GEO-ENVIRONMENTAL CONSULTING ENGINEERS

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DRAINAGE IMPACT ASSESSSMENT REPORT

PHASE 3 MITTON ROAD BUSINESS PARK
WHALLEY

REPORT REF: BEK-16211-3 January 2017

REPORT PREPARED FOR

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Project Quality Assurance Information Sheet

DRAINAGE IMPACT ASSESSMENT

Phase 3 Mitton Road Business Park, Whalley

Report Status	Final
Report No	BEK-16211-3
Rev No	0
Date	January 2017
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1. INTRODUCTION

1.1 Background

1.1.1 BEK Enviro Limited (BEK) has been commissioned by David Hollinrake (c/o Sunderland Peacock Associates) to provide a Drainage Impact Assessment for Phase 3 of Mitton Road Business Park, Mitton Road, Whalley (hereafter referred to as 'the site') to assess the principles of surface water drainage associated with the proposed development.

1.1.2 The site occupies a roughly rectangular plot of vacant land of approximately 9,500 m^2 which is located immediately east of Mitton Road some 1.1 km north-west of the centre of the village of Whalley and some 4.8 km south of Clitheroe town centre.

1.1.3 The site is currently occupied by a plot of agricultural land which is comprised of grassland and delineated by hedgerows and wooden fences.

1.2 Planning Permission

1.2.1 The Drainage Impact Assessment has been prepared to inform a Planning Application for the development of 8 commercial buildings and associated hardstanding and parking areas.

1.2.2 Specifically the following information is required as a minimum to support the outline planning application:

- 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:

- An appropriate site-specific flood risk where one is required, completed in line with the Environment Agency's guidelines: https://www.gov.uk/planning-applications-assessing-flood-risk

Indicative Site Drainage Strategy, including:

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

1.3 Scope of Report

1.3.1 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.

1.3.2 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).

1.4 Limitations

1.4.1 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.

1.4.2 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.

1.4.3 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 9,500 m^2. The site generally falls towards the east and is currently comprised of an agricultural field.

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

2.2 Topographical Survey

2.2.1 Topographical information for the development site using LIDAR data is provided within Appendix B of this report. The site is shown to fall from west to east with the general site level shown to be around 57.50 mAOD.

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

2.3.1 The existing development site is wholly comprised of an agricultural greenfield on a relatively gentle slope and therefore it is not considered to have any drains or sewers intercepting the site. There is a small existing watercourse located approximately 180 m east of the development site.

2.3.2 As part of the planning application for the Mitton Road Business Park (Phase 1) (previously granted) to the north of the development site, surface water from the development site is discharged into a collection tank before discharge into an existing soakaway which served the original 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.

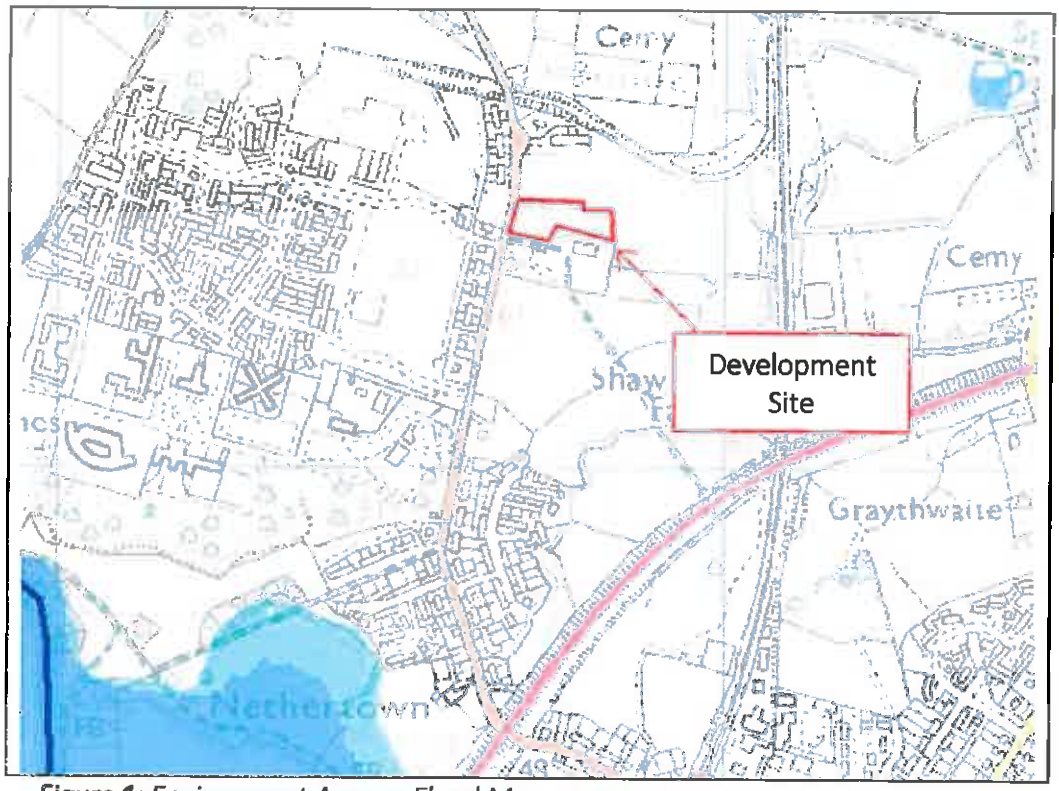


Figure 1: Environment Agency Flood Map

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.

