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FLOOD RISK & DRAINAGE IMPACT ASSESSMENT REPORT

Higher College Farm, Hothersall, Preston

Report Ref BEK-17303-1-RevB November 2018

REPORT PREPARED FOR

MR M HURST
Higher College Farmhouse
Lower Road
Hothersall
Preston
PR3 2YY

Project Quality Assurance Information Sheet

FLOOD RISK AND DRAINAGE IMPACT ASSESSMENT

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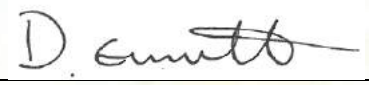
Report Status	Final
Report No	BEK-17303-1
Rev No	B
Date	November 2018
Prepared For	**MR M HURST** Higher College Farmhouse Lower Road Hothersall Preston, PR3 2YY
Prepared By	**BEK ENVIRO LIMITED** Suite One No 3 Mitton Road Business Park Mitton Road Whalley Lancashire BB7 9YE
	
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BEK Drawing No 17303-1	Site Location Plan
BEK Drawing No 17303-2	Site Layout Plan

1. INTRODUCTION

1.1 Appointment

1.1.1 BEK Enviro Limited (BEK) has been commissioned by Mark Hurst to provide a Flood Risk & Drainage Impact Assessment for Higher College Farmhouse, Hothersall, Preston (hereafter referred to as 'the site') to assess the potential risks associated with flood risk to the site for residential use.

1.1.2 The site is located within Flood Zone 1 of the Environment Agency Flood Map; and as such has a low risk of fluvial flooding.

1.2 Background

1.2.1 A site specific flood risk assessment provides an appraisal of flood risk both within the application site and any potential impact that the development will have on flood risk elsewhere; and provide recommendations for mitigation measures which may be included within the design of the development to reduce the overall risk of flooding.

1.2.2 An initial assessment indicates that the primary source of flooding risk to the development is an increase in surface water runoff as a result of development.

1.3 Objective and Scope of Work

1.3.1 The objective of this report is to evaluate the issues in regard to flood risk at the application site i.e. development of 21 new residential units at Higher College Farm, Hothersall, Preston, Lancashire.

1.3.2 The Flood Risk and Drainage Impact Assessment has been prepared to inform 'An outline planning application for a self-build residential scheme'. Specifically the following information is required as a minimum:

- Detailed site location and layout plans

Desktop study to incorporate maps showing:

- Topography of the development site, with contours at 1 m intervals
- Existing surface water flow routes, drains, sewers and watercourses
- Flood risk from main river and coastal sources
- Surface water and groundwater flood risk
- Geological and soil types

Flood Risk Assessment:

- Suitability of the proposed development in accordance with current planning policy
- Identify the risk to both the development and people from all forms of flooding
- Provide a preliminary assessment of foul and surface water management

- Review the relevant background information for the site, including:
  - National Planning Policy Framework
  - Planning Practice Guidance
  - Building Regulations Approved Document H
  - Environment Agency Flood Mapping
  - Lancashire County Council Strategic Flood Risk Assessment (2007)
  - BGS – Historic Borehole Logs
  - Cranfield University Soilscape Viewer
- Recommendation of appropriate measures to mitigate against flooding both within the proposed development, and neighbouring land and property.

Indicative Site Drainage Strategy, including:

- Preliminary sustainable drainage proposals
- Outfall Locations
- Discharge Rates
- On-site storage requirements

1.4 Scope of Report

1.4.1 The information provided within this report was undertaken via a desktop investigation using the guidance provided by Lancashire County Council in their Pre-Application Advice.

1.4.2 This report provides details of the information requested by Lancashire County Council to demonstrate how surface water will be managed on site, satisfying the principles of Paragraph 103 of the NPPF and Paragraph 80 of Section 10 of the PPG (Planning Policy Guidance).

1.5 Limitations

1.5.1 The conclusions and recommendations presented in this report are the result of our professional interpretation of the information currently available. BEK reserve the right to amend the conclusions and recommendations if further information becomes available.

1.5.2 However, it should be noted that much of the information has been derived from various internet resources and BEK takes no responsibility for the accuracy of that information.

1.5.3 The comments given in this report and the opinions expressed are based on review of information obtained by BEK.

2. DESKTOP STUDY

2.0.1 This section provides an overview of the information to satisfy the requirements of Lancashire County Council in their role as Lead Local Flood Authority (LLFA).

2.1 Site Location and Layout Plan

2.1.1 The site occupies a roughly rectangular plot of agricultural land of some 1.5 Hectares (11,000 m^2). The site generally falls towards the south and is currently comprised of a large agricultural field. Higher College Farmhouse and associated farm buildings are located towards the south of the site.

2.1.2 Detailed site location and layout plans are provided within Appendix E of this report.

2.2 Topographical Survey

2.2.1 A topographical survey of the site was completed by TriCAD Solutions Ltd in May 2017 and is provided within Appendix A of this report. The site is shown to fall from north to south with the general site level shown to be around 110 mAOD.

2.2.2 The highest spot level on the topographical survey is in the north-east of the site and is shown to be 112.23 mAOD with the lowest spot level in the south-west of the site with an elevation of 106.60 mAOD.

2.3 Existing Surface Water Flow Routes, Drains, Sewers and Watercourses

2.3.1 The existing development site is comprised of an agricultural greenfield. The agricultural field is not anticipated to have any formal drains or sewers. There is a small existing watercourse located approximately 20 m south-west of the development site.

2.3.2 It is considered that the existing farmhouse immediately south of the site is positively drained with surface water likely to drain towards an unnamed land drain located to the south-west of the site and foul from the existing farmhouse is likely to discharge into a septic tank.

2.3.3 There a number of manholes, inspection chambers and gullies located close to the existing farmhouse building with surface water directed towards the lowest part of the site in the south-west.

