Dolphin Quay
Queen Street, Emsworth
Hampshire

Geo-Environmental and Geotechnical Site Investigation Report

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E-E1667.00 101 Exploratory Hole Location Plan
27958-PD103 revision K Proposed Site Layout Plan (PDP Architecture)

Appendices

Appendix A Selected Site Images
Appendix B Exploratory Hole Logs
Appendix C Soil and Water Contamination Test Results
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Appendix E Soil Contamination Assessment Criteria, Methodology and Statistical Results
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1. Introduction

1.1. Background

Opus International Consultants (UK) Limited, (also referred to herein as "Opus" for the purposes of this report) was commissioned by Wilson House Developments Ltd (also referred to as the Client" for the purposes of this report) to undertake an intrusive ground investigation at Dolphin Quay, Queen Street, Emsworth, PO10 7BU.

The works were carried out under the supervision of Opus. The scope and specification for the Ground Investigation was set out by Opus in consultation with the Client accordance with instructions provided.

1.2. Objectives

The objectives of the investigation are:

- To define the ground related risks underlying the proposed development at site, providing relevant information for the design and construction of the proposed scheme.
- To provide an interpretative ground report and with recommendations relating to the proposed development in the context of foundations, including the flood defence wall and a qualitative assessment of the potential soil contamination risks to identified receptors.

1.3. Limitations

The client's attention is drawn to Appendix F to this report for the Conditions and Limitations.

This report has been prepared by Opus International Consultants (UK) Ltd (Opus) with all reasonable skill, care and diligence, within the terms of the Contract with The Client (Wilson House Developments Ltd) and taking account of the information made available by The Client, as well as the manpower and resources devoted to it by agreement with The Client. Opus disclaims any responsibility to The Client and others with respect to any matters outside the scope of the above Contract.

This report has been produced on behalf of The Client, and no responsibility is accepted to any other Third Party for all or any part. This report should not be relied upon or transferred to any other parties without the express written authorisation of Opus. If any unauthorised Third Party comes into possession of this report, they rely on it at their own risk and the authors owe them no duty of care or skill.

Whilst this report may express an opinion on the possible configuration of strata, contaminants or groundwater between or beyond exploratory hole positions, or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only and no liability can be accepted for any inaccuracy.

This report has been prepared on the understanding that the development is to comprise of a residential end land use. Should the proposed site usage change significantly from the above, the contents of this report will require review and amendment as appropriate.

The comments on groundwater conditions are based on observations made at the time of the investigation and also the groundwater level monitoring data. It should be noted however, that groundwater levels may vary from those reported due to seasonal or other effects.

The site plans enclosed in this report should not be used for scaling purposes.

2. The Site

2.1. Location & Access

The site is located to the South side of Queen Street, Emsworth. Directly adjacent to the east of the site is the public house 'The Lord Raglan' and opposite is a trading car garage workshop including a petrol forecourt. Queen Street meets the A259 main road at its eastern end approximately 80m east of the site. The development site is centred on National Grid Reference (NGR) 475203, 105752 and is approximately 0.13Ha in size.

Access to the site is via the main gate off Queen Street leading to the hardstanding area outside the existing site buildings. A site location plan is presented in Appendix A of this report.

2.2. Proposed Development

Opus has been provided with the drawing 27958-PD103 revision K site layout plan produced by PDP Architecture. It is understood that the redevelopment plans for the site include the construction of six residential properties; two detached, three storey properties at the south of the site on the waterfront (plots 1 & 2) and four terraced, three storey properties to the North of the site (plots 3 to 6).

The development includes an access lane leading from Queen Street leading to the rear of all units, which will contain parking spaces beneath the properties and externally for residents' vehicles. There appears to be limited soft landscaping on the development with a strip to the west of plot 1 and to the east of plot 2.

As part of the redevelopment a new harbour retaining wall is proposed along the west and south perimeter of the site.

2.3. Site Description

The site includes an unoccupied former office building and former antiques shop at the north east section of the site. These are attached to two disused boathouses to its south, with the surrounding outside areas comprising hardstanding concrete that forms the boatyard area. To the south of the site the hardstanding forms a slipway leading down to the Emsworth channel.

The one-storey boathouse roughly in the centre of the site is constructed of timber and brick, with a corrugated steel roof. It had a generally run-down appearance (outside and inside), with some sections of the roof having fallen in. The adjacent boathouse is constructed of timber and brick with large glass windows and white-painted timber cladding and is in contact with the first boathouse. Again it appears that in places the roof had actually fallen into the building. This building is single-storey, with a pair of metal doors opening onto the hardstanding concrete of the boatyard.

The buildings to the north and north east of the site were constructed of brick with tiled roofs, with the red brick building to the left being single-storey, and the white building to the right being two-storey (looking from Queen Street). These faced onto Queen Street and their general appearance was relatively well-kept.

At the time of the site walkover a sailing boat was parked on the slipway, and another was being stored on the hardstanding behind the fence where the site meets the road, stored under tarpaulin.

The topography of the site appeared to be relatively level, but raised above the water level in the adjacent channel by approximately 1.50m, which ran broadly N-S adjacent to the site almost until the road, where it meets the concrete. The channel edge was lined mostly with wooden planks supported be steel beams driven into the bed of the channel. The slipway at the South of the site is the only notable change in topography across the site, where the hardstanding lowers down to the Emsworth Channel. Drainage appeared to generally be straight off the site into the adjacent river channel.

3. Background Information

3.1. Summary of Desk Study Information

Opus completed a Desk Study for the site in October 2017 ref. E-E1667.00/DS. A summary of the salient information from the Desk Study is presented in the following Sections.

3.1.1. Site History

A review by Opus of historic sources associated with the site including OS maps, planning records and anecdotal information and a recent site walkover visit identified the following activities that may have given rise to land contamination at the site.

The site had been developed by the earliest historic OS map edition dating from the 1860's and it is understood that the site has been used for boat building for over 200 years. It is further understood from anecdotal information supplied by the client that the site was additionally used for the storage of coal, which was brought in by sea, during the end of the 19th Century.

The planning records revealed that boat building had already commenced at the site by the 1940's. Boat building activities continued at the premises for the majority of the later part of the 20th Century. Planning permission was applied for the erection of a workshop for boat building in March 1958. A year later planning permission was applied for to demolish existing cottages that had been located at the site to allow for a front boundary wall and use of the land in connection with a yacht building business. This was subsequently followed with planning permission being granted in 1960 for the erection of a yacht building shed with office accommodation.

A change to use at the site occurred in 1996 when a building unit located at the sites northern boundary was provided temporary permission (three years) to accommodate an antiques and crafts shop.

A recent site walkover survey noted that the antiques shop continued to be active at the north of the site with disused boat houses that had fallen into disrepair located in the south of the site. All of the external areas to the buildings on-site consisted of concrete hardstanding. The concrete was observed to have become broken in places and grass had grown through the cracks. A pile of waste comprising rubble from demolished on-site buildings and pieces of broken boats lay to the south of the boat houses.

No significant evidence of contamination was observed during the site walkover survey. However, it was considered that potentially there may be localised contamination associated with the waste pile of materials observed on site that appeared to predominantly consist of pieces of broken boats and rubble from the buildings. The rubble may include potentially asbestos containing material. In addition, boat construction or maintenance activities at the site could potentially have produced contaminants that could be present in the surrounding water course or in the near surface soils such as through the use of chemicals, oils and solvents.

3.1.2. Geology

With reference to the published geological map for the area, (BGS, 1998); the geology beneath the site is shown to lie directly on the solid deposits of the Lambeth Group, however various superficial soil deposits are shown in close proximity to the site that may well overlie Lambeth soils. Potential Made Ground is anticipated to be underlying the site based on previous construction activities associated with the boatyard.

Superficial soils include recent Alluvium, Head deposits and Beach and Tidal Flat Deposits. Alluvium typically comprises of normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.

The Head deposits comprises gravel, sand and clay depending on upslope source and distance from source. These are poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep, and essentially comprises sand and gravel, locally with lenses of silt, clay or peat and organic material.

The Beach and Tidal Flat Deposits comprise a mixture of variable 'Beach deposits': Shingle, sand, silt and clay, and may be in the form of dunes, sheets or banks, and 'Tidal Flat Deposits': commonly silt and clay with sand and gravel layers, with possible peat layers from the tidal zone.

The older Lambeth Group deposits from the Paleogene Period comprises of vertically and laterally variable sequences mainly of clay, some silty or sandy, with some sands and gravels, minor limestones and lignites and occasional sandstone and conglomerate.

The Lambeth Group soils at the site lie close to the Chichester Syncline to the north and may be expect to dip to the north. Subsequently the London Clay Formation is found immediately to the north of the site and the Chalk outcropping in close proximity to the south of the site.

3.1.3. Hydrogeology

The overlying superficial soils have been classified as being of High Leaching Potential (U). This description is given for soils located in urban areas where there are fewer observations than elsewhere. A worst case vulnerability classification is assumed until proven otherwise.

The site is not located within an Environment Agency designated Groundwater Source Protection Zone.

No active licensed groundwater abstraction or discharge consent was reported within 300m of the site.
Hydrology

The nearest surface water feature is the River Ems, the closest section of which flows through a culvert beneath the north of the site. It continues to run parallel to the site's southern boundary prior to joining the Emsworth Channel, which flows in a roughly north to south direction into the northern end of Chichester Harbour. Located approximately 40m east of the site and adjacent to the mooring facilities south of Dolphin Quay is an enclosed body of water known as Mill Pond. Mill Pond is noted to have a higher water level than the adjacent Emsworth Channel.

The site is located in Flood Zone 3, which includes land and property that is at a high probability of flooding. The site is located within an area where there is the potential for groundwater flooding to occur at the surface and of property situated below ground level.

3.1.4. Historic Landfill and Licensed Waste Management Facilities

One landfill site, 'Emsworth Yacht Harbour', is located approximately 475m to the south east, which was in operation between the 21st February and 15th August 1986. The landfill site was noted to have received inert waste only.

3.1.5. Radon

The site is located in an intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). However, no radon protective measures are necessary in the construction of new dwellings or extensions.

3.1.6. Environmental Sensitivity

No area with designated environmental sensitivity was reported for the site or within a 1km radius.

4. Preliminary Conceptual Site Model

4.1. General

In order for land affected by contamination to cause harm or pollution, there must be a source of the contamination (such as toxic or harmful substances in the ground), a receptor that can be harmed (such as a person whose health could be affected by the contamination or a controlled water that could be polluted by it) and a pathway by which the receptor can be exposed to the contamination (such as through direct skin exposure to contaminated soil or ingestion of contaminated water or contaminated vegetables grown in the soil).

In addition to the risk to health and plant life, contaminants may also attack materials in building components. This includes the effect of sulphates on concrete structures and also contaminants passing through walls of

water service pipes or causing degradation of pipework and affecting the taste or potability of water supplies and the accumulation of gases creating potentially explosive or asphyxiant conditions.

4.2. Potential Contaminants

The site is currently occupied by an antiques shop at its northern boundary and disused boathouses at its southern, with the surrounding external areas comprising concrete hardstanding. A stockpile consisting of broken boats and rubble was noted to the south of the boat houses on site. Potentially the rubble fraction could contain asbestos containing materials sourced from the demolished buildings on site.

Historic sources have identified that the site has been used for boat building for approximately 200 years and for coal storage towards the end of the 19th Century. With that in mind, Opus has reviewed the Department of Environment (DoE) Industry Profile for Engineering Works (shipbuilding, repair and shipbreaking) to aid in the identification of potential sources and potential contaminants associated with the site's main historical land use. However, it is noted that the variety of boats built at the site are likely to have been restricted to yacht and Zodiac type vessels.

Potential sources of contaminants associated with the site are considered to include Made Ground that may be located on site from past land raising activities, site development and/or demolition works. Made Ground may also have been impacted by exposure to soluble contaminants over the years, via vertical migration through cracks in the concrete hardstanding. Potential contaminants based on the DoE profile have been identified as follows:

- Inorganic Heavy Metals;
- Cyanides;
- Mineral Acids;
- Asbestos;
- Organic solvents/thinners;
- Biocides;
- Epoxies/vinyls;
- Polychlorinated Biphenyls;
- Oily sludges;
- Fuel/lubricating oils
- Coal/ash.

A stockpile of old broken boats and rubble from the demolition of historic buildings located within the grounds of the site may include asbestos containing materials.

The site is understood to have been developed on reclaimed land and superficial deposits comprising Alluvium were anticipated to be located beneath the site. Alluvium has the potential to generate ground gases such as carbon dioxide and methane if the soils contain a high organic content associated with the presence of organic matter such as decaying vegetation and peat.

The surrounding land has predominantly been occupied by residential land. A fuel station is located opposite the site off the northern side of Queens Street. Fuel stations can present a source of contamination to underlying soils and groundwater through creating contaminant plumes that can impact on the surrounding land if for example an oil storage tank had historically leaked or a significant spill of fuel had occurred. Therefore, the fuel station local to the site has been considered as a potential off site source of contamination to the site. If for example, petrol and/or diesel had leaked into the underlying water table due to a breach of an underground fuel storage tank, then in theory, the oil would float on the surface of the water table and begin to migrate with the hydraulic gradient of the water table, which would likely be towards the Emsworth Channel and thus beneath the site.

4.3. Receptors of Contamination and Migration Pathways

Receptors are defined as human beings, ecological systems, property or controlled waters that have the potential to experience adverse effects from direct or indirect exposure to contaminated material.

Migration pathways are defined as the courses chemicals take from a source to an exposed organism or receptor. The exposure pathway can be direct (i.e. stays within the same exposure media) or indirect transport from one medium to another takes place.

The following potential human health and environmental receptors have been identified based on the end use as a residential development without private gardens:

- Future end users (occupants of the new houses);
- Site construction and maintenance workers (acute exposure during construction phase only);
- Neighbouring occupants (acute exposure during construction phase only);
- Groundwater associated with the underlying Secondary A Aquifers (superficial and potentially solid geology); and
- Building materials.

The following potential migration pathways have been identified:

- **Inhalation**
  Human health can potentially be at risk from breathing dust and vapours from contaminated soil in the outdoor air and also the inhalation of fugitive dust inside buildings. Vapours from contaminated soil and groundwater can also migrate into buildings and be inhaled by the occupants;
- **Ingestion**
  Human health can be potentially at risk from eating and swallowing contaminated soil and groundwater. Ingestion can also occur by deliberately eating contaminated soil or indirectly by eating and smoking with dirty hands etc., or by ingestion of fugitive dust;
- **Dermal Contact**
  Human health can be potentially at risk from direct skin contact with contaminated soil and groundwater causing skin conditions such as dermatitis etc. and also dermal contact with fugitive dust inside buildings. Certain contaminants can be absorbed into the body through the skin or enter directly through open cuts and abrasions;
- **Leaching**
  Infiltration of water through soil can leach out soluble contaminants resulting in groundwater pollution;
- **Migration of Contaminated Water**
  Depending on the permeability of the ground conditions and any other man-made voids or preferential pathways, contaminated groundwater can potentially migrate laterally or vertically impacting adjacent surface and groundwater;
- **Migration of Ground Gas**
  Ground gases can migrate laterally or vertically through permeable or voided ground where they may enter and accumulate in unprotected buildings;
- **Aggressive Attack**
  Some subsurface building materials can be damaged by direct contact with aggressive ground conditions, for example sulphate attack on concrete and hydrocarbon attack on plastics.

In Table 4.1 we present a source-pathway-receptor analysis to form the preliminary conceptual model of pollutant linkages for this site, together with Risk Assessment criteria and comments based upon contaminants being potentially located beneath the site.

