

Buro Happold

**024435 Hayle Harbour Development**  
Contaminated Land Generic  
Quantitative Risk Assessment -  
Cocklebank

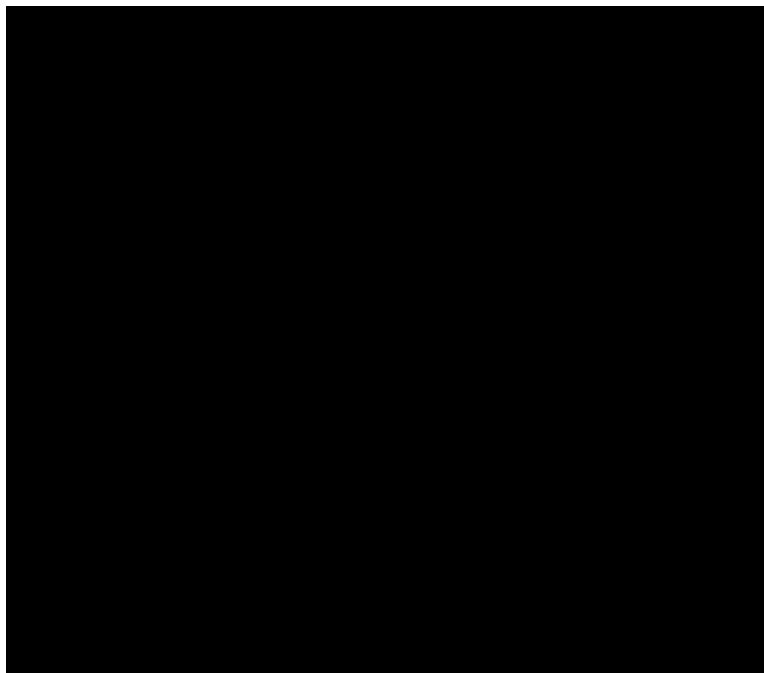
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## Executive Summary

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Buro Happold was appointed by CPR Regeneration Ltd (CPR) to undertake a contaminated land risk assessment for Cocklebank, Hayle. As part of the proposed Hayle Harbour Redevelopment, Cocklebank will be removed in order to facilitate the construction of floating pontoons for yacht mooring. This report collates and summarises contamination information from recent and previous ground investigations on Cocklebank and its surrounds. This report therefore provides a Generic Quantitative Risk Assessment (GQRA) for Cocklebank in accordance with CLR11-'Model Procedures (ref 1).

Cocklebank is located within Hayle Harbour, part of the coastal estuary of the Hayle and Angarrack Rivers. Two tidal water storage lagoons, Copperhouse Pool and Carnsew Pool, are located to the south east and south west of Cocklebank respectively and are classified as Sites of Special Scientific Interest (SSSIs). To the east of Cocklebank, the quay area (North Quay) is located, primarily used by fisherman and a dredging vessel (operating under license). Recent investigation has showed Cocklebank to comprise alternating fine to medium grained sands and silty sands in the upper 1.5m, with lenses of silty clays noted throughout. This sequence is underlain by medium grained sands. The northwest and southeast ends of the bank feature gravel, boulders and cobbles at the surface. Gravel is also present at depth within the Bank. The main contaminants of concern within Cocklebank sediments are arsenic and to a lesser extent copper and zinc. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. >2m bgl) being comparable to background concentrations found in Hayle Harbour/ Estuary, Harvey's Towans and the adjacent beach. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand). Arsenic, copper and zinc are highly leachable within all materials types.

The generic quantitative risk assessment indicates that there are potentially moderate risks to the environment under the currently existing conditions. Provided the appropriate mitigation measures are put in place and the recommendations in Section 10 adopted, the risks to people and the environment can all be mitigated to acceptably low levels. The proposed development anticipates the potential re-use of excavated material on other suitable areas of the site. Preliminary waste classification indicates that material in the top 1.5m of Cocklebank (generally silty sand and silty clay, but also some gravel) is likely to be classified as Hazardous Waste due to heavy metal concentrations. The majority of coarser grained materials (fine to medium and medium grained sand) below this depth are likely to be classified as Inert or Non-Hazardous waste. One option would be to reuse material containing contaminants at background concentrations (the lower portion of Cocklebank) in areas of soft landscaping, while pre-treating the upper portion of Cocklebank prior to placement beneath hardstanding. Any such re-use would be subsequent to discussions with the Environment Agency and could be carried out under an exemption from Environmental Permitting, or in accordance with the recently published CL:AIRE/EA Code of Practice (ref 36).

# 1 Introduction

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## 1.1 General

Buro Happold Limited has been appointed by CPR Regeneration Ltd (CPR) to undertake a contaminated land risk assessment [a Generic Quantitative Risk Assessment (GQRA)] for Cocklebank, Hayle in general accordance with CLR11-'Model Procedures (ref 1).

The site of the proposed redevelopment is extensive and comprises much of Hayle Harbour. This report, however, deals solely with the area known as Cocklebank (Figure 2). The proposed removal of Cocklebank is to facilitate the construction of floating pontoons for yacht mooring as part of the Phase 1 Hayle Harbour redevelopment. Consideration is being given to re-using the excavated spoil on other suitable areas of the proposed development.

## 1.2 Scope

This report collates and summarises contamination information from recent and previous ground investigations on Cocklebank. The objectives of this report are:

- To assess the potential for significant risks to both human and environmental receptors from contaminants identified within Cocklebank during construction and for the proposed development;
- To ascertain the contaminative status and composition of the Cocklebank to assist in the identification of an appropriate remedial strategy and potential reuse of this material; and
- To determine the likely waste classes for excavated material which is not suitable for reuse.

## 1.3 Existing information and reporting

A number of ground investigations have been carried out on or in relation to Cocklebank as discussed in Section 3.5). The analytical data from two of these investigations has been summarised and collated within this report in conjunction with the recent ground investigation. Detail on these investigations can be found in the following reports:

- Buro Happold 'Hayle Harbour Redevelopment Master Planning Vol 1 Contamination Report' (Revision 2) Job number 007838, August 2007 (ref 2).
- Buro Happold 'Re. Hayle Harbour Proposed Dredging' Letter Report 022961L071217SP, 18 December 2007 (ref 3).

#### **1.4 Limitations and exceptions**

The ground investigations carried out to date have been undertaken in general accordance with good practice guidance, relevant British Standards and established good practice. The scope and design of the recent site investigations have been based upon the known history of site use, the results of previous studies and investigations and on the development plan. On this basis the spacing of the exploratory holes and the sampling and analysis plan for this investigation is considered to have provided a reasonable level of certainty about the ground conditions. However it is important to recognise that contamination can be both widespread and relatively localised, depending upon its source and nature etc. No investigation, however comprehensive can be expected to determine absolutely the nature and extent of all the contamination which could be present on any site. There will always be an element of uncertainty about the ground conditions including contamination.

## 2 Site Location and Description

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### 2.1 Location

The site is located at Hayle Harbour, Cornwall, at National Grid Reference SU 855 540 (Figure 1). Photographs of the site are presented in Appendix D.

### 2.2 Current layout and description

At low tide Cocklebank is approximately 360m x 60m in area whilst at high tide the bank is almost completely submerged. Situated to the north-east of the bank is North Quay, to the east and south-east are East Quay and South Quay, to the north-west lies the harbour entrance, and to the south-west is a spit of land that separates Lelant Water from the main harbour (see Figure 2 for site layout).

The top of the bank is approximately 2.0m above low tide level gradually rising at the northwest and south-eastern extremities to approximately 3.0m above low tide level. The surface is generally sandy with some seaweed cover. Localised muddy areas are present, particularly on the south-western side. The north-western and south-eastern extremities are coarser than the central portion of the bank, containing gravel, boulders and cobbles at the surface. Both extremities are marked by large wooden posts that are thought to have been used for turning boats in the harbour. Photographs of the bank are included in Appendix D.

Cocklebank is accessible at low tide for two to three hours each day. The most convenient access is from the north-western end of North Quay where the water level in the channel drops to 0.5 – 1.0m during low tide. This route has been used in the past and where necessary a causeway has been created using granular materials dredged from the harbour.

Various submerged electricity cables cross beneath the harbour entrance to the north-west of the bank trending approximately north to south.

#### 2.2.1 Surrounding land uses

Cocklebank is flanked by Hayle Harbour, part of the coastal estuary of the Hayle and Angarrack Rivers (Figure 2). The town of Hayle is located at the southern end of the harbour and the open waters of the estuary are situated to the north-west (downstream) of Cocklebank. The town itself includes a large harbour and has a long history of industrial development. This history has led to its current division into the western “Foundry” and eastern “Copperhouse” areas. The harbour is dominated by two tidal water storage lagoons, Copperhouse Pool and Carnsew Pool constructed to flush sediment from the harbour along the eastern and western sides of Cocklebank, respectively. Both these pools are classified as Sites of Special Scientific Interest (SSSIs).

East of Cocklebank, the quay area (North Quay) is primarily used by fisherman and a dredging vessel (operating under license). The estuary surrounding Cocklebank is routinely dredged, with dredged spoil stored on North Quay.

### **2.3 Proposed development**

The outline scheme design for the Hayle Harbour Redevelopment is for a mixed use development comprising residential dwellings, offices, retail, a hotel, commercial/industrial and leisure uses, along with associated land and water based infrastructure.

Part of the proposed Stage 1 infrastructure works for the development include the removal of Cocklebank to create space for floating pontoons for yacht mooring. Consideration is being given to re-using this material on other areas of the development. It is anticipated that the majority of the dredged sands could be used for land raising works around North Quay, with the remaining material utilised for dune rebuilding along the northern and eastern edges of the estuary mouth. Proposed end uses for North Quay include retail, residential, industrial (fisherman's quay), sport and leisure (marina). The proposed Stage 1 infrastructure development in the vicinity of Cocklebank is shown in Figure 3.

## 3 Summary of Existing Information

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### 3.1 Site history

Cocklebank is understood to have been created in the 1830s to aid the flushing of sediment from the harbour by increasing the flow of water released from the Copperhouse and Carnsew Pools. The source of material for the bank is unknown but there is potential for mine waste, industrial waste and locally dredged material to have been used in its construction. A record dated 1832 obtained from the Hayle Archive entitled "Expense of making an embankment at Hayle" indicates that the bank was constructed of sand covered in clay. The record also refers to a weir and lists the cost of rail road, sluice gates etc. so it is possible that this record may actually relates to the construction of Carnsew Pool or the spit. Numerous vessels are known to have foundered on Cocklebank in the late 18th and early 19th centuries. Posts, presumably for navigation, are shown on the earliest map (1888) until the map dated 1964.

### 3.2 Geology

The BGS 1:50,000 Solid and Drift Penzance Sheet 351 & 358 shows Cocklebank to be underlain by Marine and Estuarine Alluvium. This in turn is underlain by Devonian Gramscatho Beds (well graded turbiditic sandstones in beds up to 2m thick with interbedded slates). Previous investigations (Section 3.5) indicate that the bank contained sandy gravelly materials to at least 4.5m below ground level (bgl). The methods of excavation however (trial pit excavation and shell and auger drilling) may not have provided representative samples below the tidal water level. Two BGS logs are available, SW53NE109 and SW53113 completed in the 1940s (refer Figure 4). These logs provide brief descriptions, mainly of sand with some gravel and cobbles extending to 33m below ground level. The interface between the Cocklebank sands and the underlying natural strata is not clear

### 3.3 Hydrogeology & hydrology

Cocklebank is surrounded by waters of Hayle Harbour which is a coastal estuary open to the Atlantic Ocean and partially fed (via Lelant pond located to the south-west of the harbour) by the River Hayle. The waters surrounding Cocklebank are tidally influenced, with a maximum tidal range of up to 5m during spring tide.

The Groundwater Vulnerability Map, Sheet 53 shows the site to lie on a Minor Aquifer. The Environment Agency (EA) informed Buro Happold in 2006 that there are no specific Environmental Quality Standards (EQSs) for Hayle Harbour. This correspondence, together with monitoring results are included in Appendix D of the Buro Happold 'Hayle Harbour Redevelopment Master Planning Report - Vol 1: Contamination Report (ref 2).

### 3.4 Ecology

According to the online map, the waters on the western side of Cocklebank are incorporated into the Hayle Estuary SSSI. The estuary is classed as being in a 'favourable' condition by the EA (as on August 2008). The

SSSI incorporates a littoral sand habitat within a marine intertidal and shallow estuarine environment. The primary reason for the SSSI status of the estuary lies in the populations of waterfowl and shorebirds that occur in winter and pass through on spring and autumn migration. The main area of terrestrial habitat within the SSSI is the Triangular Spit, which is outside the Phase 1 infrastructure boundary.

Cocklebank itself is of low ecological interest, with very low invertebrate diversity or usage by birds. Modelling of plume dispersion from dredging Cocklebank (undertaken as part of the Environmental Impact Assessment for the development, ref 4) shows some deposition of fines in lower Lelant Water, Carnsew and Copperhouse Pool. However, the settling velocity chosen for the fine material was low in order to show potential transport pathways.

A full ecological impact assessment for the site, based on the proposed development, has been carried out as part of the Environmental Impact Assessment (EIA) by others as detailed in the Environmental Statement (ref 4). Further assessment of potential risks to the ecology of the site is outside the scope of this investigation and has therefore not been undertaken.

### **3.5 Previous investigations**

A number of ground investigations have been carried out on Cocklebank and the surrounding area including the harbour/estuary, sand dunes and Copperhouse Pool. Details of these investigations have been summarised as follows.

#### **Dr P Smith, MRSC, November 1988**

The 1988 investigation (ref 5) into metal concentrations within Copperhouse Pool and other sites within Hayle reported dissolved arsenic concentrations of up to 180ug/l within the stream which runs through Copperhouse Pool (Mill Leat) and up to 3830mg/kg within sediment in the upper 0.1m. Arsenic was recorded at concentrations of up to 3400mg/kg within the top 0.5m of sediment within the Pool. Arsenic concentrations within sediments at Lelant Water, Carnsew Pool, Penpol Creek and the mouth of the Estuary were considerably lower than those in Copperhouse Pool and were considered to be comparable to background concentrations within Cornwall and Devon.

Copper concentrations in sediment within Copperhouse Pool were significantly high, ranging from 108-9315mg/kg in the upper 0.1m and 30-4090mg/kg between 0.5 and 1.5m bgl. Zinc concentrations ranged from 64-2880mg/kg in the top 0.1m and between 150 and 3125mg/kg in the 0.5-1.5m depth range.

The main source of arsenic, copper and zinc within Copperhouse Pool was considered to be freshwater inputs, e.g. Mill Leat. The report concludes that the situation could be improved if the freshwater inputs were diluted by seawater at all tidal states (i.e. keeping the water level in Copperhouse Pool high) and/or reducing/diverting the input from these freshwater sources to the Pool.

**WSP Environmental, March 1998**

The WSP report (ref 6) gives limited details of three trial pits excavated along Cocklebank numbered BH22, BH23 and BH24. It is understood that these were carried out by Geotechnical Engineering in January 1988 however the trial pit logs and locations are not available. The report states that the core of the bank was formed using stone/rubble material. No chemical data is available from this investigation.

**Buro Happold, August 2007**

Six trial pits (TP1 to TP6) and three boreholes (BH803 to BH805) were progressed within Cocklebank by CJ Associates Ltd on behalf of Buro Happold in 2005 (ref 2). The maximum depth of these boreholes (using shell & auger methods) reached 4.5mbgl, with the trial pits excavated to depths ranging between 1.5 to 2.5mbgl. A further two boreholes BH801 and BH802 were drilled within the harbour. Exploratory hole locations are shown on Figure 4, with the analytical results presented in Section 5 of this report.

**HR Wallingford, August 2007**

HR Wallingford (ref 7) undertook a numerical hydrodynamic and sediment transport modelling to assess the performance and impact of the scheme on the existing environment as part of the Environmental Impact Assessment (EIA) for Phase 1 of the development. The study focused on the current condition, impacts during construction and under the proposed operating conditions. Part of the study assessed the dispersion of fine material from Cocklebank during its removal and associated dredging of the marina area. The study concluded that the quantities of fine material released into the water column are likely to be small (in comparison to the volume of fine material naturally entrained in the water column by tide and wave action) and will depend on the type of dredging plant used. Modelling of dispersion pathways showed sediment is likely to be dispersed over a relatively wide area, extending from the Pools (Copperhouse and Carnsew) to outside the estuary with a proportion of sediment settling within the Pools. HR Wallingford recommended that sediment dispersion could be reduced by using specialist plant and restrictions on dredging to specific periods within the tidal cycle.

**Buro Happold, December 2007**

Buro Happold Limited was requested by Hayle Harbour Port Authority to undertake some sampling of the areas of Hayle Estuary that are required to be dredged under a maintenance licence with Penwith District Council. The investigation comprised the excavation of 12 hand dug trial pits to a maximum depth of 0.65m within Hayle Harbour/Estuary and the adjacent beach (ref 3). The locations of these pits in relation to Cocklebank are shown on Figure 4. Pits S5 – S7 dug in the upper extent of the proposed dredge area contained sand that was stained black with organic matter (silts etc.) with a strong natural organic odour. The remaining pits contained yellow/golden sands to the base of the pit. No samples were taken from Cockle Bank. Chemical analytical results from this investigation are summarised in Section 5 of this report.



## 4 Buro Happold 2008/2009 Ground Investigations

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### 4.1 Initial ground investigation works (2008)

The initial ground investigation was designed by Buro Happold to obtain further information on the geological profile of Cocklebank and associated contamination. Site works were undertaken by Hydrock Special Projects Limited (Hydrock) between 15 and 31 October 2008 and comprised the following:

- Drilling of 5 No. window samples on Cocklebank (designated WS701 to 705 and 707) to depths ranging between 3.8m and 5.05m; and
- Drilling one borehole using rotary percussive techniques (using an air-mist flush) to a depth of 13.8mbgl.
- Drilling of three boreholes to depths of up to 18.12m bgl, one within the former ESSO tank farm and two adjacent the Copperhouse Pool entrance;

[Note: Information gained from the boreholes not directly related to Cocklebank (i.e. former ESSO tank farm and adjacent Copperhouse Pool entrance) have not been included within this report. These results will be reported on at a later stage.]

The location of the exploratory holes are shown on Figure 4. All logging and sampling was undertaken by a Hydrock site engineer, under direct supervision of Buro Happold. The ground conditions encountered in all exploratory holes were logged in accordance with BS5930:1999. Logs for the boreholes are provided in the Hydrock Factual Report (ref 8 and Appendix B). Appropriate methods of sample collection and preservation together with procedures to avoid cross-contamination were followed as recommended in BS5930:1999 and BS10175:2001. Soil samples for contamination testing were collected from site by courier on a daily basis and sent to ALcontrol Laboratories for subsequent analysis (refer Table 4-1).

### 4.2 Supplemental Ground Investigation Works (2009)

Following the initial investigation in October 2008, further investigation works were undertaken between 24 and 26 February 2009 to provide additional information on the contamination status of the upper Cocklebank soils and to determine background concentrations for soils located in the proposed land raising and dune rebuilding areas. Site works were undertaken by Buro Happold and comprised the following:

- Drilling of 30 hand auger holes on Cocklebank (designated HA1 to HA30) to depths ranging between 0.2 metres below ground level (mbgl) to 1.4mbgl);
- Drilling of 6 hand auger holes on North Quay (designated NQHA1 to NQHA6) to depths ranging between 0.1mbgl to 0.4mbgl; and

- Collection of near surface samples (0-1.1mbgl) from the proposed dune rebuilding area (i.e. Hayle Towans) at five locations.

The location of the exploratory holes are shown on Figure 2. All logging and sampling was undertaken by a Buro Happold engineer. The ground conditions encountered in all exploratory holes were logged in accordance with BS5930:1999. Logs are provided in Appendix B. Hand auger holes were not advanced to greater depths on Cocklebank due to slumping sands (encountered at various depths) inhibiting sampling collection. Hand auger holes on North Quay were similarly restricted due to practical refusal within relatively dense soils. Further hand auger holes on North Quay were restricted by the presence of hardstanding (i.e. concrete and tarmac) or obstructions (such as vehicles and a dredged sand stockpiles).

Appropriate methods of sample collection and preservation together with procedures to avoid cross-contamination were followed as recommended in BS5930:1999 and BS10175:2001. Soil samples for contamination testing were collected from site by courier on a daily basis and sent to ALcontrol Laboratories for subsequent analysis (refer Table 4-1).

#### **4.3 Laboratory Testing**

Buro Happold scheduled a programme of chemical testing on soil samples for both investigations. All analysis was undertaken by Alcontrol Laboratories in accordance with the Buro Happold schedule. Details of the specific suites of analysis for soil samples can be found in Tables A1-7 presented in Appendix A of this report. Analysis was undertaken using methods approved under the MCERTS performance standard for soils where possible. A summary of the laboratory testing undertaken in both the 2008 and 2009 investigation is summarised in Table 4.1. The analytical data is presented in Appendix C and is discussed further in Section 6 and 7 of this report.

Table 4—1 Number of samples analysed and suites of analysis (2008 and 2009 investigations)

Suite	Soil
General Suite <sup>1</sup>	44
Sieved Suite Only <sup>2</sup>	40
Heavy Metal Suite Only <sup>3</sup>	63
Antimony, Beryllium, Mercury, Selenium, Sulphur, Sulphide	22
Tin	32
Sulphate	15
Chloride	39
Leachate suite	23
Cyanide (free or total)	35
PAHs/TPH	4
WAC analysis	1

<sup>1</sup> General Suite: Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Zinc, pH

<sup>2</sup> Sieved Suite: Arsenic, Cadmium, Chromium, Lead, Zinc, undertaken on sieved grain fractions of several soil samples

<sup>3</sup> Heavy Metal Suite: Arsenic, Cadmium, Copper, Lead and Zinc

Following initial analysis for the General Suite, further testing was undertaken on selected soil samples. These samples were dispatched to a geotechnical laboratory (Geotechnical Engineering Limited). The soil samples were submitted for particle size analysis (wet sieve) as per BS1377 Part 2. Water was used as the primary sieving medium, and the laboratory did not add any dispersal agents.

Samples were sieved across the following size fractions:

- >2mm;
- 0.6mm to 2mm;
- 0.212mm to 0.6mm;
- 0.063mm to 0.212mm; and
- <0.063mm.

Following sieving, the sieved fractions were dispatched back to ALcontrol Laboratories and analysed for Arsenic, Chromium, Cadmium, Lead and Zinc to determine whether any correlation existed between grain size and metal concentrations. Several samples were unable to be analysed due to insufficient sample quantity following sieving. Soil samples collected in the supplemental ground investigation were analysed for metals that were deemed to be of potential concern (i.e. arsenic, cadmium, lead, copper and zinc) based on initial investigation results, rather than a broad analytical suite.

## 5 Ground Conditions

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### 5.1 Cocklebank

Cocklebank comprises alternating fine to medium grained sands and silty sands in the upper 1.5m, with lenses of silty clays noted throughout. This sequence is underlain by medium grained sands. The northwest and southeast ends of the bank feature gravel, boulders and cobbles at the surface. Gravel is also present at depth. Cross-sections through Cocklebank are provided as Figure 5 and 6. Borehole log classifications were supported by sieving results, which determined that majority of soils were comprised of medium grained sand either as a primary (such as the 'sand' and 'silty sand' designated soil units) or a secondary component (such as coarse sand and sandy silts/clays), with the highest fraction range in the 212µm-600µm fraction range. The interbedded soil types are described as follows:

#### **Silty Clay**

Fine grained lenses (generally 0.05m to 0.3m thickness), comprising mostly of red/brown silty clay or sandy silt were encountered in the upper 1.2m of the central portion of Cocklebank. Occasional layers of soft black sandy silt were recorded however no evidence of organic matter or shell content were noted.

#### **Silty Sand**

The upper 1.0m of Cocklebank consisted predominantly of brown/red silty sands with some clayey sand. Occasional lenses of brown/yellow, brown or brown/grey silty sands were also recorded.

#### **Fine to Medium Grained Sand**

Fine to medium grained sands were noted within the upper 4.0m of Cocklebank. These sands are characterised as typically fine to medium grained, brown or yellow/brown with no visible carbonate or trace minerals.

#### **Medium Grained Sand**

Dense, medium grained sands were encountered throughout the soil profile, becoming predominant below approximately 1.0m. Sandy gravel lenses were also noted throughout. These sands contained a visible carbonate content and trace minerals such as zircon and showed no evidence of anthropogenic material. The soils were logged as marine deposits. No sub-surface evidence of buried materials (such as scoria blocks) was recorded.

**Gravel**

Sandy gravels and cobbles were noted in the southern and northern extremities of Cocklebank. The cobbles are of varied lithological origin, similar to cobbles strewn around the flanks of Cocklebank. Gravel was also recorded during previous investigations (Buro Happold, 2007, ref 2) within the centre of the Bank at depth.

**Bedrock**

Siltstone was encountered at 13.5mbgl (-12.08 mAOD) within the rotary percussive borehole. A layer of gravelly silt (approximately 3m thick) was located above this, thought to be weathered siltstone.

Based on evidence received to date, it is considered likely that the Cocklebank sands are sourced from historically dredged sands from within the estuary, or from other local sources such as near shore sediments and sand dunes. Finer grained fractions observed in the upper portion of Cocklebank are likely to have originated from deposition from upstream areas during slack tide, or from more recent dredged material.

**5.2 North Quay**

During the recent investigations, accessible areas of North Quay were covered by thin veneers of unconsolidated material (such as gravels or silty sands) overlaying relatively dense coal wash gravels. The density of the coal wash restricted penetration past 0.5mbgl depth.

Borehole logs from the Buro Happold, 2007 investigation (ref 2) recorded variable thicknesses of Made Ground, overlying the Gramscatho Beds at depth (approximately 6.0m bgl).

**5.3 Harvey's Towans**

Harvey's Towans (proposed dune re-building area) consists of dune sands typical of Aeolian (wind blown) deposits (i.e. fine grained, well sorted, angular) with some organic content in the upper 0.2m. A disturbed area was observed in the south, containing scoria gravels throughout. The Harbour Master has indicated that locally sourced sand (possibly dredged from Hayle Harbour) was used for emergency dune restoration material, to provide short term protection for housing on Harvey's Towans

**5.4 Groundwater**

With the exception of sea water encountered during drilling on Cocklebank, groundwater was not encountered during the recent investigation in 2008 or 2009.

## 6 Soil data assessment - contaminant source characterisation

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### 6.1 Approach

#### 6.1.1 Soil assessment criteria

Analytical data derived from the investigation has been put into context by comparison with published guidance or derived thresholds values. Current UK guidance published thresholds comprise Soil Guideline Values (SGVs), which are available for a limited number of determinands (ref 9 to 16) and land uses. For contaminants without published SGVs or where soil conditions are different to those assumed for the published SGVs (6% soil organic matter content and sandy loam soil), Generic Assessment Criteria (GAC) have been derived. The derivation of GACs has been carried out based on published statutory guidance documents (ref 17 and 18) and with consideration of the most sensitive receptors in the respective CLEA standard land-uses scenarios (the 0 to 6 year old child for the residential with and without plant uptake scenarios and the adult for the commercial / industrial land-use scenario) using the software model 'CLEA 1.04 and associated handbook (ref 19 and 20). The software model (CLEA 1.04) was issued by the Environment Agency in January 2009 and replaces all the previously issued software versions.

When deriving assessment criteria for contaminants for which updated tox reports are not currently available, health criteria value (HCV) model input parameters have been adopted as issued in the 'old style tox reports'.

The old style tox reports will in due course be superseded by new tox reports derived in line with the new guidance. However, in the interim the Environment Agency advice is to use the old style tox reports as changes associated with the new guidance are unlikely to result in significantly different HCVs.

Assessment criteria for aliphatic and aromatic hydrocarbons bands have been derived also in line with the EA publication 'The UK approach for evaluating human health risks (ref 21).

#### 6.1.2 Statistical analysis

Statistical analysis of the soil analytical results has been carried out in general accordance with the 'Guidance on Comparing Soil Contaminant Data with Critical Concentrations' (ref 23). An estimate of the true population mean has been calculated (upper confidence limit of the sample mean) for all contaminants where a sample has exceeded relevant screening criteria. The "conservative mean" contaminant concentration (US95) is then compared against the screening criteria. This approach is intended to assess the average exposure to a contaminant rather than looking at solely worst case values. Outlier testing has been carried out to indicate whether or not a data point is likely to form part of the same statistical distribution. Where a maximum concentration has been determined as an outlier (confirmed by visual/olfactory evidence or the result of an error) this concentration has not been included in the US95 calculation, but has been separately assessed.

### 6.1.3 Controlled waters assessment criteria

Potential risks to controlled waters have been assessed by examining both the soil analytical data and the soil leachability data. For the initial data assessment the principal thresholds adopted for assessing potential risks to the Minor Aquifer were the UK Drinking Water Standards (DWS) (ref 24). World Health Organisation (WHO) guidelines (ref 25) have been used where no UK DWS are available. For assessing potential risks to the harbour, Copperhouse Pool and Carnsew Pool, Marine Environmental Quality Standards (EQSs) derived under the requirements of the EC Dangerous Substances Directive (ref 26) have been adopted. The Environment Agency non-statutory EQS (operational EQS) (ref 27) along with UK DWS have been adopted where no EQS are available.

## 6.2 Sub division of chemical data

The data has been assessed with respect to:

1. Chronic risks to human health
2. Acute risks to human health
3. Risks to controlled waters (Hayle Harbour & SSSI)
4. Risks to flora
5. Risks to buildings/ structures

### 6.2.1 Reporting of data

Analytical results from the Buro Happold August 2007 and December 2007 investigations have been combined with the recent investigations in 2008 and 2009 to enable assessment and characterisation of the site wide dataset for Cocklebank. The chemical testing results together with their screening criteria are presented in Appendix A of this report as follows:

Table A1	Soil results (inorganic determinands)
Table A2	Soil results (following sieving)
Table A3	Soil results (organic determinands)
Table A4	Background soil results
Table A5	Soil leachate results
Table A6	Waste classification based on soil values
Table A7	Soil results screened against Waste Acceptance Criteria

## 6.3 Chronic Risks to Human Health

### 6.3.1 Inorganic soil results

As part of the Buro Happold, August 2007 investigation, a total of 30 soil samples from Cocklebank were analysed for a suite of inorganic and organic contaminants. During the recent 2008 and 2009 investigation, a



total of 107 soil samples from Cocklebank were analysed for a suite of inorganic and organic determinands. Results from all of these investigations have been assessed together (Appendix A – Table A1). Determinands showing one or more exceedance of a relevant threshold value have been subjected to statistical analysis in general accordance with the 'Guidance on Comparing Soil Contaminant Data with Critical Concentrations' and CLR11 where appropriate and are summarised in Table 6-1.

With the exception of arsenic and lead, all inorganic determinand concentrations were below the relevant SGVs/GACs for residential and commercial/industrial landuses. The majority of samples (70%) recorded concentrations of arsenic above the SGV for residential landuse, however in total less than 1% of samples recorded concentrations above commercial/industrial screening criteria. Two samples (<1%) recorded concentrations of lead above the SGV for residential landuse, with a single concentration of lead recorded above the SGV for commercial/industrial landuse.

**Table 6—1 Inorganic determinands (only where concentrations > SGV/GAC)**

Soil Type	Determinand	No of samples	GAC (No of samples exceeding GAC)			Max	Min	US95	Outliers
			Resi (with plant uptake)	Resi (without Plant uptake)	Commercial / industrial				
Silty Clay	Arsenic	10	32 <b>(10)</b> 100%	35 <b>(10)</b> 100%	640 <b>(5)</b> 50%	1200	250	832.7	-
	Lead	10	450 <b>(1)</b> 10%	450 <b>(1)</b> 10%	750 <b>(0)</b> 0%	460	69	228	-
Silty Sand	Arsenic	31	32 <b>(29)</b> 96%	35 <b>(29)</b> 96%	640 <b>(4)</b> 17%	1100	19	437.6	-
	Lead	31	450 <b>(1)</b> 0.03%	450 <b>(1)</b> 0.03%	750 <b>(1)</b> 0.03%	1761	6	139	-
Fine-Med Sand	Arsenic	65	32 <b>(45)</b> 69%	35 <b>(45)</b> 69%	640 <b>(0)</b> 0%	550	9	125.9	-
Med Sand	Arsenic	20	32 <b>(5)</b> 25%	35 <b>(4)</b> 17%	640 <b>(0)</b> 0%	65	10	43.4	-
Other*	Arsenic	11	32 <b>(8)</b> 73%	35 <b>(7)</b> 64%	640 <b>(0)</b> 0%	630	25	348.3	-

All concentrations in mg/kg

\*includes gravel material (made ground) and weathered natural gravels

Chart 6-1 illustrates arsenic concentrations in relation to soil type (Chart 6-1) and depth below the ground surface.(Chart 6-3). Elevated arsenic concentrations are more common in the finer grained sediments (as shown in Chart 6-1 and Table 6.1) in particular the silty sands and silty clays noted in the upper 1.5m of Cocklebank. The two sand units (fine to medium grained sands and medium grained sands) recorded considerably lower arsenic concentrations. The majority of the gravelly soils exceeded residential SGVs for arsenic, with one sample also exceeding the commercial/industrial SGV. These gravelly soils are associated with scoria block (slag from historical metal refining processes) which is likely to be the source of the high arsenic concentrations recorded.

The calculated US95 value for each soil type was above the SGV for residential landuse, but only above the commercial/industrial SGV in the silty clay.

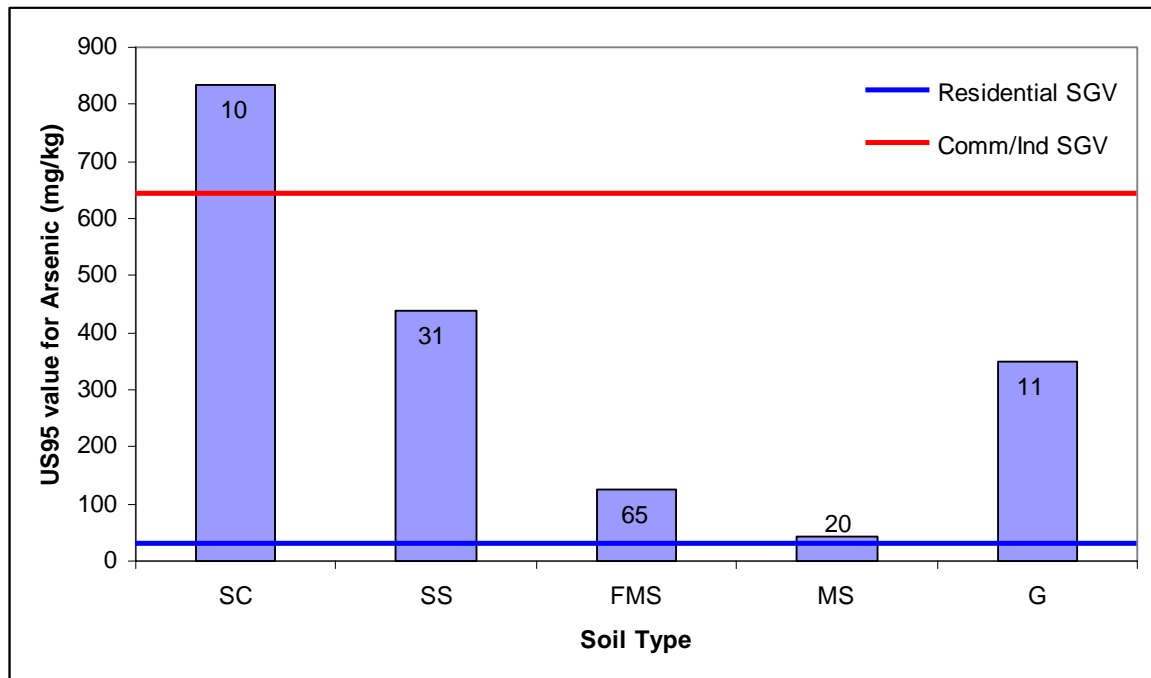


Chart 6-1 US95 value for arsenic based on soil type within Cocklebank. (Number of samples in each category shown on bar). SC- silty clay, SS- silty sand, FMS – fine to medium grained sand, MS- medium grained sand, G – gravel

### 6.3.2 Sieving Results

Following initial analysis, nine samples were submitted for particle size analysis and then each sieved fraction re-submitted for further analysis. Table A2 in Appendix A presents the results from subsequent analysis following sieving. Metal concentrations (arsenic, cadmium and lead) do not appear to be confined to a particular grain size, although metal concentrations are noticeably higher in the finer (<0.063mm) fractions and lower in the 212µm to 600µm fractions. Chart 6.2 summarises recorded arsenic concentrations across the grain sizes.

It is likely, that a proportion of the metals analysed for would have been washed out from the soil/sediment during sieving. The water used in the sieving process was not retained and therefore the proportion leached could not be determined. The concentrations recorded will therefore be different to the actual concentrations in their normal state. Refer to Section 6.7 for leachate results.

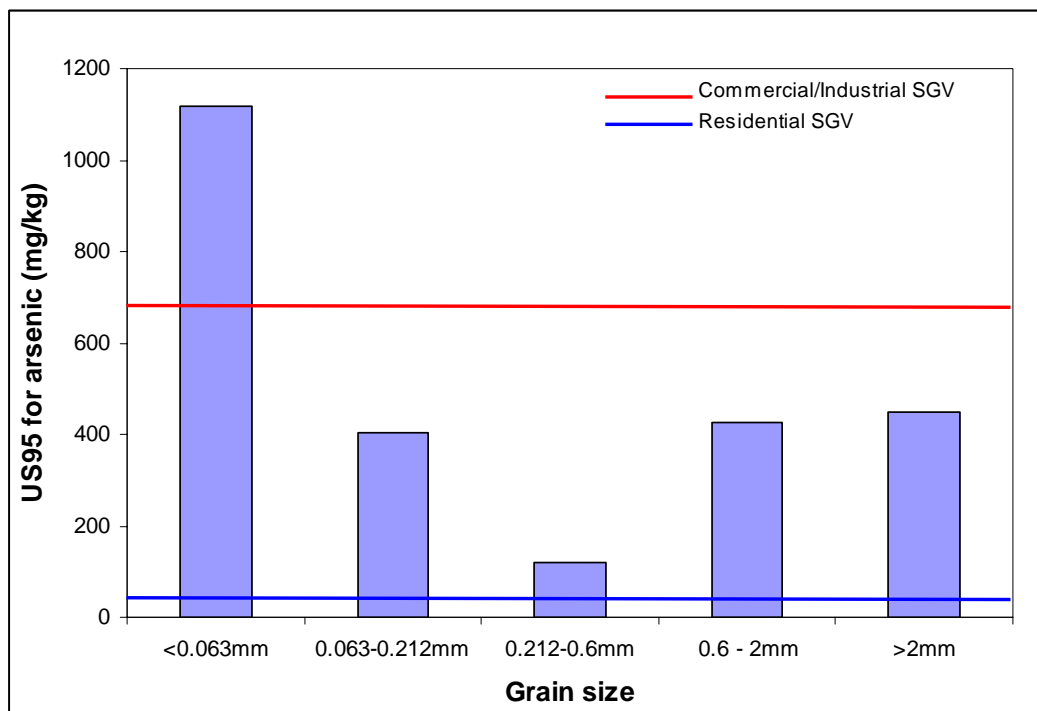


Chart 7-2 US95 value for arsenic based on grain size. (Number of samples in each category shown on bar).

### 6.3.3 Baseline Data

Baseline concentrations of inorganic data were derived from samples collected during the recent investigation (2008) from potential re-use areas where dredged Cocklebank soils could be emplaced, but also during the previous investigations in August and December 2007. The number of samples assessed within this report are outlined as follows:

- Seven samples from the beach/foredune at Rivere Towans (Buro Happold August & December 2007);
- Nine samples from Hayle Harbour/Estuary (Buro Happold December 2007);
- Nine samples from Harvey's Towans (2009); and
- Thirty four samples (August 2007) and six samples (2008) within North Quay.

Soils from the beach, harbour and Harvey's Towans are considered to have been deposited by 'natural' processes (such as marine, estuarine and aeolian processes) and have not been subjected to any anthropogenic point-source contamination. Soils from North Quay comprise of Made Ground. Results are summarised in Table 6-2 and within Appendix A – Table A.4.

Table 6—2 Range of metal concentrations recorded within 'background' areas

Soil Type	Determinand	No of samples	SGV/DIV		Max	Min	US95
			Resi (without plant uptake)	Commercial/ Industrial			
Beach	Arsenic*	7	35 (1) 14%	640 (0) 0%	39	18.9	-
	Copper**	7	190 (0) 0%	-	32	12.6	-
	Zinc**	7	720 (0) 0%	-	70	23.7	-
Harbour Bottom	Arsenic*	9	35 (1) 11%	640(0) 0%	40	24	35.5
	Copper**	9	190 (0) 0%	-	24	17	-
	Zinc**	9	720 (0) 0%	-	54	42	-
Harvey's Towans	Arsenic*	9	35 (6) 67%	640 (0) 0%	280	34	125
	Copper**	9	190 (1) 11%	-	490	23	154
	Zinc**	9	720 (1) 11%	-	750	48	266
North Quay	Arsenic*	40	35 (34) 85%	640 (2) 5%	1500	8.6	245
	Copper**	40	190 (22) 55%	-	24,200	17	871
	Zinc**	40	720 (9) 23%		21,300	21.2	901

All concentrations in mg/kg

\*SGV

\*\*DIV

**North Quay**

The majority of samples collected from across North Quay recorded concentrations of arsenic above residential (without plant uptake) SGV. Occasional samples also recorded concentrations of arsenic above the commercial/industrial SGV. The maximum concentration was some 40 times the SGV for residential (without plant uptake) landuse. The US95 value for arsenic was elevated above the residential (without plant uptake) SGV but below the commercial/industrial SGVs.