2.3.4 A surface water flow route is located towards the west of the site which flows from adjacent to the west of Spade Mill Reservoir No 2 in a southerly direction beneath Blackburn Road and adjacent to the west of the development site. It is understood the land drain is culverted as it flows along the western boundary of the site before becoming an open channel approximately 30 m south-west of the site.

2.4 Flood Risk from Main Rivers

2.4.1 The Environment Agency flood map indicates that the development site is located wholly within Flood Zone 1 as shown within the Figure overleaf. Flood Zone 1 is defined as land with a low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year.

2.4.2 As such the risk of Main River and coastal flooding to the development site is considered to be low.

Figure 1: Environment Agency Flood Map

Key

- Flood Zone 3
- Flood Zone 2
- Flood defences (Not all may be shown*)
- Areas benefiting from flood defences (Not all may be shown*)

2.5 Surface Water and Groundwater Flood Risk

2.5.1 Figure 2 below indicates that the risk of flooding from surface water to the development site is very low to low.

2.5.2 However there is a surface water flow route which flows in a southerly direction to the west of the site. The depth of flooding from this surface water flow route during the low risk event is below 300 mm adjacent to the development site.

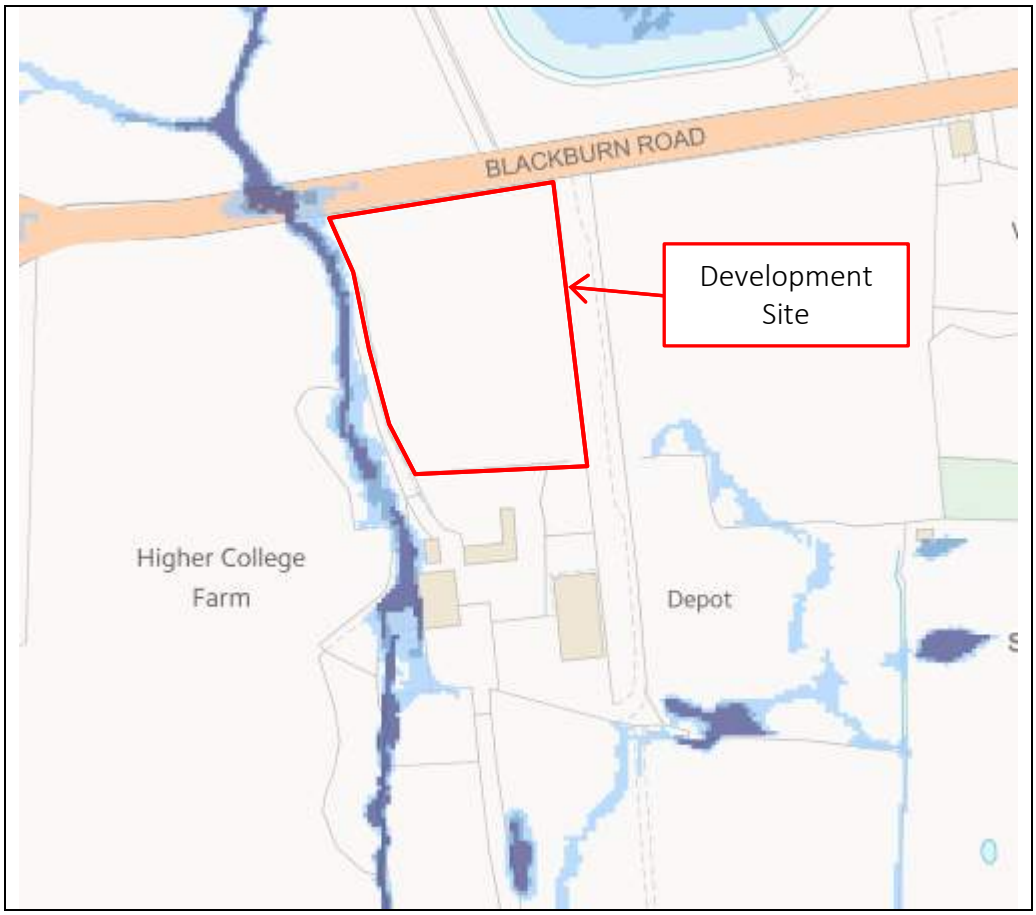


Figure 2 *: Environment Agency Flood Risk from Surface Water Map*

Key

High
Medium
Low
Very Low

2.5.3 The risk of groundwater flooding to the site is considered to be low with the Environment Agency Groundwater Designation Map indicating that the site is underlain by superficial deposits classified as a 'Secondary Undifferentiated Aquifer'.

2.5.4 The Environment Agency describes Secondary undifferentiated aquifers as:

'Undifferentiated aquifers has been assigned where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'