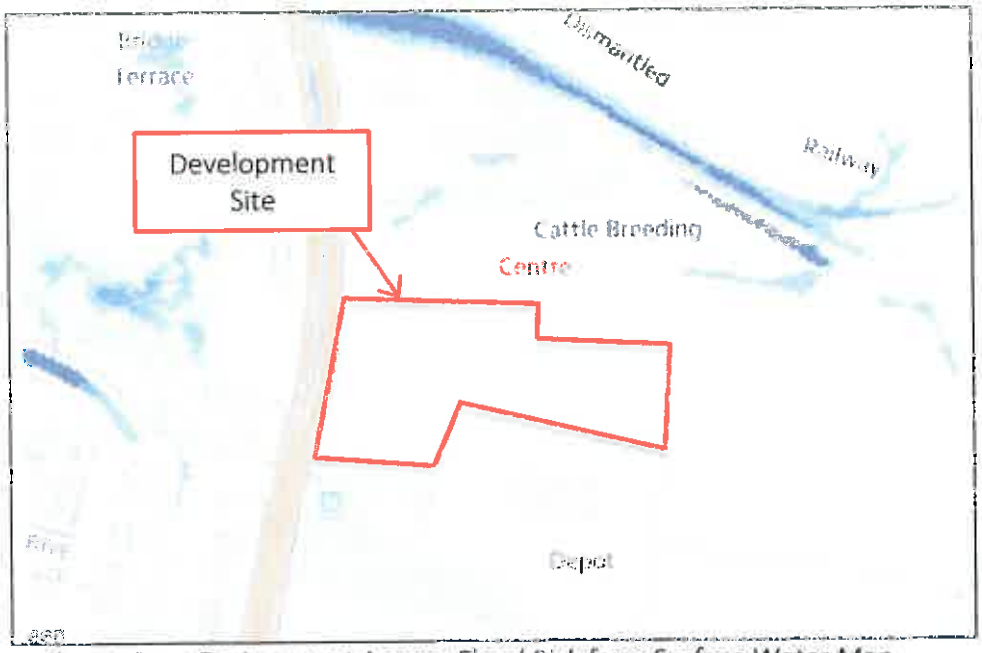


Figure 2 : Environment Agency Flood Risk from Surface Water Map

Key

High
Medium
Low
Very Low

2.5.2 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'.

2.5.3 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)*

2.5.4 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'

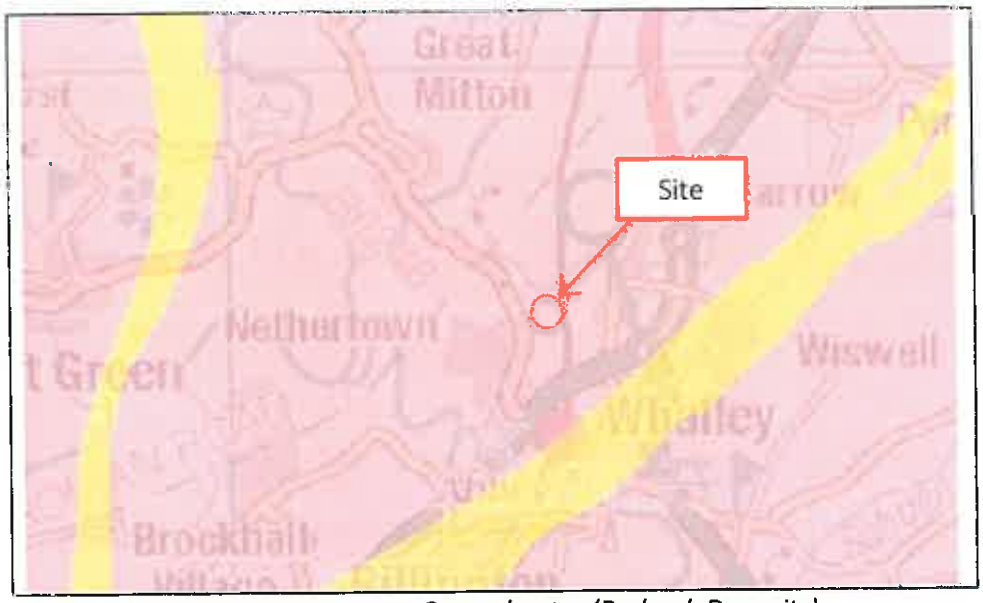


***Figure 4**: Environment Agency Groundwater (Bedrock Deposits)*

Key

- Principal
- Secondary A
- Secondary B
- Secondary (undifferentiated)
- Unknown (lakes and landslip)

2.5.5 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 Clitheroe Limestone Formation and the Hodder Mudstone Formation (undifferentiated) – Mudstone.

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.