Source	Pathway	Receptor	Preliminary Assessment of Magnitude of Risks	Comments
Impacted Made Ground: Heavy metals, chemicals, oils, solvents , TPH and PAH, VOCs, Asbestos Containing Material (ACM) Stockpile of demolition material onsite.	Direct contact: Dermal contact, Inhalation of contaminated dust/soil particulates and fibres (indoor and outdoor air).	Site users (adults and children)	Low	Post redevelopment the surface of the site will be predominantly occupied by undercroft car parking or hardstanding, which will effectively break the direct exposure pathways between future site users coming into contact with potentially contaminated soil. The main areas of potential exposure to contaminated soils are within the limited proposed areas of soft landscaping.
		Construction workers Site neighbours Maintenance workers	Low	Construction workers and site neighbours are considered to only be at risk during the ground works phase of the redevelopment. The exposure pathways (dermal contact and ingestion/inhalation) can be mitigated by workers wearing appropriate PPE, adequate washing facilities on site and good dust control measures. Maintenance workers are at a potential risk of coming into direct contact with contaminated soils if grounds maintenance activities require them to expose the underlying ground. The stockpile of demolition material on site could potentially contain asbestos and therefore, the removal of this material should be managed under the CAR 2012 regulations. It is the duty of the contractor to undertake a suitable risk assessment to determine the appropriate levels of protection which will be required.
	Inhalation of volatile organic compounds (indoor)	Site users (adults and children)	Negligible	No significant source of organic contamination (such as a fuel storage tank) has been identified at the site either historically or currently. The proposed end use, will see the installation of an undercroft car park, which would break the potential pollutant linkages between future site residents.
		Construction workers Maintenance workers	Low	No significant source of organic contamination such as a fuel storage tank has been identified at the site either historically or currently. If undiscovered contamination was encountered during the ground works phase of development then work should stop until the area of contamination had been investigated and further risk assessment completed
	Leaching	Controlled waters - groundwater	Low to medium	The site is located over Secondary A Aquifers associated with the presence of the superficial and potentially the solid geology too and thus is considered to have some vulnerability to groundwater pollution. The River Ems is culverted beneath the north of the site and the site's southern boundary faces on to the Emsworth Channel. Potentially the local surface water bodies may have been impacted historically via contaminated surface run off from boat building activities and coal storage. In addition, if the aquifers discharge into the River Ems and/or Emsworth Channel then potentially they could contaminate these water bodies via lateral migration from the site.

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	Aggressive attack	Subsurface building materials Potable water supplies	Low to medium	The Made Ground could potentially contain contaminant concentrations that could adversely impact upon subsurface building materials such as concrete and any new buried services.
Made Ground Off-site Landfill Carbon dioxide and methane	Inhalation of ground gas within current buildings on site. Explosive risk to buildings on site from accumulation of ground gas.	Site users (adults and children) Buildings	Negligible	Given the installation of fully tanked under-croft car parking, there would be no viable exposure pathways into the buildings.

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5. Investigation Methodology

5.1. Clearance of Underground Services

Prior to the intrusive ground investigation works were undertaken, Opus surveyed in the exploratory hole locations using plans provided by the client. The statutory utility plans were made available and were reviewed prior to marking out the exploratory hole locations and remained on site for the duration of the works for reference.

A Cable Avoidance Tool (CAT) and Genny were used by Opus to scan each working area prior to a 1.2m deep inspection pit being excavated with hand tools for the windowless sampling holes and cable percussion boreholes.

5.2. Exploratory Holes

The ground investigation comprised the drilling of three cable percussion boreholes (designated BH1 to BH3) and six windowless sample holes (designated WS1 to WS6).

All exploratory holes and sampling strategies were advanced and completed by approved subcontractors under the direct supervision of Opus.

The locations of all exploratory holes were set out by Opus in consultation with the Client are presented on drawing ref. E-E1667.00 Drg 101, a copy of which is included in the Drawings section.

The cable percussion boreholes were advanced using a Dando 4000 Cable Percussive Rig and to a maximum depth of 25.0m begl. On completion, the boreholes were installed with a monitoring well comprising a 50mm HDPE plain pipe with a bentonite seal from existing ground level to 1.0m begl and 50mm HDPE slotted pipe in a gravel surround to depths between 3.0m and 4.0m. The wells were fitted with a stopcock and a lockable cover at ground level to provide protection. All works were completed under the full time supervision of Opus.

The six windowless sample holes were advanced using a tracked drilling rig to depths between 3.0m and 4.00m begl. Window sample holes WS2 and WS6 were completed with similar gas/ groundwater monitoring wells as described above with the remaining holes backfilled with bentonite and the surface reinstated.

Two in-situ super heavy continuous dynamic probes were drilled adjacent to BH2 and through the base of WS6 respectively to a maximum depth of 20.0m begl. This comparative testing was carried out confirm the consistency of the deeper soil deposits below beneath the existing site buildings.

The exploratory holes were logged by Geo-Environmental Engineers from Opus in general accordance with BS EN ISO 14688 'Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description', 2002 (+A1:2013). All soil samples were placed in appropriate laboratory supplied sampling vessels. All chemical samples were dispatched to the laboratory by courier using the cool boxes supplied by the testing laboratory.

In-situ testing comprising SPT testing was carried out in all the window sample and cable percussive boreholes. It should be noted that SPT 'N' values quoted on the borehole logs presented in Appendix 'B' are uncorrected.

Soil samples were placed in containers appropriate for the type of laboratory analysis to be undertaken. All samples were labelled following standard protocols to ensure the site location, borehole location, sample depth, sample type, date and job reference were all clearly identifiable.

Once soil samples were obtained they were stored in cool boxes chilled with ice packs to preserve sample integrity as far as reasonably practicable. Subsequently the samples were transported to the laboratory under QA/QC controlled conditions employing a chain of custody system to ensure sample integrity prior to the laboratory testing.

The exploratory hole logs are presented in Appendices B.

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5.3. Chemical Testing – Soil

As part of the assessment for potential contamination at the site, selected samples were subjected to appropriate soil total and soil leachate chemical analysis. The analyses were carried out at the UKAS / MCERTS accredited laboratory of Concept Life Sciences.

The analyses carried out on selected soil samples is presented in Table 5.1.

Table 5.1: Scheduled Soil Analyses

Analyses	No. of samples
Metals and Metalloids	9
Speciated Phenols	9
Speciated PAH's	9
BTEX & MTBE	9
TPHCWG	9
SVOC's	9
Asbestos Screen	10
BRE SD1 Suite C	1
BRE SD1 Suite F	5
Waste Acceptance Criteria (WAC)	2

The results of the soil chemical analysis are presented in Appendix C.

5.4. Ground Gas and Groundwater Monitoring

Ground gas and groundwater monitoring is beyond the scope of this investigation.

5.5. Geotechnical Laboratory Testing

Representative soil samples were obtained for all soil types encountered. The Opus Engineer scheduled the samples, which were despatched for geotechnical testing at the UKAS accredited laboratory of K4 Soils Limited, for the analysis presented in Table 5.2.

Table 5.2: Scheduled Geotechnical Analyses

Geotechnical Laboratory Test	No. of Tests
Moisture Content, Liquid Limit, Plastic Limit and Plasticity Index	14
Particle Size Distribution Analysis	3
One Dimensional Consolidation Test	2
Quick Undrained Triaxial Test	17
Consolidated Undrained Triaxial Test with PwP Measurement (set of 3)	7

The results the geotechnical laboratory analysis presented in Appendix D.

6. Results of the Investigation

6.1. Ground Conditions

Generally the encountered sub-surface strata correlated with the published BGS Geological Mapping referenced in section 3.2.2. A veneer of Made Ground was encountered across the site overlying superficial Alluvium and Beach and Tidal Flat deposits which are in turn underlain by the Lambeth Group. A summary of the strata encountered in the exploratory holes is detailed below.

The ground conditions described above encountered during the investigation are summarised in Table 6.1 below. Interpretation of the salient points from the investigation data is detailed in the following sections for each particular soil type

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Table 6.1 Summary of Ground Conditions

Material	depth base of Stratum (m)
Made Ground	GL to 3.00
Alluvium (very soft organic Silt)	3.00 to 3.50
Lambeth Group (Medium Strength silty Clay)	2.80 to 4.15
Lambeth Group (High Strength very dense silty clayey Sand)	4.15 to 10.00
Lambeth Group (High Strength very dense silty clayey Sand)	10.0 to 13.0
Lambeth Group (Very High Strength silty Clay)	13.0 to 18.0
Lambeth Group (Very High Strength silty sandy CLAY)	18.0 to 20.6
Lambeth Group (Very dense silty Clayey SAND)* Cemented Sandstone noted from 22.1 to 22.4m)*	20.6 to 22.4
Lambeth Group (High Very High Strength silty CLAY)*	22.4 to 25.0**

*Proven in BH2 only
**Base of deposit not proven.

6.1.1. Made Ground

Made Ground deposits were confirmed in all exploratory hole locations beneath the internal and external ground bearing slabs (internal concrete slab thickness proven between 60mm and 90mm and external slab thickness between 130mm and 250mm). In total the depth of Made Ground was proven to between 1.30m (WS5) and 3.0m (BH2 and BH3).

In general the upper made ground beneath the site is predominantly granular, with occasional thin layers of soft clays. The gravel fraction typically consisting of flint and brick with occasional to frequent clinker deposits.

From 1.50m depth the recovered Made Ground was frequently noted as a very soft brown /light brown very sandy slightly gravelly, clayey organic Silt. The gravel fraction comprising of flint with scattered brick fragments, shell fragments and rare pottery, with a frequent organic odour.

However, the Made Ground deposits confirmed behind the existing harbour wall, along the western boundary of the site in BH1 and BH2 were largely granular soils. The upper 1.50m indicated loose or very loose silty very sandy Gravel with cobbles in BH2. The gravel fraction comprising of red brick fragments and occasional concrete fragments, with cobbles comprising loose brick and occasional full size bricks noted. In BH1 the upper 1.50m confirmed generally loose silty gravelly sand with occasional brick cobble content.

From 1.50m to 2.80m and 3.0m in BH1 and BH2 respectively, an increased silt and clay content was confirmed in the Made Ground, but largely the deposits remained granular, and comprised dark grey or dark brown/light brown clayey silty Sand and Gravel with cobbles or very gravelly silty Sand. The gravel fraction largely comprised of flint with frequent brick fragments with occasional wood fragments and rare pottery. At this depth range the soils were noted to have an organic odour.

In contrast at the south of the site offset from the slipway at BH3, the Made Ground comprised a very soft brown gravelly sandy Clay to a depth of 3.00m, with gravel comprising of flint and brick fragments.

In-situ SPT testing within the Made Ground soils across the site generally ranged between N = 0 and N = 10, with lower SPT N values of 0 – 3 recorded within the deeper very soft silt/clay soils

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6.1.2. Alluvium

Thin layers of very soft consistency dark grey slightly gravelly clayey organic Alluvial Silt was encountered in WS2, WS3, WS4 and WS5. The alluvium ranged in thickness between 0.35m to 0.90m and was encountered to a depth of between 2.2m to 3.5m bgl, and generally exhibited an organic odour. Scattered dark brown peaty psudo-fibrous material and shell fragments were occasionally noted within the alluvium.

6.1.3. Beach and Tidal Flat Deposits

Beach and Tidal Flat deposits were encountered beneath the Made Ground and Alluvium soils in all the exploratory holes and comprised a grey/ light grey sandy Gravel of angular to sub angular fine to medium grained off-white/grey flint. These deposits were encountered at a thickness of between 0.70m and 1.15m to a depth of between 2.80m and 4.15m begl.

In-situ SPT testing within the soil deposits ranged between N = 8 and N = 29, indicating the soils are typically medium density in nature (see Figure 1).

6.1.4. Lambeth Group

The Lambeth Group was encountered underlying the Tidal and Beach Flat deposits in each of three deep boreholes.

An upper thick homogenous silty Clay horizon was initially encountered in each of the boreholes to a depth of 18.5m in BH1 (towards the north of the site) and 15m in BH3 (to the south), and comprised a stiff grey/ brown silty Clay, with thin claystone fragments recovered in the upper near surface of this deposit.

In-situ SPT testing within the cohesive soils increases with depth between N = 9 at 4.0m to N = 38 at 16.0m depth (see Figure 1).

Below the silty Clays a layer of hard silty sandy Clay was confirmed in each of the boreholes. This was proven to 20.6m in BH2 (3.6m thick) whilst the base of this layer was not proven in BH1 and BH3. In-situ testing within the soils was confirmed SPT N values in excess of N = 30 and frequently in excess of N = 50 (i.e. refusal).

Below 20.6m in BH2 a layer of fine grained silty Sand was confirmed to 22.1m depth. The single SPT test carried out at 21.0m within these soils was equal N = 50 (50 blows for 80mm, i.e. refusal), indicating a very dense Sand.

Beneath the Sand layer in BH2 a 300mm thick layer of concreted Sandstone was encountered and recovered as gravel and cobbles of Sandstone with abundant of fine fossil traces (22.10m to 22.40m).

Below the Sandstone layer a hard light grey mottled red brown/ dark grey silty slight sandy Clay was recovered. The single SPT test within this lower clay deposit at 24.5m recorded N = 50 (i.e. refusal).

6.2. Insitu Testing

6.2.1. Standard Penetration Testing (SPT)

Section 5.5 commented on the recorded SPT Testing within each deposit and this summarised in the following Figure 1.

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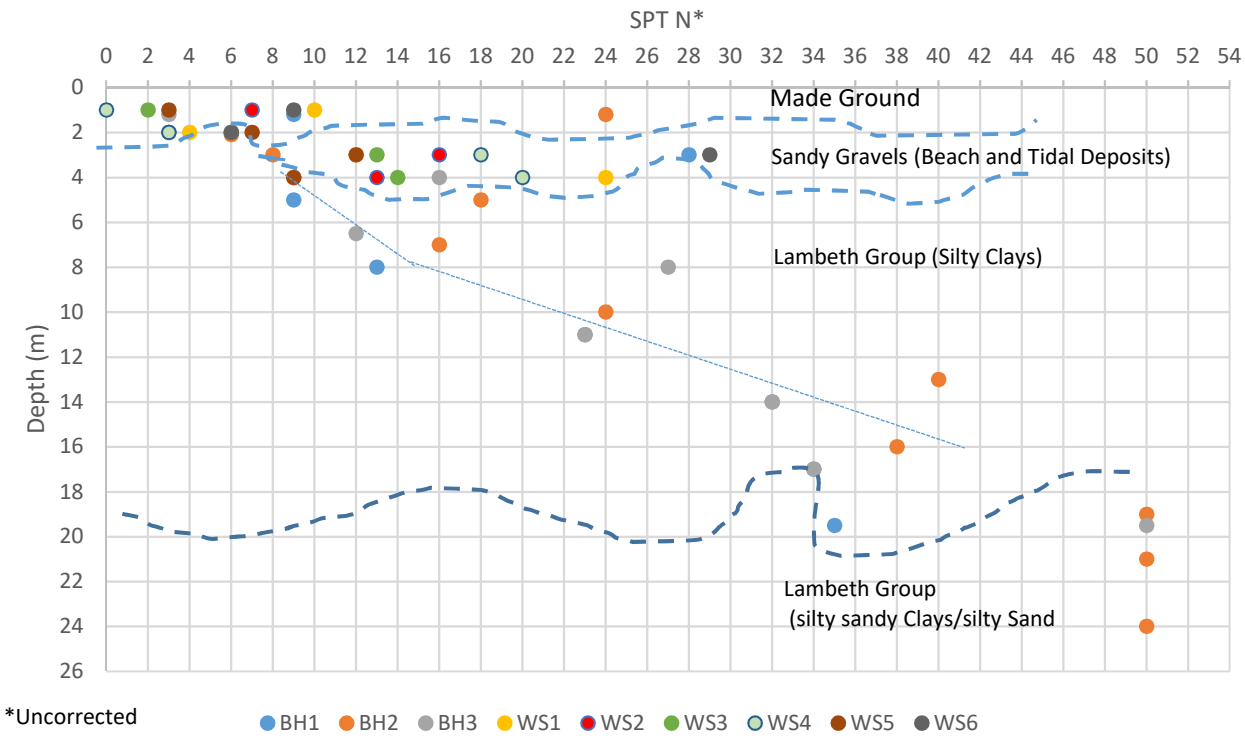
Figure 1. SPT* v Depth



6.2.2. *Dynamic Probing*

Dynamic Probe testing was undertaken in DP1, adjacent to BH2, and also at the north-east corner of the site through the base of WS6. Probing was completed to a refusal depth at 18m in DP1, whilst DP2 reached the scheduled 20m depth. The results are presented in Figure 2.

