

CROWN & SCEPTRE INN CAR PARK, MAIN ROAD, CADOXTON, NEATH, SA10 8AP

Ground Investigation Report

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0.0 FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

0.1 General

Recommendations made and opinions expressed in the report are based on the strata observed in the excavations, together with the results of site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the Exploratory Holes or which occur between Exploratory Holes. Whilst the report may suggest the likely configuration of strata, both between Exploratory Holes and below the maximum depth of investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

0.2 Investigation Procedures

Windowless Sample Boreholes and hand-dug trial pits have been employed within the project. All Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing complies with the recommendations of the British Code of Practice BS 5930:2015+A1:2020 'Site Investigations', British Code of Practice BS 10175:2011+A1:2017 'Investigation of Potentially Contaminated Sites' and BS 1377:1990 (as updated), 'Methods of Test for Soils for Engineering Purposes'.

0.3 Routine Sampling

Representative bulk disturbed and environmental samples of the different strata are taken following completion of logging. These samples are sealed and labelled in clear plastic bags and 2kg plastic tubs. Soil samples obtained for environmental testing are sampled and sealed in borosilicate amber jars or in specialist vessels where required. All samples are returned from site to QGL's facility for controlled storage within 24 hours of sampling to await test scheduling/ requirements.

0.4 In-Situ Testing, Surveying & Instrumentation

In-situ testing comprised:

- Standard Penetration Testing
- Soakaway Testing

0.5 Groundwater

Where possible, the depth of entry of any influx of groundwater is recorded during the course of boring operations. The rate of inflow into the excavation or borehole is monitored during the course of the excavation or during boring procedures. Upon encountering any water strikes, work is temporarily halted and the water levels monitored for a standard twenty-minute period recording the change in water level at the end of the twenty minutes.

Groundwater conditions observed in the excavations are those appertaining to the period of investigation. It should be noted, however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or other causes.

0.6 Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded. Unless otherwise instructed or detailed within the Contract, all soil and/or rock samples not tested will be discarded 28 days after submission of the approved final report.

1.0 INTRODUCTION

1.1 General

Upon the instructions of First Choice Housing Association (the Client), Spencer Quantum Ltd (SQL) has been commissioned to undertake a ground investigation for a plot of land at the former Crown & Sceptre Inn Car Park, Main Road, Cadoxton, Neath.

The location and current proposed layout drawings, as supplied by the Client, are presented within Appendix I for reference.

SQL have prepared and issued a Preliminary Risk Assessment report (desk study) for the development site, which should be read in conjunction with this geotechnical report: reference Q1463/PRA-CMRA *Preliminary Risk Assessment / Coal Mining Risk Assessment*, February 2024.

In this interpretative report, a factual account of the fieldwork and in-situ testing, details of the strata encountered, and groundwater and ground gas observations are presented. Guidance and recommendations on geotechnical matters are discussed along with a discussion of potential contamination of the soils.

General notes on the techniques employed by Spencer Quantum Ltd are described in the Foreword together with the limitations inherent in this type of work.

1.2 Purpose of Ground Investigation

The ground investigation was designed to address the following elements to aid the detailed design of the development:

- Site Investigation for foundation appraisal
- Sampling to allow a generic quantitative risk assessment
- Surface Water Infiltration tests
- Gas risk assessment

The intrusive investigation works comprised a series of windowless sampled boreholes and machine excavated trial holes along with in-situ soakaway testing.

1.3 Scope of Work

The scope of work undertaken was specified in the Client's enquiry document and carried out in the preparation of this assessment was as follows:

- Conduct an intrusive ground investigation with the aim to identify the underlying ground conditions targeting the issues that could potentially impact the proposed new building and infrastructure
- Carry out laboratory testing to gain further geotechnical and geo-environmental data.
- Provide an interpretative report presenting an analysis of the available information and offering recommendations on foundation options for the proposed development with regards to geotechnical parameters, site infrastructure and a baseline contamination assessment of the soils on site.

General notes on the techniques employed by Spencer Quantum are described in the Foreword together with the limitations inherent in carrying out ground investigation work.

2.0 SITE DETAIL

2.1 Site Description

The site area under review lies covers an area of c.0.15ha and lies within the suburb of Cadoxton in Neath. The postcode for the site is SA10 8AP with an approximate National Grid Reference of the site centre of 275385E 198410N.

From online sources, the site appears flat with hardstanding surfacing. Existing residential properties surround the site which front onto Main Road (A4230).

The site extent and layout of the proposed development is indicated on the Client's site plan presented in Appendix I.

An aerial view of the site from current on-line mapping is presented below with the site boundary highlighted.



Figure 1: Site Location [Not to Scale] © Google 2024

2.2 Published Geology

Details of the geology of the site are provided by British Geological Survey (BGS) Sheet SS79NE at 1:10,560 scale, and BGS's online resource Geology Viewer.

The mapping indicates superficial deposits comprising Glacial Sand & Gravel (Glaciofluvial deposits) mantling the site. The thickness of the soil cover is not indicated, although 'Gravel' is mapped in the railway cutting on

3.0 FIELDWORK

3.1 General

The Preliminary Risk Assessment indicated the following recommendations for investigation of the site:

- *In relation to any environmental/contaminated land issues, the desk study has identified the possibility of Made Ground to be present on-site and therefore a potential source of land contamination that may pose a risk to future development of the site. This could be mitigated by site-specific investigation and assessment.*
- *It is recommended that any ground investigation should include a baseline screening of potential contamination as regards human health risks and potential leachable elements, and to identify suitable founding strata determine a suitable founding option.*
- *Owing to the potential of made ground being present, and depending on the composition of the soils, a ground gas risk assessment may be required.*

During September 2024 SQL undertook the intrusive ground investigation for the proposed residential development. Supervision and attendance were provided by an Engineering Geologist from Spencer Quantum on all aspects of the site works.

All exploratory hole and trial pit locations were surveyed by an eCAT4 (Cable Avoidance Tool) prior to breaking ground.

A summary of the fieldworks is outlined below:

- Six boreholes drilled by windowless sampling methods
- Three machine excavated trial pits which were used to perform percolation tests.
- Installation of gas monitoring standpipes in one of the boreholes, with subsequent monitoring.

3.2 Exploratory Hole Locations

The exploratory hole locations were set out by a QGL Engineering Geologist.

An Exploratory Hole Location Plan is presented in Appendix I showing the relative positions of the investigation holes.

3.3 Exploratory Holes

A total of six windowless sampled boreholes were drilled by dynamic-percussive methods using a Dart Competitor mini drill-rig.

Three trial pits were machine excavated during the site works to allow percolation testing of the shallow soils.

Drilling and sampling procedures were carried out in accordance with best practice as laid out in BS5930:2015+A1:2020. Logs of the soils encountered are described as required in BS EN ISO 14688-1:2018 and BS EN ISO 14688-2:2018, by a Spencer Quantum Engineering Geologist.

The sequence of deposits encountered during the investigation is detailed within the Engineering Geologist's logs presented in Appendix II and III. The logs highlight the nature of the soils encountered and provide descriptions of the strata revealed at the site. Photographs of the windowless sampled soils are presented with the borehole logs in Appendix II. The trial pit logs, excavation and spoil photographs are presented in Appendix III. A summary of the investigation holes is provided in Table 1 over page.

Table 1: Summary of Exploratory Holes

Exploratory Hole	Purpose	Final Depth (m bgl)	In-Situ Testing	Installations
WS01	Soil Sampling & Foundation Design	1.00	SPT	N/A
WS01A	Soil Sampling & Foundation Design	1.00	SPT	N/A
WS02	Soil Sampling & Foundation Design	1.00	SPT	N/A
WS03	Soil Sampling & Foundation Design	1.00	SPT	N/A
WS04	Soil Sampling & Foundation Design	1.00	SPT	N/A
WS05	Soil Sampling & Foundation Design	2.00	SPT	Yes
TP01	Percolation Tests	1.00	Soakaway	N/A
TP02	Percolation Tests	1.00	Soakaway	N/A
TP03	Percolation Tests	1.10	Soakaway	N/A

Boreholes WS01 to WS04 all terminated at shallow depth in dense granular strata that the rig could not penetrate.

In WS05 a 50mm diameter HDPE standpipe was installed to allow monitoring of ground gases and equilibrium groundwater levels. A slotted section of pipe was placed with a pea-gravel filter surround between 1.0m and 2.0m depth to facilitate subsequent readings. The prevailing ground conditions only permitted installation of one gas monitoring standpipe in the boreholes. The readings are presented in Appendix V.

3.4 In-Situ Testing

3.4.1 Soakaway Testing

Soakaway tests were performed in the three trial pits. The tests were undertaken in accordance with BRE365. The records of the tests are included in Appendix IV.

3.4.2 Standard Penetration Tests

Standard Penetration Tests were undertaken at regular intervals in the windowless sampled boreholes. The test procedures are originally described in BS1377:1990: Part 9 and in the UK the test is standardised by BS EN ISO 22476-3:2005+A1:2011 using the Energy Ratio (Er) for the SPT hammer.

The SPT test involves driving a thick-walled open sample tube at the base of the borehole by blows from a slide hammer of known weight and drop-height. The number of blows to penetrate 300mm, following a 150mm seating drive, are added to give the SPT N Value. In granular soils the open tube sampler is replaced with a solid cone.

The N value provides an indication of the relative density or consistency (strength) of the strata. The results are presented at the relevant depth on the borehole logs in Appendix II.

3.5 Sampling - General

Samples from windowless sample boreholes are recovered in a plastic liner tube. The samples are retained in a secure channelled box to protect and allow transportation of the samples. The liner tubes are subsequently split, photographed, and logged, then if necessary sub-sampled for testing purposes.

Reference disturbed samples from the trial pits were taken for logging and geotechnical and geo-environmental testing purposes.

Sample type and sample depths from the investigation holes are recorded on the Engineering Geologist's Exploratory Hole Logs found within the relevant Appendices.

4.0 LABORATORY TESTING

4.1 General

The laboratory testing was scheduled by Spencer Quantum and comprised a number of geotechnical and geo-environmental tests on selected soil samples obtained during the investigation.

4.2 Geotechnical Laboratory Testing

All the geotechnical soil testing work was carried out in accordance with the procedures stipulated in the relevant sections of BS 1377:1990 Parts 1 - 9 *Methods of test for soils for civil engineering purposes*. Table 2 details the tests undertaken. The granular nature of the soils and limited sample recovery from the windowless sample boreholes in the prevailing ground conditions and therefore limited the extent of testing possible.

Table 2: Geotechnical Tests Undertaken

Type of Test	No of Tests
Moisture Content	13
Liquid/Plastic Limits	2
Particle Size Distribution – Coarse Soils	12
Sedimentation by Pipette – Fine soils	1
pH, Soluble & Total Sulphate	3

A full set of geotechnical laboratory test results are included in the certificates provided within Appendix VI.

4.3 Geoenvironmental Laboratory Testing

Geo-environmental testing was carried out on six selected soil samples to gain a holistic view of any raised levels of contaminants that may exist on site, as well as four samples tested by leachate preparation for contamination mobility. Table 5 below details geo-environmental tests undertaken on selected soil samples.

Table 3: Geo-environmental tests undertaken on soil samples.

Heavy Metals			
• Arsenic	• Boron	• Cadmium	• Chromium (III & VI)
• Copper	• Lead	• Mercury	• Nickel
• Zinc			
Inorganics			
• pH	• Total Cyanide	• Asbestos	• Sulphate
Poly Aromatic Hydrocarbons			
• Naphthalene	• Acenaphthylene	• Acenaphthene	• Fluorene
• Phenanthrene	• Anthracene	• Fluoranthene	• Pyrene
• Benzo(a)anthracene	• Chrysene	• Benzo(b)fluoranthene	• Benzo(k)fluoranthene
• Benzo(a)pyrene	• Indeno(1,2,3-cd) pyrene	• Dibenzo(a,h)anthracene	• Benzo(ghi)perylene
Petroleum Hydrocarbons			
<i>EPH&VPH Aliphatic Split:</i>	• C5 – C6	• C6 – C7	• C7 – C8
• C8 – C10	• C10 – C12	• C12 – C16	• C16 – C21
• C21 – C35	• C35 – C40		
<i>EPH/VPH Aromatic Split:</i>	• C5 – C7	• C7 – C8	• C8 – C10
• C10 – C12	• C12 – C16	• C16 – C21	• C21 – C35
• C35 – C40			
Aromatic, Monoaromatics & Oxygenates			
• Phenol (Total)			

A full set of Geo-Environmental laboratory test certificates are provided within Appendix VII.

5.0 GROUND CONDITIONS ENCOUNTERED

5.1 General

The sequence of deposits encountered during the investigation is detailed within the Engineering Geologist's logs presented within Appendix II & III. The following sections summarise the findings of the exploratory holes.

5.2 Ground Conditions

A summary of the distribution and depths of strata encountered is tabulated below. The logs included in Appendix II and II should be consulted for more detailed information.

Table 4: Summary of Base Depths of Strata Encountered

Strata	Base of Strata (m bgl)								
	TP01	TP02	TP03	WS01	WS01A	WS02	WS03	WS04	WS05
Made Ground	0.36	0.45	0.70	>1.0	>1.0	>1.0	>1.0	>1.0	1.0
Glacio-Fluvial	>1.0	>1.0	>1.1	-	-	-	-	-	>2.0

5.2.1 Made Ground

Nearly all Window Sample boreholes and Trial Pits proved the presence of Made Ground, with fragments of brick and coal. The exceptions were TP03, TP04 and WS01, where only topsoil and Glacial deposits were proved.

5.2.2 Superficial Deposits

All the windowless sample boreholes and trial pits proved variably silty and sandy GRAVEL with cobbles interpreted to be Made Ground or re-worked natural soils to depths of between 0.36m and >1.0m.

Trial Pits TP01, TP02 and TP03, machine excavated for the percolation testing, proved natural soils at their base, as a very sandy GRAVEL with cobbles, interpreted to be Glacio-Fluvial in origin.

5.2.4 Groundwater Conditions

No groundwater seepages were noted during the investigation.

The groundwater conditions observed in these exploratory holes are those appertaining to the period of the investigation. However, it should be noted that groundwater levels are subject to tidal, seasonal and climatic conditions or may vary due to other causes.

5.2.5 Existing Foundations

None of the Trial Pits and/or Windowless Samples had proven the presence of existing foundations within the site boundary.

6.0 GEOTECHNICAL ENGINEERING APPRAISAL

6.1 General

It is proposed develop the former car park of the Crown & Sceptre Inn for residential purposes, as indicated on the Plans included in Appendix I.

The site investigation was designed to provide geotechnical information to allow foundations and infrastructure to be designed for the new development.

The precise foundation details or loads are not known at present; therefore, this geotechnical assessment is generic in its conclusions and may need revision once further construction details are known.

6.2 Engineering Properties of Strata

The soils proved on site were generally uniform in occurrence with Made Ground over granular Glacio-Fluvial sands and gravels.

The geotechnical properties of the soils tested are summarised in Table 5 below.

Table 5: Summary of Geotechnical Testing Properties

Soils- Made Ground		Range	Average	Characteristic Value
Moisture Content	(%)	5.7 - 30	12	12
Atterberg Limits	Liquid Limit (%)	47 – 64	56	56
	Plastic Limit (%)	20	20	20
	Plasticity Index (%)	27 – 44	36	44
	Modified PI (%)	8 – 16	12	16
Particle Size Distribution	Cobbles (%)	0 – 37	N/A	N/A
	Gravel (%)	42 – 82		
	Sand (%)	12 – 23		
	Silt & Clay(%)	4 – 22		
Chemical	pH (units)	7.6 – 7.7	7.7	7.6
	Soluble Sulphate (mg/ltr)	15 – 150	64	150
Standard Penetration Test	N Value	50	50	N/A
Soils- Glacio-Fluvial		Range	Average	Characteristic Value
Moisture Content	(%)	6.6 - 28	15	15
Particle Size Distribution	Cobbles (%)	0 – 27	N/A	N/A
	Gravel (%)	40 – 78		
	Sand (%)	11 – 30		
	Silt & Clay (%)	4 – 30		
Standard Penetration Test	N Value	5 - 50	50	N/A

The Atterberg Limits tests classify the made ground with a cohesive element as of *High to Intermediate Plasticity* based on the initial classification. However, the maximum Modified Plasticity Index was 16% when corrected for the proportion of coarse fraction in the soil. This indicates the soils to be *Low Volume Change Potential* according to NHBC Standards. This would indicate a minimum founding depth of 0.7m depth where no removal or planting of trees or shrubs is proposed within influencing distance of new foundations.

The made ground was found to be predominantly a Gravel of variable sand and cobble content. Fines ranged between 5% and a maximum outlier of 22%. The Glacio-Fluvial soils were again predominantly Gravel with a variable sand and cobble content. As with the made ground one outlier of increased fines content was recorded

in TP02 at 1.0m depth. This is indicative of the depositional conditions of the Glacio-fluvial soils.

The pH value of the soils tested ranged between 7.6 and 7.7. The maximum soluble sulphate content was 150mg/litre. Companion testing of soils within the contaminated soils suites recorded a maximum pH value of 10.2 and maximum soluble sulphate content of 42mg/litre. The high pH value is likely to be attributable to concrete or cementitious material in the sample, rather than an alkali *per se*.

The predominantly coarse granular nature of both the made ground and natural soils resulted in partial penetration of the SPT's with nearly all results returning an N value of 50. This is considered to be unrepresentative of the ground conditions.

6.3 Foundations

6.3.1 Foundation Recommendations

The Made Ground (re-worked natural soils) proved on site extended to a depth of at least 1m depth in places, and of variable composition and relative density. This stratum is unsuitable for structural foundations.

All structural foundations should be placed in the granular Glacio-Fluvial deposits proved at depths below 0.4m in the trial pits.

NHBC guidelines indicate a minimum foundation depth of 0.7m where soils are of *Low* volume change potential and where no new planting is proposed.

Making allowance of the variability of the test results given the gravel and cobble content, we would recommend an allowable bearing capacity of 100kN/m² at 1m depth in natural soils.