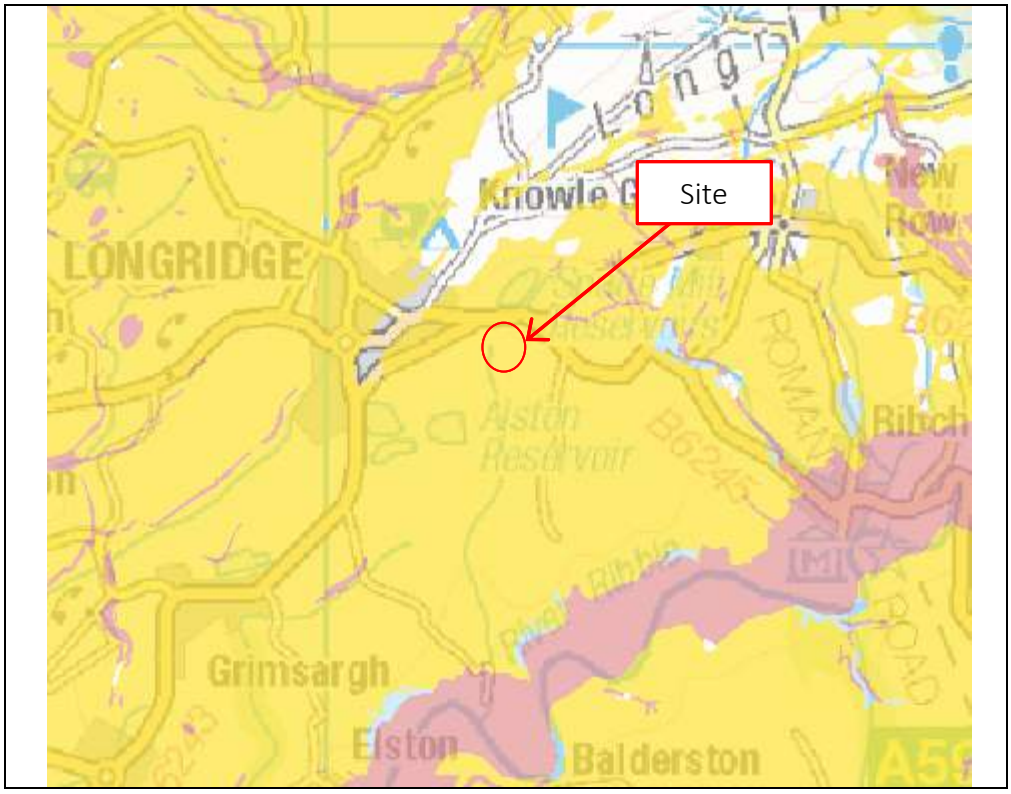


Figure 3: Environment Agency Groundwater (Superficial Deposits)

2.5.5 The bedrock aquifer designation is shown within the Figure below with the site shown to be located on bedrock classified as a 'Secondary A Aquifer' described as:

'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'

***Figure 4**: Environment Agency Groundwater (Bedrock Deposits)*

2.5.6 Due to the location of the site on an undifferentiated secondary superficial aquifer with a bedrock designation as a Secondary A aquifer it is not considered likely that groundwater flooding would pose a significant risk to the proposed site. Furthermore the Ribble Valley Strategic Flood Risk Assessment states that:

'Groundwater flooding is not considered by the Environment Agency to be a significant flood risk factor in the Ribble Valley Borough Council area.'

2.6 Geology and Soil Type

2.6.1 Information from the British Geological Society indicates that the bedrock geology at the development site is comprised of the Warley Wise Grit Member consisting of sandstones with part of the north of the site shown to be the Pendle Grit Member consisting of sandstone and siltstone.

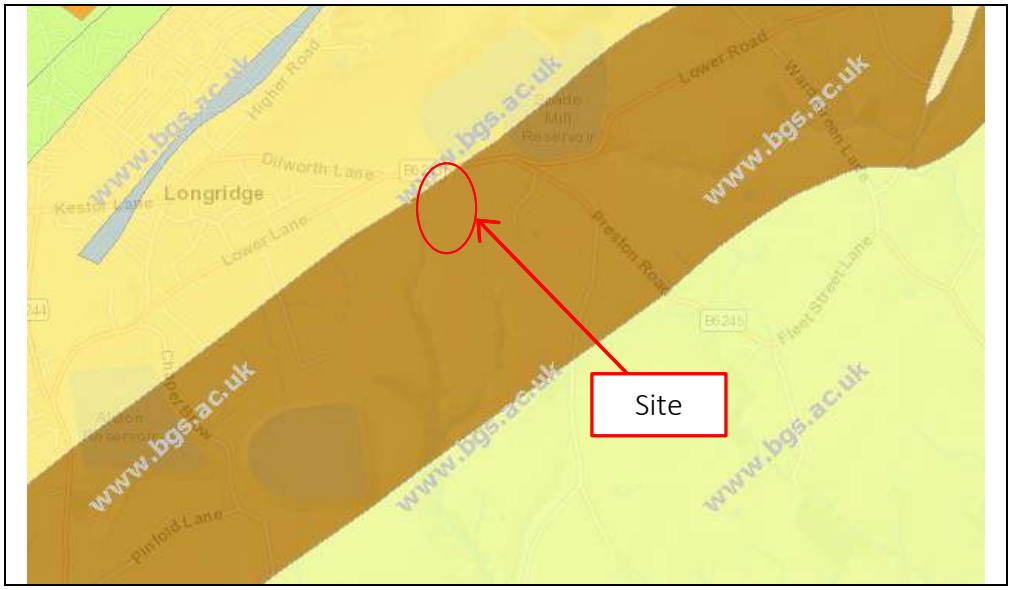


Figure 5: *BGS Bedrock Deposits*

2.6.2 The superficial geology is Till, Devensian – Diamicton (Boulder Clay). The soil type beneath the development site is considered to be slowly permeable seasonally wet acid loamy and clayey soils with impeded drainage.

