PENZANCE DRY DOCK (2009) LTD

PENZANCE DRY DOCK

PENZANCE TR18 4BW

GROUND INVESTIGATION REPORT

Contract: 24093

Date: July 2024

REGISTERED OFFICE

9 BROAD STREET
TRURO CORNWALL
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KARN GEOSERVICES LTD
Registered in the UK & Wales
Company Registration
No. 13414537

GROUND INVESTIGATION REPORT

carried out at

PENZANCE DRY DOCK

PENZANCE TR18 4BW

Prepared for

PENZANCE DRY DOCK (2009) LTD
c/o MBA Consulting
Boscawen House
Chapel Hill
Truro
TR1 3BN

Contract: 24093

Date: July 2024

EXECUTIVE SUMMARY

The following information provides a summary of the main findings of the investigation (ref: 24093/GIR dated July 2024). No reliance should be placed on this summary alone, the referenced report must be read and understood in its entirety to put the information contained herein into context.

Commissioning and purpose of assessment	Karn Geoservices Ltd was commissioned by Penzance Dry Dock Ltd to carry out a Geoenvironmental and Geotechnical Investigation Report (GIR) at Penzance Dry Dock (2009) Ltd, Wharf Road, Penzance, TR18 4BW and grid reference SW 47570 30090. The overall aim of the project was to assess land contamination sources and geotechnical constraints to the proposed development.
DESK-BASED ASSESSMENT	
Site description and proposed development	At the time of the walkover survey the site comprised a dry dock and shipbuilding yard.The site comprised the dry dock located in the centre of the site and extending in a northwest – southeast orientation. The remainder of the site comprised warehouse and office buildings with associated areas of concrete hard standing. It is understood the proposed development will comprise the installation of a 50-tonne crane on steel rails within the dry dock along with restoration work, improvements to the existing warehouse and office buildings, and the demolition and construction of a new toilet block and carpentry building.
History of site and surrounding area	The site is first shown to comprise two dry docks along with three capstans. The southern boundary of the site crosses through a bonded store. A number of other industrial buildings are present around the southern and western boundaries as well as on the eastern side of the site. The northern and eastern sides of the site are covered by rock, showing high water mark and ordinary tide lines. The 1877-1879 map labels a building in the south of the site at a smithy. From 1908 The two previously mentioned dry docks are no longer shown and one graving dock is shown in the north of the site. The northern and western parts of the site previously shown as rock/foreshore are now shown as land. Extensions to the industrial buildings in the southwest corner of the site have taken place. The 1936 plan shows additional industrial buildings in the southwest of the site. The 1962-1963 map lists the buildings on site as a works. From the 1989 to 1999 map the site is now shown to comprise of a shipbuilding yard and dry dock. No further observable changes to the site have been noted until the most recently published map dated 2024
Previous Site Investigation Reports	No previous investigation reports were provided to KGL at the time of writing.

Geology and environmental setting	The site is underlain by the Mylor Slate Formation described as Dark grey, locally green-grey slates, interbedded with thin bands and laminae of sandstone, graded and locally cross-bedded siltstone, basic lavas and sedimentary breccias. The metamorphic bedrock formed between 382.7 and 358.9 million years ago during the Devonian period. With reference to the current site use there has been significant previous construction, including infilling of historical dry docks on the site and therefore the presence of Made Ground is also likely.
Site reconnaissance findings	The research has identified evidence of potential hazards associated with underlying ground conditions, either natural or man-made, and therefore it is recommended that further work be carried out to confirm the presence, nature or extent of those hazards anticipated to impact on the site.
Geotechnical constraints assessment	The research has identified evidence of potential hazards associated with underlying ground conditions, either natural or man-made, and therefore it is recommended that further work be carried out to confirm the presence, nature or extent of those hazards anticipated to impact on the site.
Initial conceptual site model (CSM) and preliminary risk assessment (PRA)	Potentially complete contaminant linkages identified with a risk estimate of very low to moderate risk of contamination associated with Made Ground, background geochemistry, Dry dock/Ship/boatbuilding yard and Radon onsite. Uncertainties and data gaps have been identified in the CSM at desk study stage and considered in the design of the intrusive investigation.
INTRUSIVE INVESTIGATION & ASSESSMENT	
SI Scope	A ground investigation was commissioned to address the geo-environmental and geotechnical constraints identified within the preliminary investigation report. The investigation comprised windowless sampler boreholes and rotary boreholes followed by subsequent laboratory testing and reporting.
SI Factual Findings	The investigation confirmed the presence of Made Ground to a maximum depth of 5.96mbgl overlying the weathered and intact bedrock of the Mylor Slate Formation. The intact bedrock was encountered at depths between 3.90m and 5.95mbgl and comprised a weak becoming medium strong to strong with depth, partially weathered thinly laminated brown, grey, and dark grey MUDSTONE with occasional quartz and iron pyrite veining. Groundwater was encountered during the investigation and the levels varied significantly according to the tides.
Refined Conceptual Site Model and geoenvironmental assessment	The results of the site investigation and GQRA indicate that relevant contaminant linkages are absent based on the data available and therefore the site is suitable for the proposed end use. Data gaps and uncertainties have been considered and no further assessment is considered to be required.

Geotechnical Assessment	Based on the ground conditions encountered and subsequent laboratory testing it is considered that any proposed foundations around the existing dry dock (exploratory hole locations BH01-BH05 & DP01) would require a piled foundation solution. However, the proposed replacement carpenter's workshop located in the south of the site can be founded on conventional strip foundations. The investigation within the existing warehouse buildings showed the concrete slab to be approximately 120mm to 130mm thick. It is understood the proposed development will include the replacement of the existing slab or construction of a new slab over the old slab. Given the nature of the Made Ground across the site it is recommended the old slab is removed and a new slab constructed. This is due to the variability of the underling material and potential for buried tanks to be present. Historical mapping and anecdotal evidence indicate tanks have been present in this area; however, there are no records of the exact location or them being removed leaving a residual risk as the tanks rust.
Recommendations – including issues for further assessment	The site lies within an area where any permanent structures will require full radon protection measures.

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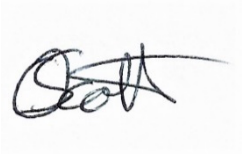

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1.0 INTRODUCTION

1.1 General

On the instructions of MBA Consulting, consulting engineers to, Penzance Dry Dock, a Geoenvironmental and Geotechnical Investigation was undertaken to determine ground conditions to enable foundation and road/hard standing design to be carried out, together with a geoenvironmental risk assessment and a review of gas emissions.

The site boundary and current site layout are shown in Appendix 1, Figures 1 and 2. The project was carried out to an agreed brief as set out in Karn Geoservices Ltd proposal (Ref. Q0704, dated April 2024).

This report should be read in conjunction with the Preliminary Investigation Report (PIR) which was reported under reference 24093/PIR in July 2024.

This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.

It is recommended that a copy of this report be submitted to the relevant authorities to enable them to carry out their own site assessment and provide any comments.

This report has been based, in part, on information supplied by others. The report has been prepared on the basis of that information being accurate.

The comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.

The comments on groundwater conditions are based on observations made at the time the site work was carried out. It should be noted that groundwater levels vary owing to seasonal or other effects.

1.2 Proposed Development

It is understood the proposed development will comprise the installation of a 50-tonne crane on steel rails within the dry dock along with restoration work, improvements to the existing warehouse and office buildings, and the demolition and construction of a new toilet block and carpentry building. A planned layout of the site has not been provided to KGL at the time of writing.

1.3 Objectives

The objective of the work is:

- to identify any land contamination and/or geotechnical constraints to the proposed development and to support discharge of relevant planning conditions and relevant building control requirements.
- to identify the need for any additional investigation or remediation works to demonstrate that the site is suitable for its proposed use.

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in CLR 11 Model Procedures for the Management of Land Contamination (Environment Agency, 2004) and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). It is also compliant with relevant planning policy and guidance.

The scope of the intrusive investigation has been designed in line with the recommendations of BS5930:2015+A1:2020 Code of practice for ground investigations (BSi, 2020), which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards. It has also been developed in general accordance with BS 10175: 2011 + A2 2017.

The scope of works for the assessment has included the following:

- design and implementation of an intrusive investigation, in situ testing, sampling, laboratory environmental and geotechnical testing.
- interpretation of data to develop a refined conceptual site model (CSM)
- generic quantitative risk assessment (GQRA) to evaluate potentially complete contaminant linkages identified in the refined CSM.

- identification of the need for further action, e.g. supplementary intrusive investigations/ monitoring, remediation works or other mitigation, if any.
- interpretation of ground conditions and geotechnical data to provide preliminary recommendations with respect to foundations and infrastructure design.
- preparation of this factual and interpretative report with recommendations for further works and/or remediation as necessary.

1.4 Existing Reports

No existing reports relevant to the site assessment have been provided to Karn Geoservices Ltd.

1.5 Limitations

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by the investigation and therefore could not be taken into account. In particular, it should be noted that there may be areas of made ground not detected due to the limited nature of the investigation or the thickness and quality of made ground across the site may be variable. In addition, groundwater levels and ground gas concentrations and flows may vary from those reported due to seasonal, or other, effects and the limitations stated in the data should be recognised.

Asbestos is often present in soils in discrete areas. Whilst asbestos-containing materials may have been locally encountered during the fieldworks or supporting laboratory analysis, the history of the site indicates that asbestos may be present in soils and could be encountered during more extensive ground works.

Preliminary geotechnical recommendations are presented, and these should be verified once proposed construction and structural design proposals are confirmed.

2.0 SITE DETAILS

2.1 Site Location

Site location details are presented below in Table 1.

Table 1: Site Location Details

Site name	Penzance Dry Dock
Full site address and postcode	Penzance Dry Dock (2009) Ltd, Wharf Road, Penzance, TR18 4BW
National Grid Reference	SW 47570 30090

2.2 Site Description

The site boundary and current site layout are shown on Figure 2. The site is irregular in shape and covers an area of c. 0.43 hectares. At the time of the walkover survey the site comprised a dry dock and shipbuilding yard.

The site comprised the dry dock located in the centre of the site and extending in a northwest – southeast orientation. The remainder of the site comprised warehouse and office buildings with associated areas of concrete hard standing.

The site was generally level with the exception of the drydock. The dry dock was approximately 5-6m deep. The dry dock was open / the gates had been removed at the time of the walkover survey and therefore surface water was present on the site.

The western part of the site is largely covered by buildings comprising a large warehouse building used for boat building, repairs, and maintenance. The buildings steel framed and clad with corrugated metal sheeting. Other buildings across the site included offices, a carpenters building, and storage buildings. These buildings were constructed of stone or block, with a mixture of pitched and flat roofs. A toilet block in the north of the site was observed to be subsiding and this is likely due to the degradation of an underlying tank.

2.3 Surrounding Land Uses

The site is located in Penzance, within a predominantly residential and industrial setting. Immediate surrounding land uses are described in Table 2.

Table 2: Surrounding Land Uses

North	Abbey Basin
South	Residential and commercial properties
East	Quay Road with Penzance Harbour beyond
West	Residential and commercial properties

2.4 Development Plans

No proposed development plans have been provided to KGL at the time of the writing.

No details of the proposed ground levels have been provided therefore for the purpose of this report it has been assumed that the current levels will remain unchanged.

3.0 DESK BASED ASSESSMENT

3.1 Geological Setting

Details of the geology underlying the site the site have been obtained from the relevant BGS sheet and are characterised by the succession recorded in Table 3.

Table 3: Summary of Site Geology

Strata	Description	Estimated thickness	Permeability
Made Ground	Although not shown on the geological maps, there is likely to be Made Ground on the site associated with the previous development. The composition, thickness, and extent of any Made Ground is unknown without intrusive investigation.	<5m	Unknown
Mylor Slate Formation	The geological map shows the site to be underlain by the Mylor Slate Formation described by the BGS as Dark grey, locally green-grey slates, interbedded with thin bands and laminae of sandstone, graded and locally cross-bedded siltstone, basic lavas and sedimentary breccias. The Mylor Slate Formation is often encountered as cohesive and granular soils overlying the bedrock which may be at some depth below ground level.	~2km	Secondary A Aquifer
Relevant information sources: BGS Geoindex ☒ BGS borehole logs ☐ Previous SI reports ☐			

4.0 SITE INVESTIGATION STRATEGY & METHODOLOGY

4.1 Introduction

Karn Geoservices Ltd carried out intrusive investigation works between the 7th and 13th of June 2024 followed by the subsequent laboratory testing and reporting.

4.2 Objectives

The specific objectives of the investigation were as follows:

- to establish the ground conditions underlying the site including the extent and thickness of any Made Ground
- to investigate specific potential sources of contamination identified in initial CSM
- to determine groundwater depth
- to assess geotechnical properties of soils

4.3 Selection of investigation methods

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

A windowless sampler rig was chosen for the site based on the anticipated geology and access requirements. The windowless sampler enabled the collection of in-situ geotechnical data and the opportunity to collect suitable samples.

A multipurpose rotary drill rig was used for the boreholes to allow dynamic sampling with insitu testing followed by rotary coring. The rotary rig allowed for good coverage of the site within the time frame and penetration of the rock to prove depths.

Prior to intrusive works, utility service plans were obtained and buried service clearance undertaken in line with Karn Geoservices Ltd health and safety procedures.

4.4 Investigation Strategy

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930:2015+ A1:2020 Code of practice for ground investigations, which maintains compliance with

BS EN 1997-1 and 1997-2 and their related standards. Whilst every attempt was made to record full details of the strata encountered in the boreholes, techniques of hole formation and sampling will inevitably lead to disturbance, mixing or loss of material in some soils and rocks.

The investigation strategy involved targeted boreholes focussing on the area of the proposed alterations.

The constraints to the investigation were as follows:

- Access limitations
- Buried services
- Existing buildings and hard standing
- Exploratory hole WS03 due UXO scan anomalies.

Details of the investigation locations, installations and rationale are presented in Table 4. Five rotary boreholes were drilled across the site to a maximum depth of 12.40mbgl and five windowless sampler boreholes were drilled to a maximum depth of 3.00mbgl before all exploratory holes were backfilled with the available arisings.

Table 4: Exploratory hole and location rationale

Investigation type	Number	Designation	Rationale examples below
Boreholes by dynamic/ windowless sampling methods	5	WS01 – WS05	To prove the geological succession beneath the site, obtain geotechnical data, and
Boreholes by dynamic sampling and rotary coring	5	BH01 – BH05	To accurately determine the depths to bedrock and collect suitable samples for laboratory testing.

4.5 Implementation of Investigation works

The exploratory holes were logged by an engineer in general accordance with the recommendations of BS 5930:2015+A1:2020 (which incorporates the requirements of BS EN ISO 14688-1, 14688-2 and 14689-1). The fieldwork was supervised full-time by an engineering geologist.

Samples collected were typically classed a Category 'C' in accordance with BSI (2007), and assessment of strength and consistency were undertaken using traditional field techniques as described in BSI (2002). Soils have been logged, generally in accordance with BSI (2004). Where relevant, the bedrock was logged in accordance with BSI (2003).

