ASHDOWN SITE INVESTIGATION
L•I•M•I•T•E•D

GEOTECHNICAL
AND
ENVIRONMENTAL
ENGINEERS

Head Office
The Old Dairy
Swanborough Farm
Swanborough
Lewes
East Sussex
BN7 3PF

Telephone
0870 777 1574

Fascimile
0870 777 1577

Website
www.AshdownSI.co.uk

Email
contact@AshdownSI.co.uk

Regional Office
Hertfordshire
(Contact via Head Office)

BUCKINGHAM PARK PRIMARY SCHOOL
HAMFIELD AVENUE
SHOREHAM BY SEA
WEST SUSSEX

GEOTECHNICAL REPORT
ON THE GROUND INVESTIGATION

Report No. LW24134 June 2013

Report prepared for the benefit of:

Morgan Sindall Plc
4th Floor London Gate
72 Dyke Road Drive
Brighton
East Sussex
BN1 6AJ

Managing Director
J.E.Bewick
BSc MSc CEnv CEng MICE

Company Secretary
V.Bewick
BSc MSc FRSS

Company Registration Number
242 6786

nqa ISO 9001 Registered
UKAS QUALITY MANAGEMENT DTS
AGS
ace consultancy engineering business environment
INVESTOR IN PEOPLE

BUCKINGHAM PARK PRIMARY SCHOOL
HAMFIELD AVENUE
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FACTUAL REPORT	
Prepared By:  **Lucy Griffiths** **BSc FGS**	Approved By:  **John Bewick** **BSc MSc CEng CEnv MICE**
GEOTECHNICAL ASSESSMENT	
Prepared By:  **Tim Howard** **BEng FGS**	Approved By:  **John Bewick** **BSc MSc CEng CEnv MICE**

BUCKINGHAM PARK PRIMARY SCHOOL
HAMFIELD AVENUE
SHOREHAM BY SEA, WEST SUSSEX

GEOTECHNICAL REPORT
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BUCKINGHAM PARK PRIMARY SCHOOL
HAMFIELD AVENUE
SHOREHAM BY SEA, WEST SUSSEX

GEOTECHNICAL REPORT
ON THE GROUND INVESTIGATION

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1. INTRODUCTION

The proposal is to construct two new classroom extensions to the existing school building at Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea.

Ashdown Site Investigation Limited was commissioned to carry out a ground investigation and geotechnical assessment of the site by Mr James Clayton of:

Morgan Sindall plc
4th Floor London Gate
72 Dyke Road Drive
Brighton
BN1 6AJ

The instruction to proceed was received in an email dated 23rd May 2013, Order number S/93P110/001.

The purpose of the works was to:

i. assess ground and groundwater conditions prevailing at the site;
ii. investigate the form of foundations to existing structures; and
iii. provide information to assist others in undertaking design of spread foundations, ground floors and soakaways.

The analysis and discussions contained in this report are based on the ground conditions encountered during the site work, together with the findings from a programme of laboratory analyses. The possibility of a variation in ground and groundwater conditions away from the positions investigated should not be overlooked. Groundwater conditions can vary both seasonally and due to other effects.

It is noted that the investigation was undertaken and the report was prepared specifically for the Client's project and the recommendations given may not be appropriate to alternative schemes. The copyright for the report and licence for its use shall remain vested in Ashdown Site Investigation Limited (the Company) who disclaim all responsibility or liability (whether at common law or under the express or implied terms of the Contract between the Company and the Client) for any loss or damage of whatever nature in the event that this report is relied on by a third party, or is issued in circumstances or for projects for which it was not originally commissioned, or where the exploratory hole records and test results contained therein are interpreted by anyone other than the Company.

2. SITE DETAILS

2.1 Site Description

The site is positioned within the grounds of Buckingham Park Primary School, located at Hamfield Avenue, Shoreham by Sea, West Sussex and is centred on the approximate Ordnance Survey national grid reference TQ 2200 0574. A site location plan and site plan are presented as Figure 1 and Figure 2, respectively.

Buckingham Park Primary School comprises of a one and two storey steel framed building, with associated hard and soft play areas to the north and east, and a small wooded area located off the south eastern corner of the school building. A man made pond was noted adjacent to the eastern side of the school. Access onto the site was via Hamfield Avenue, leading from Buckingham Road to the west.

The areas of investigation were located within a partly enclosed courtyard area, sited centrally to the main school building, and to the east of the school building.

2.2 Expected Geology

The stratigraphic succession expected to underlie the site is presented in the following table. In preparing the table reference has been made to the British Geological Survey 1:50,000 series scale map Sheet 318/333 and the British Geological Survey lexicon of named rock units.

Table 1. Expected Geological Strata

Type	Stratum	Age
Superficial Deposits	Head	Quaternary
Bedrock Geology	White Chalk Subgroup (Tarrant Chalk Member)	Cretaceous

2.2.1 Head

The Head deposits generally comprise silty clay with variable amounts of gravel and cobbles of chalk and flint. The lithology of the Head reflects the nature of the parent chalk and previously existing Quaternary, largely clay, strata. It may form infill to solution features within the chalk.

The lower part of the Head in dry valleys can be expected to comprise ‘Coombe Deposits’ or Dry Valley Deposits. These are typically pale grey or white and composed of gravel to boulder sized angular to sub-angular blocks of chalk, angular flint gravel and cobbles and occasional sandstone set in a comminuted clayey chalk matrix. Locally these deposits may be weakly cemented to form ‘Coombe Rock’ deposits.

2.2.2 White Chalk Subgroup (Tarrant Chalk Member)

The White Chalk Subgroup (Tarrant Chalk Member) comprises a weak, white chalk locally with flint bands together with scattered nodular flints. It may be expected to have a deeply convoluted upper surface as a result of solution weathering. The presence of cavities in the chalk is very rare and solution features, if present, can be expected to be infilled with Quaternary deposits such as the Head.

The infill material may be significantly weaker than the surrounding chalk. Solution features can comprise pipes extending to several metres deep into the chalk or conical depressions and basin shaped structures.

In this area the chalk may be expected to be deeply weathered in the uppermost few metres.

2.3 Radon

The Health Protection Agency (HPA) and its predecessor the National Radiological Protection Board (NRPB) have recommended to government that excessive exposures to radon should be reduced. The HPA advises that the Action Level above which radon protection should be incorporated into homes is 200 Bq/m^3, averaged over a year. Radon affected areas are defined as those areas with 1% or more of homes above this action level. Monitoring is only recommended above the Action Level.

The HPA has published Atlas maps showing estimated radon potential. These maps present the percentage of homes above the Action Level at a resolution of 1km square. The maps include consideration of British Geological Survey (BGS) data relating levels to underlying geology. These Atlas maps are indicative rather than definitive. More detailed information is available as a geographical information dataset licensed by the BGS.

Inspection of the relevant HPA Atlas map of the area shows that less than 1% of the houses are above the action level. Based on reference to this indicative document, no specific form of protection is therefore likely to be needed in connection with radon gas. However, as the definitive dataset has not been consulted, it is recommended that the local authority and/or any relevant building control organisation should be contacted to establish if they have any requirements in this connection.

2.4 Aquifer Status and Groundwater Source Protection Zones

The Environment Agency designates aquifers in accordance with the Water Framework Directive. These designations not only reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. Reference has been made to Aquifer Designation Maps available on the Environment Agency website (http://www.environment-agency.gov.uk).

The Head expected beneath the site is classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifer designation is usually given in cases where it has not been possible to attribute either Secondary A or B status to a rock type.

The White Chalk Subgroup (Tarrant Chalk Member) expected beneath the site is classified as a Principal Aquifer. Principal Aquifers comprise deposits that have high intergranular and/or fracture permeability, usually providing a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

No potable water abstraction licences are indicated within 2km of the site.

The site lies within an Environment Agency Source Protection Zone 3 (Total Catchment) with regard to the protection of the quality of groundwater that is abstracted for potable supply.

3. GROUND INVESTIGATION

3.1 Introduction

The ground investigation comprised the excavation of a series of hand dug trial pits and dynamic sampler boreholes. The fieldwork was carried out on the 28th and 30th May 2013. The exploratory hole locations are shown on the Site Plan (Figure 2).

Descriptions of the strata encountered and comments on groundwater conditions are shown in the exploratory hole records given in Appendix A. Notes to assist in the interpretation of the records are also contained in the appendix.

3.2 Exploratory Holes

3.2.1 Dynamic Sampler Boreholes

A total of four boreholes were drilled on site.

Two boreholes (designated BH1 and BH2) were drilled to depths of 8.0m below ground level.

A further two boreholes (designated KCC1 and KCC2) were drilled to depths of 2.0m and 3.0m below ground level for the purposes of in situ soakage testing.

The boreholes were formed by a series of 1.0m long hollow steel sampler tubes, reducing in diameter from 100mm to 35mm, that were driven into the ground successively by means of a track-mounted drop weight. The sampler was extracted from the ground using a hydraulically operated jack and the enclosed samples were recovered in 1.0m long plastic liners. The system enables sub-samples to be taken for detailed examination and laboratory testing.

3.2.2 Hand Dug Trial Pits

Two trial pits (designated SA1 and SA2) were excavated, using hand-tools, to depths of 0.80m below ground level for the purposes of in situ soakage testing. The pits were unsupported and were logged from the surface.

3.2.3 Foundation Inspection Pits

Three pits (designated TP1 to TP3) were excavated using hand-tools to depths of between 0.85m and 1.50m below ground level to enable inspection of the foundations to existing buildings.

3.3 Sampling

Disturbed samples of soil were taken at the depths shown in the exploratory hole records and were collected in either plastic bags, plastic tubs or amber jars fitted with gas tight lids. On collection amber jars were stored in cool boxes with cooling blocks to maintain temperatures below 4°C and were transferred to refrigerators upon return to the office until forwarded to the external accredited laboratory.

3.4 In Situ Testing

The depths of in situ testing, together with the test results, are given on the exploratory hole records or are summarised separately in Appendix A. Notes providing additional information on the tests that were performed are also included in Appendix A.

3.4.1 DPSH Dynamic Probe (Super Heavy) Testing

Dynamic probe testing was carried out adjacent to boreholes BH1 and BH2. Probing was undertaken in accordance with BS EN ISO 22476-2:2005 using a super heavy geometry.

The DPSH configuration is similar to that of the standard penetration test (SPT) except that the blow counts are recorded over 100mm increments rather than 300mm, as is the case for the SPT.