Owing to the thickness of made ground proved, a ground bearing floor slab would not be possible for the proposed building, unless the ground were treated by excavation and removal of obstructions, with appropriate proof rolling, removal of any soft spot etc., and replacement with suitable granular fill.

6.3.2 Foundation Concrete Class Designation

The Aggressive Chemical Environment for Concrete (ACEC) classification for the site has been assessed according to the guidelines within BRE Special Digest 1 (2005), Table C2 for *Brownfield* locations. For classification purposes, based on the BRE guidance, the groundwater must be classed as 'mobile' unless proven to be 'static' over a 24hr period. No groundwater was recorded in the boreholes or standpipes, but as made ground is present on the site, the possibility of perched waters cannot be discounted.

The pH values of the soil samples taken from across the site ranged from 7.6 to 7.7, with an outlier of 10.2. The levels of water-soluble sulphate (SO₄) content of the tested soil samples recorded levels up to 150mg/l.

Based on the above where concrete may come into contact with the shallow soils on site (i.e., *brownfield* setting due to the presence of made ground), the Design Sulphate (DS) class for the site is DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification is AC-1.

6.4 Earthworks

Site Preparation

Any earthworks should be carried out in accordance with BS 6031: 2009 Code of Practice for Earthworks. Workmanship for excavation shall comply with BS 8000: Part 1, sections 3.1, 3.2 and 3.3.

Prior to commencing any earthworks / groundworks for the development, any live services on and in the vicinity of the site should be accurately located and protected, or if required diverted.

Any exposed formations should be protected from the effects of the weather, site traffic, or water in order to prevent deterioration of this surface. It is recommended that any exposed formations be protected with a minimum thickness of up to 200mm of suitable granular material or a thin layer of blinding concrete, which should be placed immediately after excavation and exposure.

Depending on the foundation option adopted for the scheme, physical treatment in the form of proof rolling, excavating hard spots, re-engineering of the superficial deposits may be required. This however would need further discussion depending on the foundation opted for.

Cutting and Filling

Cutting and filling is not envisaged to be required for this development scheme.

Excavation Plant

On the basis of the observations made during the exploratory investigation, it is considered that excavations within the shallow soils can be undertaken by conventional excavation plant, although care should be taken to observe any possible water strikes within the granular bands within the soils.

Stability of Excavations

From the excavations undertaken as part of this ground investigation the cohesive soils remained stable during the length of the pits being open.

A medium to high preponderance of cobbles and boulders were encountered in the excavations for percolation tests. It should be noted that the removal of these while digging did result in some instability of the pit sides.

It is advised that any excavations left open for any length of time are protected, owing to the likelihood for ground condition deterioration if exposed to inclement weather.

Control of Groundwater

Groundwater was not encountered during the ground investigation site works.

The strata encountered includes made ground and as such may contain perched groundwater bodies. Any ingress may be accompanied by instability of any excavations.

Pavement Design

On the basis of observations made in the trial holes, for preliminary design purposes we would recommend adopting an equilibrium CBR value of 5% for any pavements or roads formed at <0.5m depth. For deeper formation levels we would recommend an equilibrium CBR value of 10%

6.6 Infiltration Tests

Infiltration tests were performed in three machine excavated trial holes in accordance with BRE365. The test results are presented in Appendix IV.

A summary of the infiltration rate calculated is presented over page.

Table 6: Summary of Infiltration Tests

Location	Test	Infiltration Rate (m/sec)	Comments
TP01	1	8.9E-05	Unable to fill pit above 0.6m depth
	2	5.2E-05	Unable to fill pit above 0.62m depth
	3	4.0E-05	Unable to fill pit above 0.51m depth
TP02	1	Unable to Calculate	Unable to fill pit above 0.21m depth Water level dropped 18cm in 90mins
TP03	1	7.6E-05	Unable to fill pit above 0.74m depth
	2	3.8E-05	Unable to fill pit above 0.74m depth
	3	4.4E-05	Unable to fill pit above 0.74m depth

Leachate testing was carried out on selected samples from the trial pits to determine the risk to controlled waters from infiltration drainage. The results are discussed in Section 7.5.

7.0 GEO-ENVIRONMENTAL CONSIDERATIONS

7.1 General

The following Section assesses the findings of the geo-environmental laboratory test results from samples obtained during the ground investigation. The risks to human health are only considered herein. This Section sets out the preliminary Conceptual Site Model (CSM) established for pollutant linkages and aims to review this CSM following assessment of the test results from the intrusive investigation.

The site is to be developed for residential purposes with areas of both hard and soft landscaping. As such, any potential pathway for any contamination to reach a receptor may be present. Therefore, in respect of a human health risk assessment the most appropriate scenario to use is a *Residential End Use with Plant Uptake* as residents can come into contact with the soils present on site.

Under Part 2A of the Environmental Protection Act 1990, contaminated land is defined as the presence of substances in, on, or under the land in which significant harm or pollution to controlled waters is being caused, or there is significant possibility of such harm or pollution to controlled waters being caused.

The potential risks to the development have been assessed by consideration of the potential contaminant linkages (PCLs) in accordance with DEFRA 2020 Land Contamination Risk Management (LCRM) guidance. LCRM enables the application of a risk management process for identifying and remediating contamination through a technical framework.

For a risk to exist there must be a source of contamination, a receptor that may be harmed, and a pathway by which the receptor could be exposed to the contaminant. Only when all three factors are present can a contamination linkage, and consequently an unacceptable risk, exist. A conceptual site model (CSM) considers all three elements and the potential for contaminant linkages that may exist for the site, including:

- Potential sources of contamination on-site and off-site;
- Potential pathways between sources and receptors, natural or man-made;
- Receptors such as humans, controlled water, ecological systems, and property.

The following assessment hierarchy, as provided in the LCRM, is followed to assess the risks to human health and controlled water:

- Stage 1 Tier 1: Preliminary Risk Assessment, including preliminary CSM
- Stage 1 Tier 2: Generic Quantitative Risk Assessment (GQRA), using appropriate Generic Assessment Criteria
- Tier 3: Detailed Quantitative Risk Assessment, using derived Site-Specific Assessment Criteria (SSACs)
- Stage 2 Options Appraisal.

A Tier 1 Preliminary CSM was completed as part of the PRA. The test results from samples taken as part of this investigation phase have been used to develop the CSM to a Tier 2 level, using appropriate GACs to carry out a generic quantitative risk assessment with the discussion of the GQRA in this report providing the Stage 2 options appraisal.

7.2 Conceptual Site Model

A Conceptual Site Model (CSM) is a representation of the current understanding of the site and its surrounding environment typically with regards to geology, groundwater, surface waters, and potential contamination on-site and adjacent off-site and any migration pathways.

The potential risk from any pollutant linkage can be assessed the following Source-Pathway-Receptor model described in the LCRM methodology.

Sources

From the CSM the following potential sources of contamination were identified:

- Made ground and potential contaminated soils from former buildings
- Sulphates and acidic/alkaline soils affecting concrete
- Organic soils
- Ground gases

Pathways

Pathways that could exist that may affect the receptors in some way but typically fall into the following categories assessed for this site:

- Direct contact – including dermal contact and ingestion
- Surface Waters – flows from flooding events
- Leaching of contaminants into groundwater and controlled waters
- Consumption by / effect on planting
- Ground and mine gas migration through permeable strata

Receptors

Considering the proposed development the likely receptors will be the future residents, construction workers, buildings and groundwater from percolation.

This was demonstrated in the preliminary CSM presented in the PRA and is re-presented below.

Table 7: Revised Initial CSM from PRA

Sources		
S1	Soils on Site	Made Ground could be present on site that could be potentially contaminated.
S2	Ground Gases	Ground gases could be generated from any made ground depending on its constituent parts and any organic or contaminated soils present.
Pathways		
P1	Direct Contact	Direct contact with soils will possibly occur during any development of the site by Groundworkers.
P2	Groundwater	Percolation of surface water, soakaway drainage and run-off may permeate into the ground and mobilise any leachable contaminants, if present.
P3	Ground Gases	Migration of potentially harmful ground gases migrating into and affecting any new buildings and occupants should be determined by a gas risk assessment
Receptors		
R1	Property	Any buildings should be designed such that any concentrations of any contaminants found that may affect building materials are accommodated for in the design.
R2	Site Workers	Workers may come into contact with the soils on site. Therefore, good practice and correct handling protocols should be established as part of any Construction Phase Plan use of the correct PPE and welfare arrangements provided to reduce and minimise any potential contact with the soils.
R3	End Users	Post development, there should be no pathways present to allow direct contact of pre-existing soils on site by residents.
R4	Controlled Waters	No controlled waters are expected to be impacted by any development of the site. Any drainage strategy should ensure measures are in place to mitigate percolation of waters through any made ground revealed into the ground or water courses.

7.3 Generic Quantitative Risk Assessment Criteria

By adopting the LCRM approach to human health risk assessment, a quantitative risk assessment has been undertaken for the proposed development adopting the most sensitive model of *Residential End Use with Plant Uptake* threshold values for a 2.5% Soil Organic Matter; site minimum 2.4%.

The assessment criteria used in this human health risk assessment is that presented by the Land Quality Management (LQM) in association with Chartered Institute of Environmental Health (CIEH) in their publication 'The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)'. The S4ULs (Suitable for Use Levels) used have been derived in accordance with UK legislation, national as well as Environment Agency policy and available guidance provided to the contaminated land practitioner community for the purpose of deriving Generic Assessment Criteria (GAC). In addition, guideline values for use in Part IIA determinations ('Category 4 screening Levels' – C4SLs) were published in 2014 by DEFRA which included lead. In the absence of a lead S4UL, the C4SL for lead was utilised. Where S4ULs are not available, then the former LQM/CIEH GAC (2009) have been used.

The LQM/CIEH S4ULs are intended for use in assessing potential risks posed to human health by contaminants in soil and are transparently derived and cautious 'trigger values' above which further assessment or remedial action may be necessary.

By using the LQM/CIEH S4AULs, Quantum Geotechnic acknowledges *Copyright Land Quality Management Ltd reproduced with permission; Publication Number S4AUL3409. All Rights Reserved.*

7.4 Human Health Generic Risk Assessment

7.4.1 Heavy Metal and Inorganic Compounds

The results of levels of potential contaminants have been compared to generic assessment criteria as described above, for a *Residential with Plant Uptake End Use*. The test certificates are included in Appendix VII. The concentrations of heavy metal and inorganic compounds are summarised in the table below.

Table 8: Summary of Heavy Metals and Inorganic Soil Test Results

Determinant	Results Range (mg/kg)	LQM/CIEH (2015) GAC (mg/kg) Residential End Use with Plant Uptake ⁽¹⁾	Exceedances
Arsenic	16 – 240	37	WS04 0.5m TP01 1.0m TP03 0.3m
Boron	< 0.4 – 1.5	290	0
Cadmium	0.59 – 12	11	TP01 1.0m
Chromium	25 – 130	910	0
Chromium Hexavalent	< 0.5	6	0
Copper	70 – 920	2,400	0
Lead ⁽²⁾	120 – 7,300	200	WS03 0.5m WS04 0.5m TP01 0.2m TP01 1.0m TP03 0.3m
Mercury	0.15 – 0.25	40	0
Nickel	24 – 59	130	0
Zinc	430 – 22,000	3,700	TP01 1.0m
Cyanide (Total) ⁽³⁾	< 0.5	34	0

Notes: (1). GAC from LQM/CIEH S4ULs 2015. (2). GAC from DEFRA C4SL.
(3). GAC from *AtRiskSoil* for acute risk.

7.4.2 Polycyclic Aromatic Hydrocarbons

The results of levels of potential polycyclic aromatic hydrocarbon contaminants have been compared to generic assessment criteria as described, for a *Residential with Plant Uptake End Use* and for a Soil Organic Matter (SOM) content of 2.5% (minimum recorded of 2.4%). The concentrations of speciated Polycyclic Aromatic

Hydrocarbon are summarised and compared in Table 9.

Table 9: Summary of Polycyclic Aromatic Hydrocarbon Soil Test Results

Determinant	Site Results Range (mg/kg)	LQM/CIEH (2015) GAC Resi + Plants (mg/kg)	
		2.5% SOM	Exceedances
Organic Matter Content	2.4 – 8.5		
Acenaphthene	<0.10 - 0.18	510	0
Acenaphthylene	<0.10 – 0.39	420	0
Anthracene	<0.10 - 0.31	5400	0
Benzo(a)anthracene	<0.1 – 2.1	11	0
Benzo(a)pyrene	<0.1 – 2.7	2.7	0
Benzo(b)fluoranthene	<0.1 – 5.0	3.3	TP01 1.0m
Benzo(ghi)perylene	<0.1 – 2.7	340	0
Benzo(k)fluoranthene	<0.1 – 1.4	93	0
Chrysene	<0.1 – 2.2	22	0
Dibenz(ah)anthracene	<0.1 - 0.6	0.28	TP01 1.0m
Fluoranthene	<0.1 – 2.1	560	0
Fluorene	<0.1 – 0.21	400	0
Indeno(1,2,3-cd) pyrene	<0.1 – 2.3	36	0
Naphthalene	<0.1 – 0.36	5.6	0
Phenanthrene	<0.1 – 1.3	220	0
Pyrene	<0.1 – 1.5	1200	0

Notes: (1). GAC from LQM/CIEH S4ULs 2015.

7.4.3 Petroleum Hydrocarbons

The results of levels of potential petroleum hydrocarbon contaminants have been compared to generic assessment criteria as described, for a Residential with Plant Uptake end-use and for a Soil Organic Matter (SOM) content of 1%. The concentrations of speciated volatile (VPH) and extractable (EPH) Petroleum Hydrocarbons are summarised and compared in Table 10.

Table 10: Summary of Petroleum Hydrocarbon Soil Test Results

Determinant	Site Results Range (mg/kg)	LQM/CIEH (2015) GAC ⁽¹⁾ Commercial (mg/kg)	
		2.5% SOM	Exceedances
Organic Matter Content	2.4 – 8.5		
VPH – Aliphatic C5-C6	<0.05	78	0
VPH – Aliphatic >C6-C7	<0.05	230 ⁽²⁾	0
VPH – Aliphatic >C7-C8	<0.05	230 ⁽²⁾	0
VPH – Aliphatic >C8-C10	<0.05	65	0
EPH – Aliphatic >C10-C12	<2.0	330	0
EPH – Aliphatic >C12-C16	<1.0 – 2.2	2,400	0
EPH – Aliphatic >C16-C21	<2.0 – 3.4	92,000 ⁽³⁾	0
EPH – Aliphatic >C21-C35	<3.0 – 5.0	92,000 ⁽³⁾	0
EPH – Aliphatic >C35-C40	<10 – 11	92,000	0
VPH – Aromatic >C5-C7	<0.05	140	0
VPH – Aromatic >C7-C8	<0.05	290	0
TPH – Aromatic >C8-C10	<0.05	83	0
EPH – Aromatic >C10-C12	<1.0	180	0
EPH – Aromatic >C12-C16	<1.0	330	0
EPH – Aromatic >C16-C21	2.6 – 10	540	0
EPH – Aromatic >C21-C35	<2.0 – 84	1,500	0
EPH – Aromatic >C35-C40	<1.0 – 21	1,500	0

Notes: <1.0(1). GAC from LQM/CIEH S4ULs 2015. (2) Combined Total for C6 – C8 Aliphatic range.
(3) Combined Total for C16 – C35 Aliphatic range

In addition to the above petroleum hydrocarbons the monoaromatic Total Phenols concentration has been compared to generic assessment criteria as described, for Residential end-use and for a Soil Organic Matter (SOM) content of 2.5% and found to be all below the detectable limit of 0.1mg/kg.

7.4.4 Asbestos

Six soil samples were sent for routine Asbestos testing and identification. Asbestos was not detected in any samples.

7.5 Leachate & Risk to Controlled Waters

7.5.1 Test Criteria

The risk to controlled waters, i.e., nearby watercourses and groundwater, is defined by the potential for any contaminants present on site to leach from the soils beneath the site and into the groundwater body.

Four samples from the trial pits have been tested for a suite of potential contaminants to assess the risk to groundwater from any mobile contamination held within the shallow soils that could be liberated by the adoption of infiltration drainage on the site.

The result ranges for leachate concentrations are presented together with the threshold levels given by the Environmental Quality Standards (EQS) guideline values as well as United Kingdom Drinking Water Standards (UKDWS) for reference.

7.5.2 Soil Leachate Test Results Comparisons

Table 11 below presents the summarised findings of the soil leachate testing undertaken compared to relevant assessment criteria where limits are proscribed. The test certificates are included in Appendix VI.

Table 11: Summary of Leachate Chemical Analysis

Determinant	Units	Site Results Range (µg/l) Leachate	Environmental Quality Standards – Freshwater ¹	UK Drinking Water Standards ²	Exceedances of EQS
Arsenic	µg/l	0.56 – 23	50	10	0
Cadmium	µg/l	<0.11	5	5	0
Chromium (Hex)	µg/l	<20	150 ³	50	0
Copper	µg/l	1.1 – 16	22 ³	2000	0
Lead	µg/l	0.54 – 22	10 ³	10	1
Mercury	µg/l	<0.05 – 0.15	1	1	0
Nickel	µg/l	<0.5 – 1.0	100 ³	20	0
Zinc	µg/l	8.9 – 14	50 ³	5000	0
Naphthalene	µg/l	<0.10	10	Not Available	0
Fluoranthene	µg/l	<0.10	0.02	Not Available	0
Benzo(a)pyrene	µg/l	<0.10	0.03	0.001	0
Total Petroleum Hydrocarbons	µg/l	<10 – 99	Not Available	10	1 (UKDWS)

¹Figures for Environmental Quality Standards (EQS) are Annual Average Concentrations derived from the Environment Agency ²UK Drinking Water Standards taken from; Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) (as amended), and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184) (as amended). ³Hardness Banding to be applied, mid hardness utilised of 100mgCaCO₃/l – using Table 2b: EGS for hardness related List 2 dangerous substances, EC Dangerous Substances Directive (76/464/EEC). NT – Not Tested. I/S – Insufficient Sample, NYS – Not Yet Specified

7.5.3 Generic Risk Assessment to Waters

The risk to controlled waters, i.e., nearby water courses and groundwater bodies, is defined by the potential for any contaminants present on site to either leach from the soils beneath the site onto controlled waters or indeed historic trapped contaminated waters within the shallow soils migrate to controlled waters.

