KINGMOOR
CONSULTING

Report Title	# Drainage Strategy
Property Address	Wath Brow Hornets Wath Brow Cleator Cumbria CA23 3EW
Client	SRE Associates
Our Reference	20-105r001
Date	17th March 2020
Prepared by	Colin Aimers BEng Hons CEng MICE CEnv Director

Contents

Introduction

The purpose of this report is to provide a strategy for the management and implementation of surface water drainage for the proposed development of a indoor training facility at the Wath Brow Hornets, Wath Brow, Cleator Cumbria (thereafter referred to as Site). The report has been commissioned by owners, for the purposes of assisting the planning process.

Research has been undertaken on the site and observations made regarding the existing site and its former history.

The report should be read in conjunction with the documents referenced to it, generally appended to this report, and all works has been designed in accordance with the following standards :

- CIRIA Publication C753 The SuDS Manual
- CIRIA Publication C768 Guidance on the Construction of SuDS

Calculations associated with the drainage have been performed by online packages from a recognised resource. Where appropriate copies of calculations are provided in the Appendices of this report.

Existing Site and Drainage

Surface Water

The site currently comprises a parcel of land approx 12,000 m2 which is the overall site used for by Wath Brow Hornets, including car parking, changing facilities, bars, spectator areas and the rugby pitch.

At present, local drainage around the site and pitch collect flows from impermeable areas and areas with formal drainage to the north east corner of the site where the surface water enters a formal drain and passes down toward the River Ehen via a formal arrangement. Beyond the site boundary, the exact arrangements for drainage are unknown and untraceable.

From discussions with neighbours to the site, it is noted that surface water runoff from the site flows towards the rear garden at No 92 Trumpet Road and over time, this has historically flooded during periods of heavy rainfall.

Foul Water

The site is presently serviced by mains foul drainage to the north west where it enters the public sewer network maintained by United Utilities. The exact arrangements of the existing network from the site were not fully investigated.

Drawing 20-105 DWG001 indicates the existing drainage on the site.

Ground Conditions

Ground conditions published by the British Geological Survey indicates that the site is underlain by Diamicton Till generally comprising sandy clays and the solid geology comprises Buttermere Formation, generally a sandstone / mudstone identified locally.

Trial pits were conducted on the site by Toman Contractor, and this indicated that the site was generally reworked gravelly clays and a large amount of imported materials comprising inert granular building waste.

Proposed Drainage Strategy

Surface Water

It is proposed that the development will discharge to the existing surface water network servicing the site. The existing network is well maintained and operational, and the additional non permeable roof area is a small proportion of the overall area carried by the drainage system.

The removal of informal drainage to ground around the proposed area of the site will also alleviate the potential runoff and flooding to adjacent properties, gardens and allotments areas.

Roofs will drain into proprietary rainwater goods present on each side of the building. This will carry water into the surface water system located around the building and discharge to a new pipe carrying the surface water system into the existing surface water network.

CCTV Surveys will be conducted on the existing network to ensure it is fit for purpose and in good condition at the time of the works.

Existing permeable surfaces and areas will be maintained and if appropriate, remedial works performed on these elements, including resurfacing with suitable imported materials, and cleaning.

Foul Water

It is not proposed that foul water will be required in the training facility and existing facilities will be used on the wider site.

Detailed Design

Surface Water

Calculations have been undertaken in UK SUDS to identify the overall site runoff. The following table indicates these greenfield flow rates for the overall site.

Storm Event	Greenfield Flow Rate (l/s)
Qbar	12.35
1 in 1 year	10.75
1 in 30 years	21
1 in 100 years	25.69
1 in 200 years	29.27

Based on the roof area of the proposed training facility, calculations undertaken in Tekla TEDDS software to calculate the required attenuation volume for the proposed impermeable areas of the new training facility based on greenfield runoff rates . From these calculations, attenuation of 15cuM based on the 1 in 100 year storm event plus 40% climate change has been calculated.