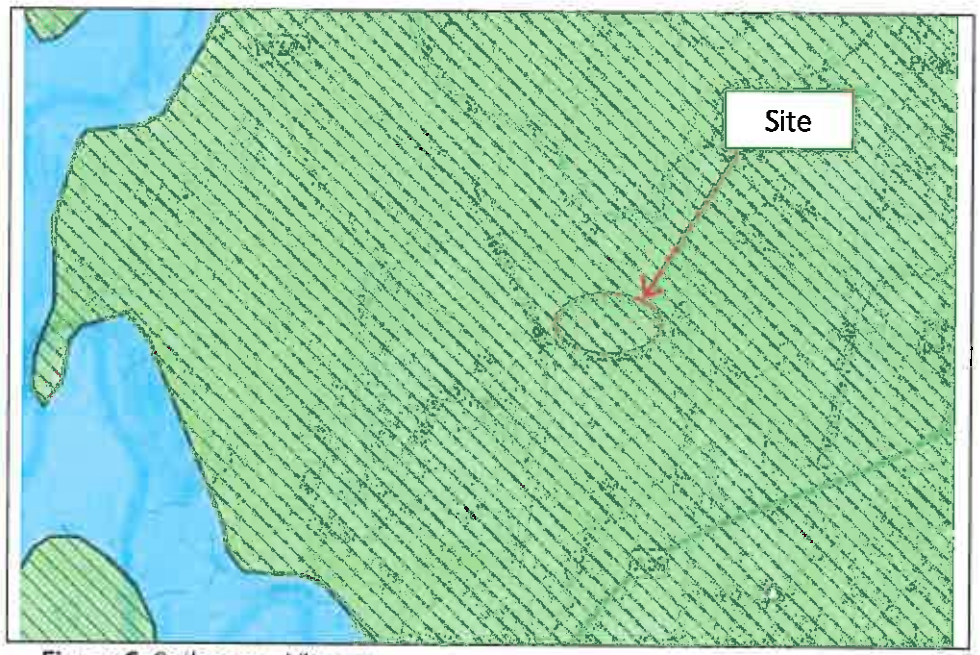


Figure 6: Soilscapes Viewer

Key

Soilscape 17:
Slowly permeable seasonally wet acid loamy and clayey soils

3. FLOOD RISK ASSESSMENT

3.1 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.

3.2 The proposed development site is located wholly within Flood Zone 1 and is less than 1 hectare in size as such it is not considered that a Site Specific Flood Risk Assessment is required.

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. However it is noted that anecdotal information indicates that soakaways have previously been utilised within the Mitton Road area of Whalley.

4.2.2 As there is anecdotal evidence that infiltration works in this area then it is considered that infiltration at the development site may be viable and therefore surface water should be discharged via soakaway in accordance with the hierarchy for surface water disposal. However, it is recommended that percolation testing at the development site is undertaken in accordance with DG 365 (2016) in order to provide evidence of the infiltration rate at the site.

4.3 Preliminary Drainage Design

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

4.3.2 The existing site is wholly comprised of an agricultural greenfield and therefore flows leaving the site will be restricted to existing greenfield runoff rates using a flow control; excess flows must be attenuated within the new drainage system prior to discharge into a surface water attenuation tank and then discharged via infiltration.

4.3.3 If it is deemed that infiltration rates at the development site are not suitable for the dissipation of surface water via infiltration methods then the hierarchy of surface water disposal recommends that discharge to watercourse is investigated and, if that is not viable, then discharge into a United Utilities sewer.

4.3.4 It is noted that foul from the site will be pumped to a receiving United Utilities sewer either connecting to the existing Phase 1 and Phase 2 foul pump or utilising a new pump for Phase 3 of the site.

4.3.5 A preliminary drainage strategy is included within Appendix C of this report.

4.4 Outfall Locations

4.4.1 As mentioned previously there is anecdotal evidence suggesting that soakaways are viable in this area however this will need to be confirmed by percolation testing in accordance with DG 365. If infiltration rates are sufficient then surface water will dispose into a soakaway within the site boundary and there will be no surface water outfall.

4.4.2 If infiltration is deemed to be unviable then the hierarchy of surface water disposal states that surface water should be discharged into watercourse. There is a watercourse located approximately 180 m east of the development site. Therefore the outfall would be located to the east of the site. It is highlighted however that there might be issues with discharging into the watercourse due to ownership issues of land between the watercourse and the development site.

4.4.3 If it is deemed infiltration and discharge to watercourse are inviable solutions then surface water from the development site should be discharged to a United Utilities surface water sewer or combined sewer. If this is the case then the surface water outfall would be located to the west of the site towards the nearest United Utilities sewer.

4.5 Discharge Rates

4.5.1 The existing site is wholly comprised of an agricultural greenfield with a total site area of 0.95 Hectares.

4.5.2 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).

4.5.3 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.

4.5.4 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	8.07	7.02
1 in 30 year		13.71
1 in 100 year		16.78

***Table 1**: Existing Surface Water Runoff (0.95 Hectare)*

4.6 On-site Storage Requirements

4.6.1 The proposed development site is comprised of commercial buildings and associated hardstanding comprising a total impermeable area of 0.48 Hectares which represents 50.5% of the total site area.

