# TECHNICAL NOTE

| | |
|---|---|
| **Job Name:** | Peter Hills School, Southwark |
| **Job No:** | 332510628/4001 |
| **Note No:** | TN001 |
| **Date:** | May 2021 |
| **Prepared By:** | Elizabeth Edney |
| **Subject:** | **Discharge of Condition 3 (Surface Water Drainage Strategy) for planning permission ref. 20/AP/2581** |

## 1. Introduction

1.1. Planning permission was granted by the London Borough of Southwark (LBS) in December 2020 under planning ref. *20/AP/2581* for the "*construction of a synthetic grass (4G) pitch 50m x 27m (1,350m$^2$) in size with associated lighting, noise reduction screening and rebound weldmesh fencing with roof netting (4.5m) around the perimeter.*"

1.2. LBS have attached a planning condition to the consent (no. 3) in relation to a surface water drainage design as follows:

> "*3. No works (excluding demolition and site clearance) shall commence until full details of the proposed surface water drainage system incorporating the Sustainable Drainage System (SuDs) have been submitted to and approved in writing by the Local Planning Authority, including detailed design, dimensions, depth and location of attenuation units and details of flow control measures.*
>
> *The specific SuDs type, arrangement and material should be given in line with the proposed strategy dependant on any necessary site investigations. The strategy should achieve a net reduction of runoff rates to 1l/s, as detailed in the Flood Risk Assessment Document Draft V1.0 prepared and authorised by Ambiental Environmental Assessment.*
>
> *The applicant must confirm that the site is safe in the event of blockage/failure of the system, including consideration of exceedance flows. The site drainage must be constructed to the approved details."*

1.3. This Note sets out the information required by SCC above to discharge Condition 3.

## 2. Existing Development and Drainage Regime

2.1. The planning consent above relates to the construction of a new synthetic grass pitch 50m x 27m (1,350m$^2$) adjacent to an existing synthetic pitch 20m x 36m (720m$^2$) as shown on the drawings by ETC Sports in **Appendix TN001-A**.

## 3. Ground Investigation & Infiltration Testing

3.1. Infiltration testing was undertaken by Ashdown Site Investigation Ltd. in May 2021 and a copy of the report is provided in **Appendix TN001-B**.

3.2. 3 no. trial pits were dug into the Made Ground at the site to between 0.9 and 1.0 metre below ground level (m bgl) to coincide with the likely base of the new surfacing.

3.3. The geological conditions at the site were observed as follows:

- Topsoil to 0.1m bgl (where present);
- Made Ground consisting of brown gravelly sandy clay to c.0.3m bgl; and
- Dark brown sandy clayey angular-subrounded fine/coarse gravel to 0.0-1.0m bgl.

3.4. No groundwater was encountered during the site investigation to the base of the trial pits.

3.5. Infiltration testing was undertaken in accordance with the BRE Digest 365 (2016) within the existing Made Ground Stratum to a depth of 0.9-1.0m bgl. The infiltration rates observed ranged from 6.10 x $10^{-6}$ m/s (0.022 m/hr) to 5.50 x $10^{-5}$ m/s (0.198 m/hr).

3.6. These rates are above the minimum recommended within the SuDS Manual for infiltration drainage (1 x $10^{-6}$ m/s) and therefore it is considered that the use of infiltration drainage is suitable at the site. As a conservative approach, the lowest infiltration rate of 6.10 x $10^{-6}$ m/s (0.022 m/hr) has been used in the MicroDrainage model.

## 4. SuDS Hierarchy

4.1. The preferred option for surface water disposal in accordance with the Building Regulations H3 hierarchy is to dispose of surface water runoff via infiltration.

4.2. Based on the geological information in **Section 3**, it is concluded that infiltration drainage is feasible at the site. This will therefore provide betterment over the drainage strategy previously proposed as part of the planning application, as infiltration is being utilised over discharge to an off-site receptor.

## 5. Surface Water Drainage Strategy

### Proposed Development and Drainage Approach

5.1. The proposals are for the construction of a new synthetic grass pitch which has an area of 1,350m$^2$. The proposals are shown on the drawings by ETC Sports in **Appendix TN001-A**.

5.2. The pitch build up is a 40mm porous macadam layer underlain by a 250mm layer of Type 1 sub-base (assumed 10% porosity) and Terram geotextile layer.

### Drainage System Design Standard and Exceedance Rates

5.3. As the facility is to be used for outdoor sports, it is not anticipated that it will be in use in heavy rainfall. Therefore, the design event, defined by surface flooding rendering the courts unplayable is determined by the 1 in 30 (3.3%) annual probability rainfall event. This is in line with general SuDS guidance for development whereby short-term surface flooding is permitted where it does not cause an increase in flood risk to others.

5.4. The MicroDrainage results in **Appendix TN001-C** show that the stone underlying the proposed courts can accommodate surface water runoff up to and including the 1 in 30 annual probability plus 10% allowance for climate change rainfall event.