This will be in the form of stormcell crates or similar buried in the remaining car park area and outfalling to the existing surface water network. We consider this an appropriate solution and would limit any increases in flows to the existing system during storm events. It would also prevent any flooding occurring within the site and to the neighbouring properties.

Appendices

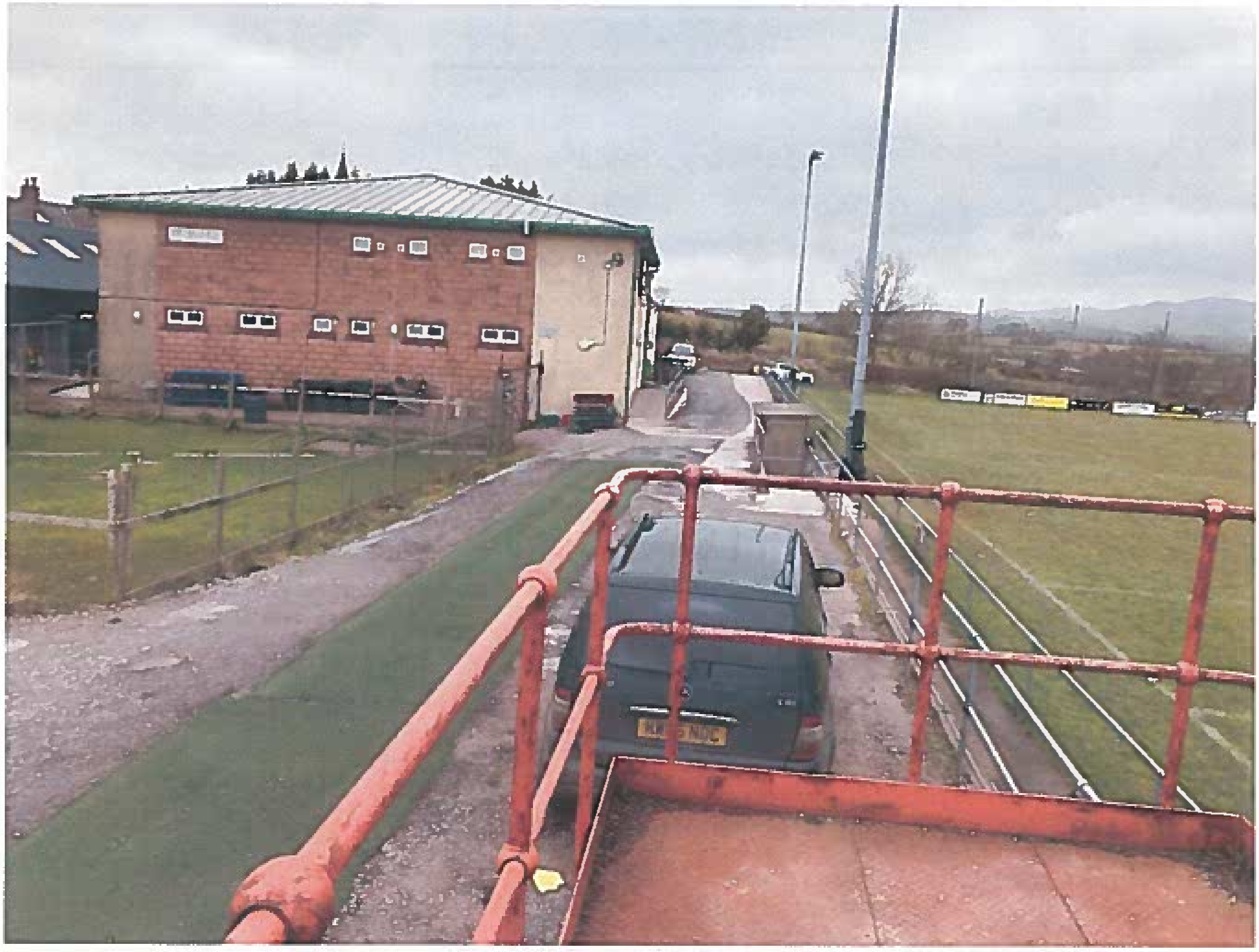
Site Photographs

View West towards Site

View West towards Site

View of proposed site

View of proposed site



View east

Garden to rear of 92

Manhole towards eastern boundary

Manhole Adjacent to eastern boundary

Final Outfall from site

Final Outfall from site

BGS Geology Maps