The soil sampling and analysis strategy was designed to characterise each encountered soil strata, permit an assessment of the potential contaminant linkages identified and investigate the geotechnical characteristics. In addition, samples were taken to allow for geo-environmental and geotechnical testing to be undertaken.

Soils collected for laboratory analysis were placed in a variety of containers appropriate to the anticipated testing suite required. They were dispatched to the laboratory in cool boxes under chain of custody documentation. Samples were stored in accordance with the Karn Geoservices Ltd quality procedures to maintain sample integrity and preservation and to minimise the chance of cross contamination.

The profiles of strata, or other features, were recorded as excavation proceeded and measurements taken from ground level. Trial pits were entered where safe to do so to allow logging, in-situ testing and sampling. Subsoil samples were taken where appropriate for subsequent laboratory examination and analyses.

The locations of the exploratory holes are shown on the Exploratory Hole Location Plan, enclosed as Appendix 1. Exploratory hole records are enclosed in Appendix 2, and in addition to detailed strata descriptions give information on any groundwater, stability and samples recovered.

5.0 LABORATORY TESTING

5.1 Geotechnical Laboratory Testing

Details of the geotechnical laboratory testing undertaken on selected samples obtained during the site investigation are detailed below in Table 5.

Table 5: Summary of Geotechnical Laboratory Testing

Test	Number of Samples
Particle Size Distribution (PSD) by wet sieving	2
Liquid and Plastic (Atterberg) Limits	1
Moisture Content	1
pH & water-soluble sulphate – Soils	6
Point Load Testing	28
Uniaxial Compressive Strength	1

Laboratory testing was undertaken, where appropriate, in accordance with BS 1377-2:2022 Method of Tests for Soils for Civil Engineering Purposes or, where superseded, by the relevant part of BS EN ISO 17892:2014 Geotechnical investigation and testing - Laboratory Testing of Soil. Tests carried out in order to classify the concrete class required on-site have been undertaken following the procedures within BRE SD1:2005. The test results are enclosed as Appendix 3. All testing was undertaken in UKAS accredited laboratories.

5.2 Geoenvironmental Laboratory Testing

Details of the geoenvironmental laboratory testing undertaken on selected samples obtained during the site investigation are detailed below in Table 6. Laboratory testing was undertaken at a UKAS accredited laboratory with ISO17025 and MCERTS accredited test methods were specified where applicable for geoenvironmental testing and as shown in the laboratory test certificates appended.

Table 6: Summary of Geoenvironmental Laboratory Testing

Test	Number of Samples
Metal & metalloid suite: Arsenic, Boron (water soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Zinc	11
Speciated Polycyclic Aromatic Hydrocarbons (USEPA 16)	11
Total petroleum hydrocarbons (TPH) – total C_{10}–C_{40}	5
Total petroleum hydrocarbons (TPH) – CWG bandings	6
Organic matter contents	11
Asbestos screens	11
Phenols – total monohydric	11
BTEX & MTBE	11
Tributyltin (TBT)	2
pH Value & Moisture Content	11

The geo-environmental laboratory test results are enclosed as Appendix 4.

6.0 GROUND CONDITIONS ENCOUNTERED

6.1 Strata Encountered

The sequence of the strata encountered during the investigation generally confirms the anticipated geology as interpreted from the geological map.

Interpolation of strata depths between locations should be undertaken with caution, particularly for depths of Made Ground where structures are still present at the time of the investigation.

For the purpose of discussion, the ground conditions encountered during the fieldworks are summarised in Table 7 below:

Table 7: Summary of Strata Encountered

Stratum	Depth Encountered (m)		Strata Thickness (m)
	From	To	
Made Ground	0.00	0.40 – 5.95	0.40 to 5.95
Mylor Slate Formation	0.40 to 5.95	>12.40[1]	Unproven
Notes: [1]Base of strata not encountered			

6.2 Made Ground

Made Ground was encountered at every exploratory hole location to a maximum depth of 5.95mbgl and varied in composition. The Made Ground generally comprised a concrete slab overlying reworked natural soils.

The thickness of Made Ground across the site varied but overall, the greatest thicknesses were encountered in the northeast of the site around the dry dock and thinnest in the south of the site.

The concrete slab thickness within the existing workshop buildings was recorded as 0.12m to 0.13m thick. The boreholes positioned around the existing dry dock recorded concrete thicknesses between 0.20m and 0.60m.

The underlying reworked natural soils were encountered up to a maximum depth of 5.95mbgl and comprised various colours of sandy clayey gravels and sandy gravelly clays. The reworked natural gravel comprised a sub-angular to sub-rounded fine to coarse mudstone, along with anthropogenic material including concrete, brick, wood,

charcoal, slag, and foreign lithologies. Timber sleepers were encountered at exploratory hole location BH03.

Standard Penetration Tests (SPT) were undertaken at regular intervals within the windowless sampler and rotary boreholes. The tests within the Made Ground recorded 'N60' values between 5 and >50 reflecting the poorly sorted and variable nature of the stratum.

6.3 Mylor Slate Formation

The Mylor Slate Formation was encountered at depths between 0.40m and 5.95mbgl and varied in composition. Exploratory holes BH01, BH02, BH04, WS03, WS04, and WS05 encountered weathered soils to depths between 5.00m and 5.60mbgl. Exploratory holes BH03, BH05, WS01, and WS02 encountered the intact bedrock directly below the Made Ground.

The weathered soils generally comprised a greyish brown clayey sandy GRAVEL with the exception of exploratory hole WS04 where the soils were recovered as a gravelly sandy CLAY. The gravel component was described as an angular to sub-rounded fine to coarse mudstone.

Standard Penetration Tests within the weathered Mylor Slate Formation recorded 'N60' values between 11 and >50 indicating the relative density of the material to be medium dense to very dense. The SPT values generally increased with depth reflecting the anticipated weathering profile.

Two samples of the weathered soils were dispatched to the laboratory for geotechnical classification testing. Particle Size Distribution (PSD) tests showed the material to comprise 4-55% Gravel, 9-33% Sand, and 12-87% Clay/Silt fractions.

A sample of cohesive soil from exploratory hole WS04 at 2.80m-3.00mbgl was scheduled for Atterberg Limit Testing. The test returned a 'NP' or Non-Plastic value, classifying the soil as being of no volume change potential in accordance with NHBC Standards Chapter 4.2.

The intact bedrock was encountered at depths between 3.90m and 5.59mbgl within the rotary boreholes. The intact bedrock generally comprised a weak becoming medium

strong to strong with depth, partially weathered thinly laminated brown, grey, and dark grey MUDSTONE with occasional quartz and iron pyrite veining. The core was noted to be locally disaggregated around some of the quartz veins.

The fractures were typically very closely to closely spaced smooth planar and locally stepped dipping sub horizontal to 40° with occasional steeper fractures dipping 70-80°. Fractures were generally tight, but some fracture surfaces showed orangish brown surface staining and locally some minor (<2mm) clay infill.

The core was sub-sampled and suitable samples recovered from depths between 5.23m and 12.54mbgl were scheduled for point load testing (axial and diametrical) and one Uniaxial Compressive Strength (UCS) test. The UCS test was undertaken on a sample obtained from BH04 at a depth of 8.20m and 8.38mbgl and recorded a maximum strength value of 16.1MPa before a single shear failure occurred.

Fourteen samples were scheduled for point load tests with both axial and diametrical tests undertaken on all samples. The results have been converted to Uniaxial Compressive Strength (UCS) using a conservative conversion factor of 22 and range between 0.66MPa and 87.5MPa for the axial tests, and 0.22MPa and 38.7MPa for the diametrical tests.

The rock testing provides a snapshot of rock strength; however, caution must be used when interpreting from rock strength testing of weathered bedrock. The samples obtained for testing are likely to be the best examples because the weaker/ lower strength samples would be too fragile and poor quality for testing. Hence, it is not a true representation of the overall rock strength.

6.4 Groundwater

Groundwater was encountered during the intrusive investigation works as detailed on the logs in Appendix 2. Groundwater was encountered at depths generally ranging from 4.00m and 11.50mbgl. The variation in depth is attributed to tidal changes affecting the groundwater level at the time of the strike.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal and tidal variations. On-going monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

7.0 GEOTECHNICAL ASSESSMENT

7.1 General

Based on the guidance given in BS EN 1997-1:2004, the proposed development may be classed as Geotechnical Category 2, a 'conventional types of structure or foundation with no exceptional risk, difficult ground, or loading conditions'.

Geotechnical Category 2 designs will normally involve quantitative geotechnical analysis, the data for which may be obtained from routine field and laboratory testing procedures.

The intention of this assessment is to determine the geotechnical properties of the strata encountered, and to review their influence on the ground engineering options for the proposed development.

7.2 Structural Details

It is understood that the proposed development is to involve the installation of a 50-tonne crane on steel rails within the dry dock along with restoration work, improvements to the existing warehouse and office buildings, and the demolition and construction of a new toilet block and carpentry building.

No specific structural details were provided at the time of preparation of this report; therefore, the following recommendations fall outside of the Eurocode 7 legislation.

7.3 Foundation Recommendations – Dry Dock & Toilet Block

Based on the ground conditions encountered and subsequent laboratory testing it is considered that any proposed foundations around the existing dry dock (exploratory hole locations BH01-BH05 & DP01) would require a piled foundation solution.

It is recommended that short bored and cast piles are taken through any Made Ground and weathered soils and emplaced within the intact Mylor Slate Formation with a minimum 3m rock socket. Based on the rotary boreholes the piles will be approximately 8-9m in length including the rock socket.

The carrying capacity of piles depends not only on their size and the ground conditions. but also, on their method of installation. Pile design and installation are continuously evolving processes and state-of-the-art techniques are often employed before they reach the public domain, perhaps several years down the line. Therefore, it is recommended that specialist Piling Contractors be contacted as to the suitability and carrying capacity of their piles in the ground conditions pertaining to the site.

The exploratory holes encountered variable Made Ground to depths between 3.90m and 5.95mbgl and included cobbles of altered mudstone, basic igneous rock (elvan / greenstone), and anthropogenic material such as wooden sleepers. The difficulties in drilling through this type of material are likely to be similar for the piling contractor. It must be noted that groundwater was encountered during the investigation and may affect the installation of piles.

7.4 Foundation Recommendations – Carpenters Workshop

Based on the ground conditions encountered and subsequent laboratory testing it is considered that the proposed replacement carpenter's workshop located in the south of the site can be founded on conventional strip foundations.

Strip foundations for the carpenter's workshop must be taken through any Made Ground and emplaced within uniform granular soil of the Mylor Slate Formation at a minimum depth of 1.00mbgl unless intact rock is encountered at a shallower depth. Based on exploratory hole WS05 located close to the existing carpenter's workshop weathered granular soils are present below 0.50mbgl.

7.5 Shallow Foundations

The recommendations for the design and construction of shallow foundations in relation to the ground conditions are set out in Table 8.

Table 8: Design and Construction of Shallow Foundations

Design/construction considerations	Design/construction recommendations
Founding stratum	Granular or intact Mylor Slate Formation
Depth	Foundations should be taken to a minimum depth of 1.00m below the final or existing ground level, whichever is lower, and at least 0.2m into the founding stratum below any overlying Made Ground or to any greater depth required in respect of the special design considerations given below. If bedrock is encountered at the southern part of the site (yet to be demolished) then the bedrock must be chased across the site so foundations are sat within uniform stratum.
Allowable bearing capacity	Strip foundations with a width of 0.60m and constructed on the granular or intact Mylor Slate Formation at a minimum depth of 1.00m may be designed using an allowable bearing capacity of 120kPa. This can be increased to 250kPa if the foundation is emplaced on the intact bedrock. The allowable bearing capacity includes a partial factor on bearing resistance of 3 against bearing capacity failure. Total settlements associated with the allowable bearing pressure are anticipated to be less than 25 mm.
Special design considerations	
Variable founding soils	Owing to the significant lateral and vertical variability of the founding strata, consideration should be given to incorporating appropriate reinforcement into the strip foundations to minimise the risk of future differential foundation movements.
Construction considerations	All foundation excavations should be inspected, and any made ground and soft, organic or otherwise unsuitable materials removed and replaced with mass concrete.

7.6 Ground Floor Slabs

The investigation within the existing warehouse buildings showed the concrete slab to be approximately 120mm to 130mm thick. It is understood the proposed development will include the replacement of the existing slab or construction of a new slab over the old slab.

Given the nature of the Made Ground across the site it is recommended the old slab is removed and a new slab constructed. This is due to the variability of the underling material and potential for buried tanks to be present. Historical mapping and anecdotal evidence indicate tanks have been present in this area; however, there are no records of the exact location or them being removed leaving a residual risk as the tanks rust.

If the new slab is to be constructed on top of the existing slab, there are potential future risks associated with the underlying ground conditions that cannot be mitigated and therefore the client must be aware of the residual risk.

7.7 Excavations

Generally, the boreholes remained stable during excavation however given the nature of the Made Ground it is recommended that excavation support systems are made available during the groundwork stage of the development

Entry into any excavations must not be undertaken without provision of suitable shoring and support and dewatering or suitable regrading and battering of side slopes to safe angles.

Excavations in the south / southwest of the site may encounter intact bedrock close to the surface. Depending on the extent of excavations in this area a breaker or ripper tooth could be required.

7.8 Chemical Attack on Buried Concrete

This assessment of the potential for chemical attack on buried concrete at the site is based on BRE Special Digest 1: Concrete in aggressive ground, which represents the most up-to-date guidance on this topic currently available in the UK.

Based on testing results, Table 9 gives the characteristic pH, water-soluble content values for soils from each of the geological units and groundwater encountered on-site.

Table 9: Characteristic pH and water-soluble sulphate values

Stratum	pH	Water Soluble Sulphate (mg/l)
Mylor Slate Formation	8.4 – 9.5	22 – 240

Based on the results above and following the steps outlined in the BRE guidance, the Design Sulphate Classes and Aggressive Chemical Environment for Concrete classifications are summarised in Table 10.

Table 10: Concrete design class

Stratum	Groundwater	Water Soluble Sulphate	
		DS Class	AC Class
Mylor Slate Formation	Mobile	DS-1	AC-1

7.9 Roads and Hardstanding

In-situ DCP testing was undertaken across the site to establish the CBR values of the material underlying the existing concrete slab. The tests were undertaken within the windowless sampler boreholes and rotary borehole BH03. The results of in-situ testing are summarised in Table 11 below:

Table 11: Summary of CBR values derived from in-situ DCP tests

Test location	Material type	Minimum CBR value (%)	Maximum CBR value (%)
DCP-1 (WS01)	Undifferentiated Made Ground and Natural	0	145
DCP-2 (WS02)	Made Ground	9	50
DCP-3 (WS03)	Made Ground	26	115
DCP-4 (WS04)	Made Ground	8	20
DCP-5 (WS05)	Made Ground	35	35
DCP-6 (BH03)	Made Ground	13	42

The DCP testing indicates variable ground conditions underlying the existing concrete slab. Some of the maximum values are anomalously high and this is likely to be cause by cobbles or anthropogenic material within the Made Ground. Based on the testing it is recommended that the underlying formation level is carefully compacted, and any soft spots removed and replaced with well-compacted granular fill prior to constructing the new slab.

The sub-grade condition at the time of construction should be confirmed by testing at the final formation level by in situ CBR testing.

