# APPENDIX H

## Results Infiltration Tests

Sirius Geotechnical report letter dated 22nd October 2019

**Sirius Geotechnical Ltd**
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www.thesiriusgroup.com

David Wright
Gleeson Regeneration Ltd
Rural Enterprise Centre
Redhills
Penrith
Cumbria
CA11 0DT

Date: 22nd October 2019

Our Ref: C8071/7464/APC/APC

Dear David,

**Re: C8071 – How Bank Farm, Egremont, Cumbria – Infiltration Testing**

## Introduction

Sirius Geotechnical Ltd (Sirius) has previously carried out a geoenvironmental appraisal of land at How Bank Farm, Egremont, on behalf of Gleeson Regeneration Ltd (Gleeson). The findings of that appraisal are presented in a report dated July 2019, and referenced C8071A.

That investigation identified natural soils comprising predominantly of sandy gravelly clay in the north-west, and granular material ranging from sandy silt to sandy gravel with cobbles in the south and east.

Consequently, Sirius was also instructed by Gleeson to undertake undertake soil infiltration rate testing at the site at locations potentially suitable to support soakaway drainage as determined from the findings of the geoenvironmental appraisal. Sirius has therefore subsequently undertaken infiltration tests at 3 No. locations, across the south and east of the site, selected based on strata encountered during the previous investigation. Testing was undertaken in general accordance with guidance given in BRE Digest 365:2016.

This letter presents the results of the soil infiltration rate testing in trial pits ('soakaway tests') carried out by Sirius.

## Fieldwork

Fieldwork was initially undertaken on 10 and 11 September 2019. A third day of fieldwork scheduled to take place on 12 September was aborted owing to difficulty in regaining access to the site with the required plant owing to poor weather conditions and wet ground across the sloping area of the site. A further phase of fieldwork was therefore carried out at later date, on 18 and 19 October 2019.

Fieldwork comprised the mechanical excavation of three trial pits (SA01 to SA03) using a wheeled backhoe excavator, the installation of a gravel pack and monitoring pipework to mitigate against instability, and the undertaking of infiltration tests at each location.

The locations of the excavations, are shown on Drawing C8071A/03 Revision A, attached to this letter.

Trial pits were excavated to depths of 1.5m below ground level (bgl). Detailed records of the depths and descriptions of strata encountered within each excavation are attached to this letter as Trial Pit Record SA01 to SA03.

In summary, below topsoil, SA01 encountered topsoil overlying clayey sandy silt; SA02 encountered slightly silty very gravelly fine to coarse sand; and, SA03 encountered silty slightly gravelly fine to medium sand. These soils were encountered to the termination depth of the respective pits.

The strata encountered at the selected infiltration test locations are approximately commensurate with those found during the aforementioned investigation and are considered representative of conditions in those areas of the site selected.

Trial pit excavations were immediately backfilled with 10mm washed gravel to approximately 0.5m bgl. Arisings from the excavation were used to bring the trial pits up to ground level. Two 62mm slotted pipes were installed into each test pit during backfilling, to allow the introduction of water and enable monitoring of water levels within the gravel.

## Infiltration Tests

Soakaway tests were undertaken in general accordance with the test method specified in BRE Digest 365:2016.

Water was added to the soakaway test pits using a gravity fed supply from a tractor towed 5,000 litre or similar bowser. The water level and time in minutes from filling the excavation was recorded.

Where possible and appropriate, three soakaway test cycles were performed at each location, on the same or consecutive days. Based generally on guidance given in the BRE Digest, it is possible to provide an indication of likely infiltration rates, using the difference in effective storage volume of water across the duration of the test, together with the internal surface area of the trial pit at 50% of the effective volume change. Soakaway calculations performed using this method are attached.

In the case of SA01 and SA03, due to the low discharge rate from the test pits, only 1 No. test was performed. In those tests, water levels were monitored periodically for 4 hours, with no significant fall in water level within the test pit observed. The pits were monitored again the following day, after a continuous period of testing of circa 21 hours.

The water level in SSA01 was found not to have fallen below the 75% level.

The water level in SS03 had fallen close to the 25% level over the 21 hour period.

Guidance in BRE Digest 365 requires a 'full-depth' test, in which water levels fall to at least 25% of the start level. In the case of the infiltration test performed at location SA03, strictly the water level during the test did not fall to at least 25% of the start level. However, as is shown on the soakaway calculation sheets, water levels fell rapidly to just above the 25% level over the 21 hour test period, and in order to calculate an infiltration rate from this test, discharge to the 25% level has been partly extrapolated.

In each test undertaken within SA02, the water level fell below the 25% full level within around four hours. However, the significant period of time elapsed between tests 01 and A1 should be noted, with only tests A1 to A3 conforming to BRE Digest 365 guidance.

Detailed results of the rates of fall, together with calculations of soil infiltration rates for each test at each location are attached. A summary of the calculated rates is presented below:

| **Trial Pit/Soakaway Ref.** | **Observed Infiltration Rate ($m/s^{-1}$)** | **Soil type** |
|---|---|---|
| SA01 Test 01 | Rate not calculable | Clayey sandy silt |
| SA02 Test 01 | $1.95 \times 10^{-5}$ | Silty gravelly sand |
| SA02 Test A1 | $1.10 \times 10^{-5}$ | Silty gravelly sand |
| SA02 Test A2 | $1.05 \times 10^{-5}$ | Silty gravelly sand |
| SA02 Test A3 | $1.01 \times 10^{-5}$ | Silty gravelly sand |
| SA03 Test 01 | $2.26 \times 10^{-6}$* | Silty gravelly sand |

* - Result conservatively extrapolated from data acquired as described above.

## Conclusions

Infiltration rates in the order of $10^{-5}$ m/s to $10^{-6}$ m/s, may be appropriate for the coarser granular superficial soils which are prevalent across the southern and eastern half of the site.

Notwithstanding, horizons of finer material e.g. silt and locally clay, are present within the dominant granular soil, particularly at depths and at lower elevations around the southern and eastern perimeters as presented on exploratory hole records within the aforementioned geoenvironmental appraisal report. No infiltration rate has been determined, owing to anticipated and demonstrably low rates, for such soils, which are unlikely to be capable of supporting soakaway drains.

Care should therefore be taken in the selection of soakaway drains, in order to avoid positioning within the finer silt and clay soils. It is recommended that confirmatory excavation at specific locations where soakaway drains are being considered, to ensure suitable soils are present around the proposed discharge location and depth.

We trust that this is satisfactory for your present needs. However, should you have any queries or require any further information, please do not hesitate to contact the undersigned.