Over half the samples analysed recorded copper concentrations above the DIV with approximately 20% of samples recording zinc concentrations above the DIV. Maximum concentrations of both copper and zinc were highly elevated (approximately two orders of magnitude greater than the DIV). These maximum concentrations were not isolated/localised with a number of samples recording concentrations within the same order of magnitude as the maximum. The US95 value for both of these metals was above the relevant DIV.

**Hayle Towans**

Numerous concentrations of arsenic (67%) were recorded above the residential (without plant uptake) SGV. A single sample also recorded concentrations of copper and zinc above relevant DIV. This sample recorded the maximum arsenic concentration and was indicated to be a statistical outlier. However, based on the borehole logs and sampling location, this sample is not considered to be part of a different soil population and was therefore included within the US95 calculation. The US95 value for arsenic was elevated above the SGV for residential (without plant uptake), while the US95 for copper and zinc was below the relevant DIV.

**Harbour Bottom**

A single sample (11%) recorded concentrations of arsenic above the SGV for residential (without plant uptake) landuse. Concentrations of copper and zinc were below the relevant DIV. The US95 for arsenic was calculated at the SGV for residential (without plant uptake) landuse.

**Beach**

A single sample (14%) recorded concentrations of arsenic marginally above the SGV for residential (without plant uptake) landuse. All concentrations of copper and zinc were below relevant DIV. The conservative average US95 value for arsenic was below the SGV for residential landuse.

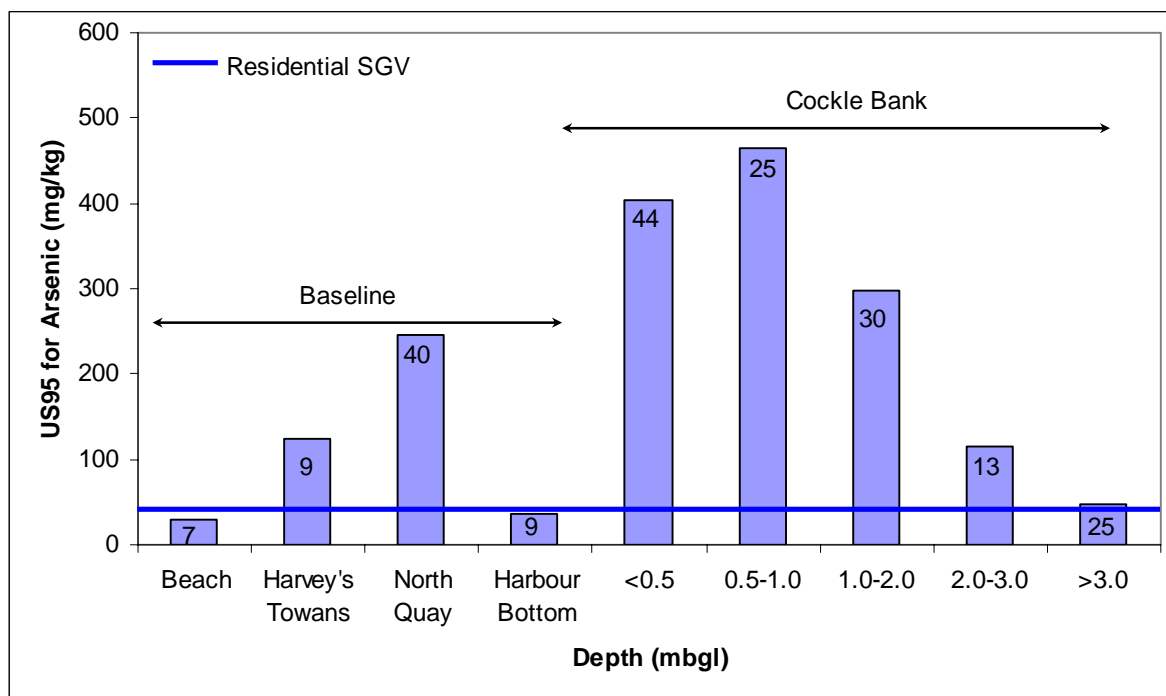


Chart 6-3 US95 values for arsenic (number of samples in each category shown on bar).

On the basis of the above, arsenic concentrations within Cocklebank are more commonly elevated within the finer grained materials (silty clay and silty sand) within the upper 2.0m. Concentrations of arsenic below this depth of 2m are similar to background concentrations (Charts 6-1, 6-3 and Figures 5 and 6).

#### 6.3.4 Organic soil results

Fifteen soil samples during the August 2007 investigation and four soil samples during the recent investigations in 2008/2009 were analysed for organic determinands listed in Appendix A – Table A.3. All organic determinand concentrations were recorded below the laboratory detection limit in samples analysed during the August 2007 investigation. The detection limit for benzene, C8-C12 range aromatic hydrocarbons and naphthalene was however above the SGV for residential (without plant uptake) and the residential (with plant uptake) SGV for benzo(a)pyrene. Subsequent analysis in the 2008 and 2009 investigations confirmed that concentrations for these determinands were in fact below the relevant SGV/GACs.

#### 6.4 Acute Risks to Human Health

There are no guidance values for assessing acute risk related to soil contamination. Because such risks are associated with short-term exposure, consideration of maximum concentrations (and not the “average” concentration which is relevant to chronic, or long-term, risk) is required. Comparison of these maximum

concentrations has been made with the various SGVs and other screening values which will provide a conservative benchmark for such short-term risks (as the SGVs etc are based upon a long-term exposure).

The maximum concentrations assessed to be most significant were arsenic and lead. The maximum recorded concentration of arsenic (recorded in as sample of silty clay) was 34 times the SGV for residential (without plant uptake) landuse and 1.8 times the SGV for commercial/industrial landuse. The second highest concentration of arsenic (recorded in a sample of silty sand) was 31 times the SGV for residential (without plant uptake) and 1.7 times the SGV for commercial/industrial landuse.

The maximum recorded concentration of lead (recorded in a sample of silty sand) was approximately four times the SGV for residential (without plant uptake) and just over two times the SGV for commercial/industrial landuse. This concentration appears to be isolated/localised with the next highest concentration recorded only marginally above the SGV for residential (without plant uptake). No other concentrations of lead were recorded above the SGV for residential or commercial/industrial landuse.

## 6.5 Risks to *Flora*

Phytotoxic effects with respect to *flora* have been assessed by statistical evaluation of the datasets of the phytotoxic elements copper and zinc from the August 2007, and recent 2008 and 2009 investigations. Results are summarised in Table 6-3, Chart 6-4 and within Appendix A – Table A.1.

The majority of samples recorded concentrations of zinc and copper above the DIV. As for arsenic, the number of exceedances for copper and zinc are greater in the finer grained sediments (Table 6-2, Chart 6-4) in particular the silty sands and silty clays noted in the upper 1.5m of Cocklebank. The two sand units (fine to medium grained sands and medium grained sands) recorded considerably less exceedances of copper and zinc. Maximum concentrations and number of exceedances were highest within the gravelly soils, which as for arsenic is likely to be associated with scoria block (slag from historical metal refining processes) within this material.

Concentrations of copper and zinc in all samples are however well below the relevant maximum permissible risk (MPR) value based on the Dutch Guidelines (ref 29).



Table 6—3 Phytotoxic determinands

Soil Type	Determinand	No of samples	Dutch Intervention Value (No. of Samples Exceeding DIVs)	Max	Min	US95
Silty Clay	Copper	10	190 <b>(10)</b> 100%	2100	450	1585.8
	Zinc	10	720 <b>(4)</b> 40%	2000	60	1131.1
Silty Sands	Copper	31	190 <b>(14)</b> 45%	1476	1	751.1
	Zinc	31	720 <b>(4)</b> 13%	1762	30	667.6
Fine- Med Sand	Copper	65	190 <b>(9)</b> 14%	1063	<6	251.5
	Zinc	65	720 <b>(2)</b> 3%	1196	35	260.1
Med Sands	Copper	20	190 <b>(1)</b> 5%	210	13	111.6
	Zinc	20	720 <b>(0)</b>	210	15.7	-
Other*	Copper	11	190 <b>(2)</b> 18%	3000	17.8	2129.5
	Zinc	11	720 <b>(3)</b> 27%	2100	71	1642.7

1. All concentrations in mg/kg

2. The calculation of US95 average concentrations is not required for determinands where exceedences of the relevant Dutch Intervention Values (DIV) (ref 29) have not been identified.

\* includes gravel material (made ground) and weathered natural gravels

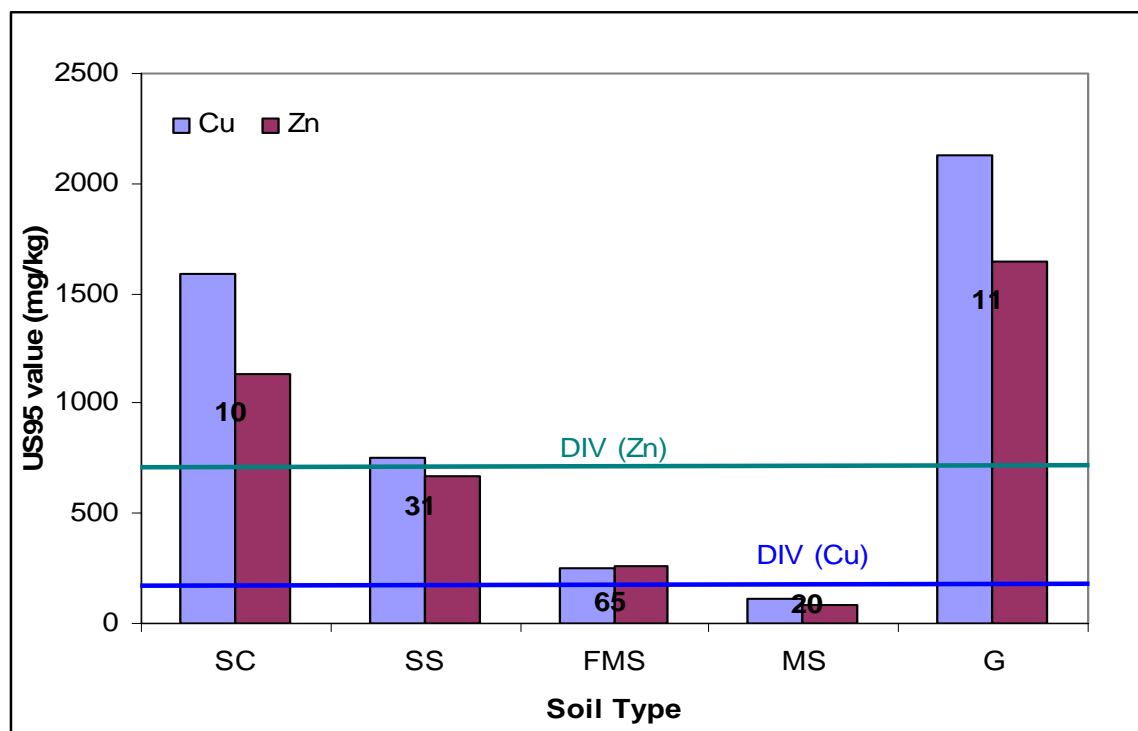


Chart 6-4 US95 value for copper and zinc based on soil type within Cocklebank. (Number of samples in each category shown on bar). SC- silty clay, SS- silty sand, FMS – fine to medium grained sand, MS- medium grained sand, G – gravel

## 6.6 Risks to buildings/structures

Classification of buried concrete against sulphate attack has been carried out through the assessment of chemical test results on various strata and various levels to the current guidance BRE SD1:2005 (ref 30). In summary the soil results for Cocklebank material at all depths give a design sulphate class of DS-1. The DS-Class converts into a classification of the aggressive chemical environment for concrete (ACEC) once the pH and mobility of groundwater are taken into consideration. The characteristic pH value soil has been taken as 8.5 for the Cocklebank material. For all foundations an ACEC classification of AC-1s has been determined assuming groundwater is static.

In order to assess the risks to conventional water pipe material from Cocklebank material, contaminant concentrations have been compared against threshold values derived by Water Regulations Advisory Scheme (WRAS) (ref 31). Where soil concentrations exceed these threshold values, it is likely that special consideration of material selection will be required. All pH values and the majority of arsenic concentrations exceeded the WRAS criteria. With reference to Table 3 of WRAS Information and Guidance Note: No 9-04-03 (ref 31),

suitable pipe materials for corrosive, toxic environments include wrapped iron, plastic coated copper pipe. The WRAS guidelines are however known to be conservative and are not risk based.

## **6.7 Leachability Data**

Soil leachability testing has been undertaken on representative samples from the ground investigations undertaken in August 2007, 2008 and 2009 following guidance within Environment Agency (2006) Remedial Targets Methodology (ref 32), specifically:

- BSEN 12457 Part 3 (Two Stage Test using a liquid to solid ratio of 2:1 in the first stage and a liquid to solid ratio of 8:1 in the second stage [Where 2:1 and 8:1 results are available for a sample the higher result of the two is used (which is generally the 2:1 result) in the following assessment]; and
- BSEN 12457 Part 2 (One Stage Test using a liquid to solid ratio of 10:1).

A total of 29 samples were submitted for leachability analysis, four from the August 2007 investigation, 23 from the 2008 investigation and two from the 2009 investigation. Determinands with one or more exceedance of relevant screening criteria are summarised in Table 6.4. The soil leachability data is presented as Table A5 in Appendix A.

**Table 6-4 Determinands showing exceedences of thresholds**

Determinand	No of samples	Adopted Screening Criteria (No. of samples exceeding adopted criteria)		Max	Min
		Marine water EQS Standards	Relevant to Major Aquifer*		
Antimony	29		5 (7) 24%	38	<0.75
Arsenic	29	25(18) 62%	10(24) 83%	430	<0.75
Chromium	29	15 (2) 7%	50 (1) 3%	63	<1
Copper	29	5 (18) 62%	2000 (0)	47	<1.6
Zinc	29	40 (4) 14%		1200	<5
Chloride (mg/L)	29		250 (25) 86%	850	69

All results in µg/L, unless otherwise indicated

\* UK Drinking Water Standards and WHO where UK DWS not available

The leachate from over 60% of soil samples analysed recorded concentrations of arsenic and copper above relevant EQS for marine waters. Occasional samples of chromium and zinc were also elevated above EQS for marine waters in leachate analysed. The leachate from over 80% of samples analysed recorded concentrations of arsenic and chloride above UK DWS, with occasional concentrations of leachable antimony and chromium recorded above UK DWS.

## 6.8 Summary of analytical data

The main contaminants of concern within Cocklebank sediments are arsenic and to a lesser extent copper and zinc. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. >2m bgl) being comparable to background concentrations found in Hayle Harbour/ Estuary, Harvey's Towans and the nearby beach. Maximum

concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand).  
Arsenic, copper and zinc are highly leachable within all materials types.

## 7 Contaminated Land Risk Assessment

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### 7.1 General approach

In the UK, the assessment of risk from contamination follows the source-pathway-target approach. If one of these three elements is absent it is considered that there is no risk of harm. If, however, there is considered to be a linkage between any given source and any given target/receptor then a risk-based approach is used to assess the significance or impact of any such linkage.

**Source** – The contaminants that have the potential to negatively affect human health and/or the health of the environment (i.e. the hazard).

**Pathway** – The potential route by which a receptor may come into contact with the source.

**Receptor** – The specific group of human beings or aspect of the environment (e.g. controlled waters) that could be affected by the source.

Risks are defined as the probability of an event occurring combined with the severity of the consequence of that event occurring. Particularly, to assess the risk to site end users posed by any given source, the sensitivity of each receptor is considered. For example, the concentration of contamination acceptable at a site to be developed as a residential property with a garden used to grow vegetables and accessible to young children is set lower than that for a commercial site where soil is exposed in minor areas of landscaping and the only long-term users of the site are adults. Similarly, a site overlying a major aquifer supplying potable water to a large population will be considered more stringently than a site overlying an impermeable geology with only minor seepages of groundwater.

### 7.2 Conceptual site model

The potential risks posed to human health and the environment by ground contamination at this site have been evaluated using a quantitative risk assessment which incorporates the 'source-pathway-receptor' identification and assessment methodology in accordance with CLR 11 (ref 1). The risk assessment process therefore involves the identification of each site specific source based on both desk based and chemical information obtained from the site investigation together with identification of each relevant exposure pathway and each potential receptor. The potential risks to the receptor are then assessed by considering the potential effect of the source on the receptor as well as the likelihood of a pathway linking the two, i.e. a pollutant linkage as discussed above.

#### 7.2.1 Potential sources

The site of the proposed redevelopment is extensive and comprises much of Hayle Harbour. This report, however, deals solely with the area known as Cocklebank. Proposals include the removal of the Cocklebank

to create space for floating pontoons for yacht mooring. The objective of this investigation was therefore to ascertain the contaminative status and composition of Cocklebank.

Based on desk based and site investigation data obtained to date the potential sources of contamination that may reasonably affect receptors on the site are summarised in Table 9-1 below:

**Table 9-1 Sources of Contamination**

Potential Source(s)	Potential Contaminants of Concern/Comments
Metal contaminated material (Cocklebank)	Arsenic concentrations in soil > SGV for residential and commercial/industrial landuse. Numerous concentrations of copper and zinc > DIV. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. >2m bgl) being comparable to background concentrations. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand). Arsenic, copper and zinc are highly leachable within all materials types.

#### 7.2.2 Potential receptors and pathways

Consideration is being given to re-using the excavated spoil from Cocklebank on other suitable areas of the proposed development. Site specific pathway receptor linkages have therefore been identified for the site (Table 9.2 overleaf) with respect to the sources outlined above and with respect to anticipated future uses of the site i.e. land raising (North Quay and dune replenishment) as described in Section 2.3.

**Table 7—2 Site Specific Receptors & Pathways**

Receptor		Pathway	E	C	P
Human Health	Construction workers	Direct contact and dermal uptake, soil and dust ingestion.		✓	✓
	Site end users (maintenance workers, site residents and the public including children, commercial users)	Direct contact and dermal uptake, soil and dust ingestion. Ingestion of contaminated water supplies.			✓
Controlled Waters	Hayle Harbour	Leaching and groundwater transport/surface runoff	✓	✓	✓
	Copperhouse Pool (SSSI)	Leaching and groundwater transport/surface runoff	✓	✓	✓
	Carnsew Pool (SSSI)	Leaching and groundwater transport/surface runoff	✓	✓	
	Minor Aquifer	Leaching and groundwater transport.		✓	✓
Flora		Direct contact and up-take <i>via</i> root system.			✓
Buildings/Services	On site structures (including water supply pipes)	Direct contact/ permeation of plastic pipe work by contaminants in soil and leachate.			✓
	Offsite structures (including water supply pipes)	Direct contact/ permeation of plastic pipe work by contaminants in leachate.			✓

E=existing condition

C=construction

P=Proposed end use

### 7.3 Presentation of risk assessment

The details of the Generic Quantitative Risk Assessment are presented in Tables 9-3 (existing site condition), 9-4 (enabling works/construction phase condition), and 9-5 (proposed development) and the results/ conclusions discussed in Section 9.



It should be noted this risk assessment has been completed without consideration of potential remedial measures however does assume use of standard site health and safety procedures and appropriate personal protective equipment (PPE) and site management practices (stockpile management, surface drainage etc). The risk assessment has been carried out for three scenarios:

- (i) Existing condition: Cocklebank remains insitu [Table 9.3];
- (ii) Enabling works/construction phase: Removal of Cocklebank and stockpiling onsite [Table 9.4]; and
- (ii) Proposed development: Reuse of material onsite as land raising material and dune replenishment [Table 9.5].

Table 7—1 Generic Quantitative Risk Assessment – Existing Condition

Source			Receptor	Pathway	Risk assessment following CIRIA C552			Comment
Origin	Zone Affected	Chemicals of Concern			Consequence	Probability	Risk	<b>Description of source [bold text].</b> Comment on hazard realisation [normal text]
<b>Metal contaminated soils</b>	Cocklebank	Heavy metals (Arsenic, Copper and Zinc)						<b>Arsenic concentrations in soil &gt; SGV for residential and commercial/industrial landuse. Numerous concentrations of copper and zinc &gt; DIV. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. &gt;2m bgl) being comparable to background concentrations. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand).</b> <b>Arsenic, copper and zinc are highly leachable within all materials types.</b>
			Hayle Harbour	Migration via leaching .	Medium	Low-likelihood	<b>Moderate/Low</b>	Cocklebank is regularly flushed by tides; hence there is potential for the migration of metal contamination via leaching. Dilution with sea water likely. Arsenic concentrations recorded in shellfish off the coast are considered unlikely to cause health problems (ref 5).
			Copperhouse Pool (SSSI)	Migration via leaching	Medium	Unlikely	Low	SSSI is adjacent to Cocklebank and of high ecological value. Used as intertidal habitat for some migratory birds. Background arsenic concentrations recorded in sediment within Copperhouse Pool are highly elevated. Cocklebank is regularly flushed by tides - dilution with seawater likely hence limited potential for the migration of metal contamination into Copperhouse Pool.
			Carnsew Pool (SSSI)	Migration via leaching	Medium	Unlikely	Low	SSSI's is adjacent to Cocklebank and of high ecological value. Used as intertidal habitat for some migratory birds. Cocklebank is regularly flushed by tides - dilution with seawater likely hence limited potential for the migration of metal contamination into Carnsew Pool

Table 7—2 Generic Quantitative Risk Assessment – Enabling works/construction phase (Removal of Cocklebank)

Source			Receptor	Pathway	Risk assessment following CIRIA C552			Comment
Origin	Zone Affected	Chemicals of Concern			Consequence	Probability	Risk	<b>Description of source [bold text].</b> Comment on hazard realisation [normal text]
<b>Metal contaminated soils</b>	Dune Rebuilding Areas	Heavy metals (Aresnic, Copper and Zinc)						<b>Arsenic concentrations in soil &gt; SGV for residential and commercial/industrial landuse. Numerous concentrations of copper and zinc &gt; DIV. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. &gt;2m bgl) being comparable to background concentrations. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand).</b>  <b>Arsenic, copper and zinc are highly leachable within all materials types.</b>
			Construction workers	Direct contact, soil / dust ingestion	Medium	Low-likelihood	<b>Moderate/Low</b>	Potential for exposure during dredging / earthworks. Period of exposure relatively limited. Potential for maximum concentrations to produce acute effects. Standard health & safety precautions likely.
			Hayle Harbour	Migration caused by sediment disturbance during removal of Cocklebank	Medium	High-likelihood	<b>High</b>	Potential for increased leaching of contaminants and sediment during removal of Cocklebank. Modelling of plume dispersion shows some deposition of fines in lower Lelant Water, Carnsew and Copperhouse Pool (ref 7). Impacts from removal are likely to be temporary.
			Copperhouse Pool (SSSI)	Migration caused by sediment disturbance during removal of Cocklebank	Medium	Low-likelihood	<b>Moderate/Low</b>	Potential for increased leaching of contaminants and sediment during removal of Cocklebank. Modelling of plume dispersion shows some deposition of fines in lower Lelant Water, Carnsew and Copperhouse Pool (ref 7). Impacts from removal are likely to be temporary. Background arsenic concentrations recorded in sediment within Copperhouse Pool are highly elevated (ref 5).
			Carnsew Pool (SSSI)	Migration caused by sediment disturbance during removal of Cocklebank	Severe	Low-likelihood	<b>Moderate</b>	Potential for increased leaching of contaminants and sediment during removal of Cocklebank. Modelling of plume dispersion shows some deposition of fines in lower Lelant Water, Carnsew and Copperhouse Pool (ref 7). Impacts from removal are likely to be temporary.
			Minor Aquifer	Migration of contamination via leaching from stockpiles	Medium	Low-likelihood	<b>Moderate/Low</b>	Potential for leaching of contaminants from stockpiling of material. Groundwater is relatively shallow (~3m bgl) in the quay areas and is in direct hydraulic continuity with the harbour. Groundwater within the higher dune areas ranges from 5-17m bgl. The site does not lie within an EA source protection zone. The nearest potable abstraction is located 320m south of the site with the harbour breaking the pathway between the two.

Table 7—3 Generic Quantitative Risk Assessment – Proposed development (Reuse of material onsite)

Source			Receptor	Pathway	Risk assessment following CIRIA C552			Comment
Origin	Zone Affected	Chemicals of Concern			Consequence	Probability	Risk	<b>Description of source [bold text].</b> Comment on hazard realisation [normal text]
Metal contaminated soils	North Quay	Heavy metals,						<b>Arsenic concentrations in soil &gt; SGV for residential and commercial/industrial landuse. Numerous concentrations of copper and zinc &gt; DIV. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. &gt;2m bgl) being comparable to background concentrations. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand).</b>  <b>Arsenic, copper and zinc are highly leachable within all materials types.</b>
			Future construction/maintenance workers	Direct contact, soil / dust ingestion	Medium	Low-likelihood	<b>Moderate/Low</b>	Potential for exposure during future construction or maintenance work. Period of exposure relatively limited. Potential for maximum concentrations to produce acute effects. Standard health & safety precautions likely.
			Future site users	Direct contact and dermal uptake, soil and dust ingestion, dust inhalation.	Medium	Likely	<b>Moderate</b>	A large proportion of site (i.e. North Quay) will be hardstanding preventing direct contact. Potential for contact in areas of soft landscaping - dune areas in particular which will be used for recreational purposes with regular contact by humans, including children.
			Hayle Harbour	Migration <i>via</i> leaching.	Mild	Low-likelihood	Low	Majority of site to be covered in hard standing limiting rainwater infiltration. Contaminants are reasonably mobile and present at high concentrations. Groundwater is relatively shallow (~3m bgl) in the quay areas and is in direct hydraulic continuity with the harbour. Groundwater within the higher dune areas ranges from 5-17m bgl. Dilution with seawater likely.
			Copperhouse Pool (SSSI)	Migration <i>via</i> leaching	Mild	Low-likelihood	Low	Majority of site to be covered in hard standing limiting rainwater infiltration. Contaminants are reasonably mobile and present at high concentrations. Groundwater is relatively shallow (~3m bgl) in the quay areas and is in direct hydraulic continuity with the harbour. Groundwater within the higher dune areas ranges from 5-17m bgl. Background arsenic concentrations recorded in sediment within Copperhouse Pool are highly elevated. Cocklebank is regularly flushed by tides - dilution with seawater likely.
			Minor Aquifer	Migration <i>via</i> leaching	Mild	Low-likelihood	Low	Majority of site to be covered in hard standing limiting rainwater infiltration. Contaminants are reasonably mobile and present at high concentrations. Groundwater is relatively shallow (~3m bgl) in the quay areas and is in direct hydraulic continuity with the harbour. Groundwater within the higher dune areas ranges from 5-17m bgl. The site does not lie within an EA source protection zone. The nearest potable abstraction is located 320m south of the site with the harbour breaking the pathway between the two.
			Flora	Direct root uptake	Medium	Likely	<b>Moderate</b>	Contaminants are reasonably mobile and present at high concentrations. Potential for uptake in areas of soft landscaping.
			Buildings/services	Direct Contact	Medium	Low-likelihood	<b>Moderate/Low</b>	Arsenic concentrations present at high concentrations. Potential for permeation of potable water supply pipelines.

## 8 Waste Management

---

### 8.1 Assessment criteria

Pending regulatory approval, it is planned that the majority of material removed from Cocklebank will be re-used elsewhere on site as fill, subject to geotechnical and environmental suitability. In order to determine the likely waste classification, soil and leachate test results have been assessed using:

- Values indicating Hazardous Waste according to the 'Environment Agency (2004) Framework for the Classification of Contaminated Soils as Hazardous Waste, Version 1, July 2004'(ref 33);
- Technical Guidance WM2 – Hazardous Waste, Interpretation of the definition and classification of hazardous waste'(ref 34); and
- Waste Acceptance Criteria (WAC) limit values for inert and hazardous waste (ref 35).

Approximately 16% of soil samples (17 out of 106) located within Cocklebank were classified as Hazardous Waste according to the 'Framework for the Classification of Contaminated Soils as Hazardous Waste' and Technical Guidance WM2 (Table A6, Appendix A) due to elevated concentrations of metals. These 'hazardous' soil samples were comprised of the follow soil types:

- Silty clay: 9/10 samples (90%);
- Silty sand: 9/31 samples (29%)
- Fine to medium grained sand: 2/65 samples (3%); and
- Gravel: 2/11 samples (18%).

The elevated concentration of arsenic recorded within the gravel deposits is due to the high percentage of broken down scoria block (slag from local historical metal smelting processes) contained within this material. When assessing the depth that these hazardous samples were collected from; over half (59%) were collected from above 0.5m bgl, just over one third (35%) were collected between 0.5 and 1.0mbgl, and only one sample (0.06%) was collected between 1.0 and 1.5m bgl.

When compared to the Waste Acceptance Criteria (WAC) limit values (Table A7, Appendix A), all three samples analysed recorded concentrations of sulphate and total dissolved solids above the Inert WAC. Two samples also recorded concentrations of copper above the Inert WAC.

Based on the assumptions and data assessment in line with current guidance, any material from above 1.5mbgl (particularly finer grained material) not suitable for re-use is likely to be disposed of to a Hazardous waste landfill facility. Any material from below 1.5m bgl is likely to be disposed of to a Non-Hazardous waste landfill facility.

Should finer grained material within the upper 1.5m of Cocklebank be geotechnically suitable for reuse onsite, this material would require some form of pre-treatment. Any such re-use will need to be carried out under an exemption from Environmental Permitting, or in accordance with the recently published CL:AIRE/EA Code of Practice (ref 36). Further details on waste management should be supplied in the Remediation Strategy/Materials Management Plan.

## 9 Conclusions

### 9.1 Cocklebank

Recent investigation has showed Cocklebank to comprise alternating fine to medium grained sands and silty sands in the upper 1.5m, with lenses of silty clays noted throughout. This sequence is underlain by medium grained sands. The northwest and southeast ends of the bank feature gravel, boulders and cobbles at the surface. Gravel is also present at depth within the Bank. The main contaminants of concern within Cocklebank sediments are arsenic and to a lesser extent copper and zinc. Contaminant concentrations generally decrease with depth and increasing grain size with concentrations recorded in coarser sand, below the low tide level (i.e. >2m bgl) being comparable to background concentrations found in Hayle Harbour/ Estuary, Harvey's Towans and the nearby beach. Maximum concentrations are highly elevated, recorded within the finer grained materials (silty clay and silty sand). Arsenic, copper and zinc are highly leachable within all materials types.

### 9.2 Risk assessment

A summary of the risk assessment for each of the three scenarios (current, during development and proposed future use) is presented in Table 11.1 and discussed in more detail in the following text.

**Table 9-1 Summary of risk assessment (pre-mitigation)**

Receptor	Source	Current risk	Risk during construction	Future risk
Site users	Metal contaminated soil	n/a	n/a	Moderate
Construction/maintenance workers		n/a	Moderate/Low	Moderate/Low*
Hayle Harbour		Moderate/Low	High	Low
Copperhouse Pool		Low	Moderate/Low	Low
Carnsew Pool		Low	Moderate	n/a
Minor Aquifer		n/a	Moderate/Low	Low
Flora		n/a	n/a	Moderate
Buildings/Services		n/a	n/a	Moderate/Low

The generic quantitative risk assessment carried out on the basis of both existing and recently acquired data indicates that there are potentially moderate risks to the environment (Hayle Harbour and SSSIs) under the currently existing conditions. The proposed removal of Cocklebank will give rise to some temporary risks, most notably to Hayle Harbour and to a lesser extent Copperhouse Pool, Carnsew Pool and the Minor Aquifer due to remobilisation of metal contaminated sediment. The short-term risks to the Minor Aquifer are likely to increase during the excavation works primarily because of the potential for runoff and leaching from stockpiles.

Although the risks from sediment remobilisation can not be completely mitigated, they can be minimised through the implementation of a rigorous environmental management plan which would incorporate the adoption of appropriate methods, such as working at the correct stages of the tide, the use of silt traps etc. Risks to the Minor Aquifer can be mitigated by the adoption of safe working practices such as pre-planned stockpile management, measures to control run off, leachate collection etc. The potential risks to construction workers from soil contaminants are capable of mitigation by means of an appropriately rigorous health and safety/hygiene regime.

The proposed development anticipates the potential re-use of excavated material on other suitable areas of the site. Without mitigation, potential risks to future site users, *flora* and buildings/services could be realised. These risks are capable of mitigation by appropriate treatment and re-use of material subject to licensing (i.e. Environmental Permitting, CL:AIRE/EA Code of Practice). One option would be to reuse material containing contaminants at background concentrations (the lower portion of Cocklebank) in areas of soft landscaping, while pre-treating the upper portion of Cocklebank prior to placement beneath hardstanding.

Provided the appropriate mitigation measures are put in place and the recommendations in Section 10 adopted, the risks to people and the environment can all be mitigated to acceptably low levels.

#### **9.2.1 Waste**

The proposed approach to waste management, subject to regulator approval, is to reuse the majority of excavated materials on site as fill. The preliminary classification indicates that material in the top 1.5m of Cocklebank (generally silty sand and silty clay, but also some gravel) is likely to be classified as Hazardous Waste due to heavy metal concentrations. The majority of coarser grained materials (fine to medium and medium grained sand) below this depth are likely to be classified as Inert or Non-Hazardous waste.

Should finer grained material within the upper 1.5m of Cocklebank be geotechnically suitable for reuse onsite, this material would require some form of pre-treatment subsequent to discussions with the Environment Agency. Any such re-use will need to be carried out under an exemption from Environmental Permitting or in accordance with the recently published CL:AIRE/EA Code of Practice (ref 36). Further details on waste management should be supplied in the Remediation Strategy/Materials Management Plan.



## 10 Recommendations

---

It is recommended that the following measures are adopted to mitigate the potential risks related to the proposed development:

1. The implementation of a rigorous health & safety regime (including PPE and personal hygiene) by the construction work force;
2. Construction workers should remain vigilant of ground conditions at all times and should report any suspect areas of potential contamination;
3. Stockpiling of grossly contaminated soils should be avoided if possible and where necessary, stockpiles should be placed on impermeable material (i.e. hardstanding) and covered when not in use; and
4. Remedial works will be required for mitigation of risks during removal and re-use of Cocklebank material. Further assessment of remedial options is required.

In addition to these measures, it is recommended that:

5. A Remedial Options Appraisal is prepared accordance with the Model Procedures for the management of land contamination, 2004, CLR11 (ref.1);
6. Following approval of the preferred remedial option, a Remediation Strategy and Materials Management Plan will need to be prepared in accordance with the Model Procedures for the management of land contamination, 2004, CLR11 (ref.1) and/or the recently published CL:AIRE/EA Code of Practice (ref 36);
7. An Environmental Management Plan should be prepared and agreed with the regulatory authorities prior to commencement of the enabling works; and
8. Provision should be made for a Verification Report to be prepared following remediation. This Report will be prepared in general accordance with the Model Procedures for the management of land contamination, 2004, CLR11 (ref.1) and/or the recently published CL:AIRE/EA Code of Practice (ref 36). This provision will need to take into account both the amount of data that will be obtained over the course of the work, but also the longevity of the work programme.