Solid Geology

GeoIndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

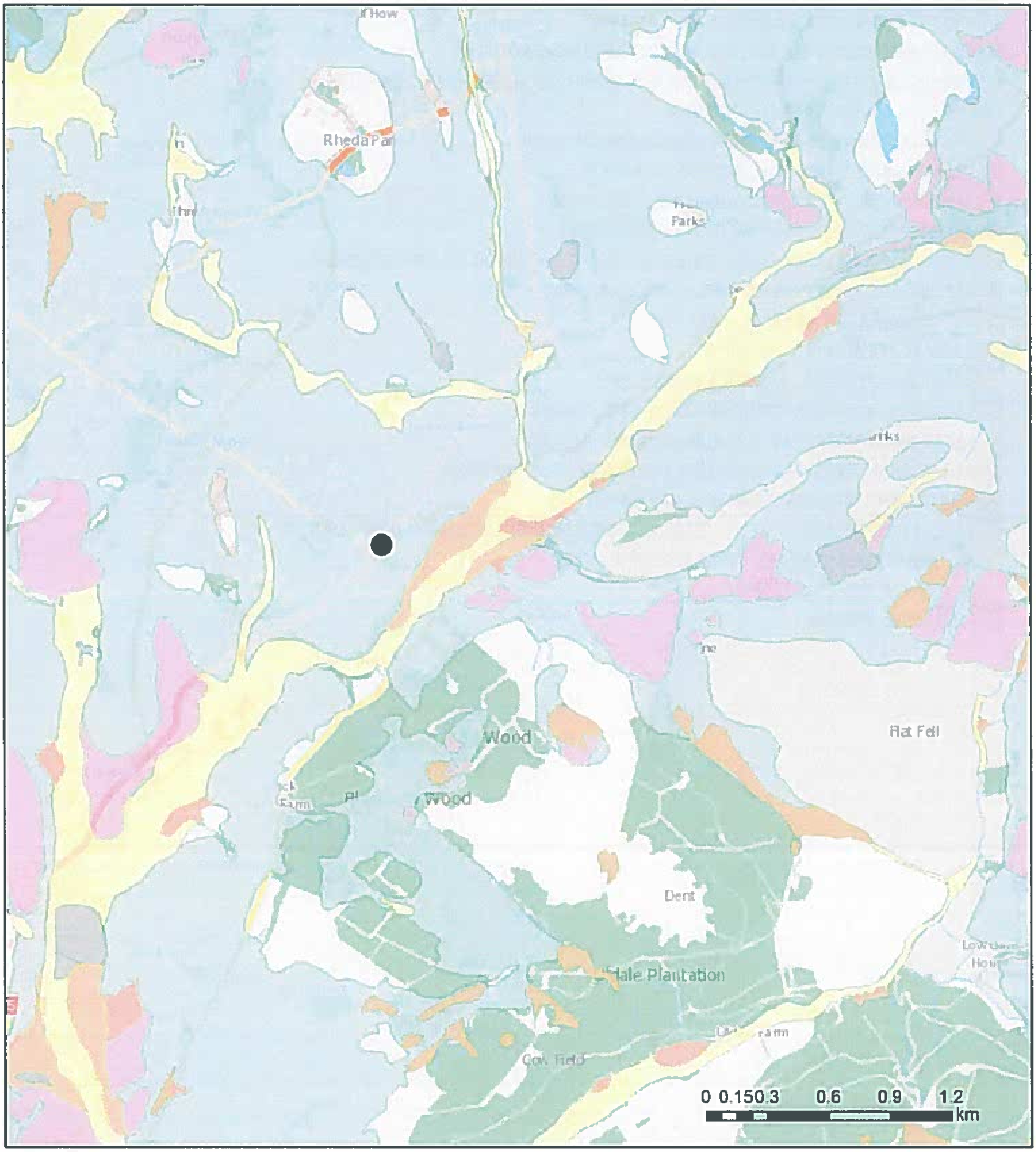
Map Key

Bedrock geology 1:50,000 scale

- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - MICRODIORITE
- KIRK STILE FORMATION - MUDSTONE AND SILTSTONE
- FIRST SHALE MEMBER - SANDSTONE, SILTSTONE AND MUDSTONE
- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- FIRST LIMESTONE (CUMBRIA) - LIMESTONE
- MILLYEAT MEMBER - MUDSTONE, SANDSTONE AND LIMESTONE
- MARSETT SANDSTONE FORMATION - CONGLOMERATE
- DEVOKE WATER TUFF MEMBER - VOLCANICLASTIC-BRECCIA
- BUTTERMERE FORMATION - MUDSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- STAINMORE FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- ST BEES SANDSTONE MEMBER - SANDSTONE