3.4.2 Undrained Shear Strength

Undrained shear strength determinations were made in situ within the fine grained soils using a Geonor hand shear vane.

Additionally undrained shear strength determinations were made within samples of the fine grained soils held in the dynamic sampler liners using a hand penetrometer. Although samples taken by the window sampling technique cannot be regarded as being undisturbed for testing purposes, penetrometer testing can provide a useful indication of the strength of the material.

3.4.3 Soakage Testing

Falling head soakage testing was carried out in boreholes KCC1 and KCC2 with the boreholes at depths of 2.0m and 3.0m, respectively. The tests, which were made within the Head deposits, were carried out in general accordance with The Soakaway Design Guide published by Kent County Council (2000).

Falling head soakage testing was also carried out in trial pits SA1 and SA2. The tests were made with the pits at a depth of 0.80m within the Head deposits. The tests were carried out in general accordance with the Building Regulations Approved Document H percolation test method.

3.5 Laboratory Testing

Results from the laboratory tests are provided in Appendix B.

Geotechnical testing was undertaken by Ashdown Site Investigation Ltd in accordance with the methods given in BS1377:1990 Parts 1 to 8 'Methods of test for soils for civil engineering purposes'. Notes to assist with the interpretation of the tests are contained within Appendix B.

The types and numbers of tests carried out are detailed in the following table. The test results are discussed in Section 5.

Table 2. Geotechnical Testing

Type of test	No. of samples tested
Moisture Content	15
Atterberg Limits	4
Particle Size Distribution	1
SO_4/ pH	3

4. GROUND CONDITIONS

4.1 Stratigraphy

4.1.1 Surface Covering

The pits within the courtyard area were excavated through brick paving bedded upon a crystalline rock sub-base, some 50mm to 75mm thick, with a geotextile membrane at the base.

TP3 was excavated through an area of wooden decking.

The remainder of the exploratory holes were excavated through a surface cover of topsoil some 100mm in thickness.

4.1.2 Made Ground

Below the surfacing in TP1 and TP2, a layer of pea gravel, thought to represent a drainage blanket, was recorded to depths of 0.30m and 0.20m below ground level, respectively.

With the exception of trial pit TP1, where it was absent, made ground, comprising silty sandy clay containing a variable quantity of flint, sandstone, clinker, ash, brick and chalk was recorded at each exploratory hole position, extending to depths of between 0.30m and 0.70m below ground level.

4.1.3 Head

Underlying the made ground, the investigation progressed through undisturbed silty sandy gravelly, generally stiff to very stiff, clay deposits. Within borehole KCC2 and trial pit TP3, the results of the in situ testing indicate that the upper part of these soils was of a firm consistency to depths of 0.9m and in excess of 1.3m, respectively. These cohesive soils were proved to extend to depths of 3.0m and 3.7m below ground level in the deeper boreholes BH2 and BH1, respectively, and were present to the full depths of the remaining shallower exploratory holes.

Beneath the clay soils, boreholes BH1 and BH2 passed down into medium dense and dense gravel. The gravel continued to a depth of 6.4m in BH1 and to the full depth of investigation (8.0m) in BH2. Within borehole BH1, the gravel deposits were underlain by dense silt and chalk gravel to a depth of 7.3m below ground level.

These soils are considered to represent the Head deposits indicated on the published geological map.

4.1.4 White Chalk Subgroup (Tarrant Chalk Member)

Within borehole BH1, the Head deposits were underlain by deposits of the White Chalk Subgroup. Based upon the results of the dynamic probing, it is judged that these deposits represent structured Chalk of Grade C or better.

4.2 Stability

With the exception of instability recorded within the pea shingle drainage blanket materials present in trial pits TP1 and TP2, all of the exploratory holes remained stable during excavation.

4.3 Groundwater Conditions

A standing water depth of 4.2m was recorded within borehole BH2 some 45 minutes after completion of drilling.

No seepages were observed in any of the other exploratory holes.

It is noted that due to the speed of drilling and the limited time available for observations, groundwater levels may not have achieved equilibrium during the course of the investigation.

4.4 Existing Foundations

Details of the foundations encountered within the foundation inspection pits are included as Figure 3 of this report.

The foundations for the existing school building were exposed in trial pits TP1 and TP2, and appeared to comprise mass concrete strip foundations bearing at depths of 1.2m and 0.85m below ground level, respectively. The foundations were noted to step out between 50mm and 200mm from the face of the wall.

The foundations for the pond structure were exposed in trial pit TP3. The wall of the pond was some 200mm thick and was supported on mass concrete footings bearing at a depth of 0.9m below ground level.

The foundations at each position were supported within the undisturbed Head deposits.

5. GEOTECHNICAL ASSESSMENT

The geotechnical assessment has been prepared in connection with the development proposals shown on the drawings produced by MH Architects (12 162, drawings PR01 to PR03, dated February and March 2013).

In summary these drawings indicate the proposed development to comprise the construction of two new extensions to provide additional classrooms/ library and new link corridor and hall extensions. In addition, refurbishment and remodelling of other areas of the school is proposed.

At the time of writing, no details were available concerning the specific loads likely to be applied to the foundations.

5.1 Foundations

5.1.1 Soil Shrinkage/Heave Potential

The fine soils of the Head deposits have been classified as clays of intermediate plasticity and with plasticity indices in the range of 19% to 30% the soils may be expected to exhibit a medium volume change potential.

It is recommended that precautions against shrinkage and heave for any foundation system constructed within the fine grained Head deposit soils should assume a medium volume change potential and take into account current guidance such as that given by the National House Builders Council (NHBC).

Whilst this report has been prepared to provide advice to assist designers in undertaking detailed design, the report itself does not represent a detailed design statement. Detailed foundation design, including assessment of minimum founding depths for spread foundations, requirements for sleeving or reinforcing of piled foundations and requirements for placement of void formers etc., must take into account the volume change potential of the soil and the presence of trees (previous, present and proposed).

It is strongly recommended that a detailed arboricultural survey should be undertaken for the site. The survey should include a review of historical photographs and detailed site plans (if available) to establish the species and location of any felled trees that may affect foundation design. The information obtained from the arboricultural survey, information on proposed planting schemes and the findings of this report should be provided to the structural engineers responsible for design of foundation systems.

Whilst a tree survey was beyond the scope of the present investigation it is noted that various mature trees were located around the footprint of the proposed extensions, specifically the proposed new classroom/ library block.

5.1.2 Spread Foundations

Any made ground and any soils disturbed by the construction or removal of any previously existing foundations and services should be regarded as being potentially variable in nature and state of compaction and, as such, unsuitable as a founding medium for shallow footings. New footings should be constructed so as to bear below such soils and onto undisturbed, competent, natural deposits.

For design purposes, a net allowable bearing capacity of 150kN/m^2 may be assumed for the construction of spread (pad or strip) foundations up to 2m across bearing within the stiff clay of the Head deposits. The quoted bearing capacity is expected to limit settlement to less than 25mm. In general a minimum depth to formation of 0.9m may be adopted, although foundations may need to be deepened where made ground is found to extend below this depth or where there is a requirement to protect foundations against seasonal soil volume changes induced by trees.

Care must be taken to ensure that new foundations do not undermine or impose additional loading (vertical or lateral) on existing foundations. Similarly, the construction of new foundations should be carefully undertaken and monitored in those situations where temporary works may affect existing foundations.

5.1.3 Piled Foundations

Consideration could be given to supporting the proposed development on piled foundations, which could be sleeved to minimise the risk of damage through soil shrinkage/heave. Piling would also allow the volume of soil to be disposed of to be minimised.

It is considered that the Head deposits would provide support to piled foundations by a combination of side adhesion (skin friction) and end bearing. Support would also be available from the underlying chalk deposits but deeper boreholes would be required to investigate the nature of the deposits and the depth at which they are likely to be encountered. During the present investigation chalk as encountered in BH1 only, below a depth of 7.3m below ground level.

The proven ground conditions would indicate that bored piles could be employed to provide a suitable foundation solution. However the method of installation would have to accommodate the presence of groundwater at relatively shallow depth. In addition, the selection of piling techniques should consider access constraints applicable to particular plant and potential vibration effects on existing structures.

Depending on the method employed it is considered likely that driving displacement (driven piles) through the dense gravels encountered at depth would prove difficult and could be disruptive to nearby structures.

For the purposes of this initial discussion and for reasons given above, consideration has been given to the adoption of bored piles, the use of which would prove beneficial as, whilst this method may require temporary steel casing

to be installed, a range of boring tools, including chisels, can be employed to progress pile bores through difficult ground.

Calculations to determine illustrative working loads for axially loaded piles have been undertaken; each calculation assuming a single pile acting in compression. Indicative capacities are presented in the following table. Available capacities may vary for piles acting in tension.

The competence of the soil profile used for these calculations has been based on the examination of the recovered samples and the results of in situ and laboratory testing. A modelled ground profile comprising stiff clay to a depth of 3.0m overlying medium dense gravel has been adopted.

In consideration of the medium volume change potential of the natural clay soils and the proximity of existing trees, it has been assumed, for the purposes of the calculation, that the upper 3m of the piles will be sleeved.

Table 3. Indicative axially loaded pile working capacities

Working Loads of Piles (kN)			
Length	**Size (mm)**		
(m)	200	300	400
5	50	95	150
7	100	180	280

Notes:
The structural strength of the concrete used in construction may limit the available working loads of the piles. Indicated pile lengths are from existing ground level. The benefit of shaft resistance within the upper 3m has been discounted.

Working capacities for pile groups should be assessed when final design details are known, although for preliminary design purposes it is likely that piles spaced at least 3 x pile diameter from other piles in any group will behave as single piles.

Where preliminary and working pile load tests are undertaken it may be appropriate to reduce Safety Factors, although 2.5 may be a minimum local authority requirement. Should testing not be undertaken it is suggested that a factor of safety of at least 3.0 should be adopted.

For all piling options it is recommended that the advice of specialist foundation contractors be sought at the earliest opportunity, from whom piling specifications should be obtained with reference to their particular products as this may affect the calculated capacity.

5.2 Groundwater

A standing water depth of 4.2m was recorded within borehole BH2 on completion of drilling. All other locations remained dry during the course of the investigation.

If encountered above the ground water level it would be expected that the ingress of ground or surface water into excavations whould be adequately managed by pumping from sumps.