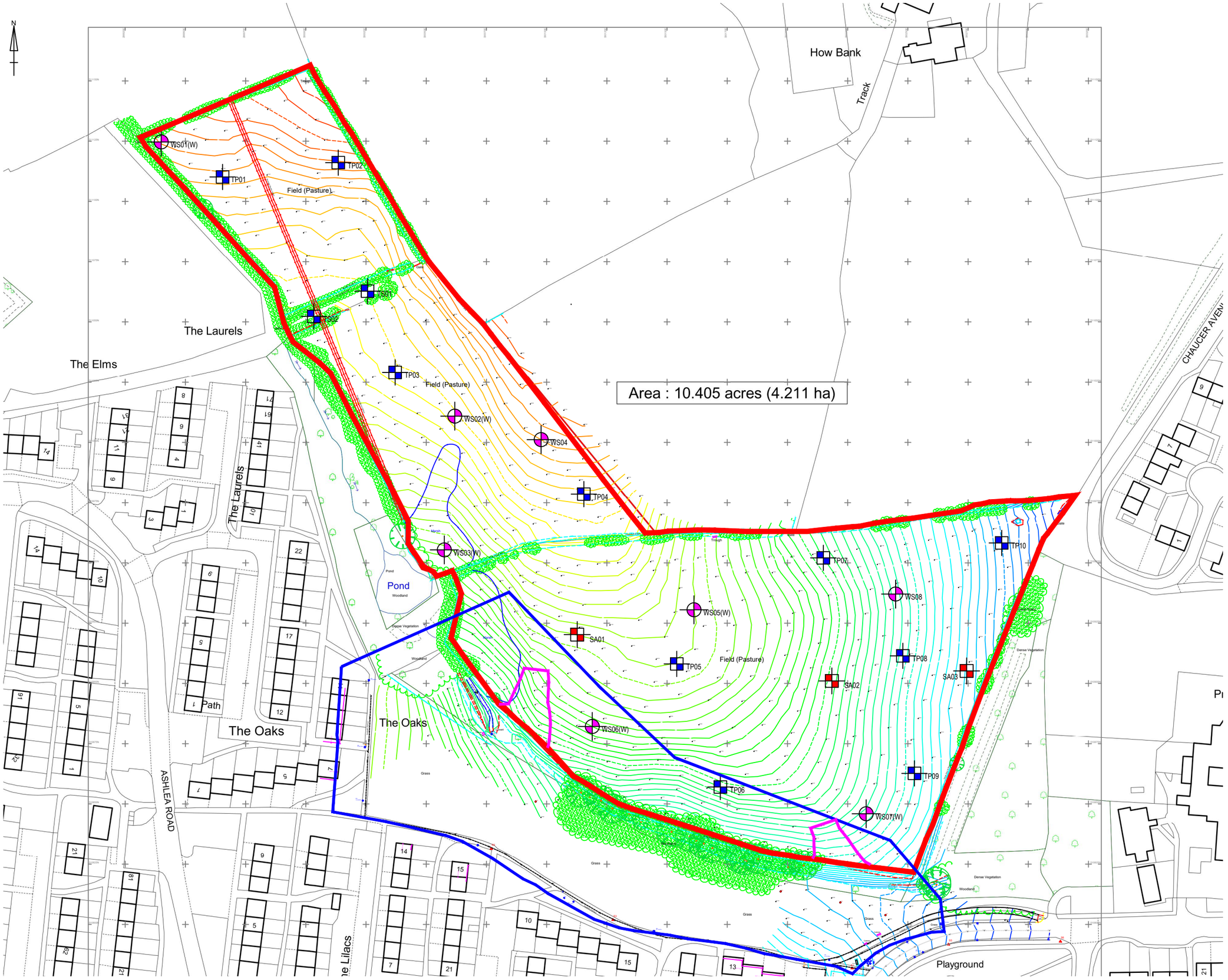
Yours sincerely,

Alastair Cook

Principal Engineer

For and on behalf of
Sirius Geotechnical Ltd

Encs: Drawing C8071A/03A Revision A
Trial Pit Records SA01 to SA03
Infiltration test result sheets




NOTES

- Site Boundary
- Extent of Environment Agency Flood Alleviation Scheme
- Proposed Embankments as Part of EA Works
- Window Sample (W - With Well)
- Trial Pits
- Soakaways Test Pit

| REVISION | | BY | DATE |
|---|---|---|---|
| 0 | For Information | MF | 31/05/19 |
| A | Proposed SA01-SA03 Added | APC | 18/07/19 |
| B | >> | >> | >> |
| C | >> | >> | >> |
| D | >> | >> | >> |

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CLIENT

**Gleeson Regeneration Ltd**

SITE

**How Bank Farm,
Egremont,
Cumbria**

DRAWING TITLE

**Exploratory Hole Location Plan**

| DRAWING NO. | REVISION NO. |
|---|---|
| C8071A/03A | A |
| DRAWN BY | APPROVED BY |
| MF | APC |
| DATE | SCALE | PAPER SIZE |
| October 2019 | 1:1500 | A3 |

# TRIAL PIT RECORD

TP No. **SA01** Sheet 1 of 1

Site: How Bank Farm, Egremont

Contract No: C8071

Client: Gleeson Regeneration Ltd

Date: 10/09/2019

Method: Pit excavated using a JCB 3CX with a 600mm toothed bucket.

Scale: 1:25

Logged By: DG

Checked By:

SAMPLE DETAILS

STRATA RECORD

| Type | Depth From - To(m) | Vane Results (kN/m2) {}{ppm} | Ground -water | Description | Depth (m) | Level (m AOD) | Legend | Backfill |
|---|---|---|---|---|---|---|---|---|
| | | | | Red brown silty fine to coarse SAND. Occasional gravel of rounded and sub rounded fine to coarse slate and sandstone. (Topsoil). | | | | |
| | | | | Red brown slightly clayey very sandy SILT. | 0.30 | 79.90 | | |
| | | | | End of trial pit at 1.50m | 1.50 | 78.70 | | |

1
2
3
4
5

Remarks and Groundwater Observations

1. Groundwater not encountered. 2. Pit remained stable. 3. Coordinates and elevation derived from hand held GPS and topographic plans. 4. Pipework installed for water level monitoring during soakaway tests.

**GL (m AOD)** 80.20

**Easting:** 300112.00

**Northing:** 510920.00

Fig No. SA01

# TRIAL PIT RECORD

TP No. **SA02** Sheet 1 of 1

Site: How Bank Farm, Egremont

Contract No: C8071

Client: Gleeson Regeneration Ltd

Date: 10/09/2019

Method: Pit excavated using a JCB 3CX with a 600mm toothed bucket.

