Strongvox Ltd

Butt's Batch, Wrington

Ground Investigation Report

Constructionline
A UK GOVERNMENT CERTIFICATION SERVICE
AGS Association of Geotechnical & Geoenvironmental Specialists
smas worksafe consultant www.smasltd.com
as recognised by SSIP SAFETY SCHEMES IN PROCUREMENT
QMS ISO 45001 : 2018 REGISTERED
Certificate No:349222020

This report has been prepared for **Strongvox Ltd** in accordance with the terms and conditions of appointment for **Butt's Batch, Wrington**. TEC cannot accept any responsibility for any use of or reliance on the contents by a third party.

Butt's Batch, Wrington

Ground Investigation Report

ISSUE RECORD					
Report Reference: 1912013.002.01					
Version	**Date**	**Amendments Record**	**Prepared by**	**Checked by**	**Authorised by**
-	July 2020	-	Ashley Thorne / Sophie Thomas	Claire Hooley	Richard Evans
A	November 2020	Updated proposed development plan	Sophie Thomas	Richard Evans	Richard Evans
Report Liability Date: July 2020					

TEC
The Old Chapel
35a Southover
Wells
Somerset
BA5 1UH
Tel: 01749 677760
Email: info@tecon.co.uk

TABLE OF CONTENTS

Executive Summary

1 Introduction 1

2 Previous TEC REport Summary 2

3 Ground Investigation Methodology 5

4 Ground Investigation Findings 7

5 Land Contamination - Generic Quantitative Risk Assessment 8

6 Land Contamination - Conclusions and Recommendations 12

7 Ground Engineering 13

8 Ground Engineering - Conclusions and Recommendations 17

9 Recommended Further Works 18

Figures and Drawings

Figure 1 Site Location Plan

Figure 2 Proposed Development Plan

Figure 3 Exploratory Hole Location Plan

Appendices

Appendix A Site Photographs

Appendix B Risk Methodologies and Evaluation

Appendix C Regulatory Correspondence
- Environmental Health – North Somerset Council

Appendix D Exploratory Hole Logs
- TEC TP01 to TP16
- TEC HS1 to HS5

Appendix E Geochemical Certificates of Analysis
- i2 Analytical Report No. 20-13631-1
- i2 Analytical Report No. 20-14554-1

Appendix F Geotechnical Laboratory Report
- K4 Soils Report No. 28345
- E Lab Soils Report No. 20-28438-1

Appendix G Generic Quantitative Risk Assessment: Human Health

Appendix H Soakage Test Results

Appendix I DCP-TRL and Clegg Hammer Results

EXECUTIVE SUMMARY

SITE INFORMATION	**Client**	Strongvox Ltd
	Site Details	The site comprises a number of undeveloped fields situated to the west of Butt's Batch and Half Yard in Wrington, to the south-west of Bristol. The centre of the site is at approximate National Grid Reference 346670, 162370 and the site covers an area of approximately 2.85Ha. The nearest postcode is BS40 5LW.
	Current Land Use	Agricultural fields.
	Proposed Development	The proposed development is understood to comprise the redevelopment of the site for a residential site end use and comprises the construction of up to 71No. residential properties with associated soft landscaping and hard infrastructure, including car parking and access roads.
BACKGROUND INFORMATION	**Geology**	The geological mapping indicates that the central and southern area of the site are underlain by superficial Head Deposits. The underlying bedrock is recorded as the Mercia Mudstone Group comprising 'dominantly red, less commonly green-grey, mudstones and subordinate siltstones'. In addition, the central area of the site is reportedly underlain by the Arden Sandstone Formation which is described as 'grey, green and purple mudstones interbedded with paler grey-green to buff coloured siltstones and fine- to medium-grained, varicoloured green, brown, buff, mauve sandstones'.
	Hydrogeology	The Superficial Head Deposits are classed as a Secondary (Undifferentiated) Aquifer. The solid geology is classified as a Secondary A Aquifer (Arden Sandstone Formation) and Secondary B Aquifer (Mercia Mudstone Group).
	Hydrology	The closest surface water course to the site is a tributary of the Congresbury Yeo, located ~80m south-east of the site. There is a single reported surface water abstraction is located within 250m of the site and is associated with spray irrigation and agricultural use (Congresbury Yeo).
	Site History	The site has remained undeveloped fields from 1884 mapping until 2020. Potentially contaminative land uses including an adjacent former railway, coal yard and sewage works have been identified in proximity to the site.
	Environmental Sensitivity	The site is considered to be of overall Low to Moderate sensitivity.
GROUND INVESTIGATION	**Ground Investigation Rationale**	The aim of these works is to provide preliminary information on geoenvironmental and ground engineering conditions and constraints associated with the site with regards to the proposed development.
	Scope of Works	Excavation of 16No. trial pits, 5No. hand dug pits, in situ DCP-TRL testing and Clegg Impact Soil Tester and BRE365 soakage test.
	Ground Conditions	Made ground was encountered across the site to depths of between 0.15m to 0.5mbgl and was noted to comprise brown slightly gravelly slightly sandy clay with occasional rootlets. The gravel was generally recorded as brick, tile, clinker, quartzite and chalk. The natural ground was generally observed to comprise stiff to very stiff, high strength, reddish brown, locally grey, slightly gravelly, slightly sandy clay, interbedded with very weak reddish brown slightly sandy mudstone. Grey sandstone was recorded within a single location between 1.8mbgl and 2.4mbgl towards the north of the site. The gravel component within the underlying materials were generally observed to comprise subangular to sub-rounded mudstone and occasional sandstone. Groundwater was encountered within a single location at a depth of 3.2mbgl.

LAND CONTAMINATION	**Contamination Characterisation**	No evidence of potentially gross contamination was recorded during the ground investigation. Notwithstanding this, laboratory analysis of made ground materials and the shallow natural soils recorded the exceedance of lead and beryllium within a number of locations when considering a residential site end use.
	Identified Pollutant Linkages	Human Health (future site end users and construction workers) - Exposure to potential contaminants of concern through ingestion, inhalation and dermal contact pathways.
	Remediation Appraisal / Likely Remedial Approach	Provision of a clean cover system within areas of proposed soft landscaping. Alternatively, given the limited thickness of made ground and localised nature of the identified contamination, further testing may be undertaken following site preparation works to confirm any requirements for remedial measures.
GROUND ENGINEERING	**Foundations**	It is considered that conventional foundations may be suitable for the proposed development. The underlying soils have been recorded to be of low to medium volume change potential, requiring a minimum founding depth of 0.9mbgl to be adopted within the design, where foundations are judged to be beyond the influence of proposed, existing, or historic planting (NHBC/ LABC). When founding at this depth, within the generally stiff, high strength clay encountered on site from a depth of 0.5mbgl, an allowable bearing resistance of 100kN/m^2 would be considered appropriate, with total settlements of less than 25mm anticipated at the assumed pressures. It should be noted that mudstone was encountered at shallow depths in some of the trial pit locations. The thickness of this material was variable and, in some locations, underlain by stiff slightly sandy clay. The minimum foundation depths for shrinkable soils would therefore still need to be considered where shallow mudstone bands are recorded. In addition, the bedrock materials may not be laterally continuous beneath the properties and care should be taken to ensure each unit is founded on similar materials in order to reduce potential differential settlement. Given the reported low to medium volume change potential of the underlying ground materials, suitable voids may be required against the foundations and below and against the sides of ground beams, as outlined in the NHBC Standards.
	Ground Floor Slabs	Based on the ground conditions encountered during the investigation, ground bearing slabs may be appropriate for the proposed development.
	Preliminary Pavement Design	A preliminary design CBR value of 3% has been derived based on the test data to-date.
	Drainage	Soakage testing undertaken to date would suggest the underlying ground materials are unlikely to provide a suitable drainage medium for the use of soakaways on site.
	Buried Concrete	The results of the sulphate and pH testing from the soils at the site yield an aggressive chemical environment class (ACEC) of AC-1, requiring a design sulphate class of DS-1 for the shallow ground conditions
RECOMMENDED FURTHER WORKS		Given the limited thickness of made ground and near surface materials across the site and localised nature of recorded contaminants of potential concern, further testing and assessment may be undertaken following the completion of site preparation works to potentially refine remedial requirements on site.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 TEC has been appointed by Strongvox Ltd to undertake a ground investigation at Butt's Batch, Wrington. All works were undertaken in accordance with our proposal letter dated 21 January 2020 and referenced RE.1912013.001.

1.2 Background

1.2.1 The site comprises a number of undeveloped fields situated to the west of Butt's Batch and Half Yard in Wrington, to the south-west of Bristol (Figure 1). The site covers an area of approximately 2.85 hectares, with the centre of the site situated at approximate National Grid Reference 346670, 162370. The nearest postcode is BS40 5LW.

1.2.2 The proposed development is understood to comprise the construction of up to 71No. residential properties with associated soft landscaping and hard infrastructure, including car parking and access roads (Figure 2).

1.2.3 A Preliminary Geoenvironmental and Geotechnical Assessment was undertaken for the site by TEC and is presented within the following report:

- Butt's Batch, Wrington – Preliminary Geoenvironmental and Geotechnical Assessment. Prepared by TEC for Strongvox Ltd. Reference 1912013.001.01 dated March 2020.

1.2.4 This phase of assessment involved the development of an outline conceptual site model, based upon desk study research and a reconnaissance survey. Given the assessment provided within the report, additional works were recommended to fully define the potential geoenvironmental and geotechnical issues associated with the site.

1.2.5 Therefore, the aim of this phase of works it to provide information on the geoenvironmental and geotechnical constraints and considerations associated with the site is relation to the proposed development.

1.3 Scope of Works

1.3.1 The scope of work undertaken as part of this report is presented below:

- **Land Contamination - Generic Quantitative Risk Assessment:** this phase of assessment involves updating the site conceptual model developed as part of the Preliminary Risk Assessment based on the findings of an exploratory ground investigation. Generic assessment criteria and assumptions, if appropriate, are used to identify relevant pollutant linkages.

- **Ground Engineering:** general recommendations in relation to ground engineering for the proposed development are provided on the basis of the findings of the exploratory ground investigation.

1.3.2 The above scope of work has been undertaken in accordance with current guidance such as CLR 11 '*Model Procedures for the Management of Land Contamination*' (Environment Agency, 2004), LCRM - *Land contamination: risk management* (Environment Agency 2019), BS10175+A2 (2017) and, where appropriate NHBC and Eurocode 7.

2 PREVIOUS TEC REPORT SUMMARY

2.1 Introduction

2.1.1 A summary of the salient information from the previous TEC Preliminary Geoenvironmental and Geotechnical Assessment (desk study) report (ref: 1912013.001.01) is presented below in Table 2.1.

Table 2.1 Previous TEC Desk Study Information

Site History	The earliest available historic OS mapping, dated 1884, recorded the site to be undeveloped fields with a tributary of the Congresbury Yeo to the south of the site and is similar to the current site layout. From 1903 mapping until 1981, a railway line was depicted along the northern boundary of the site, which is later shown as being dismantled.
Surrounding Land Use	The immediate surrounding area was identified as being predominantly for agricultural use. A former railway line is present to the immediate north of the site with residential properties beyond. To the east, a number of residential properties are located along Butt's Batch with the village of Wrington beyond. To the south, the Congresbury Yeo is present with agricultural fields beyond to both the south and west. Potentially significant features identified within the immediate vicinity of the site included the adjacent former railway line, former coal yard and current sewage works and piggery.
Geology and Hydrogeology	The geological mapping indicates that the central and southern area of the site are underlain by superficial Head Deposits comprising gravel, sand and clay locally with lenses of silt, clay or peat and organic material. The underlying bedrock is recorded as the Mercia Mudstone Group comprising 'dominantly red, less commonly green-grey, mudstones and subordinate siltstones'. In addition, the central area of the site is underlain by the Arden Sandstone formation which is described as 'grey, green and purple mudstones interbedded with paler grey-green to buff coloured siltstones and fine- to medium-grained, varicoloured green, brown, buff, mauve sandstones'. The BGS estimated soil chemistry values for the site record background lead concentrations to be in excess of the current screening values for a residential site end use. The underlying deposits are classified as Secondary Aquifers with the Superficial Head Deposits classified as Secondary (Undifferentiated), the Arden Sandstone Formation classified as a Secondary A Aquifer and the Mercia Mudstone Group is classified as a Secondary B Aquifer. The underlying superficial and solid aquifers are classified as being of high vulnerability as a result of well-connected fractures. It is considered that any hydraulic gradient is likely to be in a generally southerly direction following the general topography of the area, towards the Congresbury Yeo. There is a single groundwater abstraction location located 370m north of the site for the abstraction of groundwater for food and drink (water bottling). There are no recorded Source Protection Zones (SPZ) reported within proximity to the site. In addition, the site is reported as being located within an area that has the potential for groundwater flooding to occur at the surface and of properties situated below ground level.
Hydrology	The closest surface water course is a tributary of the Congresbury Yeo, located ~80m south-east of the site, while the Congresbury Yeo itself is located approximately 85m to the south-west of the site. The river quality of the Congresbury Yeo is classified by the Environmental Agency as River Quality B. There is a single surface water abstraction located within 250m of the site. This relates to surface water abstraction from the Congresbury Yeo for spray irrigation and agricultural use ~195m south of the site.

	There are 20No. reported licensed discharge consents to surface waters within 250m of the site, the closest of which relates to the discharge of other matter into the Congresbury Yeo ~135m south-east of the site. There are no reported pollution incidents to surface waters within 250m of the site. The site is not reported to be located within an area of extreme flooding from rivers or sea without defences. However, the southern and south-western boundaries of the site are reported as being located within an area of potential flooding from rivers or sea without defences (Zone 3) and anecdotal information provided by the current landowner indicates the land situated immediately south of the proposed development area is prone to flooding during periods of heavy rainfall.
Ground Gas Generation	The reported geology (Head Deposits, Arden Sandstone Formation and the Mercia Mudstone Group) is not considered to be a potential significant source of ground gas generation. Notwithstanding this, made ground, if present, may provide a potential source of ground gas generation subject to thickness and composition. The site is recorded as being within a Lower to Intermediate probability radon affected area (between than 1% and 3% of homes are estimated to be at or above the Action Level). Notwithstanding this, no radon protection measures are reported to be required during the construction of new dwellings or extensions.
Outline Conceptual Model	The site was considered to be of low to moderate environmental sensitivity due primarily to the presence of the underlying Secondary Aquifers and historical land uses. The main potential Significant Pollutant Linkages identified within the preliminary assessment included: - Human health (future site end users and construction workers) - exposure to potential contaminants of concern associated with potential made ground on site and potentially contaminative land uses in proximity to the site via the ingestion, dermal contact and inhalation pathways; - Human health (future site end users and construction workers) - exposure to elevated background lead concentrations within the underlying natural ground via the ingestion, dermal contact and inhalation pathways; - Controlled waters – risk to controlled waters from on-site and off-site contaminants of potential concern (CoPC) and subsequent migration to identified groundwater and surface water receptors; and - Human health (future site end users) – migration, ingress and inhalation of ground gas from the reported presence of potential made ground. Additional investigation was recommended to confirm the current contaminative status of the site and inform the remedial approach for the proposed development, if required.
Geotechnical Hazards	Based on the information presented within the Envirocheck® report and the site reconnaissance survey undertaken for the site, the potential presence of made ground of unknown thickness associated within the site development cannot be discounted. The proposed development area was noted to slope from north to south towards the Congresbury Yeo. The site is reported as being located within an area that has the potential for groundwater flooding to occur at the surface and of properties situated below ground level. While the site is not reported to be located within an area of extreme flooding from rivers or sea without defences, the southern and south-western boundary of the site is reported as being located within an area of potential flooding from rivers or sea without defences (Zone 3). The site is recorded as being within a Lower to Intermediate probability radon affected area (between than 1% and 3% of homes are estimated to be at or above the Action Level). Notwithstanding this , no radon protection measures are reported to be required during the construction of new dwellings or extensions. The Envirocheck® report indicates a moderate rating of compressible ground, with a low hazard rating for running sands. Collapsible ground, landslides and shrink/swell clays are classified as very low, with no reported hazard rating for collapsible ground or dissolution hazards on site.

2.2 Regulatory Consultation

2.2.1 Regulatory consultations were undertaken with the relevant departments at North Somerset Council with respect to possible environmental issues and ground conditions on-site and in the surrounding area. A summary of the response is provided below in Table 2.2. The full response is presented in Appendix C.

Table 2.2: Regulatory Consultations Summary

Public Health and Regulatory Services – North Somerset Council	• There are no records of any pre-license landfills sites, pollution incidents, known areas of contaminated land, Part B authorisations or private water supplies within 500m of the site; • The Council does not have any records of the storage of petroleum hydrocarbons on or in the vicinity to the site; • There are no records of any previous site investigations in proximity of the site and there are no records of any unexploded ordnance in the area; • The Council does not have any records of any known ground gas generation in the area of the site; and • The Council has no specific information on any potential issues regarding naturally elevated contaminant concentrations, however it is not uncommon to find elevated levels of lead and arsenic within the area.

