Robson Liddle

part of the nps group

# Gospel Oak Primary School
# Camden

## Ground Investigation Report

On behalf of NPS Property Consultants

Report 140361/GIR1
November 2013

# Report Issue Record

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# Executive Summary

| | | |
|---|---|---|
| SITE INFORMATION | Client | NPS Property Consultants |
| | Site | Gospel Oak Primary School Primary |
| | Site Location | Savernake Road, London, NW3 2JB. NGR 528001,185273. |
| | Current Land Use | Primary School |
| | Proposed Development | Refurbish the existing building and construction of a single storey extension to the Nursery Building. |
| GROUND INVESTIGATION | Previous Site Works | Preliminary Land Contamination and Geotechnical Risk Assessment Report by RLL, reference 13-1150/DSR3 Dated 1st March 2013. |
| | Site Works | Four hand dug pits to expose existing foundations and three windowless sampling boreholes to 5.0m bgl with 3 x 50mm standpipes & gas valves. |
| | Monitoring | One gas and groundwater level monitoring visit. |
| | Ground Conditions | Made Ground (0.50m to 2.20m) over very clayey gravel and stiff clay of the London Clay. Potential asbestos containing materials (ACM) were encountered at shallow depth in WS4a and WS4b.<br>No groundwater during investigation. Groundwater recorded between 3.10m and 3.02m bgl during monitoring in November 2013. |
| GEOTECHNICAL | Foundations | Foundations should be constructed in the natural London Clay soils. Bearing capacity of 140kPa for strips, 165kPa for pads. Soils are shrinkable (high volume change potential). |
| | Floor Slabs | Suspended floors recommended. |
| | Buried Concrete | DS3 & AC3 |
| LAND QUALITY | Risk Assessment Findings | No unacceptable risks to human health identified with the exception of potential asbestos containing materials. Whilst these do not present a risk in the current situation, redevelopment works would need to be planned accordingly to prevent disturbance of the ACM presenting a risk.<br>No unacceptable risks to controlled waters identified.<br>No remedial works considered necessary. A specialist asbestos company would need to advise on the management of risks from the asbestos containing material. |
| | Remediation | None required for land contamination. No ground gas or radon protection measures considered necessary. |
| | Water Supply Pipework | Localised elevated concentrations of hydrocarbons have been encountered, which may have the potential to attack plastics. Confirmation should be sought from the water supply company at the earliest opportunity as to there specific requirements. |

# 1 Introduction

A ground investigation was undertaken by Robson Liddle Ltd (RLL) at Gospel Oak Primary School, Camden.

The investigation was carried out in October 2013 to the instructions of NPS Property Services, architect and project manager, on behalf of Camden Council, the Client.

It is proposed to refurbish the existing building and construct a single storey extension to the Primary Building. A provisional development layout has been provided to Robson Liddle by NPS (reference drawing SK1011-130227-01) and is presented in Appendix A.

This report describes the work undertaken and presents the data obtained together with an evaluation of their significance in relation to the proposed works.

## 1.1 Scope of Works

The scope of works was specified by NPS and comprised:

- A Desk Study.
- Preliminary UXB risk assessment.
- An intrusive ground investigation consisting of a provisional five windowless sampler boreholes and foundation exposure pits.
- Groundwater and gas monitoring.
- Laboratory chemical and geotechnical testing.
- Reporting on findings of the ground investigation and presentation of results.
- Geotechnical recommendations in relation to the proposed development.
- Contamination assessment.

The Desk Study element has already been completed under separate cover (Report reference 13-1150/DSR3 dated 1st March 2013). A summary of that report's findings is presented in Section 3.

The preliminary UXB risk assessment has been undertaken by others and issued under separate cover.

# 2 Site Location

Address: Savernake Road, London

Postcode: NW3 2JB

National Grid Reference: 528001,185273

The site of the proposed development is located within the existing primary school to the east of main Gospel Oak Primary School and occupies an area of approximately 0.13ha. Access to the site is gained from Savernake Road to the east. The site location is shown on Figure 1.

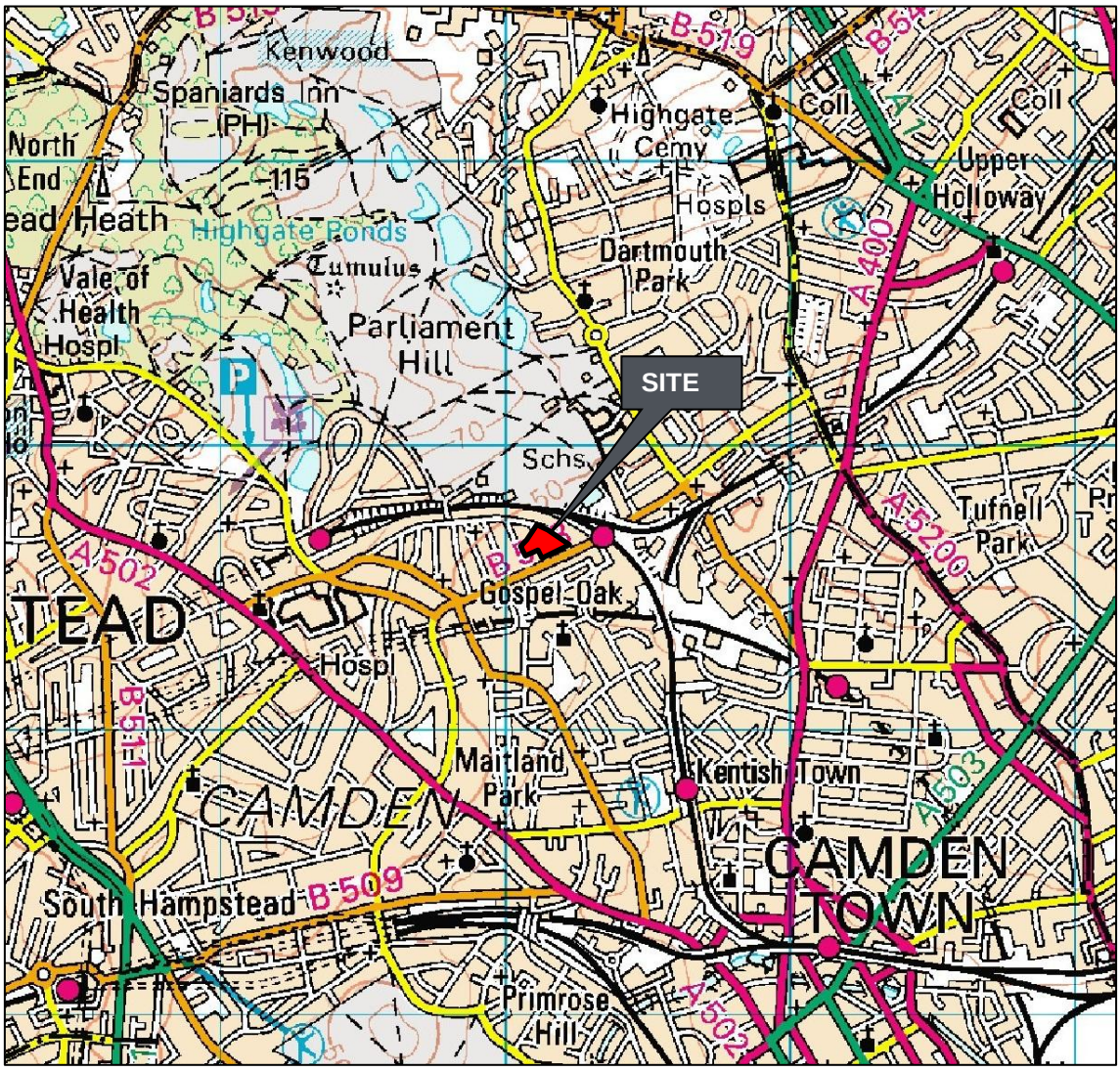



Figure 1 Site Location Plan

## 2.1 Site Description

The site comprises a nursery, which is located within the western portion of the Primary School, as shown in Figure 2. The boundary of the Primary School is shown in pink. The boundary of the study site is shown by the dashed black line. The site is occupied by a single storey nursery school building with the remainder of the site being hard standing play areas. Mature trees were present surrounding much of the site. Access is gained from the east off Rona Road.

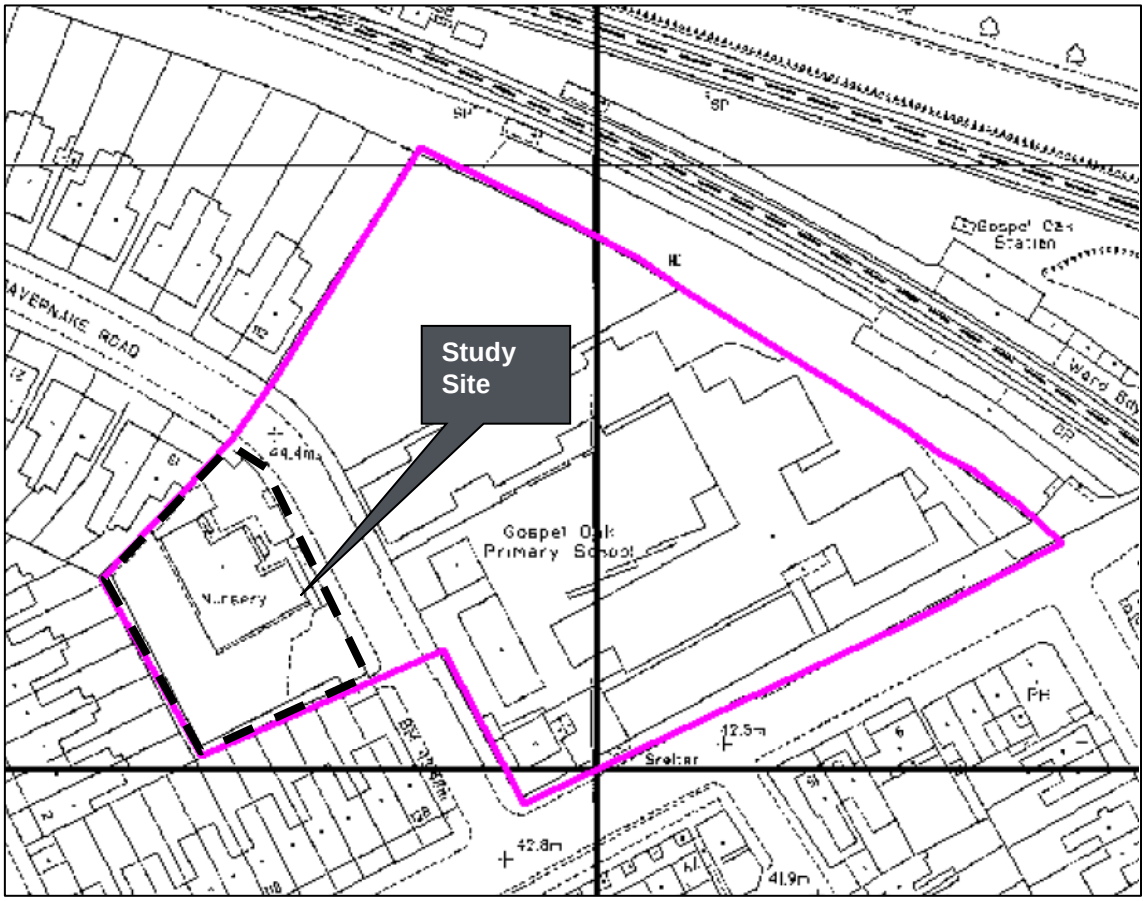



Figure 2. Site Layout.

# 3 Summary of Previous Work

A Preliminary Land Contamination and Geotechnical Risk Assessment report was undertaken for the site by Robson Liddle (reference 13-1150/DSR3 dated 1st March 2013). The work comprised a desk study, site walkover survey and a preliminary land contamination risk assessment. The salient findings of that report are summarised in the following sections.

## 3.1 Site History

The site was undeveloped agricultural land at the time of the first mapping in 1873 but was developed by 1896 as residential dwellings and allotment gardens. The majority of the site was then constructed in 1951 as a school with further developments in 1991 to reach the current school layout.

## 3.2 Geology

The 1:50,000 scale British Geological Survey (BGS) geological map indicates the site to be underlain by London Clay Formation (clay, silt and sand) of Eocene Period. No superficial deposits are indicated to underlie the site. The BGS describe the London Clay Formation as "*fine sandy, silty clay / clayey silt*".

## 3.3 Hydrogeology

The Environment Agency classifies the London Clay Formation at the site to be an unproductive Aquifer ("rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow"). The site does not lie within a Source Protection Zone and there are no current groundwater abstraction points within 500m of the site.

The site is considered therefore to be of low sensitivity with respect to groundwater.

## 3.4 Hydrology

The culverted River Fleet is present approximately 148m south west at its nearest point. On the basis of the underlying low permeability geology the site is considered to be of low sensitivity with respect to surface water.

## 3.5 Radon

The Envirocheck report states that the site is in a lower probability radon area as less than 1% homes being above the action level of 200Bqm$^{-3}$. Therefore no radon protective measures are necessary in the construction of new dwellings or extensions.

## 3.6 Landfill

There are no historical landfills recorded within 500m of the site. However, Gospel Oak Brick Works was located within 100m to the south of the site and appears to have once been quarried and subsequently backfilled. On the basis of the low permeability of the anticipated underlying geology and the distance from the site this is not considered to present a significant risk to the site.

## 3.7 Summary of the Contamination Risk Assessment

Widespread contamination across the site is unlikely to be present as a result of the historical or current use of the site.

There is the potential for a risk of ground gas migration to the site from a possibly backfilled brickworks quarry 100m to the south of the site. However on the basis of the low permeability of the anticipated underlying geology and the distance from the site this is not considered to present a significant risk.

## 3.8 Geotechnical Hazards

The primary geotechnical risks are considered to be:

- Shrinking / swelling clays.
- Possible Made Ground.
- Buried structures from any previous development.

# 4 Ground Investigation

The scope of the intrusive investigation was proposed by NPS and should have comprised a provisional five hand dug trial pits to expose existing foundations and five windowless sample exploratory holes.

During the works, the fourth windowless sampler borehole encountered potential asbestos containing materials (ACM). To protect the health and safety of workers undertaking the position was abandoned. An alternative location (1m away) also encountered suspected ACM and was also abandoned. A sample of the ACM was submitted for laboratory analysis and confirmed to be Amosite fibres.

Subsequent to this, the site was closed by the school caretaker, and there was insufficient time to complete the fifth hole and only three of the five foundation exposure pits could be completed.

The procedures followed in this site investigation are based on BS 5930:1999 + Annex 2:2010 - Code of Practice for Site Investigations. The soils and rocks encountered have been described in accordance with BS5930:1999 + Annex 2:2010 and BS EN ISO 14688-1:2002 and BS EN ISO 14689-1:2003.

The approximate positions of the exploratory holes are shown on the Exploratory Hole Location Plan Drawing 140361-D01 in Appendix B and the exploratory hole records are included in Appendix C.

## 4.1 Foundation Exposure Pits

Three trial pits (TP1 to TP3) were excavated by hand to depths varying between 0.4m and 0.7m below ground level (bgl) in order to expose the foundations of the existing school building. The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. In situ hand shear vane testing was carried out in suitable strata. The details of the exposed foundations can found on drawing 140361-D02 which is included with the trial pit logs in Appendix C.

## 4.2 Windowless Sampler Boreholes

Three boreholes (WS1 to WS3) were formed to a depth of 5.0m on 17th October 2013 using windowless sampling techniques in order to obtain samples for laboratory testing

and to provide geotechnical information for foundation design. The aborted boreholes were designated WS4a and WS4b.

Representative disturbed small (1kg) and environmental (identified on the borehole logs as D and ES) samples of the soils encountered were obtained at regular intervals. In situ hand shear vane testing was carried out in suitable strata.

A detailed description of all strata and groundwater encountered, samples, in situ tests and other pertinent information observed are included on the borehole logs in Appendix C.

## 4.3 Dynamic Probing

Three Dynamic Probe Holes (DP1, DP2 and DP3) were undertaken adjacent to the corresponding windowless sampler boreholes using super-heavy dynamic probe equipment. The dynamic probe apparatus conforms to BS 1377 (1990) Part 9 and effectively drives a $90^{o}$ (sacrificial) cone into the ground using a 63.5kg automatic trip hammer falling over 750mm. The number of blows required to achieve increments of 100mm penetration is recorded and plotted graphically on the records, which are presented in Appendix C.

## 4.4 Installations

Gas / Groundwater monitoring wells designed to allow monitoring of ground gases and shallow groundwater within the superficial deposits were installed into all three boreholes on completion, as detailed in Table 1. The response zone comprised slotted pipe with a 10mm inert gravel surround. The strata above the response zone were sealed with bentonite. Installation details for the monitoring wells are also shown in the relevant borehole logs in Appendix C.

**Table 1 Summary of Monitoring Installations**

| Hole | Base (m bgl) | Dia. (mm) | Response Zone (m bgl) | Headworks |
|---|---|---|---|---|
| WS1 | 5.0 | 50 | 1.0 to 5.0 | Gas valve, flush locked cover |
| WS2 | 5.0 | 50 | 1.0 to 5.0 | Gas valve, flush locked cover |
| WS3 | 4.0 | 50 | 1.0 to 4.0 | Gas valve, flush locked cover |

# 5 Laboratory Testing

## 5.1 General

All laboratory testing was scheduled by Robson Liddle and is summarised as follows:

## 5.2 Geotechnical Testing

Samples of soil retained from the exploratory holes were scheduled for geotechnical laboratory testing. The geotechnical analysis was carried out in accordance with BS1377: 1990 'Soils for Civil Engineering Purposes'. The following tests were carried out on selected samples:

- 3 natural moisture contents and Atterberg Limits
- 3 BRE SD1 sulphate suites

The results are presented in Appendix D.