The sub-grade soils can be regarded as non-frost-susceptible, based upon the criteria given in Appendix 1 of TRRL (1970) Report Road Note 29. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450 mm.

8.0 GEOENVIRONMENTAL ASSESSMENT

8.1 Refinement of the Conceptual Site Model

A Preliminary Investigation Report undertaken by Karn Geoservices Ltd (ref: 24093/PIR, dated July 2024) identified a moderate risk of contamination associated with the sites previous use, elevated heavy metals, Made Ground and a moderate risk of gas ingression from Radon.

8.2 Linkages for assessment

In line with CLR11 (Environment Agency, 2004), there are two stages of quantitative risk assessment, generic (GQRA) and detailed (DQRA). The GQRA comprises the comparison of soil, groundwater, soil gas and ground gas results with generic assessment criteria (GAC) that are appropriate to the linkage being assessed. This comparison can be undertaken directly against the laboratory results or following statistical analysis depending upon the sampling procedure that was adopted.

Following the refinement of the initial CSM, the potentially complete contaminant linkages that require further assessment and the methodology of assessment are presented in Table 12.

Table 12: Linkages for GQRA

Potentially relevant contaminant linkage	Assessment method
Soil	
Oral, dermal and inhalation exposure with impacted soil, soil vapour and dust by future site users	Human health GAC in Appendix 5 for a commercial end-use based on the existing and proposed use of the site.
Inhalation exposure of future site users to asbestos fibres	Qualitative assessment based on the asbestos minerals present, their form, concentration, location and the nature of the proposed development.
Contaminants permeating potable water supply pipes	Comparison of soil data to UKWIR (2010) guidance on plastic water supply pipes.
Water	

Potentially relevant contaminant linkage	Assessment method
Migration of contaminants to secondary aquifer	The potential for migration has been considered qualitatively using soil results.
Ground Gas	
Concentrations of Radon gas entering and accumulating in enclosed spaces or small rooms in new buildings, which could affect future site users.	Full Radon barriers will be required in permanent structures within the proposed development.

8.3 Methodology and assessment of soil results

The analysis of laboratory results relating to soil samples submitted for testing, including leachate analysis, is included in the following sections.

8.4 Exposure to impacted soil by site users

In order to assess the soil results against the appropriate GAC, the soil results have been split into appropriate data sets relevant to the oral, dermal and inhalation linkage.

The datasets being considered in the assessment are:

- Data set 1 Made Ground
- Data set 2 Mylor Slate Formation

As an initial assessment of each dataset, all soil results in each dataset have been directly compared against the GAC for commercial end use.

8.5 Data set 1 – Made Ground

All made ground results have been compared with the commercial end use GAC. A soil organic matter (SOM) of 6 % has been selected since laboratory results within the Made Ground range from 0.76 % to 20%. The geo-environmental laboratory test results are enclosed as Appendix 4.

Results indicate that all contaminants are below the commercial end use GAC therefore it is considered that a relevant contaminant linkage does not exist.

The results of the chemical testing show that levels of TPH were observed in exploratory hole WS04 at 2.50m and WS05 at 1.20m, above the limit of detection of 10mg/kg for total hydrocarbons. However, this was the result of total TPH testing, rather than speciated TPH analysis. Other exploratory holes which were tested for speciated hydrocarbons, while noted above the limits of detection, did not exhibit levels elevated above the individual fractions. Based on this information, we would conclude that the level of total TPH in WS04 and WS05, would also not contain levels above the speciated hydrocarbon fractions, and therefore we do not consider further speciated testing would be required.

8.6 Data set 2 – weathered Mylor Slate Formation

All weathered Mylor Slate Formation results have been compared with the commercial end use GAC. A soil organic matter (SOM) of 1% has been selected since laboratory results within the weathered Mylor Slate Formation range from 0.79% and 1.3%. The geo-environmental laboratory test results are enclosed as Appendix 4.

Results indicate that all contaminants are below the commercial end use GAC therefore it is considered that a relevant contaminant linkage does not exist.

8.7 Summary of Data sets

All samples of Made Ground and the weathered Mylor Slate Formation are below the GAC for a commercial end use. Based on the above assessment, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use.

8.8 Inhalation Exposure of site users to asbestos fibres

The visual inspection at the laboratory identified no materials suspected of potentially containing asbestos and the scheduled laboratory screening for asbestos found no detectable asbestos fibres within the samples tested.

8.9 Protection of Services

For initial assessment purposes, the results of the investigation have been compared with the GAC presented in *UKWIR Report 10/WM/03/21. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites* (UKWIR, 2010).

The results indicate that a relevant linkage may exist associated with organic contaminants (mineral oils C_{11}–C_{20} and C_{21}–C_{40} bands) therefore pollutant polyethylene (PE) water supply pipes are expected to be unsuitable for use on the development.

It should be noted that at the time of this investigation the future routes of water supply pipes had not been established, hence the investigation and sampling strategy may not be fully compliant with UKWIR recommendations.

9.0 PRELIMINARY WASTE CLASSIFICATION

In accordance with the definition provided in the Waste Framework Directive (WFD), materials are only considered waste if 'they are discarded, intended to be discarded or required to be discarded, by the holder'. Naturally occurring soils are not considered waste if reused on the site of origin for the purposes of development. Soils such as made ground that are not of clean and natural origin (irrespective of whether they are contaminated or not) and other materials such as recycled aggregate, do not become waste until the criteria above are met.

Excavation arisings from the development may therefore be classified as waste if surplus to requirements or unsuitable for reuse. The site owner has a duty to ensure that any waste produced from the site, or soil imported to the site is handled safely and within the law.

One of the ways this can be achieved is set out in the Definition of Waste: Development Industry Code of Practice (DoWCoP) (CL:AIRE, March 2011). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006).

The handling, re-use or disposal of waste is regulated by the Environment Agency. The Agency will take into account the use of the DoWCoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the DoWCoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development. This may be because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

9.1 Hazardous waste assessment

Technical Guidance WM3 (EA, 2018) sets out in Appendix D requirements for waste sampling. It is a legal requirement to correctly assess and classify waste. The level of sampling should be proportionate to the volume of waste and its heterogeneity. The preliminary assessment provided below is based only upon the available sample results and may not be sufficient to adequately classify the waste.

Should there be a requirement for off-site disposal, the waste should be tested for a broad suite of contaminants and subject to the appropriate WAC test and disposed of within the appropriately licensed landfill. Note that it is ultimately for landfills to confirm what wastes they are able to accept within the constraints of their permit.

10.0 CONCLUSIONS

In accordance with good practice, data gaps and uncertainties in the refined CSM have been identified at this stage. These are summarised in Table 13 along with the likely implications.

Table 13: Summary of Data Gaps and Uncertainties

Data gap/ uncertainty	Details	Implications
Asbestos not found in samples tested	Although not encountered to date, asbestos containing material (ACM) could still be present in discrete locations	Vigilance should be maintained for any potential ACM or fibrous material during below ground works

10.1 Geoenvironmental Assessment

The key findings of the geoenvironmental assessment are as follows:

- All samples of Made Ground and the weathered Mylor Slate Formation are below the GAC for a commercial end use. Based on the above assessment, no potentially significant risks associated with the soil contamination have been identified and it is considered that the site may be regarded as suitable for the proposed end use.
- The British Geological Survey, in conjunction with the Radiation Protection Division of the Health Protection Agency, indicates the site to lie within a Radon Affected Area. Therefore, if any new permanent structures are to be built, the guidance recommends that full radon protective measures should be installed in line with the Building Research Establishment, Report BR211

10.2 Recommendations

The results of the site investigation and GQRA indicate that relevant contaminant linkages are absent based on the data available and therefore the site is suitable for the proposed end use. Although not encountered to date, localised sources of contamination could still be present, although they are unlikely to be widespread. Data gaps and uncertainties have been considered and no further assessment is considered to be required.

Should unforeseen contamination be encountered during the development then specialist advice should be sought to determine the appropriate course of action.

10.3 Other Considerations

There are several other areas of research which are beyond the scope of this report. All or none of the following may be applicable to the site, either on the outcome of consultation with a regulatory body or as a result of the research for this Preliminary Investigation. They include:

10.4 Archaeology

Should the site be situated on or within an area of archaeological sensitivity, the advisor to the relevant local authority should be consulted. The requirement for an archaeological report may be identified within a planning condition, if appropriate, for the site.

10.5 Ecology

There may be a requirement for a detailed ecological report, dependant on the type or size of the development, or due to evidence identified during the site reconnaissance or desk study. This requirement may be identified within a planning condition, if appropriate, for the site

10.6 Unexploded Ordnance (UXO)

There may be a requirement for a UXO report, dependant on the site location, historical use and surrounding site history, as well as the type or size of the development. This requirement may be identified within a planning condition.

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12.0 CONSTRAINTS

This report and the site investigation carried out in connection with the report (together the "Services") were compiled and carried out by KARN GEOSERVICES LTD (KARN GEOSERVICES LTD) for Penzance Dry Dock Ltd (the "client") in accordance with the terms of a contract [KARN GEOSERVICES LTD Standard Terms and Conditions] amend if work not done under KARN GEOSERVICES LTD standard terms between KARN GEOSERVICES LTD and the "client", dated 30th April 2024. The Services were performed by KARN GEOSERVICES LTD with the skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by KARN GEOSERVICES LTD taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between KARN GEOSERVICES LTD and the client.

Other than that, expressly contained in paragraph 1 above, KARN GEOSERVICES LTD provides no other representation or warranty whether express or implied, in relation to the Services.

Unless otherwise agreed in writing the Services were performed by KARN GEOSERVICES LTD exclusively for the purposes of the client. KARN GEOSERVICES LTD is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, KARN GEOSERVICES LTD does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and KARN GEOSERVICES LTD disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

It is KARN GEOSERVICES LTD's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without KARN GEOSERVICES LTD 's review and advice shall be at the client's sole and own risk. Should KARN GEOSERVICES LTD be requested to review the report after the date of this report, KARN GEOSERVICES LTD shall be entitled to additional payment at the then existing rates or such other terms as agreed between KARN GEOSERVICES LTD and the client.

The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon

in the future without the written advice of KARN GEOSERVICES LTD. In the absence of such written advice of KARN GEOSERVICES LTD, reliance on the report in the future shall be at the client's own and sole risk. Should KARN GEOSERVICES LTD be requested to review the report in the future, KARN GEOSERVICES LTD shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between KARN GEOSERVICES LTD and the client.

The observations and conclusions described in this report are based solely upon the Services which were provided pursuant to the agreement between the client and KARN GEOSERVICES LTD. KARN GEOSERVICES LTD has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and KARN GEOSERVICES LTD. KARN GEOSERVICES LTD is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, KARN GEOSERVICES LTD did not seek to evaluate the presence on or off the site of asbestos, invasive plants, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials, unless specifically identified in the Services.

The Services are based upon KARN GEOSERVICES LTD's observations of existing physical conditions at the Site gained from a visual inspection of the site together with KARN GEOSERVICES LTD's interpretation of information, including documentation, obtained from third parties and from the client on the history and usage of the site, unless specifically identified in the Services or accreditation system (such as UKAS ISO 17020:2012 clause 7.1.6):

a. the Services were based on information and/or analysis provided by independent testing and information services or laboratories upon which KARN GEOSERVICES LTD was reasonably entitled to rely
b. the Services were limited by the accuracy of the information, including documentation, reviewed by KARN GEOSERVICES LTD and the observations possible at the time of the visual inspection
c. the Services did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services.

KARN GEOSERVICES LTD is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to KARN GEOSERVICES LTD and including the doing of any independent investigation of the information provided to KARN GEOSERVICES

LTD save as otherwise provided in the terms of the contract between the client and KARN GEOSERVICES LTD.

The intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined locations based on the known historic/operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the properties of the materials adjacent and local conditions, together with the position of any current structures and underground utilities and facilities, and natural and other activities on-site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and KARN GEOSERVICES LTD] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on-site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX 1

DEVELOPMENT DRAWINGS

KARN GEOSERVICES LTD
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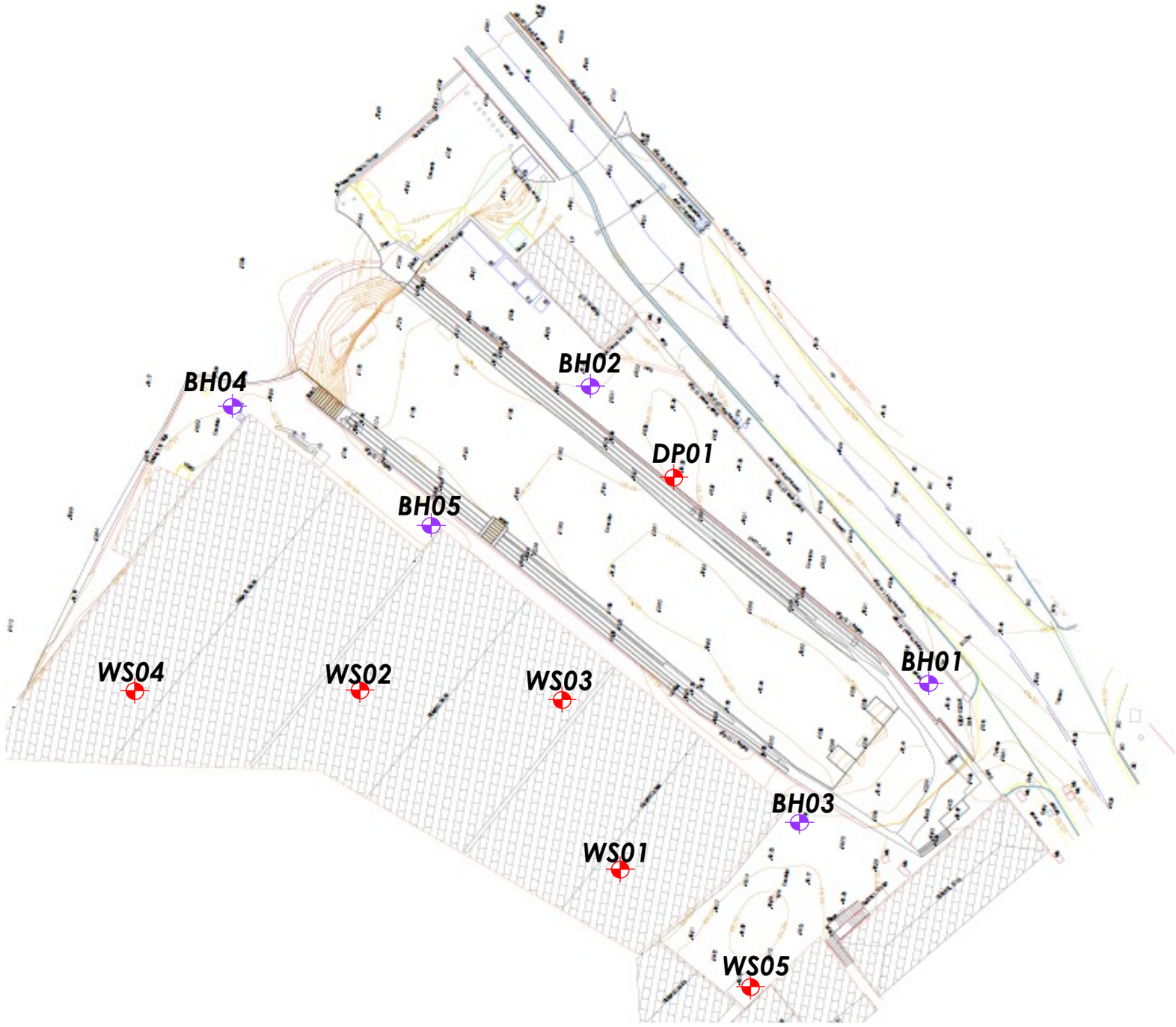
Title: Site Location Plan		
Site: Penzance Dry Docks		
Client: Penzance Dry Docks		Job No: 24093
Figure: 1	Date Drawn: 18-07-2024	Scale: NTS