3 GROUND INVESTIGATION METHODOLOGY

3.1 Background

3.1.1 The exploratory ground investigation undertaken was designed to provide information on the ground conditions to aid with the design of the development; and to investigate the potential pollutant linkages identified as part of the Preliminary Risk Assessment.

3.1.2 All site works were undertaken in accordance with BS5930:2015, BS10175+A2:2017 and, where appropriate, Eurocode 7. Works were supervised by a suitably experienced geoenvironmental consultant from TEC.

3.2 Methodology

3.2.1 A summary of the ground investigation works undertaken and the rationale for each location is provided in in Table 3.1, as follows:

Table 3.1: Summary of Ground Investigation Works

Investigation Method	Location	Date(s)	Location Rationale	Purpose
Trial Pitting (Terex 890)	TP01 – TP16	04.06.2020 - 05.06.2020	Positioned to provide spatial coverage across the site area	Characterisation of shallow ground conditions; and Collection of geochemical and geotechnical samples for laboratory analysis
BRE365 – Soakage Tests	TP01 (SA01) and TP02 (SA02)	04.06.2020	Positioned within potential soakaway locations	Soakage testing following BRE365 methodology
Hand Dug Pits	HS1 to HS5	12.06.2020	Positioned to provide spatial coverage across the site area	Characterisation of shallow ground materials; and Collection of geochemical samples for analysis
Dynamic Cone Penetrometer (DCP-TRL)	DCP01 and DCP02	12.6.2020	Located in approximate areas of proposed access roads/ parking within the southern area of the site	Provision of indicative Californian Bearing Ratio (CBR) values
Clegg Hammer Tests	TP04, TP05, TP07, TP09, TP11 and TP12	04.6.2020 - 05.6.2020	Located in approximate areas of proposed access roads/ parking within the central and northern area of the site	Provision of indicative Californian Bearing Ratio (CBR) values

3.2.2 Exploratory hole locations are presented on Figure 3. A detailed description of encountered ground conditions are shown on exploratory hole logs presented in Appendix D.

3.3 Field Testing

3.3.1 A summary of in situ field testing undertaken as part of these ground investigation works is provided in Table 3.2

Table 3.2: Summary of Field Testing

Field Test	Purpose
Hand Shear Vane (HSV)	Estimation of undrained shear strengths of cohesive strata

3.4 Chemical Testing

3.4.1 Laboratory testing was scheduled on the basis of the Preliminary Risk Assessment and field observations.

3.4.2 Representative soil and groundwater samples were collected and chemically tested at i2 Analytical Ltd, a UKAS/MCERTS accredited laboratory, for a selection of the following parameters:

Soils (Totals)

- *Heavy metals and metalloids;*
- *Total Organic Carbon (TOC);*
- *Phenols (monohydric);*
- *Total Cyanide;*
- *Sulphate, sulphide, elemental sulphur and pH;*
- *Speciated Polyaromatic Hydrocarbons (PAH);*
- *Total Petroleum Hydrocarbons (TPH-CWG), including BTEX and MTBE; and*
- *Asbestos Screen.*

3.4.3 Geochemical certificates of analysis are presented Appendix E.

3.5 Geotechnical Testing

3.5.1 Selected soil samples were submitted for geotechnical analysis at K4 Soils Ltd. Laboratory testing was scheduled upon the basis of field observations for a selection of the following:

- *Atterberg limit tests – natural moisture content, liquid limit and plastic limit;*
- *Particle size distribution (PSD) tests;*
- *Point load tests; and*
- *BRE SD1 Suite B – Water soluble and acid soluble sulphates, total sulphur and pH.*

3.5.2 Soil geotechnical certificates of analysis are presented in Appendix F.

3.6 General Sampling

3.6.1 Samples were collected in accordance with the following guidance;

- BS5930:2015 – Code of practice for ground investigations;
- BS-EN 1997-2:2007 - Eurocode 7 — Geotechnical design —Part 2: Ground investigation and testing
- BS ISO 10175:2011+A2:2017 - Investigation of potentially contaminated sites – Code of practice;
- BS ISO 18400-105 Soil quality – Sampling - Packaging, transport, storage and preservation of samples; and
- BS ISO 18400-106 Soil quality – Sampling - Quality control and quality assurance.

4 GROUND INVESTIGATION FINDINGS

4.1 Introduction

4.1.1 A summary of encountered ground conditions for the site is provided below. Detailed descriptions of encountered ground conditions are shown on exploratory hole logs presented in Appendix D. Photographs of the materials encountered are presented within Appendix A.

Made Ground

4.1.2 Made ground was encountered across the site to depths of between 0.15m to 0.5mbgl and was noted to comprise brown slightly gravelly slightly sandy clay with occasional rootlets. The gravel was generally recorded as brick, tile, clinker, quartzite and chalk.

Solid Geology

4.1.3 The natural ground was generally observed to comprise stiff to very stiff, high strength, reddish brown, locally grey, slightly gravelly, slightly sandy clay, interbedded with very weak reddish brown slightly sandy mudstone. Grey sandstone was recorded within a single location between 1.8mbgl and 2.4mbgl towards the north of the site.

4.1.4 The gravel component within the underlying materials were generally observed to comprise subangular to sub-rounded mudstone and occasional sandstone.

4.2 Groundwater

4.2.1 Groundwater observations recorded during the ground investigation are summarised in Table 4.1 below. Groundwater observations are also shown on the exploratory hole logs in Appendix D.

Table 4.1: Summary of Groundwater Conditions

Location	Groundwater Strike (mbgl)
	05/06/2020
TP15	3.2

4.2.2 Groundwater was encountered at a single location on site at TP15, located within the southern area of the site.

4.2.3 It should be noted that groundwater conditions recorded during the investigation may not be representative of long-term conditions and that groundwater levels may vary in response to meteorological/ seasonal changes.

4.3 Contamination Observations

4.3.1 No visual or olfactory evidence of potentially gross contamination was observed during the ground investigation.

5 LAND CONTAMINATION - GENERIC QUANTITATIVE RISK ASSESSMENT

5.1.1 The generic quantitative risk assessment comprises a screening of identified contaminants against generic assessment criteria (GAC) that are appropriate to the site setting and the receptors concerned.

5.2 Human Health

Methodology

5.2.1 Detailed information on the background legislation and selection of the GAC used within this assessment for human health is presented in Appendix G.

5.2.2 The standard land use for the site, for use in this generic assessment, has been defined as "*residential with homegrown produce*" based on the proposed development and in accordance with current guidance.

5.2.3 As the site investigation methodology involved targeted sampling, statistical analysis has not been undertaken and the results have been directly compared to the GAC.

Summary of Results

5.2.4 The full human health generic quantitative risk assessment is presented in Appendix G.

Made Ground / Near Surface Materials

5.2.5 The results of the assessment recorded localised exceedances of the GAC and therefore the following contaminants of potential concern (CoPC) have been identified within the made ground and near surface materials;

- Heavy *metals – lead (TP14 at 0.1mbgl) and beryllium (HS1 at 0.3mbgl and HS2 at 0.5mbgl)*

5.2.6 An asbestos screen completed on samples of the made ground and near surface materials at the laboratory recorded no suspected asbestos containing material or detectable asbestos fibres.

5.3 Controlled Waters

Methodology

5.3.1 Leachate analysis has not been undertaken on the sampled made ground/ shallow soils and no groundwater samples have been collected as part of this site investigation, owing to the following;

- No visual or olfactory evidence of contamination was noted during the site investigation;
- The site is underlain by cohesive strata, which would restrict migration of any potential leachable contaminants;
- No consistent groundwater body was recorded during the ground investigation works; and
- There are no reported groundwater abstractions within 250m and the site is not reported to be located within an Environment Agency Source Protection Zone.

5.3.2 On this basis, no risk to controlled waters from migration of leachable contaminants within the made ground or migration of dissolved phase contaminants to the wider aquifer has been identified. Therefore, these potential pollutant linkages have not been considered further within this assessment.

5.4 Ground Gas

5.4.1 In accordance with BS8485:2019 and CL:AIRE RB17, an assessment of the risk posed by ground gases at the site has been undertaken based on the findings of the desk study and ground investigation and the conceptual side model. The following site specific information has been considered as part of the assessment;

- No landfills, areas of potentially significant infilled ground or mine openings/ workings have been identified within proximity to the site;
- A shallow thickness of made ground has been recorded at the site to depths of between 0.15m and 0.5mbgl. No significant organic material was observed within these soils and it is considered that the majority of this material is likely to be removed as part of site preparation works;
- The natural soils were recorded to generally be cohesive in nature and of typically low organic content; and
- The site is located within a lower to immediate radon affected area, which does not require radon protective measures within the proposed development.

5.4.2 No credible source or pathway for ground gas has been identified at the site as part of these works. Therefore, no further ground gas monitoring or assessment is considered to be required and no specific ground gas protection measures are considered necessary for the proposed development. Therefore, these potential pollutant linkages have not been considered further within this assessment.

5.5 Updated Conceptual Model

5.5.1 The findings of the site investigation and the GQRA have been used to update the conceptual model and confirm the relevant pollutant linkages associated with the proposed development.

Identified Sources

5.5.2 Sources of contamination identified on and within the vicinity of the site are summarised below:

On Site Sources

- Made ground and shallow natural soils

Off Site Sources

- Potentially contaminative land uses within proximity of the site including adjacent former railway, coal yard and sewage treatment works

Identified Receptors

5.5.3 Receptors identified as part of this updated conceptual model are:

- Current/future site users; and
- Construction workers;

Identified Pathways

5.5.4 Potential contaminant pathways relating to the identified receptors and contaminants of concern include:

- Dermal contact – contact with soil, dust or water;
- Ingestion - ingestion of soil, dust or water; and
- Inhalation – inhalation of soil, dust or vapours;

5.5.5 The updated conceptual model is presented in Table 5.1. References to risk estimations are made in accordance with the methodology presented in CIRIA publication C552 (2001) titled *'Contaminated Land Risk Assessment: A Guide to Good Practice'* and summarised in Appendix B.

Table 5.1: Updated Conceptual Model (Hazard Assessment and Risk Estimation)

Identified Hazard / Source	Identified Receptor	Potential Pathway	Potential Consequence of Source-Pathway-Receptor Pollutant Linkage	Potential Likelihood for Source-Pathway-Receptor Pollutant Linkage	Risk Classification
Made Ground / Near Surface Materials	Current and future site users and construction workers	Exposure to potential contaminants through ingestion, inhalation and dermal contact.	Medium	**Low Likelihood to Likely:** Made ground has been recorded across the site to depths of 0.5mbgl. Laboratory geochemical analysis of representative samples of the made ground and shallow natural ground recorded localised exceedances of heavy metals (lead and beryllium) when considering a residential site end us with homegrown produce. Therefore, where made ground remains in soft landscaping areas after finished site levels have been achieved, exposure to potential contaminants cannot be discounted.	**Low to Moderate**
Potentially Contaminative Land Uses - off site	Current and future site users and construction workers	Exposure to potential contaminants through ingestion, inhalation and dermal contact.	Medium	**Unlikely**: While a number of potentially contaminative current and historic process have been recorded in close proximity to the site, no visual or olfactory evidence of potentially significant contamination was observed within the ground materials encountered at the site.	**Low Risk**

6 LAND CONTAMINATION - CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

6.1.1 Laboratory analytical results of the encountered made ground and near surface materials reported both organic and inorganic contaminants to be generally below the relevant GAC for a residential site end use with homegrown produce. However, localised exceedances of the GAC have been recorded during the exploratory investigation for lead and beryllium.

6.1.2 No risk to controlled waters from migration of leachable contaminants within the made ground or migration of dissolved phase contaminants to the wider aquifer has been identified.

6.1.3 No credible source or pathway for ground gas has been identified at the site as part of these works. Therefore, no further ground gas monitoring or assessment is considered to be required and no specific ground gas protection measures are considered necessary for the proposed development. In addition, no radon protective measures are considered necessary within the construction of new homes.

6.2 Remedial Appraisal

6.2.1 Localised contaminants of potential concern (CoPC) have been recorded within the made ground and shallow natural soils when considering a residential site end use.

6.2.2 Therefore, where soft landscaping is proposed in such areas and where made ground / near surface materials remain after finished site levels have been achieved, localised exposure to potential contaminants cannot be discounted and a suitable cover system may be required within areas of soft landscaping. Alternatively, given the limited and localised nature of these exceedances further testing may be undertaken once final site levels are achieved, and final proposed development designs are in place, to determine the requirement for any such remedial measures.

6.3 General Considerations

6.3.1 Given the presence of general made ground, good brownfield site working practices should be adopted by construction workers to mitigate against potential risks.

6.3.2 Should water supply pipes be placed within the made ground encountered at the site, due consideration would need to be given to the UK Water Industry Research Ltd (UKWIR) guidance.

6.3.3 Based on our conceptual understanding of the site to-date, it would be anticipated that similar ground conditions to those encountered as part of this assessment exist across the site areas where access has been possible. However, should significant thicknesses of made ground be encountered, or visual or olfactory evidence of potentially significant contamination be identified during the development works, further investigation and assessment may be required.

7 GROUND ENGINEERING

7.1 Proposed Development

7.1.1 The site comprises a number of undeveloped fields, currently used for agricultural purposes.

7.1.2 The proposed development is understood to comprise the redevelopment of the site for a residential site end use and comprises the construction of up to 71No. residential properties with associated soft landscaping and hard infrastructure, including car parking and access roads.

7.1.3 Although no details have been provided to TEC, line loads of up to 75kN per metre run have been assumed for the residential development at this preliminary stage and general recommendations with regards to the ground engineering have been made.

7.2 Site Preparation

7.2.1 The site was noted to generally slope from north to site with available Ordnance Survey mapping indicating the northern site boundary is located at ~17mAOD (Above Ordnance Datum) sloping down to the southern boundary, which is located at ~13.0mAOD. While full details have not been provided, consideration to the slope and potential for retaining features may be required during the construction of the proposed development.

7.3 Geotechnical Test Data Summary

7.3.1 Laboratory test data are presented in Appendix F while in situ test results are presented on the engineering logs Appendix D.

Classification

7.3.2 Atterberg Limit tests were undertaken on 4no. cohesive samples, summarised in Table 7.1 below:

Table 7.1: Summary of Laboratory Test Results

Moisture Content (%)	Plasticity Index (%)	% passing 425µm sieve	Modified Plasticity Index[(1)] (%)	Volume Change Potential[(1)]
22 - 34	19 – 33	54 – 100	12.9 – 32.7	Low to Medium

Note 1: Based on recommendations provided in the NHBC Standard

7.3.3 In addition, particle size distribution (PSD) tests were undertaken on 2no. samples of the more granular deposits, as follows;

- TP05 at 1.5m – slightly gravelly sandy silty clay with a recorded fines component of 42.5%, sand component of 51.0% and gravel component of 6.5%; and
- TP15 at 1.1m – sandy silty clay with occasional gravel with a recorded fines component of 42.7%, sand component of 41.9% and gravel component of 15.4%.

Soil Strength

7.3.4 A summary of the geotechnical field test data is provided in Table 7.2 overleaf.

Table 7.2: Summary of Geotechnical Field Test Data

Stratum	Hand Shear Vane Range (kPa)	Characteristic Strength (kPa)	Undrained Strength Classification(1)
Mercia Mudstone Group (Cohesive)	95 - 260	100	High Strength

(1) BS5930:2015/ BS EN ISO 14688-2:2004

Rock Strength

7.3.5 Pont Load tests were undertaken on representative samples of the encountered mudstone as summarised in Table 7.3 below:

Table 7.3: Summary of Laboratory Test Results

Stratum	Number of Tests	Point Load - $Is_{(50)}$	Unconfined Compressive Strength (MPa)
Mercia Mudstone Group	5	0.52 - 5.92	11.5 - 136.2

7.4 Foundations

7.4.1 It is considered that conventional foundations may be suitable for the proposed development. The underlying soils have been recorded to be of low to medium volume change potential, requiring a minimum founding depth of 0.9mbgl to be adopted within the design, where foundations are judged to be beyond the influence of proposed, existing, or historic planting (NHBC/ LABC).

7.4.2 When founding at this depth, within the generally stiff, high strength clay encountered on site from a depth of 0.5mbgl, an allowable bearing resistance of 100kN/m^2 would be considered appropriate, with total settlements of less than 25mm anticipated at the assumed pressures.

7.4.3 It should be noted that mudstone was encountered at shallow depths in some of the trial pit locations. The thickness of this material was variable and, in some locations, underlain by stiff slightly sandy clay. The minimum foundation depths for shrinkable soils would therefore still need to be considered where shallow mudstone bands are recorded. In addition, the bedrock materials may not be laterally continuous beneath the properties and care should be taken to ensure each unit is founded on similar materials in order to reduce potential differential settlement.

7.4.4 Given the reported low to medium volume change potential of the underlying ground materials, suitable voids may be required against the foundations and below and against the sides of ground beams, as outlined in the NHBC Standards.

7.5 Ground Floor Slabs

7.5.1 Based on the ground condition encountered during the investigation, ground bearing slabs may be appropriate for the proposed development.