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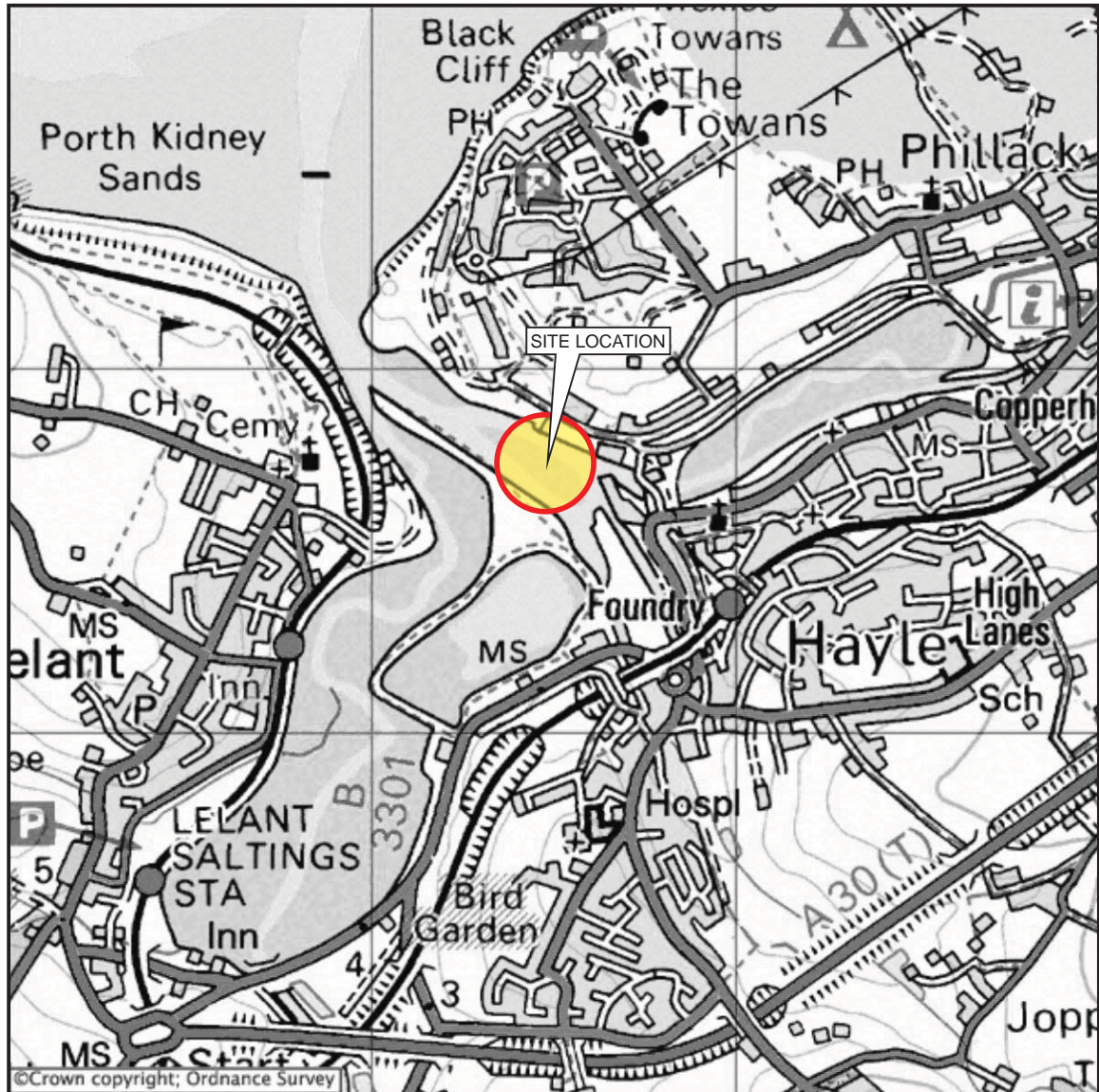
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## Figures

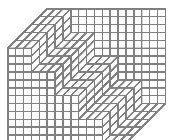
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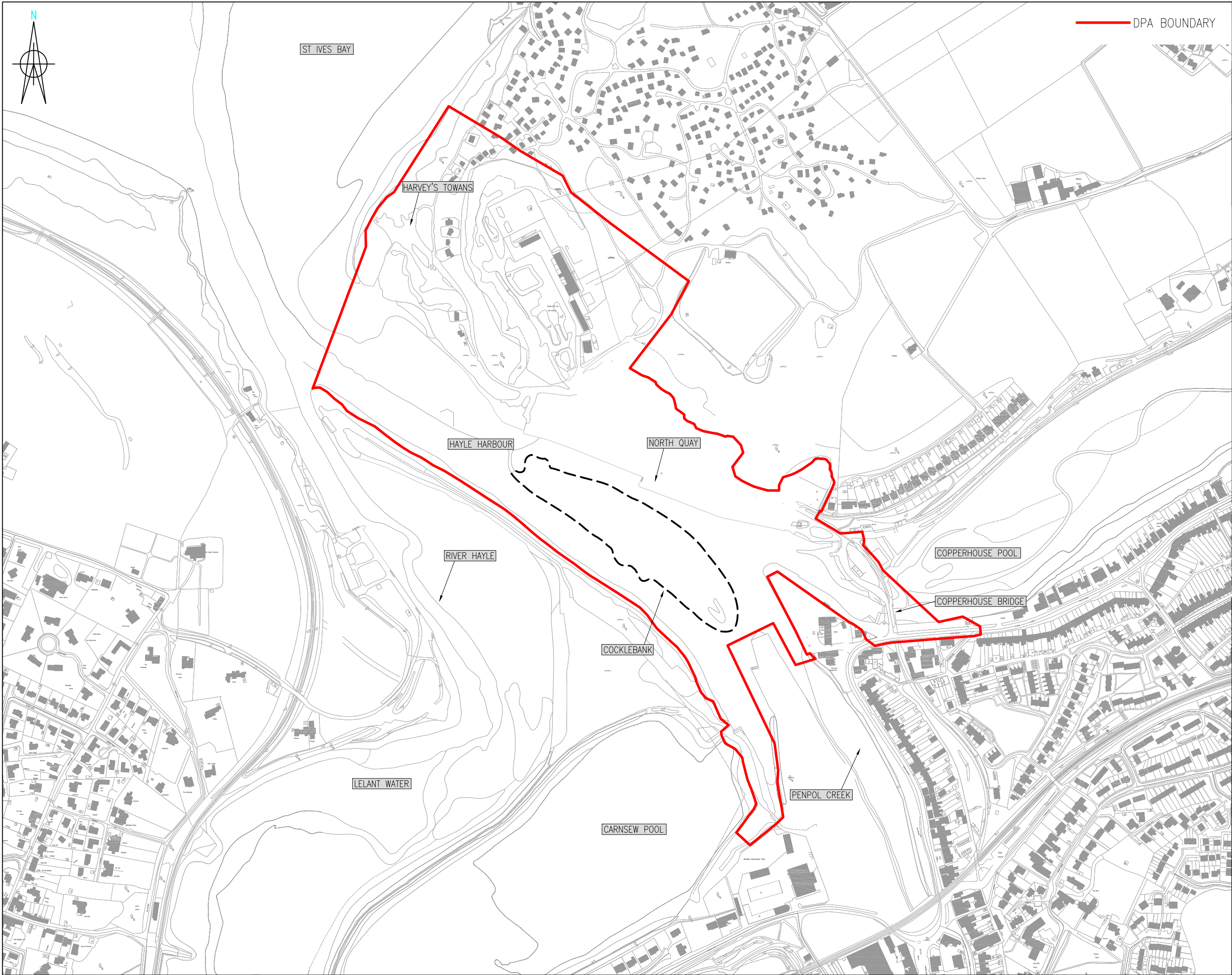
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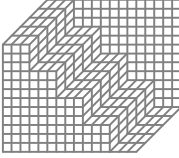
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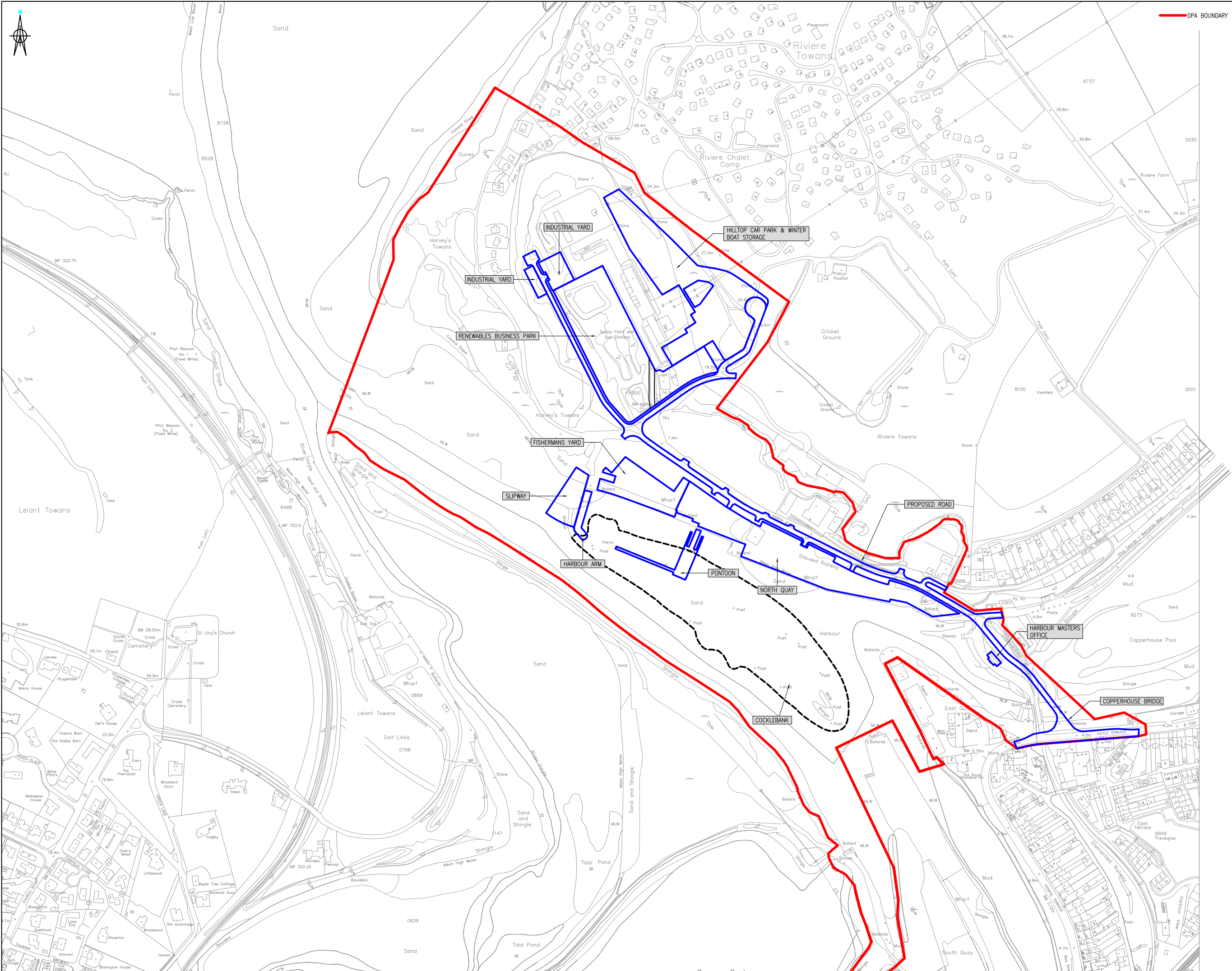
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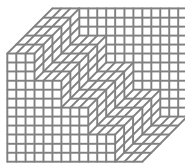
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**FIGURE 3**

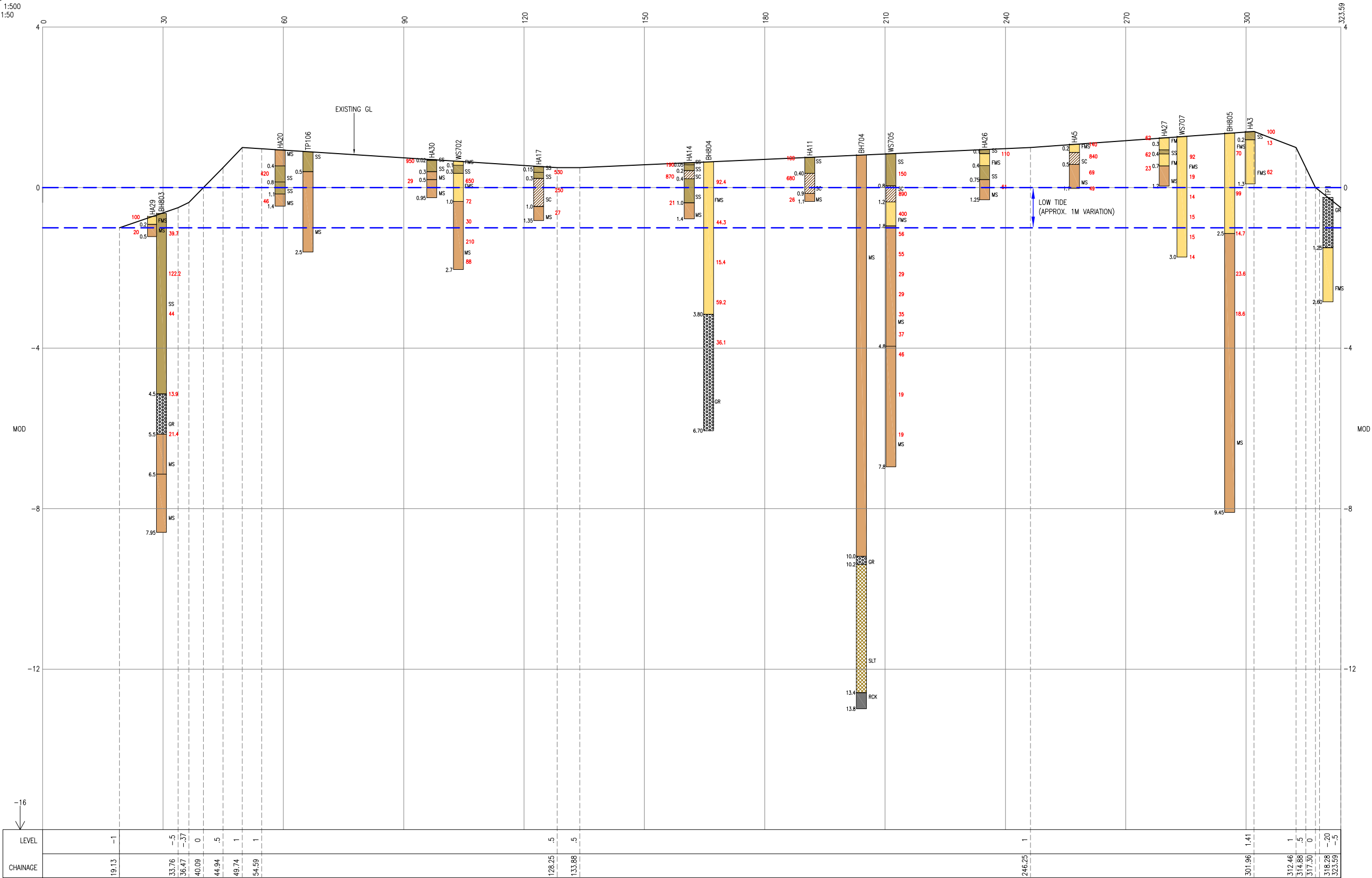
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SECTION 1  
SCALES  
HORIZ. 1:500  
VERT. 1:50



LEVEL		-1	-5	-37	0	.5	1	1	.5	.5	1	1.41	1	.5	0	-20	-5
CHAINAGE		19.13	33.76	36.47	40.09	44.94	49.74	54.59	128.25	133.88	246.25	301.96	312.46	314.88	317.30	318.28	323.59

2.0 ARSENIC CONCENTRATION (MG/KG)

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FIGURE 5**

Scales@A1 AS SHOWN

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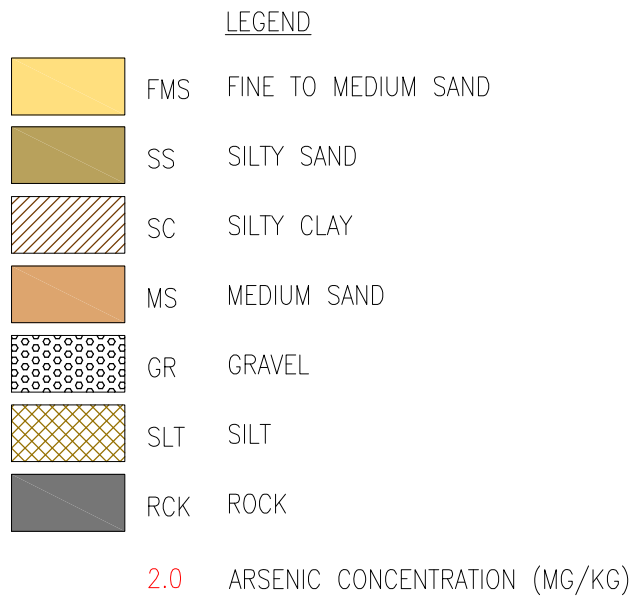
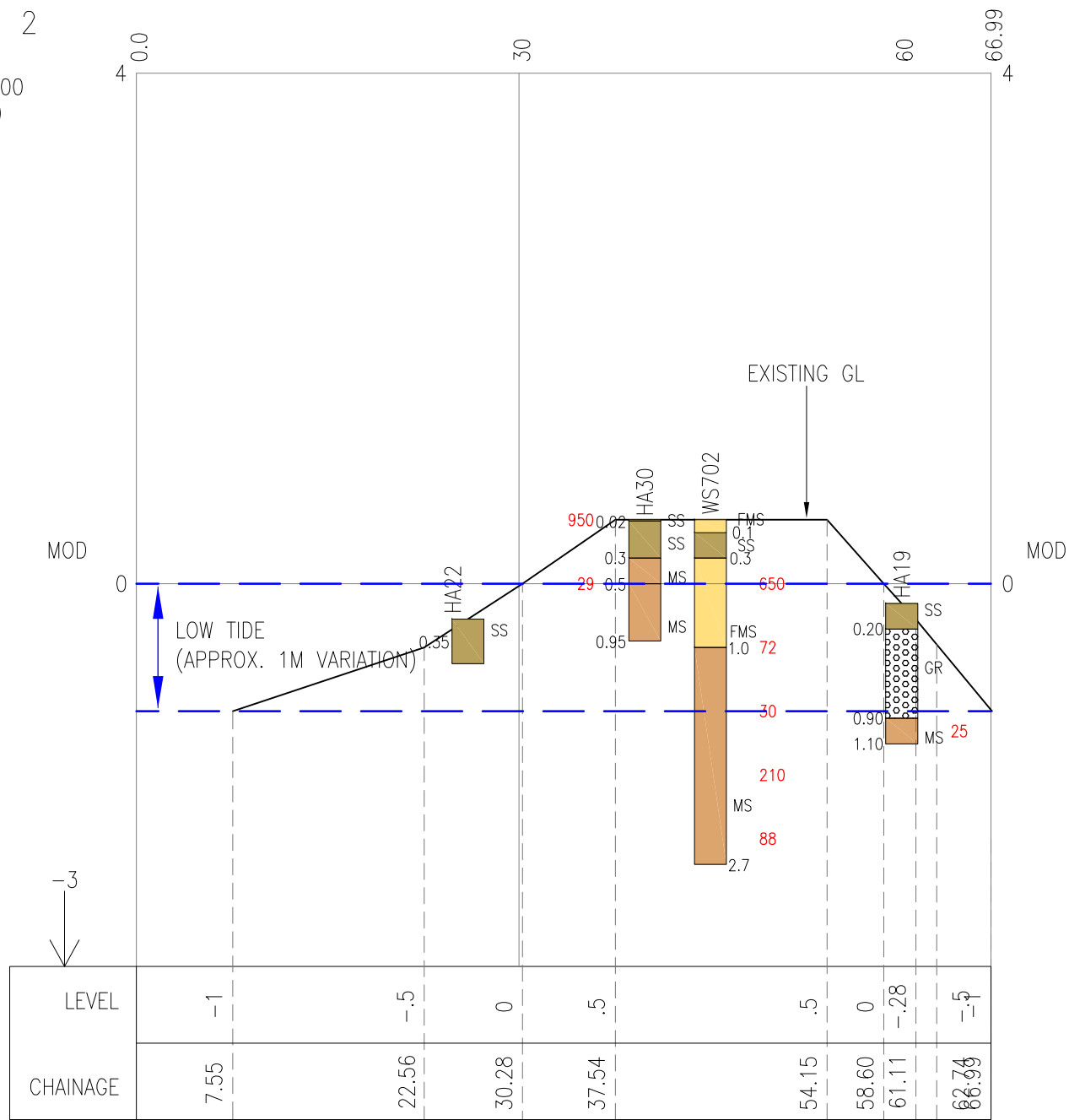
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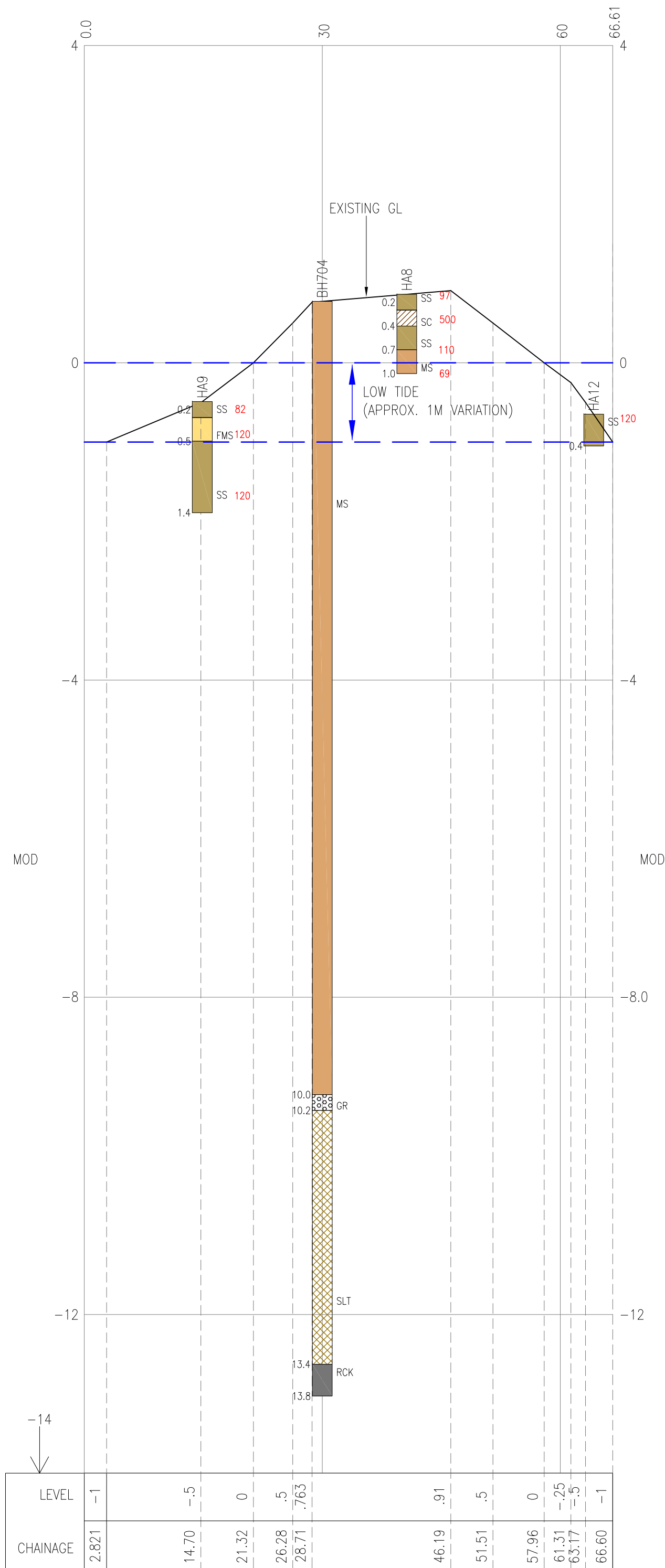
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SECTION 2  
SCALES  
HORIZ. 1:500  
VERT. 1:50



SECTION 3  
SCALES  
HORIZ. 1:500  
VERT. 1:50



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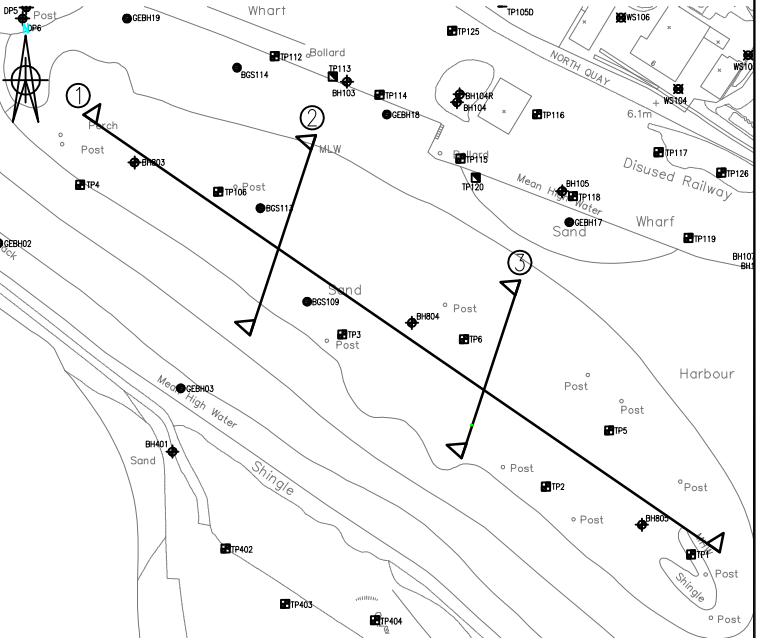
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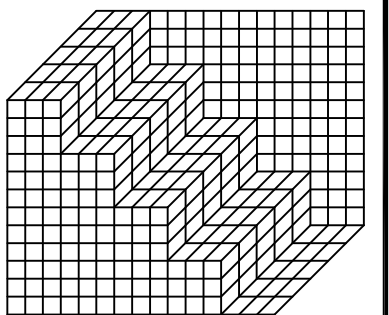
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FIGURE 6

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## Appendix A   Analytical Tables

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[illegible]

SS = Silty Sand      FMS = Fine to Medium Sand      MS = Medium Sand      SC = Silty Clay      G = Gravel

Contaminated Land Generic Quantitative Risk Assessment, Cockle Bank, Hayle Harbour Redevelopment

Table A2- Metals concentrations in soil (per grain size)										Sample Location																		Soil Screening Criteria				
Sample Identity		WS701					WS702					WS702					WS703					WS703					Commercial Industrial	Residential Without Plant Uptake	Residential With Plant Uptake	Daily Intensive Golfing		
Soil Type	Grain Size	Fine to Medium Grained Sands					Silty Sands					Fine to Medium Grained Sands					Sandy Clay					Gravel										
		>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm	>2mm*	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm	>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm	>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm	>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm						
Depth (mbgl)		0.50					0.50					2.00					0.50					4.00										
Sampled Date		15/10/2008	15/10/2008	15/10/2008	15/10/2008	15/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	17/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008	20/10/2008							
Sample Number(s)		1	4	3	2	2	5	11	9	7	7	6	12	10	8	8	13	19	17	15	15	14	20	18	16	16						
Wt%		23	3	43	27	4	2	12	33	25	28	<1	4	82	13	1	4	4	32	31	29	40	5	51	4	0						
Metals																																
Arsenic	mg/kg	190	110	61	440	660	2300	1200	320	650	1750	54	86	44	230	NDP	250	700	300	570	1700	44	23	14	51	NDP	640					
Cadmium	mg/kg	0.8	0.7	0.5	2.3	3.3	13	7.4	2.3	4.3	9	<0.2	0.7	0.4	1.4	NDP	1.5	4.2	2	3.5	8.5	<0.2	0.3	0.3	0.6	NDP	300					
Chromium	mg/kg	30	12	5.8	22	19	19	7.9	21	40	19	<4.5	5.1	<4.5	16	NDP	76	28	8.8	20	39	19	4.7	<4.5	14	NDP	330					
Lead	mg/kg	170	40	24	150	210	140	160	61	170	260	12	18	10	68	NDP	110	120	59	140	220	8	3	<2	10	NDP	750					
Zinc	mg/kg	540	290	120	570	680	660	840	350	875	1200	86	160	110	440	NDP	930	920	340	750	1900	120	80	50	200	NDP	720					

Table A2- Metals concentrations in soil (per grain size)		WS705					WS705					WS707					WS707					Soil Screening Values			
Sample Identity		Sandy Clay					Sandy Clay					Medium Grained Sands					Medium Grained Sands								
Soil Type		>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063	>2mm*	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm	>2mm	0.6 - 2mm	0.212-0.6mm	0.063-0.212*	0.063-0.212*	>2mm*	0.6 - 2mm	0.212-0.6mm	0.063-0.212mm	<0.063mm				
Grain Size		1.00					2.00					0.50					2.00								
Depth (mbgl)		31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	31/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008	16/10/2008				
Sampled Date		21	27	25	23	23	22	28	26	24	24	29	35	33	31	31	30	36	34	32	32				
Sample Number(s)		2	9	32	20	37	0	3	66	11	0	5	5	78	11	1	0	5	81	13	1				
Wt%																									
Metals																									
Arsenic	mg/kg	380	1200	580	660	960	11	36	22	110	NDP	210	66	39	340	NDP	6	15	13	27	NDP	640	35	32	720
Cadmium	mg/kg	2.1	7.3	3.7	4.7	5.4	<0.2	0.4	0.3	0.6	NDP	0.8	0.5	0.4	1.7	NDP	0.3	0.3	0.2	0.3	NDP	300	30	22	
Chromium	mg/kg	30	31	20	37	43	18	<4.5	<4.5	21	NDP	46	7.7	5.1	29	NDP	<4.5	<4.5	<4.5	8.9	NDP	330	38	37	
Lead	mg/kg	110	330	230	340	420	14	12	4	35	NDP	33	15	8	93	NDP	<2	5	3	23	NDP	750	450	450	
Zinc	mg/kg	850	1500	580	1300	1500	42	130	79	310	NDP	940	170	100	680	NDP	16	46	38	82	NDP				

Notes

All values above are in mg/kg

**BOLD** = SGV (EA, 2009)

*Italics* = Generic Assessment Criteria (GACs) derived inline with guidance published by the EA, 2009

\*pH dependent (8)

Soil organic matter (SOM) is conservatively assumed to be 1% - **DEFAULT VALUE IS 6%**

Soil type is conservatively assumed to be sand - **DEFAULT SOIL TYPE IS SANDY LOAM**

For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model

For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly

For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m-3

NA: Not applicable

1 - Soil Guideline Values - Environment Agency 2009

2 - Dutch Intervention Values - Circular on Target Values and Intervention Values for Soil Remediation, Ministry of Housing, Spatial Planning and the Environment (2000)

# Contaminated Land Generic Quantitative Risk Assessment, Cockle Bank, Hayle Harbour Redevelopment

Table A3- Soil results (Organics)		Sample Location																		Soil Screening Values <sup>1</sup>		
		BH 2008/2009				BH, August 2007																
Sample Identity		WS701	HA2	HA5	HA10	BH803	BH803	BH803	BH803	BH803	BH804	BH804	BH804	BH804	BH804	BH805	BH805	BH805	BH805	BH805		
Depth (mbgl)		1.00	0.0-0.1	0.3-0.5	0.30-0.55	0.5	1.5	2.5	4.5	5.5	0.5	1.5	2.5	3.5	4.5	0.5	1.5	2.5	3.5	4.5		
Sampled Date		21/10/2008	24/02/2009	24/02/2009	24/02/2009																	
Sample Number(s)		13-14	13	21	35																	
Soil Type		SS	FMS	SC	FMS	FMS	FMS	FMS	FMS	G	FMS	FMS	FMS	FMS	G	FMS	FMS	MS	MS	MS		
<b>Hydrocarbons</b>																						
MTBE	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
Benzene	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
Toluene	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
Ethyl benzene	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
m & p Xylene	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
o Xylene	µg/kg	<10	-	-	-	<25	<25	<25	<25	<25	<10	<10	<10	<31	<10	<32	<32	<31	<10	<31		
PRO aromatic C6-C7	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
PRO aromatic >C7-C8	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
PRO aromatic >C8-C10	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aromatic >C10-C12	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aromatic >C12-C16	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aromatic >C16-C21	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aromatic >C21-C35	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
PRO aliphatic C5- C6	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
PRO aliphatic >C6- C8	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
PRO aliphatic >C8- C10	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aliphatic >C10-C12	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aliphatic >C12-C16	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aliphatic >C16-C21	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
TPH aliphatic >C21-C35	µg/kg	<35	-	-	-	<35	-	-	-	-	<35	-	-	-	-	<35	-	-	-	-		
GRO C4-C10	µg/kg	<10	-	-	-	<10	-	-	-	-	<10	-	-	-	-	<10	-	-	-	-		
GRO C10-C12	µg/kg	<10	-	-	-	<10	-	-	-	-	<10	-	-	-	-	<10	-	-	-	-		
Total GRO																						
TPH C10-C40	µg/kg	<10	<35	240	42																	
<b>PAH</b>																						
PAH TOTAL(EPA16)	mg/kg	0.06	0.16	2.1	0.565																	
Naphthalene	µg/kg	<10	<9	170	24	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Acenaphthylene	µg/kg	<5	<12	55	<12	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Acenaphthene	µg/kg	<14	<8	36	<8	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Fluorene	µg/kg	<12	<10	110	<10	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Phenanthrene	µg/kg	28	24	340	65	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Anthracene	µg/kg	<9	<16	120	<16	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Fluoranthene	µg/kg	<25	35	310	78	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Pyrene	µg/kg	<22	31	220	69	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Benzo[a]anthracene	µg/kg	23	29	170	78	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Chrysene	µg/kg	11	24	150	66	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Benzo[b]fluoranthene	µg/kg	<16	20	120	43	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Benzo[k]fluoranthene	µg/kg	<25	<14	69	29	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Benzo[a]pyrene	µg/kg	<12	<15	120	43	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Dibenzo[a,h]anthracene	µg/kg	<11	<18	62	33	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Indeno[1,2,3-cd]pyrene	µg/kg	<8	<23	<23	<23	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
Benzo[g,h,i]perylene	µg/kg	<10	<24	72	36	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000		
<b>Others</b>																						
PCBs	µg/kg	-	<35	<35	<35																	
Phenols	mg/kg	-	<0.15	<0.15	<0.15																	

## Notes

All values above are in mg/kg

**BOLD** = SGV (EA, 2009)

*Italics* = Generic Accessment Criteria (GACs) derived inline with guidance published by the EA, 2009

\*pH dependent (8)

Soil organic matter (SOM) is conservatively assumed to be 1% - **DEFAULT VALUE IS 6%**

Soil type is conservatively assumed to be sand - **DEFAULT SOIL TYPE IS SANDY LOAM**

For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer

For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly

For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m-3

NA: Not applicable

Contaminated Land Generic Quantitative Risk Assessment, Cockle Bank, Hayle Harbour Redevelopment

Table A4 - Soil results (Background Samples)																																	
Area		BEACH								Harbour Bottom										Harvey's Towns								Screening Criteria					
Sample Identity		BEACH1	BEACH2	TP801	TP802	TP803	TP804	TP805	S1	S2	S3	S5	S6	S7	S8	S9	S10	D1	D2	D3	D4	D4	D5	D6	D6	D7	Commercial/ Industrial <sup>1</sup>	Residential Without Plant Uptake <sup>2</sup>	Residential With Plant Uptake <sup>2</sup>	Dutch Intervention Guideline <sup>2</sup>			
Depth		0.5	0.3	1.2	1.2	1.2	1.2	1	0.5	0.3	0.4	0.3	0.6	0.5	0.4	0.5	0.5	0.0-0.2	0.4-0.8	0.0-0.1	0.0-0.1	0.8-1.1	0.0-0.1	0.0-0.1	0.6-0.7	0.0-0.1							
Sampled Date		27/11/2007	27/11/2007	2005	27/06/1905	27/06/1905	27/06/1905	27/06/1905	27/11/2007	27/11/2007	27/11/2007	27/11/2007	27/11/2007	27/11/2007	27/11/2007	27/11/2007	27/11/2007	25/02/2009	25/02/2009	25/02/2009	25/02/2009	25/02/2009	25/02/2009	25/02/2009	25/02/2009	25/02/2009							
Batch		1	1	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1							
Location		Dune	Dune	Beach Sand	Beach Sand	Beach Sand	Beach Sand	Beach Sand	Sands-	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand							
Sample Number(s)		1-2	3	-	-	-	-	-	4-5	6	7	8	9	10	11-12	13-14	15	4-5	6	7	8	9	10	11-12	13-14	15							
		Units																															
Inorganics																																	
Total Sulphate	mg/kg	4800	3300	<5	<5	<5	<5	<5	4800	5200	5300	4500	4300	4100	4100	4500	5100	-	-	-	-	-	-	-	-	-	-	-	-				
Boron Water Soluble	mg/kg	<3.5	<3.5	-	-	-	-	-	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	-	-	-	-	-	-	-	-	-	-	-					
Arsenic	mg/kg	30	39	27	22.1	21.2	18.9	21.5	28	29	26	24	26	31	27	40	25	280	35	34	36	34	40	40	42	42	42	42					
Barium	mg/kg	<6	<6	-	-	-	-	-	<6	<6	<6	<6	<6	6	<6	<6	<6	-	-	-	-	-	-	-	-	-	-	-					
Beryllium	mg/kg	<0.4	<0.4	-	-	-	-	-	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	-	-	-	-	-	-	-	-	-	-	-					
Cadmium	mg/kg	<0.3	<0.3	0.8	0.15	0.3	0.11	0.11	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.6	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3						
Chromium	mg/kg	<4.5	5.3	3.8	3.7	3.1	2.5	2.7	<4.5	12	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	<4.5	-	-	-	-	-	-	-	-	-	-						
Copper	mg/kg	21	32	17.1	18.4	14.8	12.6	14.1	23	21	20	17	24	23	24	23	22	490	23	24	27	31	27	27	28	32	32						
Lead	mg/kg	13	11	6.7	9.1	6.8	6.8	6.8	7	8	6	6	9	7	11	7	11	100	7	8	10	9	11	11	9	10	10						
Mercury	mg/kg	<0.6	<0.6	0.1	0.1	0.1	0.1	0.1	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	-	-	-	-	-	-	-	-	-	-						
Nickel	mg/kg	2.3	3.9	3.6	3.4	2.7	2.6	2.3	1.2	3.6	1.1	1.4	1.6	2.2	1.5	2.4	1.5	-	-	-	-	-	-	-	-	-	-						
Selenium	mg/kg	<3	<3	1.1	0.9	1.1	1.0	1.1	<3	<3	<3	<3	<3	<3	<3	<3	<3	-	-	-	-	-	-	-	-	-	-						
Tin	mg/kg	4	6	2.3	2.3	2.1	1.9	2.2	3	4	2	4	4	3	6	5	5	-	-	-	-	-	-	-	-	-	-						
Vanadium	mg/kg	8.2	11	-	-	-	-	-	6.8	11	6.7	6.8	6.9	8.1	7.1	8.8	7.3	-	-	-	-	-	-	-	-	-	-						
Zinc	mg/kg	48	70	33	27.9	49	23.7	26.6	42	51	42	44	46	47	44	54	49	750	54	48	66	63	58	51	49	63							
Total Cyanide	mg/kg	<1	<1	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	-	-	-	-	-	-	-						
Ammoniacal Nitrogen as N	mg/kg	<15	<15	-	-	-	-	-	<15	<15	<15	<15	<15	<15	<15	<15	<15	-	-	-	-	-	-	-	-	-	-						

Table A4 - Soil results (Background Samples)																												North Quay												Screening Criteria																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Area																												Commercial 'Industrial'				Residential Without Plant Uptake <sup>2</sup>		Residential With Plant Uptake <sup>2</sup>		Dutch Intervention Guideline <sup>2</sup>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
Sample Identity		BH103		BH104		BH105		TP106		TP107		TP108		TP110		TP111		TP112		TP114		TP115		TP116		TP117		TP118		TP119		TP122		TP125		TP126		TP127		NQHA1		NQHA2		NQHA4		NQHA5		NQHA6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
Depth		0-0.5		1.5		1		0.5		1.5		0.6		1		0.15		0.5		0.4		0.5		0.7		0.25		0.5		1.5		0.5		0.5		1		0.5		0.1		0.5		1		0.5		2.5		0.3		1.5		0.3		1		0.2		0.0-0.1		0.2-0.3		0.0-0.1		0.0-0.1		0.2-0.3		0.2-0.3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
Sampled Date		August 2007 investigation																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							



Contaminated Land Generic Quantitative Risk Assessment, Cockle Bank, Hayle Harbour Redevelopment

Table A5- Leachate results		Sample Location																												
		TP2-D1	TP2-D2	TP4-D1	TP4-D5	WS701				WS702			WS703						WS705						WS707			HA11	HA25	
DETERMINAND	Liquid-solid ratio	10:1	10:1	10:1	10:1	10:1	10:1C	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1	10:1C	10:1C		
	Depth (m/bgl)	0.25	1.4	0.5	1.5	1	1.5	2	3.5	0.5	1.5	2.5	0.50	1.50	2.50	3.50	4.50	6.00	8.00	0.50	1.50	2.50	3.50	4.50	6.00	0.5	1.5	2.5	0.45-0.80	0.3-0.4
	Soil Type	SS	MS	SS	SS	FMS	MS	MS	MS	SS	FMS	FMS	SC	FMS	FMS	FMS	G	G	FMS	SS	FMS	FMS	FMS	FMS	FMS	FMS	FMS	MS	SC	SS
	Depth mOD					<0.05	<0.55	<1.05	<2.55	<0.08	<1.08	<2.08	<0.15	<1.15	<2.15	<3.15	<4.15	<5.65	<7.65	0.45	<0.55	<1.55	<2.55	<3.55	<5.05	0.11	<0.89	<1.89	-	-
<b>Inorganics</b>																														
Chloride	mg/l	651	668	278	520	220	390	490	400	850	510	390	480	490	480	220	69	110	380	440	450	490	440	330	430	420	400	330	470	410
Fluoride (Disolved)	mg/l					<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.7
Sulphate	mg/l					39	58	77	61	140	78	63	130	74	72	38	14	21	58	66	68	250	65	52	63	67	64	54	76	68
Dissolved Organic Carbon	mg/l					<1	<3	3	<1	11	2	1	6	<1	<1	<1	4	<1	<1	1	<1	<1	<1	<1	<1	2	1	1	<3	<3
Total Dissolved Solids @ 105C	mg/l					460	470	920	750	1500	950	760	930	940	920	430	170	230	730	810	830	1000	800	630	800	800	760	600	910	790
Chemical Oxygen Demand	mg/l	163	75	55	61	<10	-	18	10	37	<10	<7	17	<10	<10	<10	12	<10	10	12	13	10	11	10	<7	10	10	-	-	-
Phenolics (as phenol)	mg/l					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01
Total Sulphur as SO4 (Dissolved)	mg/l	129	182	41	640																									
Conductivity uS/cm @ 25C	uS/cm	21.7	22.8	9.94	25.3																									
pH units		7.72	7.72	7.81	7.81																									
Total Organic Carbon	mg/l	3	3	2	4																									
Ammoniacal Nitrogen as N	mg/l	0.2	0.2	0.2	0.2																									
<b>Metals</b>																														
Antimony	µg/l	12	14	5	5	4	4.7	2.4	1.3	38	7.2	3.9	1.2	15	<0.75	1.8	<0.75	<0.75	<0.75	13	3.7	12	3.8	1.7	0.98	2.4	3.4	1.3	6	2.7
Arsenic	µg/l	134	108	11	21	10	9	9.8	16	110	72	90	95	62	57	28	21	14	5.8	239	240	140	430	270	150	86	14	9.5	180	320
Barium	µg/l					1	64	12	4	5	1	6	3	4	3	1	4	3	2	<1	2	2	1	2	1	2	9	2	4	4
Boron	µg/l	302	459	859	473	50	90	110	60	330	60	<20	240	100	110	30	<20	<20	120	140	100	120	80	50	70	90	50	20	390	420
Cadmium	µg/l	<0.4	<0.4	<0.4	<0.4	<0.22	<0.22	<0.22	<0.22	0.79	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	0.53	<0.22	<0.22	<0.22	0.54	<0.22	<0.22	<0.22	<0.22
Chromium	µg/l	2	2	4	2	<1	<1	6	<1	2	1	1	<1	1	1	1	<1	2	<1	<1	<1	43	<1	<1	<1	2	63	<1	<1	<1
Copper	µg/l	23	5	47	30	3.6	<1.6	13	4.3	3.6	9.1	6.3	4	8	6.1	5.1	1.9	3.5	2.7	7.8	1.9	37	6.3	5.3	1.9	25	6.3	7.1	7.3	9.1
Lead	µg/l	<1	1	1	1	0.6	<0.4	3.8	<0.4	1.7	0.5	<0.5	0.7	<0.4	2	<0.4	<0.4	<0.4	<0.4	0.9	<0.4	0.6	<0.4	<0.4	<0.4	0.8	1.5	0.5	7	5
Molybdenum	µg/l					<1	<1	2	<1	130	2	1	68	3	<1	2	2	2	1	2	<1	2	1	<1	<1	1	<1	<1	30	20
Nickel	µg/l	2	<1	<1	4	<1.5	<1.5	<1.5	<1.5	1.6	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Selenium	µg/l	6	4	2	4	2	2	4	7	2	<1	5	<1	<1	<1	<1	<1	<1	1	6	3	5	2	2	5	5	5	<1	5	4
Tin	µg/l					<1	-	<1	4	2	3	3	<1	3	<1	1	<1	<1	2	<1	<1	<1	<1	<1	<1	2	1	<1	-	-
Zinc	µg/l	31	19	23	63	<5	<5	6	<5	9	5	<5	1,200	<5	710	<5	<5	100	5	5	<5	180	<5	<5	<5	6	21	10	<5	<5
Mercury	µg/l	0.06	0.15	0.14	0.07	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

SS = Silty Sand FMS = Fine to Medium Sand MS = Medium Sand SC = Silty Clay G = Gravel

1. Environment Agency: Internal Guidance on the Interpretation and Application of Regulation 15 of the Waste Management Licensing Regulations, 1995 (The Protection of Groundwater) with respect to Landfill 1999.

2. UK Drinking Water Inspectorate: Water Supply (Water Quality) Regulations 2000.

3. World Health Organisation (WHO): Guidelines for Drinking Water Quality, Third Edition, Volume 1, Recommendations 2004.