## 6. Water Quality and Maintenance

6.1. The sources of surface water runoff from the proposed development will be from the pitch areas themselves which will be relatively clean in nature and will be filtered through the porous surfacing to the underlying stone before runoff infiltrates to ground.

6.2. Surface water runoff and water quality will be managed during construction by the appointed contractor.

6.3. Peter Hills School will be responsible for the maintenance of the surface water drainage system once constructed.

## 7. Summary

7.1. The sections above confirm that the proposed surface water drainage system has been designed to comply with national and local standards.

**DOCUMENT ISSUE RECORD**

| Technical Note No | Rev | Date | Prepared | Reviewed | Approved |
|---|---|---|---|---|---|
| 332510628/4001/TN001 | - | 03/06/21 | E Edney | J Pulsford | J Pulsford |
| | | | | | |



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# TECHNICAL NOTE

## Appendix TN001-A

Drawing 002_A  dated May 2021

# Peter Hills C of E Primary School
# 2 Beatson Walk
# Rotherhithe
# London

## In Situ Infiltration Test Report

**Report Beneficiary:**
Active Landscapes Ltd
4 Wigwell Gardens
Great Horwood
Milton Keynes
Buckinghamshire
MK17 0QX

## Project Reference: P15156

## Report Reference: R14827

| Document Control | | | |
|---|---|---|---|
| **Issue No.** | **Status** | **Issue Date** | **Notes** |
| 1 | Final | 21st May 2021 | |

| Report Section | Prepared By | Approved By |
|---|---|---|
| In Situ Infiltration Testing | Rebecca Webb<br>BSc FGS | Steven McSwiney<br>BA mod Geol MSc FGS |

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## Limitations

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## FIGURES AND APPENDICES

# 1. INTRODUCTION

Ashdown Site Investigation Ltd was requested to undertake in situ infiltration testing at Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London to assist others with the design of a sustainable drainage system (SuDS) for the proposed development, understood to be a new playing pitch.

The specific objectives of the works were to:
a) Establish the expected geology and hydrogeology at the site;
b) Investigate the shallow ground and groundwater conditions at the test locations; and
c) Undertake in situ soakage testing and provide infiltration rates to assist others in undertaking design of SuDS.

The scope of the works covered by this report, and the terms and conditions under which they were undertaken, were set out within the offer letter Q10775, dated 7th April 2021. The instruction to proceed was received from ETC Sports Surfaces Limited.

# 2. SITE CONTEXT

## 2.1 Site Details

The site lies within the grounds of Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London, and is centred on the approximate Ordnance Survey national grid reference TQ 3596 8034. A site location plan and site plan are presented as Figure 1 and Figure 2, respectively.

## 2.2 Geological and hydrogeological Data Review

### *2.2.1 Expected Geology and Aquifer Designation*

The stratigraphic succession that may be expected to underlie the site is presented in the following table.

*Table 1. Expected Strata and Aquifer Designation*

| Type | Stratum | Aquifer Designation |
|---|---|---|
| **Artificial Ground** | Made Ground | n/a |
| **Superficial** | Alluvium | Secondary Undifferentiated Aquifer |
| **Bedrock** | Lambeth Group | Secondary A Aquifer |

Anecdotal evidence indicates made ground soils may be present beneath the site.

Alluvium is a term for any material that has been transported and laid down by rivers. It can variably comprise sand and gravel, and, where deposited on flood plains may include compressible organic clay and silt. Peat and sand horizons may be present within the deposits, indicating localised changes within the depositional regime.

The Lambeth Group (formerly named the Woolwich and Reading Beds) comprises a complex and laterally variable sequence of sedimentary deposits including clay, silt, sand and gravel. Inter-laminated clay and sand deposits are common in the lower part of the succession. The component formations are the Upnor Formation, Reading Formation and Woolwich Formation.

### *2.2.2 Groundwater Source Protection Zones*

The site does not lie within an Environment Agency Source Protection Zone with regard to the protection of the quality of groundwater that is abstracted for potable supply.

# 3. SITE WORKS

The site works comprised the excavation of three hand dug pits, designated TP01 to TP03, to depths of 0.90m or 1.00m below ground level. The exploratory hole locations, specified by others, are shown on Figure 2.

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in the appendices, together with notes to assist in their interpretation.

Falling head soakage testing was undertaken in the trial pits in general accordance with BRE guidance BRE guidance[1], other than the pits did not all achieve three fills due to the slow draining nature of the soils and works being limited to a single day on site.

[1] Section 3.2.3 of Building Research Establishment (BRE) Digest 365, 2016.

# 4. GROUND CONDITIONS

## 4.1 Stratigraphy

### *4.1.1 Surface Covering*

Each of the exploratory holes was excavated through a surface cover of topsoil some 100mm in thickness.

### *4.1.2 Made Ground*

Made ground, generally comprising gravelly sandy clay and sandy clayey gravel, was recorded to the full depth of each trial pit; the pits having been excavated to depths of 0.90m or 1.00m below ground level. The gravel fraction comprised variable quantities of flint, brick, concrete, chalk, metal, plastic, clinker-like material, charcoal-like material and ash-like material.