Scale: 1:25

Logged By: DG

Checked By:

SAMPLE DETAILS

STRATA RECORD

| Type | Depth From - To(m) | Vane Results (kN/m2) {}{ppm} | Ground -water | Description | Depth (m) | Level (m AOD) | Legend | Backfill |
|---|---|---|---|---|---|---|---|---|
| | | | | Red brown silty fine to coarse SAND. Occasional gravel of rounded and sub rounded fine to coarse slate and sandstone. (Topsoil). | | | | |
| | | | | Red brown slightly silty very gravelly fine to coarse SAND. Gravel is rounded and sub rounded fine to coarse limestone and occasional sandstone. | 0.30 | 74.45 | | |
| | | | | End of trial pit at 1.50m | 1.50 | 73.25 | | |

1
2
3
4
5

Remarks and Groundwater Observations

1. Groundwater not encountered. 2. Pit remained stable. 3. Coordinates and elevation derived from hand held GPS and topographic plans. 4. Pipework installed for water level monitoring during soakaway tests.

**GL (m AOD)** 74.75

**Easting:** 300218.00

**Northing:** 510900.00

Fig No. SA02

# TRIAL PIT RECORD

TP No. **SA03** Sheet 1 of 1

Site: How Bank Farm, Egremont

Contract No: C8071

Client: Gleeson Regeneration Ltd

Date: 10/09/2019

Method: Pit excavated using a JCB 3CX with a 600mm toothed bucket.

Scale: 1:25

Logged By: DG

Checked By:

SAMPLE DETAILS

STRATA RECORD

| Type | Depth From - To(m) | Vane Results (kN/m2) {}{ppm} | Ground -water | Description | Depth (m) | Level (m AOD) | Legend | Backfill |
|---|---|---|---|---|---|---|---|---|
| | | | | Red brown silty fine to coarse SAND. Occasional gravel of rounded and sub rounded fine to coarse slate and sandstone. (Topsoil). | | | | |
| | | | | Red brown silty slightly gravelly fine to medium SAND. Gravel is rounded and sub rounded fine to coarse limestone and occasional sandstone. | 0.30 | 66.30 | | |
| | | | | End of trial pit at 1.50m | 1.50 | 65.10 | | |

1
2
3
4
5

Remarks and Groundwater Observations

1. Groundwater not encountered. 2. Pit remained stable. 3. Coordinates and elevation derived from hand held GPS and topographic plans. 4. Pipework installed for water level monitoring during soakaway tests.

**GL (m AOD)** 66.60

**Easting:** 300274.00

**Northing:** 510905.00

Fig No. SA03

| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Geeson Developmentss Ltd | | |
| Site: | How Bank Farm, Egremont | | |
| Job No: | C8071 | Test No: | SA02 Test 01 |

## CALCULATION OF SOIL INFILTRATION RATE

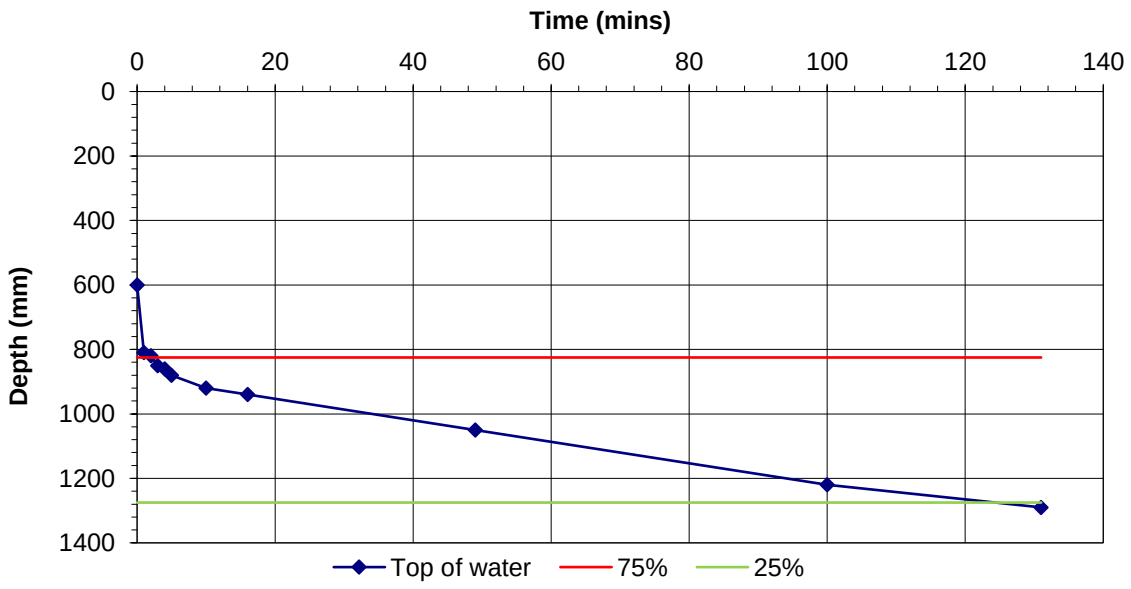
| Time (min) | Depth (mm) |
|---|---|
| 0 | 600 |
| 1 | 810 |
| 2 | 820 |
| 3 | 850 |
| 4 | 860 |
| 5 | 880 |
| 10 | 920 |
| 16 | 940 |
| 49 | 1050 |
| 100 | 1220 |
| 131 | 1290 |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| Depth at start of test (mm)= | 600mm |
| Depth of trial pit (mm)= | 1500mm |
| 75% effective depth (mm)= | 825mm |
| 50% effective depth = | 1050mm |
| 25% effective depth = | 1275mm |
| Base area of pit ($m^2$) = | 0.900 |
| Effective area of loss 50% ($m^2$) = | 2.790 |
| Volume outflow 75 - 25% ($m^3$) = | 0.405 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 1 |
| tp 25 (min) = | 125 |

| Soil infiltration rate, f, (m/s) = | 1.95E-05 | Normal test |
|---|---|---|
| Input by: | DG | Date: 12/09/2019 |
| Checked by: | APC | Date: 16/09/2019 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Geeson Developmentss Ltd | | |
| Site: | How Bank Farm, Egremont | | |
| Job No: | C8071 | Test No: | SA03 Test 01 |