4. Environment Agency Non-Statutory (Operational) Environmental Quality Standards

	exceed both criteria
	exceed drinking water guidelines
	exceed marine water criteria



# Contaminated Land Generic Quantitative Risk Assessment, Cockle Bank, Hayle Harbour Redevelopment

Table A7 Soil results against Waste Acceptance Criteria		Sample Location			Inert waste <sup>1</sup>	Stable non-reactive hazardous waste <sup>2</sup>	Hazardous Waste <sup>3</sup>
Sample Identity		WS701	HA11	HA25			
Depth		1.5	0.45-0.80	0.3-0.4			
Strata		MS	SC	SS			
Sampled Date		21/10/2008	21/10/2008	21/10/2008			
	Units						
<b>Leachate</b>							
<b>Metals</b>							
Antimony Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	0.047	0.060	0.027	0.06	0.7	5
Arsenic Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	0.090	1.800	3.200	0.5	2	25
Boron Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	0.90	3.90	4.20			
Barium Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	0.64	0.04	0.04	20	100	300
Cadmium Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.0022	<0.0022	<0.0022	0.5	10	70
Chromium Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.01	<0.01	<0.01	2	50	100
Copper Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.016	0.073	0.091	0.5	10	50
Lead Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.004	0.007	0.005	0.5	10	40
Mercury Dissolved (CEN 10:1C) (CVAA)	mg/kg	0.0001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.01	0.03	0.02	0.5	10	30
Nickel Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.015	<0.015	<0.015	0.4	10	40
Selenium Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	0.02	0.05	0.04	0.1	0.5	7
Zinc Dissolved (CEN 10:1C) (ICP-MS)	mg/kg	<0.05	<0.05	<0.05	4	50	200
<b>Inorganics</b>							
Chloride (CEN 10:1C)	mg/kg	3,900	4,700	4,100	800	15,000	25,000
Fluoride (CEN 10:1C)	mg/kg	<5	7	7	10	150	500
Sulphate (CEN 10:1C)	mg/kg	580	760	680	1000 <sup>4</sup>	20,000	50,000
Dissolved Organic Carbon (CEN 10:1C)	mg/kg	<30	<30	<30	500 <sup>5</sup>	800	1000
Total Dissolved Solids <sup>6</sup> (by meter) (CEN 10:1C)	mg/kg	4700	9100	7900	4000	60,000	100,000
Phenols Monohydric (CEN 10:1C)	mg/kg	<0.1	0.1	0.1	1		
<b>Solid Phase</b>							
Total Organic Carbon	w/w%	<0.5	-	-	3%		6%
BTEX	mg/kg	-	-	-	6		
PCBs (7 congeners)	mg/kg	-	-	-	1		
Mineral Oil	mg/kg	-	-	-	500		
pH	pH units	8.46	-	-		>6	
PAHs -total 17 including coronene	mg/kg	-	-	-	100		

SS = Silty Sand, SC = Silty Clay, MS = Medium Grained Sand

**Bold** - value is above method detection limit

1 - Waste Acceptance Criteria Limiting values for contaminants in inert waste according to the GUIDANCE ON SAMPLING AND TESTING OF WASTES TO MEET LANDFILL WASTE ACCEPTANCE PROCEDURES

2 - Waste Acceptance Criteria Limiting values for contaminants in stable non-reactive hazardous waste in non-hazardous landfill according to the GUIDANCE ON SAMPLING AND TESTING OF WASTES TO MEET LANDFILL WASTE ACCEPTANCE PROCEDURES

3 - Waste Acceptance Criteria Limiting values for contaminants in hazardous waste according to the GUIDANCE ON SAMPLING AND TESTING OF WASTES TO MEET LANDFILL WASTE ACCEPTANCE PROCEDURES

4 - If an inert waste does not meet the SO<sub>4</sub> L/S10, alternative limit values of 1500 mg/l SO<sub>4</sub> at C<sub>0</sub> (initial eluate from the percolation test (prCENT/TS 14405:2003)) AND 6000mg/kg SO<sub>4</sub> at L/S10 (either from the percolation test or batch test BS EN 12457-3), can be used to demonstrate compliance with the acceptance criteria for inert wastes.

5 - In the case of soils, a higher TOC limit value may be permitted by the Environment Agency at an inert waste landfill, provided the DOC value of 500 mg/kg is achieved at L/S 10 l/kg, either at the soil's own pH or at a pH value between 7.5 and 8.0.

6 - The values for TDS can be used instead of values for Cl and SO<sub>4</sub>

## Appendix B    Hydrock Ground Investigation Factual Report

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## **Proposed Foreshore Development, Hayle Harbour: Factual Ground Investigation**

Final Report

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&

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for

Buro Happold

Hydrock Ref: R/SP08052/001

November 2008



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**Project:** HAYLE HARBOUR REDEVELOPMENT, CORNWALL

**Title:** FACTUAL GROUND INVESTIGATION REPORT

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1	November 2008	Original issue.

Hydrock Special Projects Limited has prepared this report in accordance with the instructions of the above named Client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.



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## **1.0 INTRODUCTION**

### **1.1 Terms of Reference**

Hydrock Special Projects (Hydrock) was appointed by Buro Happold in October 2008 to undertake drilling works within the proposed Foreshore Development Area of Hayle Harbour in Hayle, Cornwall.

Specifically, three areas were targeted within the Harbour area;

- The Cockle Bank;
- Former fuel depot, adjacent to the eastern quay; and
- The Copperhouse Pool swing bridge.

A site location plan (Drawing SP08052/G001) is presented in Appendix A.

### **1.2 Scope of Works**

The scope of this commission has been defined in Section 1.4 of the Buro Happold document entitled 'Specification for Ground Investigation Document' Rev. 01, dated September 2008, and is broadly outlined below;

- Six dynamic sampling boreholes (using a Comacchio MC205 tracked drilling rig) to a maximum depth of 10m below ground level (bgl), or refusal (whichever occurred first) on Cockle Bank;
- In addition to the above, two rotary percussive boreholes (using a Comacchio MC205 and air compressor) were required to depths of 30m;
- A single Comacchio MC205 borehole (using a combination of dynamic sampling and rotary cored techniques) in the former fuel depot, adjacent to the existing tank farm. The borehole was to be progressed to 10m bgl or groundwater, whichever came first, and installed to full depth with a groundwater/gas monitoring well.
- Three Comacchio MC205 boreholes adjacent to the Copperhouse Pool swing bridge;
  - One adjacent to each of the existing bridge abutments;
  - a borehole as close to the centre of the river channel as reasonably practicable; and
  - a third borehole on the left bank of the Copperhouse Pool.
- Associated in-situ testing, logging, sampling and laboratory geotechnical and geochemical testing, as appropriate; and
- Factual reporting.





### **1.3 Limitations**

The report has been prepared for the exclusive benefit of Buro Happold and those parties designated by them for the purpose of providing geotechnical recommendations for the site. The report contents should only be used in that context.

The work has been carried out in general accordance with recognised best practice as detailed in guidance documents such as in BS5930:1999.

### **1.4 Information Sources Provided by the Client**

- Buro Happold drawing 'Figure 2' entitled 'Proposed Exploratory Hole Location Plan' Rev 01, dated August 2008 – Presented in Appendix A.
- FSP Architects drawing 'C100' entitled 'Existing Services Layout – Sheet 1' Rev 01, dated February 2005.
- Excerpt from Unknown Author document entitled 'The World's Knowledge' showing a map of Hayle Harbour indicating the location of seawater tunnel from Carnsew to the power station (below the Cockle Bank).



## **2.0 SITE DESCRIPTION**

### **2.1 Introduction**

The site encompasses the northern and eastern quay areas of Hayle Harbour. The site area also includes a sandbank which is exposed at low tide in the Hayle Estuary (the Cockle Bank), a former fuel depot yard and a disused swing bridge in the area of the Copperhouse Pool. The town centre of Hayle lies to the south of the site at approximate NGR 155645E 037600N.

A site location plan is presented in Appendix A. Photos of key site areas are presented in Appendix B.

### **2.2 Former Fuel Depot Area**

This area is situated off the north quay area of Hayle Harbour and is accessed via the Copperhouse Pool swing bridge.

The depot area can be described as being an area of concrete and tarmac hardstanding used predominantly for the storage of lobster pots and aggregates. The depot area is roughly square in shape with plan dimensions of approx. 70m by 80m. The area is secure, being fenced off on its southern, eastern and, in part, northern margins and by a sheer cliff face in the northern and western margins. This area lies at an elevation of approximately 5m AOD.

### **2.3 Cockle Bank**

The Cockle Bank is a longitudinal sand and shingle bank which is exposed at low tide and lies in the middle of Hayle Estuary. It is approximately 380m long and 80m wide and was historically used for shellfish farming. This area lies at an elevation of approximately 0 - 1m AOD.

### **2.4 Copperhouse Pool Swing Bridge**

The swing bridge lies at the entrance to the harbour area and is adjacent the Harbour Master's office. The bridge is understood to be a former railway bridge. Below the bridge abutment and on the northern bank of the estuary is an area of shingle beach which is exposed at low tide.

The Copperhouse Pool is also understood to be of historical and archaeological significance and within an area of special scientific interest. This area lies at an elevation of approximately 1 - 2m AOD.



## **2.5 Regional Geology**

The general geology of the site area is shown on the 1:50,000 geological map of Hayle (Sheet 351 & 358) which indicates the site to be underlain by Quaternary Sand over Mylor Slates of the Devonian period.



### **3.0 GROUND INVESTIGATION**

#### **3.1 Introduction**

The ground investigation works were undertaken between 13 October and 31 October 2008. All drilling works were supervised by a Hydrock Engineer and a representative from Buro Happold.

No borehole coordinates were supplied by Buro Happold and the setting out of the boreholes was at the discretion of the Buro Happold representative. The elevation of each borehole location was calculated (via levelling techniques) by Hydrock. The exploratory hole logs and photographs of the cores are presented in Appendix C.

#### **3.2 Rationale**

The exploratory hole types and their locations were chosen by Buro Happold and set out by a Buro Happold engineer.

The investigation comprised the following:

- Dynamic sampled boreholes to confirm the geological succession and to obtain samples for contamination analysis;
- Rotary cored boreholes to confirm the deeper geological succession;
- Rotary percussive boreholes to identify the depth to bedrock on the Cockle Bank; and
- A gas and groundwater monitoring installation at the former fuel depot to identify contamination associated with former buried tanks in the area.

#### **3.3 Former Fuel Depot Area**

One borehole was dynamically sampled up to 1.30m depth bgl then rotary cored, to a maximum depth of 8.08m bgl (Borehole BH1001). This borehole was drilled between 13 October 2008 and 14 October 2008 and was drilled using a Comacchio MC205 drill rig. Dynamic sampling barrels were 1.5m in length and produced a core of 89mm diameter. An ODEX core barrel was used for the rotary coring which also produced a core of 89mm diameter, air mist flush was used for coring. All cores were extruded horizontally and laid out sequentially in wooden core boxes for logging and sampling. Disturbed and undisturbed samples were obtained at regular intervals and on encountering each stratum. This borehole was completed with a standard (63mm slotted HDPE) gas and water monitoring installation and a road weight cover.



### **3.4 The Cockle Bank**

Five boreholes were dynamically sampled to a maximum depth of 8.0m on the Cockle Bank (WS701, 702, 703, 705 and 707). These boreholes were drilled between 15 October 2008 and 31 October 2008 and were drilled using a Comacchio MC205 drill rig. Dynamic sampling barrels were 1.5m in length and produced a core of 89mm diameter. All cores were extruded horizontally and laid out sequentially in wooden core boxes for logging and sampling. Disturbed and undisturbed samples were obtained at regular intervals and on encountering each stratum. All boreholes were cased to their full depth.

Drilling was particularly difficult owing to a very limited tidal window (when the Cockle Bank is exposed above sea level) and the saturated sand horizons that were encountered.

In addition, one borehole (BH704) was progressed using rotary percussive techniques using an air-mist flush. This borehole was advanced to 13.8m bgl in order to identify depth to the top of the underlying bedrock. Changes in the colour and constituents of the arisings were noted during the drilling process.

### **3.5 Copperhouse Pool Area**

Two boreholes were progressed dynamic sampling techniques with rotary cored follow-on (BH1002 & BH1003). Borehole BH1004 could not be drilled owing to archaeological constraints and this borehole was terminated at the request of the local council.

The boreholes were progressed in order to confirm the deeper geology, to identify competent bearing strata and provide samples for contamination testing. These boreholes were drilled between 14 October 2008 and 27 October 2008 using a Comacchio MC205 drill rig.

Dynamic sampling barrels were 1.5m in length and produced a core of 89mm diameter. An ODEX overburden system with an air-mist flush was used for the rotary coring, which also produced a core of 89mm diameter. All cores were extruded horizontally and laid out sequentially in wooden core boxes for logging and sampling. Disturbed and undisturbed samples were obtained at regular intervals and on encountering each stratum.

### **3.6 Geotechnical Testing**

#### **3.6.1 *In-Situ* Testing**

Standard penetration tests (SPT) were performed in the boreholes BH1002 and BH1003 at 0.5m centres, as instructed by Buro Happold. This data is presented with the logs in Appendix C.

#### **3.6.2 Laboratory Testing**

Geotechnical laboratory testing was scheduled by Buro Happold, the results of which are presented in Appendix D.



## **4.0 PHYSICAL GROUND CONDITIONS**

The findings of the ground investigation are presented in the following sections.

### **4.1 Made Ground**

Made Ground was encountered in boreholes BH1001, BH1002 and BH1003 and generally consisted of medium very loose to medium dense clayey sandy gravels and loose gravelly sand.

The gravel mainly comprised sub-angular to sub-rounded fine to coarse siltstone and clinker. This horizon extended from ground level and was 1.3m thick in BH1001 (base 1.28m AoD), 1.0m thick in BH1002 (base 0.5m AoD) and 3.7m thick in BH1003 (base 1.28m AoD).

SPT N values recorded within the Made Ground ranged from 0 – 14 in BH1003 and 0 in BH1002.

### **4.2 Marine Deposits**

Marine Deposits were encountered in all boreholes with the exception of borehole BH1001 (at the former fuel depot). These deposits consisted of very loose to medium dense fine to medium sand and occasional firm reddish brown gravelly clays. Their base was recorded at a level of -12.1m AoD in BH701 on the Cockle Bank. At the Copperhouse Pool area, these deposits extended to a level of -7.2m AoD in BH1002 and -8.5m AoD in BH1003.

SPT N values recorded in the unsaturated zone ranged from 13 – 18 (in BH1002 & 1003).

### **4.3 Mylor Slates**

Moderately strong siltstone was encountered in boreholes BH1001, BH1002, BH1003 and BH704 at depths of 3.5, -7.2, -8.5 and -12.1m AoD respectively. This horizon generally consisted of closely to medium bedded grey siltstone with very closely to medium spaced fractures. Many gravel sized quartzitic and pyritic inclusions were also encountered in each of the boreholes.

The base of the Mylor Slates was not proven.

### **4.4 Groundwater**

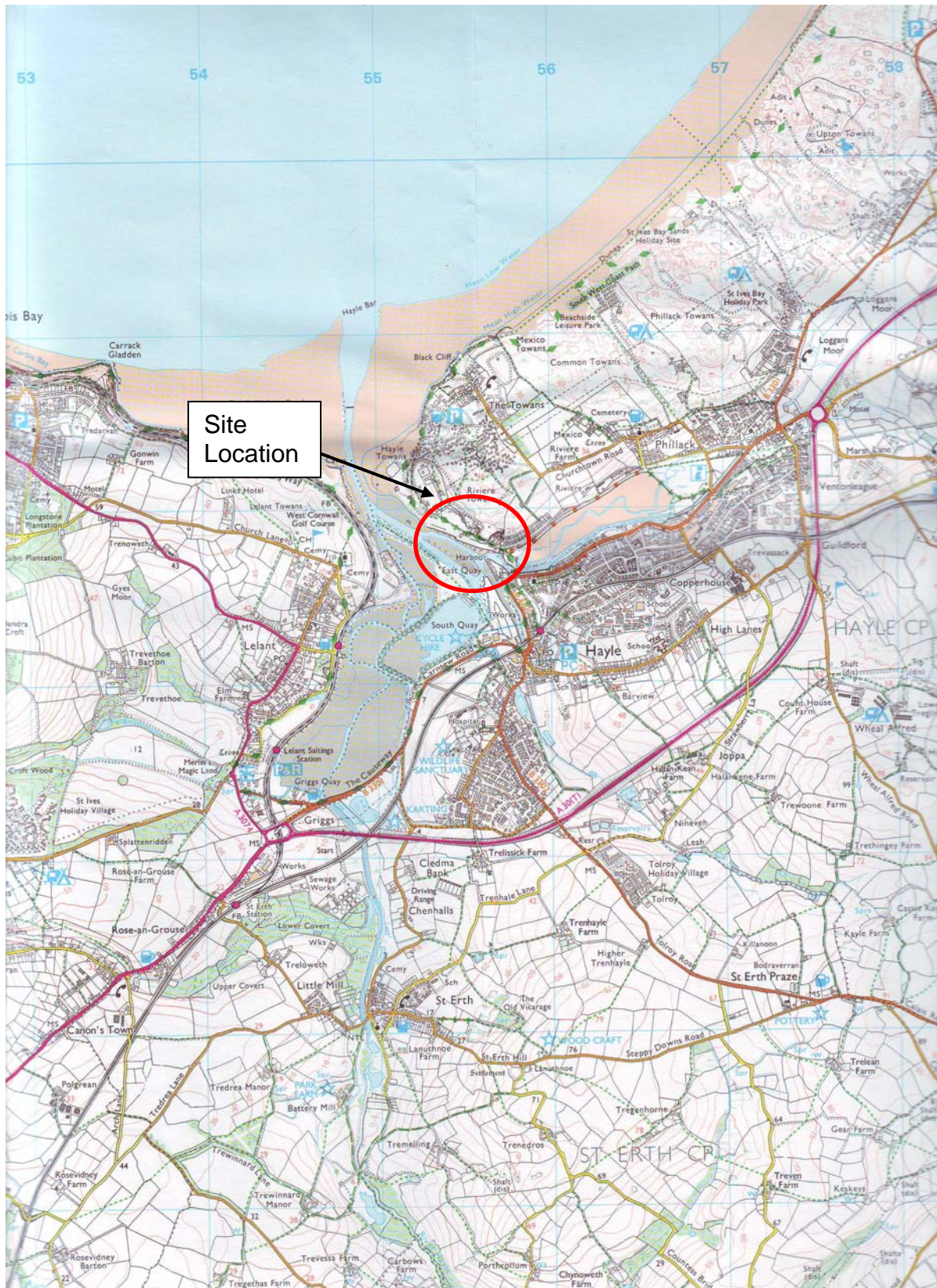
Groundwater in the former fuel depot was struck within the Mylor Slate horizon at a level of -1.75m AoD, rising to 2.1m AoD when dipped 24 hrs later.




## **Appendix A**

### **SITE LOCATION PLAN & BOREHOLE LOCATION PLAN**

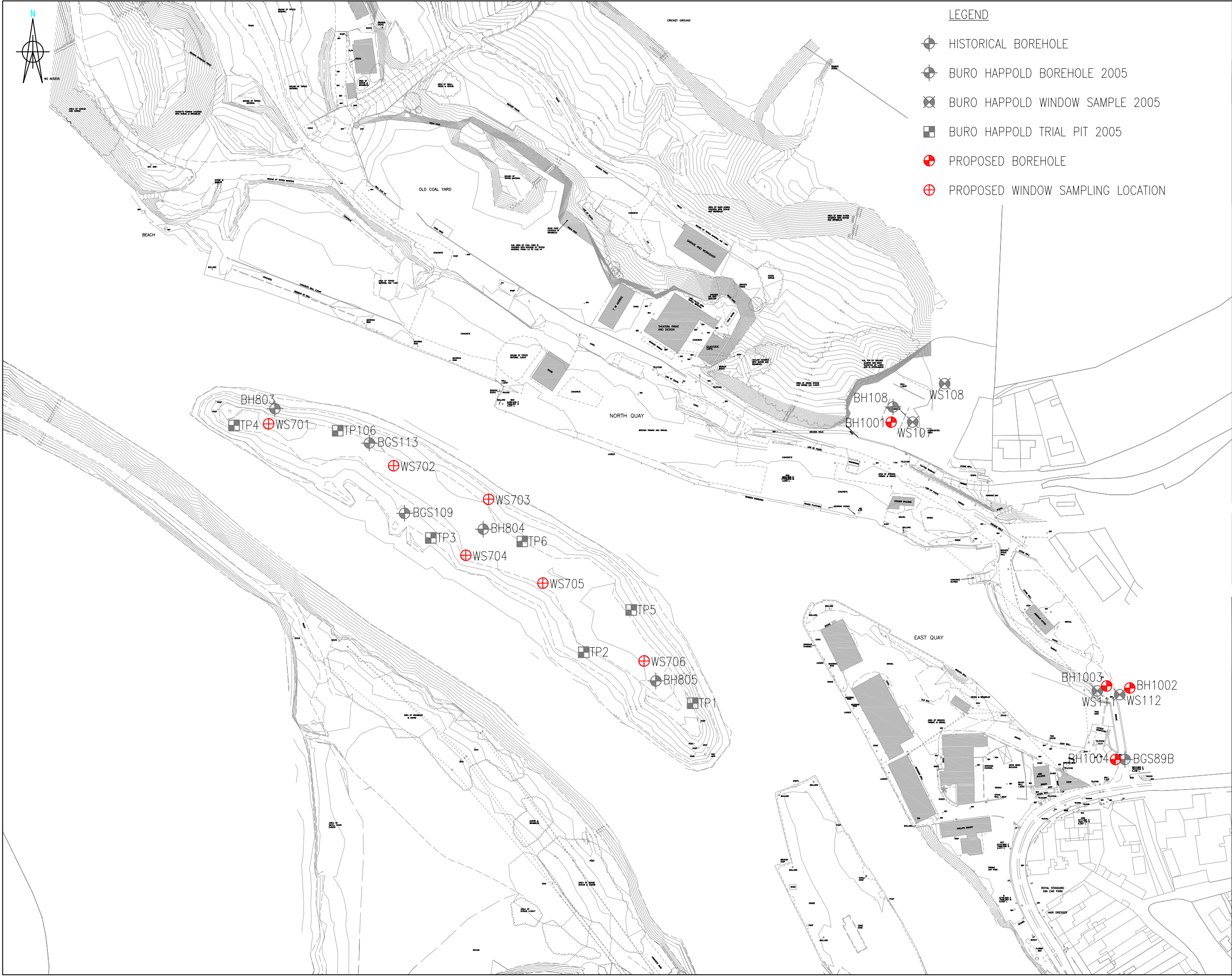




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Client: Buro Happold	 <b>Hydrock</b> Consultants Over Court Barns Over Lane Almondsbury Bristol BS32 4DF Tel: +44 (0)1454 619 533 Fax: +44 (0)1454 614 125
Site: Hayle Harbour, Cornwall	
Drawing No: SP08052/G001	
Title: Site Location Plan	
Scale: 1:25,000	





LEGEND

- HISTORICAL BOREHOLE
- BURO HAPPOLD BOREHOLE 2005
- BURO HAPPOLD WINDOW SAMPLE 2005
- BURO HAPPOLD TRIAL PIT 2005
- PROPOSED BOREHOLE
- PROPOSED WINDOW SAMPLING LOCATION

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CONSTRUCTION.

MAINTENANCE/CLEANING/OPERATION.

DECOMMISSIONING/DEMOLITION.

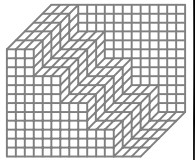
Notes

01 BH1002 MOVED BH1003 & 1004 ADDED	NG/JB
26.09.08	
Rev Description/Date	Drn/Chk

INFORMATION

Status of drawing

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Buro Happold  
Consulting Engineers

Architect LDA  
Project Hayle - ES Phase 1  
Drg Title PROPOSED EXPLORATORY HOLE LOCATION PLAN

Scales@A3 1:2000  
Drawn by NG  
Checked by JB  
Date AUG 2008

Job No. 024435  
Drg No. FIGURE 2

Rev 01



## **Appendix B**

### **SITE WALKOVER PHOTOGRAPHS**





**Plate 1: View of Copperhouse Pool looking south towards Hayle town centre.**



**Plate 2: Looking north towards BH1002 at low tide**



**Plate 3: Looking south west towards Cockle Bank**



**Plate 4: Looking south east towards Cockle Bank and Hayle Harbour Quayside**



## **Appendix C**

### EXPLORATORY HOLE LOGS & PHOTOGRAPHS

<div><div><div>Hydrock</div><div>Consultants</div></div><div><div>Hydrock Consultants</div><div>Over Court Barns</div><div>Over Lane</div><div>Almondsbury</div><div>Bristol</div><div>BS32 4DF</div></div><div><div>Tel: 01454 619 533</div><div>Fax: 01454 614 125</div><div>e-mail: bristol@hydrock.com</div></div></div>				<div>Borehole No</div> <div>WS701</div> <div>Page No. 1 of 1</div>					
Project: Hayle - ES Phase 1				Project No: SP08052		Logged By: RPS			
Location: Hayle Harbour, Cornwall				Date: 15/10/2008		Checked By: ARC			
Client: Buro Happold				Co-ords: -		Level: 1.06mAod			
Progress	Samples / Tests			Water	Instrum-entation	Stratum Description	Depth	Level m AOD	Legend
Sample Run Size (mm)	Depth	Type	Results						
0.00-0.50 0mm 100% rec	0.50	AJ PT				Medium dense (inferred) light brown to cream medium to coarse slightly gravelly SAND. Gravels are of mudstone, limestone and quartzite.(MARINE DEPOSITS)			
0.50-1.00 0mm 90% rec						...cobble of coal at 0.5m.			
1.00-1.50 0mm 80% rec	1.00	AJ PT				...siltstone coarse gravel band at 0.83m. ...becoming brown and slightly clayey between 0.92 - 1.13m. ...gravel is angular fine to medium of sandstone between 1.18 - 1.27m.	1		
1.50-2.00 0mm 60% rec	1.50	AJ PT				Medium dense (inferred) light cream yellow medium to coarse SAND. Occasional fine to medium gravel of quartzite.(MARINE DEPOSITS)		-0.36	
2.00-2.50 0mm 100% rec	2.00	AJ PT					2		
2.50-3.00 0mm 90% rec	2.50	AJ PT							
3.00-3.50 0mm 80% rec	3.00	AJ PT					3		
3.50-4.00 0mm 80% rec	3.50	AJ PT							
	4.00	AJ PT					4	-2.95	
						End of Borehole at 4.00 m			
							5		
							6		
							7		
							8		

General Remarks

BH terminated at engineers request.

Key:

Cu - Undrained shear strength (kPa) - Hand Vane & Penetrometer


D - Disturbed Sample


PT - Plastic Tub Sample

AJ - Amber Jar


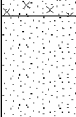

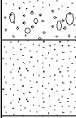

V - Vile

U - Undisturbed

 Standing Water Level

 Groundwater Strike



<div>Hydrock Consultants</div>				<div>Hydrock Consultants Over Court Barns Over Lane Almondsbury Bristol BS32 4DF</div>		<div>Tel: 01454 619 533 Fax: 01454 614 125 e-mail: bristol@hydrock.com</div>		<div>Dynamic Sample Borehole</div>		<div>Borehole No</div> <div>WS702</div> <div>Page No. 1 of 1</div>		
Project: Hayle - ES Phase 1						Project No: SP08052			Logged By: MR			
Location: Hayle Harbour, Cornwall						Date: 17/10/2008			Checked By: ARC			
Client: Buro Happold						Co-ords: -			Level: 0.42mAod			
<div>Progress</div> <div>Sample Run</div> <div>Size (mm)</div> <div>0.00-1.00</div> <div>100% rec</div> <div>1.00-2.00</div> <div>90% rec</div> <div>2.00-2.70</div> <div>60% rec</div>	Samples / Tests			Water	Instrum-entation	Stratum Description	Depth	Level m AOD	Legend			
	Depth	Type	Results									
	0.50	AJ PT								Uncompact dark grey sandy SILT.(MARINE DEPOSITS)	0.32	
										Medium dense (inferred) brown mottled dark grey silty SAND.(MARINE DEPOSITS)	0.12	
	1.00	AJ PT								Medium dense (inferred) brown SAND with dark grey laminations of silty SAND.(MARINE DEPOSITS)		
										Medium dense (inferred) light brown SAND.(MARINE DEPOSITS)	1	
	1.50	AJ PT										
	2.00	AJ PT								...layer of angular coarse siltstone GRAVEL at 2.0m.	2	
2.50	AJ PT											
End of Borehole at 2.70 m							-2.28					
							3					
							4					
							5					
							6					
							7					
							8					

General Remarks

BH termination at 2.7m due to blowing sand in casing. No progress made in time available.

Key:

- Cu - Undrained shear strength (kPa) - Hand Vane & Penetrometer
- D - Disturbed Sample
- PT - Plastic Tub Sample
- AJ - Amber Jar
- V - Vile
- U - Undisturbed



Standing Water Level



Groundwater Strike

<div>Hydrock Consultants</div>				<div>Hydrock Consultants Over Court Barns Over Lane Almondsbury Bristol BS32 4DF</div> <div>Tel: 01454 619 533 Fax: 01454 614 125 e-mail: bristol@hydrock.com</div>		<div>Borehole No</div> <div>WS703</div> <div>Page No. 1 of 1</div>			
Project: Hayle - ES Phase 1				Project No: SP08052		Logged By: MR			
Location: Hayle Harbour, Cornwall				Date: 20/10/2008		Checked By: ARC			
Client: Buro Happold				Co-ords: -		Level: 0.35mAod			
Progress Sample Run Size (mm)	Samples / Tests			Water Strikes	Instrum- entation	Stratum Description	Depth	Level m AOD	Legend
	Depth	Type	Results						
0.00-1.00 100% rec	0.50	AJ PT				Uncompact black mottled brown sandy SILT.(MARINE DEPOSITS)			
						...becomes dark grey from 0.7m.			
1.00-2.00 90% rec	1.00	AJ PT				Medium dense (inferred) light brown SAND.(MARINE DEPOSITS)	1	-0.55	
	1.50	AJ PT							
2.00-3.00 80% rec	2.00	AJ PT					2		
	2.50	AJ PT							
3.00-4.00 80% rec	3.00	AJ PT				...layer of coarse grained sand with occasional fine GRAVEL between 2.7 - 3.0m.	3		
	3.50	AJ PT							
4.00-5.00 60% rec	4.00	AJ PT				Loose (inferred) grey mottled brown slightly sandy GRAVEL. Gravel is angular to subangular fine of quartz, siltstone and schist.(MARINE DEPOSITS)	4	-3.45	
	4.50	AJ PT							
5.00-6.00 50% rec	5.00	AJ PT				...layer of dense (inferred) slightly silty gravelly SAND between 4.7 - 5.0m.	5		
6.00-7.00 10% rec	6.00	AJ PT				Medium dense (inferred) light brown SAND.(MARINE DEPOSITS)	6	-5.65	
7.00-8.00 100% rec	7.00	AJ PT					7		
	8.00	AJ PT				End of Borehole at 8.00 m	8	-7.65	

General Remarks

BH terminated at 8.0m due to time constraints associated with tide times.

Key:

- Cu - Undrained shear strength (kPa) - Hand Vane & Penetrometer
- D - Disturbed Sample
- PT - Plastic Tub Sample
- AJ - Amber Jar
- V - Vile
- U - Undisturbed



Standing Water Level



Groundwater Strike



Dynamic Sample  
Borehole

Borehole No

WS705

Page No. 1 of 1

Project: Hayle - ES Phase 1

Project No: SP08052

Logged By: MR

Location: Hayle Harbour, Cornwall

Date: 31/10/2008

Checked By: ARC

Client: Buro Happold

Co-ords: -

Level: 0.95mAod

Progress Sample Run Size (mm)	Samples / Tests			Water Strikes	Instrum- entation	Stratum Description	Depth	Level m AOD	Legend
	Depth	Type	Results						
0.00-0.80 100% rec	0.50	PT AJ				Loose (inferred) dark brown silty SAND.(MARINE DEPOSITS)			
0.80-1.80 100% rec	1.00	PT AJ				Very soft light brown silty slightly gravelly CLAY. Gravel is angular to sub angular fine to coarse siltstone.(MARINE DEPOSITS)	1	0.15	
	1.50	PT AJ				Loose (inferred) dark grey mottled brown SAND.(MARINE DEPOSITS)		-0.25	
1.80-2.80 90% rec	2.00	PT AJ				Loose (inferred) light brown SAND.(MARINE DEPOSITS)	2	-0.85	
	2.50	PT AJ							
2.80-3.80 90% rec	3.00	PT AJ					3		
	3.50	PT AJ							
3.80-4.80 60% rec	4.00	PT AJ				...rare pieces of sandstone gravel from 3.8m.	4		
	4.50	PT AJ							
4.80-5.80 100% rec	5.00	PT AJ				Loose (inferred) light brown mottled grey gravelly SAND. Gravel is angular to sub angular fine to coarse siltstone, quartz and igneous material.(MARINE DEPOSITS)	5	-3.85	
5.80-6.80 60% rec	6.00	PT AJ					6		
6.80-7.80 10% rec	7.00	PT AJ					7		
						End of Borehole at 7.80 m	8	-6.85	

## General Remarks

Borehole drilled using duplexer sampling equipment and a water flush. Borehole terminated at 7.8m bgl due to time constraints associated with tide times.

## Key:

Cu - Undrained shear strength (kPa) - Hand Vane & Penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
AJ - Amber Jar  
V - Vile  
U - Undisturbed



Standing Water Level



Groundwater Strike

<div><div><div>Hydrock</div><div>Consultants</div></div><div><div>Hydrock Consultants</div><div>Over Court Barns</div><div>Over Lane</div><div>Almondsbury</div><div>Bristol</div><div>BS32 4DF</div></div><div><div>Tel: 01454 619 533</div><div>Fax: 01454 614 125</div><div>e-mail: bristol@hydrock.com</div></div></div>				<div>Borehole No</div> <div>WS707</div> <div>Page No. 1 of 1</div>					
Project: Hayle - ES Phase 1				Project No: SP08052		Logged By: MR			
Location: Hayle Harbour, Cornwall				Date: 16/10/2008		Checked By: ARC			
Client: Buro Happold				Co-ords: -		Level: 0.61mAod			
Progress Sample Run Size (mm)	Samples / Tests			Water Strikes	Instrum- entation	Stratum Description	Depth	Level m AOD	Legend
	Depth	Type	Results						
0.00-1.00 90% rec	0.50	AJ PT				Medium dense (inferred) light brown SAND.(MARINE DEPOSITS)			
1.00-2.00 60% rec	1.00	AJ PT				...layer of dark brown silty sandy between 0.5 - 1.08m	1		
	1.50	AJ PT							
2.00-3.00 50% rec	2.00	AJ PT				...sand becomes coarse grained from 2.1m	2		
	2.50	AJ PT							
	3.00	AJ PT				End of Borehole at 3.00 m	3	-2.40	
							4		
							5		
							6		
							7		
							8		

General Remarks

BH termination at 3.0m due to blowing sand in casing. No progress made in time available.

Key:

- Cu - Undrained shear strength (kPa) - Hand Vane & Penetrometer
- D - Disturbed Sample
- PT - Plastic Tub Sample
- AJ - Amber Jar
- V - Vile
- U - Undisturbed



Standing Water Level



Groundwater Strike

Project Name: Hayle - ES Phase 1	Project No. : SP08052	Co-ords: -	Hole Type RO
Location: Hayle Harbour, Cornwall		Level: 1.33 m AOD	Scale 1:50
Client: Buro Happold		Dates: 30/10/2008	Logged By MR

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								SAND. (MARINE DEPOSITS)	
									1
									2
									3
									4
									5
									6
									7
									8
									9

Remarks: Borehole drilled using rotary open holed techniques. Rock encountered at 13.4m bgl. Borehole terminated at 13.8m bgl at engineers request.

<b>In-situ Testing</b> SPT Standard Penetration Test (Split Spoon) CPT Standard Penetration Test (Solid Cone) HSV Hand Shear Vane U Undisturbed Sample and number of blows <b>Borehole Types</b> DP Dynamic Sampling Cable Cable Percussion Rotary Rotary Core RO Rotary Openhole	<b>Sample Types</b> D Disturbed Sample LB Large Bulk Sample B Bulk Sample AJ Amber Jar Sample W Water Sample V Vial SPTLS SPT Sample
--	---

Project Name:  
Hayle - ES Phase 1

Project No. :  
SP08052

Co-ords: -

Hole Type  
RO

Location: Hayle Harbour, Cornwall

Level: 1.33 m AOD

Scale  
1:50

Client: Buro Happold

Dates: 30/10/2008

Logged By  
MR

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					10.20 (0.00)	-8.88		Dark grey silty GRAVEL. Gravel is angular to sub angular fine to coarse siltstone, quartz and schist. (MARINE DEPOSITS)	
					(3.20)			Orange brown gravelly SILT. Gravel is angular to sub angular fine to coarse siltstone and quartz. (MARINE DEPOSITS)	11
									12
									13
		13.50	D		13.40 (0.40)	-12.08		SILTSTONE recovered as gravel of siltstone and quartz. (MYLOR SLATES)	
					13.80	-12.48		End of Borehole at 13.80 m	14
									15
									16
									17
									18
									19

Remarks: Borehole drilled using rotary open holed techniques. Rock encountered at 13.4m bgl. Borehole terminated at 13.8m bgl at engineers request.

In-situ Testing  
 SPT Standard Penetration Test (Split Spoon)  
 CPT Standard Penetration Test (Solid Cone)  
 HSV Hand Shear Vane  
 U Undisturbed Sample and number of blows  
 Borehole Types  
 DP Dynamic Sampling  
 Cable Cable Percussion  
 Rotary Rotary Core  
 RO Rotary Openhole

Sample Types  
 D Disturbed Sample  
 LB Large Bulk Sample  
 B Bulk Sample  
 AJ Amber Jar Sample  
 W Water Sample  
 V Vial  
 SPTLS SPT Sample

Dynamic Sampled  
and Rotary Cored

Borehole No

BH1001

Page No. 1 of 1

Project:	Hayle - ES Phase 1	Project No:	SP08052	Logged By:	RPS
Location:	Hayle Harbour, Cornwall	Date:	13/10/2008	Checked By:	ARC
Client:	Buro Happold	Co-ords:	-	Level:	4.75mAod

Progress Sample Run Size (mm)	Samples/ Tests			Mechanical Log				Water Strikes	Instrum- entation	Stratum Description	Depth	Legend
	Depth	Type	Results	TCR	SCR	RQD	IF/ Min mean/ max					
0.30-1.00 100% rec	0.50	AJ PT								Cementaceous matrix supported CEMENT.(MADE GROUND)		
	0.75	AJ PT								Grey slightly clayey SAND. Sand is coarse. Gravel is angular of mudstone and siltstone.(MADE GROUND)		
1.27-2.77	1.57	C					30 200 400			Black slightly clayey gravelly SAND. Gravel is angular fine to coarse of siltstone and quartzite.(MADE GROUND)	1	
				95	75	55				Moderately strong medium grey SILTSTONE. Partially weathered with closely to medium spaced fractures. Fractures are open, planar, smooth with sub-horizontal joints. Fracture surfaces are open and discoloured orange/brown. Many gravel sized quartzitic and pyritic inclusions.(MYLOR SLATES)	2	
2.77-4.37	3.07	C					10 30 100				3	
				100	35	20				...many large gravel sized quartzitic inclusions between 3.9 - 4.3m.	4	
4.37-5.87							30 150 250				5	
				100	60	50					6	
5.87-8.08	6.87	D					NI				7	
				100	0	0	10 20 40				8	
End of Borehole at 8.08 m												

## General Remarks

Strong visual and olfactory evidence of petroleum hydrocarbon contamination noted down to water table (at approximately 6.5m). BH terminated at engineers request.

## Key:

(c)SPT - Standard Penetration Test  
Cu - Undrained shear strength (kPa) from Hand Vane or penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
V - Vile Sample  
AJ - Amber Jar Sample  
U - Undisturbed Sample

Standing Water Level after 20mins

Groundwater Strike

Dynamic Sampled  
and Rotary CoredBorehole No  
**BH1002**  
Page No. 1 of 2

Project: Hayle - ES Phase 1	Project No: SP08052	Logged By: MR
Location: Hayle Harbour, Cornwall	Date: 27/10/2008	Checked By: ARC
Client: Buro Happold	Co-ords: -	Level: 1.50mAod

Progress Sample Run Size (mm)	Samples/ Tests			Mechanical Log				Water Strikes	Instrum- entation	Stratum Description	Depth	Legend
	Depth	Type	Results	TCR	SCR	RQD	IF/ Min mean/ max					
0.00-0.50 100% rec										Very loose (saturated) reddish brown mottled grey slightly clayey sandy GRAVEL. Gravel is angular to sub angular fine to coarse siltstone and clinker.(MADE GROUND)		
0.50-1.00 100% rec	0.50 0.50	SPT PT AJ	N = 0 (2,2, 0,0,0,0)								1	
1.00-1.50 100% rec	1.00 1.00	SPT PT AJ	N = 1 (0,1, 0,1,0,0)							Very loose (saturated) dark grey slightly silty sandy GRAVEL. Gravel is angular to sub angular fine to coarse siltstone.(MARINE DEPOSITS)		
1.50-2.00 100% rec	1.50 1.50	SPT PT AJ	N = 13 (4,3, 4,3,3,3)							Medium dense light brown SAND.(MARINE DEPOSITS)		
	2.00	PT AJ								...blowing sands in casing. Advanced casing through sands to 7.2m	2	
											3	
											4	
											5	
											6	
											7	
7.20-8.70 90% rec	7.20	PT AJ								Medium dense (inferred) light brown silty SAND.(MARINE DEPOSITS)		
	8.00	PT AJ									8	
	8.70	D					10 20 30			Moderately strong highly weathered medium bedded grey SILTSTONE. Fractures are very closely to closely		

## General Remarks

Borehole commenced with dynamic sampling to 2.0m. Advanced casing to 7.2m due to blowing sands and unable to retrieve sample. Sample retrieved from 7.2m to 8.7m. Continued borehole with rotary coring into rock to a total depth of 15.88m. Borehole backfilled with arisings on completion. Groundwater encountered at 1.2m.