7.6 Preliminary Pavement Design

7.6.1 The CBR results are summarised in Table 7.4 including recommended values for preliminary design purposes based upon these initial findings. The results are presented in Appendix I.

Table 7.4: Summary of CBR Data

Stratum	Method	Derived CBR Values (%)	Recommended CBR for Preliminary Design (%)
Mercia Mudstone Group at assumed formation level >500mmbgl	DCP(1)	7.4 - 13.9	3
	Clegg Impact Soil Tester	3.13 – 9.82(2) 6.77 – 14.68(3)	
	Correlations with plasticity indices(4)	3 – 5	

(1) Jones CR and R Jolt (1991)

(2) Based upon Equation 1 – Clegg (1980): CBR = 0.07 (CIV)2

(3) Based upon Equation 2 – Clegg (1986): CBR = (0.24 (CIV) + 1)2

(4) CD225 (2020) Design for new pavement foundations (formerly IAN 73/06 revision 1 (2009), HD 25/94) and LR1132 (1984), assumes low water table and average and well drained construction conditions

7.6.2 It should be noted that all road formations should be proof rolled and soft spots removed and replaced with selected granular fill and, where adoptable, a pavement of sufficient thickness (>450mm) to prevent the penetration of frost should be employed.

7.6.3 CBR values of the subgrade should be confirmed by in situ testing when final formation levels are known.

7.7 Excavations

7.7.1 Excavations at the site for conventional foundations may be achievable using conventional equipment, although it is anticipated that breakers may be required at relatively shallow depths where mudstone is encountered.

7.7.2 Groundwater seepage was recorded at a single location (TP15) at a depth of 3.2mbgl. Based on observations made during the ground investigations, groundwater ingress into excavations is considered unlikely to be significantly problematic although some dewatering may be required, particularly where excavations are left open for any length of time. It would be recommended that formation levels are protected to mitigate against softening associated with any such water ingress.

7.7.3 It should be noted that groundwater levels might fluctuate according to the season and from year to year. This may have implications on recommendations, including those for foundations and excavations. Accordingly, a careful watch should be maintained during any future groundworks and the recommendations presented in this report may be subject to amendment should additional information becoming available.

7.7.4 It is recommended that appropriate shoring/temporary works are used in accordance with current Health and Safety requirements where access for personnel is required into excavations.

7.8 Protection of Buried Concrete

7.8.1 BRE SD1 Suite B testing was undertaken on 4no. samples of the encountered ground materials.

7.8.2 The results of the testing, together with the resulting Aggressive Chemical Environment for Concrete (ACEC) Class and Design Sulphate (DS) Class, as derived in accordance with BRE Special Digest 1, are presented in Table 7.5. The full laboratory results are presented in Appendix F.

Table 7.5: Summary of ACEC

Stratum	No. of tests	pH	Water Soluble Sulphate (mg/l)	Oxidisable Sulphides (%)	Total Potential Sulphates (%)	ACEC	DS
Made Ground	8	7.2 - 7.6	0.0078 - 0.030	-	-	AC-1	DS-1
Natural	4	8.0 - 8.4	<0.02	<0.01	0.03 – 0.12	AC-1	DS-1

7.9 Drainage

7.9.1 Soakage testing was undertaken at 2No. locations on site in general accordance with BRE365 (Appendix H).

7.9.2 Both soakage tests failed to drain during the test period (i.e. 75% effective water depth). Based on the testing undertaken to date, the encountered ground materials are considered unlikely to provide a suitable drainage material for the use of soakaways on site.

7.10 Waste

7.10.1 Waste Acceptance Criteria (WAC) testing has not been carried out as part of this assessment. The geochemical analysis results may be used to aid in Basic Characterisation for potential waste ground materials produced at the site although WAC testing may be required to be undertaken to support any off-site disposal of materials generated as part of the development works.

8 GROUND ENGINEERING - CONCLUSIONS AND RECOMMENDATIONS

8.1.1 Conventional foundations may be suitable for the proposed development. A minimum founding depth of 0.9m would be recommended where outside the influence of existing or proposed trees/ planting. At this depth, the encountered materials are considered to be able to provide an allowable bearing resistance in the region of 100kN/m^2. Given the presence of soils of low to medium volume change potential, suitable voids may be required against the foundations and below and against the sides of ground beams, as outlined in the NHBC Standards.

8.1.2 It should be noted that mudstone was encountered at shallow depths in some of the trial pit locations. The thickness of this material was variable and, in some locations, underlain by stiff slightly sandy clay. The minimum foundation depths for shrinkable soils would therefore still need to be considered where shallow mudstone bands are recorded. In addition, the bedrock materials may not be laterally continuous beneath the properties and care should be taken to ensure each unit is founded on similar materials in order to reduce potential differential settlement.

8.1.3 A preliminary design CBR value in of 3% has been derived based on the test data to-date. CBR values of the subgrade should be confirmed by in situ testing when final formation levels are known.

8.1.4 The results of the soakage testing undertaken indicate that soakaways are unlikely to be feasible for the proposed development.

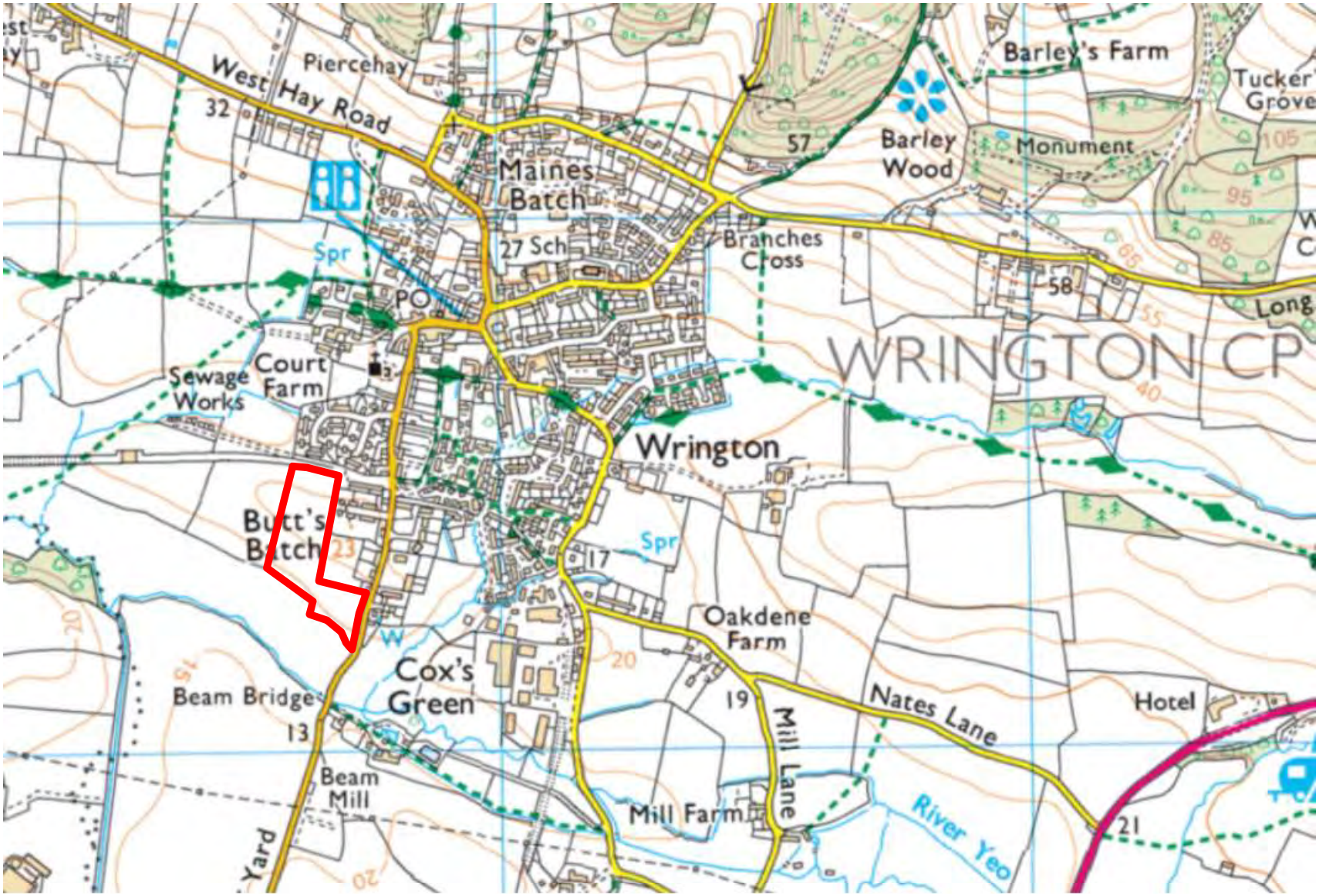
8.1.5 The results of the sulphate and pH testing from the soils at the site yield an aggressive chemical environment class (ACEC) of AC-1, requiring a design sulphate class of DS-1 for the shallow ground conditions.

9 RECOMMENDED FURTHER WORKS

9.1.1 Given the assessment presented within this report, additional sampling and analysis may be undertaken once site preparation works are complete to allow for potential refinement of the remedial requirements on site.

TEC

FIGURES AND DRAWINGS



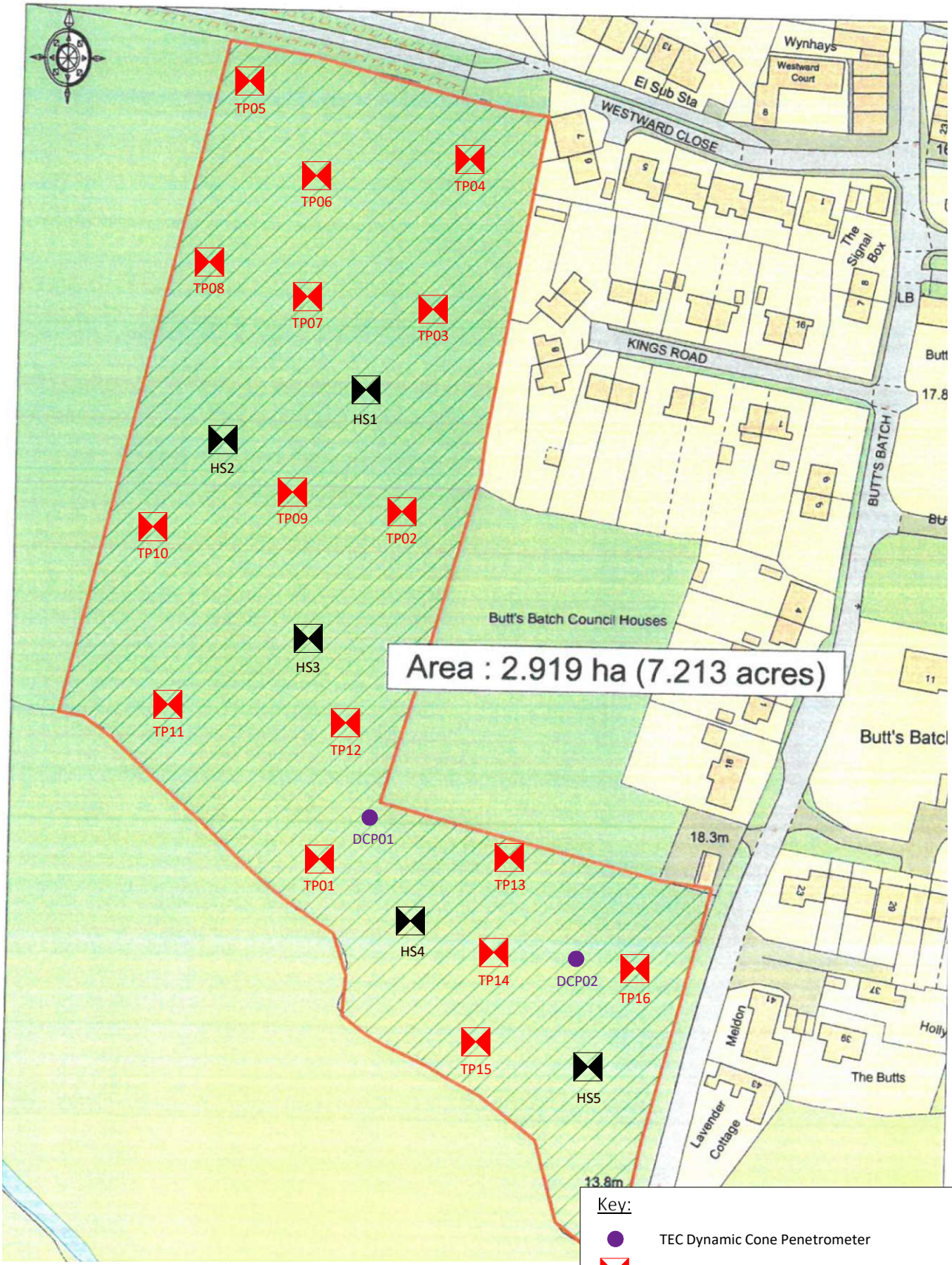
Approximate Site Location:

Ordnance Survey © Crown Copyright [2020] All rights reserved.
Licence number 100043301

tec	TEC The Old Chapel 35a Southover Wells, Somerset BA5 1UH	Tel: 01749 677760 Email: info@tecon.co.uk Web: www.tecon.co.uk	Site Name: Butts Batch, Wrington	Drawing Name: Site Location Plan	Client Name: Strongvox Ltd	Project No: 1912013.002	Figure No: 1	Date: July 2020	Scale: NTS

Extract of Focus On Design 'Butts Batch, Wrington - Illustrative Masterplan' Dwg No. 0701-1003, August 2020

tec	TEC The Old Chapel 35a Southover Wells, Somerset BA5 1UH	Tel: 01749 677760 Email: info@tecon.co.uk Web: www.tecon.co.uk	Site Name: Butts Batch, Wrington			Scale: NTS
Drawing Name: Proposed Development Plan			Client Name: Strongvox Ltd	Project No: 1912013.002	Date: November 2020	Figure No: 2A



Extract of OS plan provided by client (Strongvox Ltd)

Key:

- TEC Dynamic Cone Penetrometer
- TEC Trial Pit
- TEC Hand Dug Pit

*All locations are approximate

tec	TEC The Old Chapel 35a Southover Wells, Somerset BA5 1UH	Tel: 01749 677760 Email: info@tecon.co.uk Web: www.tecon.co.uk	Site Name: Butts Batch, Wrington		Scale: NTS
Drawing Name: Exploratory Hole Location Plan		Client Name: Strongvox Ltd	Project No: 1912013.002	Date: July 2020	Figure No: 3

Appendix A

Site Photographs

Photograph 1: TP01 (SA01) located on the southern border of the site.

Photograph 2: View ofTP02 (SA02) along the Eastern border of the site.

Photograph 3: Encountered materials recovered from TP05

Photograph 4: Encountered materials recovered from TP12.

Photograph 5: Encountered materials recovered from TP11.

Photograph 6: Encountered materials recovered from TP16.

Appendix B

Risk Methodologies and Evaluation

Risk Evaluation

The qualitative assessment methodology presented in CIRIA publication C552 (2001) titled *'Contaminated Land Risk Assessment: A Guide to Good Practice'* has been used by TEC for the basis of evaluating potential risk.

The method requires an assessment of the:

- magnitude of the probability or likelihood of the risk occurring (Table 1); and
- magnitude of the potential consequence or severity of the risk occurring (Table 2)

Table 1. Classification of Probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short-term and likely over the long-term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place, and is less likely in the short-term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table 2. Classification of Consequence

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. (Note: Water Resources Act contains no scope for considering significance of pollution). Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem, or organisation forming part of such ecosystem (note: the definitions of ecological systems within the draft circular on Contaminated Land, DETR, 2000).	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to human health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water resources. (Note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within draft circular on Contaminated Land, DETR, 2000).	Concentration of a contaminant from site exceeding the generic or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the draft circular on Contaminated Land, DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (for example foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc), easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discolouration of concrete.

The combination of the two factors is determined using Table 3 and the resulting level of risk is described in Table 4. The evaluation can be applied to each of the scenarios identified in the risk model and the overall risk assessed.

Table 3. Combination of Consequence with Probability

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	**Very High Risk**	**High Risk**	**Moderate Risk**	**Moderate/Low Risk**
	Likely	**High Risk**	**Moderate Risk**	**Moderate/Low Risk**	**Low Risk**
	Low Likelihood	**Moderate Risk**	**Moderate/Low Risk**	**Low Risk**	**Very Low Risk**
	Unlikely	**Moderate/Low Risk**	**Low Risk**	**Very Low Risk**	**Very Low Risk**

Table 4. Description of risks and likely action required

Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, or there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short-term and are likely over the longer-term.
Moderate Risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the long-term.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Using the risk model the pollutant linkages are identified and a preliminary estimate of risk undertaken. If there is no pollutant linkage identified, then there is no risk. If the estimate of risk for all the linkages and exposure scenarios is very low at this stage then it is likely that no further assessment will be required.