## 5.3 Contamination Testing

Four samples of soils were retained from the exploratory holes and were scheduled for chemical laboratory testing. The soil samples were analysed for a combination of the following:

Arsenic
Boron (water soluble)
Cadmium
Chromium (total and VI)
Copper
Lead
Mercury
Nickel
Selenium
Zinc
pH
Total Organic Carbon
Phenols
PAH (USEPA 16) (2 samples)
TPH (CWG) (2 samples)
Asbestos screen (1 sample)
Asbestos ID (1 sample)

The chemical analysis was undertaken by MCERTS and UKAS accredited laboratory Exova. Certificates of analysis are included Appendix E.

# 6 Ground Conditions

## 6.1 General

The results of this investigation were consistent with the anticipated geology. A summary of the strata encountered is presented in Table 2 and summarised in the sections 6.2 to 6.6. For full details of the strata encountered reference should be made to the exploratory hole logs in Appendix C.

**Table 2 Ground Conditions**

| Stratum | Depth to top (m bgl) | | |
|---|---|---|---|
| | WS1 | WS2 | WS3 |
| Topsoil | GL | - | GL |
| Made Ground | 0.20 | GL | 0.50 |
| Head | 1.20 | 2.20 | - |
| River Terrace Gravel | 2.10 | 2.70 | - |
| London Clay | 2.50 | 3.00 | 0.60 |
| Base of hole | 5.0 | 5.0 | 5.0 |
| Groundwater | Dry | Dry | Dry |

## 6.2 Topsoil

Topsoil was encountered in WS1 and WS3 to 0.20 and 0.50m below ground level (bgl) respectively. The material consisted of dark grey brown sandy clay with fine rootlets.

## 6.3 Hardstanding

Hardstanding was encountered in WS2 to 0.70m below ground level (bgl). The material consisted a 0.20m of tarmac over 0.30m of sub-base over 0.20m of concrete.

## 6.4 Made Ground

Made Ground materials were encountered in all locations to depths ranging from 0.60m (WS3) to 2.20m bgl (WS2). The materials generally comprised grey brown sandy slightly clayey gravel with low concrete cobble content. The gravel was angular fine to coarse concrete and brick.

Within WS4a and WS4b potential ACM was encountered within the Made Ground. Due to the presence of the potential ACM the holes were abandoned.

## 6.5 London Clay

The Made Ground was underlain by the bedrock geology of the London Clay. This material was weathered to a very clayey sandy gravel and a stiff clay near the surface, with intact bedrock being encountered at depths of 0.6m to 3.0m bgl.

## 6.6 Groundwater

No groundwater was encountered during the intrusive works. Monitoring of groundwater levels within the standpipes installed was undertaken on the 11th November 2013, the results are presented in Table 3.

**Table 3 Groundwater Monitoring Results**

| Hole | WS1 | WS2 | WS3 |
|---|---|---|---|
| Depth to water | 3.10m bgl | 3.20m bgl | 3.20m bgl |

## 6.7 Field Observations of Contamination

Potential asbestos containing materials (ACM) were recorded in WS4a and 4WSb. No other visual or olfactory evidence of contamination was encountered.

## 6.8 Shrinkable Soils

Cohesive soils (clay and silt) may undergo volume change when subject to changes in moisture content. This can cause ground movement of soils where seasonal changes or tree root action affect the moisture content. Where foundations are constructed in such soils these movements can lead to damage of the superstructure. These movements are greatest where trees are removed or tree root systems are severed as this allows the soils to regain their equilibrium moisture content resulting in expansion.

The NHBC (National House Building Council) has derived minimum foundation depths and other precautions relating to ground movements in shrinkable soils. These standards are set out in NHBC Chapter 4.2 “Building Near Trees” (2001) and are commonly adopted for both residential and non-residential structures.

The Modified Plasticity Index is related to volume change potential and NHBC recommended minimum foundation depths as indicated in Table 4.

**Table 4 Volume Change Potential**

| Modified Plasticity Index | Volume Change Potential | Minimum Foundation Depth |
|---|---|---|
| 40% or greater | High | 1.00m |
| 20% to 40% | Medium | 0.90m |
| 10% to 20% | Low | 0.75m |
| Less than 10% | Non shrinkable | 0.60m |

The plasticity indices of 4 soil samples of the natural clay strata ranged from 39% to 51%, with the percentage of the soil <425µm being 100%. The calculated modified plasticity indices were therefore 39% to 51%.

On this basis of the modified plasticity index, the clay soils would therefore be considered to be of **high volume change potential** with respect to NHBC Chapter 4.2 "Building Near Trees" (NHBC, 2011). Consequently a minimum foundation depth of 0.90m is recommended where foundations are outside the influence zone of trees.

## 6.9 Soil Strength

The results of hand shear vane tests ranged from 70kPa to 140kPa (the upper limit of measurement for the apparatus). The shear strength values are shown on Figure 3.

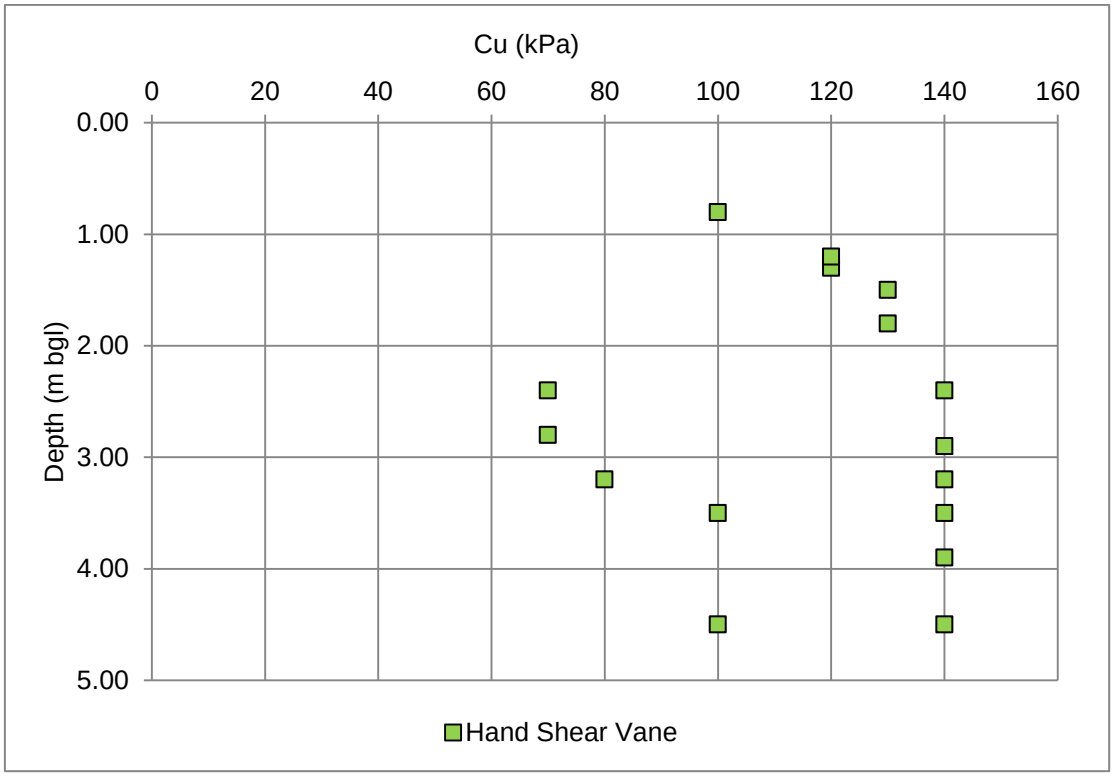



Figure 3 Shear strength

# 7 Geotechnical Assessment

## 7.1 Proposed Development

It is understood from NPS that the existing building will be extended to the south and the north east, with single storey structures supported on 600mm wide strip foundations. A new canopy is also proposed along the western and southern sides.

## 7.2 Summary of Ground Conditions

The investigation identified between 0.50m and 2.20m of topsoil and Made Ground over medium dense very clayey sandy gravel and stiff clay of the weathered London Clay.

During subsequent monitoring of the standpipes, groundwater was recorded at depths of 3.10m to 3.20m bgl.

## 7.3 Foundation Design Principles

The two primary factors controlling the performance of foundations are bearing capacity and settlement. The degree of settlement at bearing capacity failure (ultimate bearing capacity) is usually considerably greater than the settlement tolerances of the structure, therefore it is usually tolerable settlement that dictates the allowable bearing pressure for foundation design. In general, the ultimate bearing capacity is usually divided by a safety factor of 3 for a safe bearing capacity to maintain total settlement within tolerable limits for most structures, and this is generally accepted to be 25mm. However, it should be noted that total settlements are usually less than this value as the average actual imposed load will be less than the design load.

## 7.4 Foundation Solutions

Based on the ground conditions encountered, conventional spread foundations would be suitable for the proposed structure. These should be taken down through any Made Ground or any soft deposits and constructed within the natural stiff clay or gravel at a minimum depth of 1.00m bgl, although it is acknowledged that actual foundations depths will be greater than this due to the depth of Made ground.

Based on a lower bound value for undrained shear strength of 70kPa an allowable bearing capacity of 140kPa would be appropriate for strip footings or 165kPa for

square pads. Total settlements for foundations designed to the proposed loadings are likely to be in the order of 15 to 25mm.

Foundations will need to be deepened and have precautions adopted within the influence zone of existing, proposed or felled trees, in accordance with NHBC Chapter 4.2, assuming soils of high volume change potential. It is noted that there are a number of trees around the site boundary, but the majority of the site is clear of significant vegetation.

All foundations should be inspected by a suitably qualified and competent person to ensure that foundations are placed in competent material capable of supporting the intended loads and below any signs of tree root action or desiccation.

## 7.5 Buried Structures

Notwithstanding the ground conditions revealed by the intrusive investigations, it is important to note that both foundation and ground floor slab construction could be significantly influenced by pre-existing subsurface construction associated with the current development of the site. This could include, for example, foundations and underground services, which will need to be fully grubbed out beneath areas of new construction, in addition to other possible buried structures, infilled pits and channels, where they interfere with the new build.

## 7.6 Floor Slabs

The underlying soils are high volume change potential clays with some vegetation in the vicinity of the site, or deep Made Ground. Therefore a fully suspended ground floor slab would be required. If a ground bearing slab is desired, then any desiccated soils and Made Ground should be removed and replaced with well compacted granular fill.

No radon protection measures are considered necessary. The ground gas monitoring has not recorded elevated concentrations of ground gas and consequently no protection measures are considered necessary.

## 7.7 Buried Concrete

Buried concrete classification is based on guidelines provided in BRE Special Digest 1.

Chemical Analysis was undertaken on three soil samples for pH and a total potential sulphate suite (Water soluble sulphate, total sulphate and total sulphur).

An assessment for total potential sulphate indicates that the soils are not considered to be pyritic and an assessment of the design class can be made on soluble sulphates.

The pH values ranged from 7.6 to 8.0 with water soluble sulphate concentrations of 80mg/l to 2990mg/l. Therefore it is recommended that a Design Class of DS3 and AC3 should be assumed for buried concrete in accordance with BRE Special Digest 1 (BRE, 2005) assuming natural ground and mobile groundwater conditions.

## 7.8 Excavations

Conventional mechanical backhoe excavators should prove suitable for excavation within the weathered bedrock. The clay soils should remain stable for sufficient time to pour concrete. Entry into shallow excavations by personnel should be minimised, and excavation stability should be assessed by suitably qualified and experienced staff and shoring used when required. Entry into deeper excavations should not be permitted unless full support is provided.

No groundwater was encountered during the investigation. During a subsequent monitoring visit water levels were recorded at 3.10m to 3.20m bgl.

The low permeability of the natural clay strata is likely to result in very low inflow rates and it is considered that groundwater control can be achieved by pumping.

It should also be noted that potential ACM have been identified within the Made Ground. Further information is provided within section 8.4.

# 8 Contamination Risk Assessment

## 8.1 Desk Study Conceptual Site Model (CSM)

The preliminary CSM developed as part of the Desk study recorded the risk of exposure at the site as low in relation to soil contamination due to the absence of any on-site sources of significant contamination being identified during the assessment.

## 8.2 Introduction to Human Health Risk Assessment

A generic quantitative risk assessment (GQRA) has been undertaken using the geochemical results for the soil samples retained from the site. The approach to human health risk assessment adopted in this report is consistent with the Environment Agency's Model Procedures (CLR11) and other relevant guidance (including SR3, BS10175:2001 and PPS23).

The laboratory soil data has been compared to relevant critical concentrations as outlined in the guidance. These criteria can be either Generic Assessment Criteria (GAC) or Site Specific Assessment Criteria (SSAC). For the purpose of this generic quantitative risk assessment, GAC will be used. Soil Guideline Values (SGVs) have not been released for all of the determinants assessed and for all land uses. Therefore, where appropriate, use has been made of GAC published in August 2009 by Land Quality Management for the Chartered Institute of Environmental Health (referred to herein as LQM GAC). The proposed development is a school which is not a defined end use, therefore a CLEA 'residential' end use has been conservatively been considered assumed for the assessment.

The % total organic carbon (TOC) for two samples were 1.2% and 4.3%, average 2.8%. From this the Soil Organic Matter (SOM) can be calculated. The Environment Agency Briefing Note 7 (EA, 2005) states that %SOM = %TOC/0.58. Therefore for the site the SOM is 2.07% and 7.4%, average 4.74%. Where the assessment criteria are reliant on Soil Organic Matter (SOM); assessment criteria derived for 2.5% SOM have been used.

The results of the laboratory geochemical soil analysis have been statistically analysed to ensure a true representative assessment of the site is made and allow a comparison with the appropriate GAC. Statistical analysis has been undertaken in accordance with the report: Guidance on Comparing Soil Contamination Data with a Critical

Concentration, published by the Chartered Institute of Environmental Health through CL:AIRE (Contaminated Land: Applications In Real Environments) in May 2008.

In order to undertake the statistical assessments, the ESI Contaminated Land Statistics Calculator software has been utilised. This software has been developed in accordance with the CL:AIRE guidance.

The statistical tests are structured according to the reason for the assessment (i.e., whether the assessment is addressing concerns relating to either the planning or Part IIA regimes).

The statistical tests are presented in terms of a Null and an Alternative Hypothesis. The tests are structured to show, at the defined level of confidence, which of the two hypotheses is most likely to be true in a particular case. By convention, the Null Hypothesis is the starting proposition against which the key question (i.e. can we confidently say that the level of contamination at the Site is high relative to an appropriate measure of risk?) can be tested. Hence, for the planning assessment:

- The Null Hypothesis (H0) is that the level of contamination in the study area is same as or greater than the critical concentration; and
- The Alternative Hypothesis is that the level of contamination is lower than the critical concentration.

If the Null Hypothesis cannot confidently be rejected, then further assessment or remediation may be required. However, if the Null Hypothesis can confidently be rejected in favour of the Alternative Hypothesis, it can be concluded that there is good evidence that no further action is required.

## 8.3 Soil Assessment

To ascertain a preliminary assessment of the contaminative nature of the near surface materials across the site, five soil samples were retained during the site investigation works and submitted for laboratory analysis.

The chemical analysis was undertaken at the laboratories of Exova. The results are included in Appendix E.

### 8.3.1 Heavy Metals

The results of the chemical analysis for heavy metal concentrations within the soil samples are summarised in Table 5 below.

**Table 5 Summary of Heavy Metals**

| Determinant | GAC | Concentration Range | | $H_0$ Rejected? | Evidence Level |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Arsenic | 32[1] | 9 | 18 | Yes | 100% |
| Boron (w/s) | 291[2] | 1.2 | 3.1 | Yes | 100% |
| Cadmium | 10[1] | <0.5 | 6.7 | Yes | 96% |
| Chromium (total) | 3000[2] | 28 | 78 | Yes | 100% |
| Chromium (VI) | 4.3[2] | <1 | - | Yes | 100% |
| Copper | 2330[2] | 20 | 201 | Yes | 100% |
| Lead | 450[1] | 18 | 361 | Yes | 97% |
| Mercury | 11[1] | <0.5 | 1.2 | Yes | 100% |
| Nickel | 130[1] | 15 | 74 | Yes | 100% |
| Selenium | 350 | <2 | - | Yes | 100% |
| Zinc | 3750[2] | 77 | 535 | Yes | 100% |

Results in mg/kg unless stated otherwise
[1] CLEA SGV GAC
[2] LQM GAC

All available metals soil data have been incorporated within the Statistical Calculator. The key inputs to and outputs from the Calculator tool are included in Appendix F.

Based on the full metals datasets for the near surface soils the Statistical Calculator indicates that we can be 96% to 100% confident in rejecting the Null Hypothesis for the planning scenario. This result indicates that the observed metals concentrations within the near surface soils are unlikely to pose any significant risks to human health in a Planning context.

### 8.3.2 Polyaromatic Hydrocarbons

The results of the chemical analysis for Polyaromatic Hydrocarbons (PAH USEPA16) are summarised in Table 6.