## Key:

(c)SPT - Standard Penetration Test  
Cu - Undrained shear strength (kPa) from Hand Vane or penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
V - Vile Sample  
AJ - Amber Jar Sample  
U - Undisturbed Sample

Standing Water Level after 20mins

Groundwater Strike

Dynamic Sampled  
and Rotary CoredBorehole No  
**BH1002**  
Page No. 2 of 2

Project: Hayle - ES Phase 1

Project No: SP08052

Logged By: MR

Location: Hayle Harbour, Cornwall

Date: 27/10/2008

Checked By: ARC

Client: Buro Happold

Co-ords: -

Level: 1.50mAod

Progress Sample Run Size (mm)	Samples/ Tests			Mechanical Log				Water Strikes	Instrum- entation	Stratum Description	Depth	Legend
	Depth	Type	Results	TCR	SCR	RQD	IF/ Min mean/ max					
8.70-12.29	11.70	D		100	0	0				spaced dipping between 60 and 70 degrees, open, planar with sub vertical joints. Many gravel sized quartzitic and pyritic inclusions.(MYLOR SLATES)	10	
	12.50	C					30 80 250				11	
12.29-15.00				100	10	0					12	
											13	
											14	
15.00-15.80	15.50	C		100	60	50				Moderately strong partially weathered medium bedded grey SILTSTONE. Fractures are closely to medium spaced dipping between 40 and 50 degrees, open, planar with sub vertical joints. Fracture surfaces are discoloured with oxidised deposits.(MYLOR SLATES)	15	
										End of Borehole at 15.88 m	16	
											17	

## General Remarks

Borehole commenced with dynamic sampling to 2.0m. Advanced casing to 7.2m due to blowing sands and unable to retrieve sample. Sample retrieved from 7.2m to 8.7m. Continued borehole with rotary coring into rock to a total depth of 15.88m. Borehole backfilled with arisings on completion. Groundwater encountered at 1.2m.

## Key:

(c)SPT - Standard Penetration Test  
Cu - Undrained shear strength (kPa) from Hand Vane or penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
V - Vile Sample  
AJ - Amber Jar Sample  
U - Undisturbed Sample

Standing Water Level after 20mins

Groundwater Strike



Dynamic Sampled  
and Rotary CoredBorehole No  
**BH1003**  
Page No. 1 of 2

Project: Hayle - ES Phase 1

Project No: SP08052

Logged By: MR

Location: Hayle Harbour, Cornwall

Date: 14/10/2008

Checked By: ARC

Client: Buro Happold

Co-ords: -

Level: 4.98mAod

Progress	Samples/ Tests			Mechanical Log				Water	Instrum-	Stratum Description	Depth	Legend
Sample Run Size (mm)	Depth	Type	Results	TCR	SCR	RQD	IF/ Min mean/ max	Strikes	entation			
0.00-0.50 100% rec										Medium dense reddish brown clayey GRAVEL. Gravel is angular to sub angular fine to coarse siltstone.(MADE GROUND)		
0.50-1.00 90% rec	0.50	SPT PT AJ	N = 14 (3,4, 4,3,4,3)							Loose dark grey gravelly SAND. Gravel is angular to sub angular fine to coarse siltstone and igneous material.(MADE GROUND)	1	
1.00-1.50 100% rec	1.00	SPT PT AJ	N = 4 (0,0, 1,1,1,1)									
1.50-2.00 80% rec	1.50	SPT PT AJ	N = 2 (1,0, 1,0,1,0)									
2.00-2.50 70% rec	2.00	SPT PT AJ	N = 2 (1,0, 1,0,1,0)									
2.50-3.00 100% rec	2.50	SPT PT AJ	N = 3 (1,0, 1,1,1,0)							Loose dark grey mottled black gravelly SAND. Gravel is angular to sub angular fine to coarse siltstone.(MARINE DEPOSITS)	3	
3.00-3.50 100% rec	3.00	SPT PT AJ	N = 3 (1,1, 1,1,1,0)									
3.50-4.00 80% rec	3.50	SPT PT AJ	N = 9 (2,3, 3,2,2,2)							Firm reddish brown gravelly CLAY. Gravel is angular to sub angular fine to coarse siltstone.(MARINE DEPOSITS)	4	
4.00-4.50 20% rec	4.00	PT AJ								... borehole collapse and blowing sands into casing. Advance casing to 11.75m.		
4.50-5.00 50% rec	4.50	PT AJ								... becomes stiff from 5.0m.	5	
5.00-5.75 80% rec	5.00	SPT PT AJ	N = 18 (3,3, 4,4,4,6)									
5.75-11.75 0% rec	5.75 6.00	SPT PT AJ	N = 17 (2,3, 3,3,3,8)							Medium dense light brown SAND.(MARINE DEPOSITS) ... blowing sand in casing at 6.0m therefore progressed casing to 11.75m.	6	
	7.00	PT AJ									7	
											8	

## General Remarks

Borehole terminated at 11.75m due to blowing sand in casing. Re-drilled borehole on Monday 20th with open holing to 13.5m bgl where rock was encountered. Continued borehole with rotary coring into rock to a total depth of 18.12m. Borehole backfilled with arisings on completion. Groundwater encountered at 4.9m bgl.

## Key:

(c)SPT - Standard Penetration Test  
Cu - Undrained shear strength (kPa) from Hand Vane or penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
V - Vile Sample  
AJ - Amber Jar Sample  
U - Undisturbed Sample

Standing Water Level after 20mins

Groundwater Strike



Project: Hayle - ES Phase 1

Project No: SP08052

Logged By: MR

Location: Hayle Harbour, Cornwall

Date: 14/10/2008

Checked By: ARC

Client: Buro Happold

Co-ords: -

Level:	4.98mAod
--------	----------

Progress	Samples/ Tests			Mechanical Log				Water Strikes	Instrum- entation	Stratum Description	Depth	Legend	
Sample Run Size (mm)	Depth	Type	Results	TCR	SCR	RQD	IF/ Min mean/ max						
13.40-15.00	13.50	D					10 20 40			Medium dense light brown SAND.(MARINE DEPOSITS)	10		
											11		
													12
													13
												</	


### General Remarks

Borehole terminated at 11.75m due to blowing sand in casing. Re-drilled borehole on Monday 20th with open holing to 13.5m bgl where rock was encountered. Continued borehole with rotary coring into rock to a total depth of 18.12m. Borehole backfilled with arisings on completion. Groundwater encountered at 4.9m bgl.

Key:
------

(c) SPT - Standard Penetration Test  
Cu - Undrained shear strength (kPa) from Hand Vane  
or penetrometer  
D - Disturbed Sample  
PT - Plastic Tub Sample  
V - Vile Sample  
AJ - Amber Jar Sample  
U - Undisturbed Sample

 Standing Water Level after 20mins

 Groundwater Strike



**Plate 1: WS701 – 0m to 2.8m**



**Plate 2: WS701 – 2.5m to 4.0m**





**Plate 3: WS702 – 0m to 2.7m**



**Plate 4: WS703 – 0m to 8.0m**



**Plate 5: WS705 – 0.8m to 7.8m**



**Plate 6: WS707 – 0m to 3.0m**





Plate 7: BH1001 – 0.3m to 1.0m



Plate 8: BH1001 – 1.27m to 4.37m



**Plate 9: BH1001 – 4.37m to 8.08m**



**Plate 10: BH1002 – 0m to 8.7m**





**Plate 11: BH1002 – 8.7m to 12.29m**



**Plate 12: BH1002 – 12.29m to 15.08m**



**Plate 13: BH1002 – 15.08m to 15.88m**



**Plate 14: BH1003 – 0m to 2.5m**





**Plate 15: BH1003 – 2.5m to 5.75m**



**Plate 16: BH1003 – 5.75m to 7.25m**





Plate 17: BH1003 – 13.4m to 17.62m



Plate 18: BH1003 – 17.62m to 18.12m



## **Appendix D**

### **GEOTECHNICAL TEST RESULTS**

# SUMMARY OF UNCONFINED COMPRESSIVE STRENGTH TESTS



Rock Characterisation, Testing and Monitoring, International Society for Rock Mechanics: Brown: 1981.

Hole Reference	Sample No	Sample Type	Depth m	Moisture Content %	Bulk Density Mg/m <sup>3</sup>	Dry Density Mg/m <sup>3</sup>	Length mm	Diameter mm	Length: Diameter ratio	Test Duration min	Stress Rate kN/min	Load at Failure Mg/m <sup>3</sup>	UCS MPa	Mode of Failure	Description of Sample
BH1002		C	12.54	0.38	2.67	2.66	119.55	73.26	1.63	7	26	220.4	52.3	A	Grey SILTSTONE
BH1002		C	15.55	1.5	2.67	2.63	130.95	73.06	1.79	6.5	26	186.0	44.4	A	Grey SILTSTONE
BH1003		C	17.88	1.9	2.74	2.69	145.37	73.17	1.99	4.5	34	123.4	29.3	A	Grey SILTSTONE

Key: Mode of Failure : A = Axial cleavage, E = Explosive, P = Plastic, S = Shear.

Note: Axis of loading parallel to core axis.

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON L. MARTIN

	STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Compiled By	Date	Checked By	Date	Contract Ref:
			08.12.08			740832
		Contract: Hayle Harbour, Cornwall				Page of 

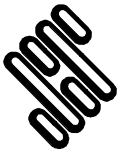

# SUMMARY OF POINT LOAD INDEX TEST RESULTS

(International Society for Rock Mechanics : 1985)

Hole Reference	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D <sub>e</sub> ) (mm)	Point Load (I <sub>s</sub> ) (MN/m <sup>2</sup> )	Size Factor (F)	Point Load Index (I <sub>s(50)</sub> ) (MN/m <sup>2</sup> )	Moisture Content (%)	Rock Type
BH1002	8.70	A	72	46	4.540	65	1.08	1.12	1.21	3.6	SILTSTONE
BH1002	8.70	A	72	36	1.675	57	0.51	1.06	0.54	3.5	SILTSTONE
BH1002	8.70	I	35	59	26.340	51	10.02	1.01	10.12	1.2	SILTSTONE
BH1002	11.70	A	72	48	13.020	66	2.96	1.14	3.37	1.0	SILTSTONE
BH1002	11.70	A	72	47	14.085	66	3.27	1.13	3.70	1.5	SILTSTONE
BH1002	11.70	A	72	38	11.220	59	3.22	1.08	3.48	0.76	SILTSTONE
BH1002	12.50	A	73	39	32.385	60	8.93	1.09	9.73	0.38	SILTSTONE
BH1002	12.58	A	73	44	16.375	64	4.00	1.12	4.48	0.38	SILTSTONE

Key : A = Axial, D = Diametral, I = Irregular

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON L. MARTIN

 <b>STRUCTURAL SOILS</b> The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Compiled By	Date	Checked By	Date	Contract Ref:
		<b>08.12.08</b>			<b>740832</b>
	Contract: <b>Hayle Harbour, Cornwall</b>				Page _____ of _____ 

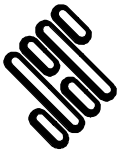

# SUMMARY OF POINT LOAD INDEX TEST RESULTS

(International Society for Rock Mechanics : 1985)

Hole Reference	Depth (m)	Type of Test	Width or Length (W or L) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D <sub>e</sub> ) (mm)	Point Load (I <sub>s</sub> ) (MN/m <sup>2</sup> )	Size Factor (F)	Point Load Index (I <sub>s(50)</sub> ) (MN/m <sup>2</sup> )	Moisture Content (%)	Rock Type
BH1002	15.52	A	73	24	1.085	47	0.49	0.97	0.48	1.5	SILTSTONE
BH1002	15.52	A	73	39	10.240	60	2.82	1.09	3.07	1.5	SILTSTONE
BH1003	13.50	A	72	34	28.920	56	9.28	1.05	9.74	0.57	SILTSTONE
BH1003	13.50	A	72	42	24.635	62	6.40	1.10	7.04	0.64	SILTSTONE
BH1003	13.50	A	72	36	9.225	57	2.80	1.06	2.97	0.74	SILTSTONE
BH1003	17.81	D	67	73	6.410	73	1.20	1.19	1.43	1.9	SILTSTONE
BH1003	17.81	A	73	69	7.525	80	1.17	1.24	1.45	1.9	SILTSTONE

Key : A = Axial, D = Diametral, I = Irregular

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON L. MARTIN

 <b>STRUCTURAL SOILS</b> The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Compiled By	Date	Checked By	Date	Contract Ref:
		<b>08.12.08</b>			<b>740832</b>
	Contract: <b>Hayle Harbour, Cornwall</b>				Page of 

## Appendix C    Laboratory Analytical Reports

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## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm                  Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm      Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client



**Validated**

# ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** SOLID

**Location:** Hayle Cornwall

**Client Contact:** Tom Smith

[illegible]

**All results expressed on a dry weight basis.**

**Date** 06.11.2008

**Validated**

## Preliminary



## ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** SOLID

**Location:** Hayle Cornwall

**Client Contact:** Tom Smith

[illegible]

**All results expressed on a dry weight basis.**

**Date** 06.11.2008

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.09889 Moisture Content Ratio (%) = 9.83  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 91.05  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits			
Batch		3						
Sample Number(s)		65-67			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Sampled Date		23/10/08						
Sample Identity		WS703/11						
Depth (m)		6.00						
Solid Waste Analysis								
Total Organic Carbon (%)		<0.2			-	-	-	
Loss on Ignition (%)		-			-	-	-	
Sum of BTEX (mg/kg)		-			-	-	-	
Sum of 7 PCBs (mg/kg)		-			-	-	-	
Mineral Oil (mg/kg)		-			-	-	-	
PAH Sum of 17(mg/kg)		-			-	-	-	
pH (pH Units)		8.82			-	-	-	
ANC to pH 7 (mol/kg)		-			-	-	-	
ANC to pH 4 (mol/kg)		-			-	-	-	
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg			
		C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg				
Arsenic		0.014		0.14		-	-	-
Barium		0.004		0.04		-	-	-
Cadmium		<0.00022		<0.0022		-	-	-
Chromium		0.002		0.02		-	-	-
Copper		0.0035		0.035		-	-	-
Mercury		<0.00001		<0.0001		-	-	-
Molybdenum		0.001		0.01		-	-	-
Nickel		<0.0015		<0.015		-	-	-
Lead		<0.0004		<0.004		-	-	-
Antimony		<0.00075		<0.0075		-	-	-
Selenium		<0.001		<0.01		-	-	-
Zinc		0.10		1.0		-	-	-
Chloride		110		1100		-	-	-
Fluoride		<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>		21		210		-	-	-
Total Dissolved Solids		230		2300		-	-	-
Phenols Monohydric		<0.01		<0.1		-	-	-
Dissolved Organic Carbon		<1		<10		-	-	-
Leach Test Information								
Date Prepared		30/10/08			-			
pH (pH Units)		8.982			-			
Conductivity (µS/cm)		432			-			
Temperature (°C)		19.1			-			
Volume Leachant (Litres)		0.891			-			
Volume of Eluate VE1 (Litres)		-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11671	Moisture Content Ratio (%) =	29.75
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	77.07
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits			
Batch		3						
Sample Number(s)		44-46			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Sampled Date		23/10/08						
Sample Identity		WS703/3						
Depth (m)		1.50						
Solid Waste Analysis								
Total Organic Carbon (%)		<0.2			-	-	-	
Loss on Ignition (%)		-			-	-	-	
Sum of BTEX (mg/kg)		-			-	-	-	
Sum of 7 PCBs (mg/kg)		-			-	-	-	
Mineral Oil (mg/kg)		-			-	-	-	
PAH Sum of 17(mg/kg)		-			-	-	-	
pH (pH Units)		8.64			-	-	-	
ANC to pH 7 (mol/kg)		-			-	-	-	
ANC to pH 4 (mol/kg)		-			-	-	-	
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg			
		C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg				
Arsenic		0.062		0.62		-	-	-
Barium		0.004		0.04		-	-	-
Cadmium		<0.00022		<0.0022		-	-	-
Chromium		0.001		0.01		-	-	-
Copper		0.0080		0.080		-	-	-
Mercury		<0.00001		<0.0001		-	-	-
Molybdenum		0.003		0.03		-	-	-
Nickel		<0.0015		<0.015		-	-	-
Lead		<0.0004		<0.004		-	-	-
Antimony		0.015		0.15		-	-	-
Selenium		<0.001		<0.01		-	-	-
Zinc		<0.005		<0.05		-	-	-
Chloride		490		4900		-	-	-
Fluoride		<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>		74		740		-	-	-
Total Dissolved Solids		940		9400		-	-	-
Phenols Monohydric		<0.01		<0.1		-	-	-
Dissolved Organic Carbon		<1		<10		-	-	-
Leach Test Information								
Date Prepared		30/10/08			-			
pH (pH Units)		9.146			-			
Conductivity (µS/cm)		1706			-			
Temperature (°C)		19.2			-			
Volume Leachant (Litres)		0.873			-			
Volume of Eluate VE1 (Litres)		-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.10826 Moisture Content Ratio (%) = 20.15  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 83.23  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		3					
Sample Number(s)		54-56			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/7					
Depth (m)		3.50					
Solid Waste Analysis							
Total Organic Carbon (%)	<0.2				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.75				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.028		0.28		-	-	-
Barium	0.003		0.03		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.001		0.01		-	-	-
Copper	0.0051		0.051		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.002		0.02		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	0.0018		0.018		-	-	-
Selenium	<0.001		<0.01		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	220		2200		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	38		380		-	-	-
Total Dissolved Solids	430		4300		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	30/10/08			-			
pH (pH Units)	9.049			-			
Conductivity (µS/cm)	778			-			
Temperature (°C)	19.3			-			
Volume Leachant (Litres)	0.882			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.09733 Moisture Content Ratio (%) = 8.16  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 92.46  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		3					
Sample Number(s)		59-61			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/9					
Depth (m)		4.50					
Solid Waste Analysis							
Total Organic Carbon (%)	<0.2				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.86				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.021		0.21		-	-	-
Barium	0.001		0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0019		0.019		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.002		0.02		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	<0.00075		<0.0075		-	-	-
Selenium	<0.001		<0.01		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	69		690		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	14		140		-	-	-
Total Dissolved Solids	170		1700		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	4		40		-	-	-
Leach Test Information							
Date Prepared	30/10/08			-			
pH (pH Units)	9.071			-			
Conductivity (µS/cm)	295			-			
Temperature (°C)	19.3			-			
Volume Leachant (Litres)	0.893			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.09889
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	9.83
Dry Matter Content Ratio (%) =	91.05

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		3					
Sample Number(s)		65-67			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/11					
Depth (m)		6.00					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	<0.02		<0.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	30/10/08	-					
pH (pH Units)	8.982	-					
Conductivity (µS/cm)	432	-					
Temperature (°C)	19.1	-					
Volume Leachant (Litres)	0.891	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11671
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	29.75
Dry Matter Content Ratio (%) =	77.07

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		3					
Sample Number(s)		44-46			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/3					
Depth (m)		1.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.10		1.0		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.003		0.03		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	30/10/08	-					
pH (pH Units)	9.146	-					
Conductivity (µS/cm)	1706	-					
Temperature (°C)	19.2	-					
Volume Leachant (Litres)	0.873	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report



# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

WAC ANALYTICAL RESULTS					REF:CEN12457-2		
Mass Sample taken (kg) =		0.10826		Moisture Content Ratio (%) =		20.15	
Mass of dry sample (kg) =		0.09		Dry Matter Content Ratio (%) =		83.23	
Particle Size <4mm =		>95%					
Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		3					
Sample Number(s)		54-56			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/7					
Depth (m)		3.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-		-	-	-	
Loss on Ignition (%)		-		-	-	-	
Sum of BTEX (mg/kg)		-		-	-	-	
Sum of 7 PCBs (mg/kg)		-		-	-	-	
Mineral Oil (mg/kg)		-		-	-	-	
PAH Sum of 17(mg/kg)		-		-	-	-	
pH (pH Units)		-		-	-	-	
ANC to pH 7 (mol/kg)		-		-	-	-	
ANC to pH 4 (mol/kg)		-		-	-	-	
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.03		0.3		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.001		0.01		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	30/10/08	-					
pH (pH Units)	9.049	-					
Conductivity (µS/cm)	778	-					
Temperature (°C)	19.3	-					
Volume Leachant (Litres)	0.882	-					
Volume of Eluate VE1 (Litres)	-						
Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable							

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

WAC ANALYTICAL RESULTS					REF: CEN12457-2		
Mass Sample taken (kg) =		0.09733		Moisture Content Ratio (%) =		8.16	
Mass of dry sample (kg) =		0.09		Dry Matter Content Ratio (%) =		92.46	
Particle Size <4mm =		>95%					

Job Number	200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch	3					
Sample Number(s)	59-61			Inert Waste Landfill	Stable Non- reactive Hazardous Waste in Non- Hazardous Landfill	Hazardous Waste Landfill
Sampled Date	23/10/08					
Sample Identity	WS703/9					
Depth (m)	4.50					
<b>Solid Waste Analysis</b>						
Total Organic Carbon (%)	-			-	-	-
Loss on Ignition (%)	-			-	-	-
Sum of BTEX (mg/kg)	-			-	-	-
Sum of 7 PCBs (mg/kg)	-			-	-	-
Mineral Oil (mg/kg)	-			-	-	-
PAH Sum of 17(mg/kg)	-			-	-	-
pH (pH Units)	-			-	-	-
ANC to pH 7 (mol/kg)	-			-	-	-
ANC to pH 4 (mol/kg)	-			-	-	-

Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	<0.02		<0.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	12		120		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-

Leach Test Information		
Date Prepared	30/10/08	-
pH (pH Units)	9.071	-
Conductivity (µS/cm)	295	-
Temperature (°C)	19.3	-
Volume Leachant (Litres)	0.893	-
Volume of Eluate VE1 (Litres)	-	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

\* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture content and description			WET	
TM008	BS 1377:Part 1977	Particle size distribution of solid samples			DRY	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓	✓	DRY	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit			NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer			DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓		DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓	✓	DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓		DRY	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>  
 \* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM132	In - house Method	ELTRA CS800 Operators Guide	✓	✓	DRY	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓	✓	WET	
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC	✓	✓	DRY	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser			WET	
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique	✓		WET	
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry			NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm                  Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm      Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

**Validated**

## ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** SOLID

**Location:** Hayle Cornwall

**Client Contact:** Tom Smith

[illegible]

**All results expressed on a dry weight basis.**

**Date** 06.11.2008



☒

11

» Shown on prev. report

**Client Contact:** Tom Smith

[illegible]

**Date** 06.11.2008

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.12931	Moisture Content Ratio (%) =	43.77
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	69.56
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		1-2			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS702/1					
Depth (m)		0.5					
Solid Waste Analysis							
Total Organic Carbon (%)	1.2				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.49				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Arsenic	0.11		1.1		-	-	-
Barium	0.005		0.05		-	-	-
Cadmium	0.00079		0.0079		-	-	-
Chromium	0.002		0.02		-	-	-
Copper	0.0036		0.036		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.13		1.3		-	-	-
Nickel	0.0016		0.016		-	-	-
Lead	0.0017		0.017		-	-	-
Antimony	0.038		0.38		-	-	-
Selenium	0.007		0.07		-	-	-
Zinc	0.009		0.09		-	-	-
Chloride	850		8500		-	-	-
Fluoride	0.7		7		-	-	-
Sulphate as SO <sub>4</sub>	140		1400		-	-	-
Total Dissolved Solids	1500		15000		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	11		110		-	-	-
Leach Test Information							
Date Prepared	29/10/08			-			
pH (pH Units)	8.714			-			
Conductivity (µS/cm)	27000			-			
Temperature (°C)	19.4			-			
Volume Leachant (Litres)	0.861			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11377	Moisture Content Ratio (%) =	26.47
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	79.07
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		5-6			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS702/3					
Depth (m)		1.5					
Solid Waste Analysis							
Total Organic Carbon (%)		<0.2			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.56			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Arsenic	0.072		0.72		-	-	-
Barium	0.001		0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.001		0.01		-	-	-
Copper	0.0091		0.091		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.002		0.02		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0005		0.005		-	-	-
Antimony	0.0072		0.072		-	-	-
Selenium	0.002		0.02		-	-	-
Zinc	0.005		0.05		-	-	-
Chloride	520		5100		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	78		780		-	-	-
Total Dissolved Solids	950		9500		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	2		20		-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	9.154	-					
Conductivity (µS/cm)	1713	-					
Temperature (°C)	19.2	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1081	Moisture Content Ratio (%) =	20.27
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	83.15
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits			
Batch		1						
Sample Number(s)		9-10			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Sampled Date		21/10/08						
Sample Identity		WS702/5						
Depth (m)		2.5						
Solid Waste Analysis								
Total Organic Carbon (%)		<0.2			-	-	-	
Loss on Ignition (%)		-			-	-	-	
Sum of BTEX (mg/kg)		-			-	-	-	
Sum of 7 PCBs (mg/kg)		-			-	-	-	
Mineral Oil (mg/kg)		-			-	-	-	
PAH Sum of 17(mg/kg)		-			-	-	-	
pH (pH Units)		8.76			-	-	-	
ANC to pH 7 (mol/kg)		-			-	-	-	
ANC to pH 4 (mol/kg)		-			-	-	-	
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg			
		C <sub>2</sub>		A <sub>2</sub>				
				mg/l		mg/kg		
Arsenic		0.090		0.90		-	-	-
Barium		0.006		0.06		-	-	-
Cadmium		<0.00022		<0.0022		-	-	-
Chromium		0.001		0.01		-	-	-
Copper		0.0063		0.063		-	-	-
Mercury		<0.00001		<0.0001		-	-	-
Molybdenum		0.001		0.01		-	-	-
Nickel		0.0016		0.016		-	-	-
Lead		<0.0004		<0.004		-	-	-
Antimony		0.0039		0.039		-	-	-
Selenium		<0.001		<0.01		-	-	-
Zinc		<0.005		<0.05		-	-	-
Chloride		390		3900		-	-	-
Fluoride		<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>		63		630		-	-	-
Total Dissolved Solids		760		7600		-	-	-
Phenols Monohydric		<0.01		<0.1		-	-	-
Dissolved Organic Carbon		1		10		-	-	-
Leach Test Information								
Date Prepared		29/10/08			-			
pH (pH Units)		9.278			-			
Conductivity (µS/cm)		1323			-			
Temperature (°C)		19.6			-			
Volume Leachant (Litres)		0.882			-			
Volume of Eluate VE1 (Litres)		-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.10725 Moisture Content Ratio (%) = 19.41  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 83.75  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		11-12			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/1					
Depth (m)		0.5					
Solid Waste Analysis							
Total Organic Carbon (%)	0.3				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.66				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Arsenic	0.086		0.86		-	-	-
Barium	0.002		0.02		-	-	-
Cadmium	0.00054		0.0054		-	-	-
Chromium	0.002		0.02		-	-	-
Copper	0.025		0.25		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.001		0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0008		0.008		-	-	-
Antimony	0.0024		0.024		-	-	-
Selenium	0.005		0.05		-	-	-
Zinc	0.006		0.06		-	-	-
Chloride	420		4200		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	67		670		-	-	-
Total Dissolved Solids	800		8000		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	2		20		-	-	-
Leach Test Information							
Date Prepared	29/10/08			-			
pH (pH Units)	9.107			-			
Conductivity (µS/cm)	1443			-			
Temperature (°C)	19.5			-			
Volume Leachant (Litres)	0.883			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1167	Moisture Content Ratio (%) =	30.47
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	76.65
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		15-16			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/3					
Depth (m)		1.5					
Solid Waste Analysis							
Total Organic Carbon (%)		<0.2			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.66			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg	
		C <sub>2</sub>		A <sub>2</sub>			
		mg/l		mg/kg			
		Arsenic	0.014		0.14		-
Barium	0.009		0.09		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.063		0.63		-	-	-
Copper	0.0063		0.063		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0015		0.015		-	-	-
Antimony	0.0034		0.034		-	-	-
Selenium	0.005		0.05		-	-	-
Zinc	0.021		0.21		-	-	-
Chloride	400		4000		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	64		640		-	-	-
Total Dissolved Solids	760		7600		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	1		10		-	-	-
Leach Test Information							
Date Prepared		29/10/08	-				
pH (pH Units)		9.543	-				
Conductivity (µS/cm)		1350	-				
Temperature (°C)		19.4	-				
Volume Leachant (Litres)		0.873	-				
Volume of Eluate VE1 (Litres)		-					

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10853	Moisture Content Ratio (%) =	21.26
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	82.47
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		19-20			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/5					
Depth (m)		2.5					
Solid Waste Analysis							
Total Organic Carbon (%)		<0.2			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.64			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
	Arsenic	0.0095		0.095		-	-
Barium	0.002		0.02		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0071		0.071		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0005		0.005		-	-	-
Antimony	0.0013		0.013		-	-	-
Selenium	<0.001		<0.01		-	-	-
Zinc	0.010		0.10		-	-	-
Chloride	330		3300		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	54		540		-	-	-
Total Dissolved Solids	600		6000		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	1		10		-	-	-
Leach Test Information							
Date Prepared		29/10/08			-		
pH (pH Units)		9.478			-		
Conductivity (µS/cm)		1112			-		
Temperature (°C)		19.3			-		
Volume Leachant (Litres)		0.881			-		
Volume of Eluate VE1 (Litres)		-					

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable



# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.12931
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	43.77
Dry Matter Content Ratio (%) =	69.56

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		1-2			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS702/1					
Depth (m)		0.5					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.33		3.3		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.002		0.02		-	-	-
COD (CEN 10:1)	37		370		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	8.714	-					
Conductivity (µS/cm)	27000	-					
Temperature (°C)	19.4	-					
Volume Leachant (Litres)	0.861	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11377
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	26.47
Dry Matter Content Ratio (%) =	79.07

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		5-6			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS702/3					
Depth (m)		1.5					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.06		0.6		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.003		0.03		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	9.154	-					
Conductivity (µS/cm)	1713	-					
Temperature (°C)	19.2	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

WAC ANALYTICAL RESULTS					REF: CEN12457-2		
Mass Sample taken (kg) =		0.1081		Moisture Content Ratio (%) =		20.27	
Mass of dry sample (kg) =		0.09		Dry Matter Content Ratio (%) =		83.15	
Particle Size <4mm =		>95%					

Job Number	200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch	1					
Sample Number(s)	9-10			Inert Waste Landfill	Stable Non- reactive Hazardous Waste in Non- Hazardous Landfill	Hazardous Waste Landfill
Sampled Date	21/10/08					
Sample Identity	WS702/5					
Depth (m)	2.5					
<b>Solid Waste Analysis</b>						
Total Organic Carbon (%)	-			-	-	-
Loss on Ignition (%)	-			-	-	-
Sum of BTEX (mg/kg)	-			-	-	-
Sum of 7 PCBs (mg/kg)	-			-	-	-
Mineral Oil (mg/kg)	-			-	-	-
PAH Sum of 17(mg/kg)	-			-	-	-
pH (pH Units)	-			-	-	-
ANC to pH 7 (mol/kg)	-			-	-	-
ANC to pH 4 (mol/kg)	-			-	-	-

Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<b>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</b>		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	<0.02		<0.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.003		0.03		-	-	-
COD (CEN 10:1)	<7		<70		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
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					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-

<b>Leach Test Information</b>		
Date Prepared	29/10/08	-
pH (pH Units)	9.278	-
Conductivity (µS/cm)	1323	-
Temperature (°C)	19.6	-
Volume Leachant (Litres)	0.882	-
Volume of Eluate VE1 (Litres)	-	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10725
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	19.41
Dry Matter Content Ratio (%) =	83.75

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		11-12			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/1					
Depth (m)		0.5					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.09		0.9		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.002		0.02		-	-	-
COD (CEN 10:1)	<7		<70		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	9.107	-					
Conductivity (µS/cm)	1443	-					
Temperature (°C)	19.5	-					
Volume Leachant (Litres)	0.883	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1167
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	30.47
Dry Matter Content Ratio (%) =	76.65

Job Number		200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch		1					
Sample Number(s)		15-16			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/3					
Depth (m)		1.5					
Solid Waste Analysis							
Total Organic Carbon (%)	-				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	-				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.05		0.5		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.001		0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	9.543	-					
Conductivity (µS/cm)	1350	-					
Temperature (°C)	19.4	-					
Volume Leachant (Litres)	0.873	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10853
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	21.26
Dry Matter Content Ratio (%) =	82.47

Job Number		200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch		1					
Sample Number(s)		19-20			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		21/10/08					
Sample Identity		WS707/5					
Depth (m)		2.5					
Solid Waste Analysis							
Total Organic Carbon (%)		-					
Loss on Ignition (%)		-					
Sum of BTEX (mg/kg)		-					
Sum of 7 PCBs (mg/kg)		-					
Mineral Oil (mg/kg)		-					
PAH Sum of 17(mg/kg)		-					
pH (pH Units)		-					
ANC to pH 7 (mol/kg)		-					
ANC to pH 4 (mol/kg)		-					
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	<0.02		<0.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	29/10/08	-					
pH (pH Units)	9.478	-					
Conductivity (µS/cm)	1112	-					
Temperature (°C)	19.3	-					
Volume Leachant (Litres)	0.881	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

\* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture content and description			WET	
TM008	BS 1377:Part 1977	Particle size distribution of solid samples			DRY	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓	✓	DRY	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit			NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer			DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓		DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓	✓	DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓		DRY	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>  
 \* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM132	In - house Method	ELTRA CS800 Operators Guide	✓	✓	DRY	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓	✓	WET	
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC	✓	✓	DRY	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser			WET	
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique	✓		WET	
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry			NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.



## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]

## ALcontrol Laboratories Analytical Services

### Sample Descriptions

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm Medium

2mm - 10mm Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

**Validated**

## ALcontrol Laboratories Analytical Services Table Of Results

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** SOLID

**Location:** Hayle Cornwall

**Client Contact:** Tom Smith

[illegible]

**All results expressed on a dry weight basis.**

**Date** 06.11.2008

Validated ☒  
Preliminary ☐

# ALcontrol Laboratories Analytical Services

## Table Of Results

# ISO 17025 accredited  
M MCERTS accredited  
\* Subcontracted test  
» Shown on prev. report

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 024435

**Matrix:** LIQUID  
**Location:** Hayle Cornwall  
**Client Contact:** Tom Smith

Sample Identity	BH108	BH1001									
Depth (m)	1.40	1.60									
Sample Type	LIQUID	LIQUID									
Sampled Date	23.10.08	23.10.08									
Sample Received Date	25.10.08	25.10.08									
Batch	2	2									
Sample Number(s)	23-25	26-28									
										Method Code	LoD/Units
Antimony Dissolved (ICP-MS)	26	8.2								TM152 <sup>#</sup>	<0.75 ug/l
Arsenic Dissolved (ICP-MS)	33	140								TM152 <sup>#</sup>	<0.75 ug/l
Boron Dissolved (ICP-MS)	59	110								TM152 <sup>#</sup>	<20 ug/l
Cadmium Dissolved (ICP-MS)	1.4	<0.22								TM152 <sup>#</sup>	<0.22 ug/l
Chromium Dissolved (ICP-MS)	2	1								TM152 <sup>#</sup>	<1 ug/l
Copper Dissolved (ICP-MS)	54	14								TM152 <sup>#</sup>	<1.6 ug/l
Lead Dissolved (ICP-MS)	1.0	<0.4								TM152 <sup>#</sup>	<0.4 ug/l
Nickel Dissolved (ICP-MS)	5.8	5.8								TM152 <sup>#</sup>	<1.5 ug/l
Selenium Dissolved (ICP-MS)	7	3								TM152 <sup>#</sup>	<1 ug/l
Zinc Dissolved (ICP-MS)	270	20								TM152 <sup>#</sup>	<5 ug/l
Mercury Dissolved (CVAF)	<0.01	<0.01								TM183 <sup>#</sup>	<0.01 ug/l
BOD	5	11								TM045 <sup>#</sup>	<1 mg/l
COD	370	210								TM107 <sup>#</sup>	<7 mg/l
Conductivity (at 20 deg.C)	1.2	0.76								TM120 <sup>#</sup>	<0.014 mS/cm
Sulphate (soluble)	55	33								TM098 <sup>#</sup>	<3 mg/l
Chloride	200	110								TM097 <sup>#</sup>	<1 mg/l
Sulphide	<0.1	<0.1								TM101	<0.1 mg/l
Ammoniacal Nitrogen as N	<0.2	<0.2								TM099 <sup>#</sup>	<0.2 mg/l
Total Organic Carbon	4	6								TM090 <sup>#</sup>	<3 mg/l
Phenols Monohydric	<0.01	<0.01								TM062 <sup>#</sup>	<0.01 mg/l
Total Cyanide	<0.05	<0.05								TM153 <sup>#</sup>	<0.05 mg/l
pH Value	7.49	7.48								TM133 <sup>#</sup>	<1.00 pH Units
EPH (DRO) (C10-C40) Aqueous	21	16000								TM172 <sup>#</sup>	<10 ug/l
GRO (C4-C10)	<10	68								TM089 <sup>#</sup>	<10 ug/l
GRO (C10-C12)	<10	94								TM089 <sup>#</sup>	<10 ug/l
Benzene	<10	<10								TM089 <sup>#</sup>	<10 ug/l
Toluene	<10	<10								TM089 <sup>#</sup>	<10 ug/l
Ethyl benzene	<10	<10								TM089 <sup>#</sup>	<10 ug/l
m & p Xylene	<10	<10								TM089 <sup>#</sup>	<10 ug/l
o Xylene	<10	<10								TM089 <sup>#</sup>	<10 ug/l
Sum m&p and o Xylene	<10	<10								TM089 <sup>#</sup>	<10 ug/l

Date 06.11.2008



**Validated**

## Preliminary



## ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** LIQUID

**Location:** Hayle Cornwall

**Client Contact:** Tom Smith

[illegible]

**Date** 06.11.2008

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11376	Moisture Content Ratio (%) =	26.61
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	78.98
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		2					
Sample Number(s)		30			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/1					
Depth (m)		0.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
	Arsenic	0.095		0.95		-	-
Barium	0.003		0.03		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0040		0.040		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.068		0.68		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0007		0.007		-	-	-
Antimony	0.0012		0.012		-	-	-
Selenium	0.005		0.05		-	-	-
Zinc	1.2		12		-	-	-
Chloride	480		4800		-	-	-
Fluoride	0.6		6		-	-	-
Sulphate as SO <sub>4</sub>	130		1300		-	-	-
Total Dissolved Solids	930		9300		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	6		60		-	-	-
Leach Test Information							
Date Prepared	01/11/08	-					
pH (pH Units)	8.697	-					
Conductivity (µS/cm)	1814.0	-					
Temperature (°C)	19.4	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11063	Moisture Content Ratio (%) =	23.18
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	81.18
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		2					
Sample Number(s)		37-39			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/13					
Depth (m)		8.00					
Solid Waste Analysis							
Total Organic Carbon (%)	<0.2				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.85				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
	Arsenic	0.0056		0.056		-	-
Barium	0.003		0.03		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0027		0.027		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.005		0.05		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	<0.00075		<0.0075		-	-	-
Selenium	0.001		0.01		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	380		3800		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	58		580		-	-	-
Total Dissolved Solids	730		7300		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	01/11/08			-			
pH (pH Units)	9.251			-			
Conductivity (µS/cm)	1293.0			-			
Temperature (°C)	19.4			-			
Volume Leachant (Litres)	0.879			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable



# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.12065	Moisture Content Ratio (%) =	34.86
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	74.15
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		2					
Sample Number(s)		29			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/5					
Depth (m)		2.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg	
		C <sub>2</sub>		A <sub>2</sub>			
		mg/l		mg/kg			
		Arsenic	0.057		0.57		-
Barium	0.003		0.03		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.001		0.01		-	-	-
Copper	0.0061		0.061		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0020		0.020		-	-	-
Antimony	<0.00075		<0.0075		-	-	-
Selenium	<0.001		<0.01		-	-	-
Zinc	0.71		7.1		-	-	-
Chloride	480		4800		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	72		720		-	-	-
Total Dissolved Solids	920		9200		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared		01/11/08	-				
pH (pH Units)		9.204	-				
Conductivity (µS/cm)		1650.0	-				
Temperature (°C)		19.5	-				
Volume Leachant (Litres)		0.869	-				
Volume of Eluate VE1 (Litres)		-					

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11376
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	26.61
Dry Matter Content Ratio (%) =	78.98

Job Number		200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch		2					
Sample Number(s)		30			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/1					
Depth (m)		0.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.24		2.4		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	17		170		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
<b>Leach Test Information</b>							
Date Prepared	01/11/08	-					
pH (pH Units)	8.697	-					
Conductivity (µS/cm)	1814.0	-					
Temperature (°C)	19.4	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

### CEN 10:1 ONE STAGE BATCH TEST

## REF:CEN12457-2

Mass Sample taken (kg) =	0.11063	Moisture Content Ratio (%) =	23.18
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	81.18
Particle Size <4mm =	>95%		