Figure 2. Dynamic Probe Plot v Depth

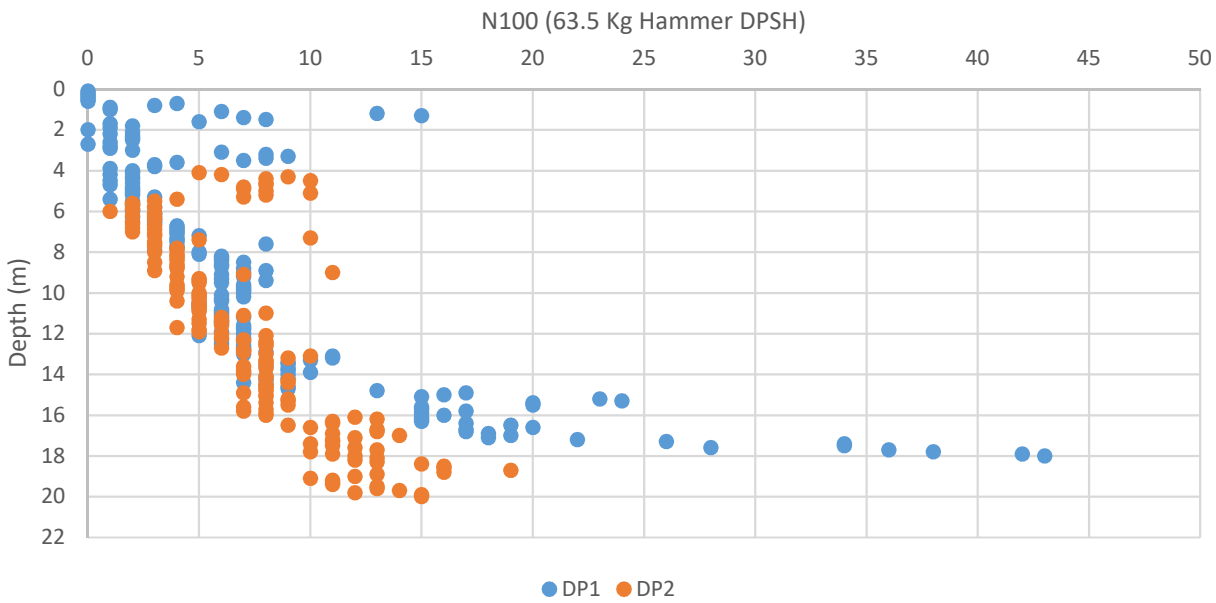


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Figure 2 shows the consistency of the in-situ field data at the south west and north east corners of the site (DP1 and DP2 respectively). Based on the recovered soil data from the deeper boreholes, the plot shown in figure 2 suggests there is consistency of the underlying geology beneath the building areas at the north west of the site.

6.3. Groundwater Observations

Immediately following the drilling of each window sample hole the standing groundwater level was recorded between 1.80m begl and 2.50m begl.

The standing groundwater levels in the borehole monitoring wells post drilling are summarised in Table 6.2.

Table 6.2: Recorded Standing Groundwater Levels Post Installation

Details of Visit	Standing Groundwater Level (m begl)			
	BH1	BH2	BH3	WS1
20/09/2017 0800 hrs (Low water 05:16hrs)	2.11	2.12	2.41	2.30
20/09/2017 1200 hrs (High water 12:10hrs)	1.54	0.67	2.30	1.58

6.3.1. Seepages

During the drilling of the boreholes within the deeper Lambeth Group soils groundwater seepages were recorded in BH1 and BH2 at approximately 6.50m begl and at 8.4m begl in BH3.

6.3.2. Water Strikes

Within BH2 a deep water strike was recorded at the top of the dense Sand layer at 20.6m rising to 15.0m after 20 mins.

Immediate following the drilling of each window sample hole standing groundwater levels were confirmed between 1.80m begl and 2.50m begl.

6.4. Field Observations

A single suspected olfactory suggestion of contamination at the base of the Made Ground in WS3 at 1.35m to 1.60m, which coincided with recovered wood fragments that were noted to have an odour with similarities to wood preservative (Creosote or similar).

7. Chemical Test Results

7.1. Soil

The procedure for assessing the risk to human health entails the initial comparison of results to the Environment Agency Soil Guideline Values (SGV's), DEFRA Category 4 Screening Levels, Opus In-House Tier 1 Screening Values (IHSV's) and Land Quality Management (LQM) & Chartered Institute for Environmental Health (CIEH) 'Suitable 4 Use Levels' (S4UL's) derived using CLEA 1.06 to be protective of human health. If any potentially significant concentrations are recorded, the results are subjected to statistical analysis in accordance with the CL:AIRE and CIEH document entitled 'Guidance on Comparing Soil Contamination with a Critical Concentration', published in May 2008.

TPH CWG, BTEX and VOC analysis cannot be assessed by statistical means due to the samples analysed being targeted and hence not being part of a general screen. Any elevated concentrations detected as a result of the targeted sampling and analysis would skew the statistical analysis and general distribution of the data set giving a false representation of the distribution of TPH CWG and BTEX contamination at the site.

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The proposed end use of the site, which is residential without private gardens, fits the Generic Assessment Criteria end land use scenario 'residential without plant uptake'.

The statistical analysis model as outlined below is only undertaken where exceedances of the Tier I Screening values are identified. Where the objective is to demonstrate 'suitability for use', the Null and Alternative Hypotheses are as follows:

- Null Hypothesis: "Is the true mean concentration more than or equal to that of the critical concentration?"; or,
- Alternative Hypothesis: "Is the true mean concentration less than the critical concentration?"

Eight soil samples were tested for Soil Organic Matter (SOM). The SOM contents have been averaged for each soil type and an assumed SOM for comparison with the most appropriate GAC criteria has been selected as shown in Table 7.2.

Table 7.2: Strata Type and SOM

Soil type	Soil Organic Matter (%)	
	Mean Laboratory Result	Assumed
Made Ground	0.78	1.00
Alluvium	2.30	2.50

7.1.1. Metals

Nine samples of Made Ground were analysed for a standard metals suite. The generic screen identified exceedances of lead in eight of the nine samples, with the maximum reported lead concentration of 1100mg/kg was reported for soil sample BH2/0.5m.

The subsequent statistical analysis of the lead data set within the Made Ground has confirmed the Null Hypothesis, meaning that the true mean concentration is equal or greater than the critical concentration. The assessment has further indicated that the elevated lead concentrations are representative of the Made Ground across the site and not as hot spots of contamination. The generic screen and statistical analysis therefore indicates a potential risk to human health with respect to the identified, elevated lead within the Made Ground.

7.1.2. Speciated PAH's

Nine samples of Made Ground were analysed for the USEPA 16 most carcinogenic PAH congeners. Elevated concentrations were recorded in one of the Made Ground samples as detailed in Table 7.3.

Table 7.3 Exceedances of Screening Analysis for PAH

Determinant	Screening Value (mg/kg)	Elevated Concentration (mg/kg)	Sample Reference	Strata Type
Benzo(a)anthracene	11.0	22.0	WS2/0.20m	Made Ground
Chrysene	30.0	31.0	WS2/0.20m	Made Ground
Benzo(b)fluoranthene	3.90	25.0	WS2/0.20m	Made Ground
Benzo(a)pyrene	3.20	22.0	WS2/0.20m	Made Ground
Dibenz(a,h)anthracene	0.31	0.40, 4.60	BH2/0.50m WS2/0.20m	Made Ground

The subsequent statistical analysis of the Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenz(a,h)anthracene data sets within the Made Ground has confirmed the Null Hypothesis, meaning that the true mean concentration is equal or greater than the critical concentration. The assessment has further indicated that the elevated PAH concentrations represent a hotspot of contamination. The generic screen and statistical analysis therefore indicates a potential risk to human health with respect to the identified, elevated PAH's within the Made Ground. However, the contamination is anticipated to be present within a localised area of the site.

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The source of the elevated PAH contamination could potentially have derived from the ash and clinker observed within exploratory hole WS2 between depths of 0.12m and 0.65m.

7.1.3. Cyanide and Total Phenol

Four samples of Made Ground and two samples of Topsoil were analysed for Cyanide and total Phenol. None of the concentrations were recorded above the lower laboratory detection limit. Hence, no further assessment is considered necessary for Cyanide or Total Phenol with respect to human health.

7.1.4. Speciated TPH, BTEX, MTBE and VOC, SVOC

Nine samples of natural soils (Alluvium) were analysed for speciated TPH, BTEX, MTBE and SVOC. One soil sample was analysed for VOC (WS3/1.5m). These soil samples were targeted to determine if:

1. There was any evidence of contamination migrating beneath the site from the nearby fuel station via the local groundwater table; or,
2. Olfactory evidence of a pungent creosote type odour was noted from pieces of wood contained within the soil arisings located at a depth of 1.35m to 1.60m within exploratory hole WS3. The analysis of soil arisings taken at this depth from other exploratory holes would help to determine if any reported contamination was localised to WS3 or had potentially impacted on the surrounding soil and groundwater.

The results have been compared against the generic assessment criteria for a residential land use without plant uptake to provide an initial assessment of contamination, however it is noted that the soil samples were taken at a depth greater than 1.0m. Thus, if any exceedance is found, then theoretically the only likely pathway is via inhalation of impacted air unless existing site levels were to be significantly reduced for the proposed redevelopment. An SOM of 2.5% has been used in the assessment to reflect the organic matter content reported for the Alluvium samples.

All VOC concentrations were reported below the Laboratory Method Detection Limit (LMDL) for soil sample WS3/1.5m.

Nine soil samples were analysed for TPH and BTEX. All TPH and BTEX concentrations were reported either below the LMDL or the relevant assessment criteria.

Nine soil samples were analysed for SVOCs. All SVOC concentrations were reported below the LMDL with exception of the PAH congeners. Whilst concentrations of PAHs were detected above the LMDL, they were still below the relevant human health criteria.

Hence, the natural alluvial deposits do not appear to have been adversely impacted by organic contamination either where the creosote odour was observed at 1.5mbgl within WS3 or from the fuel station off-site source migrating beneath the site via the local groundwater. Hence, no remedial action is considered necessary for Speciated TPH, BTEX, VOC or SVOC with respect to human health.

7.1.5. Asbestos Screen

Ten samples of Made Ground were analysed for the presence of asbestos. Asbestos was not detected within any of the samples tested. Hence, no further assessment is considered necessary for asbestos with respect to human health with regards to asbestos in soils.

It is noted that no asbestos testing was undertaken for the existing stockpile of demolition rubble on the site. The stockpile of demolition material on site could potentially contain asbestos and therefore, the removal of this material should be managed under the CAR 2012 regulations. It is the duty of the contractor to undertake a suitable risk assessment to determine the appropriate levels of protection which will be required.

7.1.6. Waste Acceptance Criteria

Two soil samples of Made Ground were analysed for Waste Acceptance Criteria (WAC) for the purpose of facilitating the disposal of Made Ground spoil from the site once the ground works phase of the redevelopment commences. The results of the WAC analysis indicate that the Made Ground is likely to be accepted at an

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inert landfill site, however it is noted that chloride and total dissolved solids did slightly exceed the inert allowable limit for soil sample WS4/0.60m. The WAC results, general soil laboratory results and physical description of the soils and European Waste Code should be forwarded to the selected landfill operator so that they can make an informed decision on whether or not the spoil from site can be accepted as inert waste.

8. ENGINEERING PROPERTIES OF MATERIALS

This section outlines the selection of representative geotechnical soil parameters. The parameters are based on the sample descriptions, in-situ testing, laboratory test results from the site investigation and empirical data.

8.1. Plasticity Index and Moisture Content Testing

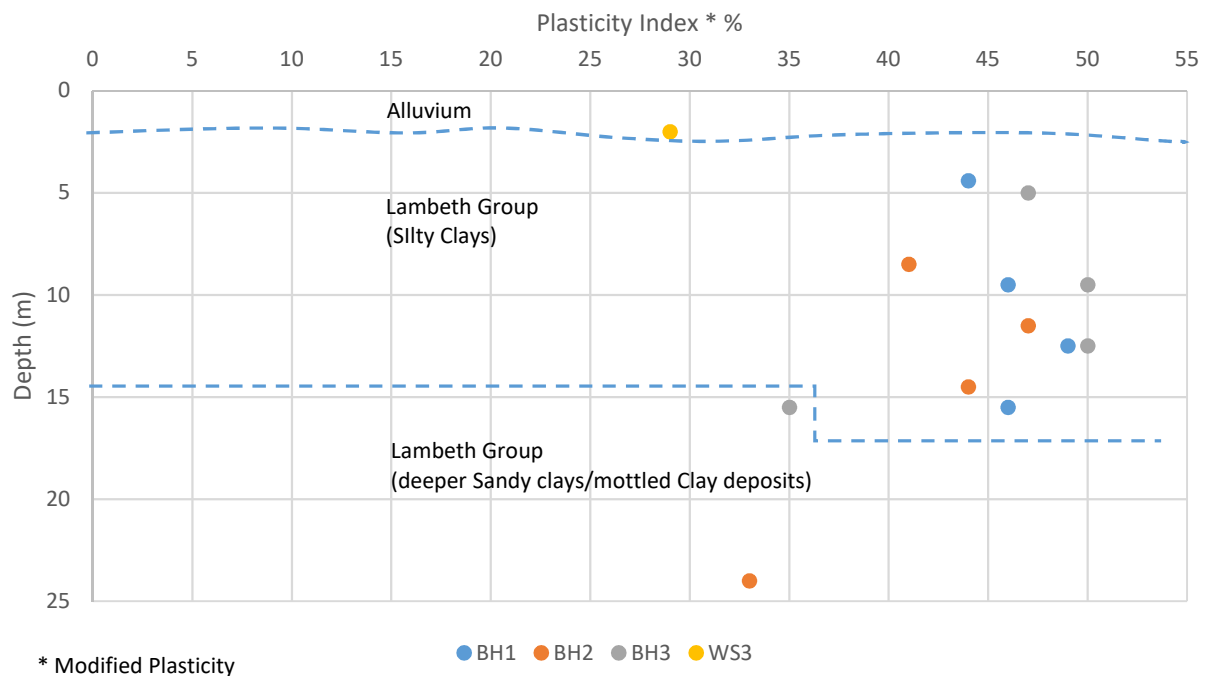
The results from the 14No. Plasticity Index tests and soil moisture content determinations for the strata encountered on site have recorded the following ranges:

Moisture Content	64% (Alluvium)
	21% to 30% (Lambeth Group)
Modified Plasticity Index	29% (Alluvium)
	33% to 50% (Lambeth Group)
Liquid limit	54 – 80% (Alluvium and Lambeth Group)
Plastic Limit	35% (Alluvium)
	21% to 31% (Lambeth Group)

The results have shown the single test within the shallow cohesive alluvial deposits as having Medium Volume Change potential whilst the deep Lambeth Group Clays are frequently in excess of 40% Modified Soil Plasticity and thus considered to have high plasticity and high volume change potential.

The results of the soil plasticity Index testing is presented in Figure 3 below.

Figure 3. Plot of Soil Plasticity Index* v Depth



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8.2. Particle Size Distribution

The results from the 3no. Particle Size Distribution (PSD) analysis broadly correlate with field descriptions.

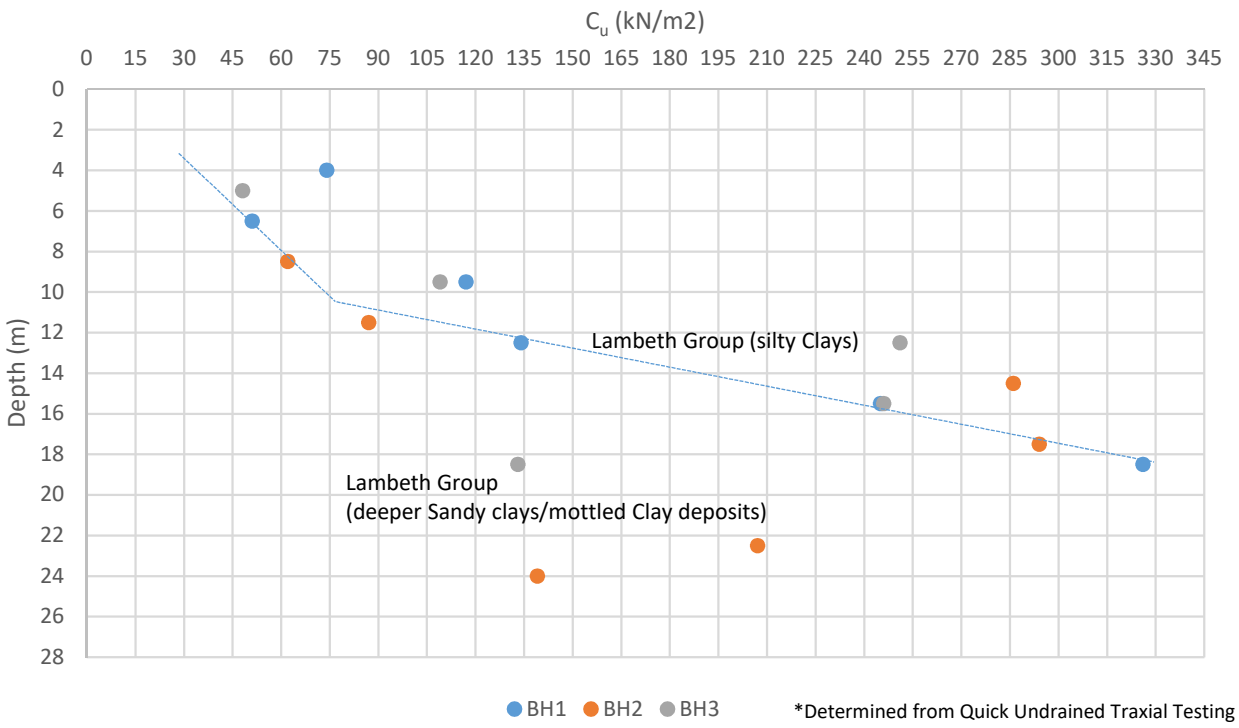
2No. tests were carried out on recovered bulk disturbed samples from the Beach and Tidal Flat Deposits from BH2 and BH3 at 3.00m and 4.00m depth respectively. The testing confirmed these soils as a sandy Gravel soil or silty/ clayey slightly sandy Gravel.