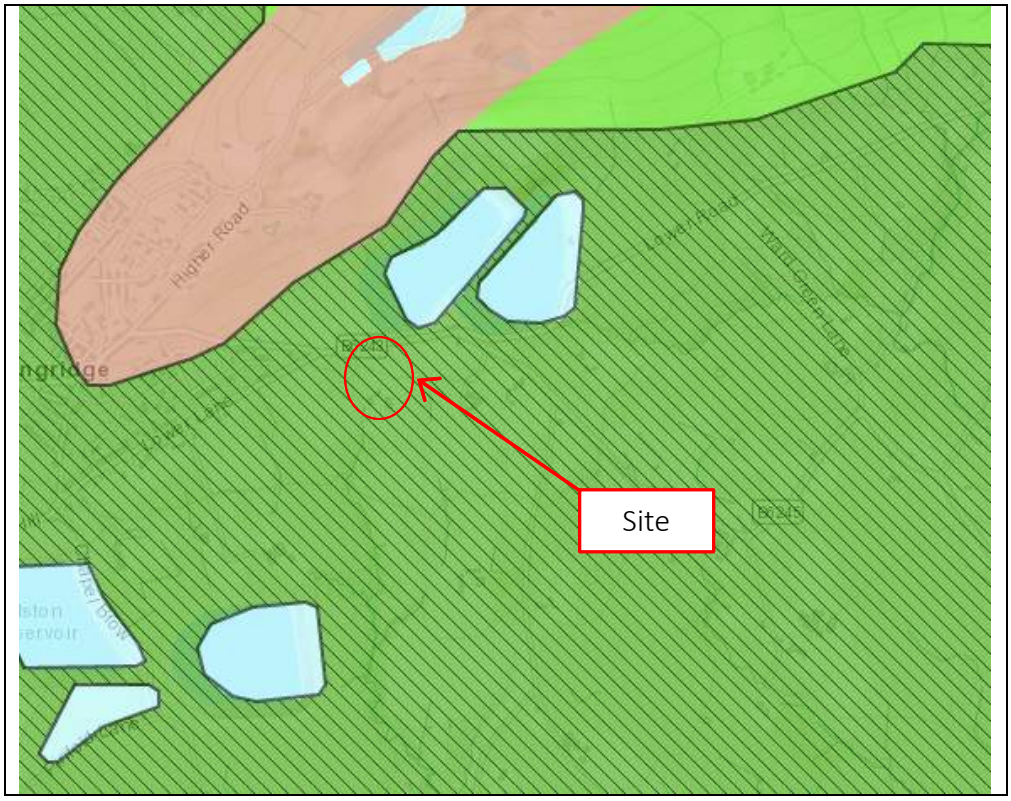


Figure 6: *Soilscapes Viewer*

Key

Soilscape 18:
Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils

3. FLOOD RISK ASSESSMENT

3.0.1 It is usual for the Environment Agency to raise an objection to development applications within the floodplain, or Zones 2 and 3 of the Environment Agency flood map until the issue of flood risk has been properly evaluated. The Agency will also object to developments where the total site area is in excess of 1 Hectare until suitable consideration has been given to surface water runoff.

3.0.2 The proposed development site is located wholly within Flood Zone 1 however it is greater than 1 hectare in size as such it is considered that a Site Specific Flood Risk Assessment is required.

3.1 Sequential and Exception Test

3.1.1 The objective of the Sequential Test is to steer new development to areas of the lowest probability of flooding, this takes into account the flood zones and the flood risk vulnerability classification of developments.

3.1.2 The Environment Agency flood map indicates that the proposed development site is within Flood Zone 1. Flood Zone 1 is defined as land assessed as having a less than 1 in 1000 annual probability of river flooding in any one year.

3.1.3 Proposals for the application site are for the development of new residential units at the site.

3.1.4 In accordance with Table 2 'Flood Risk Vulnerability Classification' of the Technical Guidance to the National Planning Policy Framework, commercial developments are defined as 'more vulnerable' development.

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test Required	✓	✓
	Zone 3a	Exception Test Required	✓	x	Exception Test Required	✓
	Zone 3b	Exception Test Required	✓	x	x	x

Table 1: Flood Risk Vulnerability and Flood Zone Compatibility

3.1.5 'More Vulnerable' developments within Flood Zone 1 are considered appropriate development. As such it is not considered that the undertaking of a Sequential/Exception Test will be required.

3.2 Historical Flooding

3.2.1 An internet search of flooding in the Hothersall area did not result in any results however it is acknowledged that the area is essentially rural therefore historical incidents of flooding may not have been recorded.

3.2.2 A review of Ribble Valley Borough Council Strategic Flood Risk Assessment indicates that there have been a number of historical flood event in the Ribble Valley area however Hothersall or Longridge are not referenced as having flooded.

3.2.3 A number of flooding incidents have been recorded in Ribchester located some 3.8 km south-east of the site however due to the distances involved it is not considered that the site has experienced flooding.

3.3 Surface Water Runoff

3.3.1 The proposed development site is over 1 Hectare in size therefore surface water runoff will need to be adequately assessed in order to ensure flood risk at the site and elsewhere is not increased as a result of development.

3.3.2 Surface water runoff will be assessed in more detailed in Section 4 of this report.

3.4 Fluvial Flooding

3.4.1 As mentioned previously within Section 2.4 of this report the site is located within Flood Zone 1 of the Environment Agency flood map.

3.4.2 Flood Zone 1 is defined as land with a low probability (less than 1 in 1000 year (<0.1% AEP) annual probability of river or sea flooding in any year.

3.4.3 As such the risk to the site from fluvial flooding is considered to be low.

3.5 Reservoir Flooding

3.5.1 The Environment Agency Flooding from Reservoirs map identifies that the proposed development is within the extent of flooding following a breach of a reservoir.