5.3 Stability of Excavations

It would be expected that excavations within the fine grained Head deposits soils would be stable in the short term. However where excavations are required to remain stable in the medium or long term they should be suitably supported or side slopes battered back to a safe angle of repose.

Where personnel access is required to any excavation its stability must be assessed by a suitably qualified and experienced responsible person. Entry into unsupported excavations should only be permitted where they have been assessed as safe to enter but in any case it is advised that personnel access to unsupported excavations greater than 1.2m depth should be prohibited.

Under all circumstances attention must be paid to ensuring the stability of nearby structures.

5.4 Aggressivity to Concrete

In consideration of the soils encountered beneath the site and its present usage it is considered that ‘natural ground conditions’ may be assumed for the purpose of assessing the aggressivity of the chemical environment for concrete classification (ACEC class). Conservatively, given the localised occurrence of groundwater seepages, ‘mobile groundwater’ conditions have also been assumed.

Chemical analysis of the soil indicates a sulphate content falling into Design Sulfate Class DS-1 of Table C1 of the Building Research Establishment Special Digest No 1 “Concrete in aggressive ground”, 2005. The results of the pH tests indicate that the underlying soils are or alkaline.

In accordance with the BRE digest, a DS-1 Design Sulfate Class and an AC-1 ACEC classification may be assumed as a minimum for the design of concrete in contact with the ground.

5.5 Ground Floors

In view of the presence of soils of medium volume change potential underlying the site, it is recommended that ground floors for all sensitive structures should be suspended.

Ground bearing floor slabs may, however, be considered where made ground soils are not present or are to be removed from beneath building footprints and the depth of foundations required to protect against seasonal soil volume changes close to trees is less than 1.5m. In such circumstances further works should be undertaken to demonstrate that, close to the time of construction, no significant

soil desiccation is present. If ground bearing floors are adopted it is recommended that the potential for differential movement both between the floor slab and walls and across the floor slab itself should be anticipated. Such floors should be fully debonded from walls and should be suitably reinforced to enable spanning of soft spots. Formations should be adequately proof rolled and any excessively soft materials excavated and replaced with a suitable well graded granular fill. The depth of any fill should be limited to a maximum of 600mm unless placed to an engineering specification designed to limit internal settlement of the fill materials to a tolerance to be advised by the designer.

The detailing of services through, or under, ground-bearing floors should incorporate flexible connections and, where appropriate, enhanced falls.

5.6 Drainage

Trial Pit Falling Head Soakage Testing

In situ soakage testing was carried out in general accordance with the requirements of the Building Regulations Approved Document H. From the results of the soakage tests, calculations were made to determine the infiltration rate that could be expected for soakaways constructed into the underlying Head soils.

For each test the soil infiltration rate (f) was calculated by dividing the volume of water lost between 25% and 75% of the test depth by the sum of the average surface area of the sides of the pit during the test monitoring period, and its base area. This figure was then divided by the duration of the test in seconds to give the soil infiltration rate in metres per second. The following infiltration rates were derived from the tests.

SA1 - Test 1: $f = 1.2 \times 10^{-5}$ m/s
SA1 - Test 2: $f = 5.7 \times 10^{-6}$ m/s
SA2 - Test 1: $f = 1.0 \times 10^{-4}$ m/s
SA2 - Test 2: $f = 4.5 \times 10^{-5}$ m/s
SA2 - Test 3: $f = 6.1 \times 10^{-5}$ m/s

Borehole Falling Head Soakage Testing

In situ soakage testing was undertaken in accordance with 'The Soakaway Design Guide' published by Kent County Council (July 2000). From the results of the tests, calculations were made in accordance with the guide to estimate the infiltration rate that could be expected for soakaways constructed to discharge into the underlying soils within the test zone. The following infiltration rates were derived from the tests.

KCC1: $f = 2.2 \times 10^{-5}$ m/s under 1.4m head of water assumed
KCC2: $f = 7.5 \times 10^{-6}$ m/s under 1.8m head of water assumed

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

To minimise the risk of subsidence, soakaways should be constructed a minimum of 5.0m away from proposed or existing buildings.

In the event that discharge to ground via soakaways is proposed, it is recommended that designers refer to Pollution Prevention Guidance Notes (PPGs) published by the Environment Agency for advice on legal requirements and good practice to reduce risks to groundwater. In particular reference should be made to PPGs 1 and 3, providing general advice on the prevention of pollution and the use and design of oil separators in surface water drainage systems, respectively. The Local Authority and/or relevant water company should be consulted in relation to consent for discharge of water from rooftops, areas of hardstanding and roadways to drains.

6. CONCLUSIONS

The following conclusions present a summary of the main findings of the investigation. However, no reliance should be placed on any point of the conclusions until the whole of the report has been read as other sections of the report may put into context the information contained herein.

- The ground investigation confirmed the underlying soils to comprise a shallow thickness of made ground, generally overlying stiff clay and medium dense to dense gravel of the Head deposits. Deposits of the White Chalk Subgroup were recorded below a depth of 7.3m below ground level within borehole BH1 only.

- A standing water depth of 4.2m was recorded within borehole BH2 only on completion of drilling.

- It is recommended that precautions against shrinkage and heave for any foundation system constructed within the fine grained Head deposit soils should assume a medium volume change potential and take into account current guidance such as that given by the National House Builders Council (NHBC).

- For design purposes, a net allowable bearing capacity of 150kN/m^2 may be assumed for the construction of spread (pad or strip) foundations up to 2m across bearing within the stiff clay of the Head deposits.

- Indicative pile capacities are included in the body of the report.

- If encountered, it would be expected that ingress of ground or surface water into excavations above the water table would be adequately managed by pumping from sumps.

- Entry into unsupported excavations should only be permitted where they have been assessed as being safe to enter but in any case it is advised that personnel access to unsupported excavations greater than 1.2m depth should be prohibited. Particular attention must be paid to ensuring the stability of nearby structures.

- In accordance with the BRE digest, a DS-1 Design Sulfate Class and an AC-1 ACEC classification may be assumed as a minimum for the design of concrete in contact with the ground.

- In view of the presence of soils of medium volume change potential it is recommended that ground floors for all sensitive structures should be suspended.

- The results from the soil infiltration rate tests are included in the body of the report.

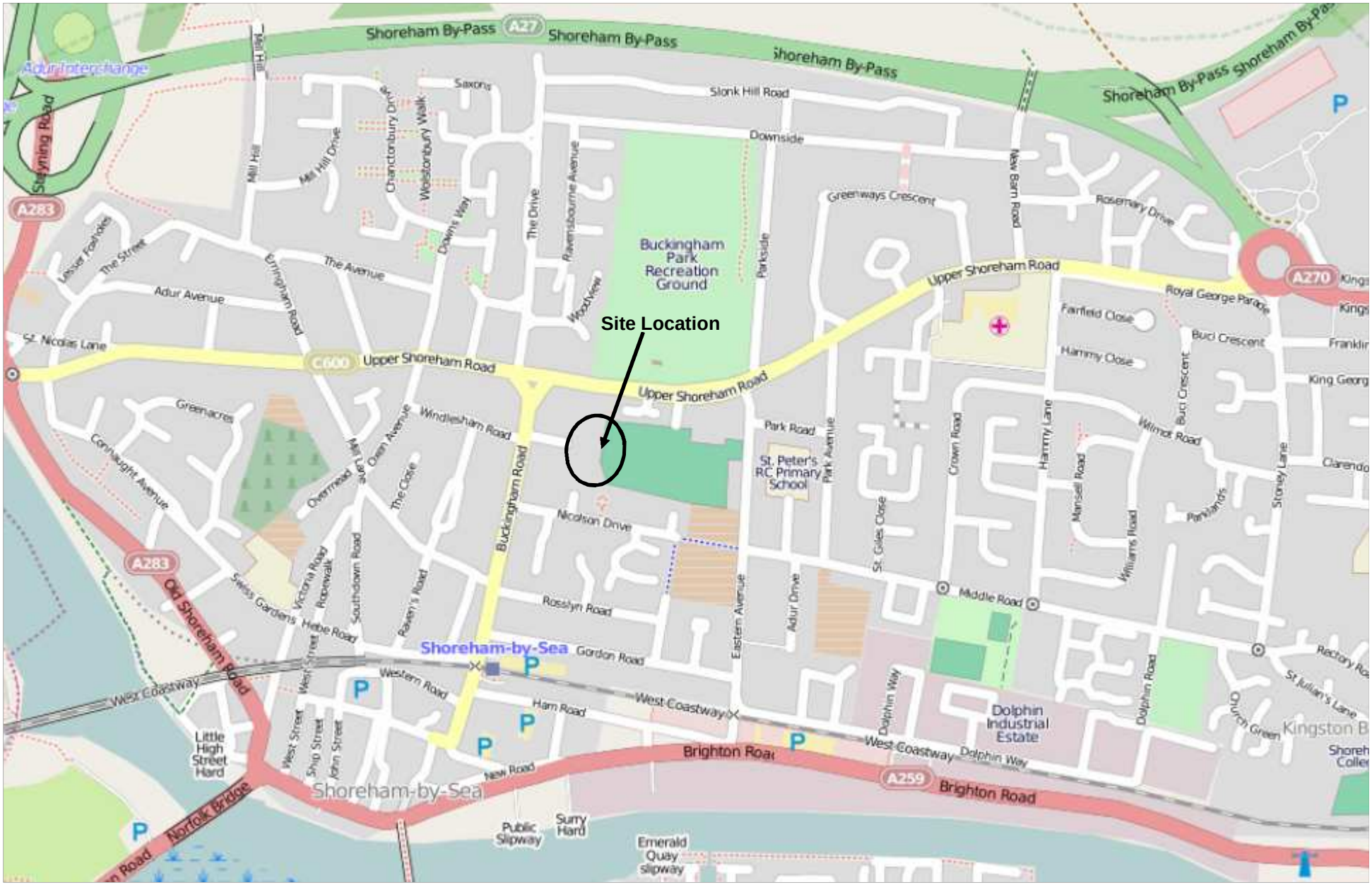
Ashdown Site Investigation Limited
June 2013

