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Spittal, Thurso

Phase 2 Ground Investigation Report

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Executive Summary

Appointment	Curtins were instructed by Field to undertake an intrusive Phase 2 Ground Investigation for the site located at Spittal, Halkirk, KW12 6XA. It is understood that the Proposed Development will comprise a battery energy storage system (BESS) with a capacity of up to 300 megawatts (MW), including associated infrastructure comprising underground cabling, access tracks, drainage, landscaping and biodiversity enhancements.
Current Site Status and Site Walkover	A site walkover was undertaken by a Curtins Engineer on 22 January 2024. The site is a large agricultural field downslope from a large pastural farm. Overhead pylons cross the site on a north to south bearing in the west section of the Site. The site slopes from east to north-west. Drainage burns bound the site on the south, east and north boundaries. The north boundary drainage burn shows potential shallow rock at the base of the burn. The site is immediately surrounded by agricultural land to the east, south and west and a recently constructed electrical substation to the north. The area of the site proposed for access roads, the east of the Site, is bound by a road and further agricultural land. There were no visual or olfactory indications of contaminated land issues on the site. The planning boundary for the site is approximately 48.5 ha in size and is centred on National Grid Reference (NGR) 315725, 955062. The area assessed as part of the programme of ground investigations was confined to areas that would accommodate primary site infrastructure, comprising an area of approximately 11 ha.. The topography of the site slopes from 114m AOD in the area of the proposed access road leading from the A9 to 86m AOD in the northwestern corner of the site.
Fieldwork	The ground investigation was undertaken by Curtins between 20 February and 22 February 2024 and comprised 10 windowless sample boreholes, 23 machine excavated trial pits and 1 infiltration testing in general accordance with BRE Digest 365. A total of three return gas and groundwater monitoring visits have been undertaken. The arisings of the boreholes and trial pits were logged by a suitably qualified Curtins engineer and representative samples of the soil were submitted for geotechnical and environmental laboratory testing.
Laboratory Testing	Representative samples of the site soils were obtained and submitted to a suitably accredited laboratory for environmental and geotechnical analyses. The environmental chemistry results for soils have been compared with the Tier 1 criteria for soils with respect to human health for Commercial end use scenario reflecting the proposed end usage (battery storage facility) The geotechnical testing undertaken comprised Water Content, Bulk Density, Particle Density, Particle Size Distribution, Water Content/Dry Density Relationship, and CBR.
Generic Quantitative Risk Assessment	**Human Health** – The risk to future site users is considered Low with no further actions required. **Water Environment** – The risk presented to the Water Environment is assessed to be Low with no further actions required. **Ground Gas** – The risk presented by ground gases is assessed as Low and no ground gas protection measures are required for the development site.
Preliminary Geotechnical Assessment	The bedrock underlying the Site is considered a suitable founding stratum due to the shallow depth beneath existing ground level and an estimated allowable bearing capacity of 150kPa for a 1.5m x 1.5m pad foundation at a minimum depth of 1.1m bgl. Where Glacial Till is found at foundation level, it should be excavated out to the bedrock and backfilled with Class 6F2/6G5. For a proposed raft foundation, a minimum 750mm of Class 6F2/6F5 granular fill would need to be placed beneath the slab (assuming a low volume change potential within the Cohesive Glacial Till) with Class 2 general fill placed down to the weathered bedrock of the Spittal Flagstone Formation. All fill materials should be placed and compacted to an earthworks specification. N.B. the low volume

	change potential described above is based on engineering judgement in this area of Scotland including investigations in similar over-consolidated glacial till soils and descriptions of the soil but is subject to receipt of further testing. A detailed settlement assessment should also be undertaken to confirm the material parameters required for the fill, to detail the compaction requirements, determine the appropriate thickness of Class 6F2/6F5 granular fill beneath the raft and to ensure settlements are not excessive At this stage and based on the CBR results carried out and where near surface natural soils are encountered at road pavement formation levels, a California Bearing Ration of <2.5% can be assumed and full road capping should be allowed for to mitigate total and differential settlements. Further in-situ CBR testing should be undertaken at formation level where hardstanding is proposed to confirm the CBR value used in preliminary design. Subject to further geotechnical testing, it is likely that the Glacial Till can be classified as a Class 2 general fill, and both the weathered and competent bedrock as Class 1. In general, the Glacial Till samples tested were considered too wet in their current condition to be suitable for reuse below structures and/ or external areas (ie. the natural water content of the samples is too high to achieve adequate compaction in the region of >95 %, with 0-5 % air voids. As such, consideration should be given to drying out the cut soils and retesting prior to placement and compaction or reducing the natural water content by adding a lime or cement-based drying agent followed by suitable field testing. Localised areas of cut material may also require to be dried out prior to reuse as a general fill. Acceptable levels for compaction should be reported in a site-specific Earthworks Specification. The poor infiltration is likely a result of the cohesive nature of the Glacial Till and impermeable nature of the bedrock and therefore soakaway type drainage is not recommended.
Preliminary Geotechnical Assessment (Concrete classification)	<u>Stratum Design</u> — <u>Sulphate Class</u> — <u>ACEC Class</u> Topsoil — DS-1 — AC-1s Glacial Till — DS-1 — AC-1s
Recommendations	• A settlement assessment should be carried out to confirm suitability and buildup of a raft foundation and estimate differential settlements. • Earthworks should be undertaken in accordance with an Earthworks Specification and a detailed settlement assessment is likely to be required for a raft foundation on Engineered Fill. • Further trial pitting should be carried out in order to carry out hand shear vanes to provide more strength data to obtain samples within the Glacial Till for Atterberg Limit testing. Once complete, this report should be revisited and the proposed foundation build ups updated accordingly. • Coring of the bedrock may be required to determine the strength profile to aid the cut and fill process through the bedrock • Additional CBR tests on the subgrade are recommended post cut/fill to determine if ground improvement is required (if CBR is <2.5%). • The report is to be updated with a proposed foundation solution once further investigation is undertaken and structural loadings are known. • Basic radon protection measures are considered necessary in the construction of any enclosed spaces.

1.0 Introduction

1.1 Project Background

Curtins were instructed by Field to undertake an intrusive Phase 2 Ground Investigation for a battery energy storage system (BESS) and associated infrastructure in Spittal, Thurso (the Proposed Development).

This report has been undertaken to support the planning application for the Proposed Development. A copy of the site layout for the Proposed Development is included in Appendix A.

Curtins has previously prepared a Phase 1 Preliminary Risk Assessment (ref. 085447-CUR-XX-XX-RP-GE-0001) (1) for the Proposed Development which recommended a Phase 2 ground investigation to further determine the contamination risk on-site and support the design.

1.2 Scope of Services

The investigation was undertaken to provide an assessment of both geoenvironmental and geotechnical ground conditions on the subject site with respect to any potential contamination in the underlying soils and/ or groundwater.

Specifically, the report is intended to determine:

a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use.

b) If there is a risk of groundwater and/ or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use.

c) If there is a risk to the end user from soil gases including methane, carbon dioxide, oxygen, and hydrogen sulphide.

d) Shallow and deep ground conditions.

e) Recommendations for the design of foundations and building ground floor slabs.

f) Recommendations for hardstanding design.

g) Recommendations for the specification of sub-structure concrete.

2.0 Site Setting

2.1 Current Setting and Site Walkover

A Site walkover was undertaken by a Curtins Engineer on 22 January 2024. The walkover was undertaken to ascertain current Site conditions. The weather was generally characterised by strong winds followed by clear skies after a period of heavy rain.

The Site is a large agricultural field located downslope from a large pastural farm. In the west section, overhead pylons cross the Site on a north-to-south bearing. The site slopes downwards from east to northwest.

Drainage burns bound the Site on the south, east and north boundaries. The north boundary drainage burn shows potential shallow rock at the base of the burn. The Site is immediately surrounded by agricultural land to the east, south and west and a recently constructed electrical substation to the north. The area of the Site proposed for access roads, the east of the Site, is bound by a road and further agricultural land.

There were no visual or olfactory indications of contaminated land issues on the Site.

The planning boundary for the site is approximately 48.5 ha in size and is centred on National Grid Reference (NGR) 315725, 955062. The area assessed as part of the programme of ground investigations was confined to areas that would accommodate primary site infrastructure, comprising an area of approximately 11 ha. The site location is presented in Figure 2.1 below. The topography of the site slopes from 114m AOD in the area of the proposed access road leading from the A9 to 86m AOD in the northwestern corner of the site.

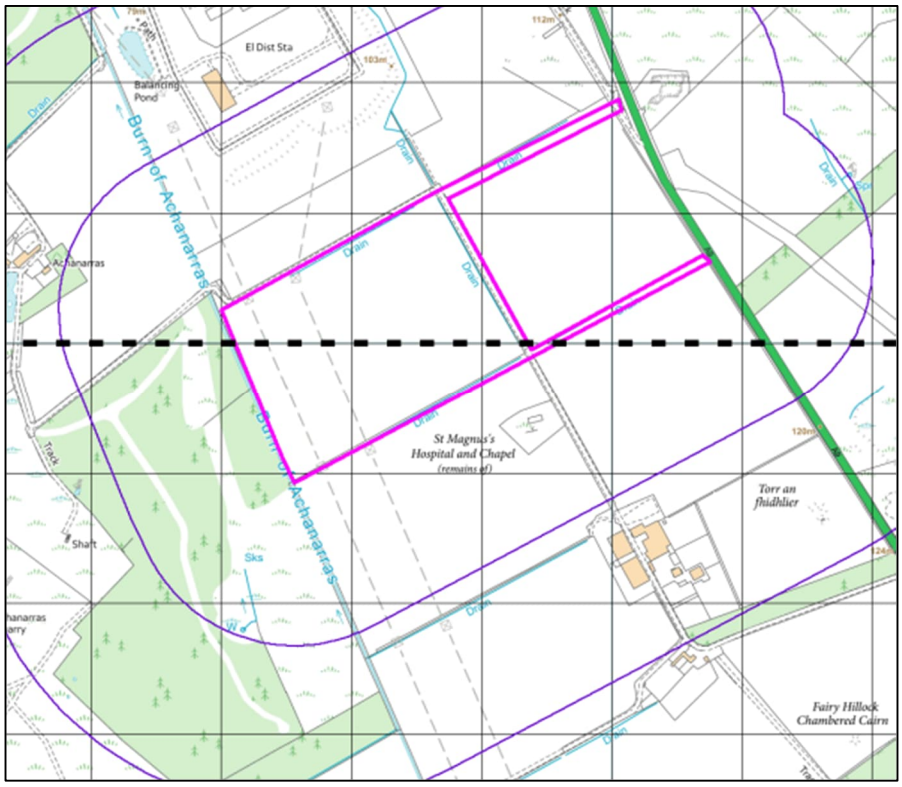

Figure 2.1 – Site development boundary outlined in pink (Landmark Envirocheck 332995318) (2)

The immediate surrounding land use to the development site is highlighted in Table 2.2.

Table 2.2 – Surrounding Area

Surrounding Area	N	Electrical Substation	
	E	Agricultural land	
	S	Agricultural land	
	W	Agricultural land and woodland	

2.2 Site History

With reference to the Curtins Phase 1 report (1), the site is shown to have undergone minimal development from the earliest available mapping published in 1877 through to present day. During this time, the site is thought to have been used for agricultural activity. The area surrounding the development site predominantly comprised agricultural land with associated infrastructure, a quarry identified on historical mapping located 50m north-east of the site (infilled circa 1960), and overhead pylons shown crossing the site in a north to south orientation serving an electrical transmission substation 250m to the north of the Site (the Spittal Converter Station).

2.3 Geology, Hydrogeology and Hydrology

With reference to the Curtins Phase 1 report (1) and the 1:50,000 BGS map (Stonehaven – Sheet 067), the site is underlain by Superficial Deposits comprising Devensian Till (Glacial Till). Superficial deposits are in turn underlain by bedrock deposits comprising siltstone, mudstone, and sandstone of the Spittal Flagstone Formation.

Details on the hydrogeological classification of the Glacial Till are not given by SEPA mapping. The Spittal Flagstone Formation is characterised as a moderately productive aquifer, locally yielding small amounts of groundwater.

There are no licensed surface water abstraction points recorded within 500m of the site. There are no licensed groundwater abstraction points recorded within 1km of the site.

There are no recorded discharge consents within 250m of the site.

The nearest surface water feature is the Halkirk Burn, located adjacent to the western boundary of the site.

2.4 Unexploded Ordnance (UXO) Risk Assessment

Military activities including those conducted as part of both the First and Second World Wars have resulted in a legacy of unexploded ordnance (UXO) being present within the shallow soils of the UK.

UXO result from various sources including both allied (military training) and German (bombing raids) with a guide figure of approximately 10% of all munitions failing to function as designed.

The likelihood of UXO being encountered on a development site is influenced by several factors including the proximity to strategic targets, the nature of the development works being undertaken and evidence of local damage in the post-war periods amongst others. To determine the likelihood of UXO being present on a site, a stepwise risk assessment process is followed. This process is outlined within CIRIA C681 Unexploded Ordnance: A Guide for the Construction Industry with the following commentary considered to represent a Preliminary Risk Assessment intended to guide if and where there is a requirement for a Detailed Risk Assessment.

The risk presented by Unexploded Ordnance, identified using preliminary Unexploded Bomb (UXB) risk maps retrieved from Zetica UXO, indicates that the site is situated in a designated Low-Risk area in respect to the potential presence of UXB as a result of World War Two bombing (3).

Based on the foregoing commentary, it is recommended that no further action is needed in reference to UXO for the intrusive ground investigation works if undertaken by Curtins.

3.0 Initial Conceptual Site Model

With reference to the Phase 1 report, the Initial Conceptual Site Model (CSM) provided within the Phase 1 report is included in Table 3.0.

The CSM details the source-pathway-receptor linkages or potential contaminant linkages (PCL) that have been identified for the site. The GQRA details the associated level of risk relating to these potential contaminant linkages**.**

The CSM concerns risk to human health, Water and Environment. The CSM follows the framework outlined within CIRIA C552 which is summarised within Appendix E.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PCL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

- The table below represents the first stage in the land quality risk assessment process; **the Qualitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e., low to negligible risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made in order to have sufficient confidence to support a risk characterisation or management decision, e.g., remedial action.
- In the absence of specific site data, a Generic Quantitative Risk Assessment is invariably recommended.

Conceptual Site Model			Qualitative Risk Assessment			Recommended Actions
Source	**Pathway(s)**	**Receptor(s)**	**Consequence**	**Likelihood of Occurrence**	**Risk Rating**	
Made Ground and contamination associated with: Uncontrolled deposition during construction of pylons and adjacent sub-station. Fuel Spills from farming equipment during farming activities on the Site.	**Direct contact, ingestion,** inhalation (dust and vapours).	**Site end-user**	**Mild** Acute health risk	**Low** Due to the nature of the Site having undergone minimal development over time the presence of made ground is considered Low.	**Low**	Generic Quantitative Risk Assessment recommended as part of the ground investigation to confirm risk assessment and findings of previous ground investigations.
	Vertical migration through the superficial deposits (soils) May occur due physical processes including capillary action and downwards into the natural deposits through infiltration, however presence of cohesive glacial till may limit vertical migration on Site	**Water Environment (groundwater)** Unclassified Aquifer. No potable abstraction points located within the vicinity of the site.	**Mild** Pollution of non-sensitive water resources	**Low** There is limited potential for the leaching of contamination from made ground arising. There is also a lack of potable abstractions within the area.	**Low**	
	Horizontal migration over and through the superficial deposits (soils).	**Water Environment (surface water)** Achanarras Burn	**Medium** Pollution of sensitive water resources	**Unlikely** Unlikely considering the distance to the receptor and presence of anticipated cohesive soils.	**Moderate/ Low**	
Production of ground generating gases from: Made ground from infilled quarry to the north and north east of the Site.	**Vertical and horizontal migration** through the underlying superficial deposits, however, cohesive deposits may limit vertical gas migration	**Site end-user**	**Medium** Human health risk	**Unlikely** With reference to BS8576:2013 (Ref.10), these sources are considered to have a moderate gassing potential, however the feature was considered to be located sufficient distance from likely receptors to pose a significant risk.	**Low**	Ground Gas Monitoring Risk is considered low due to cohesive nature of on-site superficial soils. However, any residual risk can be mitigated though ground gas monitoring. Recommended as part of the ground investigation.

4.0 Fieldworks

4.1 General

The ground investigation was undertaken by Curtins between 20th and 22nd February 2024. A summary of the scope and rationale for the intrusive works undertaken is summarised in Table 4.1 below.

The ground investigation was designed by Curtins based on the site layout available at the time, findings of the Phase 1 and in general accordance with current UK guidance including LCRM (4), British Standard (BS) 10175 (5), BS5930:2020 (6) and Eurocode 7 (7).

Table 4.1 – Phase 2 Ground Investigation Scope and Rationale

Exploratory Hole Type	Exploratory Hole Ref.	Exploratory Hole Depth (m bgl)	Rationale
10 No. Windowless Sample Boreholes	BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH10	1.40 1.20 1.30 2.60 1.50 1.55 1.30 1.30 0.80 1.35	• To determine shallow ground conditions. • To confirm geotechnical parameters. • Collect soil and groundwater samples (if available) for geotechnical analysis. • To determine groundwater depth/level.
24 No. Machine Excavated Trial Pits	TP01 TP02 TP03 TP04 TP05 TP06 TP07 TP08 TP09 TP10 TP11 TP12 TP13	0.60 0.60 1.10 1.10 0.60 1.10 0.30 1.20 0.70 0.80 0.80 0.80 0.80	• To mass characterise shallow ground conditions. • Target potential areas of contamination • Obtain bulk geotechnical samples for earthworks laboratory testing. • Perform infiltration tests for potential soakaway design.

Exploratory Hole Type	Exploratory Hole Ref.	Exploratory Hole Depth (m bgl)	Rationale
	TP14	1.50	
	TP15	0.60	
	TP16	0.90	
	TP17	0.50	
	TP18	0.40	
	TP19	0.90	
	TP20	0.80	
	TP21	0.60	
	TP22	1.20	
	TP23	1.00	
	SA01	1.60	

Curtins Exploratory Hole Location drawing (085447-CUR-00-XX-DR-GE-0001), records the locations of all exploratory hole locations a copy of which is contained within Appendix A.

4.2 Soil Logging and Sampling

Exploratory hole arisings were logged on site by a suitably qualified Curtins engineer in accordance with the requirements of BS5930:2020 (6). Copies of the exploratory hole logs are provided in Appendix B, with ground conditions presented in Section 5.1.

Representative soil samples were selected for laboratory chemical and geotechnical analysis, based on field observations and to provide a characterisation of the strata encountered. The samples were placed in laboratory-provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical analysis was DETS and geotechnical analysis was MATtest Ltd and the environmental testing laboratory was DETS.

4.3 Post Investigation Monitoring

An initial programme of three gas and groundwater monitoring visits were proposed in order determine underlying gas and groundwater regime for the development site. The three return monitoring visits were undertaken on 13 March 2024, 27 March 2024, and 09 April 2024.

5.0 In-Situ & Laboratory Testing

5.1 Environmental Chemical Testing

A programme of environmental chemistry testing was scheduled, with analytical suites developed reflecting the preliminary CSM in Section 4.0 and observations made during the ground investigation.

Given the potential for site wide sources of contamination the sampling positions were generally located in a semi targeted array to give an adequate and representative coverage of the site accounting for the historical site use and the immediate environmental setting, along with targeting areas of the proposed development.

5.1.1 Soil Analysis

Soil samples were taken from across the site and tested for the suite listed in Table 5.1.1

The nature and type of soil contamination potentially present on the site was considered to include, amongst others; ash, hydrocarbons (e.g., fuel oils), heavy metals and asbestos the extent of which is captured by the broad environmental testing suite detailed in Table 5.1.1. Copies of the environmental chemistry testing certificates can be referred to in Appendix C of this report.

Copies of the environmental chemistry testing certificates can be referred to in Appendix C of this report.

Table 5.1.1 – Environmental Chemistry Analysis Suite: Soils

Analysis	Limit of Detection (LOD)
Asbestos Screen	N/A
pH	N/A
Organic Matter	0.1%
Arsenic	1 mg/kg
Boron (water soluble)	0.2 mg/kg
Cadmium	0.1 mg/kg
Chromium	0.15 mg/kg
Chromium VI	1 mg/kg
Copper	0.2 mg/kg
Lead	0.3 mg/kg
Mercury	0.05 mg/kg
Nickel	1 mg/kg
Selenium	0.5 mg/kg
Zinc	1 mg/kg
TPH (Aro/Ali C5-C35) inc BTEX	0.01 to 10 mg/kg
PAH (speciated)	<0.05 to <0.1 mg/kg
Phenols (total)	<0.1 mg/kg
Cyanide (total)	0.1 mg/kg
Sulphate (SO_4)	<1.25 mg/l

5.2 Geotechnical Testing

Soil samples taken during the ground investigation works were prepared in accordance with BS1377: Part 1:2016. The following geotechnical in-situ and laboratory testing has been undertaken as presented in Table 5.2. The results of the testing are discussed further in Section 6.0 and presented in Appendix C.

Table 5.2 – Geotechnical Testing (Soils)

Test Type	Quantity	Standard
In-Situ Testing		
Standard Penetration Testing	11	BS5930:2015, Clause 41
In-Situ Dynamic Cone Penetrometer (DCP) Testing	5	BS 1377:1990
Soakaway Infiltration	1	BRE Digest 365
Laboratory Testing		
Particle Size Distribution (wet sieve)	11	BS 1377:2022
Water Content	14	
Water Content/Bulk Density	5	
Particle Density	5	
CBR	5	
Water Content/Dry Density Relationship	6	

6.0 Ground Conditions

6.1 Encountered Ground Conditions

The following section discusses the ground conditions determined from the ground investigation and laboratory testing described in Section 5.1, with detailed information presented on the exploratory hole logs in Appendix B.

Where necessary, the determination of characteristic parameters has been based on a cautious estimate of results derived from laboratory, published correlations and field tests, complemented with engineering judgement and consideration of the relevant limit state. The parameters should be cross-referenced with the specific strata subparagraphs in this section and duly referenced especially with regard to the variable depth to the Spittal Flagstone Formation. The below figures should be referenced accordingly in relation to the field and laboratory testing results.

Table 6.1 – Summary of Ground Conditions Encountered

Stratum	Depth to top of strata		Thickness (m)		General Description
	m BGL	m AOD	Min	Max	
Topsoil	GL	87.97 – 109.22	0.15	0.30	Dark brown very gravelly silty SAND with frequent rootlets.
Devensian Till (Glacial Till)	0.15 – 0.30	87.77 – 109.06	0.50	1.70	Soft to firm brown and grey mottled orange/grey/brown silty sandy gravelly CLAY with high flagstone cobble content.
Spittal Flagstone Formation	0.30 – 2.00	87.57 – 106.57	>0.10*	>0.65*	Greyish brown gravelly very clayey fine to coarse SAND (residual). Weak grey/orangish-brown FLAGSTONE

Notes - *Base of unit not encountered.

6.1.1 Topsoil

Topsoil, consisting of dark brown, very gravelly silty sand with frequent rootlets, was encountered from ground level in all exploratory hole locations across the site. The thickness of the Topsoil ranged between 0.20m and 0.30m.

6.1.2 Superficial – Glacial Till

Superficial deposits of Glacial Till were encountered underlying the Topsoil in all exploratory hole locations excluding BH06, BH09, TP07, and TP18 at depths ranging from 0.20m bgl / 87.77m AOD (BH04) to 0.15m bgl / 109.06m AOD (TP01) and proven to a maximum depth of 2.00m bgl / 87.88m AOD (BH04).

The superficial deposits were encountered as cohesive soils described as soft to firm, brown/grey/mottled orange, silty, sandy, gravelly CLAY with high flagstone cobble content. Gravel is sub-angular to sub-rounded, fine to coarse flagstone.

The thickness of the superficial deposits ranged from 0.50m to 0.70m. However, localised deepening as identified in TP14 (up to 1.10m), and BH04 (up to 1.70m).

Classification Testing

Nine particle size distribution (PSD) tests were undertaken on samples submitted from the Glacial Till. The results of these tests are presented in Appendix D. The results suggest a predominantly cohesive material (silt/clay) with a cohesive content ranging between 27% and 75%.

One SPT achieved full penetration and recorded an uncorrected SPT 'N' value of 8.

Based on a firm soil that can be moulded by fingers, an angle of shearing resistance of 25° is recommended for the cohesive Glacial Till from published guidance in the ICE Manual of Geotechnical Engineering, Table 18.3 (8).

All soils are cohesive. However, the PSD for TP01 at 0.3m does not appear to match the log description or the lab description. The PSD is 12% clay, 15% silt, 17% sand, 45% gravel, and 11% cobbles; the laboratory results suggest a more granular soil. Similar factual laboratory results were found in TP12 at 0.5m and TP14 at 1m. It is believed that the soils were recovered as clay, so they have a more cohesive engineering behaviour.

Unit Weight

A unit weight of 17kN/m^3 is recommended based on the guidance in BS8004:2015 (9) for a low to medium-strength clay above and below the groundwater table.

Earthworks Testing

The Specification for Highways Works (Volume 1, Series 600 Earthworks) classifies a material with >15% fines (<63µm) as a cohesive material and material with <15% fines as a granular material.

Final site levels are to be determined, however at this stage it as appropriate to consider the shallow soils to be excavated in areas of cut to classify as a Class 2 acceptable earthworks material.

Nine particle size distribution tests (PSD) tests were undertaken on samples submitted from the Glacial Till. The results classify the samples as a Class 2 acceptable earthworks material.

Six dry density/moisture content relationship tests were undertaken on samples taken of the Glacial Till, with the results summarised in Table 6.1.2. The maximum dry density ranged from 1.52 Mg/m^3 to 1.89 Mg/m^3, with an average of 1.71 Mg/m^3.

Table 6.1.2 – Suitability for Reuse of Materials

Location Reference	Test Depth m bgl (Elevation m AOD)	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m^3)	As Received Moisture Content (%)	Wet/Dry of Optimum
TP04	0.50 (95.04)	12.6	1.82	24.2	Wet
TP05	0.30 (96.57)	16.2	1.74	-	-
TP06	0.50 (92.97)	12.8	1.86	18.9	Wet
TP10	0.50 (88.28)	17.6	1.69	-	-
TP15	0.40 (90.62)	22.8	1.52	42.9	Wet
TP23	0.50 (104.96)	11.5	1.89	17.5	Wet

6.1.3 Bedrock – Spittal Flagstone Formation

The bedrock geology of the Spittal Flagstone Formation was encountered directly underlying the superficial deposits in the majority of exploratory locations at depths ranging from 0.70m bgl / 87.57m AOD (TP12) to 0.40m bgl / 106.57m AOD (TP01) and proven to a maximum depth of 2.60m bgl / 87.17m AOD (BH04 - base not encountered). Exceptionally, bedrock is encountered across the site, including in TP18 at 0.20m BGL (96.02m AOD) and as deep as 1.40m BGL (89.06m AOD). The specific bedrock profile is likely to be deeply hummocky and complicated but believed to be generally constrained to those depths. In BH06, residual soils comprising weathered bedrock were encountered directly underlying the Topsoil and were described as greyish brown, gravelly, very clayey, fine to coarse SAND with gravel of angular, fine to coarse flagstone. In BH09 and TP18, the unweathered bedrock was encountered directly underlying the Topsoil and was described as weak, grey/orangish-brown flagstone recovered as locally clayey, angular, fine to coarse GRAVEL.

6.1.4 Classification Testing

Two particle size distribution tests were undertaken on samples of the Spittal Flagstone Formation. The results of these tests are presented in Appendix D. The results suggest a predominantly granular material (sand/gravel/cobbles) with a fines content of 11%.

Ten SPTs were undertaken within the Spittal Flagstone Formation. Nine of the SPTs reached refusal with uncorrected SPT 'N' values of 50. A single SPT undertaken in BH04 at 2.00m bgl achieved full penetration with a recorded SPT 'N' value of 10 which is indicative of loose to medium dense, granular residual soil of the weathered bedrock.

Angle of Shearing Resistance can be estimated from SPT's using the guidance from Peck, Hanson and Thornburn (1974) (8). Based on an SPT of 50, this gives an Angle of Shearing Resistance of 41°..

A characteristic unit weight of 19kN/m^3 is recommended based on the guidance for a granular soil above and below the groundwater table.