Appendix C

Regulatory Correspondence

Date: **25 March 2020**
Ref: RJA/357255
Your Ref
Contact: Richard Allard
Direct Dial: 01275 884798
Email: richard.allard@n-somerset.gov.uk

North Somerset COUNCIL
a unitary authority

Sophie Thomas
TEC
The Old Chapel
35A Southover
Wells
Somerset
BA5 1UH

Public Health and Regulatory Services
North Somerset Council
Floor 1, Town Hall
Weston-super-Mare
Somerset
BS23 1UJ

Dear Sophie

Re: Land of Butts Batch, Wrington

With reference to your email dated 03 March 2020, please find below the information you require.

1. North Somerset Council does not have any records of any pre-license landfill sites within 500m of the subject site.

2. North Somerset Council does not have any records of any pollution incidents or known areas of contaminated land within 500m of the subject site.

3. North Somerset Council does not have any records of any Part B authorisations within 500m of the subject site.

4. North Somerset Council does not have any records of any private water supplies within 500m of the subject site.

5. North Somerset Council does not have any records of the storage of petroleum hydrocarbons on or in the vicinity of the subject site.

6. North Somerset Council does not have any records of any previous site investigations on or in close proximity to the site

7. North Somerset Council does not have any records of any unexploded ordnance in the site area

8. North Somerset Council does not have any records of any known problems with ground gas in the site area

9. North Somerset Council does not have any specific information on any potential issues regarding naturally elevated contaminant concentrations, however it is not uncommon to find elevated levels of lead and arsenic within the area.

10. North Somerset Council does not have any other information which may have an impact upon the contaminative status of the site.

Please note that the information provided should not prejudice any further enquiries with other Authorities and is based on that currently available to North Somerset Council. The Council does not guarantee the validity or accuracy of the information and accepts no liability for any loss or damage, costs or claims arising either directly or indirectly from its use or interpretation.

The fee for this search is £79 + VAT, an invoice will follow shortly.

Should you require any more information or wish to discuss the above, please do not hesitate to contact me.

Yours sincerely

Richard Allard
Senior Scientific Officer

This letter can be made available in large print, audio, easy read and other formats.
Documents on our website can also be emailed to you as plain text files.
Help is also available for people who require council information in languages other than English. For more information contact the sender of this letter.

The content of this communication is meant for disclosure to the intended recipient(s) only. If you have received this in error, please notify the sender and destroy the communication without copying it or forwarding it.
You should be aware that all communications received and sent by this council are subject to the Freedom of Information Act 20

Appendix D

Exploratory Hole Logs

Trial Pit Log

Trialpit No **TP01**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.9m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.50	D			0.50			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of quartzite, clinker, brick, chalk and tile. (MADE GROUND)
	1.00	D			1.00			Stiff reddish brown sandy CLAY.
					1.90			Very weak reddish brown slightly sandy MUDSTONE.
								End of pit at 1.9 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP02**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 2.1m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
					0.30			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of quartzite, clinker, brick, and tile. (MADE GROUND)
	0.80	D			0.80			Stiff reddish brown slightly gravelly slightly sandy CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
					2.10			Very weak reddish brown slightly sandy MUDSTONE.
								End of pit at 2.1 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

AGS

Trial Pit Log

Trialpit No **TP03**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 2.9m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	2.20	D			0.15			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of brick, tile, clinker, quartzite and chalk. (MADE GROUND)
								Very weak reddish brown slightly sandy MUDSTONE.
					2.90			End of pit at 2.9 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 3.3m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m × 0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.5 0.5 0.5	HV HV HV	100kPa 125kPa 95kPa		0.30			Brown slightly clayey gravelly sand with occasional rootlets. Gravel of quartzite, chalk, clay pipe, brick and tile. (MADE GROUND)
								Stiff high strength reddish brown sandy CLAY.
					2.00			Very weak reddish brown slightly sandy MUDSTONE.
	3.20	D			3.25			End of pit at 3.3 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 3.5m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.10	ES			0.20			Brown slightly gravelly sandy clay with occasional rootlets. Gravel of chalk, brick, quartzite and clinker. (MADE GROUND)
								Very weak reddish brown sandy MUDSTONE.
	1.50	B			1.50			Reddish brown slightly gravelly sandy silty CLAY. Gravel of fine to medium subangular mudstone.
	1.50	D						
					3.20			Very weak reddish brown sandy MUDSTONE.
					3.50			End of pit at 3.5 m

Remarks:

Stability: Stable

Trial Pit Log

Trialpit No **TP06**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 2.3m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.10	ES						Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel ofbrick, tile, clinker and quartzite. (MADE GROUND)
					0.30			Reddish brown mottled grey slightly sandy MUDSTONE.
	1.0	HV	105kPa		1.00			Stiff to very stiff high strength reddish brown slightly gravelly slightly sandy CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
	1.0	HV	135kPa					
	1.0	HV	150kPa					
	1.20	D			1.30			Very weak reddish brown mottled grey slightly sandy MUDSTONE.
					2.30			End of pit at 2.3 m

Remarks: Terminated due to the presence of bedrock

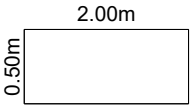
Stability: Stable

Trial Pit Log

Trialpit No **TP07**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 2.9m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
					0.20			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of quartzite, clinker, flint, brick and tile. (MADE GROUND)
								Very weak reddish brown slightly sandy MUDSTONE.
					1.40			Very stiff reddish brown slightly sandy CLAY.
					1.60			Very weak reddish brown mottled grey slightly sandy MUDSTONE.
	2.00	D			1.80			Grey slightly gravelly SANDSTONE. Gravel of sub angular to sub rounded fine to coarse mudstone.
					2.40			Very weak reddish brown slightly sandy MUDSTONE.
					2.90			End of pit at 2.9 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

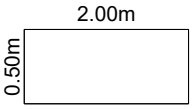
Stability: Stable

Trial Pit Log

Trialpit No **TP08**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 04/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 3.8m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES						Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of fine to coarse chalk, brick, tile and clinker. (MADE GROUND)
					0.30			Stiff reddish brown slightly sandy CLAY.
					1.00			Very weak reddish brown mottled grey slightly sandy slightly clayey MUDSTONE.
					1.80			Stiff reddish brown slightly gravelly slightly sandy CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
					3.00			Very weak reddish brown MUDSTONE.
					3.80			End of pit at 3.8 m

1 2 3 4 5

Remarks:

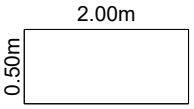
Stability: Stable

Trial Pit Log

Trialpit No **TP09**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.5m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
					0.30			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of chalk, quartzite, brick, tile and clinker. (MADE GROUND)
								Very weak reddish brown slightly sandy MUDSTONE.
	1.20	D						
	1.20	ES						
	1.3	HV	150kPa		1.30			
	1.3	HV	225kPa					Very stiff high strength reddish brown slightly gravelly slightly sandy CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
	1.3	HV	260kPa		1.50			End of pit at 1.5 m

Remarks: Terminated due to the presence of bedrock

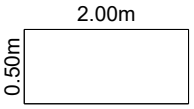
Stability: Stable

Trial Pit Log

Trialpit No **TP10**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.2m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
					0.15			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of chalk, quartzite, brick, tile and clinker. (MADE GROUND)
								Very weak reddish brown MUDSTONE.
					0.70			Very weak reddish brown gravelly MUDSTONE. Gravel of angular to sub rounded fine to coarse quartzite and sandstone.
	1.00	D						
					1.15			End of pit at 1.2 m

Remarks: Terminated due to the presence of bedrock

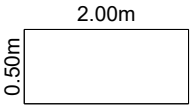
Stability: Stable

Trial Pit Log

Trialpit No **TP11**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 3.4m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
								Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of chalk, brick, quartzite, tile and clinker. (MADE GROUND)
					0.30			Very weak reddish brown slightly sandy MUDSTONE.
					1.00			Extremely weak reddish brown mottled grey slightly clayey slightly gravelly MUDSTONE. Gravel of angular to sub rounded fine to coarse quartzite.
					1.80			Reddish brown mottled grey slightly clayey slightly gravelly SAND. Gravel of sub angular to sub rounded fine to coarse quartzite and mudstone.
	3.10	ES						
					3.40			End of pit at 3.4 m

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP12**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.9m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.90	B			0.20			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of chalk, brick, clinker and quartzite. (MADE GROUND)
								Stiff grey slightly gravelly slightly sandy CLAY with rare lithorelicts of mudstone. Gravel of sub angular to sub rounded fine to coarse quartzite.
					1.20			Very weak slightly clayey slightly sandy MUDSTONE.
					1.90			End of pit at 1.9 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP13**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.7m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.10	D						Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, quartzite and clinker. (MADE GROUND)
					0.30			Very stiff high strength reddish brown slightly gravelly sandy CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
	0.8	HV	175kPa					
	0.8	HV	175kPa					
	0.8	HV	250kPa					
	1.50	ES			1.50			Very weak grey slighlty sandy MUDSTONE. Very closely to closely laminated.
					1.70			*Very closely to closely spaced laminae*
								End of pit at 1.7 m

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP14**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: 2.00m × 0.50m Inclination: ° Orientation: ° Depth: 1.9m	Scale 1:25
Client: Strongvox Ltd			Logged AT

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES			0.25			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of brick, quartzite, chalk, tile and clinker. (MADE GROUND)
					0.75			Stiff brown slightly sandy CLAY
					1.10			Very weak reddish brown mottled grey slightly sandy MUDSTONE
					1.90			Very weak grey MUDSTONE
								End of pit at 1.9 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

Trial Pit Log

Trialpit No **TP15**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 3.2m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
								Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of brick, tile, clinker, quartzite. (MADE GROUND)
	0.60	D			0.50			Medium strong to strong grey SANDSTONE.
	1.10	D			0.90			Light grey slightly clayey slightly gravelly SAND. Gravel of sub angular to sub rounded fine to coarse sandstone and mudstone.
					1.30			Reddish brown sandy silty CLAY with occasional fine to medium strongly cemented mudstone fragments.
					1.70			Very weak grey MUDSTONE.
	2.50	ES			2.50			Stiff high strength reddish brown mottled grey slightly gravelly CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
	2.5	HV	110kPa					
	2.5	HV	110kPa					
	2.5	HV	125kPa					
▼					3.10			Brown slightly silty slightly sandy GRAVEL of angular to sub rounded fine to coarse sandstone and mudstone.
					3.20			End of pit at 3.2 m

1 2 3 4 5

Remarks:

Stability: Stable

AGS

Trial Pit Log

Trialpit No **TP16**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 05/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 1.3m	Scale 1:25
Client: Strongvox Ltd			Logged AT

2.00m

0.50m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
					0.15			Brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel of brick, chalk, clinker and quartzite. (MADE GROUND)
								Stiff brown slightly sandy CLAY.
					0.50			Medium strong light grey SANDSTONE.
					0.60			Stiff reddish brown slightly gravelly CLAY. Gravel of sub angular to sub rounded fine to coarse mudstone.
					1.15			Very weak grey slightly clayey MUDSTONE.
					1.25			End of pit at 1.3 m

1 2 3 4 5

Remarks: Terminated due to the presence of bedrock

Stability: Stable

AGS

Trial Pit Log

Trialpit No **HS1**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 12/06/2020
Location: Wrington		Dimensions: 0.30m (0.30m) Inclination: ° Orientation: ° Depth: 0.4m	Scale 1:25
Client: Strongvox Ltd			Logged AT

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.30	ES			0.35			Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, clinker and quartzite. (MADE GROUND)
					0.40			Very weak reddish brown MUDSTONE. End of pit at 0.4 m

Remarks: Hand dug location for geoenvironmental sampling only

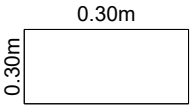
Stability:

Trial Pit Log

Trialpit No **HS2**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 12/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 0.5m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES						Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, clinker and quartzite. (MADE GROUND)
	0.50	ES			0.40			Stiff reddish brown CLAY.
					0.50			End of pit at 0.5 m

1
2
3
4
5

Remarks: Hand dug location for geoenvironmental sampling only

Stability:

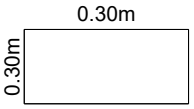
AGS

Trial Pit Log

Trialpit No **HS3**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 12/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 0.2m	Scale 1:25
Client: Strongvox Ltd			Logged AT



Water Strike	Samples and In Situ Testing: Depth	Type	Results	Information	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES			0.20			Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, clinker and quartzite. (MADE GROUND)
								End of pit at 0.2 m

1
2
3
4
5

Remarks: Hand dug location for geoenvironmental sampling only

Stability:

AGS

Trial Pit Log

Trialpit No **HS4**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 12/06/2020
Location: Wrington		Dimensions: 0.30m x 0.30m Inclination: ° Orientation: ° Depth: 0.3m	Scale 1:25
Client: Strongvox Ltd			Logged AT

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.25	ES			0.25			Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, clinker and quartzite. (MADE GROUND)
								End of pit at 0.3 m

1
2
3
4
5

Remarks: Hand dug location for geoenvironmental sampling only

Stability:

Trial Pit Log

Trialpit No **HS5**

Sheet 1 of 1

Project Name: Butts Batch	Project No. 1912013	Co-ords: - Level: mbgl	Date 12/06/2020
Location: Wrington		Dimensions: Inclination: ° Orientation: ° Depth: 0.5m	Scale 1:25
Client: Strongvox Ltd			Logged AT

0.30m

0.30m

Water Strike	Samples and In Situ Testing				Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results	Information				
	0.30	ES			0.35			Brown slightly gravelly slightly sandy clay. Gravel of brick, tile, clinker and quartzite. (MADE GROUND)
	0.45	ES			0.45			Stiff reddish brown slightly sandy CLAY.
								End of pit at 0.5 m

1 2 3 4 5

Remarks: Hand dug location for geoenvironmental sampling only

Stability:

Appendix E

Geochemical Certificates of Analysis

Ashely Thorne
Tweedie Evans Consulting Ltd
The Old Chapel
35a Southover
Wells
Somerset
BA5 1UH

t: 01749 677 760
f: 01749 679 345

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 20-13631

Project / Site name:	Butts Batch	**Samples received on:**	09/06/2020
Your job number:	1912013	**Sample instructed/ Analysis started on:**	11/06/2020
Your order number:		**Analysis completed by:**	25/06/2020
Report Issue Number:	1	**Report issued on:**	25/06/2020
Samples Analysed:	3 soil samples		

Signed: A. Czerwińska

Agnieszka Czerwińska

Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 20-13631

Project / Site name: Butts Batch

Lab Sample Number				1530989	1530990	1530991		
Sample Reference				TP06	TP08	TP14		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.10	0.10	0.10		
Date Sampled				04/06/2020	04/06/2020	05/06/2020		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1		
Moisture Content	%	N/A	NONE	9.9	9.0	8.0		
Total mass of sample received	kg	0.001	NONE	0.40	0.42	0.40		
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected		
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.6	7.6	7.4		
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1		
Total Sulphate as SO_4	mg/kg	50	MCERTS	890	-	-		
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.011	0.0078	0.0092		
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.8	1.9	2.0		
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0		
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05		
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	22	20		
Barium (aqua regia extractable)	mg/kg	1	MCERTS	460	640	520		
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.2	1.3	1.2		
Boron (water soluble)	mg/kg	0.2	MCERTS	1.2	1.8	1.8		
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.0	1.7	1.2		
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2		
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	34	33	30		
Copper (aqua regia extractable)	mg/kg	1	MCERTS	34	38	36		
Lead (aqua regia extractable)	mg/kg	1	MCERTS	87	190	220		
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	0.5	< 0.3		
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	27	25		
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.8	3.2	< 1.0		
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	45	45	40		
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	190	340	190		

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 20-13631

Project / Site name: Butts Batch

Lab Sample Number				1530989	1530990	1530991		
Sample Reference				TP06	TP08	TP14		
Sample Number				None Supplied	None Supplied	None Supplied		
Depth (m)				0.10	0.10	0.10		
Date Sampled				04/06/2020	04/06/2020	05/06/2020		
Time Taken				None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	< 1.0	-	-		
Toluene	µg/kg	1	MCERTS	< 1.0	-	-		
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	-		
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	-		
o-xylene	µg/kg	1	MCERTS	< 1.0	-	-		
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	-		
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	< 10	-	-		
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-		
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-		
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	-		
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	-	-		
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	-		
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001	-	-		
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	-		
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	-		
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	-	-		
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	-	-		
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	-		

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-13631

Project / Site name: Butts Batch

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1530989	TP06	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1530990	TP08	None Supplied	0.10	Brown loam and clay with gravel and vegetation.
1530991	TP14	None Supplied	0.10	Brown loam and clay with gravel and vegetation.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-13631

Project / Site name: Butts Batch

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-13631

Project / Site name: Butts Batch

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
TP06		S	20-13631	1530989	c	Total cyanide in soil	L080-PL	c
TP08		S	20-13631	1530990	c	Total cyanide in soil	L080-PL	c

Key: a - No sampling date b - Incorrect container
c - Holding time d - Headspace e - Temperature

Ashley Thorne
Tweedie Evans Consulting Ltd
The Old Chapel
35a Southover
Wells
Somerset
BA5 1UH

t: 01749 677 760
f: 01749 679 345
e: ashley.thorne@tecon.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 20-14554