**Table 6 Summary of Polyaromatic Hydrocarbons**

| Determinant | GAC | Concentration Range | | $H_0$ Rejected? | Evidence Level |
|---|---|---|---|---|---|
| | | Min | Max | | |
| Acenaphthene | 480 | <0.1 | 0.3 | Yes | 100% |
| Acenaphthylene | 400 | <0.1 | <0.1 | Yes | 100% |
| Anthracene | 4900 | <0.1 | 1.1 | Yes | 100% |
| Benz(a)anthracene | 4.7 | <0.1 | 2.0 | No | 93% |
| Benzo(a)pyrene | 0.94 | <0.1 | 2.1 | No | 0% |
| Benzo(b)fluoranthene | 6.5 | <0.1 | 2.2 | Yes | 96% |
| Benzo(ghi)perylene | 46 | <0.1 | 1.8 | Yes | 100% |
| Benzo(k)fluoranthene | 9.6 | <0.1 | 1.1 | Yes | 100% |
| Chrysene | 8 | <0.1 | 1.9 | Yes | 98% |
| Dibenz(a,h)anthracene | 0.86 | <0.1 | 0.8 | No | 57% |
| Fluoranthene | 460 | 0.1 | 4.3 | Yes | 100% |
| Fluorene | 380 | <0.1 | 0.2 | Yes | 100% |
| Indeno(1,2,3-cd)pyrene | 3.9 | <0.1 | 1.3 | Yes | 96% |
| Naphthalene | 3.7 | <0.1 | 0.1 | Yes | 100% |
| Phenanthrene | 200 | <0.1 | 3.0 | Yes | 100% |
| Pyrene | 1000 | 0.1 | 3.7 | Yes | 100% |

Results in mg/kg unless stated otherwise;
GAC is LQM GAC for a SOM of 2.5%.

All available PAH soil data has been incorporated within the Statistical Calculator. The key inputs to and outputs from the Calculator tool are included in Appendix F.

Based on the full PAH datasets the Statistical Calculator indicates that we can be 96% to 100% confident in rejecting the Null Hypothesis for the planning scenario for the majority of the determinants with the exception of Benz(a)anthracene, Benzo(a)pyrene and Dibenz(a,h)anthracene. This result indicates that the recorded PAH concentrations with the exception of Benz(a)anthracene, Benzo(a)pyrene and Dibenz(a,h)anthracene are unlikely to pose any significant risks to human health in a Planning context.

While the concentrations of a limited number of PAH determinants are elevated with respect to human health GAC for a residential end use, this end use is considered overly conservative for a school site. Furthermore the presence of hardstanding and buildings over all of the proposed development area of the site will break the pathway between the source and the end user and therefore reducing the potential for direct contact with these compounds. On this basis we consider that the concentrations of PAHs exceeding the GAC are unlikely present a risk to Human Health.

### 8.3.3 Petroleum Hydrocarbons and BTEX

All soil samples were analysed for total petroleum hydrocarbons (TPH CGW) in an aromatic/aliphatic split and BTEX (benzene, toluene, ethylbenze and xylene), the results of which are summarised in Table 7.

**Table 7 Summary of Petroleum Hydrocarbons**

| Determinant | GAC | Concentration Range | | $H_0$ Rejected? | Evidence Level |
|---|---|---|---|---|---|
| | | Min | Max | | |
| EC>5-6 Aliphatic | 110 | <0.01 | - | Yes | 100% |
| EC>6-8 Aliphatic | 370 | <0.01 | - | Yes | 100% |
| EC>8-10 Aliphatic | 110 | <1 | - | Yes | 100% |
| EC>10-12 Aliphatic | 540 | <1 | - | Yes | 100% |
| EC>12-16 Aliphatic | 3000 | <1 | - | Yes | 100% |
| EC>16-35 Aliphatic | 76000 | 7.23 | 18.40 | Yes | 100% |
| EC>35-44 Aliphatic | 76000 | <1 | 2.11 | Yes | 100% |
| EC>5-7 Aromatic | 280 | 10.20 | 20.50 | Yes | 100% |
| EC>7-8 Aromatic | 611 | <0.01 | - | Yes | 100% |
| EC>8-10 Aromatic | 151 | <0.01 | - | Yes | 100% |
| EC>10-12 Aromatic | 346 | <1 | - | Yes | 100% |
| EC>12-16 Aromatic | 593 | <1 | - | Yes | 100% |
| EC>16-21 Aromatic | 770 | <1 | - | Yes | 100% |
| EC>21-35 Aromatic | 1230 | <1 | 1.55 | Yes | 100% |
| EC>35-44 Aromatic | 1230 | 2.41 | 16.50 | Yes | 100% |
| Benzene | 0.33 | <0.01 | - | Yes | 100% |
| Toluene | 610 | <0.01 | - | Yes | 100% |
| Ethylbenzene | 350 | <0.01 | - | Yes | 100% |
| m&p-Xylene | 230 | <0.01 | - | Yes | 100% |
| o-Xylene | 250 | <0.01 | - | Yes | 100% |

Results in mg/kg unless stated otherwise
GAC is LQM GAC for a SOM of 2.5%

All available TPH and BTEX soil data have been incorporated within the Statistical Calculator. The key inputs to and outputs from the Calculator tool are included in Appendix F.

Based on the full TPH and BTEX datasets the Statistical Calculator indicates that we can be 100% confident in rejecting the Null Hypothesis for the planning scenario. This result indicates that the observed TPH concentrations are unlikely to pose any significant risks to human health in a Planning context.

## 8.4 Asbestos

A potential asbestos containing material (ACM) was encountered in WS4a and the position was backfilled as a precaution to avoid disturbance to the material. The borehole was relocated approximately 1m away and designated WS4b and this position also encountered a potential ACM, and also backfilled.

The materials were present at a depth of approximately 0.40m below the surface, beneath tarmac hardstanding and granular Made Ground.

It must be noted that the full extent of the affected area was not delineated due to the location being abandoned due to the risks associated with disturbance of ACMs.

A sample of the suspected ACM was submitted for laboratory analysis and confirmed to be Amosite fibres. The laboratory certificate is included in Appendix E.

In the current situation, the materials do not present a risk to site users due to the hardstanding cover. However, redevelopment works would need to be planned accordingly so that the risks from disturbance of the materials can be properly managed. A suitably qualified and licenced asbestos survey and management company should be contacted in this regard.

## 8.5 Controlled Waters

The Desk Study undertaken as part of this assessment considered the risks to controlled waters (groundwater and surface water) to be low.

With the exception of the Made Ground that no significant sources of land contamination was encountered and therefore based on the information available the ground conditions present at the site are unlikely to pose a significant risk to controlled waters.

## 8.6 Water Pipelines

The current guidance on selection of materials for water supply pipes to be laid in contaminated land is contained in UKWIR Report 10/WM/03/02 (re-issued 2010) which sets out in Table 3.1 of that document threshold values for a selection of organic contaminants that may have a detrimental effect on pipes and fittings. However, the

document is for guidance and is not mandatory and has not been adopted universally by all water suppliers.

In addition, various consultative technical bodies have expressed concern on the nature of the document and the methodologies proposed, which would result in significant cost and time implications for all site assessments. It is Robson Liddle Ltd's opinion that the guidance is not appropriate and it has not been followed as part of this report.

The site is brownfield and there is a presumption in the guidance that barrier pipe will be required. The investigation and assessment has indicated localised elevated concentrations of TPH contaminants within the Made Ground which may have the potential to attack plastics and as such standard pipework may not be suitable for the site. In light of the conflicting and ambiguous guidance, confirmation should be sought from the water supply company at the earliest opportunity as to there specific requirements.

## 8.7 Ground Gas Assessment

### 8.7.1 Radon

The site is in a lower probability radon area as less than 1% homes being above the action level of 100Bqm$^{-3}$. Therefore no radon protective measures are necessary in the construction of new dwellings or extensions.

### 8.7.2 Landfill Gas

There are no historical landfills recorded within 500m of the site. However, Gospel Oak Brick Works was located within 100m to the south of the site and appears to have once been quarried and subsequently backfilled.

On the basis of the low permeability of the anticipated underlying geology and the distance from the site this is not considered to present a significant risk to the site.

Confirmatory monitoring was undertaken on 11th November. The results of this are presented in Table 8.

**Table 8 Gas Monitoring Results 11/11/2013**

| Borehole Ref: | | WS1 | Ws2 | WS3 |
|---|---|---|---|---|
| Oxygen (%) | | 17.2 | 17.0 | 17.3 |
| Nitrogen (%) | | 80.1 | 79.8 | 79.7 |
| Carbon Dioxide (%) | | 2.5 | 3.1 | 2.9 |
| Methane (%) | | 0.0 | 0.0 | 0.0 |
| LEL(%) | | 0.0 | 0.0 | 0.0 |
| Flow l/H | Peak | 0.0 | 0.0 | 0.0 |
| | Stable | 0.0 | 0.0 | 0.0 |
| Atmospheric Pressure (mB): | | 1020 | 1020 | 1020 |
| Groundwater m bgl | | 3.10 | 3.20 | 3.20 |

The results suggest that the site is not being affected by on site gas generation of migration from nearby sources and therefore no gas protection measures are considered necessary.

## 8.8 Site Conceptual Model

Following the generic quantitative risk assessment, a summary of the potential pollutant linkages identified for the site is presented in the Site Conceptual Model in Table 9.

**Table 9 Site Conceptual Model**

| Potential Source and Pollutant | Pathway | Receptor | Potential Pollutant Linkage? | Probability of exposure, consequence and magnitude of risk. |
|---|---|---|---|---|
| Slightly elevated concentrations of the following recorded in the near surface soils.<br><br>• Benz(a)anthracene,<br>• Benzo(a)pyrene,<br>• Dibenz(a,h)anthracene | Direct contact, soil ingestion, and dust inhalation | Human Health – existing and future users of the site | No: Source identified within the near surface deposits however presence of hardstanding over the development site breaks the linkage | Probability: Low<br>Consequence: Medium<br>**Magnitude: Low Risk** |
| | Vapour inhalation | Human Health – existing and future users of the site | No: Potential source identified within the near surface deposits however no significant concentrations of volatile determinants identified | Probability: Low<br>Consequence: Low<br>**Magnitude: Low Risk** |
| | leachate generation and migration from soil sources | Controlled Waters – groundwater and surface waters in hydraulic connectivity | No: Hardstanding limits percolation from surface and breaks pathway. | Probability: Low<br>Consequence: Low<br>**Magnitude: Low Risk** |
| | Permeation through potable water supply pipes | Human Health – future users of the site | Possible: Localised elevated concentrations of PAH and TPH contaminants which may have the potential to attack pipes. | Probability: Medium<br>Consequence: Low<br>**Magnitude: Moderate Risk** |
| | Root uptake. | Ecology - existing trees and landscaping onsite | No: No landscaped areas. | Probability: Low<br>Consequence: Very Low<br>**Magnitude: Low Risk** |
| Ground gas – see Section 8.7 for details | Permeation through ground and collection within buildings | Human Health – existing and future users of the site | No ground gas recorded. | Probability: Low<br>Consequence: Low<br>**Magnitude: Low Risk** |

## 8.9 Material Reuse

Based on the GQRA carried out the soil sampled does not pose a potential risk to human receptors and would be suitable for re-use.

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008, updated 2011 and is now widely accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR).

Under the CL:AIRE Voluntary Code of Practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site. Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Based upon the data obtained from the ground investigation there would not be a requirement to take material off-site as long as a suitable Materials Management Plan (MMP) was in place.

# 9 Limitations and Uncertainties

## 9.1 General

This report has been prepared by Robson Liddle with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the Client.

The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true representative data with respect to site conditions. The information reported herein is based on the interpretation of data collected during the site investigation, pertaining specifically to the soil samples retained from the identified locations. Should additional information become available that may influence the opinions expressed in this report, Robson Liddle reserves the right to review such information and, if warranted, to alter the opinions accordingly.

The evaluation and conclusions do not preclude the existence of other site conditions and contamination, which could not reasonably have been revealed by the site investigation works undertaken at the time of writing. This report should be used for information purposes only and should not be construed as a comprehensive characterisation of all site conditions or potential contaminants.

This report has been prepared solely for the use of the client, and may not be relied upon by other parties without written consent from Robson Liddle.

Robson Liddle disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

## 9.2 Site Specific

Not all locations that were intended to be investigated were completed. There may therefore be deeper areas of Made Ground and buried structures that may be present in these areas.

# 10 General Notes

This report will be prepared for the exclusive use of the client named in the document and copyright will subsist with Robson Liddle Limited. Prior written permission must be obtained to reproduce all or part of the report. It will be prepared on the understanding that you will disclose its contents to parties directly involved in the current investigation, preparation and development of the site. Further copies may be obtained with the client's written permission from Robson Liddle Limited with whom a master copy of the document will be retained.

The report and /or opinion will be prepared for the specific purpose stated in the document and in relation to the nature and extent of proposals made available to us at the time of your enquiry. The recommendations should not be used for other schemes on or adjacent to the site without further reference to Robson Liddle Limited. The assessment of the factual data will be provided to assist the client and his Engineer and/or advisors in the preparation of their designs.

The report will be based on the ground conditions encountered in the exploratory holes together with the results of field and laboratory testing in the context of the proposed development. There may be special conditions, appertaining to the site, however, which may not be revealed by the investigation, and which may not be taken into account in the report.

Methods of construction and/or design other than those proposed by the designers or referred to in the report may require consideration during the evolution of the proposals and further assessment of the geotechnical data would be required to provide discussion and recommendation appropriate to these methods.

The accuracy of the results reported will depend upon the technique of measurement, investigation and test used and these values should not be regarded necessarily as characteristic of the strata as a whole. Where such measurements are critical, the technique of the investigation will need to be reviewed and supplementary investigation undertaken in accordance with the advice of the company where necessary.

Whilst the report may express an opinion on possible configurations of strata between or beyond exploratory holes, or on possible presence of a feature based on either

visual, verbal, written, cartographical, photographic or published evidence, this will be for guidance only and no liability can be accepted for its accuracy.

Ground conditions should be monitored during the construction of the works and the recommendations of the report re-evaluated in the light of these data by the supervising geotechnical engineers.

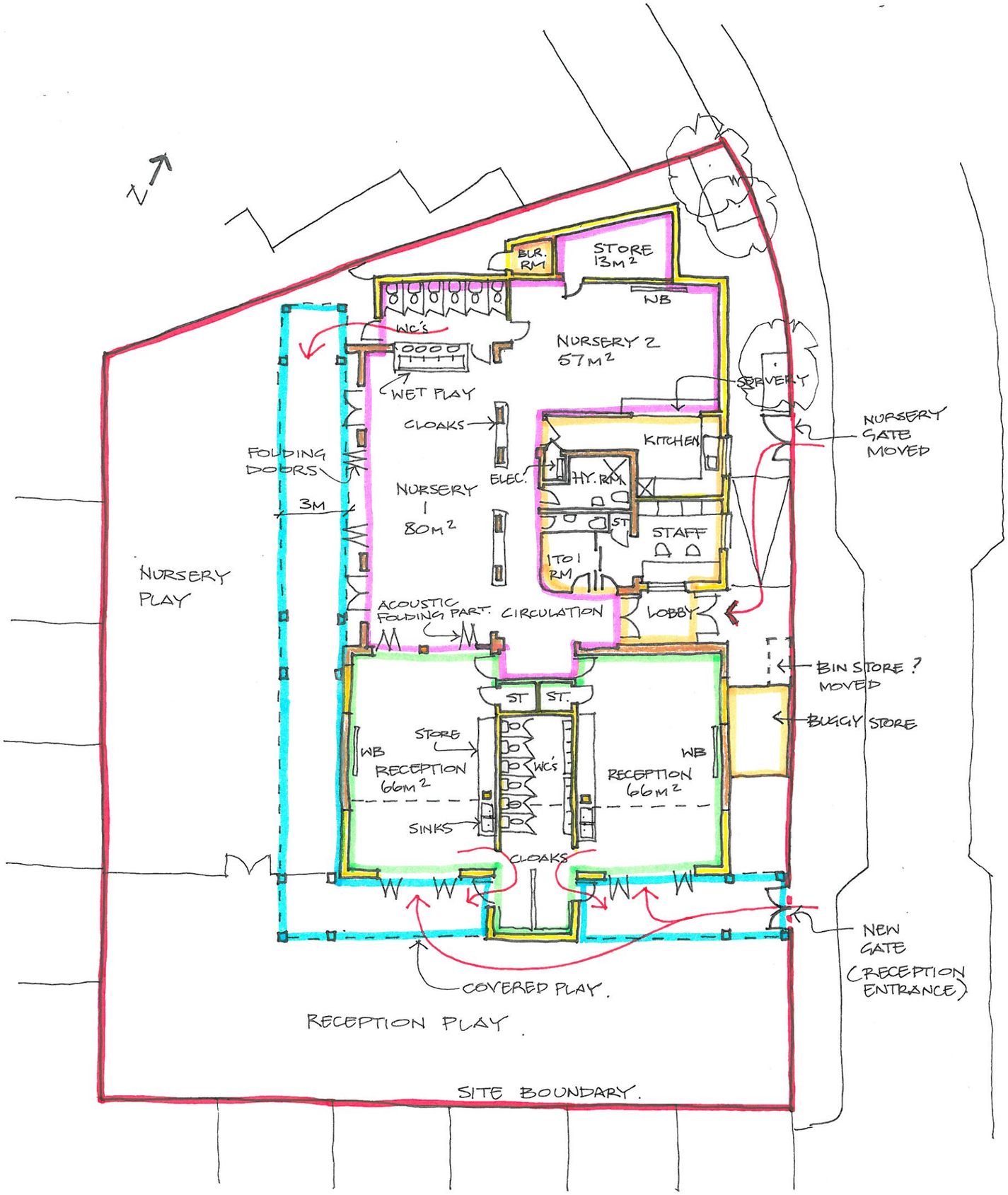
Any comments on groundwater conditions will be based on observations made at the time of the investigation, unless specifically stated otherwise. It should be noted, however, that the observations are subject to the method and speed of the boring, drilling or excavation and that groundwater levels will vary due to seasonal or other effects.