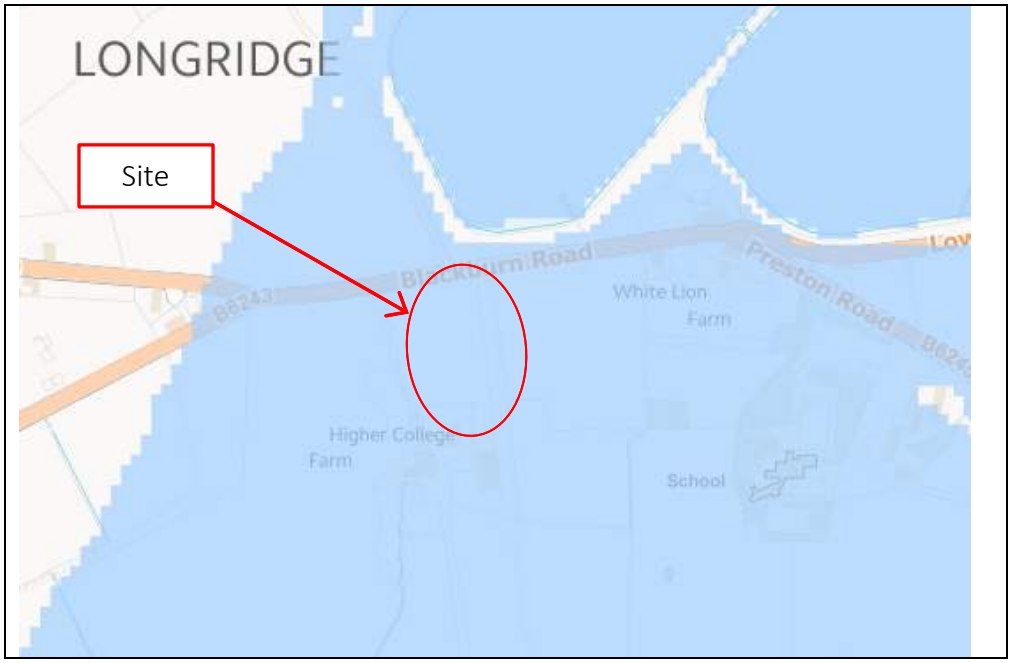


Figure 6: EA Flood Risk From Reservoir

3.5.2 There are two reservoirs located in close proximity to the site located some 45 m north of the site at the closest point. The reservoirs are known as Spade Mill Reservoir No 1 and No 2 and are owned by United Utilities.

3.5.3 It is noted that reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs are regularly inspected by reservoir panel engineers and the EA ensures that reservoirs are regularly inspected and essential safety work is undertaken as appropriate. As such the risk of flooding from this source is considered to be low.

3.6 Groundwater

3.6.1 As mentioned in Section 2.5 of this report the site is underlain by superficial deposits comprising Boulder Clay and bedrock deposits of the Warley Wise Grit Member.

3.6.2 The superficial deposits are classified by the Environment Agency as a 'Secondary Undifferentiated Aquifer'.

3.6.3 The bedrock aquifer designation is classified as a 'Secondary A Aquifer'.

3.6.4 Due to the location of the site on an undifferentiated secondary superficial aquifer with a bedrock designation as a Secondary A aquifer it is not considered likely that groundwater flooding would pose a significant risk to the proposed site. Furthermore the Ribble Valley Strategic Flood Risk Assessment states that:

'Groundwater flooding is not considered by the Environment Agency to be a significant flood risk factor in the Ribble Valley Borough Council area.'

3.6.5 As such the risk to the site from groundwater flooding is considered to be low.

3.7 Surface Water

3.7.1 As mentioned in Section 2.5 of this report the risk of surface water flooding to the site is considered to be very low to low with a surface water flow route located to the west of the site. As such the risk to the proposed development is considered to be low.

4. INDICATIVE DRAINAGE STRATEGY

4.1 Surface Water Drainage Hierarchy

4.1.1 The hierarchy for disposal of surface water from new developments is outlined within the Building Regulations Approved Document H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public sewer

4.2 Infiltration

4.2.1 Soilscapes viewer maps show that the site is situated on slowly permeable seasonally wet clayey and loamy soils. These types of soils would generally be unsuitable dissipation of surface water via infiltration.

4.2.2 Although considered very unlikely to be viable, the Lead Local Flood Authority may request additional evidence that the infiltration is unviable at the site. This can be provided by completing a percolation test in accordance with DG 365 (2016) as part of a detailed drainage design.

4.3 Discharge to Watercourse

4.3.1 The nearest watercourse to the site is a land drain which flows along the western boundary of the site in a southerly direction, it is understood that the land drain is culverted along the west of the site. The watercourse eventually discharges into the River Ribble some 3.7 km south of the site.

4.3.2 It is proposed that surface water is discharged into this land drain at existing greenfield runoff rates.

4.4 Preliminary Drainage Design

4.4.1 The purpose of this assessment is to demonstrate that a surface water drainage strategy is feasible for the development proposals and land available.

4.4.2 The existing site is comprised of a large agricultural field. Therefore flows leaving the development site will be restricted to existing greenfield runoff rates using a flow control; and excess flows must be attenuated within the new drainage system prior to discharge into the land drain/culverted watercourse which runs adjacent to the west of the site.

4.4.3 It is proposed that foul from the residential dwellings buildings will be pumped to a receiving foul sewer located towards the north of the site. The foul sewer

has been constructed as part of a new residential development off Dilworth Lane to the north of the site.

4.4.4 A preliminary drainage strategy is included within Appendix D of this report.

4.5 Outfall Locations

4.5.1 The hierarchy of surface water disposal states that surface water should be discharged into watercourse as discharge via infiltration is unlikely to be viable. The nearest watercourse is a land drain which flows towards the south located to the south-west of the development site.

4.5.2 As such the outfall from the site will be located to the west or south-west into the existing land drain which eventually discharges into the River Ribble some 3.7 km south of the site.

4.6 Discharge Rates

4.6.1 The existing site is wholly comprised of an agricultural greenfield.

4.6.2 Greenfield runoff rate limits are required to meet normal Greenfield runoff rate limits are required to meet normal best criteria in line with the Environment Agency Guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 Rev. E (2012) and the CIRIA SUDS Manual (2007).

4.6.3 Utilising the HR Wallingford Greenfield Runoff Estimation for Sites website greenfield runoff rates have been calculated for the 1 in 1 year, 1 in 30 year and 1 in 100 year return periods, and a summary of the results is tabulated below.

4.6.4 Flows in excess of this must be attenuated within the boundary of the development prior to disposal.

Return Period	Q_{bar}	Peak Flow Rate Site
1 in 1 year	10.1	8.79
1 in 30 year		17.17
1 in 100 year		21.01

Table 2: Existing Surface Water Runoff (1.13 Hectares)

4.7 On-site Storage Requirements

4.7.1 The proposed development site is comprised of 21 new residential dwellings and associated hardstanding comprising a total impermeable area of 0.56 Hectares which represents 49.6% of the total site area.