FIGURES

Figure 1 Site Location Plan

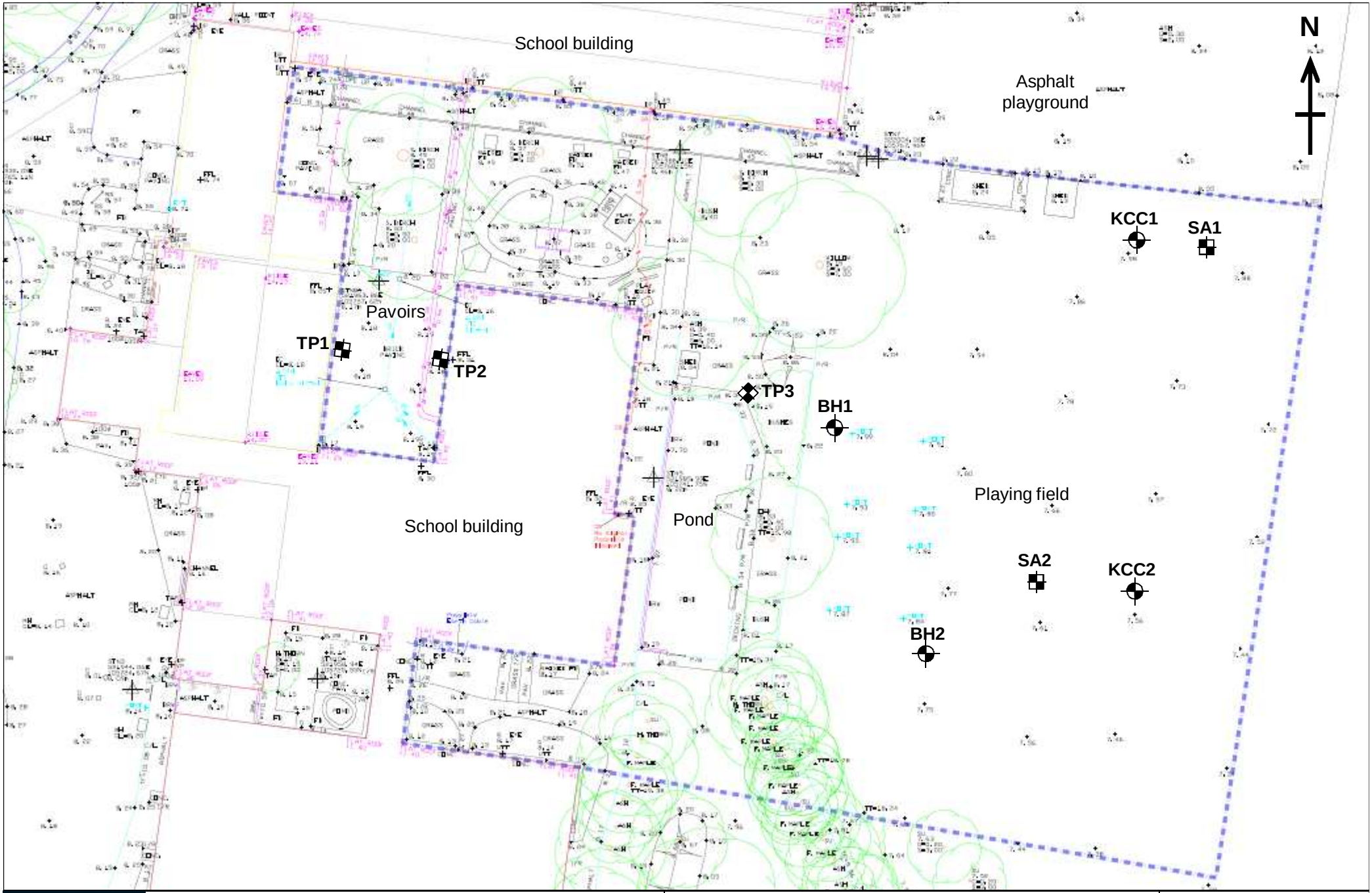
Figure 2 Site Plan

Figure 3 Foundation Inspection Pits



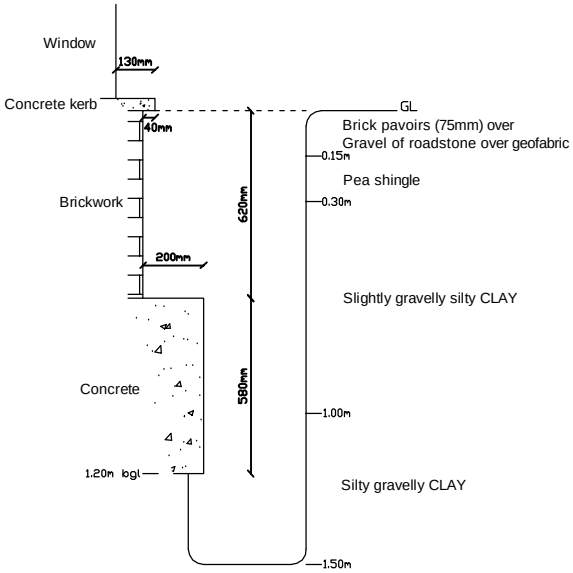
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ASHDOWN SITE INVESTIGATION L·I·M·I·T·E·D	SITE: Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea, West Sussex	Site Location Plan Not To Scale	Figure 1 LW24134

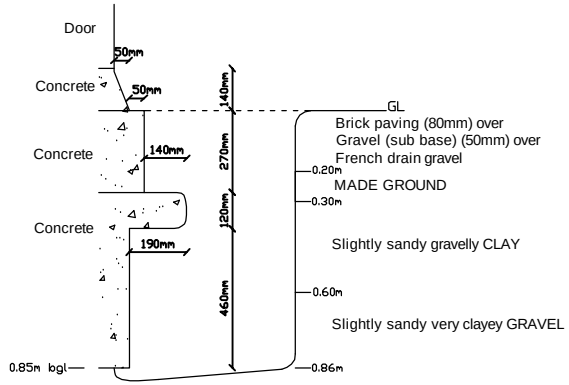


ASHDOWN SITE INVESTIGATION L·I·M·I·T·E·D	SITE: Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea, West Sussex	Site Plan Not To Scale
		Figure 2 LW24134

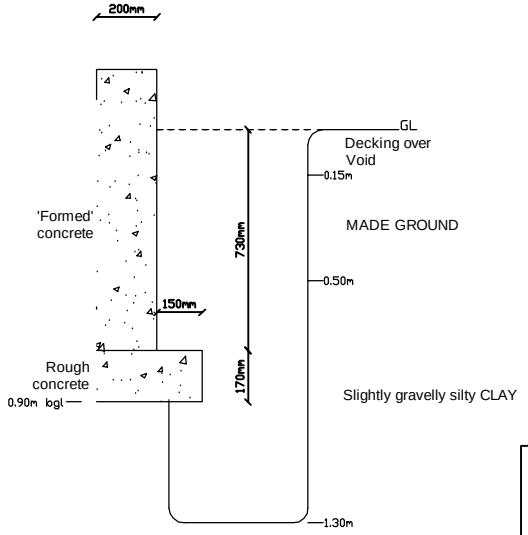
TP1



TP2



TP3



ASHDOWN SITE INVESTIGATION LIMITED

The Old Dairy,
Swanborough Farm,
Swanborough,
Lewes,
East Sussex
BN7 3PF
Tel: 01273 483119 Fax: 01273 483104
email: contact@ashdownsi.co.uk

DRAWN BY:	DATE:	SCALE (at A4)
TSH	Jun. 2013	1:25

SITE:
Buckingham Park Primary Schoc
Hamfield Avenue,
Shoreham by Sea,
West Sussex

REPORT REF.:	FIGURE NO.:
LW24134	3

DRAWING TITLE:
Foundation Details

APPENDIX A

Exploratory Hole Notes

In Situ Testing Notes

Exploratory Hole Records

DPSH Continuous Dynamic Probe N100 v Depth Profiles

Summary of Borehole Falling Head Soakage Tests

Summary of Trial Pit Falling Head Soakage Tests

NOTES FOR THE INTERPRETATION OF EXPLORATORY HOLE RECORDS

1 Symbols and abbreviations

Samples

U 'Undisturbed' Sample: - also known as 'U100' or 'U4' - 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.
Uo Sample not obtained.
U* Full penetration of sample not obtained.
U** Full penetration obtained but limited sample recovered.
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
E Environmental Suite (including a jar sample, tub sample and vial sample)

In situ Testing

S Standard penetration test (SPT): In the borehole record the depth of the test is that at the start of the normal 450mm penetration, the number of blows to achieve the standard penetration of 300mm (the 'N' value) is shown after the test index letter, but the seating blows through the initial 150mm penetration are not reported unless the full penetration of 450mm cannot be achieved. In the latter case, the symbols below are added to the test index letter:-
S(R) Refusal of standard penetration test. Blow count reported includes seating blows. Total penetration of refused SPT reported in mm in brackets on borehole record.
So 'Split spoon' SPT sampler sank under its own weight.
The test is usually completed when the number of blows reaches 50 (25 blows for seating count). The depths of both the top and bottom of the test drive are shown in the sample column on the Borehole Record. If a sample is not recovered in the sampler, a disturbed sample is taken over the depth of the test as boring continues.

C Standard Penetration Test (SPT) conducted usually in coarse grained soils or weak rocks using the same procedure as for the SPT but with a 50mm diameter, 60º apex solid cone fitted in place of the sampler. Variations in test results are indicated by the same symbols as for the SPT (above).

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: See Insitu Testing Notes in Appendix C for full description. Number of blows for 300mm penetration shown under Vane/Pen Test and N Value column. In sand the number of blows is approximately equivalent to the SPT "N" value.

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 14688-1:2002) and Part 2 Principles of classification (BS EN 14688-2:2004).

Fine Grained Soils

The consistency of fine grained soils given in the report is based on visual inspection of the samples and the strength is based on results of in situ and/or laboratory undrained shear strength tests when carried out.

The consistency is determined on the following basis:

Consistency	**Manual Test**
Very Soft	Soil exudes between fingers when squeezed in hand
Soft	Soils can be moulded by light finger pressure
Firm	Cannot be moulded by finger but rolled to 3mm threads without breaking/crumbling
Stiff	Crumbles/breaks when rolled to 3mm thick threads but can be moulded into a lump again
Very Stiff	Cannot be moulded and crumbles under pressure, can be indented by thumbnail

Based on BS EN ISO 14688-1:2002

The terms used for the designation of the undrained shear strength are as follows:

Undrained Shear Strength	
Extremely to Very Low	<20 kPa
Low	20-40 kPa
Medium	40-75 kPa
High	75-150 kPa
Very High	150-300 kPa
Extremely high	300-600 kPa

Based on BS EN ISO 14688-2:2004

Note: The undrained shear strength of the soils is measured either by laboratory testing or in the field using hand penetrometer or shear vane.