Project / Site name:	Butts Batch, Wrington	**Samples received on:**	16/06/2020
Your job number:	1912013.002	**Sample instructed/ Analysis started on:**	16/06/2020
Your order number:		**Analysis completed by:**	29/06/2020
Report Issue Number:	1	**Report issued on:**	29/06/2020
Samples Analysed:	5 soil samples		

Signed:

Will Fardon

Technical Reviewer (CS Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 20-14554

Project / Site name: Butts Batch, Wrington

Lab Sample Number				1535897	1535898	1535899	1535900	1535901
Sample Reference				HS1	HS2	HS3	HS4	HS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.50	0.20	0.35	0.30
Date Sampled				12/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	9.6	11	11	8.0	9.3
Total mass of sample received	kg	0.001	NONE	0.50	0.50	0.50	0.50	0.50
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	7.2	7.7	7.5	7.6	7.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO_4	mg/kg	50	MCERTS	-	-	-	-	970
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.018	0.023	0.019	0.017	0.030
Sulphide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Organic Carbon (TOC)	%	0.1	MCERTS	2.7	0.9	3.6	2.8	3.4
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.13	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.10	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.10	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.08	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.15	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.17	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.08	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80	< 0.80	< 0.80	0.99	< 0.80

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number: 20-14554

Project / Site name: Butts Batch, Wrington

Lab Sample Number				1535897	1535898	1535899	1535900	1535901
Sample Reference				HS1	HS2	HS3	HS4	HS5
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.50	0.20	0.35	0.30
Date Sampled				12/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	12	20	19	16
Barium (aqua regia extractable)	mg/kg	1	MCERTS	470	310	570	480	490
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.9	1.8	1.5	1.7	1.7
Boron (water soluble)	mg/kg	0.2	MCERTS	1.5	0.9	1.8	1.4	1.6
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.3	0.9	1.4	1.5	1.1
Chromium (hexavalent)	mg/kg	1.2	MCERTS	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	45	40	39	43	44
Copper (aqua regia extractable)	mg/kg	1	MCERTS	58	47	63	50	65
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	52	140	170	120
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.4	0.4	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	30	27	30	30
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	46	39	42	49	49
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	240	230	240	230	200
Monoaromatics & Oxygenates								
Benzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Toluene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
o-xylene	µg/kg	1	MCERTS	-	-	-	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	-	-	-	-	< 1.0
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-	-	-	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	-	-	-	-	< 0.001
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-	-	-	-	< 10

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-14554

Project / Site name: Butts Batch, Wrington

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1535897	HS1	None Supplied	0.30	Brown loam and sand with gravel and vegetation.
1535898	HS2	None Supplied	0.50	Brown sandy clay with gravel and vegetation.
1535899	HS3	None Supplied	0.20	Brown loam and sand with gravel and vegetation.
1535900	HS4	None Supplied	0.35	Brown loam and sand with gravel and vegetation.
1535901	HS5	None Supplied	0.30	Brown loam and sand with gravel and vegetation.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-14554

Project / Site name: Butts Batch, Wrington

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

Analytical Report Number : 20-14554

Project / Site name: Butts Batch, Wrington

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

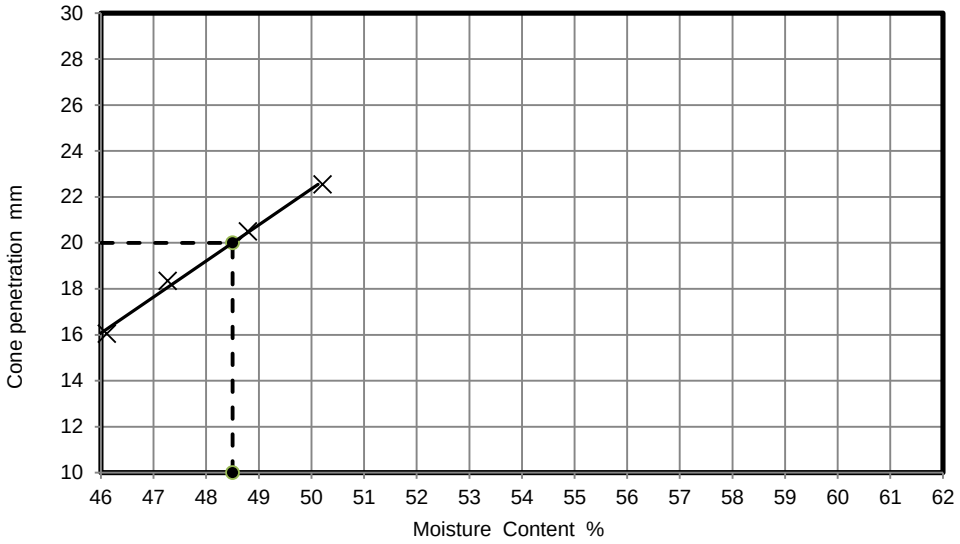
Appendix F

Geotechnical Laboratory Report

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Site Name	Butts Batch			Sample No.	2
Project No.	1912013	Client	TEC	Depth Top	1.00 m
Soil Description	Dark grey and brown mottled slightly sandy silty CLAY with occasional fmc claystone fragments			Depth Base	- m
				Sample Type	D
				Samples received	09/06/2020
				Schedules received	10/06/2020
				Project Started	11/06/2020
				Date Tested	23/06/2020

Job No.	28345
Borehole/Pit No.	TP01

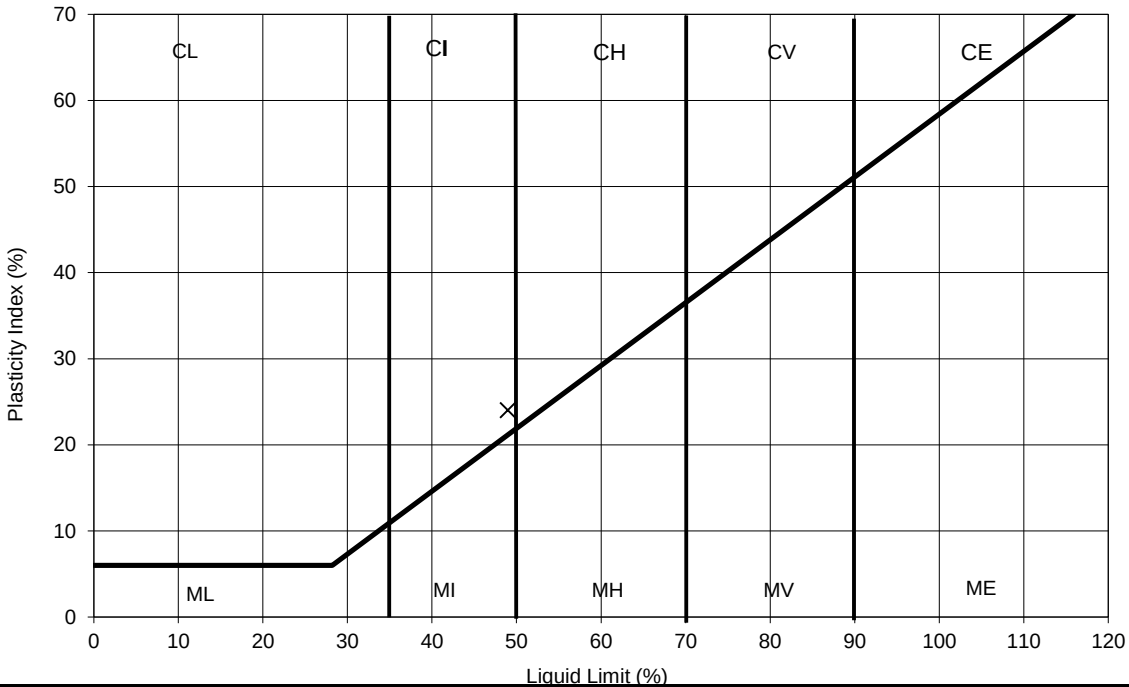


NATURAL MOISTURE CONTENT	**22**	**%**
% PASSING 425µm SIEVE	**54**	**%**
LIQUID LIMIT	**49**	**%**
PLASTIC LIMIT	**25**	**%**
PLASTICITY INDEX	**24**	**%**

Remarks

Sample washed to obtain test fraction

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

Initials: J.P
Date: 29/06/2020

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU
Tel: 01923 711 288 Email: James@k4soils.com

2519

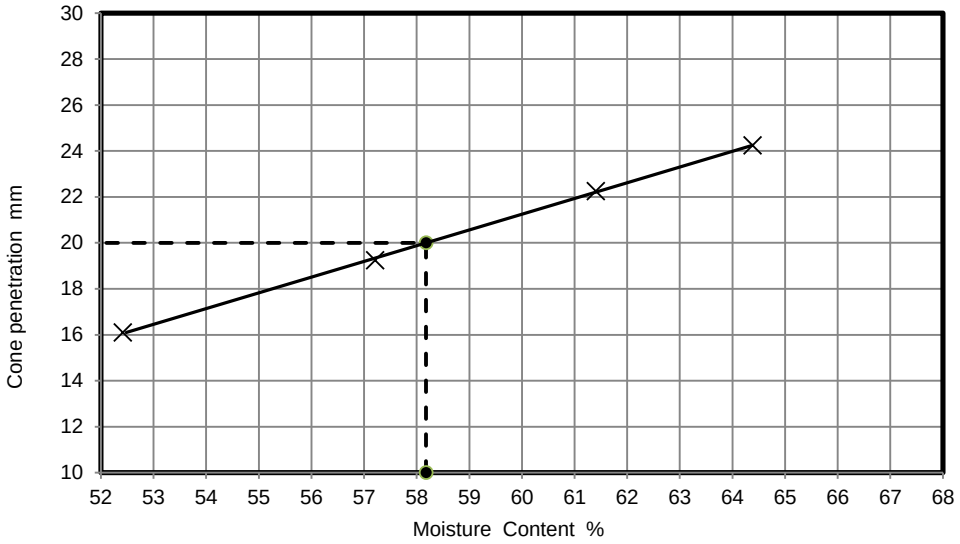
Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

MSF-5 R2

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Site Name	Butts Batch			Sample No.	3
Project No.	1912013	Client	TEC	Depth Top	0.80 m
Soil Description	Reddish brown slightly mottled grey slightly sandy silty CLAY			Depth Base	- m
				Sample Type	D
				Samples received	09/06/2020
				Schedules received	10/06/2020
				Project Started	11/06/2020
				Date Tested	23/06/2020

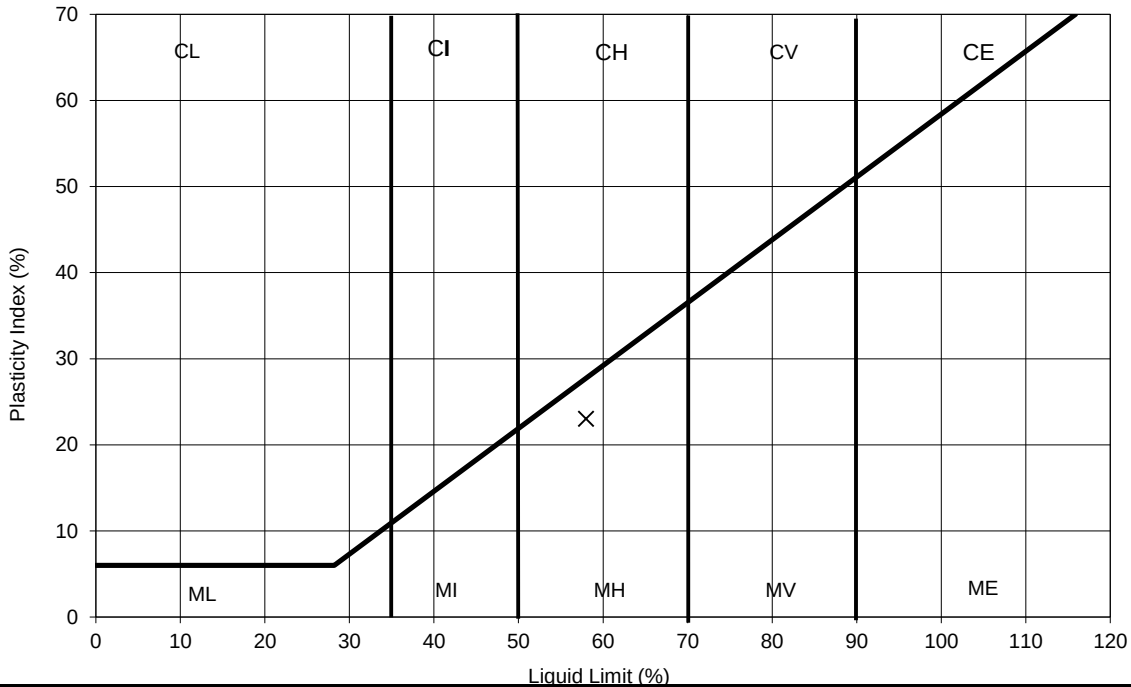
Job No.	28345
Borehole/Pit No.	TP02



NATURAL MOISTURE CONTENT	**29**	**%**
% PASSING 425µm SIEVE	**100**	**%**
LIQUID LIMIT	**58**	**%**
PLASTIC LIMIT	**35**	**%**
PLASTICITY INDEX	**23**	**%**

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

Initials: J.P
Date: 29/06/2020

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU
Tel: 01923 711 288 Email: James@k4soils.com

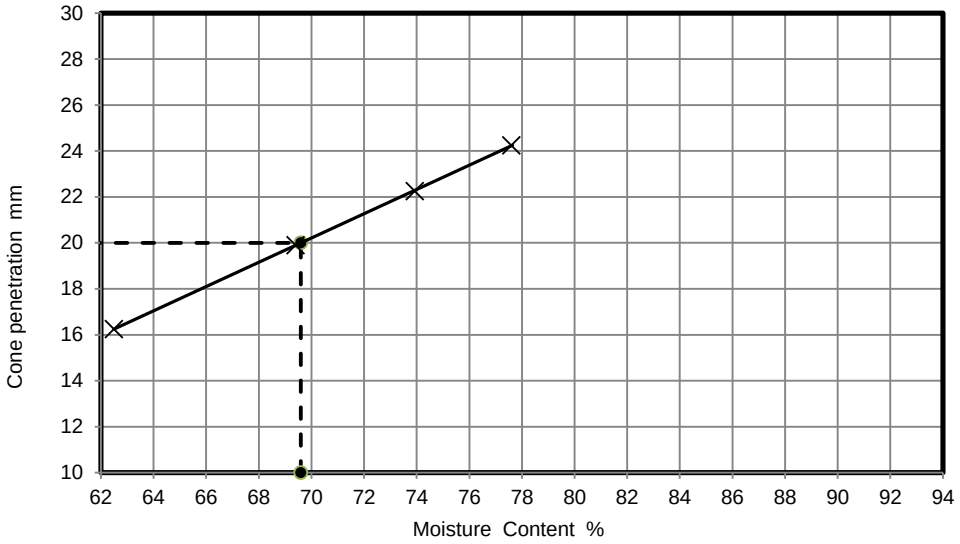
2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Site Name	Butts Batch			Sample No.	7
Project No.	1912013	Client	TEC	Depth Top	1.20 m
Soil Description	Reddish brown slightly mottled grey slightly sandy silty CLAY with rare fine gravel			Depth Base	- m
				Sample Type	D
				Samples received	09/06/2020
				Schedules received	10/06/2020
				Project Started	11/06/2020
				Date Tested	23/06/2020

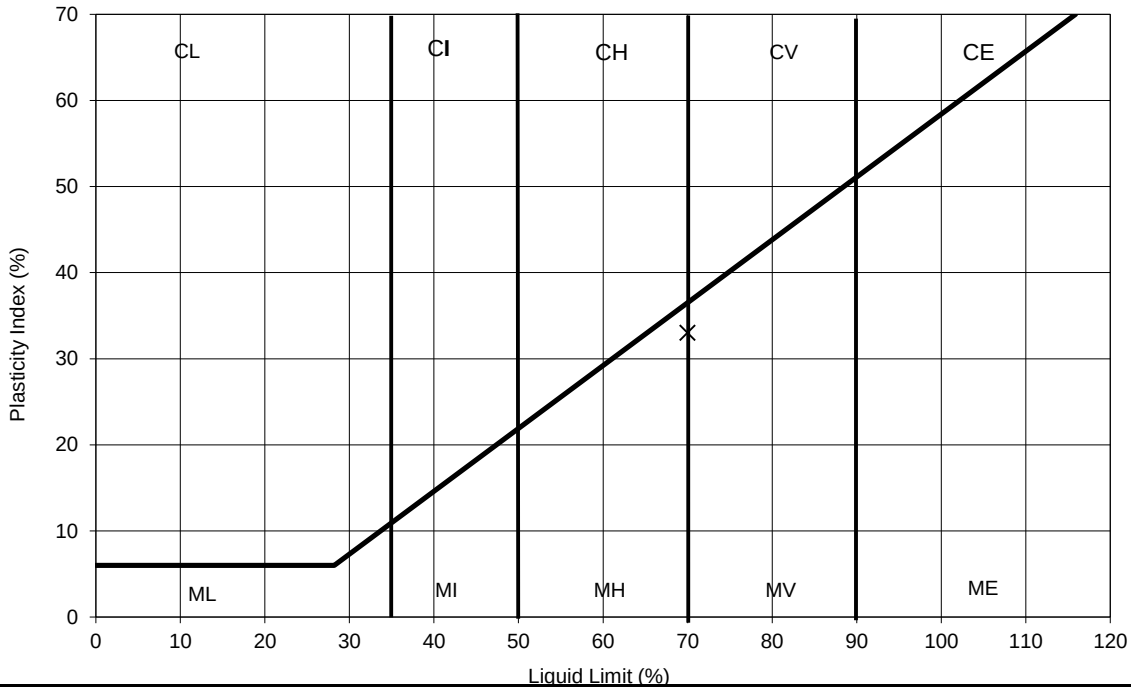
Job No.	28345
Borehole/Pit No.	TP06



NATURAL MOISTURE CONTENT	**34**	**%**
% PASSING 425µm SIEVE	**99**	**%**
LIQUID LIMIT	**70**	**%**
PLASTIC LIMIT	**37**	**%**
PLASTICITY INDEX	**33**	**%**