4.6.2 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	Max Discharge Rate (l/s)	Indicative Attenuation Volumes (m^3)		
		No Climate Change	20% Climate Change	40% Climate Change
1 in 100 year	16.78	176.6	238.7	300.7

***Table 2**: Indicative Attenuation Volumes (0.48 Hectares Impermeable)*

4.6.3 The figure 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.

4.6.4 As such it is proposed a geocellular storage tank of 20 m x 20 m and a depth of 0.8 m 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. This volume could be attenuated on site without the use of infiltration prior to discharge at greenfield rates if soakaway systems are not deemed feasible.

4.6.5 A geocellular tank could be located beneath the car park area and permeable paving could be utilised to provide additional storage and an additional level of SUDS treatment as part of the detailed drainage design.

4.6.6 It is proposed that surface water from the site is discharged into the ground via infiltration following completion of percolation testing to ensure infiltration at the development site is feasible. If infiltration in not feasible then discharge of surface water should be disposed of into a watercourse or United Utilities public sewer following the hierarchy of surface water disposal.

5. CONCLUSION & RECOMMENDATIONS

5.1 This report provides information to enable the Lead Local Flood Authority (Lancashire County Council) to assess whether the development proposal meets the requirement of Paragraph 103 of the NPPF or Paragraph 80 of Section 10 of the PPG in principle.

5.2 The site is located within Flood Zone 1 with a total site area of less than 1 Hectares therefore a site specific flood risk assessment is not required, however this report indicates that the site is at low risk of flooding from rivers and the sea and low risk of surface water and groundwater flooding.

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

5.4 It is highly recommended that percolation testing at the development site is undertaken to determine the infiltration rate at the site from which an adequately sized soakaway can be determined. If infiltration is not feasible then discharge to watercourse or discharge to United Utilities sewer should be investigated in accordance with the hierarchy of surface water disposal.

5.5 In the event that infiltration at the development site is not viable then it is still considered that the proposed development would have sufficient space to attenuate flows within geocellular storage crates within the development site boundary prior to discharge at greenfield runoff rates.

5.6 Surface water attenuation requirements have been determined using the limiting greenfield discharge rate for the site. The maximum attenuation storage required is some 301 m^3 however this is subject to change following the production of detailed development plans and confirmation that infiltration is viable or otherwise.

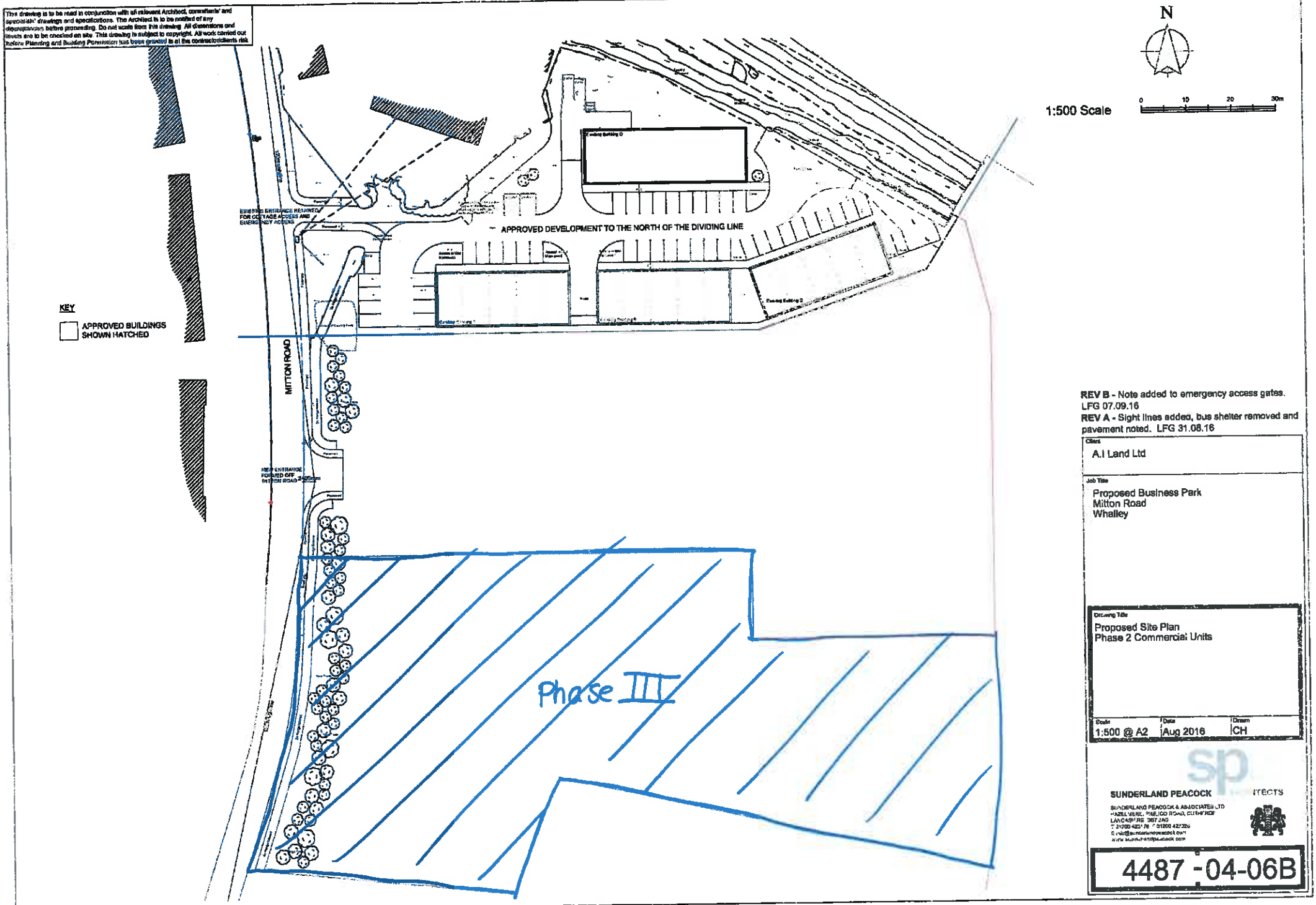
5.7 Therefore the proposed development would be able to manage surface water generated as a result of the development and would not increase flood risk at the development site or downstream of the site.