Job Number	200817832				<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch	2						
Sample Number(s)	37-39				<div>Inert Waste Landfill</div> <div>Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill</div> <div>Hazardous Waste Landfill</div>		
Sampled Date	23/10/08						
Sample Identity	WS703/13						
Depth (m)	8.00						
<b>Solid Waste Analysis</b>							
Total Organic Carbon (%)	-				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	-				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<b>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</b>		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.12		1.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.002		0.02		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
<b>Leach Test Information</b>							
Date Prepared	01/11/08	-					
pH (pH Units)	9.251	-					
Conductivity (µS/cm)	1293.0	-					
Temperature (°C)	19.4	-					
Volume Leachant (Litres)	0.879	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.12065	Moisture Content Ratio (%) =	34.86
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	74.15
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		2					
Sample Number(s)		29			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		23/10/08					
Sample Identity		WS703/5					
Depth (m)		2.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.11		1.1		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	<10		<100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	01/11/08	-					
pH (pH Units)	9.204	-					
Conductivity (µS/cm)	1650.0	-					
Temperature (°C)	19.5	-					
Volume Leachant (Litres)	0.869	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

\* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture content and description			WET	
TM008	BS 1377:Part 1977	Particle size distribution of solid samples			DRY	
TM045	MEWAM BOD5 2nd Ed.HMSO 1988 / Method 5210B, AWWA/APHA, 20th Ed., 1999; SCA Blue Book 130	Determination of BOD5 (ATU) by Oxygen Meter	✓		NA	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection	✓		NA	
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)			NA	
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)	✓		NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water	✓		NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓		NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓	✓	DRY	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser	✓		NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

\* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM099	BS 2690: Part 7:1968 / BS 6068: Part 2.11:1984	Determination of Ammonium in Water Samples using the Kone Analyser	✓		NA	
TM101	Method 4500B & C, AWWA/APHA, 20th Ed., 1999	Determination of Sulphide in soil and water samples using the Kone Analyser			NA	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit	✓		NA	
TM120	Method 2510B, AWWA/APHA, 20th Ed., 1999 / BS 2690: Part 9:1970	Determination of Electrical Conductivity using a Conductivity Meter	✓		NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer			DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓		DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓	✓	DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓		DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓	✓	DRY	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓		NA	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓	✓	WET	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
PFD	Possible Fibres Detected	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM136	Method 17.10, Second Site property, March 2003	Determination of Sulphur by HPLC	✓	✓	DRY	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS	✓		NA	
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser			WET	
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser	✓		NA	
TM172		EPH in Waters	✓		NA	
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters			NA	
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique	✓		WET	
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry			NA	
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry	✓		NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]



# ALcontrol Laboratories Analytical Services

## Sample Descriptions

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref :** 024435

### Grain sizes

<0.063mm	Very Fine
0.1mm - 0.063mm	Fine
0.1mm - 2mm	Medium
2mm - 10mm	Coarse
>10mm	Very Coarse

Sample Identity	Depth (m)	Colour	Grain Size	Description	Batch
BA1	0.0-0.1	Brown	0.1mm - 0.063mm	Silt Loam	1
D1	0.0-0.2	Dark Grey	0.1mm - 0.063mm	Silt Loam	1
D2	0.4-0.8	Light Grey	0.1mm - 0.063mm	Loamy Sand	1
D3	0.0-0.1	Light Grey	0.1mm - 0.063mm	Silt Loam with some Stones	1
D4	0.0-0.1	Light Brown	0.1mm - 0.063mm	Sand	1
D4	0.8-1.1	Beige	0.1mm - 0.063mm	Sand	1
D5	0.0-0.1	Beige	0.1mm - 2mm	Sand with some Vegetation	1
D6	0.0-0.1	Beige	0.1mm - 2mm	Sand with some Vegetation	1
D6	0.6-0.7	Beige	0.1mm - 2mm	Sand	1
D7	0.0-0.1	Beige	0.1mm - 2mm	Sand	1
HA1	0.0	Light Brown	0.1mm - 2mm	Sand with some Vegetation	1
HA2	0.0	Brown	0.1mm - 2mm	Sand with some Stones	1
HA2	0.0-0.1	Light Brown	0.1mm - 2mm	Sand	1
HA2	0.5-0.7	Beige	0.1mm - 2mm	Sand	1
HA3	0.0	Brown	0.1mm - 0.063mm	Silt Loam with some Stones	1
HA3	0.2-0.4	Beige	0.1mm - 2mm	Sand	1
HA3	1.0-1.3	Beige	0.1mm - 2mm	Sand	1
HA4	0.0	Light Brown	0.1mm - 2mm	Sand with some Stones	1
HA4	0.3-0.5	Beige	0.1mm - 2mm	Sand with some Stones	1
HA4	0.7-0.8	Light Brown	0.1mm - 2mm	Sand	1
HA5	0.0	Light Brown	0.1mm - 2mm	Sand with some Stones	1
HA5	0.3-0.5	Brown	0.1mm - 2mm	Sandy Clay Loam with some Stones	1
HA5	0.7-0.9	Light Brown	0.1mm - 2mm	Sand	1
HA5	1.0-1.3	Light Brown	0.1mm - 2mm	Sand	1
HA6	0.0-0.2	Brown	0.1mm - 2mm	Loamy Sand with some Stones	1
HA6	0.3-0.5	Light Brown	0.1mm - 2mm	Sand	1
HA7	0.0-0.1	Light Brown	0.1mm - 0.063mm	Loamy Sand	1
HA8	0.0-0.1	Dark Grey	0.1mm - 0.063mm	Loamy Sand	1
HA8	0.30-0.55	Brown	0.1mm - 0.063mm	Loamy Sand with some Stones	1
HA8	0.6-0.7	Brown	0.1mm - 0.063mm	Silt Loam with some Stones	1
HA8	0.7-1.0	Light Brown	0.1mm - 0.063mm	Sandy Loam	1
HA9	0.0-0.5	Brown	0.1mm - 2mm	Sand with some Stones	1
HA9	0.30-0.45	Brown	0.1mm - 2mm	Sand with some Stones	1

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

# ALcontrol Laboratories Analytical Services

## Sample Descriptions

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref :** 024435

### Grain sizes

<0.063mm	Very Fine
0.1mm - 0.063mm	Fine
0.1mm - 2mm	Medium
2mm - 10mm	Coarse
>10mm	Very Coarse

Sample Identity	Depth (m)	Colour	Grain Size	Description	Batch
HA9	1.0-1.4	Light Brown	0.1mm - 2mm	Loamy Sand with some Stones	1
HA10	0.0-0.1	Brown	0.1mm - 2mm	Sandy Loam with some Stones	1
HA10	0.30-0.55	Light Brown	0.1mm - 2mm	Loamy Sand	1
HA11	0.0-0.1	Brown	0.1mm - 0.063mm	Loamy Sand	1
HA11	0.45-0.80	Brown	0.1mm - 0.063mm	Sandy Silt Loam	1
HA11	1.0-1.4	Beige	0.1mm - 0.063mm	Sand	1
HA12	0.0-0.1	Brown	0.1mm - 0.063mm	Sandy Loam	1
HA13	0.0-0.2	Brown	<0.063mm	Loamy Sand	1
HA14	0.00-0.05	Brown	0.1mm - 2mm	Loamy Sand with some Stones	1
HA14	0.2-0.3	Brown	0.1mm - 2mm	Sandy Clay Loam	1
HA14	1.0-1.3	Light Brown	0.1mm - 2mm	Sand	1
HA15	0.0-0.1	Brown	0.1mm - 2mm	Loamy Sand	1
HA16	0.0-0.1	Brown	0.1mm - 2mm	Sand with some Stones	1
HA16	0.25-0.60	Brown	0.1mm - 0.063mm	Silt Loam	1
HA17	0.15-0.25	Brown	0.1mm - 0.063mm	Silt Loam	1
HA17	0.60-0.75	Brown	0.1mm - 0.063mm	Sand	1
HA17	1.0-1.3	Beige	0.1mm - 0.063mm	Sand	1
HA19	1.0-1.1	Beige	0.1mm - 0.063mm	Sand	1
HA21	0.5-0.7	Dark Grey	0.1mm - 0.063mm	Loamy Sand with some Stones	1
HA24	0.00-0.05	Grey	0.1mm - 0.063mm	Loamy Sand	1
HA24	0.5-0.6	Beige	0.1mm - 0.063mm	Silt Loam	1
HA25	0.00-0.05	Brown	0.1mm - 0.063mm	Loamy Sand with some Stones	1
HA25	0.3-0.4	Brown	0.1mm - 0.063mm	Loamy Sand	1
HA25	0.75-0.95	Light Brown	0.1mm - 2mm	Sand	1
HA26	0.0-0.1	Brown	0.1mm - 2mm	Loamy Sand	1
HA26	1.00-1.15	Light Brown	0.1mm - 2mm	Sand	1
HA27	0.0-0.1	Brown	0.1mm - 2mm	Sand with some Stones	1
HA27	0.4-0.5	Brown	0.1mm - 2mm	Sand with some Stones	1
HA27	0.8-1.0	Light Brown	0.1mm - 2mm	Sand	1
HA28	0.0-0.1	Brown	0.1mm - 2mm	Sand with some Vegetation	1
HA29	0.0-0.1	Brown	0.1mm - 2mm	Sand with some Stones	1
HA29	0.4-0.5	Light Brown	0.1mm - 2mm	Sand	1
HA30	0.02-0.05	Brown	0.1mm - 2mm	Sandy Silt Loam	1

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Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm Fine

0.1mm - 2mm Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client



**Validated**

## Preliminary



# ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/02799/02/01

Matrix: SOLID

**Client:** Buro Happold

**Location:** HAYLE

**Client Ref. No.:** 024435

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 10.03.2009

**Validated**

## Preliminary



## ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/02799/02/01

**Matrix:** SOLID

**Client:** Buro Happold

**Location:** HAYLE

**Client Ref. No.:** 024435

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 10.03.2009

**Validated**

## Preliminary



## ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

**Matrix:** SOLID

**Location:** HAYLE

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 10.03.2009

**Validated**

## Preliminary



# ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/02799/02/01

Matrix: SOLID

**Client:** Buro Happold

**Location:** HAYLE

**Client Ref. No.:** 024435

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 10.03.2009



☒

11

- # ISO 17025 accredited
- M MCERTS accredited
- \* Subcontracted test
- » Shown on prev. report

**Client Contact:**James Boyle

[illegible]

**Date** 10.03.2009

**Validated**

## ALcontrol Laboratories Analytical Services Table Of Results

<sup>#</sup> ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref. No.:** 024435

Matrix: SOLID

**Location:** HAYLE

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 10.03.2009

☒

11

» Shown on prev. report

**Client Contact:**James Boyle

[illegible]

**Date** 10.03.2009

## Table Of Results - Appendix

**Job Number:** 09/02799/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP No Determination Possible

\* Subcontracted test

ACM      Asbestos Containing Material

» Result previously reported (Incremental reports only)

# ISO 17025 accredited

M MCERTS Accredited

EC Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.  
**WET** indicates samples analysed as submitted.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 09/02799/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]

## ALcontrol Laboratories Analytical Services

### Sample Descriptions

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm      Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm      Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

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<sup>1</sup> Sample Description supplied by client

# ALcontrol Laboratories Analytical Services

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-3

Mass Sample taken (kg) =	0.23593	Moisture Content Ratio (%) =	35.04
Mass of dry sample (kg) =	0.175	Dry Matter Content Ratio (%) =	74.05
Particle Size <4mm =	>95%		

Job Number		200902799				<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch		1						
Sample Number(s)		37				Inert Waste Landfill	Stable Non- reactive Hazardous Waste in Non- Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		25/02/09						
Sample Identity		HA11						
Depth (m)		0.45-0.80						
Solid Waste Analysis								
Total Organic Carbon (%)		-				3	5	6
Loss on Ignition (%)		-				-	-	10
Sum of BTEX (mg/kg)		-				6	-	-
Sum of 7 PCBs (mg/kg)		-				1	-	-
Mineral Oil (mg/kg)		-				500	-	-
PAH Sum of 17(mg/kg)		-				100	-	-
pH (pH Units)		-				-	>6	-
ANC to pH 7 (mol/kg)		-				-	to be evaluated	to be evaluated
ANC to pH 4 (mol/kg)		-				-	to be evaluated	to be evaluated
Eluate Analysis		Conc <sup>n</sup> in 2:1 eluate	Conc <sup>n</sup> in 8:1 eluate	2:1 conc <sup>n</sup> leached	Cumulative conc <sup>n</sup> leached	<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
		C <sub>2</sub>	C <sub>8</sub>	A <sub>2</sub>	A <sub>2-10</sub>			
		mg/l			mg/kg			
Arsenic		0.099	0.19	0.20	1.8	0.5	2	25
Barium		0.029	<0.001	0.06	0.04	20	100	300
Cadmium		<0.00022	<0.00022	<0.00044	<0.0022	0.04	1	5
Chromium		0.002	<0.001	<0.002	<0.01	0.5	10	70
Copper		0.011	0.0067	0.022	0.073	2	50	100
Mercury		<0.00001	<0.00001	<0.00002	<0.0001	0.01	0.2	2
Molybdenum		0.006	0.002	0.01	0.03	0.5	10	30
Nickel		<0.0015	<0.0015	<0.003	<0.015	0.4	10	40
Lead		0.0013	0.0006	0.003	0.007	0.5	10	50
Antimony		0.0018	0.0067	0.0036	0.060	0.06	0.7	5
Selenium		0.021	0.002	0.04	0.05	0.1	0.5	7
Zinc		0.018	<0.005	0.04	<0.05	4	50	200
Chloride		2500	140	5000	4700	800	15000	25000
Fluoride		1.3	0.6	3	7	10	150	500
Sulphate as SO <sub>4</sub>		370	29	730	760	1000	20000	50000
Total Dissolved Solids		4500	320	9100	9100	4000	60000	100000
Phenols Monohydric		<0.01	0.01	<0.02	0.1	1	-	-
Dissolved Organic Carbon		<3	<3	<6	<30	500	800	1000
Leach Test Information								
Date Prepared		16/03/09	16/03/09					
pH (pH Units)		8.170	9.035					
Conductivity (µS/cm)		7.38	563					
Temperature (°C)		19.7	18.0					
Volume Leachant (Litres)		0.289	1.4					
Volume of Eluate VE1 (Litres)		0.245						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

# ALcontrol Laboratories Analytical Services

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-3

Mass Sample taken (kg) =	0.22336	Moisture Content Ratio (%) =	27.27
Mass of dry sample (kg) =	0.175	Dry Matter Content Ratio (%) =	78.57
Particle Size <4mm =	>95%		

Job Number		200902799			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		55			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		26/02/09					
Sample Identity		HA25					
Depth (m)		0.3-0.4					
Solid Waste Analysis							
Total Organic Carbon (%)	-				3	5	6
Loss on Ignition (%)	-				-	-	10
Sum of BTEX (mg/kg)	-				6	-	-
Sum of 7 PCBs (mg/kg)	-				1	-	-
Mineral Oil (mg/kg)	-				500	-	-
PAH Sum of 17(mg/kg)	-				100	-	-
pH (pH Units)	-				-	>6	-
ANC to pH 7 (mol/kg)	-				-	to be evaluated	to be evaluated
ANC to pH 4 (mol/kg)	-				-	to be evaluated	to be evaluated
Eluate Analysis	Conc <sup>n</sup> in 2:1 eluate	Conc <sup>n</sup> in 8:1 eluate	2:1 conc <sup>n</sup> leached	Cumulative conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>	C <sub>8</sub>	A <sub>2</sub>	A <sub>2-10</sub>			
	mg/l		mg/kg				
Arsenic	0.14	0.34	0.28	3.2	0.5	2	25
Barium	0.027	<0.001	0.05	0.04	20	100	300
Cadmium	<0.00022	<0.00022	<0.00044	<0.0022	0.04	1	5
Chromium	0.001	<0.001	<0.002	<0.01	0.5	10	70
Copper	0.016	0.0080	0.031	0.091	2	50	100
Mercury	<0.00001	<0.00001	<0.00002	<0.0001	0.01	0.2	2
Molybdenum	0.005	0.001	0.01	0.02	0.5	10	30
Nickel	<0.0015	<0.0015	<0.003	<0.015	0.4	10	40
Lead	0.0008	0.0004	0.002	0.005	0.5	10	50
Antimony	<0.00075	0.0031	<0.0015	0.027	0.06	0.7	5
Selenium	0.016	0.002	0.03	0.04	0.1	0.5	7
Zinc	0.026	<0.005	0.05	<0.05	4	50	200
Chloride	2100	130	4300	4100	800	15000	25000
Fluoride	1.2	0.6	2	7	10	150	500
Sulphate as SO <sub>4</sub>	320	27	650	680	1000	20000	50000
Total Dissolved Solids	3800	290	7700	7900	4000	60000	100000
Phenols Monohydric	<0.01	0.01	<0.02	0.1	1	-	-
Dissolved Organic Carbon	<3	<3	<6	<30	500	800	1000
Leach Test Information							
Date Prepared	16/03/09	16/03/09					
pH (pH Units)	8.234	8.824					
Conductivity (µS/cm)	6.36	524					
Temperature (°C)	19.7	18.7					
Volume Leachant (Litres)	0.302	1.4					
Volume of Eluate VE1 (Litres)	0.245						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation



## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

## Supplemental Report

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 09/02799/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

**Report Key :**

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

NDP	No Determination Possible	*	Subcontracted test
ACM	Asbestos Containing Materia	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
		EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

**Summary of Method Codes contained within report :**

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry			NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.  
**WET** indicates samples analysed as submitted.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 09/02799/02/01

**Client:** Buro Happold

**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]



Buro Happold  
Camden Mill  
Lower Bristol Road  
Bath  
BA2 3DQ

ATTN: James Boyle

## CERTIFICATE OF ANALYSIS

**Date:** 04 March, 2009

**Our Reference:** 09/00980/02/01

**Your Reference:**

**Location:** HAYLE HARBOUR

A total of 9 samples was received for analysis on Friday, 23 January 2009 and completed on Tuesday, 03 February 2009. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials- whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample. Asbestos testing - we are not accredited for screen testing of asbestos fibres. We are only accredited for asbestos containing materials found in bulk samples.

Signed

**Diane Whittlestone** **David O'Hare**  
Tech. Support Manager Project Manager

**Kim Harrison**  
Project Coordinator  
Team Leader

**Byron Hagan**  
Project Coordinator  
Team Leader

Valid if signed by any of the above signatories.

**Compiled By**

.....  
*Gemma Daly*



ALcontrol Laboratories  
TEST SCHEDULE

JOB NUMBER : 09/980/02  
CLIENT : Buro Happold  
CONTACT : James Boyle  
DATE OF RECEIPT : 23/01/09  
LOCATION : HAYLE HARBOUR

BATCH NUMBER : 1  
CLIENT REF/CODE :  
ORDER NUMBER : 024435  
TURNAROUND : 3 days

Numeric values indicate  
additional scheduling  
  
\* indicates test subcontracted

Sample Number	Sample Identity	UKAS Accredited ?			✓	Arsenic (S)	Cadmium (S)	Chromium (S)	✓	Lead (S)	✓	Zinc (S)																
		P / V	Depth	Sample Type																								
1	WS701	BAG	0.50	SOLID	X	X	X	X	X	X	X	X																
2	WS702	BAG	0.50	SOLID	X	X	X	X	X	X	X	X																
3	WS702	BAG	2.00	SOLID	X	X	X	X	X	X	X	X																
4	WS703	BAG	0.50	SOLID	X	X	X	X	X	X	X	X																
5	WS703	BAG	4.00	SOLID	X	X	X	X	X	X	X	X																
6	WS705	BAG	1.00	SOLID	X	X	X	X	X	X	X	X																
7	WS705	BAG	2.00	SOLID	X	X	X	X	X	X	X	X																
8	WS707	BAG	0.50	SOLID	X	X	X	X	X	X	X	X																
9	WS707	BAG	2.00	SOLID	X	X	X	X	X	X	X	X																
		Total Number of Tests			9	9	9	9	9	9	9	9																

ISO 17025 Form				FORM NO:SQS 105
ALCONTROL LABORATORIES				SHEET 1 OF 1
				ISSUE NO: 2
				WRITTEN BY: DOH
Title of Form				ISSUE DATE: 27/01/05
Notification of NDP's (No determination possible).				APPROVED BY: DP
<b>Job Number :</b> 09/980 <b>Client :</b> <b>Sample Type :</b> Solid				
Job No.	Sample No.	Sample ID.	Analyte(s)	Reason
09/980	7	W705 - 2.00	Metals	Insufficient Sample
09/980	5	WS703 - 4.0	Metals	Insufficient Sample
09/980	3	WS702 - 2.0	Metals	Insufficient Sample
09/980	8	WS707 - 0.5	Metals	Insufficient Sample
09/980	9	WS707 - 2.0	Metals	Insufficient Sample

## ALcontrol Laboratories Analytical Services

### Sample Descriptions

**Job Number:** 09/00980/02/01

**Client:** Buro Happold

**Client Ref :**

## Grain sizes

<0.063mm                  Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm      Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client



☒

11

# ISO 17025 accredited  
M MCERTS accredited  
\* Subcontracted test  
» Shown on prev. report

**Client Contact:** James Boyle

[illegible]

**Date** 04.03.2009

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 09/00980/02/01  
**Client:** Buro Happold  
**Client Ref. No.:**

**Report Key :**

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP	No Determination Possible	*	Subcontracted test
ACM	Asbestos Containing Materia	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
		EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### **Summary of Method Codes contained within report :**

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.  
**WET** indicates samples analysed as submitted.

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 09/00980/02/01

**Client:** Buro Happold

**Client Ref. No.:**

### Summary of Coolbox temperatures

Batch No.	Coolbox Temperature (°C)
1	15

# **APPENDIX**

## APPENDIX

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following:  
NRA Leach tests, flash point, ammonium as NH<sub>4</sub> by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, the individual sub sample scheduled will be screened in house for the presence of large asbestos containing material fragments/pieces. If no asbestos containing material is found this will be reported as 'no asbestos containing material detected'. If asbestos containing material is detected it will be removed and analysed by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If asbestos containing material is present no analysis will be undertaken. At no point is the fibre content of the soil sample determined.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.
8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.
9. NDP – No determination possible due to insufficient/unsuitable sample.
10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
11. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.
12. **Surrogate recoveries** – Most of our organic methods include surrogates, the recovery of which is monitored, but not corrected or reported.  
For EPH, MO, PAH and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted.
13. **Product analyses** – Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
14. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).
15. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 14).
16. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.
17. Our MCERTS accreditation for PAHs by GCMS applies to all product types apart from Kerosene, where naphthalene only is not accredited.
18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.
19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.
20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.
21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.
22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials – whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 – C10 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

### LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GS MS
SVOC	DCM	LIQUID/LIQUID SHAKEN SVOC	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM/EA	SOLID PHASE EXTRACTION	GC MS
TRIAZINE HERBS	DCM/EA	SOLID PHASE EXTRACTION	GC MS
PHENOLS MS	DCM	SOLID PHASE EXTRACTION	GC MS
TPH by INFRA RED (IR)	TCE	LIQUID/LIQUID EXTRACTION	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID EXTRACTION	HPLC
SAPONIFIABLE	TCE	LIQUID/LIQUID EXTRACTION	HPLC
UNSAPONIFIABLE	TCE	LIQUID/LIQUID EXTRACTION	HPLC
GLYCOLS	DCM	LIQUID/LIQUID EXTRACTION	EZ FLASH

### SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
Solvent Extractable Matter	D&C	DCM	SOXTHERM	GRAVIMETRIC
Cyclohexane Ext. Matter	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
Thin Layer Chromatography	D&C	DCM	SOXTHERM	IATROSCAN
Elemental Sulphur	D&C	DCM	SOXTHERM	HPLC
Phenols by GCMS	WET	DCM	SOXTHERM	GC-MS
Herbicides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
Pesticides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Min oil)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Cleaned up)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG by GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB tot / PCB con	D&C	HEXANE:ACETONE	END OVER END	GC-MS
Polyaromatic Hydrocarbons (MS)	D&C	HEXANE:ACETONE	Microwave TM218.	GC-MS
C8-C40 (C6-C40)EZ Flash	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Polyaromatic Hydrocarbons Rapid GC	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Semi Volatile Organic Compounds	WET	DCM:ACETONE	SONICATE	GC-MS

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 09/00980/02/01

**Client:** Buro Happold

**Client Ref :**

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm Medium

2mm - 10mm Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

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Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

☒

1

- # ISO 17025 accredited
- M MCERTS accredited
- \* Subcontracted test
- » Shown on prev. report

**Client Contact:**James Boyle

**All results expressed on a dry weight basis.**

**Date** 03.02.2009



## Table Of Results - Appendix

**Job Number:** 09/00980/02/01

**Client:** Buro Happold

**Client Ref. No.:**

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP No Determination Possible

\* Subcontracted test

ACM      Asbestos Containing Material

» Result previously reported (Incremental reports only)

# ISO 17025 accredited

M MCERTS Accredited

EC      Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### **Summary of Method Codes contained within report :**

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

**WET** indicates samples analysed as submitted.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 09/00980/02/01

**Client:** Buro Happold

**Client Ref. No.:**

## Summary of Coolbox temperatures

[illegible]

# ALcontrol Laboratories Analytical Services

## Sample Descriptions

**Job Number:** 09/00835/02/01  
**Client:** Buro Happold  
**Client Ref :** 22500

**Grain sizes**  
<0.063mm Very Fine  
0.1mm - 0.063mm Fine  
0.1mm - 2mm Medium  
2mm - 10mm Coarse  
>10mm Very Coarse

Sample Identity	Depth (m)	Colour	Grain Size	Description	Batch
WS701 2mm	0.50	Brown	0.1mm - 2mm	Dry Sample Received with some Stones	1
WS701 63mic	0.50	Brown	<0.063mm	Dry Sample Received	1
WS701 212mic	0.50	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS701 600mic	0.50	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS702 2mm	0.50	Brown	0.1mm - 2mm	Dry Sample Received	1
WS702 2mm	2.00	Black	2mm - 10mm	Dry Sample Received	1
WS702 63mic	0.50	Brown	<0.063mm	Dry Sample Received	1
WS702 63mic	2.00	Brown	<0.063mm	Dry Sample Received	1
WS702 212mic	0.50	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS702 212mic	2.00	Light Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS702 600mic	0.50	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS702 600mic	2.00	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS703 2mm	0.50	Brown	0.1mm - 2mm	Dry Sample Received with some Stones	1
WS703 2mm	4.00	Grey	2mm - 10mm	Dry Sample Received with some Stones	1
WS703 63mic	0.50	Dark Brown	<0.063mm	Dry Sample Received	1
WS703 63mic	4.00	Cream	<0.063mm	Dry Sample Received	1
WS703 212mic	0.50	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS703 212mic	4.00	Cream	0.1mm - 0.063mm	Dry Sample Received	1
WS703 600mic	0.50	Dark Brown	0.1mm - 2mm	Dry Sample Received	1
WS703 600mic	4.00	Cream	0.1mm - 2mm	Dry Sample Received	1
WS705 2mm	1.00	Brown	2mm - 10mm	Dry Sample Received with some Stones	1
WS705 2mm	2.00	Grey	0.1mm - 2mm	Dry Sample Received	1
WS705 63mic	1.00	Brown	<0.063mm	Dry Sample Received	1
WS705 63mic	2.00	Beige	0.1mm - 0.063mm	Dry Sample Received	1
WS705 212mic	1.00	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS705 212mic	2.00	Cream	0.1mm - 0.063mm	Dry Sample Received	1
WS705 600mic	1.00	Brown	0.1mm - 0.063mm	Dry Sample Received	1
WS705 600mic	2.00	Cream	0.1mm - 0.063mm	Dry Sample Received with some Stones	1
WS707 2mm	0.50	Brown	0.1mm - 2mm	Dry Sample Received with some Stones	1
WS707 2mm	2.00	White	2mm - 10mm	Dry Sample Received with some Stones	1
WS707 63mic	0.50	Brown	<0.063mm	Dry Sample Received	1
WS707 63mic	2.00	Cream	<0.063mm	Dry Sample Received	1
WS707 212mic	0.50	Light Brown	0.1mm - 0.063mm	Dry Sample Received	1

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 09/00835/02/01

**Client:** Buro Happold

**Client Ref :** 22500

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm Medium

2mm - 10mm Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client

☒

11

- # ISO 17025 accredited
- M MCERTS accredited
- \* Subcontracted test
- » Shown on prev. report

**Client Contact:**James Boyle

[illegible]

**Date** 29.01.2009

☒

11

- # ISO 17025 accredited
- M MCERTS accredited
- \* Subcontracted test
- » Shown on prev. report

**Matrix:** SOLID

**Location:** Hayle Harbour

**Client Contact:**James Boyle

**All results expressed on a dry weight basis.**

**Date** 29.01.2009

**Validated**

# ALcontrol Laboratories Analytical Services

<sup>#</sup> ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 09/00835/02/01

**Matrix:** SOLID

**Client:** Buro Happold

**Location:** Hayle Harbour

**Client Ref. No.:** 22500

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 29.01.2009

☒

11

- # ISO 17025 accredited
- M MCERTS accredited
- \* Subcontracted test
- » Shown on prev. report

**Client Contact:**James Boyle

[illegible]

**Date** 29.01.2009



## Table Of Results - Appendix

**Job Number:** 09/00835/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 22500

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP No Determination Possible

\* Subcontracted test

ACM      Asbestos Containing Material

» Result previously reported (Incremental reports only)

# ISO 17025 accredited

M MCERTS Accredited

EC      Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### **Summary of Method Codes contained within report :**

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.  
**WET** indicates samples analysed as submitted.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 09/00835/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 22500

### Summary of Coolbox temperatures

[illegible]

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref :** 024435

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm Medium

2mm - 10mm Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client





# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.11365 Moisture Content Ratio (%) = 26.47  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 79.07  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		122-124			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/1					
Depth (m)		0.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.46			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.023		0.23		-	-	-
Barium	0.002		0.02		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.001		0.01		-	-	-
Copper	0.0078		0.078		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.002		0.02		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0008		0.008		-	-	-
Antimony	0.013		0.13		-	-	-
Selenium	0.006		0.06		-	-	-
Zinc	0.005		0.05		-	-	-
Chloride	440		4400		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	66		660		-	-	-
Total Dissolved Solids	810		8100		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	1		10		-	-	-
Leach Test Information							
Date Prepared	06/11/08	-					
pH (pH Units)	8.5	-					
Conductivity (µS/cm)	1480	-					
Temperature (°C)	19	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.10784 Moisture Content Ratio (%) = 19.84  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 83.44  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		152-154			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/11					
Depth (m)		6.00					
Solid Waste Analysis							
Total Organic Carbon (%)	-				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.63				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.015		0.15		-	-	-
Barium	0.001		0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0019		0.019		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	0.00098		0.0098		-	-	-
Selenium	0.002		0.02		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	430		4300		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	63		630		-	-	-
Total Dissolved Solids	800		8000		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	9.5	-					
Conductivity (µS/cm)	1430	-					
Temperature (°C)	18	-					
Volume Leachant (Litres)	0.882	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.11126 Moisture Content Ratio (%) = 23.60  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 80.91  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		128-130			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/3					
Depth (m)		1.50					
Solid Waste Analysis							
Total Organic Carbon (%)	-				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.66				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.024		0.24		-	-	-
Barium	<0.001		<0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0019		0.019		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	0.0037		0.037		-	-	-
Selenium	0.003		0.03		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	450		4500		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	68		680		-	-	-
Total Dissolved Solids	830		8300		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	06/11/08			-			
pH (pH Units)	8.8			-			
Conductivity (µS/cm)	1480			-			
Temperature (°C)	19.1			-			
Volume Leachant (Litres)	0.879			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable



# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11471	Moisture Content Ratio (%) =	27.78
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	78.26
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits			
Batch		6						
Sample Number(s)		134-136			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Sampled Date		31/10/08						
Sample Identity		WS705/5						
Depth (m)		2.50						
Solid Waste Analysis								
Total Organic Carbon (%)		-				-	-	-
Loss on Ignition (%)		-				-	-	
Sum of BTEX (mg/kg)		-				-	-	
Sum of 7 PCBs (mg/kg)		-				-	-	
Mineral Oil (mg/kg)		-				-	-	
PAH Sum of 17(mg/kg)		-				-	-	
pH (pH Units)		8.63				-	-	
ANC to pH 7 (mol/kg)		-				-	-	
ANC to pH 4 (mol/kg)		-				-	-	
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg			
		C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg				
Arsenic		0.014		0.14	-	-	-	
Barium		0.002		0.02	-	-	-	
Cadmium		0.00053		0.0053	-	-	-	
Chromium		0.043		0.43	-	-	-	
Copper		0.037		0.37	-	-	-	
Mercury		<0.00001		<0.0001	-	-	-	
Molybdenum		0.002		0.02	-	-	-	
Nickel		5.9		59	-	-	-	
Lead		0.0006		0.006	-	-	-	
Antimony		0.012		0.12	-	-	-	
Selenium		0.005		0.05	-	-	-	
Zinc		0.18		1.8	-	-	-	
Chloride		490		4900	-	-	-	
Fluoride		1.0		10	-	-	-	
Sulphate as SO <sub>4</sub>		250		2500	-	-	-	
Total Dissolved Solids		1000		10000	-	-	-	
Phenols Monohydric		<0.01		<0.1	-	-	-	
Dissolved Organic Carbon		<1		<10	-	-	-	
Leach Test Information								
Date Prepared		09/11/08			-			
pH (pH Units)		4.6			-			
Conductivity (µS/cm)		1880			-			
Temperature (°C)		18.8			-			
Volume Leachant (Litres)		0.875			-			
Volume of Eluate VE1 (Litres)		-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1098	Moisture Content Ratio (%) =	22.46
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	81.66
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits			
Batch		6						
Sample Number(s)		140-142			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill	
Sampled Date		31/10/08						
Sample Identity		WS705/7						
Depth (m)		3.50						
Solid Waste Analysis								
Total Organic Carbon (%)		-				-	-	-
Loss on Ignition (%)		-				-	-	
Sum of BTEX (mg/kg)		-				-	-	
Sum of 7 PCBs (mg/kg)		-				-	-	
Mineral Oil (mg/kg)		-				-	-	
PAH Sum of 17(mg/kg)		-				-	-	
pH (pH Units)		8.67				-	-	
ANC to pH 7 (mol/kg)		-				-	-	
ANC to pH 4 (mol/kg)		-				-	-	
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg			
		C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg				
		Arsenic	0.043		0.43	-	-	-
Barium	0.002		0.02	-	-	-		
Cadmium	<0.00022		<0.0022	-	-	-		
Chromium	<0.001		<0.01	-	-	-		
Copper	0.0063		0.063	-	-	-		
Mercury	<0.00001		<0.0001	-	-	-		
Molybdenum	0.001		0.01	-	-	-		
Nickel	<0.0015		<0.015	-	-	-		
Lead	<0.0004		<0.004	-	-	-		
Antimony	0.0038		0.038	-	-	-		
Selenium	0.002		0.02	-	-	-		
Zinc	<0.005		<0.05	-	-	-		
Chloride	440		4400	-	-	-		
Fluoride	0.5		5	-	-	-		
Sulphate as SO <sub>4</sub>	65		650	-	-	-		
Total Dissolved Solids	800		8000	-	-	-		
Phenols Monohydric	<0.01		<0.1	-	-	-		
Dissolved Organic Carbon	<1		<10	-	-	-		
Leach Test Information								
Date Prepared		09/11/08	-					
pH (pH Units)		8.754	-					
Conductivity (µS/cm)		1468	-					
Temperature (°C)		19.5	-					
Volume Leachant (Litres)		0.88	-					
Volume of Eluate VE1 (Litres)		-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) = 0.10588 Moisture Content Ratio (%) = 17.81  
 Mass of dry sample (kg) = 0.09 Dry Matter Content Ratio (%) = 84.88  
 Particle Size <4mm = >95%

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		146-148			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/9					
Depth (m)		4.50					
Solid Waste Analysis							
Total Organic Carbon (%)	-				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.66				-	-	-
ANC to pH 7 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Arsenic	0.027		0.27		-	-	-
Barium	0.001		0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0053		0.053		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	0.0017		0.017		-	-	-
Selenium	0.002		0.02		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	330		3300		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	52		520		-	-	-
Total Dissolved Solids	630		6300		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	9.115	-					
Conductivity (µS/cm)	1154	-					
Temperature (°C)	19.1	-					
Volume Leachant (Litres)	0.884	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11365	Moisture Content Ratio (%) =	26.47
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	79.07
Particle Size <4mm =	>95%		

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		122-124			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/1					
Depth (m)		0.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.14		1.4		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	06/11/08	-					
pH (pH Units)	8.5	-					
Conductivity (µS/cm)	1480	-					
Temperature (°C)	19	-					
Volume Leachant (Litres)	0.876	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10784
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	19.84
Dry Matter Content Ratio (%) =	83.44

Job Number		200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch		6					
Sample Number(s)		152-154			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/11					
Depth (m)		6.00					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.07		0.7		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
					-	-	-
<b>Leach Test Information</b>							
Date Prepared	09/11/08	-					
pH (pH Units)	9.5	-					
Conductivity (µS/cm)	1430	-					
Temperature (°C)	18	-					
Volume Leachant (Litres)	0.882	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11126
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	23.60
Dry Matter Content Ratio (%) =	80.91

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		128-130			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/3					
Depth (m)		1.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.10		1.0		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	12		120		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	06/11/08	-					
pH (pH Units)	8.8	-					
Conductivity (µS/cm)	1480	-					
Temperature (°C)	19.1	-					
Volume Leachant (Litres)	0.879	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

WAC ANALYTICAL RESULTS					REF:CEN12457-2		
Mass Sample taken (kg) =		0.11471		Moisture Content Ratio (%) =		27.78	
Mass of dry sample (kg) =		0.09		Dry Matter Content Ratio (%) =		78.26	
Particle Size <4mm =		>95%					

Job Number	200817832			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch	6					
Sample Number(s)	134-136			Inert Waste Landfill	Stable Non- reactive Hazardous Waste in Non- Hazardous Landfill	Hazardous Waste Landfill
Sampled Date	31/10/08					
Sample Identity	WS705/5					
Depth (m)	2.50					
<b>Solid Waste Analysis</b>						
Total Organic Carbon (%)	-			-	-	-
Loss on Ignition (%)	-			-	-	-
Sum of BTEX (mg/kg)	-			-	-	-
Sum of 7 PCBs (mg/kg)	-			-	-	-
Mineral Oil (mg/kg)	-			-	-	-
PAH Sum of 17(mg/kg)	-			-	-	-
pH (pH Units)	-			-	-	-
ANC to pH 7 (mol/kg)	-			-	-	-
ANC to pH 4 (mol/kg)	-			-	-	-

Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.12		1.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	13		130		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
					-	-	-

Leach Test Information		
Date Prepared	09/11/08	-
pH (pH Units)	4.6	-
Conductivity (µS/cm)	1880	-
Temperature (°C)	18.8	-
Volume Leachant (Litres)	0.875	-
Volume of Eluate VE1 (Litres)	-	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1098
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	22.46
Dry Matter Content Ratio (%) =	81.66

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		140-142			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/7					
Depth (m)		3.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.08		0.8		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	8.754	-					
Conductivity (µS/cm)	1468	-					
Temperature (°C)	19.5	-					
Volume Leachant (Litres)	0.88	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report



# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10588
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	17.81
Dry Matter Content Ratio (%) =	84.88

Job Number		200817832			Landfill Waste Acceptance Criteria Limits		
Batch		6					
Sample Number(s)		146-148			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		31/10/08					
Sample Identity		WS705/9					
Depth (m)		4.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.05		0.5		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	11		110		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	9.115	-					
Conductivity (µS/cm)	1154	-					
Temperature (°C)	19.1	-					
Volume Leachant (Litres)	0.884	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

\* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM008	BS 1377:Part 1977	Particle size distribution of solid samples			DRY	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓	✓	DRY	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser	✓	✓	DRY	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit			NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer			DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓	✓	DRY	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓	✓	WET	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## Table Of Results - Appendix

**Job Number:** 08/17832/02/01

**Client:** Buro Happold

**Client Ref. No.:** 24435

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP No Determination Possible

\* Subcontracted test

NFD      No Fibres Detected

» Result previously reported (Incremental reports only)

# ISO 17025 accredited

M MCERTS Accredited

PFD	Possible Fibres Detected
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
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88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

EC      Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 08/17832/02/01  
**Client:** Buro Happold  
**Client Ref. No.:** 24435

### Summary of Coolbox temperatures

[illegible]



Buro Happold  
Camden Mill  
Lower Bristol Road  
Bath  
BA2 3DQ

ATTN: James Boyle

## CERTIFICATE OF ANALYSIS

**Date:** 22 January, 2009

**Our Reference:** 08/17301/02/02

**Your Reference:**

**Location:** Hoyle Harbour

Supplement 002: to report number 08/17301/02/01.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials- whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample. Asbestos testing - we are not accredited for screen testing of asbestos fibres. We are only accredited for asbestos containing materials found in bulk samples.

Signed

**Diane Whittlestone** **David O'Hare**  
Tech. Support Manager Project Manager

**Kim Harrison**  
Project Coordinator  
Team Leader

**Byron Hagan**  
Project Coordinator  
Team Leader

Valid if signed by any of the above signatories.