Soil leachate testing carried out as part of this investigation revealed one raised contaminant at one location compared to Environmental Water Standard for freshwater, where thresholds are published; the Lead concentration in TP03 (at 0.3m depth). The level of total petroleum hydrocarbons did exceed the drinking water standard in one sample also.

The soils on site are classified as a Secondary 'A' Aquifer, so not significant in water supply terms. Any waters percolating through the soils on site will inevitably attenuate when passing through the unsaturated zone, then dilute further by groundwater flow below the surface. Considering this and the historic land use and industrial setting of the wider area, it is unlikely that the recorded levels of mobile contamination are significant regionally.

On the basis of the leachate test results, while one marginal exceedance of the freshwater EQA has been noted, it is considered that this outlier is an acceptably low risk to the groundwater and controlled waters from any mobile contaminants that may be present in the shallow soils.

SuDS drainage is proposed to be utilised on the site. On the basis of the leachate test results, there is a low risk from the mobilisation of any potential contaminants from soakaway percolation to an extent that would impact controlled waters.

7.6 Contaminated Land Options Appraisal

7.6.1 Human Health Risk of Site End Users

Soil test results for Petroleum Hydrocarbons and the majority of Polyaromatic Hydrocarbons fell below the respective GAC threshold for the Residential setting. The exception was the level of Benzo[b]fluoranthene and Dibenz(a,h)Anthracene in TP01 from the sample at 1.0m depth, both polyaromatic hydrocarbons. Benzo[b]fluoranthene can be found in coal, coke oven emissions and petroleum products. It can also be produced by the incomplete burning of organic matter. Dibenz(a,h)anthracene is generated when organic matter or fuel is incompletely burnt or combusted. Examples include industrial emissions such as coke oven operations in the coal and steel industry, coal tar distillation

There were several exceedances of heavy metals for a Residential end use with Plant Uptake setting for Arsenic, Cadmium, Lead and Zinc. These hotspots were identified in WS03, WS04, TP01 and TP03. The areal extent of the contamination appears to be on the western half of the site but over its full length. Delineating areas that require any remediation would need further testing and assessment, but on a site of this size may not be practical in construction terms.

The site is proposed to be developed for residential purposes, therefore in order to mitigate the risk to an acceptable level to future site users from the contaminant source identified (the shallow made ground), it is recommended the made ground is capped in areas of soft landscaping with a minimum 600mm thickness of clean topsoil/sub-soil with a separating membrane at the interface of in-situ and imported soils. Alternatively, the contaminated soils could be removed and replaced with clean imported soil.

In areas of hard landscaping, hard cover and buildings, the pathway for any receptor being affected by the contamination levels is severed, so the risk is reduced to acceptable levels.

The mitigation measures adopted may require a remediation strategy to define the appropriate actions and verification that the measures have been put in place in line with the guidelines contained in LCRM, Stage 3.

7.6.2 Human Health Risks during Construction

The risk to site workers in construction from contamination sources is commonly assessed by comparison of

concentrations to the threshold for a *Commercial* End use.

Soil test results for all potential contaminants fell below the GAC threshold for the Commercial setting with the exception of Lead levels at two locations: TP01 and TP03.

These levels do not present an unacceptable risk, but the risk must be communicated to all workers. Site workers who may come into contact with the soils should be protected from handling any soils with appropriate PPE and site hygiene facilities,

HSE guidance *HSG 66 Protection of workers and the general public during the development of contaminated land* presents recommendations on appropriate PPE. This is no longer current but is cited in Building Regulations guidance and discusses the acceptable levels of measures for workers in such ground conditions.

As general good practice with all construction schemes involving earthworks, precautions should be undertaken should any Made Ground or unforeseen contaminated land be encountered. Operatives working with, or likely to come into contact with made ground and soils with the potential to harness raised concentrations of contaminants, should observe particular precautions concerning personal hygiene. They should be issued with the appropriate personal protective equipment and should be instructed in safe working methods. In addition, adequate welfare facilities should be provided for all site staff.

7.6.3 Waste Assessment

No formal waste assessment has been undertaken as part of this commission. If materials are to be removed from site, the further assessment of the soils on site should be carried out in advance of the construction phase and a waste assessment carried out in accordance with NRW/EA document WM3: *Waste classification – Guidance on the classification and assessment of waste* (2021).

Any materials movement should be in accordance with the protocols detailed in CL:AIRE guidance *Definition of Waste: Code of Practice* (2011).

7.7 Ground Gas Risk Assessment

7.7.1 Shallow Ground Gases

Following five return visits to monitor gas concentrations in the borehole installation over a period of 3 months, the risk of ground gases within the shallow soils has been assessed using the guidance set out in the CIRIA publication “*Assessing risk posed by hazardous ground gases to buildings (C665)*”. The readings are presented in Appendix V.

In summary, the following range of levels were recorded:

Table 12: Summary of Gas Concentrations

Gas	Minimum	Maximum
Oxygen	16.4%	20.2%
Carbon Dioxide	0.1%	0.7%
Methane	0.4%	0.5%
Carbon Monoxide	0 ppm	0 ppm
Hydrogen Sulphide	0 ppm	0 ppm
Gas Flow	0.0 litre/hour	1.9 litre/hour

The maximum potentially harmful ground gas concentration recorded was 0.7% (by volume) of Carbon Dioxide. The borehole installation recorded a maximum gas flow of 1.9litres/hour.

The gas screening value (GSV) that can be used to define any mitigation measures for the development of the site can be calculated as follows:

$$\text{GSV} = \text{Gas Flow (Litres/hour)} \times \text{Max. Gas Concentration (\%)} / 100$$

For the maximum concentration of Carbon Dioxide measured, the calculated GSV is 0.013. This would place the site as Characteristic Situation 1 (CS1) as defined by CIRIA C665, i.e. *Very Low Risk*.

7.7.2 Mine Gases

The site lies in an area of former coal mining and as such could be at risk from migration of mine gases.

Methane can be released from coal when worked and may accumulate in the voids left by the mining operations. Other mine gases e.g., carbon dioxide, carbon monoxide may also subsequently accumulate in mining voids as a result of various chemical processes. These gases may later migrate or vent to atmosphere or be displaced by mine water flooding the mining voids and forced to the surface. Mine gases may, in certain circumstances, accumulate within dwellings and pose a risk of asphyxiation, fire or explosion.

It is well documented that the coal seams in the South Wales Coalfield have a poorly developed structure that reduces the risk of migration of methane through the body of the coal and is a factor in the low levels of risk from methane found in ground investigations in this area. The Coal Authority has published lists of coal seams that are prone to spontaneous combustion and none of the seams found in South Wales are included on that list.

The Coal Mining Report presented in the PRA indicated that the Coal Authority had no records of any mine gas emissions in the site area, no mine entries are recorded close to the site, no faulting affected the site and the shallowest seam to underlie the site was calculated to be at significant depth.

The CL:AIRE publication *Good Practice for Risk Assessment for Coal Mine Gas Emissions* presents a matrix for the risk assessment of mine gas risk (Figure 13.1).

This presents the following questions where the site lies within the defined Coal Mining Reporting area:

1. Mine Entries > 50m from the site boundary
2. Workings > 150m depth
3. No faults or other potential pathways connecting surface to deeper unflooded workings
4. Outside area of past or probable shallow workings on Coal Authority viewer

At this site, all these statements are true. The matrix concludes that the site is therefore in a *Negligible Risk Zone* and mitigation in respect of mine gases is not required

7.8 Updated Conceptual Site Model

From the findings of the investigation and conclusions drawn the initial Conceptual Site model can be revised and updated as over page.

Table 13: Updated Conceptual Site Model

Sources		Initial CSM	Revised CSM
S1	Soils on Site	Made Ground could be present on site that could be potentially contaminated.	Made Ground has been proved on site with elevated heavy metals contamination. Mitigation measures are required to sever the pollutant linkage from the soils with site end users by importing 600mm of clean cover in soft landscaped/garden areas with a separating membrane.
S2	Ground Gas	Ground gases could be generated from any made ground depending on its constituent parts and any organic or contaminated soils present. Mine gases could be present that migrate to present a risk to buildings and residents	Ground gases have been recorded on site in the shallow soils with a classification of CS1. The site is concluded to be in a Negligible Risk Zone from mine gases.
Pathways			
P1	Direct Contact	Direct contact with soils will possibly occur during the development of the site by Groundworkers.	The levels of contaminants proved in the soils will be adequately mitigated against by adopting correct PPE during development. Post development, there should be no pathways present to allow direct contact as the development should be constructed on, capped with hardstanding, or imported clean soil.
P2	Groundwater	Percolation of surface water and run-off may permeate into the ground and mobilise any leachable contaminants, if present.	No raised concentrations of contaminants have been proved that are an unacceptable risk, limiting the risk of any mobile contamination.
P3	Ground Gases	Migration of potentially harmful ground gases affecting buildings and residents could be a risk.	The preliminary gas risk assessment has identified the site to fall within CS1 <i>Very Low Risk</i> . Mine gas risk is concluded to be of negligible risk.
Receptors			
R1	Property	Any buildings should be designed such that any concentrations of contaminants found that may affect building materials are accommodated for in the design. Any ground gas mitigation measures identified should be incorporated into the building design.	No adverse levels of contaminants will affect building materials. ACEC Class AC-1 has been recommended for structural concrete. No special gas protection measures are required – CS1 classification.
R2	Site Workers	Workers may come into contact with the potentially contaminated soils on site. Therefore, good practice and correct handling protocols should be established as part of any Construction Phase Plan, use of the correct PPE and welfare arrangements provided to reduce and minimise any potential contact with the soils.	The use of the correct PPE and suitable welfare arrangements should be adopted to reduce and minimise any potential contact with, or effects of, the soils.
R3	End Users	Post development, the scheme design should allow no pathways to allow direct contact of pre-existing soils on site by residents.	The importation of clean soils in gardens and landscaped areas along with hardcover of the development will sever any pathways to affect the site end users. Ground gas concentrations have indicated a classification of a minimum of CS1 for the site. The buildings should therefore be designed to this.
R4	Controlled Waters	The drainage strategy for the site should ensure that no controlled waters be impacted by the construction works or development.	The proposed drainage strategy should address this. Any drainage strategy should ensure measures are in place to mitigate percolation of waters through the underlying fill material into the ground or water courses.

8.0 REFERENCES

British Geological Survey:

- BGS Sheet SS79NE at 1:10,560 scale
- BGS Lexicon of Named Rock Units (www.bgs.ac.uk/lexicon)
- BGS Geology of Britain Viewer (www.bgs.ac.uk)

Specialist Publications: -

- BS 5930:2015+A1:2020 '*Code of Practice for Site Investigations*'
- BS 1377:1990 '*Methods of test for soils for civil engineering purposes*'
- BS 10175:2011+A2:2017 '*Code of Practice for Investigation of Potentially Contaminated Sites*'
- BS EN ISO 14688-1:2018 Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- BS EN ISO 14688-2:2018 Geotechnical investigation and testing. Identification and classification of soil. Principles for a classification.
- BS EN ISO 14689-1:2018 Ground Investigation and Testing – Identification and classification of rock
- Health and Safety Executive Guidance Note EH40/90
- BRE (2005) Special Digest 1:2005, 3rd Edition, Concrete in aggressive ground. BRE, Garston.
- BS 6031: 2009 Code of Practice for Earthworks.
- CIRIA Report C665, 2007, *Assessing risk posed by hazardous ground gases to buildings*
- CL:AIRE, 2021, *Good Practice for Risk Assessment for Coal Mine Gas Emissions*
- ICE UK Specification for Ground Investigation Second Edition.
- Specification for Highways Works Series 600 Earthworks
- Environment Agency Science Report SC050021/[various] (2009) *Soil Guideline Values*
- LQM/CIEH Publication S4UL3409 (2015) '*Generic Assessment Criteria for Human Health Risk Assessment*'
- Health & Safety Executive, 1991, HSG66, *Protection of Workers and the General Public during the Development of Contaminated Land*.

APPENDIX I – SITE PLANS



- PUB PARKING
- RESIDENTIAL PARKING
- HARD LANDSCAPING
- SOFT LANDSCAPING

TABLE OF UNIT DIMENSIONS

UNIT 1 FOOTPRINT	HEIGHT
MAX: 12.0M (depth) X 5.0M (frontage)	9M
MIN: 5.0M (depth) X 5.0M (frontage)	7M
UNIT 2 FOOTPRINT	HEIGHT
MAX: 12.0M (depth) X 5.0M (frontage)	9M
MIN: 5.0M (depth) X 5.0M (frontage)	7M

f	07.11.23	parking amended
e	15.09.23	parking amended
d	29.06.23	scale parameters amended
c	27.06.23	scale parameters amended
b	06.06.23	scale parameters and parking amended
a	17.04.23	general amendments

dwg no	Ra	3369	s3	002	f
client	El Group				
project	Crown and Sceptre Cadroxton Neath				
title	general siteplan				
date	04.23	scale	1:200		
drawn	dr	check	dr	size	A2

spatial

north

3

stage

scale 1

1:200

scale 2

scale 3

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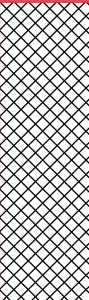
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APPENDIX II – WINDOWLESS SAMPLE LOGS

Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association										Window Sample No. WS01			
Dates : 26/9/24 - 26/9/24 Location : Cadoxton					Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:					
	Samples		Sample Run		Tests		STRATA				Water		
	Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)			
1	0.00 - 1.00	B 1						Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]		(0.60)			
							0.60	Medium dense to dense brown silty sandy fine to coarse sub-angular to sub-rounded GRAVEL [MADE GROUND]		0.60			
						1.00	SPT (S) 50/200mm 3-14-22-20-8/50mm-0/mm	1.00	WS terminated in dense strata/obstruction at 1m depth		1.00		
Equipment / plant used: Remarks:													
 Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:					Operator:		Logged By:		Sheet No. 1 Of 1		m Per Page 3	All measurements in metres unless otherwise stated	

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS01

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By.

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park										Window Sample No.	
Client : First Choice Housing Association										WS01A	
Dates : 26/9/24 - 26/9/24					Job Number : Q1463			Ground Level :			
Location : Cadoxton					Engineer : SQL			Coordinates:			
	Samples		Sample Run		Tests		STRATA				
	Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)	Water
1	0.00 - 0.50	B 1					(0.50)	Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]		(0.50)	
	0.50 - 1.00	B 2					0.50	Medium dense to dense brown very silty sandy fine to coarse sub-angular to sub-rounded GRAVEL [MADE GROUND]		0.50	
								(0.50)		(0.50)	
					1.00	SPT (S) 3/50mm (4-12-3/50mm--)	1.00	WS terminated in dense strata/obstruction at 1m depth		1.00	
Equipment used:											
Remarks:											
		Plas Newydd, Llanedi, Pontarddulais, Swansea				Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated	
		Tel: email:						1 Of 1	3		

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS01A

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By:

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association										Window Sample No. WS02	
Dates : 26/9/24 - 26/9/24 Location : Cadoxton					Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:			
Samples		Sample Run		Tests		STRATA					
Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)	Water	
0.00 - 1.00	B 1						Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]				
						(0.50)			(0.50)		
						0.50 (0.20)	Grey-dark grey sandy SILT [MADE GROUND]		0.50 (0.20)		
						0.70 (0.30)	Medium dense to dense brown very silty sandy fine to coarse sub-angular to sub-rounded GRAVEL [Possible MADE GROUND]		0.70 (0.30)		
1				1.00	SPT (S) 50/75mm (18-12-50--)	1.00	WS terminated in dense strata/obstruction at 1m depth		1.00		
Equipment used: Remarks:											
 Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:					Operator:		Logged By:		Sheet No. 1 Of 1		m Per Page 3
									All measurements in metres unless otherwise stated		

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS02

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

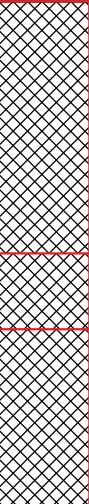
Logged By.

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association										Window Sample No. WS03			
Dates : 26/9/24 - 26/9/24 Location : Cadoxton					Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:					
Samples		Sample Run		Tests		STRATA							
Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)	Water			
0.00 - 1.00	B 1						Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]						
						(0.50)				(0.50)			
						0.50 (0.15)	Grey-dark grey ashy/sandy SILT/GRAVEL [MADE GROUND]			0.50 (0.15)			
						0.65 (0.35)	Medium dense to dense brown very silty sandy fine to coarse sub-angular to sub-rounded GRAVEL [Possible MADE GROUND]		0.65 (0.35)				
1				1.00	SPT (S) 50/200mm (5-9-13-24-13/50mm-)	1.00	WS terminated in dense strata/obstruction at 1m depth		1.00				
Equipment used: Remarks:													
 Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:					Operator:		Logged By:		Sheet No. 1 Of 1		m Per Page 3	All measurements in metres unless otherwise stated	

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS03

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:

JOB NAME:	CADOXTON	JOB NUMBER:	Q1463
BOREHOLE NUMBER:	WS03	BOX NUMBER:	- OF: -
FROM (m):	GL	TO (m):	1.0

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 (m)

Quantum Geotech

100 200 300 400 500 600 700 800 900 1000



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By:

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park										Window Sample No.				
Client : First Choice Housing Association										WS04				
Dates : 26/9/24 - 26/9/24					Job Number : Q1463			Ground Level :						
Location : Cadoxton					Engineer : SQL			Coordinates:						
Samples		Sample Run		Tests		STRATA								
Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)	Water				
0.00 - 1.00	B 1					(0.20)	Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]		(0.20)					
						0.20	Medium dense to dense brown silty to very silty sandy fine to coarse sub-angular to sub-rounded GRAVEL [MADE GROUND]		0.20					
0.50	ES 1					(0.80)			(0.80)					
1				1.00	SPT (S) 50/75mm (4-8-50--)	1.00	WS terminated in dense strata/obstruction at 1m depth		1.00					
Equipment used:														
Remarks:														
					Plas Newydd, Llanedi, Pontarddulais, Swansea		Operator:		Logged By.		Sheet No. 1 Of 1	m Per Page 3	All measurements in metres unless otherwise stated	

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS04

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By.