It is recognised that any coarse grained soil that has in excess of approximately 35% fine grained soil (clay and silt) can often be expected to behave as a fine grained soil despite the dominance of coarse grained material within the soil mass. To reflect this, it is the soil type that dominates the behaviour of the soil mass that appears on the exploratory hole records.

Coarse Grained Soils

The relative densities of coarse grained soils (sand and gravel) given in the report are based on field estimations and the results of the Standard Penetration Test (SPT) and equivalent correlation from other testing. The classification in terms of "N" Values is as follows:

SPT 'N' Value	**Relative Density**
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Greater than 50	Very Dense

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 14689-1:2003).

The description of rock mass includes the type of rock, structure, discontinuities and weathering.

The unconfined compressive strength of rock material is determined on the following basis:

Term	**Field Identification**	**Unconfined Compressive Strength (MPa)**
Extremely Weak	Indented by thumbnail	Less than 1
Very Weak	Crumbles under firm blows with point of geological hammer, peeled by pocket knife	1 to 5
Weak	Peeled by pocket knife with difficulty, shallow indentations made by firm blow with geological hammer	5 to 25
Medium Strong	Cannot be peeled or scraped with knife, can be fractured with single firm blow of geological hammer	25 to 50
Strong	Requires more than one blow of geological hammer to fracture	50 to 100
Very Strong	Requires may blows of geological hammer to fracture it	100 to 250
Extremely Strong	Can only be chipped with geological hammer	Greater and 250

The terms describing discontinuity and bedding spacing are as follows:

Bedding Thickness	
Very Thick	>2000mm
Thick	2000-600mm
Medium	600-200mm
Thin	200-60mm
Very Thin	60-20mm
Thickly Laminated	20-6mm
Thinly Laminated	<6mm

Discontinuity Spacing	
Very Wide	>2000mm
Wide	2000-600mm
Medium	600-200mm
Close	200-60mm
Very Close	60-20mm
Extremely Close	<20mm

Chalk

Chalk description is based on BS EN ISO 14688 and BS EN ISO 14689. 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. See additional chalk classification notes.

IN-SITU TESTING NOTES

1 Standard Penetration Testing

Standard penetration testing (SPT) is carried out within a cased cable percussion borehole. The test is performed using a either a split spoon (barrel) sampler in finer grained deposits, or, in coarser grained soils or weak rocks, using a 50mm diameter, 60º apex solid cone fitted in place of the sampler.

The sampler is driven into the deposits at the base of the borehole by means of a 63.5kg hammer falling freely through 760mm.

In the borehole record the depth of the test is that at the start of the normal 450mm penetration, the number of blows to achieve the standard penetration of 300mm (the "N" value) is shown after the test index letter, but the seating blows through the initial 150mm penetration are not reported unless the full penetration of 450mm cannot be achieved.

(BS EN ISO 22476-3:2005, Geotechnical investigation and testing – Field Testing, Part 3)

2 Dynamic Probe Testing

The DPH (heavy) dynamic probing rig drives a 32mm diameter rod with a 15cm^2 area, 90º end cone into the ground by means of a 50kg hammer which falls freely through a distance of 0.5m. The number of blows per 100mm penetration (N_{100}) is recorded.

The DPSH (super heavy) dynamic probing rig drives a 35mm diameter rod with a 20cm^2 area, 90º end cone into the ground by means of a 63.5kg hammer that falls freely through a distance of 0.75m. The number of blows per 100mm penetration (N_{100}) is recorded. The results can provide a useful indication of the relative strength of the material. The dynamic probing is carried out in accordance with BS EN ISO 22476-2:2005.

A tentative correlation with the Standard Penetration Test (SPT) N value can be made summing three consecutive the N_{100} blow counts.

3 Perth Penetrometer Test

In this test a hardened stainless steel rod is driven into the deposit by a 9.5kg sliding hammer falling freely through 600mm. After an initial penetration of 150mm the number of blows required to drive the rod a further 300mm is recorded. In sand the Perth blow count gives a close correlation to the "N-value" that could be expected from a standard penetration test (SPT) made in similar materials. The results are less reliable in coarser grained materials but can give an indication of their engineering properties. The perth penetrometer test is carried out in accordance with the Australian Standard AS 1289:6.3.3-1997, Method of Testing Soils for Engineering Purposes, there is no European equivalent code.

4 Undrained Shear Strength

Undrained shear strength determinations are made in situ within the fine grained soils using a Geonor hand shear vane or (usually in the case of window sampler boreholes) a hand penetrometer. The test records the undrained shear strength (cohesion) in kN/m^2. The shear vane records a maximum shear strength of 130kN/m^2 and the hand penetrometer records a maximum shear strength of 250kN/m^2.

3 California Bearing Ratio Test

In this test a hand held Farnell cone penetrometer apparatus is pushed into the deposits for the estimation of the California bearing ratio of the subgrade (for use in pavement design). The test equipment is design for the estimation of the bearing ratio of fine grained soils (clay and silt) only and is unsuitable for use in coarse grained soils and rock.

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GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: BH1

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 30/05/2013 | End Date: 30/05/2013

Standpipe Installation	Samples and Testing: Sample Type	Depths: From (m)	Depths: To (m)	Vane/ Pen Test N Value	DPSH Profile Blows/100mm (5 15 25)	Strata: Legend	Depth / Reduced Level	Strata Descriptions
							0.00	Ground Level
							0.10	Topsoil.
	J T	0.20						MADE GROUND: Dark brown slightly silty sandy gravelly clay. Gravel is fine to coarse flint, sandstone and clinker/ ash with occasional brick.
	J T	0.50					0.60	
	J T H	0.80		195				Very stiff brown slightly gravelly sandy CLAY with iron staining. Gravel is fine to medium flint. (Head)
	D V	1.00		>130				
	H	1.10		195				becoming gravelly below 1.1m depth.
								becoming very gravelly below 1.5m depth.
							1.80	
	H	1.90		195				Very stiff yellow brown slightly silty sandy CLAY. (Head) with a pocket of fine to medium gravel of chalk and flint between 1.8m and 1.9m depth.
	D V	2.00		>130				
	H	2.20		195				
	H	2.50		185				
	H	2.60		195				
	H	2.80		210				
								with occasional fine gravel of flint below 2.9m depth.
							3.10	
	D H	3.30		225				Very stiff orange brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse flint. (Head)
	H	3.50		225				
	H	3.60		225			3.70	
	D	4.00						Dense orange brown slightly sandy silty clayey fine to coarse GRAVEL of flint with occasional iron staining. (Head)
	D	5.00						becoming slightly clayey and sandy below 4.9m depth.

Remarks:

Borehole dry and stable on completion.

Dynamic probe carried out adjacent to borehole.

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: IT

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: BH1

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 30/05/2013 | End Date: 30/05/2013

Standpipe Installation	Samples and Testing: Sample Type	Depths: From (m)	Depths: To (m)	Vane/ Pen Test N Value	DPSH Profile Blows/100mm (5 15 25)	Strata: Legend	Strata: Depth / Reduced Level	Strata: Strata Descriptions
								Dense orange brown slightly clayey silty sandy fine to coarse GRAVEL of flint with occasional iron staining. (Head) becoming medium dense below 5.3m depth.
							5.90	
	D	6.10						Medium dense light orange brown and off white fine to coarse GRAVEL of chalk. (Head)
							6.40	
								Dense light yellow brown clayey SILT and weak low density fine to coarse GRAVEL of chalk with occasional flints. (Head)
	D	7.00					7.30	
								Structured CHALK recovered as gravelly silt. Clasts are weak low density off white. Matrix is off white and light yellow brown. With occasional flints. (White Chalk Subgroup, Grade C or better)
	D	8.00					8.00	
								End of Borehole

Remarks:

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: IT

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Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: BH2

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 30/05/2013 | End Date: 30/05/2013

Standpipe Installation	Samples and Testing: Sample Type	Depths: From (m)	Depths: To (m)	Vane/ Pen Test N Value	DPSH Profile Blows/100mm (5 15 25)	Strata: Legend	Depth / Reduced Level	Strata Descriptions
							0.00	Ground Level
							0.10	Topsoil.
	J T	0.30						MADE GROUND: Dark brown gravelly sandy clay. Gravel is fine to medium flint and ash/ clinker with occasional brick.
	J T	0.60					0.70	
	H	0.80		140				Stiff brown slightly sandy gravelly CLAY. Gravel is fine to medium flint. (Head)
	J T	0.90						
	D	1.00						becoming very gravelly CLAY/ clayey GRAVEL with depth.
							1.30	
	H	1.40		140				Stiff yellow brown slightly sandy gravelly CLAY. Gravel is fine to coarse chalk and flint. (Head)
	D	1.50						
							1.90	
	H	1.90		100				Stiff orange brown slightly gravelly sandy CLAY with iron staining. Gravel is fine to medium flint. (Head) becoming gravelly below 2.1m depth.
	D	2.10						
	H	2.20		130				
	H	2.50		100				
	H	2.70		130				becoming slightly sandy below 2.8m depth.
	D H	2.90		170			3.00	
	V	3.00		>130				Medium dense orange brown sandy clayey fine to coarse GRAVEL of flint. (Head)
	D	3.50						
							4.00	
	D	4.10						Medium dense light orange brown and off white silty clayey fine to coarse GRAVEL of chalk with occasional fine to coarse gravel and cobbles of flint. (Head)
	D	5.00						

Remarks:

Standing water level at 4.2m 45 minutes after completion of borehole.

Borehole stable on completion.

Dynamic probe carried out adjacent to borehole.

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: IT

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: BH2

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 30/05/2013 | End Date: 30/05/2013

Standpipe Installation	Samples and Testing: Sample Type	Depths: From (m)	Depths: To (m)	Vane/ Pen Test N Value	DPSH Profile Blows/100mm (5 15 25)	Strata: Legend	Strata: Depth / Reduced Level	Strata Descriptions
	D	6.00						Medium dense light yellow brown and off white silty clayey fine to coarse GRAVEL of chalk with occasional fine to coarse gravel and cobbles of flint. (Head) with thin horizons of weak low density fine to coarse gravel of chalk below 5.3m depth.
	D	7.00						
	D	8.00					8.00	
								End of Borehole

Remarks:

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: IT

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: KCC1

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Standpipe Installation	Samples and Testing				Strata		
	Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
						0.00	Ground Level
						0.10	Topsoil.
						0.40	MADE GROUND: Brown grey silty gravelly clay. Gravel is fine to coarse flint with occasional brick.
	D	0.50					Stiff friable dark orange brown gravelly CLAY. Gravel is fine to coarse flint. (Head)
	H	0.60		100		0.90	
	D	1.10					Off white/ cream gravelly clayey SILT. Gravel is fine to medium chalk and flint. (Head)
	D	2.00				2.00	
							End of Borehole

Remarks:
Borehole dry and stable on completion.