**Compiled By**

.....  
*Gemma Daly*

# ALcontrol Laboratories

## TEST SCHEDULE

**JOB NUMBER :** 08/17301/02  
**CLIENT :** Buro Happold  
**CONTACT :** James Boyle  
**DATE OF RECEIPT :** 17/10/08  
**LOCATION :** Hoyle Harbour

**BATCH NUMBER :** 1  
**CLIENT REF/CODE :**  
**ORDER NUMBER :** SD08052  
**TURNAROUND :** 7 days

Numeric values indicate additional scheduling  
 \* indicates test subcontracted

Sample Number	Sample Identity	P / V	Depth	Sample Type	UKAS Accredited ?	Miscellaneous Analysis (S)*	% Stones >10mm	Soil Organic Matter (S)	TOC (S)	Arsenic (S)	Cadmium (S)	Chromium (S)	Copper (S)	Lead (S)	Nickel (S)	Tin (S)	Zinc (S)	Cyanide Easily Liberatable (S)	Sulphide Easily Liberated (S)	Chloride Soluble Kone (S)	pH (S)	Ammoniacal Nitrogen as N (S)	Sulphate Total (S)	CEN Leach 10:1	Metals ICP-MS 9 (CEN 10:1)	Mercury (CEN 10:1) (CVAE)	Barium (CEN 10:1) (ICP-MS)	Beryllium (CEN 10:1) (ICP-MS)	Molybdenum (CEN 10:1) (ICP-MS)
1	BH1001	JAR 250g	0.75	SOLID			X	X	X	X	X	X	X	X	X	X	X			X									
2	BH1001	JAR 250g	0.50	SOLID		Sample on Hold																							
3	BH1001	1KGTub	0.50	SOLID		Sample on Hold																							
4	BH1001	1KGTub	0.75	SOLID														X	X										
5	WS701	1KGTub	1.00	SOLID														X	X										
6	WS701	1KGTub	1.50	SOLID														X	X										
7	WS701	1KGTub	2.00	SOLID														X	X										
8	WS701	1KGTub	2.50	SOLID														X	X										
9	WS701	1KGTub	3.00	SOLID														X	X										
10	WS701	1KGTub	3.50	SOLID														X	X										
11	WS701	1KGTub	4.00	SOLID														X	X										
12	WS701	JAR 250g	0.50	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
13	WS701	JAR 250g	1.00	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
14	WS701	JAR 250g	1.50	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
15	WS701	JAR 250g	2.00	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
16	WS701	JAR 250g	2.50	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
17	WS701	JAR 250g	3.00	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
18	WS701	JAR 250g	3.50	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
19	WS701	JAR 250g	4.00	SOLID			X	X	X	X	X	X	X	X	X	X	X			X			X						
20	WS701	1KGTub	0.50	SOLID		3												X	X										
Total Number of Tests						1	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	4	4	4	4	4	4

# ALcontrol Laboratories

## TEST SCHEDULE

**JOB NUMBER :** 08/17301/02  
**CLIENT :** Buro Happold  
**CONTACT :** James Boyle  
**DATE OF RECEIPT :** 17/10/08  
**LOCATION :** Hoyle Harbour

**BATCH NUMBER :** 1  
**CLIENT REF/CODE :**  
**ORDER NUMBER :** SD08052  
**TURNAROUND :** 7 days

Numeric values indicate additional scheduling  
 \* indicates test subcontracted

Sample Number	Sample Identity	UKAS Accredited ?																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		P / V	Depth	Sample Type																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

# ALcontrol Laboratories

## TEST SCHEDULE

**JOB NUMBER :** 08/17301/02  
**CLIENT :** Buro Happold  
**CONTACT :** James Boyle  
**DATE OF RECEIPT :** 17/10/08  
**LOCATION :** Hoyle Harbour

**BATCH NUMBER :** 1  
**CLIENT REF/CODE :**  
**ORDER NUMBER :** SD08052  
**TURNAROUND :** 7 days

Numeric values indicate additional scheduling  
 \* indicates test subcontracted

Sample Number	Sample Identity	UKAS Accredited ?			PAH 16 EPA GC-FID (S)	✓																									
		P / V	Depth	Sample Type			EPH C10-40 GC Risk Band (S)	TDS (CEN 10:1C)	TDS (CEN 8:1)	TDS (CEN 2:1)	DOC (CEN 10:1C)	DOC (CEN 8:1)	DOC (CEN 2:1)	Phenols HPLC (CEN 10:1C)	Phenols HPLC (CEN 8:1)	Phenols HPLC (CEN 2:1)	Sulphate Kone (CEN 10:1C)	Sulphate Kone (CEN 8:1)	Sulphate Kone (CEN 2:1)	Fluoride Kone (CEN 10:1C)	Fluoride Kone (CEN 8:1)	Fluoride Kone (CEN 2:1)	Chloride Kone (CEN 10:1C)	Chloride Kone (CEN 8:1)	Chloride Kone (CEN 2:1)	Antimony (CEN 10:1C) (ICP-MS)	Antimony (CEN 8:1) (ICP-MS)	Antimony (CEN 2:1) (ICP-MS)	Mercury (CEN 10:1C) (CVAF)		
1	BH1001	JAR 250g	0.75	SOLID		X																									
2	BH1001	JAR 250g	0.50	SOLID																											
3	BH1001	1KGTub	0.50	SOLID																											
4	BH1001	1KGTub	0.75	SOLID																											
5	WS701	1KGTub	1.00	SOLID																											
6	WS701	1KGTub	1.50	SOLID																											
7	WS701	1KGTub	2.00	SOLID																											
8	WS701	1KGTub	2.50	SOLID																											
9	WS701	1KGTub	3.00	SOLID																											
10	WS701	1KGTub	3.50	SOLID																											
11	WS701	1KGTub	4.00	SOLID																											
12	WS701	JAR 250g	0.50	SOLID																											
13	WS701	JAR 250g	1.00	SOLID																											
14	WS701	JAR 250g	1.50	SOLID																											
15	WS701	JAR 250g	2.00	SOLID																											
16	WS701	JAR 250g	2.50	SOLID																											
17	WS701	JAR 250g	3.00	SOLID																											
18	WS701	JAR 250g	3.50	SOLID																											
19	WS701	JAR 250g	4.00	SOLID																											
20	WS701	1KGTub	0.50	SOLID																											
		Total Number of Tests																													



ALcontrol Laboratories  
TEST SCHEDULE

JOB NUMBER : 08/17301/02  
CLIENT : Buro Happold  
CONTACT : James Boyle  
DATE OF RECEIPT : 17/10/08  
LOCATION : Hoyle Harbour

BATCH NUMBER : 1  
CLIENT REF/CODE :  
ORDER NUMBER : SD08052  
TURNAROUND : 7 days

Numeric values indicate additional scheduling  
\* indicates test subcontracted

		UKAS Accredited ?																					
Sample Number	Sample Identity	P / V	Depth	Sample Type	✓	PAH Spec MS (S)	Coronene Rapid GC (S)	✓	Phenols HPLC (S)	✓	GRO BTEX MTBE GC (S)												
1	BH1001	JAR 250g	0.75	SOLID	2	X	X		X														
2	BH1001	JAR 250g	0.50	SOLID	Sample on Hold		Sample on Hold																
3	BH1001	1KGTub	0.50	SOLID	Sample on Hold		Sample on Hold																
4	BH1001	1KGTub	0.75	SOLID				X															
5	WS701	1KGTub	1.00	SOLID				X															
6	WS701	1KGTub	1.50	SOLID																			
7	WS701	1KGTub	2.00	SOLID																			
8	WS701	1KGTub	2.50	SOLID																			
9	WS701	1KGTub	3.00	SOLID																			
10	WS701	1KGTub	3.50	SOLID																			
11	WS701	1KGTub	4.00	SOLID																			
12	WS701	JAR 250g	0.50	SOLID																			
13	WS701	JAR 250g	1.00	SOLID	2	X	X		X														
14	WS701	JAR 250g	1.50	SOLID																			
15	WS701	JAR 250g	2.00	SOLID																			
16	WS701	JAR 250g	2.50	SOLID																			
17	WS701	JAR 250g	3.00	SOLID																			
18	WS701	JAR 250g	3.50	SOLID																			
19	WS701	JAR 250g	4.00	SOLID																			
20	WS701	1KGTub	0.50	SOLID																			
				Total Number of Tests	2	2	2	2	2	2	2												

## Sample Descriptions

**Job Number:** 08/17301/02/02

**Client:** Buro Happold

**Client Ref :**

## Grain sizes

<0.063mm                  Very Fine

0.1mm - 0.063mm    Fine

0.1mm - 2mm      Medium

2mm - 10mm      Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials-whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client



# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17301/02/02

**Client:** Buro Happold

**Client Ref. No.:**

### Summary of Coolbox temperatures

Batch No.	Coolbox Temperature (°C)
1	9.5

# **APPENDIX**

## APPENDIX

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following:  
NRA Leach tests, flash point, ammonium as  $\text{NH}_4$  by the BRE method, VOC TICS, SVOC TICS, TOF-MS SCAN/SEARCH and TOF-MS TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for both soil jars, tubs and volatile jars. All waters and vials will be discarded 10 days after the analysis is completed (e-mailed). All material removed during an asbestos containing material screen and analysed for the presence of asbestos will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, the soil sample will be screened for the presence of fibres in-house and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, they will be removed and analysed by our documented in house method based on HSG 248(2005). If a sample is suspected of containing asbestos, then further preparation and analysis will be suspended on that sample until the asbestos result is known. If asbestos is present, then no further analysis will be undertaken.
7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace or sediment is present in the volatile sample. This will be flagged up as an invalid VOC on the test schedule or recorded on the log sheet.
8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.
9. NDP – No determination possible due to insufficient/unsuitable sample.
10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.
11. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.
12. **Surrogate recoveries** – Most of our organic methods include surrogates, the recovery of which is monitored, but not corrected or reported.  
For EPH and PAH on soils the result is not surrogate corrected, but a percentage recovery is quoted.
13. **Product analyses** – Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
14. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).
15. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 14).
16. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.
17. Our MCERTS accreditation for PAHs by GCMS applies to all product types apart from Kerosene, where naphthalene only is not accredited.
18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.
19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.
20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GC/FID/GCMS and all subcontracted analysis.
21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.
22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials – whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
23. Analysis and identification of specific compounds using GC/FID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C4 – C10 range, the total area of the chromatogram is integrated and expressed as  $\mu\text{g/kg}$  or  $\mu\text{g/l}$ . Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

**LIQUID MATRICES EXTRACTION SUMMARY**

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB TOTAL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GS MS
SVOC	DCM	LIQUID/LIQUID SHAKEN SVOC	GC MS
FREE SULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PEST OCP/OPP	DCM/EA	SOLID PHASE EXTRACTION	GC MS
TRIAZINE HERBS	DCM/EA	SOLID PHASE EXTRACTION	GC MS
PHENOLS MS	DCM	SOLID PHASE EXTRACTION	GC MS
TPH by INFRA RED (IR)	TCE	LIQUID/LIQUID EXTRACTION	HPLC
MINERAL OIL by IR	TCE	LIQUID/LIQUID EXTRACTION	HPLC
SAPONIFIABLE	TCE	LIQUID/LIQUID EXTRACTION	HPLC
UNSAAPONIFIABLE	TCE	LIQUID/LIQUID EXTRACTION	HPLC
GLYCOLS	DCM	LIQUID/LIQUID EXTRACTION	EZ FLASH

**SOLID MATRICES EXTRACTION SUMMARY**

ANALYSIS	D/C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
Solvent Extractable Matter	D&C	DCM	SOXTHERM	GRAVIMETRIC
Cyclohexane Ext. Matter	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
Thin Layer Chromatography	D&C	DCM	SOXTHERM	IATROSCAN
Elemental Sulphur	D&C	DCM	SOXTHERM	HPLC
Phenols by GCMS	WET	DCM	SOXTHERM	GC-MS
Herbicides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
Pesticides	D&C	HEXANE:ACETONE	SOXTHERM	GC-MS
EPH (DRO)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Min oil)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH (Cleaned up)	D&C	HEXANE:ACETONE	END OVER END	GC-FID
EPH CWG by GC	D&C	HEXANE:ACETONE	END OVER END	GC-FID
PCB tot / PCB con	D&C	HEXANE:ACETONE	END OVER END	GC-MS
Polyaromatic Hydrocarbons (MS)	D&C	HEXANE:ACETONE	END OVER END	GC-MS
C8-C40 (C6-C40)EZ Flash	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Polyaromatic Hydrocarbons Rapid GC	WET	HEXANE:ACETONE	SHAKER	GC-EZ
Semi Volatile Organic compounds	WET	DCM:ACETONE	SONICATE	GC-MS

## ALcontrol Laboratories Analytical Services Sample Descriptions

**Job Number:** 08/17301/02/01

**Client:** Buro Happold

**Client Ref :**

## Grain sizes

<0.063mm                      Very Fine

0.1mm - 0.063mm Fine

0.1mm - 2mm Medium

2mm - 10mm Coarse

>10mm                      Very Coarse

[illegible]

\* These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

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Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

<sup>1</sup> Sample Description supplied by client



Validated ☒  
Preliminary ☐

# ALcontrol Laboratories Analytical Services

## Table Of Results

# ISO 17025 accredited  
M MCERTS accredited  
\* Subcontracted test  
» Shown on prev. report

**Job Number:** 08/17301/02/01  
**Client:** Buro Happold  
**Client Ref. No.:**

**Matrix:** SOLID  
**Location:** Hoyle Harbour  
**Client Contact:** James Boyle

Sample Identity	BH1001	WS701	WS701	WS701	WS701	WS701	WS701	WS701	WS701	Method Code	LoD/Units
Depth (m)	0.75	0.50	1.00	1.50	2.00	2.50	3.00	3.50	4.00		
Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID		
Sampled Date	13.10.08	15.10.08	15.10.08	15.10.08	15.10.08	15.10.08	15.10.08	15.10.08	15.10.08		
Sample Received Date	17.10.08	17.10.08	17.10.08	17.10.08	17.10.08	17.10.08	17.10.08	17.10.08	17.10.08		
Batch	1	1	1	1	1	1	1	1	1		
Sample Number(s)	1,4	12,20	5,13	6,14	7,15	8,16	9,17	10,18	11,19		
Total Sulphate	2800	3800	2500	5300	5400	5200	2600	5500	5200	TM129 <sup>#</sup> <sub>M</sub>	<100 mg/kg
Arsenic	1300	240	37	35	21	44	65	16	10	TM129 <sup>#</sup> <sub>M</sub>	<3.0 mg/kg
Cadmium	10	1.2	0.3	0.3	0.2	0.3	0.5	<0.2	<0.2	TM129	<0.2 mg/kg
Chromium	43	11	23	<4.5	<4.5	<4.5	14	<4.5	<4.5	TM129 <sup>#</sup> <sub>M</sub>	<4.5 mg/kg
Copper	1200	460	64	110	45	90	110	30	20	TM129 <sup>#</sup> <sub>M</sub>	<6 mg/kg
Lead	1200	80	7	34	10	14	18	6	6	TM129 <sup>#</sup> <sub>M</sub>	<2 mg/kg
Nickel	17	14	17	4.7	2.7	4.1	9.5	3.3	2.9	TM129 <sup>#</sup> <sub>M</sub>	<0.9 mg/kg
Tin	1500	59	12	19	5	12	61	13	4	TM129 <sup>#</sup>	<1 mg/kg
Zinc	1200	330	240	100	61	120	160	46	37	TM129 <sup>#</sup> <sub>M</sub>	<2.5 mg/kg
ANC at pH4	1.5	-	-	5.0	-	-	-	-	-	TM182 <sup>#</sup>	<0.03 mol/kg
ANC at pH6	0.13	-	-	0.30	-	-	-	-	-	TM182 <sup>#</sup>	<0.03 mol/kg
Easily Liberated Sulphide	<15	<15	<15	<15	<15	<15	<15	<15	<15	TM180 <sup>#</sup>	<15 mg/kg
Chloride (soluble)	36	4000	1800	3700	4400	4000	1900	3900	4200	TM097 <sup>#</sup> <sub>M</sub>	<2 mg/kg
Soil Organic Matter	14	0.67	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	TM132 <sup>#</sup>	<0.35 %
Total Organic Carbon	8.1	0.4	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	TM132 <sup>#</sup> <sub>M</sub>	<0.2 %
Phenols Monohydric	<0.15	-	<0.15	-	-	-	-	-	-	TM062 <sup>#</sup> <sub>M</sub>	<0.15 mg/kg
Easily Liberatable Cyanide	<1	<1	<1	<1	<1	<1	<1	<1	<1	TM153	<1 mg/kg
% Stones Greater than 10mm	<0.1	<0.1	48	<0.1	<0.1	<0.1	99	<0.1	<0.1	TM008	<0.1 %
Ammoniacal Nitrogen as N	0.932.32	110	<15	<15	<15	<15	<15	<15	29	TM024 <sup>#</sup> <sub>M</sub>	<15 mg/kg
Loss on Ignition	9.5	-	-	1.8	-	-	-	-	-	TM018 <sup>#</sup> <sub>M</sub>	<0.3 %
pH Value	7.69	8.45	8.49	8.46	8.39	8.43	8.63	8.50	8.53	TM133 <sup>#</sup> <sub>M</sub>	<1.00 pH Units
EPH (DRO) (C10-C40)	180	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup> <sub>M</sub>	<35 mg/kg
EPH (DRO) (C10-C40) % Surrogate Recovery	95	-	96	-	-	-	-	-	-	TM061 <sup>#</sup> <sub>M</sub>	%
EPH C10-12	<35	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup>	<35 mg/kg
EPH >C12-16	<35	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup>	<35 mg/kg
EPH >C16-21	37	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup>	<35 mg/kg
EPH >C21-35	93	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup>	<35 mg/kg
EPH >C35-40	<35	-	<35	-	-	-	-	-	-	TM061 <sup>#</sup>	<35 mg/kg
GRO (C4-C10)	<10	-	<10	-	-	-	-	-	-	TM089	<10 ug/kg
GRO (C10-C12)	<10	-	<10	-	-	-	-	-	-	TM089	<10 ug/kg
Benzene	<10	-	<10	-	-	-	-	-	-	TM089 <sup>#</sup> <sub>M</sub>	<10 ug/kg

All results expressed on a dry weight basis.

Date 19.11.2008



**Validated**

## Preliminary



# ALcontrol Laboratories Analytical Services

# ISO 17025 accredited

<sup>M</sup> MCERTS accredited

\* Subcontracted test

» Shown on prev. report

**Job Number:** 08/17301/02/01

**Client:** Buro Happold

**Client Ref. No.:**

**Matrix:** SOLID

**Location:** Hoyle Harbour

**Client Contact:**James Boyle

[illegible]

**All results expressed on a dry weight basis.**

**Date** 19.11.2008

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1195	Moisture Content Ratio (%) =	32.72
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	75.35
Particle Size <4mm =	>95%		

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1			<div>Inert Waste Landfill</div> <div>Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill</div> <div>Hazardous Waste Landfill</div>		
Sample Number(s)		1,4					
Sampled Date		13/10/08					
Sample Identity		BH1001					
Depth (m)		0.75					
Solid Waste Analysis					<div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div> <div>-</div>		
Total Organic Carbon (%)	8.1						
Loss on Ignition (%)	9.5						
Sum of BTEX (mg/kg)	<0.01						
Sum of 7 PCBs (mg/kg)	-						
Mineral Oil (mg/kg)	-						
PAH Sum of 17(mg/kg)	-						
pH (pH Units)	7.69						
ANC to pH 6 (mol/kg)	0.13						
ANC to pH 4 (mol/kg)	1.5						
Eluate Analysis					Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached
		C <sub>2</sub>		A <sub>2</sub>			
		mg/l		mg/kg			
Arsenic	0.094		0.94		-	-	-
Barium	0.028		0.28		-	-	-
Cadmium	0.00036		0.0036		-	-	-
Chromium	0.001		0.01		-	-	-
Copper	0.019		0.19		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	0.004		0.04		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0016		0.016		-	-	-
Antimony	0.028		0.29		-	-	-
Selenium	0.004		0.04		-	-	-
Zinc	0.011		0.11		-	-	-
Chloride	1		10		-	-	-
Fluoride	0.5		5		-	-	-
Sulphate as SO <sub>4</sub>	15		150		-	-	-
Total Dissolved Solids	89		890		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	3		30		-	-	-
Leach Test Information							
Date Prepared	09/11/08			-			
pH (pH Units)	8.1			-			
Conductivity (µS/cm)	160			-			
Temperature (°C)	19.1			-			
Volume Leachant (Litres)	0.871			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10348	Moisture Content Ratio (%) =	14.05
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	87.68
Particle Size <4mm =	>95%		

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		5,13			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		15/10/08					
Sample Identity		WS701					
Depth (m)		1.00					
Solid Waste Analysis							
Total Organic Carbon (%)		<0.2			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		<0.01			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.49			-	-	-
ANC to pH 6 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg	
		C <sub>2</sub>		A <sub>2</sub>			
		mg/l		mg/kg			
		Arsenic	0.010		0.10		-
Barium	0.001		0.01		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0036		0.036		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0006		0.006		-	-	-
Antimony	0.0040		0.040		-	-	-
Selenium	0.002		0.02		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	220		2200		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	39		390		-	-	-
Total Dissolved Solids	460		4600		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared		09/11/08	-				
pH (pH Units)		8.742	-				
Conductivity (µS/cm)		93.2	-				
Temperature (°C)		18.8	-				
Volume Leachant (Litres)		0.887	-				
Volume of Eluate VE1 (Litres)		-					

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.11678	Moisture Content Ratio (%) =	30.45
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	76.66
Particle Size <4mm =	>95%		

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		7,15			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		15/10/08					
Sample Identity		WS701					
Depth (m)		2.00					
Solid Waste Analysis							
Total Organic Carbon (%)		<0.2			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		8.39			-	-	-
ANC to pH 6 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis		Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg	
		C <sub>2</sub>		A <sub>2</sub>			
		mg/l		mg/kg			
		Arsenic	0.0098		0.098		-
Barium	0.012		0.12		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	0.006		0.06		-	-	-
Copper	0.013		0.13		-	-	-
Mercury	0.00002		0.0002		-	-	-
Molybdenum	0.002		0.02		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	0.0038		0.038		-	-	-
Antimony	0.0024		0.024		-	-	-
Selenium	0.004		0.04		-	-	-
Zinc	0.006		0.06		-	-	-
Chloride	490		4900		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	77		770		-	-	-
Total Dissolved Solids	920		9200		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	3		30		-	-	-
Leach Test Information							
Date Prepared		09/11/08	-				
pH (pH Units)		9.6	-				
Conductivity (µS/cm)		1690	-				
Temperature (°C)		18.8	-				
Volume Leachant (Litres)		0.873	-				
Volume of Eluate VE1 (Litres)		-					

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10845	Moisture Content Ratio (%) =	19.79
Mass of dry sample (kg) =	0.09	Dry Matter Content Ratio (%) =	83.48
Particle Size <4mm =	>95%		

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		10,18			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		15/10/08					
Sample Identity		WS701					
Depth (m)		3.50					
Solid Waste Analysis							
Total Organic Carbon (%)	<0.2				-	-	-
Loss on Ignition (%)	-				-	-	-
Sum of BTEX (mg/kg)	-				-	-	-
Sum of 7 PCBs (mg/kg)	-				-	-	-
Mineral Oil (mg/kg)	-				-	-	-
PAH Sum of 17(mg/kg)	-				-	-	-
pH (pH Units)	8.50				-	-	-
ANC to pH 6 (mol/kg)	-				-	-	-
ANC to pH 4 (mol/kg)	-				-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
	Arsenic	0.016		0.16		-	-
Barium	0.004		0.04		-	-	-
Cadmium	<0.00022		<0.0022		-	-	-
Chromium	<0.001		<0.01		-	-	-
Copper	0.0043		0.043		-	-	-
Mercury	<0.00001		<0.0001		-	-	-
Molybdenum	<0.001		<0.01		-	-	-
Nickel	<0.0015		<0.015		-	-	-
Lead	<0.0004		<0.004		-	-	-
Antimony	0.0013		0.013		-	-	-
Selenium	0.004		0.04		-	-	-
Zinc	<0.005		<0.05		-	-	-
Chloride	410		4000		-	-	-
Fluoride	<0.5		<5		-	-	-
Sulphate as SO <sub>4</sub>	61		610		-	-	-
Total Dissolved Solids	750		7500		-	-	-
Phenols Monohydric	<0.01		<0.1		-	-	-
Dissolved Organic Carbon	<1		<10		-	-	-
Leach Test Information							
Date Prepared	09/11/08			-			
pH (pH Units)	9.017			-			
Conductivity (µS/cm)	1348			-			
Temperature (°C)	18.9			-			
Volume Leachant (Litres)	0.882			-			
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-3

Mass Sample taken (kg) = 0.23159 Moisture Content Ratio (%) = 32.72  
 Mass of dry sample (kg) = 0.175 Dry Matter Content Ratio (%) = 75.35  
 Particle Size <4mm = >95%

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		1,4			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		13/10/08					
Sample Identity		BH1001					
Depth (m)		0.75					
Solid Waste Analysis							
Total Organic Carbon (%)	8.1				3	5	6
Loss on Ignition (%)	9.5				-	-	10
Sum of BTEX (mg/kg)	<0.01				6	-	-
Sum of 7 PCBs (mg/kg)	-				1	-	-
Mineral Oil (mg/kg)	-				500	-	-
PAH Sum of 17(mg/kg)	-				100	-	-
pH (pH Units)	7.69				-	>6	-
ANC to pH 6 (mol/kg)	0.13				-	to be evaluated	to be evaluated
ANC to pH 4 (mol/kg)	1.5				-	to be evaluated	to be evaluated
Eluate Analysis	Conc <sup>n</sup> in 2:1 eluate	Conc <sup>n</sup> in 8:1 eluate	2:1 conc <sup>n</sup> leached	Cumulative conc <sup>n</sup> leached	Limit values for compliance leaching test using BS		
	C <sub>2</sub>	C <sub>8</sub>	A <sub>2</sub>	A <sub>2-10</sub>	EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Arsenic	0.19	0.16	0.37	1.6	0.5	2	25
Barium	0.49	0.036	0.99	1.1	20	100	300
Cadmium	<0.00022	<0.00022	<0.00044	<0.0022	0.04	1	5
Chromium	0.002	<0.001	<0.002	<0.01	0.5	10	70
Copper	0.028	0.016	0.056	0.18	2	50	100
Mercury	<0.00001	<0.00001	<0.00002	<0.0001	0.01	0.2	2
Molybdenum	0.011	0.001	0.02	0.03	0.5	10	30
Nickel	0.0036	<0.0015	0.007	<0.015	0.4	10	40
Lead	0.0010	0.0012	0.002	0.012	0.5	10	50
Antimony	0.022	0.010	0.044	0.12	0.06	0.7	5
Selenium	<0.001	<0.001	<0.002	<0.01	0.1	0.5	7
Zinc	0.068	<0.005	0.14	0.11	4	50	200
Chloride	9	<1	18	14	800	15000	25000
Fluoride	1.0	0.8	2	8	10	150	500
Sulphate as SO <sub>4</sub>	64	14	130	220	1000	20000	50000
Total Dissolved Solids	220	67	450	920	4000	60000	100000
Phenols Monohydric	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	10	<3	20	<30	500	800	1000
Leach Test Information							
Date Prepared	07/11/08	09/11/08					
pH (pH Units)	8.4	8.3					
Conductivity (µS/cm)	390	110					
Temperature (°C)	18.9	19					
Volume Leachant (Litres)	0.293	1.4					
Volume of Eluate VE1 (Litres)	0.275						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation



# ALcontrol Laboratories Analytical Services

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

### WAC ANALYTICAL RESULTS

REF:CEN12457-3

Mass Sample taken (kg) = 0.22012 Moisture Content Ratio (%) = 25.59  
 Mass of dry sample (kg) = 0.175 Dry Matter Content Ratio (%) = 79.62  
 Particle Size <4mm = >95%

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		6,14			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		15/10/08					
Sample Identity		WS701					
Depth (m)		1.50					
Solid Waste Analysis							
Total Organic Carbon (%)	0.2				3	5	6
Loss on Ignition (%)	1.8				-	-	10
Sum of BTEX (mg/kg)	-				6	-	-
Sum of 7 PCBs (mg/kg)	-				1	-	-
Mineral Oil (mg/kg)	-				500	-	-
PAH Sum of 17(mg/kg)	-				100	-	-
pH (pH Units)	8.46				-	>6	-
ANC to pH 6 (mol/kg)	0.30				-	to be evaluated	to be evaluated
ANC to pH 4 (mol/kg)	5.0				-	to be evaluated	to be evaluated
Eluate Analysis	Conc <sup>n</sup> in 2:1 eluate	Conc <sup>n</sup> in 8:1 eluate	2:1 conc <sup>n</sup> leached	Cumulative conc <sup>n</sup> leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>	C <sub>8</sub>	A <sub>2</sub>	A <sub>2-10</sub>			
		mg/l		mg/kg			
Arsenic	0.015	0.0078	0.030	0.090	0.5	2	25
Barium	0.37	<0.001	0.74	0.64	20	100	300
Cadmium	0.00034	<0.00022	0.0007	<0.0022	0.04	1	5
Chromium	0.002	<0.001	<0.002	<0.01	0.5	10	70
Copper	0.0056	<0.0016	0.011	<0.016	2	50	100
Mercury	<0.00001	0.00001	<0.00002	0.0001	0.01	0.2	2
Molybdenum	0.002	<0.001	<0.002	<0.01	0.5	10	30
Nickel	<0.0015	<0.0015	<0.003	<0.015	0.4	10	40
Lead	0.0009	<0.0004	0.002	<0.004	0.5	10	50
Antimony	0.0059	0.0045	0.012	0.047	0.06	0.7	5
Selenium	0.012	<0.001	0.02	0.02	0.1	0.5	7
Zinc	0.016	<0.005	0.03	<0.05	4	50	200
Chloride	1900	79	3800	3900	800	15000	25000
Fluoride	1.0	<0.5	2	<5	10	150	500
Sulphate as SO <sub>4</sub>	270	15	530	580	1000	20000	50000
Total Dissolved Solids	1900	180	3800	4700	4000	60000	100000
Phenols Monohydric	<0.01	<0.01	<0.02	<0.1	1	-	-
Dissolved Organic Carbon	<3	<3	<6	<30	500	800	1000
Leach Test Information							
Date Prepared	07/11/08	09/11/08					
pH (pH Units)	8.081	9.5					
Conductivity (µS/cm)	5700	310					
Temperature (°C)	19	19.1					
Volume Leachant (Litres)	0.305	1.4					
Volume of Eluate VE1 (Litres)	0.3						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.1195
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	32.72
Dry Matter Content Ratio (%) =	75.35

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		1,4			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		13/10/08					
Sample Identity		BH1001					
Depth (m)		0.75					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS		
	C <sub>2</sub>		A <sub>2</sub>		EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.02		0.2		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	8.1	-					
Conductivity (µS/cm)	160	-					
Temperature (°C)	19.1	-					
Volume Leachant (Litres)	0.871	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

## CEN 10:1 ONE STAGE BATCH TEST

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

WAC ANALYTICAL RESULTS					REF: CEN12457-2		
Mass Sample taken (kg) =		0.11678		Moisture Content Ratio (%) =		30.45	
Mass of dry sample (kg) =		0.09		Dry Matter Content Ratio (%) =		76.66	
Particle Size <4mm =		>95%					

Job Number	200817301			<u>Landfill Waste Acceptance Criteria Limits</u>		
Batch	1					
Sample Number(s)	7,15			Inert Waste Landfill	Stable Non- reactive Hazardous Waste in Non- Hazardous Landfill	Hazardous Waste Landfill
Sampled Date	15/10/08					
Sample Identity	WS701					
Depth (m)	2.00					
<b>Solid Waste Analysis</b>						
Total Organic Carbon (%)	-			-	-	-
Loss on Ignition (%)	-			-	-	-
Sum of BTEX (mg/kg)	-			-	-	-
Sum of 7 PCBs (mg/kg)	-			-	-	-
Mineral Oil (mg/kg)	-			-	-	-
PAH Sum of 17(mg/kg)	-			-	-	-
pH (pH Units)	-			-	-	-
ANC to pH 7 (mol/kg)	-			-	-	-
ANC to pH 4 (mol/kg)	-			-	-	-

Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		<u>Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg</u>		
	C <sub>2</sub>		A <sub>2</sub>				
	mg/l		mg/kg				
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.11		1.1		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
COD (CEN 10:1)	18		180		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
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					-	-	-
					-	-	-
					-	-	-
					-	-	-

Leach Test Information		
Date Prepared	09/11/08	-
pH (pH Units)	9.6	-
Conductivity (µS/cm)	1690	-
Temperature (°C)	18.8	-
Volume Leachant (Litres)	0.873	-
Volume of Eluate VE1 (Litres)	-	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

# ALcontrol Laboratories Analytical Services

## CEN 10:1 ONE STAGE BATCH TEST

## WAC ANALYTICAL RESULTS

REF:CEN12457-2

Mass Sample taken (kg) =	0.10845
Mass of dry sample (kg) =	0.09
Particle Size <4mm =	>95%

Moisture Content Ratio (%) =	19.79
Dry Matter Content Ratio (%) =	83.48

Job Number		200817301			Landfill Waste Acceptance Criteria Limits		
Batch		1					
Sample Number(s)		10,18			Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sampled Date		15/10/08					
Sample Identity		WS701					
Depth (m)		3.50					
Solid Waste Analysis							
Total Organic Carbon (%)		-			-	-	-
Loss on Ignition (%)		-			-	-	-
Sum of BTEX (mg/kg)		-			-	-	-
Sum of 7 PCBs (mg/kg)		-			-	-	-
Mineral Oil (mg/kg)		-			-	-	-
PAH Sum of 17(mg/kg)		-			-	-	-
pH (pH Units)		-			-	-	-
ANC to pH 7 (mol/kg)		-			-	-	-
ANC to pH 4 (mol/kg)		-			-	-	-
Eluate Analysis	Conc <sup>n</sup> in 10:1 eluate		10:1 conc <sup>n</sup> leached		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	C <sub>2</sub>		A <sub>2</sub>				
		mg/l		mg/kg			
Beryllium Dissolved (CEN 10:1) (ICP-MS)	<0.001		<0.01		-	-	-
Boron Dissolved (CEN 10:1) (ICP-MS)	0.06		0.6		-	-	-
Tin Dissolved (CEN 10:1) (ICP-MS)	0.004		0.04		-	-	-
COD (CEN 10:1)	10		100		-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
					-	-	-
Leach Test Information							
Date Prepared	09/11/08	-					
pH (pH Units)	9.017	-					
Conductivity (µS/cm)	1348	-					
Temperature (°C)	18.9	-					
Volume Leachant (Litres)	0.882	-					
Volume of Eluate VE1 (Litres)	-						

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable

## Supplemental Report

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

## REF:CEN12457-3

[illegible]

Soil Test Information		
Date Prepared	07/11/08	09/11/08
pH (pH Units)	8.4	8.3
Conductivity (µS/cm)	390	110
Temperature (°C)	18.9	19
Volume Leachant (Litres)	0.293	1.4
Volume of Eluate VE1 (Litres)	0.275	

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

## Supplemental Report

## CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

## REF:CEN12457-3

[illegible]

Date Prepared	07/11/08	09/11/08
pH (pH Units)	8.081	9.5
Conductivity (µS/cm)	5700	310
Temperature (°C)	19	19.1
Volume Leachant (Litres)	0.305	1.4
Volume of Eluate VE1 (Litres)	0.3	

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

## Supplemental Report

# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17301/02/01  
**Client:** Buro Happold  
**Client Ref. No.:**

### Report Key :

NDP No Determination Possible  
 NFD No Fibres Detected  
 # ISO 17025 accredited  
 PFD Possible Fibres Detected

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>  
 \* Subcontracted test  
 » Result previously reported (Incremental reports only)  
 M MCERTS Accredited  
 EC Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM008	BS 1377:Part 1977	Particle size distribution of solid samples			DRY	
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition	✓	✓	WET	
TM024	Method 4500A & B, AWWA/APHA, 20th Ed., 1999	Determination of Exchangeable Ammonium in soil samples	✓	✓	WET	
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)	✓		DRY	
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)	✓	✓	DRY	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection			NA	
TM062	MEWAM BOOK 124 1988.HMSO/ Method 17.7, Second Site property, March 2003	Determination of Phenolic compounds by HPLC with electro-chemical detection	✓	✓	WET	
TM074	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS. MCERTS Accreditation on Soils for Naphthalene except when Kerosene present.	✓		DRY	
TM074	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS. MCERTS Accreditation on Soils for Naphthalene except when Kerosene present.	✓	✓	DRY	
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)			WET	
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)	✓		WET	
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)	✓	✓	WET	
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water			NA	
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser			NA	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.



# ALcontrol Laboratories Analytical Services

## Table Of Results - Appendix

**Job Number:** 08/17301/02/01  
**Client:** Buro Happold  
**Client Ref. No.:**

### Report Key :

Results expressed as (e.g.) 1.03E-07 is equivalent to 1.03x10<sup>-7</sup>

NDP	No Determination Possible	*	Subcontracted test
NFD	No Fibres Detected	»	Result previously reported (Incremental reports only)
#	ISO 17025 accredited	M	MCERTS Accredited
PFD	Possible Fibres Detected	EC	Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### Summary of Method Codes contained within report :

Method No.	Reference	Description	ISO 17025 Accredited	MCERTS Accredited	Wet/Dry Sample <sup>1</sup>	Surrogate Corrected
TM097	Modified: US EPA Method 325.1 & 325.2	Determination of Chloride using the Kone Analyser	✓	✓	DRY	
TM098	Method 4500E, AWWA/APHA, 20th Ed., 1999	Determination of Sulphate using the Kone Analyser			NA	
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser			NA	
TM107	ISO 6060-1989	Determination of Chemical Oxygen Demand using COD Dr Lange Kit			NA	
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water			NA	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer			DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓		DRY	
TM129	Method 3120B, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 3050B	Determination of Metal Cations by IRIS Emission Spectrometer	✓	✓	DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓		DRY	
TM132	In - house Method	ELTRA CS800 Operators Guide	✓	✓	DRY	
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter	✓	✓	WET	
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS			NA	
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the "Skalar SANS+ System" Segmented Flow Analyser			WET	
TM180	Sulphide in waters and waste waters 1991 ISBN 01 175 7186 SCA rec. 2007 (unpublished)	The Determination Of Easily Liberated Sulphide In Soil Samples by Ion Selective Electrode Technique	✓		WET	

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## Table Of Results - Appendix

**Job Number:** 08/17301/02/01

**Client:** Buro Happold

**Client Ref. No.:**

**Report Key :**

Results expressed as (e.g.) 1.03E-07 is equivalent to  $1.03 \times 10^{-7}$

NDP No Determination Possible

\* Subcontracted test

NFD      No Fibres Detected

» Result previously reported (Incremental reports only)

# ISO 17025 accredited

M MCERTS Accredited

PFD	Possible Fibres Detected
1	1
2	1
3	1
4	1
5	1
6	1
7	1
8	1
9	1
10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	1
21	1
22	1
23	1
24	1
25	1
26	1
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89	1
90	1
91	1
92	1
93	1
94	1
95	1
96	1
97	1
98	1
99	1
100	1

EC      Equivalent Carbon (Aromatics C8-C35)

Note: Method detection limits are not always achievable due to various circumstances beyond our control.

### **Summary of Method Codes contained within report :**

[illegible]

<sup>1</sup> Applies to Solid samples only. **DRY** indicates samples have been dried at 35°C. **NA** = not applicable.

## ALcontrol Laboratories Analytical Services Table Of Results - Appendix

**Job Number:** 08/17301/02/01

**Client:** Buro Happold

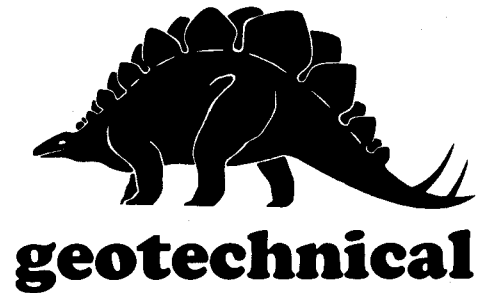
**Client Ref. No.:**

### Summary of Coolbox temperatures

[illegible]

Extractable Petroleum Hydrocarbons (formally Diesel Range Organics) :- Any compound extractable in n-hexane within the carbon range C10-C40, includes Aliphatic (Min Oil), Aromatic (PAHs) and naturally occurring compounds.

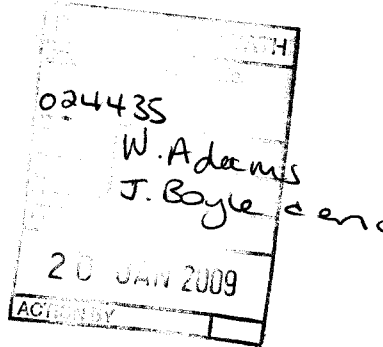
Our Ref: 22500  
Your Ref: 024435



Buro Happold Ltd  
Camden Mill  
Lower Bristol Road  
Bath

BA2 3DQ

**For the attention of James Boyle**



16 January 2009

Dear Sirs

**Hayle Harbour**

Please find enclosed the laboratory test results for the samples provided by yourselves from the above site.

Testing was carried out as per your written instructions and the results presented in the attached figures.

We have also taken this opportunity to enclose our invoice for the work carried out. Please note samples will be stored for a period of **one month** from the invoice date and then disposed of unless otherwise instructed.