7.3 Soil weight

- The soil unit weight varies depending on the type of material and its compaction state.
- Rock in its natural state has a higher unit weight than when used as fill (Refer chapters 9 and 12).
- The unit weight for saturated and dry soils varies.

Table 7.3 Representative range of dry unit weight.

Type	*Soil description*	*Unit weight range (kN/m³)*	
		Dry	*Saturated*
Cohesionless	Soft sedimentary (chalk, shale, siltstone, coal)	12	18
Compacted Broken rock	Hard sedimentary (Conglomerate, sandstone)	14	19
	Metamorphic	18	20
	Igneous	17	21
Cohesionless	Very loose	14	17
	Loose	15	18
Sands and gravels	Medium dense	17	20
	Dense	19	21
	Very dense	21	22
Cohesionless	Loose		
	Uniformly graded	14	17
Sands	Well graded	16	19
	Dense		
	Uniformly graded	18	20
	Well graded	19	21
Cohesive	Soft – organic	8	14
	Soft – non organic	12	16
	Stiff	16	18
	Hard	18	20

- Use saturated unit weight for soils below the water table and within the capillary fringe above the water table.
- Buoyant unit weight = Saturated unit weight – unit weight of water (9.81 kN/m^3).
- The compacted rock unit weight shown is lower than the in situ unit weight.

Figure 6.1– Excerpt from Handbook of Geotechnical Investigation and Design Tables, 2nd Ed., Table 7.3

6.2 Visual and Olfactory Indicators of Contamination

No visual or olfactory indicators of gross or mobile phase contamination were encountered within the Topsoil or underlying natural soils during the initial ground investigation.

6.3 Obstructions Encountered

No unexpected obstructions were encountered within any exploratory hole locations throughout the duration of the ground investigations. All exploratory locations were terminated prior to target depth due to the presence of hard bedrock, difficult to dig.

The presence of further obstructions not identified by the ground investigations cannot be discounted.

6.4 Groundwater

Five groundwater seepages were encountered during the investigation at depths ranging from 87.08m AOD (BH10) and 97.10m AOD (BH04). These strikes are thought to be representative of ‘perched groundwater’ either between superficial and bedrock strata, or within localised bands/lenses of granular soils within the predominantly cohesive superficial Glacial Till.

The return monitoring visits did not record any groundwater within borehole installations and the wells were recorded as dry as shown in Table 6.4 below.

Table 6.4 – Summary of Groundwater Seepages and Return Groundwater Levels

Exploratory Hole Location Ref.	During Ground Investigation		Post Investigation Monitored Groundwater Levels		
	Seepage Depth (m bgl/ m AOD)	Installation Strata	Monitored Depth (m bgl/m AOD)		
BH01	-	GT/SFF	DRY	DRY	DRY
BH02	0.70/95.53	GT	DRY	DRY	DRY
BH03	0.75/97.10		DRY	DRY	DRY
BH04	1.60/88.17		DRY	DRY	DRY
BH05	-	GT/SFF	DRY	DRY	DRY
BH06	-		DRY	DRY	DRY
BH07	-		DRY	DRY	DRY
BH08	0.90/88.89		DRY	DRY	DRY
BH09	-	SFF	DRY	DRY	DRY
BH10	1.00/87.08	GT/SFF	DRY	DRY	DRY

GT: Glacial Till

SFF: Spittal Flagstone Formation

7.0 Ground and Groundwater Contamination Risk Assessment

This section of the report includes the assessment of the potential solid contamination, liquid, and gas, identified on the subject site which may present a risk to the potential end users, associated utilities, and the wider environment.

In guidance published by the Environment Agency, the risk to human health or water environment is determined through an assessment of contaminant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (12).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment, further detail can be applied to the conceptual site model to provide a detailed interpretation on a site-by-site basis. As part of the planning process, this approach is adopted in order to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required in order for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in Section 3.0, in conjunction with observations made during the ground investigation and is based solely on the results of the chemical testing data obtained as part of Curtins Consulting's ground investigation.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

7.1 Human Health GQRA

Detailed guidance on human health risk assessment is available within several documents, published by both the Environment Agency and Defra. Guidance includes Contaminated Land Exposure Assessment (CLEA) v1.071 model Report SC050021/SR2: Human Health Toxicological Assessment of Contaminants in Soil and Report SC059921/SR3: Updated Technical Background to the CLEA Model (13).

A generic quantitative risk assessment (GQRA) has been carried out for the Potential Contaminant Linkages (PCLs) investigated by screening soil contamination data against relevant Generic Assessment Criteria (GAC) where available, including:

i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 2.5% soil organic matter (SOM) content;

ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third-party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds;

iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium, and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

The Proposed Development comprises a battery energy storage system, including associated infrastructure. Given the above, this GQRA initially considers the following land use scenario for the development as part of a robust conservative assessment:

- Commercial

Details of the GAC's adopted for the GQRA are provided in Appendix D.

7.1.1 Soils

As part of the investigation, a total of fourteen environmental samples were submitted for environmental testing based on a suite presented in Table 5. The distribution of samples and quantity of sampling is considered sufficient for the development site.

As discussed within the previous section, comparison of the soil analysis results has been undertaken against conservative Generic Assessment Criteria (GAC) for Commercial end use.

Soil organic matter (SOM) has a strong bearing on the availability of potential contaminants and therefore influences the Tier 1 thresholds. The SOM typically ranged from 0.3% to 5.0%, with an average of 2.1%. As such, as part of a conservative assessment, the comparison has been made against GACs developed for a sandy soil with a SOM of 2.5%. The results of the environmental testing are appended in Appendix C. Copies of the adopted Tier 1 thresholds are contained within Appendix D.

With respect to the adopted conservative screening criteria for Commercial end usage, the results of the screening did not identify any exceedances within samples submitted for chemical analysis. Consequently, on-site shallow soils are unlikely to present a risk to future site users.

7.1.2 Asbestos

A total of fourteen samples were submitted to the laboratory for an Asbestos presence screen. The testing concluded that Asbestos was not positively identified in any of the samples submitted for laboratory testing.

7.1.3 Groundwater Derived Vapours

Five shallow groundwater seepages were recorded on-site as part of the ground investigation. Additionally, no groundwater was encountered as part of the post-investigation groundwater monitoring programme. As previously discussed, no gross or mobile phase contamination was encountered within the Made Ground or natural soils during the ground investigation. With this in mind, groundwater-derived vapours are unlikely to present a risk to future site users.

7.2 Water Environment – GQRA

In the absence of groundwater recorded during the monitoring visits, the risk to water environments is deemed to be Low, owing to the overall limited nature of mobile contamination revealed on site.

With reference to the foregoing commentary, the risk to water environments is assessed as Low and therefore there is no requirement for further action in terms of risk to controlled waters.

7.3 Ground Gas – GQRA

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (14) BSI Publication code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2019 (15) and BS8576 (12).

The gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within the Phase 1 Preliminary Risk Assessment (desk study) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

7.3.1 Asphyxiant, Noxious and Explosive Gases

The Preliminary Conceptual Site Model (PCSM) presented within Section 3.0 noted the potential for gases to arise from uncontrolled deposition of Made Ground on-site. The ground investigation did not encounter any Made Ground across the site. The remainder of the site comprised Topsoil over natural soils with no organic or putrescible material. With reference to BS8576, Figure 6; the development site would be considered to have a ‘very low’ gassing potential.

Consequently, ground gas monitoring would not necessarily be required to further determine risk, however to establish a baseline gas regime and validate the qualitative assessment of ground gas risk, ten dual-purpose gas and groundwater monitoring installations were constructed within boreholes as detailed in Appendix B.

A programme of three gas and groundwater monitoring visits was proposed with visits undertaken between 13 March and 09 April 2024. Gas monitoring to date has been undertaken during stable atmospheric pressures with barometric pressure ranging from 996 mb to 1006 mb. A summary of the soil gas monitoring results is presented in Table 7.3.1 below, with the monitoring results and log sheets presented in Appendix C.

Table 7.3.1 – Summary of Soil Gas Monitoring Results

Location	CO_2 Range (% $^{vol}/_{vol}$)	CH_4 Range (% $^{vol}/_{vol}$)	O_2 (% $^{vol}/_{vol}$)	Max Flow Rate (l/hr)	Steady State Flow Rate (l/hr)
BH01	0.2 – 0.6	<0.1	19.7	<0.1	<0.1
BH02	<0.1	<0.1	20.5 – 20.8	<0.1	<0.1
BH03	<0.1	<0.1	20.2 – 20.5	<0.1	<0.1
BH04	<0.1 – 0.2	<0.1	20.5 – 20.9	<0.1	<0.1
BH05	<0.1	<0.1	20.9 – 21.1	<0.1	<0.1
BH06	<0.1	<0.1	19.2 – 19.6	<0.1	<0.1
BH07	0.2 – 0.4	<0.1	20.2 – 20.4	<0.1	<0.1
BH08	<0.1	<0.1	19.4 – 20.0	<0.1	<0.1
BH09	<0.1	<0.1	20.1 – 20.3	<0.1	<0.1
BH10	<0.1	<0.1	20.4 – 20.9	<0.1	<0.1

Hydrogen sulphide and carbon monoxide were not detected during any of the ground gas monitoring visits.

Maximum concentrations of carbon dioxide and methane were recorded at 0.6% $^{vol}/_{vol}$ and <0.1% $^{vol}/_{vol}$ respectively. The ground gas concentrations are consistent with natural soils. As previously detailed, the above is considered to comprise 'very low' gassing potential in accordance with BS8576 Figure 6.

Considering both a 'worst credible scenario' (maximum 'absolute' flow rate, maximum gas concentration within a single borehole location) and 'worst possible scenario' (maximum 'absolute' flow rate, maximum gas concentration across all borehole locations) the Hazardous Gas Flow Rates (Q_{hg}) for the site are evaluated as 0.0006 (carbon dioxide) and <0.0001 (methane).

In this site situation, the calculated Hazardous Gas Flow Rates (Q_{hg}) are considered to be reflective of a conservative assessment of Gas Screening Values (GSV) with generally negligible flow rates and non-detectable concentrations of methane recorded.

With reference to CIRIA C665 (14), the above calculated GSV, indicate a Characteristic Situation (CS) 1 in regard to ground risk.

7.4 Radon Gas

The BGS Radon Mapping (16) confirms the site is situated in a radon area where >3-5% of homes are at or above the radon action level. On this basis basic radon protection measures are considered necessary in the construction of any enclosed spaces.

Where a new development incorporates a basement the advice of a specialist Radon assessor must be obtained. No basement is proposed as part of the Proposed Development.

8.0 Revised Conceptual Site Model

The preliminary conceptual site model (PCSM) presented and discussed in Section 3.0 of this report has been revised following the GQRA in Section 7.0 above and this revised Conceptual Site Model (CSM) is presented in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential contaminant linkages (PCL) that have been identified for the site. The GQRA details the associated level of risk relating to these potential contaminant linkages.

The CSM concerns risk to human health, Water and Environment and follows the framework outlined within CIRIA C552 which is summarised within Appendix E.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PCL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations 2015 which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate/ manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements and therefore construction workers involved in the building works at the site have been discounted as a human receptor in the conceptual site model.

- The table below represents the second stage in the land quality risk assessment process: The Quantitative Risk Assessment.
- In order for a development site to be deemed 'suitable for use', the level of risk needs to be brought down to acceptable levels, i.e., low to negligible risk. The purpose of each stage of risk assessment is ultimately to establish, if there is a requirement for additional levels of assessment to be made in order to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Recommended Actions
Source	**Pathway(s)**	**Receptor(s)**	**Consequence**	**Likelihood of Occurrence**	**Risk Rating**	
On-site sources of potential contamination: *None.*	**Direct contact, ingestion,** inhalation (dust and vapours).	**Site end-user**	**Medium** Acute health risk	**Unlikely** Made Ground was not encountered onsite. Samples of onsite shallow natural soils sent for chemical testing did not identify any chemical exceedances against commercial GACs.	**Low**	**No further action required**
	Vertical and horizontal migration through the superficial deposits (soils) May occur due physical processes including; capillary action and downwards into the natural deposits through infiltration, however, on Site deposits were identified as predominantly cohesive in nature, reducing the potential for vertical migration.	**Water Environment (Groundwater and Surface Water)** Moderately productive aquifer associated with Spittal Flagstone Formation. No potable abstraction points located within the vicinity of the site. Achanarras Burn	**Medium** Pollution of sensitive water resources	**Unlikely** Made Ground was not encountered onsite. Five groundwater strikes were recorded during the investigation, these were characterised as perched water and not representative of a sensitive resource. Samples of onsite shallow natural soils sent for chemical testing did not identify any chemical exceedances against commercial GACs, in addition no visual or olfactory contamination was encountered onsite. Consequently, the risk to the water environment is deemed as low.	**Low**	
Off-site sources of potential contamination: Uncontrolled deposition of Made Ground associated with infilled quarry to the north and north east of the Site. Potential for localised fuel spills from farming equipment during farming activities on the Site upgradient from site.	**Horizontal migration via preferential pathway through the superficial deposits/bedrock from upgradient sources from the site.** **Followed by inhalation (vapours)**	**End users of site** Residents, visitors, site users, staff, and trespassers.	**Medium** Chronic health risk	**Unlikely** No indicators of potential visual or olfactory indicators of mobile phase contamination were encountered during the ground investigation. Consequently, it is unlikely that off-site sources of potential contamination have impacted the development site. Based on the above, it is considered unlikely that off-site sources of contamination could migrate onto the development site and pose a risk to future site users,	**Low**	**No further action required.**

On-site and off-site sources of potential ground gas: *Made ground from infilled quarry to the north and north east of the Site.* *No sources of ground gas generation identified on site.*	**Vertical and horizontal migration** **Vertical and horizontal migration through the superficial soils and residual bedrock.**	**Site end-user**	**Medium** Human health risk	**Low** Based on the results of the ground gas monitoring visits, in regard to ground gas risk assessment the site has been determined to be within a Characteristic Situation 1 (CS1) scenario. This is reflective of the absence of Made Ground. Consequently, the ground gas risk for the site is considered to be low	**Low**	**No further action required**

9.0 Preliminary Geotechnical Assessment

The recommendations provided within this section are based on a review of the recent records of ground conditions encountered across the site, along with the Proposed Development. This section will assess the relevant geotechnical issues for the proposed development. The site layout for the Proposed Development is contained within Appendix A. The engineering assessment considers (floor slab, foundation design, bearing capacity, settlement, excavations, earthworks, pavement design, and drainage) for the site. Structural details and loadings have not yet been provided. It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 GI Report and the construction-stage designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the ongoing project design proposals, the ground investigation information, and their own examination of the site.

9.1 Geotechnical Considerations

9.1.1 Compressible and Variable Thickness Superficial Deposits

The Glacial Till was encountered as soft to firm brown and grey mottled orange/grey/brown silty sandy gravelly CLAY with high flagstone cobble content between 0.50m and 1.70m thick. Only 1 No. SPT's were carried out in the Glacial Till, giving 8 at an 1.2m bgl (88.57m AOD). Due to the limited information, it is unlikely that the required bearing capacity will be achieved in these soils.

Under shallow foundation loading, cohesive soils are likely undergo settlement. Over the design life of the buildings, this loading can lead to excess pore water pressure dissipating leading to consolidation settlement. In order to determine suitability for shallow raft foundations, further in situ testing and Atterberg Limit testing need to be carried out to confirm the strength and consolidation parameters. Further to this a settlement assessment would be required.

9.1.2 Shrinkable Soils

As per the NHBC Chapter 4.2 (2024), "Shrinkable soils, often change volume as moisture content fluctuates seasonally and as a result of factors, including the action of tree roots. The resulting shrinkage or swelling can cause subsidence or heave damage to foundations, the structures they support and services". Given the cohesive nature of the Glacial Till, there is a potential of volume change potential that can affect the proposed foundations and floor slab. Currently there are no Atterberg Limit tests available and therefore the shrink/swell potential of the Glacial Till cannot be determined. It is recommended that further trial pitting is carried out in order to carry out Atterberg Limit tests.

9.1.3 Excavating Bedrock

From the proposed site levels it can be seen that up to 4m of cut is required in the northeast part of the site. In this area of site, the nearest borehole is BH03, where it can be seen that Bedrock is encountered at 1m bgl and recovered as a gravel down to 1.3m bgl. With 4m of cut, this would require 3m of Bedrock to be excavated. As the extent of the Bedrock recovered as a gravel is unknown, further investigation would be required to determine where competent Bedrock is reached, as there may be issues with excavating through the Bedrock.

9.2 Earthworks

For the proposed earthworks, it is anticipated that a significant cut and fill will be undertaken to achieve formation level due to the sloping nature of the site and presence of shallow bedrock.

Earthworks should be undertaken in accordance with an Earthworks Specification (citing Series 600 of the Specification for Highway Works).

Depending on the level of cut and location, cut materials are likely to comprise Glacial Till and/or weathered bedrock (Spittal Flagstone Formation – mudstone, siltstone, sandstone).

It is likely that the excavated material will classify as a Class 1 or Class 2 Acceptable Earthworks Fill (in accordance with Table 6/2 SHW Series 600) subject to the screening of oversize material >300mm and to the receipt of further testing undertaken in accordance with a site specific earthworks specification.

A summary of the grading results is provided in Table 9.1 together with the determined material classification (assuming oversize material removed).

Subject to the removal of oversize material (>125mm), the results suggest that excavated Glacial Till is likely to classify as a Class 2 Acceptable Earthworks Material in accordance with the SHW Series 600, Table 6/2.

The Weathered Spittal Flagstone Formation is likely to be classified as a Class 1 Acceptable Earthworks Material, subject to further geotechnical testing. The Bedrock is also likely to be classified as a Class 1 with the appropriate screening of the material, some degree of crush processing and the appropriate geotechnical testing.

In general, the materials tested were considered too wet in their current condition to be suitable for reuse below structures and/ or external areas (i.e. the natural water content of the samples is too high to achieve adequate compaction in the region of >95 %, with 0-5 % air voids. As such, consideration should be given to drying out the cut soils through natural drying processes (during the summer) and/or turning, aeration, and retesting prior to placement and compaction. Alternatively, the natural water content can be reduced by adding a lime- or cement-based drying agent, followed by field-suitable testing specified in a site-specific earthworks specification. Acceptable levels for compaction should be reported in a site-specific Earthworks Specification.

Table 9.1 – Summary of Grading Results with Determined Material Classification

Sample	Depth	500	300	125	90	75	37.5	28	20	14	10	6.3	5	3.35	2	1.18	600	300	150	63	Class
TP01	0.30	100	100	100	100	92	70	63	53	52	50	48	47	46	44	43	40	38	32	27	2C
TP02	0.40	100	100	100	100	100	93	93	93	92	91	90	90	89	88	86	81	77	69	60	2A & 2B
TP04	0.50	100	100	100	100	100	100	100	98	94	92	91	90	89	87	84	79	72	62	49	2A & 2B
TP08	0.50	100	100	100	85	85	83	83	83	83	82	82	82	82	81	76	68	64	59	53	2A & 2B
TP11	0.70	100	100	100	100	100	83	63	47	42	37	31	29	26	24	22	19	17	14	11	1A/1B
TP12	0.50	100	100	100	100	100	92	85	75	72	66	62	60	56	52	49	45	42	36	31	2C
TP13	0.75	100	100	100	82	73	42	36	30	27	25	23	23	22	21	20	18	17	14	11	1A/1B
TP14	1.00	100	100	100	100	100	86	77	67	63	61	58	57	56	54	52	50	47	40	31	2C
TP16	0.50	100	100	100	100	100	97	93	92	90	87	84	83	80	76	72	66	62	52	42	2C
TP19	0.50	100	100	100	100	100	100	100	100	100	99	86	95	94	92	90	86	83	80	75	2A & 2B
TP22	0.50	100	100	89	89	84	78	78	75	74	73	72	71	71	70	68	66	63	54	44	2C

9.3 Foundation Design

9.3.1 Shallow Foundations

The Proposed Development comprises a BESS with a maximum expected loading of 50kN/m^2. Since the ground investigation was completed, a cut-and-fill design has been provided. A review of the foundation advice should be undertaken pre-construction.

Where shallow bedrock is present, shallow foundations are likely to be suitable, finding the weathered flagstone encountered at depths ranging between 87.07m AOD (BH07) and 108.82m AOD (TP01).

Shallow foundations are structural elements that transfer building loads to the ground near the surface, typically no deeper than the width of the foundation itself. They are designed for structures where the surface soils can effectively bear loads.

Shallow foundations encompass both spread (or isolated) footings and raft foundations:

- Spread Footings: These support individual columns or piers and spread the load over a wider area.
- Raft Foundations: These distribute the load from an entire building or a large portion of it across a large area, usually when the soil bearing capacity is low.

The bedrock profile is likely to exhibit significant variability. This variability means that the depth to bedrock can differ drastically within short distances. During excavation, site-specific conditions will reveal these discrepancies. Identifying the shallowness of bedrock is most accurately achieved through direct observation and measurement during the excavation process, as preliminary surveys and borehole data may not fully capture the irregularities of the subsurface.

A conservative bearing capacity check has therefore been for the Weathered Flagstone using guidance from Tomlinson (2001), Hansen (1968), Bowles (1988) and Eurocode 7: Geotechnical Design to confirm feasibility. Based on an angle of Shearing Resistance of 41°, for a 1.5m x 1.5m pad foundation, at a minimum of 1.1m bgl, a bearing capacity of approximately 150kPa is estimated within the Weathered Bedrock.

In areas where thicker cohesive strata are anticipated (due to the sloping nature of the site) over-excavation and replacement with competent granular fill material will be required in order to achieve adequate bearing capacities and limit differential settlements. Foundations should not be formed or spread across mixed cohesive and granular soils.

The engineering characteristics of any clayey and silty soils at shallow depths are particularly sensitive to changes in soil moisture content and will soften considerably when exposed to free water. It would, therefore, be prudent to program foundation construction for the dry summer months where possible. Where this is not possible, steps should be taken to protect construction activities in adverse weather, for example, not placing any fill until the compaction plant is on-site to work it and excavating grips or temporary drainage ditches to collect runoff and/ or groundwater during periods of particularly heavy rain.

9.3.2 Raft Foundation

For a proposed raft foundation, a minimum 750mm of Class 6F2/6F5 granular fill would need to be placed beneath the slab (assuming a low volume change potential within the Cohesive Glacial Till) with Class 2 general fill placed down to the weathered bedrock of the Spittal Flagstone Formation. All fill materials should be placed and compacted to an earthworks specification. N.B. the low volume change potential described above is based on engineering judgement in this area of Scotland including investigations in similar overconsolidated glacial till soils and descriptions of the soil but is subject to receipt of further testing.

A detailed settlement assessment should also be undertaken to confirm the material parameters required for the fill, to detail the compaction requirements, determine the appropriate thickness of Class 6F2/6F5 granular fill beneath the raft and to ensure settlements are not excessive.

9.3.3 Ground Floor Slab

Assuming excavation and replacement of the softer and cohesive soils will be undertaken and all structural fill will be tested and placed strictly in accordance with an appropriate earthworks specification, then ground bearing floor slabs founding in the Granular bedrock deposits or Granular Engineered Fill are considered to be feasible. Consideration would need to be given to potential total and differential settlements.

Prior to the placement of the founding materials and the construction of the ground bearing floor slab, the formation will need to be inspected and checked by a suitably qualified engineer to ensure the ground conditions are as expected.

9.4 Groundwater and Excavations

Five seepages were identified throughout the duration of the ground investigation, as identified in Table 6.4. Given this, additional seepages of perched groundwater cannot be discounted and may be present in shallow excavations.

The trial pits carried out on site appeared to be stable during excavations. However, this may be different during the construction phase due to unknown variables such as heavy rain and higher groundwater. In accordance with Health and Safety Regulations, side support for safety purposes should be provided to all excavations that appear unstable and those that are more than 1.2m deep. Excavations are likely to be stable at suitable batters. No observations regarding unusual instability were made in the Trial Pit logs.

During the Site investigation it was noted that rock was relatively easily excavated by the tracked excavator in the upper 100mm but proved more resilient with depth. Coring of the bedrock was out of the scope of this investigation. It is noted that up to 4m of cut is required at the site, with approximately 3m of bedrock. Further ground investigation would be required in order to confirm the strength of the bedrock with depth through logging and the appropriate testing to determine the most appropriate excavating method.

Noticeable amounts of standing water within the excavations could weaken the founding soils; as such, where encountered, the water should be removed, facilitating suitable methods such as sump pumping. General advice on de-watering in accordance with CIRIA Report C750: Groundwater Control (17) should be taken into consideration. The chosen contractor should provide details on how they intend to ensure the safety and stability of proposed excavations.

9.5 Hardstanding Design

CBR values are used to determine road pavement construction thicknesses. In-situ CBR testing (via DCP) has been undertaken across the development site, with results ranging from 1.6% to >20%.

It should be noted that these tests were undertaken before earthworks. The higher values are thought to be reflective of cobbles within the Glacial Till and/or encountering underlying bedrock and do not reflect a realistic CBR value post-cut and fill.

Five laboratory CBR tests were undertaken on samples of Glacial Till at depths ranging between 0.40m and 0.50m bgl. The CBR results ranged between 0.5% to 1.7%, with an average CBR of 0.92%.

Based on published standards (CD225 Design for new pavement foundations) a subgrade with a subgrade surface modulus <30MPa (approximate 2.5% CBR) is considered unsuitable to support the construction of a pavement foundation and improvement of the subgrade is required. It is recommended that a characteristic CBR of 2.5% is used in preliminary designs and it is recommended that further in-situ CBR tests are undertaken post cut / fill and at formation level to confirm the preliminary design CBR is achieved prior to construction. As mentioned above, if the CBR value at subgrade level is <2.5% improvement may be required.

The above is subject to in situ testing during construction. Any soft or loose layers encountered in otherwise competent formations should be removed and replaced with well compacted imported granular fill.

9.6 Preliminary Soakaway Design

Infiltration testing undertaken in general accordance with BRE Digest 365 was undertaken in one location across the site (SA01).

The purpose of the test was to determine the infiltration rate of the shallow soils, to determine if soakaway type drainage is likely to be suitable at the site.

SA01 was excavated to a depth of 1.60m bgl (88.48m AOD). The ground conditions comprised Topsoil from ground level to 0.20m bgl (89.88m AOD), underlain by firm brown very gravelly silty sandy CLAY to 1.00m bgl (89.08m AOD), which was further underlain by Spittal Flagstone Formation to termination depth of the trial pit of 1.60m bgl (88.48m AOD).

The pit was filled with water to a depth of 0.51m bgl and during a period of 90 minutes a 10mm drop in water level was observed to 0.52m bgl. The soakaway test was unsuccessful due to the 75% and 25% drop in water levels being unachieved.

The poor infiltration is likely a result of the cohesive nature of the Glacial Till and impermeable nature of the bedrock. Soakaway type drainage is therefore not recommended and therefore does not form part of the Proposed Development.

9.7 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in the Building Research Establishment (BRE) Special Digest 1 3rd Edition of 2017 (11) . A summary of the results obtained during the ground investigation works are summarised in Table 9.2a. Table 9.2b summarises the classification, based on geology.

Table 9.2a – Summary of pH and water soluble (2:1) sulphate testing

Stratum	Test Type	Range
Topsoil	*pH*	*5.6 – 6.5*
	Water Soluble Sulphate (mg/l)	*<10 – 13*
Glacial Till	*pH*	*5.9 – 7.3*
	Water Soluble Sulphate (mg/l)	*<10 – 34*

A total of 14 samples underwent water soluble sulphate and pH testing (six no. Topsoil and 8 no. Glacial Till). Using BRE Special Digest 1, the Aggressive Chemical Environmental for Concrete (ACEC) classification has been derived from sulphate and pH values for each stratum. These are highlighted in Table 6.5b.

Table 9.2b – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class (1)
Topsoil	*DS-1*	*AC-1*
Glacial Till	*DS-1*	*AC-1*

(1) ACEC assessment was based on mobile groundwater condition.

10.0 Conclusions

10.1 Conclusions

A revised tabulated Conceptual Site Model has been derived following the findings of the Generic Quantitative Risk Assessment and is presented in Section 8.0.

The environmental chemistry soil results have been compared with the Generic Assessment Criteria (GAC) for soils with respect to human health against Commercial thresholds. The results of environmental testing did not record any exceedances of contaminants above the adopted GACs, nor the presence of Asbestos.

The risk to water environments is considered Low.

A review of the ground gas risk highlights no ground gas protection measures are required for the site.

