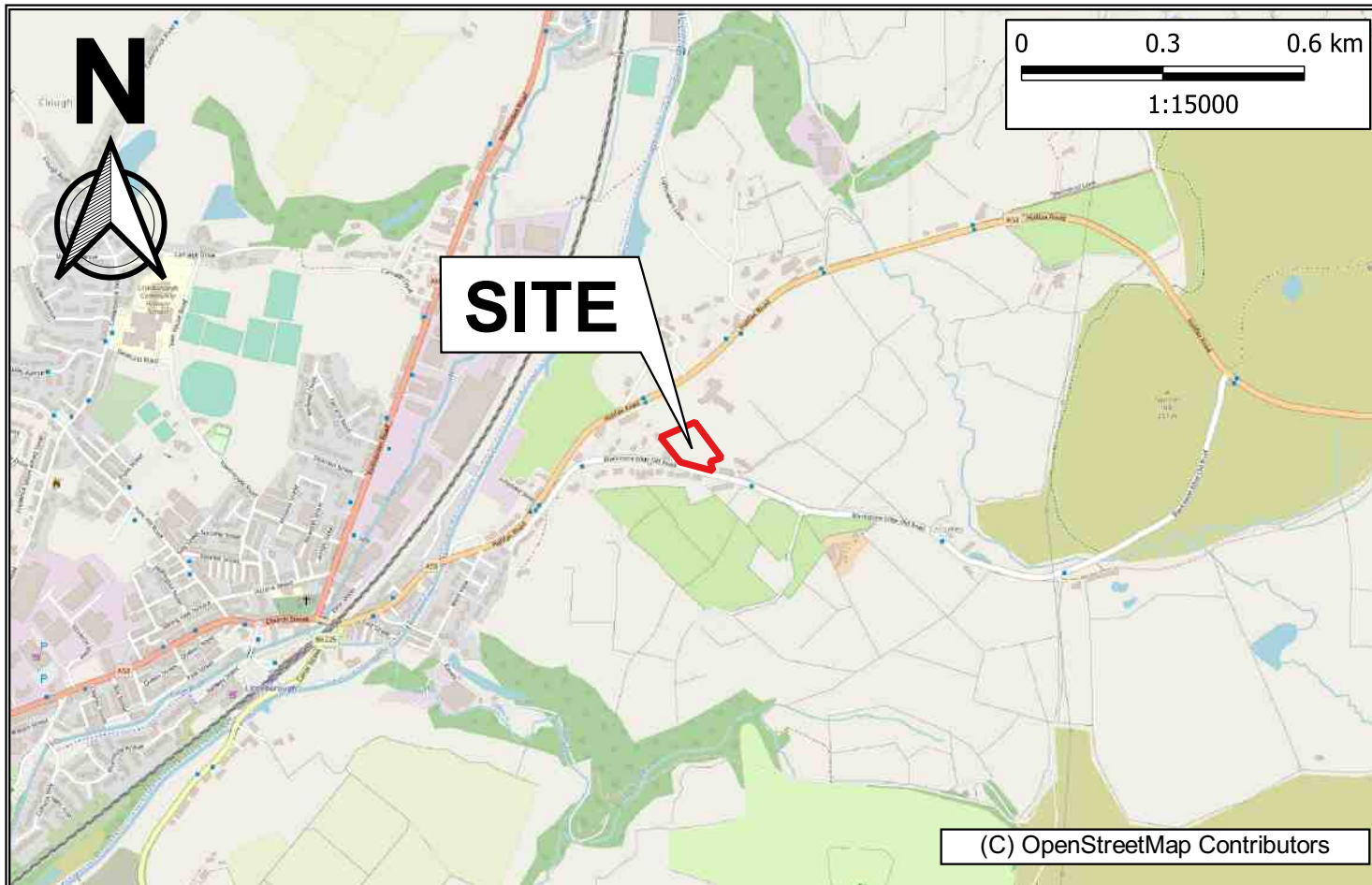
The site is currently utilised as pastureland. It drains to the north overland, and the flow is potentially picked up by the drainage facilities serving Tall Trees. This connects into the private drainage system flowing northwards along the track. This private drain connects to the combined sewer in Halifax Road. An access strip was retained by the current owners for access to the private drain. The proposal is to develop an Eco-house and accompanying car parking and a garage.

An assessment of the site settings and existing constraints in conjunction with the development proposals have resulted in the following recommendations for the safe development of the site:

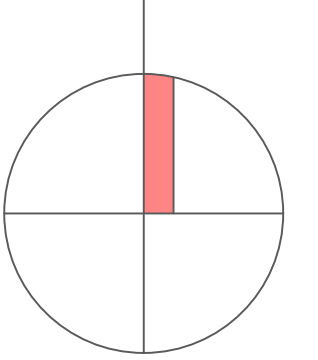
- » The nearest ground investigation showed 3m layer of clay overlying the bedrock although no superficial soils are recorded on the BGS mapping. This indicates that the soils beneath the site would have little potential for the use of infiltration.
- » The attenuation required for a 1 in 30-year storm event, requires a storage volume of **5.3 m³** and for the 1 in 100-year event, a storage capacity of between **12.7 m³** and **16.88 m³** will be required from on-site storage as well as SuDS systems.
- » There is potential to connect the surface water and foul flows towards Blackstone Edge Old Road, but this would require surface water and foul water pumping stations. The suitability and depth of a potential connection into the adjacent sewer should be confirmed on site.
- » A pre-development advice received from United Utilities considered a flow rate of 5l/s would be acceptable if infiltration proved to be impractical.
- » All proposed outflow connections from the development should be agreed with the Lead Local Planning Authority and United Utilities.

APPENDIX A

FIGURES, PLANS AND DRAWINGS



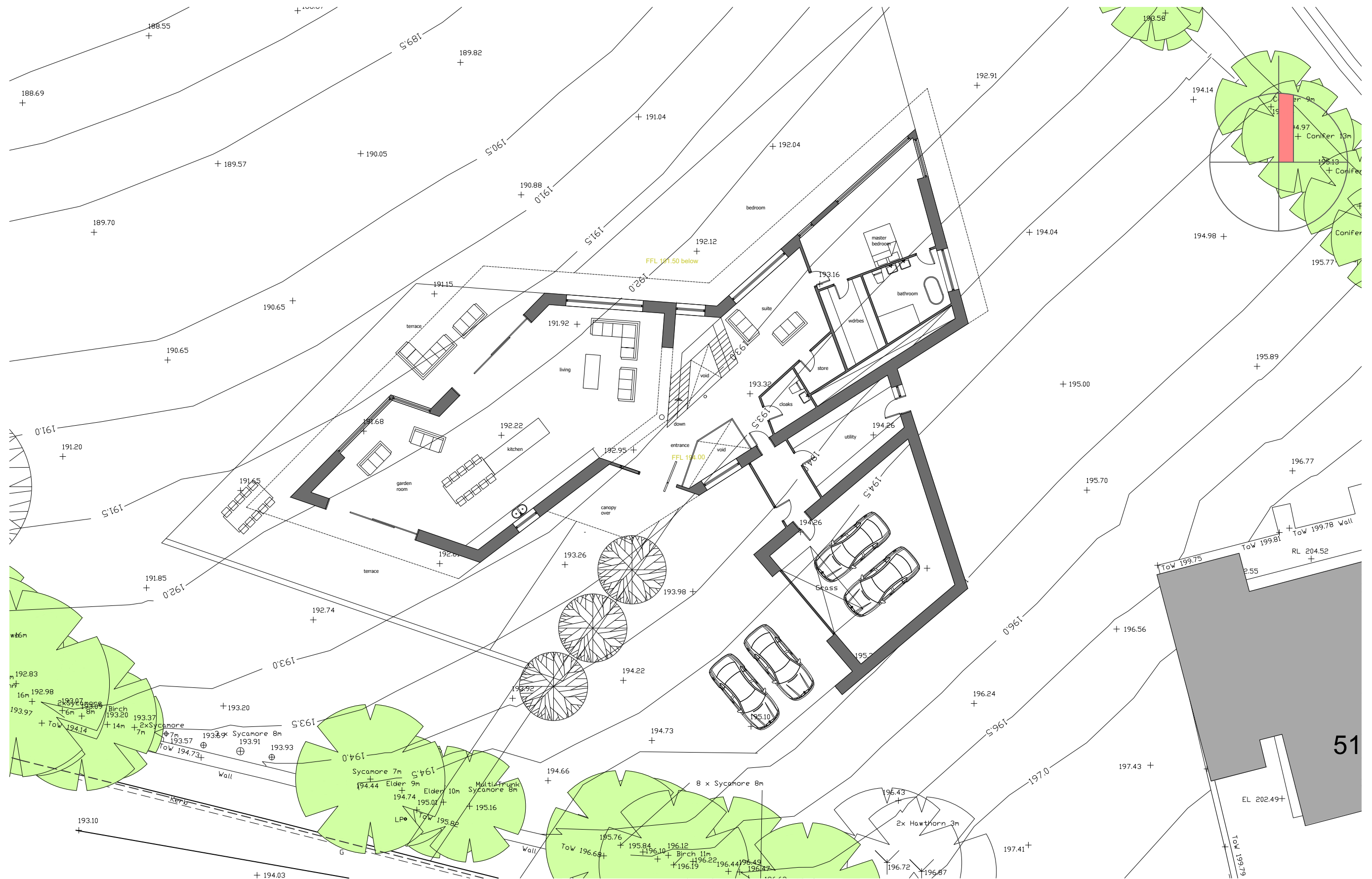
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Site: The Edge House, Blackstone Edge Old Road				Scale (see scale bar): 1:15,000 & 1:2,500 @ A4			
Job No.: FRA 22 1111	Drawn By: JL	Checked By: MJ	Drawn: July 2022	Figure: 1	Revision:		



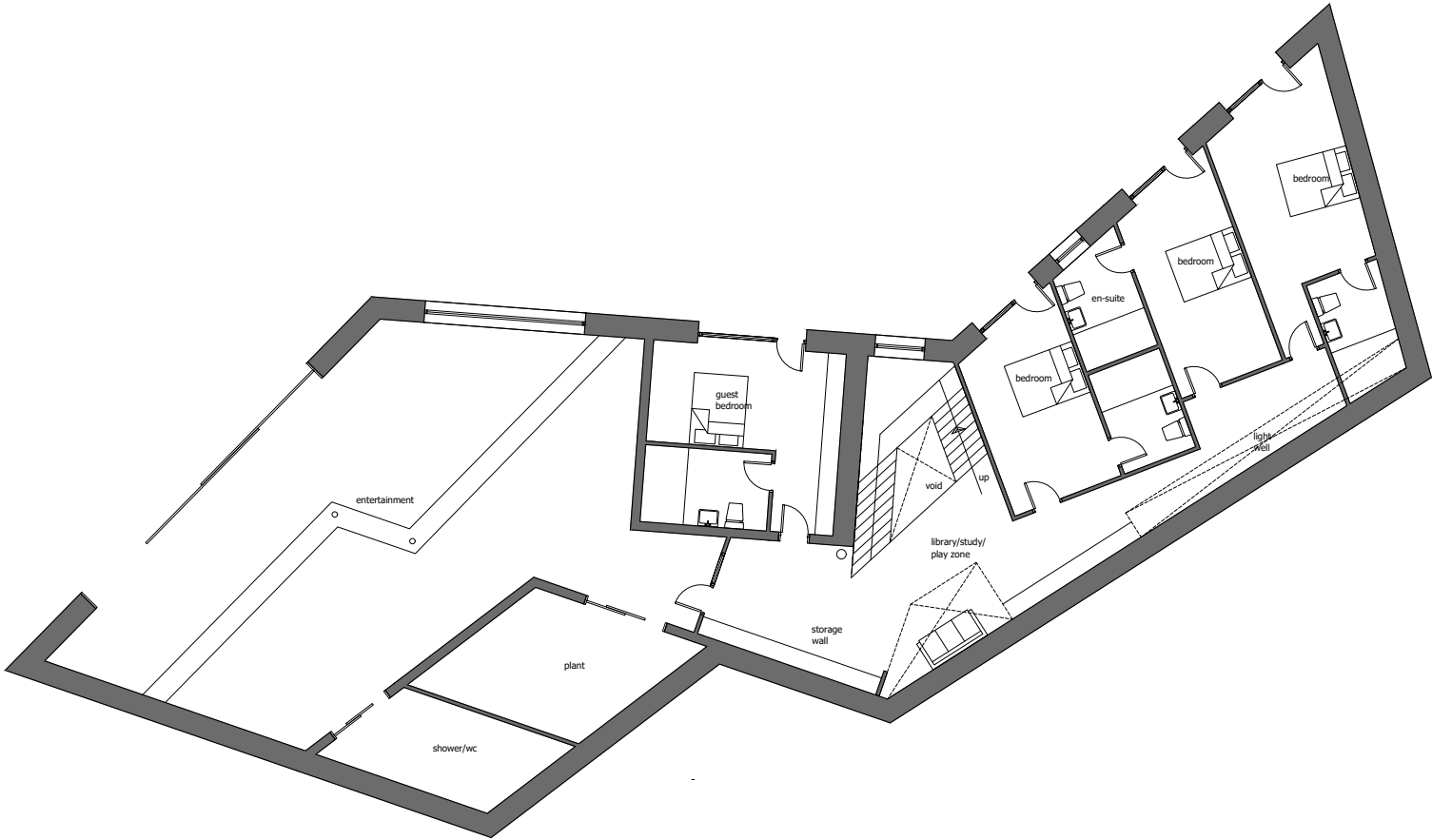
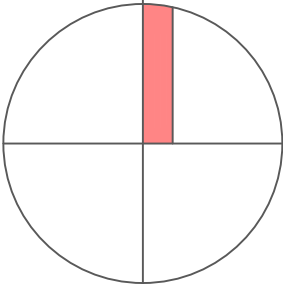
		contract no	drawing no	revision	Blue Pit Mill Queensway Castleton Rochdale OL11 2PG +44 (0)1706 631347 info@cjpartnership.com www.cjpartnership.com	
		drawn by	date	scale @ A3		
				Revisions: A.		