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

Initials: J.P
Date: 29/06/2020

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU
Tel: 01923 711 288 Email: James@k4soils.com

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

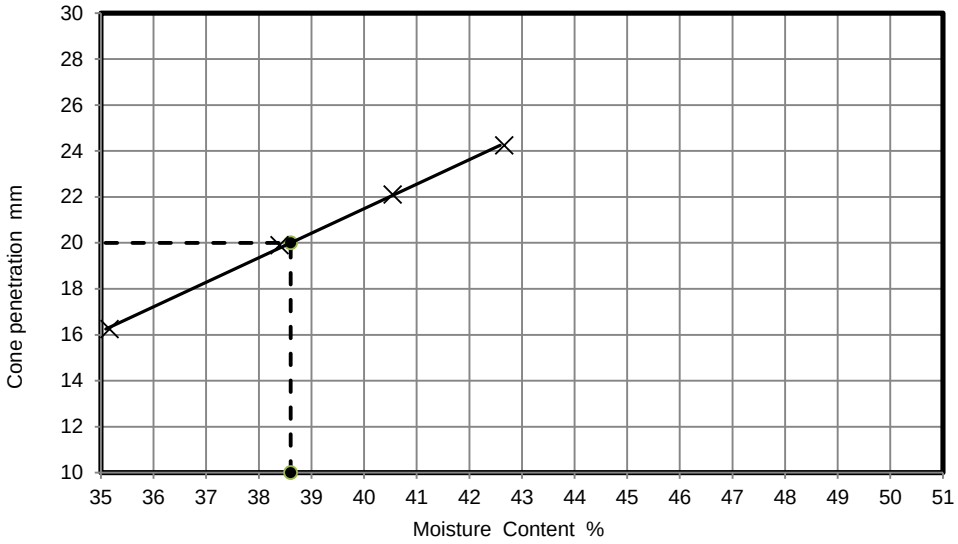
MSF-5 R2

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

Site Name	Butts Batch			Sample No.	14
Project No.	1912013	Client	TEC	Depth Top	0.90 m
Soil Description	Grey slightly mottled light brown slightly sandy silty CLAY			Depth Base	- m
				Sample Type	B
				Samples received	09/06/2020
				Schedules received	10/06/2020
				Project Started	11/06/2020
				Date Tested	23/06/2020

Job No. 28345

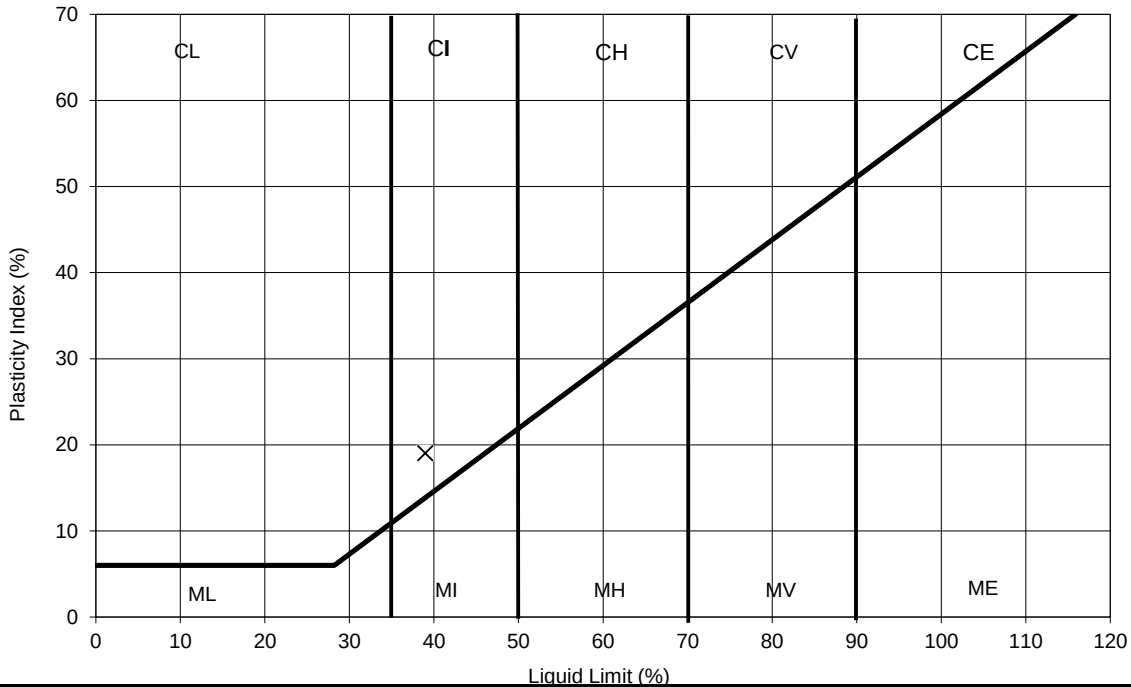
Borehole/Pit No. TP12



NATURAL MOISTURE CONTENT	**22**	**%**
% PASSING 425µm SIEVE	**100**	**%**
LIQUID LIMIT	**39**	**%**
PLASTIC LIMIT	**20**	**%**
PLASTICITY INDEX	**19**	**%**

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Checked and Approved

Initials: J.P

Date: 29/06/2020

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU
Tel: 01923 711 288 Email: James@k4soils.com

UKAS TESTING

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
28345	Butts Batch	Samples received	09/06/2020
		Schedule received	10/06/2020
Project No.	Client	Project started	11/06/2020
1912013	TEC	Testing Started	23/06/2020

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top m	Base m	Type		%	%	%	%	%	
TP01	2	1.00	-	D	Dark grey and brown mottled slightly sandy silty CLAY with occasional fmc claystone fragments	22	54	49	25	24	Sample washed to obtain test fraction
TP02	3	0.80	-	D	Reddish brown slightly mottled grey slightly sandy silty CLAY	29	100	58	35	23	
TP06	7	1.20	-	D	Reddish brown slightly mottled grey slightly sandy silty CLAY with rare fine gravel	34	99	70	37	33	
TP12	14	0.90	-	B	Grey slightly mottled light brown slightly sandy silty CLAY	22	100	39	20	19	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3, 4.4 and 5.0

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials **J.P**

Date: 29/06/2020

Summary of Point Load Test Results

Job No.	Project Name	Programme	
28345	Butts Batch	Samples received	09/06/2020
		Schedule received	10/06/2020
Project No.	Client	Project started	11/06/2020
1912013	TEC	Date started	16/06/2020

Hole No.	Sample				Description	Test Type	Sample Width W (mm)	Platen Separation D (mm)	Failure Load P (kN)	Equivalent Diameter De (mm)	P/De2 (Mpa)	Correction Factor F	Is (50)	Remarks
	Ref	Top m	Base m	Type										
TP15	12	0.60	-	D	Grey cobble size SANDSTONE fragments	Irregular lump	79.00	39.00	21.00	62.63	5.35	1.11	5.92	
TP15	12	0.60	-	D	Grey cobble size SANDSTONE fragments	Irregular lump	49.00	39.00	12.50	49.33	5.14	0.99	5.11	
TP15	12	0.60	-	D	Grey cobble size SANDSTONE fragments	Irregular lump	90.00	20.00	3.50	47.87	1.53	0.98	1.50	
TP15	12	0.60	-	D	Grey cobble size SANDSTONE fragments	Irregular lump	70.00	10.00	1.52	29.85	1.71	0.79	1.35	
TP15	12	0.60	-	D	Grey cobble size SANDSTONE fragments	Irregular lump	65.00	23.00	1.05	43.63	0.55	0.94	0.52	

Tested in accordance with ISRM 325-89 RTH Suggested Method for Determining Point Load Strength

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

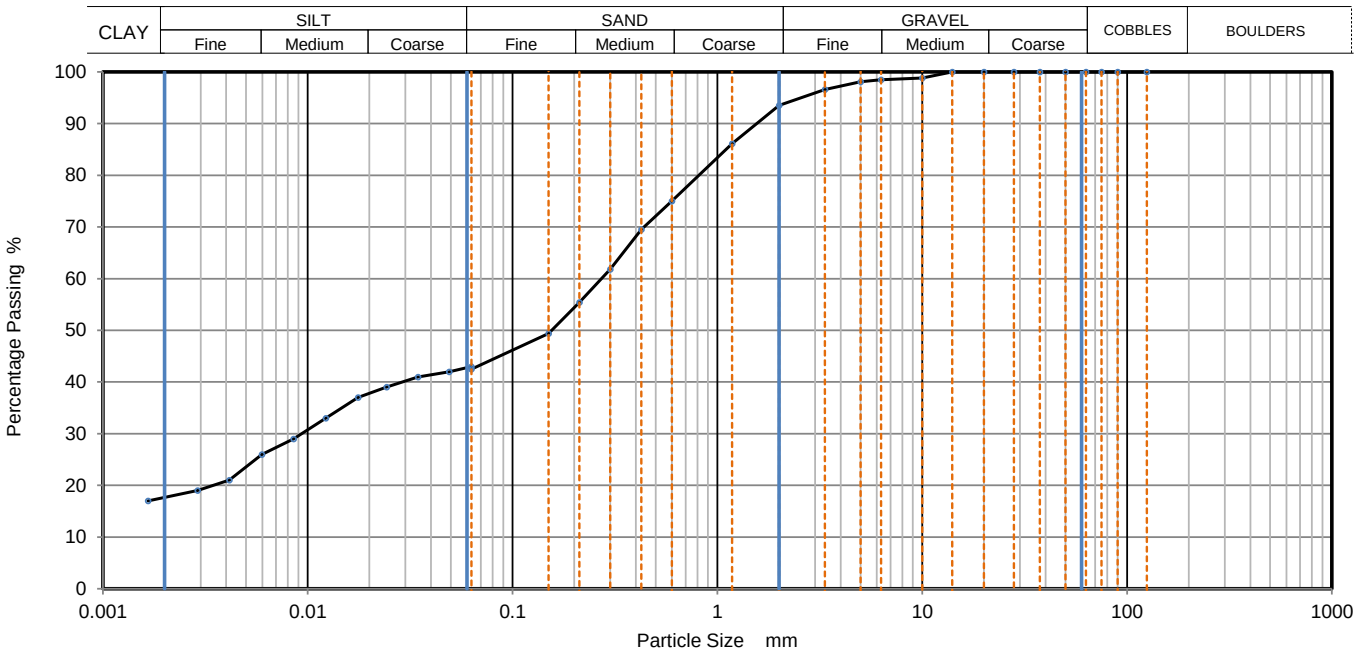
Initials **J.P**

Date: 29/06/2020

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

PARTICLE SIZE DISTRIBUTION

Site Name	Butts Batch			Job Ref	28345
				Borehole/Pit No.	TP05
Project No.	1912013	Client	TEC	Sample No.	15
				Depth Top	1.50 m
Soil Description	Reddish brown slightly gravelly sandy silty CLAY (gravel is fm and sub-angular)			Depth Base	- m
				Sample Type	B
				Samples received	09/06/2020
				Schedules received	10/06/2020
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	11/06/2020
				Date tested	23/06/2020



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0490	42
75	100	0.0345	41
63	100	0.0242	39
50	100	0.0176	37
37.5	100	0.0123	33
28	100	0.0085	29
20	100	0.0060	26
14	100	0.0041	21
10	99	0.0029	19
6.3	99	0.0017	17
5	98		
3.35	97		
2	94		
1.18	86		
0.6	75	Particle density	(assumed)
0.425	70	2.70	Mg/m3
0.3	62		
0.212	55		
0.15	49		
0.063	43		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	6.5
Sand	51.0
Silt	24.9
Clay	17.6

Grading Analysis		
D100	mm	
D60	mm	0.273
D30	mm	0.00937
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com

Tel: 01923 711288

Checked and Approved

Initials: **J.P**

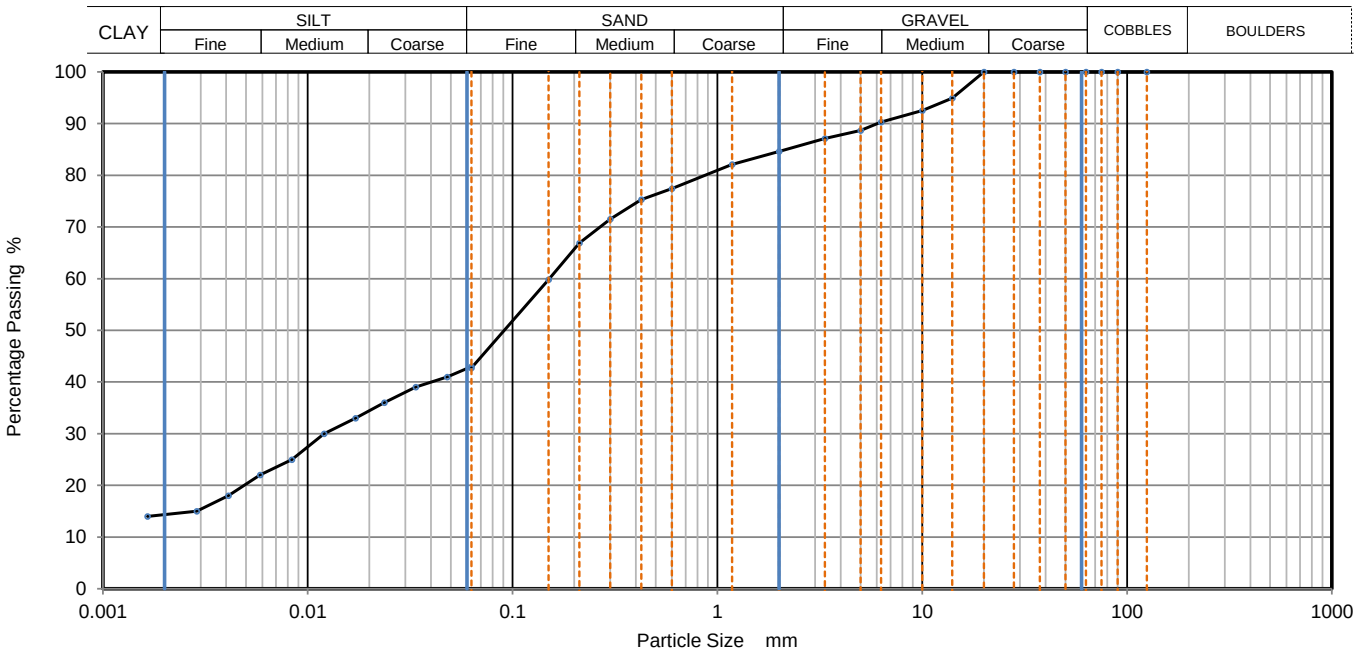
Date: 29/06/2020

UKAS TESTING 2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

PARTICLE SIZE DISTRIBUTION

Site Name	Butts Batch			Job Ref	28345	
				Borehole/Pit No.	TP15	
Project No.	1912013	Client	TEC	Sample No.	13	
				Depth Top	1.10	m
Soil Description	Grey mottled reddish brown sandy silty CLAY with occasional fm strongly cemented mudstone fragments			Depth Base	-	m
				Sample Type	D	
				Samples received	09/06/2020	
				Schedules received	10/06/2020	
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	11/06/2020	
				Date tested	23/06/2020	



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0630	43
90	100	0.0479	41
75	100	0.0336	39
63	100	0.0236	36
50	100	0.0171	33
37.5	100	0.0120	30
28	100	0.0084	25
20	100	0.0059	22
14	95	0.0041	18
10	93	0.0029	15
6.3	90	0.0017	14
5	89		
3.35	87		
2	85		
1.18	82		
0.6	77	Particle density	(assumed)
0.425	75	2.70	Mg/m3
0.3	72		
0.212	67		
0.15	60		
0.063	43		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	15.4
Sand	41.9
Silt	28.4
Clay	14.3

Grading Analysis		
D100	mm	
D60	mm	0.152
D30	mm	0.0118
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com

Tel: 01923 711288

Checked and Approved

Initials: **J.P**

Date: 29/06/2020

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

cs@elab-uk.co.uk
info@elab-uk.co.uk

2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	20-28438
Issue:	1
Date of Issue:	17/06/2020
Contact:	James Phaure
Customer Details:	K4 Soils Laboratory Ltd Unit 8 Watford HertfordshireWD18 9RU
Quotation No:	Q16-00568
Order No:	Not Supplied
Customer Reference:	28345
Date Received:	12/06/2020
Date Approved:	17/06/2020
Details:	Butts Batch
Approved by:	

Mike Varley, Technical Manager

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

This report may only be reproduced in full

Sample Summary

Report No.: 20-28438, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
205905	TP01 2 1.00	Not Provided	12/06/2020	Silty loam	a
205906	TP05 6 1.50	Not Provided	12/06/2020	Silty loam	a
205907	TP06 7 1.20	Not Provided	12/06/2020	Clayey loam	a
205908	TP12 14 0.90	Not Provided	12/06/2020	Silty loam	a

Results Summary

Report No.: 20-28438, issue number 1

				ELAB Reference	205905	205906	205907	205908
				Customer Reference	2	6	7	14
				Sample ID				
				Sample Type	DISTURBED	DISTURBED	DISTURBED	BULK
				Sample Location	TP01	TP05	TP06	TP12
				Sample Depth (m)	1.00	1.50	1.20	0.90
				Sampling Date	Not Provided	Not Provided	Not Provided	Not Provided
Determinand	**Codes**	**Units**	**LOD**					
Soil sample preparation parameters								
Material removed	N	%	0.1		< 0.1	< 0.1	< 0.1	< 0.1
Description of Inert material removed	N		0		None	None	None	None
Anions								
Water Soluble Sulphate	M	g/l	0.02		< 0.02	< 0.02	< 0.02	< 0.02
Inorganics								
Total Sulphur	N	%	0.01		0.04	0.01	0.02	0.02
Acid Soluble Sulphate (SO4)	U	%	0.02		0.11	0.04	0.06	0.06
Miscellaneous								
pH	M	pH units	0.1		8.0	8.4	8.4	8.0

Tests marked N are not UKAS accredited.