## CALCULATION OF SOIL INFILTRATION RATE

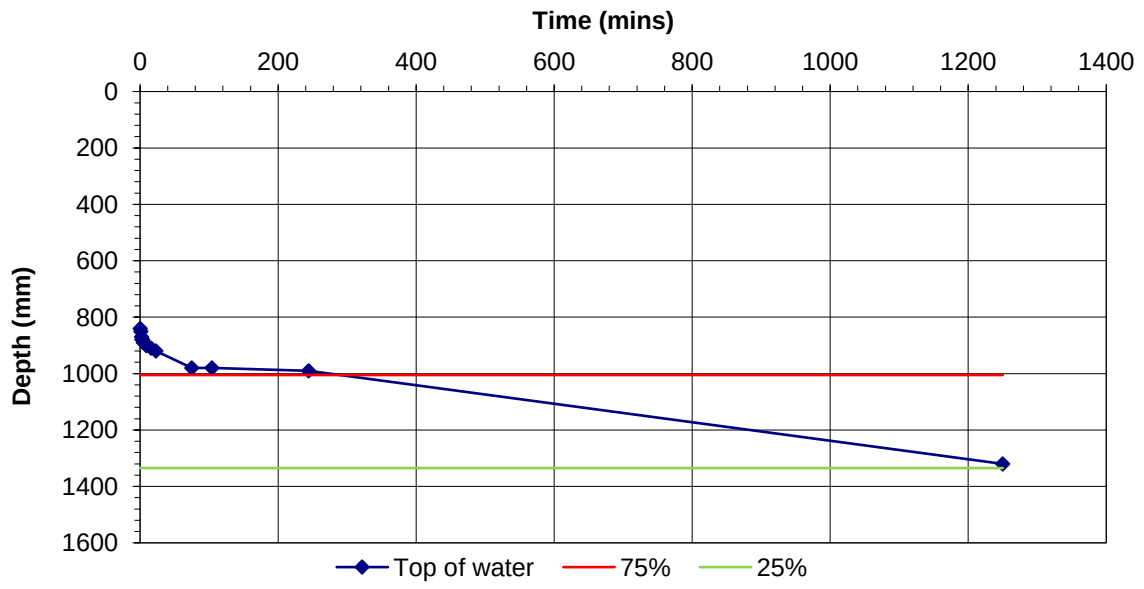
| Time (min) | Depth (mm) |
|---|---|
| 0 | 840 |
| 1 | 850 |
| 2 | 870 |
| 3 | 880 |
| 4 | 880 |
| 5 | 890 |
| 9 | 900 |
| 16 | 910 |
| 23 | 920 |
| 75 | 980 |
| 104 | 980 |
| 244 | 990 |
| 1250 | 1320 |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| Depth at start of test (mm)= | 840mm |
| Depth of trial pit (mm)= | 1500mm |
| 75% effective depth (mm)= | 1005mm |
| 50% effective depth = | 1170mm |
| 25% effective depth = | 1335mm |
| Base area of pit ($m^2$) = | 0.900 |
| Effective area of loss 50% ($m^2$) = | 2.286 |
| Volume outflow 75 - 25% ($m^3$) = | 0.297 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 320 |
| tp 25 (min) = | N/A |

| Soil infiltration rate, f, (m/s) = | N/A | Normal test |
|---|---|---|
| Input by: | DG | Date: 12/09/2019 |
| Checked by: | APC | Date: 16/09/2019 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Geeson Developmentss Ltd | | |
| Site: | How Bank Farm, Egremont | | |
| Job No: | C8071 | Test No: | SA01 Test 01 |

## CALCULATION OF SOIL INFILTRATION RATE

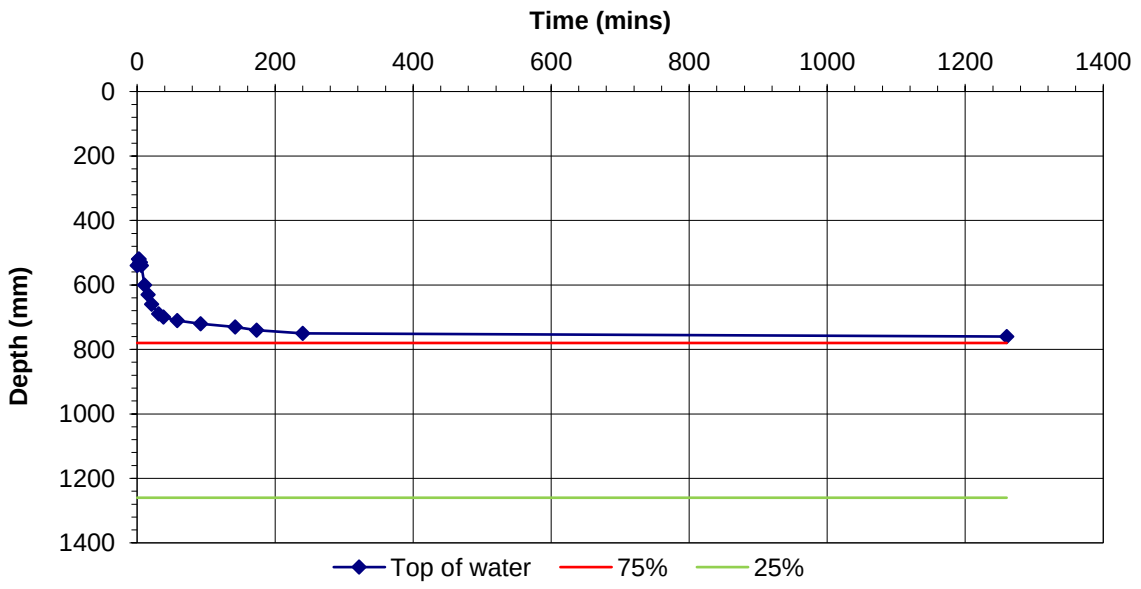
| Time (min) | Depth (mm) |
|---|---|
| 0 | 540 |
| 2 | 520 |
| 3 | 520 |
| 4 | 530 |
| 5 | 530 |
| 6 | 540 |
| 11 | 600 |
| 16 | 630 |
| 21 | 660 |
| 31 | 690 |
| 38 | 700 |
| 58 | 710 |
| 92 | 720 |
| 142 | 730 |
| 173 | 740 |
| 240 | 750 |
| 1260 | 760 |
| | |
| | |
| | |

| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| Depth at start of test (mm)= | 540mm |
| Depth of trial pit (mm)= | 1500mm |
| 75% effective depth (mm)= | 780mm |
| 50% effective depth = | 1020mm |
| 25% effective depth = | 1260mm |
| Base area of pit ($m^2$) = | 0.900 |
| Effective area of loss 50% ($m^2$) = | 2.916 |
| Volume outflow 75 - 25% ($m^3$) = | 0.432 |

| From the graph: | |
|---|---|
| tp 75 (min) = | |
| tp 25 (min) = | |

| Soil infiltration rate, f, (m/s) = | NA | Normal test |
|---|---|---|
| Input by: | DG | Date: 12/09/2019 |
| Checked by: | APC | Date: 16/09/2019 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Gleeson Regeneration | | |
| Site: | How Bank Farm, Egremont | | |
| Job No: | C8071 | Test No: | SA02 Test A1 |

## CALCULATION OF SOIL INFILTRATION RATE

| Time (min) | Depth (mm) |
|---|---|
| 0 | 700 |
| 1 | 820 |
| 2 | 860 |
| 3 | 870 |
| 4 | 880 |
| 5 | 900 |
| 11 | 910 |
| 20 | 980 |
| 106 | 1150 |
| 130 | 1170 |
| 190 | 1260 |
| 250 | 1350 |