5.8 As such it is considered that the information provided satisfies the Lead Local Flood Authority (Lancashire County Council) with regards to drainage for the outline planning application for Phase 3 of Mitton Road Business Park, Mitton Road, Whalley.

APPENDIX A

Layout and Location Plans

This drawing is to be read in conjunction with all relevant Architect, consultants' and specialists' drawings and specifications. The Architect is to be notified of any discrepancies before proceeding. Do not scale from this drawing. All dimensions and levels are to be checked on site. This drawing is subject to copyright. All work carried out before Planning and Building Permission has been granted is at the contractor/clients risk.



REV B - Note added to emergency access gates. LFG 07.09.16
REV A - Sight lines added, bus shelter removed and pavement noted. LFG 31.08.16

Client
A.I Land Ltd

Job Title
Proposed Business Park
Mitton Road
Whalley

Drawing Title
Proposed Site Plan
Phase 2 Commercial Units

Scale	Date	Drawn
1:500 @ A2	Aug 2016	CH

SUNDERLAND PEACOCK
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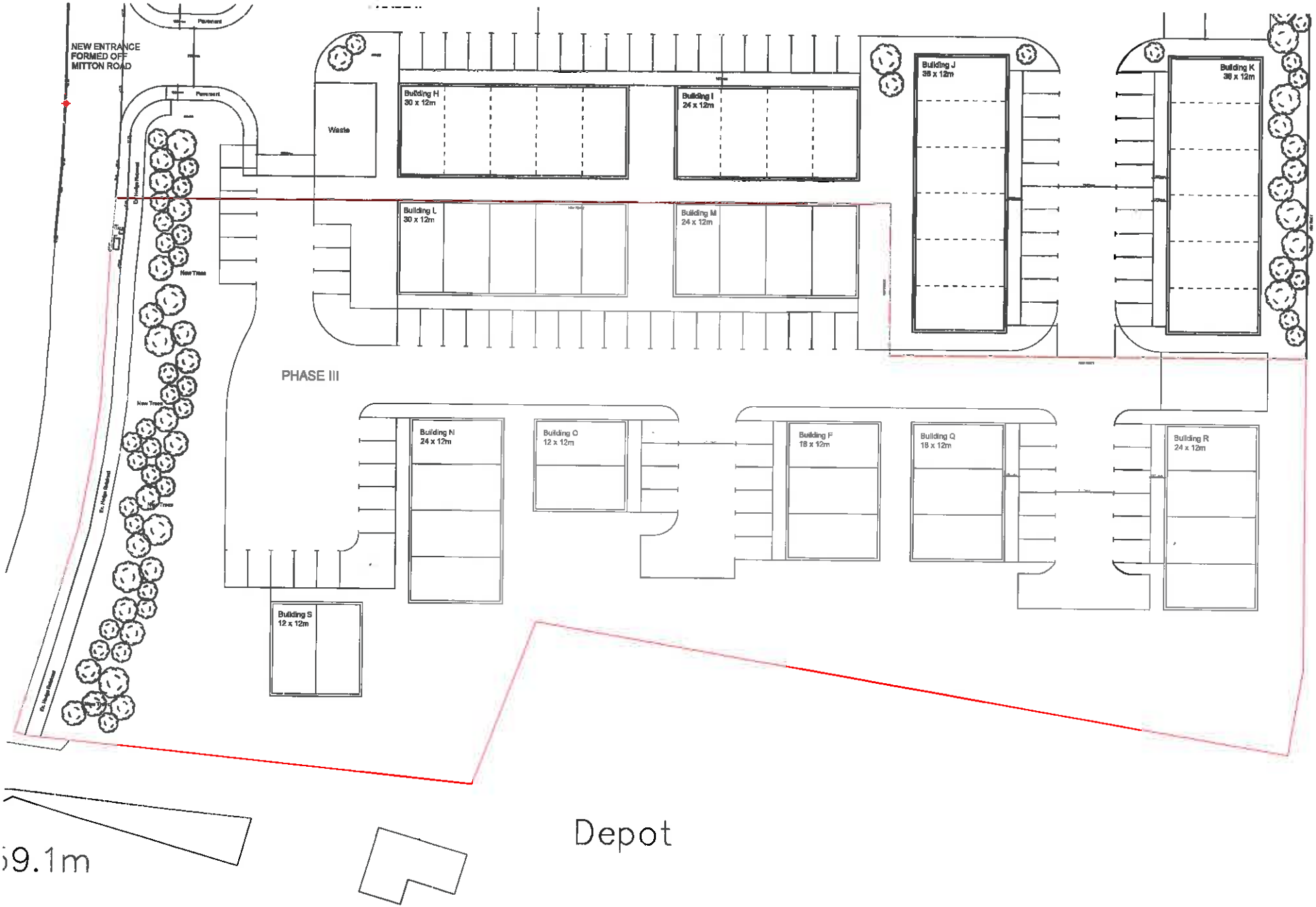
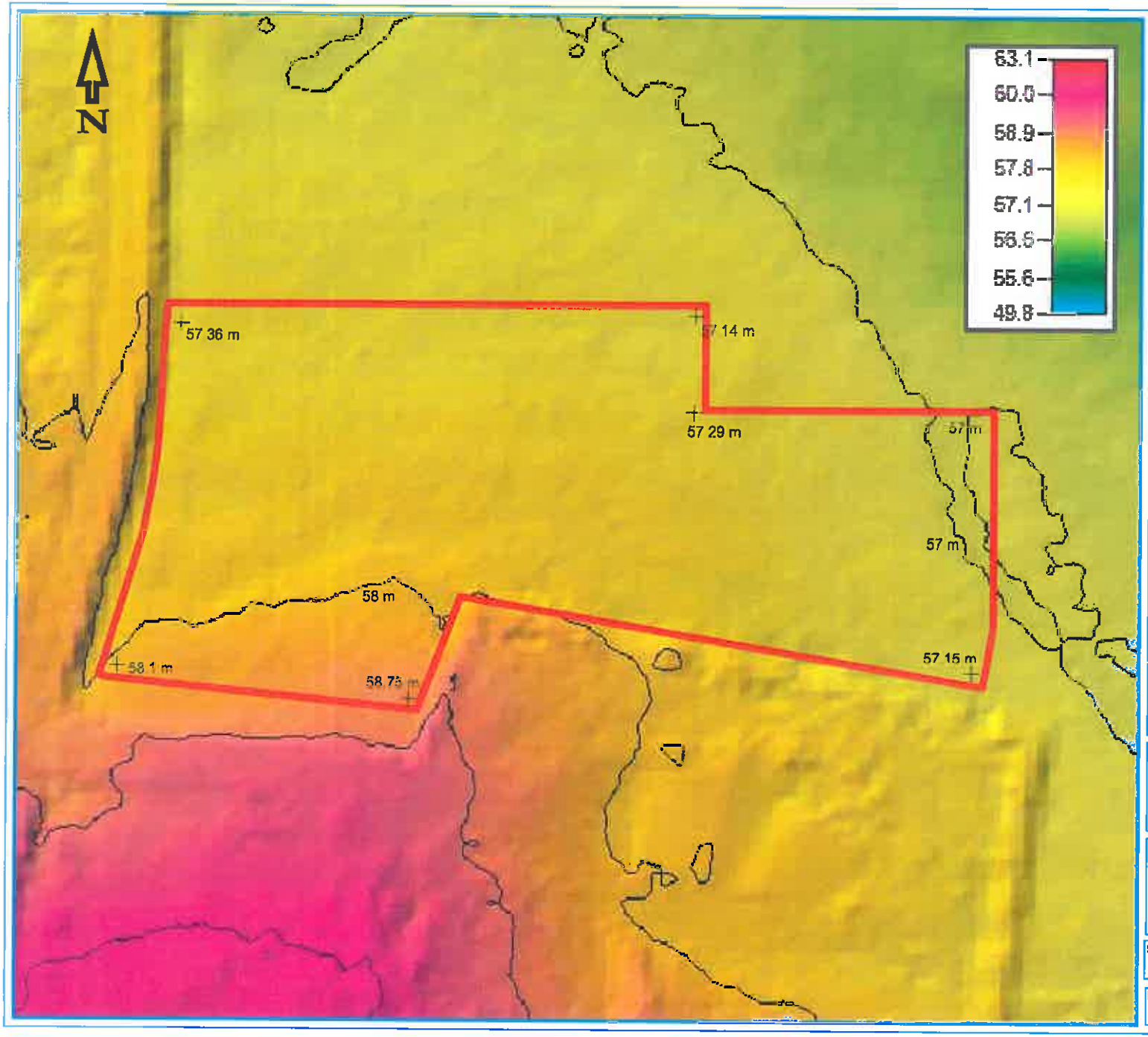

NEW ENTRANCE
FORMED OFF
MITTON ROAD
Pavement
Pavement
Waste
Building H
30 x 12m
Building I
24 x 12m
Building J
36 x 12m
Building K
36 x 12m
Building L
30 x 12m
Building M
24 x 12m
New Trees
PHASE III
Building N
24 x 12m
Building O
12 x 12m
Building P
18 x 12m
Building Q
18 x 12m
Building R
24 x 12m
Building S
12 x 12m
Depot
9.1m

APPENDIX B

Topographical Information (LIDAR)



LEGEND

SITE FOOTPRINT

57.14 m — SPOT LEVEL

58 m — COUNTOUR

REV	DESCRIPTION	DATE	BY

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.
SUNDERLAND PEACOCK ASSOCIATES