APPENDIX B

SITE INFORMATION



		contract no	drawing no	revision	Blue Pit Mill Queensway Castleton Rochdale OL11 2PG +44 (0)1706 631347 info@cjpartnership.com www.cjpartnership.com	CJPARTNERSHIP ENVIRONMENTAL ARCHITECTS 
		drawn by	date	scale @ A3		
				Revisions: A.		



lower ground floor plan

Martin Muldowney
The Edge House
Blackstone Edge Old Road
Littleborough
Rochdale

Lower Ground Floor Plan

work to figured dimensions

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contract no
3588

drawing no
04

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date
April 2021

revision

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1:200

Revisions:
A.

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north elevation



west elevation

Martin Muldowney The Edge House Blackstone Edge Old Road Littleborough Rochdale	Elevations as Proposed Sheet 01	contract no 3588	drawing no 06	revision	Preliminary	Blue Pit Mill Queensway Castleton Rochdale OL11 2PG +44 (0)1706 631347 info@cjpartnership.com www.cjpartnership.com	CJPARTNERSHIP ENVIRONMENTAL ARCHITECTS
	work to figured dimensions	drawn by	date April 2021	scale @ A3 1:200			
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				Revisions: A.			

Swaindrod Colliery

Littleborough

[Home Office Plan n^o. 1242]

1" map. new series.

76. (Rochdale).

6" map. Lancashire 81. SE.W.

off the new Halifax. Littleborough Road, near Moorcock Inn.

about a mile east of Littleborough

The following is the vertical section at shaft S to the immediate east of Moorcock Inn. ~~See~~

Top Clay, &c	9'0"
Shales	27'0"
Coal	6"
Fireclay	4'6"
	<u>41'0"</u>

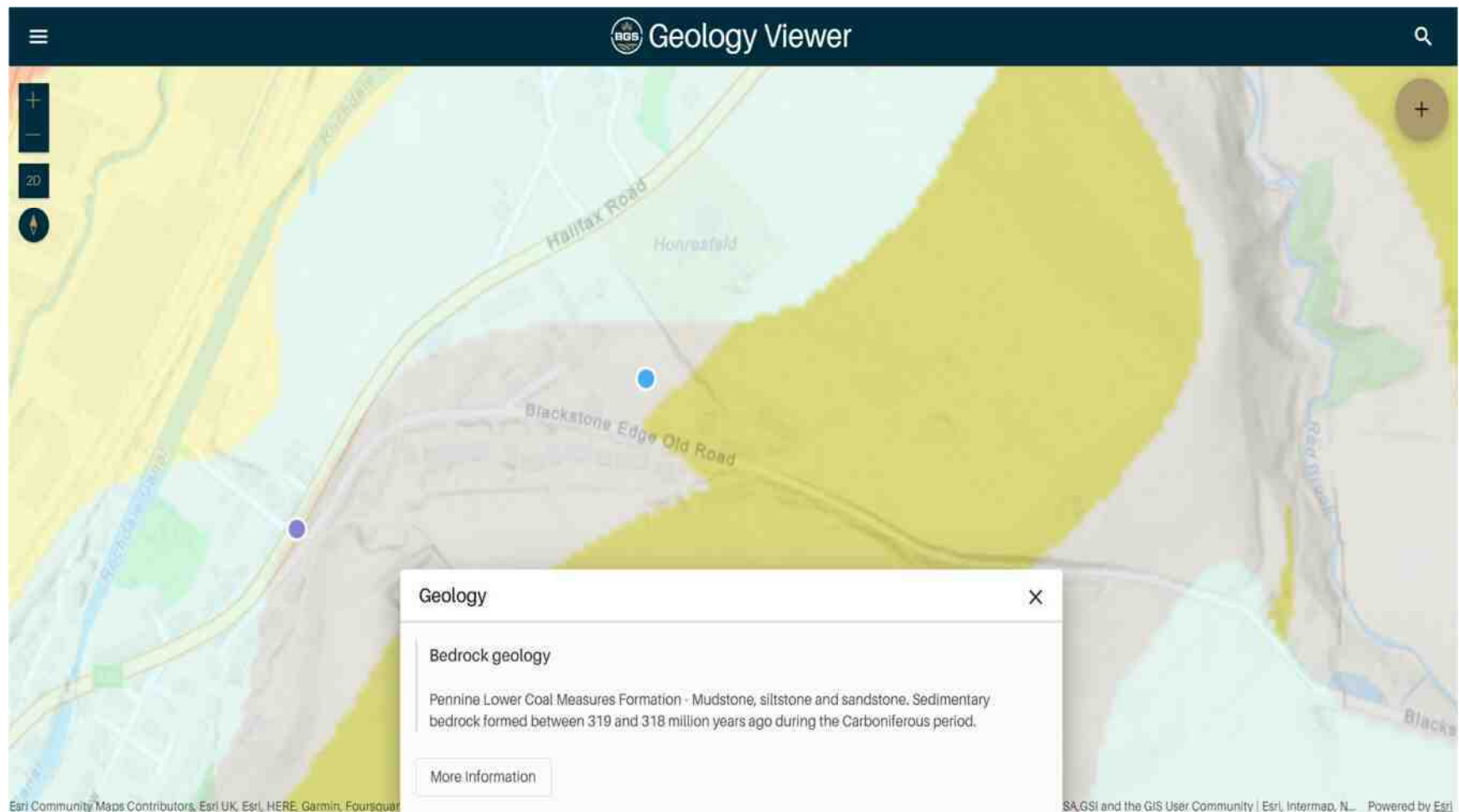
The following is the section at the point 'A' on 25" plan 81.7—SW corner:—

Shales	12'0"
Coal	7"
Silt	3"
Coal	4"
Fireclay	2'6"
	<u>15'8"</u>

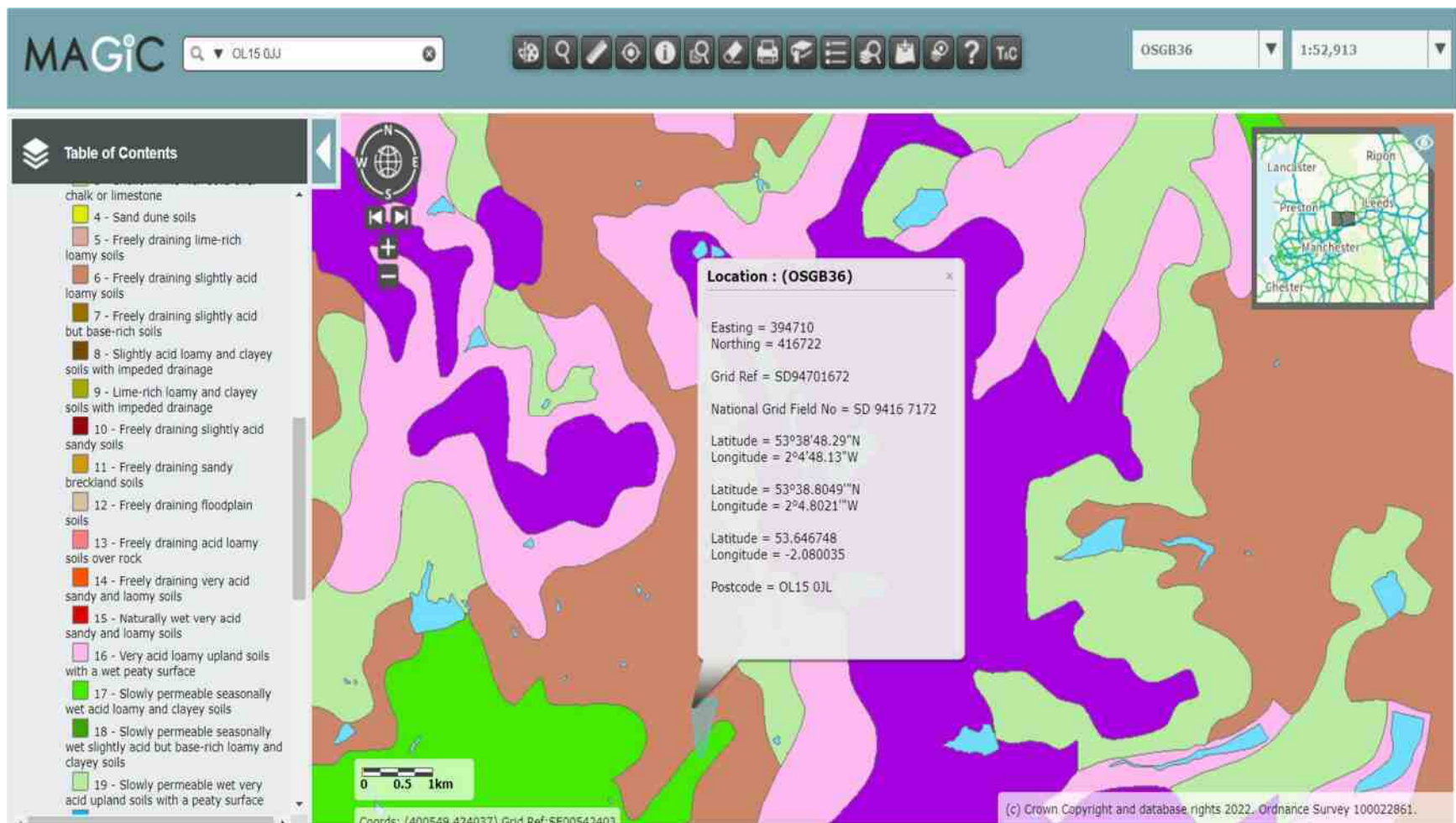
This coal & fireclay was worked by the Swaindrod Colliery 1881 by Messrs Ireland, Buckley, & Company.

It is not stated which coal this is. anywhere.

Probably in the Millstone Grit series.