## 4.2 Groundwater Conditions and Stability

Each of the exploratory holes was recorded to remain dry and stable during the course of excavation.

It should be noted that water levels within the exploratory holes may not have equilibrated with the groundwater table at the time the readings were recorded and that groundwater levels should be expected to fluctuate seasonally.

# 5. STORMWATER INFILTRATION SYSTEMS

In-situ infiltration testing[2] was carried out in each of the trial pits.

For the majority of tests, the soil infiltration rate (f) was calculated by dividing the volume of water lost between 75% and 25% of the initial test depth by the sum of the average surface area of the sides of the trial pit in contact with the water during the test monitoring period, and its base area. This figure was then divided by the test duration (time taken for the water level to fall between 75% and 25% of the initial test depth) to give the soil infiltration rate in metres per second.

During the first test in trial pit TP02 and the second test in TP03, the water level within the test pits did not fall below 25% of the initial test depth and calculation of the soil infiltration rates in accordance with the BRE digest was not possible. For each of these tests, the soil infiltration rate has therefore been calculated by dividing the volume of water lost during the test by the product of the average surface area of the trial pit in contact with water during the test period and the test duration in seconds.

The infiltration rates derived from the tests are summarised in the following table.

*Table 2. Calculated Infiltration Rates*

| Exploratory Hole | Test Response Zone Depth (m) | | Stratum | Infiltration Rate (f) (m/sec) |
|---|---|---|---|---|
| | Top | Bottom | | |
| **TP01 Test 1** | 0.52 | 1.00 | Made Ground | $5.5 \times 10^{-5}$ |
| **TP01 Test 2** | 0.60 | 1.00 | Made Ground | $1.5 \times 10^{-5}$ |
| **TP01 Test 3** | 0.70 | 1.00 | Made Ground | $1.4 \times 10^{-5}$ |
| **TP02 Test 1** | 0.38 | 0.90 | Made Ground | $3.0 \times 10^{-6}$ |
| **TP03 Test 1** | 0.47 | 0.90 | Made Ground | $2.2 \times 10^{-5}$ |
| **TP03 Test 2** | 0.38 | 0.90 | Made Ground | $1.4 \times 10^{-5}$ |

The value 'f' is equivalent to the soil infiltration coefficient 'q' quoted in the Construction Industry Research and Information Association (CIRIA) Report 156.

The results from the infiltration tests should be provided to engineers responsible for the design of the drainage system.

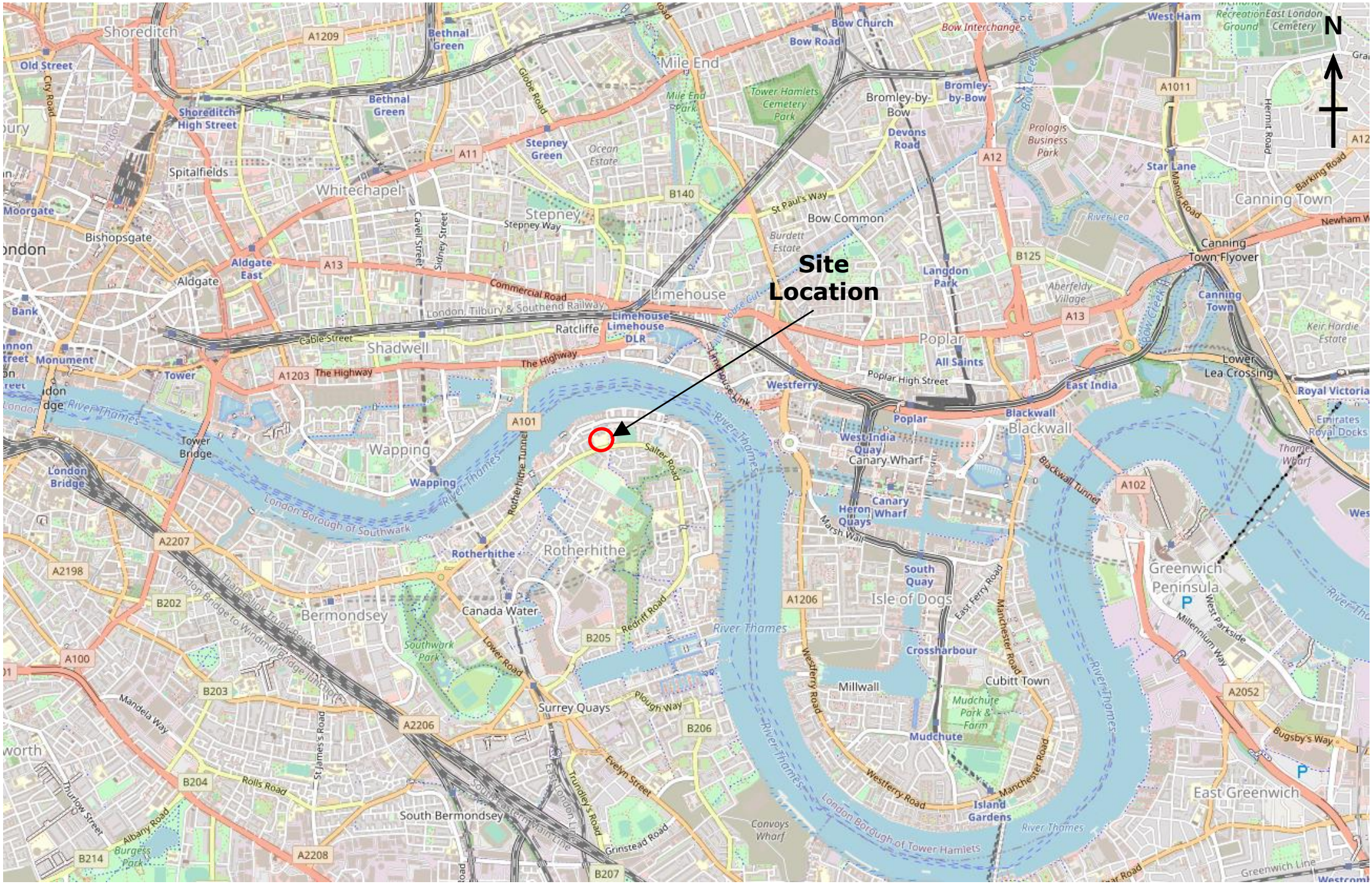
To comply with building regulations[3], point discharging infiltration systems (conventional ring or trench soakaways) are required to be constructed a minimum of 5.0m away from proposed or existing buildings.