A further single test was carried out on a deeper recovered soil sample from BH2 at 20.50m depth. The testing confirmed the soils fine grained silty clayey Sand matrix.

8.3. Quick Undrained Triaxial Testing

Single stage quick undrained triaxial compression tests were undertaken on seventeen (17no.) undisturbed soil samples recovered from the cohesive Lambeth Group Formation. Sample depths ranged between 4.00m to 24.00mbgl and their undrained cohesion values generally increase with depth between 48kN/m^2 and 326kN/m^2. These results are graphically depicted in the strength v depth plot of shown in the Figure 4 below:

Figure 4 Undrained Shear Strength* v Depth



The trend line depicted in Figure 3 shows that within the homogeneous cohesive silty Clay soils of the Lambeth Group, the soils are described as having medium strength between depths of 4.0m to 10.0m (45kN/m^2 to 75kN/m^2), increasing to high strength between 10m to 12m depth (75kN/m^2 to 150kN/m^2) and very high strength from 12.0m to 18.0m depth (150kN/m^2 – 300KN/m^2).

8.4. Consolidated Undrained Triaxial with Porewater Pressure Measurement

Effective stress assessment of cohesive Lambeth Group soils along the length of the proposed harbour retaining wall was undertaken on 7No recovered undisturbed soils between a depth of 4.0m and 15.50m depth from BH1 to BH3. A set of three sub-samples were taken by the laboratory and tested at different cell pressures to allow assessment of the soils effective shear strength parameters (c' and φ'). The determined parameters from scheduled testing is presented in Figure 5 below.

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Figure 5. Laboratory Determined Effective Stress (Soil Strength) Parameters

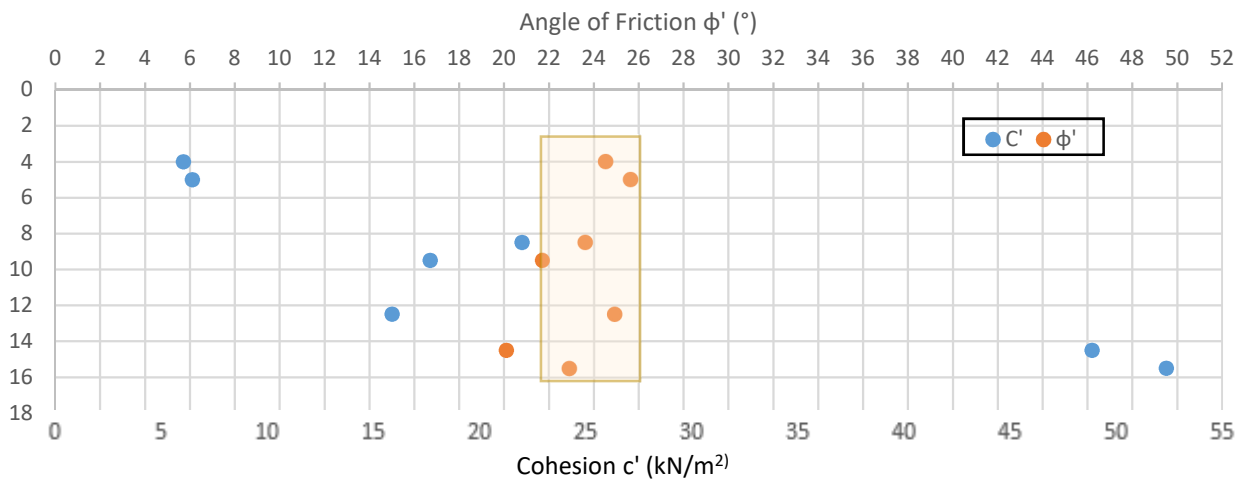

Figure 5 shows the consistency in the result for the effective angle of friction determined for the high to very high strength Clay soils. The highlighted area on figure 5 shows typical values for ϕ′ ranging between 22° to 26°. This result is comparable when the parameter is derived from determined soil plasticity index values (assume 46%, Figure 3) which gives a slightly more conservative value of the order of 21° (BS8002, 2015).

The effective cohesion is more variable with notably lower c' = 5kN/m^2 for the upper clay soils (4-6m depth) and recorded higher c' = (45-50kN/m^2) for the deeper hard clay deposits. It can be expected that the value of c' mobilised along the failure surface behind and in front of a wall will be much smaller than the values derived from laboratory analysis due to remoulding. (Ciria, 2017). Some apparent cohesion is expected within these over-consolidated soils in the drained long term condition and lower bound values of c' in the order of 0 to 5 kN/m^2 is considered to be appropriate.

8.5. One Dimensional Consolidation Testing

2No. one dimensional consolidation testing was carried out on undisturbed samples recovered from BH1 and BH3, at a depth 4.00m and 5.00m respectively from the upper cohesive Lambeth Group clay soils.

The recorded coefficient of volume change compressibility (m_v) against the applied stress ranges in the Oedometer is presented in the Figure 5 below.

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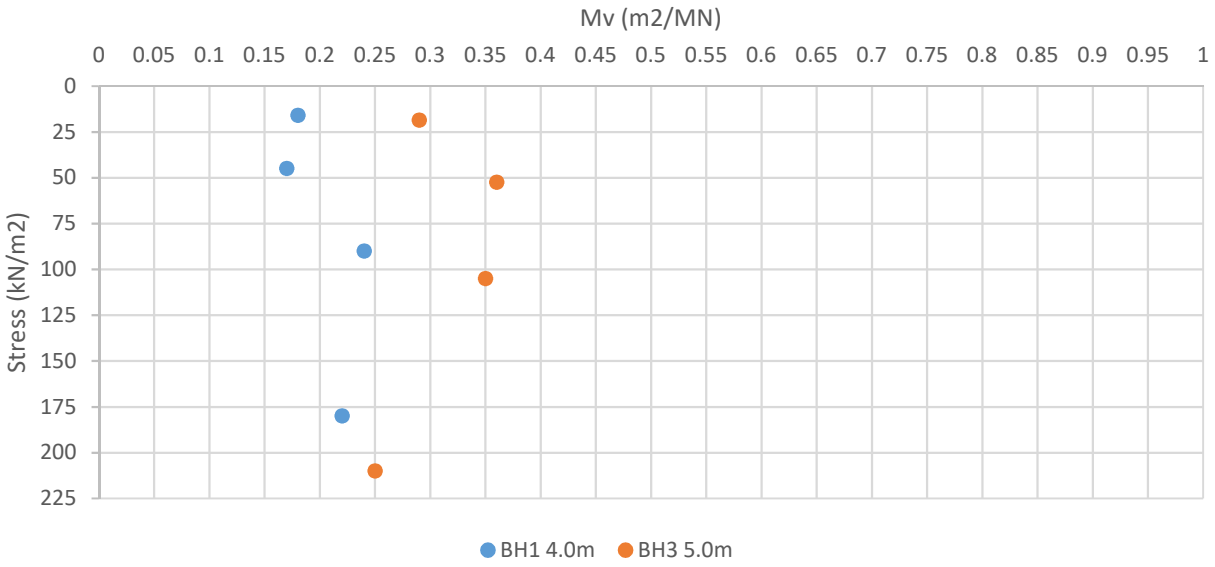
Figure 6 Coefficient of Volume Change Compressibility (m_v) v Stress*



*Midpoint of stress range on Odometer

The m_v values recorded are considered typical for weathered over-consolidated soil (typically ranging between 0.10-0.30m^2/MN) with a medium compressibility.

The geotechnical assessment and recommendations relating to the above results are included within Section 8 of this report.

8.6. Aggressivity Testing

The aggressive chemical environment to concrete has been assessed by testing selected Made Ground and natural soils from across the site for appropriate determinants. The following range of values were recorded.

Made Ground Soils (9 No. samples between 0.2m and 1.6m depth)	
(Water Soluble) Sulphate	<0.01 to 0.26g/l
pH	7.8 to 9.3
Natural Soils (6 No. samples between 2.0m and 15.0m depth)	
Total Sulphate	0.27 to 0.72%
Total Sulphur	0.35 to 1.40%
pH	7.6 to 8.5
(Water soluble) Magnesium	14 to 40 mg/l
Chloride (2:1)	41 to 680 mg/l
Nitrate (2:1)	<1.0 to 8.3 mg/l
Water Soluble Sulphate	0.11 to 0.53 g/l

The results of the geotechnical testing for pH and sulphate carried out during this investigation are included alongside the chemical testing data in Appendix C. All other geotechnical laboratory are presented in Appendix D.

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8.7. Summary of Geotechnical Soil and Rock Parameters

The recommended geotechnical parameters for the soil deposits that may be encountered underlying the area of investigation are presented in Table 8.1. The soil parameters have been derived from a consideration of each material's physical properties (from laboratory testing), relative density (based upon SPT N information), or on soil strength (based upon Triaxial testing of the more cohesive soils) as described in Section 6.

Table 8.1: Preliminary Design Soil Parameters

Depth (m bgl)	Strata	Unit Weight (kN/m^3)	Typical SPT N value	Undrained Cohesion c_u (kN/m^2)	Peak effective Angle of Shearing Resistance $\varphi'_{pk,k}$ (°)	Effective Cohesion c' (kN/m^2)	Elastic Modulus E' (MPa)
GL to 3.00	Made Ground	16	-	-	-	-	-
3.00 to 3.50	Alluvium (very soft organic Silt)	16	2 – 6	<10 - 20	-	-	4
2.80 to 5.00	Medium Dense sandy Gravels (Beach and Tidal Flat Deposits)	19	8 - 29	-	35	-	20
4.15 to 10.00	Lambeth Group (Medium Strength silty Clay)	19	9 - 22	45-75*	22 - 26	0-5	15
10.00 to 13.00	Lambeth Group (High Strength very dense silty clayey Sand)	19.5	22 - 30	75-150*			25
13.00 to 18.00	Lambeth Group (Very High Strength silty Clay)	20	30 - 44	150-300*			40

** Strength increasing with depth through the deposit over this range*

Drained Shear Strength Parameters - The SPT N results have been used to provide an estimate the internal friction angle of the Beach and Tidal Flat Deposits.

9. Environmental Assessment

9.1. Soil

Elevated levels of lead and some PAH congeners have been identified within the near surface Made Ground samples on site. The lead concentrations are considered to be representative of all of the Made Ground on site.

The elevated PAH concentrations identified are considered to represent a hotspot of contamination associated with exploratory hole WS2/0.2m. Exploratory hole WS2 was located towards the site's northern boundary and would be situated beneath the proposed houses.

It is the opinion of Opus that both the lead and PAH exceedance's are unlikely to pose a risk to future site users based on the properties being situated over undercroft car parking. Thus the risk of direct contact occurring between future site residents and contaminated soils is considered negligible.

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However, the proposed redevelopment does include two strips of soft landscaping and these areas will require some remediation to ensure that future site residents are not at risk of coming into direct contact with contaminated soils.

9.2. Gas

Gas monitoring was beyond the scope of the ground investigation, given that there will not be any viable exposure pathways for ground gas to ingress into the buildings, due to the proposed presence of a fully tanked and sealed under croft car park below each plot which will mitigate ingress into the buildings. If these plans alter, further assessment of the ground gas regime and the risks posed to the further development would need to be undertaken.

9.3. Updated Conceptual Site Model

The updated Conceptual Site Model is based on the information obtained from the intrusive investigation to date as detailed in Table 9.1 below.

Table 9.1 Updated Source Pathway-Receptor Relationships

Source Material/Activity	Potential Contaminant	Pathways	Receptor	Risk	Further Investigation Recommended
Ground Gas					
Alluvium	Carbon Dioxide and Methane	Inhalation (indoor air)	Future residents	Negligible	No. The presence of a fully tanked under croft car park below each plot will protect against any ground gas ingress into the buildings.
Soil					
Made Ground	Lead	Ingestion, inhalation (contaminated dust), dermal contact.	Future residents Construction Workers, Maintenance Workers	Low to medium within areas of proposed soft landscaping	Yes (remediation)
Made Ground (localised on site)	PAH's	Ingestion, inhalation (contaminated dust), dermal contact.	Future residents Construction Workers, Maintenance Workers	Low to negligible	Yes (remediation)
Made Ground (localised on site)	PAH's	Direct contact	Plastic Water Supply Pipes	Low	Contact water supply company for requirements

Opus did not undertake the assessment of the stockpile onsite with regards to asbestos, therefore it is recommended that prior to any removal or physical works involving this material, it is sampled and analysed for the presence of asbestos.

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9.4. Health & Safety

During the construction of the development, a high standard of health and safety awareness should be maintained in order to protect construction workers from exposure to potentially contaminated soil. It is therefore recommended that the appropriate precautions given in Health and Safety Executive Report HS(G)66 'Protection of workers and the general public during the redevelopment of contaminated land' are adopted.

It is our judgement that The Construction Design and Management (CDM) Regulations 2015 will apply to this project. As a designer, we have a responsibility to inform you of your duties to which you are subject by virtue of the Regulations as specified in regulation 9 (1).

We therefore draw your attention to the CDM Regulations 2015 and the Approved Codes of Practice contained therein.

The following basic health and safety measures should be adopted as a minimum during the site development works:

- Basic Personal Protective Equipment (PPE) including hard hats, gloves, coveralls and steel toe-capped boots to be worn at all times;
- Eating, drinking and smoking to be forbidden at all times except in designated mess areas; and,
- Breathing equipment to be available for those working in confined or unventilated spaces.

If ground conditions should differ significantly from those encountered during the intrusive investigation, including the discovery of any visible or odorous contamination, site redevelopment works should be suspended until the suspect material has been inspected and assessed by a competent Geo-Environmental Engineer.

9.5. Disposal and Re-use of Soil

The reuse of Made Ground as engineered fill should be undertaken in accordance with an appropriate Environment Agency licence as defined in the statutory guidance on the 'Definition of Waste' or CL:AIRE Code of Practice.

The WAC analysis undertake to date for the Made Ground material indicates that the Made Ground could be disposed of to a licensed inert landfill. However, it is recommended that the WAC laboratory certificates and the general soil laboratory results are provided to the selected landfill operator so that they can make an informed decision as to whether or not they can accept the waste.

9.6. Liaison with Regulators

It is recommended that this report be submitted to the Local Authority Environmental Health Officer for review and comment prior to any irrevocable action taking place.

9.7. Water Supply Pipes

If new water service pipes are required for the proposed development it is recommended that the water supply utility company is contacted for confirmation of pipe type prior to any construction work commencing on the site.

The use of recycled aggregate material made from road planning's should be avoided for backfilling around services.

9.8. Environmental Protection

The following environmental protection measures should be adopted as a minimum during the site redevelopment works:

- Covering and dampening of spoil to prevent the spread of dust;

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- Made Ground and natural soils should be stockpiled separately to avoid cross-contamination of material that may be retained on site or for waste disposal purposes;
- Containment of surface water runoff to prevent the pollution of surface water drains, sewers etc.; and,
- Cleaning and washing of boots, vehicle wheels and other equipment at site entry and exit points to prevent the spread of mud.

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10. Geotechnical Assessment

This section of the report presents the geotechnical issues to be considered at the development site in light of the proposed end use, and puts forward possible solutions that could be considered for foundations and retaining systems.

The following discussion explores suitable geotechnical solutions for the proposed development. However, detailed design, which is outside the scope of this report, will be required to demonstrate the adequacy of the chosen solutions, the performance of which should be fully warranted to satisfy the Client's requirements. The findings of the site investigations and the geotechnical interpretation of those findings in this report is intended to assist in developing a viable ground and/ or deep foundation solution(s) for the proposed development.

10.1. Geotechnical Issues

The most economic foundation solution for the proposed development will need to take account of a number of factors which could affect the economic viability and constructability of different foundation and retaining wall solutions. This assessment is based on the planning drawings provided to Opus (site layout Plans drawing No. 27958-PD103 revision K/PDP Architecture) which shows the proposed residential accommodation, which includes the construction of six residential properties; two three storey detached properties to the South of the site on the waterfront (plots 1 & 2), and four three storey terraced properties to the North of the site (plots 3 to 6). The following geotechnical issues are considered to exist across the proposed development site.