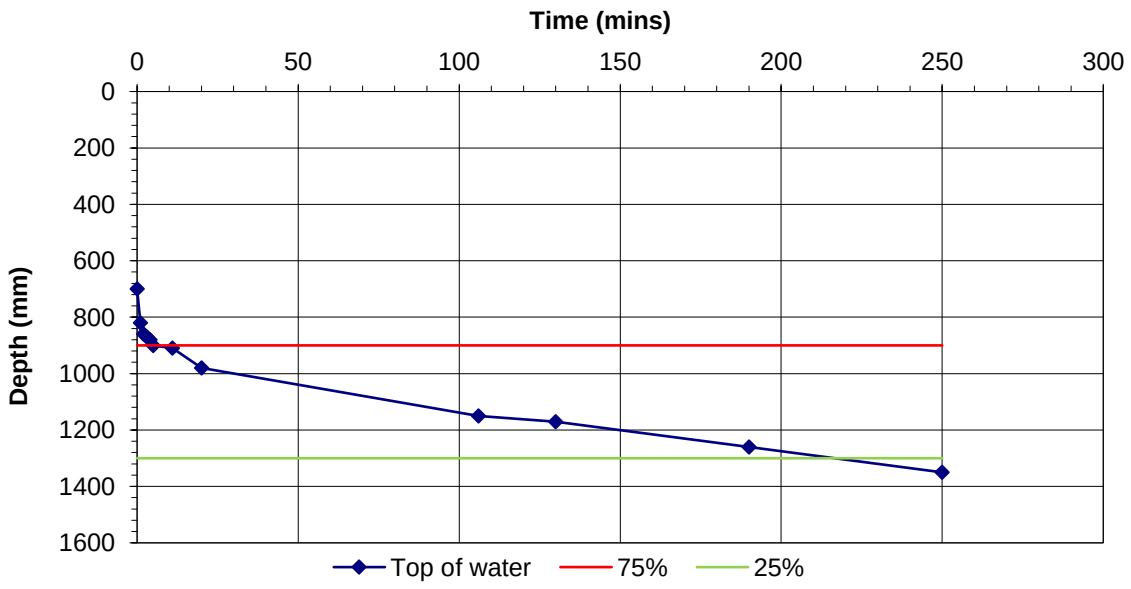
| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| Depth at start of test (mm)= | 700mm |
| Depth of trial pit (mm)= | 1500mm |
| 75% effective depth (mm)= | 900mm |
| 50% effective depth = | 1100mm |
| 25% effective depth = | 1300mm |
| Base area of pit ($m^2$) = | 0.900 |
| Effective area of loss 50% ($m^2$) = | 2.580 |
| Volume outflow 75 - 25% ($m^3$) = | 0.360 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 5 |
| tp 25 (min) = | 216 |

| Soil infiltration rate, f, (m/s) = | 1.10E-05 | Normal test |
|---|---|---|

| Input by: | DG | Date: | 18/10/2019 |
|---|---|---|---|
| Checked by: | APC | Date: | 23/10/2019 |



| SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007 | | | |
|---|---|---|---|
| Client: | Gleeson Regeneration | | |
| Site: | How Bank Farm, Egremont | | |
| Job No: | C8071 | Test No: | SA02 Test A2 |

## CALCULATION OF SOIL INFILTRATION RATE

| Time (min) | Depth (mm) |
|---|---|
| 0 | 700 |
| 4 | 850 |
| 10 | 910 |
| 21 | 940 |
| 79 | 1090 |
| 120 | 1160 |
| 210 | 1270 |
| 219 | 1283 |
| 230 | 1300 |

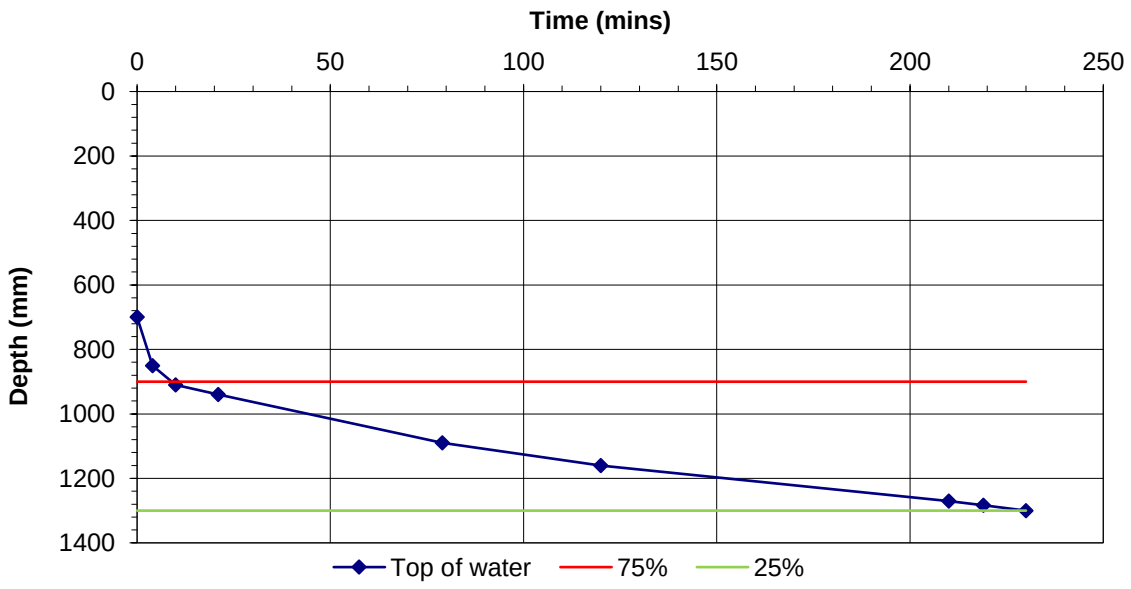
| Size of Soakaway | | |
|---|---|---|
| | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| Depth at start of test (mm)= | 700mm |
| Depth of trial pit (mm)= | 1500mm |
| 75% effective depth (mm)= | 900mm |
| 50% effective depth = | 1100mm |
| 25% effective depth = | 1300mm |
| Base area of pit ($m^2$) = | 0.900 |
| Effective area of loss 50% ($m^2$) = | 2.580 |
| Volume outflow 75 - 25% ($m^3$) = | 0.360 |

| From the graph: | |
|---|---|
| tp 75 (min) = | 9 |
| tp 25 (min) = | 230 |

| Soil infiltration rate, f, (m/s) = | 1.05E-05 | Normal test |
|---|---|---|

| Input by: | DG | Date: | 18/10/2019 |
|---|---|---|---|
| Checked by: | APC | Date: | 23/10/2019 |



| | | | | |
|---|---|---|---|---|
| | **SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2007** | | | |
| | **Client:** | **Gleeson Regeneration** | | |
| | **Site:** | **How Bank Farm, Egremont** | | |
| | **Job No:** | C8071 | **Test No:** | **SA02 Test A3** |