**Ashdown Site Investigation Ltd.**

[2] Conducted in general accordance with the requirements of BRE 365, Soakaway Design.
[3] The Building Regulations 2010; Part H; Drainage and Waste Disposal

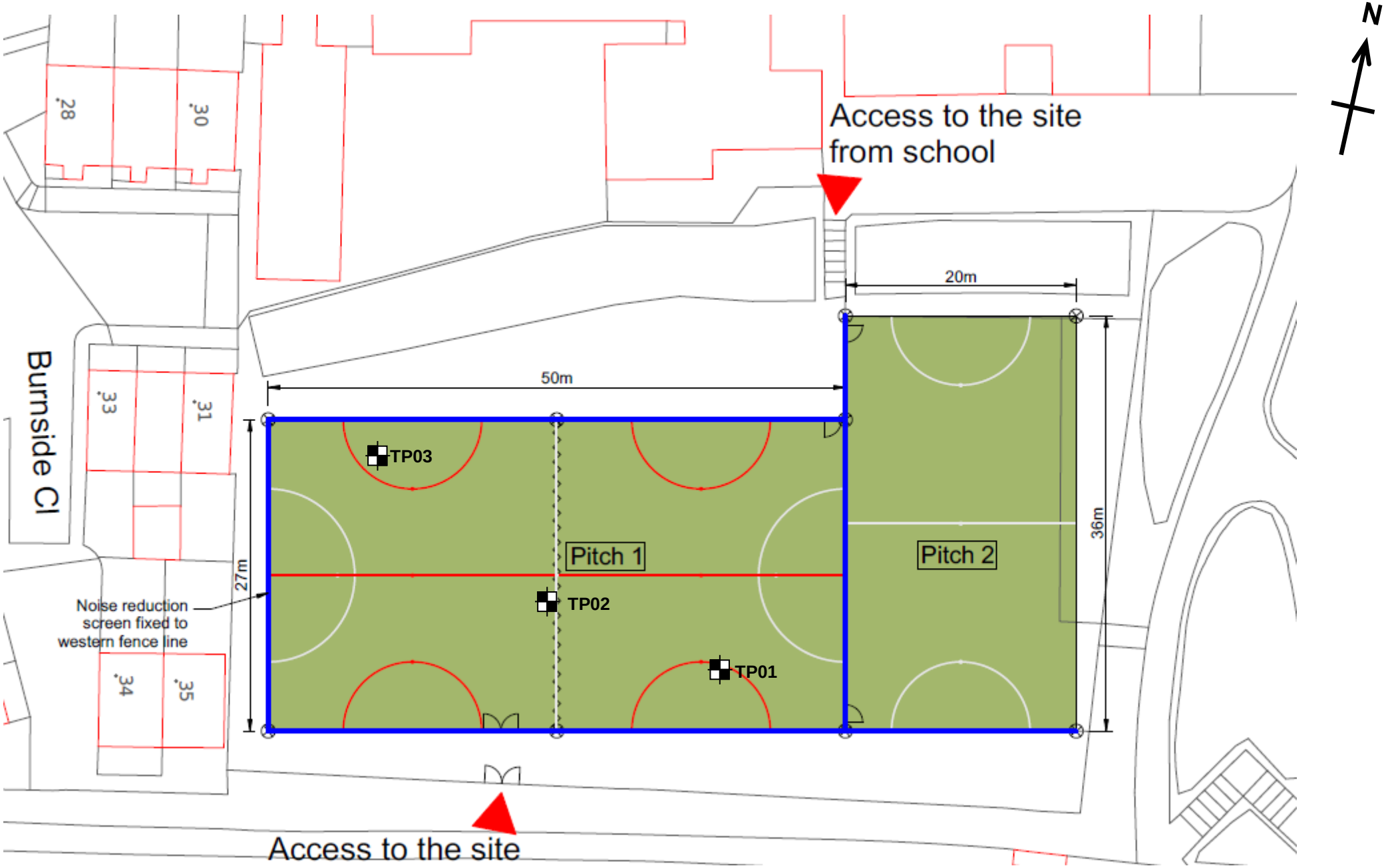
## FIGURES AND APPENDICES

Figure 1 Site Location Plan
Figure 2 Site Plan
Exploratory Hole Notes
Exploratory Hole Records
Summary of Trial Pit Falling Head Soakage Test Results






| ASHDOWN SITE INVESTIGATION LIMITED | Site Location Plan | Site Name | Figure No. | Project Reference |
|---|---|---|---|---|
| | | Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London | 1 | P15156 |




| ASHDOWN SITE INVESTIGATION LIMITED | Site Plan | Site Name | Figure No. | Project Reference |
|---|---|---|---|---|
| | | Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London | 2 | P15156 |

# NOTES FOR THE INTERPRETATION OF EXPLORATORY HOLE RECORDS

## 1 Symbols and abbreviations

*Samples*

U 'Undisturbed' Sample: - 100mm diameter by 450mm long. The number of blows to drive in the sampling tube is shown after the test index letter in the SPT column.
$U_o$ Sample not obtained
U* Full penetration of sample not obtained
Pi Piston Sample: 'Undisturbed' sample 100mm diameter by 600mm long.
D Disturbed Sample
R Root Sample
B Bulk Disturbed Sample
W Water Sample
J Jar Sample (sample taken in amber glass jar fitted with gas tight lid)
T Tub Sample
Vi Vial Sample

*In situ Testing*

S Standard penetration test (SPT): Using the split spoon sampler.

C Standard Penetration Test (SPT): using a solid cone instead of the sampler - conducted usually in coarse grained soils or weak rocks.

V Shear Vane Test: Undrained shear strength (cohesion) ($kN/m^2$) shown within the Vane/Pen Test and N Value column.

H Hand penetrometer Test: Undrained shear strength (cohesion) ($kN/m^2$) shown within the Vane/Pen Test and N Value column.

P Perth Penetrometer Test: Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column.

*Excavation Method*

CP Cable Percussion Borehole
WLS Dynamic Sampler Borehole using windowless sampler tubes
WS Dynamic Sampler Borehole using window sampler tubes
TP Trial Pit excavated using mechanic excavator