BGS Bedrock Geology – Contains British Geological Survey Materials © UKRI 2022



Defra Soilscape Mapping - (c) Crown Copyright and database rights 2021. Ordnance Survey 100022861

H.M. LAND REGISTRY

FILE NUMBER

GM 328292

ORDNANCE SURVEY
PLAN REFERENCE

COUNTY

SHEET

NATIONAL GRID

SECTION

GREATER MANCHESTER

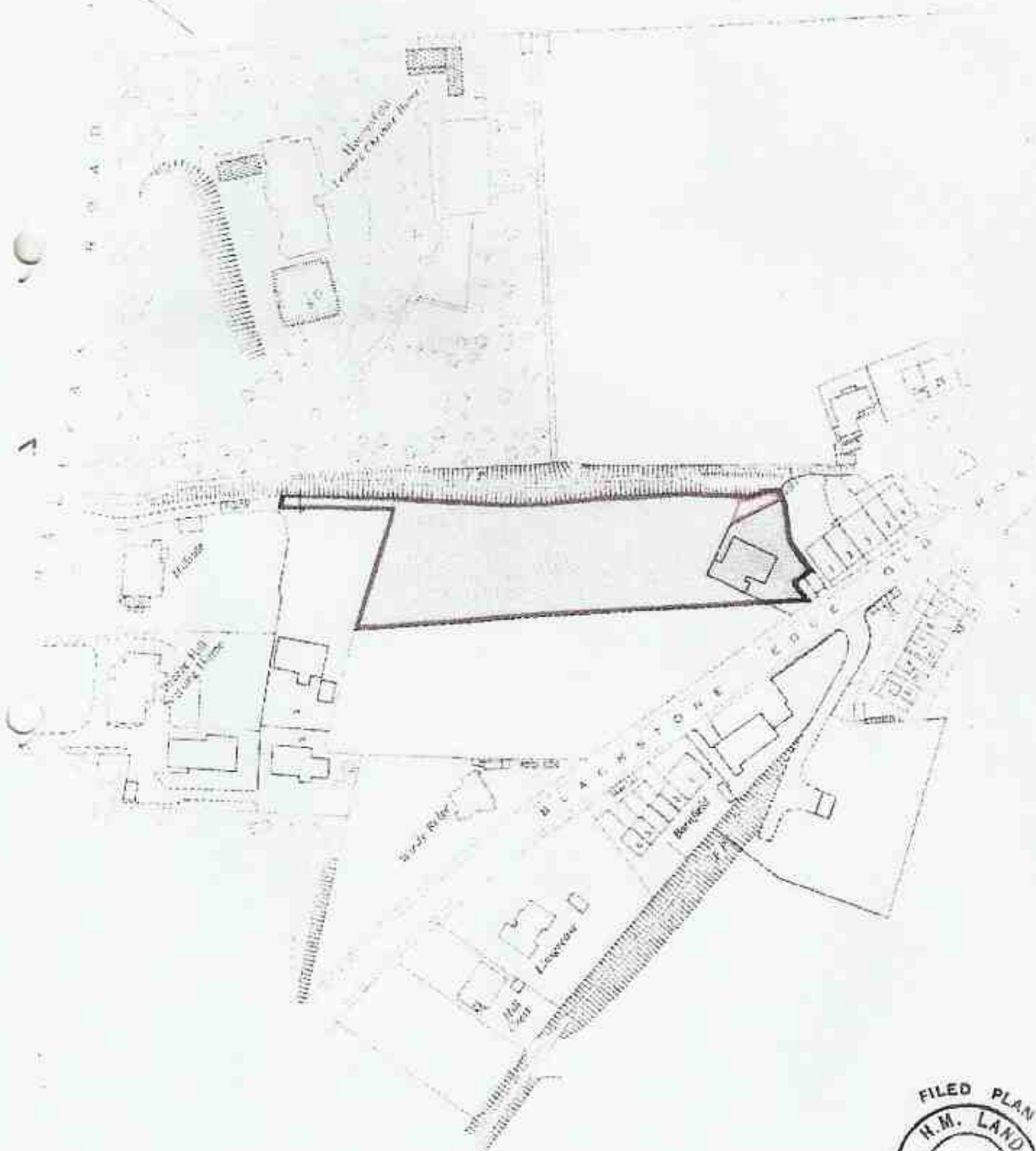
SD 9416

D

Scale 1:250

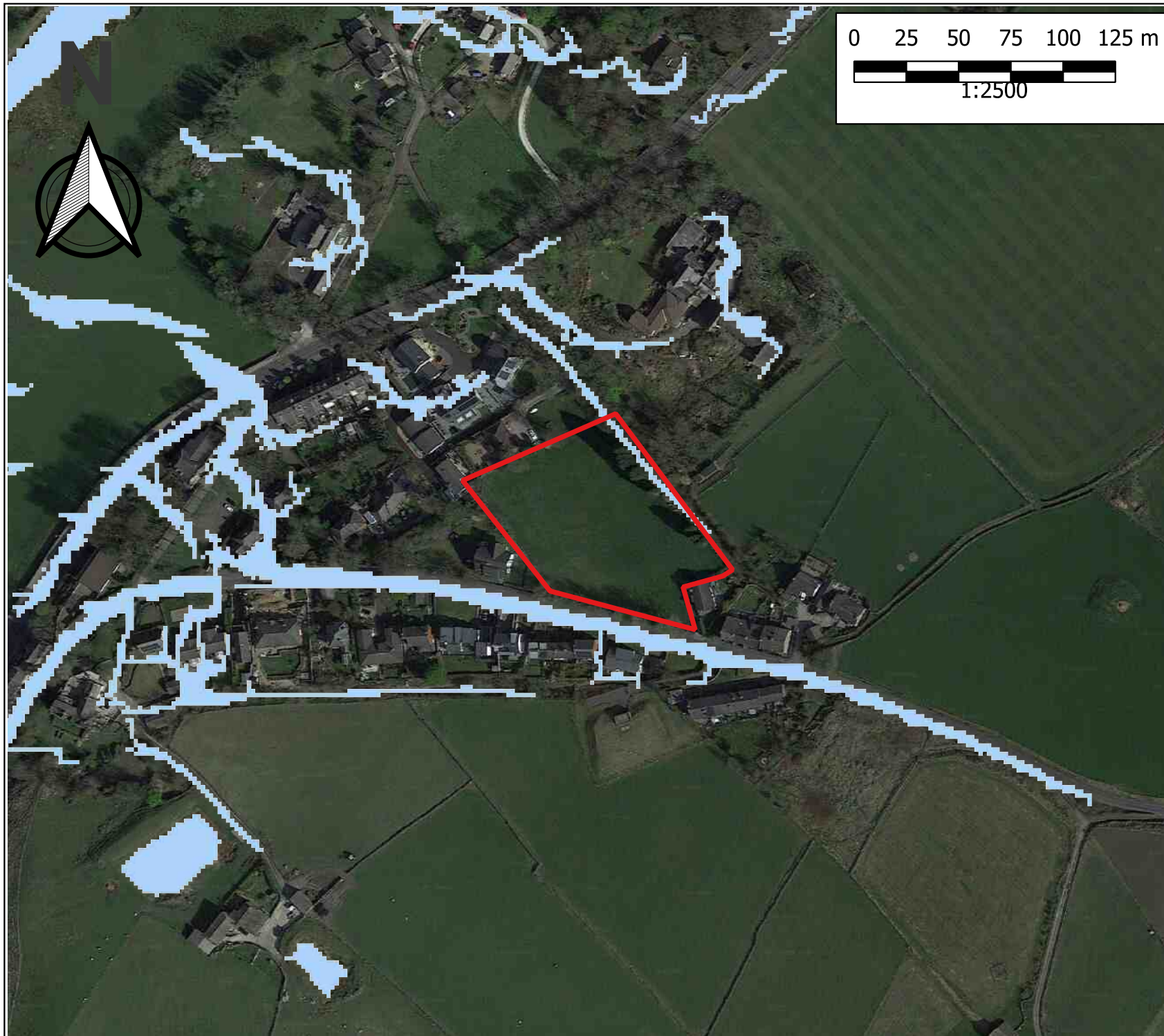
ROCKDALE DISTRICT

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Incomplete without the preceding notes page.

1/10/93



0 25 50 75 100 125 m
1:2500

KEY



Site Location

Sampling locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:

CJ Partnership

Site:

Blackstone Edge Old Road

Title:

Low Surface Water Risk

Job No.:

FRA 22 1111

Scale (see scale bar):

1:2500 @ A4

Figure:

1

Rev:

Drawn By:

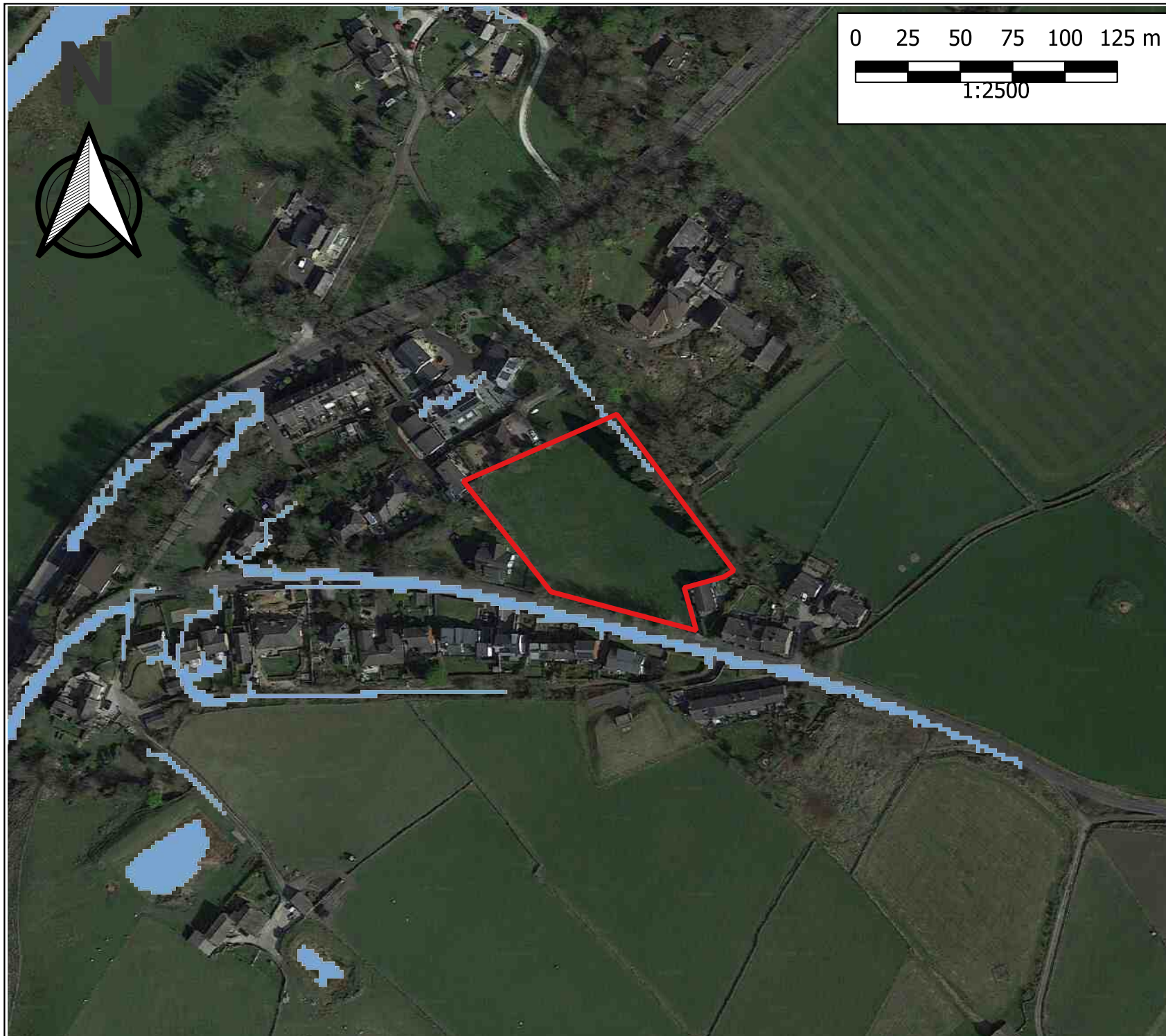
JL

Checked By:

MJ

Drawn:

Aug 2022



KEY



Site Location

Sampling locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:

CJ Partnership

Site:

Blackstone Edge Old Road

Title:

Medium Surface Water

Job No.:

FRA 22 1111

Scale (see scale bar):

1:2500 @ A4

Figure:

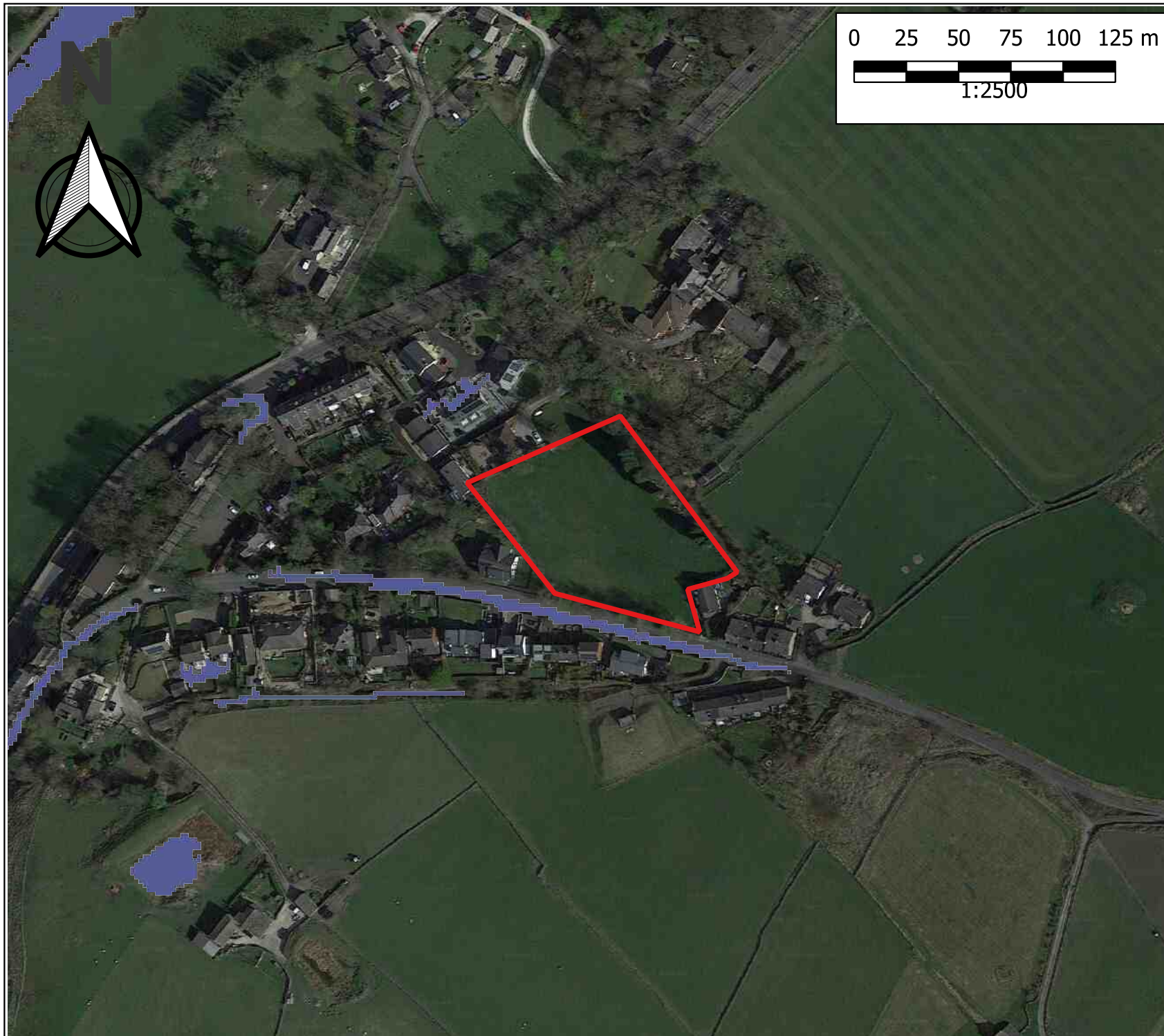
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Rev:

Drawn By:
JL

Checked By:
MJ

Drawn:
Aug 2022



KEY



Site Location

Sampling locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client:

CJ Partnership

Site:

Blackstone Edge Old Road

Title:

High Surface Water Risk

Job No.:

FRA 22 1111

Scale (see scale bar):

1:2500 @ A4

Figure:

1

Rev:

Drawn By:
JL

Checked By:
MJ

Drawn:
Aug 2022

APPENDIX C

CONSULTEE CORRESPONDENCE

Jenna Lowe

From: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Sent: 01 August 2022 16:58
To: Jenna Lowe
Subject: RE: SuDS QUERY - FRA 22 1111 - The Edge House, Blackstone Edge Old Road
Attachments: RBC Drainage Planning Advice.docx

Afternoon Jenna,

I have answered your questions in [blue text alongside your email \(below\)](#).

Stephen McCann

Drainage & Flooding Engineer
Highways, Property & Strategic Housing



 01706 924606

 07552 570262

 stephen.mccann@rochdale.gov.uk

From: Sharon Hill L <Sharon.Hill@Rochdale.Gov.UK>
Sent: 01 August 2022 15:38
To: Stephen McCann <Stephen.McCann@Rochdale.Gov.UK>
Subject: FW: SuDS QUERY - FRA 22 1111 - The Edge House, Blackstone Edge Old Road

Hello Stephen

Please see below, is this something you could respond to/provide?

Regards

Sharon Hill L

Team Leader (Planning Support, Data & Innovation)
Planning & Development



 01706 924305

 sharon.hill@rochdale.gov.uk

From: Jenna Lowe <j.lowe@thelkgroup.com>
Sent: 29 July 2022 14:11
To: Development Management <development.management@rochdale.gov.uk>
Subject: SuDS QUERY - FRA 22 1111 - The Edge House, Blackstone Edge Old Road

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Sustainable Drainage Strategy (SuDS), for a site located at The Edge House, Blackstone Edge Old Road, Lydgate, Littleborough, OL15 0JJ, centred at approximate National Grid Reference 394702E, 416739N.

The area of interest appears to be within Flood Zone 1.

BGS data indicates that the site is within an area underlain by N/A superficial deposits and Darwen Flags - Sandstone bedrock.

The site location is attached to this email.

To complete the SUDs, we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

- Details of any flood defences in the immediate area, including their extent, crest levels (and datum), assumed level of standard, construction and maintenance regime, as well as any other structures which may influence the local hydraulics. [Ask the EA.](#)
- Records of any historic flood events and potential sources of flooding from rivers, land drainage, groundwater, foul and surface water sewers on site and in the area. [As Drainage Officer, I do not have any records of flooding of this site, in the last 5 years.](#)
- Any restrictions applied to ordinary watercourses and sewers in the area. [The only sewers recorded are the public combined sewers in the main roads, which are managed by United Utilities, so you will need to contact them.](#)
- Highway drainage restrictions and records. [Highway Drainage along Blackstone Edge road is very likely to be connected to the public combined sewer in this road.](#)
- Indications if the site is within the Critical Drainage Area. [The site is not located within a CD area.](#)
- Policies that may relate to Sustainable Drainage Systems (SuDS). [See appended.](#)

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, what the charge will be, and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site would also be appreciated.

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

Regards,
Jenna

Jenna Lowe

From: wastewaterdeveloperservices@uuplc.co.uk
Sent: 03 August 2022 12:02
To: Jenna Lowe
Subject: Pre Development Enquiry for: The Edge House, Blackstone Edge Old Road, Littleborough UU
Reference Number : 02536954

Good morning Jenna,

Pre Development Enquiry for: The Edge House, Blackstone Edge Old Road, Littleborough UU Reference Number : 02536954

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

<https://www.unitedutilities.com/builders-developers/working-near-our-assets/>

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 225mm diameter public combined sewer within Blackstone Edge Old Road located to the South of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.

This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**

2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The [North West SuDS Pro-Forma](#) provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

<https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs>

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

<https://www.gov.uk/government/publications/groundwater-protection-position-statements>

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the open ordinary watercourse located 300m West of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 225mm diameter public combined sewer within Blackstone Edge Old Road located South of the proposed site at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 5l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the public sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

We have reviewed our records and can confirm that there does not appear to be any charted public sewers located within the boundary of proposed development. However, due to the accuracy of the records and the public sewer transfer legislation in 2011, not all public sewers are shown on our records so we would ask that you proceed with caution and carry out your own site investigation works. If any uncharted sewers are identified while carrying out your works we would ask that you contact United Utilities at the earliest opportunity so that we can offer guidance and update our records.

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address:

DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

<https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/>

Historic Flooding

I can confirm that we have no current record of sewer flooding on our DG5 register within the vicinity of the proposed development. The DG5 register is a register of properties that have flooded as a result of hydraulic inadequacy of the public sewer network.

Please note that United Utilities Water Limited (Uuw) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which Uuw has no control and not a facet of sewer capacity; or
- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

<https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/>

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,



Ashleigh Bellerby
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07826891650
unitedutilities.com

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----- Original Message -----

From: Jenna Lowe [j.lowe@thelkgroup.com]

Sent: 29/07/2022 14:18

To: wastewaterdeveloperservices@uuplc.co.uk

Subject: SuDS QUERY - FRA 22 1111 - The Edge House, Blackstone Edge Old Road, Littleborough

EXTERNAL EMAIL This email originated outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear Sir/Madam,

LK Consult Ltd. has been commissioned to undertake a Sustainable Drainage Strategy (SuDS), for a site located at The Edge House, Blackstone Edge Old Road, Lydgate, Littleborough, OL15 0JJ, centred at approximate National Grid Reference 394702E, 416739N.

The area of interest appears to be within Flood Zone 1.

BGS data indicates that the site is within an area underlain by N/A superficial deposits and Darwen Flags - Sandstone bedrock.

The site location and Wastewater Pre-Development Enquiry form are attached to this email.

To complete the SUDs, we would be grateful if you could supply us with the following, if available, for the vicinity of the site:

1. Records of any historic flood events and potential sources of flooding from foul and surface water sewers on site and in the area.
2. Any restrictions to discharge into the sewers

If you have any queries, please do not hesitate to get in touch.

We are, of course, happy to pay your reasonable charge for this service. Please let me know by return what information is available, what the charge will be, and we will pay the relevant fees by debit card as soon as possible.

Any advice or recommendations you may have regarding the potential discharges from the development of this site would also be appreciated.

We will be in contact with all other relevant authorities to get a more complete understanding of the issues in the area.