- Overcoming deeper worked ground behind the existing harbour defences and below the existing site buildings.
- Overcoming a shallow consolidating layer (Alluvium) below the Made Ground proven to 3.5m depth.
- Shallow perched ground water levels which are also effected by tidal movements.
- Water strikes within the Lambeth Group soils

10.2. Foundation Design

The following discussion of foundation options should be regarded as preliminary and subject to review as and once the detail of the intended development, associated foundation loadings and final site levels are known.

10.2.1. Initial Foundation Considerations

Ground conditions encountered within the investigation have indicated that a thin veneer of Made Ground soil across the site both immediately behind the existing harbour wall and beneath/ around the existing site buildings. These deposits include both loose granular soils (notably within upper layers) and soft cohesive soils proven to a depth of 3.0m. Additionally a 0.90m thick compressible natural organic alluvial Silt (Alluvium) layer is frequently noted beneath the site, and confirmed to a depth of 3.5m.

As a result of the depth to the base of the Made Ground, deepening of the foundations would be required below economical levels for traditional shallow foundations, and therefore the construction of (deep) spread or pad foundations are not considered to be a viable option for the proposed structures. In addition high perched groundwater were encountered at a depth of 1m in BH2 (with likely tidal influence of change in levels).

Subsequently at this stage we recommend a piled option to be the most suitable foundation solution to support the wall/ column loads from the proposed structures.

A piled wall would also be the most viable option for the new harbour/ flood protection structure along the western and southern boundaries of the site.

10.2.2. Piled Foundations

Cohesive Lambeth Group deposits were encountered beneath the Made Ground, Alluvium and Beach/Tidal Flat deposits in each of the deep boreholes. The clay is described as high to very high strength, and very stiff between 4.15m to 15.0m, and then becoming a hard silty sandy Clay to a depth of 20m. When comparing the continuous dynamic probe plots presented in Figure 2, the consistency of the field data at the south west and north east corners of the site (i.e. DP1 and DP2) provides confidence that a similar underlying geological profile also exists beneath the building areas at the north west of the site.

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Depending on foundation load conditions, choice of pile type and diameter it would be feasible given the size of the development that these should be designed to embed into the aforementioned clays soils.

The following assumptions should be considered for design of the deep piled foundations:

- Pile shaft friction should be ignored within the Made Ground and Alluvium deposits.
- A bearing capacity factor of 9.0 and adhesion factor in the order of 0.20 for the Lambeth Group Clays.

Final designs for the foundations should be carried out by a suitable qualified engineer based on the findings of this investigation and any further investigation works and with reference to the anticipated loadings and serviceability requirements for the proposed structure. This includes temporary and permanent works design for the embedded retaining harbour wall, including the anticipated soil and hydrostatic pressures acting on the wall. The designer should assess whether drained, undrained or a mixture of both conditions exist for the permanent works and apply appropriately for the design.

Although not recorded until a depth of in excess of 20m, the Lambeth Group is typical known for its state of heterogeneity and this is observed by the deeper water strike, sand lenses, variation in soil strength and localised cemented Sandstone. The groundwater strike observed in BH2 during the site drilling works indicate groundwater pressure at depth and this should be taken account of within the pile design, as it is possible that this deeper water bearing horizon will be encountered.

10.2.3. Ground Floor Slab Design

Due to the depth of the made ground, a suspended floor slab will be required for a proposed ground floor slab arrangement.

Final designs for the floor slabs should be carried out by a suitably qualified Engineer based on the findings of this investigation and with reference to the anticipated loadings and serviceability requirements for the proposed structure.

10.2.4. Buried Concrete

The results of the pH, water soluble sulphate, total sulphate and total sulphur analysis have been assessed for potential aggression to buried concrete in accordance with the Building Research Establishment: Special Digest 1: 2005 – Concrete in Aggressive Ground. With reference to the desk study review findings, we consider that the site can be classified as a 'Brownfield site'.

In accordance with Part C of BRE Special Digest 1:2005, based on the testing carried out to date within made ground we consider that the materials underlying the site are initially assigned a Design Sulphate Class DS-1 and an ACEC (Aggressive Chemical Environment for Concrete) Class AC-1.

For the natural ground we consider that the materials underlying the site are initially assigned a Design Sulphate Class DS-2 and an ACEC (Aggressive Chemical Environment for Concrete) Class AC-2 (based on water soluble sulphate and pH levels).

With the natural ground samples it is also evident for each individual natural sample tested (6No.) the amount of calculated Oxidisable Sulfides (as % SO_4) is in excess of 0.3% and therefore considered to contain pyrite. With Total Potential Sulphate (%) equal to or in excess of 2.4% in 4 out of the 6No samples tested a much higher design sulphate class would be expected to be assigned (i.e. DS-5).

The concrete classification assumes the high potential sulphate results recorded within the laboratory analysis of the Lambeth Group Deposits (i.e. the Pyrite bearing soils) are unlikely to be exposed to ground which has been disturbed to the extent that contained pyrite might oxidise and the resultant sulphate ions reach the concrete (the only form of construction and ground disturbance which is considered to be in these deeper deposits is the piles). If for some reason other deep constructions activities are needed into these deposits then the concrete classification would require review.

The specific concrete mixes for the Design Concrete Class (DCC) to be used on site will be determined by the site specific concrete requirements in terms of the required durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM), detailed in Part 2 with further guidance in Parts 3 and 4 of BRE Special Digest 1.

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10.2.5. Soakaways/ Drainage

Given the depth and extent of Made Ground in the development area and high perched groundwater table, it is considered that soakaways are unlikely to comprise a viable means of surface water drainage over much of the site area and an alternative method to discharge should be sought.

10.3. Design Recommendations

Any design recommendations made within this report are considered the most appropriate considering a number of factors including investigation findings, financial and safety implications. All design recommendations are considered to be achievable within a safe system of work. During construction due consideration should be taken in relation to the safety implications inherent in the chosen construction method.

Any design recommendations suggested within this report should be carried out in line with current best practice and regulatory requirements. We consider that the contractor carrying out any recommendations contained within this report will be aware of the standard construction processes involved and have detailed knowledge of the relevant health and safety measures.

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11. Recommendations

The following further works have been recommended prior to the development of the site:

- Finalisation of geotechnical designs for the proposed development with reference to a finalised planning layout, the magnitude of imposed structural loadings for the foundations and harbour wall, and following consultation with a design engineer;
- Submission of this report to the Local Authority Environmental Health Officer for review and comment prior to any irrevocable action taking place;
- Confirmation of the water supply pipe specification with the appropriate authorities prior to construction;
- Completion of a remediation strategy to mitigate against the risk of future site users coming into contact with lead contaminated soil.
- Vigilance should be observed during the groundworks and demolition phases for any potentially contaminated or other unsuitable material not identified during the ground investigation, which should be excluded from any earthworks operations. Further Waste Acceptance Criteria testing should be carried out on any unsuitable material to be removed from site.

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12. References

BGS. (1998). *Solid and Drift Map 1:50 000 Sheet 316 Fareham.*
BS8002. (2015). *Code of Practice for Earth Retaining Stuctures.*
Ciria. (2017). *Guidance on Embedded Retaining Wall Design.*

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Drawings

PRELIMINARY

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Revision	Amendment	Approved	Date
P1	PRELIMINARY ISSUE	DC	22.09.17

OPUS
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Modulus House,
Salterns Lane, Fareham
Hampshire PO16 0QS

Approved	Approved Date
DC	SEPT 2017

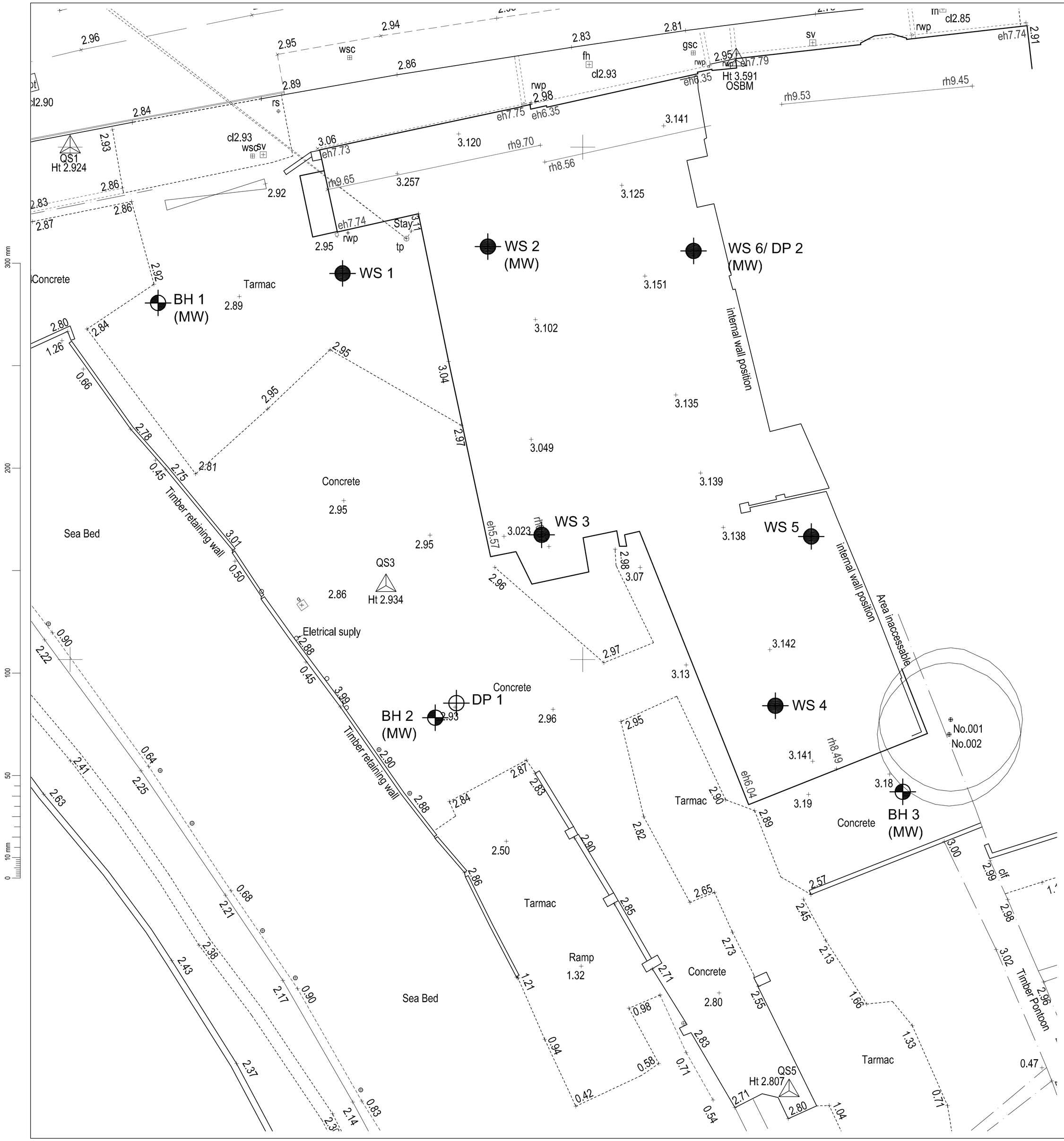
Drawn	Scales
JEN	NTS

Project
DOLPHIN QUAY
EMSWORTH

Sheet
SITE LOCATION PLAN

Project No.	Sheet. No.	Revision
FA E-E1667.00	100	P1

Original Sheet Size A4 [210x297] Plot Date 2017-09-22 at 2:05:37 PM Path N:\Projects\EE1600-EE1699\EE1667\04 CAD\Current Working Drawings\FA E-E1667.00 100.dwg 100



NOTES

1. This drawing is to be read in conjunction with all other Opus International consultants (UK) ltd drawings, and any other relevant information.
2. No dimensions are to be scaled from this drawing, but must be taken from site and / or the details.
3. Unless noted otherwise all dimensions are in millimeters and all levels are in meters from the site datum.
4. The electronic information from this drawing can not be guaranteed as dimensionally drawn exact. Figured dimensions must be used for setting out and detailing. Opus International consultants (UK) ltd logos and company information must be removed from copies if information is re-used.
5. Please note that these drawings, whilst design drawings, may not be fully accurate dimensionally. Therefore they should be checked against hard copies with notification of discrepancies for confirmation.
6. The Contractor is responsible for the design of all temporary works, and is also responsible for the safe maintenance and stability of the existing buildings at all times.

Revision	Amendment	Approved	Revision Date
P1	Preliminary Issue	DC	22.09.17

Construction Risks	Maintenance/Cleaning Risks	Demolition/Adaption Risks

The table above is provided to assist the Principal Contractor to fulfil his obligations under the Construction (Design & Management) Regulations 2015. It does not include residual risks that a competent Contractor will be aware of nor does it absolve the Principal Contractor of his legal responsibilities.

SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX

DRAWING IN PROGRESS

PLOTTED ON 2017-9-25 AT 11:51 AM

PRELIMINARY

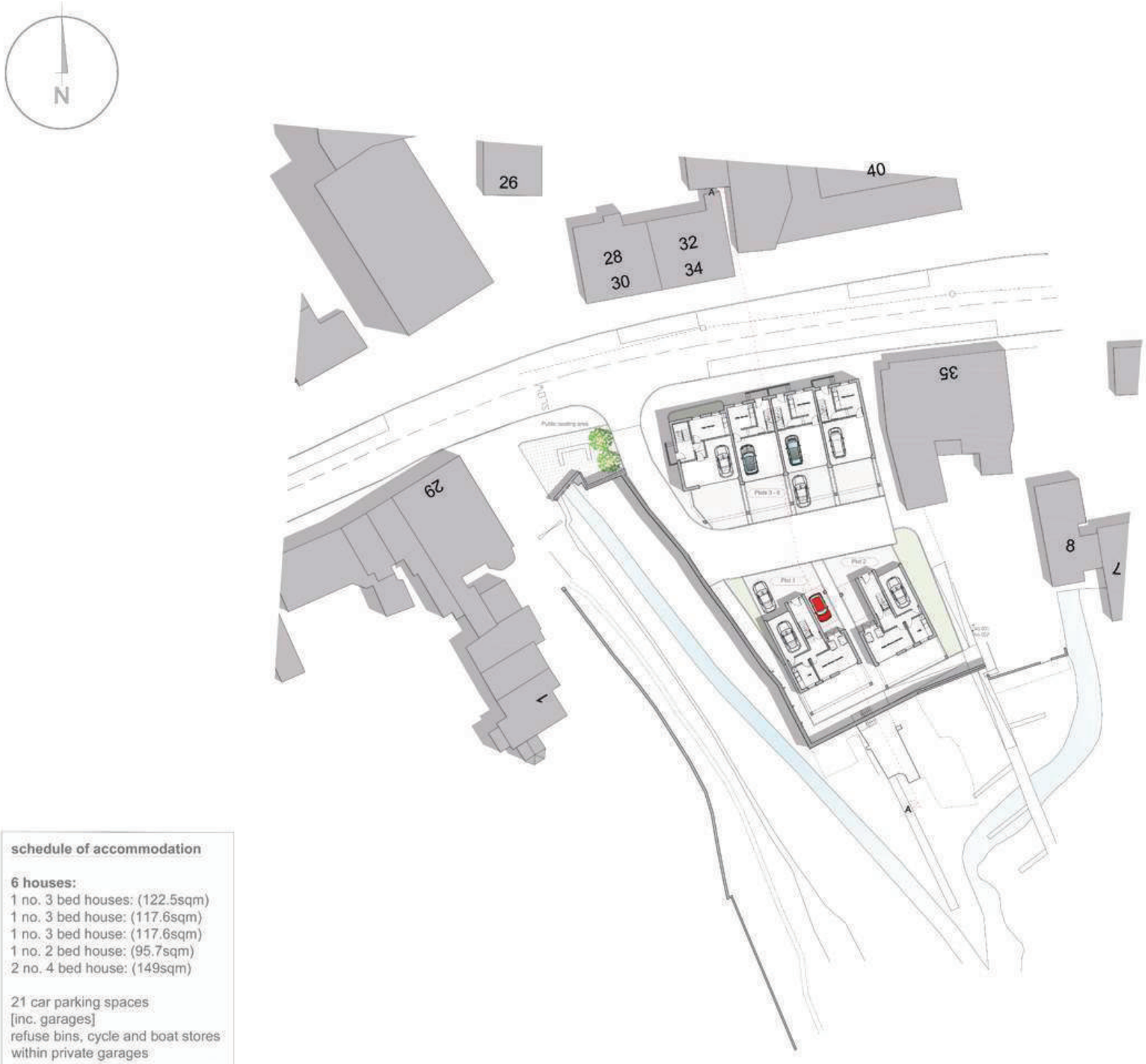
OPUS
Fareham Office
+44 1329 822021
Modulus House,
Salterns Lane, Fareham
Hampshire PO16 0QS