Unless specifically stated, the investigation will not take into account of possible effects of mineral extraction.

The economic viability of the proposals referred to in the report, or of the solutions put forward to any problems encountered, will depend on very many factors in addition to geotechnical considerations hence its evaluation will be outside the scope of the report.

# Appendix A

# Proposed Development Plan




KEY

- RECEPTION
- NURSERY
- EXISTING WALLS
- NEW WALLS

GOSPEL OAK PRIMARY SCHOOL
NURSERY EXTENSION
1:200 @ A3
SK1011/130227/01

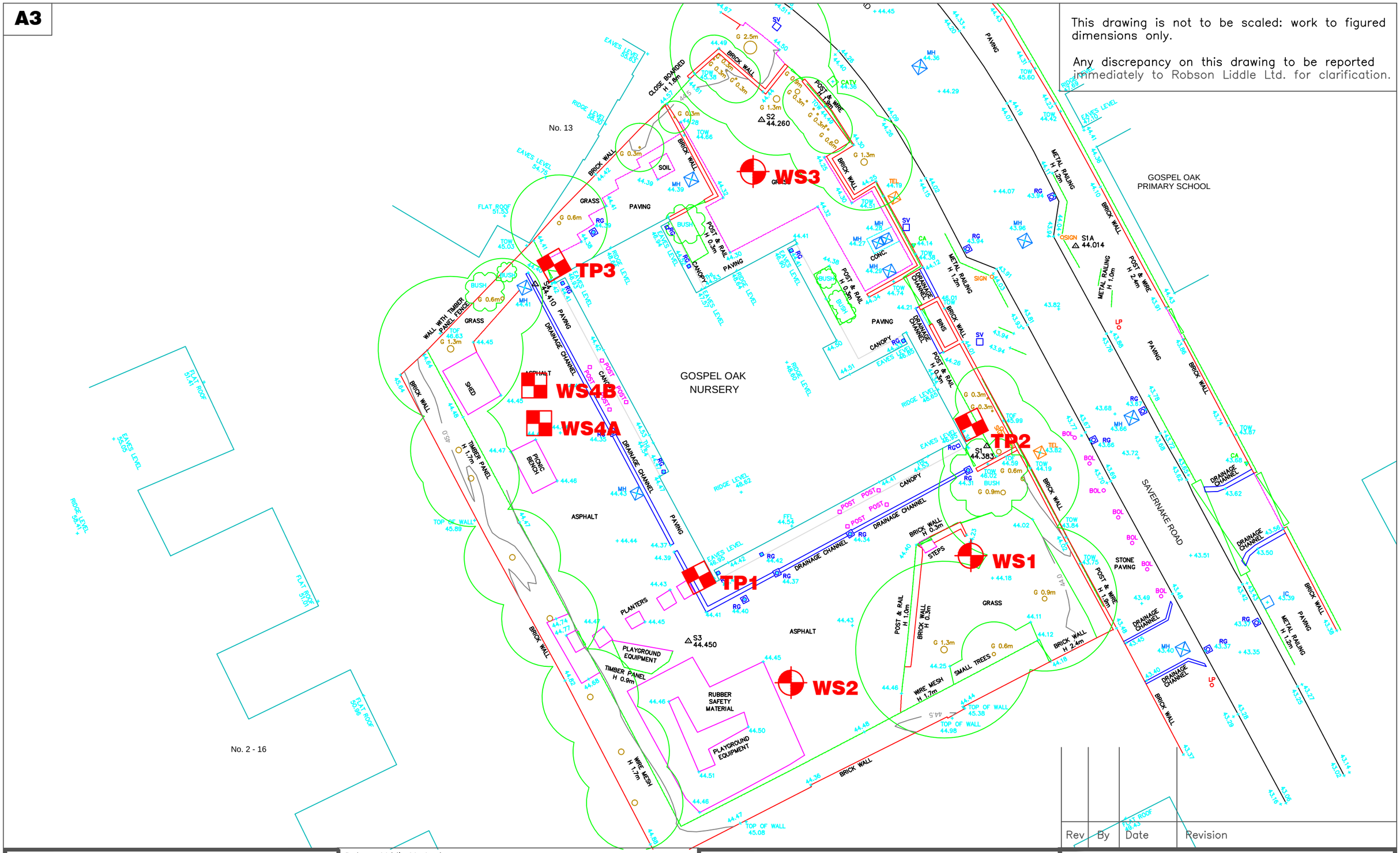
# Appendix B

# Exploratory Hole Plan

A3

This drawing is not to be scaled: work to figured dimensions only.

Any discrepancy on this drawing to be reported immediately to Robson Liddle Ltd. for clarification.




| Rev | By | Date | Revision |
|---|---|---|---|

Robson Liddle
consulting engineers
Part of the nps group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email: mail@robsonliddle.com


Client: **NPS**

Drawing Status: **INFORMATION**

Job Title: **Gospel Oak Primary School London**

Dwg Title: **Exploratory Hole Location Plan**

Scale NTS Drawn MA

Date Oct 13 Checked MA

Drawing no: **140361- D01**

Rev **-**

# Appendix C

# Exploratory Hole Logs

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
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## BOREHOLE LOG

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | **WS1** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) 44.20 | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| 0.10 | ES | | | 44.00 | | 0.20 | TOPSOIL: Brown silty sandy clay with fine rootlets. | |
| 0.40 | ES | | | | | (1.00) | MADE GROUND: Light grey brown sandy slightly clayey gravel with low concrete cobble content. Gravel is angular fine to coarse concrete and brick. | |
| | | | | 43.00 | | 1.20 | | |
| 1.30 | | HV 120 kPa | | | | | Stiff brown CLAY. | |
| 1.50 | B | | | | | | | |
| 1.50 | | HV 130 kPa | | | | (0.90) | | |
| | | | | 42.10 | | 2.10 | | |
| 2.10 | D | | | | | (0.40) | Light brown very clayey sandy GRAVEL. Gravel is rounded fine to coarse flint. | |
| | | | | 41.70 | | 2.50 | | |
| | | | | | | | Stiff blue grey CLAY. | |
| 2.80 | | HV 70 kPa | | | | | (London Clay) | |
| 3.20 | | HV 80 kPa | | | | | | |
| 3.50 | D | | | | | | | |
| 3.50 | | HV 100 kPa | | | | (2.50) | | |
| | | | | | | | Stiff brown CLAY. | |
| 4.50 | | HV 100 kPa | | | | | | |
| | | | | 39.20 | | 5.00 | | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | |
| | | | | | | | | | | | No groundwater encountered. 50mm gas monitoring well installed. Dynamic Probe DP1 undertaken adjacent to hole. |

| All dimensions in metres Scale 1:37.5 | Contractor: | Method/ Plant Used: Windowless Sampling | Logged By: MA |
|---|---|---|---|

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## BOREHOLE LOG

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | **WS2** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) 44.45 | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | 44.25 | | 0.20 | MADE GROUND: Tarmac underlain by sandy gravel (sub bace). Gravel is angular chrushed stone. | |
| 0.30 | ES | | | 43.95 | | (0.30) 0.50 | MADE GROUND: Grey brown sandy slightly clayey gravel. Gravel is angular fine crushed concrete. | |
| | | | | 43.75 | | 0.70 | Concrete. | |
| | | | | 43.25 | | (0.50) 1.20 | MADE GROUND: Grey brown sandy gravel. Gravel is angular fine crushed concrete. | |
| 1.20 | D | | | 42.25 | | (1.00) 2.20 | MADE GROUND: Brown gravelly clay. Gravel is angular fine to medium brick. | |
| 2.20 | D | | | | | | | |
| 2.30 | ES | | | | | | | |
| 2.40 | | HV 70 kPa | | 41.75 | | (0.50) 2.70 | Stiff grey brown CLAY. | |
| | | | | 41.45 | | (0.30) 3.00 | Light brown clayey GRAVEL. Gravel is rounded fine to coarse flint. | |
| 3.20 | D | | | | | | Stiff grey brown mottled CLAY. (London Clay) | |
| 3.50 | | HV 140 kPa | | | | | | |
| | | | | | | (2.00) | | |
| 4.50 | | HV 140 kPa | | 39.45 | | 5.00 | | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | No groundwater encountered. 50mm gas monitoring well installed. Dynamic Probe DP2 undertaken adjacent to hole. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:37.5 | Contractor: | Method/ Plant Used: Windowless Sampling | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

## BOREHOLE LOG

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | WS3 |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) 44.30 | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| 0.20 | ES | | | 43.80 | | (0.50) 0.50 | TOPSOIL: Dark grey brown silty sandy clay with fine rootlets. | |
| 0.50 | ES | | | 43.70 | | 0.60 | Concrete | |
| 0.80 | | HV 100 kPa | | | | | Stiff grey brown CLAY. | |
| 1.20 | D | | | | | | | |
| 1.20 | | HV 120 kPa | | | | | | |
| 1.80 | | HV 130 kPa | | | | | | |
| 2.20 | D | | | | | | | |
| 2.40 | | HV 140 kPa | | | | | | |
| 2.90 | D | | | | | (4.40) | | |
| 2.90 | | HV 140 kPa | | | | | | |
| 3.20 | | HV 140 kPa | | | | | | |
| 3.90 | | HV 140 kPa | | | | | | |
| | | | | 39.30 | | 5.00 | | |

| Boring Progress and Water Observations | | | | | |
|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt |
| | | | | | |

| Chiselling | | | Water Added | |
|---|---|---|---|---|
| From | To | Hours | From | To |
| | | | | |

**GENERAL REMARKS**

No groundwater encountered.
50mm gas monitoring well installed.
Dynamic Probe DP3 undertaken adjacent to hole.

| All dimensions in metres Scale 1:37.5 | Contractor: | Method/ Plant Used: Windowless Sampling | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

## BOREHOLE LOG

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | **WS4a** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) 44.45 | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | 44.25 | | (0.20) 0.20 | MADE GROUND: Tarmac underlain by brown sandy gravel (sub base). Gravel is angular fine to coarse crushed stone. | |
| 0.20 | ES | | | 43.95 | | (0.30) 0.50 | MADE GROUND: Brown slightly clayey gravelly sand. Gravel is angular fine to coarse crushed stoen concrete and brick. Potential asbestos encountered at 0.4m, | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Potential asbestos encountered. Hole relocated 1m to north. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

## BOREHOLE LOG

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | **WS4b** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) 44.45 | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | 44.25 | | (0.20) 0.20 | MADE GROUND: Tarmac underlain by brown sandy gravel (sub base). Gravel is angular fine to coarse crushed stone. | |
| | | | | 44.05 | | (0.20) 0.40 | MADE GROUND: Brown slightly clayey gravelly sand. Gravel is angular fine to coarse crushed stoen concrete and brick. Potential asbestos encountered at 0.4m, | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Potential asbestos encountered. Location abandoned. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

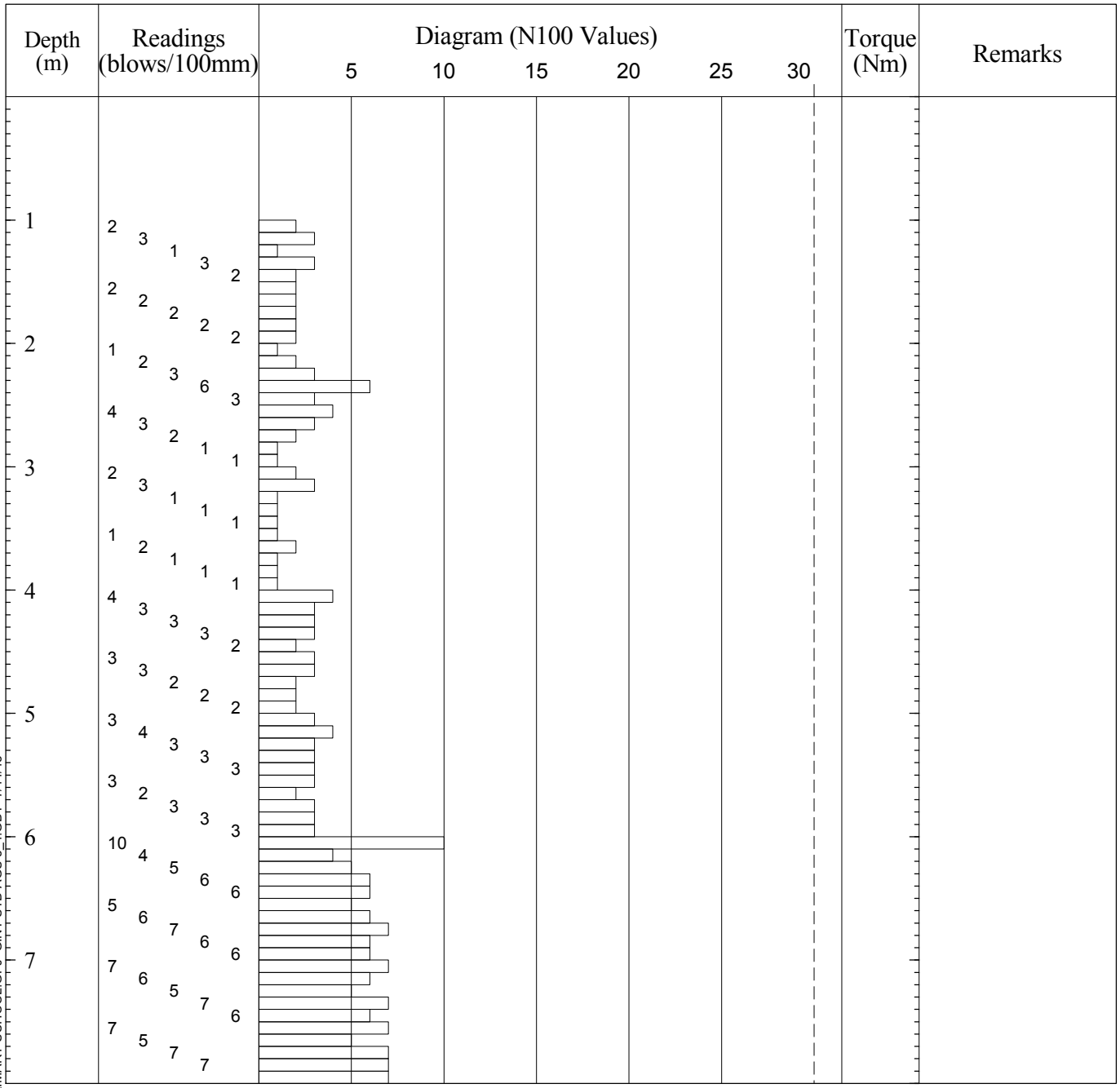
ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP1 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.20 | | |
| Contractor | | | | Sheet |
| | | | | 1 of 2 |




| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

**GENERAL REMARKS**

Dynamic probe undertaken adjacent to WS1.

| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP1 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.20 | | |
| Contractor | | | | Sheet |
| | | | | 2 of 2 |

| Depth (m) | Readings (blows/100mm) | Diagram (N100 Values) 5 10 15 20 25 30 | Torque (Nm) | Remarks |
|---|---|---|---|---|
| | 7 | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |

| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

**GENERAL REMARKS**

Dynamic probe undertaken adjacent to WS1.

| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

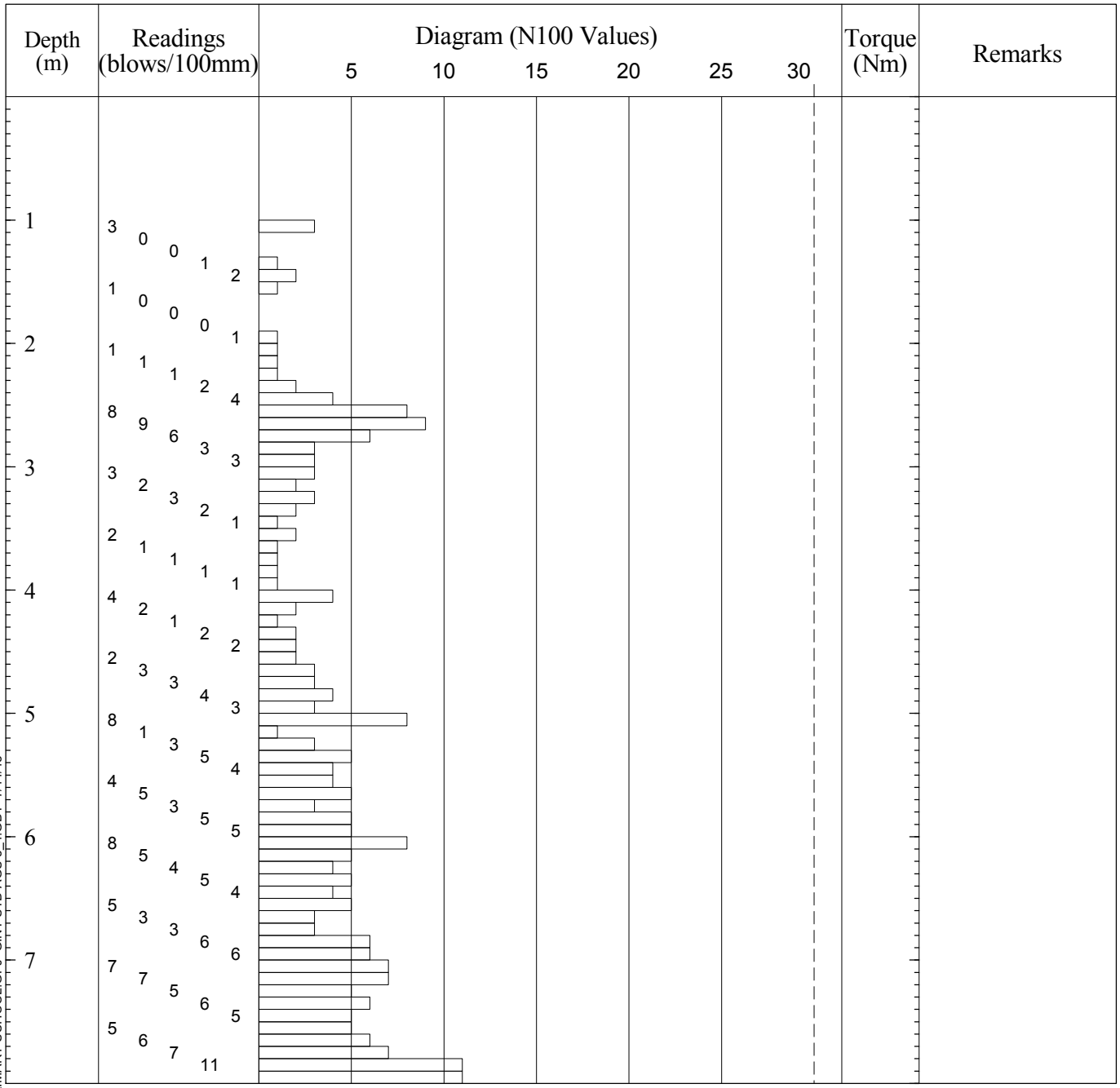
AGS3 DYNAMIC PROBE 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP2 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.45 | | |
| Contractor | | | | Sheet |
| | | | | 1 of 2 |




| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

**GENERAL REMARKS**

Dynamic probe undertaken adjacent to WS2.

| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
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Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP2 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.45 | | |
| Contractor | | | | Sheet |
| | | | | 2 of 2 |

| Depth (m) | Readings (blows/100mm) | Diagram (N100 Values) 5 10 15 20 25 30 | Torque (Nm) | Remarks |
|---|---|---|---|---|
| | 11 | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |

| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

**GENERAL REMARKS**

Dynamic probe undertaken adjacent to WS2.

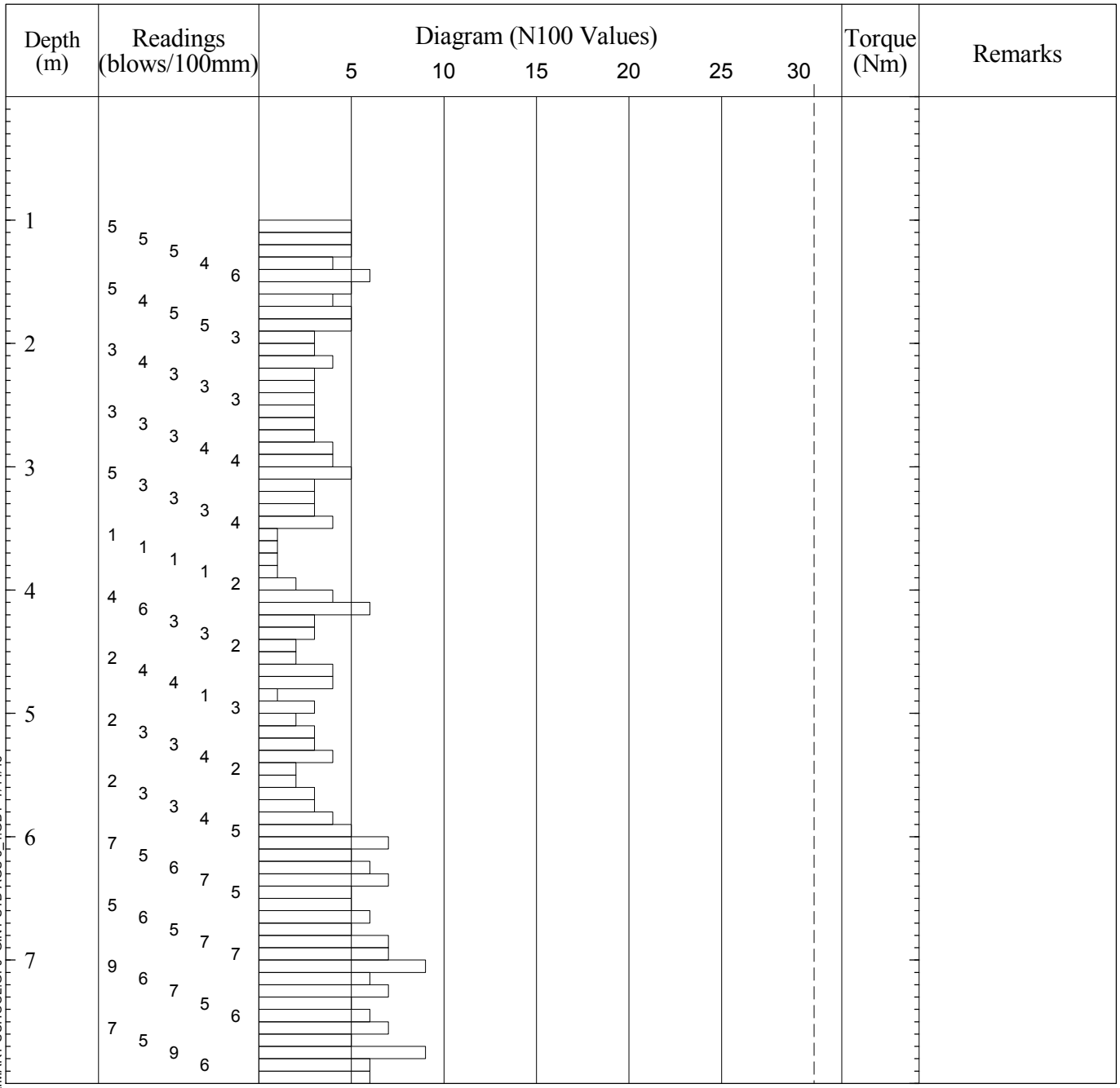
| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP3 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.30 | | |
| Contractor | | | | Sheet |
| | | | | 1 of 2 |




| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

**GENERAL REMARKS**

Dynamic probe undertaken adjacent to WS2.

| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## DYNAMIC PROBE LOG

| Project | | | | PROBE No |
|---|---|---|---|---|
| Gospel Oak Primary School | | | | DP3 |
| Job No | Date | Ground Level (m) | Co-Ordinates () | |
| 140361 | 17-10-13<br>17-10-13 | 44.30 | | |
| Contractor | | | | Sheet |
| | | | | 2 of 2 |

| Depth (m) | Readings (blows/100mm) | Diagram (N100 Values) 5 10 15 20 25 30 | Torque (Nm) | Remarks |
|---|---|---|---|---|
| | 6 | | | |
| 9 | | | | |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |

| | |
|---|---|
| Hammer Wt (kg) | 63.5 |
| Hammer Drop (mm) | 750 |
| Cone Dia (mm) | 50.5 |
| Cone Type | 90° point |
| Damper | |

GENERAL REMARKS

Dynamic probe undertaken adjacent to WS2.

| All dimensions in metres<br>Scale 1:50 | Client NPS Property Consultants Limited | Method/<br>Plant Used | Logged By |
|---|---|---|---|

AGS3 DYNAMIC PROBE 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 7/11/13

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## BOREHOLE LOG

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Nursery School | | | | **TP1** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | | | 0.10 | Concrete slab underlain by orange brown sand (coarse). | |
| | | | | | | (0.40) 0.50 | MADE GROUND: Grey brown sandy gravel. Gravel is angular fine to coarse crushed stone, brick and concrete. | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Generaly stable. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 22/10/13

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## BOREHOLE LOG

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Nursery School | | | | **TP2** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | | | 0.10 | Concrete slab underlain by orange brown sand (coarse). | |
| | | | | | | (0.40) 0.50 | MADE GROUND: Grey brown snady gravel. Gravel is angular fine to coarse crushed stone, brick and concrete. | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Refusal on concrete. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 22/10/13

# Robson Liddle Geotechnical

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

## BOREHOLE LOG

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Nursery School | | | | **TP3** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | | | 0.10 | Concrete slab underlain by orange brown sand (coarse). | |
| | | | | | | (0.30) 0.40 | MADE GROUND: Grey brown snady gravel. Gravel is angular fine to coarse crushed stone, brick and concrete. | |
| 0.50 | | HV 140 kPa | | | | (0.30) 0.70 | Stiff brown CLAY. | |
| 0.70 | | HV 140 kPa | | | | | | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Refusal on concrete. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 22/10/13

# Robson Liddle Geotechnical

## BOREHOLE LOG

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Nursery School | | | | **WS4a** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | | | (0.20) 0.20 | MADE GROUND: Tarmac underlain by brown sandy gravel (sub base). Gravel is angular fine to coarse crushed stone. | |
| 0.20 | ES | | | | | (0.30) 0.50 | MADE GROUND: Brown slightly clayey gravelly sand. Gravel is angular fine to coarse crushed stoen concrete and brick. Potential asbestos encountered at 0.4m, | |

| Boring Progress and Water Observations | | | | | | Chiselling | | | Water Added | | GENERAL REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt | From | To | Hours | From | To | Potential asbestos encountered. Hole moved 1m to the north. |
| | | | | | | | | | | | |

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 22/10/13

# Robson Liddle Geotechnical

## BOREHOLE LOG

Robson Liddle Ltd
3 Capital Court, Sowton Ind Est
Exeter. EX27LW
Telephone: 01392 351200

| Project: | | | | BOREHOLE No.: |
|---|---|---|---|---|
| Gospel Oak Nursery School | | | | **WS4b** |
| Job No: 140361 | Date Start 17-10-13 End 17-10-13 | Ground Level: (m) | Co-Ordinates: () | |
| Client: NPS Property Consultants Limited | | | | Sheet: 1 of 1 |

| SAMPLES & TESTS | | | Water | STRATA | | | | Instrument/ Backfill |
|---|---|---|---|---|---|---|---|---|
| Depth | Type | Test Result | | Ground Level | Legend | Depth (Thickness) | DESCRIPTION | |
| | | | | | | (0.20) 0.20 | MADE GROUND: Tarmac underlain by brown sandy gravel (sub base). Gravel is angular fine to coarse crushed stone. | |
| | | | | | | (0.20) 0.40 | MADE GROUND: Brown slightly clayey gravelly sand. Gravel is angular fine to coarse crushed stoen concrete and brick. Potential asbestos encountered at 0.4m, | |

| Boring Progress and Water Observations | | | | | |
|---|---|---|---|---|---|
| Date | Time | Depth | Casing Depth | Casing Dia. mm | Water Dpt |
| | | | | | |

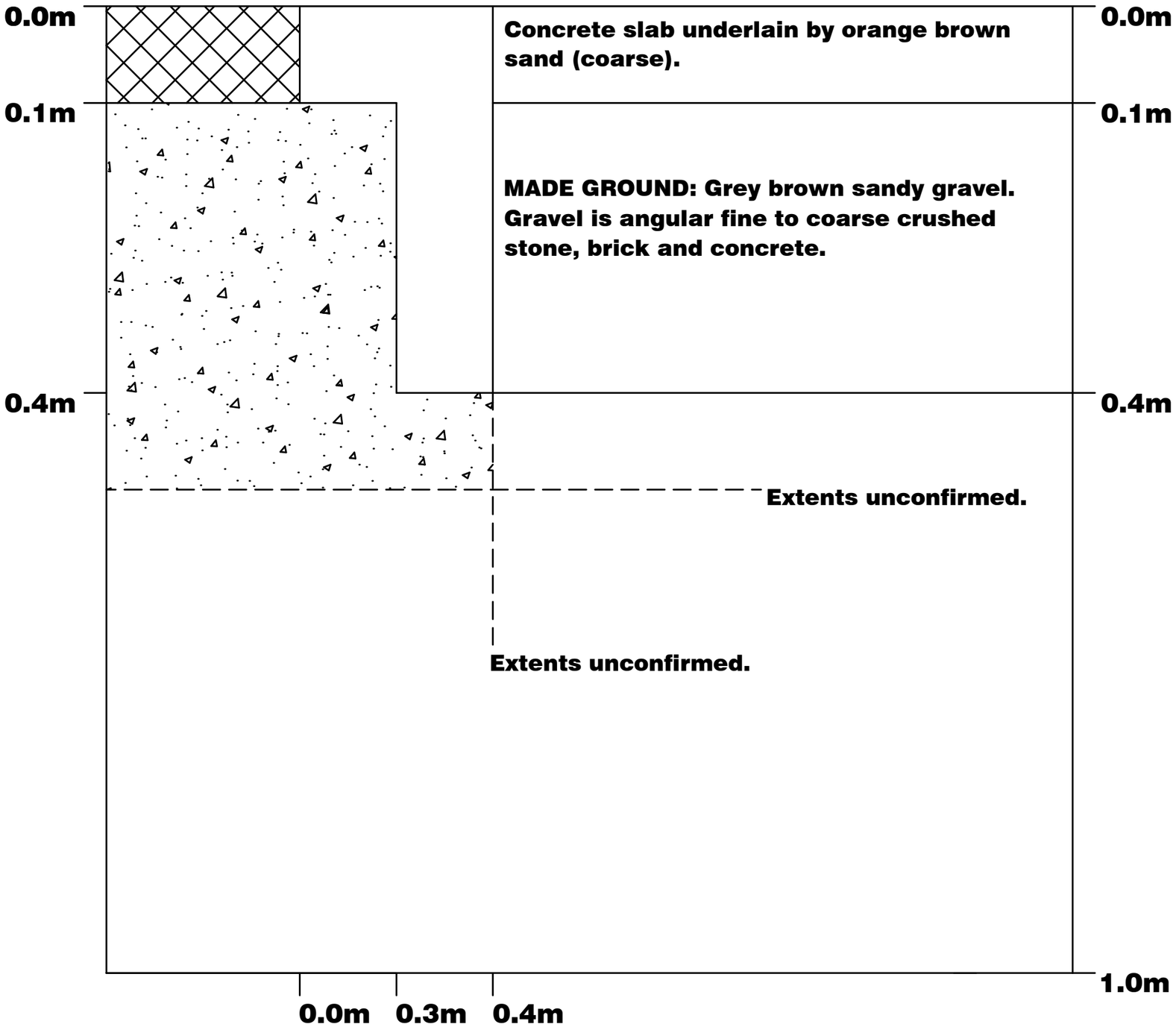
| Chiselling | | | Water Added | |
|---|---|---|---|---|
| From | To | Hours | From | To |
| | | | | |

**GENERAL REMARKS**

Potential asbestos encountered.
Location abandoned.

| All dimensions in metres Scale 1:25 | Contractor: | Method/ Plant Used: Hand Dug | Logged By: MA |
|---|---|---|---|

ROBSON LIDDLE BH 140361 GOSPEL OAK PRIMARY SCHOOL.GPJ GINT STD AGS 3_1.GDT 22/10/13




This drawing is not to be scaled: work to figured dimensions only.

Any discrepancy on this drawing to be reported immediately to Robson Liddle Ltd. for clarification.

All depths are taken from ground level.