JOB TITLE.
PHASE 3 MITTON ROAD BUSINESS PARK, MITTON ROAD, WHALLEY

DRAWING TITLE.
LIDAR TOPOGRAPHY WITH COUNTOURS

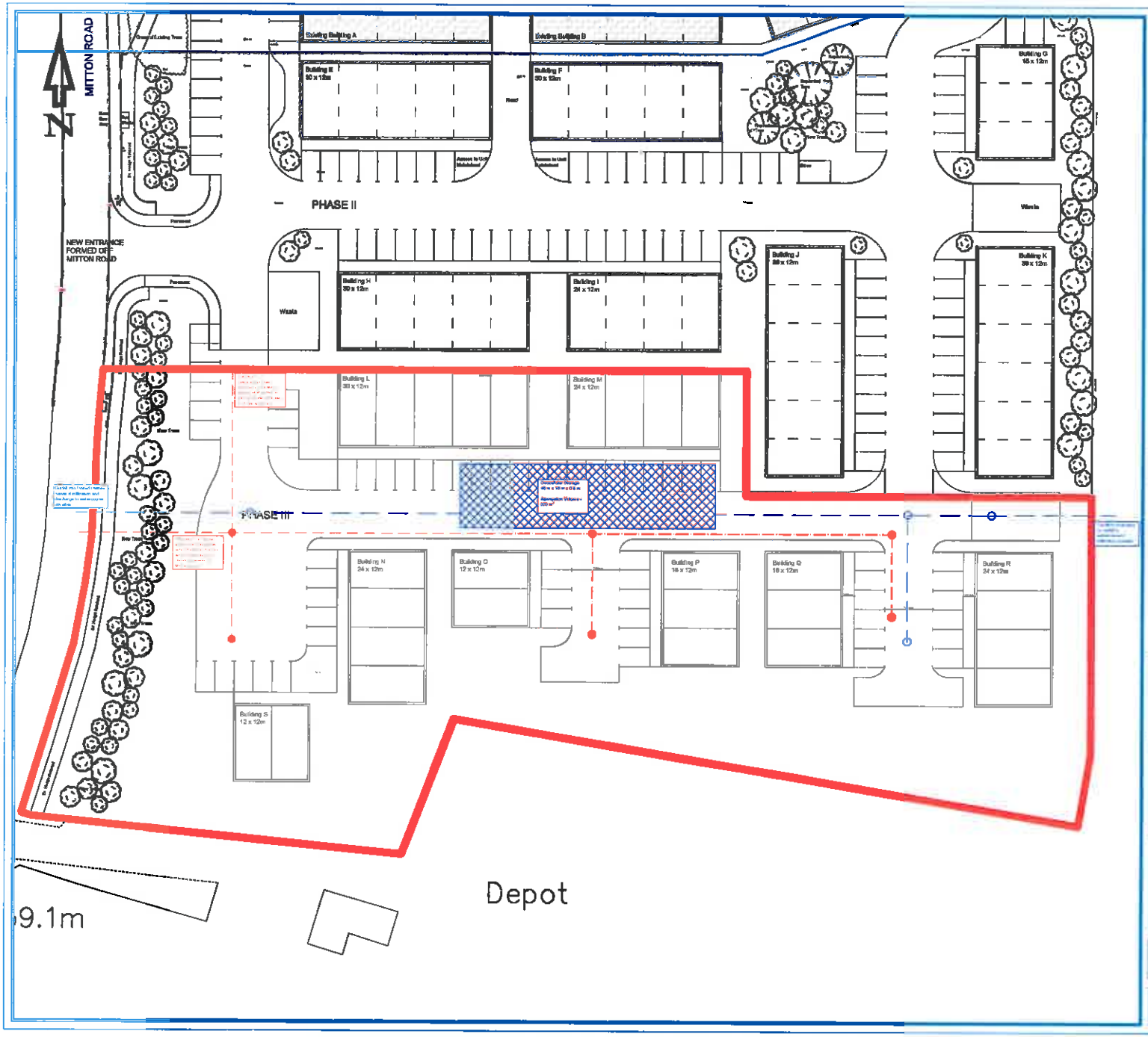
SCALE @ A3.	DRAWN BY.	APPROVED BY.	DATE.
NTS	D.E.	M.B.	18/01/17

DRAWING No. 16211-2

REV. -

APPENDIX C

Preliminary Drainage Strategy



LEGEND

- SITE FOOTPRINT
- SURFACE WATER DRAINAGE
- SURFACE WATER MANHOLE
- GEOCELLULAR ATTENUATION STORAGE
- FOUL DRAINAGE
- FOUL DRAINAGE MANHOLE

REV	DESCRIPTION	DATE	BY

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.
SUNDERLAND PEACOCK ASSOCIATES

JOB TITLE.
PHASE 3 MITTON ROAD BUSINESS PARK, MITTON ROAD, WHALLEY

DRAWING TITLE.
PRELIMINARY DRAINAGE PLAN

SCALE @ A3.	DRAWN BY.	APPROVED BY.	DATE.
NTS	D.E.	M.B.	18/01/17

DRAWING No. 16211-3

REV.