Designed	Approved	Approved Date
DC	DC	SEPT 2017
Drawn	**Scale**	
JEN	1:100	

Project
DOLPHIN QUAY
EMSWORTH

Sheet
EXPLORATORY HOLE LOCATION PLAN

Project No.	Sheet. No.	Revision
FA E-E1667.00	101	P1



schedule of accommodation

6 houses:
1 no. 3 bed houses: (122.5sqm)
1 no. 3 bed house: (117.6sqm)
1 no. 3 bed house: (117.6sqm)
1 no. 2 bed house: (95.7sqm)
2 no. 4 bed house: (149sqm)

21 car parking spaces
[inc. garages]
refuse bins, cycle and boat stores
within private garages

notes

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all dimensions to be checked on site prior to commencement of construction works and the architect notified of any discrepancy.

figured dimensions are to be used in preference to scaled dimensions.

no deviation from this drawing will be permitted without prior consent of the architect.

all drawings are prepared subject to a full measured and structural survey of the buildings and site.

all structural work is subject to the appointment of a structural engineer to confirm and agree the structural proposals.

os promap licence no. 100020449.

health & safety
exceptional risks involving specific methods of construction or exceptional maintenance issues:

NO SIGNIFICANT RISK

scale width 50 mm @ a1 - 25 mm @ a3

revision	notes	date	drawn	checked
A	Revised following comments from Engineer / Environmental Agent	21-10-13	HM	MBW
B	Revised following comments from pre-app	07-01-14	HM	MBW
C	Revised following comments from pre-app	14-02-14	HM	
D	Revised following client comments	04-04-14	HM	
E	Revised following public consultation	02-05-14	HM	
F	Flood defence wall added	08-05-14	HM	
G	Revised following planning application	06-08-14	KHC	HM
H	Revised following client comments	04-09-14	HM	
J	Revised for new application	17-02-16	HM	
K	Revised following pre-application comments	25-04-16	HM	

client

PLANNING

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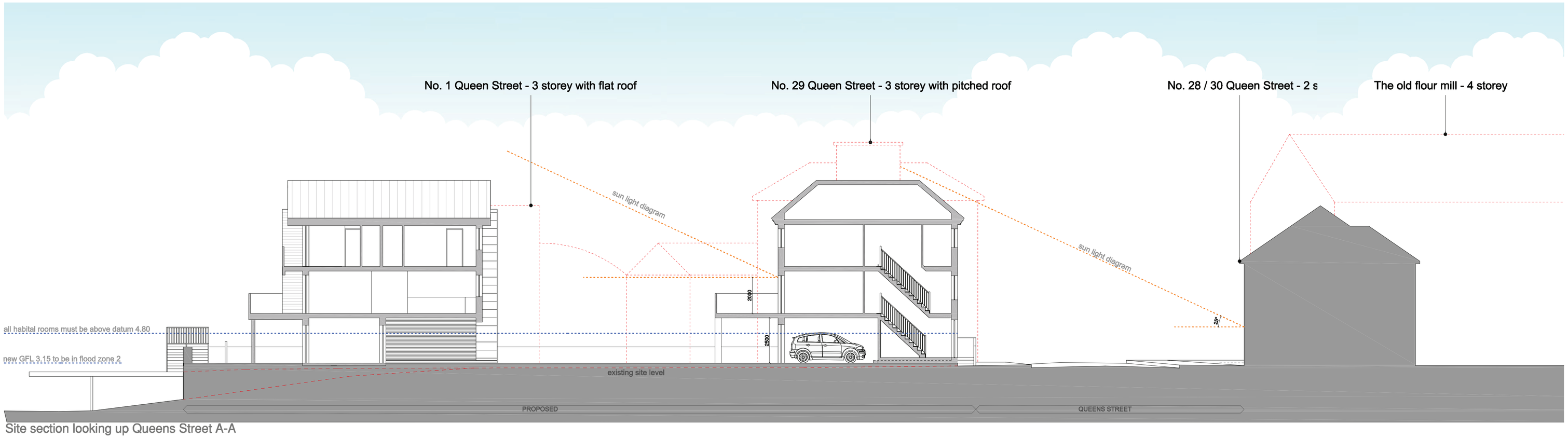
email pdp@pdp-architects.co.uk
www.pdp-architects.co.uk

project: Proposed Development
Dolphin Quay
Emsworth

detail: Site Layout Plan

drawn	checked
HM	MBW
date: March 2013	status: Planning
a1 scale: 1:250 / a3 scale: 1:500	27958-PD103 rev K



Site section looking up Queens Street A-A

notes

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all dimensions to be checked on site prior to commencement of construction works and the architect notified of any discrepancy.

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os promap licence no. 100020449.

health & safety:
exceptional risks involving specific methods of consruction or exceptional maintenance issues:

NO SIGNIFICANT RISK

scale width 50 mm @ a1 • 25 mm @ a3

revision	notes	date	drawn	checke
A	Revised following pre-app comments	08-04-14	HM	
B	Revised to suit new scheme	12-05-14	HM	

client

PLANNING

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www.pdp-architects.co.uk

project Proposed Development
Dolphin Quay
Emsworth

detail Proposed Site Section A-A

drawn	checked
HM	MBW
date	status
Oct 2013	Planning
a1 scale / a3 scale	rev
1:125 1:250	27958-PD109 B

Appendix A

Selected Site Images

Photograph 1: WS1 GL to 0.7m begl

Photograph 2: WS1 0.7 to 1.0m begl

Photograph 3: WS1 1.0 to 2.0m begl

Photograph 4: WS1 2.0 to 3.0m begl

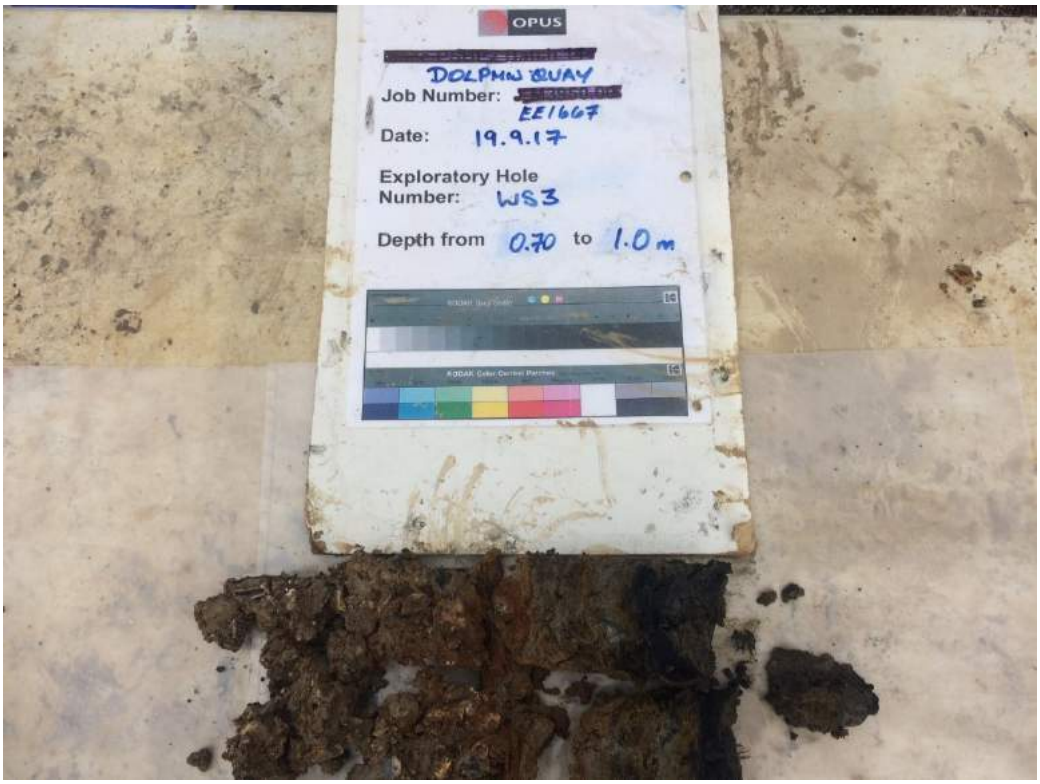
Photograph 5: WS1 3.0 to 4.0m begl

Photograph 6: WS2 GL to 0.7m begl

Photograph 7: WS2 1.0 to 2.0m begl

Photograph 8: WS2 2.0 to 3.0m begl

Photograph 9: WS2 3.0 to 4.0m begl



Photograph 10: WS3 GL to 0.7m begl

Photograph 11: WS3 1.0 to 2.0m begl

Photograph 12: WS2 2.0 to 3.0m begl

Photograph 13: WS3 2.0 to 3.0m begl

Photograph 14: WS4 GL – 1.0m

Photograph 15: WS5 GL – 1.0m

Photograph 16: WS6 GL – 1.0m

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Appendix B

Exploratory Hole Logs

Exploratory Hole ID:	Client:	
BH1	Wilson House Developments Limited	OPUS www.opusinternational.co.uk
Job No: E-E1667.00	Site: Dolphin Quay	Start Date: 15/09/2018 / End Date: 18/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1004E - 1992N	18/09/2017	DC
	Ground Level (mAOD): 2.920	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Tarmac	0.08	2.84		ES34	0.10 - 0.20			
Made Ground: comprising dark grey very gravelly clayey sandy Silt with cobbles. Sand is fine to coarse grained. Gravel is subangular fine to coarse of red brick, occasional slate, clinker. Cobbles of red brick. Occasional to frequent half sized brick. Occasional wood fragments.	0.37	2.55				PID=0.0 ppm		
	0.43	2.49		ES35	0.37 - 0.43			
				B1	0.40 - 0.70			
	1.00	1.92				PID=0.1 ppm		
				ES36	0.50			
Made Ground: comprising gravelly silty Sand. Sand is fine to coarse grained. Gravel is fine of clinker and ash.	1.50	1.42				PID=0.0 ppm		
				ES37	1.00 - 1.20			
Made Ground: comprising light brown/light grey silty gravelly Sand with cobbles. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint. Frequent brick and concrete fragments. Cobbles of concrete fragments.						PID=0.1 ppm		
				B2	1.20			
						N=9(6,5/3,2,2,2) (C)		
				ES38	1.50			
	2.80	0.12				PID=0.0 ppm		
Made Ground: comprising dark grey and dark brown gravelly silty Sand with occasional cobbles. Sand is fine to coarse grained. Gravel is subangular fine to coarse grained of flint with frequent red brick fragments, rare chalk clasts. Slight organic odour.				B3	2.00			
				ES39				
	3.50	-0.58				PID=0.1 ppm		
						N=3(4,2/1,0,1,1) (C)		
Dark brown/brown/light brown clayey silty Sand and Gravel with cobbles. Sand is fine to coarse grained. Gravel is subangular fine to coarse grained of flint with frequent red brick fragments, rare chalk clasts. Cobbles of flint. Slight organic odour. Sample recovered as wet. 2.0m. No further odour				B4	2.50 - 2.90			
				B5	3.00			
				ES40				
						PID=0.2 ppm		
						N=28 (5,9/6,7,8,7) (C)		
Medium dense grey/light grey sandy GRAVEL with frequent cobble content. Sand is medium to coarse grained. Gravel is angular to subangular fine to medium of flint. Very slight organic odour. (Beach and Tidal Flat Deposits)				D6	3.50			
				U7	4.00			
				D8	4.40			
				D9	5.00			
						N=9(1,1/2,2,2,3) (S)		
Stiff consistency dark brown/grey brown/grey stiff silty CLAY. Rare medium flint gravel. (Lambeth Group) From 4.40m there is no gravel. From 6.50 to 8.50m occasional claystone fragment.				D10	6.00			
				U11	6.50			
				D12	7.00			
				D13	7.50			
				D14	8.00			
						N=13 (5,4/2,3,3,5) (S)		
				B15	8.30			
				U16	9.50			
				D17	9.80			

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 4.00mbegl, 150mm casing to 9.50mbegl. Reduced at 7.50mbegl. 2. Water added from 2.50m through granular soils. 3. Seepage confirmed at 6.50m sealed at 9.50m. 4. End of shift 15.9 borehole at 5.5m, casing at 4.0m hole dry. Start of shift 18.9 hole dry. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 2

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk	
BH1	Site: Dolphin Quay		
Job No: E-E1667.00		Start Date: 15/09/2018	End Date: 18/09/2017
Drilling Equipment/ Excavation Method: Dando 4000 CP Rig	Co-ords: 1004E - 1992N	Backfill Date: 18/09/2017	Field Records: DC
	Ground Level (mAOD): 2.920	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
				D18	10.50			
				D19	11.00	N=23 (2,4/4,5,7,7) (S)		
				D20	12.00			
				U21	12.50			
				D22	12.80			
				D23	13.50			
				D24	14.00	N=32 (3,5/5,8,9,10) (S)		
				D25	15.00			
				U26	15.50			
				D27	15.95			
				D28	16.50			
				D29	17.00	N=34 (3,4/7,8,9,10) (S)		
				D30	18.00			
Dark brown/grey brown/grey stiff sandy silty CLAY. Sand is fine to medium grained. (Lambeth Group)	18.50	-15.58		U31	18.50			
				D32	18.90			
				D33	19.50	N=35 (3,4/7,8,9,11) (S)		
	20.00	-17.08						

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 4.00mbegl, 150mm casing to 9.50mbegl. Reduced at 7.50mbegl. 2. Water added from 2.50m through granular soils. 3. Seepage confirmed at 6.50m sealed at 9.50m. 4. End of shift 15.9 borehole at 5.5m, casing at 4.0m hole dry. Start of shift 18.9 hole dry. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 2 of 2

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
BH2	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 14/09/2017 / End Date: 15/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1018E - 1972N	15/09/2017	DC
	Ground Level (mAOD): 2.930	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey reinforced CONCRETE. Mesh reinforcement at base of concrete approx 6mm diameter, spacing 200mm centres.	0.13	2.80		ES47	0.20	PID=0.7 ppm		
Made Ground: comprising loose grey silty very sandy Gravel with cobbles. Sand is fine to coarse grained. Gravel is subangular of red brick fragments and occasional concrete fragments. Rare metal fragment. Cobbles of brick. Occasional full sized bricks. Rare glass fragments.	1.50	1.43		B1 ES48 ES49 B2	0.40 - 0.60 0.50 1.00 1.20	PID=0.1 ppm PID=0.0 ppm N=24 (5,6/7,8,6,3) (C)		
Made Ground: comprising dark grey very gravelly sandy Silt or very silty Sand with cobbles. Sand is fine to coarse grained. Gravel is brick and occasional concrete fragments. Frequent rounded to subrounded flint. Rare metal fragment. Slight ashy odour.	2.00	0.93		ES50 B3 ES51	1.60 1.70 - 2.00 2.00	PID=0.3 ppm		
Made Ground: comprising dark grey gravelly very sandy Silt or very silty Sand. Gravel. Sand is fine to coarse grained. Gravel is subangular to rounded fine to coarse of flint. Frequent red brick fragments. Rare pottery fragment. Slight organic odour. Occasional wood fragments.	3.00 3.60	-0.07 -0.67		B4 B5 ES52	2.10 3.00	PID=0.2 ppm N=6(2,1/2,2,1,1) (C)		
Loose grey/light grey silty slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to subangular frequently subrounded of fine to medium, frequently coarse of off-white/grey flint. (Beach and Tidal Flat Deposits)	4.30 4.80	-1.37 -1.87		D6 ES53	3.60	PID=0.1 ppm N=8(4,3/3,1,2,2) (C)		
Soft consistency grey brown gravelly CLAY with cobbles. Gravel is angular to rounded fine to coarse of flint. Cobbles of rounded flint. (Lambeth Group) 4.0m. Stiff consistency				B7 B8 ES54	3.70 - 3.90 4.00	PID=0.1 ppm		
Stiff consistency grey/dark brown silty CLAY. Possible fissuring but not well defined. (Lambeth Group)						N=9(1,0/2,2,2,3) (C)		
Stiff consistency grey/dark brown silty CLAY. Possible fissuring but not well defined. Claystone fragments recovered, probable minor bands. (Lambeth Group) 6.50m Very stiff consistency				D9 D10 B11 D12 B13 D14	4.80 5.00 5.30 - 5.60 6.00 6.50 - 6.90 7.00	N=18 (3,13/8,4,3,3) (S)		
Very stiff consistency grey/dark brown silty CLAY with lenses/laminations of dark grey/black psudo fibrous Lignite. (Lambeth Group)	8.40 8.70	-5.47 -5.77		D15 D16 U17	8.00 8.40 8.50	N=16 (1,2/3,4,4,5) (S)		
Very stiff consistency grey/dark brown silty CLAY. Possible fissuring but not well defined. (Lambeth Group)				D18 D19 D20	8.95 9.50 10.00			