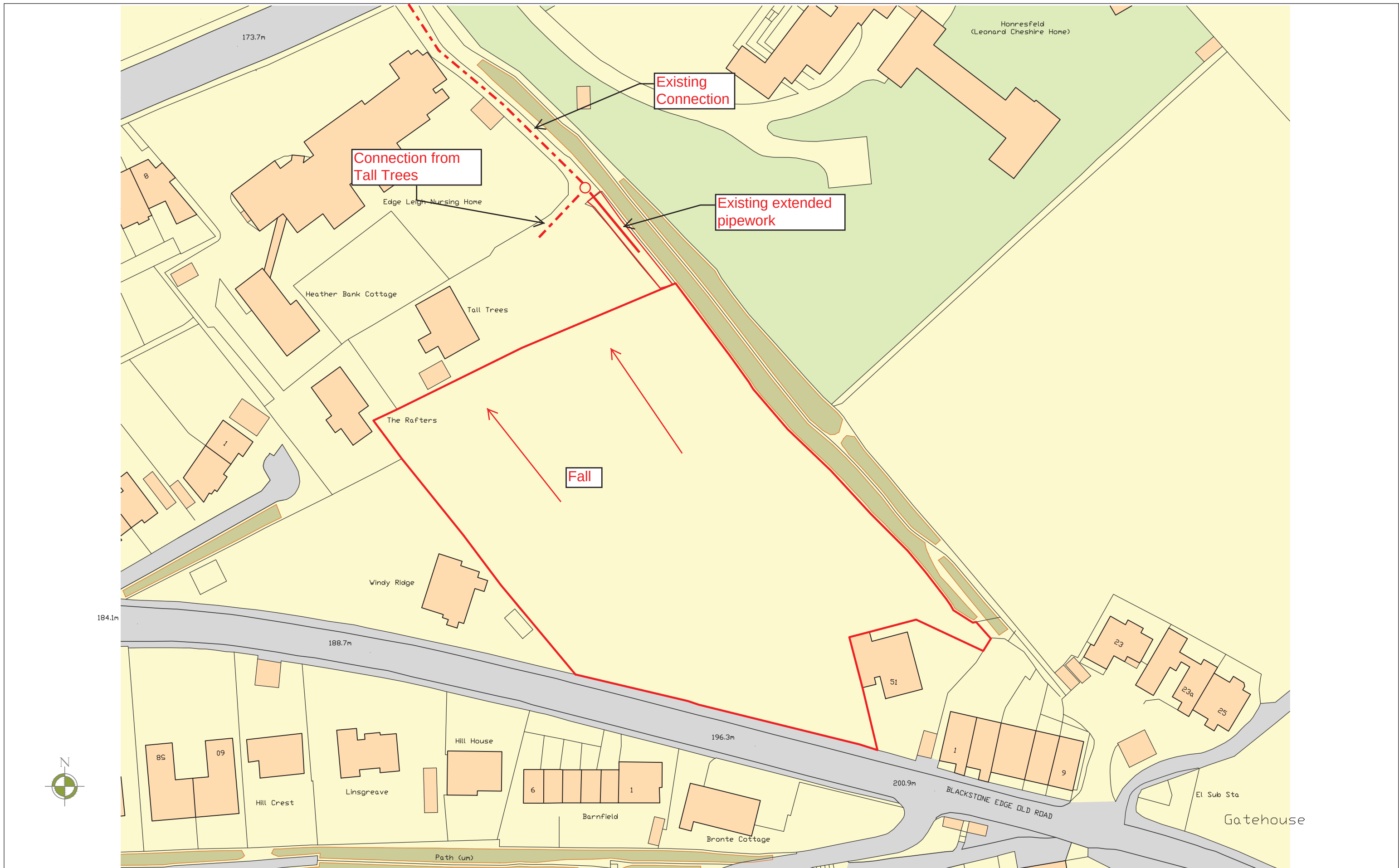
Regards,

Jenna



Jenna Lowe MSc, BSc. (Hons)
Flood Risk Engineer
0161 763 7200 | 07467 957756
Manchester | London | Swindon | Liverpool | Glasgow
www.thelkgroup.com

I N C R E A S I N G L A N D V A L U E



Gordon Foxton
Residential Development
Blackstone Edge Old Road
Littleborough

Location Plan

work to figured dimensions

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contract no

3191 01

drawn by

Ordnance Survey

drawing no

date

27.06.12

revision

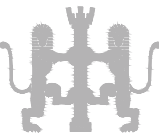
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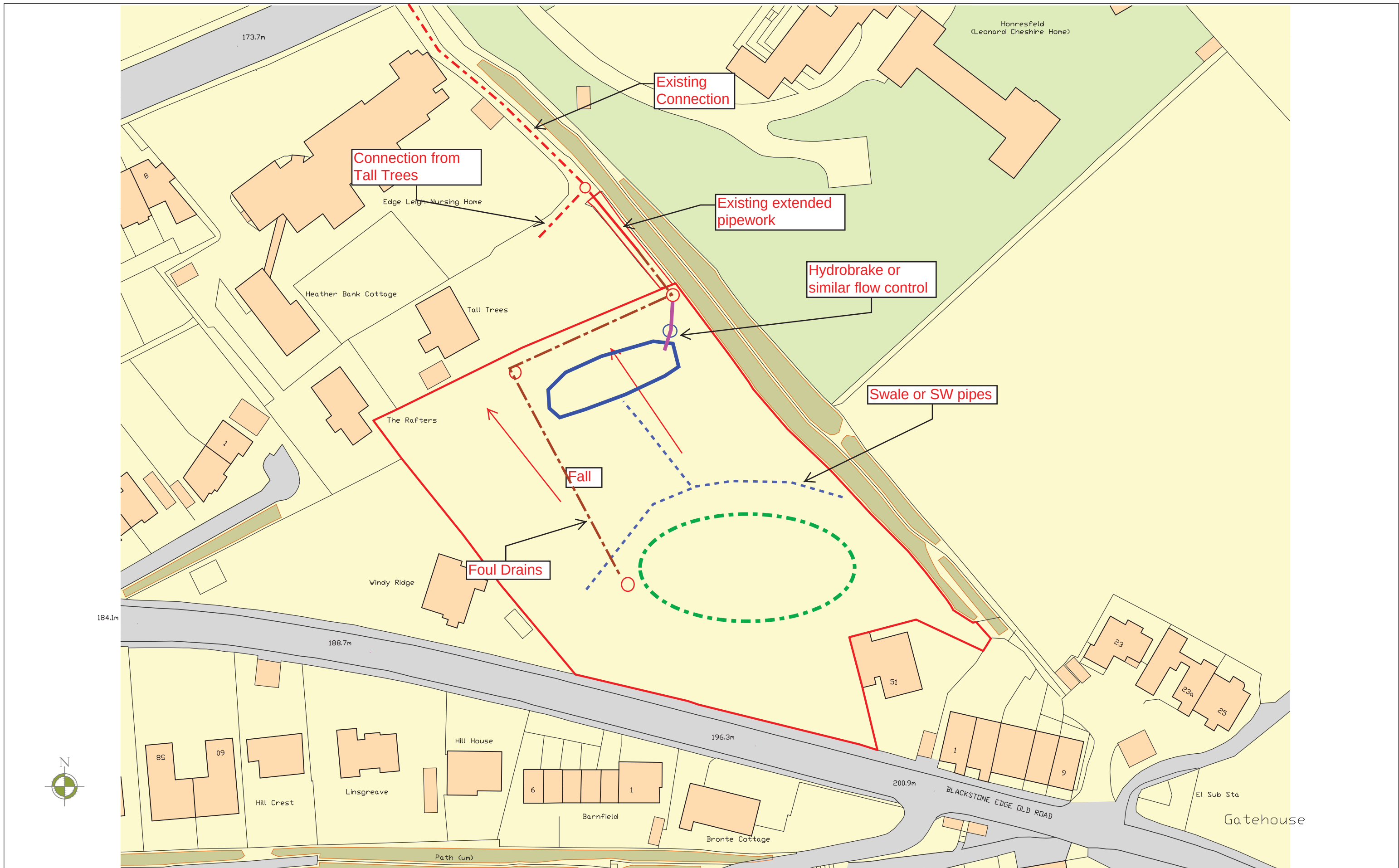
1:750

Revisions:
A.

Blue Pit Mill Queensway
Castleton Rochdale OL11 2PG
+44 (0)1706 631347
info@cjpartnership.com
www.cjpartnership.com

CJPARTNERSHIP
ENVIRONMENTAL ARCHITECTS





Gordon Foxton
Residential Development
Blackstone Edge Old Road
Littleborough

Location Plan

work to figured dimensions

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contract no

3191 01

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Ordnance Survey

drawing no

date

27.06.12

revision

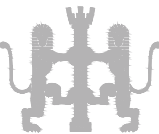
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Revisions:
A.

Blue Pit Mill Queensway
Castleton Rochdale OL11 2PG
+44 (0)1706 631347
info@cjpartnership.com
www.cjpartnership.com

CJPARTNERSHIP
ENVIRONMENTAL ARCHITECTS



APPENDIX D

CALCULATIONS



MasterDrain
HY 11.0

The LK Group www.thelkgroup.com		Eton Business Park, Eton Hill Road, Radcliffe M26 2ZS Tel: 0161 763 7200 email: m.jones@thelkgroup.com		Job No.		
				Sheet no. 1		
				Date 15/08/22		
Project The Edge House, Blackstone Edge Old Road				By	Checked	Reviewed
Title The Edge House, Blackstone Edge Old Road						

Hydrological Data:-

FSR Hydrology:-

Location = EDGE HOUSE	Grid reference = SD 9416
M5-60 (mm) = 19.5	r = 0.24
Soil runoff = 0.50	SAAR (mm/yr) = 1190
WRAP = 5	Area = England & Wales
Hydrological area = 10	Hydrological zone = 6

Soil classification for WRAP type 5

Soils of wet uplands -

- i) with peaty or humose surface horizons and impermeable layers at shallow depth;
- ii) deep raw peat associated with gentle upland slopes or basin sites;
- iii) bare rock cliffs and screes;
- iv) shallow, permeable rocky soils on steep slopes.

Design data:-

Area = 0.00078 Km² - 0.078 Ha - 780 m²

Calculation method:-

Runoff is calculated from:-

$$Q_{\text{BAR(rural)}} = 0.00108 \text{ AREA}^{0.89} \cdot \text{SAAR}^{1.17} \cdot \text{SOIL}^{2.17}$$

where

AREA = Site area in Km²
 SAAR = Standard Average Annual Rainfall (mm/yr)
 SOIL = Soil value derived from Winter Rainfall Acceptance Potential
 Q_{BAR(rural)} = Runoff (cumecs)

Q_{BAR(rural)} is then multiplied by a growth factor - GC(T) - for different storm return periods derived from EA publication W5-074/A.

Calculated data:-

For areas less than 50Ha, a modified calculation which multiplies the 50Ha runoff value by the ratio of the site area to 50Ha is used

Reducing factor used for these calculations is 0.002

Mean Annual Peak Flow $Q_{\text{BAR(rural)}} = 0.80 \text{ l/s}$



MasterDrain
HY 11.0

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 15/08/22		
By	Checked	Reviewed

Project	The Edge House, Blackstone Edle Old Road
Title	The Edge House, Blackstone Edle Old Road

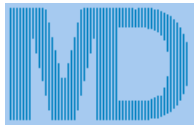
Values for $Q_{BAR(rural)}$

Ret. per.	m ³ /hr	l/s	l/s/ha	Ret. per.	m ³ /hr	l/s	l/s/ha
1yr	2.452	0.681	8.732	100yr+20%	7.269	2.019	25.888
2yr	2.683	0.745	9.554	100yr+30%	7.875	2.188	28.045
5yr	3.490	0.970	12.430	100yr+40%	8.481	2.356	30.202
10yr	3.981	1.106	14.177	200yr	6.923	1.923	24.655
30yr	4.846	1.346	17.258	200yr + 30%	9.000	2.500	32.051
50yr	5.337	1.482	19.005	500yr	7.875	2.188	28.045
100yr	6.058	1.683	21.573	1000yr	8.769	2.436	31.230

Growth factors -

1yr	2yr	5yr	10yr	30yr	50yr	100yr	200yr	500yr	1000yr
0.85	0.93	1.21	1.38	1.68	1.85	2.10	2.40	2.73	3.04

The above is based on the Institute of Hydrology Report 124
to which you are referred for further details (see Sect 7).
Note that the 200 and above year growth curves were taken from W5-074.



MasterDrain
SW

The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 1		
Date 15/08/22		
By	Checked	Reviewed

Project	30 Years Storage Event Edge House, Blackstone Edge Old Road
Title	30 Years Storage Event Edge House, Blackstone Edge Old Road

Data:-

FSR Hydrology:-

Location = EDGE HOUSE

M5-60 (mm) = 19.5

Soil index = 0.50

Return period = 30

UCWI = 120.9

Grid reference = SD 9416

r = 0.24

SAAR (mm/yr) = 1190

WRAP = 5

Climate change = 0

Soils of wet uplands -

i) with peaty or humose surface horizons and impermeable layers at shallow depth;

ii) deep raw peat associated with gentle upland slopes or basin sites;

iii) bare rock cliffs and screes;

iv) shallow, permeable rocky soils on steep slopes.