## CALCULATION OF SOIL INFILTRATION RATE

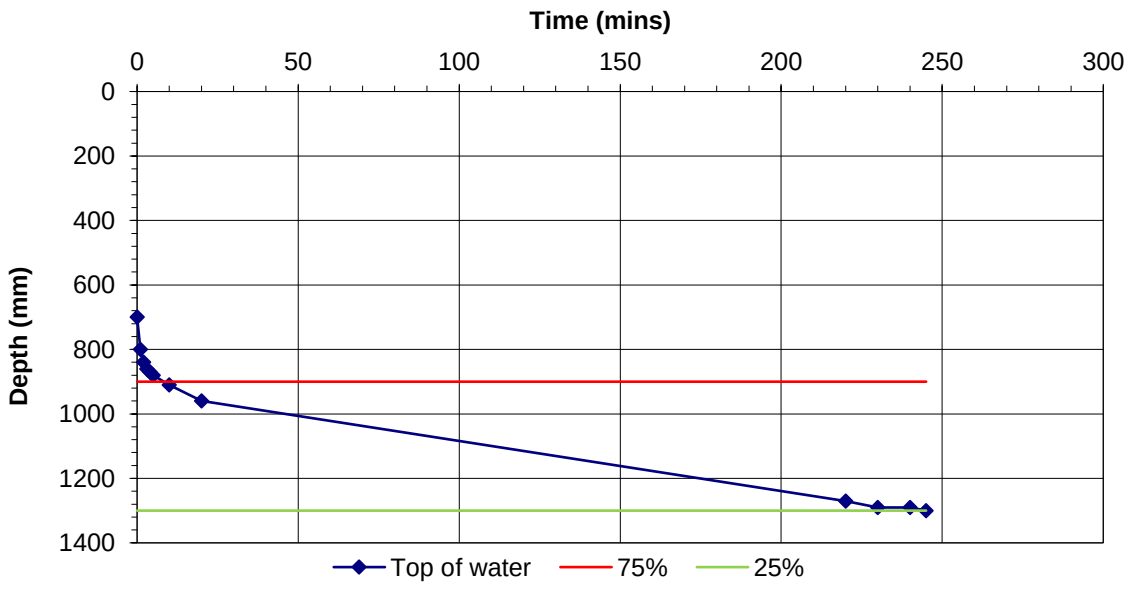
| Time (min) | Depth (mm) |
|---|---|
| 0 | 700 |
| 1 | 800 |
| 2 | 840 |
| 3 | 860 |
| 4 | 870 |
| 5 | 880 |
| 10 | 910 |
| 20 | 960 |
| 220 | 1270 |
| 230 | 1290 |
| 240 | 1290 |
| 245 | 1300 |

| | | |
|---|---|---|
| **Size of Soakaway** | Length (m) = | 1.50 |
| | Width (m) = | 0.60 |
| | Depth (m) = | 1.50 |

| | |
|---|---|
| **Depth at start of test (mm)=** | 700mm |
| **Depth of trial pit (mm)=** | 1500mm |
| **75% effective depth (mm)=** | 900mm |
| **50% effective depth =** | 1100mm |
| **25% effective depth =** | 1300mm |
| **Base area of pit ($m^2$) =** | 0.900 |
| **Effective area of loss 50% ($m^2$) =** | 2.580 |
| **Volume outflow 75 - 25% ($m^3$) =** | 0.360 |

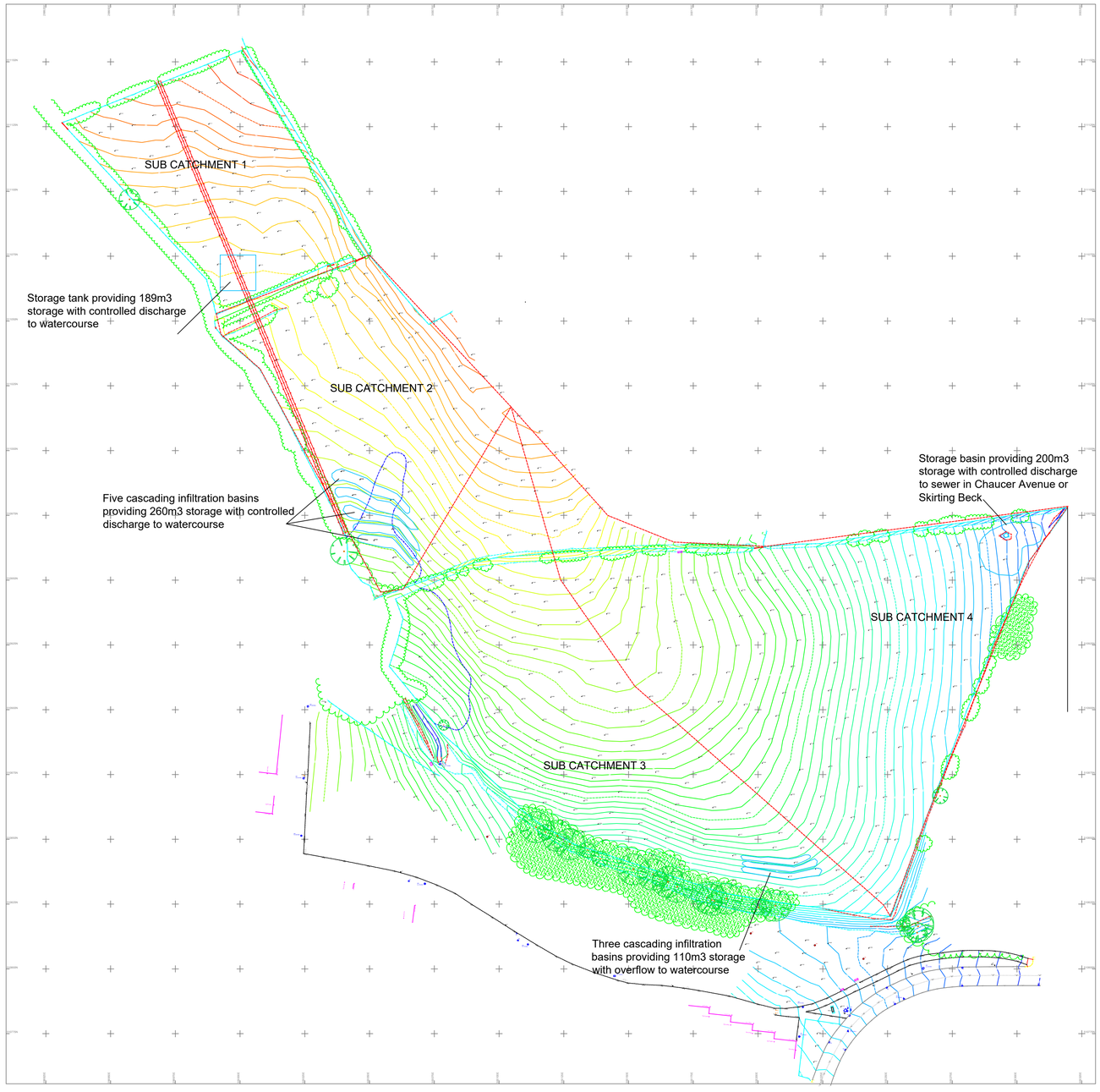
| **From the graph:** | |
|---|---|
| **tp 75 (min) =** | 9 |
| **tp 25 (min) =** | 239 |

| | | | |
|---|---|---|---|
| **Soil infiltration rate, f, (m/s) =** | | **1.01E-05** | **Normal test** |
| **Input by:** | **DG** | **Date:** | **19/10/2019** |
| **Checked by:** | **APC** | **Date:** | **23/10/2019** |