The BGS Radon Mapping (16) confirms the site is situated in a radon area where >3-5% of homes are at or above the radon action level. On this basis basic radon protection measures are considered necessary in the construction of any enclosed spaces. If the Proposed Development were to incorporate a basement the advice of a specialist Radon assessor would need to be obtained.

The bedrock underlying the Site is considered a suitable founding stratum due to the shallow depth beneath existing ground level and an estimated allowable bearing capacity of 150kPa for a 1.5m x 1.5m pad foundation at a minimum depth of 1.1m bgl. Where Glacial Till is found at foundation level, it should be excavated out to the bedrock and backfilled with Class 6F2/6G5.

For a proposed raft foundation, a minimum 750mm of Class 6F2/6F5 granular fill would need to be placed beneath the slab (assuming a low volume change potential within the Cohesive Glacial Till) with Class 2 general fill placed down to the weathered bedrock of the Spittal Flagstone Formation. All fill materials should be placed and compacted to an earthworks specification. N.B. the low volume change potential described above is based on engineering judgement in this area of Scotland including investigations in similar overconsolidated glacial till soils and descriptions of the soil but is subject to receipt of further testing. A detailed settlement assessment should also be undertaken to confirm the material parameters required for the fill, to detail the compaction requirements, determine the appropriate thickness of Class 6F2/6F5 granular fill beneath the raft and to ensure settlements are not excessive

At this stage and based on the CBR results carried out and where near surface natural soils are encountered at road pavement formation levels, a California Bearing Ration of <2.5% can be assumed and full road capping should be allowed for to mitigate total and differential settlements. Further in-situ CBR testing should be undertaken at formation level where hardstanding is proposed to confirm the CBR value used in preliminary design.

The poor infiltration is likely a result of the cohesive nature of the Glacial Till and impermeable nature of the bedrock and therefore soakaway type drainage is not recommended.

Subject to further geotechnical testing, it is likely that the Glacial Till can be classified as a Class 2 general fill, and both the weathered and competent bedrock as Class 1.

In general, the Glacial Till samples tested were considered too wet in their current condition to be suitable for reuse below structures and/ or external areas (i.e. the natural water content of the samples is too high to achieve adequate compaction in the region of >95 %, with 0-5 % air voids). As such, consideration should be given to drying out the cut soils and retesting prior to placement and compaction or reducing the natural water content by adding a lime or cement-based drying agent followed by field suitable field testing. Localised areas of cut material may also require to be dried out prior to reuse as a general fill. Acceptable levels for compaction should be reported in a site-specific Earthworks Specification.

10.2 Recommendations

In light of the ground investigation undertaken to date across the development site, the following recommendations are made:

- A settlement assessment should be carried out to confirm suitability and buildup of a raft foundation and estimate differential settlements.
- Further trial pitting should be undertaken in order to carry out hand shear vanes to provide more strength data and to obtain samples within the Glacial Till for Atterberg Limit testing. Once complete, this report should be revisited and the proposed foundation build ups updated accordingly.
- Coring of the bedrock may be required to determine the strength profile to aid the cut and fill process through the bedrock.
- Earthworks should be undertaken in accordance with an Earthworks Specification and a detailed settlement assessment is likely to be required for a raft foundation on Engineered Fill;
- Additional CBR tests on the subgrade are recommended post cut/fill to determine if ground improvement is required (if CBR is <2.5%).
- The report is to be updated with a proposed foundation solution once further investigation is undertaken and structural loadings are known. This should be undertaken pre-construction.
- Basis basic radon protection measures are considered necessary in the construction of any enclosed spaces.

It is recommended that no further environmental works are considered necessary and based on this information a remediation strategy is not considered necessary

11.0 References

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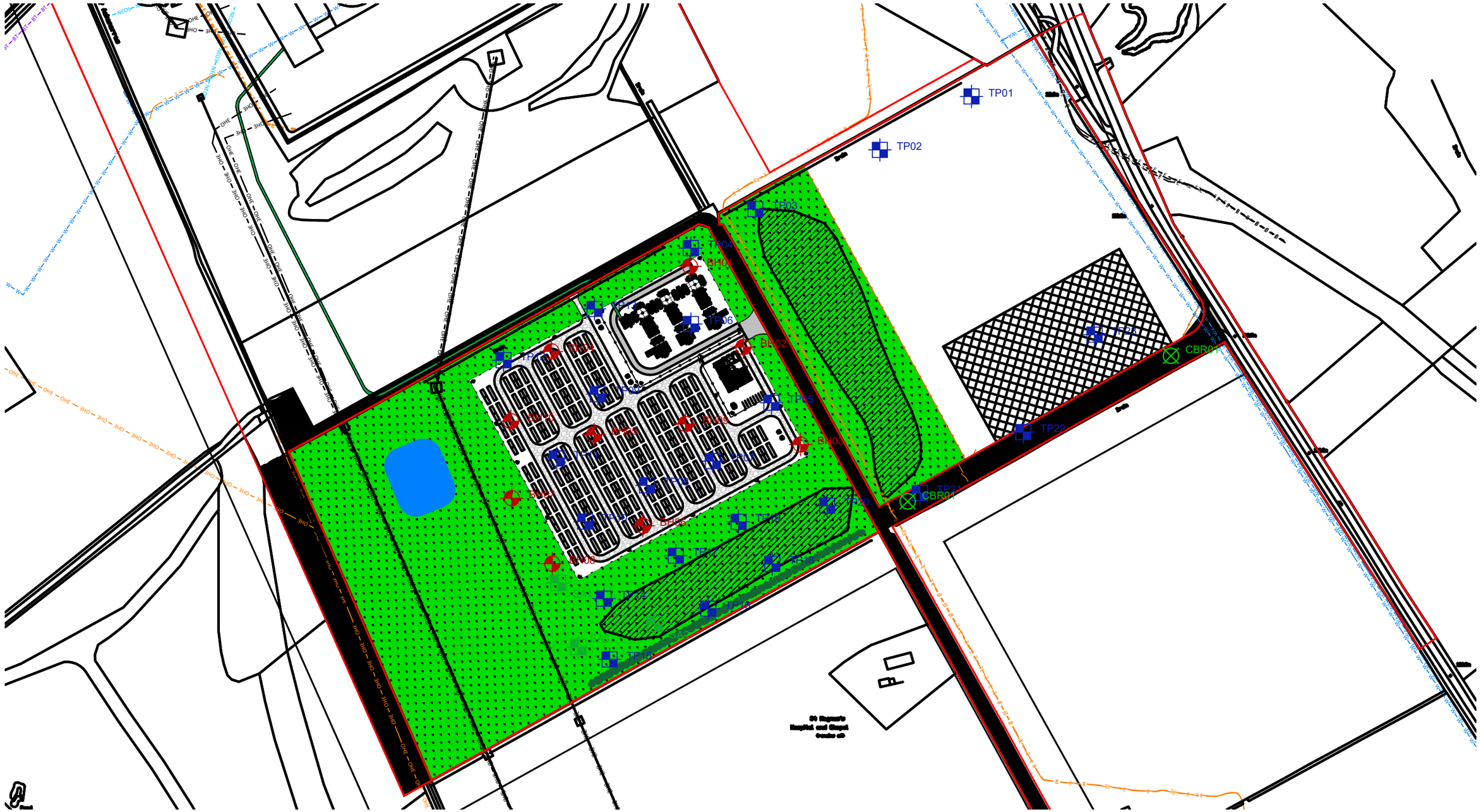
12.0 Appendices

Appendix A – Drawings

Appendix B – Supporting Information



Key

Cable Percussive Boreholes	CP
Machine Excavated Trial Pits	TP
Soakaway Tests	SA
CBR TEST	CBR

REV	ISSUED	00/00/00	XXX	XXX
Rev:	Description:	Date:	By:	Chkd:

Curtins

Office
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Email
Web

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Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Project: SPITTAL		Status: FINAL	
Drg Title: FINAL GROUND INVESTIGATION LOCATIONS		Drawn By MTL	Checked By CD
		Designed By MTL	Date 16/12/24
		Scales @ A3 NTS	

Project No - Originator - Function - Spatial - Form - Discipline - Number	Revision
085447 - CUR - XX - ST - D - GE - 00002	P01

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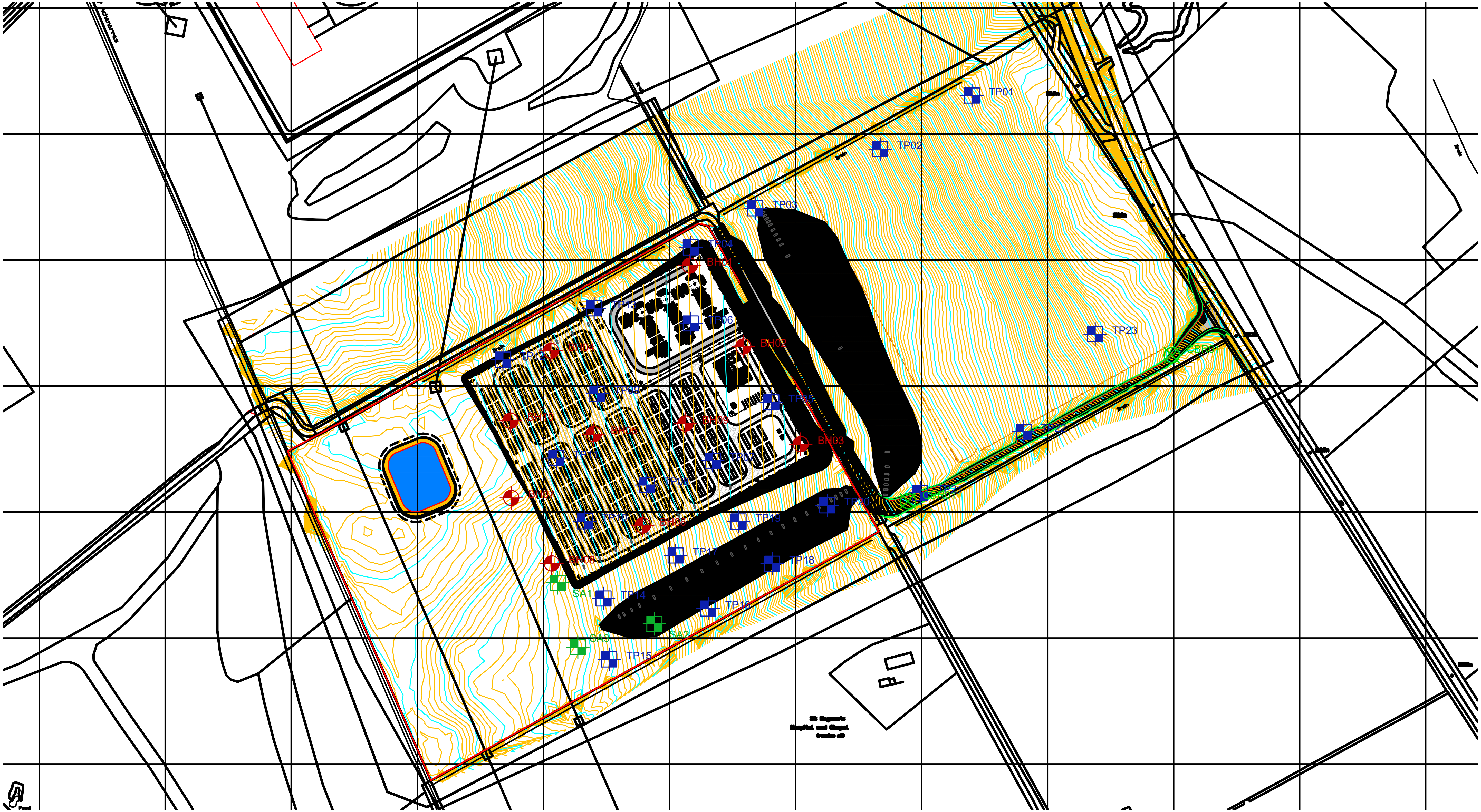

Key

Cable Percussive Boreholes		CP
Machine Excavated Trial Pits		TP
Soakaway Tests		SA
CBR TEST		CBR

REV	ISSUED	00/00/00	XXX	XXX
Rev:	Description:	Date:	By:	Chkd:

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Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Project: SPITTAL		Status: FINAL	
Drg Title: CUT & FILL SITE LAYOUT		Drawn By MTL	Checked By CD
		Designed By MTL	Date 10/07/24
		Scales @ A3 NTS	
Project No - Originator - Function - Spatial - Form - Discipline - Number			Revision
085447 - CUR - XX - ST - D -GE- 00003			P01

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Trial Pit Log

Trialpit No **SA01**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315611.37 - 954943.82 Level: 90.08	Date 22/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 1.60	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	89.88		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				1.00	89.08		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				1.60	88.48		FLAGSTONE End of pit at 1.60 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP01**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315940.11 - 955330.63 Level: 109.22	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 0.60	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.30	BB		0.15	109.06		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.40	108.82		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.60	108.62		FLAGSTONE End of pit at 0.60 m

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Remarks: No Groundwater Encountered

Stability: Stable

AGS

Trial Pit Log

Trialpit No **TP02**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315904.59 - 955318.52 Level: 107.07	Date 21/02/2024
Location: Thurso	Dimensions (m): Depth 0.60	2.2 × 1.5	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	106.87		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.40 0.40	BB ES		0.50	106.57		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.60	106.47		FLAGSTONE End of pit at 0.60 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No
TP03
Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315768.15 - 955241.03 Level: 98.09	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 1.10	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.15	97.94		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
							Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.90	97.19		FLAGSTONE
				1.10	96.99		End of pit at 1.10 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP04**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315747.11 - 955151.02 Level: 95.54	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5, Depth 1.10	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.30	95.24		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50	BB		0.90	94.64		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				1.10	94.44		FLAGSTONE End of pit at 1.10 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP05**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315778.52 - 955080.32 Level: 96.87	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5, Depth 0.60	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	96.67		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.30	BB		0.40	96.47		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.60	96.27		FLAGSTONE End of pit at 0.60 m

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Remarks: No Groundwater Encountered

Stability: Stable

AGS

Trial Pit Log

Trialpit No
TP06
Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315694.82 - 955140.94 Level: 93.47	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 1.10	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 0.50	BB ES		0.30	93.17		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.90	92.57		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				1.10	92.37		FLAGSTONE End of pit at 1.10 m

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Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP07**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315716.85 - 955048.61 Level: 93.75	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 0.30	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10 0.10	BB ES		0.20 0.30	93.54 93.44		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets FLAGSTONE End of pit at 0.30 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP08**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315679.62 - 955026.03 Level: 91.68	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5, Depth 1.20	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.30	91.38		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.50	BB					
				1.10	90.58		FLAGSTONE
				1.20	90.48		End of pit at 1.20 m

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Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP09**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315624.05 - 955090.98 Level: 90.43	Date 20/02/2024
Location: Thurso	Dimensions (m): Depth 0.70	2.2 × 1.5	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	90.13		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.50	89.93		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.60	BB		0.70	89.73		FLAGSTONE End of pit at 0.70 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP10**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315595.35 - 955011.98 Level: 88.78	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 0.80	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
							TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.30	88.48		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.50	BB					
				0.60	88.18		FLAGSTONE
				0.80	87.98		End of pit at 0.80 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No
TP11
Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315598.44 - 955061.73 Level: 88.58	Date 20/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 0.80	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	88.28		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50	ES					Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.70	BB		0.60	87.98		FLAGSTONE
				0.80	87.78		End of pit at 0.80 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP12**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315569.20 - 955126.66 Level: 88.27	Date 20/02/2024
Location: Thurso	Dimensions (m): Depth 0.80 — 2.2 × 1.5		Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES		0.20	88.07		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50	BB		0.70	87.57		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.80	87.47		FLAGSTONE End of pit at 0.80 m

1 2 3 4

Remarks: No Groundwater Encountered

Stability: Stable

AGS

Trial Pit Log

Trialpit No **TP13**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315635.87 - 955160.40 Level: 91.38	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 0.80	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30	91.08		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
							Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.75	BB		0.70	90.68		FLAGSTONE
				0.80	90.58		End of pit at 0.80 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP14**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315621.46 - 954952.27 Level: 90.46	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 1.50	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	90.16		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50	ES					Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	1.00	BB					
				1.40	89.06		FLAGSTONE
				1.50	88.96		End of pit at 1.50 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP15**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315658.89 - 954881.86 Level: 91.02	Date 21/02/2024
Location: Thurso	Dimensions (m): Depth 0.60	2.2 × 1.5	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30	90.72		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.40	BB		0.50	90.52		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.60	90.42		FLAGSTONE End of pit at 0.60 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP16**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315708.57 - 954905.95 Level: 92.58	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 0.90	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES					TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.30	92.28		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
	0.50	BB					
				0.70	91.88		FLAGSTONE
				0.90	91.68		End of pit at 0.90 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP17**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315699.26 - 954979.35 Level: 93.18	Date 21/02/2024
Location: Thurso	Dimensions (m): Depth 0.50 — 2.2 × 1.5		Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.10	ES					TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.30	92.88		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.40	92.78		FLAGSTONE
				0.50	92.68		End of pit at 0.50 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP18**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315783.60 - 954956.21 Level: 96.22	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 x 1.5 Depth 0.40	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	96.02		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
				0.40	95.82		FLAGSTONE End of pit at 0.40 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No
TP19
Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315756.03 - 955018.14 Level: 95.88	Date 21/02/2024
Location: Thurso	Dimensions (m): Depth 0.90	2.2 × 1.5	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	95.58		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50 0.50	BB ES					Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.70	95.18		FLAGSTONE
				0.90	94.98		End of pit at 0.90 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP20**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315832.89 - 954990.92 Level: 99.03	Date 21/02/2024
Location: Thurso	Dimensions (m): Depth 0.80 — 2.2 × 1.5		Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	98.83		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.50 0.50	BB ES		0.60	98.43		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.80	98.23		FLAGSTONE End of pit at 0.80 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP21**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315899.02 - 955015.28 Level: 101.50	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 0.60	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	101.30		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
	0.40	BB		0.40	101.10		Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.60	100.90		FLAGSTONE End of pit at 0.60 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP22**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315922.10 - 955061.25 Level: 102.93	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 1.20	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50	BB		0.20	102.73		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
							Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				1.00	101.93		FLAGSTONE
				1.20	101.73		End of pit at 1.20 m

Remarks: No Groundwater Encountered

Stability: Stable

Trial Pit Log

Trialpit No **TP23**

Sheet 1 of 1

Project Name: Spittal, Thurso	Project No. 085447	Co-ords: 315987.40 - 955060.45 Level: 105.46	Date 21/02/2024
Location: Thurso		Dimensions (m): 2.2 × 1.5 Depth 1.00	Scale 1:20
Client: Field Energy			Logged ML

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.50 0.50	BB ES		0.20	105.26		TOPSOIL. Dark brown very gravelly silty sand with very fine rootlets
							Firm brown very gravelly sandy silty CLAY with high cobble content. Cobbles of angular Flagstone.
				0.70	104.76		FLAGSTONE
				1.00	104.46		End of pit at 1.00 m

Remarks: No Groundwater Encountered

Stability: Stable

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Borehole Log

Borehole No. **BH01**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315716.1 N: 955195.5	**Hole Type** WS
Location:	Thurso		**Level:**	95.19	**Scale** 1:25
Client:	Curtins		**Dates:**	19/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	94.98		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50	B					Soft to firm brown and grey mottled orange slightly sandy gravelly locally very gravelly CLAY. Gravel is angular fine to coarse of predominantly flagstone.
		0.50	ES					
		0.80	ES					
		1.00	B		0.90	94.28		Weak grey FLAGSTONE, recovered as an angular fine to coarse gravel.
		1.20 - 1.40	D					
		1.20	SPT	50 (11,14/50 for 50mm)				
					1.40	93.78		*No further progress, presumed bedrock.* End of Borehole at 1.40m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.40m and terminated on presumed bedrock. No groundwater encountered. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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Borehole Log

Borehole No. **BH02**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315758.0 N: 955131.3	**Hole Type** WS
Location:	Thurso		**Level:**	96.23	**Scale** 1:25
Client:	Curtins		**Dates:**	19/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	96.03		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
	▼	0.50 0.50	B ES					Soft greyish brown sandy locally very sandy gravelly CLAY. Gravel is angular of predominantly flagstone.
		1.00 1.00 1.10 - 1.20 1.10	B ES D SPT	50 (25 for 100mm/50 for 0mm)	1.20	95.03		*No further progress, presumed bedrock* End of Borehole at 1.20m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.10m and terminated on presumed bedrock. Water strike at 0.70m and remaining at this level after 20mins. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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Borehole Log

Borehole No. **BH03**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315803.3 N: 955057.3	**Hole Type** WS
Location:	Thurso		**Level:**	97.85	**Scale** 1:25
Client:	Curtins		**Dates:**	19/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	ES		0.30	97.55		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
	▼	0.60 0.60	B ES					Soft brown and grey mottled orange slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of various lithologies including flagstone.
		1.00 1.00 - 1.30 1.00	ES D SPT	50 (8,9/50 for 150mm)	1.00	96.85		Weak grey FLAGSTONE, recovered as an angular fine to coarse gravel.
					1.30	96.55		*No further progress, presumed bedrock* End of Borehole at 1.30m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.30m and terminated on presumed bedrock. Water strike at 0.75m and remaining at this level after 20mins. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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Borehole Log

Borehole No. **BH04** Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315598.7 N: 955126.5	**Hole Type** WS
Location:	Thurso		**Level:**	89.77	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	ES		0.30	89.47		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Soft to firm brown and grey mottled orange slightly sandy gravelly locally very gravelly CLAY. Gravel is angular fine to coarse of predominantly flagstone.
		1.00 1.00	B ES					
		1.20 - 1.65 1.20	D SPT	N=8 (2,5/2,2,2,2)				
	▼	1.80	B					
		2.00 - 2.45 2.00 - 2.60 2.00	D B SPT	N=10 (2,1/2,2,2,4)	2.00	87.77		Weak orangish brown FLAGSTONE, recovered as a clayey angular fine to coarse gravel.
		2.60	SPT	50 (25 for 0mm/50 for 0mm)	2.60	87.17		*No further progress, presumed bedrock* End of Borehole at 2.60m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 2.60m and terminated on presumed bedrock. Water strike at 1.60m and remaining at this level after 20mins. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
KP	

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Borehole Log

Borehole No. **BH05**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315637.0 N: 955067.4	**Hole Type** WS
Location:	Thurso		**Level:**	90.25	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.25	90.00		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Soft to firm brownish grey slightly sandy gravelly CLAY. Gravel is angular fine to coarse of predominantly flagstone.
		1.00 1.00	B ES		1.10	89.15		
		1.20 - 1.50 1.20	D SPT	50 (11,14/50 for 150mm)				Weak grey FLAGSTONE, recovered as a very clayey angular fine to coarse gravel.
					1.50	88.75		*No further progress, presumed bedrock* End of Borehole at 1.50m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.50m and terminated on presumed bedrock. No groundwater encountered. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
KP	

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Borehole Log

Borehole No. **BH06**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315675.8 N: 954996.3	**Hole Type** WS
Location:	Thurso		**Level:**	91.96	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	91.66		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Greyish brown gravelly very clayey fine to coarse SAND. Gravel is angular fine to coarse of predominantly flagstone.
		1.00 1.00	B ES		0.90	91.06		Weak orangish brown FLAGSTONE, recovered as a very clayey angular fine to coarse gravel.
		1.20 1.20	D SPT	50 (8,14/50 for 200mm)	1.55	90.41		*No further progress, presumed bedrock* End of Borehole at 1.55m

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.55m and terminated on presumed bedrock. No groundwater encountered. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
KP	

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Borehole Log

Borehole No. **BH07**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315568.6 N: 955018.9	**Hole Type** WS
Location:	Thurso		**Level:**	87.97	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	87.77		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Soft greyish brown sandy locally very sandy gravelly CLAY. Gravel is angular of predominantly flagstone.
		1.00 1.00	B ES		0.90	87.07		Weak orangish brown FLAGSTONE, recovered as a very clayey angular fine to coarse gravel.
		1.20 - 1.27 1.20	D SPT	50 (25 for 100mm/50 for 0mm)	1.30	86.67		*No further progress, presumed bedrock* End of Borehole at 1.30m

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.30m and terminated on presumed bedrock. No groundwater encountered. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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Borehole Log

Borehole No. **BH08**

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315606.6 N: 954959.1	**Hole Type** WS
Location:	Thurso		**Level:**	89.79	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	89.59		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Soft to firm brownish grey slightly sandy gravelly CLAY. Gravel is angular fine to coarse of predominantly flagstone.
	▼				0.90	88.89		
		1.00 1.00	B ES					Weak orangish brown FLAGSTONE, recovered as a clayey angular fine to coarse gravel.
		1.20 - 1.30 1.20	D SPT	50 (25 for 100mm/50 for 50mm)	1.30	88.49		*No further progress, presumed bedrock* End of Borehole at 1.30m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.30m and terminated on presumed bedrock. Water strike at 0.90m and remaining at this level after 20mins. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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Borehole Log

Borehole No. **BH09** Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315708.4 N: 955075.3	**Hole Type** WS
Location:	Thurso		**Level:**	93.75	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.30	93.45		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.60	B		0.80	92.95		Weak grey FLAGSTONE, recovered as an angular fine to coarse gravel.
								No further progress, presumed bedrock
								End of Borehole at 0.80m

Remarks:

Inspection pit dug to a depth of 0.80m and terminated on presumed bedrock. No groundwater encountered. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
KP	

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Borehole Log

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Borehole No. BH10

Sheet 1 of 1

Project Name:	Spittal	**Project No.** GD 0727	**Co-ords:**	E: 315568.6 N: 955080.5	**Hole Type** WS
Location:	Thurso		**Level:**	88.08	**Scale** 1:25
Client:	Curtins		**Dates:**	20/02/2024 - 20/04/2024	**Rig Type** Competitor Dart

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.10	ES		0.20	87.88		Grass over brown clayey sandy gravelly TPOSOIL with frequent rootlets. Gravel is angular to subangular fine to coarse of various lithologies.
		0.50 0.50	B ES					Soft greyish brown slightly sandy gravelly CLAY. Gravel is angular of predominantly flagstone.
	▼	1.00 1.00	B ES		0.80	87.28		Weak grey FLAGSTONE, recovered as an angular fine to coarse gravel.
		1.20 - 1.35 1.20	D SPT	50 (25 for 100mm/50 for 50mm)	1.35	86.73		*No further progress, presumed bedrock* End of Borehole at 1.35m

1 2 3 4 5

Remarks:

Inspection pit dug to a depth of 1.20m. Borehole progressed with windowless sampling techniques to a depth of 1.35m and terminated on presumed bedrock. Seepage at 1.00m. Borehole fitted with a wellpoint on completion.