HDP Trial Pit excavated using hand tools

## 2 Soil Description

Description and classification of soils has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of soil, Part 1 Identification and description (BS EN ISO 14688-1) and Part 2 Principles of classification (BS EN 14688-2) as well as the BS5930 code of Practice for Ground Investigations.

## 3 Rock Description

Description and classification of rocks has been carried out using as a general basis the British Standard Geotechnical investigation and testing – Identification and classification of rock, Part 1 Identification and classification (BS EN ISO 14689-1) as well as the BS5930 code of Practice for Ground Investigations. TCR – Total Core Recovery, SCR – Solid Core Recovery, RQD – Rock Quality Designation, NI – Non Intact, If – indicative fracture spacing (min/ave/max), FI – Fracture Index.

## 4 Chalk Description

Chalk description is based on BS EN ISO 14688, BS EN ISO 14689 and BS5930. The classification of chalk generally follows the guidance offered by the Construction Industry Research and Information Association (CIRIA) C574, 'Engineering in Chalk'. This is based on assessment of chalk density, discontinuity and aperture spacing, and the proportion of intact chalk to silt of chalk.

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**Site Name:** Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London

**Job Number:** P15156

**Start Date:** 06/05/2021

**End Date:** 06/05/2021

**Trial Pit Number:** **TP01**



| Samples and In Situ Testing | | | | Legend | Depth/ Reduced Level | Stratum Description |
|---|---|---|---|---|---|---|
| Sample/ Test Type | Depth From (m) | Depth To (m) | Test Result | | | |
| | | | | | 0.00 | Topsoil. |
| D | 0.20 | | | | 0.10 | MADE GROUND: Brown and dark brown gravelly sandy clay. Gravel is angular to subrounded fine to coarse flint, brick, concrete, clinker-like material and ash-like material. |
| | | | | | 0.30 | MADE GROUND: Dark brown sandy clayey angular to subrounded fine to coarse gravel of brick, chalk, metal, clinker-like material, charcoal-like material and ash-like material. |
| D | 0.60 | | | | | |
| | | | | | 1.00 | End of trial pit at 1.00m |