KARN GEOSERVICES LTD
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Title: Exploratory Hole Location Plan		
Site: Penzance Dry Docks		
Client: Penzance Dry Docks		Job No: 24093
Figure: 2	Date Drawn: 18-07-2024	Scale: NTS

APPENDIX 2

SITE WORK

Drilling Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH01	BH		AC+OS/MA	1:50	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.50			MADE GROUND: Concrete.
		0.90	ES					MADE GROUND: Black locally dark brown clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone, concrete, basic igneous rock, and brick.
		1.20	SPT	N=4 (1,1/1,1,1,1)				*1.00m: Wood.*
		1.50	ES		1.40			MADE GROUND: Orangish brown slightly sandy slightly gravelly clay. Gravel is fine to coarse sub-angular to sub-rounded basic igneous rock.
		2.20	SPT	N=9 (1,2/1,2,4,2)				
		2.60	ES		2.40			MADE GROUND: Greyish brown locally brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone.
		3.20	SPT	N=16 (3,3/6,4,3,3)				
		3.30	ES					
		4.20	SPT	N=16 (3,3/4,3,3,6)				
		4.80	ES		4.50			Yellowish brown slightly sandy slightly gravelly clay.
		5.20	SPT	~~50 (25 for 100mm/50 for 25mm)~~	5.20			ODEX CASING
		5.30 - 5.60		100 16 0	5.30			Medium strong to strong locally weathered dark grey and light grey bonded laminated MUDSTONE. Fractures are closely spaced smooth planar dipping 0-20 degrees. Localised brownish staining on fracture surfaces. No infill. Mylor Slate Formation
		5.70 - 5.80	C 11					
			3		6.60			
		5.60 - 8.40		40 41 23	6.70			Quartz vein disaggregated localised brownish colouration around quartz vein. Mylor Slate Formation
			5					Medium strong to strong locally weathered dark grey and light grey bonded laminated MUDSTONE. Fractures are closely spaced smooth planar dipping 0-20 degrees. Localised brownish staining on fracture surfaces. No infill. Mylor Slate Formation
								Quartz vein disaggregated localised brownish colouration around quartz vein. Mylor Slate Formation
		8.90 - 9.05 8.50 - 10.00	C	100 86 57	9.30			Strong locally partially weathered dark grey and locally brownish grey MUDSTONE. Fractures are closely spaced smooth planar dipping 0-20 degrees. Orangish brown surface staining on fractures. Mylor Slate Formation
					9.42			

Type/FI | TCR | SCR | RQD | D/R/(SPT)

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater encountered at 11.50mbgl.

Rotary Core Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH01	BH		AC+OS/MA	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		10.36 - 10.46 10.00 - 11.50	C 8	100	96	70		11.50			Strong locally partially weathered dark grey and locally brownish grey MUDSTONE. Fractures are closely spaced smooth planar dipping 0-20 degrees. Orangish brown surface staining on fractures. Mylor Slate Formation *10.70m: Quartz vein* *11.35m: Quartz vein* End of Borehole at 11.500m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

Groundwater encountered at 11.50mbgl.

Drilling Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH02	BH		OS/MA+AC	1:50	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing							Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results								
									0.60			MADE GROUND: Concrete.
		1.00	ES									MADE GROUND: reworked greyish brown locally brown slightly clayey sandy gavel of fine to coarse sub-angular to sub-rounded mudstone.
		1.60	SPT	N=7 (2,2/2,1,2,2)								
		1.70	ES									
		2.40	ES									
		2.60	SPT	N=7 (1,2/2,2,1,2)								
		3.00	ES									
		3.60	SPT	N=7 (1,2/2,2,1,2)								
	▼	3.80	ES									
		4.20	ES									
		4.60	SPT	54 (3,3/54 for 225mm)					4.50			Grey sandy clayey GRAVEL of angular to sub-angular fine to coarse mudstone. Weathered Mylor Slate Formation.
		5.00 - 6.50			80	50	7		5.00			Predominantly non-intact very weak to weak light greyish brown and dark brown thinly laminated MUDSTONE. Mylor Slate Formation
		6.98 - 7.12 6.50 - 7.70	C		100	91	78		6.10			Weak to medium strong light grey and reddish brown thinly laminated MUDSTONE. Fractures are closely spaced sub-horizontal 70-80 degree stepped and planar, smooth with orange and brown staining and clay smearing. Mylor Slate Formation
		7.60 - 7.74	C						6.90			Medium strong dark grey thinly laminated MUDSTONE. Fractures are closely spaced sub-horizontal 30 degree planar smooth, widely spaced sub-horizontal 70 degree planar smooth. All with orangish brown staining on fractures. Mylor Slate Formation
		7.70 - 9.30			94	79	54		9.10			Medium strong dark grey thinly laminated MUDSTONE. Fractures are closely spaced sub-horizontal 30 degree planar smooth, widely spaced sub-horizontal 70 degree planar smooth. All with orangish brown staining on fractures. Mylor Slate Formation *9.40-9.80m: Non Intact*
			Type/FI	TCR	SCR	RQD	D/R/(SPT)					

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater encountered at 4.00mbgl.

Rotary Core Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH02	BH		OS/MA+AC	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
		9.30 - 10.80		100	74	56		10.80			Medium strong dark grey thinly laminated MUDSTONE. Fractures are closely spaced sub-horizontal 30 degree planar smooth, widely spaced sub-horizontal 70 degree planar smooth. All with orangish brown staining on fractures. Mylor Slate Formation
											End of Borehole at 10.800m

10 11 12 13 14 15 16 17 18 19

Type/FI	TCR	SCR	RQD	D/R/(SPT)

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

Groundwater encountered at 4.00mbgl.

Drilling Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH03	BH		OS.MA+AC	1:50	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
					0.22			MADE GROUND: Concrete.
		0.40	ES		0.60			MADE GROUND: Black locally orangish greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded igneous rock and mudstone.
		0.70	ES					MADE GROUND: Brown locally orangish brown over dark brown clayey sandy gravel of fine to coarse sub-angular to sub-rounded igneous rock and mudstone.
		1.20	SPT	N=12 (1,2/1,4,4,3)				
		1.30	ES					
		1.80	ES					
		2.20	ES		2.10			MADE GROUND: reworked brown locally orangish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone.
		2.20	SPT	N=4 (1,2/1,1,1,1)				
		2.60	ES					
		3.20	SPT	N=6 (2,2/1,2,2,1)				
		3.50	ES					
		4.20	SPT	N=10 (3,2/3,3,2,2)	4.20			NO RECOVERY
	▼	4.60	ES		4.50			MADE GROUND: Greyish brown slightly clayey slightly gravelly sand. Gravel is fine to coarse sub-angular to sub-rounded mudstone.
		5.10	ES		4.75			MADE GROUND: reworked brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone.
		5.50	SPT	~~50 (4,2/50 for 150mm)~~	5.50			MADE GROUND: Wooden sleeper
		5.80 - 7.00		100 | 100 | 50	5.95			Weak to medium strong light grey and reddish brown thinly laminated MUDSTONE. Fractures closely spaced sub-horizonal 70-80 degrees stepped and planar smooth with orange and brown staining and clay smearing. Mylor Slate Formation
								7.00-7.50m: Very weak
		7.00 - 8.50		100 | 73 | 31	7.50			Medium strong light grey thinly laminated MUDSTONE. Fractures closely spaced sub-horizonal 45 degree planar smooth occasional quartz veins <5mm. Mylor Slate Formation
		8.00 - 8.10	C					
		8.50 - 10.00		100 | 72 | 60				
			Type/FI	TCR | SCR | RQD | D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater encountered at 4.50mbgl.

Rotary Core Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH03	BH		OS.MA+AC	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Medium strong light grey thinly laminated MUDSTONE. Fractures closely spaced sub-horizonal 45 degree planar smooth occasional quartz veins <5mm. Mylor Slate Formation
		10.00 - 10.80		100	69	50					
		10.62 - 10.88	C								
		10.80 - 12.40		100	100	68					
		12.44 - 12.54	C					12.40			End of Borehole at 12.400m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

Groundwater encountered at 4.50mbgl.

Drilling Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH04	BH		OS/MA+AC	1:50	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing						Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results							
								0.20			MADE GROUND: Concrete.
								0.50			MADE GROUND: Greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded igneous rock and concrete.
		1.10	ES								MADE GROUND: reworked dark brownish grey slightly clayey sandy GRAVEL of fine to coarse sub-angular to sub-rounded igneous rock and mudstone.
		1.10	SPT	N=5 (1,1/1,2,1,1)				1.20			MADE GROUND: reworked yellowish brown clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone, brick and basic igneous rock.
		2.10	SPT	N=6 (1,1/2,1,2,1)							
		2.20	ES								
		3.10	SPT	N=14 (2,2/3,2,4,5)							
		3.20	ES								
								3.40			Greyish brown slightly clayey sandy GRAVEL of fine to coarse sub-angular to sub-rounded mudstone. Weathered Mylor Slate Formation
		3.70	ES								
		4.10	SPT	N=12 (3,2/2,3,3,4)							
		4.20	ES								
		4.70	ES								
		5.10	SPT	N=26 (3,3/4,4,8,10)							
		5.20	ES								
								5.40			Light brownish black slightly clayey sandy GRAVEL of fine to coarse sub-angular to sub-rounded mudstone. Weathered Mylor Slate Formation
		~~5.60~~	~~SPT~~	~~50 (25 for 75mm/50 for 75mm)~~				5.60			Weak brownish grey weathered MUDSTONE recovered as an angular fine to coarse GRAVEL. Weathered Mylor Slate Formation
		5.60 - 7.00		91	61	40		6.08			*6.04m: Quartz vein* Medium strong to strong partially weathered dark grey MUDSTONE. Localised brownish grey mottling and minor Iron Pyritre veining throughout. Fractures smooth planar closely spaced dipping 5-20 degrees. Localised brown staining on surfaces. Mylor Slate Formation
		~~7.00 - 7.14~~	C								
		7.00 - 8.50		100	97	29					
		8.20 - 8.39	C								
		8.50 - 10.00		100	93	56		8.65			Strong partially weathered dark grey MUDSTONE with fine (<5mm) quartz veining and locally bands of reduction. Fractures are localised brown. Mylor Slate Formation
		9.43 - 9.51	C								
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater encountered at 4.00mbgl.

Rotary Core Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 13/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH04	BH		OS/MA+AC	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
											Strong partially weathered dark grey MUDSTONE with fine (<5mm) quartz veining and locally bands of reduction. Fractures are localised brown. Mylor Slate Formation
		10.00 - 11.50		100	83	38					
		11.27 - 11.35	C								
								11.50			End of Borehole at 11.500m
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

10 11 12 13 14 15 16 17 18 19

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

Groundwater encountered at 4.00mbgl.

Drilling Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 03/09/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH05	BH		AC+OS/MA	1:50	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing						Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results							
								0.25			MADE GROUND: Macadam and concrete
		0.70	ES								MADE GROUND: light brownish locally greyish brown slightly sandy clayey gravel of fine to coarse sub-angular to sub-rounded basic igneous rock
		1.20	SPT	N=11 (2,2/3,4,2,2)							
		1.40	ES								
		1.90	ES								
		2.20	SPT	N=10 (1,2/2,3,3,2)							
		2.50	ES								
		3.20	SPT	N=16 (7,3/2,3,4,7)				3.20			MADE GROUND: reworked black slightly gravelly sandy silt. Gravel is fine to coarse sub-angular to sub-rounded mudstone.
		3.60	ES								*3.30m: Wood*
		3.90	SPT	~~50 (25 for 95mm/50 for 125mm)~~				3.90			ODEX CASING.
		4.00 - 5.50		100	87	0		4.00			Predominantly non-intact very weak light greyish brown and dark brown thinly laminated MUDSTONE. Fractures very closely spaced sub-horizontal 30 degree planar smooth, medium spaced 80 degree stepped smooth. Locally non intact. Mylor Slate Formation
		5.23 - 5.30	C								
		5.50 - 7.00		93	70	30					
		6.67 - 6.79	C								
		7.51 - 7.63	C					7.00			Medium strong dark grey thinly laminated MUDSTONE. Fractures are closely spaced sub-horizontal 30 degree planar smooth, widely spaced sub-horizontal 70 degree planar smooth. All with orangish brown staining on fractures. Mylor Slate Formation
		7.00 - 8.50		100	95	81					
		8.50 - 10.00		100	70	22		8.50			Quartz. Mylor Slate Formation
								8.70			Weak to medium strong light grey and reddish brown thinly laminated MUDSTONE. Fractures closely spaced sub-horiztonal 70-80 degrees stepped and planar smooth with orange and brown staining and clay smearing. Locally non intact. Mylor Slate Formation
			Type/FI	TCR	SCR	RQD	D/R/(SPT)				

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Rotary Core Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 03/09/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Celtic Drilling	Drilling Equipment: Comacchio Geo 205

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
BH05	BH		AC+OS/MA	1:50	Sheet 2 of 2

Well	Water	Depth (m)	Type /FI	Coring TCR	Coring SCR	Coring RQD	Diameter Recovery (SPT)	Depth (m)	Level (m)	Legend	Stratum Description
								10.00			Weak to medium strong light grey and reddish brown thinly laminated MUDSTONE. Fractures closely spaced sub-horiztonal 70-80 degrees stepped and planar smooth with orange and brown staining and clay smearing. Locally non intact. Mylor Slate Formation
											End of Borehole at 10.000m

10 11 12 13 14 15 16 17 18 19

Type/FI	TCR	SCR	RQD	D/R/(SPT)