**Brick**

**Blocks**

**Concrete**

| Rev | By | Date | Revision |
|---|---|---|---|
| | | | |

Robson Liddle
consulting engineers
Part of the nps group

Robson Liddle Limited
One Capital Court, Sowton Industrial Estate, Exeter, Devon, EX2 7FW
telephone: 01392 351200, facsimile: 01392 351218,
email: mail@robsonliddle.com

Client:
**NPS Property Consultants Ltd**

Drawing Status
**INFORMATION**

Job Title:
**Gospel Oak Nursery School**

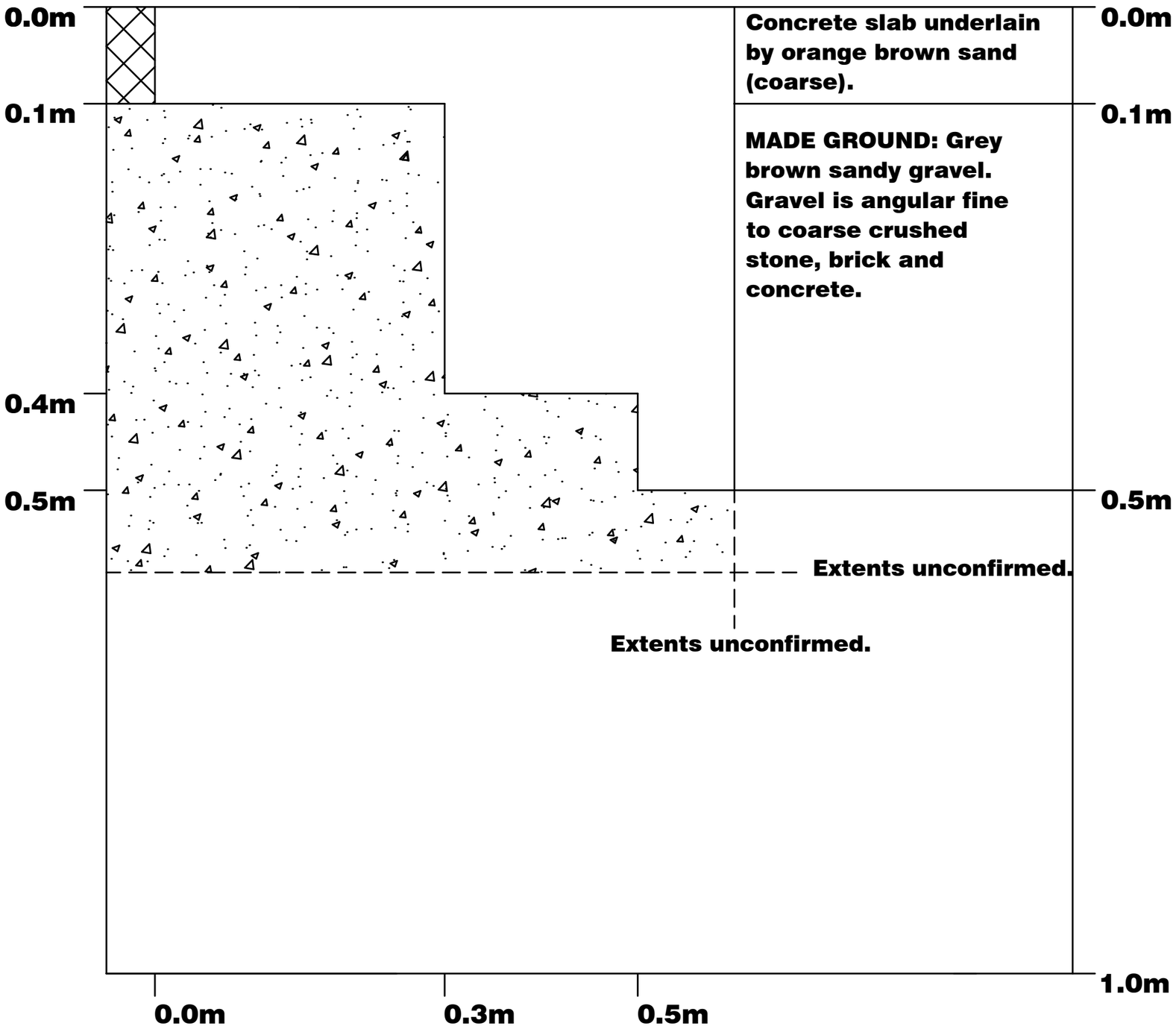
Dwg Title:
**TP1 Foundation Exposure Sketch Plan**

Scale NTS Drawn MA

Date Oct 13 Checked

Drawing no: **140361-D02**

Rev **-**




This drawing is not to be scaled: work to figured dimensions only.

Any discrepancy on this drawing to be reported immediately to Robson Liddle Ltd. for clarification.

All depths are taken from ground level.

**Brick**

**Blocks**

**Concrete**

| Rev | By | Date | Revision |
|---|---|---|---|

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Part of the nps group

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telephone: 01392 351200, facsimile: 01392 351218,
email: mail@robsonliddle.com

Client: **NPS Property Consultants Ltd**

Drawing Status: **INFORMATION**

Job Title: **Gospel Oak Nursery School**

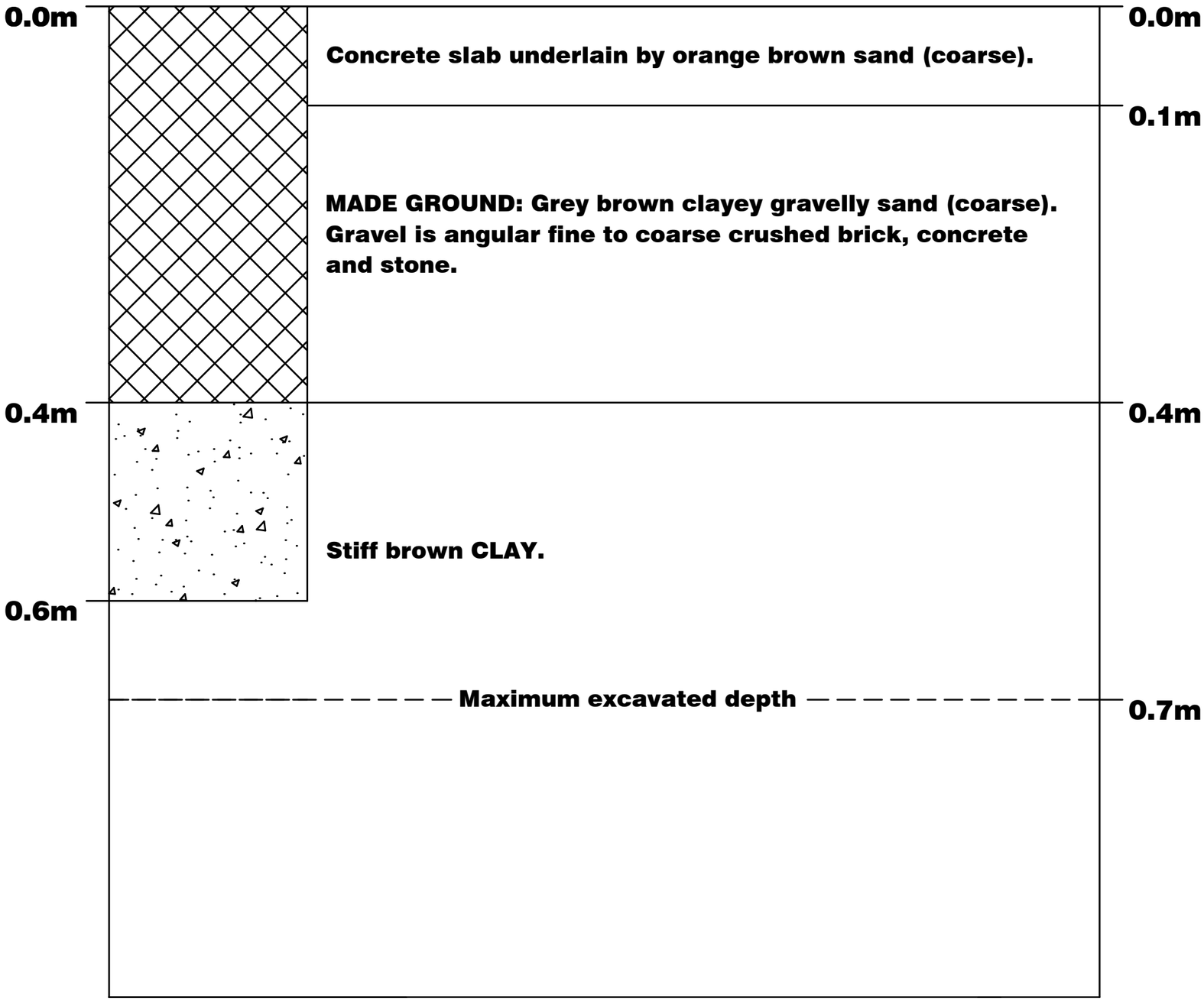
Dwg Title: **TP2 Foundation Exposure Sketch Plan**

Scale NTS Drawn MA

Date Oct 13 Checked

Drawing no: **140361-D02**

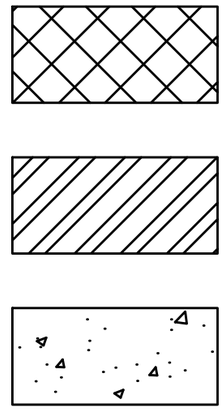
Rev **-**




This drawing is not to be scaled: work to figured dimensions only.

Any discrepancy on this drawing to be reported immediately to Robson Liddle Ltd. for clarification.

All depths are taken from ground level.




| Rev | By | Date | Revision |
|---|---|---|---|

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email: mail@robsonliddle.com

Job Title:
**Gospel Oak Nursery School**

Client:
**NPS Property Consultants Ltd**

Dwg Title:
**TP3 Foundation Exposure Sketch Plan**

Drawing Status
**INFORMATION**

Scale NTS Drawn MA

Date Oct 13 Checked

Drawing no: **140361-D02**

Rev **-**

# Appendix D

# Geotechnical Test Certificates

## Summary of Index Property Test Results

**Job: Gospel Oak** **Job No: 5894**
**Client: Robson Liddle Ltd** **Client Job No: 140361**

| Sample Reference | Natural MC (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index (%) | % Passing .425mm | Modified Plasticity Index (%) | Preparation Method | Description/ Remarks |
|---|---|---|---|---|---|---|---|---|
| WS1 1.50m (D) | 26.0 | 60 | 21 | 39 | 100.0 | 39 | Natural | Brown silty/sandy CLAY |
| WS3 1.20m (D) | 21.6 | 74 | 25 | 49 | 99.7 | 49 | Mechanical | Brown silty slightly sandy CLAY |
| WS3 2.20m (D) | 29.1 | 76 | 25 | 51 | 100.0 | 51 | Natural | Brown silty CLAY |

*Tests carried out in accordance with Clauses 3.2, 4.3, 5.3 and 5.4 of BS1377: Part 2: 1990*

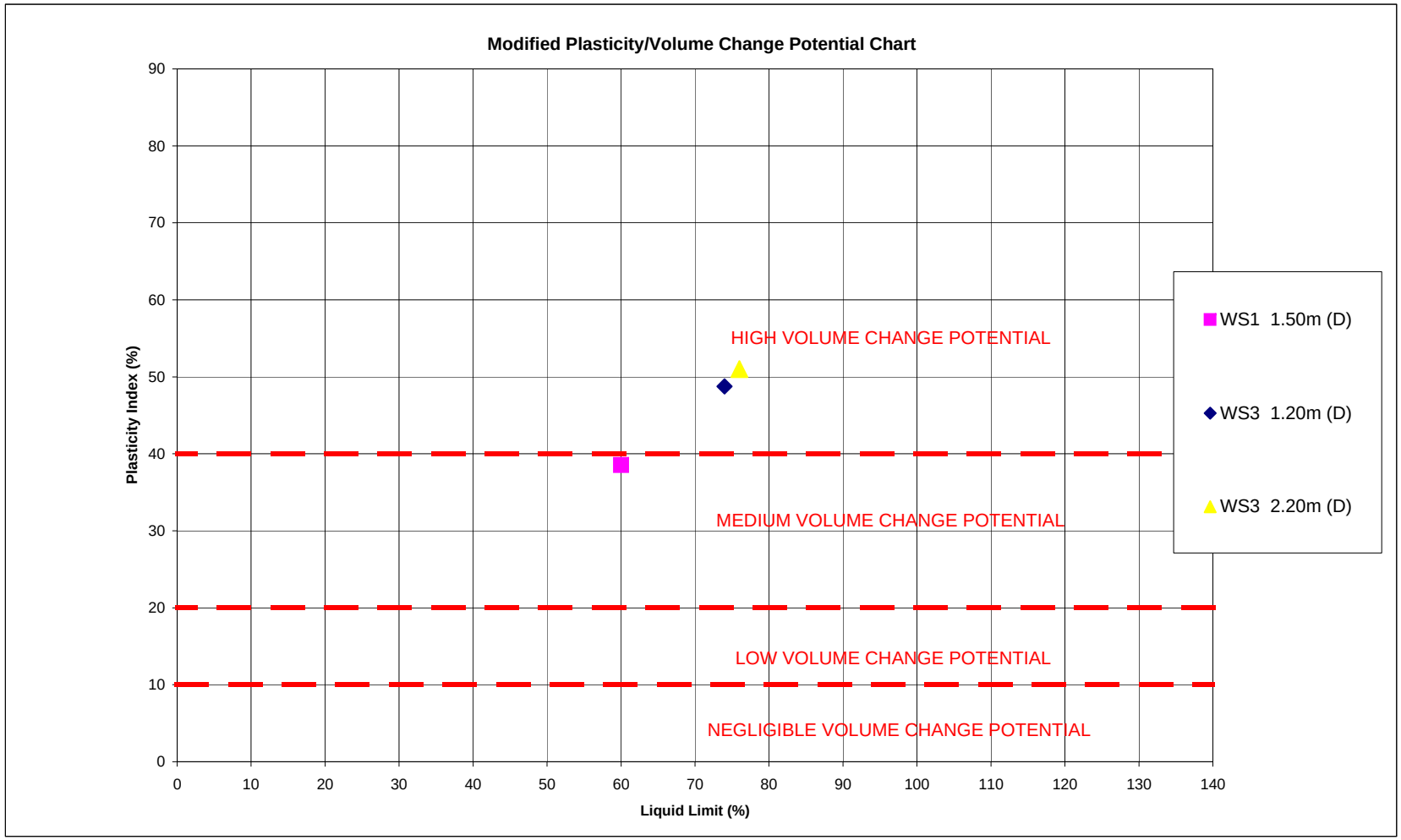
*Modified Plasticity Index is defined in NHBC Chapter 4.2 as the PI multiplied by the percentage of particles passing the .425mm sieve.*

*Non-Modified Plasticity Indices plotted on the attached chart.*

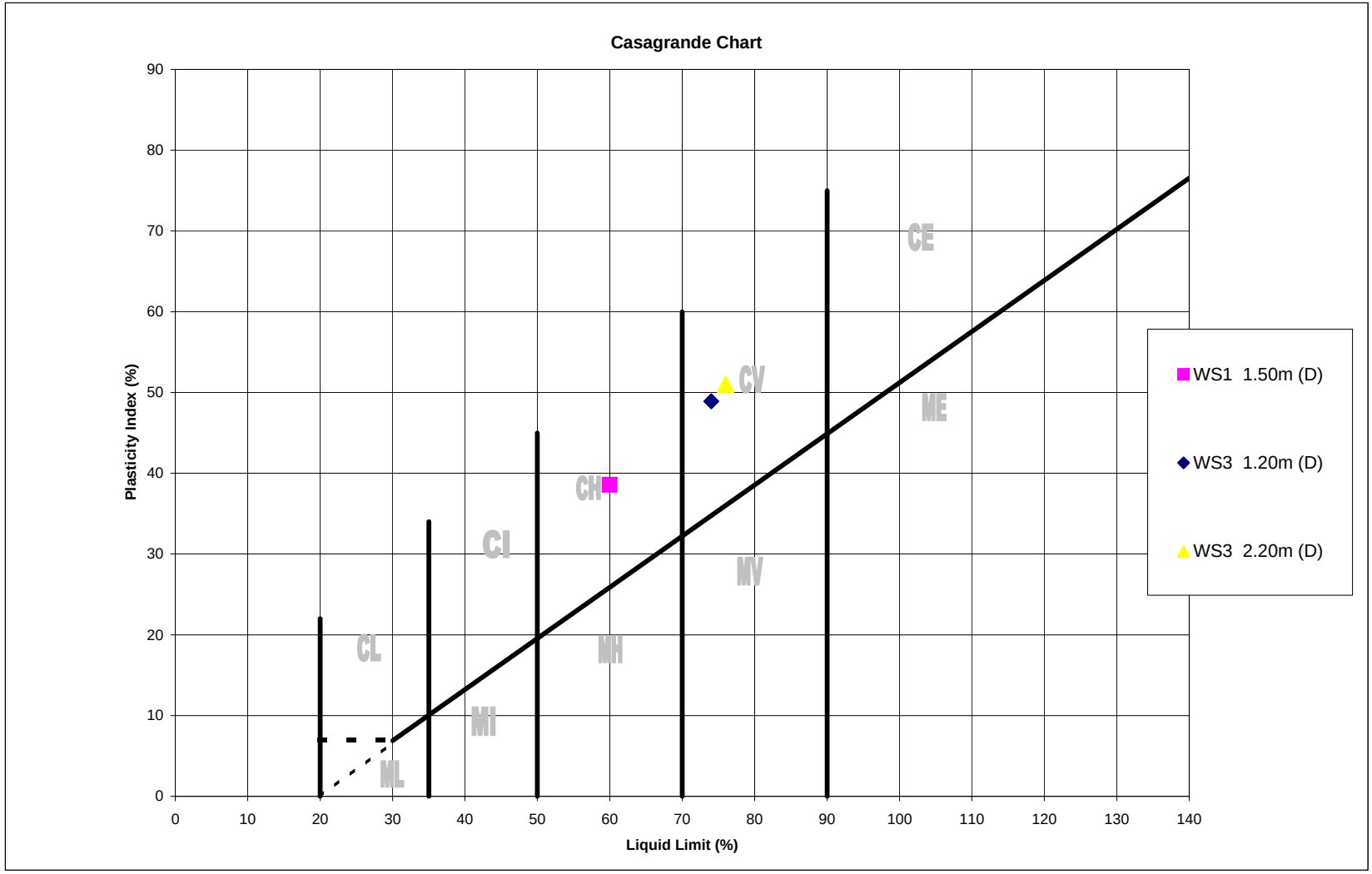
*Prepared By:* DA Date: 24/10/2013 *Processed By:* MD Date: 31/10/2013

*Tested By* DA Date: 29/10/2013 *Checked By:* EB Date: 01/11/2013

## Summary of Index Property Test Results



## Summary of Index Property Test Results



Evelyn Burnside
South West Geotechnical Ltd
Unit 3 Brooklands
Howden Road
Tiverton
Devon
EX16 5HW

**QTS Environmental Ltd**
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
**t:** 01622 850410
russell.jarvis@qtsenvironmental.com