Logged By:	Checked By:
JM	

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CBR Data Interpretation

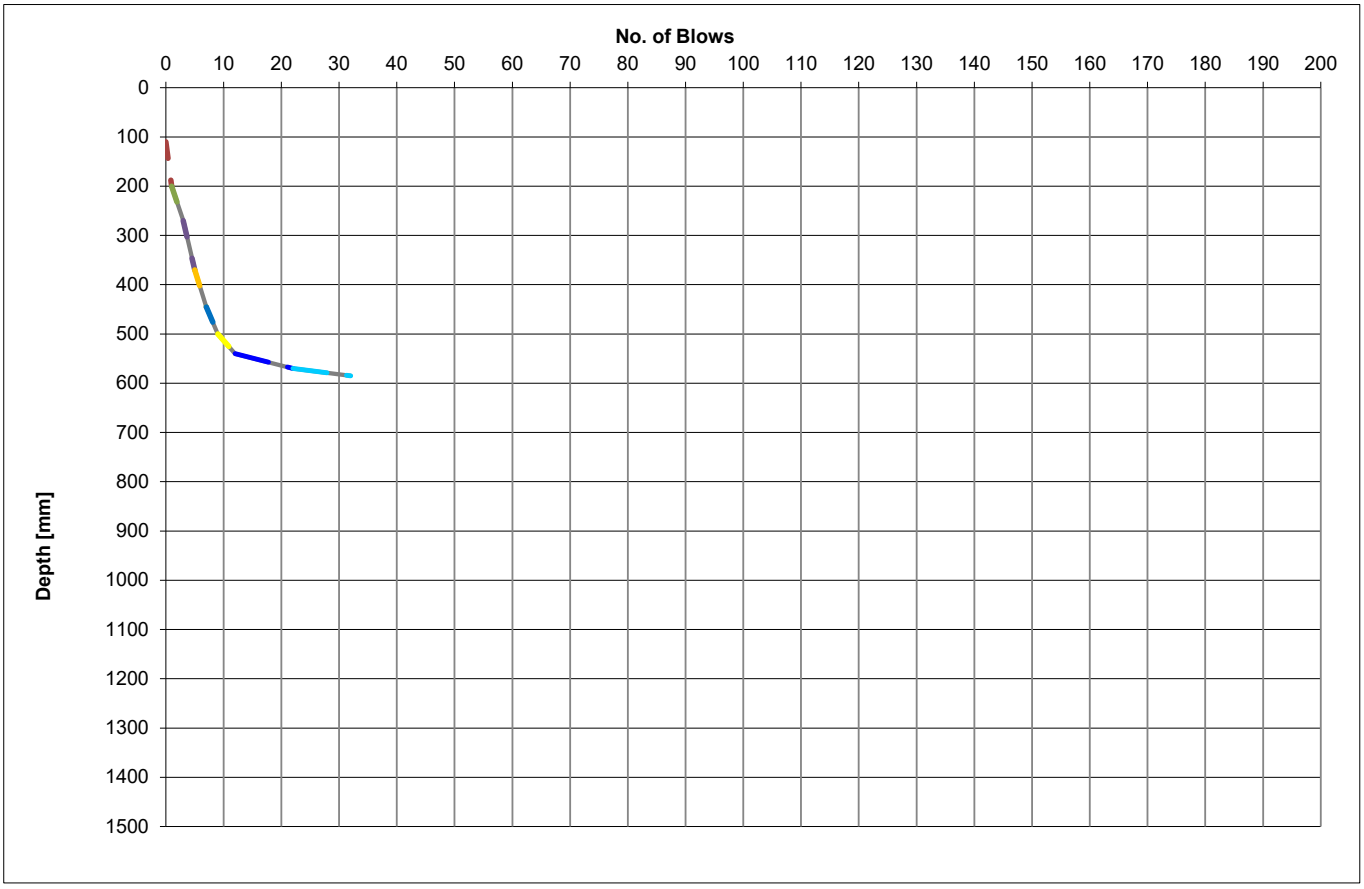
Method: CS 229- Data for pavement assessment Section 6 (Mar 2020)

Formula: Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Location CBR 01 - Spittal, Thurso

Coordinates E: 315898.423 N: 955007.288 Level (m AOD): 101.239

Date 20/02/2024



CBR RESULTS

TEST	Depth m		CBR Value
No	From	To	%
CBR 01	0.11	0.20	2.6
CBR 01	0.20	0.27	7.0
CBR 01	0.27	0.37	4.8
CBR 01	0.37	0.45	6.6
CBR 01	0.45	0.50	9.1
CBR 01	0.50	0.54	19.5
CBR 01	0.54	0.57	94.6
CBR 01	0.57	0.59	196.7

CBR Data Interpretation

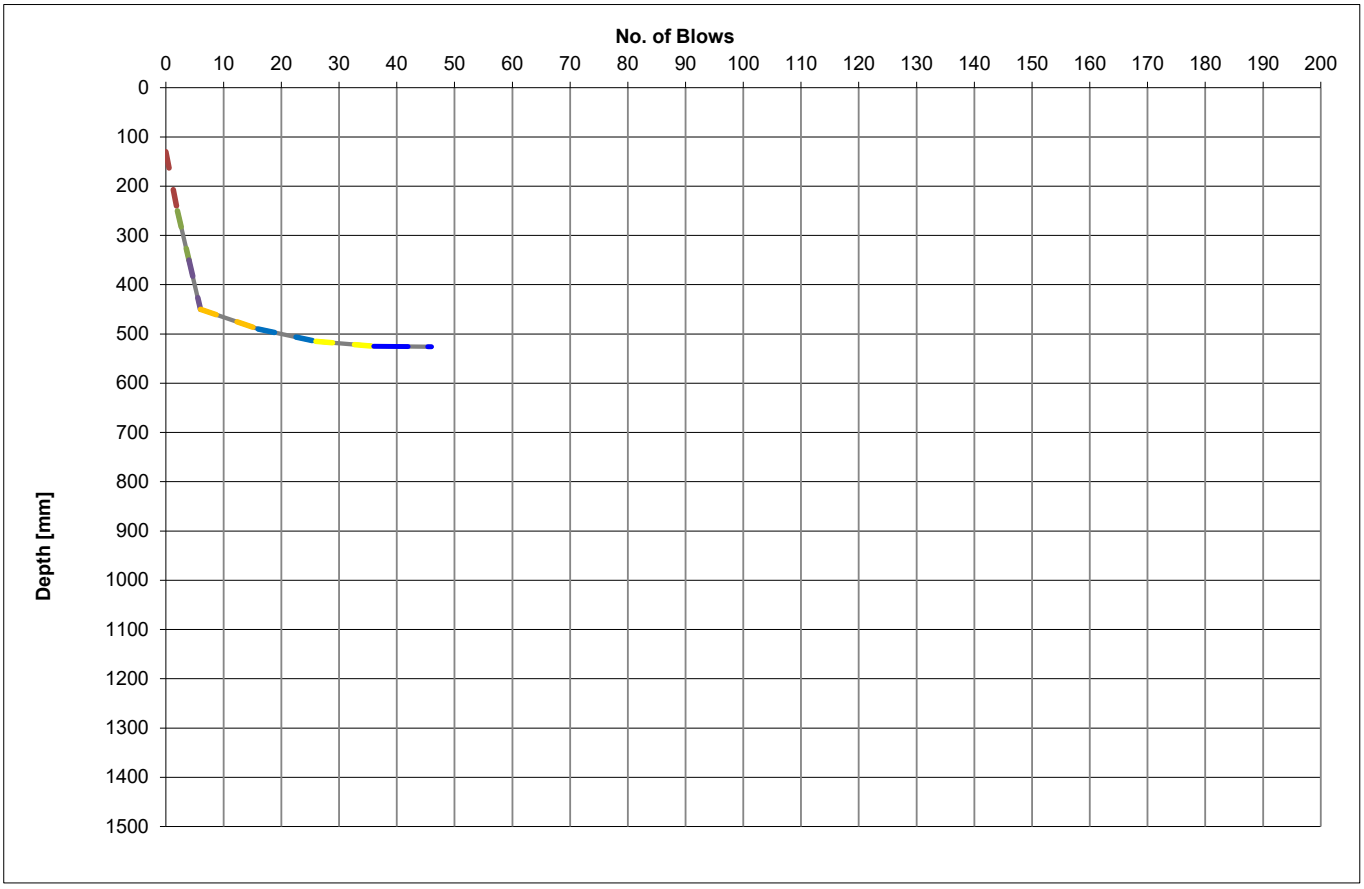
Method: CS 229- Data for pavement assessment Section 6 (Mar 2020)

Formula: Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Location CBR 1A - Spittal, Thurso

Coordinates E: 315897.196 N: 955006.905 Level (m AOD): 101.271

Date 20/02/2024



CBR RESULTS

TEST	Depth m		CBR Value
No	From	To	%
CBR 01A	0.13	0.25	4.0
CBR 01A	0.25	0.35	4.8
CBR 01A	0.35	0.45	4.8
CBR 01A	0.45	0.49	69.8
CBR 01A	0.49	0.52	114.7
CBR 01A	0.52	0.53	302.0
CBR 01A	0.53	0.53	3443.5

CBR Data Interpretation

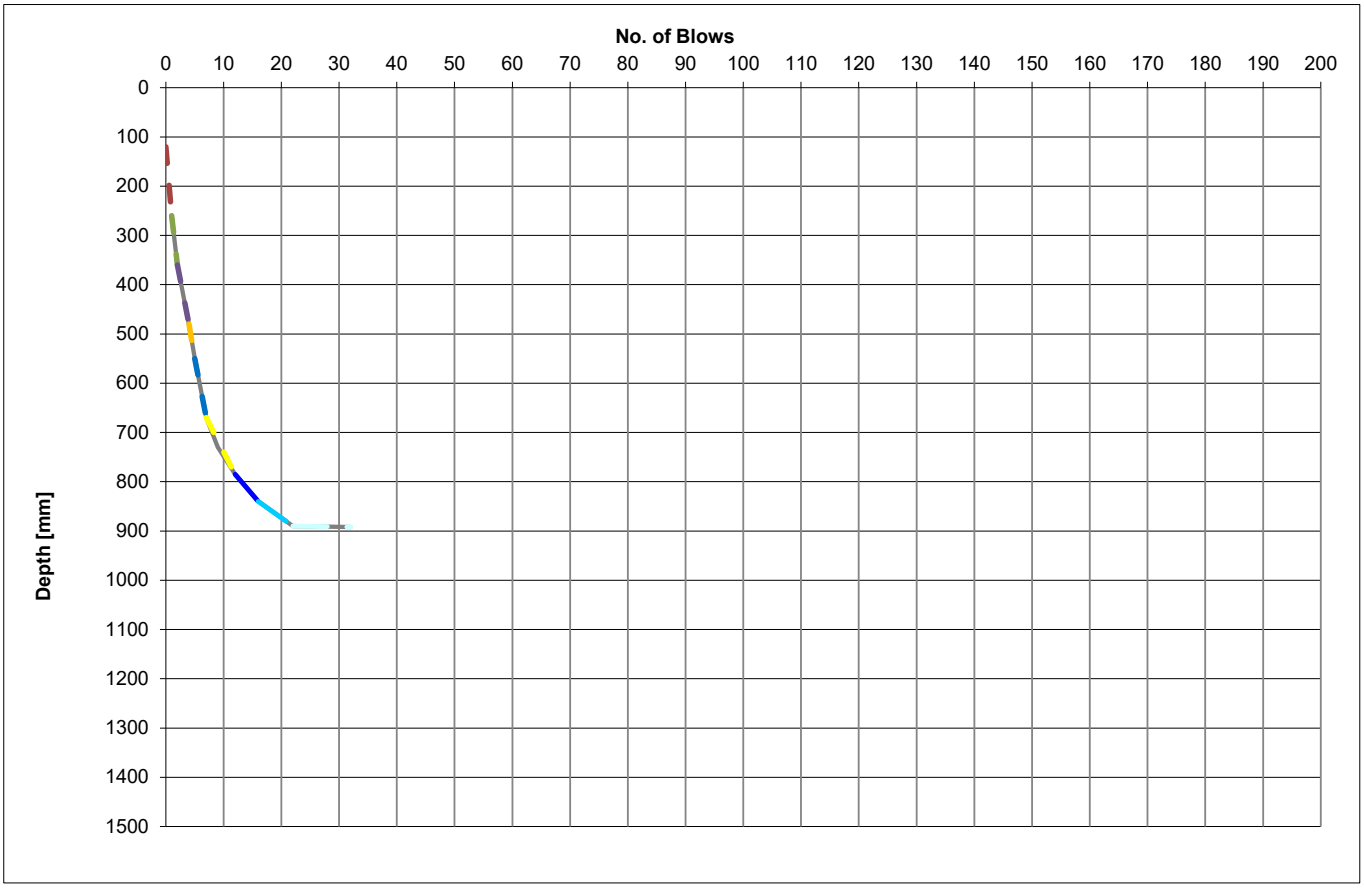
Method: CS 229- Data for pavement assessment Section 6 (Mar 2020)

Formula: Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Location CBR 02 - Spittal, Thurso

Coordinates E: 315984.544 N: 955057.011 Level (m AOD): 105.248

Date 20/02/2024



CBR RESULTS

TEST	Depth m		CBR Value
No	From	To	%
CBR 02	0.12	0.26	1.6
CBR 02	0.26	0.36	2.3
CBR 02	0.36	0.48	4.0
CBR 02	0.48	0.55	3.4
CBR 02	0.55	0.67	4.0
CBR 02	0.67	0.79	11.0
CBR 02	0.79	0.84	18.9
CBR 02	0.84	0.89	32.1
CBR 02	0.89	0.89	1655.1

CBR Data Interpretation

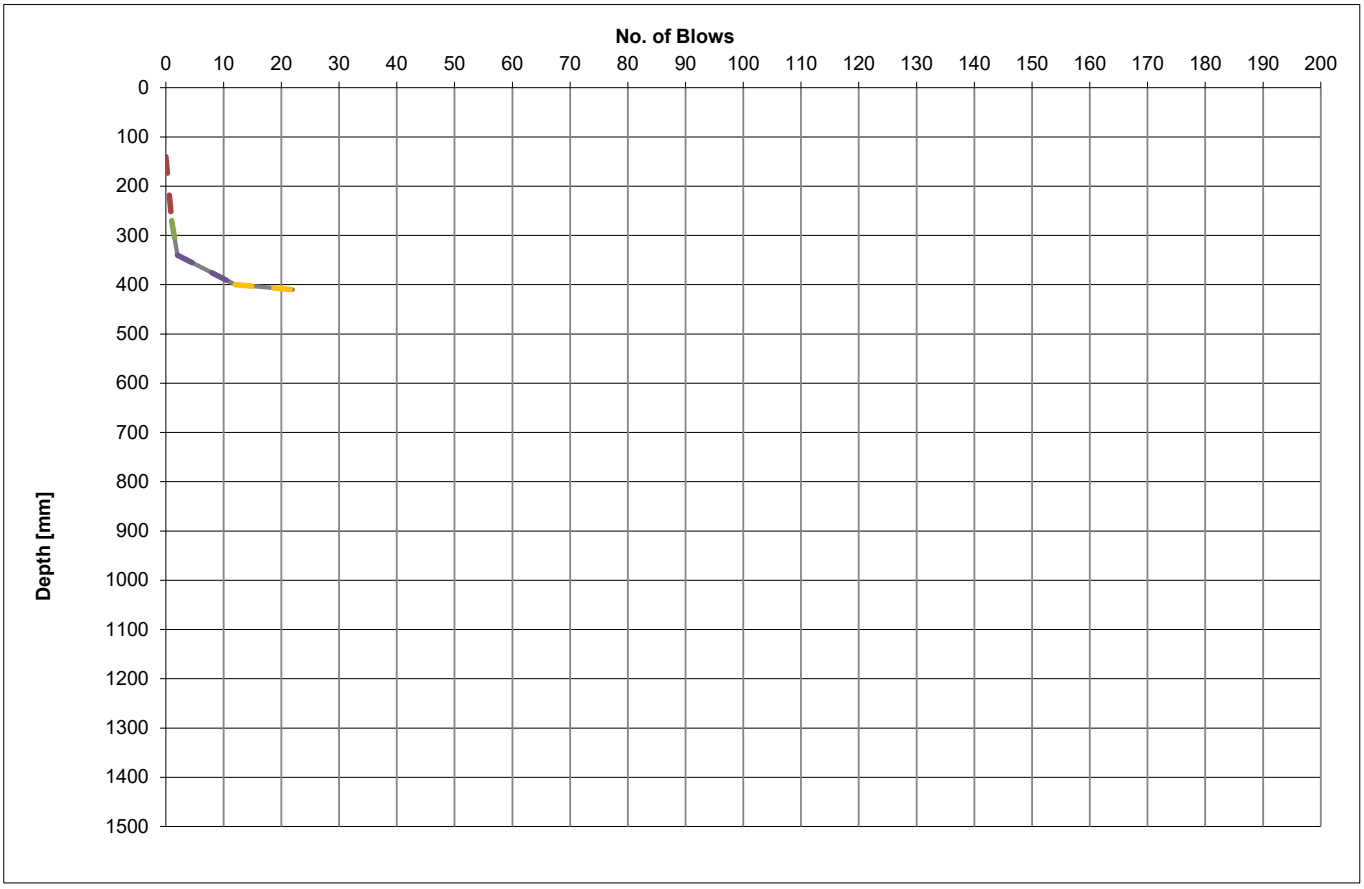
Method: CS 229- Data for pavement assessment Section 6 (Mar 2020)

Formula: Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Location CBR 03 - Spittal, Thurso

Coordinates E: 315921.579 N: 955325.259 Level (m AOD): 108.142

Date 20/02/2024



CBR RESULTS

TEST	Depth m		CBR Value
No	From	To	%
CBR 03	0.14	0.27	1.8
CBR 03	0.27	0.34	3.4
CBR 03	0.34	0.40	45.4
CBR 03	0.40	0.41	302.0

CBR Data Interpretation

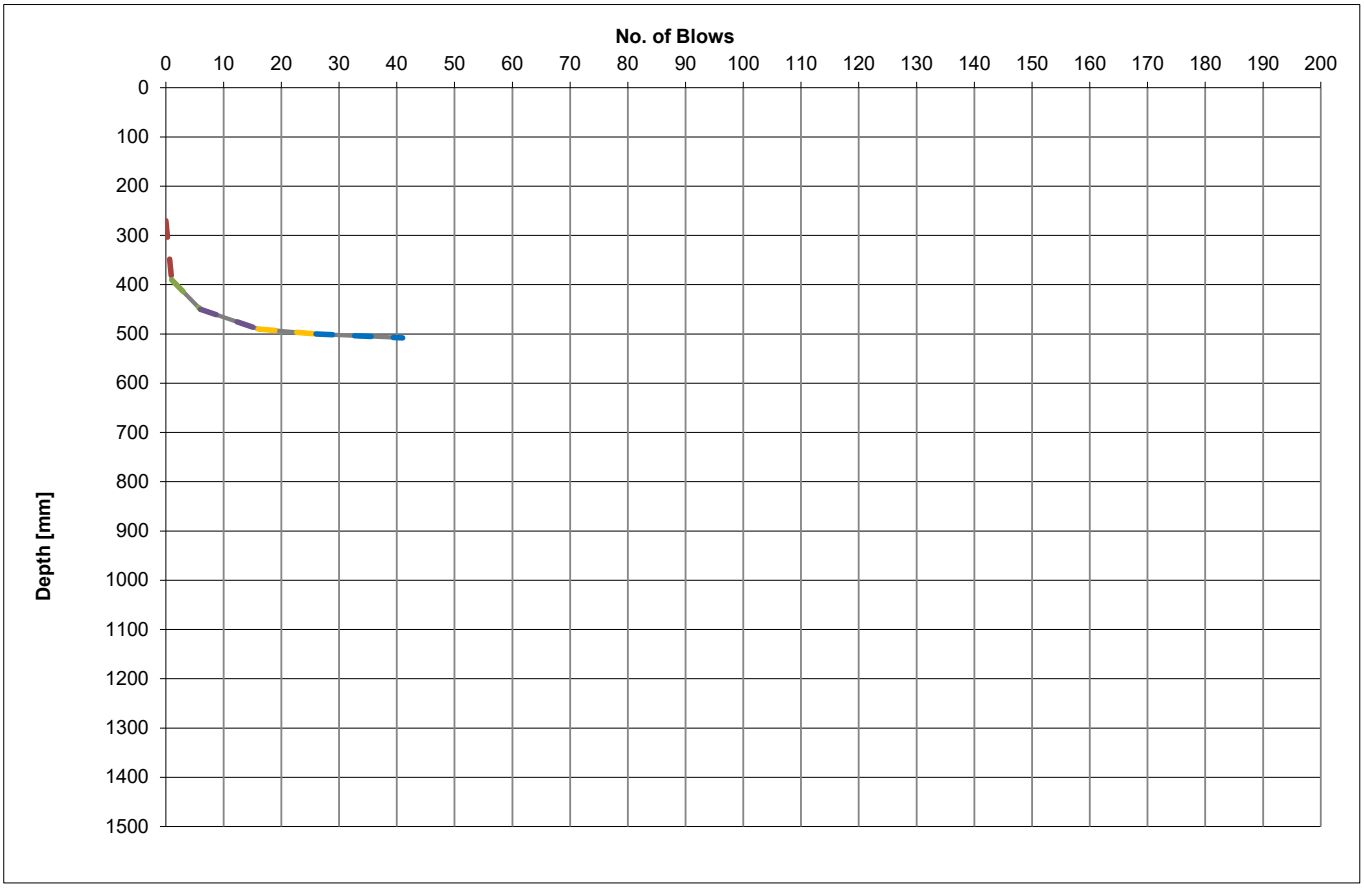
Method: CS 229- Data for pavement assessment Section 6 (Mar 2020)

Formula: Log10(CBR)=2.48 - 1.057 Log10(mm/blow)

Location CBR 03A - Spittal, Thurso

Coordinates E: 315921.987 N: 955324.042 Level (m AOD): 108.118

Date 20/02/2024



CBR RESULTS

TEST	Depth m		CBR Value
No	From	To	%
CBR 03A	0.27	0.39	1.9
CBR 03A	0.39	0.45	21.8
CBR 03A	0.45	0.49	69.8
CBR 03A	0.49	0.50	302.0
CBR 03A	0.50	0.51	586.9

Certificate of Analysis

Certificate Number	24-04770	*Issued:*	12-Mar-24

Client Curtins Consulting
29 St Vincent Place
Glasgow
G1 2DT

Our Reference	24-04770
Client Reference ~	(not supplied)
Order No ~	(not supplied)
Contract Title ~	Spittal
Description	14 Soil samples.
Date Received	06-Mar-24
Date Started	06-Mar-24
Date Completed	12-Mar-24
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By [redacted]
Kirk Bridgewood
General Manager

2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

	Lab No	2308406	2308407	2308408	2308409	2308410	2308411
	Sample ID ~	TP04	TP06	TP13	TP12	TP11	TP14
	Depth ~	0.10	0.50	0.20	0.10	0.50	0.50
	Other ID ~						
	Sample Type ~	ES	ES	ES	ES	ES	ES
	Sampling Date ~	20/02/2024	20/02/2024	20/02/2024	20/02/2024	21/02/2024	21/02/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Arsenic	DETSC 2301#	0.2	mg/kg	33	35	27	16	13	10
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.6	< 0.2	0.6	< 0.2	0.3	< 0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.5	0.6	0.6	0.6	0.3
Chromium	DETSC 2301#	0.15	mg/kg	50	56	43	49	53	48
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	35	56	35	72	81	48
Lead	DETSC 2301#	0.3	mg/kg	170	43	260	420	71	54
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l		< 10				< 10
Mercury	DETSC 2325#	0.05	mg/kg	0.09	< 0.05	0.06	< 0.05	0.14	< 0.05
Nickel	DETSC 2301#	1	mg/kg	29	42	26	46	53	48
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	150	160	180	180	160	180
Inorganics									
pH	DETSC 2008#		pH	6.0	6.7	6.0	6.5	5.9	6.7
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.5	< 0.1	0.3	< 0.1	0.2	< 0.1
Organic matter	DETSC 2002#	0.1	%	5.0	0.8	3.4	0.7	3.2	0.5
Ammonia Aqueous Extract as N	DETSC 2119*	10	mg/l		< 10				< 10
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l		4.8				4.6
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l		12				< 1.0
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	13	< 10	12	< 10	< 10	< 10
Sulphur as S, Total	DETSC 2320	0.01	%		< 0.01				< 0.01
Sulphate as SO4, Total	DETSC 2321#	0.01	%		0.02				0.01
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	0.02	< 0.01	< 0.01	0.02	0.02	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Results and Sample details provided by client and DETS do not the validity of the results: * -not accredited. - # - MCERTS (accreditation only applies if report carries the MCERTS logo).

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

	Lab No	2308406	2308407	2308408	2308409	2308410	2308411
	Sample ID ~	TP04	TP06	TP13	TP12	TP11	TP14
	Depth ~	0.10	0.50	0.20	0.10	0.50	0.50
	Other ID ~						
	Sample Type ~	ES	ES	ES	ES	ES	ES
	Sampling Date ~	20/02/2024	20/02/2024	20/02/2024	20/02/2024	21/02/2024	21/02/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	0.5	< 0.3	< 0.3	< 0.3

Key: ~ Sample details provided by client and can affect the validity of the results: * -not accredited.: # -MCERTS (accreditation only applies if report carries the MCERTS logo).

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

	Lab No	2308412	2308413	2308414	2308415	2308416	2308417
	Sample ID ~	TP16	TP17	TP08	TP07	TP19	TP20
	Depth ~	0.10	0.10	0.50	0.10	0.50	0.50
	Other ID ~						
	Sample Type ~	ES	ES	ES	ES	ES	ES
	Sampling Date ~	21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
	Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Arsenic	DETSC 2301#	0.2	mg/kg	25	34	19	36	14	26
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.5	0.5	0.3	0.4	0.2	0.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.5	0.6	0.4	0.2	0.4
Chromium	DETSC 2301#	0.15	mg/kg	40	40	47	46	51	41
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	37	40	60	32	45	70
Lead	DETSC 2301#	0.3	mg/kg	130	150	45	55	33	59
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l			< 10		< 10	
Mercury	DETSC 2325#	0.05	mg/kg	0.06	< 0.05	0.10	< 0.05	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	26	32	42	31	40	45
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	160	150	140	130	180	150
Inorganics									
pH	DETSC 2008#		pH	5.6	5.8	6.2	6.0	6.8	6.6
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.5	0.5	< 0.1	0.5	< 0.1	0.1
Organic matter	DETSC 2002#	0.1	%	3.9	3.7	1.4	4.1	0.8	1.2
Ammonia Aqueous Extract as N	DETSC 2119*	10	mg/l			< 10		< 10	
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l			5.9		5.2	
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l			< 1.0		< 1.0	
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	13	13	19	11	13	13
Sulphur as S, Total	DETSC 2320	0.01	%			0.03		0.02	
Sulphate as SO4, Total	DETSC 2321#	0.01	%			0.06		0.03	
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	170	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	37	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	210	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	19	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	24	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	43	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	250	< 10	< 10	< 10	< 10	< 10
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Test Sample details provided by client and DETS cannot the validity of the results: * -not accredited. # MCERTS (accreditation only applies if report carries the MCERTS logo).

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

				Lab No	2308412	2308413	2308414	2308415	2308416	2308417
				Sample ID ~	TP16	TP17	TP08	TP07	TP19	TP20
				Depth ~	0.10	0.10	0.50	0.10	0.50	0.50
				Other ID ~						
				Sample Type ~	ES	ES	ES	ES	ES	ES
				Sampling Date ~	21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024	21/02/2024
				Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Acenaphthylene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg		0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg		< 1.6	< 1.7	< 1.6	< 1.6	< 1.6	< 1.6
Phenols										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg		< 0.3	< 0.3	0.3	0.5	< 0.3	< 0.3

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

	Lab No	2308418	2308419
	Sample ID ~	TP23	TP02
	Depth ~	0.50	0.40
	Other ID ~		
	Sample Type ~	ES	ES
	Sampling Date ~	21/02/2024	21/02/2024
	Sampling Time ~	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	29	23
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	< 0.2	0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.1
Chromium	DETSC 2301#	0.15	mg/kg	41	46
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	86	33
Lead	DETSC 2301#	0.3	mg/kg	64	37
Magnesium Aqueous Extract (2:1)	DETSC 2076*	10	mg/l		
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	59	37
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	190	160
Inorganics					
pH	DETSC 2008#		pH	7.3	6.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	0.2
Organic matter	DETSC 2002#	0.1	%	0.3	0.8
Ammonia Aqueous Extract as N	DETSC 2119*	10	mg/l		
Chloride Aqueous Extract (2:1)	DETSC 2055	1	mg/l		
Nitrate Aqueous Extract as NO3 (2:1)	DETSC 2055	1	mg/l		
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	23	11
Sulphur as S, Total	DETSC 2320	0.01	%		
Sulphate as SO4, Total	DETSC 2321#	0.01	%		
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
TPH Ali/Aro Total C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	0.2

Results and Sample details provided by client and DETS do not the validity of the results: * -not accredited.: #-MCERTS (accreditation only applies if report carries the MCERTS logo).

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

	Lab No	2308418	2308419
	Sample ID ~	TP23	TP02
	Depth ~	0.50	0.40
	Other ID ~		
	Sample Type ~	ES	ES
	Sampling Date ~	21/02/2024	21/02/2024
	Sampling Time ~	n/s	n/s

Test	Method	LOD	Units		
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.1
Pyrene	DETSC 3301	0.1	mg/kg	0.2	0.1
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
PAH 16 Total	DETSC 3301	1.6	mg/kg	< 1.7	< 1.7
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3

Key: ~ Sample details provided by client and can affect the validity of the results: * -not accredited.: # -MCERTS (accreditation only applies if report carries the MCERTS logo).