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

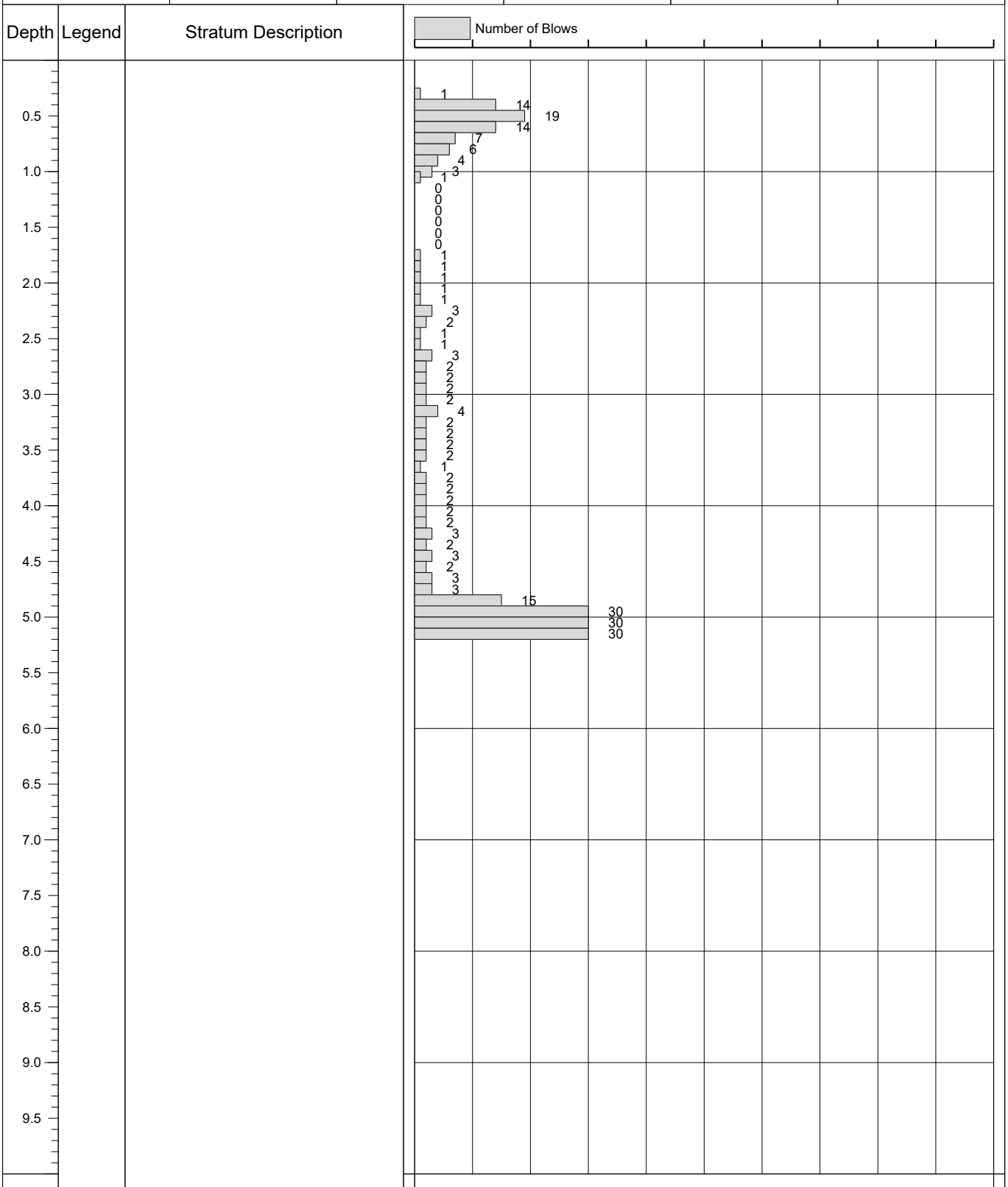
Remarks

Groundwater not encountered.

Probe Test Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
DP01	DP			1:50	Sheet 1 of 1



Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation				Drilling Flush					
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation	Depth Top	Depth Base	Type	Colour	Min (%)	Max (%)

Remarks

Groundwater not encountered.

Windowless Sampler Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name: Karn Geoservices	Drilling Equipment: Archway Dart 549

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS01	WS		KC	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.25	SPT	N=50 (4,7/50 for 260mm)	0.13			MADE GROUND: Concrete slab.
		0.30	ES		0.40			NO RECOVERY - appears to be natural in the base of the hole.
								End of Borehole at 0.400m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Windowless Sampler Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS02	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	SPT	N=13 (4,6/5,3,3,3,2)				MADE GROUND: Brown sandy clayey gravel of fine to coarse sub-angular to sub-rounded mudstone, basic igneous rock, and chert.
		0.40	ES		0.60			MADE GROUND: Greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded igneous rock.
		1.00	SPT	N=48 (10,15/16,12,10,10)	1.00			End of Borehole at 1.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Windowless Sampler Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS03	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.12			MADE GROUND: Concrete slab.
					0.50			MADE GROUND: Black locally greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone and basic igneous rock.
		0.70	SPT	50 (25 for 30mm/50 for 75mm)	0.70			Greyish slightly sandy slightly clayey GRAVEL of fine to coarse sub-angular to sub-rounded altered mudstone. Weathered Mylor Slate Formation.
								End of Borehole at 0.700m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Windowless Sampler Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS04	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.12			MADE GROUND: Concrete.
		0.30	ES					MADE GROUND: Brown locally greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone.
		1.00	SPT	N=4 (1,1/1,1,1,1)				
		1.40	ES					
		2.00	SPT	N=11 (2,2/3,2,2,4)				
					2.30			MADE GROUND: Dark brown locally black slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone.
		2.50	ES					
		2.80 - 3.00	B		2.70			Light brown slightly clayey sandy GRAVEL of fine to coarse sub-angular to sub-rounded fine to coarse mudstone. Weathered Mylor Slate Formation
		3.00	SPT	50 (8,14/50 for 150mm)	3.00			End of Borehole at 3.000m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Windowless Sampler Log

Project Name: Penzance Dry Dock	Client: c/o MBA Consulting	Date: 12/06/2024
Location: Penzance	Contractor:	
Project No. : 24093	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS05	WS			1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.13			MADE GROUND: Concrete.
		0.30	ES		0.50			MADE GROUND: black locally brown gravelly sandy clay. Gravel is fine to coarse sub-angular to sub-rounded mudstone, charcoal and slag.
		1.00	SPT	N=9 (2,1/1,0,3,5)				MADE GROUND: greyish brown slightly clayey sandy gravel of fine to coarse sub-angular to sub-rounded mudstone and basic igneous rock.
		1.20	ES					
		1.50 - 1.70	B		1.40			Light brown slightly clayey sandy GRAVEL of fine to coarse sub-angular to sub-rounded mudstone. Weathered Mylor Slate Formation
		1.70	SPT	50 (25 for 125mm/50 for 110mm)	1.70			End of Borehole at 1.700m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Groundwater not encountered.

Date Drawn: 18/06/2024	Scale: NTS	Title: Core Photos	
KARN GEOSERVICES		Site: Penzance Dry Dock	
		Client: Penzance Dry Dock	Job No: 24093

Date Drawn: 18/06/2024	Scale: NTS	Title: Core Photos	
KARN GEOSERVICES		Site: Penzance Dry Dock	
		Client: Penzance Dry Dock	Job No: 24093

Date Drawn: 18/06/2024	Scale: NTS	Title: Core Photos	
KARN GEOSERVICES		Site: Penzance Dry Dock	
		Client: Penzance Dry Dock	Job No: 24093

Date Drawn: 18/06/2024	Scale: NTS	Title: Core Photos	
KARN GEOSERVICES		Site: Penzance Dry Dock	
		Client: Penzance Dry Dock	Job No: 24093

Date Drawn: 18/06/2024	Scale: NTS	Title: Core Photos	
KARN GEOSERVICES		Site: Penzance Dry Dock	
		Client: Penzance Dry Dock	Job No: 24093

FELLOWS INTERNATIONAL GROUP
UXO Risk Specialists

UXO Risk Management Report

FIG Reference: 3930L

Client: Karn Geoservices

Project: Penzance Dry Dock

Site Location: Wharf Road, Penzance, TR18 4BW

Project Dates: 10-13 June 2024

Document Control

Version Date	Version	Author	Reviewer	Comments
17 Jun. 24	1.0	Vicky Harper	Carl Parnell MIExpE	Original

Quality Check

Version Date	Version	Checked by	Comments
17 Jun. 24	1.0	Keith Rayment	QC / format check

Document Approval

	Reviewed by	Approved by
Signature		
Print Name	Carl Parnell MIExpE	Keith Rayment
Date	17 June 2024	17 June 2024

Distribution

Date	Copy No.	Recipient	Format
17 Jun. 24	1	Karn Geoservices	PDF
17 Jun. 24	2	Fellows International Group Ltd.	PDF

FELLOWS

1. Project Detail

Client:	Karn Geoservices
Survey Objectives:	To locate, using electromagnetic means, any Unexploded Ordnance [UXO] that could pose a risk to intrusive engineering ground investigation works.
Location:	Penzance Dry Dock
Dates:	10-13 June 2024

2. Equipment

UXO Locator:	Ebinger Magnex 120LW Magnetometer

3. Method

A single Fellows UXO Survey Engineer using an Ebinger Magnex 120LW Magnetometer supported the intrusive engineering works in accordance with the approved Methodology and Risk Assessment documentation to identify possible UXO in the vicinity.

See GI Position Log for details.

4. Results

Commencing at 0800 on the dates listed above, Fellows provided UXO Engineer support on site during intrusive ground works.

No evidence of UXO was found in the cleared areas.
A UXO Clearance Status Certificate is attached.

NOTE: Only the positions of the ground investigation listed on the GI Position Log are certified free from UXO. If it is intended to conduct intrusive ground engineering operations outside of these surveyed positions a danger from UXOs still exists and the site should be surveyed for any UXO contamination before any future groundwork starts.

5. Unexploded Bomb (UXB) Penetration Depth

The magnetometer survey depth at each GI position is individually assessed taking into account the estimated maximum penetration depth for a typical WWII aerial weapon in relation to the ground conditions encountered. Unless otherwise stated, the depth achieved is that considered sufficient to clear the position for UXBs.

UXO Clearance Status Certificate

Site Name: Penzance Dry Dock

FIG Ref: 3930L

Date of Certificate: 17 June 2024

The Unexploded Ordnance (UXO) clearance status for each GI position is indicated on the attached GI Position Log to the logged depth (referenced to ground level), subject to the limitations outlined below. The GI positions cleared were identified to the Fellows UXO Engineer by the onsite Engineer.

Fellows UXO Survey Engineer: David Francis

Limitations

Detection of a UXO depends on a sufficient magnetic susceptibility contrast between the UXO and its host materials. Significant degradation of the casing of such a device or highly magnetic soils may prevent detection under certain circumstances.

The radius of detection (from each GI position) for a particular type of UXO depends on several parameters including the sensor system used, the size and orientation of the device and the levels of ambient magnetic noise on the site. High levels of noise may prevent detection in certain areas.

FELLOWS

GI Position Log

GI No.	Cleared Yes/No	Equipment Used	Survey Depth	Remarks
BH01	Yes	Ebinger Magnex 120LW Magnetometer	5.5m	No evidence of UXO contamination
BH02	Yes	Ebinger Magnex 120LW Magnetometer	5.5m	No evidence of UXO contamination
BH03	Yes	Ebinger Magnex 120LW Magnetometer	5.5m	No evidence of UXO contamination
BH04	Yes	Ebinger Magnex 120LW Magnetometer	5.5m	No evidence of UXO contamination
BH05	Yes	Ebinger Magnex 120LW Magnetometer	5m	No evidence of UXO contamination
WS01	Yes	Ebinger Magnex 120LW Magnetometer	3.7m	No evidence of UXO contamination
WS02	Yes	Ebinger Magnex 120LW Magnetometer	1.45m	No evidence of UXO contamination
WS03	NO	Ebinger Magnex 120LW Magnetometer	0.5m	Drill refused at 0.5m UXO scan shows anomalies below 0.5m Client advised WS abandoned
WS04	Yes	Ebinger Magnex 120LW Magnetometer	1.5m	No evidence of UXO contamination
WS05	Yes	Ebinger Magnex 120LW Magnetometer	1.7m	No evidence of UXO contamination

FELLOWS INTERNATIONAL GROUP
UXO Risk Specialists

Fellows International Group Ltd
160 Ordnance Business Park
Aerodrome Road
Gosport
Hampshire
PO13 0FG

t. 08000 424 424
e. info@fellowsintgroup.com

APPENDIX 3

LABORATORY CERTIFICATES – GEOTECHNICAL TESTS

Laboratory Report

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES A PHENNA GROUP COMPANY

Contract Number: 73427

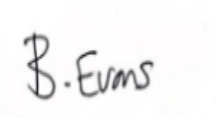
Client Ref: **24093**
Client PO: **24093/OS**

Client: **Karn Geoservices Limited**

Contract Title: **Penzance Dry Dock**
For the attention of: **Mike Austin**

Date Received: **25-06-2024**
Date Completed: **09-07-2024**
Report Date: **09-07-2024**

This report has been checked and approved by:



Brendan Evans
Office Administrator

Description	Qty
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	2
Water Soluble Sulphate 2:1 extract Sub-contracted Test	6
pH value of soil Sub-contracted Test	6
Uniaxial Compressive Strength of Rock inc sample prep 54-165mm diameter cores ISRM Suggested Method for determining uniaxial compressive strength - @ Non Accredited Test	1
Determination of Point Load Value Axial or Diametrical including WC ***Please note GSTL is not accredited for the water content of rock*** ISRM Suggested Method for Point Load Strength - * UKAS	28
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	1
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	1
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

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)

GEO Site & Testing Services Ltd
Unit 3-4 Heol Aur, Dafen Ind Est, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784 040 Fax: 01554 784 040 info@gstl.co.uk https://gstl.co.uk

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377:1990 - Part 2 : 4.3 & 5.3)	
Contract Number	73427	
Project Name	Penzance Dry Dock	
Date Tested	02/07/2024	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
WS04		B	2.80	-	3.00	Off white slightly gravelly slightly sandy chalky CLAY/SILT
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
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				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		

Operator
Owain Davies

NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.3 & 5.3)

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES

Contract Number	73427
Project Name	Penzance Dry Dock
Date Tested	02/07/2024

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
WS04		B	2.80	-	3.00	16		NP		91	
				-							
				-							
				-							
				-							
				-							
				-							
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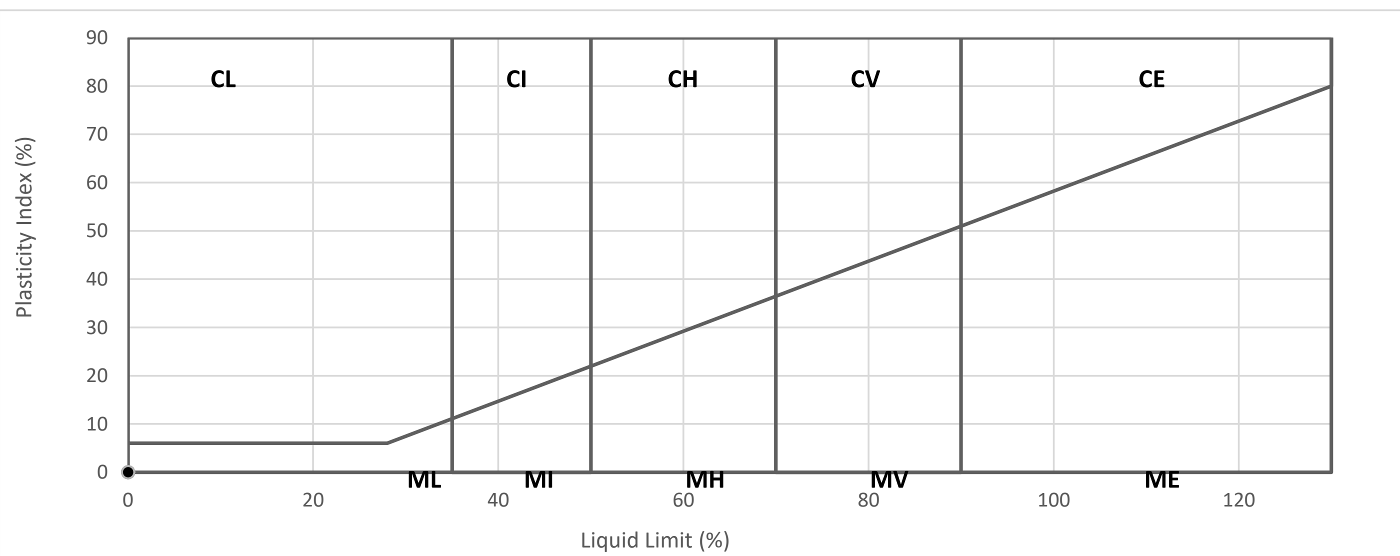
				-							
				-							
				-							
				-							
				-							