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: TH

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Borehole No.: KCC2

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Standpipe Installation	Samples and Testing				Strata		
	Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
						0.00	Ground Level
						0.10	Topsoil.
						0.30	MADE GROUND: Brown grey silty gravelly clay. Gravel is fine to coarse flint and brick.
	D H	0.50		60			Firm orange brown slightly gravelly silty CLAY. Gravel is fine to medium flint. (Head)
	D H	1.00		130		1.20	becoming stiff below 0.9m depth.
	H	1.50		90			Firm to stiff orange brown CLAY with dark orange brown speckling. (Head)
	H	1.90		90			
	D	2.00					with dark orange brown mottling below 2.0m depth.
	D	3.00				3.00	becoming gravelly (gravel is fine to coarse flint) below 2.8m depth.
							End of Borehole

Remarks:
Borehole dry and stable on completion.

Excavation Method: Dynamic Sampler

Borehole Diameter: Various

Made By: TH

ASHDOWN SITE INVESTIGATION LIMITED
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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Trial Pit No.: SA1

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Samples and Testing				Strata		
Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
					0.00	Ground Level
J T	0.10				0.10	Topsoil.
J T	0.35				0.40	MADE GROUND: Dark brown slightly sandy gravelly clay. Gravel is fine to coarse flint with occasional brick.
J T D	0.60 0.80				0.80	Firm orange brown very gravelly CLAY. Gravel is fine to coarse flint. (Head)
						End of Pit

Remarks:
Trial pit dry and stable on completion.

Excavation Method: Hand Dug

Dimensions: 0.3m x 0.3m

Made By: IT

ASHDOWN SITE INVESTIGATION LIMITED
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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Trial Pit No.: SA2

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Samples and Testing				Strata		
Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
					0.00	Ground Level
					0.10	Topsoil.
J T	0.20				0.35	MADE GROUND: Dark brown slightly sandy gravelly clay. Gravel is fine to coarse flint and brick with occasional clinker.
J T	0.50				0.60	Firm dark brown slightly sandy CLAY. (Head)
J T	0.70					
D V	0.80		>130		0.80	Very stiff orange brown slightly gravelly slightly sandy CLAY. Gravel is fine to medium flint. (Head)
						End of Pit

Remarks:
Trial pit dry and stable on completion.

Excavation Method: Hand Dug

Dimensions: 0.3m x 0.3m

Made By: IT

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Trial Pit No.: TP1

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Samples and Testing				Strata		
Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
					0.00	Ground Level
					0.15	Brick pavers (75mm) over, Grey medium gravel of roadstone over, Geofabric.
					0.30	Pea shingle (drainage blanket)
J T	0.50					Firm to stiff brown grey slightly gravelly silty CLAY. Gravel is fine to medium flint. (Head)
					1.00	
						Firm to stiff light yellow silty gravelly CLAY. Gravel is fine chalk. (Head)
D V	1.50		90		1.50	
						End of Pit

Remarks:
Trial pit dry on completion.

Trial pit unstable in shingle.

Excavation Method: Hand Dug

Dimensions:

Made By: TH

ASHDOWN SITE INVESTIGATION LIMITED
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERS
Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Trial Pit No.: TP2

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Samples and Testing				Strata		
Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
					0.00	Ground Level
J T	0.25				0.20	Brick paving (80mm) over, Grey medium gravel of roadstone (50mm) over,
					0.30	Pea shingle (drainage blanket)
J T	0.50					MADE GROUND: Brown slightly sandy very gravelly clay. Gravel is fine to coarse flint and chalk with occasional brick and clinker.
D	0.80				0.60	Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse flint. (Head)
					0.86	Medium dense light brown and brown slightly sandy very clayey fine to medium GRAVEL of flint. (Head)
						End of Pit

Remarks:
Trial pit dry on completion.

Trial pit unstable in shingle.

Excavation Method: Hand Dug

Dimensions:

Made By: IT

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Swanborough Farm
Swanborough
Lewes, East Sussex
BN7 3PF

Trial Pit No.: TP3

Site Name: Buckingham Park Primary School, Shoreham by Sea

Job No.: LW24134

Start Date: 28/05/2013 | End Date: 28/05/2013

Samples and Testing				Strata		
Sample Type	Depths From (m)	Depths To (m)	Vane/ Pen Test N Value	Legend	Depth / Reduced Level	Strata Descriptions
					0.00	Ground Level
					0.15	Decking over, Void.
J T	0.40				0.50	MADE GROUND: Brown slightly gravelly silty sandy clay. Gravel is fine to coarse brick and flint with pockets of clinker at base.
V	1.00		55			Firm orange brown slightly gravelly silty CLAY. Gravel is fine to coarse flint. (Head)
D	1.30				1.30	
						End of Pit

Remarks:
Trial pit dry and stable on completion.

Excavation Method: Hand Dug

Dimensions:

Made By: TH

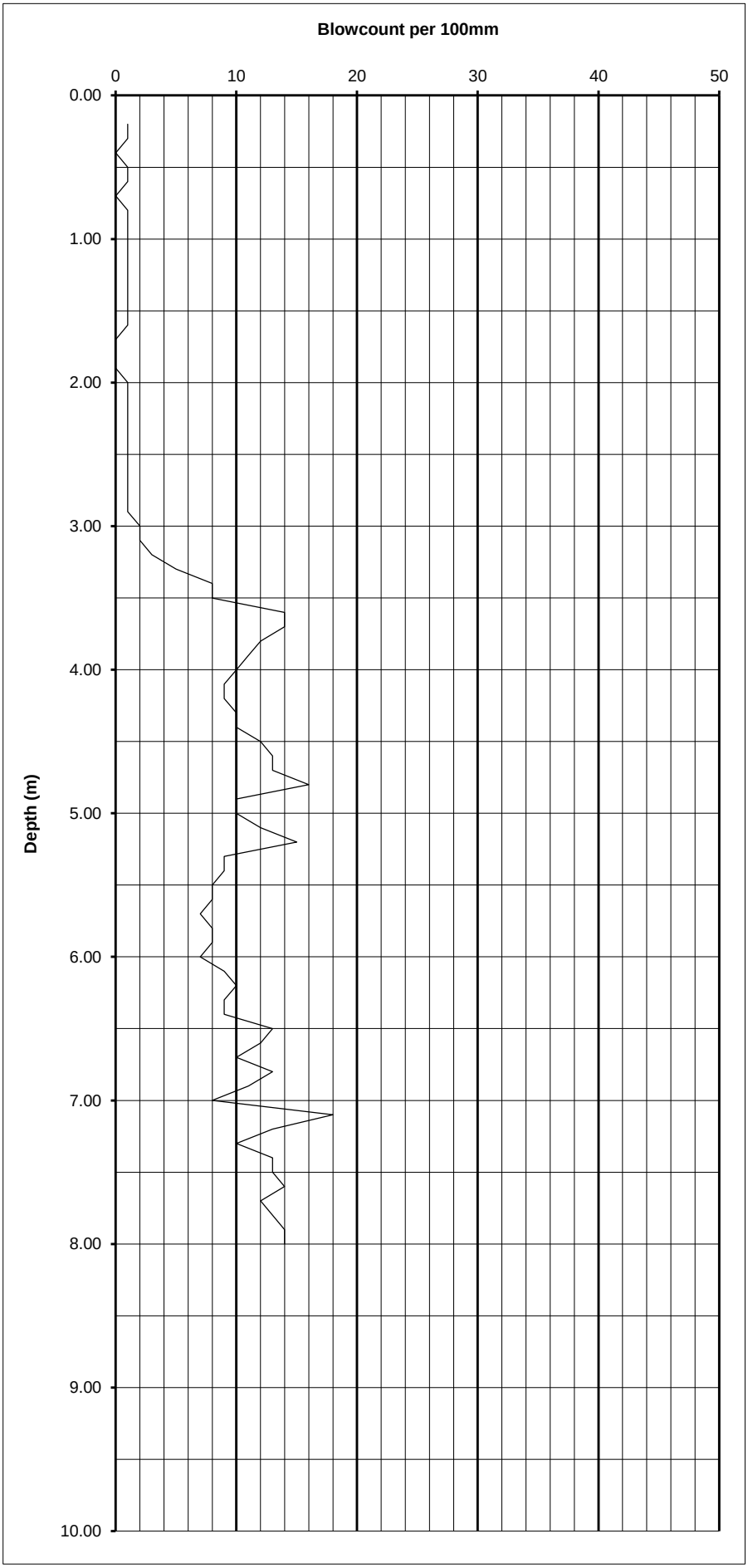
ASHDOWN SITE INVESTIGATION LTD

DPSH Continuous Dynamic Probe N100 vs Depth Profile

SITE Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea **REPORT REF.** LW24134

DPT No. BH1

Depth (m)	Blows	Torque (Kgm)
0.00		
0.10		
0.20	1	
0.30	1	
0.40	0	
0.50	1	
0.60	1	
0.70	0	
0.80	1	
0.90	1	
1.00	1	
1.10	1	
1.20	1	
1.30	1	
1.40	1	
1.50	1	
1.60	1	
1.70	0	
1.80	0	
1.90	0	
2.00	1	
2.10	1	
2.20	1	
2.30	1	
2.40	1	
2.50	1	
2.60	1	
2.70	1	
2.80	1	
2.90	1	
3.00	2	
3.10	2	
3.20	3	
3.30	5	
3.40	8	
3.50	8	
3.60	14	
3.70	14	
3.80	12	
3.90	11	
4.00	10	
4.10	9	
4.20	9	
4.30	10	
4.40	10	
4.50	12	
4.60	13	
4.70	13	
4.80	16	
4.90	10	
5.00	10	
5.10	12	
5.20	15	
5.30	9	
5.40	9	
5.50	8	
5.60	8	
5.70	7	
5.80	8	
5.90	8	
6.00	7	
6.10	9	
6.20	10	
6.30	9	
6.40	9	
6.50	13	
6.60	12	
6.70	10	
6.80	13	
6.90	11	
7.00	8	
7.10	18	
7.20	13	
7.30	10	
7.40	13	
7.50	13	
7.60	14	
7.70	12	
7.80	13	
7.90	14	
8.00	14	
8.10		
8.20		
8.30		
8.40		
8.50		
8.60		
8.70		
8.80		
8.90		
9.00		
9.10		
9.20		
9.30		
9.40		
9.50		
9.60		
9.70		
9.80		
9.90		
10.00		