: n/s -not

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2308406	TP04 0.10	SOIL	NAD	none	Ben Rose
2308407	TP06 0.50	SOIL	NAD	none	Ben Rose
2308408	TP13 0.20	SOIL	NAD	none	Ben Rose
2308409	TP12 0.10	SOIL	NAD	none	Ben Rose
2308410	TP11 0.50	SOIL	NAD	none	Ben Rose
2308411	TP14 0.50	SOIL	NAD	none	Ben Rose
2308412	TP16 0.10	SOIL	NAD	none	Ben Rose
2308413	TP17 0.10	SOIL	NAD	none	Ben Rose
2308414	TP08 0.50	SOIL	NAD	none	Ben Rose
2308415	TP07 0.10	SOIL	NAD	none	Ben Rose
2308416	TP19 0.50	SOIL	NAD	none	Ben Rose
2308417	TP20 0.50	SOIL	NAD	none	Ben Rose
2308418	TP23 0.50	SOIL	NAD	none	Ben Rose
2308419	TP02 0.40	SOIL	NAD	none	Ben Rose

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Chemical Analysis
Threshold Breaches

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

Job	Lab No	Sample ID	Depth	Other ID	Test	Result	Threshold Upper	Threshold Lower	Threshold	SOM Result	SOM1/ SOM6
24-04770	2308406	TP04	0.10		pH	5.96	8	6	CURTINS4 Residential without Home Grown Produce end	4.9563	SOM1
24-04770	2308408	TP13	0.20		pH	5.95	8	6	CURTINS4 Residential without Home Grown Produce end	3.3844	SOM1
24-04770	2308410	TP11	0.50		pH	5.88	8	6	CURTINS4 Residential without Home Grown Produce end	3.1753	SOM1
24-04770	2308412	TP16	0.10		pH	5.64	8	6	CURTINS4 Residential without Home Grown Produce end	3.9361	SOM1
24-04770	2308413	TP17	0.10		pH	5.82	8	6	CURTINS4 Residential without Home Grown Produce end	3.7204	SOM1
24-04770	2308415	TP07	0.10		Arsenic	35.84	35	-9999	CURTINS4 Residential without Home Grown Produce end	4.0683	SOM1
24-04770	2308406	TP04	0.10		pH	5.96	8	6	CURTINS5 Open Space end use	4.9563	SOM1
24-04770	2308408	TP13	0.20		pH	5.95	8	6	CURTINS5 Open Space end use	3.3844	SOM1
24-04770	2308410	TP11	0.50		pH	5.88	8	6	CURTINS5 Open Space end use	3.1753	SOM1
24-04770	2308412	TP16	0.10		pH	5.64	8	6	CURTINS5 Open Space end use	3.9361	SOM1
24-04770	2308413	TP17	0.10		pH	5.82	8	6	CURTINS5 Open Space end use	3.7204	SOM1
24-04770	2308406	TP04	0.10		pH	5.96	8	6	CURTINS6 Parks end use	4.9563	SOM1
24-04770	2308408	TP13	0.20		pH	5.95	8	6	CURTINS6 Parks end use	3.3844	SOM1
24-04770	2308410	TP11	0.50		pH	5.88	8	6	CURTINS6 Parks end use	3.1753	SOM1
24-04770	2308412	TP16	0.10		pH	5.64	8	6	CURTINS6 Parks end use	3.9361	SOM1
24-04770	2308413	TP17	0.10		pH	5.82	8	6	CURTINS6 Parks end use	3.7204	SOM1
24-04770	2308406	TP04	0.10		pH	5.96	8	6	CURTINS7 Commercial end use	4.9563	SOM1
24-04770	2308408	TP13	0.20		pH	5.95	8	6	CURTINS7 Commercial end use	3.3844	SOM1
24-04770	2308410	TP11	0.50		pH	5.88	8	6	CURTINS7 Commercial end use	3.1753	SOM1
24-04770	2308412	TP16	0.10		pH	5.64	8	6	CURTINS7 Commercial end use	3.9361	SOM1
24-04770	2308413	TP17	0.10		pH	5.82	8	6	CURTINS7 Commercial end use	3.7204	SOM1
24-04770	2308406	TP04	0.10		Arsenic	32.64	32	-9999	CURTINS8 Residential with consumption of Produce end u	4.9563	SOM1
24-04770	2308406	TP04	0.10		pH	5.96	8	6	CURTINS8 Residential with consumption of Produce end u	4.9563	SOM1
24-04770	2308407	TP06	0.50		Arsenic	34.63	32	-9999	CURTINS8 Residential with consumption of Produce end u	0.8469	SOM1
24-04770	2308408	TP13	0.20		pH	5.95	8	6	CURTINS8 Residential with consumption of Produce end u	3.3844	SOM1
24-04770	2308410	TP11	0.50		pH	5.88	8	6	CURTINS8 Residential with consumption of Produce end u	3.1753	SOM1
24-04770	2308412	TP16	0.10		pH	5.64	8	6	CURTINS8 Residential with consumption of Produce end u	3.9361	SOM1

Key: ~ Sample details provided by client and can affect the validity of the results

Summary of Chemical Analysis
Threshold Breaches

Our Ref 24-04770
Client Ref ~
Contract Title ~ Spittal

Job	Lab No	Sample ID	Depth	Other ID	Test	Result	Threshold Upper	Threshold Lower	Threshold	SOM Result	SOM1/ SOM6
24-04770	2308413	TP17	0.10		Arsenic	34.05	32	-9999	CURTINS8 Residential with consumption of Produce end u	3.7204	SOM1
24-04770	2308413	TP17	0.10		pH	5.82	8	6	CURTINS8 Residential with consumption of Produce end u	3.7204	SOM1
24-04770	2308415	TP07	0.10		Arsenic	35.84	32	-9999	CURTINS8 Residential with consumption of Produce end u	4.0683	SOM1

Key: ~ Sample details provided by client and can affect the validity of the results

Information in Support of the Analytical Results

Our Ref 24-04770
Client Ref ~
Contract ~ Spittal

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2308406	TP04 0.10 SOIL	20/02/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX / C5-C10 (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
2308407	TP06 0.50 SOIL	20/02/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), Ammonia Aqueous Extract (3 days), BTEX / C5-C10 (14 days), Total Sulphur ICP (7 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono	
2308408	TP13 0.20 SOIL	20/02/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX / C5-C10 (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
2308409	TP12 0.10 SOIL	20/02/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (14 days), BTEX / C5-C10 (14 days), Naphthalene (14 days), PAH FID (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
2308410	TP11 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308411	TP14 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	Ammonia Aqueous Extract (3 days), Total Sulphur ICP (7 days), pH + Conductivity (7 days)	
2308412	TP16 0.10 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308413	TP17 0.10 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308414	TP08 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	Ammonia Aqueous Extract (3 days), Total Sulphur ICP (7 days), pH + Conductivity (7 days)	
2308415	TP07 0.10 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308416	TP19 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	Ammonia Aqueous Extract (3 days), Total Sulphur ICP (7 days), pH + Conductivity (7 days)	
2308417	TP20 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308418	TP23 0.50 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2308419	TP02 0.40 SOIL	21/02/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

LABORATORY TEST CERTIFICATE

MATtest Limited
materials testing & consultancy

10 Queenslie Point
Queenslie Industrial Estate
120 Stepps Road
Glasgow
G33 3NQ

Tel: 0141 774 4032

email: info@mattest.org
Website: www.mattest.org

Certificate No : **24/305 - 01-1**

To : **Mark Lane**

Client : **Curtins Ltd.**
1a Belford Road
Edinburgh
EH4 3BL

LABORATORY TESTING OF SOIL

Introduction

We refer to samples taken from Spittal and delivered to our laboratory on 12th March 2024.

Material & Source

Sample Reference	:	See Report Plates
Sampled By	:	Client
Sampling Certificate	:	Not Supplied
Location	:	See Report Plates
Description	:	See Page 2
Date Sampled	:	Not Supplied
Date Tested	:	12th March 2024 Onwards
Source	:	085447 - Spittal

Test Results

As Detailed On Page 2 to Page 27 inclusive

Comments

The results contained in this report relate to the sample(s) as received
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate

Remarks

[redacted]

Date 02/04/2024

T McLelland (Director)

UKAS TESTING
2643

TRIAL PIT	SAMPLE	DEPTH (m)	SAMPLE DESCRIPTION
TP01	B	0.30	Brown very gravelly very sandy very silty CLAY with cobbles. Gravel is fine to coarse.
TP02	B	0.40	Brown slightly gravelly very sandy very silty CLAY with cobbles. Gravel is fine to coarse.
TP04	B	0.50	Brown gravelly very sandy very silty CLAY with highly weathered mudstone fragments. Gravel is fine to coarse.
TP05	B	0.30	Brown slightly gravelly slightly clayey sandy SILT. Gravel is fine to coarse.
TP06	B	0.50	Brown gravelly sandy silty CLAY. Gravel is fine to coarse.
TP08	B	0.50	Brown slightly gravelly very sandy clayey SILT with cobbles. Gravel is fine to coarse.
TP09	B	0.60	Brown slightly clayey slightly silty fine to coarse CRUSHED ROCK.
TP10	B	0.50	Brown very gravelly sandy silty CLAY with black staining. Gravel is fine to coarse.
TP11	B	0.70	Brown sandy silty clayey fine to coarse CRUSHED ROCK / highly weathered MUDSTONE.
TP12	B	0.50	Brown very gravelly very sandy very silty CLAY with cobbles. Gravel is fine to coarse.
TP13	B	0.75	Brown slightly clayey silty fine to coarse CRUSHED ROCK with cobbles.
TP14	B	1.00	Brown very gravelly very sandy very silty CLAY with cobbles. Gravel is fine to coarse.
TP15	B	0.40	Brown gravelly slightly sandy slightly silty CLAY. Gravel is fine to coarse.
TP16	B	0.50	Brown very gravelly very sandy very silty CLAY with sandstone fragments. Gravel is fine to coarse.
TP19	B	0.50	Brown slightly gravelly very clayey very sandy SILT. Gravel is fine to medium.
TP20	B	0.50	Brown slightly gravelly sandy clayey SILT. Gravel is fine to coarse.
TP22	B	0.50	Brown gravelly very sandy silty CLAY with cobbles. Gravel is fine to coarse.
TP23	B	0.50	Brown very gravelly slightly silty sandy CLAY. Gravel is fine to coarse.

SUMMARY OF SAMPLE DESCRIPTIONS

TRIAL PIT	SAMPLE	DEPTH (m)	WATER CONTENT (%)
TP01	B	0.30	18.8
TP02	B	0.40	23.7
TP04	B	0.50	24.2
TP06	B	0.50	18.9
TP08	B	0.50	33.0
TP09	B	0.60	16.3
TP11	B	0.70	24.4
TP12	B	0.50	19.4
TP13	B	0.75	16.4
TP14	B	1.00	19.0
TP15	B	0.40	42.9
TP16	B	0.50	21.1
TP19	B	0.50	28.3
TP22	B	0.50	18.4

Tested in accordance with BS 1377 - 2 : 2022 : Clause 4.1

SUMMARY OF WATER CONTENT TEST RESULTS

TRIAL PIT	SAMPLE	DEPTH (m)	WATER CONTENT (%)	BULK DENSITY (Mg/m^3)	DRY DENSITY (Mg/m^3)
TP06	B	0.50	18.9	1.86	1.56
TP09	B	0.60	16.3	1.60	1.38
TP15	B	0.40	42.9	1.79	1.25
TP20	B	0.50	26.1	1.78	1.41
TP22	B	0.50	18.4	1.83	1.55

Tested in accordance with BS 1377 - 2 : 2022 : Clause 8
Bulk Density : Linear Measurement

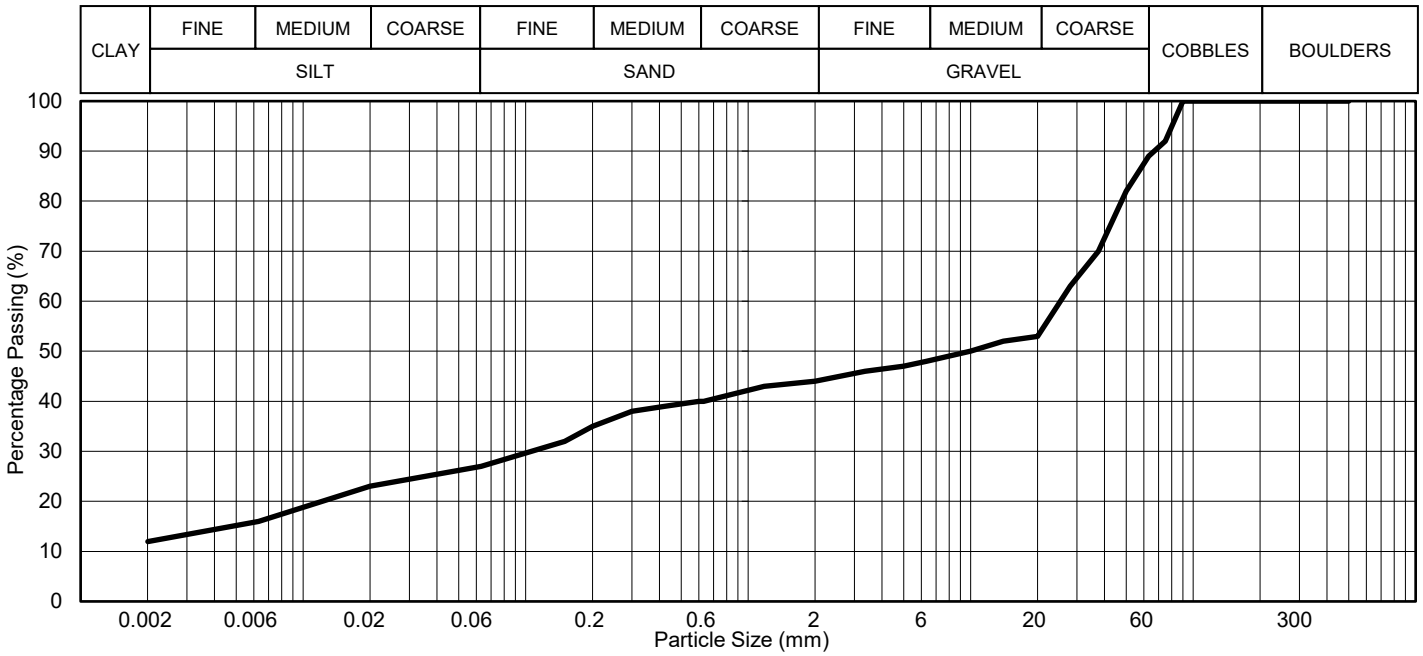
SUMMARY OF WATER CONTENT AND BULK DENSITY TEST RESULTS

TRIAL PIT	SAMPLE	DEPTH (m)	PARTICLE DENSITY (Mg/m³)
TP06	B	0.50	2.61
TP09	B	0.60	2.53
TP15	B	0.40	2.55
TP20	B	0.50	2.57
TP22	B	0.50	2.58

Tested in accordance with BS 1377 - 2 : 2022 : Clause 9.2
(Gas jar method)

SUMMARY OF PARTICLE DENSITY TEST RESULTS

Borehole	TP01
Sample	B
Depth (m)	0.30



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	23
300.0	100	-	-	0.0063	16
125.0	100	-	-	0.0020	12
90.0	100	-	-		
75.0	92	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	89	-	-	-	
50.0	82	-	-		
37.5	70	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	63	-	-		
20.0	53	-	-		
14.0	52	-	-		
10.0	50	-	-	**PERCENTAGE SOIL TYPES**	
6.3	48	-	-		
5.0	47	-	-		
3.350	46	-	-		
2.000	44	-	-		
1.180	43	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	40	-	-		
0.600	40	-	-		
0.425	39	-	-		
0.300	38	-	-		
0.200	35	-	-		
0.150	32	-	-		
0.063	27	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
12	15	17	45	11

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

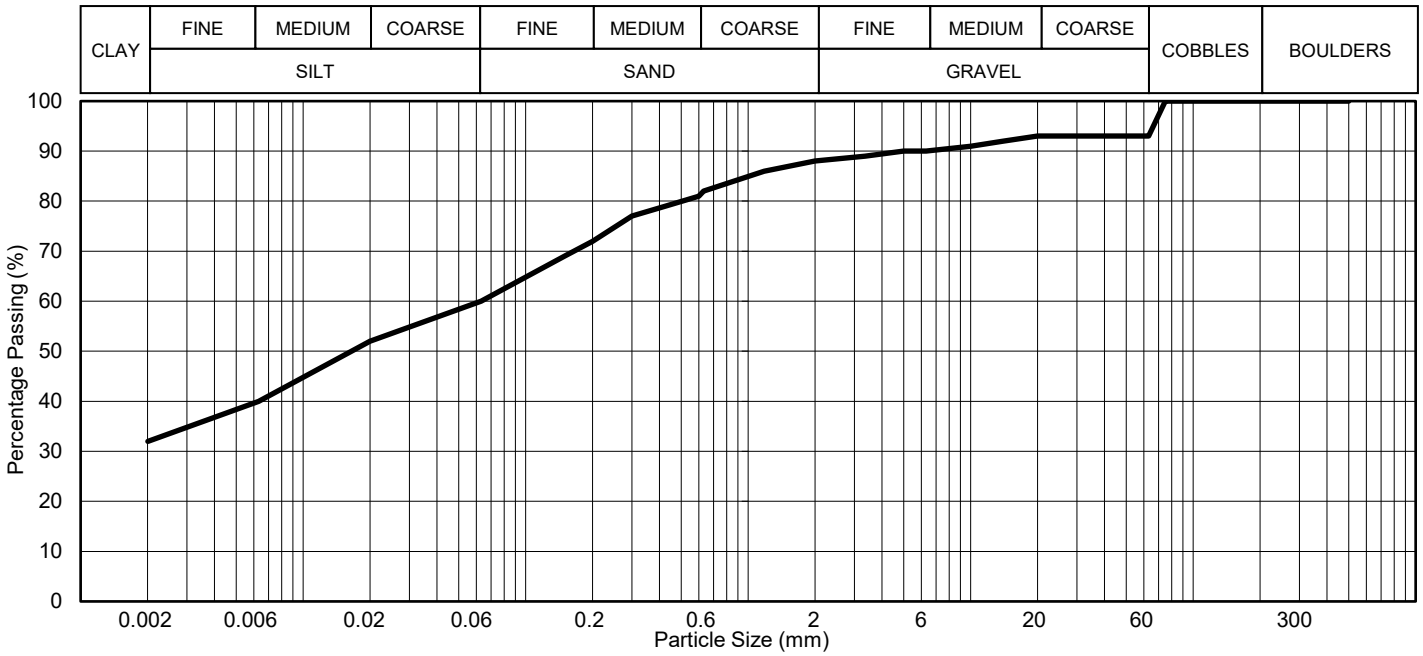
Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

CURTINS LTD.
SPITTAL

MATtest Limited
materials testing & consultancy

Borehole	TP02
Sample	B
Depth (m)	0.40



SIEVING			
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable	
		Lower %	Upper %
500.0	100	-	-
300.0	100	-	-
125.0	100	-	-
90.0	100	-	-
75.0	100	-	-
63.0	93	-	-
50.0	93	-	-
37.5	93	-	-
28.0	93	-	-
20.0	93	-	-
14.0	92	-	-
10.0	91	-	-
6.3	90	-	-
5.0	90	-	-
3.350	89	-	-
2.000	88	-	-
1.180	86	-	-
0.630	82	-	-
0.600	81	-	-
0.425	79	-	-
0.300	77	-	-
0.200	72	-	-
0.150	69	-	-
0.063	60	-	-

SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Particle Size (mm)	Percentage Passing (%)
0.0200	52
0.0063	40
0.0020	32

GRADING CLASSIFICATION (SHW TABLE 6/2)

-

Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.

PERCENTAGE SOIL TYPES

CLAY	SILT Ŧ	SAND	GRAVEL	COBBLES
32	28	28	5	7

UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

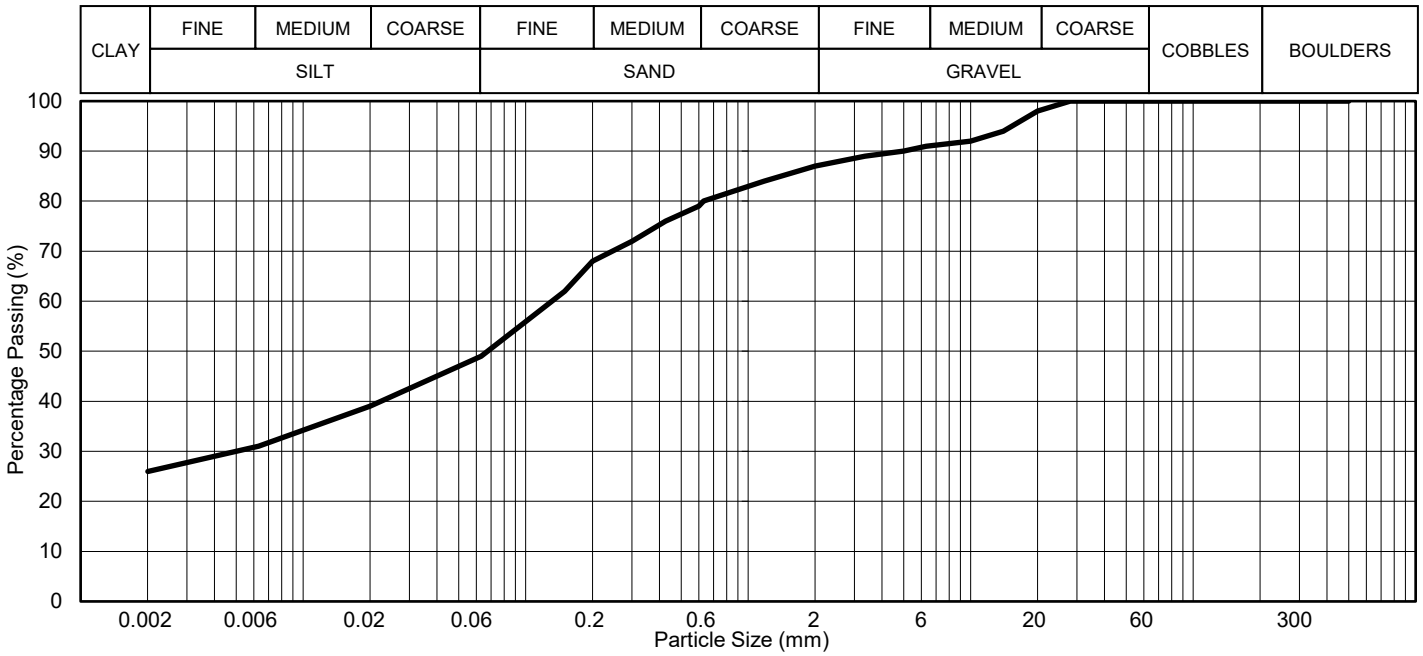
Ŧ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

CURTINS LTD.
SPITTAL

MATtest Limited
materials testing & consultancy

Borehole	TP04
Sample	B
Depth (m)	0.50



SIEVING			
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable	
		Lower %	Upper %
500.0	100	-	-
300.0	100	-	-
125.0	100	-	-
90.0	100	-	-
75.0	100	-	-
63.0	100	-	-
50.0	100	-	-
37.5	100	-	-
28.0	100	-	-
20.0	98	-	-
14.0	94	-	-
10.0	92	-	-
6.3	91	-	-
5.0	90	-	-
3.350	89	-	-
2.000	87	-	-
1.180	84	-	-
0.630	80	-	-
0.600	79	-	-
0.425	76	-	-
0.300	72	-	-
0.200	68	-	-
0.150	62	-	-
0.063	49	-	-

SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Particle Size (mm)	Percentage Passing (%)
0.0200	39
0.0063	31
0.0020	26

GRADING CLASSIFICATION (SHW TABLE 6/2)

-

Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.

PERCENTAGE SOIL TYPES

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
26	23	38	13	0

UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)

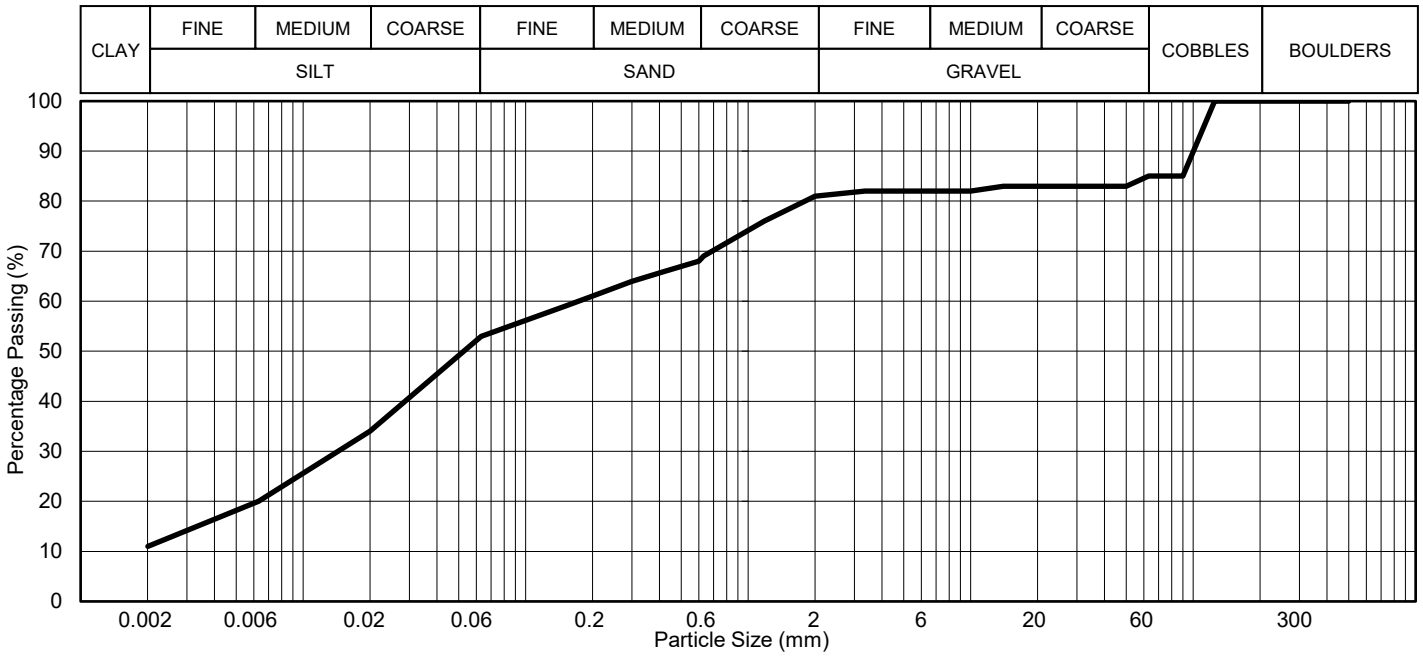
D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP08
Sample	B
Depth (m)	0.50



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	34
300.0	100	-	-	0.0063	20
125.0	100	-	-	0.0020	11
90.0	85	-	-		
75.0	85	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	85	-	-	-	
50.0	83	-	-		
37.5	83	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	83	-	-		
20.0	83	-	-		
14.0	83	-	-		
10.0	82	-	-	**PERCENTAGE SOIL TYPES**	
6.3	82	-	-		
5.0	82	-	-		
3.350	82	-	-		
2.000	81	-	-		
1.180	76	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	69	-	-		
0.600	68	-	-		
0.425	66	-	-		
0.300	64	-	-		
0.200	61	-	-		
0.150	59	-	-		
0.063	53	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
11	42	28	4	15