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

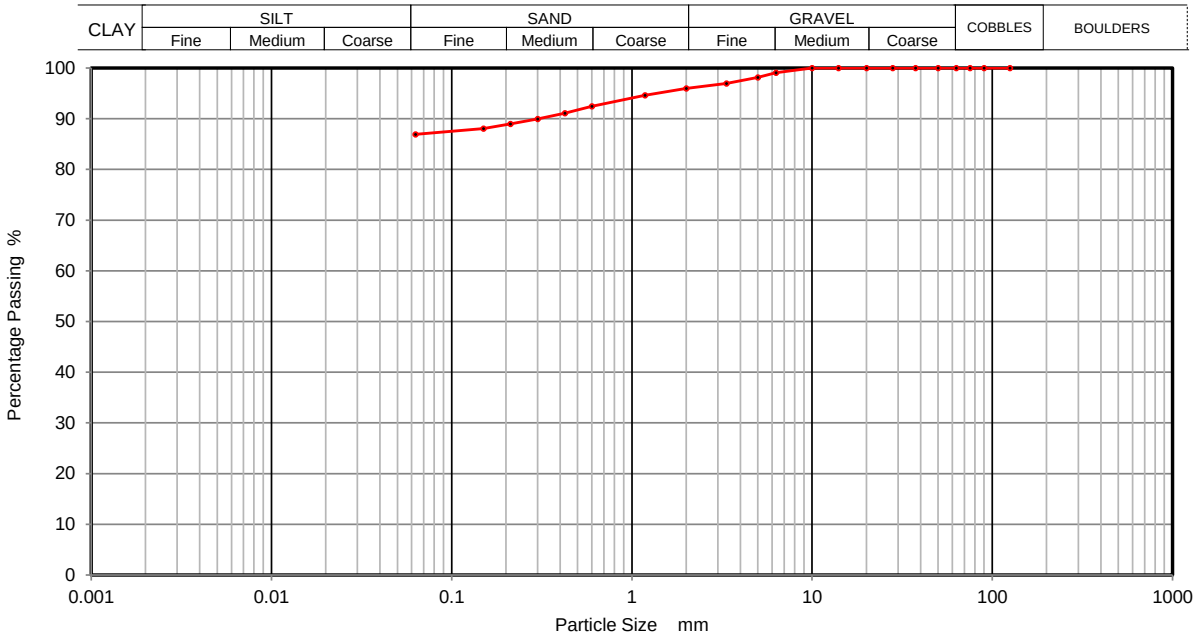
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:2015+A1:2020



Operator
Owain Davies

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2**	Contract Number	73427
		Borehole/Pit No.	WS04
Project Name	Penzance Dry Dock	Sample No.	
Soil Description	Off white slightly gravelly slightly sandy chalky CLAY/SILT	Depth Top	2.80
		Depth Base	3.00
Date Tested	04/07/2024	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	100		
20	100		
14	100		
10	100		
6.3	99		
5	98		
3.35	97		
2	96		
1.18	95		
0.6	92		
0.425	91		
0.3	90		
0.212	89		
0.15	88		
0.063	87		

Sample Proportions	% dry mass
Cobbles	0
Gravel	4
Sand	9
Silt and Clay	87

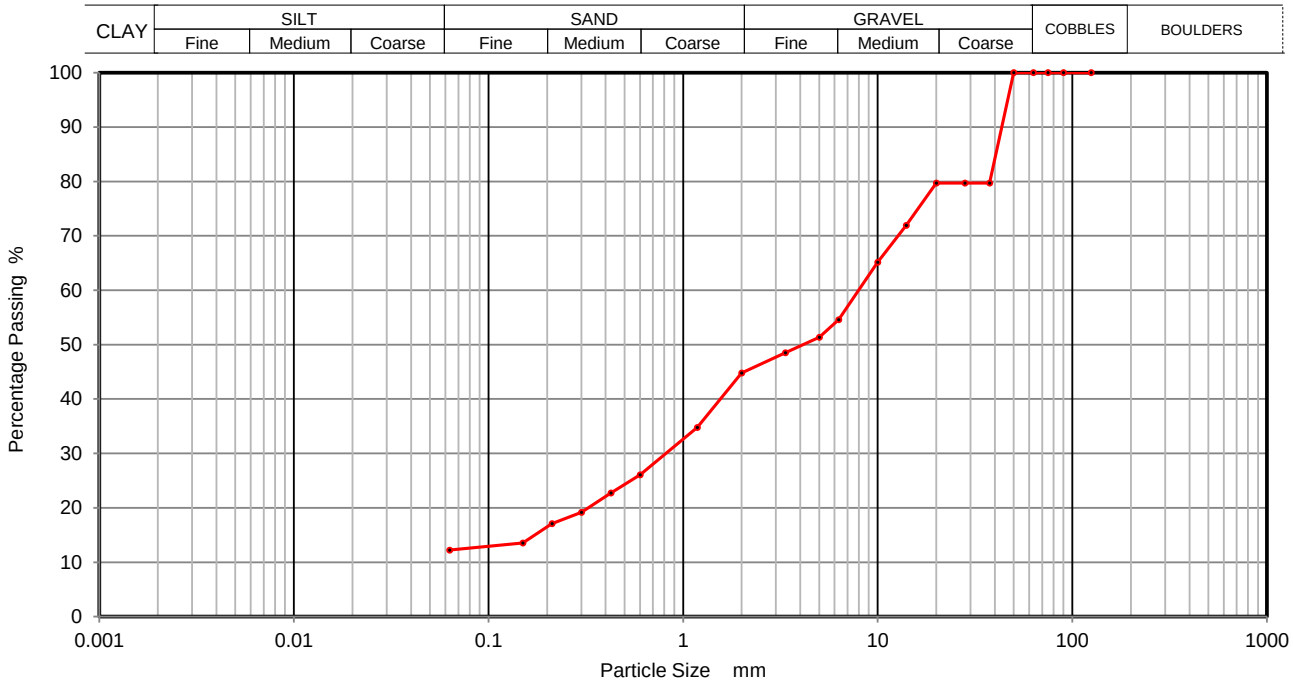
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	73427
		Borehole/Pit No.	WS05
Project Name	Penzance Dry Dock	Sample No.	
Soil Description	Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.50
		Depth Base	1.70
Date Tested	04/07/2024	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	80		
28	80		
20	80		
14	72		
10	65		
6.3	55		
5	51		
3.35	49		
2	45		
1.18	35		
0.6	26		
0.425	23		
0.3	19		
0.212	17		
0.15	14		
0.063	12		

Sample Proportions	% dry mass
Cobbles	0
Gravel	55
Sand	33
Silt and Clay	12

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

Point Load Test

The complete ISRM suggested methods for rock characterization, testing and monitoring 1974-2006 Determining Point Load Strength

Contract Number	73427
Project Name	Penzance Dry Dock
Sample Type	Core
Date Tested	25/06/2024

*Please note that GSTL is not accredited for the water content of rock

Hole Reference	Depth (m)			Sample No	Test Type		Width	Platen Seperation	Failure Load	Equivalent Diameter	Point Load	Size Factor	Point Load Index	Moisture Content	Description	Angle Between Plane of Anisotropy & Core Axis	Type of Anisotropy (Bedding or Cleavage)
					d / a / b / i	I //											
BH01	5.70	-	5.80		d			90	1.79		0.22	1.30	0.29	1.5	SILTSTONE		
BH01	5.70	-	5.80		a		90	43	9.64	70.20	1.96	1.16	2.28	1.8	SILTSTONE		
BH01	8.90	-	9.05		d			90	0.41		0.05	1.30	0.07	5.6	SILTSTONE		
BH01	8.90	-	9.05		a		90	75	0.45	92.71	0.05	1.32	0.07	5.5	SILTSTONE		
BH01	10.36	-	10.48		d			90	0.52		0.06	1.30	0.08	5.7	SILTSTONE		
BH01	10.36	-	10.48		a		90	66	1.78	86.97	0.24	1.28	0.30	5.2	SILTSTONE		
BH02	6.98	-	7.12		d			90	1.99		0.25	1.30	0.32	3.6	SILTSTONE		
BH02	6.98	-	7.12		a		90	54	0.22	78.66	0.04	1.23	0.04	3.6	SILTSTONE		
BH02	7.60	-	7.74		d			90	1.85		0.23	1.30	0.30	6.5	SILTSTONE		
BH02	7.60	-	7.75		a		90	85	0.19	98.69	0.02	1.36	0.03	5.6	SILTSTONE		
BH03	8.00	-	8.10		d			90	0.09		0.01	1.30	0.01	4.6	SILTSTONE		
BH03	8.00	-	8.10		a		90	54	2.93	78.66	0.47	1.23	0.58	4.4	SILTSTONE		
BH03	10.82	-	10.88		d			90	1.23		0.15	1.30	0.20	6.1	SILTSTONE		
BH03	10.82	-	10.88		a		90	78	1.22	94.54	0.14	1.33	0.18	6.5	SILTSTONE		
BH03	12.44	-	12.54		d			90	10.93		1.35	1.30	1.76	0.6	SILTSTONE		
BH03	12.44	-	12.54		a		90	54	20.06	78.66	3.24	1.23	3.98	1.1	SILTSTONE		
BH04	7.00	-	7.40		d			90	2.07		0.26	1.30	0.33	5.4	SILTSTONE		
BH04	7.00	-	7.14		a		90	48	1.59	74.16	0.29	1.19	0.35	8.6	SILTSTONE		
BH04	9.43	-	9.51		d			90	0.62		0.08	1.30	0.10	5.0	SILTSTONE		
BH04	9.43	-	9.51		a		90	48	0.95	74.16	0.17	1.19	0.21	4.0	SILTSTONE		
BH04	11.27	-	11.35		d			90	0.08		0.01	1.30	0.01	1.8	SILTSTONE		
BH04	11.27	-	11.35		a		90	42	3.67	69.37	0.76	1.16	0.88	2.6	SILTSTONE		
BH05	5.23	-	5.30		d			90	0.16		0.02	1.30	0.03	3.9	SILTSTONE		
BH05	5.23	-	5.30		a		90	32	0.33	60.56	0.09	1.09	0.10	4.0	SILTSTONE		
BH05	6.67	-	6.79		d			90	0.56		0.07	1.30	0.09	8.8	SILTSTONE		
BH05	6.67	-	6.79		a		90	54	0.41	78.66	0.07	1.23	0.08	11.4	SILTSTONE		
BH05	7.51	-	7.63		d			90	3.15		0.39	1.30	0.51	6.7	SILTSTONE		
BH05	7.51	-	7.63		a		90	53	1.28	77.93	0.21	1.22	0.26	6.5	SILTSTONE		

Key	Reported As
Width	(W) mm
Platen Separation	(D) mm
Failure Load	(P) kN
Equivalent Diameter	(De) mm
Point Load	(Is) MPa
Size Factor	(F)
Point Load Index	(Is(50)) MPa
Moisture Content	%
Description	SC

Operator
Julian Jones

UKAS TESTING
2788

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

Determination of Unconfined Compressive Strength
ISRM Suggested Methods Vol 16, No. 2, pp. 135-140 1979

Contract Number	73427
Project Name	Penzance Dry Dock
Sample Preperation	Sawing and Grinding
Date Tested	25/06/2024

Hole Reference	Depth (m)			Diameter	Length	Initial Mass	Moisture Content	Bulk Density	Dry Density	Load Failure	Maximum Strength	Type of Failure
BH04	8.20		8.38	89.9	185.3	3020.0	1.3	2.57	2.53	101.9	16.1	Single Shear

Key	Reported As
Diameter	mm
Length	mm
Initial Mass	g
Moisture Content	%
Bulk Density	Mg/m^3
Dry Density	Mg/m^3
Load Failure	kN
Maximum Strength	MPa

Operator
Julian Jones

4161

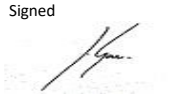
CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

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

Analytical Test Report: L24/05844/GSL - 24-46863

Your Project Reference:	**Penzance Dry Dock 24093**		
Your Order Number:	73427	Samples Received / Instructed:	28/06/2024 / 28/06/2024
Report Issue Number:	1	Sample Tested:	28/06 to 09/07/2024
Samples Analysed:	6 soil samples	Report issued:	09/07/2024

Signed



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: 29.05.2024
Issued by: J. Gane
Issue No: 4
Rev No: 10

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/05844/GSL - 24-46863

Project Reference - Penzance Dry Dock 24093

Analytical Test Results - Chemical Analysis

Lab Reference			377210	377211	377212	377213	377214	377215
Client Sample ID			-	-	-	-	-	-
Client Sample Location			WS4	WS5	BH1	BH1	BH3	BH4
Client Sample Type			B	B	C	C	C	C
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			2.80	1.50	5.70	10.38	12.44	8.20
Depth - Bottom (m)			3.00	1.70	5.80	10.48	12.54	8.39
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Other	Other	Other	Other	Other	Other
Determinant	**Units**	**Accreditation**						
Water soluble sulphate (as SO_4)	(mg/l)	u	28	160	240	160	22	170
pH Value	pH Units	MCERTS	8.8	8.4	8.6	8.9	9.5	8.9

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/05844/GSL - 24-46863

Project Reference - Penzance Dry Dock 24093

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
377210	-	WS4	B	-	Light brown clayey silt	-	-	100
377211	-	WS5	B	-	Greyish brown gravelly clayey silt	-	-	82
377212	-	BH1	C	-	Dark grey mudstone	-	-	100
377213	-	BH1	C	-	Dark grey mudstone	-	-	100
377214	-	BH3	C	-	Grey mudstone	-	-	100
377215	-	BH4	C	-	Grey mudstone	-	-	100

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/05844/GSL - 24-46863

Project Reference - Penzance Dry Dock 24093

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
377210	-	WS4	B	-	
377211	-	WS5	B	-	
377212	-	BH1	C	-	
377213	-	BH1	C	-	
377214	-	BH3	C	-	
377215	-	BH4	C	-	

L24/05844/GSL - 24-46863

Project Reference - Penzance Dry Dock 24093

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	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