APPENDIX D

Greenfield Runoff Rates

HR Wallingford
Working with water

Greenfield runoff estimation for sites

Site name: Phase 3 Mitton Road

Site location: Mitton Road

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 CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude: 53.83194° N

Longitude: 2.41633° W

Reference: gcw61pb3z2vy / 0.95

Date: 16 Jan 2017

Site characteristics

Total site area	0.95	ha
Significant public open space	0	ha
Area positively drained	0.95	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	4
HOST class	N/A
SPR	0.47

Hydrological characteristics

	Default	Edited	
SAAR	1134	1134	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
Hydrological region	10	10	
Growth curve factor: 1 year	0.87	0.87	
Growth curve factor: 10 year	1.38	1.38	
Growth curve factor: 30 year	1.7	1.7	
Growth curve factor: 100 year	2.08	2.08	

Greenfield runoff rates

	Default	Edited	
Qbar	8.07	8.07	l/s
1 in 1 year	7.02	7.02	l/s
1 in 30 years	13.71	13.71	l/s
1 in 100 years	16.78	16.78	l/s

Please note that a minimum flow of 5 l/s applies to any site

APPENDIX E

On-site Storage Requirements

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name: Phase 3 Mitton Road

Site location: Mitton Road

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 CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude: 53.83181° N

Longitude: 2.4162° W

Reference: gcw61pb942ww / 0.95

Date: 16 Jan 2017

Site characteristics

Total site area	0.95	ha
Significant public open space	0	ha
Area positively drained	0.95	ha
Impermeable area	0.48	ha
Percentage of drained area that is impermeable	50.53	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.95	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	4
HOST class	N/A
SPR	0.47

Hydrological characteristics

	Default	Edited	
SAAR	1134	1134	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
Hydrological region	10	10	
Growth curve factor: 1 year	0.87	0.87	
Growth curve factor: 10 year	1.38	1.38	
Growth curve factor: 30 year	1.7	1.7	
Growth curve factor: 100 year	2.08	2.08	

Design criteria

Climate change allowance factor	1	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	8.07	8.07	l/s
1 in 1 year	7.02	7.02	l/s
1 in 30 years	13.71	13.71	l/s
1 in 100 years	16.78	16.78	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	19.20	19.20	m^3
Attenuation storage	176.61	176.61	m^3
Long term storage	23.45	23.45	m^3
Treatment storage	57.60	57.60	m^3
Total storage	219.26	219.26	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name: Phase 3 Mitton Road

Site location: Mitton Road

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 CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

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Date: 16 Jan 2017

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Significant public open space	0	ha
Area positively drained	0.95	ha
Impermeable area	0.48	ha
Percentage of drained area that is impermeable	50.53	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.95	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	4
HOST class	N/A
SPR	0.47

Hydrological characteristics

	Default	Edited	
SAAR	1134	1134	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
Hydrological region	10	10	
Growth curve factor: 1 year	0.87	0.87	
Growth curve factor: 10 year	1.38	1.38	
Growth curve factor: 30 year	1.7	1.7	
Growth curve factor: 100 year	2.08	2.08	

Design criteria

Climate change allowance factor	1.2	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	8.07	8.07	l/s
1 in 1 year	7.02	7.02	l/s
1 in 30 years	13.71	13.71	l/s
1 in 100 years	16.78	16.78	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	19.20	19.20	m^3
Attenuation storage	238.66	238.66	m^3
Long term storage	23.45	23.45	m^3
Treatment storage	57.60	57.60	m^3
Total storage	281.31	281.31	m^3

HR Wallingford
Working with water

Surface water storage requirements for sites

Site name: Phase 3 Mitton Road

Site location: Mitton Road

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 CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Site coordinates

Latitude: 53.83181° N

Longitude: 2.4162° W

Reference: gcw61pb942ww / 0.95

Date: 16 Jan 2017

Site characteristics

Total site area	0.95	ha
Significant public open space	0	ha
Area positively drained	0.95	ha
Impermeable area	0.48	ha
Percentage of drained area that is impermeable	50.53	%
Impervious area drained via infiltration	0	ha
Return period for infiltration system design	10	year
Impervious area drained to rainwater harvesting systems	0	ha
Return period for rainwater harvesting system design	10	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	0.95	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Use Long Term Storage
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	4
HOST class	N/A
SPR	0.47

Hydrological characteristics

	Default	Edited	
SAAR	1134	1134	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
Hydrological region	10	10	
Growth curve factor: 1 year	0.87	0.87	
Growth curve factor: 10 year	1.38	1.38	
Growth curve factor: 30 year	1.7	1.7	
Growth curve factor: 100 year	2.08	2.08	

Design criteria

Climate change allowance factor	1.4	
Urban creep allowance factor	1.1	
Interception rainfall depth	5	mm

Greenfield runoff rates

	Default	Edited	
Qbar	8.07	8.07	l/s
1 in 1 year	7.02	7.02	l/s
1 in 30 years	13.71	13.71	l/s
1 in 100 years	16.78	16.78	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	19.20	19.20	m^3
Attenuation storage	300.70	300.70	m^3
Long term storage	23.45	23.45	m^3
Treatment storage	57.60	57.60	m^3
Total storage	343.35	343.35	m^3

GEO-ENVIRONMENTAL CONSULTING ENGINEERS

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