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association										Window Sample No. WS05			
Dates : 26/9/24 - 26/9/24 Location : Cadoxton					Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:					
Samples		Sample Run		Tests		STRATA							
Depth	Type No.	Diam. (mm)	Recovery (%)	Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Depth (Thickness)	Water	Install/Backfill		
0.00 - 1.00	B 1					(0.40)	Tarmacadam over brown-grey Hardcore (Limestone angular Gravel) [MADE GROUND]		(0.40)				
						0.40	Medium dense to dense dark grey and brown silty to very silty ashy sandy fine to coarse sub-angular to sub-rounded GRAVEL [MADE GROUND]		0.40				
						(0.60)			(0.60)				
1				1.00	SPT (S) 6 (3-3-3-1-1-1)	1.00	No Recovery		1.00				
						(1.00)			(1.00)				
2				2.00	SPT (S) 50/225mm (3-12-18-17-15-)	2.00	WS terminated in dense strata/obstruction at 2m depth		2.00				
Equipment used: Remarks:													
 Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:					Operator:		Logged By:		Sheet No. 1 Of 1		m Per Page 3	All measurements in metres unless otherwise stated	

Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Borehole No.

WS05

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:

JOB NAME: CADOXTON JOB NUMBER: Q1463
BOREHOLE NUMBER: WS05 BOX NUMBER: - OF: -
FROM (m): GL TO (m): 1.0

(Metre) 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 (m)



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By.

Sheet No.
1 Of 1

m Per
Page
2

All measurements in
metres unless
otherwise stated



APPENDIX III – TRIAL PIT LOGS

Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association							Trial Pit No. TP01	
Dates : 26/9/24 - 26/9/24 Location : Cadoxton			Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata			WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	
	0.30 -	B1 ES1 ES2			0.16	Tarmacadam over grey Hardcore [MADE GROUND]		(0.16)
					0.16	Black and dark grey ashy/sandy angular fine to coarse GRAVEL with some cobbles and rare boulders of Sandstone & brick		0.16
					0.14			(0.14)
					0.30	[MADE GROUND]		0.30
					0.06			(0.06)
				0.36	Brown sandy angular to sub-angular fine to coarse GRAVEL [MADE GROUND]		0.36	
					Grey slightly silty very sandy sub-angular fine to coarse GRAVEL with some to many cobbles and boulders		(0.64)	
					0.64			
1	1.00 -	B2 ES3			1.00	Pit terminated at 1.0m to carry out Soakaway Test		1.00

PLAN 		Groundwater: Stability: Shoring:		Remarks: Soakaway test carried out in TP	
Equipment Used:					

	Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:	Operator:	Logged By:	Sheet No. 1 Of 2	m Per Page 3	All measurements in metres unless otherwise stated	
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Contract : Former Crown & Sceptre Car Park

Client : First Choice Housing Association

Trial Pit No.

TP01

Dates : 26/9/24 - 26/9/24

Job Number : Q1463

Ground Level :

Location : Cadoxton

Engineer : SQL

Coordinates:



Plas Newydd, Llanedi, Pontarddulais, Swansea

Tel:
email:

Operator:

Logged By:

Sheet No.
2 Of 2

m Per
Page

All measurements in
metres unless
otherwise stated



Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association							Trial Pit No. TP02	
Dates : 26/9/24 - 26/9/24 Location : Cadoxton			Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata			WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	
1	0.30 -	B1 ES1			0.20	Tarmacadam over grey Hardcore [MADE GROUND]		(0.20)
					0.20	Grey and dark grey ashy/sandy very gravelly SILT / very silty GRAVEL (gravel: angular fine to coarse brick/sandstone) with some cobbles of Sandstone & brick [MADE GROUND]		0.20
					0.25			(0.25)
					0.45			Grey-brown very silty very sandy sub-angular to sub-rounded fine to coarse GRAVEL with some to many cobbles
			0.55	(0.55)				
	1.00 -	B2 ES2			1.00	Pit terminated at 1.0m to carry out Soakaway Test		1.00

PLAN 		Groundwater: Stability: Shoring:		Remarks: Soakaway test carried out in TP	
Equipment Used:					

	Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:	Operator:	Logged By:	Sheet No. 1 Of 2	m Per Page 3	All measurements in metres unless otherwise stated	
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Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association		Trial Pit No. TP02
Dates : 26/9/24 - 26/9/24 Location : Cadoxton	Job Number : Q1463 Engineer : SQL	Ground Level : Coordinates:



	Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:	Operator:	Logged By:	Sheet No. 2 Of 2	m Per Page	All measurements in metres unless otherwise stated	
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Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association							Trial Pit No. TP03	
Dates : 26/9/24 - 26/9/24 Location : Cadoxton			Job Number : Q1463 Engineer : SQL			Ground Level : Coordinates:		

m B.G.L.	Samples		Tests		Strata			WATER
	Depth	Type No.	Depth	Test Results	Depth (Thickness)	Description	Legend	
1	0.30 -	B1 ES1 ES2			0.16	Tarmacadam over grey Hardcore [MADE GROUND]		(0.16)
					0.16	Grey sub-angular COBBLES and Hardcore [MADE GROUND]		0.16 (0.11)
					0.27	Dark grey gravelly (angular fine to coarse) Ash/SAND with some cobbles and rare boulders of clinker/slag/sandstone [MADE GROUND]		0.27 (0.21)
					0.21			
					0.48	Brown gravelly (angular to sub-angular fine to coarse) SAND [MADE GROUND]		0.48 (0.07)
	1.00 -	B2 ES3			0.07	Grey angular to sub-angular COBBLES [MADE GROUND]		0.55 (0.15)
					0.55			
					0.15			
					0.70	Brown slightly silty very Sandy fine to coarse sub-angular to sub-rounded GRAVEL with some sub-rounded Cobbles		0.70 (0.40)
					0.40			
		1.10	Pit terminated at 1.1m to carry out Soakaway Test		1.10			

PLAN 	Groundwater: Stability: Shoring:	Remarks: Soakway test carried out in TP
-----------------	--	--

Equipment Used:							
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	Plas Newydd, Llanedi, Pontarddulais, Swansea Tel: email:	Operator:	Logged By:	Sheet No. 1 Of 2	m Per Page 3	All measurements in metres unless otherwise stated	
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Contract : Former Crown & Sceptre Car Park Client : First Choice Housing Association		Trial Pit No. TP03
Dates : 26/9/24 - 26/9/24 Location : Cadoxton	Job Number : Q1463 Engineer : SQL	Ground Level : Coordinates:

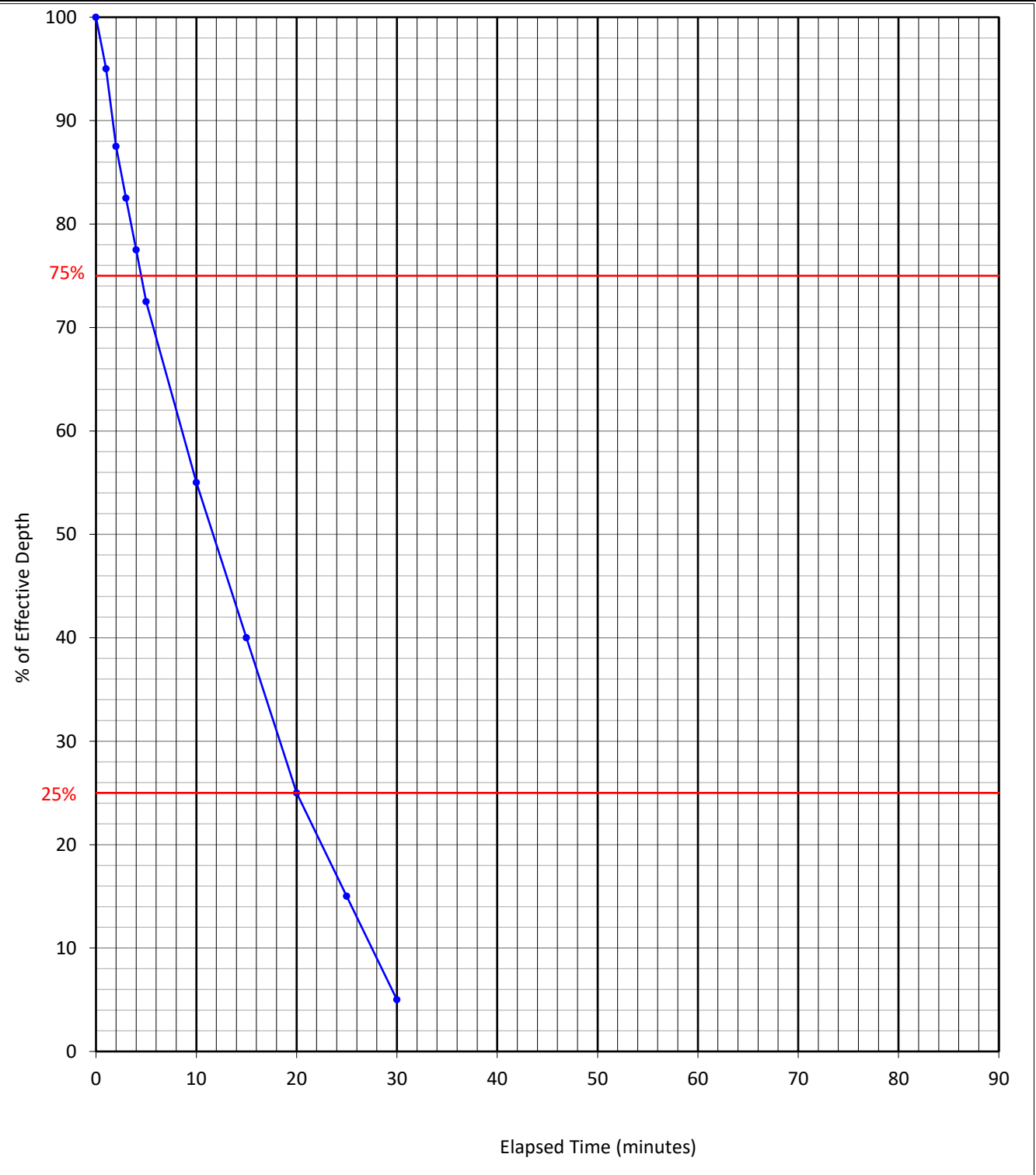


APPENDIX IV – SOAKAWAY TEST RESULTS

SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP01
Test No : 1
Date : 26/09/2024



	t_{p75} = 4.0 minutes
	t_{p25} = 20.0 minutes

Sheet 2 of 2

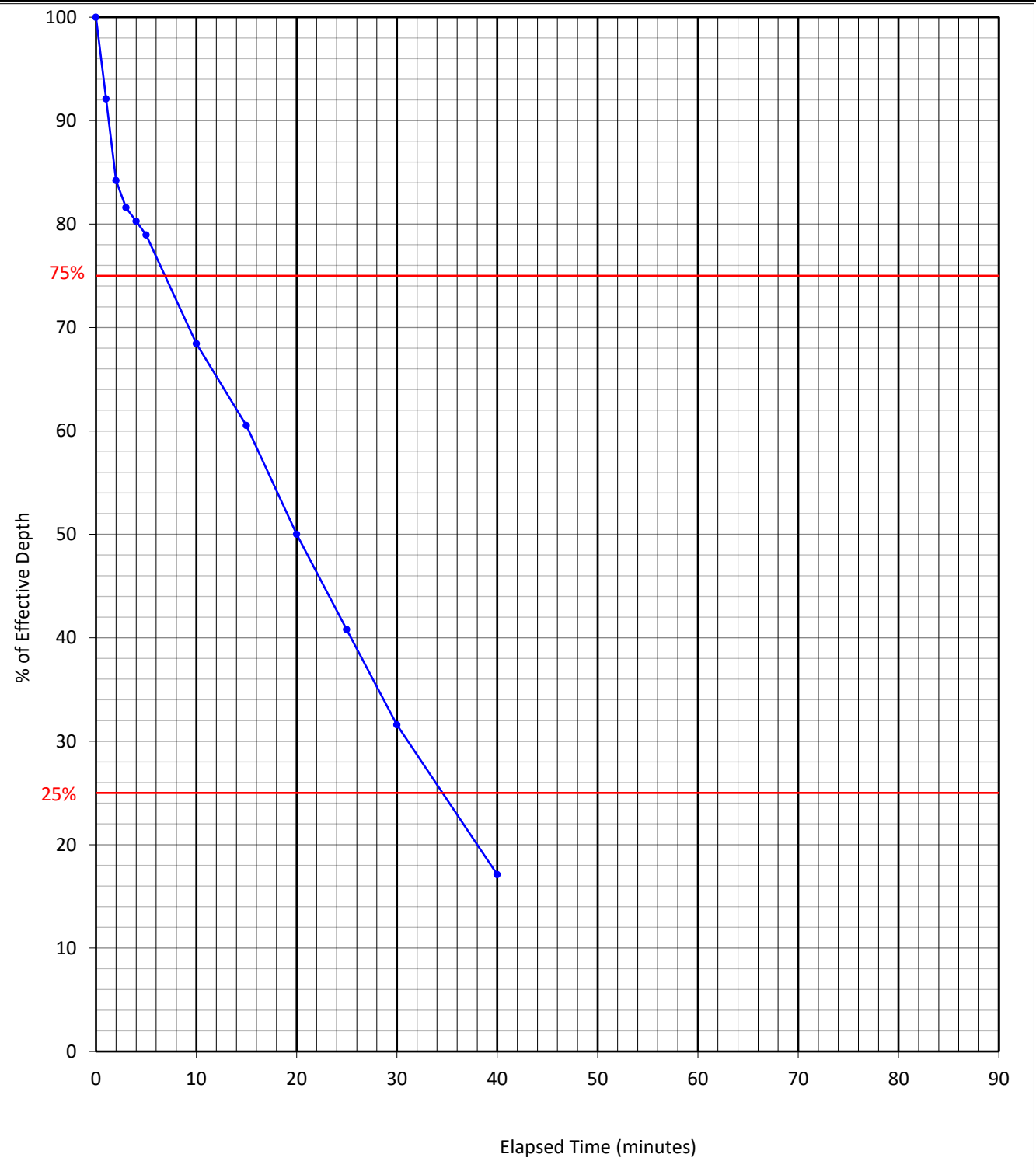
Remarks: Unable to fill pit above 0.6m depth



SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP01
Test No : 2
Date : 26/09/2024



	t_{p75} = 7.0 minutes
	t_{p25} = 34.0 minutes

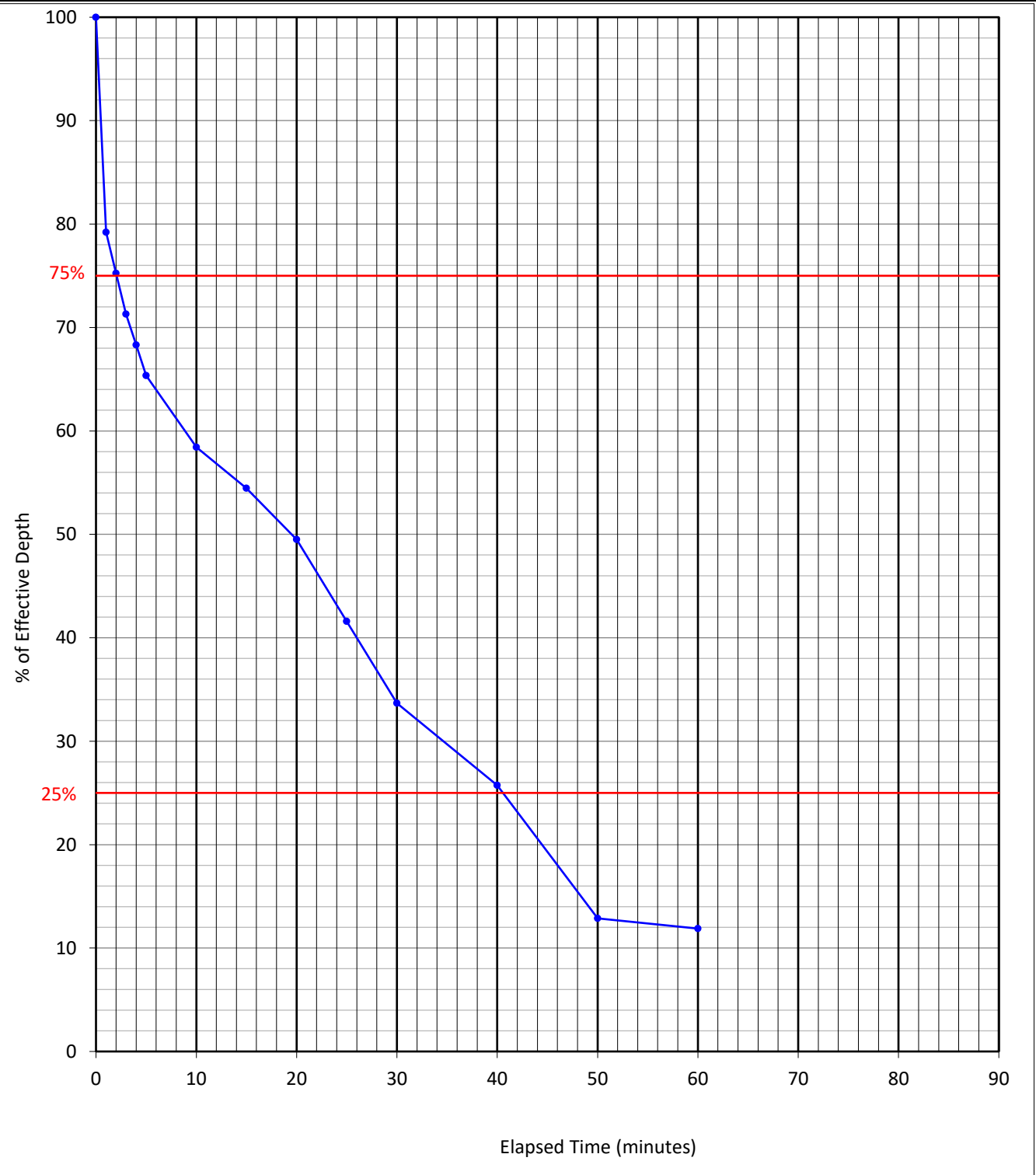
Remarks: Unable to fill pit above 0.62m depth



SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP01
Test No : 3
Date : 26/09/2024



	$t_{p75} = 2.0$ minutes
	$t_{p25} = 41.0$ minutes

Sheet 2 of 2

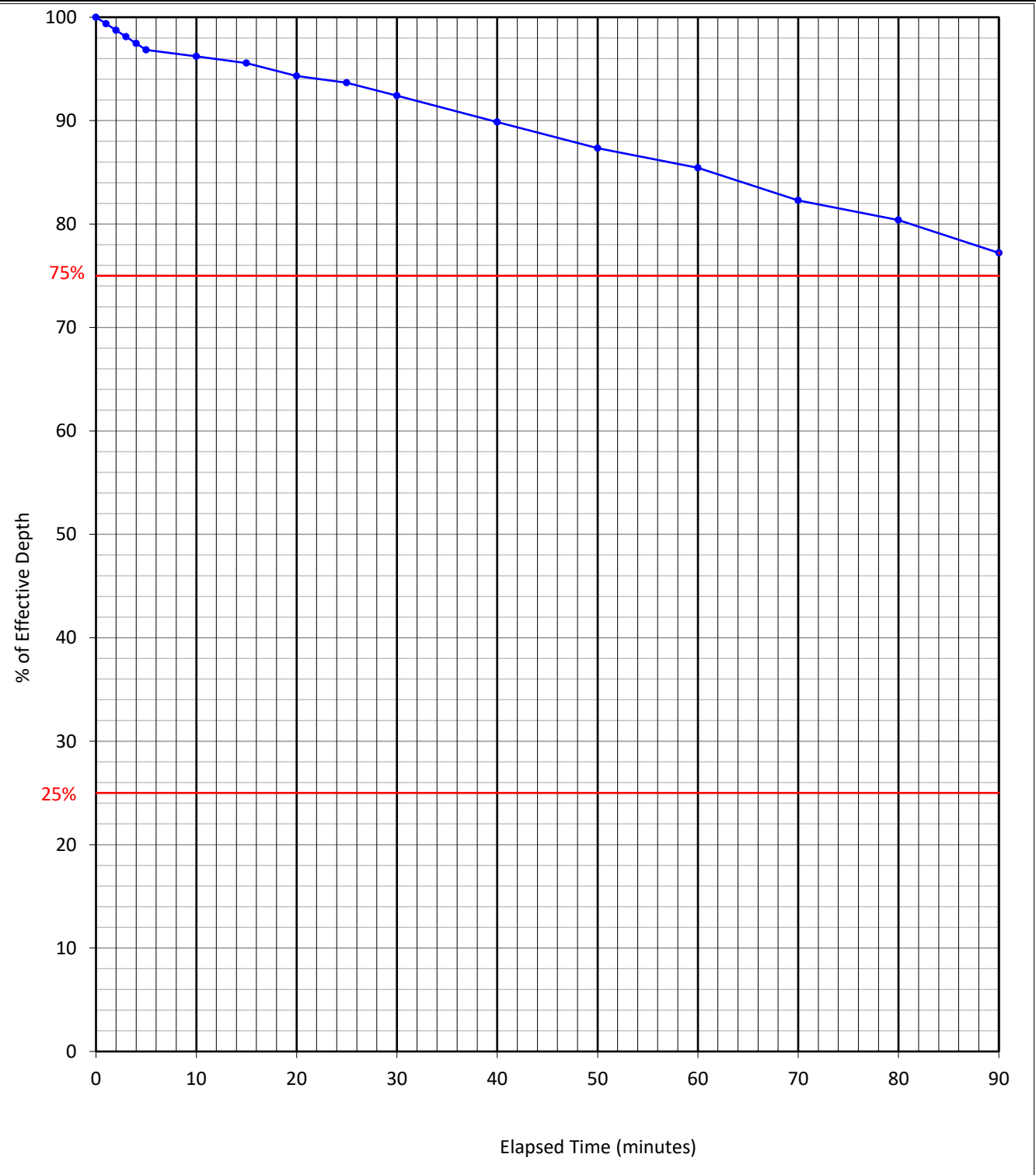
Remarks: Unable to fill pit above 0.51m depth



SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP02
Test No : 1
Date : 26/09/2024



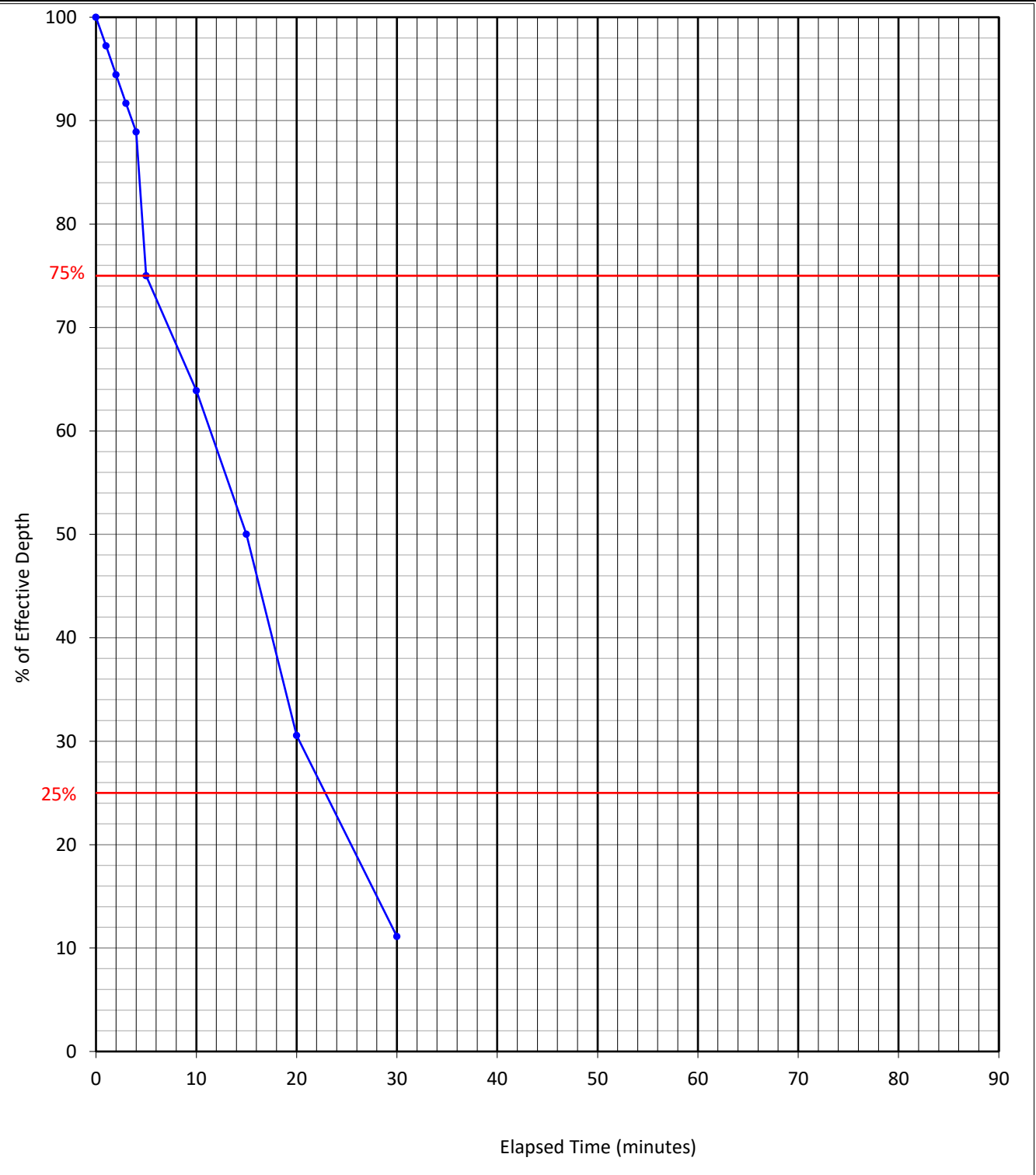
	t_{p75} =	minutes
	t_{p25} =	minutes

Remarks: Unable to fill pit above 0.21m depth.
75% Effective depth not reached in 90mins

SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP03
Test No : 1
Date : 26/09/2024



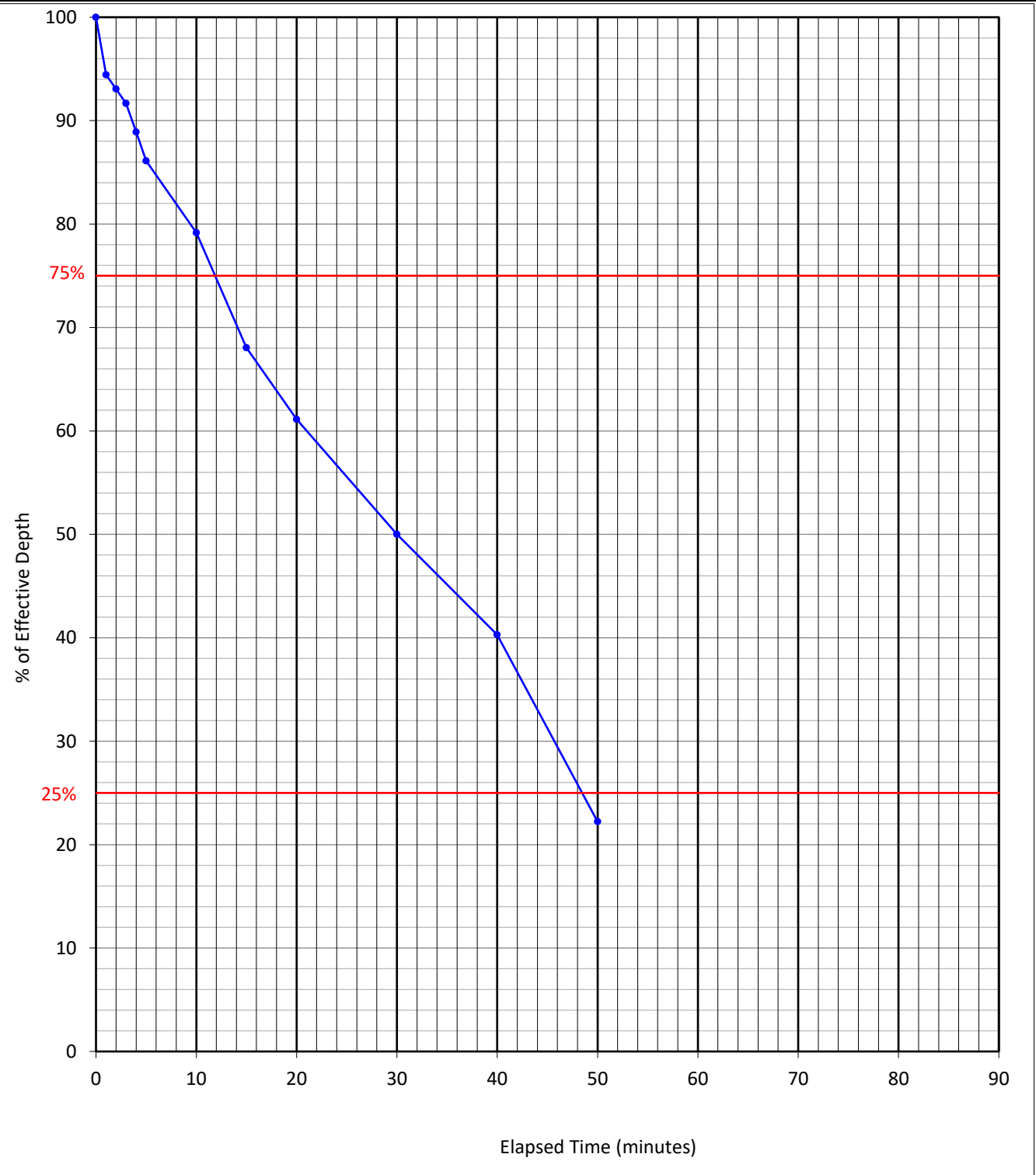
	t_{p75} = 5.0 minutes
	t_{p25} = 23.0 minutes

Remarks: Unable to fill pit above 0.74m depth

SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP03
Test No : 2
Date : 26/09/2024



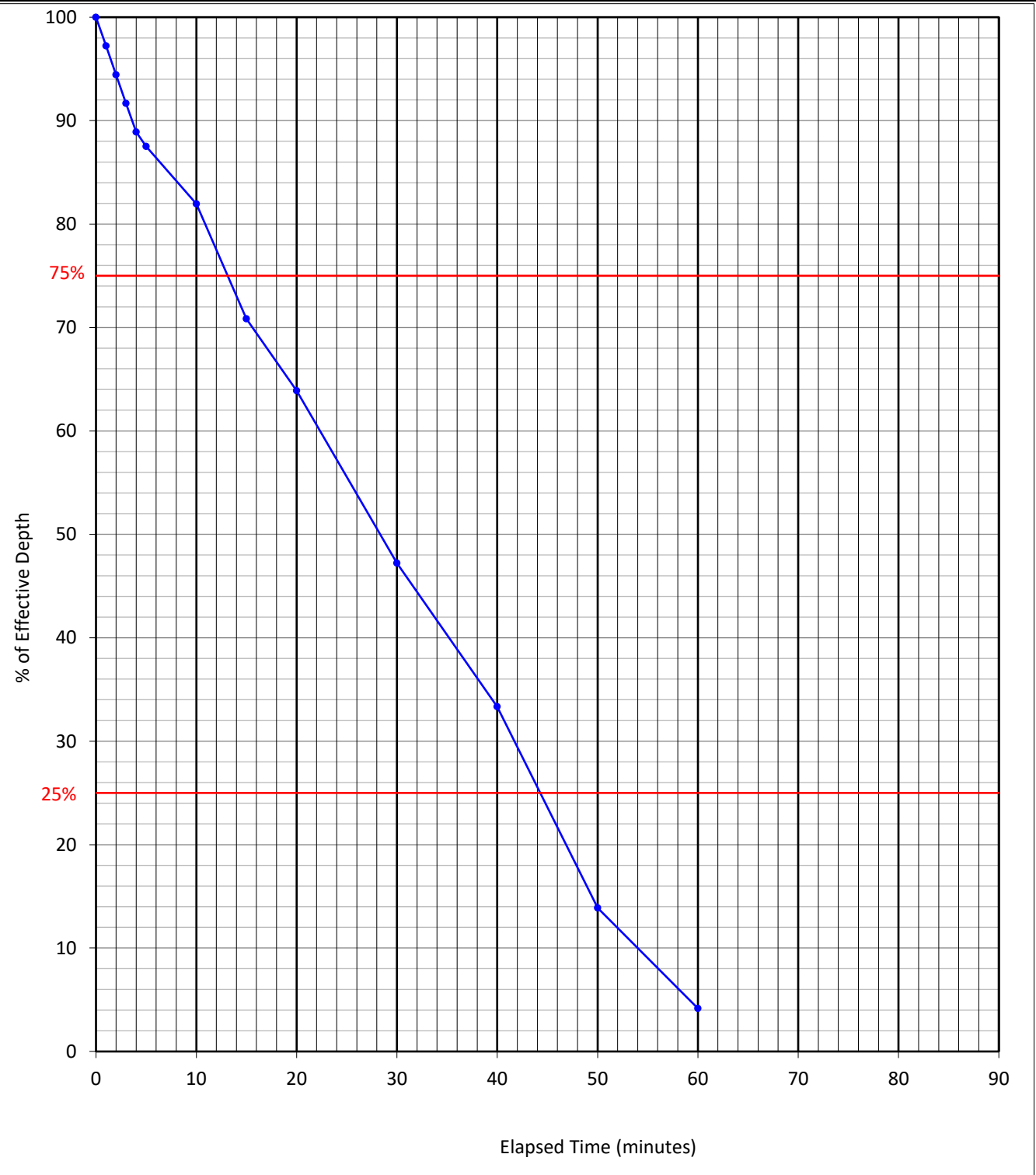
	t_{p75} = 12.0 minutes
	t_{p25} = 48.0 minutes

Remarks: Unable to fill pit above 0.74m depth

SPENCER QUANTUM - Soakaway Test

Project: Former Crown & Sceptre Car Park, Cadoxton
Project No: Q1463
Client: First Choice Housing Association

Test Location : TP03
Test No : 3
Date : 26/09/2024



	t_{p75} = 13.0 minutes
	t_{p25} = 44.0 minutes

Sheet 2 of 2

Remarks: Unable to fill pit above 0.74m depth



APPENDIX V – GAS MONITORING RESULTS

Page 1 of 1

Installation Date: 26/09/24				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
N/A	A	50mm HDPE	2.00	1.0 - 2.0

[illegible]