# APPENDIX I

## Plan of sub-catchments




Notes:

| REV: | DESCRIPTION: | BY: | DATE: |
|---|---|---|---|

STATUS: PRELIMINARY

**joc consultants ltd**
Park Farm House
Leathley Lane
Leathley
Otley
LS21 2JU

tel/fax: 0113 284 2838

www.jocconsultants.co.uk

CLIENT: GLEESON REGENERATION LTD
5 Europa Court
Sheffield Business Park
Sheffield S9 1EX

ARCHITECT:

SITE: HOW BANK FARM

TITLE: Drainage Strategy Plan

| SCALE AT A1: | DATE: | DRAWN: | CHECKED: |
|---|---|---|---|
| 1:1000 | 06-08-2020 | JOC | JOC |

| PROJECT NO: | DRAWING NO: | REVISION: |
|---|---|---|
| 19-013 | 19-013-001 | - |

# APPENDIX J

## UK SuDS estimates of attenuation storage in sub-catchments

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | John O'Connor |
| Site name: | How Bank Farm SC1 |
| Site location: | Egremont CA22 2HD |

This is an estimation of the storage volume requirements that are needed 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). 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 design of the drainage scheme.

## Site Details

| | |
|---|---|
| Latitude: | 54.48443° N |
| Longitude: | 3.54253° W |
| Reference: | 3355119437 |
| Date: | Jul 27 2020 15:16 |

## Site characteristics

| | |
|---|---|
| Total site area (ha): | 0.611 |
| Significant public open space (ha): | 0 |
| Area positively drained (ha): | 0.611 |
| Impermeable area (ha): | 0.306 |
| Percentage of drained area that is impermeable (%): | 50 |
| Impervious area drained via infiltration (ha): | 0 |
| Return period for infiltration system design (year): | 10 |
| Impervious area drained to rainwater harvesting (ha): | 0 |
| Return period for rainwater harvesting system (year): | 10 |
| Compliance factor for rainwater harvesting system (%): | 66 |
| Net site area for storage volume design (ha): | 0.61 |
| Net impermable area for storage volume design (ha): | 0.35 |
| Pervious area contribution to runoff (%): | 30 |

* 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 $Q_{BAR}$ and other flow rates will have been reduced accordingly.

## Methodology

| | |
|---|---|
| esti | IH124 |
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 4 | 4 |
| SPR: | 0.47 | 0.47 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| Rainfall 100 yrs 6 hrs: | -- | 70 |
| Rainfall 100 yrs 12 hrs: | -- | 84 |
| FEH / FSR conversion factor: | 1 | 1 |
| SAAR (mm): | 1135 | 1135 |
| M5-60 Rainfall Depth (mm): | 20 | 20 |
| 'r' Ratio M5-60/M5-2 day: | 0.3 | 0.3 |
| Hydological 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 years: | 2.08 | 2.08 |
| $Q_{BAR}$ for total site area (l/s): | 5.19 | 5.19 |
| $Q_{BAR}$ for net site area (l/s): | 5.19 | 5.19 |

## Design criteria

| | |
|---|---|
| Climate change allowance factor: | 1.4 |
| Urban creep allowance factor: | 1.1 |
| Volume control approach | Use long term storage |
| Interception rainfall depth (mm): | 5 |
| Minimum flow rate (l/s): | 5 |

## Site discharge rates

| | Default | Edited |
|---|---|---|
| 1 in 1 year (l/s): | 5 | 5 |
| 1 in 30 years (l/s): | 8.8 | 8.8 |
| 1 in 100 year (l/s): | 10.8 | 10.8 |

## Estimated storage volumes

| | Default | Edited |
|---|---|---|
| Attenuation storage 1/100 years (m³): | 189 | 189 |
| Long term storage 1/100 years (m³): | 0 | 0 |
| Total storage 1/100 years (m³): | 189 | 189 |

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | John O'Connor |
| Site name: | How Bank Farm SC2 |
| Site location: | Egremont CA22 2HD |

This is an estimation of the storage volume requirements that are needed 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). 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 design of the drainage scheme.

### Site Details

| | |
|---|---|
| Latitude: | 54.48443° N |
| Longitude: | 3.54253° W |
| Reference: | 2612139595 |
| Date: | Jul 27 2020 15:17 |

## Site characteristics

| | |
|---|---|
| Total site area (ha): | 0.743 |
| Significant public open space (ha): | 0 |
| Area positively drained (ha): | 0.743 |
| Impermeable area (ha): | 0.372 |
| Percentage of drained area that is impermeable (%): | 50 |
| Impervious area drained via infiltration (ha): | 0 |
| Return period for infiltration system design (year): | 10 |
| Impervious area drained to rainwater harvesting (ha): | 0 |
| Return period for rainwater harvesting system (year): | 10 |
| Compliance factor for rainwater harvesting system (%): | 66 |
| Net site area for storage volume design (ha): | 0.74 |
| Net impermable area for storage volume design (ha): | 0.42 |
| Pervious area contribution to runoff (%): | 30 |

* 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 $Q_{BAR}$ and other flow rates will have been reduced accordingly.