**Remarks**

**Groundwater:** Trial pit dry on completion.

**Stability:** Trial pit stable on completion.

**Notes:** n/a

**Excavation Method:** HDP

**Pit Length:** 1.00m

**Pit Width:** 0.30m

**Made By:** RJ

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**Site Name:** Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London

**Job Number:** P15156

**Start Date:** 06/05/2021

**End Date:** 06/05/2021

**Trial Pit Number:** **TP02**



| Samples and In Situ Testing | | | | Legend | Depth/ Reduced Level | Stratum Description |
|---|---|---|---|---|---|---|
| Sample/ Test Type | Depth From (m) | Depth To (m) | Test Result | | | |
| | | | | | 0.00 | Topsoil. |
| D | 0.20 | | | | 0.10 | MADE GROUND: Brown, dark brown and grey sandy silty angular to subrounded fine to coarse gravel of brick, charcoal-like material, clinker-like material, plastic, flint and concrete with cobbles of flint and brick. |
| D | 0.70 | | | | 0.50 | MADE GROUND: Dark brown gravelly sandy clay. Gravel is angular to subrounded fine to coarse flint, brick, clinker-like material and charcoal-like material. |
| | | | | | 0.90 | End of trial pit at 0.90m |

**Remarks**

**Groundwater:** Trial pit dry on completion.

**Stability:** Trial pit stable on completion.

**Notes:** No further progress below 0.90m - too gravelly/ dense.

**Excavation Method:** HDP

**Pit Length:** 1.00m

**Pit Width:** 0.30m

**Made By:** RJ

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**Site Name:** Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London

**Job Number:** P15156

**Start Date:** 06/05/2021

**End Date:** 06/05/2021

**Trial Pit Number:** **TP03**



| Samples and In Situ Testing | | | | Legend | Depth/ Reduced Level | Stratum Description |
|---|---|---|---|---|---|---|
| Sample/ Test Type | Depth From (m) | Depth To (m) | Test Result | | | |
| | | | | | 0.00 | Topsoil. |
| | | | | | 0.10 | MADE GROUND: Brown and dark brown silty clayey angular to subrounded fine to coarse gravel of brick, flint, ceramic, concrete, clinker-like material, charcoal-like material with occasional cobbles of brick, flint and concrete. |
| D | 0.50 | | | | | |
| D | 0.80 | | | | | |
| | | | | | 0.90 | End of trial pit at 0.90m |

**Remarks**

**Groundwater:** Trial pit dry on completion.

**Stability:** Trial pit stable on completion.

**Notes:** No further progress below 0.90m - too gravelly/ dense.

| | |
|---|---|
| **Excavation Method:** | HDP |
| **Pit Length:** | 1.00m |
| **Pit Width:** | 0.30m |
| **Made By:** | RJ |

# ASHDOWN SITE INVESTIGATION LIMITED

| | |
|---|---|
| Site: Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London | Project No: P15156<br>Sheet No.: 1 of 3 |

## SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

| TP01 (Test 1) | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.52 |
| 1 | 0.57 |
| 2 | 0.60 |
| 5 | 0.66 |
| 10 | 0.73 |
| 15 | 0.76 |
| 20 | 0.82 |
| 30 | 0.90 |
| 65 | 0.95 |
| Pit Length – 1.00m<br>Pit Width - 0.30m<br>Pit Depth – 1.00m bgl | |

| TP01 (Test 2) | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.60 |
| 1 | 0.65 |
| 2 | 0.70 |
| 5 | 0.73 |
| 8 | 0.76 |
| 12 | 0.78 |
| 22 | 0.79 |
| 47 | 0.80 |
| 85 | 0.91 |
| 105 | 0.93 |
| Pit Length – 1.00m<br>Pit Width - 0.30m<br>Pit Depth – 1.00m bgl | |

| TP01 (Test 3) | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.70 |
| 1 | 0.72 |
| 2 | 0.72 |
| 6 | 0.73 |
| 8 | 0.74 |
| 13 | 0.74 |
| 15 | 0.75 |
| 20 | 0.77 |
| 30 | 0.78 |
| 40 | 0.80 |
| 60 | 0.83 |
| 70 | 0.90 |
| 105 | 0.93 |
| Pit Length – 1.00m<br>Pit Width - 0.30m<br>Pit Depth – 1.00m bgl | |

Remarks: bgl - below ground level.

# ASHDOWN SITE INVESTIGATION LIMITED

| | | | |
|---|---|---|---|
| Site: | Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London | Project No: | P15156 |
| | | Sheet No.: | 2 of 3 |

## SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

| **TP02 (Test 1)** | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.38 |
| 1 | 0.40 |
| 3 | 0.41 |
| 5 | 0.43 |
| 6 | 0.43 |
| 11 | 0.44 |
| 15 | 0.45 |
| 18 | 0.47 |
| 29 | 0.47 |
| 38 | 0.47 |
| 45 | 0.48 |
| 60 | 0.49 |
| 82 | 0.50 |
| 94 | 0.50 |
| 110 | 0.52 |
| 165 | 0.52 |
| 172 | 0.53 |
| Pit Length – 1.00m<br>Pit Width - 0.30m<br>Pit Depth – 0.90m bgl | |

Remarks: bgl - below ground level.