Yours faithfully  
**Geotechnical Engineering Limited**

**Mark Adams**  
**Deputy Laboratory Manager**

---

**Directors:** A. B. Milne BSc MSc DIC CEng MICE    A. L. M. Milne  
J.C.W. Hanson BSc MSc CGeol FGS EurGeol    N.V. Parry BEng MSc CEng MICE MIHT SILC

**Registered Office:** Centurion House, Olympus Park, Quedgeley, Gloucester GL2 4NF

**Registered No.** 700739, England    **VAT Number:** 682 5857 89

**Payments:** Geotechnical Engineering Ltd.

**Bank Account No:** 01713840    Sort Code: 30 93 48

**Geotechnical Engineering Ltd**  
Centurion House  
Olympus Park, Quedgeley  
Gloucester GL2 4NF  
telephone: (01452) 527743  
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e-mail: [geotech@geoeng.co.uk](mailto:geotech@geoeng.co.uk)  
[www.geoeng.co.uk](http://www.geoeng.co.uk)

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD

BH/TP No.

WS701

SITE HAYLE HARBOUR

SAMPLE No./TYPE

D

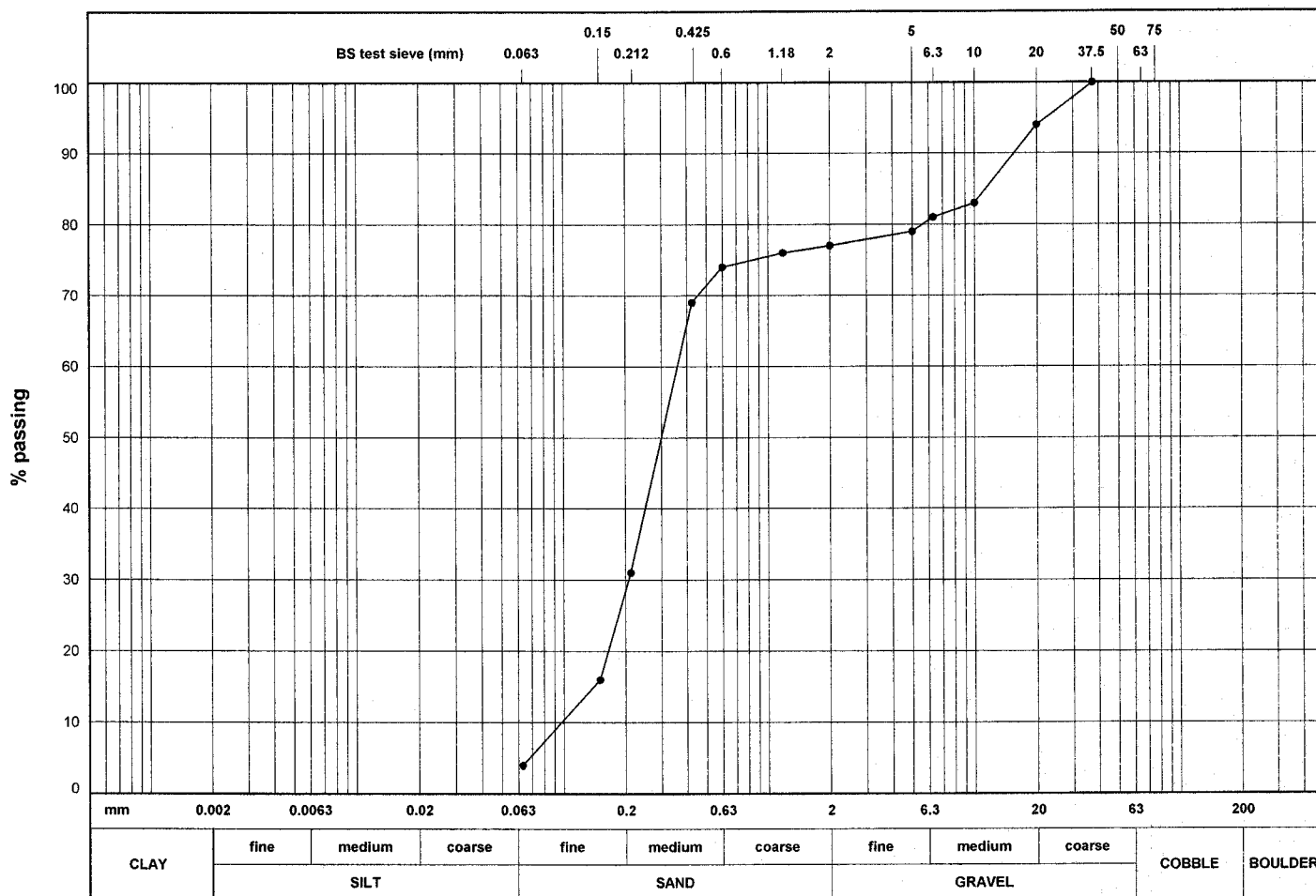
SAMPLE DEPTH (m)

0.50

DESCRIPTION Brown slightly silty SAND with much f-c gravel

SPECIMEN DEPTH (m)

0.50



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY							
SILT		150		5	79	20	
SILT & CLAY	4	75		2	77	6	
SAND	73	63		1.18	76	2	
GRAVEL	23	50		0.6	74		
COBBLE & BOULDER	0	37.5	100	0.425	69		
test method(s)	9.3	20	94	0.212	31		
test method:		10	83	0.15	16		
9.2 - wet sieving		6.3	81	0.063	4		
9.3 - dry sieving							ORIGINATOR
9.4 - sedimentation by pipette							MB
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MJA

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD

BH/TP No.

WS702

SITE HAYLE HARBOUR

SAMPLE No./TYPE

D

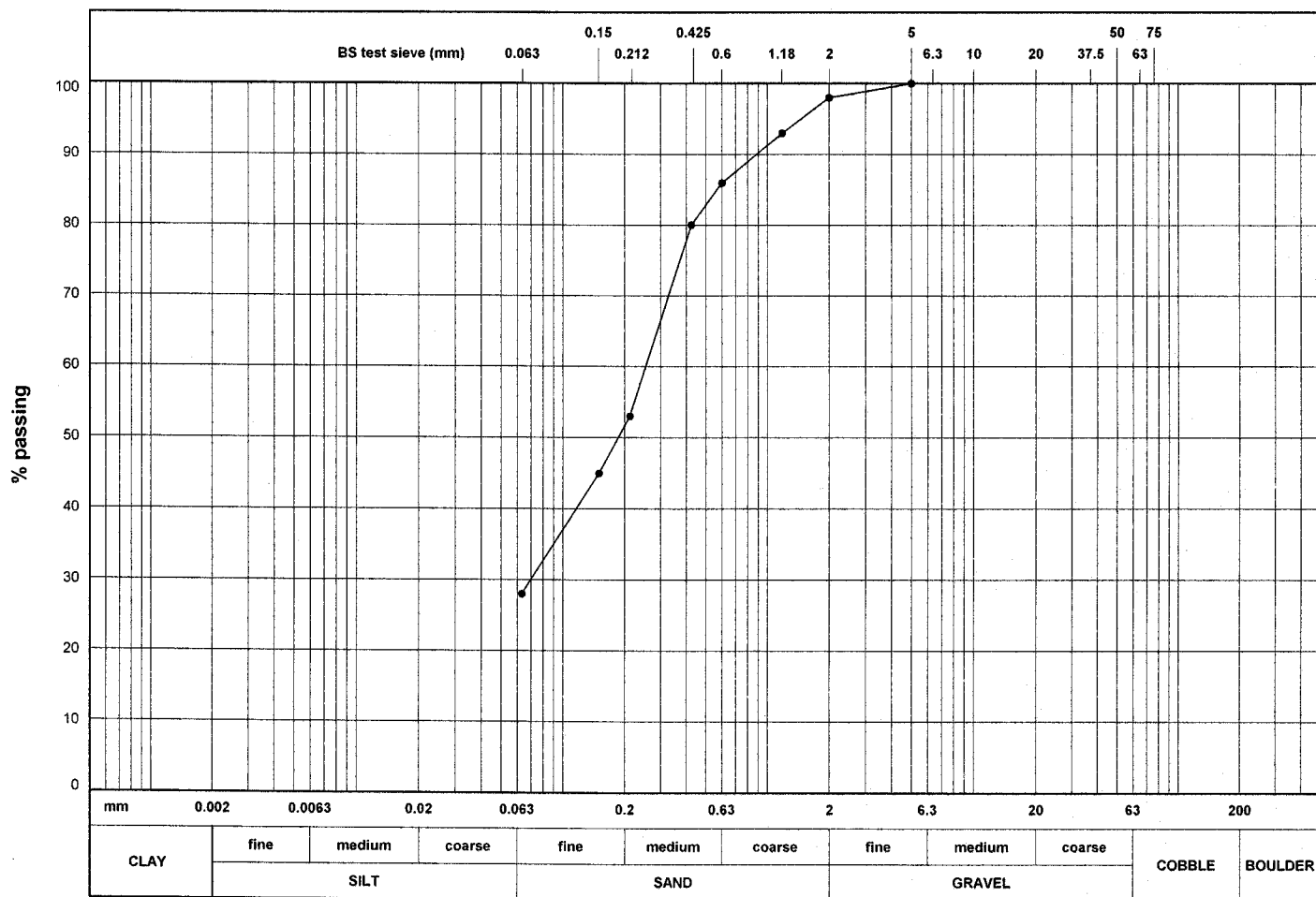
SAMPLE DEPTH (m)

0.50

DESCRIPTION Brown very clayey SAND with a little fine gravel

SPECIMEN DEPTH (m)

0.50



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY							
SILT		150		5	100	20	
SILT & CLAY	28	75		2	98	6	
SAND	70	63		1.18	93	2	
GRAVEL	2						
COBBLE & BOULDER	0						
test method(s)	9.3	50		0.6	86		
test method:		37.5		0.425	80		
9.2 - wet sieving		20		0.212	53		
9.3 - dry sieving		10		0.15	45		
9.4 - sedimentation by pipette		6.3		0.063	28		
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	ORIGINATOR
						22500	CHECKED

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

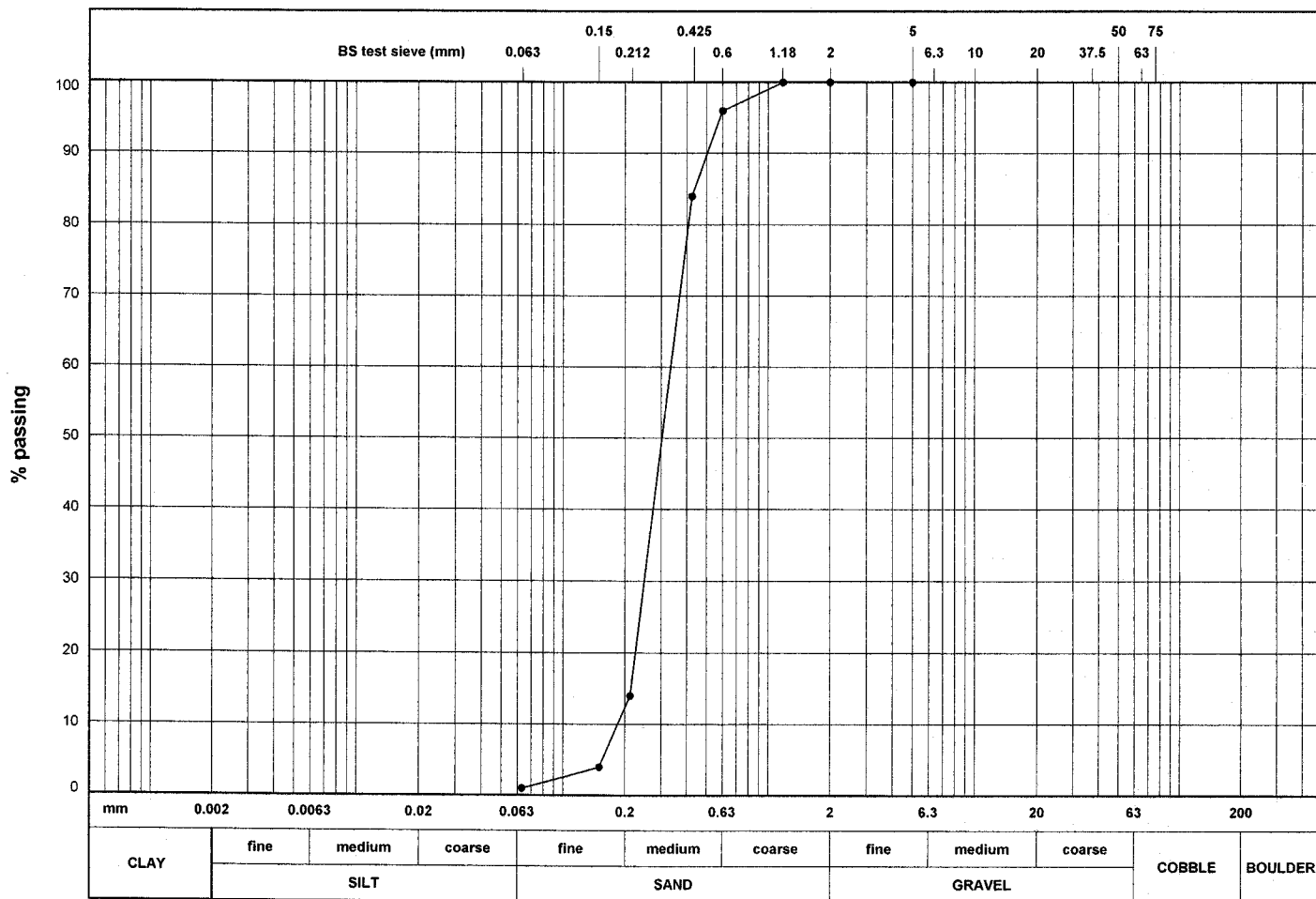
BH/TP No. WS702

SAMPLE No./TYPE D

SAMPLE DEPTH (m) 2.00

DESCRIPTION Yellow-brown slightly silty SAND

SPECIMEN DEPTH (m) 2.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (μm)	% finer
CLAY							
SILT		150		5	100	20	
SILT & CLAY	1	75		2	100	6	
SAND	99	63		1.18	100	2	
GRAVEL	0						
COBBLE & BOULDER	0						
test method(s)	9.3	50		0.6	96		
test method:		37.5		0.425	84		
9.2 - wet sieving		20		0.212	14		
9.3 - dry sieving		10		0.15	4		
9.4 - sedimentation by pipette		6.3		0.063	1		
9.5 - sedimentation by hydrometer							ORIGINATOR
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	



**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

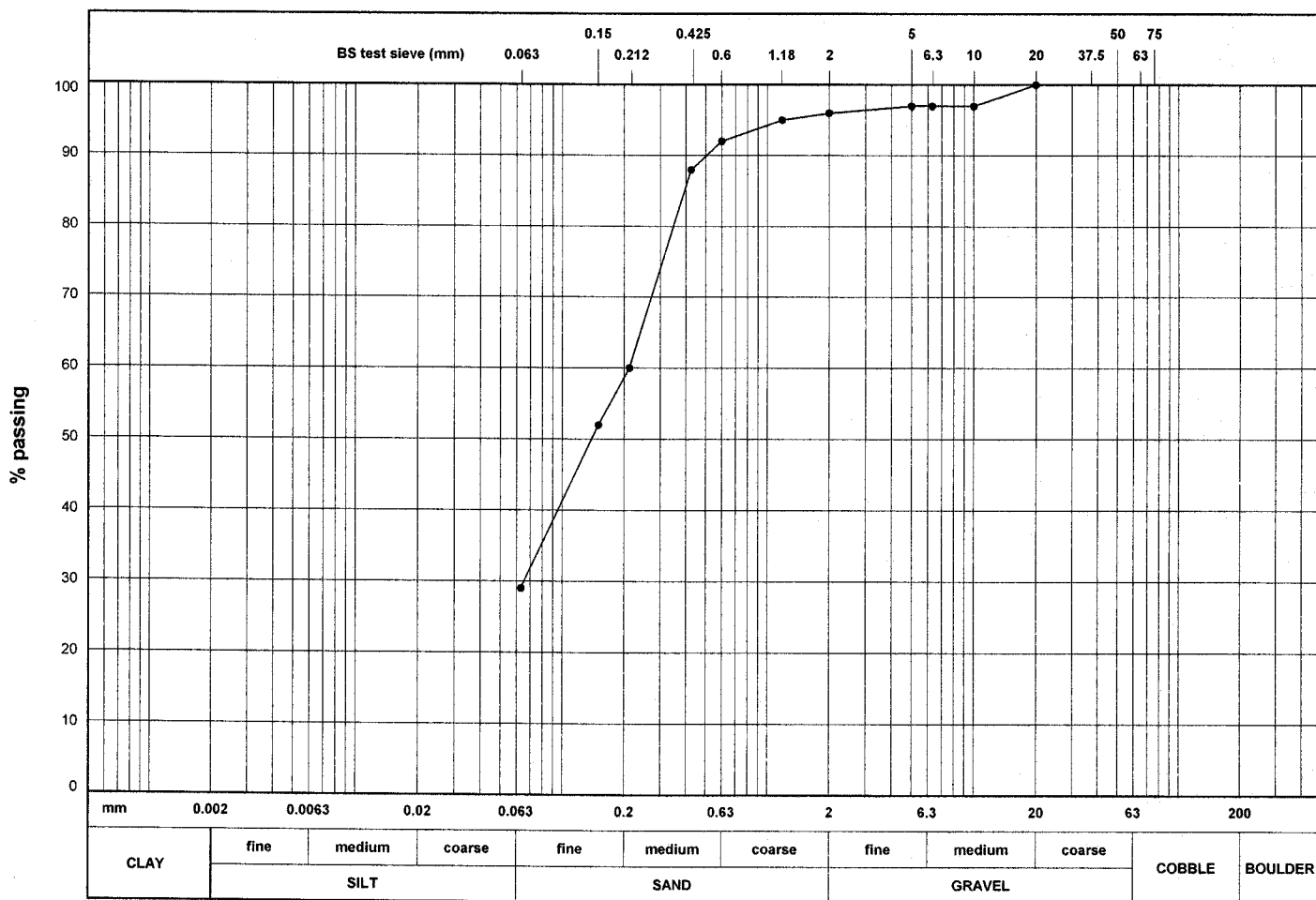
BH/TP No. WS703

SAMPLE No./TYPE D

SAMPLE DEPTH (m) 0.50

DESCRIPTION Brown very clayey SAND with a little f-m gravel

SPECIMEN DEPTH (m) 0.50



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	97	20	
SILT		75		2	96	6	
SILT & CLAY	29	63		1.18	95	2	
SAND	67	50		0.6	92		
GRAVEL	4	37.5		0.425	88		
COBBLE & BOULDER	0	20	100	0.212	60		
test method(s)	9.3	10	97	0.15	52		
test method:		6.3	97	0.063	29		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	ORIGINATOR
						22500	CHECKED

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

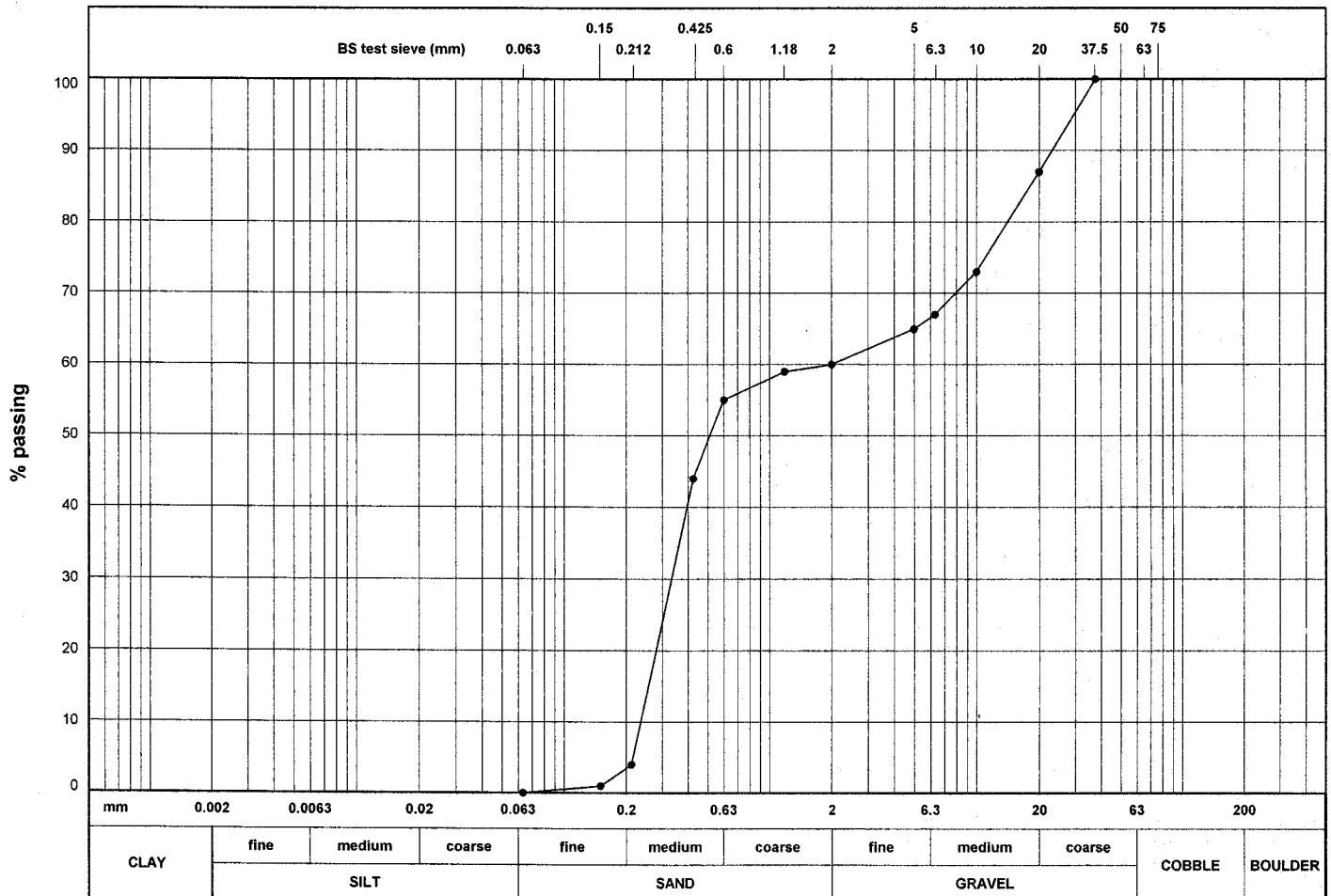
BH/TP No. WS703

SAMPLE No./TYPE D

SAMPLE DEPTH (m) 4.00

DESCRIPTION Yellow-brown SAND with much f-c gravel

SPECIMEN DEPTH (m) 4.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY							
SILT		150		5	65	20	
SILT & CLAY	0						
SAND	60	75		2	60	6	
GRAVEL	40						
COBBLE & BOULDER	0	63		1.18	59	2	
test method(s)	9.3	50		0.6	55		
test method:		37.5	100	0.425	44		
9.2 - wet sieving		20	87	0.212	4		
9.3 - dry sieving		10	73	0.15	1		
9.4 - sedimentation by pipette							ORIGINATOR
9.5 - sedimentation by hydrometer		6.3	67	0.063	0		MA
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MA

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

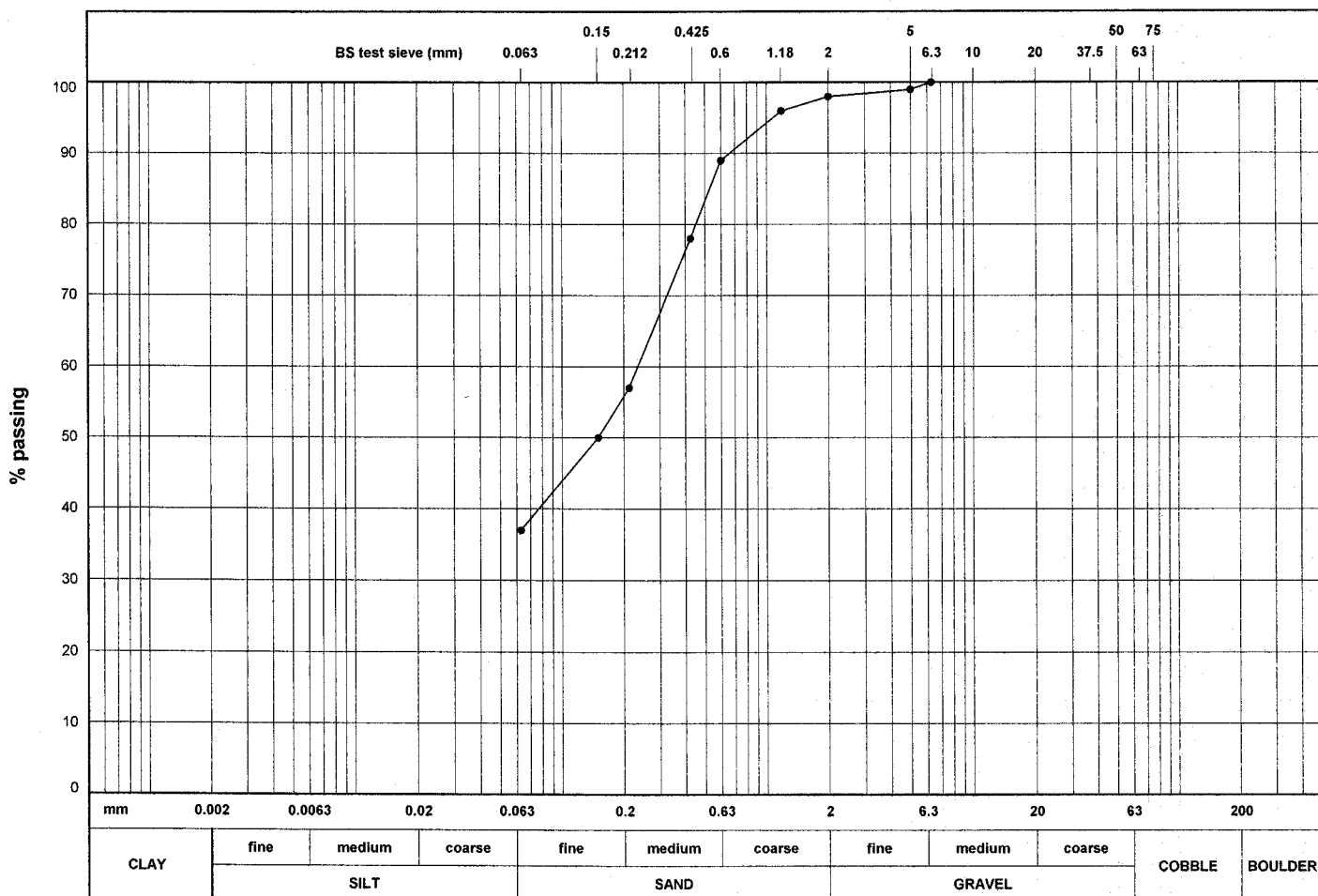
BH/TP No. WS705

SAMPLE No./TYPE D

SAMPLE DEPTH (m) 1.00

DESCRIPTION Brown sandy CLAY with a little fine gravel

SPECIMEN DEPTH (m) 1.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	99	20	
SILT		75		2	98	6	
SILT & CLAY	37	63		1.18	96	2	
SAND	61	50		0.6	89		
GRAVEL	2	37.5		0.425	78		
COBBLE & BOULDER	0	20		0.212	57		
test method(s)	9.3	10		0.15	50		
test method:		6.3	100	0.063	37		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MA

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD

BH/TP No.

WS705

SITE HAYLE HARBOUR

SAMPLE No./TYPE

D

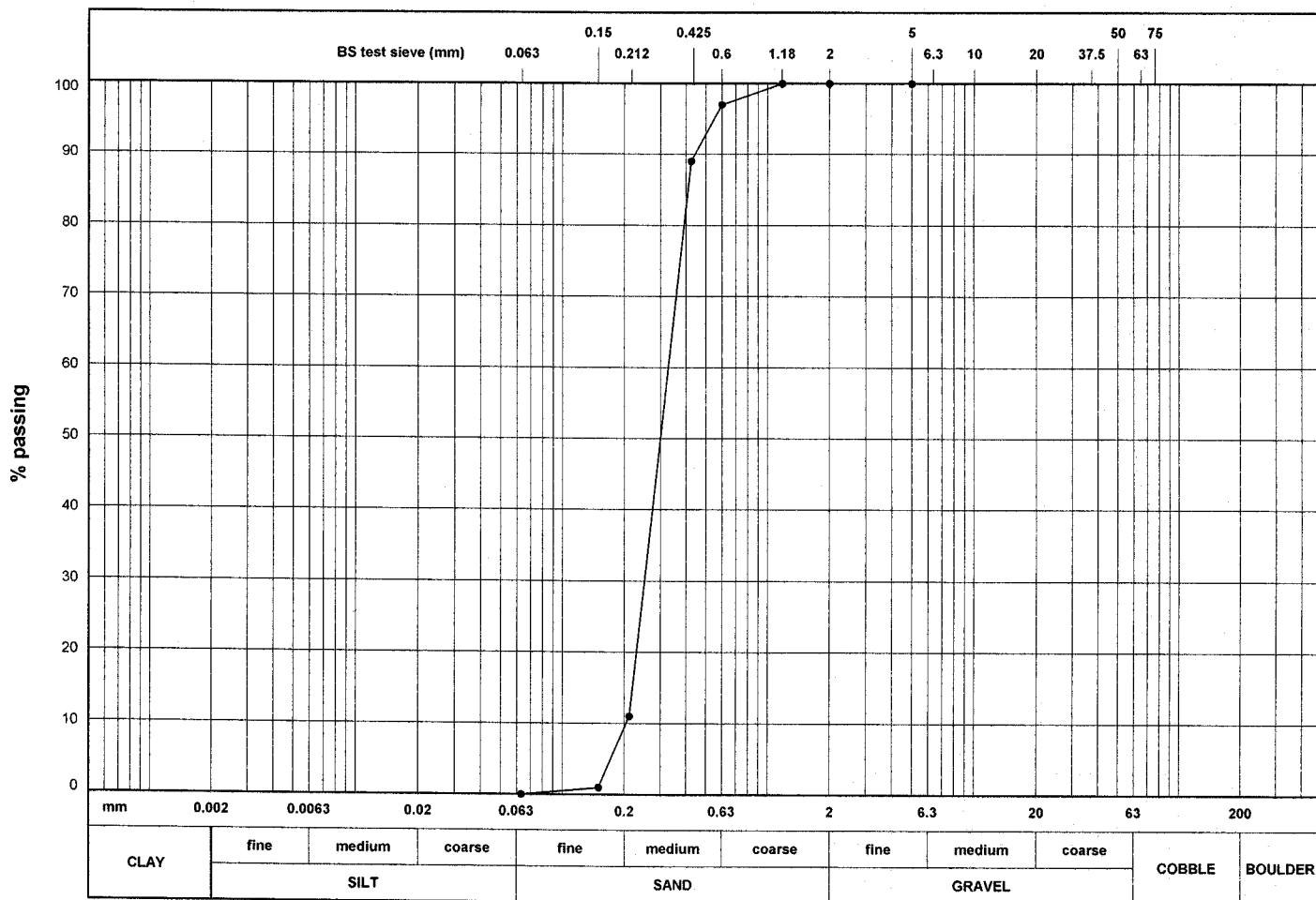
SAMPLE DEPTH (m)

2.00

DESCRIPTION Yellow-brown SAND

SPECIMEN DEPTH (m)

2.00



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY							
SILT		150		5	100	20	
SILT & CLAY	0						
SAND	100	75		2	100	6	
GRAVEL	0	63		1.18	100	2	
COBBLE & BOULDER	0						
test method(s)	9.3	50		0.6	97		
test method:		37.5		0.425	89		
9.2 - wet sieving		20		0.212	11		
9.3 - dry sieving		10		0.15	1		
9.4 - sedimentation by pipette		6.3		0.063	0		
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MJA

**PARTICLE SIZE DISTRIBUTION**

BS.1377 : Part 2 : 1990 : 9



CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

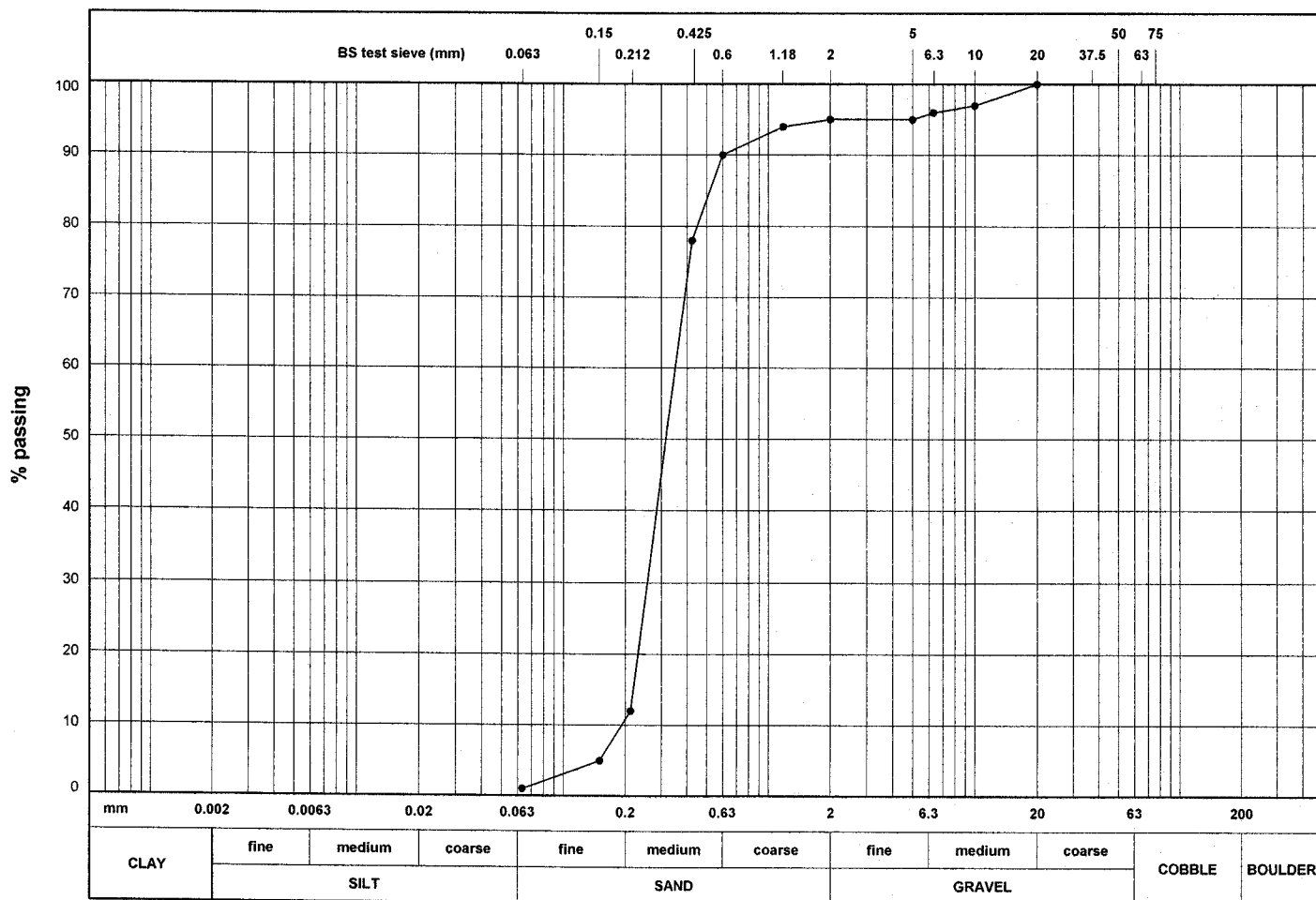
BH/TP No. WS707

SAMPLE No./TYPE D

SAMPLE DEPTH (m) 0.50

DESCRIPTION Brown slightly silty SAND with a little f-m gravel

SPECIMEN DEPTH (m) 0.50



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY		150		5	95	20	
SILT		75		2	95	6	
SILT & CLAY	1	63		1.18	94	2	
SAND	94	50		0.6	90		
GRAVEL	5	37.5		0.425	78		
COBBLE & BOULDER	0	20	100	0.212	12		
test method(s)	9.3	10	97	0.15	5		
test method:		6.3	96	0.063	1		
9.2 - wet sieving							
9.3 - dry sieving							
9.4 - sedimentation by pipette							
9.5 - sedimentation by hydrometer							
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MAA

Geotechnical Engineering Limited

# PARTICLE SIZE DISTRIBUTION

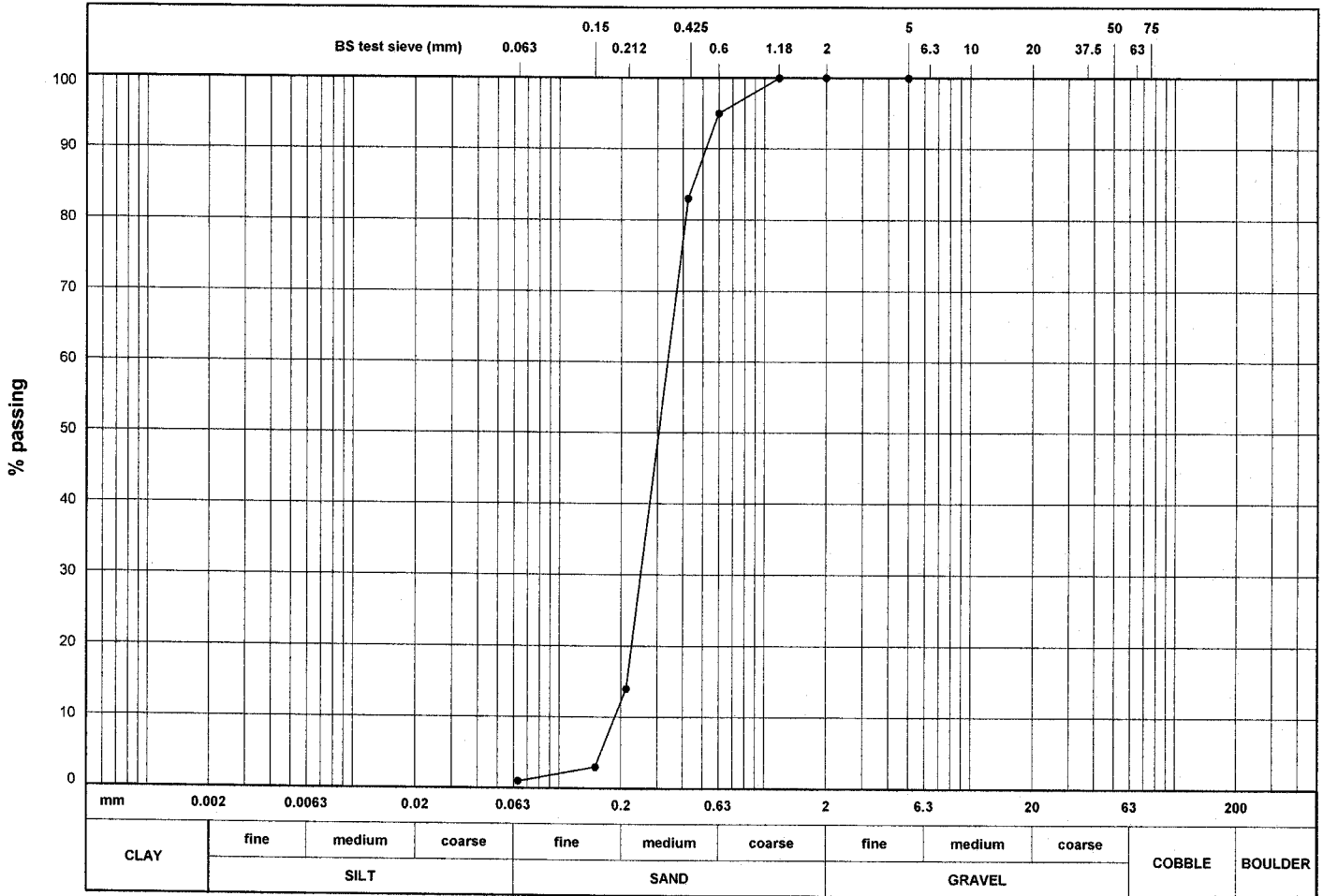


BS.1377 : Part 2 : 1990 : 9

CLIENT BURO HAPPOLD LTD  
SITE HAYLE HARBOUR

BH/TP No. WS707  
SAMPLE No./TYPE D  
SAMPLE DEPTH (m) 2.00  
SPECIMEN DEPTH (m) 2.00

DESCRIPTION Yellow-brown slightly silty SAND



soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	particle size (µm)	% finer
CLAY							
SILT		150		5	100	20	
SILT & CLAY	1						
SAND	99	75		2	100	6	
GRAVEL	0						
COBBLE & BOULDER	0	63		1.18	100	2	
test method(s)	9.3	50		0.6	95		
test method:		37.5		0.425	83		
9.2 - wet sieving		20		0.212	14		
9.3 - dry sieving		10		0.15	3		
9.4 - sedimentation by pipette							ORIGINATOR
9.5 - sedimentation by hydrometer		6.3		0.063	1		
remarks:	# denotes sample tested is smaller than that which is recommended in accordance with BS1377					CONTRACT	CHECKED
						22500	MA

## Appendix D    Photographs

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Photo 1 (left):  
Looking north from  
the southern edge of  
Cockle Bank.



Photo 2 (above): Looking north,  
drilling WS701 in the northern  
portion of Cockle Bank



Photo 3 (left): Looking South, mooring point on southern edge of Cockle Bank .



Buro Happold

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