# QTS Environmental Report No: 13-17371

| | |
|---|---|
| **Site Reference:** | Gospel Oak |
| **Project / Job Ref:** | 5894 |
| **Order No:** | None Supplied |
| **Sample Receipt Date:** | 24/10/2013 |
| **Sample Scheduled Date:** | 24/10/2013 |
| **Report Issue Number:** | 1 |
| **Reporting Date:** | 30/10/2013 |

**Authorised by:**

Russell Jarvis
Director
**On behalf of QTS Environmental Ltd**

**Authorised by:**

Kevin Old
Director
**On behalf of QTS Environmental Ltd**

**QTS Environmental Ltd**
**Unit 1, Rose Lane Industrial Estate**
**Rose Lane**
**Lenham Heath**
**Maidstone**
**Kent ME17 2JN**
**Tel : 01622 850410**

4480

| Soil Analysis Certificate | | | | | | |
|---|---|---|---|---|---|---|
| **QTS Environmental Report No: 13-17371** | **Date Sampled** | None Supplied | None Supplied | None Supplied | | |
| **South West Geotechnical Ltd** | **Time Sampled** | None Supplied | None Supplied | None Supplied | | |
| **Site Reference: Gospel Oak** | **TP / BH No** | WS1 | WS2 | WS3 | | |
| **Project / Job Ref: 5894** | **Additional Refs** | None Supplied | None Supplied | None Supplied | | |
| **Order No: None Supplied** | **Depth (m)** | 2.10 | 2.20 | 2.90 | | |
| **Reporting Date: 30/10/2013** | **QTSE Sample No** | 83622 | 83623 | 83624 | | |

| Determinand | Unit | MDL | Accreditation | | | | | |
|---|---|---|---|---|---|---|---|---|
| pH | pH Units | N / a | MCERTS | 8.0 | 8.0 | 7.6 | | |
| Total Sulphate as $SO_4$ | mg/kg | < 200 | NONE | 791 | 667 | 14660 | | |
| W/S Sulphate as $SO_4$ (2:1) | g/l | < 0.01 | NONE | 0.08 | 0.13 | 2.99 | | |
| Total Sulphur | mg/kg | < 200 | NONE | 276 | 235 | 4957 | | |
| Ammonium as $NH_4$ | mg/kg | < 0.5 | NONE | < 0.5 | 2.8 | 2 | | |
| W/S Chloride (2:1) | mg/kg | < 1 | NONE | 11 | 23 | 58 | | |
| Water Soluble Nitrate (2:1) as $NO_3$ | mg/kg | < 3 | NONE | 4 | 4 | < 3 | | |
| W/S Magnesium | mg/kg | < 10 | NONE | 34 | 80 | 1340 | | |

Analytical results are expressed on a dry weight basis where samples are dried at less than 30$^{O}$C
Analysis carried out on the dried sample is corrected for the stone content
Subcontracted analysis $^{(S)}$

**QTS Environmental Ltd**
**Unit 1, Rose Lane Industrial Estate**
**Rose Lane**
**Lenham Heath**
**Maidstone**
**Kent ME17 2JN**
**Tel : 01622 850410**

4480

| Soil Analysis Certificate - Sample Descriptions | |
|---|---|
| QTS Environmental Report No: 13-17371 | |
| South West Geotechnical Ltd | |
| Site Reference: Gospel Oak | |
| Project / Job Ref: 5894 | |
| Order No: None Supplied | |
| Reporting Date: 30/10/2013 | |

| QTSE Sample No | TP / BH No | Additional Refs | Depth (m) | Moisture Content (%) | Sample Matrix Description |
|---|---|---|---|---|---|
| 83622 | WS1 | None Supplied | 2.10 | 8.9 | Brown clay with rubble |
| 83623 | WS2 | None Supplied | 2.20 | 16.6 | Light brown clay |
| 83624 | WS3 | None Supplied | 2.90 | 18.5 | Brown clay |

Insufficient sample I/S
Unsuitable Sample U/S

**QTS Environmental Ltd**
**Unit 1, Rose Lane Industrial Estate**
**Rose Lane**
**Lenham Heath**
**Maidstone**
**Kent ME17 2JN**
**Tel : 01622 850410**

4480

| **Soil Analysis Certificate - Methodology & Miscellaneous Information** |
|---|
| **QTS Environmental Report No: 13-17371** |
| **South West Geotechnical Ltd** |
| **Site Reference: Gospel Oak** |
| **Project / Job Ref: 5894** |
| **Order No: None Supplied** |
| **Reporting Date: 30/10/2013** |

| Matrix | Analysed On | Determinand | Brief Method Description | Method No |
|---|---|---|---|---|
| Soil | D | Metals | Determination of metals by aqua-regia digestion followed by ICP-OES | E002 |
| Soil | D | Cations | Determination of cations in soil by aqua-regia digestion followed by ICP-OES | E002 |
| Soil | D | Boron - Water Soluble | Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES | E012 |
| Soil | AR | Chromium - Hexavalent | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry | E016 |
| Soil | D | Magnesium - Water Soluble | Determination of water soluble magnesium by extraction with water followed by ICP-OES | E025 |
| Soil | D | Chloride - Water Soluble (2:1) | Determination of chloride by extraction with water & analysed by ion chromatography | E021 |
| Soil | AR | Cyanide - Total | Determination of total cyanide by distillation followed by colorimetry | E015 |
| Soil | AR | Cyanide - Complex | Determination of complex cyanide by distillation followed by colorimetry | E015 |
| Soil | AR | Cyanide - Free | Determination of free cyanide by distillation followed by colorimetry | E015 |
| Soil | AR | Electrical Conductivity | Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement | E022 |
| Soil | D | Elemental Sulphur | Determination of elemental sulphur by solvent extraction followed by turbidimeter | E020 |
| Soil | D | Fluoride - Water Soluble | Determination of Fluoride by extraction with water & analysed by ion chromatography | E023 |
| Soil | D | FOC (Fraction Organic Carbon) | Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate | E011 |
| Soil | D | Loss on Ignition @ 450°C | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace | E019 |
| Soil | AR | Moisture Content | Moisture content; determined gravimetrically | E003 |
| Soil | D | Organic Matter | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate | E011 |
| Soil | AR | pH | Determination of pH by addition of water followed by electrometric measurement | E007 |
| Soil | D | Phosphorus | Determination of phosphorus by aqua-regia digestion followed by ICP-OES | E002 |
| Soil | D | Sulphate (as SO4) - Water Soluble (2:1) | Determination of water soluble sulphate by extraction with water followed by ICP-OES | E014 |
| Soil | D | Sulphate (as SO4) - Total | Determination of total sulphate by extraction with 10% HCl followed by ICP-OES | E013 |
| Soil | AR | Sulphide | Determination of sulphide by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode | E018 |
| Soil | D | Sulphur - Total | Determination of total sulphur by extraction with aqua-regia, potassium iodide/iodate followed by ICP-OES | E002 |
| Soil | AR | Thiocyanate (as SCN) | Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry | E017 |
| Soil | D | Total Organic Carbon (TOC) | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate | E011 |
| Soil | AR | BTEX | Determination of BTEX by headspace GC-MS | E001 |
| Soil | D | Cyclohexane Extractable Matter (CEM) | Gravimetrically determined through extraction with cyclohexane | E009 |
| Soil | AR | Diesel Range Organics (C10 - C24) | Determination of hexane/acetone extractable hydrocarbons by GC-FID | E004 |
| Soil | AR | Mineral Oil (C10 - C40) | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge | E004 |
| Soil | AR | PAH - Speciated (EPA 16) | Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards | E005 |
| Soil | AR | PCB - 7 Congeners | Determination of PCB by extraction with acetone and hexane followed by GC-MS | E008 |
| Soil | D | Petroleum Ether Extract (PEE) | Gravimetrically determined through extraction with petroleum ether | E009 |
| Soil | AR | Phenols - Total (monohydric) | Determination of phenols by distillation followed by colorimetry | E010 |
| Soil | AR | SVOC | Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS | E006 |
| Soil | D | Toluene Extractable Matter (TEM) | Gravimetrically determined through extraction with toluene | E009 |
| Soil | AR | EPH (C10 – C40) | Determination of acetone/hexane extractable hydrocarbons by GC-FID | E004 |
| Soil | AR | VPH (C6 - C10) | Determination of hydrocarbons C6-C10 by headspace GC-MS | E001 |
| Soil | AR | EPH TEXAS | Determination of acetone/hexane extractable hydrocarbons by GC-FID | E004 |
| Soil | AR | TPH CWG | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge | E004 |
| Soil | AR | TPH LQM | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge | E004 |
| Soil | AR | EPH (with florisil cleanup) | Determination of acetone/hexane extractable hydrocarbons with florisil cleanup step by GC-FID | E004 |
| Soil | AR | EPH Product ID | Determination of acetone/hexane extractable hydrocarbons by GC-FID | E004 |
| Soil | AR | VOCs | Determination of volatile organic compounds by headspace GC-MS | E001 |

Key

**D Dried**
**AR As Received**

# Appendix E

# Chemical Test Certificates

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United Kingdom
WA7 4QX

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# Test Certificate

**Client:** Robson Liddle Ltd
1 Capital Court, Sowton Industrial Estate, Exeter, EX2 7FW
**Site:** Gospel Oak Nursery School - 140361
**Date Tested:** 24/10/13, 29/10/13, 01/11/13, 05/11/13, 06/11/13
**Date Reported:** 6 November, 2013
**Date Received:** 23 October, 2013
**Sample Type:** Solid

**Certificate No:** 13/2791/R/S$/C1
**File No:** 13/2791/R/S$
**Client Ref:** PO12007446

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | **Lab sample ref:** | **B455171** | **B455172** | **B455173** | **B455174** |
| | | | | | **Client sample ref:** | **WS1** | **WS2** | **WS2** | **WS3** |
| | | | | | | **0.1m** | **0.3m** | **2.3m** | **0.3m** |
| | | | | | **Date sampled:** | **Not Stated** | **Not Stated** | **Not Stated** | **Not Stated** |
| | | | | | **Sample matrix (see notes page):** | **S** | **OS** | **S** | **S** |
| **Determinand** | **Method** | **Units** | **ISO17025** | **MCERTS** | **LOD** | | | | |
| **Deviation Assessment** | | | | | | | | | |
| Deviation(s) | C. Review | N/A | N/A | N/A | N/A | 5 | 5 | 5 | 5 |
| **MCERTS Sample Prep** | | | | | | | | | |
| % Stones | Stones | % | N/A | N/A | 0 | 24.9 | 41.4 | 0.0 | 9.6 |
| Moisture Content @ 35° | CTP01 | % w/w | N/A | N/A | 0.1 | 17.0 | 9.8 | 14.5 | 15.2 |
| Sample Description^ | SGP5 | | N/A | N/A | | 4A | 7A | 3 | 4A |
| **Metals** | | | | | | | | | |
| Arsenic | CTP11A 2 | mg/kg | Y | Y | 2 | 9 | 18 | 13 | 17 |
| Boron (water soluble)* | AN03 | mg/kg | Y | N | 0.1 | 1.3 | 1.9 | 1.2 | 3.1 |
| Cadmium | CTP11A 0.5 | mg/kg | Y | Y | 0.5 | 0.7 | 0.9 | <0.5 | 6.7 |
| Chromium (total) | CTP11A 3 | mg/kg | Y | Y | 3 | 28 | 28 | 52 | 78 |
| Copper | CTP11A 3 | mg/kg | Y | Y | 3 | 26 | 55 | 20 | 201 |
| Lead | CTP11A 1 | mg/kg | Y | Y | 1 | 87 | 298 | 18 | 361 |
| Mercury | CTP11A 0.5 | mg/kg | Y | Y | 0.5 | <0.5 | <0.5 | <0.5 | 1.2 |
| Nickel | CTP11A 2 | mg/kg | Y | Y | 2 | 15 | 19 | 32 | 74 |
| Selenium | CTP11A 2 | mg/kg | Y | Y | 2 | <2 | <2 | <2 | <2 |
| Zinc | CTP11A 2 | mg/kg | Y | Y | 2 | 114 | 239 | 77 | 535 |
| **Misc** | | | | | | | | | |
| pH* | AN5a | | Y | Y | | 7.9 | 9.9 | 8.4 | 7.5 |
| Phenols (screen) M | CTP20 | mg/kg | Y | N | 1 | <1 | <1 | | |
| TOC* | AN48b | % | N | N | 0.1 | 4.3 | 1.2 | | |
| Chromium (VI) | CTP15a | mg/kg | Y | N | 1 | <1 | <1 | <1 | <1 |
| Asbestos Screen* | Asb subcon | | Y | N/A | | | NAD | | |
| **PAH (USEPA16)** | | | | | | | | | |
| Acenaphthene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 0.3 | | |
| Acenaphthylene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | <0.1 | | |
| Anthracene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 1.1 | | |
| Benz(a)anthracene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 2.0 | | |
| Benzo(a)pyrene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 2.1 | | |
| Benzo(b)fluoranthene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 2.2 | | |
| Benzo(ghi)perylene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 1.8 | | |
| Benzo(k)fluoranthene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 1.1 | | |
| Chrysene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 1.9 | | |
| Dibenz(a,h)anthracene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 0.8 | | |
| Fluoranthene M | GCM 501 | mg/kg | Y | Y | 0.1 | 0.1 | 4.3 | | |
| Fluorene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 0.2 | | |
| Indeno(1,2,3-cd)pyrene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 1.3 | | |
| Naphthalene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 0.1 | | |
| Phenanthrene M | GCM 501 | mg/kg | Y | Y | 0.1 | <0.1 | 3.0 | | |
| Pyrene M | GCM 501 | mg/kg | Y | Y | 0.1 | 0.1 | 3.7 | | |

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W: www.exova.com

# Test Certificate

**Client:** Robson Liddle Ltd
1 Capital Court, Sowton Industrial Estate, Exeter, EX2 7FW
**Site:** Gospel Oak Nursery School - 140361
**Date Tested:** 24/10/13, 29/10/13, 01/11/13, 05/11/13, 06/11/13
**Date Reported:** 6 November, 2013
**Date Received:** 23 October, 2013
**Sample Type:** Solid

**Certificate No:** 13/2791/R/S$/C1
**File No:** 13/2791/R/S$
**Client Ref:** PO12007446

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | **Lab sample ref:** | **B455171** | **B455172** |
| | | | | | **Client sample ref:** | **WS1** | **WS2** |
| | | | | | | **0.1m** | **0.3m** |
| | | | | | **Date sampled:** | **Not Stated** | **Not Stated** |
| | | | | | **Sample matrix (see notes page):** | **S** | **OS** |
| **Determinand** | **Method** | **Units** | **ISO17025** | **MCERTS** | **LOD** | | |
| **TPH Banded(Ali/Aro)** | | | | | | | |
| EC>5-6 Aliphatic M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| EC>6-8 Aliphatic M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| EC>8-10 Aliphatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>10-12 Aliphatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>12-16 Aliphatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>16-35 Aliphatic M | SOP05a | µg/kg | Y | N | 1000 | 7230 | 18400 |
| EC>35-44 Aliphatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | 2110 |
| Total Aliphatics M | SOP05a | µg/kg | Y | N | 1000 | 10200 | 20500 |
| EC>5-7 Aromatic M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| EC>7-8 Aromatic M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| EC>8-10 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>10-12 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>12-16 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | <1000 |
| EC>16-21 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | 1550 |
| EC>21-35 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | 2410 | 16500 |
| EC>35-44 Aromatic M | SOP05a | µg/kg | Y | N | 1000 | <1000 | 2990 |
| Total Aromatics M | SOP05a | µg/kg | Y | N | 1000 | 2410 | 21100 |
| Methyl t-butyl ether M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| Benzene (VPH) M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| Toluene (VPH) M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| Ethylbenzene (VPH) M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| m&p-Xylene (VPH) M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| o-Xylene (VPH) M | SOP05 | µg/kg | Y | N | 10 | <10 | <10 |
| Total VPH M | SOP05 | µg/kg | Y | N | 10 | 2970 | <10 |
| TPH M | SOP05a | µg/kg | Y | N | 1000 | 12600 | 41600 |

Notes
1. All analyses performed on the sample dried at 35ºC, except analyses suffixed with 'M'.
2. Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at 35ºC' where applicable.
3. All results are expressed as dry weight.
4. MCERTS accreditation applicable to Sample Matrix 'S' only.
5. Natural stones (pebbles, gravels etc.) which do not pass a 2mm sieve are excluded from dried analyses.
6. Tests marked * indicate subcontracted analyses.
7. NAD denotes 'No Asbestos Detected'.
8. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
9. ^Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sandy loam, 5. Sandy clay, 6. Clayey loam, 7. Other.
suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons
10. Dates of testing for all parameters are available on request.
11. Please note 'Asbestos screen' testing has been analysed at Exova (Glasgow). This laboratory holds UKAS accreditation (UKAS No. 0568) for both 'Asbestos Screen' and 'Identification' as per document 'HSG 248'.
12. Where a deviation has been found in relation to the sample(s) submitted for testing, the test result may be compromised. Reasons for deviating samples are denoted by means of a number 1, 2, 3, 4, 5, 6 or 7 under the analyte 'Deviation(s)'. Explanation of this number coding as follows: 1. Sample was not cooled, 2. Sample not submitted in an appropriate container (organic testing), 3. Sample not submitted in an appropriate container (inorganic testing), 4. Sample not submitted in an appropriate container (all testing), 5. Sample lacks the date and time of sampling, 6. Sample has exceeded the maximum preservation time and, 7. Other, (e.g. inappropriate headspace).
13. Please note subcontracted tests have been analysed at Exova (Hillington). This laboratory holds UKAS accreditation (UKAS No. 0568).