# ASHDOWN SITE INVESTIGATION LIMITED

| | |
|---|---|
| Site: Peter Hills C of E Primary School, 2 Beatson Walk, Rotherhithe, London | Project No: P15156<br>Sheet No.: 3 of 3 |

## SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

| TP03 (Test 1) | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.47 |
| 1 | 0.50 |
| 3 | 0.53 |
| 6 | 0.56 |
| 8 | 0.59 |
| 12 | 0.62 |
| 20 | 0.63 |
| 35 | 0.66 |
| 42 | 0.71 |
| 65 | 0.80 |
| 82 | 0.90 |
| Pit Length – 1.00m<br>Pit Width - 0.30m<br>Pit Depth – 0.90m bgl | |

| TP03 (Test 2) | |
|---|---|
| Time (mins) | Depth to water (m bgl) |
| 0 | 0.38 |
| 2 | 0.39 |
| 16 | 0.40 |
| 36 | 0.52 |
| 45 | 0.60 |
| 72 | 0.67 |
| 88 | 0.70 |
| 100 | 0.72 |
| Pit Length – 1.00 m<br>Pit Width - 0.30m<br>Pit Depth – 0.90m bgl | |

Remarks: bgl - below ground level.

# TECHNICAL NOTE

## Appendix TN001-B

Infiltration Testing Report by Ashdown Site Investigations Ltd. (ref. R14827) dated 21st May 2021


Project :

# Peter Hill, London

Title :

Site Plan

Drawing Number :

002

| Date: | Scale: |
|---|---|
| 03 April 2020 | 1:500 @ A3 |

Revisions

| | |
|---|---|
| A | Removed goal recesses |
| | |
| | |
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| | |

# TECHNICAL NOTE

## Appendix TN001-C

MicroDrainage Source Control Outputs

## Summary of Results for 30 year Return Period (+10%)

Half Drain Time : 50 minutes.

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 15 min Summer | 0.181 | 0.181 | 4.1 | 13.2 | O K |
| 30 min Summer | 0.211 | 0.211 | 4.1 | 17.3 | O K |
| 60 min Summer | 0.228 | 0.228 | 4.1 | 19.5 | O K |
| 120 min Summer | 0.233 | 0.233 | 4.1 | 20.2 | O K |
| 180 min Summer | 0.226 | 0.226 | 4.1 | 19.3 | O K |
| 240 min Summer | 0.216 | 0.216 | 4.1 | 17.9 | O K |
| 360 min Summer | 0.194 | 0.194 | 4.1 | 14.9 | O K |
| 480 min Summer | 0.174 | 0.174 | 4.1 | 12.3 | O K |
| 600 min Summer | 0.160 | 0.160 | 4.0 | 10.4 | O K |
| 720 min Summer | 0.149 | 0.149 | 3.7 | 9.0 | O K |
| 960 min Summer | 0.131 | 0.131 | 3.2 | 6.9 | O K |
| 1440 min Summer | 0.105 | 0.105 | 2.6 | 4.5 | O K |
| 2160 min Summer | 0.081 | 0.081 | 2.0 | 2.7 | O K |
| 2880 min Summer | 0.066 | 0.066 | 1.6 | 1.8 | O K |
| 4320 min Summer | 0.049 | 0.049 | 1.2 | 1.0 | O K |
| 5760 min Summer | 0.044 | 0.044 | 0.9 | 0.8 | O K |
| 7200 min Summer | 0.040 | 0.040 | 0.8 | 0.6 | O K |
| 8640 min Summer | 0.037 | 0.037 | 0.7 | 0.5 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Time-Peak (mins) |
|---|---|---|---|
| 15 min Summer | 87.490 | 0.0 | 17 |
| 30 min Summer | 55.863 | 0.0 | 31 |
| 60 min Summer | 34.065 | 0.0 | 52 |
| 120 min Summer | 20.171 | 0.0 | 84 |
| 180 min Summer | 14.701 | 0.0 | 118 |
| 240 min Summer | 11.703 | 0.0 | 152 |
| 360 min Summer | 8.452 | 0.0 | 216 |
| 480 min Summer | 6.710 | 0.0 | 274 |
| 600 min Summer | 5.607 | 0.0 | 334 |
| 720 min Summer | 4.840 | 0.0 | 394 |
| 960 min Summer | 3.836 | 0.0 | 512 |
| 1440 min Summer | 2.761 | 0.0 | 752 |
| 2160 min Summer | 1.986 | 0.0 | 1104 |
| 2880 min Summer | 1.571 | 0.0 | 1468 |
| 4320 min Summer | 1.128 | 0.0 | 2176 |
| 5760 min Summer | 0.892 | 0.0 | 2872 |
| 7200 min Summer | 0.743 | 0.0 | 3656 |
| 8640 min Summer | 0.640 | 0.0 | 4280 |