- OREBANK SANDSTONE - SANDSTONE
- ENNERDALE INTRUSION - GRANITE, GRANOPHYRIC
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - FELSITE
- LAKE DISTRICT DEVONIAN MINOR INTRUSION SUITE - ANDESITE
- ST BEES SHALE FORMATION - SILTSTONE AND MUDSTONE, INTERBEDDED
- WHITEHAVEN SANDSTONE FORMATION - SANDSTONE
- ST BEES EVAPORITE FORMATION - DOLOMITIC LIMESTONE, MUDSTONE AND ANHYDRITE-STONE
- LATTERBARROW SANDSTONE FORMATION - SANDSTONE
- HENSINGHAM GRIT - SANDSTONE
- BROCKRAM - BRECCIA

Superfical Geology

GEOINDEX ONSHORE



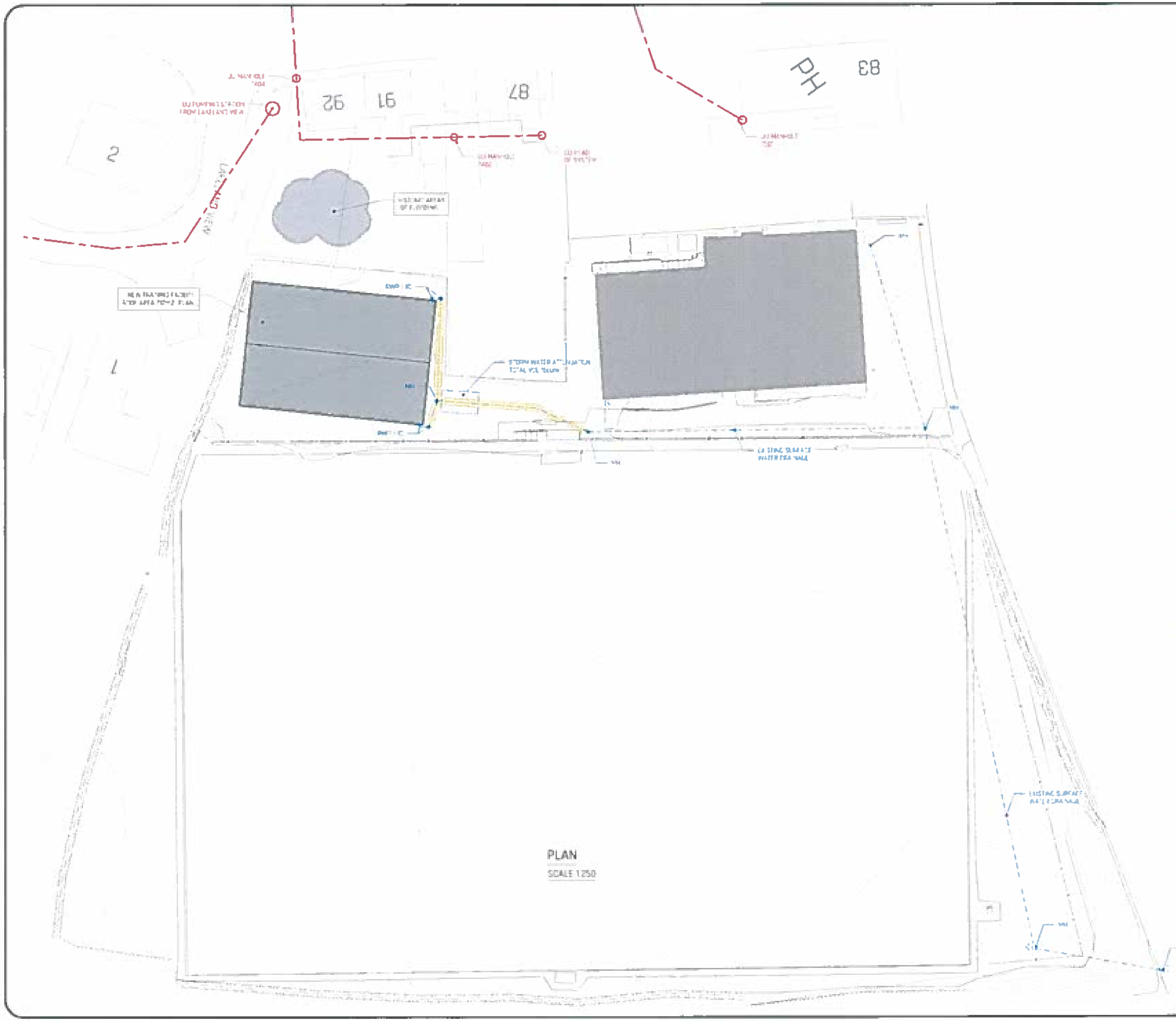
Geolndex Onshore Data Sources: NERC, Natural England, English Heritage and Ordnance Survey