Method Summary

Report No.: 20-28438, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	15/06/2020	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	16/06/2020	115	Ion Chromatography
Water soluble anions	M	Air dried sample	15/06/2020	172	Ion Chromatography
Total organic carbon/Total sulphur	N	Air dried sample	15/06/2020	216	IR

Tests marked N are not UKAS accredited

Report Information

Report No.: 20-28438, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
ELAB are unable to provide an interpretation or opinion on the content of this report.
The results relate only to the sample received.
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request
Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Appendix G

Generic Quantitative Risk Assessment: Human Health

Project Number: 1912013.002.01		Lab Sample Number	1530989	1530990	1530991	1535897	1535898	1535899	1535900	1535901	
Project Name: Butts Batch, Wrington		Sample Reference	TP06	TP08	TP14	HS1	HS2	HS3	HS4	HS5	
Site End Use:	GAC (mg/kg)	Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	
Residential with homegrown produce		Depth (m)	0.10	0.10	0.10	0.30	0.50	0.20	0.35	0.30	
		Date Sampled	04/06/2020	04/06/2020	05/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020	
Determinand			1	2	3	4	5				
Arsenic	37[1]	mg/kg	16	22	20	16	12	20	19	16	
Boron	290[3]	mg/kg	1.2	1.8	1.8	1.5	0.9	1.8	1.4	1.6	
Cadmium	22[1]	mg/kg	1.0	1.7	1.2	1.3	0.9	1.4	1.5	1.1	
Chromium (total)	910[3]	mg/kg	34	33	30	45	40	39	43	44	
Chromium (VI)	21[1]	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	
Copper	2400[3]	mg/kg	34	38	36	58	47	63	50	65	
Lead	200[1]	mg/kg	87	190	220	110	52	140	170	120	
Mercury	40[2]	mg/kg	< 0.3	0.5	< 0.3	< 0.3	< 0.3	0.4	0.4	0.6	
Nickel	130[2]	mg/kg	23	27	25	34	30	27	30	30	
Selenium	350[2]	mg/kg	2.8	3.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Zinc	3700[3]	mg/kg	190	340	190	240	230	240	230	200	
Beryllium	1.7[3]	mg/kg	1.2	1.3	1.2	1.9	1.8	1.5	1.7	1.7	
Vanadium	410[3]	mg/kg	45	45	40	46	39	42	49	49	
Barium	1300[4]	mg/kg	460	640	520	470	310	570	480	490	
Cyanide (Total)	20[5]	mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	
Phenol (Monohydric)	120[3]	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Sulphide	-	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Total Organic Carbon (TOC)	-	%	1.8	1.9	2.0	2.7	0.9	3.6	2.8	3.4	
Naphthalene	2.3[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Acenaphthylene	170[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Acenaphthene	210[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Fluorene	170[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Phenanthrene	95[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	< 0.05	
Anthracene	2400[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Fluoranthene	280[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.13	< 0.05	
Pyrene	620[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.10	< 0.05	
Benzo(a)anthracene	7.2[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.10	< 0.05	
Chrysene	15[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	
Benzo(b)fluoranthene	2.6[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.15	< 0.05	
Benzo(k)fluoranthene	77[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.17	< 0.05	
Benzo(a)pyrene	2.2[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	
Indeno(1,2,3-cd)pyrene	27[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	< 0.05	
Dibenz(a,h)anthracene	0.24[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
Benzo(ghi)perylene	320[3]	mg/kg	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	< 0.05	
Speciated Total EPA-16 PAHs	-	mg/kg	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80	0.99	< 0.80	
Benzene	0.087[3]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
Toluene	130[3]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
Ethylbenzene	47[3]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
p & m-xylene	56[3]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
o-xylene	60[3]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	49[4]	µg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
TPH Aliphatic C5 - C6	42[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	
TPH Aliphatic C6 - C8	100[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	
TPH Aliphatic C8 - C10	27[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	
TPH Aliphatic C10 - C12	130[3]	mg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
TPH Aliphatic C12 - C16	1100[3]	mg/kg	< 2.0	-	-	-	-	-	-	< 2.0	
TPH Aliphatic C16 - C21	65000[3]	mg/kg	< 8.0	-	-	-	-	-	-	< 8.0	
TPH Aliphatic C21 - C35	65000[3]	mg/kg	< 8.0	-	-	-	-	-	-	< 8.0	
TPH Aromatic C5 - C7	70[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	

Project Number: 1912013.002.01		Lab Sample Number	1530989	1530990	1530991	1535897	1535898	1535899	1535900	1535901	
Project Name: Butts Batch, Wrington		Sample Reference	TP06	TP08	TP14	HS1	HS2	HS3	HS4	HS5	
Site End Use:	**GAC (mg/kg)**	Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied	
Residential with homegrown produce		Depth (m)	0.10	0.10	0.10	0.30	0.50	0.20	0.35	0.30	
		Date Sampled	04/06/2020	04/06/2020	05/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020	12/06/2020	
TPH Aromatic C7 - C8	130[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	
TPH Aromatic C8 - C10	34[3]	mg/kg	< 0.001	-	-	-	-	-	-	< 0.001	
TPH Aromatic C10 - C12	74[3]	mg/kg	< 1.0	-	-	-	-	-	-	< 1.0	
TPH Aromatic C12 - C16	140[3]	mg/kg	< 2.0	-	-	-	-	-	-	< 2.0	
TPH Aromatic C16 - C21	260[3]	mg/kg	< 10	-	-	-	-	-	-	< 10	
TPH Aromatic C21 - C35	1100[3]	mg/kg	< 10	-	-	-	-	-	-	< 10	

Notes:

[1] DEFRA C4SLs (2014)

[2] Environment Agency SGVs (2009)

[3] LQM/CIEH S4ULs (2015)

[4] CL:AIRE, AGS & EIS (2009)

[5] Dutch Intervention Value for free cyanide (VROM 2000)

*All GACs based on a sandy soil and Soil Organic Matter (SOM) of 1% where applicable.

Concentration does not exceed GAC

Concentration exceeds GAC

No set GAC

Appendix H

Soakage Test Results

Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2016) Soakaway Design

Project:	**Butt's Batch, Wrington**
Project Number:	**1912013.002**
Test Pit Reference:	TP01
Client:	Strongvox Ltd
Operator:	AT
Test Date:	04/06/2020

Test 1

Time (m)	Depth (mm bgl)
0	850
5	870
10	890
15	900
20	920
30	970
45	1000
120	1100
240	1120
420	1130

Test 2

Time (m)	Depth (mm bgl)

Test 3

Time (m)	Depth (mm bgl)

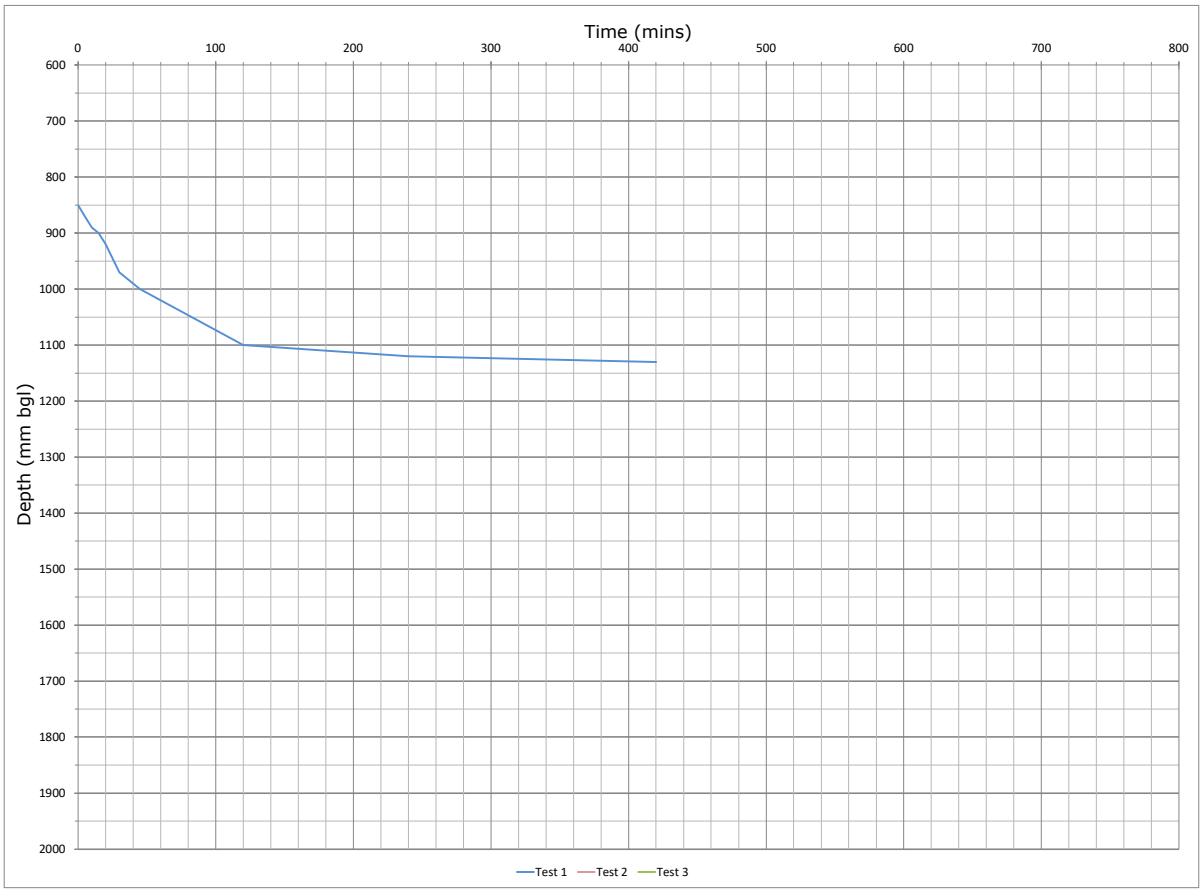
Ground Conditions / Comments

Pit reference	TP01
Pit depth (m)	1.90
Pit width (m)	0.50
Pit length (m)	2.00
Depth to standing water (m)	-
Granular Fill used to stabilise the pit?	N

	Test 1	Test 2	Test 3
Max. depth (mm bgl)	1900		
Effective depth (mm bgl)	850		
Effective drop (mm)	1050		
25% effective depth (mm bgl)	1113		
50% effective depth (mm bgl)	1375		
75% effective depth (mm bgl)	1638		
t_{25} (min)			
t_{75} (min)			
V_{p75-25} (m^3)	0.53		
a_{p50} (m^2)	3.63		
t_{p75-25} (min)	0		

Note: Where granular fill used to stabilise the test pit, assume there to be 30% free volume.

Soil Infiltration Rate (m/sec)	**NA**		
Soil Infiltration Rate (mm/hr)	**NA**		
Extrapolated Data?	**No**		



Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2016) Soakaway Design

Project:	**Butt's Batch, Wrington**
Project Number:	**1912013.002**
Test Pit Reference:	TP02
Client:	Strongvox Ltd
Operator:	AT
Test Date:	04/06/2020

Test 1

Time (m)	Depth (mm bgl)
0	1000
10	1100
60	1150
180	1150
360	1150
420	1150

Test 2

Time (m)	Depth (mm bgl)

Test 3

Time (m)	Depth (mm bgl)

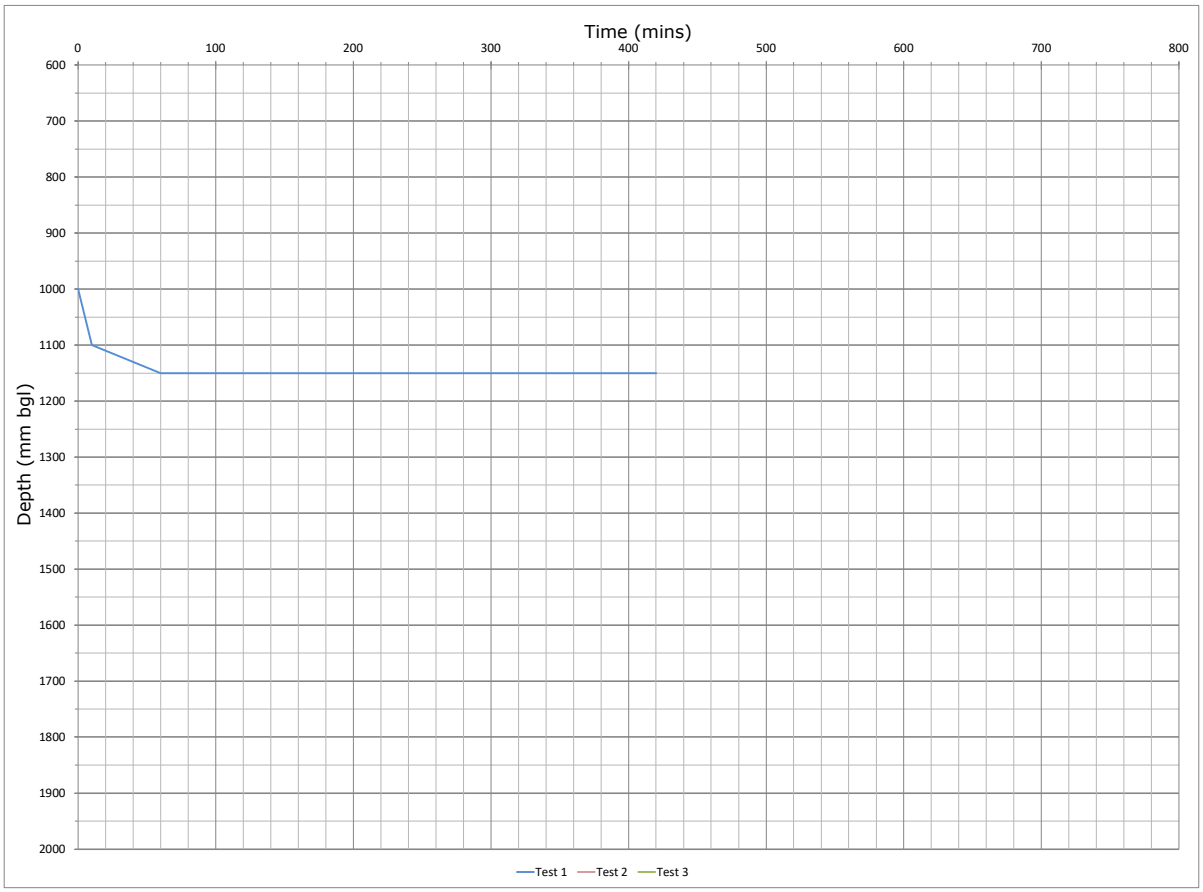
Ground Conditions / Comments

Pit reference	TP02
Pit depth (m)	2.10
Pit width (m)	0.50
Pit length (m)	2.00
Depth to standing water (m)	-
Granular Fill used to stabilise the pit?	N

	Test 1	Test 2	Test 3
Max. depth (mm bgl)	2100		
Effective depth (mm bgl)	1000		
Effective drop (mm)	1100		
25% effective depth (mm bgl)	1275		
50% effective depth (mm bgl)	1550		
75% effective depth (mm bgl)	1825		
t_{25} (min)			
t_{75} (min)			
V_{p75-25} (m^3)	0.55		
a_{p50} (m^2)	3.75		
t_{p75-25} (min)	0		

Note: Where granular fill used to stabilise the test pit, assume there to be 30% free volume.