APPENDIX VI – GEOTECHNICAL TEST RESULTS

SPENCER QUANTUM

SUMMARY OF LABORATORY TEST RESULTS



Sample						Index Properties								PSD Analysis						Chemical Tests				Remarks
EH No.	Sample		Depth (m)		Stratum	w %	LL %	PL %	PI %	<425 µm %	PI Mod %	Casegrande Classification	Bulk Density Mg/m³	Cobbles %	Gravel %	Sand %	Silt %	Clay %	pH	Sulphate Content				
	Type	No.	From	To																Soil %	Water %	2:1 Ex mg/l		
WS01	B	1	0.00	1.00	MG	8.7								0	78	14	8							
WS01A	B	1	0.00	0.50	MG	12													7.7			27		
WS01A	B	2	0.50	1.00	MG	30	64	20	44	36	16	CH		0	56	22	22	15						
WS02	B	1	0.00	1.00	MG	7.9								0	77	14	9							
WS03	B	1	0.00	1.00	MG	8.9								22	60	12	6		7.6			15		
WS04	B	1	0.00	1.00	MG	7.2								37	42	14	7		7.7			150		
WS05	B	1	0.00	1.00	MG	5.7								0	82	14	4							
TP01	B	1	0.20		MG	8.9								0	82	12	6							
TP01	B	2	1.00		G-F	10								27	58	11	4							
TP02	B	1	0.30		MG	26	47	20	27	30	8	CI		20	43	23	14							
TP02	B	2	1.00		G-F	28								0	40	30	30							
TP03	B	1	0.30		MG	9.5								0	78	16	6							
TP03	B	2	1.00		G-F	6.6								13	70	11	6							
JOB NO: Q1463						CONTRACT : Crown & Sceptre Inn, Cadoxton																	TABLE: App V	



Laboratory Report



Contract Number: 74995

Client Ref: **Q1463**

Client PO: **Q1463**

Date Received: **30-09-2024**

Date Completed: **11-10-2024**

Report Date: **11-10-2024**

Client: **Spencer Quantum Ltd**

This report has been checked and approved by:

Contract Title: **Q1463 - Cadoxton**

For the attention of: **John Stark**



Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	13
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	2
Particle Size Distribution BS EN ISO 17892-4 : 5.1 - * UKAS	12
Sedimentation by Pipette BS EN ISO 17892-4 : 5.4	1
Water Soluble Sulphate 2:1 extract Sub-contracted Test	3
pH value of soil Sub-contracted Test	3
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP01**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

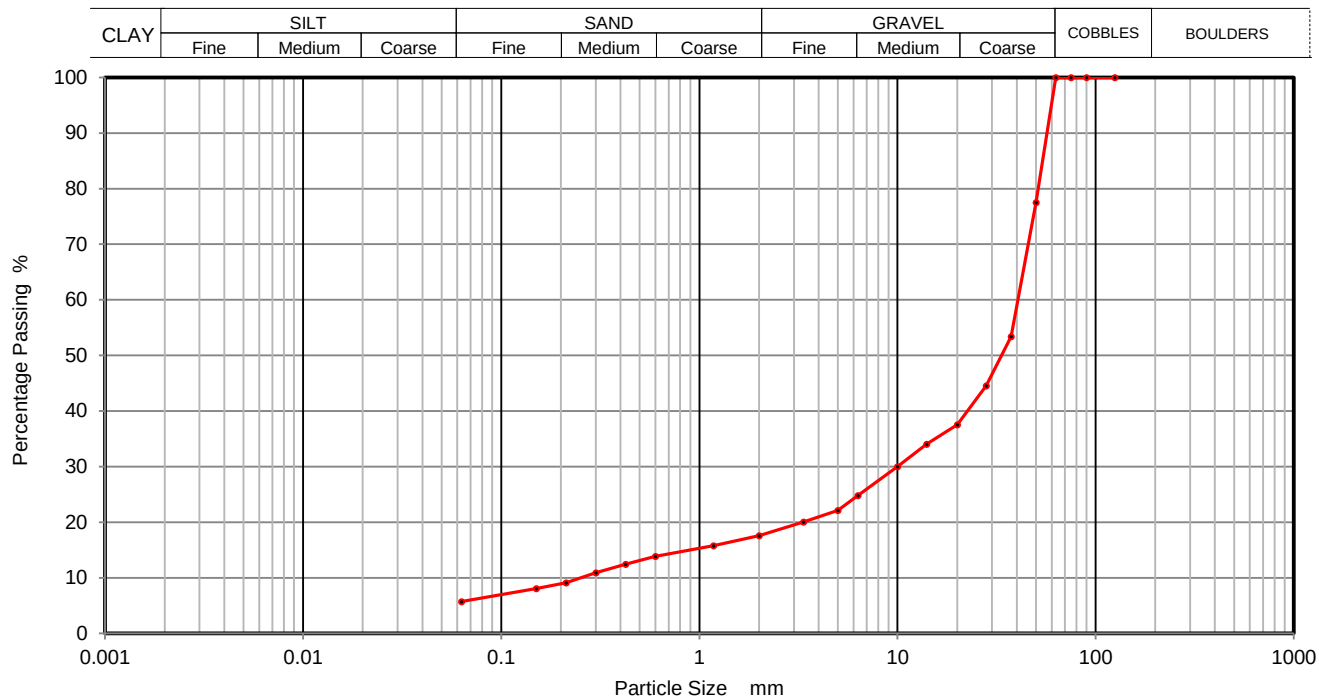
Sample Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.20**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	77		
37.5	53		
28	45		
20	38		
14	34		
10	30		
6.3	25		
5	22		
3.35	20		
2	18		
1.18	16		
0.63	14		
0.425	12		
0.30	11		
0.20	9		
0.15	8		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	12
Silt and Clay	6

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP01**

Project Name **Q1463 - Cadoxton**

Sample No. **2**

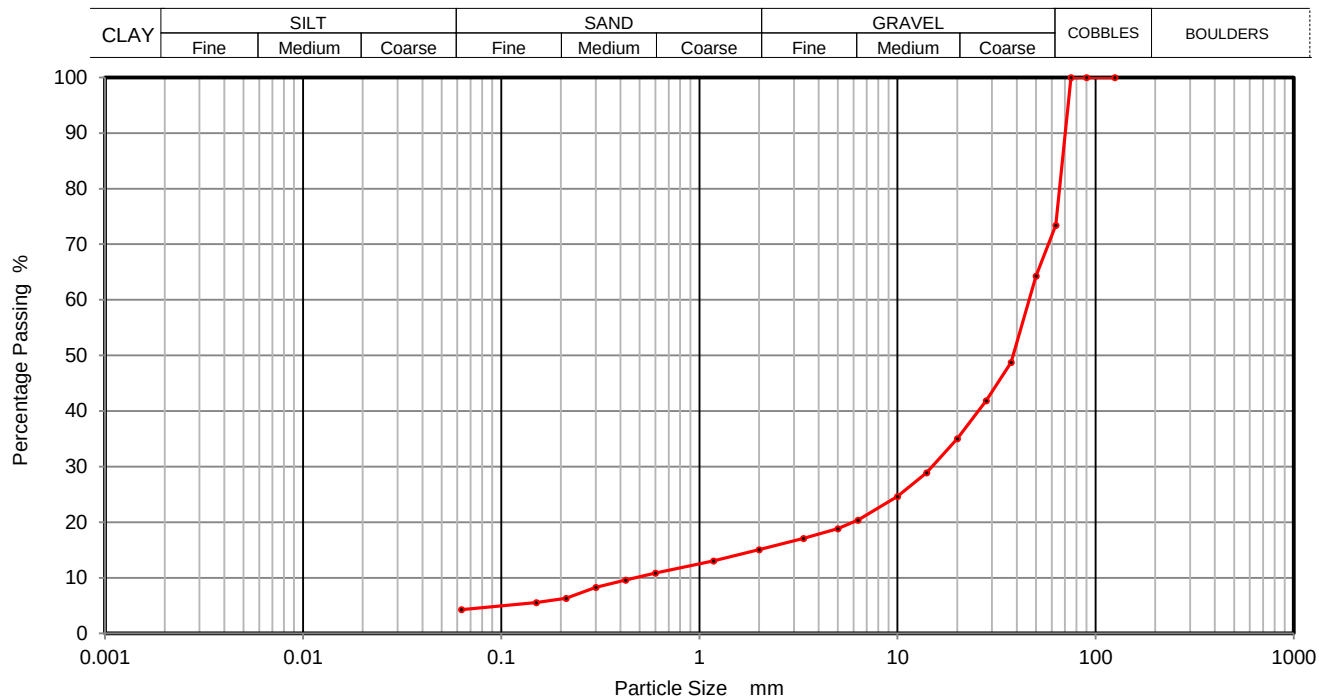
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles**

Depth Top **1.00**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	73		
50	64		
37.5	49		
28	42		
20	35		
14	29		
10	25		
6.3	20		
5	19		
3.35	17		
2	15		
1.18	13		
0.63	11		
0.425	10		
0.30	8		
0.20	6		
0.15	6		
0.063	4		

Sample Proportions	% dry mass
Cobbles	27
Gravel	58
Sand	11
Silt and Clay	4

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP02**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

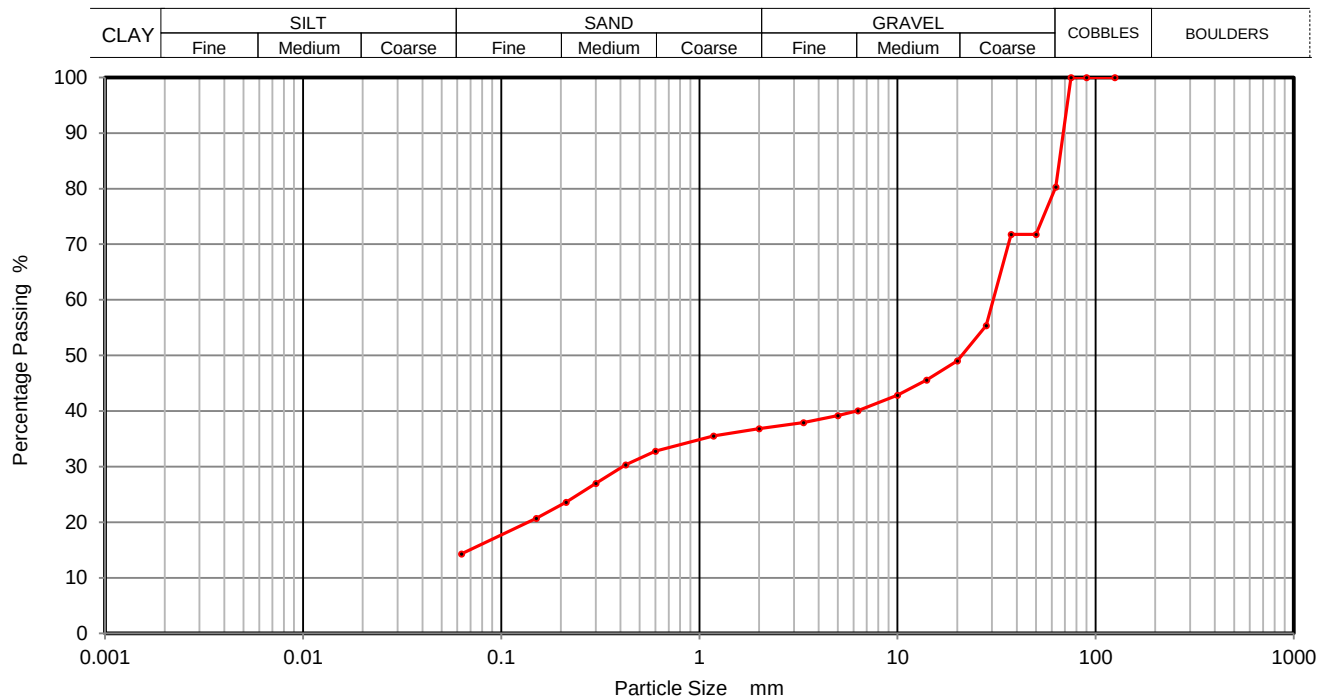
Sample Description **Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles**

Depth Top **0.30**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	80		
50	72		
37.5	72		
28	55		
20	49		
14	46		
10	43		
6.3	40		
5	39		
3.35	38		
2	37		
1.18	36		
0.63	33		
0.425	30		
0.30	27		
0.20	24		
0.15	21		
0.063	14		

Sample Proportions	% dry mass
Cobbles	20
Gravel	43
Sand	23
Silt and Clay	14

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP02**

Project Name **Q1463 - Cadoxton**

Sample No. **2**

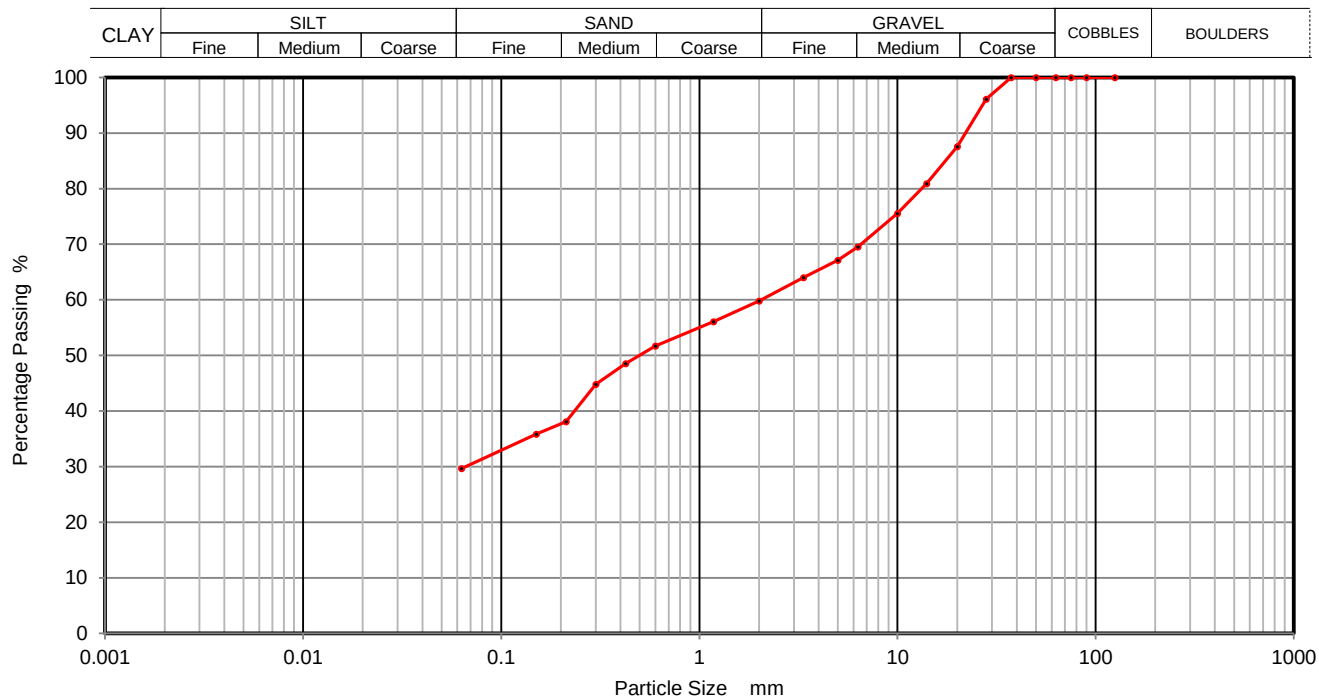
Sample Description **Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **1.00**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	88		
14	81		
10	76		
6.3	70		
5	67		
3.35	64		
2	60		
1.18	56		
0.63	52		
0.425	49		
0.30	45		
0.20	38		
0.15	36		
0.063	30		

Sample Proportions	% dry mass
Cobbles	0
Gravel	40
Sand	30
Silt and Clay	30

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP03**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

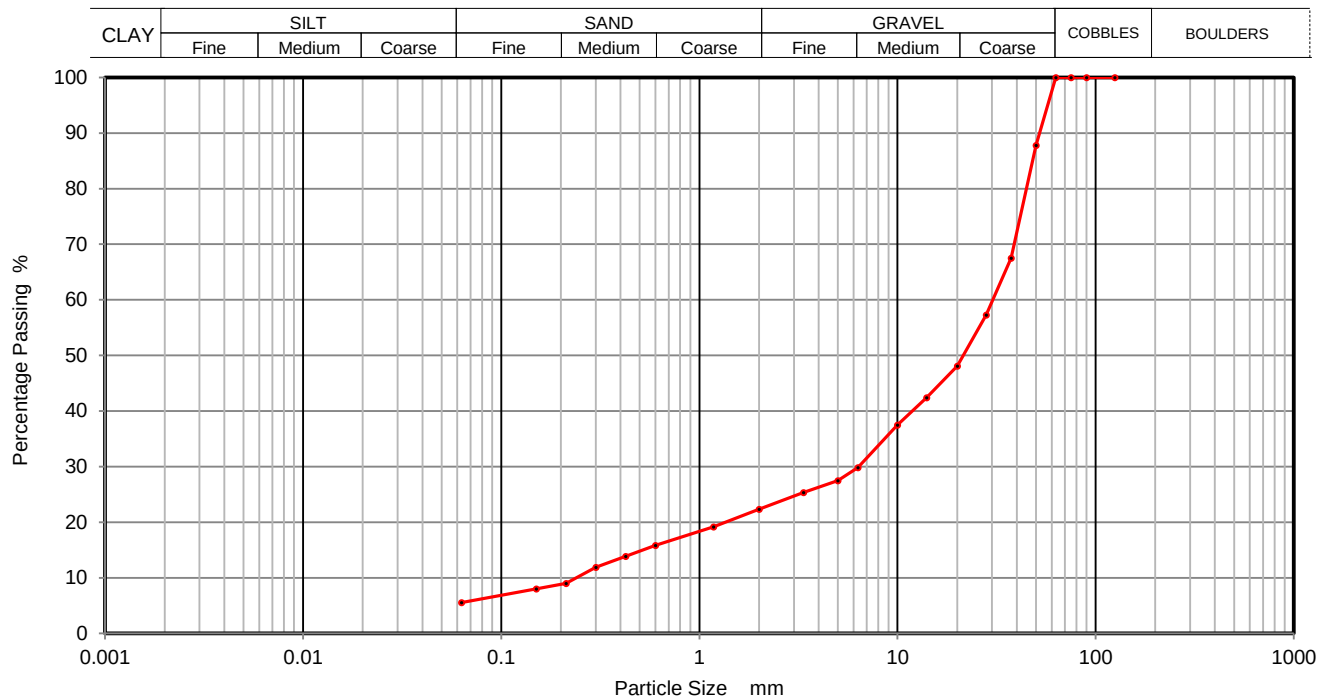
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.30**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	88		
37.5	68		
28	57		
20	48		
14	42		
10	37		
6.3	30		
5	27		
3.35	25		
2	22		
1.18	19		
0.63	16		
0.425	14		
0.30	12		
0.20	9		
0.15	8		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	78
Sand	16
Silt and Clay	6