## Summary of Results for 30 year Return Period (+10%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 10080 min Summer | 0.034 | 0.034 | 0.6 | 0.5 | O K |
| 15 min Winter | 0.200 | 0.200 | 4.1 | 15.8 | O K |
| 30 min Winter | 0.235 | 0.235 | 4.1 | 20.5 | O K |
| 60 min Winter | 0.255 | 0.255 | 4.1 | 23.1 | O K |
| 120 min Winter | 0.254 | 0.254 | 4.1 | 23.0 | O K |
| 180 min Winter | 0.241 | 0.241 | 4.1 | 21.3 | O K |
| 240 min Winter | 0.224 | 0.224 | 4.1 | 19.0 | O K |
| 360 min Winter | 0.189 | 0.189 | 4.1 | 14.3 | O K |
| 480 min Winter | 0.164 | 0.164 | 4.1 | 10.9 | O K |
| 600 min Winter | 0.148 | 0.148 | 3.7 | 8.8 | O K |
| 720 min Winter | 0.134 | 0.134 | 3.3 | 7.2 | O K |
| 960 min Winter | 0.112 | 0.112 | 2.8 | 5.1 | O K |
| 1440 min Winter | 0.084 | 0.084 | 2.1 | 2.9 | O K |
| 2160 min Winter | 0.061 | 0.061 | 1.5 | 1.5 | O K |
| 2880 min Winter | 0.049 | 0.049 | 1.2 | 1.0 | O K |
| 4320 min Winter | 0.042 | 0.042 | 0.9 | 0.7 | O K |
| 5760 min Winter | 0.037 | 0.037 | 0.7 | 0.5 | O K |
| 7200 min Winter | 0.033 | 0.033 | 0.5 | 0.4 | O K |
| 8640 min Winter | 0.031 | 0.031 | 0.5 | 0.4 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Time-Peak (mins) |
|---|---|---|---|
| 10080 min Summer | 0.564 | 0.0 | 5104 |
| 15 min Winter | 87.490 | 0.0 | 17 |
| 30 min Winter | 55.863 | 0.0 | 31 |
| 60 min Winter | 34.065 | 0.0 | 58 |
| 120 min Winter | 20.171 | 0.0 | 92 |
| 180 min Winter | 14.701 | 0.0 | 128 |
| 240 min Winter | 11.703 | 0.0 | 164 |
| 360 min Winter | 8.452 | 0.0 | 228 |
| 480 min Winter | 6.710 | 0.0 | 284 |
| 600 min Winter | 5.607 | 0.0 | 344 |
| 720 min Winter | 4.840 | 0.0 | 406 |
| 960 min Winter | 3.836 | 0.0 | 522 |
| 1440 min Winter | 2.761 | 0.0 | 754 |
| 2160 min Winter | 1.986 | 0.0 | 1108 |
| 2880 min Winter | 1.571 | 0.0 | 1468 |
| 4320 min Winter | 1.128 | 0.0 | 2148 |
| 5760 min Winter | 0.892 | 0.0 | 2856 |
| 7200 min Winter | 0.743 | 0.0 | 3624 |
| 8640 min Winter | 0.640 | 0.0 | 4296 |

## Summary of Results for 30 year Return Period (+10%)

| Storm Event | Max Level (m) | Max Depth (m) | Max Infiltration (l/s) | Max Volume (m³) | Status |
|---|---|---|---|---|---|
| 10080 min Winter | 0.029 | 0.029 | 0.4 | 0.3 | O K |

| Storm Event | Rain (mm/hr) | Flooded Volume (m³) | Time-Peak (mins) |
|---|---|---|---|
| 10080 min Winter | 0.564 | 0.0 | 5240 |

## Rainfall Details

| | | | |
|---|---|---|---|
| Rainfall Model | FSR | Winter Storms | Yes |
| Return Period (years) | 30 | Cv (Summer) | 0.750 |
| Region | England and Wales | Cv (Winter) | 0.840 |
| M5-60 (mm) | 20.100 | Shortest Storm (mins) | 15 |
| Ratio R | 0.450 | Longest Storm (mins) | 10080 |
| Summer Storms | Yes | Climate Change % | +10 |

## Time Area Diagram

Total Area (ha) 0.135

| Time (mins) From: | To: | Area (ha) |
|---|---|---|
| 0 | 4 | 0.135 |

## Model Details

Storage is Online Cover Level (m) 0.290

## Porous Car Park Structure

| | | | |
|---|---|---|---|
| Infiltration Coefficient Base (m/hr) | 0.02200 | Width (m) | 27.0 |
| Membrane Percolation (mm/hr) | 1000 | Length (m) | 50.0 |
| Max Percolation (l/s) | 375.0 | Slope (1:X) | 300.0 |
| Safety Factor | 2.0 | Depression Storage (mm) | 5 |
| Porosity | 0.10 | Evaporation (mm/day) | 3 |
| Invert Level (m) | 0.000 | Cap Volume Depth (m) | 0.250 |