Runoff factor (RF) = 80.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 740 m²

Total area (TA) = 780 m²

Mean disch. rate = 5.000 l/s

Additional flow = 0.00 l/s

Pervious area = 40 m²

Equiv area = 624 m² (TA x RF).

Areal reduction factor = 1.000

Climate change factor = 0

Calculated data:-

Time to max = 19.0 mins

Rainfall at max = 55.65 mm/hr

Pipeline storage = 0.0 m³

Offline storage = 0.0 m³

Calculated storage volume = 5.3 m³

Allowed discharge rate = 5.000 l/s

Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours

Rainfall rate = 10.00 mm/hr

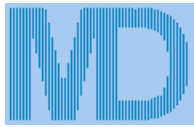
Calculated storage volume = 0.0 m³

Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	674.4	1125	5.3	400 x 600	29.4	500 x 500	21.2
150	299.7	1200	4.7	600 x 900	12.8	500 x 750	14.1
225	133.2	1275	4.1	800 x 1200	7.2	500 x 1000	10.6
300	74.9	1350	3.7			750 x 1000	7.1
375	48.0	1425	3.3			750 x 1200	5.9
450	33.3	1500	3.0			750 x 1500	4.7
525	24.5	1575	2.7			1000 x 1000	5.3
600	18.7	1650	2.5			1000 x 1200	4.4
675	14.8	1725	2.3			1000 x 1500	3.5
750	12.0	1800	2.1			1000 x 1800	2.9
825	9.9	1875	1.9			1000 x 2000	2.6
900	8.3	1950	1.8			1500 x 1500	2.4
975	7.1	2025	1.6			1500 x 1800	2.0
1050	6.1	2100	1.5			1500 x 2000	1.8



The LK Group

www.thelkgroup.com

Eton Business Park,
Eton Hill Road,
Radcliffe M26 2ZS
Tel: 0161 763 7200
email: m.jones@thelkgroup.com

Job No.		
Sheet no. 2		
Date 15/08/22		
By	Checked	Reviewed

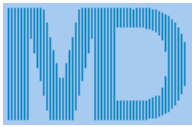
Project	30 Years Storage Event Edge House, Blackstone Edge Old Road
Title	30 Years Storage Event Edge House, Blackstone Edge Old Road

MasterDrain
SW

Data:-

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	74.0	7.710	3.000	4.710
20	54.0	11.287	6.000	5.287
30	44.0	13.757	9.000	4.757
40	38.0	15.704	12.000	3.704
50	33.0	17.330	15.000	2.330
60	30.0	18.736	18.000	0.736
70	27.0	19.979	21.000	0.000
80	25.0	21.094	24.000	0.000
90	24.0	22.107	27.000	0.000
100	22.0	23.035	30.000	0.000
110	21.0	23.892	33.000	0.000
120	20.0	24.686	36.000	0.000
130	19.0	25.427	39.000	0.000
140	18.0	26.121	42.000	0.000
150	17.0	26.772	45.000	0.000
160	16.0	27.385	48.000	0.000
170	16.0	27.964	51.000	0.000
180	15.0	28.528	54.000	0.000
190	15.0	29.080	57.000	0.000
200	14.0	29.613	60.000	0.000
210	14.0	30.126	63.000	0.000
220	13.0	30.623	66.000	0.000
230	13.0	31.103	69.000	0.000
240	13.0	31.570	72.000	0.000
250	12.0	32.022	75.000	0.000
260	12.0	32.462	78.000	0.000
270	12.0	32.890	81.000	0.000
280	11.0	33.307	84.000	0.000
290	11.0	33.714	87.000	0.000
300	11.0	34.110	90.000	0.000
310	11.0	34.498	93.000	0.000
320	10.0	34.876	96.000	0.000
330	10.0	35.246	99.000	0.000
340	10.0	35.609	102.000	0.000
350	10.0	35.963	105.000	0.000
360	10.0	36.311	108.000	0.000
370	10.0	36.652	111.000	0.000
380	9.0	36.986	114.000	0.000
390	9.0	37.315	117.000	0.000
400	9.0	37.637	120.000	0.000
410	9.0	37.953	123.000	0.000
420	9.0	38.264	126.000	0.000
430	9.0	38.570	129.000	0.000
440	8.0	38.871	132.000	0.000
450	8.0	39.167	135.000	0.000
460	8.0	39.458	138.000	0.000
470	8.0	39.745	141.000	0.000
480	8.0	40.027	144.000	0.000
490	8.0	40.306	147.000	0.000
500	8.0	40.580	150.000	0.000
510	8.0	40.850	153.000	0.000
520	8.0	41.117	156.000	0.000
530	8.0	41.380	159.000	0.000
540	7.0	41.639	162.000	0.000
550	7.0	41.895	165.000	0.000
560	7.0	42.148	168.000	0.000
570	7.0	42.397	171.000	0.000
580	7.0	42.643	174.000	0.000
590	7.0	42.886	177.000	0.000
600	7.0	43.127	180.000	0.000

Storage volume (m³) = 5.3 m³



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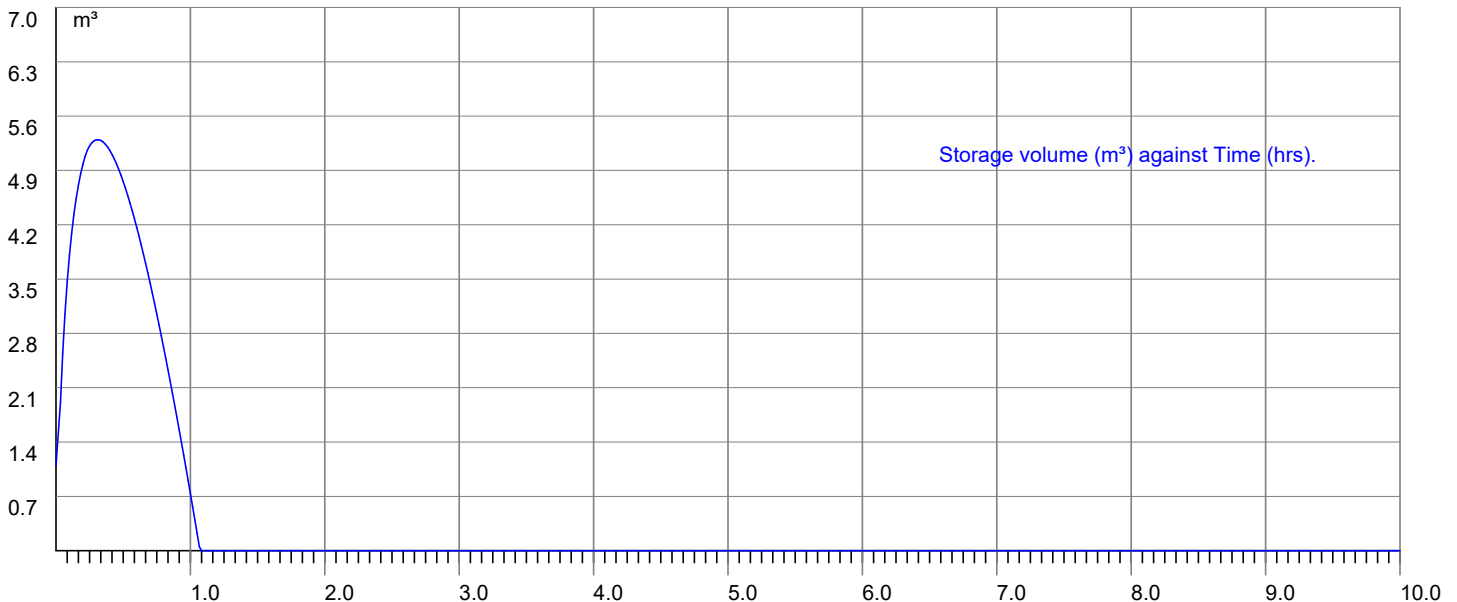
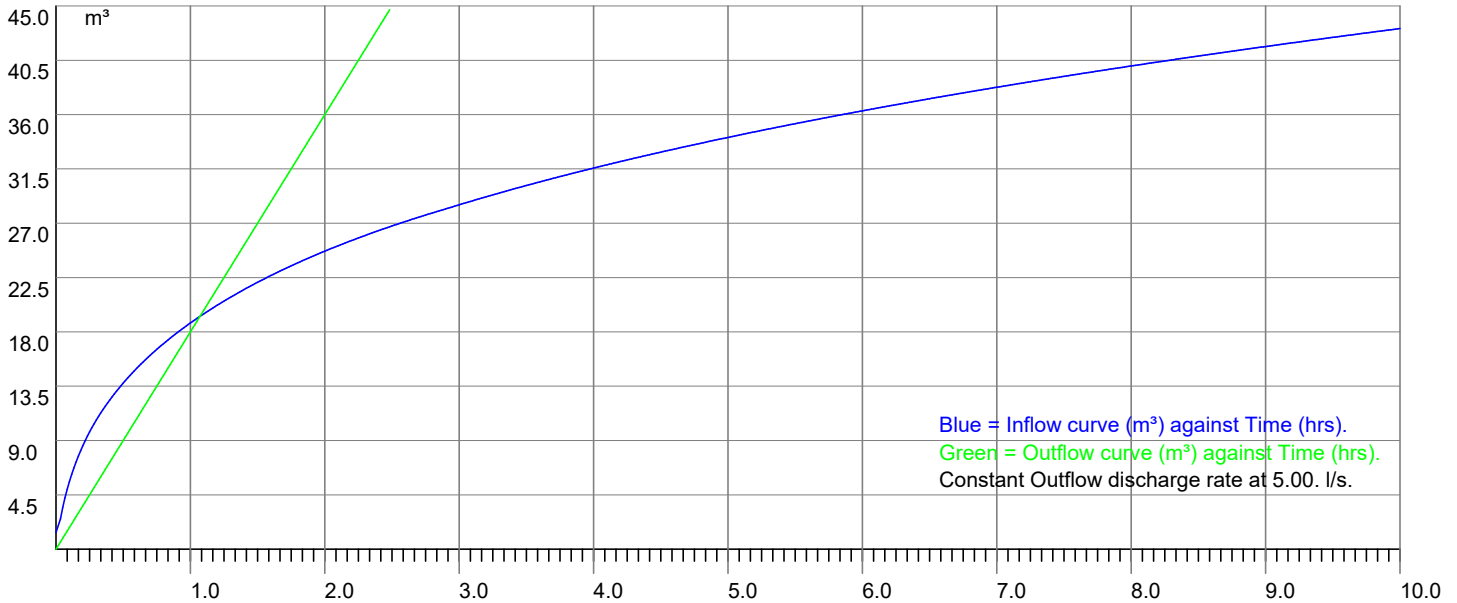
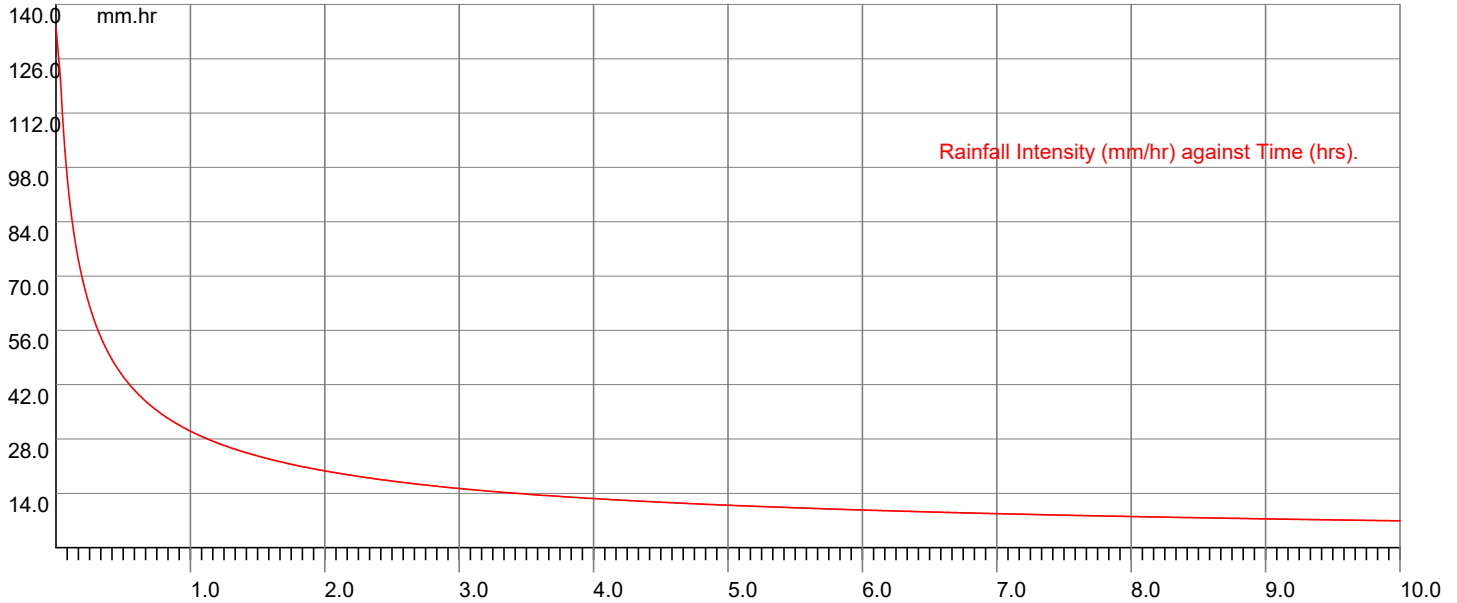
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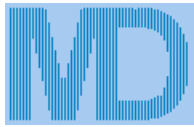
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Project **30 Years Storage Event Edge House, Blackstone Edge Old Road**