4.7.2 Using the Surface Water Storage Requirement module on HR Wallingford website indicative attenuation volumes for the 1 in 100 year event has been

calculated below. An additional 20% and 40% has been added to account for climate change over the lifetime of the development.

Return Period	Indicative Attenuation Volumes (m^3)		
	No Climate Change	20% Climate Change	40% Climate Change
1 in 100 year	201	290	378

Table 3: Indicative Attenuation Volumes (0.56 Hectares Impermeable)

4.7.3 The figures calculated above are indicative at this stage of the project and are subject to change following the results of percolation testing at the development site, and must not be used for detailed design purposes.

4.7.4 As such it is considered that a geocellular storage tank of 24 m x 11 m and a depth of 1.6 m at 95% porosity would be sufficient to attenuate flows on site for the 1 in 100 year plus 40% climate change rainfall event prior to discharge at greenfield runoff rate.

4.7.5 Alternatively, a mixture of attenuation and SUDS structures such as oversized pipes, swales, permeable paving and attenuation storage tanks could be utilised within the site to attenuate surface water prior to discharge.

4.7.6 It is noted that the current proposed site plans indicate that geocellular storage tanks could be located within the public open space of the site, alternatively private driveways could potentially be constructed from permeable paving, oversized pipes could be utilised beneath the roads within the site and swales could be utilised within the grassed areas of the site.

5. CONCLUSION AND RECOMMENDATIONS

5.1 The proposed development at Higher College Farm, Hothersall comprises the development of 21 residential dwellings and associated infrastructure and landscaping.

5.2 The site is shown to be located within Flood Zone 1 of the Environment Agency Flood map.

5.3 The primary source of flood risk to the site is identified to be from an increase in surface water runoff as a result of development.

5.4 Environment Agency surface water flood maps indicate the site is at very low risk of surface water flooding with a surface water flow route adjacent to the west of the site. It is considered that the surface water flow route is an existing unnamed watercourse/land drain and the risk of flooding from this source to the development is considered to be low.

5.5 The site is within an area that would experience flooding following a breach of the reservoirs located to the north of the site, however reservoir flooding is extremely unlikely to happen and the EA undertake routine inspection of reservoirs to ensure the risks of failure are low. As such this is considered to represent a low risk of flooding to the site.

5.5 The risks from secondary sources of flooding such as groundwater flooding, river flooding and artificial water sources have been investigated and are deemed to present a low risk of flooding to the site.

5.6 The site is comprised of an agricultural greenfield therefore greenfield runoff rates have been determined using IOH124 method.

5.7 Greenfield runoff rates have been determined to be 8.79 l/s, 17.17 l/s and 21.01 l/s for the 1 in 1 year, 1 in 30 year and 1 in 100 year return periods respectively.

5.8 It is considered that infiltration at the site is unlikely to be viable due to the underlying boulder clay at the site therefore following the hierarchy of surface water disposal, it is recommended that surface water is discharged into the unnamed watercourse/land drain to the west of the site.

5.9 Surface water attenuation requirements have been determined using the limiting greenfield discharge rate for the site. The maximum attenuation storage required is 378 m^3 however this is subject to change following production of a detailed drainage design for the site.

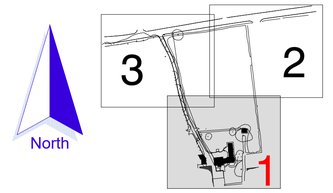
5.10 Therefore the proposed development would be able to manage surface water generated as a result of the development and would not increase flood risk at the development site or downstream of the site.

APPENDIX A

Topographical Survey

Notes

All Dimensions to be checked on site. Walls shown on plans are not to be assumed to be solid & should be checked for thickness, construction, load bearing capacity & stability.



0 2 4 6 8 10 12 14 16 18 20
Metres

ABBREVIATIONS

BOL	Bollard
BT	BT Cover
CH	Cable Height
CL	Cover Level
DK	Drop Kerb
EH	Eaves Height
FFL	Finished Floor Level
GU	Gully
IC	Inspection Cover
MH	Man Hole
RH	Ridge/Roof Height
SP	Sign Post
SVP	Soil Vent Pipe
TF	Top of Fence
TL	Threshold Level
TP	Telegraph Pole
TH	Top of Hedge
TW	Top of Wall
WV	Water Valve