Comments

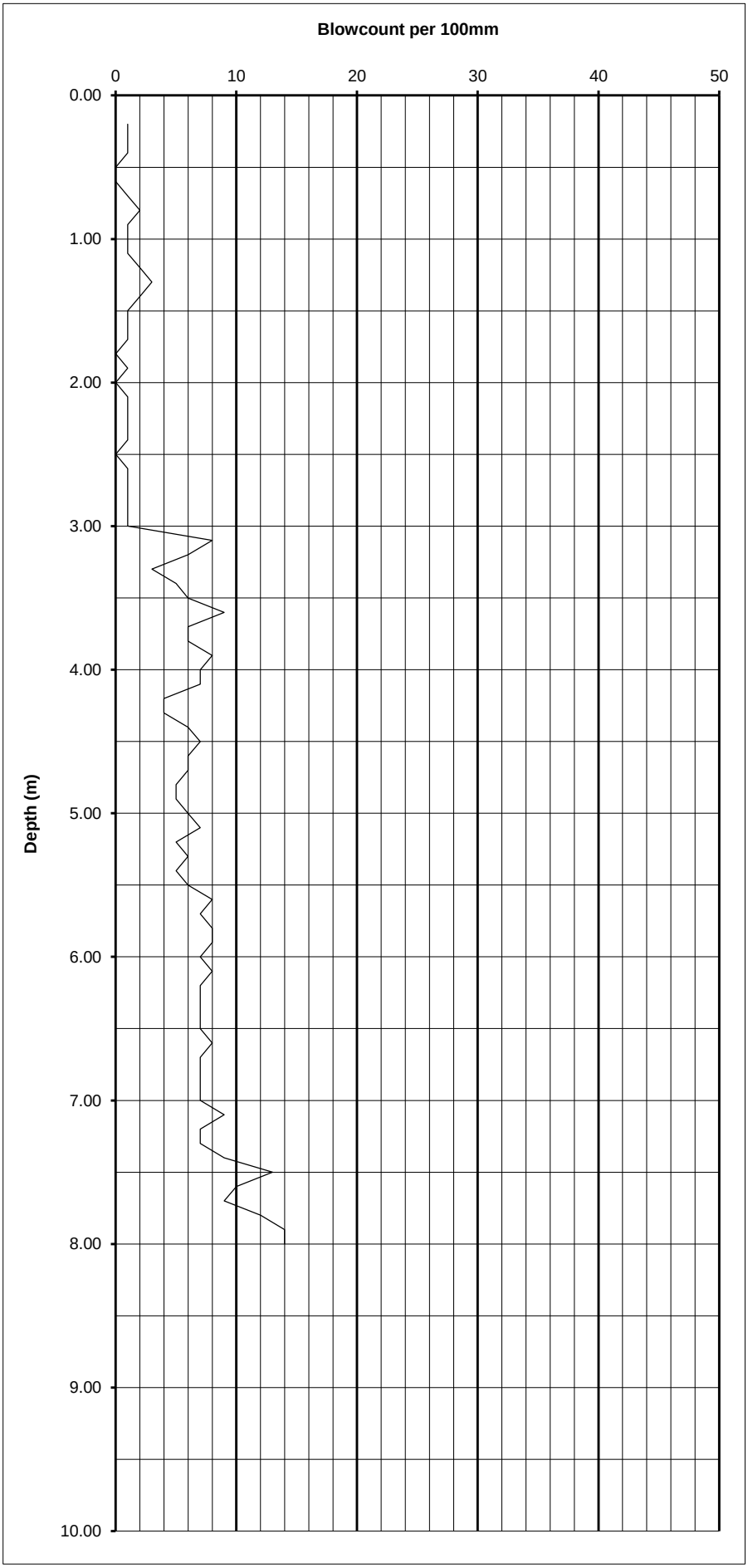
ASHDOWN SITE INVESTIGATION LTD

DPSH Continuous Dynamic Probe N100 vs Depth Profile

SITE Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea **REPORT REF.** LW24134

DPT No. BH2

Depth (m)	Blows	Torque (Kgm)
0.00		
0.10		
0.20	1	
0.30	1	
0.40	1	
0.50	0	
0.60	0	
0.70	1	
0.80	2	
0.90	1	
1.00	1	
1.10	1	
1.20	2	
1.30	3	
1.40	2	
1.50	1	
1.60	1	
1.70	1	
1.80	0	
1.90	1	
2.00	0	
2.10	1	
2.20	1	
2.30	1	
2.40	1	
2.50	0	
2.60	1	
2.70	1	
2.80	1	
2.90	1	
3.00	1	
3.10	8	
3.20	6	
3.30	3	
3.40	5	
3.50	6	
3.60	9	
3.70	6	
3.80	6	
3.90	8	
4.00	7	
4.10	7	
4.20	4	
4.30	4	
4.40	6	
4.50	7	
4.60	6	
4.70	6	
4.80	5	
4.90	5	
5.00	6	
5.10	7	
5.20	5	
5.30	6	
5.40	5	
5.50	6	
5.60	8	
5.70	7	
5.80	8	
5.90	8	
6.00	7	
6.10	8	
6.20	7	
6.30	7	
6.40	7	
6.50	7	
6.60	8	
6.70	7	
6.80	7	
6.90	7	
7.00	7	
7.10	9	
7.20	7	
7.30	7	
7.40	9	
7.50	13	
7.60	10	
7.70	9	
7.80	12	
7.90	14	
8.00	14	
8.10		
8.20		
8.30		
8.40		
8.50		
8.60		
8.70		
8.80		
8.90		
9.00		
9.10		
9.20		
9.30		
9.40		
9.50		
9.60		
9.70		
9.80		
9.90		
10.00		



Comments

ASHDOWN SITE INVESTIGATION LIMITED

Site:	Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea, West Sussex	Report No.: LW24134 Sheet No.: 1 of 1

SUMMARY OF BOREHOLE FALLING HEAD SOAKAGE TEST RESULTS

Borehole **KCC1**	
Time (mins)	Depth to water (m)
0	0.05
1	0.10
2	0.12
4	0.18
5	0.22
9	0.30
39	0.45
84	0.60
126	0.74
189	0.90
223	0.97
Borehole Depth (m)	2.00
Casing Depth (m)	1.00
Casing Diameter (mm)	50.00
Depth	Borehole Diameter (mm)
1.00m to 2.00m	70.00

Borehole **KCC2**	
Time (mins)	Depth to water (m)
0	0.05
1	0.08
2	0.10
3	0.13
10	0.28
34	0.47
102	0.70
134	0.70
Borehole Depth (m)	3.00
Casing Depth (m)	1.00
Casing Diameter (mm)	50.00
Depth	Borehole Diameter (mm)
1.00m to 2.00m	79.00
2.00m to 3.00m	70.00

ASHDOWN SITE INVESTIGATION LIMITED

Site:	Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea, West Sussex	Report No.: LW24134 Sheet No.: 1 of 2

SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

Trial Pit **SA1 (Test 1)**	
Time (mins)	Depth to water (m bgl)
0	0.50
1	0.52
2	0.53
4	0.55
8	0.57
16	0.60
32	0.64
60	0.70
98	0.76
110	Dry
Pit Length - 0.30m Pit Width - 0.30m Pit Depth - 0.80m bgl	

Trial Pit **SA1 (Test 2)**	
Time (mins)	Depth to water (m bgl)
0	0.47
1	0.48
2	0.48
4	0.49
8	0.51
16	0.58
32	0.59
60	0.61
99	0.65
174	0.70
Pit Length - 0.30m Pit Width - 0.30m Pit Depth - 0.80m bgl	

Remarks: bgl - below ground level.

ASHDOWN SITE INVESTIGATION LIMITED

Site:	Buckingham Park Primary School, Hamfield Avenue, Shoreham by Sea, West Sussex	Report No.: LW24134 Sheet No.: 2 of 2

SUMMARY OF TRIAL PIT FALLING HEAD SOAKAGE TEST RESULTS

Trial Pit **SA2 (Test 1)**	
Time (mins)	Depth to water (m bgl)
0	0.53
1	0.59
2	0.62
4	0.66
8	0.72
16	Dry
Pit Length - 0.30m Pit Width - 0.30m Pit Depth - 0.80m bgl	

Trial Pit **SA2 (Test 2)**	
Time (mins)	Depth to water (m bgl)
0	0.48
1	0.52
2	0.54
4	0.56
8	0.62
16	0.70
30	Dry
Pit Length - 0.30m Pit Width - 0.30m Pit Depth - 0.80m bgl	

Trial Pit **SA2 Test 3**	
Time (mins)	Depth to water (m bgl)
0	0.46
1	0.50
2	0.53
4	0.54
8	0.60
16	0.70
32	0.79
36	Dry
Pit Length - 0.30m Pit Width - 0.30m Pit Depth - 0.80m bgl	

Remarks: bgl - below ground level.

APPENDIX B

Geotechnical Laboratory Testing Notes

Geotechnical Test Results

GEOTECHNICAL LABORATORY TESTING NOTES

1 Index Tests

Index (Atterberg Limit) tests are undertaken on samples of fine grained soils provide the primary information for the classification of fine grained soils.

Fine grained soil is tested to determine its liquid and plastic limits, which are moisture contents that define boundaries between material consistency states. These tests are used to evaluate indices used for soil identification and to help determine the shrinkage and swelling characteristics of the soil under conditions of changing moisture content. The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

The consistency index is derived from the Index Tests and is summarized in the following table. These divisions may be approximate, particularly for low plasticity soils.

Consistency	Consistency Index
Very Soft	<0.25
Soft	0.25 to 0.50
Firm	0.50 to 0.75
Stiff	0.75 to 1.00
Very Stiff	>1.00

Based on BN EN ISO 14688-2:2004

2 Particle Size Distribution Tests

Sieve analyses are carried out soil samples to establish their particle size distribution that can assist in the assessment of the permeability and classification of granular soils.

The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

3 Natural Moisture/ Saturated Moisture Content Determination of Chalk

The results of natural moisture or saturated moisture content tests of disturbed samples of chalk are used to assist in the classification of the chalk to determine key geotechnical parameters of strength, density and crushing properties.