Title **30 Years Storage Event Edge House, Blackstone Edge Old Road**





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Project	100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road
Title	100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road

Data:-

FSR Hydrology:-

Location = EDGE HOUSE

M5-60 (mm) = 19.5

Soil index = 0.50

Return period = 100

UCWI = 120.9

Grid reference = SD 9416

r = 0.24

SAAR (mm/yr) = 1190

WRAP = 5

Climate change = 20

Soils of wet uplands -

- i) with peaty or humose surface horizons and impermeable layers at shallow depth;
- ii) deep raw peat associated with gentle upland slopes or basin sites;
- iii) bare rock cliffs and screes;
- iv) shallow, permeable rocky soils on steep slopes.

Runoff factor (RF) = 80.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = Impervious Area*100/(Impervious Area+Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 740 m²

Total area (TA) = 780 m²

Mean disch. rate = 5.000 l/s

Additional flow = 0.00 l/s

Pervious area = 40 m²

Equiv area = 624 m² (TA x RF).

Areal reduction factor = 1.000

Climate change factor = 20

Calculated data:-

Time to max = 37.0 mins

Rainfall at max = 61.85 mm/hr

Pipeline storage = 0.0 m³

Offline storage = 0.0 m³

Calculated storage volume = 12.7 m³

Allowed discharge rate = 5.000 l/s

Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours

Rainfall rate = 15.00 mm/hr

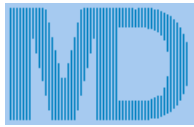
Calculated storage volume = 0.0 m³

Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	1617.1	1125	12.8	400 x 600	70.5	500 x 500	50.8
150	718.7	1200	11.2	600 x 900	30.7	500 x 750	33.9
225	319.4	1275	9.9	800 x 1200	17.3	500 x 1000	25.4
300	179.7	1350	8.9			750 x 1000	16.9
375	115.0	1425	8.0			750 x 1200	14.1
450	79.9	1500	7.2			750 x 1500	11.3
525	58.7	1575	6.5			1000 x 1000	12.7
600	44.9	1650	5.9			1000 x 1200	10.6
675	35.5	1725	5.4			1000 x 1500	8.5
750	28.7	1800	5.0			1000 x 1800	7.1
825	23.8	1875	4.6			1000 x 2000	6.3
900	20.0	1950	4.3			1500 x 1500	5.6
975	17.0	2025	3.9			1500 x 1800	4.7
1050	14.7	2100	3.7			1500 x 2000	4.2



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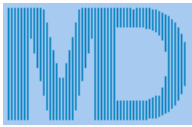
Project	100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road
Title	100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road

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SW

Data:-

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	113.0	11.793	3.000	8.793
20	84.0	17.547	6.000	11.547
30	69.0	21.533	9.000	12.533
40	59.0	24.677	12.000	12.677
50	52.0	27.297	15.000	12.297
60	47.0	29.551	18.000	11.551
70	43.0	31.531	21.000	10.531
80	40.0	33.296	24.000	9.296
90	37.0	34.886	27.000	7.886
100	35.0	36.330	30.000	6.330
110	33.0	37.650	33.000	4.650
120	31.0	38.863	36.000	2.863
130	30.0	39.982	39.000	0.982
140	28.0	41.017	42.000	0.000
150	27.0	41.979	45.000	0.000
160	26.0	42.873	48.000	0.000
170	25.0	43.707	51.000	0.000
180	24.0	44.526	54.000	0.000
190	23.0	45.339	57.000	0.000
200	22.0	46.120	60.000	0.000
210	21.0	46.872	63.000	0.000
220	21.0	47.597	66.000	0.000
230	20.0	48.298	69.000	0.000
240	20.0	48.977	72.000	0.000
250	19.0	49.634	75.000	0.000
260	19.0	50.272	78.000	0.000
270	18.0	50.891	81.000	0.000
280	18.0	51.493	84.000	0.000
290	17.0	52.080	87.000	0.000
300	17.0	52.651	90.000	0.000
310	17.0	53.207	93.000	0.000
320	16.0	53.751	96.000	0.000
330	16.0	54.281	99.000	0.000
340	15.0	54.799	102.000	0.000
350	15.0	55.306	105.000	0.000
360	15.0	55.802	108.000	0.000
370	15.0	56.288	111.000	0.000
380	14.0	56.763	114.000	0.000
390	14.0	57.229	117.000	0.000
400	14.0	57.686	120.000	0.000
410	14.0	58.135	123.000	0.000
420	13.0	58.575	126.000	0.000
430	13.0	59.007	129.000	0.000
440	13.0	59.431	132.000	0.000
450	13.0	59.848	135.000	0.000
460	13.0	60.258	138.000	0.000
470	12.0	60.661	141.000	0.000
480	12.0	61.058	144.000	0.000
490	12.0	61.448	147.000	0.000
500	12.0	61.832	150.000	0.000
510	12.0	62.210	153.000	0.000
520	12.0	62.583	156.000	0.000
530	11.0	62.950	159.000	0.000
540	11.0	63.312	162.000	0.000
550	11.0	63.668	165.000	0.000
560	11.0	64.020	168.000	0.000
570	11.0	64.366	171.000	0.000
580	11.0	64.709	174.000	0.000
590	11.0	65.046	177.000	0.000
600	10.0	65.379	180.000	0.000

Storage volume (m³) = 12.7 m³



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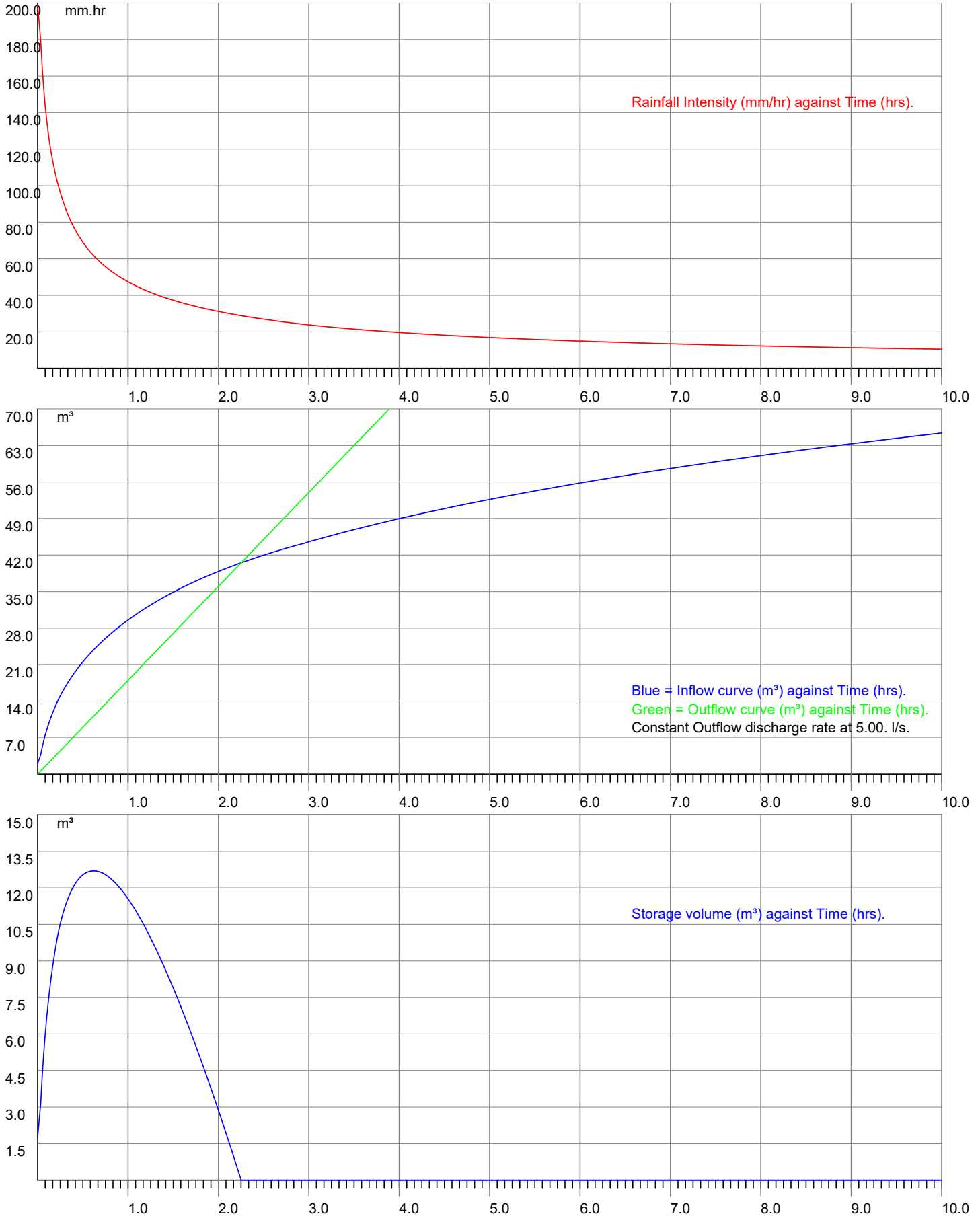
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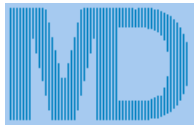
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Project **100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road**

Title **100 Years + 20% CC Storage Event Edge House, Blackstone Edge Old Road**





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Project	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road
Title	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road

Data:-

FSR Hydrology:-

Location = EDGE HOUSE

M5-60 (mm) = 19.5

Soil index = 0.50

Return period = 100

UCWI = 120.9

Grid reference = SD 9416

r = 0.24

SAAR (mm/yr) = 1190

WRAP = 5

Climate change = 40

Soils of wet uplands -

i) with peaty or humose surface horizons and impermeable layers at shallow depth;

ii) deep raw peat associated with gentle upland slopes or basin sites;

iii) bare rock cliffs and screes;

iv) shallow, permeable rocky soils on steep slopes.