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

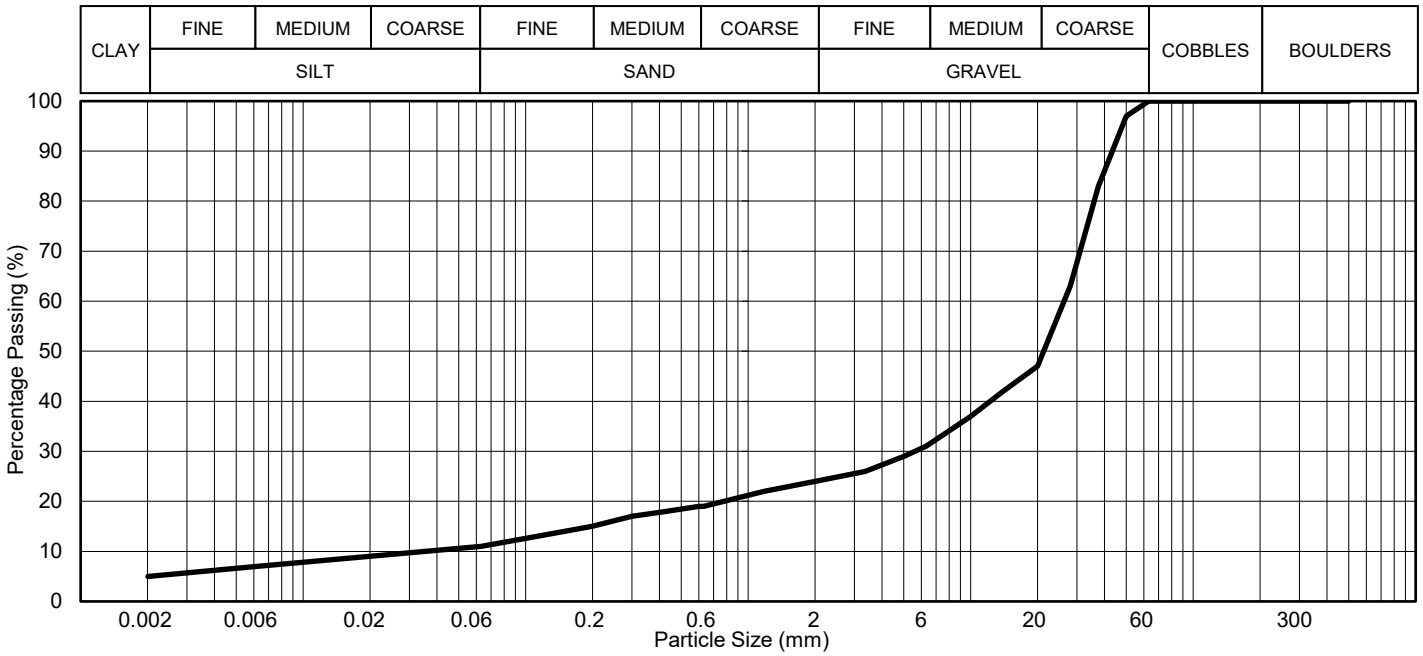
Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP11
Sample	B
Depth (m)	0.70



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	9
300.0	100	-	-	0.0063	7
125.0	100	-	-	0.0020	5
90.0	100	-	-		
75.0	100	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	100	-	-	-	
50.0	97	-	-		
37.5	83	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	63	-	-		
20.0	47	-	-		
14.0	42	-	-		
10.0	37	-	-	**PERCENTAGE SOIL TYPES**	
6.3	31	-	-		
5.0	29	-	-		
3.350	26	-	-		
2.000	24	-	-		
1.180	22	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	19	-	-		
0.600	19	-	-		
0.425	18	-	-		
0.300	17	-	-		
0.200	15	-	-		
0.150	14	-	-		
0.063	11	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
5	6	13	76	0

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

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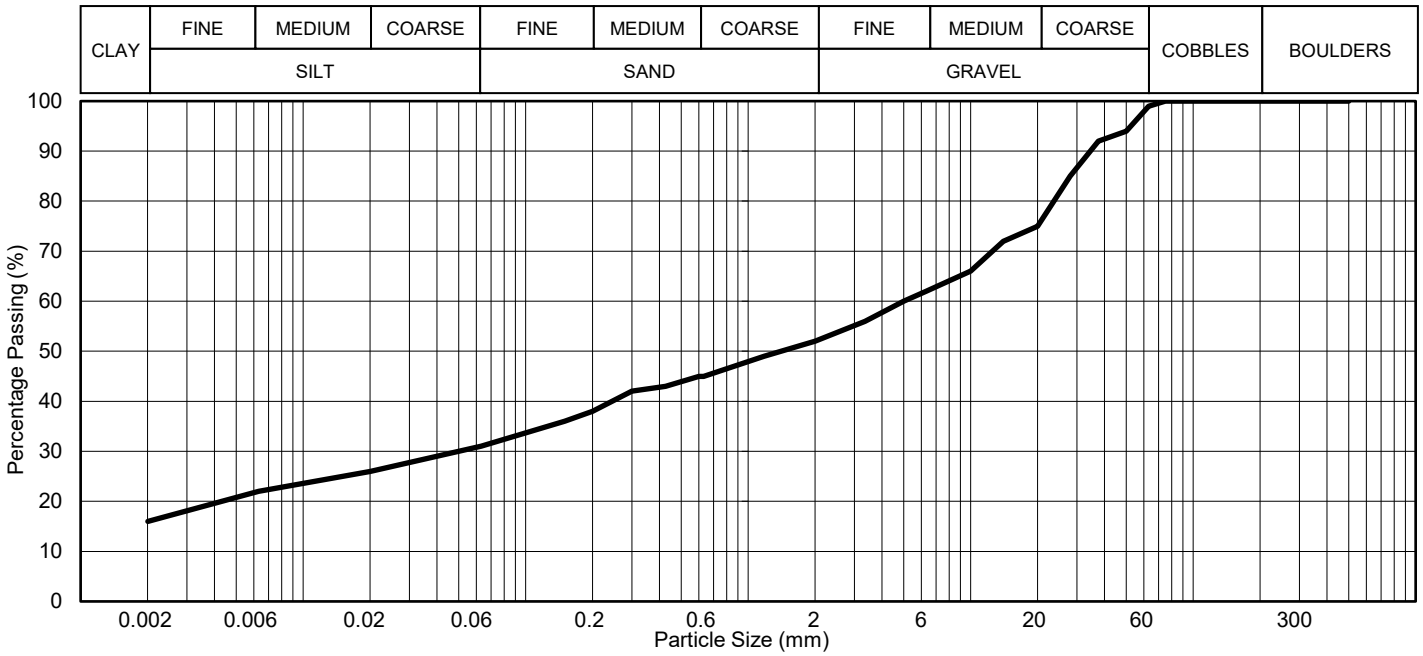
Borehole	TP12
Sample	B
Depth (m)	0.50



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	26
300.0	100	-	-	0.0063	22
125.0	100	-	-	0.0020	16
90.0	100	-	-		
75.0	100	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	99	-	-	-	
50.0	94	-	-		
37.5	92	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	85	-	-		
20.0	75	-	-		
14.0	72	-	-		
10.0	66	-	-	**PERCENTAGE SOIL TYPES**	
6.3	62	-	-		
5.0	60	-	-		
3.350	56	-	-		
2.000	52	-	-		
1.180	49	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	45	-	-		
0.600	45	-	-		
0.425	43	-	-		
0.300	42	-	-		
0.200	38	-	-		
0.150	36	-	-		
0.063	31	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
16	15	21	47	1

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

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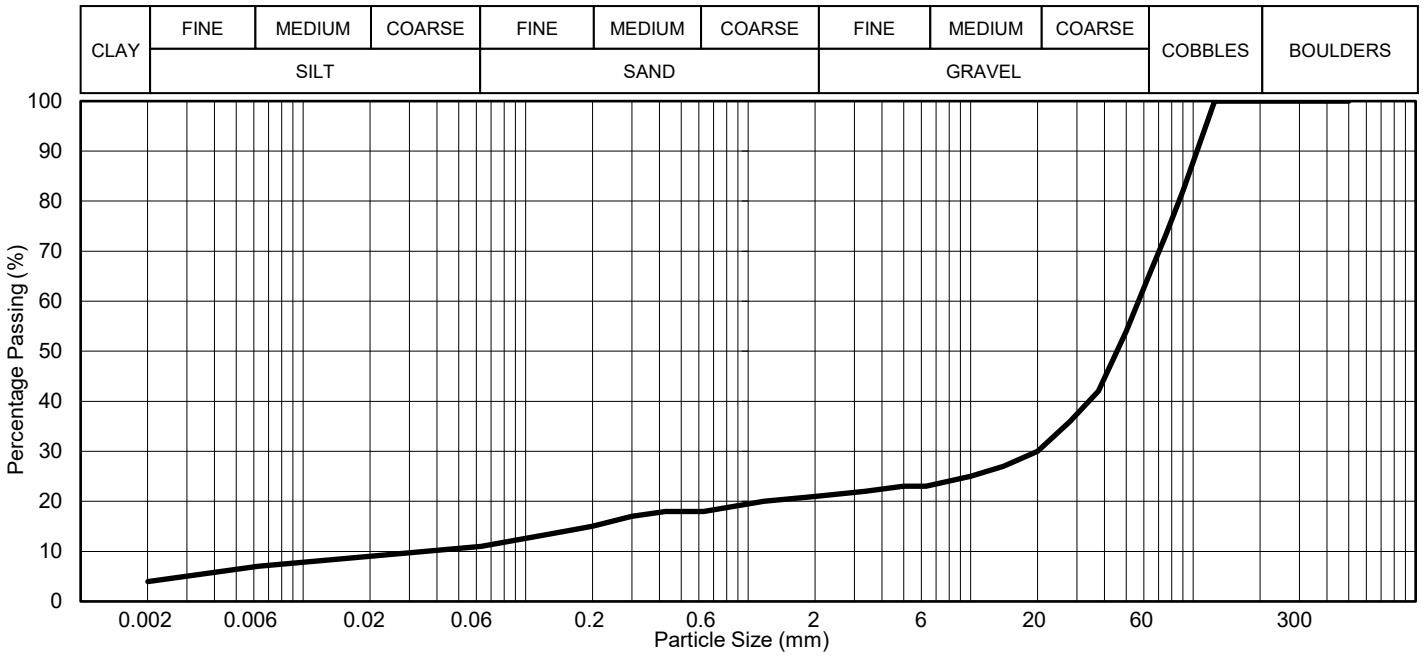
Borehole	TP13
Sample	B
Depth (m)	0.75



SIEVING			
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable	
		Lower %	Upper %
500.0	100	-	-
300.0	100	-	-
125.0	100	-	-
90.0	82	-	-
75.0	73	-	-
63.0	65	-	-
50.0	54	-	-
37.5	42	-	-
28.0	36	-	-
20.0	30	-	-
14.0	27	-	-
10.0	25	-	-
6.3	23	-	-
5.0	23	-	-
3.350	22	-	-
2.000	21	-	-
1.180	20	-	-
0.630	18	-	-
0.600	18	-	-
0.425	18	-	-
0.300	17	-	-
0.200	15	-	-
0.150	14	-	-
0.063	11	-	-

SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Particle Size (mm)	Percentage Passing (%)
0.0200	9
0.0063	7
0.0020	4

GRADING CLASSIFICATION (SHW TABLE 6/2)
-
Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.

PERCENTAGE SOIL TYPES				
CLAY	SILT ₸	SAND	GRAVEL	COBBLES
4	7	10	44	35

UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)		
D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT -		-

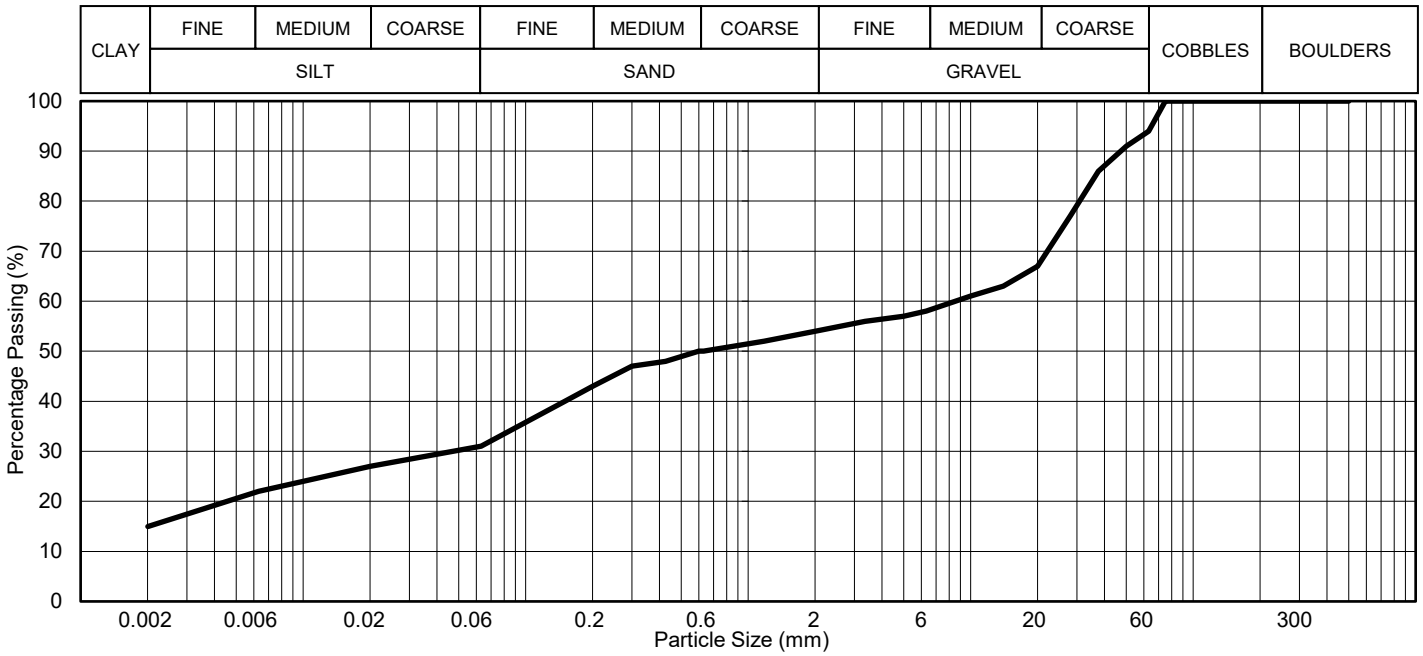
Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP14
Sample	B
Depth (m)	1.00



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	27
300.0	100	-	-	0.0063	22
125.0	100	-	-	0.0020	15
90.0	100	-	-		
75.0	100	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	94	-	-	-	
50.0	91	-	-		
37.5	86	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	77	-	-		
20.0	67	-	-		
14.0	63	-	-		
10.0	61	-	-	**PERCENTAGE SOIL TYPES**	
6.3	58	-	-		
5.0	57	-	-		
3.350	56	-	-		
2.000	54	-	-		
1.180	52	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	50	-	-		
0.600	50	-	-		
0.425	48	-	-		
0.300	47	-	-		
0.200	43	-	-		
0.150	40	-	-		
0.063	31	-	-		

CLAY	SILT Ŧ	SAND	GRAVEL	COBBLES
15	16	23	40	6

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

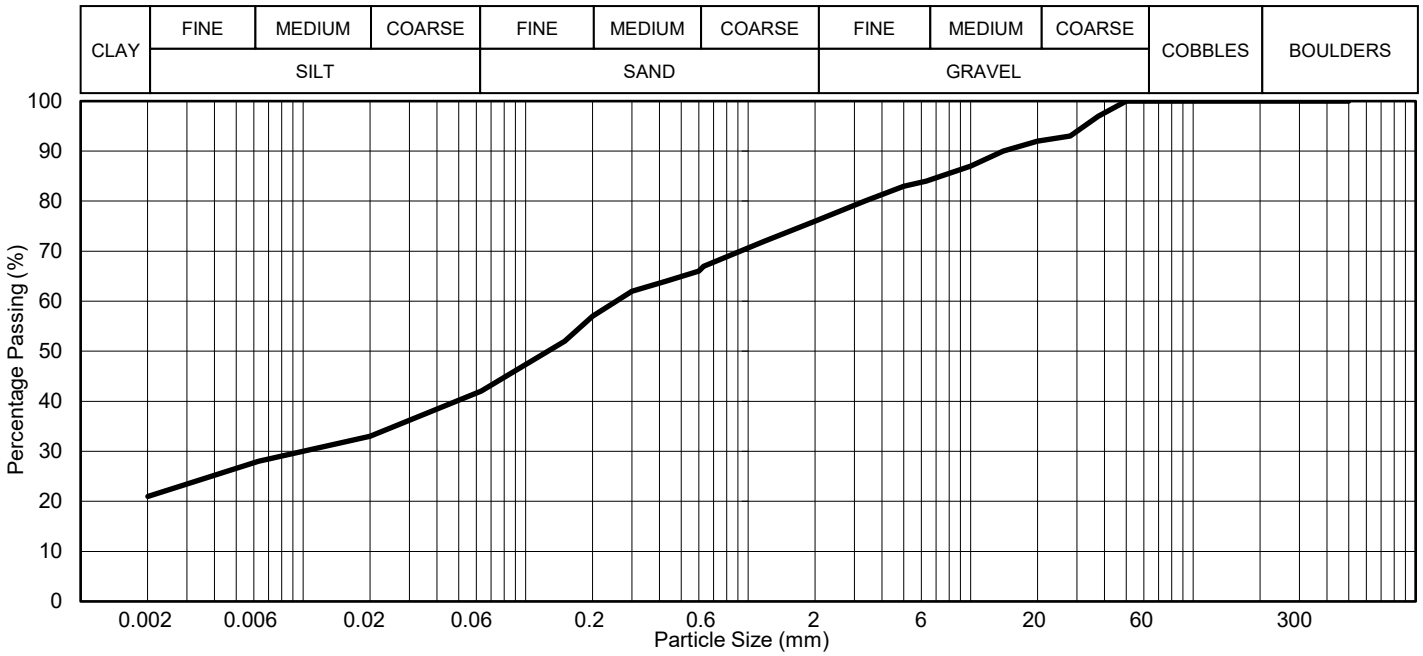
Remarks

Ŧ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP16
Sample	B
Depth (m)	0.50



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	33
300.0	100	-	-	0.0063	28
125.0	100	-	-	0.0020	21
90.0	100	-	-		
75.0	100	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	100	-	-	-	
50.0	100	-	-		
37.5	97	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	93	-	-		
20.0	92	-	-		
14.0	90	-	-		
10.0	87	-	-	**PERCENTAGE SOIL TYPES**	
6.3	84	-	-		
5.0	83	-	-		
3.350	80	-	-		
2.000	76	-	-		
1.180	72	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	67	-	-		
0.600	66	-	-		
0.425	64	-	-		
0.300	62	-	-		
0.200	57	-	-		
0.150	52	-	-		
0.063	42	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
21	21	34	24	0

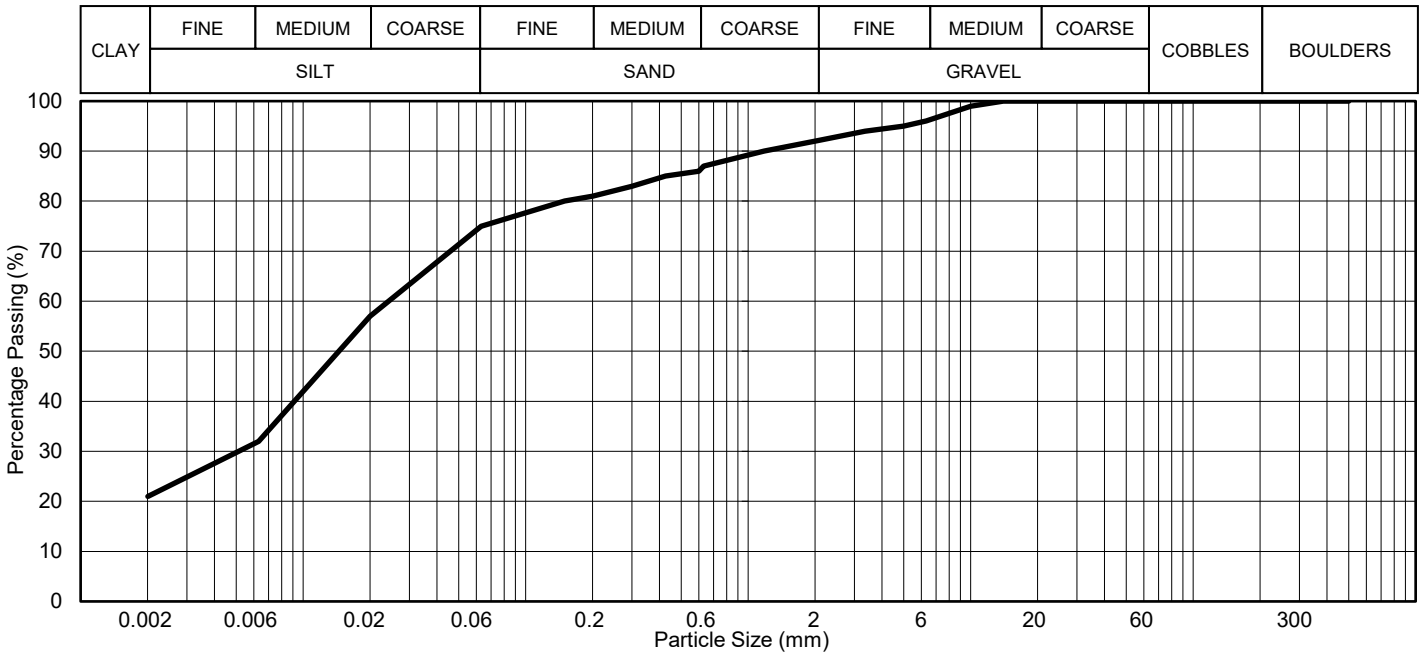
D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP19
Sample	B
Depth (m)	0.50



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	57
300.0	100	-	-	0.0063	32
125.0	100	-	-	0.0020	21
90.0	100	-	-		
75.0	100	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	100	-	-	-	
50.0	100	-	-		
37.5	100	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	100	-	-		
20.0	100	-	-		
14.0	100	-	-		
10.0	99	-	-	**PERCENTAGE SOIL TYPES**	
6.3	96	-	-		
5.0	95	-	-		
3.350	94	-	-		
2.000	92	-	-		
1.180	90	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	87	-	-		
0.600	86	-	-		
0.425	85	-	-		
0.300	83	-	-		
0.200	81	-	-		
0.150	80	-	-		
0.063	75	-	-		

CLAY	SILT Ŧ	SAND	GRAVEL	COBBLES
21	54	17	8	0

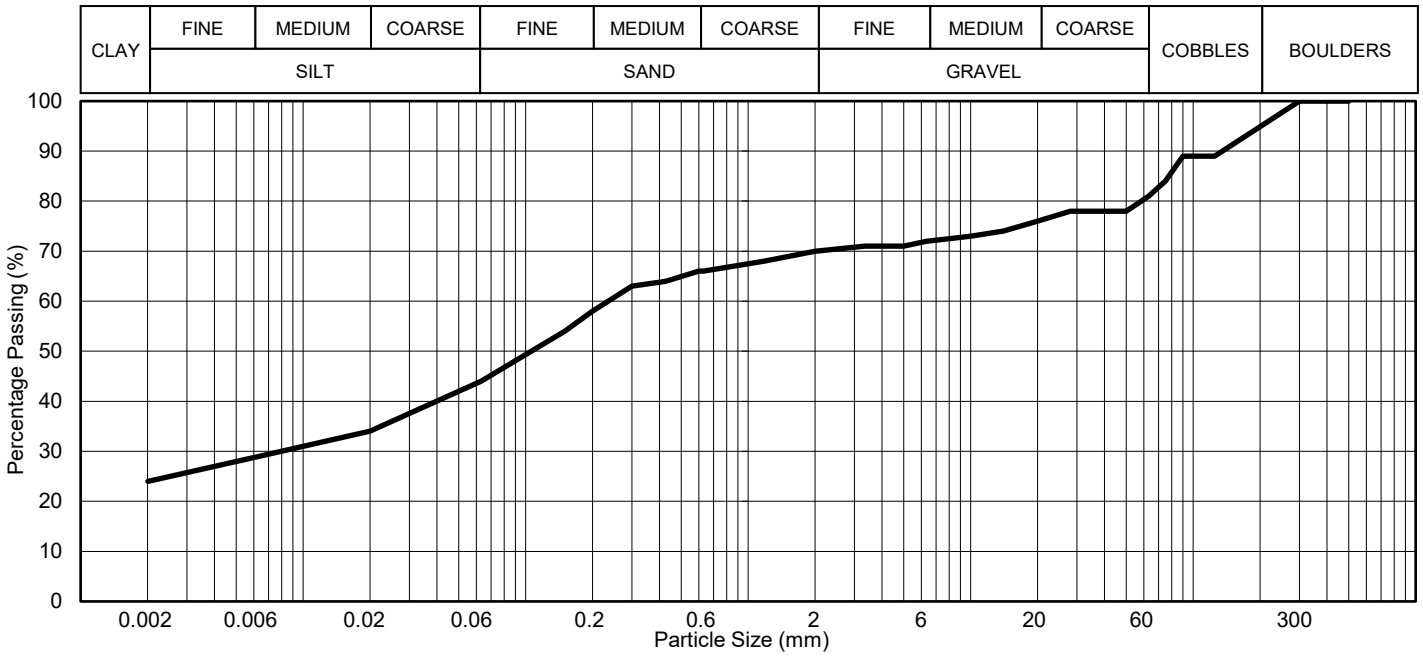
D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

Ŧ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

Borehole	TP22
Sample	B
Depth (m)	0.50



SIEVING				SEDIMENTATION (Assumed ρs of 2.65Mg/m³)	
Sieve Size (mm)	Percentage Passing (%)	Specification Not Applicable		Particle Size (mm)	Percentage Passing (%)
		Lower %	Upper %		
500.0	100	-	-	0.0200	34
300.0	100	-	-	0.0063	29
125.0	89	-	-	0.0020	24
90.0	89	-	-		
75.0	84	-	-	**GRADING CLASSIFICATION (SHW TABLE 6/2)**	
63.0	81	-	-	-	
50.0	78	-	-		
37.5	78	-	-	Grading classification proves the material has met the relevant grading requirements only. Further testing may be required to assess compliance with SHW.	
28.0	78	-	-		
20.0	76	-	-		
14.0	74	-	-		
10.0	73	-	-	**PERCENTAGE SOIL TYPES**	
6.3	72	-	-		
5.0	71	-	-		
3.350	71	-	-		
2.000	70	-	-		
1.180	68	-	-	**UNIFORMITY COEFFICIENT (SHW TABLE 6/1 NOTE 5)**	
0.630	66	-	-		
0.600	66	-	-		
0.425	64	-	-		
0.300	63	-	-		
0.200	58	-	-		
0.150	54	-	-		
0.063	44	-	-		

CLAY	SILT ₸	SAND	GRAVEL	COBBLES
24	20	26	11	19

D10	D60	Specification
-	-	
UNIFORMITY COEFFICIENT	-	-

Remarks

₸ Where a sedimentation test was not carried out, this figure represents total fines, i.e., particles of diameter less than 63 microns

Sample does not meet minimum mass requirement for material type

PARTICLE SIZE DISTRIBUTION - BS 1377 - 2 : 2022 : CLAUSE 10

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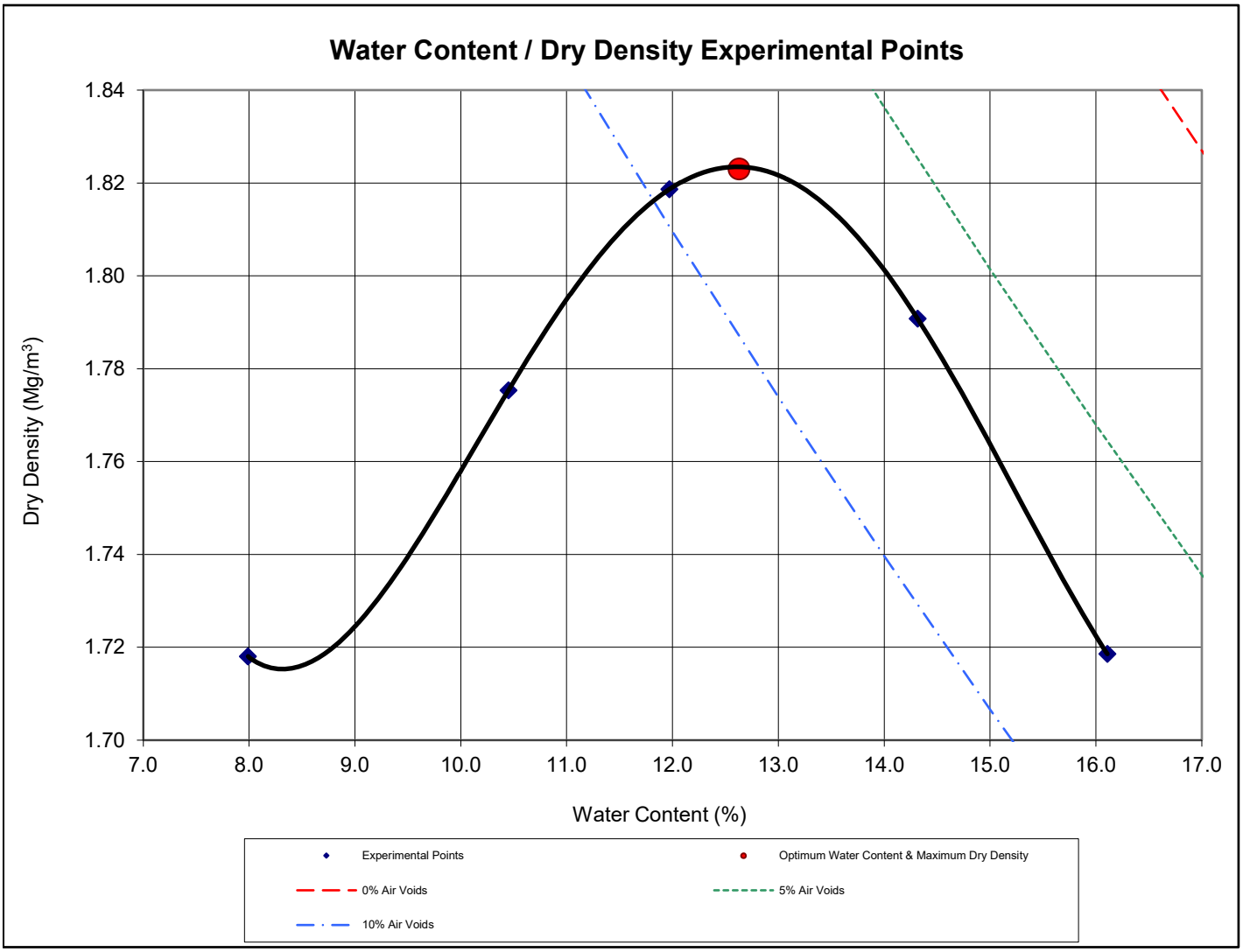