Map Key

Superficial deposits 1:50,000 scale

- GLACIOFLUVIAL DEPOSITS, DEVENSIAN - SAND AND GRAVEL
- TILL, DEVENSIAN - DIAMICTON
- TALUS - ROCK FRAGMENTS, ANGULAR, UNDIFFERENTIATED SOURCE ROCK
- HUMMOCKY (MOUNDY) GLACIAL DEPOSITS, DEVENSIAN - CLAY, SAND AND GRAVEL
- ALLUVIUM - CLAY, SILT, SAND AND GRAVEL
- HEAD - CLAY, SILT, SAND AND GRAVEL
- RIVER TERRACE DEPOSITS, 1 - CLAY, SAND AND GRAVEL
- ALLUVIAL FAN DEPOSITS - SAND AND GRAVEL
- PEAT - PEAT
- SUPERFICIAL THEME NOT MAPPED [FOR DIGITAL MAP USE ONLY] - UNKNOWN/UNCLASSIFIED ENTRY

Drawings



KEY

UNITED UTILITIES COMBINED

SITE FOUL DRAINAGE

EXISTING SITE SURFACE WATER

PROPOSED SURFACE WATER

IMPERMEABLE SURFACES

UNDERGROUND CRATED ATTENUATION

KINGMOOR CONSULTING

NEW TRAINING FACILITY
WATH BROW HORNETS, CLEATOR

SURFACE AND FOUL WATER
DETAILED ARRANGEMENTS

1:250	FOR PLANNING PURPOSES	
A1	C AIMERS	C AIMERS
PLANNING	MARCH 2020	MARCH 2020
20-105-DWG001		A

Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

HR Wallingford
Working with water

Calculated by:	Colin Aimers
Site name:	Wath Brow Hornets
Site location:	Cleator

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	54.51604° N
Longitude:	3.50404° W
Reference:	1184592397
Date:	Mar 17 2020 09:16

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.20

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

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

Hydrological characteristics

	Default	Edited
SAAR (mm):	1337	1337
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	12.35	12.35
1 in 1 year (l/s):	10.75	10.75
1 in 30 years (l/s):	21	21
1 in 100 year (l/s):	25.69	25.69
1 in 200 years (l/s):	29.27	29.27