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:
S Blemings
Account Manager

Approved by:
A Young
Operations Manager

0871

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# Test Certificate

**Client:** Robson Liddle Ltd
1 Capital Court, Sowton Industrial Estate, Exeter, EX2 7FW
**Site:** Gospel Oak Nursery School - 140361
**Date Tested:** 19/11/13
**Date Reported:** 19 November, 2013
**Date Received:** 18 November, 2013
**Sample Type:** Solid

**Certificate No:** 13/3028/R/S/C1
**File No:** 13/3028/R/S
**Client Ref:** None Supplied

| | |
|---|---|
| **Lab sample ref:** | **B456064** |
| **Client sample ref:** | **WS4** |
| | **0.3m** |
| **Date sampled:** | **Not Stated** |
| **Sample matrix (see notes page):** | **S** |

| Determinand | Method | Units | ISO17025 | LOD | |
|---|---|---|---|---|---|
| **Deviation Assessment** | | | | | |
| Deviation(s) | C. Review | N/A | N/A | N/A | N/A |
| **Misc** | | | | | |
| Asbestos Screen* | Asb subcon | | Y | | DET |
| Asbestos ID* | Asb subcon | | Y | | Amosite (Brown Asbestos) Loose Fibres |

Notes
1. All analyses performed on the sample dried at 35ºC, except analyses suffixed with 'M'.
2. Analyses suffixed 'M' were performed on the sample as received and corrected for '% moisture at 35ºC' where applicable.
3. All results are expressed as dry weight.
4. MCERTS accreditation applicable to Sample Matrix 'S' only.
5. Natural stones (pebbles, gravels etc.) which do not pass a 2mm sieve are excluded from dried analyses.
6. Tests marked * indicate subcontracted analyses.
7. NAD denotes 'No Asbestos Detected'.
8. DET denotes 'Detected'.
9. The laboratory has tested the material/items supplied by the client as sampled in accordance with the client's own requirements.
10. ^Sample Description key: 1. - Sand, 2. Loam, 3. Clay, 4. Sandy loam, 5. Sandy clay, 6. Clayey loam, 7. Other.
suffixed with: A - Stones, B - Construction rubble, C - Visible Hydrocarbons
11. Dates of testing for all parameters are available on request.
12. Please note 'Asbestos screen' testing has been analysed at Exova (Glasgow). This laboratory holds UKAS accreditation (UKAS No. 0568) for both 'Asbestos Screen' and 'Identification' as per document 'HSG 248'.

Signed for, and on behalf of Exova (UK) Ltd.

Prepared by:
S Blemings
Account Manager

Approved by:
E Gaskell
Section Leader - Metals



UKAS TESTING
0871

# Appendix F

# Statistical Analysis - Inputs and Outputs

| | |
|---|---|
| Client/client ref | NPS Property Consultants |
| Project ref | 140361 |
| Site ref | Gospel Oak Primary School |
| Data description | Preliminary Site Invesitgation |
| Contaminant(s) | Metals |
| Test scenario | Planning: is true mean lower than critical concentration (μ < Cc)? |
| Date | 11 November 2013 |
| User details | C Riley |

Statistics Calculator (Version 2)

# Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

Go to summary | Project details | Select all filters | Deselect all filters | Paste Values

| Easting | Northing | Depth (m) | User-defined 1 | User-defined 2 | User-defined 3 | Sample ID | Arsenic | Boron (water soluble)* | Cadmium | Chromium (total) | Chromium (VI) | Copper | Lead | Mercury | Nickel | Selenium | Zinc | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.1 | | | | WS1 | 9 | 1.3 | 0.7 | 28 | <1 | 26 | 87 | <0.5 | 15 | <2 | 114 | | | | | | | | | |
| | | 0.3 | | | | WS2 | 18 | 1.9 | 0.9 | 28 | <1 | 55 | 298 | <0.5 | 19 | <2 | 239 | | | | | | | | | |
| | | 2.3 | | | | WS2 | 13 | 1.2 | <0.5 | 52 | <1 | 20 | 18 | <0.5 | 32 | <2 | 77 | | | | | | | | | |
| | | 0.3 | | | | WS3 | 17 | 3.1 | 6.7 | 78 | <1 | 201 | 361 | 1.2 | 74 | <2 | 535 | | | | | | | | | |

Client/client ref: NPS Property Consultants
Project ref: 140361
Site ref: Gospel Oak Primary School
Data description: Preliminary Site Investigation
Contaminant(s): Metals
Test scenario: Planning
Date: 11 November 2013
User details: C Riley

| | Arsenic | Boron (water soluble)* | Cadmium | Chromium (total) | Chromium (VI) | Copper | Lead | Mercury | Nickel | Selenium | Zinc | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Critical concentration, $C_c$ | 32 | 291 | 10 | 3000 | 4.3 | 2330 | 450 | 11 | 130 | 350 | 3750 | | | | | | | | | |
| Notes | CLEA | LQM | CLEA | LQM | LQM | LQM | CLEA(2002) | CLEA | CLEA | CLEA | LQM | | | | | | | | | |
| Full dataset size | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Outliers present? | No | No | Yes | No | No | Yes | No | Yes | No | No | No | | | | | | | | | |
| Number of outliers temporarily excluded | 0 | | | | | | | | | | | | | | | | | | | |
| Number removed by filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample size, n | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample mean, $\bar{x}$ | 14.25 | 1.875 | 2.1375 | 46.5 | 0.5 | 75.5 | 191 | 0.4875 | 35 | 1 | 241.25 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| Standard deviation, s | 4.1129876 | 0.8732125 | 3.0537886 | 23.853721 | 0 | 85.050965 | 164.41208 | 0.475 | 26.993826 | 0 | 207.73761 | | | | | | | | | |
| Number of non-detects | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Set non-detect values to: | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit |
| Distribution | Normal | Normal | Non-normal | Normal | Single value | Normal | Normal | Non-normal | Normal | Single value | Normal | | | | | | | | | |
| Statistical approach | Auto: One-sample | Auto: One-sample | Auto: Chebychev | Auto: One-sample | Auto: Chebychev | Auto: One-sample | Auto: One-sample | Auto: Chebychev | Auto: One-sample | Auto: Chebychev | Auto: One-sample | Auto | Auto | Auto | Auto | Auto | Auto | Auto | Auto | Auto |
| Test scenario: | Planning: is true mean lower than critical concentration (μ < Cc)? | | | | Evidence level required: | 95% | Use Normal distribution to test for outliers | | | | | | | | | | | | | |
| t statistic, $t_0$ (or $k_0$) | -8.631195569 | -662.2099736 | -5.149341327 | -247.6343221 | N/A | -53.01527142 | -3.150620001 | -44.26315789 | -7.038646422 | N/A | -33.78059386 | | | | | | | | | |
| Upper confidence limit (on true mean concentration, μ) | 19.089677 | 2.9024931 | 8.793078 | 74.568237 | 0.5 | 175.57792 | 384.46069 | 1.5227385 | 66.763142 | 1 | 485.69105 | | | | | | | | | |
| Evidence level | 100% | 100% | 96% | 100% | 100% | 100% | 97% | 100% | 100% | 100% | 100% | | | | | | | | | |
| Base decision on: | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | | | | | | | | | |
| Result | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | | | | | | | | | |
| Select dataset | ● Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y |

Back to data | Go to outlier test | Go to normality test | Show individual summary

| | |
|---|---|
| Client/client ref | NPS Property Consultants |
| Project ref | 140361 |
| Site ref | Gospel Oak Primary School |
| Data description | Preliminary Site Investigation |
| Contaminant(s) | PAH and BTEX |
| Test scenario | Planning: is true mean lower than critical concentration (μ < Cc)? |
| Date | 11 November 2013 |
| User details | C Riley |

Statistics Calculator (Version 2)

# Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

Go to summary | Project details | Select all filters | Deselect all filters | Paste Values

| Easting | Northing | Depth (m) | User-defined 1 | User-defined 2 | User-defined 3 | Sample ID | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene | Benzo(ghi)perylene | Benzo(k)fluoranthene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-cd)pyrene | Naphthalene | Phenanthrene | Pyrene | Toluene | Ethylbenzene | m&p-Xylene | o-Xylene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.1 | | | | WS1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | 0.3 | | | | WS2 | 0.3 | <0.1 | 1.1 | 2 | 2.1 | 2.2 | 1.8 | 1.1 | 1.9 | 0.8 | 4.3 | 0.2 | 1.3 | 0.1 | 3 | 3.7 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | 2.3 | | | | WS2 | | | | | | | | | | | | | | | | | | | | |
| | | 0.3 | | | | WS3 | | | | | | | | | | | | | | | | | | | | |
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Client/client ref: NPS Property Consultants
Project ref: 140361
Site ref: Gospel Oak Primary School
Data description: Preliminary Site Investigation
Contaminant(s): PAH and BTEX
Test scenario: Planning
Date: 11 November 2013
User details: C Riley

| | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo(b)fluoranthene | Benzo(ghi)perylene | Benzo(k)fluoranthene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-cd)pyrene | Naphthalene | Phenanthrene | Pyrene | Toluene | Ethylbenzene | m&p-Xylene | o-Xylene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Critical concentration, $C_c$ | 480 | 400 | 4900 | 4.7 | 0.94 | 6.5 | 46 | 9.6 | 8 | 0.86 | 460 | 380 | 3.9 | 3.7 | 200 | 1000 | 0.33 | 350 | | |
| Notes | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | | | | |
| Full dataset size | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Outliers present? | No | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) |
| Number of outliers temporarily excluded | 0 | | | | | | | | | | | | | | | | | | | |
| Number removed by filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample size, n | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Sample mean, $\bar{x}$ | 0.175 | 0.05 | 0.575 | 1.025 | 1.075 | 1.125 | 0.925 | 0.575 | 0.975 | 0.425 | 2.2 | 0.125 | 0.675 | 0.075 | 1.525 | 1.9 | 0.005 | 0.005 | 0.005 | 0.005 |
| Standard deviation, s | 0.1767767 | 0 | 0.7424621 | 1.3788582 | 1.4495689 | 1.5202796 | 1.2374369 | 0.7424621 | 1.3081475 | 0.5303301 | 2.9698485 | 0.106066 | 0.8838835 | 0.0353553 | 2.085965 | 2.5455844 | 0 | 0 | 0 | 0 |
| Number of non-detects | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 2 | 2 | 2 | 2 |
| Set non-detect values to: | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit |
| Distribution | N/A (n<3) | Single value | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | Single value | Single value | Single value | Single value |
| Statistical approach | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebyche |

Test scenario: Planning: is true mean lower than critical concentration (μ < Cc)?
Evidence level required: 95%
Use Normal distribution to test for outliers

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t statistic, $t_0$ (or $k_0$) | -3838.6 | N/A | -9332.238095 | -3.769230769 | 0.131707317 | -5 | -51.51428571 | -17.19047619 | -7.594594595 | -1.16 | -218 | -5065 | -5.16 | -145 | -134.559322 | -554.5 | N/A | N/A | N/A | N/A |
| Upper confidence limit (on true mean concentration, μ) | 0.7198624 | 0.05 | 2.8634219 | 5.2749265 | 5.5428714 | 5.8108164 | 4.7390366 | 2.8634219 | 5.0069815 | 2.0595871 | 11.353688 | 0.4519174 | 3.3993118 | 0.1839725 | 7.9543759 | 9.7460181 | 0.005 | 0.005 | 0.005 | 0.005 |
| Evidence level | 100% | 100% | 100% | 93% | 0% | 96% | 100% | 100% | 98% | 57% | 100% | 100% | 96% | 100% | 100% | 100% | 100% | 100% | | |
| Base decision on: | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | lower bound | lower bound |
| Result | μ < Cc | μ < Cc | μ < Cc | μ ≥ Cc | μ ≥ Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ ≥ Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | μ < Cc | |
| Select dataset | ● Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y |

Back to data | Go to outlier test | Go to normality test | Show individual summary

| | |
|---|---|
| Client/client ref | NPS Property Consultants |
| Project ref | 140361 |
| Site ref | Gospel Oak Primary School |
| Data description | Preliminary Site Investigation |
| Contaminant(s) | TPH |
| Test scenario | Planning: is true mean lower than critical concentration (μ < Cc)? |
| Date | 11 November 2013 |
| User details | C Riley |

Statistics Calculator (Version 2)

# Input data

This spreadsheet has been produced based on the document 'Guidance on Comparing Soil Contamination Data with a Critical Concentration (CIEH/CL:AIRE, 2008)'. Users of this spreadsheet should always refer to this guidance, the User Manual and to relevant guidance on UK legislation and policy, in order to understand how the procedure should be applied in an appropriate context.

Go to summary | Project details | Select all filters | Deselect all filters | Paste Values

| Easting | Northing | Depth (m) | User-defined 1 | User-defined 2 | User-defined 3 | Sample ID | EC>5-6 Aliphatic | EC>6-8 Aliphatic | EC>8-10 Aliphatic | EC>10-12 Aliphatic | EC>12-16 Aliphatic | EC>16-35 Aliphatic | EC>35-44 Aliphatic | EC>5-7 Aromatic | EC>7-8 Aromatic | EC>8-10 Aromatic | EC>10-12 Aromatic | EC>12-16 Aromatic | EC>16-21 Aromatic | EC>21-35 Aromatic | EC>35-44 Aromatic | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter | Filter |
| | | 0.1 | | | | WS1 | <0.01 | <0.01 | <1 | <1 | <1 | 7.23 | <1 | <0.01 | <0.01 | <1 | <1 | <1 | <1 | 2.41 | <1 | | | | | |
| | | 0.3 | | | | WS2 | <0.01 | <0.01 | <1 | <1 | <1 | 18.4 | 2.11 | <0.01 | <0.01 | <1 | <1 | <1 | 1.55 | 16.5 | 2.99 | | | | | |
| | | 2.3 | | | | WS2 | | | | | | | | | | | | | | | | | | | | |
| | | 0.3 | | | | WS3 | | | | | | | | | | | | | | | | | | | | |
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Client/client ref: NPS Property Consultants
Project ref: 140361
Site ref: Gospel Oak Primary School
Data description: Preliminary Site Investigation
Contaminant(s): TPH
Test scenario: Planning
Date: 11 November 2013
User details: C Riley

| | EC>5-6 Aliphatic | EC>6-8 Aliphatic | EC>8-10 Aliphatic | EC>10-12 Aliphatic | EC>12-16 Aliphatic | EC>16-35 Aliphatic | EC>35-44 Aliphatic | EC>5-7 Aromatic | EC>7-8 Aromatic | EC>8-10 Aromatic | EC>10-12 Aromatic | EC>12-16 Aromatic | EC>16-21 Aromatic | EC>21-35 Aromatic | EC>35-44 Aromatic | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Critical concentration, $C_c$ | 55 | 160 | 46 | 230 | 1700 | 64000 | 64000 | 130 | 270 | 65 | 160 | 310 | 480 | 1100 | 1100 | | | | | |
| Notes | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | LQM 2.5% | | | | | |
| Full dataset size | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| Outliers present? | No | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | N/A (n<3) | | | | | |
| Number of outliers temporarily excluded | 0 | | | | | | | | | | | | | | | | | | | |
| Number removed by filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sample size, n | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **0** | **0** | **0** | **0** | **0** |
| Sample mean, $\bar{x}$ | 0.005 | 0.005 | 0.5 | 0.5 | 0.5 | 12.815 | 1.305 | 0.005 | 0.005 | 0.5 | 0.5 | 0.5 | 1.025 | 9.455 | 1.745 | No Data | No Data | No Data | No Data | No Data |
| Standard deviation, s | 0 | 0 | 0 | 0 | 0 | 7.8983827 | 1.1384419 | 0 | 0 | 0 | 0 | 0 | 0.7424621 | 9.9631345 | 1.7606959 | | | | | |
| Number of non-detects | **2** | **2** | **2** | **2** | **2** | 0 | **1** | **2** | **2** | **2** | **2** | **2** | **1** | 0 | **1** | 0 | 0 | 0 | 0 | 0 |
| Set non-detect values to: | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit | Half detection limit |
| Distribution | Single value | Single value | Single value | Single value | Single value | N/A (n<3) | N/A (n<3) | Single value | Single value | Single value | Single value | Single value | N/A (n<3) | N/A (n<3) | N/A (n<3) | | | | | |
| Statistical approach | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto: Chebychev | Auto | Auto | Auto | Auto | Auto |

| Test scenario: | Planning: is true mean lower than critical concentration (μ < Cc)? | | | | Evidence level required: | 95% | Use Normal distribution to test for outliers | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| t statistic, $t_0$ (or $k_0$) | N/A | N/A | N/A | N/A | N/A | -11456.97135 | -79501.48447 | N/A | N/A | N/A | N/A | N/A | -912.3333333 | -154.7970192 | -882.1325301 | | | | | |
| Upper confidence limit (on true mean concentration, μ) | 0.005 | 0.005 | 0.5 | 0.5 | 0.5 | 37.159451 | 4.8139136 | 0.005 | 0.005 | 0.5 | 0.5 | 0.5 | 3.3134219 | 40.163443 | 7.1718292 | | | | | |
| Evidence level | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | | | | | |
| Base decision on: | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | evidence level | | | | | |
| Result | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | **μ < Cc** | | | | | |
| Select dataset | ● Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y | ○ Y |

**Back to data** | **Go to outlier test** | **Go to normality test** | **Show individual summary**

## Head Office

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