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 5.50mbegl, 150mm casing to 23.0.mbegl. Reduced at 20.60mbegl. 2. Water added from 3.7m through granular soils. 3. Seepage confirmed at 3.0m dried out at 8.50m. 4. Water strike at 20.60m rising to 15.0m. 5. End of shift 14.9 borehole at 20.6m, casing at 20.6m, water at 15.0m. Start of shift 15.9 water at Ground level. 6. Chiselling through hardstratum in made ground 1hr 1.50m to 1.90m and through sandstone 1hr from 22.1m to 22.4m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 3

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk	
BH2	Site: Dolphin Quay		
Job No: E-E1667.00		Start Date: 14/09/2017	End Date: 15/09/2017
Drilling Equipment/ Excavation Method: Dando 4000 CP Rig	Co-ords: 1018E - 1972N	Backfill Date: 15/09/2017	Field Records: DC
	Ground Level (mAOD): 2.930	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
						N=24 (2,4/5,6,6,7) (S)		
				D21	11.00			
				U22	11.50			
				D23	11.85			
12.0m. Hard consistency				ES55				
				D24	12.50			
				D25	13.00	N=40 (4,6/7,9,12,12) (S)		
14.0m. Slightly sandy with scattering of fine light grey silt.				D26	14.00			
				U27	14.50			
				D28	14.85		15.00	
				ES56				
				D29	15.50			
				D30	16.00	N=38 (3,9/9,9,9,11) (S)		
Hard consistency Grey/dark brown sandy silty CLAY. Sand is fine to medium grained. (Lambeth Group)	17.00	-14.07		D31	17.00			
				D32	17.50			
				D33	17.95			
				D34	18.50			
				D35	19.00	N=50 (4,10/15,16,15,4) (S)		
				D36	20.00			

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 5.50mbegl, 150mm casing to 23.0.mbegl. Reduced at 20.60mbegl. 2. Water added from 3.7m through granular soils. 3. Seepage confirmed at 3.0m dried out at 8.50m. 4. Water strike at 20.60m rising to 15.0m. 5. End of shift 14.9 borehole at 20.6m, casing at 20.6m, water at 15.0m. Start of shift 15.9 water at Ground level. 6. Chiselling through hardstratum in made ground 1hr 1.50m to 1.90m and through sandstone 1hr from 22.1m to 22.4m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key
- D - Disturbed Representative
- B - Bulk Representative
- S - Spot Non-Representative
- W - Water
- U - Undisturbed Representative
- J - Jar Sample
- ES - Environmental Sample

Test Type Key
- (C) - Cone SPT
- (S) - Spoon SPT
- P - Pocket Penetrometer Reading
- PID - PID Reading
- V - Hand Shear Vane Reading

Sheet: Sheet 2 of 3

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
BH2	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 14/09/2017 / End Date: 15/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1018E - 1972N	15/09/2017	DC
	Ground Level (mAOD): 2.930	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Very dense dark grey/dark brown silty clayey SAND. Sand is fine to medium grained. (Lambeth Group)	20.60	-17.67		D37	20.50		20.60	
				D38	21.00			
Recovered as gravels and cobbles of grey SANDSTONE. Abundant fine gravel sized tubular fossils (foraminiferid) (Lambeth Group)	22.10	-19.17		D39	22.00			
				D40	22.10			
	22.40	-19.47		U41	22.50			
Driller notes: Stiff grey silty CLAY (Lambeth Group)	22.60	-19.67		D42	22.80			
Hard consistency light grey mottled red brown/purple/ orange brown/dark grey silty slightly sandy CLAY (Lambeth Group)				ES57				
				B43	23.00 - 23.50			
				U44	24.00			
				D45	24.35			
				D46	24.50			
	25.00	-22.07						

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 5.50mbegl, 150mm casing to 23.0.mbegl. Reduced at 20.60mbegl. 2. Water added from 3.7m through granular soils. 3. Seepage confirmed at 3.0m dried out at 8.50m. 4. Water strike at 20.60m rising to 15.0m. 5. End of shift 14.9 borehole at 20.6m, casing at 20.6m, water at 15.0m. Start of shift 15.9 water at Ground level. 6. Chiselling through hardstratum in made ground 1hr 1.50m to 1.90m and through sandstone 1hr from 22.1m to 22.4m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key
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- J - Jar Sample
- ES - Environmental Sample

Test Type Key
- (C) - Cone SPT
- (S) - Spoon SPT
- P - Pocket Penetrometer Reading
- PID - PID Reading
- V - Hand Shear Vane Reading

Sheet: Sheet 3 of 3

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS
BH3	Site: Dolphin Quay	www.opusinternational.co.uk
Job No: E-E1667.00		Start Date: 18/09/2017 / End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1041E - 1969N	19/09/2017	CGJ
	Ground Level (mAOD): 3.180	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Concrete	0.15	3.03						
MADE GROUND: Comprising loose concrete fill	0.20	2.98						
Concrete slab	0.25	2.93		B1	0.40 - 0.70			
MADE GROUND: Comprising light brown silty sandy Gravel. Sand is fine to coarse grained. Gravel is subangular to rounded of chalk and occasional brick fragments.	0.90	2.28		B2	1.20	N=3(1,0/1,1,0,1) (C)		
MADE GROUND: Comprising soft consistency brown silty gravelly sandy Clay. Sand is fine to coarse grained. Gravel is subangular to rounded of brick fragments and flint.				B3	2.10	N=3(1,0/1,0,1,1) (C)		
Medium dense grey/greyish brown sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to subrounded fine to medium of flint. (Beach and Tidal Flat Deposits)	3.00	0.18		B4	3.00	N=16 (1,4/4,5,4,3) (C)		
				B5	3.50			
				B6	4.00			
Stiff consistency grey/greyish brown silty CLAY. (Lambeth Group)	4.15	-0.97				N=5(1,1/1,1,1,2) (C)		
				U7	4.40			
				D8	5.00			
Stiff consistency grey/greyish brown silty CLAY with occasional fragments of Claystone. (Lambeth Group)	6.00	-2.82		B9	6.00 - 6.40			
				D10	6.50	N=12 (2,1/2,3,3,4) (S)		
				D11	7.00			
				D12	7.50			
				D13	8.00			
Stiff consistency grey/greyish brown silty CLAY. (Lambeth Group)	8.40	-5.22		D14	8.30	N=27 (4,3/11,8,5,3) (S)		
				U15	9.50			
				D16	9.80			

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 4.50mbegl, 150mm casing to 10.50mbegl. Reduced at 8.50mbegl. 2. Water added from 3.00m through granular soils. 3.Seepage confirmed at 8.4m dried out at 12.5m. Further seepage at 15.5m and dried out at 16.5m 4.End of shift 18.9 borehole at 3.5m, casing at 3.5m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 3

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
BH3	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 18/09/2017 / End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1041E - 1969N	19/09/2017	CGJ
	Ground Level (mAOD): 3.180	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
				D17	10.50			
				D18	11.00	N=23 (2,3/5,5,6,7) (S)		
				D19	12.00			
				U20	12.50			
				D21	12.80			
				D22	13.50			
				D23	14.00	N=32 (4,6/7,7,8,10) (S)		
				D24	15.00			
Stiff consistency grey/greyish brown silty sandy CLAY. Sand is fine to coarse grained. (Lambeth Group)	15.50	-12.32		U25	15.50			
				D26	15.95			
				D27	16.50			
				D28	17.00	N=34 (3,6/7,7,9,11) (S)		
				D29	18.00			
				U30	18.50			
				D31	18.90			
				D32	19.50			
Driller notes: Dense grey silty SAND + Black rounded	19.70	-16.52						
	20.00	-16.82						

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 4.50mbegl, 150mm casing to 10.50mbegl. Reduced at 8.50mbegl. 2. Water added from 3.00m through granular soils. 3.Seepage confirmed at 8.4m dried out at 12.5m. Further seepage at 15.5m and dried out at 16.5m 4.End of shift 18.9 borehole at 3.5m, casing at 3.5m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
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J - Jar Sample	
ES - Environmental Sample	

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
BH3	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 18/09/2017 / End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando 4000 CP Rig	1041E - 1969N	19/09/2017	CGJ
	Ground Level (mAOD): 3.180	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
pebbles in base of SPT spoon (Lambeth Group)						N=50 (5,8/12,20,18) (S)		

Remarks:

1. Hand excavated from GL to 1.20mbegl. 200mm casing to 4.50mbegl, 150mm casing to 10.50mbegl. Reduced at 8.50mbegl. 2. Water added from 3.00m through granular soils. 3.Seepage confirmed at 8.4m dried out at 12.5m. Further seepage at 15.5m and dried out at 16.5m 4.End of shift 18.9 borehole at 3.5m, casing at 3.5m. 5.Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 6.All SPT (Standard Penetration Test) N value results shown are uncorrected 7. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 3 of 3

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
WS1	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 19/09/2017 / End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1013E - 1994N	19/09/2017	DC
	Ground Level (mAOD): 2.950	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Tarmac				ES	0.10	PID=0.1 ppm		
Made Ground: Comprising dark brown/grey very gravelly very silty Sand with cobbles. Sand is fine to coarse grained. Gravel is subangular fine to coarse of brick and flint. Frequent chalk fragments, ashy fragments and clinker. Cobbles of subangular to rounded flint and occasional brick.	0.20	2.75						
Made Ground: Comprising grey silty slightly sandy Gravel with cobbles. Sand is fine to coarse grained. Gravel is subrounded fine to coarse of flint. Cobbles of subrounded flint.	0.53	2.42		ES	0.60	PID=0.1 ppm		
				ES	1.00	PID=0.1 ppm N=10 (3,2/3,2,3,2) (C)		
1.80m. Brown				ES	1.80 - 2.00		1.90 ▼	
Made Ground: Comprising dark grey/black with occasional light brown/yellow (silt lenses) slightly sandy slightly gravelly clayey organic Silt. Sand is fine to coarse grained. Occasional fine gravel sized psudofibrous peaty fragments. Occasional fine gravel sized wood fragments. Gravel is rounded to subangular of flint. Rare cobbles of flint. Rare pottery fragments and concrete fragments.	2.00	0.95		ES	2.00 - 2.20	N=4(1,1/1,0,1,2) (C) PID=0.0 ppm		
Medium dense grey/brown slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is subangular to angular fine to medium and frequently coarse of flint. (Beach and Tidal Flat Deposits)	2.75	0.20				PID=0.1 ppm N=12 (3,3/3,3,2,4) (C)		
	4.00	-1.05				N=24 (8,8/7,7,6,4) (C)		

Remarks:

1. Borehole cased to 3.0m. 2 Groundwater at 1.90m 3.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 4. Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 5.All SPT (Standard Penetration Test) N value results shown are uncorrected 6. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
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J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 1

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk	
WS2	Site: Dolphin Quay		
Job No: E-E1667.00		Start Date: 19/09/2017	End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1020E - 1995N	19/09/2017	DC
	Ground Level (mAOD): 3.102	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey Concrete	0.05	3.05		ES	0.05 - 0.10			
Made Ground: Comprising light brown silty gravelly Clay with cobbles. Gravel is of rounded to subangular flint and brick. Cobbles of red brick. Occasional clinker fragments.	0.12	2.98		ES	0.20	PID=0.0 ppm PID=0.0 ppm		
Made Ground: Comprising dark brown/grey very gravelly silty clayey Sand with cobbles. Sand is fine to coarse grained. Gravel is of angular to subangular fine to coarse red brick and subangular to rounded flint. Occasional ashy clinker deposits. Occasional cobble sized (oyster?) shells. 0.50m. Becoming very silty Sand and Gravel.	0.65	2.45		ES	0.70	PID=0.0 ppm N=7(2,2/1,2,2,2) (C)		
Made Ground: Comprising grey /light grey/brown silty Sand and Gravel. Sand is fine to coarse grained. Gravel is subangular fine to coarse of flint.	1.45	1.65		ES	1.50	PID=0.1 ppm		
Made Ground: Comprising very soft light brown very sandy very gravelly clayey Silt with cobbles. Sand is fine to coarse grained. Gravel is subrounded to subangular fine to coarse of flint with frequent scattering of red brick fragments.	1.80	1.30		ES	1.80 - 2.00	PID=0.2 ppm N=6(2,2/2,1,1,2) (C)	1.80 ▼	
Made Ground: Comprising dark grey/black with occasional light brown/yellow (silt lenses) sligtly sandy slightly gravelly clayey organic Silt. Sand is fine to coarse grained. Occasional fine gravel sized psudofibrous peaty fragments. Occasional fine gravel sized wood fragments. Gravel is rounded to subangular of flint. Rare cobbles of flint. Occasional off-white shell fragments and frequent red brick fragments. Pungent organic odour.	2.30	0.80		ES	2.50	PID=0.8 ppm		
Soft consistency dark brown mottled dark grey gravelly organic SILT. Gravel is rounded to subrounded fine to coarse of flint. Frequent fine shell fragments. Strong organic odour. Scattered dark brown peaty psudo fibrous material. (Alluvium)	2.75	0.35				N=16 (4,4/3,3,4,6) (C)		
Medium dense grey/brown slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is subangular to angular fine to medium and frequently coarse of flint. (Beach and Tidal Flat Deposits)	4.00	-0.90				N=13 (5,2/3,2,2,6) (C)		

Remarks:

1. Borehole cased to 3.0m. 2 Groundwater at 1.80m. 3.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 4. Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 5.All SPT (Standard Penetration Test) N value results shown are uncorrected 6. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
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W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 1

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
WS3	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 19/09/2017 / End Date: 19/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1023E - 1981N	19/09/2017	DC
	Ground Level (mAOD): 3.023	Logged: DC / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey Concrete	0.09	2.93						
Made Ground: Comprising grey/dark brown/brown very silty clayey gravelly Sand with occasional cobbles. Sand is fine to coarse grained. Gravel is subangular fine to coarse of brick and subangular to subrounded fine to coarse flint. Cobble of subrounded flint. Occasional clinker fragments.	0.55	2.47		ES	0.20	PID=0.0 ppm		
Made Ground: Comprising grey /light grey/brown silty Sand and Gravel. Sand is fine to coarse grained. Gravel is subangular fine to coarse of flint.	0.80	2.22		ES	0.60	PID=0.0 ppm		
Made Ground: Comprising dark grey/grey very sandy organic Silt. Sand is fine to coarse grained with occasional fine to medium grained laminae/lenses and angular to subangular medium flint. Strong organic odour.				ES	1.00	PID=0.1 ppm N=2(0,0/0,0,0,2) (C)		
1.35m - 1.60m. Wood fragments with pungent creosote odour.	1.60	1.42		ES	1.50	PID=0.3 ppm		
Very soft consistency dark grey slightly gravelly organic SILT. Strong organic odour. Frequent fine shells. Gravel is of black subangular flint. (Alluvium)				ES	1.70	PID=5.2 ppm	1.90 ▼	
				D	2.00	N=6(0,0/0,0,2,4) (C)		
Dark grey clayey silty sandy GRAVEL. Sand is fine to coarse grained. Gravel is subangular of flint. Occasional cobble sized subangular flint. Organic odour on clayey deposits. (Beach and Tidal Flat Deposits)	2.40	0.62		ES	2.50	PID=0.0 ppm		
Medium dense grey/brown slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is subangular to angular fine to medium and frequently coarse of flint. (Beach and Tidal Flat Deposits)	2.95	0.07				N=13 (6,6/5,4,3,1) (C)		
	4.00	-0.98				N=14 (2,2/3,3,4,4) (C)		

Remarks:

1. Borehole cased to 3.0m. 2 Groundwater at 1.90m. 3.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 4. Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 5.All SPT (Standard Penetration Test) N value results shown are uncorrected 6. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key
- D - Disturbed Representative
- B - Bulk Representative
- S - Spot Non-Representative
- W - Water
- U - Undisturbed Representative
- J - Jar Sample
- ES - Environmental Sample

Test Type Key
- (C) - Cone SPT
- (S) - Spoon SPT
- P - Pocket Penetrometer Reading
- PID - PID Reading
- V - Hand Shear Vane Reading