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.0 Description. Issued

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Site Address

Higher College Farm
Lower Road
Hothersall PR3 2YY

Project Description

Site Survey

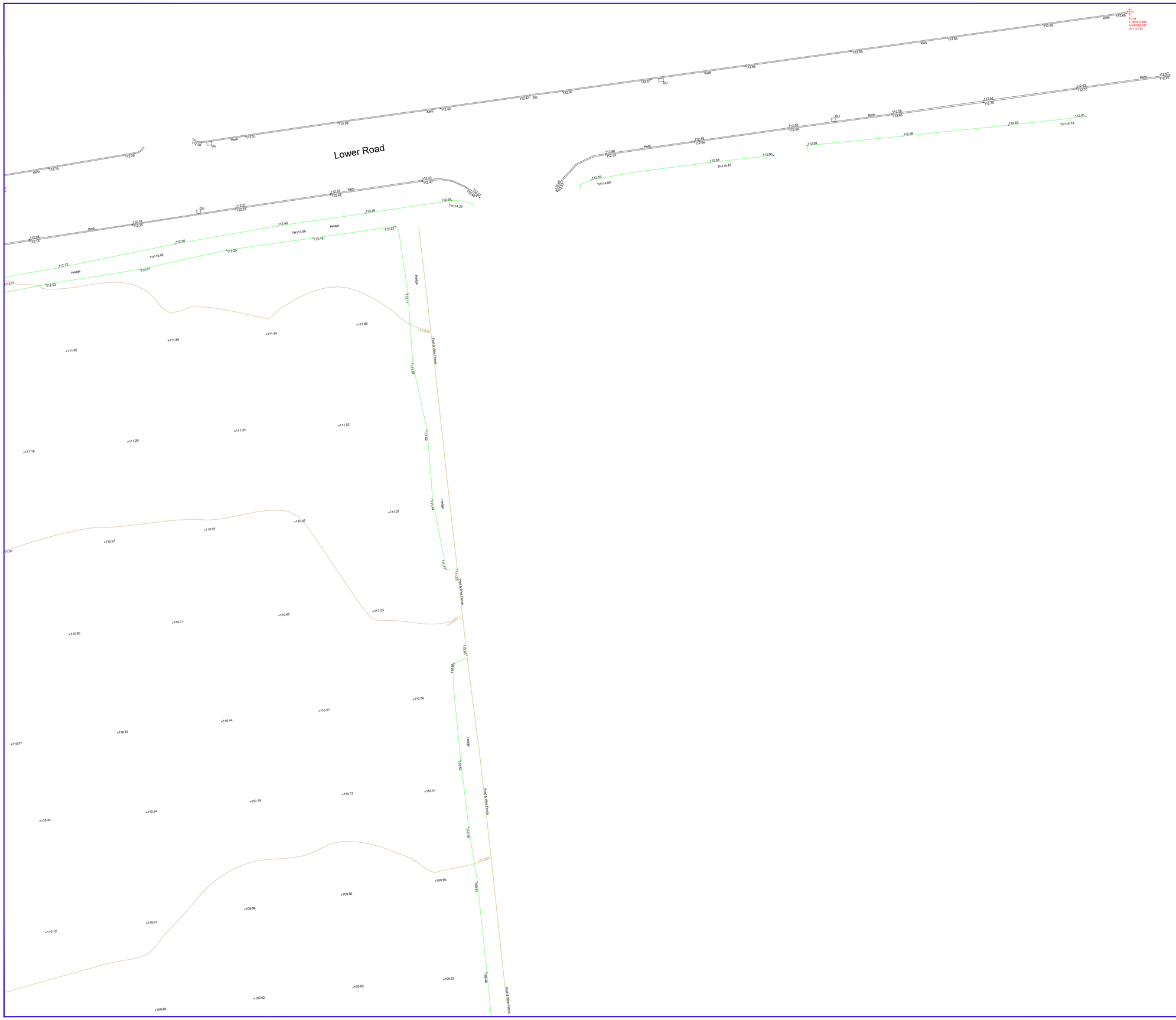
Drawing Title

Existing Site Layout

Scale	Date	Drawn By
1:200@A1	30/05/2017	MW

Drawing Number

TRI-2005-01



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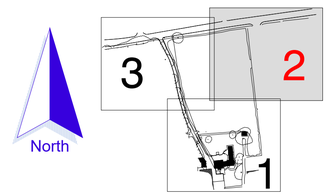

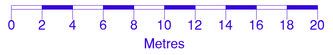

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Site Address

Higher College Farm
Lower Road
Hothersall PR3 2YY

Project Description

Site Survey

Drawing Title

Existing Site Layout

Scale	Date	Drawn By
1:200@A1	30/05/2017	MW

Drawing Number

TRI-2005-02

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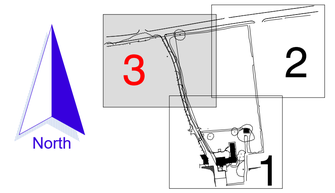

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TL	Threshold Level
TP	Telegraph Pole
TH	Top of Hedge
TW	Top of Wall
WV	Water Valve

NOTE

All levels and coordinates relate to OSGB36(15) using GNSS data.

Levels defining edge of carriageway are observed at channel (bottom of kerb).

Rev.0 Description. Issued

TriCAD Solutions Ltd.
BUILDING & LAND SURVEYORS
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tel 01254 614055 fax 01254 209754 e-mail sales@tricadsolutions.co.uk

Site Address
Higher College Farm
Lower Road
Hothersall PR3 2YY

Project Description
Site Survey

Drawing Title
Existing Site Layout

Scale	Date	Drawn By
1:200@A1	30/05/2017	MW

Drawing Number
TRI-2005-03

APPENDIX B

Greenfield Runoff Rates

HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	David Emmott
Site name:	Higher College Farm
Site location:	Hothersall

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.82953° N
Longitude:	2.5854° W

Reference:	6494316
Date:	2018-11-22T12:42:45

Methodology	IH124

Site characteristics

Total site area (ha)	1.13

Methodology

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
SOIL type	4	4
HOST class	---	---
SPR/SPRHOST	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm)	1185	1185
Hydrological region	10	10
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Notes:

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	10.1	10.1
1 in 1 year (l/s)	8.79	8.79
1 in 30 years (l/s)	17.17	17.17
1 in 100 years (l/s)	21.01	21.01

APPENDIX C

On-site Storage Requirements

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	David Emmott
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Site coordinates

Latitude:	53.82923° N
Longitude:	2.58537° W

Reference:	6494322
Date:	2018-11-22T12:58:55

Methodology	IH124

Site characteristics

Total site area (ha)	1.13
Significant public open space (ha)	0.57
Area positively drained (ha)	0.559999999
Pervious area contribution (%)	30
Impermeable area (ha)	0.559999999
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.56
Net impermeable area for storage volume design (ha)	0.56

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

Design criteria

Volume control approach	Use long term storage

	Default	Edited
Climate change allowance factor	1.0	1.0
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	5	5

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
Qbar total site area (l/s)	10.1	--
SOIL type	4	4
HOST class	N/A	N/A
SPR	0.47	0.47