Soil Infiltration Rate (m/sec)	**NA**		
Soil Infiltration Rate (mm/hr)	**NA**		
Extrapolated Data?	**No**		



Appendix I

DCP-TRL and Clegg Hammer Results

TRL Dynamic Cone Penetration Test Results

DCP1

Cumulative Blow Count	Penetration (mm)	Penetration Index (DPI) mm/blow	Estimated CBR[1] (%)	Adjusted CBR[2] (%)
0	30			
1	50	20.0	12.7	6.8
2	70	20.0	12.7	6.9
4	90	10.0	26.5	14.7
5	110	20.0	12.7	7.2
6	130	20.0	12.7	7.3
8	150	10.0	26.5	15.5
10	170	10.0	26.5	15.7
12	190	10.0	26.5	16.0
13	210	20.0	12.7	7.8
16	250	13.3	19.5	12.4
18	290	20.0	12.7	8.3
20	330	20.0	12.7	8.6
22	370	20.0	12.7	8.8
23	400	30.0	8.3	5.9
25	450	25.0	10.1	7.3
28	500	16.7	15.4	11.7
31	550	16.7	15.4	12.0
33	600	25.0	10.1	8.1
36	650	16.7	15.4	12.8
39	700	16.7	15.4	13.2
42	750	16.7	15.4	13.5
45	800	16.7	15.4	13.9

DCP1

Project:	Butts Batch, Wrington
Project No.	1912013.002
Client:	Strongvox Ltd
Test No.	DCP1
Test Date:	12/06/2020
Surface Moisture:	Dry
Soil Type	Clay over mudstone

Notes/Comments

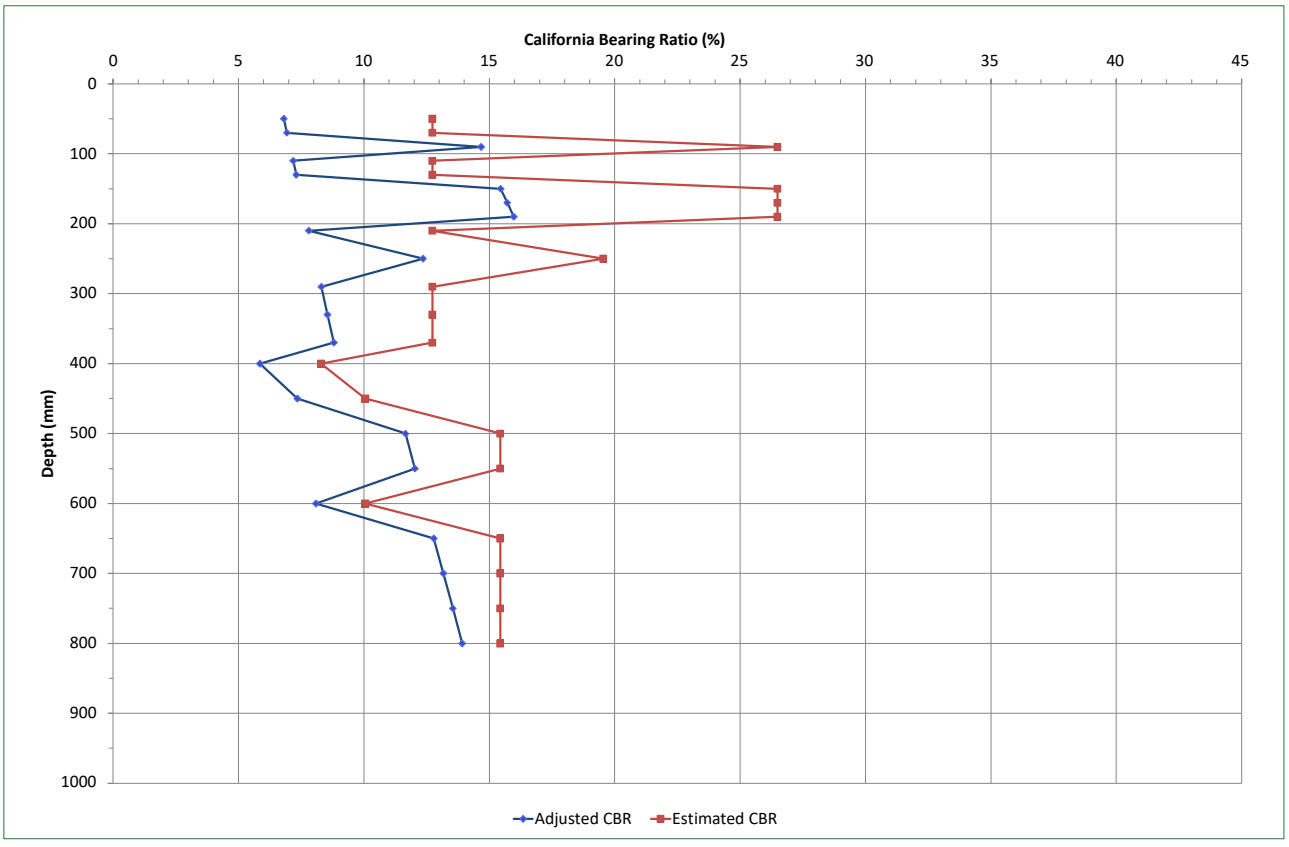
Notes:

1. CBR Value calculated using Jones C R and J Rolt (1991), "*Operating instructions for the TRL dynamic cone penetrometer*" (2nd edition). Information Note. Crowthorne: Transport Research Laboratory, as follows:

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\ \text{Log}_{10}(\text{DPI})$$

2. Adjusted CBR vaules obtined from Table 4.2 of Simon Done and Piouslin Samuel (2006), "*Measuring Road Pavement Strength and Designing Low Volume Sealed Roads using the Dynamic Cone Penetrometer*" Unpublished TRL Project Report UPR/IE/76/06 Project Record No R7783.

The CBR Adjustment Factors are applied to unpaved roads on the assumption that the effect of moisture will be a maximum at the top surface and will reduce linearly to zero at a depth of 1000 mm.



TRL Dynamic Cone Penetration Test Results

DCP2

Cumulative Blow Count	Penetration (mm)	Penetration Index (DPI) mm/blow	Estimated CBR[1] (%)	Adjusted CBR[2] (%)
0	40			
1	60	20.0	12.7	6.9
2	80	20.0	12.7	7.0
5	100	6.7	40.7	22.7
7	120	10.0	26.5	15.1
10	140	6.7	40.7	23.5
14	160	5.0	55.1	32.4
16	180	10.0	26.5	15.8
18	200	10.0	26.5	16.1
21	250	16.7	15.4	9.8
25	300	12.5	20.9	13.7
28	350	16.7	15.4	10.5
30	400	25.0	10.1	7.1
33	450	16.7	15.4	11.3
36	500	16.7	15.4	11.7
39	550	16.7	15.4	12.0
41	600	25.0	10.1	8.1
44	650	16.7	15.4	12.8
46	700	25.0	10.1	8.6
49	750	16.7	15.4	13.5
53	800	12.5	20.9	18.9

DCP2

Project:	Butts Batch, Wrington
Project No.	1912013.002
Client:	Strongvox Ltd
Test No.	DCP2
Test Date:	12/06/2020
Surface Moisture:	Dry
Soil Type	Clay over mudstone

Notes/Comments

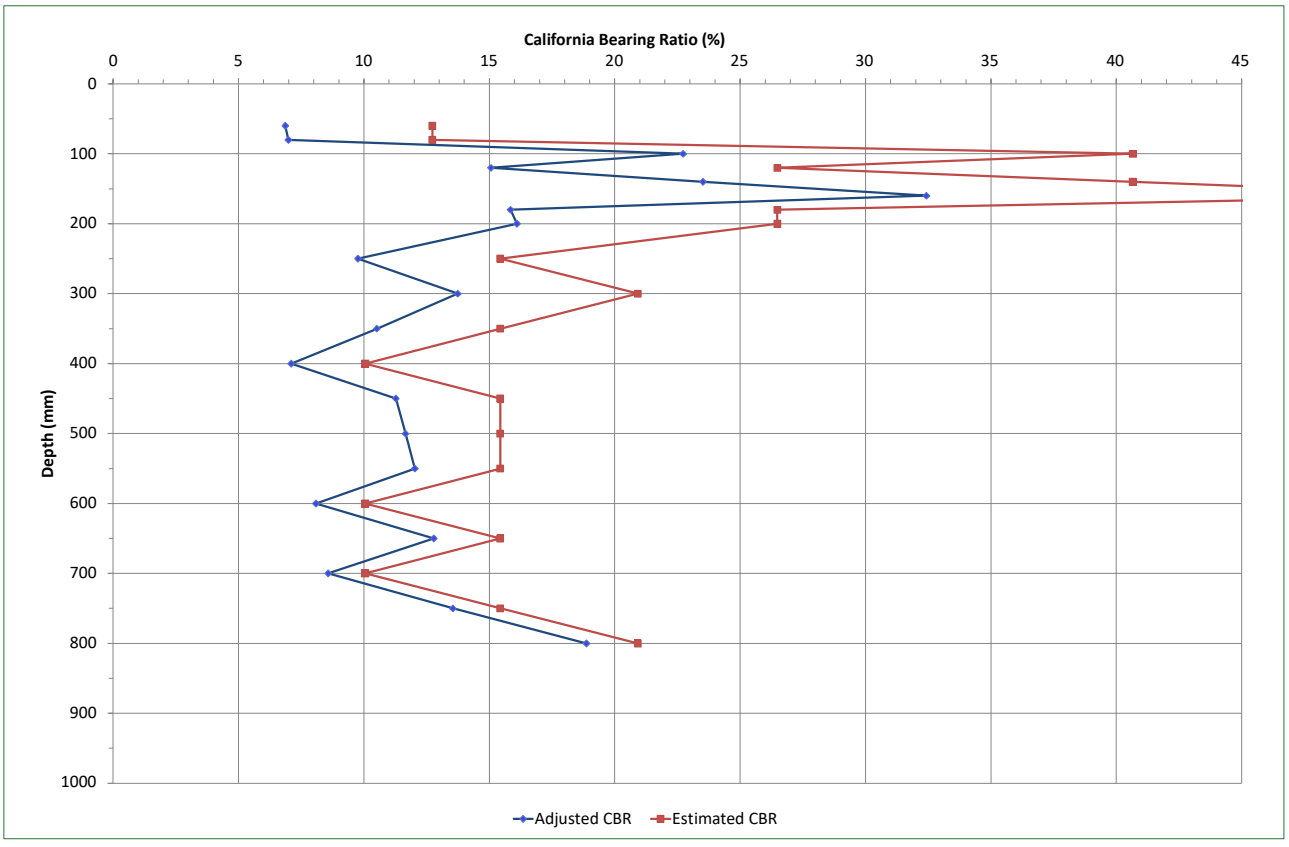
Notes:

1. CBR Value calculated using Jones C R and J Rolt (1991), "*Operating instructions for the TRL dynamic cone penetrometer*" (2nd edition). Information Note. Crowthorne: Transport Research Laboratory, as follows:

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057\ \text{Log}_{10}(\text{DPI})$$

2. Adjusted CBR vaules obtined from Table 4.2 of Simon Done and Piouslin Samuel (2006), "*Measuring Road Pavement Strength and Designing Low Volume Sealed Roads using the Dynamic Cone Penetrometer*" Unpublished TRL Project Report UPR/IE/76/06 Project Record No R7783.

The CBR Adjustment Factors are applied to unpaved roads on the assumption that the effect of moisture will be a maximum at the top surface and will reduce linearly to zero at a depth of 1000 mm.



Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP04
Date:	04/06/2020
Soil Type:	Clay

TP04

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	4	7	7	10	11	7.00	11.56
2	8	10	9	10	9	7.00	11.56
3	8	6	5	9	10	5.67	9.99
AVERAGE				**9.666667**		**6.56**	**11.04**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	9	11	10	11	7.00	11.56
2	6	9	11	11	12	8.47	13.25
3	5	7	9	10	10	7.00	11.56
AVERAGE				**10.33333**		**7.49**	**12.12**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	7	7	8	8	4.48	8.53
2	5	6	7	7	7	3.43	7.18
3	4	6	7	7	8	3.43	7.18
AVERAGE				**7.333333**		**3.78**	**7.63**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: $CBR = 0.07\ (CIV)^2$

(2) Clegg (1986) equation: $CBR = (0.24\ (CIV) + 1)^2$

Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP05
Date:	04/06/2020
Soil Type:	Clay

TP05

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	3	4	6	8	9	4.48	8.53
2	4	5	6	7	8	3.43	7.18
3	5	7	8	9	9	5.67	9.99
AVERAGE				**8**		**4.53**	**8.56**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	8	9	9	10	5.67	9.99
2	7	8	9	9	9	5.67	9.99
3	8	9	10	11	10	8.47	13.25
AVERAGE				**9.666667**		**6.60**	**11.07**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	12	13	13	14	14	13.72	19.01
2	6	7	8	9	10	5.67	9.99
3	6	9	11	12	13	10.08	15.05
AVERAGE				**11.66667**		**9.82**	**14.68**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: CBR = 0.07 $(CIV)^2$

(2) Clegg (1986) equation: CBR = $(0.24\ (CIV) + 1)^2$

Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP07
Date:	04/06/2020
Soil Type:	Clay over mudstone

TP07

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	4	6	8	9	10	5.67	9.99
2	8	10	10	11	11	8.47	13.25
3	7	9	10	11	11	8.47	13.25
AVERAGE				**10.33333**		**7.54**	**12.16**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	4	7	9	10	11	7.00	11.56
2	6	9	10	11	11	8.47	13.25
3	10	12	13	14	14	13.72	19.01
AVERAGE				**11.66667**		**9.73**	**14.61**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	6	6	7	7	3.43	7.18
2	3	5	6	6	6	2.52	5.95
3	4	5	6	7	7	3.43	7.18
AVERAGE				**6.666667**		**3.13**	**6.77**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: CBR = 0.07 $(CIV)^2$

(2) Clegg (1986) equation: CBR = $(0.24\ (CIV) + 1)^2$

Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP09
Date:	05/06/2020
Soil Type:	Clay over mudstone

TP09

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	6	7	8	8	4.48	8.53
2	5	7	7	8	9	4.48	8.53
3	5	7	9	10	10	7.00	11.56
AVERAGE				**8.666667**		**5.32**	**9.54**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	8	10	11	11	8.47	13.25
2	6	8	9	10	11	7.00	11.56
3	6	7	8	9	10	5.67	9.99
AVERAGE				**10**		**7.05**	**11.60**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	8	10	8	11	4.48	8.53
2	6	9	10	9	10	5.67	9.99
3	9	10	11	11	12	8.47	13.25
AVERAGE				**9.333333**		**6.21**	**10.59**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: $CBR = 0.07\ (CIV)^2$

(2) Clegg (1986) equation: $CBR = (0.24\ (CIV) + 1)^2$

Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP11
Date:	05/06/2020
Soil Type:	Clay over mudstone

TP11

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	8	11	12	13	10.08	15.05
2	8	11	13	13	13	11.83	16.97
3	6	8	10	10	11	7.00	11.56
AVERAGE				**11.66667**		**9.64**	**14.53**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	4	6	7	9	9	5.67	9.99
2	5	10	9	10	11	7.00	11.56
3	6	9	10	11	11	8.47	13.25
AVERAGE				**10**		**7.05**	**11.60**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	9	11	11	10	8.47	13.25
2	5	9	11	11	10	8.47	13.25
3	5	9	11	12	12	10.08	15.05
AVERAGE				**11.33333**		**9.01**	**13.85**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: $CBR = 0.07\ (CIV)^2$

(2) Clegg (1986) equation: $CBR = (0.24\ (CIV) + 1)^2$

Clegg Impact Soil Tester Results

Project:	Butts Batch, Wrington
Project No:	1912013.002
Client:	Strongvox Ltd
Location:	TP12
Date:	05/06/2020
Soil Type:	Clay over mudstone

TP12

300mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	8	9	10	11	7.00	11.56
2	5	8	9	9	10	5.67	9.99
3	7	8	9	10	10	7.00	11.56
AVERAGE				**9.666667**		**6.56**	**11.04**

Depth (mbgl):	0.30

600mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	6	8	10	9	10	5.67	9.99
2	8	9	9	10	11	7.00	11.56
3	4	5	7	7	7	3.43	7.18
AVERAGE				**8.666667**		**5.37**	**9.58**

Depth (mbgl):	0.60

900mm below formation level

Test No.	CIV 1	CIV 2	CIV 3	CIV 4	CIV 5	CBR(1)	CBR(2)
1	5	8	8	9	9	5.67	9.99
2	5	8	9	9	10	5.67	9.99
3	6	7	8	8	9	4.48	8.53
AVERAGE				**8.666667**		**5.27**	**9.50**

Depth (mbgl):	0.90

CIV = Clegg Impact Value

CBR = California Bearing Ratio

(1) Clegg (1980) equation: $CBR = 0.07\ (CIV)^2$

(2) Clegg (1986) equation: $CBR = (0.24\ (CIV) + 1)^2$