## Methodology

| | |
|---|---|
| esti | IH124 |
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 4 | 4 |
| SPR: | 0.47 | 0.47 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| Rainfall 100 yrs 6 hrs: | -- | 70 |
| Rainfall 100 yrs 12 hrs: | -- | 84 |
| FEH / FSR conversion factor: | 1 | 1 |
| SAAR (mm): | 1135 | 1135 |
| M5-60 Rainfall Depth (mm): | 20 | 20 |
| 'r' Ratio M5-60/M5-2 day: | 0.3 | 0.3 |
| Hydological 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 years: | 2.08 | 2.08 |
| $Q_{BAR}$ for total site area (l/s): | 6.31 | 6.31 |
| $Q_{BAR}$ for net site area (l/s): | 6.31 | 6.31 |

## Design criteria

| | |
|---|---|
| Climate change allowance factor: | 1.4 |
| Urban creep allowance factor: | 1.1 |
| Volume control approach | Use long term storage |
| Interception rainfall depth (mm): | 5 |
| Minimum flow rate (l/s): | 5 |

## Site discharge rates

| | Default | Edited |
|---|---|---|
| 1 in 1 year (l/s): | 5.5 | 5.5 |
| 1 in 30 years (l/s): | 10.7 | 10.7 |
| 1 in 100 year (l/s): | 13.1 | 13.1 |

## Estimated storage volumes

| | Default | Edited |
|---|---|---|
| Attenuation storage 1/100 years (m³): | 260 | 260 |
| Long term storage 1/100 years (m³): | 0 | 0 |
| Total storage 1/100 years (m³): | 260 | 260 |

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | John O'Connor |
| Site name: | How Bank Farm SC3 |
| Site location: | Egremont CA22 2HD |

This is an estimation of the storage volume requirements that are needed 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). 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 design of the drainage scheme.

## Site Details

| | |
|---|---|
| Latitude: | 54.48510° N |
| Longitude: | 3.54364° W |
| Reference: | 315747871 |
| Date: | Aug 06 2020 11:39 |

## Site characteristics

| | |
|---|---|
| Total site area (ha): | 1.26 |
| Significant public open space (ha): | 0 |
| Area positively drained (ha): | 1.26 |
| Impermeable area (ha): | 0.63 |
| Percentage of drained area that is impermeable (%): | 50 |
| Impervious area drained via infiltration (ha): | 0.63 |
| Return period for infiltration system design (year): | 10 |
| Impervious area drained to rainwater harvesting (ha): | 0 |
| Return period for rainwater harvesting system (year): | 10 |
| Compliance factor for rainwater harvesting system (%): | 66 |
| Net site area for storage volume design (ha): | 0.42 |
| Net impermable area for storage volume design (ha): | 0.24 |
| Pervious area contribution to runoff (%): | 30 |

* 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 $Q_{BAR}$ and other flow rates will have been reduced accordingly.

## Methodology

| | |
|---|---|
| esti | IH124 |
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 4 | 4 |
| SPR: | 0.47 | 0.47 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| Rainfall 100 yrs 6 hrs: | -- | 70 |
| Rainfall 100 yrs 12 hrs: | -- | 84 |
| FEH / FSR conversion factor: | 1 | 1 |
| SAAR (mm): | 1169 | 1169 |
| M5-60 Rainfall Depth (mm): | 20 | 20 |
| 'r' Ratio M5-60/M5-2 day: | 0.3 | 0.3 |
| Hydological 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 years: | 2.08 | 2.08 |
| $Q_{BAR}$ for total site area (l/s): | 11.08 | 11.08 |
| $Q_{BAR}$ for net site area (l/s): | 3.73 | 3.73 |

## Design criteria

| | |
|---|---|
| Climate change allowance factor: | 1.4 |
| Urban creep allowance factor: | 1.1 |
| Volume control approach | Use long term storage |
| Interception rainfall depth (mm): | 5 |
| Minimum flow rate (l/s): | 5 |

## Site discharge rates

| | Default | Edited |
|---|---|---|
| 1 in 1 year (l/s): | 5 | 5 |
| 1 in 30 years (l/s): | 6.3 | 6.3 |
| 1 in 100 year (l/s): | 7.8 | 7.8 |

## Estimated storage volumes

| | Default | Edited |
|---|---|---|
| Attenuation storage 1/100 years (m³): | 109 | 109 |
| Long term storage 1/100 years (m³): | 0 | 0 |
| Total storage 1/100 years (m³): | 109 | 109 |

# Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

| | |
|---|---|
| Calculated by: | John O'Connor |
| Site name: | How Bank Farm SC4 |
| Site location: | Egremont CA22 2HD |

This is an estimation of the storage volume requirements that are needed 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). 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 design of the drainage scheme.

## Site Details

| | |
|---|---|
| Latitude: | 54.48894° N |
| Longitude: | 3.51746° W |
| Reference: | 2421080788 |
| Date: | Aug 06 2020 13:28 |

## Site characteristics

| | |
|---|---|
| Total site area (ha): | 1.65 |
| Significant public open space (ha): | 0 |
| Area positively drained (ha): | 1.65 |
| Impermeable area (ha): | 0.825 |
| Percentage of drained area that is impermeable (%): | 50 |
| Impervious area drained via infiltration (ha): | 0.825 |
| Return period for infiltration system design (year): | 10 |
| Impervious area drained to rainwater harvesting (ha): | 0 |
| Return period for rainwater harvesting system (year): | 10 |
| Compliance factor for rainwater harvesting system (%): | 66 |
| Net site area for storage volume design (ha): | 0.56 |
| Net impermable area for storage volume design (ha): | 0.32 |
| Pervious area contribution to runoff (%): | 30 |

* 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 $Q_{BAR}$ and other flow rates will have been reduced accordingly.

## Methodology

| | |
|---|---|
| esti | IH124 |
| $Q_{BAR}$ estimation method: | Calculate from SPR and SAAR |
| SPR estimation method: | Calculate from SOIL type |

## Soil characteristics

| | Default | Edited |
|---|---|---|
| SOIL type: | 4 | 4 |
| SPR: | 0.47 | 0.47 |

## Hydrological characteristics

| | Default | Edited |
|---|---|---|
| Rainfall 100 yrs 6 hrs: | -- | 70 |
| Rainfall 100 yrs 12 hrs: | -- | 84 |
| FEH / FSR conversion factor: | 0.93 | 1 |
| SAAR (mm): | 1227 | 1227 |
| M5-60 Rainfall Depth (mm): | 20 | 20 |
| 'r' Ratio M5-60/M5-2 day: | 0.3 | 0.3 |
| Hydological 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 years: | 2.08 | 2.08 |
| $Q_{BAR}$ for total site area (l/s): | 15.36 | 15.36 |
| $Q_{BAR}$ for net site area (l/s): | 5.17 | 5.17 |

## Design criteria

| | |
|---|---|
| Climate change allowance factor: | 1.4 |
| Urban creep allowance factor: | 1.1 |
| Volume control approach | Use long term storage |
| Interception rainfall depth (mm): | 5 |
| Minimum flow rate (l/s): | 5 |

## Site discharge rates

| | Default | Edited |
|---|---|---|
| 1 in 1 year (l/s): | 5 | 5 |
| 1 in 30 years (l/s): | 8.8 | 8.8 |
| 1 in 100 year (l/s): | 10.8 | 10.8 |

## Estimated storage volumes

| | Default | Edited |
|---|---|---|
| Attenuation storage 1/100 years (m³): | 156 | 172 |
| Long term storage 1/100 years (m³): | 0 | 0 |
| Total storage 1/100 years (m³): | 156 | 172 |

End of Report