Test Method	:	Clause 11.5: 4.5kg rammer, 5 layers, 27 blows/layer
Preparation Method	:	Separate samples
% Passing 37.5mm	:	100
% Passing 20mm	:	98
Grading Zone	:	2
Particle Density	:	2.65 Mg/m^3 (Assumed)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
8.0	1.72
10.5	1.78
12.0	1.82
14.3	1.79
16.1	1.72

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
12.6	**1.82**

Remarks

Borehole :	TP04
Sample :	B
Depth (m) :	0.50

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

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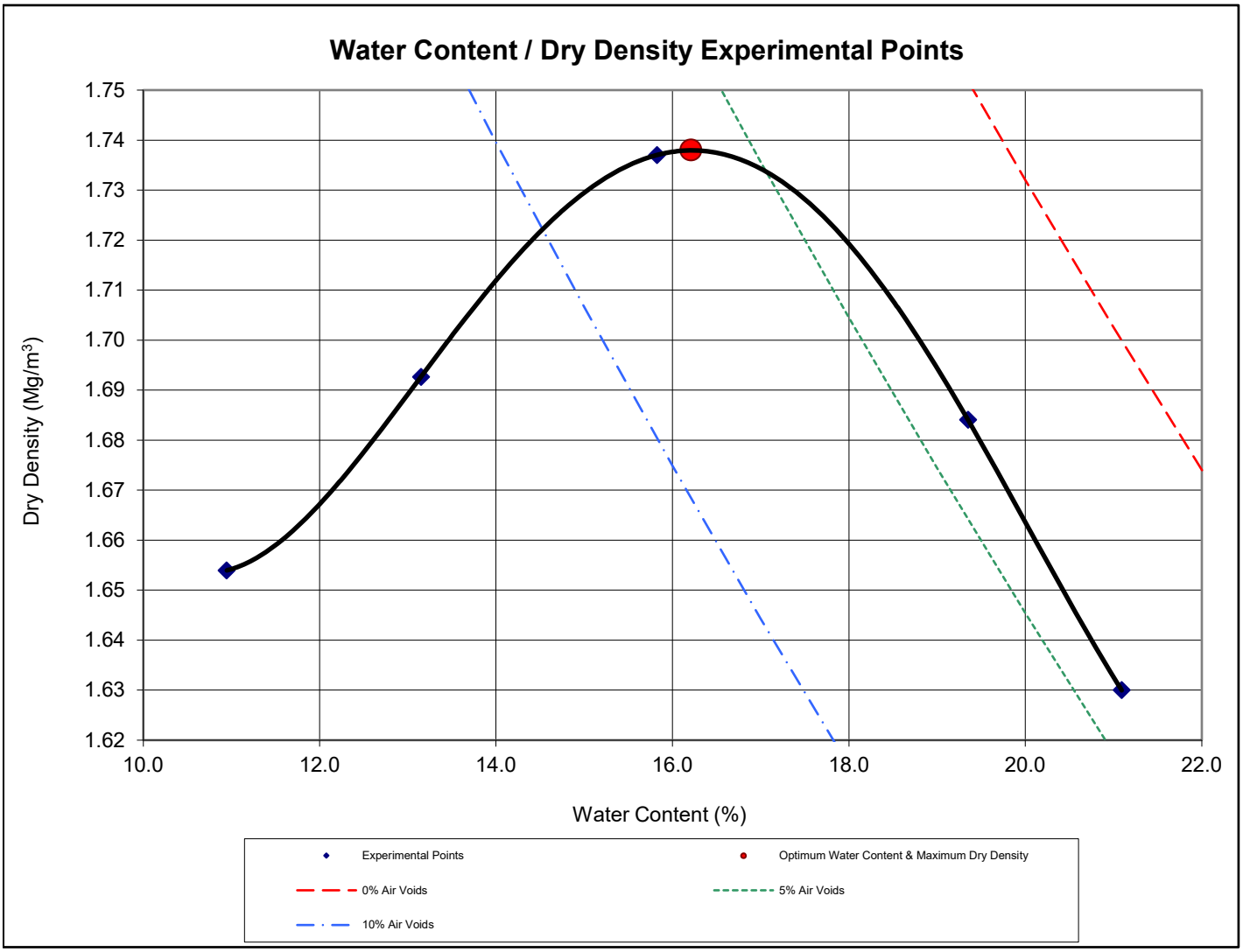

Test Method	:	Clause 11.5: 4.5kg rammer, 5 layers, 27 blows/layer
Preparation Method	:	Separate samples
% Passing 37.5mm	:	100
% Passing 20mm	:	100
Grading Zone	:	1
Particle Density	:	2.65 Mg/m^3 (Assumed)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
10.9	1.65
13.1	1.69
15.8	1.74
19.3	1.68
21.1	1.63

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
16.2	**1.74**

Remarks

Borehole :	TP05
Sample :	B
Depth (m) :	0.30

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

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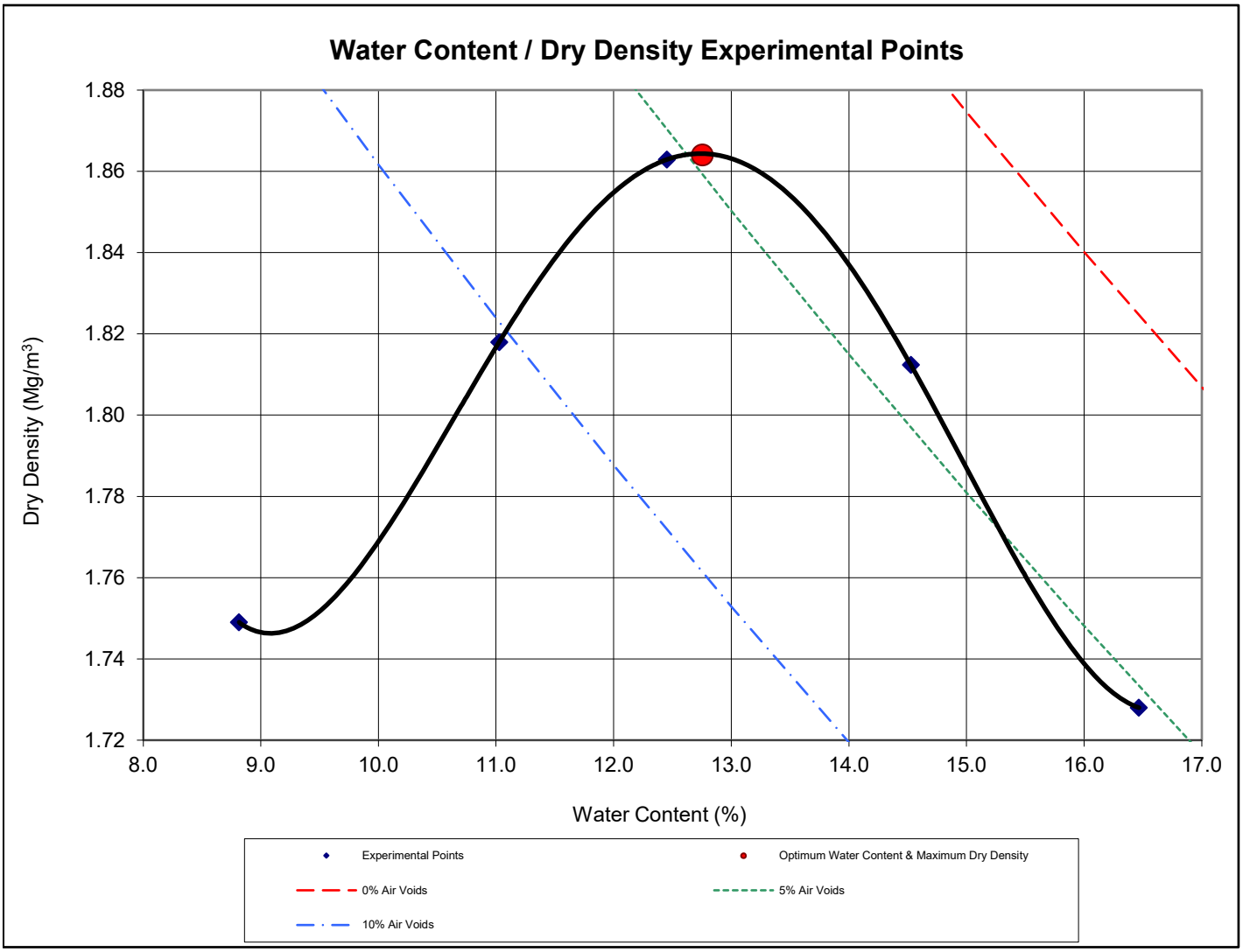

Test Method	:	Clause 11.6: 4.5kg rammer, 5 layers, 62 blows/layer	
Preparation Method	:	Separate samples	
% Passing 37.5mm	:	83	
% Passing 20mm	:	74	
Grading Zone	:	x	
Particle Density	:	2.61	Mg/m^3 (Measured in accordance with BS 1377 - 2 : 2022 : Clause 9)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
8.8	1.75
11.0	1.82
12.5	1.86
14.5	1.81
16.5	1.73

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
12.8	**1.86**

Remarks

Materials which contain more than 10% retained on a 37.5mm test sieve and 30% retained on a 20mm test sieve are not suitable for this test (Zone X - BS 1377 - 2 : 2022 : 11, Figure 4). In this instance only material passing the 37.5mm sieve was tested.

Borehole :	TP06
Sample :	B
Depth (m) :	0.50

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

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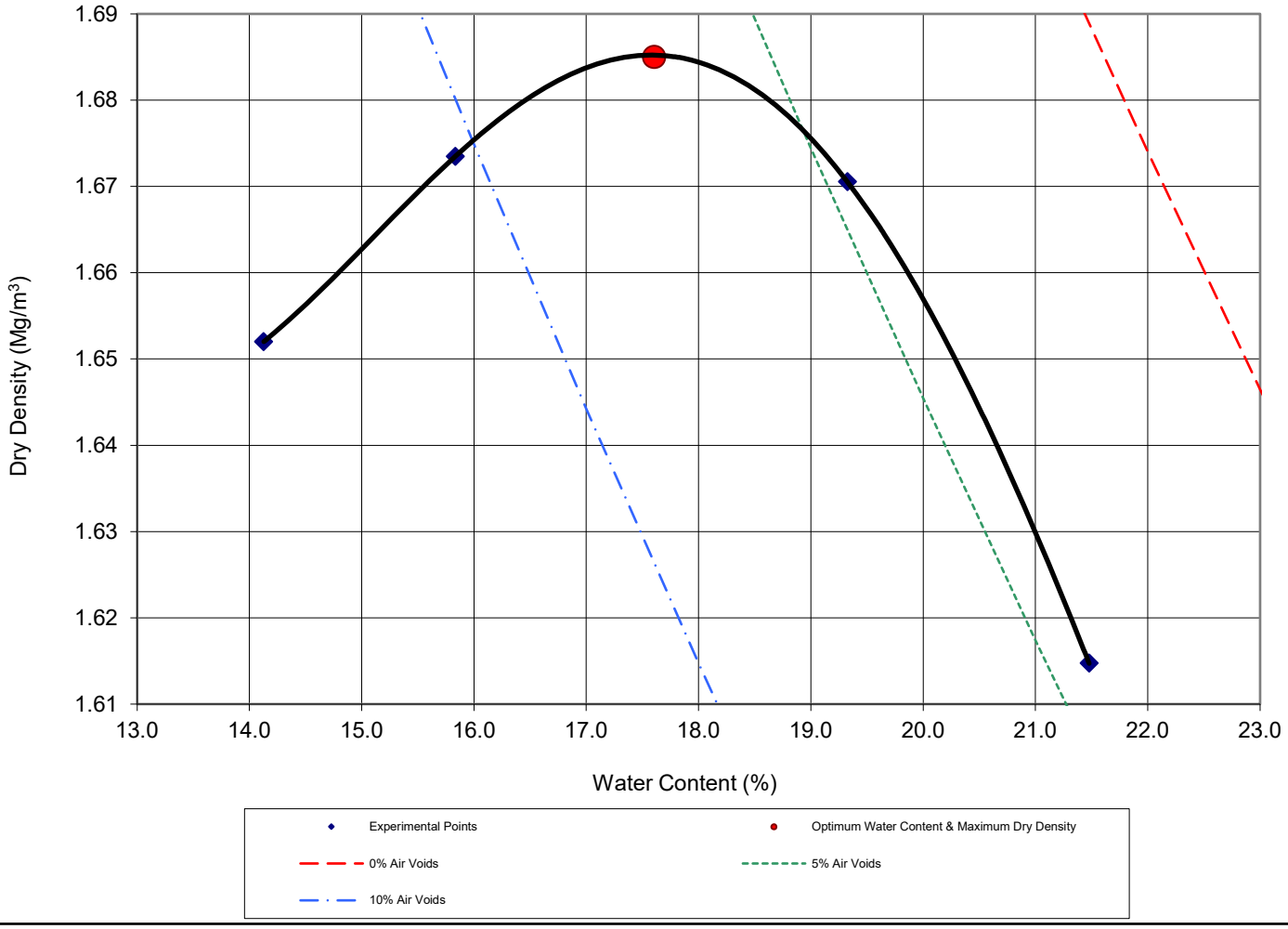
Water Content / Dry Density Experimental Points



Test Method	:	Clause 11.6: 4.5kg rammer, 5 layers, 62 blows/layer
Preparation Method	:	Separate samples
% Passing 37.5mm	:	90
% Passing 20mm	:	82
Grading Zone	:	5
Particle Density	:	2.65 Mg/m^3 (Assumed)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
14.1	1.65
15.8	1.67
17.6	1.69
19.3	1.67
21.5	1.61

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
17.6	**1.69**

Remarks

Borehole :	TP10
Sample :	B
Depth (m) :	0.50

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

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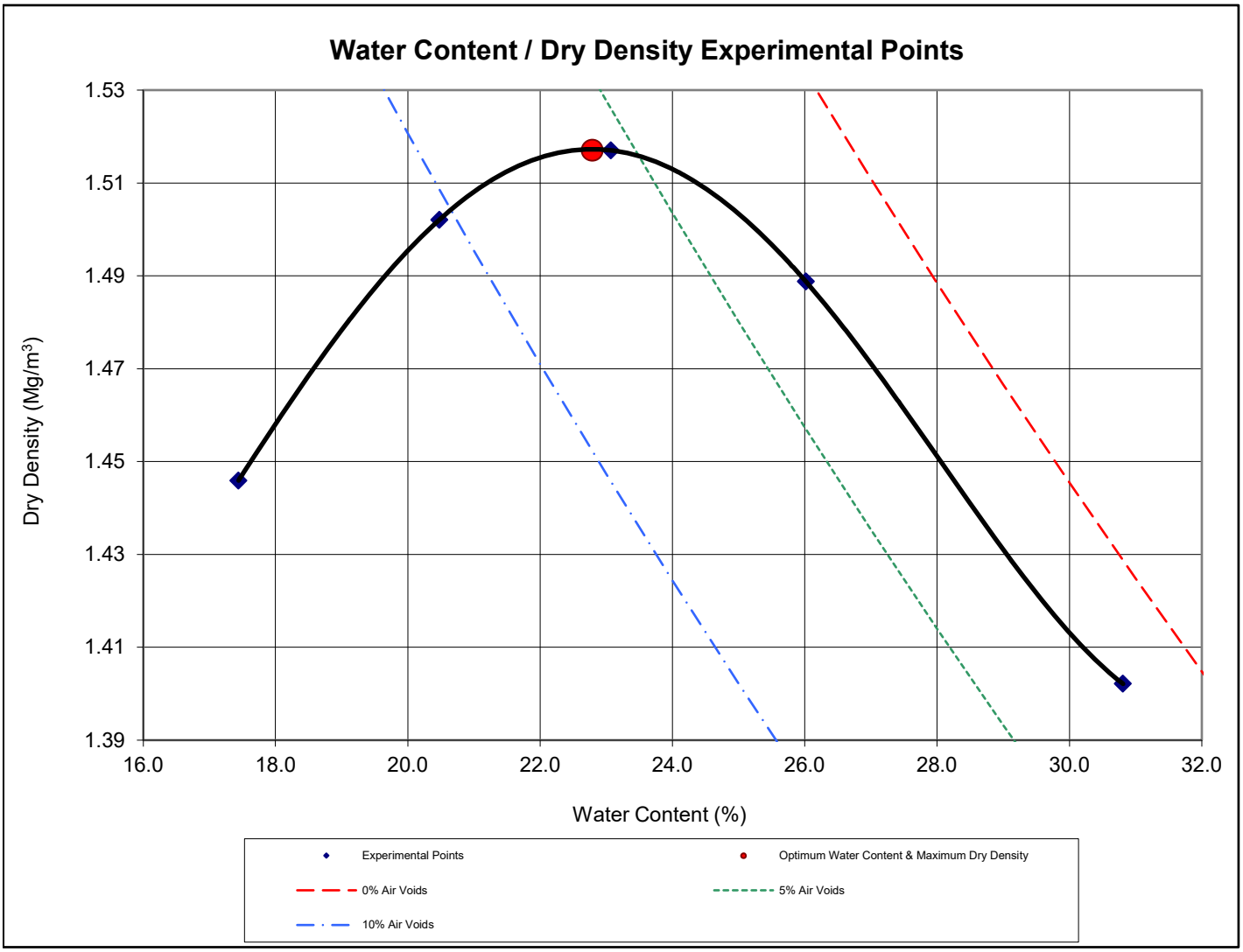

Test Method	:	Clause 11.6: 4.5kg rammer, 5 layers, 62 blows/layer
Preparation Method	:	Separate samples
% Passing 37.5mm	:	87
% Passing 20mm	:	87
Grading Zone	:	x
Particle Density	:	2.55 Mg/m^3 (Measured in accordance with BS 1377 - 2 : 2022 : Clause 9)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
17.4	1.45
20.5	1.50
23.1	1.52
26.0	1.49
30.8	1.40

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
22.8	**1.52**

Remarks

Materials which contain more than 10% retained on a 37.5mm test sieve and 30% retained on a 20mm test sieve are not suitable for this test (Zone X - BS 1377 - 2 : 2022 : 11, Figure 4). In this instance only material passing the 37.5mm sieve was tested.

Borehole :	TP15
Sample :	B
Depth (m) :	0.40

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

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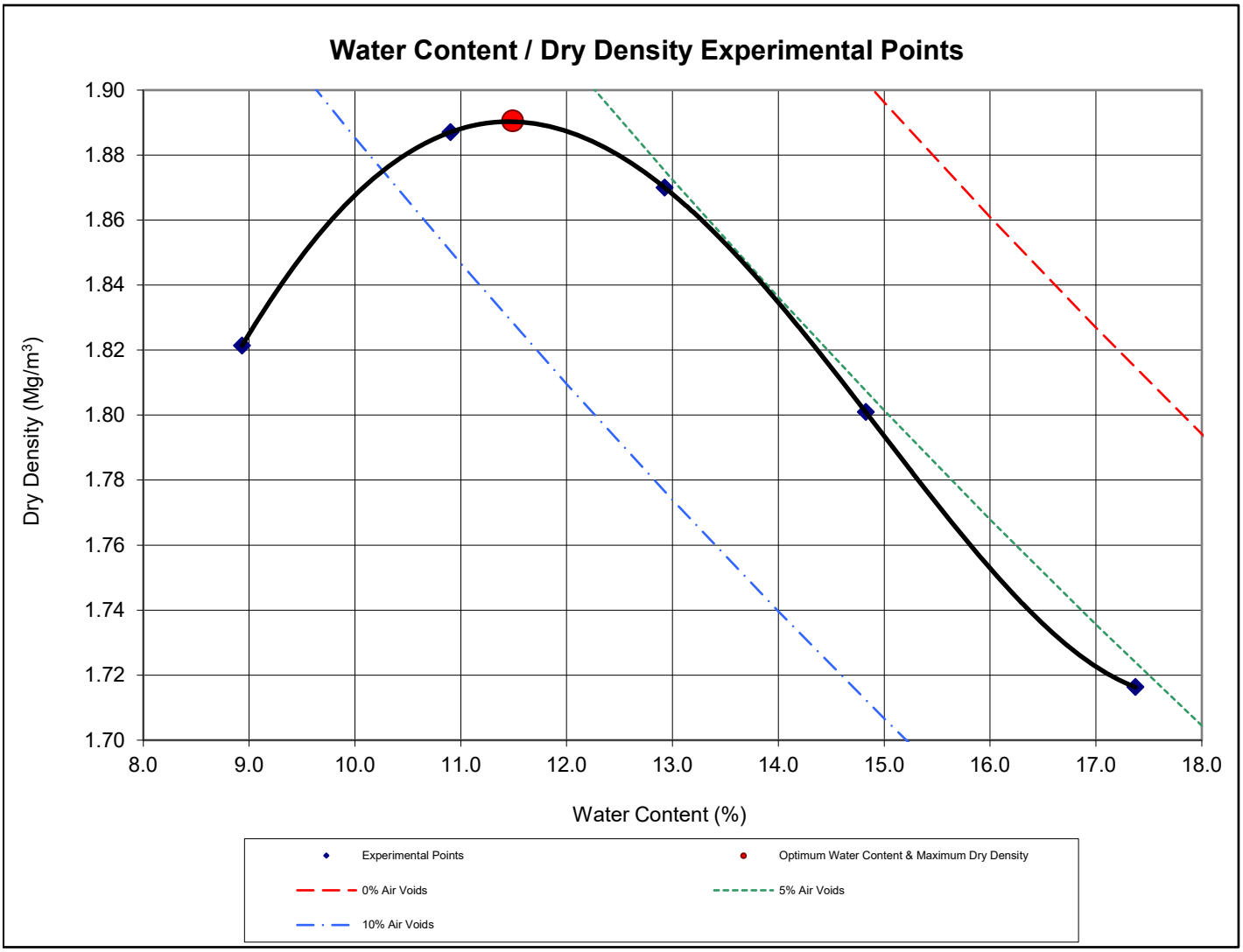


Test Method	:	Clause 11.6: 4.5kg rammer, 5 layers, 62 blows/layer
Preparation Method	:	Separate samples
% Passing 37.5mm	:	72
% Passing 20mm	:	59
Grading Zone	:	x
Particle Density	:	2.65 Mg/m^3 (Assumed)

Experimental Points	
Water Content (%)	Dry Density (Mg/m^3)
8.9	1.82
10.9	1.89
12.9	1.87
14.8	1.80
17.4	1.72

Optimum Water Content (%)	**Maximum Dry Density (Mg/m^3)**
11.5	**1.89**

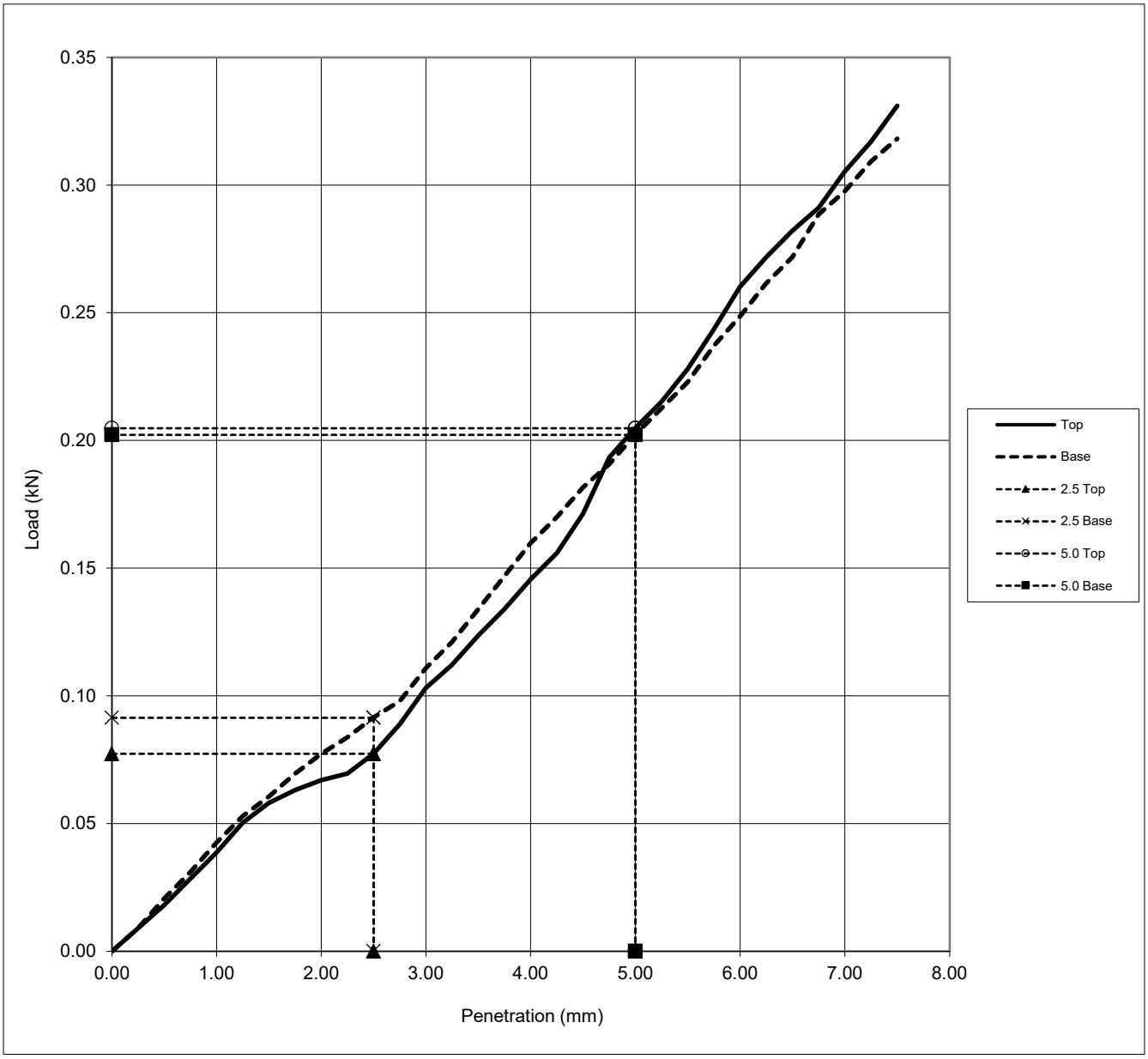
Remarks

Materials which contain more than 10% retained on a 37.5mm test sieve and 30% retained on a 20mm test sieve are not suitable for this test (Zone X - BS 1377 - 2 : 2022 : 11, Figure 4). In this instance only material passing the 37.5mm sieve was tested.