Runoff factor (RF) = 80.0, calculated from:-

Runoff factor = $(0.829 \times \text{PIMP}) + (25 \times \text{SOIL}) + (0.078 \times \text{UCWI}) - 20.7$

where

PIMP = Impervious Area * 100 / (Impervious Area + Pervious Area)

UCWI = Calculated value for Wetness Index

Design data:-

Imperv. area = 740 m²

Total area (TA) = 780 m²

Mean disch. rate = 5.000 l/s

Additional flow = 0.00 l/s

Pervious area = 40 m²

Equiv area = 624 m² (TA x RF).

Areal reduction factor = 1.000

Climate change factor = 40

Calculated data:-

Time to max = 46.0 mins

Rainfall at max = 64.14 mm/hr

Pipeline storage = 0.0 m³

Offline storage = 0.0 m³

Calculated storage volume = 16.9 m³

Allowed discharge rate = 5.000 l/s

Available MH storage = 0.0 m³

Fixed 6 hour data:-

Rainfall event = 6 hours

Rainfall rate = 17.00 mm/hr

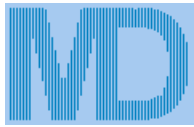
Calculated storage volume = 0.0 m³

Allowed discharge rate = 5.000 l/s

Rainfall intensities calculated using the Wallingford Procedure

Storage lengths for initial calculation (x 1.1, 1.2, 1.3 or 1.5 as above if required) :-

Diam	Len	Diam	Len	Ovoid	Len	Box culvert	Len
100	2150.0	1125	17.0	400 x 600	93.8	500 x 500	67.5
150	955.6	1200	14.9	600 x 900	40.8	500 x 750	45.0
225	424.7	1275	13.2	800 x 1200	23.0	500 x 1000	33.8
300	238.9	1350	11.8			750 x 1000	22.5
375	152.9	1425	10.6			750 x 1200	18.8
450	106.2	1500	9.6			750 x 1500	15.0
525	78.0	1575	8.7			1000 x 1000	16.9
600	59.7	1650	7.9			1000 x 1200	14.1
675	47.2	1725	7.2			1000 x 1500	11.3
750	38.2	1800	6.6			1000 x 1800	9.4
825	31.6	1875	6.1			1000 x 2000	8.4
900	26.5	1950	5.7			1500 x 1500	7.5
975	22.6	2025	5.2			1500 x 1800	6.3
1050	19.5	2100	4.9			1500 x 2000	5.6



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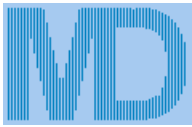
Project	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road
Title	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road

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Data:-

Time (mins)	Rain mm/hr	Inflow (m3)	Outflow (m3)	Balance (m3)
10	132.0	13.758	3.000	10.758
20	98.0	20.471	6.000	14.471
30	81.0	25.121	9.000	16.121
40	69.0	28.790	12.000	16.790
50	61.0	31.846	15.000	16.846
60	55.0	34.476	18.000	16.476
70	51.0	36.786	21.000	15.786
80	47.0	38.846	24.000	14.846
90	43.0	40.701	27.000	13.701
100	41.0	42.386	30.000	12.386
110	38.0	43.926	33.000	10.926
120	36.0	45.340	36.000	9.340
130	35.0	46.646	39.000	7.646
140	33.0	47.854	42.000	5.854
150	31.0	48.975	45.000	3.975
160	30.0	50.019	48.000	2.019
170	29.0	50.991	51.000	0.000
180	28.0	51.948	54.000	0.000
190	27.0	52.895	57.000	0.000
200	26.0	53.806	60.000	0.000
210	25.0	54.684	63.000	0.000
220	24.0	55.530	66.000	0.000
230	24.0	56.348	69.000	0.000
240	23.0	57.139	72.000	0.000
250	22.0	57.906	75.000	0.000
260	22.0	58.650	78.000	0.000
270	21.0	59.373	81.000	0.000
280	21.0	60.076	84.000	0.000
290	20.0	60.759	87.000	0.000
300	20.0	61.426	90.000	0.000
310	19.0	62.075	93.000	0.000
320	19.0	62.709	96.000	0.000
330	18.0	63.328	99.000	0.000
340	18.0	63.933	102.000	0.000
350	18.0	64.524	105.000	0.000
360	17.0	65.103	108.000	0.000
370	17.0	65.669	111.000	0.000
380	17.0	66.224	114.000	0.000
390	16.0	66.767	117.000	0.000
400	16.0	67.301	120.000	0.000
410	16.0	67.824	123.000	0.000
420	16.0	68.337	126.000	0.000
430	15.0	68.841	129.000	0.000
440	15.0	69.336	132.000	0.000
450	15.0	69.823	135.000	0.000
460	15.0	70.301	138.000	0.000
470	14.0	70.771	141.000	0.000
480	14.0	71.234	144.000	0.000
490	14.0	71.689	147.000	0.000
500	14.0	72.137	150.000	0.000
510	14.0	72.579	153.000	0.000
520	14.0	73.013	156.000	0.000
530	13.0	73.442	159.000	0.000
540	13.0	73.864	162.000	0.000
550	13.0	74.280	165.000	0.000
560	13.0	74.690	168.000	0.000
570	13.0	75.094	171.000	0.000
580	13.0	75.493	174.000	0.000
590	12.0	75.887	177.000	0.000
600	12.0	76.276	180.000	0.000

Storage volume (m³) = 16.9 m³



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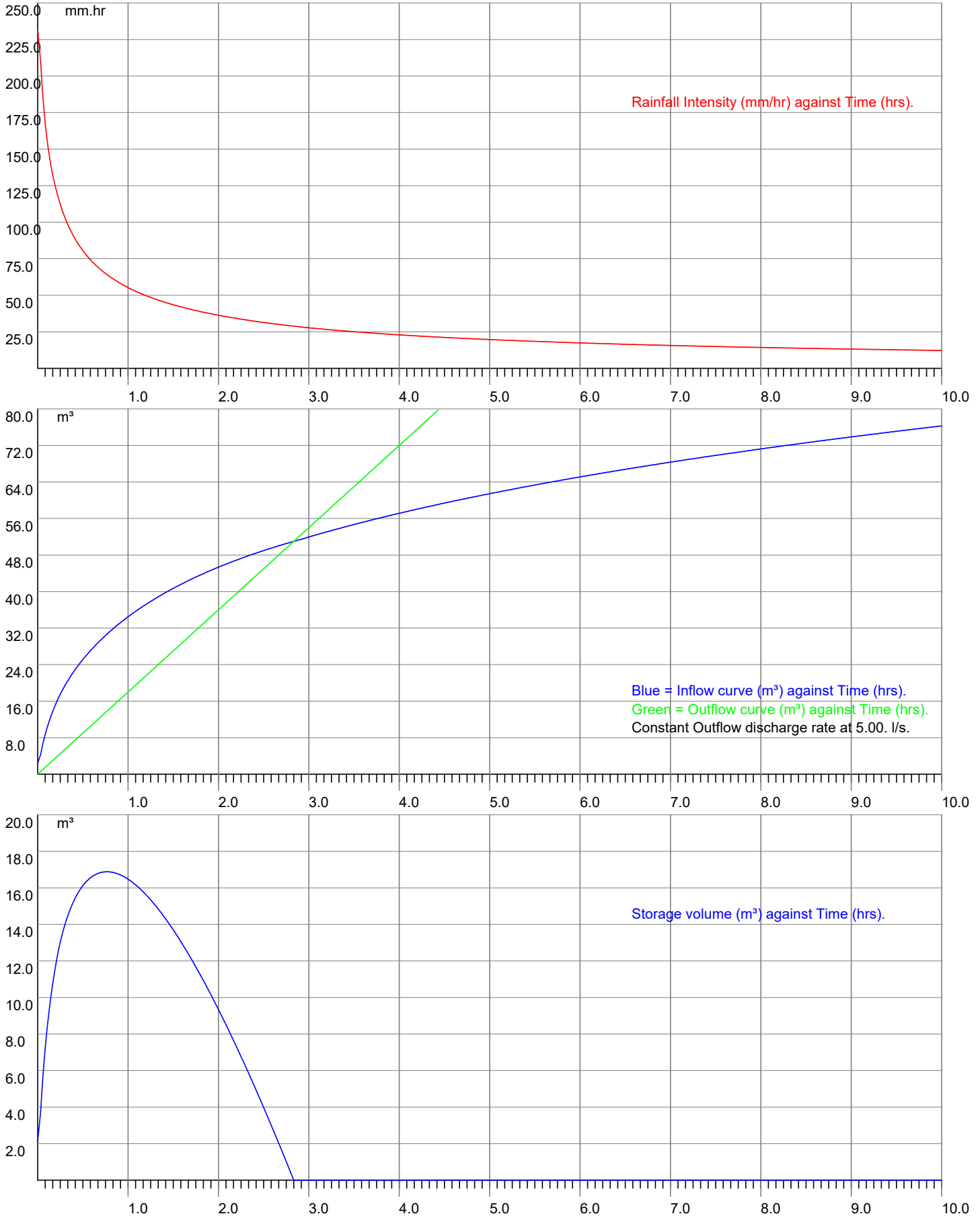
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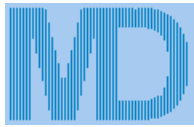
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Project **100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road**

Title **100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road**





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Project	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road
Title	100 Years + 40% CC Storage Event Edge House, Blackstone Edge Old Road

Explanatory notes for Peak Flow Storage

- 1) This system uses the rainfall intensity/ duration curve calculated using either the Wallingford or FEH method as selected.
- 2) The balance is calculated from the inflow minus the outflow.
- 3) The storage volume is the maximum value of the balance curve.
- 4) This method was described by Davis (1963) - see Butler & Davies, 2nd edition, p294
- 5) References to 'storm duration' relate only to the hydrograph method (qv).
- 6) There are always 600 steps in the calculation process, thus a 'run' time of 10 hours will be sampled every minute,

Explanatory notes for Hydrograph Storage

- 1) The user has the choice of Summer or Winter curves
- 2) The mean intensity varies with the duration of the storm curve
- 3) There are always 120 steps in the calculation process, irrespective of storm duration.
- 4) The balance is calculated from the inflow minus the outflow.
- 5) The storage volume is the sum of the balance values for each step.
- 6) Varying durations should be tried to find the maximum storage value - this can be narrowed down very closely.

*Modelling using the flow characteristics of the restrictor is available using Vortex Control modelling function. Please be aware that this function needs the full design data file to function.

Why do the two methods give different results?

The rainfall characteristics for each method are very different.

The Peak flow (using the Intensity/Duration/Frequency curve) does not model the actual rainfall. This curve is joined points which represent the mean intensity of a storm at a given duration i.e. a value of 19.5 mm/hr for a 60 minute storm indicates that over the sixty minute period, the mean intensity was 19.5 mm/hr. The calculation method samples the IDF curve for a given location and frequency (Return Period) and calculates the storage for that rate and duration less the outflow volume. The maximum value is displayed as the 'worst case' storage. The outflow volume is constant throughout the process at the specified discharge rate.

The hydrograph method uses a standard curve for either Winter or Summer storms. Traditionally these are symmetrical about the central peak. UK rainfall does not fit into this convenient curve, so the calculations are dealing with a stylised set of data. The mean intensity for the storm is calculated from the IDF curve and applied to the curve data, calculating the storage for that step less the outflow volume. The final storage volume is the sum of the storage for all the steps. The outflow volume varies with the hydraulic head on the control device using flow equations provided by the control manufacturer. This is a far more accurate method than the peak flow method and often results in bigger storage volumes.

It can be seen that these two methods are very different, and the user may have the choice of which result to use. This is not an exact science, though is often treated as such by those that do not understand the principles of the calculations.

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offices in Manchester,
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Manchester (Head Office)

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- Geotechnical
- Contaminated Land
- Flood Risk and Drainage
- Asbestos
- Invasive Species
- Land Remediation
- Project Management
- Land Drilling

APPENDIX B

SITE INFORMATION

APPENDIX C

CONSULTEE CORRESPONDENCE

APPENDIX D

CALCULATIONS