L24/05844/GSL - 24-46863

Project Reference - Penzance Dry Dock 24093

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
377210	-	WS4	B	-		A
377211	-	WS5	B	-		A
377212	-	BH1	C	-		A
377213	-	BH1	C	-		A
377214	-	BH3	C	-		A
377215	-	BH4	C	-		A

APPENDIX 4

LABORATORY CERTIFICATES – GEOENVIRONMENTAL TESTS

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-19786-1
Initial Date of Issue:	10-Jul-2024
Re-Issue Details:	
Client	Karn Geoservice Ltd
Client Address:	West Langarth Farm Penstraze Truro Cornwall TR4 8PH
Contact(s):	Lucy Quick
Project	24093 Penzance Dry Dock

Quotation No.:	Q24-35202	**Date Received:**	21-Jun-2024
Order No.:		**Date Instructed:**	21-Jun-2024
No. of Samples:	13		
Turnaround (Wkdays):	14	**Results Due:**	10-Jul-2024
Date Approved:	10-Jul-2024	**Subcon Results Due:**	12-Jul-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 - Miscellaneous Solid

Project: 24093 Penzance Dry Dock

Client: Karn Geoservice Ltd			**Chemtest Job No.:**		24-19786	24-19786
Quotation No.: Q24-35202			**Chemtest Sample ID.:**		1824801	1824806
Order No.:			Client Sample Ref.:		ES2	ES3
			Client Sample ID.:		ES2	ES3
			Sample Location:		WS04	BH01
			Sample Type:		MISCSOLID	MISCSOLID
			Top Depth (m):		1.40	2.60
			Date Sampled:		12-Jun-2024	13-Jun-2024
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Tributyltin (TBT)	SN		mg/kg	0.0200000	See Attached	See Attached

Results - Soil

Project: 24093 Penzance Dry Dock

Client: Karn Geoservice Ltd				**Chemtest Job No.:**		24-19786	24-19786	24-19786	24-19786	24-19786	24-19786	24-19786	24-19786
Quotation No.: Q24-35202				**Chemtest Sample ID.:**		1824799	1824800	1824802	1824803	1824804	1824805	1824807	1824808
Order No.:				Client Sample Ref.:		ES1	ES1	ES3	ES1	ES2	ES1	ES5	ES1
				Client Sample ID.:		ES1	ES1	ES3	ES1	ES2	ES1	ES5	ES1
				Sample Location:		WS03	WS04	WS04	WS05	WS05	BH01	BH01	BH02
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.20	0.30	2.50	0.30	1.20	0.90	4.80	1.00
				Date Sampled:		12-Jun-2024	12-Jun-2024	12-Jun-2024	12-Jun-2024	12-Jun-2024	13-Jun-2024	13-Jun-2024	13-Jun-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
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	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture		N	2030	%	0.020	7.8	11	7.4	14	8.5	12	22	11
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones	None	Stones	Stones	None	Stones
Soil Texture		N	2040		N/A	Loam	Loam	Loam	Sand	Loam	Clay	Clay	Loam
pH at 20C		M	2010		4.0	8.6	8.7	7.7	7.9	8.1	8.3	8.4	8.6
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	1.9	2.0	3.7	1.6	0.69	2.1	10	1.3
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50		
Arsenic		M	2455	mg/kg	0.5	160	90	190	38	450	140	51	78
Cadmium		M	2455	mg/kg	0.10	0.42	< 0.10	< 0.10	0.46	< 0.10	0.28	0.85	< 0.10
Chromium		M	2455	mg/kg	0.5	170	63	60	39	49	120	39	35
Copper		M	2455	mg/kg	0.50	230	110	500	520	140	290	35	81
Mercury		M	2455	mg/kg	0.05	6.6	0.12	0.42	4.3	0.56	3.5	0.06	0.07
Nickel		M	2455	mg/kg	0.50	180	56	72	38	57	77	30	24
Lead		M	2455	mg/kg	0.50	800	42	880	280	120	830	31	56
Selenium		M	2455	mg/kg	0.25	1.5	1.4	2.4	0.53	2.4	1.6	1.0	2.0
Zinc		M	2455	mg/kg	0.50	510	210	220	280	170	680	160	93
Chromium (Trivalent)		N	2490	mg/kg	1.0	170	63	60	39	49	120	39	35
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter		M	2625	%	0.40	14	3.0	2.1	20	1.3	6.7	0.76	1.2
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10			90		4000		< 10	< 10
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		130		< 1.0		
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		2800		< 1.0		
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		7000		< 1.0		
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		2000		< 1.0		
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	2680	mg/kg	5.0	< 5.0	< 5.0		12000		< 5.0		
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	2680	mg/kg	1.0	40	41		43		41		
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		70		< 1.0		
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		1900		< 1.0		

Results - Soil

Project: 24093 Penzance Dry Dock

Client: Karn Geoservice Ltd				**Chemtest Job No.:**		24-19786	24-19786	24-19786	24-19786	24-19786	24-19786	24-19786	24-19786
Quotation No.: Q24-35202				**Chemtest Sample ID.:**		1824799	1824800	1824802	1824803	1824804	1824805	1824807	1824808
Order No.:				Client Sample Ref.:		ES1	ES1	ES3	ES1	ES2	ES1	ES5	ES1
				Client Sample ID.:		ES1	ES1	ES3	ES1	ES2	ES1	ES5	ES1
				Sample Location:		WS03	WS04	WS04	WS05	WS05	BH01	BH01	BH02
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.20	0.30	2.50	0.30	1.20	0.90	4.80	1.00
				Date Sampled:		12-Jun-2024	12-Jun-2024	12-Jun-2024	12-Jun-2024	12-Jun-2024	13-Jun-2024	13-Jun-2024	13-Jun-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**								
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	2680	mg/kg	1.0	11	< 1.0		2000		9.5		
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	2680	mg/kg	1.0	11	< 1.0		1300		< 1.0		
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	2680	mg/kg	5.0	62	41		5300		50		
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	2680	mg/kg	10.0	62	41		17000		50		
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0		
Naphthalene		M	2800	mg/kg	0.10	0.74	< 0.10	0.47	1.6	< 0.10	0.89	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	0.56	< 0.10	< 0.10	0.44	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	0.16	< 0.10	< 0.10	0.13	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	1.1	< 0.10	3.5	2.1	< 0.10	3.7	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	0.20	< 0.10	1.3	< 0.10	< 0.10	0.77	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	1.5	< 0.10	13	2.7	0.56	12	0.69	< 0.10
Pyrene		M	2800	mg/kg	0.10	1.4	< 0.10	9.5	4.3	1.1	8.6	0.62	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	0.89	< 0.10	7.1	< 0.10	< 0.10	6.2	0.49	< 0.10
Chrysene		M	2800	mg/kg	0.10	0.89	< 0.10	6.9	< 0.10	< 0.10	6.8	0.51	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	1.4	< 0.10	9.1	< 0.10	< 0.10	11	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	0.40	< 0.10	3.8	< 0.10	< 0.10	4.2	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	0.84	< 0.10	5.8	< 0.10	< 0.10	7.1	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	0.76	< 0.10	5.3	< 0.10	< 0.10	6.6	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	1.3	< 0.10	< 0.10	1.1	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	0.75	< 0.10	3.1	< 0.10	< 0.10	4.2	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	11	< 2.0	71	11	< 2.0	74	2.3	< 2.0
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: 24093 Penzance Dry Dock

Client: Karn Geoservice Ltd				**Chemtest Job No.:**		24-19786	24-19786	24-19786
Quotation No.: Q24-35202				**Chemtest Sample ID.:**		1824809	1824810	1824811
Order No.:				Client Sample Ref.:		ES2	ES5	ES9
				Client Sample ID.:		ES2	ES5	ES9
				Sample Location:		BH03	BH03	BH03
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.70	2.20	5.10
				Date Sampled:		13-Jun-2024	13-Jun-2024	13-Jun-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
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
Moisture		N	2030	%	0.020	9.3	15	14
Soil Colour		N	2040		N/A	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Loam	Loam	Clay
pH at 20C		M	2010		4.0	8.7	8.8	8.9
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	1.3	4.7	7.2
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50	
Arsenic		M	2455	mg/kg	0.5	100	43	150
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	67	27	53
Copper		M	2455	mg/kg	0.50	60	46	93
Mercury		M	2455	mg/kg	0.05	0.07	0.05	0.41
Nickel		M	2455	mg/kg	0.50	78	21	61
Lead		M	2455	mg/kg	0.50	34	35	62
Selenium		M	2455	mg/kg	0.25	0.84	0.54	1.2
Zinc		M	2455	mg/kg	0.50	150	59	250
Chromium (Trivalent)		N	2490	mg/kg	1.0	67	27	53
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter		M	2625	%	0.40	3.1	1.7	0.79
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10			< 10
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	2680	mg/kg	5.0	< 5.0	< 5.0	
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	2680	mg/kg	1.0	43	57	
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	

Results - Soil

Project: 24093 Penzance Dry Dock

Client: Karn Geoservice Ltd				**Chemtest Job No.:**		24-19786	24-19786	24-19786
Quotation No.: Q24-35202				**Chemtest Sample ID.:**		1824809	1824810	1824811
Order No.:				Client Sample Ref.:		ES2	ES5	ES9
				Client Sample ID.:		ES2	ES5	ES9
				Sample Location:		BH03	BH03	BH03
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		0.70	2.20	5.10
				Date Sampled:		13-Jun-2024	13-Jun-2024	13-Jun-2024
				Asbestos Lab:		NEW-ASB	NEW-ASB	NEW-ASB
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	2680	mg/kg	1.0	< 1.0	< 1.0	
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	2680	mg/kg	5.0	43	57	
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	2680	mg/kg	10.0	43	57	
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0	
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0	
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0	
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	0.47	0.33
Pyrene		M	2800	mg/kg	0.10	< 0.10	0.37	0.28
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0
Total Phenols		M	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	Allkaline 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-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
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*; Dibenz[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.	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
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 ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

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

Certificate of Analysis

Report No.:	**24-04623-1**
Issue No.:	**1**
Date of Issue	**10/07/2024**
Customer Details:	Chemtest Ltd, Depot Road, Newmarket, Suffolk, CB8 0AL, United Kingdom
Customer Contact:	Joanne Ould
Customer Order No.:	27239
Customer Reference:	Not Supplied
Quotation Reference:	Q24-02233 (Issue: 9)
Description:	2 geo samples
Date Received:	26/06/2024
Date Started:	26/06/2024
Date Completed:	08/07/2024
Test Methods:	Details available on request (refer to SOP code against relevant result/s)
Notes:	None

Approved By: **David Long, LIMS Manager**

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13 St Martins Way, Bedford, Bedfordshire, MK42 0LF. T +44 1462 480 400
A member of the RPS Group plc. Terms and conditions apply - copy on request

Results Summary

Report No.: 24-04623-1

Customer Reference: Not Supplied

Customer Order No: 27239

Customer Sample No	**1824801**	**1824806**
Customer Sample ID	WS04	BH01
RPS Sample No	60256	60257
Sample Type	**GEO**	**GEO**
Sample Matrix	SOIL	SOIL
Sampling Date	12/06/2024	13/06/2024

Determinand	CAS No	Codes	SOP	RL	Units		
tributyltin (TBT)	36643-28-4	N	S395LL	2	kg as cation	< 2.0	< 2.0

Deviating Samples

Report No.: 24-04623-1

Customer Reference: Not Supplied

Customer Order No: 27239

Our policy on Deviating Samples has been implemented in accordance with UKAS Policy on Deviating Samples (TPS63).
RPS is not responsible for the integrity of samples as received, unless RPS personnel performed the sampling. Samples submitted may be declared to be deviating.
Where applicable the analysis method remains UKAS accredited, however results reported for a deviating sample may be compromised.
Where no sampling date was supplied, samples have been declared to be deviating. If the date can be supplied, results may be reissued if assessed not deviating.
Where the sample container used was unsuitable or broken, the sample is flagged as deviating and re-sampling/re-submisson may be required.

RPS No.	Customer No.	Customer ID	Date Sampled	Containers Received	Deviating	Reason for Deviation
60256	1824801	WS04	12/06/2024	250 mL amber glass jar	No	
60257	1824806	BH01	13/06/2024	250 mL amber glass jar	No	

Report No.: 24-04623-1

Type	Matrix Code	Description
Food	CEREALPROD	Cereals, grains & products
Food	DRIEDFRUIT	Dried fruits
Food	FRIEDBAKED	Fried or baked food
Food	LEGUME	Legumes
Food	MEAT	Meat
Food	POWDERED	Powdered food
Food	PULSE	Pulses (dried legumes)
Food	VEGETABLES	Vegetables
Gas	TDTUBE	TD Tube
Gas	TENAX	Tenax Tube
Gas	TUBE	Tube
Gas	VAPOUR	Gas
Geological	SED_MAR	Marine Sediment
Geological	SED_RIV	River Sediment
Geological	SLUDG_SOL	Sludge (solid only)
Geological	SOIL	Soil
Liquid	BEVERAGE	Beverage
Liquid	BLOOD	Blood
Liquid	CONDENSATE	Condensate
Liquid	FOAM_LIQ	Liquid foam
Liquid	FORMULATN	Formula
Liquid	LEACHATE	Leachate
Liquid	OIL/GREASE	Oil or grease
Liquid	SLUDG_LIQ	Sludge (liquid only)
Liquid	SOLVENT	Solvent
Liquid	URINE	Urine
Sludge	SLUDG_WHL	Sludge for bulk route
Solid	BADGE	Badge
Solid	BEDDING	Bedding
Solid	BIOTA	Biota (general)
Solid	BIOTA_F	Biota (fish)
Solid	BIOTA_SF	Biota (shellfish)
Solid	CONSTRCTN	Construction materials
Solid	FABRIC	Fabrics & furnishing materials
Solid	FEED	Animal feed
Solid	FERTILISER	Fertiliser
Solid	FILTER	Filter
Solid	FOAM	Solid foam material
Solid	PACKAGING	Packaging material
Solid	PAPER	Paper
Solid	PLANT	Plant (vegetation)
Solid	POWDER	Powder
Solid	SWAB	Swab
Water	BAL	Ballast Water
Water	BIL	Bilge Water
Water	DW	Drinking Water
Water	EFFLUENT	Effluent
Water	GW	Ground Water
Water	INFLUENT	Influent
Water	MINEW	Mine Water
Water	SALTW	Salt Water
Water	SW	Surface Water
Water	TW	Tap Water
Water	W	Water

Report No.: 24-04623-1

Key Code	Description
N	Not Accredited Test
U	UKAS Accredited Test - UKAS accreditation is only implied if the report carries the UKAS logo
UF	UKAS Flexible Scope Test
M	MCERTS Accredited Test - MCERTS accreditation is only implied if the report carries the MCERTS logo
O	Marine Management Organisation (MMO) Validated
SN	Subcontracted to approved laboratory not accredited for the test
SU	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
SIN	Subcontracted to internal RPS Group laboratory not accredited for the test
SIU	Subcontracted to internal RPS Group laboratory UKAS Accredited for the test
SIM	Subcontracted to internal RPS Group laboratory MCERTS/UKAS Accredited for the test
*	Modified standard method
I/S (in results)	Insufficient Sample
U/S (in results)	Unsuitable Sample
S/C (in results)	See Comments
ND (in results)	Not Detected
DW (in units)	Results are expressed on a dry weight basis
L (in results)	Result is outside normal limits

Sample Type	Sample Retention and Disposal Period
Foodstuff	1 month (if frozen) from the issue date of this report
Waters	2 weeks from the issue date of this report
Other Liquids	1 month from the issue date of this report
Solids / Soils	1 month from the issue date of this report
Sediments	1 month from the issue date of this report

Note: Sample retention may be subject to agreement with the customer for particular projects

Where the dry solids value of a sample is low (<50%), reporting limits are automatically raised for all determinants analysed on an as-received basis.