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **TP03**

Project Name **Q1463 - Cadoxton**

Sample No. **2**

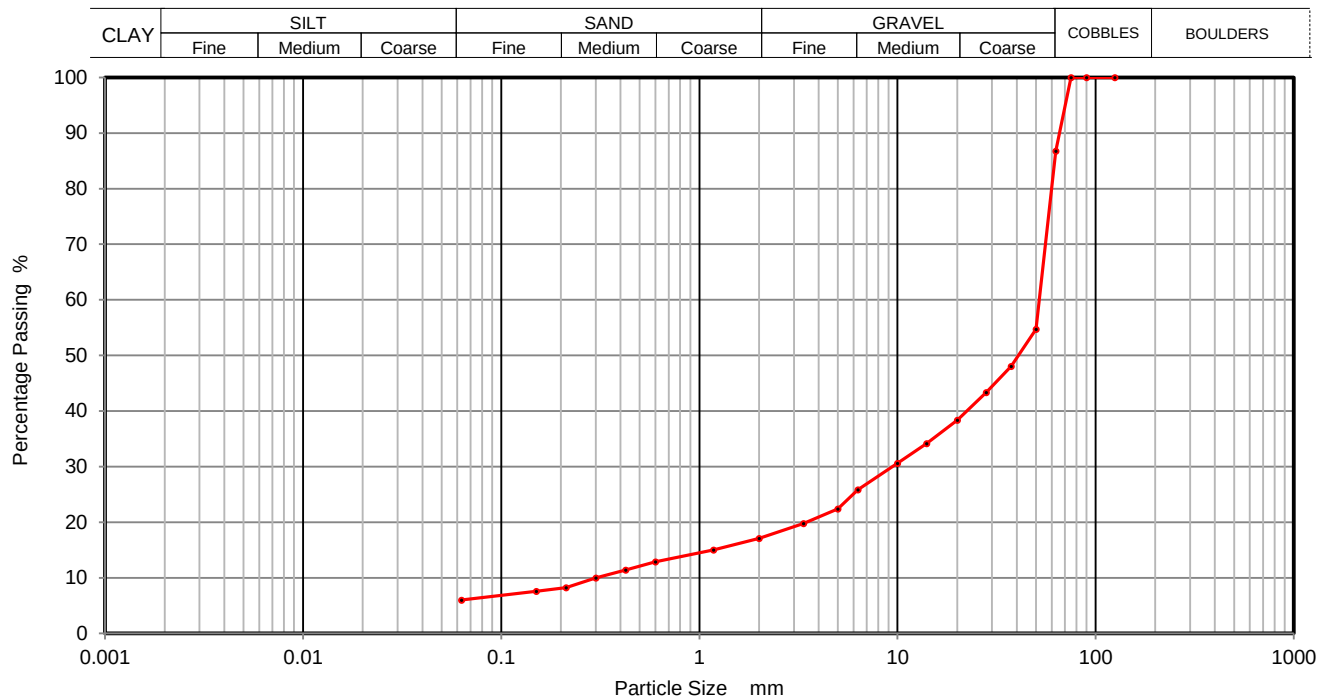
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles**

Depth Top **1.00**

Depth Base

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	87		
50	55		
37.5	48		
28	43		
20	38		
14	34		
10	31		
6.3	26		
5	22		
3.35	20		
2	17		
1.18	15		
0.63	13		
0.425	11		
0.30	10		
0.20	8		
0.15	8		
0.063	6		

Sample Proportions	% dry mass
Cobbles	13
Gravel	70
Sand	11
Silt and Clay	6

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **WS01**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

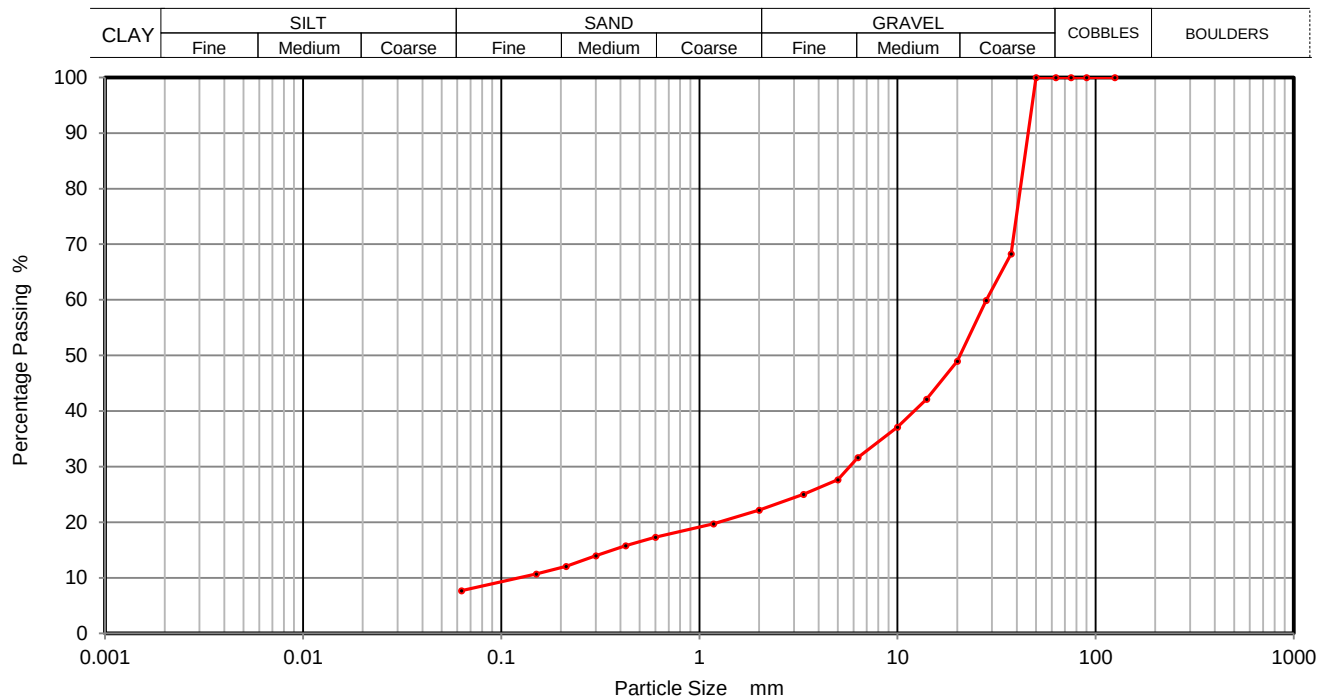
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.00**

Depth Base **1.00**

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	68		
28	60		
20	49		
14	42		
10	37		
6.3	32		
5	28		
3.35	25		
2	22		
1.18	20		
0.63	17		
0.425	16		
0.30	14		
0.20	12		
0.15	11		
0.063	8		

Sample Proportions	% dry mass
Cobbles	0
Gravel	78
Sand	14
Silt and Clay	8

Remarks
Preparation and testing in accordance with BS17892 unless noted below

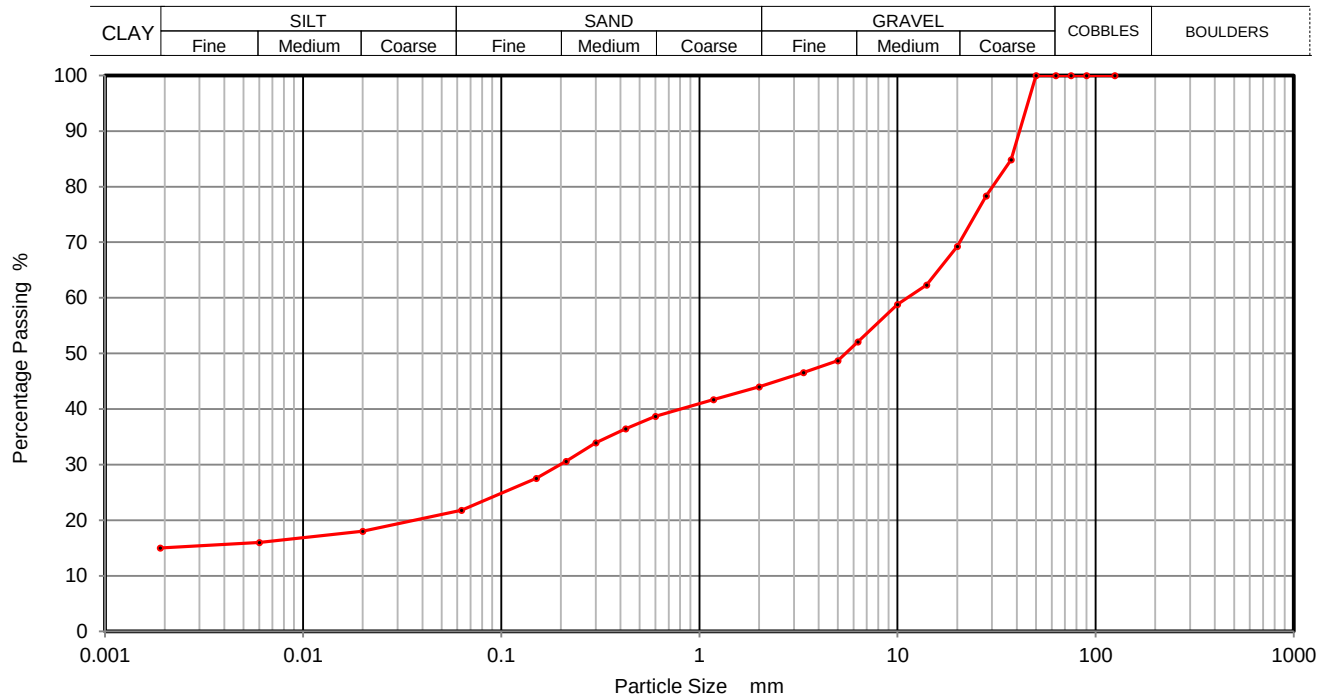
Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve & Pipette Analysis, Clause 5.2 & 5.4

Contract Number	74995
Borehole/Pit No.	WS01A
Sample No.	2
Depth Top	0.50
Depth Base	1.00
Sample Type	B

Project Name	Q1463 - Cadoxton
Sample Description	Brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL
Date Tested	04/10/2024



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	18
90	100	0.0060	16
75	100	0.0020	15
63	100		
50	100		
37.5	85		
28	78		
20	69		
14	62		
10	59		
6.3	52		
5	49		
3.35	47		
2	44		
1.18	42		
0.63	39		
0.425	36		
0.30	34		
0.20	31		
0.15	28		
0.063	22		

Sample Proportions	% dry mass
Cobbles	0
Gravel	56
Sand	22
Silt	7
Clay	15

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator
Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **WS02**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

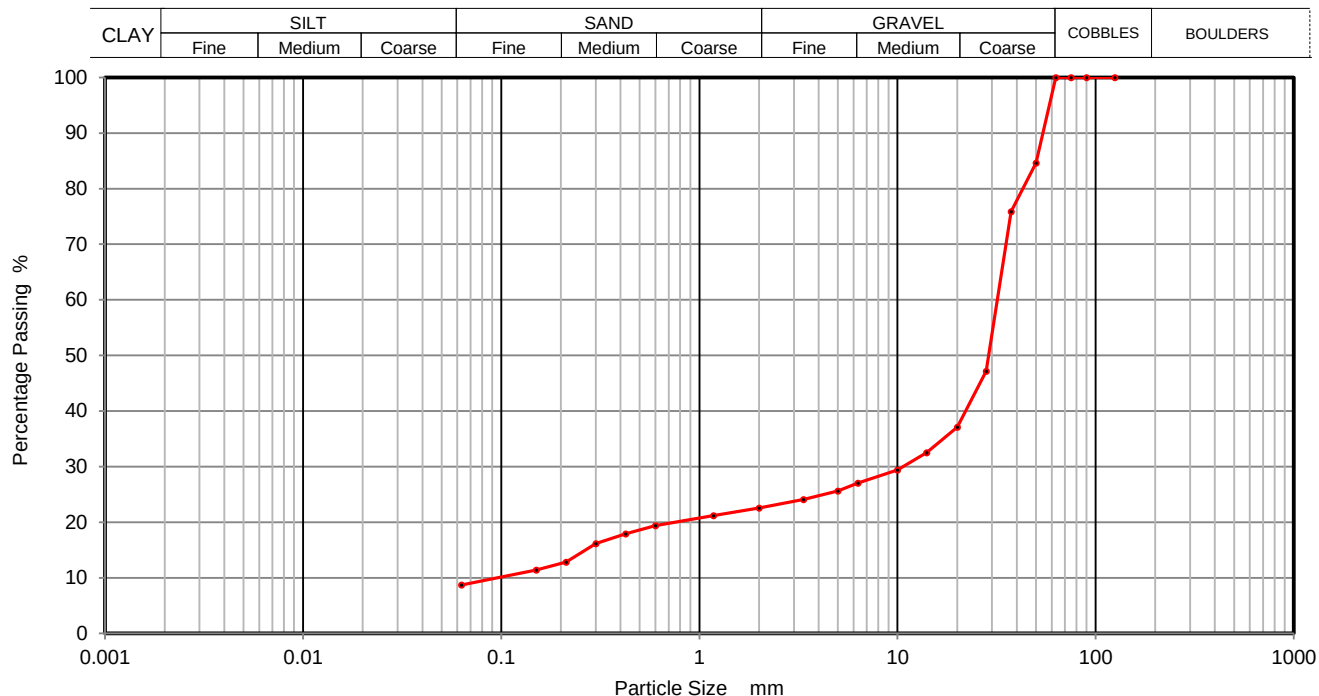
Sample Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.00**

Depth Base **1.00**

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	85		
37.5	76		
28	47		
20	37		
14	33		
10	29		
6.3	27		
5	26		
3.35	24		
2	23		
1.18	21		
0.63	19		
0.425	18		
0.30	16		
0.20	13		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	14
Silt and Clay	9

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **WS03**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

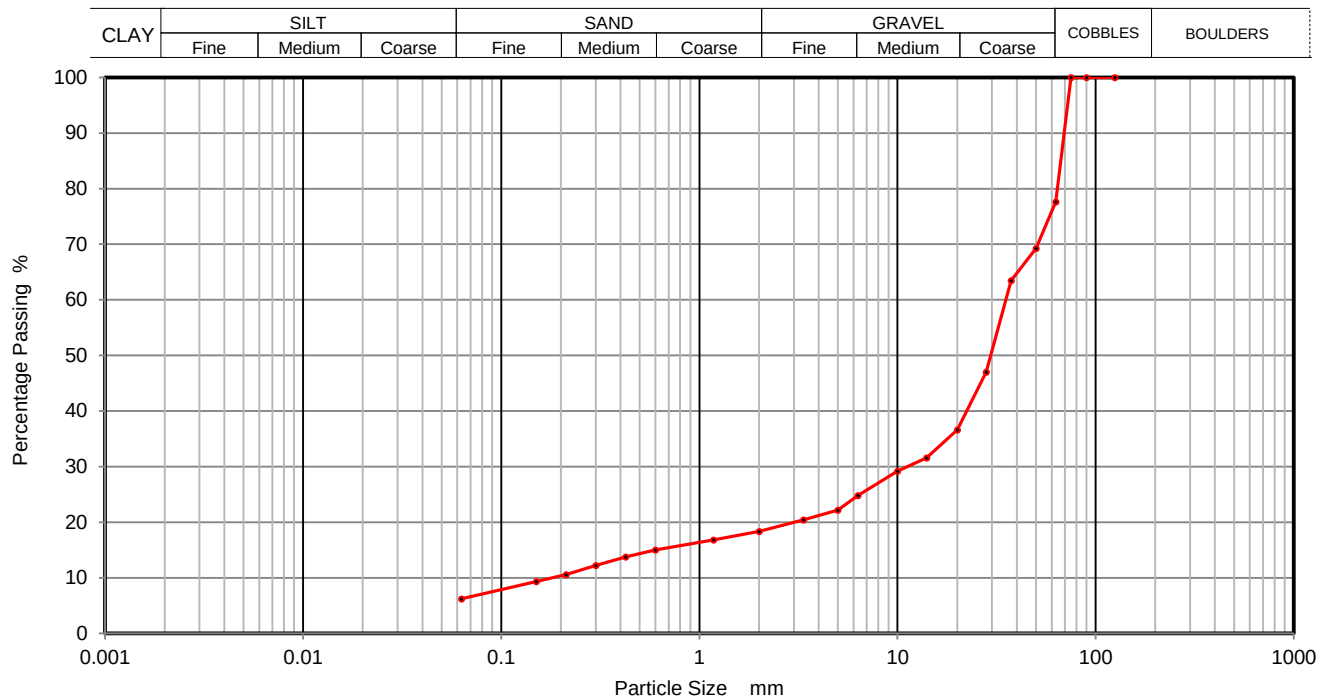
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles**

Depth Top **0.00**

Depth Base **1.00**

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	78		
50	69		
37.5	63		
28	47		
20	37		
14	32		
10	29		
6.3	25		
5	22		
3.35	20		
2	18		
1.18	17		
0.63	15		
0.425	14		
0.30	12		
0.20	11		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	22
Gravel	60
Sand	12
Silt and Clay	6

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **WS04**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