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	Calcs for				Start page no./Revision 1	
	Calcs by C	Calcs date 17/03/2020	Checked by	Checked date	Approved by	Approved date

ATTENUATION DESIGN

In accordance with CIRIA publication C753 - The SUDS Manual

Tedds calculation version 1.0.04

Allowable discharge method

Site characteristics

Location	Carlisle
Hydrological region	10
Soil type (Wallingford Procedure W.R.A.P map)	4
Standard percentage runoff	SPR = **0.47**
Average annual rainfall	SAAR = **800** mm
5 year return period rainfall of 60 minute duration	M5_60min = **17.0** mm
Ratio 60-minute to 2 day rainfalls of 5 year return	r = **0.35**
Rainfall intensity increase due to global warming	$p_{climate}$ = **40%**

Catchment details

Subcatchment	Name	Area (ha)	PIMP (%)	Impermeable. area (ha)
1;	New Training;	0.03;	100.0	0.03;
	Total	0.03;	100.0	0.03;

Greenfield runoff rates

Catchment area — AREA = **50.00** hectare

Greenfield runoff rate (50 hectare site) — $\bar{Q}_{rural} = 0.00108 m^3/s \times (AREA/1km^2)^{0.89} \times (SAAR/1mm)^{1.17} \times SPR^{2.17}$ = **282.2** l / s

Greenfield runoff rate — $\bar{Q} = \bar{Q}_{rural} / AREA \times A$ = **0.1** l / s

Greenfield runoff rate per unit area — $\bar{Q}_A = \bar{Q} / A$ = **5.6** l / s / hectare

Estimated site discharges

FSR growth rate (2 year)	FSR_{2yr} = **0.91**
Discharge (2 year)	$Q_{2yr} = \bar{Q} \times FSR_{2yr}$ = **0.1** l/s
FSR growth rate (30 year)	FSR_{30yr} = **1.70**
Discharge (30 year)	$Q_{30yr} = \bar{Q} \times FSR_{30yr}$ = **0.2** l/s
FSR growth rate (100 year)	FSR_{100yr} = **2.08**
Discharge (100 year)	$Q_{100yr} = \bar{Q} \times FSR_{100yr}$ = **0.3** l/s

Table equations

Total surface water	$V_w = A_{imp} \times M$
Permitted dischrage	$Q_{allow} = Q_{2yr} \times D$
Storage volume required	$V_{req} = V_w - Q_{allow}$

Attenuation storage

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m^3)	Permit dischrge (2 years) (m^3)	Storage vol. reqd (m^3)
5	0.36;	8.5;	1.47;	12.5;	3.12;	0.04;	3.08
10	0.51;	12.1;	1.51;	18.1;	4.54;	0.08;	4.46
15	0.62;	14.7;	1.52;	22.4;	5.59;	0.12;	5.48
30	0.79;	18.7;	1.54;	28.8;	7.20;	0.23;	6.97

Duration (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall (mm)	Total surf water (m^3)	Permit dischrge (2 years) (m^3)	Storage vol. reqd (m^3)
60	1.00;	23.8;	1.54;	36.6;	9.14;	0.46;	8.68
120	1.22;	29.1;	1.52;	44.2;	11.04;	0.92;	10.12
240	1.50;	35.6;	1.49;	53.0;	13.24;	1.85;	11.39
360	1.69;	40.2;	1.47;	59.0;	14.74;	2.77;	11.96
600	1.95;	46.3;	1.44;	66.6;	16.65;	4.62;	12.02
1440	2.48;	59.0;	1.39;	82.2;	20.55;	11.09;	9.45

Attenuation storage required

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

Maximum attenuation storage required $V_{req\_max} = V_{max} \times p_{hydro}$ = **15.0 m^3**

Interception storage

Interception rainfall depth d_{int} = 5 mm

Volume of interception storage required $V_{int\_req} = 0.8 \times A_{imp} \times d_{int}$ = **1.00 m^3**