Hydrology

	Default	Edited
SAAR (mm)	1185	1185
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.3	0.3
Rainfall 100 yrs 6 hrs	70	
Rainfall 100 yrs 12 hrs	99.96	
FEH/FSR conversion factor	1.19	1.19
Hydrological region	10	
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 10 year	1.38	1.38
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	10.1	10.1
Qbar net site area (l/s)	5.01	5.01
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	8.5	8.5
1 in 100 years (l/s)	10.4	10.4

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	22	22
Attenuation storage (m^3)	201	201
Long term storage (m^3)	91	91
Treatment storage (m^3)	67	67
Total storage *(excluding treatment)* (m^3)	315	315

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	David Emmott
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Site coordinates

Latitude:	53.82923° N
Longitude:	2.58537° W

Reference:	6494322
Date:	2018-11-22T12:58:20

Methodology	IH124

Site characteristics

Total site area (ha)	1.13
Significant public open space (ha)	0.57
Area positively drained (ha)	0.559999999
Pervious area contribution (%)	30
Impermeable area (ha)	0.559999999
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.56
Net impermeable area for storage volume design (ha)	0.56

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

Design criteria

Volume control approach	Use long term storage

	Default	Edited
Climate change allowance factor	1.2	1.2
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	5	5

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
Qbar total site area (l/s)	10.1	--
SOIL type	4	4
HOST class	N/A	N/A
SPR	0.47	0.47

Hydrology

	Default	Edited
SAAR (mm)	1185	1185
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.3	0.3
Rainfall 100 yrs 6 hrs	70	
Rainfall 100 yrs 12 hrs	99.96	
FEH/FSR conversion factor	1.19	1.19
Hydrological region	10	
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 10 year	1.38	1.38
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	10.1	10.1
Qbar net site area (l/s)	5.01	5.01
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	8.5	8.5
1 in 100 years (l/s)	10.4	10.4

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	22	22
Attenuation storage (m^3)	290	290
Long term storage (m^3)	91	91
Treatment storage (m^3)	67	67
Total storage *(excluding treatment)* (m^3)	404	404

HR Wallingford
Working with water

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	David Emmott
Site name:	Higher College
Site location:	Longridge

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Site coordinates

Latitude:	53.82923° N
Longitude:	2.58537° W

Reference:	6494322
Date:	2018-11-22T12:54:58

Methodology	IH124

Site characteristics

Total site area (ha)	1.13
Significant public open space (ha)	0.57
Area positively drained (ha)	0.559999999
Pervious area contribution (%)	30
Impermeable area (ha)	0.559999999
Percentage of drained area that is impermeable (%)	100
Impervious area drained via infiltration (ha)	0
Return period for infiltration system design (year)	10
Impervious area drained to rainwater harvesting systems (ha)	0
Return period for rainwater harvesting system design (year)	10
Compliance factor for rainwater harvesting system design (%)	66
Net site area for storage volume design (ha)	0.56
Net impermeable area for storage volume design (ha)	0.56

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

Design criteria

Volume control approach	Use long term storage

	Default	Edited
Climate change allowance factor	1.4	1.4
Urban creep allowance factor	1.1	1.1
Interception rainfall depth (mm)	5	5
Minimum flow rate (l/s)	5	5

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type

	Default	Edited
Qbar total site area (l/s)	10.1	--
SOIL type	4	4
HOST class	N/A	N/A
SPR	0.47	0.47

Hydrology

	Default	Edited
SAAR (mm)	1185	1185
M5-60 Rainfall Depth (mm)	20	20
'r' Ratio M5-60/M5-2 day	0.3	0.3
Rainfall 100 yrs 6 hrs	70	
Rainfall 100 yrs 12 hrs	99.96	
FEH/FSR conversion factor	1.19	1.19
Hydrological region	10	
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 10 year	1.38	1.38
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Site discharge rates

	Default	Edited
Qbar total site area (l/s)	10.1	10.1
Qbar net site area (l/s)	5.01	5.01
1 in 1 year (l/s)	5	5
1 in 30 years (l/s)	8.5	8.5
1 in 100 years (l/s)	10.4	10.4

Estimated storage volumes

	Default	Edited
Interception storage (m^3)	22	22
Attenuation storage (m^3)	378	378
Long term storage (m^3)	91	91
Treatment storage (m^3)	67	67
Total storage *(excluding treatment)* (m^3)	492	492

APPENDIX D

Preliminary Drainage Design

LEGEND

PROPOSED SURFACE WATER DRAIN

PROPOSED SW MANHOLE

PROPOSED FOUL DRAIN

PROPOSED FOUL MANHOLE

REV	DESCRIPTION	DATE	BY

GEO-ENVIRONMENTAL CONSULTING ENGINEERS
Suite One, No 3 Mitton Road Business Park, Mitton Road, Whalley, Lancashire BB7 9YE
Tel: 01254 377622 Mob: 07906753583
Email: mbuckley@bekenviro.co.uk
Web: www.bekenviro.co.uk

CLIENT.

MR M HURST

JOB TITLE.

HIGHER COLLEGE FARMHOUSE, HOTHERSALL, PRESTON

DRAWING TITLE.

PRELIMINARY DRAINAGE DESIGN

SCALE @ A3.	DRAWN BY.	APPROVED BY.	DATE.
NTS	D.E.	M.B.	23/11/18

DRAWING No.	REV.
17303-5	-

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Rev	Drawn	Description	Date
A	RBM	Entrance layout amended.	15.11.2018

Client
Mr M. Hurst

Job Title
Proposed Development of
Land Adjacent to
Higher College Farm
Longridge
PR3 2YY

Drawing Title
Illustrative Site Layout

Scale	Date	Drawn
1:200 @ A1	Sept 2018	RBM

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5296 - P01 REV A