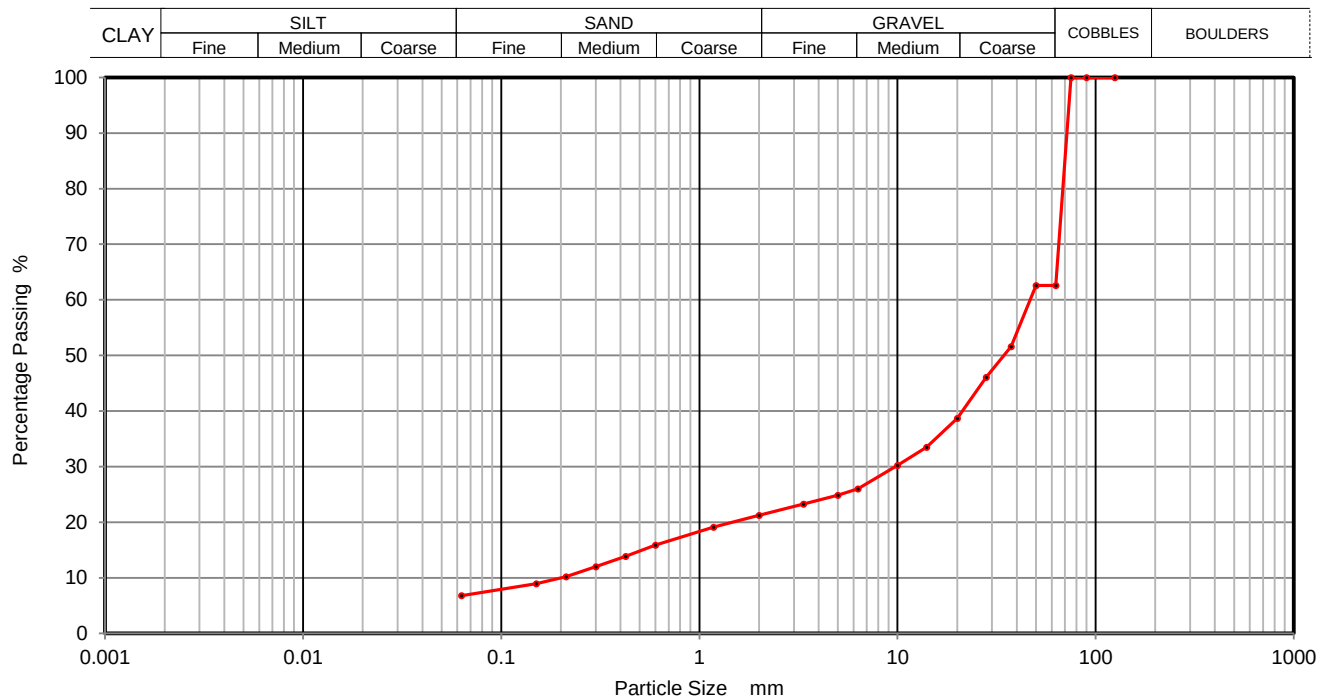
Sample Description **Brown/ grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles**

Depth Top **0.00**

Depth Base **1.00**

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	63		
50	63		
37.5	52		
28	46		
20	39		
14	33		
10	30		
6.3	26		
5	25		
3.35	23		
2	21		
1.18	19		
0.63	16		
0.425	14		
0.30	12		
0.20	10		
0.15	9		
0.063	7		

Sample Proportions	% dry mass
Cobbles	37
Gravel	42
Sand	14
Silt and Clay	7

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **74995**

Borehole/Pit No. **WS05**

Project Name **Q1463 - Cadoxton**

Sample No. **1**

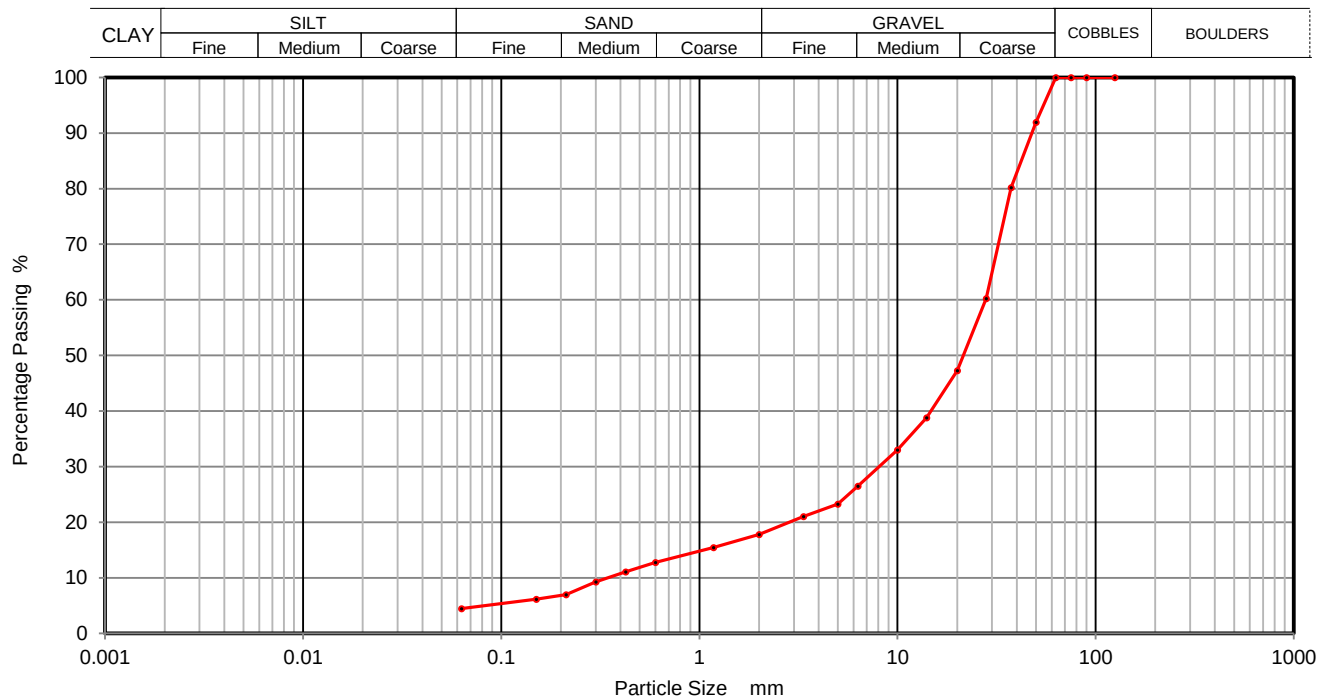
Sample Description **Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL**

Depth Top **0.00**

Depth Base **1.00**

Date Tested **04/10/2024**

Sample Type **B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	92		
37.5	80		
28	60		
20	47		
14	39		
10	33		
6.3	27		
5	23		
3.35	21		
2	18		
1.18	15		
0.63	13		
0.425	11		
0.30	9		
0.20	7		
0.15	6		
0.063	4		

Sample Proportions	% dry mass
Cobbles	0
Gravel	82
Sand	14
Silt and Clay	4

Remarks
Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron Thomas

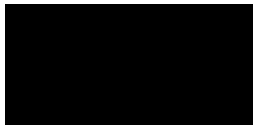


GSTL

Unit 3-4 Heol Aur
Dafen Ind Estate
Dafen
SA14 8QN

Analytical Test Report: L24/09193/GSL - 24-50552

Your Project Reference:	Q1463 Cadoxton		
Your Order Number:	74995	Samples Received / Instructed:	03/10/2024 / 03/10/2024
Report Issue Number:	1	Sample Tested:	03/10 to 11/10/2024
Samples Analysed:	3 sample(s)	Report issued:	11/10/2024



James Gane
Analytical Services Manager
CTS Group

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 09.10.2024

Issued by: J. Gane

Issue No: 4

Rev No: 15



L24/09193/GSL - 24-50552

Project Reference - Q1463 Cadoxton

Analytical Test Results - Chemical Analysis

Lab Reference			404075	404076	404077
Client Sample ID			-	-	-
Client Sample Location			WS01A	WS03	WS04
Client Sample Type			B	B	B
Client Sample Number			1	1	1
Depth - Top (m)			0.00	0.00	0.00
Depth - Bottom (m)			0.50	1.00	1.00
Date of Sampling			-	-	-
Time of Sampling			-	-	-
Sample Matrix			Clay	Clay	Clay
Determinant	Units	Accreditation			
Water soluble sulphate (as SO ₄)	(mg/l)	u	27	15	150
pH Value	pH Units	MCERTS	7.7	7.6	7.7



L24/09193/GSL - 24-50552

Project Reference - Q1463 Cadoxton

Sample Descriptions

7 - 11 Harding Street
Leicester
LE1 4DH

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
404075	-	WS01A	B	1	Grey slightly gravelly silty clay	-	-	77
404076	-	WS03	B	1	Brown slightly gravelly silty clay	-	-	100
404077	-	WS04	B	1	Brown very gravelly silty clay	-	-	100



L24/09193/GSL - 24-50552

Project Reference - Q1463 Cadoxton

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
404075	-	WS01A	B	1	
404076	-	WS03	B	1	
404077	-	WS04	B	1	



L24/09193/GSL - 24-50552

Project Reference - Q1463 Cadoxton

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis



L24/09193/GSL - 24-50552

Project Reference - Q1463 Cadoxton

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
404075	-	WS01A	B	1		A
404076	-	WS03	B	1		A
404077	-	WS04	B	1		A

APPENDIX VII – GEO-CHEMICAL TEST RESULTS

Final Report

Report No.: 24-31667-1

Initial Date of Issue: 11-Oct-2024

Re-Issue Details:

Client Spencer Quantum Ltd

Client Address: Parcau Farm
Penrhiwllan
Llandysul
Ceredigion
SA44 5NW

Contact(s): John Stark

Project Q1463 Cadoxton

Quotation No.: Q23-32755

Date Received: 01-Oct-2024

Order No.:

Date Instructed: 01-Oct-2024

No. of Samples: 6

Turnaround (Wkdays): 5

Results Due: 07-Oct-2024

Date Approved: 11-Oct-2024

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: Q1463 Cadoxton

Client: Spencer Quantum Ltd		Chemtest Job No.:		24-31667	24-31667	24-31667	24-31667	24-31667	24-31667	24-31667
Quotation No.: Q23-32755		Chemtest Sample ID.:		1874388	1874389	1874390	1874391	1874392	1874393	1874393
Order No.:		Client Sample Ref.:		ES1	ES1	ES1	ES3	ES1	ES1	ES1
		Client Sample ID.:		ES1	ES1	ES1	ES3	ES1	ES1	ES1
		Sample Location:		WS03	WS04	TP01	TP01	TP02	TP03	TP03
		Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):		0.50	0.50	0.20	1.00	0.30	0.30	0.30
		Date Sampled:		27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024
		Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	HWOL Code	Accred.	SOP	Units	LOD					
ACM Type		U	2192		N/A	-	-	-	-	-
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	14	11	9.2	9.8	15
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Clay	Clay	Clay	Clay	Loam
pH at 20C		U	2010		4.0	7.9	8.2	7.8	8.3	7.6
Boron (Hot Water Soluble)		U	2120	mg/kg	0.40	1.5	0.59	< 0.40	< 0.40	0.65
Sulphate (2:1 Water Soluble) as SO4		U	2120	g/l	0.010	< 0.010	< 0.010	0.010	0.042	< 0.010
Cyanide (Total)		U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic		U	2455	mg/kg	0.5	16	45	19	150	36
Cadmium		U	2455	mg/kg	0.10	0.59	2.4	1.8	12	0.59
Chromium		U	2455	mg/kg	0.5	43	60	30	130	33
Copper		U	2455	mg/kg	0.50	95	130	95	800	70
Mercury		U	2455	mg/kg	0.05	0.25	0.17	0.16	0.15	0.15
Nickel		U	2455	mg/kg	0.50	33	24	45	57	26
Lead		U	2455	mg/kg	0.50	380	600	720	7300	120
Zinc		U	2455	mg/kg	0.50	910	1800	2000	22000	430
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0	< 1.0	2.2
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	< 2.0	< 2.0	< 2.0	2.0	3.4
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	3.00	< 3.0	3.3	< 3.0	< 3.0	5.0
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	< 10	< 10	< 10	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	5.00	< 5.0	< 5.0	< 5.0	< 5.0	11
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	< 10	< 10	< 10	11
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25

Results - Soil

Project: Q1463 Cadovoxton

Client: Spencer Quantum Ltd		Chemtest Job No.:	24-31667	24-31667	24-31667	24-31667	24-31667	24-31667
Quotation No.: Q23-32755		Chemtest Sample ID.:	1874388	1874389	1874390	1874391	1874392	1874393
Order No.:		Client Sample Ref.:	ES1	ES1	ES1	ES3	ES1	ES1
		Client Sample ID.:	ES1	ES1	ES1	ES3	ES1	ES1
		Sample Location:	WS03	WS04	TP01	TP01	TP02	TP03
		Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):	0.50	0.50	0.20	1.00	0.30	0.30
		Date Sampled:	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024
		Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	2.6	3.3	2.7
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0	2.5	< 2.0
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0	1.5	< 1.0
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	< 5.0	5.8	< 5.0
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	< 10	< 10	< 10
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	< 10	< 10	< 10
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	< 10	< 10	< 10
Organic Matter		U	2625	%	0.40	4.5	3.1	2.4
Naphthalene		U	2800	mg/kg	0.10	0.23	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	2800	mg/kg	0.10	0.45	0.89	< 0.10
Anthracene		U	2800	mg/kg	0.10	0.14	0.25	< 0.10
Fluoranthene		U	2800	mg/kg	0.10	0.55	1.7	< 0.10
Pyrene		U	2800	mg/kg	0.10	0.57	1.2	< 0.10
Benzo[a]anthracene		U	2800	mg/kg	0.10	0.43	1.1	< 0.10
Chrysene		U	2800	mg/kg	0.10	0.53	1.3	< 0.10
Benzo[b]fluoranthene		U	2800	mg/kg	0.10	0.80	1.6	< 0.10
Benzo[k]fluoranthene		U	2800	mg/kg	0.10	0.25	0.45	< 0.10
Benzo[a]pyrene		U	2800	mg/kg	0.10	0.53	0.72	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	2800	mg/kg	0.10	0.37	0.68	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	2800	mg/kg	0.10	0.41	0.55	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	5.3	10	< 2.0
Total Phenols		U	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8–C10 Aromatics: >C5–C7,>C7–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

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I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

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Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

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- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

- DW - Drinking Water
- GW - Ground Water
- LE - Land Leachate
- NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Final Report

Report No.: 24-31644-1

Initial Date of Issue: 07-Oct-2024

Re-Issue Details:

Client Spencer Quantum Ltd

Client Address: Parcau Farm
Penrhiwllan
Llandysul
Ceredigion
SA44 5NW

Contact(s): John Stark

Project Q1463 CADOXTON

Quotation No.: Q23-32755

Date Received: 01-Oct-2024

Order No.:

Date Instructed: 01-Oct-2024

No. of Samples: 4

Turnaround (Wkdays): 5

Results Due: 07-Oct-2024

Date Approved: 07-Oct-2024

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: Q1463 CADOXTON

Client: Spencer Quantum Ltd	Chemtest Job No.:					24-31644	24-31644	24-31644	24-31644
Quotation No.: Q23-32755	Chemtest Sample ID.:					1874302	1874303	1874304	1874305
Order No.:	Client Sample Ref.:					ES2	ES2	ES2	ES3
	Client Sample ID.:					ES2	ES2	ES2	ES3
	Sample Location:					TP01	TP02	TP03	TP03
	Sample Type:					SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.2	0.3	0.3	1.0
	Date Sampled:					27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024
Determinand	Accred.	SOP	Type	Units	LOD				
pH at 20C	U	1010	2:1		4.0	7.9	7.8	10.1	8.9
Sulphate	U	1220	2:1	mg/l	1.0	7.3	< 1.0	16	20
Cyanide (Total)	U	1300	2:1	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1455	2:1	µg/l	0.20	0.56	2.8	23	6.9
Boron (Dissolved)	U	1455	2:1	µg/l	10.0	< 10	< 10	36	35
Cadmium (Dissolved)	U	1455	2:1	µg/l	0.11	< 0.11	< 0.11	< 0.11	< 0.11
Copper (Dissolved)	U	1455	2:1	µg/l	0.50	1.1	5.5	16	6.1
Mercury (Dissolved)	U	1455	2:1	µg/l	0.05	< 0.05	< 0.05	0.15	< 0.05
Nickel (Dissolved)	U	1455	2:1	µg/l	0.50	< 0.50	< 0.50	1.0	< 0.50
Lead (Dissolved)	U	1455	2:1	µg/l	0.50	0.54	1.2	22	6.5
Zinc (Dissolved)	U	1455	2:1	µg/l	2.5	9.4	8.9	12	14
Chromium (Total)	N	1455	2:1	µg/l	0.50	< 0.50	< 0.50	4.0	< 0.50
Chromium (Hexavalent)	U	1490	2:1	µg/l	20	< 20	< 20	< 20	< 20
C2 Aliphatic TPH >C5-C6	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C6-C8	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10	24	< 0.10	< 0.10
C2 Aliphatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10	52	< 0.10	< 0.10
C2 Aliphatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aliphatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0	76	< 5.0	< 5.0
C2 Aromatic TPH >C5-C7	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C7-C8	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10	23	< 0.10	< 0.10
C2 Aromatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Aromatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
C2 Total Aromatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0	23	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	2:1	µg/l	10	< 10	99	< 10	< 10
Naphthalene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Leachate

Project: Q1463 CADOXTON

Client: Spencer Quantum Ltd	Chemtest Job No.:					24-31644	24-31644	24-31644	24-31644
Quotation No.: Q23-32755	Chemtest Sample ID.:					1874302	1874303	1874304	1874305
Order No.:	Client Sample Ref.:					ES2	ES2	ES2	ES3
	Client Sample ID.:					ES2	ES2	ES2	ES3
	Sample Location:					TP01	TP02	TP03	TP03
	Sample Type:					SOIL	SOIL	SOIL	SOIL
	Top Depth (m):					0.2	0.3	0.3	1.0
	Date Sampled:					27-Sep-2024	27-Sep-2024	27-Sep-2024	27-Sep-2024
Determinand	Accred.	SOP	Type	Units	LOD				
Fluoranthene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	2:1	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	2:1	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	Compliance Test for Leaching of Granular Waste Material and Sludge	

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2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

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