Soil Typing	Description
Type 1	Clay - Brown
Type 2	Clay - Grey/Black
Type 3	Sand
Type 4	Top Soil (Standard)
Type 5	Top Soil (High Peat)
Type 6	Made Ground (>50% Clay)
Type 7	Made Ground (>50% Sand)
Type 8	Made Ground (>50% Top Soil)
Type X	Other

Dev code	Description
D	No sampling date provided.
T	No sampling time provided.
Z	Temperature of samples exceeded in transit/storage.
V	Excessive headspace for volatile determinands.
P	Sample submitted without required preservative(s).
C	Incorrect container.
H	Holding time exceeded (sampling to extraction).
X	Holding time exceeded (sampling to receipt).

Note: Where the following information is included in this certificate, it has usually been supplied by the customer: Customer Sample ID, Sample Location, Sample Depth, Sampling Date and Sampling Time. The laboratory shall not be responsible for any information that is supplied by the customer that may affect the validity of results.

APPENDIX 5

GEOENVIRONMENTAL ASSESSMENT

		Generic Assessment Criteria for Commercial end use			
		1% SOM (mg/kg)	2.5% SOM (mg/kg)	6% SOM (mg/kg)	Primary Data Source
Metals	Arsenic	640	640	640	C4SL DEFRA 2014
	Boron	240000	240000	240000	S4UL LQM/CIEH 2015
	Beryllium	12	12	12	S4UL LQM/CIEH 2015
	Cadmium	410	410	410	S4UL LQM/CIEH 2015
	Chromium (III)	8600	8600	8600	S4UL LQM/CIEH 2015
	Chromium (VI)	49	49	49	S4UL LQM/CIEH 2015
	Copper	68000	68000	68000	S4UL LQM/CIEH 2015
	Lead	2300	2300	2300	C4SL DEFRA 2014
	Mercury (Inorganic)	1100	1100	1100	S4UL LQM/CIEH 2015
	Mercury (Elemental)	58	58	58	S4UL LQM/CIEH 2015
	Mercury (Methyl)	320	320	320	S4UL LQM/CIEH 2015
	Nickel	980	980	980	S4UL LQM/CIEH 2015
	Selenium	12000	12000	12000	S4UL LQM/CIEH 2015
	Vanadium	9000	9000	9000	S4UL LQM/CIEH 2015
	Zinc	730000	730000	730000	S4UL LQM/CIEH 2015
	Acenaphthene	84000	97000	100000	S4UL LQM/CIEH 2015
	Acenaphthylene	29000	30000	30000	S4UL LQM/CIEH 2015
	Anthracene	150000	150000	150000	S4UL LQM/CIEH 2015
	Benzo(a)anthracene	49	56	62	S4UL LQM/CIEH 2015
	Benzo(a)pyrene	21	21	21	C4SL DEFRA 2014
	Benzo(b)fluoranthene	44	44	45	S4UL LQM/CIEH 2015
	Benzo(ghi)perylene	3900	4000	4000	S4UL LQM/CIEH 2015
	Benzo(k)fluoranthene	1200	1200	1200	S4UL LQM/CIEH 2015
	Chrysene	350	350	350	S4UL LQM/CIEH 2015
	Dibenz(a,h)anthracene	3.5	3.6	3.6	S4UL LQM/CIEH 2015
	Fluoranthene	23000	23000	23000	S4UL LQM/CIEH 2015
	Fluorene	63000	68000	71000	S4UL LQM/CIEH 2015
	Indeno(1,2,3-cd)pyrene	500	510	510	S4UL LQM/CIEH 2015
	Naphthalene	190	460	1100	S4UL LQM/CIEH 2015
	Phenanthrene	22000	22000	23000	S4UL LQM/CIEH 2015
	Pyrene	54000	54000	54000	S4UL LQM/CIEH 2015
	Coal Tar (BaP)	15	15	15	S4UL LQM/CIEH 2015
Aliphatic / Aromatic Hydrocarbons	TPH-CWG - Aliphatic >EC5 - EC6	3200	5900	12000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC6 - EC8	7800	17000	40000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC8 - EC10	2000	4800	11000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC10 - EC12	9700	23000	47000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC12 - EC16	59000	82000	90000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC16 - EC35	1600000	1700000	1800000	S4UL LQM/CIEH 2015
	TPH-CWG - Aliphatic >EC35 - EC44	1600000	1700000	1800000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC5 - EC7	26000	46000	86000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC7 - EC8	56000	110000	180000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC8 - EC10	3500	8100	17000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC10 - EC12	16000	28000	34000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC12 - EC16	36000	37000	38000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC16 - EC21	28000	28000	28000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC21 - EC35	28000	28000	28000	S4UL LQM/CIEH 2015
	TPH-CWG - Aromatic >EC35 - EC44	28000	28000	28000	S4UL LQM/CIEH 2015
	Aliphatic + Aromatic >EC44 - EC70	28000	28000	28000	S4UL LQM/CIEH 2015
BTEX & MTBE	Benzene	27	47	90	C4SL DEFRA 2014
	Toluene	65000	110000	180000	S4UL LQM/CIEH 2015
	Ethylbenzene	4700	13000	27000	S4UL LQM/CIEH 2015
	m-xylene	62000	14000	31000	S4UL LQM/CIEH 2015
	p -xylene	59000	14000	30000	S4UL LQM/CIEH 2015
	o-xylene	6600	150000	33000	S4UL LQM/CIEH 2015
	MTBE (Methyl Tertiary Butyl Ether)	75000	12100	22400	CL:AIRE SOIL GAC 2010
Chloroalkanes & alkenes	Tetrachloroethene	19	42	95	S4UL LQM/CIEH 2015
	1,1,1 Trichloroethane	660	1300	3000	S4UL LQM/CIEH 2015
	1,1,1,2 Tetrachloroethane	110	250	560	S4UL LQM/CIEH 2015
	1,1,2,2 Tetrachloroethane	270	550	1100	S4UL LQM/CIEH 2015
	Tetrachloromethane (Carbon Tetrachlo	2.9	6.3	14	S4UL LQM/CIEH 2015
	1,2-Dichloroethane	0.67	0.97	1.7	S4UL LQM/CIEH 2015
	Trichloroethene	1.2	2.6	5.7	S4UL LQM/CIEH 2015
	Trichloromethane	99	170	350	S4UL LQM/CIEH 2015
	Vinyl Chloride (cloroethene)	0.059	0.077	0.12	S4UL LQM/CIEH 2015
Pesticides	Aldrin	170	170	170	S4UL LQM/CIEH 2015
	Dieldrin	170	170	170	S4UL LQM/CIEH 2015
	Atrazine	9300	9400	9400	S4UL LQM/CIEH 2015
	Dichlorvos	140	140	140	S4UL LQM/CIEH 2015
	Alpha - Endosulfan	5600	7400	8400	S4UL LQM/CIEH 2015
	Beta - Endosulfan	6300	7800	8700	S4UL LQM/CIEH 2015
	Alpha -Hexachlorocyclohexanes	170	180	180	S4UL LQM/CIEH 2015
	Beta -Hexachlorocyclohexanes	65	65	65	S4UL LQM/CIEH 2015
	Gamma -Hexachlorocyclohexanes	67	69	70	S4UL LQM/CIEH 2015

Explosives	2,4,6 Trinitrotoluene	1000	1000	1000	S4UL LQM/CIEH 2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	210000	210000	210000	S4UL LQM/CIEH 2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	110000	110000	110000	S4UL LQM/CIEH 2015
Chlorobenzenes	1,2,4-Trimethylbenzene	220	530	1300	S4UL LQM/CIEH 2015
	Chlorobenzene	56	130	290	S4UL LQM/CIEH 2015
	1,2-Dichlorobenzene	2000	4800	11000	S4UL LQM/CIEH 2015
	1,3-Dichlorobenzene	30	73	170	S4UL LQM/CIEH 2015
	1,4-Dichlorobenzene	4400	10000	25000	S4UL LQM/CIEH 2015
	1,2,3,-Trichlorobenzene	102	250	590	S4UL LQM/CIEH 2015
	1,2,4,-Trichlorobenzene	220	530	1300	S4UL LQM/CIEH 2015
	1,3,5,-Trichlorobenzene	23	55	130	S4UL LQM/CIEH 2015
	1,2,3,4,-Tetrachlorobenzene	1700	3080	4400	S4UL LQM/CIEH 2015
	1,2,3,5,- Tetrachlobenzene	49	120	240	S4UL LQM/CIEH 2015
	1,2,4, 5,- Tetrachlobenzene	42	72	96	S4UL LQM/CIEH 2015
	Pentachlrobenzene	640	770	830	S4UL LQM/CIEH 2015
	Hexachlorobenzene	110	120	120	S4UL LQM/CIEH 2015
Phenols & Chloro-phenols	Total Phenols (monohydric)	440	690	1300	S4UL LQM/CIEH 2015
	Chlorophenols (4 Congeners)	3500	4000	4300	S4UL LQM/CIEH 2015
	Pentachlorophenols	400	400	400	S4UL LQM/CIEH 2015
Others	Carbon Disulphide	11	22	47	S4UL LQM/CIEH 2015
	Hexachloro-1,3-Butadiene	31	66	120	S4UL LQM/CIEH 2015
	Perfluorooctanesulfonic acid (PFOS)	0.019	0.019	0.019	EA 2022
	Perfluorooctanoic Acid (PFOA)	0.035	0.035	0.035	EA 2022
	Cyanide	650	650	650	USEPA 2010

APPENDIX 5

ENVIRONMENTAL RISK ASSESSMENT

5.1 STATUTORY FRAMEWORK AND DEFINITIONS

The statutory definition of 'contaminated land' is defined in Part IIA of the Environmental Protection Act 1990, which was inserted by Section 57 of the Environment Act 1995, and came into force in England in 2000, as;

> *'any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:*
>
> *(a) significant harm is being caused or there is a significant possibility of such harm being caused; or*
>
> *(b) pollution of controlled waters is being, or is likely to be, caused'.*

The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, and SR3.

In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A *'pollutant linkage'* may be defined as the link between a contaminant *'source'* and a *'receptor'* by means of a *'pathway'*.

5.2 ASSESSMENT METHODOLOGY

The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

Stages 1 and 2 develop a *'conceptual model'* based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. Specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to specific industrial processes.

If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

All site works should be in general accordance with the British Standards, BS 5930:2015, ISO 1997, and BS 10175:2011.

The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.

The end-use may be defined as one of the following;

- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetable may be grown for home consumption
- Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
- Allotments – specific areas where vegetables are grown for home consumption.
- Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.
- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children's play area, sports grounds and dig walking.
- Commercial – industrial premises where there is limited exposure to soil.

Exposure pathways for each type of end-use are given below:

Standard Land Use	Oral Routes			Dermal Routes	Inhalation Routes				
	Direct soil & dust ingestion	Consumption of homegrown produce	Soil attached to homegrown produce	Indoor	Outdoor	Indoor dust	Outdoor dust	Indoor vapour	Outdoor vapour
Residential with homegrown produce	□	□	□	□	□	□	□	□	□
Residential without homegrown produce	□	X	X	□	□	□	□	□	□
Allotments	□	□	□	X	□	X	□	□	□
Public open space – adjacent to dwellings	□	X	X	□	□	□	□	X	□
Public open space – parkland	□	X	X	X	□	X	□	X	□
Commercial	□	X	X	□	X	□	X	□	X

In the first instance, soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM. Screening levels for lead are taken from guidance published by DEFRA as no S4UL has been derived.

The decision to use S4ULs is based on the fact that C4SLs are primarily intended for use under Part 2A of the Environmental Protection Act 1990 in determining when land is not contaminated land as defined under the Act. By its definition, this implies a lower standard of protection than the previous SGVs due to their use of a "Low Level of Toxicological Concern", as opposed to the minimal or tolerable level of risk. As such, it was considered that, excepting lead, S4ULs are suitable in evaluating this site.

Where no S4UL or C4SL is available, the assessment criteria (AC) may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07. Toxicological and physico-

chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), and for contaminants not considered in this document the fate and transport data used in previous versions of the CLEA model has been used.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration'. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

5.3 RISK EVALUATION

The risk evaluation is a qualitative method for interpreting the data from the hazard estimation stage. It involves the classification of the:

- magnitude of the potential 'consequence' (severity) of the risk occurring and:
- magnitude of the 'probability' (likelihood) of the risk occurring.

These are defined in the following sections:

5.4 CLASSIFICATION OF CONSEQUENCE

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High Concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse can also equate to a short-term human health risk if buildings are occupied.

Medium	Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). Pollution of sensitive water resources (note: Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem, (note: the definitions of ecological systems within Draft Circular on Contaminated Land, DETR, 2000).	Concentrations of a contaminant from site exceed the generic, or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer. Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in the *Draft Circular on Contaminated Land*, DETR 2000). Damage to sensitive buildings/ structures/services or the environment.	Pollution of non-classified ground water. Damage to building rendering it unsafe to occupy (eg foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in landscaping scheme. Discoloration of concrete

In theory, both severe and medium classification can result in death. The differential is that severe relates to short term risk while medium relates to long-term risk. Therefore, the classification of severe requires urgent action while medium may require urgent action but usually long term action would be sufficient.

5.5 CLASSIFICATION OF PROBABILITY

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur.

	Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term

For the purposes of this preliminary investigation, any source of contamination that has been identified by professional judgement as potentially impacting on the site has been classified as being 'likely' to be present, unless proven otherwise by intrusive investigation.

5.6 COMPARISON OF CONSEQUENCE AGAINST PROBABILITY

These classifications are compared to indicate the risk presented by each pollutant linkage. Once the consequence and probability have been classified they can be used to produce a risk category as below:

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Negligible risk

The action required for the classified risks are as follows:

Very high risk	There is a high probability that severe harm could a risk to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required
High risk	Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.
Negligible risk	There is no foreseeable risk of harm.

The risk evaluation will address the potential pollutant linkages between an identified source of contamination and the likely receptors both on and off site.

The potential receptors include:

1) Humans – current site occupants, construction workers, future site users and neighbouring site users.

2) Controlled Waters – surface water and groundwater resources

3) Plants – current and future site vegetation

4) Building materials

The potential hazards to be considered in relation to contamination are:

a) Ingestion and inhalation.

b) Uptake of contaminants via cultivated vegetables.

c) Dermal contact

d) Phytotoxicity (the prevention or inhibition of plant growth)

e) Contamination of water resources

f) Chemical attack on building materials and services

g) Fire and explosion

Dependent on the outcome of the initial, generic contamination risk assessment, further detailed assessment of the identified risks may be required.

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