Borehole :	TP23
Sample :	B
Depth (m) :	0.50

Tested in accordance with BS 1377 - 2 : 2022

DETERMINATION OF WATER CONTENT / DRY DENSITY RELATIONSHIP

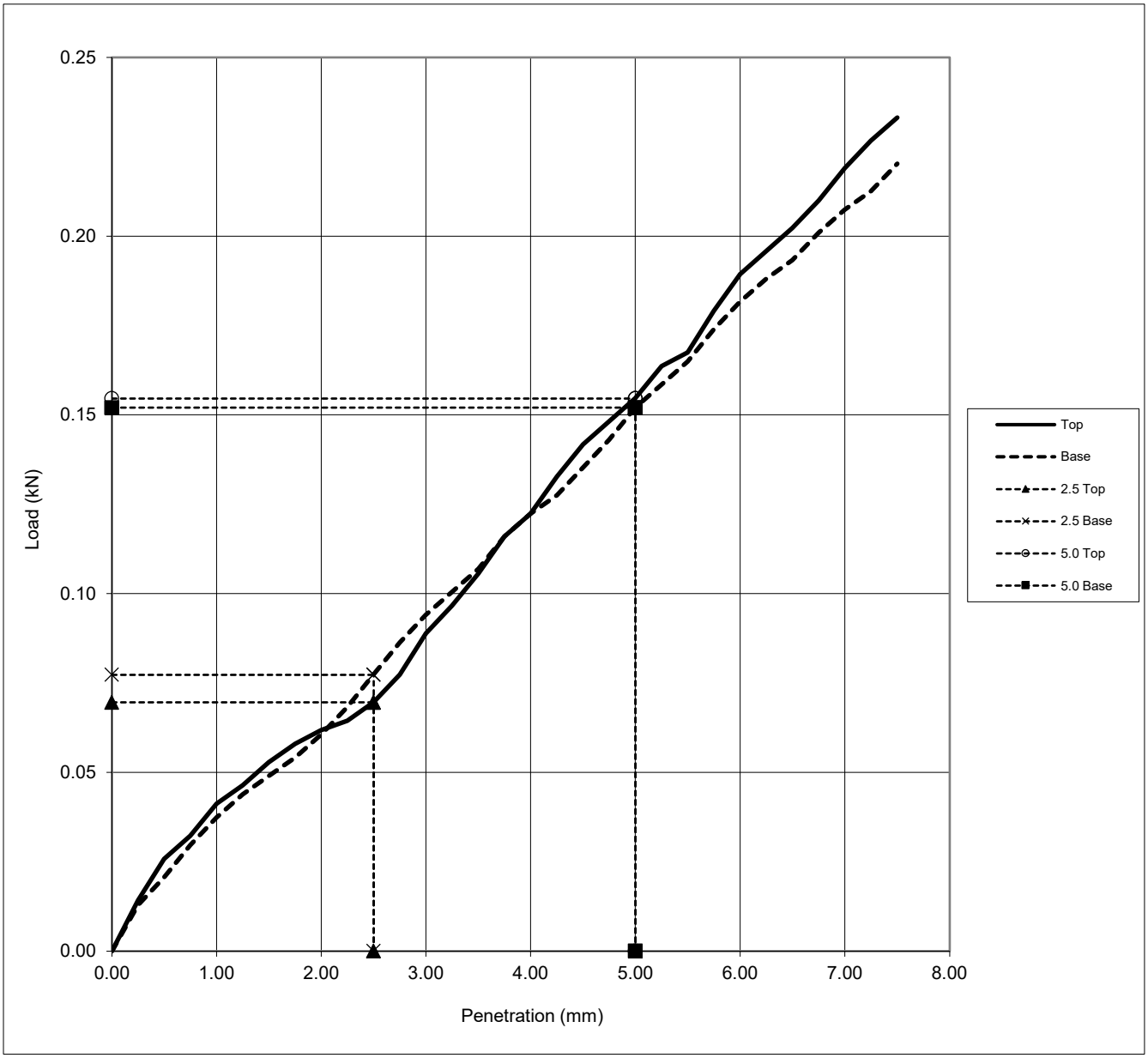


				Top	Base			
Water Content	28.0	%						
Bulk Density	1.92	Mg/m^3	Water Content	27.9	28.0	%	**Borehole**	**TP02**
Dry Density	1.50	Mg/m^3	CBR (%) at 2.5mm	0.6	0.7	%	**Sample**	**B**
Compactive Effort	2.5kg Rammer		CBR (%) at 5.0mm	1.0	1.0	%	**Depth (m)**	**0.40**
Surcharge Used	-	kg	Curve Corrected	No			**Lime Added (%)**	**-**
Soaking Period	-	days	Test Condition	Unsoaked			**Cement Added (%)**	**-**
Amount of swell	-	mm	Material Removed	7		%	**Accepted CBR (%)**	**1.0**

Remarks;

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Tested in accordance with BS 1377 - 2 : 2022 : Clause 15

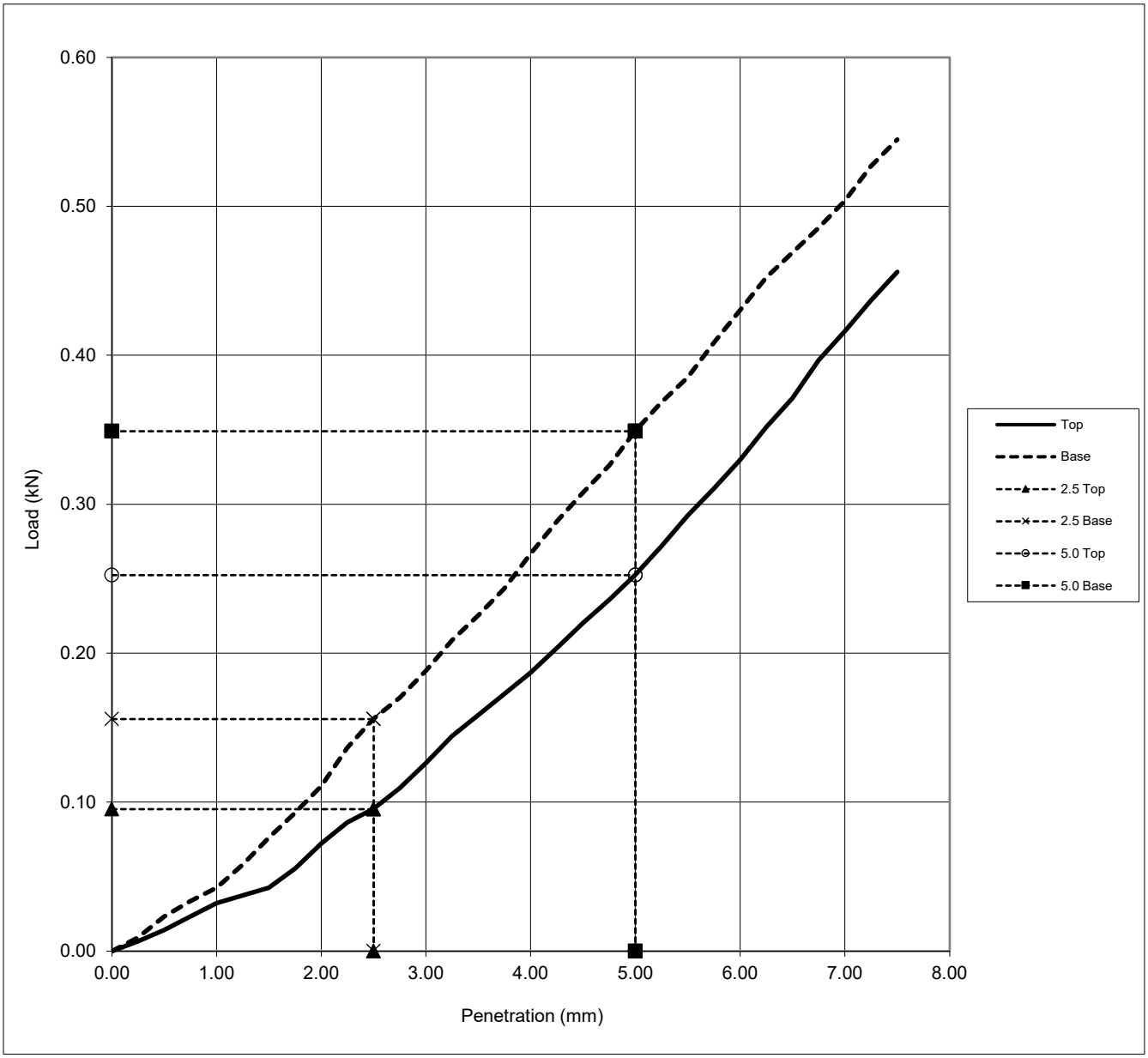


				Top	Base			
Water Content	43.0	%						
Bulk Density	1.79	Mg/m^3	Water Content	42.4	43.6	%	**Borehole**	**TP15**
Dry Density	1.25	Mg/m^3	CBR (%) at 2.5mm	0.5	0.6	%	**Sample**	**B**
Compactive Effort	2.5kg Rammer		CBR (%) at 5.0mm	0.8	0.8	%	**Depth (m)**	**0.40**
Surcharge Used	-	kg	Curve Corrected	No			**Lime Added (%)**	**-**
Soaking Period	-	days	Test Condition	Unsoaked			**Cement Added (%)**	**-**
Amount of swell	-	mm	Material Removed	13		%	**Accepted CBR (%)**	**0.8**

Remarks;

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Tested in accordance with BS 1377 - 2 : 2022 : Clause 15

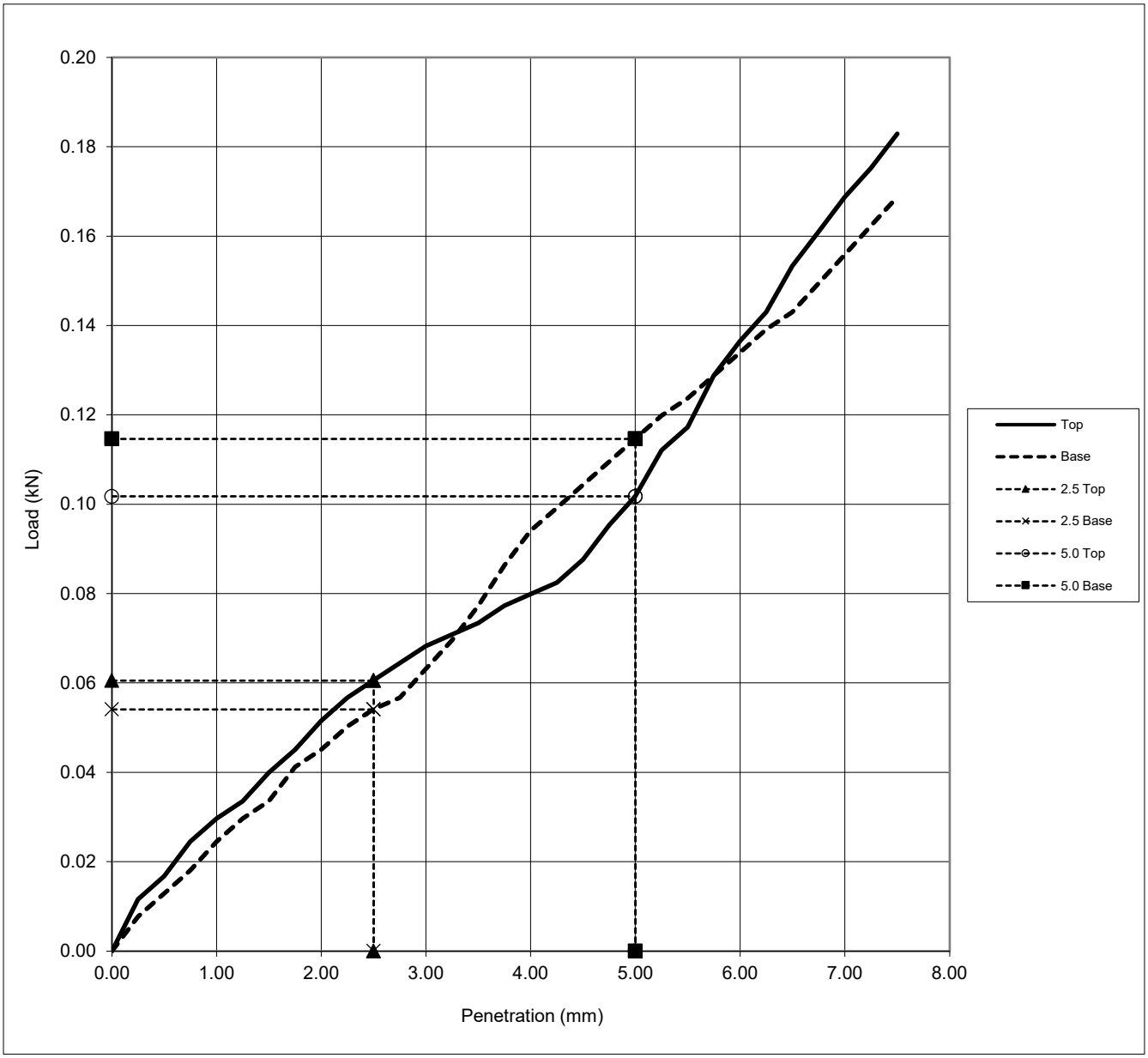


Water Content	26.0	%		Top	Base				
Bulk Density	1.78	Mg/m^3	Water Content	26.2	25.8	%	**Borehole**	**TP20**	
Dry Density	1.41	Mg/m^3	CBR (%) at 2.5mm	0.7	1.2	%	**Sample**	**B**	
Compactive Effort	2.5kg Rammer		CBR (%) at 5.0mm	1.3	1.7	%	**Depth (m)**	**0.50**	
Surcharge Used	-	kg	Curve Corrected	No			**Lime Added (%)**	**-**	
Soaking Period	-	days	Test Condition	Unsoaked			**Cement Added (%)**	**-**	
Amount of swell	-	mm	Material Removed	1		%	**Accepted CBR (%)**	**1.7**	

Remarks;

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Tested in accordance with BS 1377 - 2 : 2022 : Clause 15

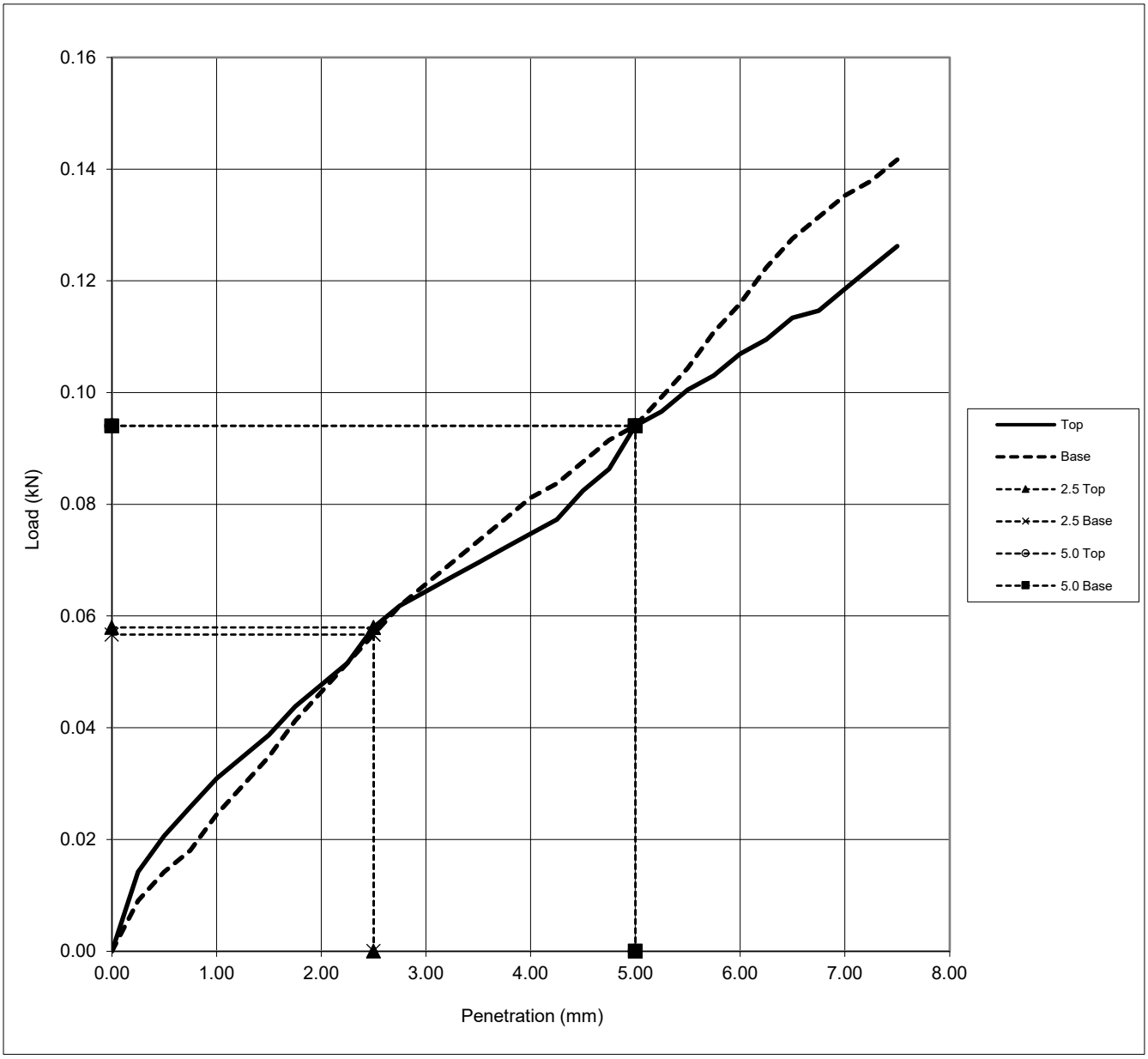


				Top	Base			
Water Content	24.7	%						
Bulk Density	1.96	Mg/m^3	Water Content	24.8	24.7	%	**Borehole**	**TP22**
Dry Density	1.57	Mg/m^3	CBR (%) at 2.5mm	0.5	0.4	%	**Sample**	**B**
Compactive Effort	2.5kg Rammer		CBR (%) at 5.0mm	0.5	0.6	%	**Depth (m)**	**0.50**
Surcharge Used	-	kg	Curve Corrected	No			**Lime Added (%)**	**-**
Soaking Period	-	days	Test Condition	Unsoaked			**Cement Added (%)**	**-**
Amount of swell	-	mm	Material Removed	24		%	**Accepted CBR (%)**	**0.6**

Remarks;

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Tested in accordance with BS 1377 - 2 : 2022 : Clause 15



Water Content	17.2	%
Bulk Density	2.02	Mg/m^3
Dry Density	1.73	Mg/m^3
Compactive Effort	2.5kg Rammer	
Surcharge Used	-	kg
Soaking Period	-	days
Amount of swell	-	mm

	Top	Base	
Water Content	17.5	17.0	%
CBR (%) at 2.5mm	0.4	0.4	%
CBR (%) at 5.0mm	0.5	0.5	%
Curve Corrected	No		
Test Condition	Unsoaked		
Material Removed	41		%

Borehole	**TP23**
Sample	**B**
Depth (m)	**0.50**
Lime Added (%)	**-**
Cement Added (%)	**-**
Accepted CBR (%)	**0.5**

Remarks;

DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Tested in accordance with BS 1377 - 2 : 2022 : Clause 15

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Spittal	**Date:**	13/03/2024
Job Number:	085447	**Visit:**	1
Client:	Field Energy	**Weather:**	Weather
Barometric State:	Rising/Steady	**Ground Conditions:**	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	998	0.0	0.0	0.0	0.0	0.6	0.6	19.7	0	0	DRY	1.35	
BH02	998	0.0	0.0	0.0	0.0	0.1	0.1	20.6	0	0	DRY	1.20	
BH03	996	0.0	0.0	0.0	0.0	0.1	0.1	20.2	0	0	DRY	1.30	
BH04	998	0.0	0.0	0.0	0.0	0.2	0.2	20.6	0	0	DRY	2.60	
BH05	998	0.0	0.0	0.0	0.0	0.1	0.1	21.1	0	0	DRY	1.45	
BH06	998	0.0	0.0	0.0	0.0	0.1	0.1	19.2	0	0	DRY	1.50	
BH07	998	0.0	0.0	0.0	0.0	0.3	0.3	20.4	0	0	DRY	1.28	
BH08	998	0.0	0.0	0.0	0.0	0.1	0.1	19.4	0	0	DRY	1.30	
BH09	998	0.0	0.0	0.0	0.0	0.1	0.1	20.3	0	0	DRY	0.75	
BH10	998	0.0	0.0	0.0	0.0	0.1	0.1	20.5	0	0	DRY	1.34	

Notes

Logged by

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Spittal	**Date:**	27/03/2024
Job Number:	085447	**Visit:**	2
Client:	Field Energy	**Weather:**	Wet
Barometric State:	Stable	**Ground Conditions:**	Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	996	0.0	0.0	0.0	0.0	0.5	0.5	19.70	0	0	DRY	1.35	
BH02	996	0.0	0.0	0.0	0.0	0.1	0.1	20.80	0	0	DRY	1.20	
BH03	996	0.0	0.0	0.0	0.0	0.1	0.1	20.20	0	0	DRY	1.30	
BH04	996	0.0	0.0	0.0	0.0	0.1	0.1	20.50	0	0	DRY	2.60	
BH05	996	0.0	0.0	0.0	0.0	0.1	0.1	20.90	0	0	DRY	1.45	
BH06	996	0.0	0.0	0.0	0.0	0.1	0.1	19.4	0	0	DRY	1.50	
BH07	996	0.0	0.0	0.0	0.0	0.4	0.4	20.4	0	0	DRY	1.28	
BH08	996	0.0	0.0	0.0	0.0	0.1	0.1	19.8	0	0	DRY	1.30	
BH09	996	0.0	0.0	0.0	0.0	0.1	0.1	20.1	0	0	DRY	0.75	
BH10	996	0.0	0.0	0.0	0.0	0.1	0.1	20.4	0	0	DRY	1.34	
0													
0													
0													
0													
0													

Notes

Logged by

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

GAS MONITORING LOG SHEET

Project:	Spittal	**Date:**	09/04/2024
Job Number:	085447	**Visit:**	3
Client:	Field Energy	**Weather:**	Wet
Barometric State:	Steady	**Ground Conditions:**	Wet

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
BH01	1006	0.0	0.0	0.0	0.0	0.2	0.2	19.7	0	0	DRY	1.35	
BH02	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.5	0	0	DRY	1.20	
BH03	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.5	0	0	DRY	1.30	
BH04	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.9	0	0	DRY	2.60	
BH05	1006	0.0	0.0	0.0	0.0	0.1	0.1	21.0	0	0	DRY	1.45	
BH06	1006	0.0	0.0	0.0	0.0	0.1	0.1	19.6	0	0	DRY	1.50	
BH07	1006	0.0	0.0	0.0	0.0	0.2	0.2	20.2	0	0	DRY	1.28	
BH08	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.0	0	0	DRY	1.30	
BH09	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.1	0	0	DRY	0.75	
BH10	1006	0.0	0.0	0.0	0.0	0.1	0.1	20.9	0	0	DRY	1.34	
0													
0													
0													
0													
0													

Notes

Logged by

1% gas volume = 10,000 ppm
Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.
All other gases recorded at 'steady state' unless otherwise stated

Curtins Ltd
1a Belford Mews, Edinburgh
Tel: 0121 643 4694

CALCULATION SHEET - SOIL INFILTRATION RATE

Project:	Spittal, Thurso
Job Number:	085447
Author:	KD

Hole Ref.:	SA101
Test Date:	22/02/2024
Test No.:	1 of 1

2.00	m	Length of trial pit
1.50	m	Width of trial pit
1.60	m	Depth (total) of trial pit
3.00	m^2	Area of trial pit base
0.50	m bgl	Water level at start of test (approximate invert level)
0.52	m bgl	Water level at end of test
0.02	m	Effective storage depth
0.51	m bgl	Effective storage depth (75% full)
0.52	m bgl	Effective storage depth (25% full)
0.030	**m^3**	**Effective storage volume (V_{75-25})**
3.070	**m^2**	**Internal surface area (50% effective depth) (a_{50})**
3420	**s**	**Time for head to fall from 75% to 25% effective depth (t_{75-25})**

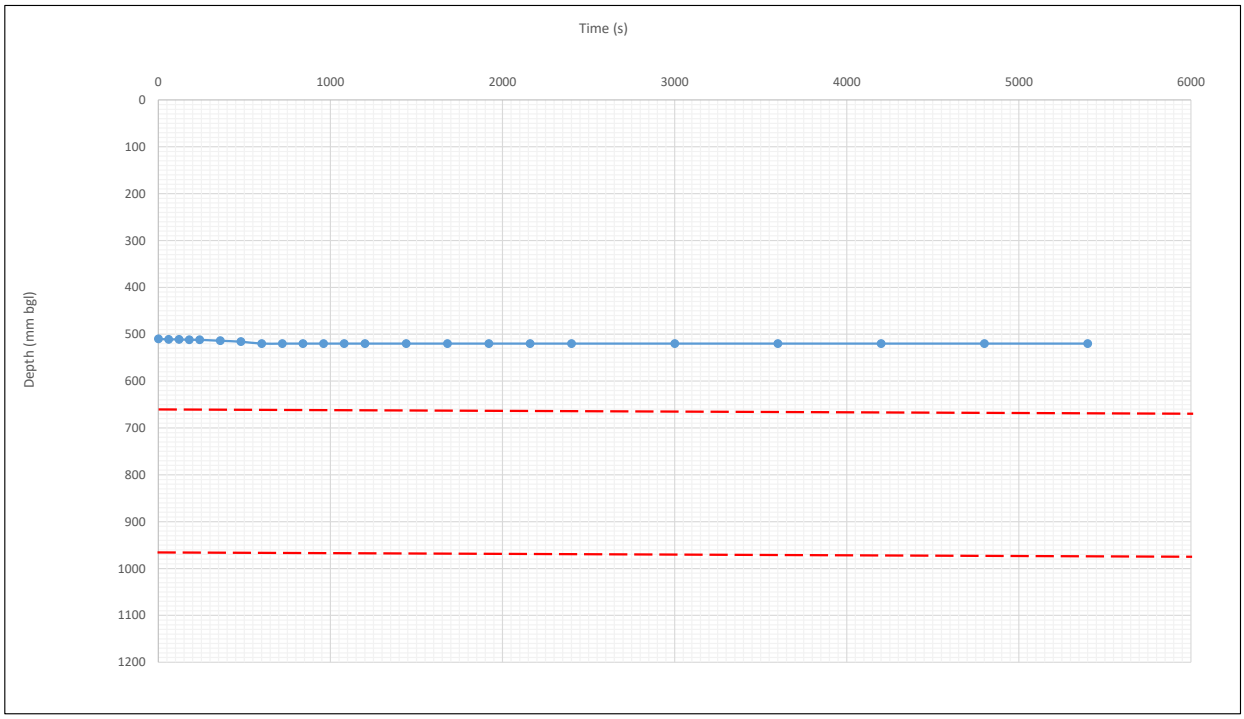
2.86E-06 m/s	**Soil infiltration rate (f)**

RAW DATA

Project:	Spittal, Thurso
Job Number:	085447
Author:	KD

Hole Ref.:	SA101
Test Date:	22/02/2024
Test No.:	1 of 1

Time (min)	Time (s)	Depth (mm bgl)	Stratum
0	0	510	**Firm Brown very gravelly sandy silty CLAY**/FLAGSTONE
1	60	511	
2	120	511	
3	180	512	
4	240	512	
6	360	514	
8	480	516	
10	600	520	
12	720	520	
14	840	520	
16	960	520	
18	1080	520	
20	1200	520	
24	1440	520	
28	1680	520	
32	1920	520	
36	2160	520	
40	2400	520	
50	3000	520	
60	3600	520	
70	4200	520	
80	4800	520	
90	5400	520	



Note 1: Pit backfilled with arisings.

Appendix C – Qualitative Risk Assessment Rationale

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem, or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway, and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of a particular event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe, medium, mild, or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or low likelihood or unlikely.

The consequences and probabilities are subsequently cross correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

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

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	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. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures, and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (Inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures, and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

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 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.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	*Harm* is *likely to arise* to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	*It is possible* that without appropriate further action *harm could arise* to a designated receptor. It is relatively *unlikely* that any such harm would be *severe**,*** and if any harm were to occur it is *more likely* that such harm would be *relatively mild.*
Low Risk	*It is possible* that *harm could arise* to a designated receptor from an identified hazard. It is *likely* that, at worst, if any harm was realised any effects would be *mild.*
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term ‘risk’ in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.