The tests are carried out in accordance with BS1377: Part 2: 1990 + A1:1996 Classification tests.

4 Soil Suction Testing

Soil suction tests are undertaken for the determination of the state of desiccation in clay soils.

The testing is carried out in accordance with the Building Research Establishment Information Paper IP4/93, dated February 1993.

5 Triaxial Compression Tests

Undrained triaxial compression tests are carried out on undisturbed samples of cohesive soil in order to assist in the determination of the undrained shear strength of the soil. The results of moisture content and density determinations are also included.

The tests are carried out in accordance with BS1377: Part 7: 1990 + A1:1994 Shear strength tests (total stress).

6 Shear Vane and Hand Penetrometer Testing

Undisturbed samples are tested in the laboratory using a Geonor Hand Shear Vane for the determination of their undrained shear strength.

The vane tests are carried out in general accordance with BS1377: Part 7: 1990 + A1:1994 Shear strength tests (total stress).

7 One Dimensional Consolidation Tests

One-dimensional consolidation tests are performed on undisturbed soil samples to ascertain their settlement characteristics.

The tests are carried out in accordance with BS1377: Part 5: 1990 + A1:1994 Compressibility, Permeability and Durability tests.

8 Dry Density / Moisture Content Relationship (Compaction) Testing

Compaction testing for the determination of the dry density / moisture content relationship is carried out on using either a 2.5kg, 4.5kg hammer or a vibrating hammer.

The tests are carried out in accordance with the British Standard BS1377: Part 4: 1990 + A1 & A2:2002 Compaction-related tests.

9 California Bearing Ratio

The soil is usually compacted at the as dug “natural” moisture content and often at moisture contents around the natural moisture content.

The California bearing ratio is determined in accordance with the British Standard BS1377: Part 4: 1990 + A1 & A2:2002 Compaction related tests.

10 Chemical Testing

Soil samples are tested for their concentration of water soluble sulphate and pH for use in concrete mix design.

Water samples are tested for total sulphate concentration and pH value.

Where a water soluble sulphate content in soils or a total sulphate content in groundwater exceeds 3000mg/l SO_4 the magnesium sulphate content of the samples is required to be determined (BRE Special Digest 1:2005).

ASHDOWN SITE INVESTIGATION LTD

Site:	Buckingham Park Primary School, Hamfield Avenue, Shoreham-by-Sea, West Sussex	Report No: Sheet No:	LW24134 1 of 1

SOIL CLASSIFICATION SUMMARY

Sample No.	Depth (m)	Nat. Moist. Cont. (w %)	Equiv. Moist. Cont. (w_a %)	Atterberg Limits W_l %	Atterberg Limits W_p %	Atterberg Limits I_p %	Class'n	Cons. Index (I_c)	% passing 425 *µm* sieve	Visual Description of Sample
BH1	2.00	21	21	37	18	19	CI	0.86	99	Stiff light brown and dark brown mottled CLAY with rare fine chalk gravel.
	3.30	19	20	41	18	23	CI	0.92	95	Stiff brown occasionally black slightly gravelly slightly sandy CLAY. Gravel is fine to coarse flint.
	4.00	9								
	5.00	7								
	6.00	15								
	7.00	20								
	8.00	21								
BH2	1.00	22	35	49	19	30	CI	0.47	60	Soft dark brown gravelly sandy CLAY. Gravel is fine to coarse flint.
	2.10	27	28	47	19	28	CI	0.68	95	Firm brown slightly gravelly slightly sandy CLAY. Gravel is fine flint.
	2.90	25								
	4.10	16								
	5.00	17								
	6.00	20								
	7.00	21								
	8.00	21								

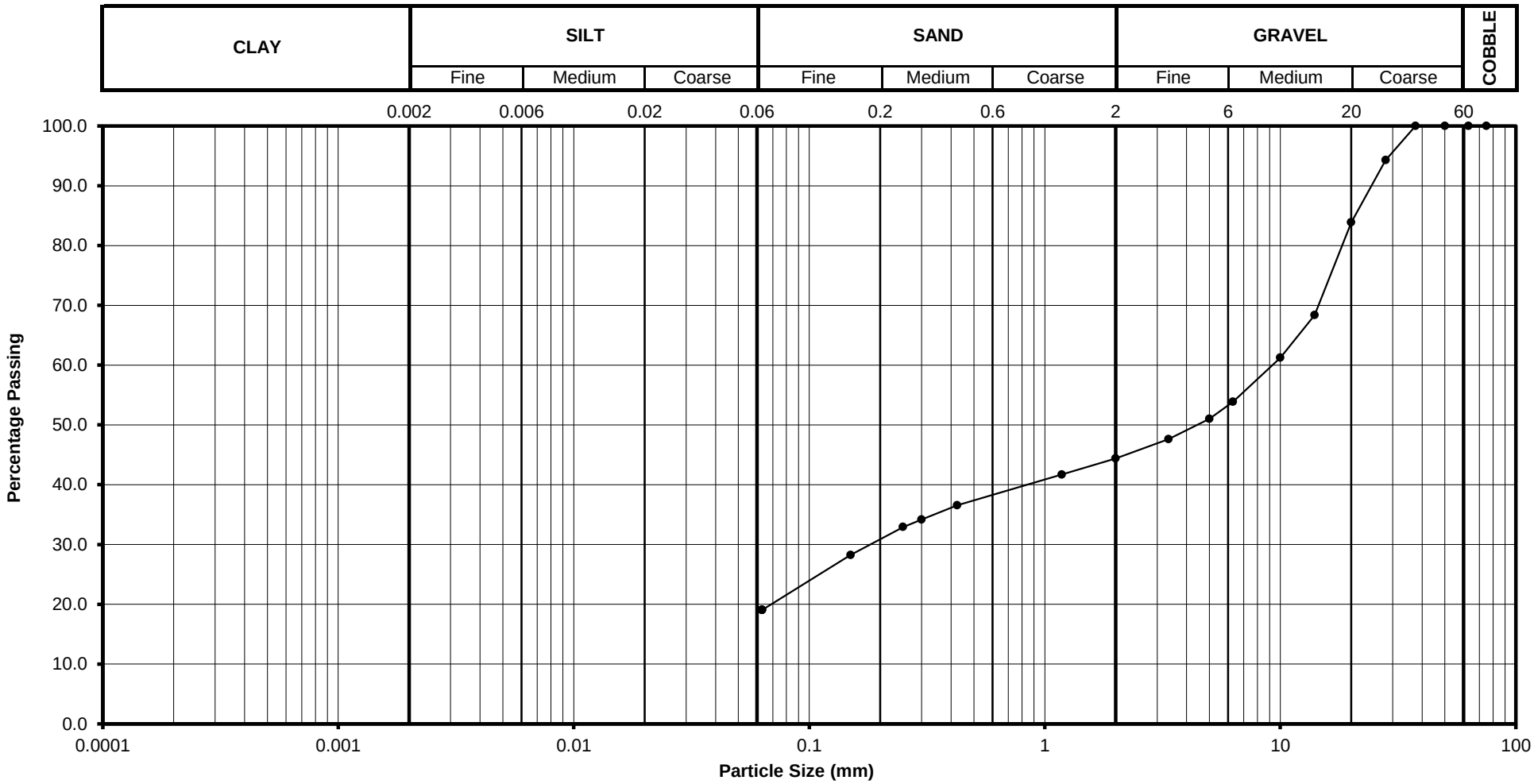
Remarks:

Swanborough Farm
Swanborough
Lewes, East Sussex
BN73PF

ASHDOWN SITE INVESTIGATION LTD
Geotechnical and Environmental Engineers

ASHDOWN SITE INVESTIGATION LIMITED

Particle Size Distribution by Wet Sieve; BS1377: Part 2 1990



Job Name	Buckingham Park School, Shoreham.	**BH/ TP No.**	BH2	**Sample Description**	Clayey very sandy GRAVEL.
Job No.	LW24134	**Sample Depth (m)**	3.50		

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone (01424) 718618
Facsimile (01424) 729911

2683 2683

THE ENVIRONMENTAL LABORATORY LTD

F.A.O. David Harris
Ashdown Site Investigation Limited
The Old Dairy, Swanborough Farm
Swanborough, Lewes,
East Sussex, BN7 9PF

Reporting Date: 13 June 2013

ANALYTICAL REPORT No. AR44824

Samples Received By: Laboratory Courier
Sample Receipt Date: 06/06/13
Your Job No: LW24134
Your Order No: 130323
Site Location: Buckingham Park School, Shoreham
No Samples Received: 3
Date of Sampling: ---

This report was written by: N. Williams

Authorised By;

Steve Knight
Reporting Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)

THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonards On Sea, East Sussex, TN38 9BY
Tel: 01424 718618 Fax: 01424 729911

2683 2683

ANALYTICAL REPORT No. AR44824

Location: Buckingham Park School, Shoreham

Your Job No: LW24134
Your Order No: 130323
Reporting Date: 13/06/13

F.A.O. David Harris
Ashdown Site Investigation Limited
The Old Dairy, Swanborough Farm
Swanborough, Lewes,
East Sussex, BN7 9PF

Soils

		Characteristic	Silt loam	Silt loam	Chalk
		TP/BH	BH1	BH2	BH2
		Depth (m)	1.00	1.50	7.00
		Our ref	72897	72898	72899
pH Value**	(Units)		7.6	8.3	8.5
Water Soluble Sulphate	(mg/l as SO_4)		34	32	30

All results expressed on dry weight basis
** - MCERTS accredited test

N. Williams

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone (01424) 718618
Facsimile (01424) 729911

2683 2683

THE ENVIRONMENTAL LABORATORY LTD

SAMPLE RECEIPT AND TEST DATES

Our Analytical Report Number	AR44824
Your Job No:	LW24134
Sample Receipt Date:	06/06/13
Reporting Date:	13/06/13
Registered:	06/06/13
Prepared:	07/06/13
Analysis complete:	13/06/13

TEST METHOD SUMMARY

PARAMETER	Analysis Undertaken on	Date Tested	Method Number	Technique
pH Value**	Air dried sample	10/06/13	113	Probe
Water Soluble Sulphate	Air dried sample	10/06/13	209	Colorimetry

** - MCERTS Accredited test
Determinands not marked with * or ** are non accredited
MCERTS accreditation covers samples which are predominantly sand, clay, loam or combinations of these three soil types

Any comments, opinions, or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)