Sheet: Sheet 1 of 1

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
WS4	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 20/09/2017 / End Date: 20/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1034E - 1973N	20/09/2017	CGJ
	Ground Level (mAOD): 3.141	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey Concrete	0.06	3.08						
Made Ground: Comprising yellow/grey very gravelly Sand (lean mix). Gravel is of angular to subangular flint aggregate. Probable cement content. (Subbase).	0.20	2.94		ES	0.30	PID=0.0 ppm		
Made Ground: Comprising red/brown/dark brown/dark grey silty very gravelly clayey Sand with cobbles. Sand is fine to coarse grained. Gravel is of subangular red brick fragments and flint. Occasional clinker, scattered ash. Cobbles of brick and occasional flint. 0.20. Clear plastic membrane	0.60	2.54		ES	0.60	PID=0.0 ppm		
	1.00	2.14				N=0(0,0/0,0,0,0) (C)		
Made Ground: Comprising soft consistency dark brown very sandy very gravelly silty Clay. Sand is fine to coarse grained. Gravel is subangular of red bricks, flint, clinker, fine concrete fragments. Rare pottery, frequent rootlets and rare glass fragments.	1.30	1.84		ES	1.10	PID=0.0 ppm		
Made Ground: Comprising soft consistency brown/ orange slightly sandy silty slightly gravelly Clay. Sand is fine to medium grained. Gravel is fine to coarse of flint and occasional red brick fragments.				ES	1.75	PID=0.0 ppm		
Made Ground: Comprising soft consistency dark brown/ dark grey clayey Silt with rare gravel of chalk and red brick fragment. Medium organic odour. 1.70m. Scattering of fine red brick.	2.00	1.14		ES	2.00	PID=0.0 ppm N=3(0,0/0,1,1,1) (C)		
Soft consistency mottled light grey/black/light brown/ reddish brown silty Clay. Occasional scattering of fine flint gravel.							2.50 ▼	
Soft consistency dark grey/black/dark brown clayey organic SILT. Medium organic odour. Fine scattering of shells. (Alluvium)	2.95	0.19		ES	3.00	PID=0.0 ppm N=18 (3,3/5,4,4,5) (C)		
Medium dense light brown/cream brown/grey silty slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to rounded fine to coarse of flint. (Beach and Tidal Flat Deposits)	3.50	-0.36						
	4.00	-0.86				N=20 (5,6/6,7,4,3) (C)		

Remarks:

1. Borehole cased to 3.0m. 2 Groundwater at 2.50m. 3.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 4. Descriptions are reported in accordance with the guidance stated in BS5930:1999+A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 5.All SPT (Standard Penetration Test) N value results shown are uncorrected 6. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 1

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS www.opusinternational.co.uk
WS5	Site: Dolphin Quay	
Job No: E-E1667.00		Start Date: 20/09/2017 / End Date: 20/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1036E - 1981N	20/09/2017	CGJ
	Ground Level (mAOD): 3.138	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey Concrete	0.08	3.06		ES	0.10	PID=0.0 ppm		
Made Ground: Comprising off-white silt of Chalk with dark grey mottling. Frequent scattered flint and occasional red brick fragments.	0.25	2.89		ES	0.30	PID=0.0 ppm		
Made Ground: Dark brown silty gravelly Sand with frequent cobbles. Sand is fine to coarse grained. Gravel is subangular to angular fine to coarse of brick and subangular to subrounded fine to coarse of flint. Occasional concrete fragments. Cobbles of red brick. Frequent scattering of fine gravel sized clinker fragments.	1.00	2.14		ES	1.00	PID=0.0 ppm N=3(1,1/1,1,1,0) (C)		
Made Ground: Comprising brown/grey brown silty sandy Gravel. Sand is fine to coarse grained. Gravel is subangular to rounded fine to coarse of flint and brick.	1.30	1.84						
Grey/dark brown very soft silty CLAY. One cobble of flint slight organic odour. (Alluvium)				ES	2.00	PID=0.0 ppm N=7(3,2/2,1,2,2) (C)		
Loose orange brown/brown silty sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to subrounded fine to coarse of flint. (Beach and Tidal Flat Deposits)	2.20	0.94						
Medium dense Brown slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to subrounded fine to medium of flint. (Beach and Tidal Flat Deposits) At 2.60m becoming dark grey and silty.	2.60	0.54		ES	3.00	PID=0.0 ppm N=12 (4,4/4,3,3,2) (C)		
	4.00	-0.86				N=9(3,3/2,2,3,2) (C)		

Remarks:

1. Borehole cased to 3.0m. 2.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 3. Descriptions are reported in accordance with the guidance stated in BS5930:1999 +A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 4.All SPT (Standard Penetration Test) N value results shown are uncorrected 5. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 1

Exploratory Hole ID:	Client: Wilson House Developments Limited	OPUS
WS6	Site: Dolphin Quay	www.opusinternational.co.uk
Job No: E-E1667.00		Start Date: 20/09/2017 / End Date: 20/09/2017

Drilling Equipment/ Excavation Method:	Co-ords:	Backfill Date:	Field Records:
Dando Terrier Rig Mk2	1030E - 1995N	20/09/2017	CGJ
	Ground Level (mAOD): 3.151	Logged: CGJ / Chkd: CDS	Appr: CDS

Strata Description	Depth (m)	Level (m)	Legend	Sample Type	Sample Depth (m)	Tests	Groundwater Records	Backfill Details
Grey Concrete	0.06	3.09		ES	0.10	PID=0.0 ppm		
Made Ground: Comprising brown/grey gravelly silty Sand with cobbles. Sand is fine to coarse grained. Gravel is of red brick and flint. Cobbles of red brick fragments. Scattering of fine gravel sized ash and clinker fragments.	0.30	2.85		ES	0.30	PID=0.0 ppm		
Made Ground: Comprising grey brown gravelly silty clayey Sand with cobbles. Sand is fine to coarse grained. Gravel is subagular to subrounded fine to coarse of flint. Frequent fine gravel sized red brick fragments. Cobbles of subrounded flint.	1.00	2.15		ES	1.00	PID=0.0 ppm N=9(2,2/2,3,2,2) (C)		
Made Ground: Comprising brown/grey brown silty sandy Gravel. Sand is fine to coarse grained. Gravel is subangular to rounded fine to coarse of flint and brick.	1.50	1.65						
Made Ground: Comprising brown silty sandy gravelly CLAY. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint.	1.80	1.35						
Made Ground: Comprising soft consistency grey slightly sandy slightly gravelly very silty CLAY. Sand is fine to coarse grained. Gravel is fine of flint.				ES	2.00	PID=0.0 ppm N=6(2,1/2,2,1,1) (C)		
Made Ground: Comprising brown silty sandy gravelly CLAY. Sand is fine to coarse grained. Gravel is subangular to subrounded fine to coarse of flint.	2.40	0.75						
Medium dense brown slightly sandy GRAVEL. Sand is fine to coarse grained. Gravel is angular to subrounded fine to medium of flint. (Beach and Tidal Flat Deposits)	2.80	0.35		ES	3.00	PID=0.0 ppm N=29 (4,6/7,8,7,7) (C)		
At 3.40m becoming very sandy.	4.00	-0.85						

Remarks:

1. Borehole cased to 3.0m. 2.Hand dug from GL to 1.00m begl. Windowless sampling from 1.00 to 4.00m begl. 3. Descriptions are reported in accordance with the guidance stated in BS5930:1999 +A2:2010 incorporating the requirements of BS EN ISO 14688-2:2002, BS EN ISO14688-2:2004. 4.All SPT (Standard Penetration Test) N value results shown are uncorrected 5. Ground level and coordinates are approximate and interpolated from survey drawing 13093/J. Brotherton & Partners.

Sample Type Key	Test Type Key
D - Disturbed Representative	(C) - Cone SPT
B - Bulk Representative	(S) - Spoon SPT
S - Spot Non-Representative	P - Pocket Penetrometer Reading
W - Water	PID - PID Reading
U - Undisturbed Representative	V - Hand Shear Vane Reading
J - Jar Sample	
ES - Environmental Sample	

Sheet: Sheet 1 of 1

Appendix C

Soil and Water Contamination Test Results

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Concept Life Sciences Analytical & Development Services Limited registered in England and Wales (No 2514788)

Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 685708-1

Date of Report: 11-Oct-2017

Customer: OPUS International Consultants (UK) Ltd.
Modulus House
Salterns Lane
Fareham
Hampshire
PO16 0QS

Customer Contact: Mr Chris Summers

Customer Job Reference: E-E1667.00
Customer Purchase Order: FA21345
Customer Site Reference: Dolphin Quay
Date Job Received at Concept: 24-Sep-2017
Date Analysis Started: 29-Sep-2017
Date Analysis Completed: 11-Oct-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked
and authorised by :
Stefan Kondziela
Customer Service Advisor

Issued by :
Stefan Kondziela
Customer Service Advisor

Waste Acceptance Criteria

Customer Sample Reference : WS2
SAL Sample Reference : 685708 032
Project Site : Dolphin Quay
Customer Reference : E-E1667.00
Bottom Depth : 0.70
Date Sampled : 19-SEP-2017
Matrix Class : Sandy Soil

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
Loss on Ignition	Grav	0.1	%	N	**3.1**			10.0
pH	Probe			M	**8.2**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**0.8**	3.0	5.0	6.0
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PAH (Sum)	Calc	1.6	mg/kg	N	**4.6**	100.0		
PCB EC7 (Sum)	Calc	0.0070	mg/kg	U	(26) <0.0070	1.0		
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) **10**	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	**0.069**	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.016**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.014**	2.0	50.0	100.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	**0.013**	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.0062**	0.1	0.5	7.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	**0.032**	4.0	50.0	200.0
Chloride	Calc (W)	10	mg/kg	N	**410**	800.0	15000.0	25000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**0.92**	10.0	150.0	500.0
Sulphate	Calc (W)	5	mg/kg	N	**79**	1000.0	20000.0	50000.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Dissolved Organic Carbon	Calc	10	mg/kg	N	**18**	500.0	800.0	1000.0
Total Dissolved Solids	Calc	1000	mg/kg	N	**1400**	4000.0	60000.0	100000.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Waste Acceptance Criteria

Customer Sample Reference : WS4
SAL Sample Reference : 685708 044
Project Site : Dolphin Quay
Customer Reference : E-E1667.00
Bottom Depth : 0.60
Date Sampled : 19-SEP-2017
Matrix Class : Sandy Soil

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
Loss on Ignition	Grav	0.1	%	N	**8.0**			10.0
pH	Probe			M	**8.3**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**1.9**	3.0	5.0	6.0
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.0070	mg/kg	U	(26) <0.0070	1.0		
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) **2**	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	**0.032**	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	**0.27**	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.017**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.063**	2.0	50.0	100.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	**0.010**	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	**0.026**	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	**0.014**	0.1	0.5	7.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	**0.029**	4.0	50.0	200.0
Chloride	Calc (W)	10	mg/kg	N	**1500**	**800.0**	15000.0	25000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**2.9**	10.0	150.0	500.0
Sulphate	Calc (W)	5	mg/kg	N	**290**	1000.0	20000.0	50000.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Dissolved Organic Carbon	Calc	10	mg/kg	N	**29**	500.0	800.0	1000.0
Total Dissolved Solids	Calc	1000	mg/kg	N	**4300**	**4000.0**	60000.0	100000.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 002**	**685708 005**	**685708 013**	**685708 015**	**685708 027**
				Customer Sample Reference	**BH1**	**BH1**	**BH2**	**BH2**	**WS1**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.43**	**1.50**	**0.50**	**1.60**	**0.8**
				Top Depth	**0.37**				**0.6**
				Date Sampled	**18-SEP-2017**	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**25**	**13**	**15**	**12**	**11**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 031**	**685708 032**	**685708 034**	**685708 035**	**685708 037**
				Customer Sample Reference	**WS2**	**WS2**	**WS2**	**WS2**	**WS3**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.20**	**0.70**	**2.0**	**2.50**	**0.20**
				Top Depth			**1.8**		
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**12**	**7.8**	**15**	**29**	**12**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 040**	**685708 041**	**685708 044**	**685708 046**	**685708 048**
				Customer Sample Reference	**WS3**	**WS3**	**WS4**	**WS4**	**WS4**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**1.50**	**1.70**	**0.60**	**1.75**	**3.00**
				Top Depth					
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**24**	**31**	**23**	**31**	**36**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 050**	**685708 052**	**685708 054**	**685708 055**
				Customer Sample Reference	**WS5**	**WS5**	**WS6**	**WS6**
				Test Sample	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.30**	**2.00**	**0.10**	**0.50**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**14**	**18**	**14**	**12**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 002**	**685708 005**	**685708 013**	**685708 015**	**685708 027**
				Customer Sample Reference	**BH1**	**BH1**	**BH2**	**BH2**	**WS1**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**0.43**	**1.50**	**0.50**	**1.60**	**0.8**
				Top Depth	**0.37**				**0.6**
				Date Sampled	**18-SEP-2017**	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 031**	**685708 032**	**685708 034**	**685708 035**	**685708 037**
				Customer Sample Reference	**WS2**	**WS2**	**WS2**	**WS2**	**WS3**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**0.20**	**0.70**	**2.0**	**2.50**	**0.20**
				Top Depth			**1.8**		
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 040**	**685708 041**	**685708 044**	**685708 046**	**685708 048**
				Customer Sample Reference	**WS3**	**WS3**	**WS4**	**WS4**	**WS4**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**1.50**	**1.70**	**0.60**	**1.75**	**3.00**
				Top Depth					
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**685708 050**	**685708 052**	**685708 054**	**685708 055**
				Customer Sample Reference	**WS5**	**WS5**	**WS6**	**WS6**
				Test Sample	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**0.30**	**2.00**	**0.10**	**0.50**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
OPUS Fareham Standard Suite

				Concept Reference	**685708 002**	**685708 013**	**685708 015**	**685708 027**	**685708 031**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**WS1**	**WS2**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.43**	**0.50**	**1.60**	**0.8**	**0.20**
				Top Depth	**0.37**			**0.6**	
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
Chromium VI	ICP/OES	1	mg/kg	N	<1	<1	<1	<1	<1
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1	<1
(Water Soluble) Sulphate expressed as SO4	2:1 Extraction/ICP/OES (TRL 447 T1)	0.01	g/l	N	**0.08**	**0.09**	**0.26**	<0.01	**0.02**
pH	Probe			M	**9.0**	**8.6**	**8.9**	**9.3**	**7.8**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
OPUS Fareham Standard Suite

				Concept Reference	**685708 037**	**685708 044**	**685708 050**	**685708 054**
				Customer Sample Reference	**WS3**	**WS4**	**WS5**	**WS6**
				Test Sample	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.20**	**0.60**	**0.30**	**0.10**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Boron (water-soluble)	ICP/OES	1	mg/kg	N	<1	<1	<1	<1
Chromium VI	ICP/OES	1	mg/kg	N	<1	<1	<1	<1
Cyanide (Total)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1
Phenols (Total-Mono)	Colorimetry (CF)	1	mg/kg	M	<1	<1	<1	<1
(Water Soluble) Sulphate expressed as SO4	2:1 Extraction/ICP/OES (TRL 447 T1)	0.01	g/l	N	**0.03**	**0.09**	**0.06**	**0.11**
pH	Probe			M	**8.6**	**8.3**	**8.4**	**9.1**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
OPUS Fareham Standard Suite

				Concept Reference	**685708 002**	**685708 013**	**685708 015**	**685708 027**	**685708 031**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**WS1**	**WS2**
				Test Sample	**M40**	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**0.43**	**0.50**	**1.60**	**0.8**	**0.20**
				Top Depth	**0.37**			**0.6**	
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Arsenic	ICP/OES	2	mg/kg	M	**26**	**12**	**17**	**7**	**12**
Cadmium	ICP/OES	1	mg/kg	M	**2**	<1	**1**	<1	<1
Chromium	ICP/OES	1	mg/kg	M	**19**	**20**	**24**	**16**	**14**
Copper	ICP/OES	1	mg/kg	M	**150**	**140**	**260**	**21**	**57**
Lead	ICP/OES	1	mg/kg	M	**230**	**1100**	**420**	**160**	**710**
Mercury	ICP/OES	1	mg/kg	M	<1	**4**	**1**	**1**	**2**
Nickel	ICP/OES	1	mg/kg	M	**67**	**15**	**32**	**11**	**14**
Selenium	ICP/OES	3	mg/kg	M	<3	<3	<3	<3	<3
Zinc	ICP/OES	1	mg/kg	M	**440**	**580**	**380**	**47**	**190**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
OPUS Fareham Standard Suite

				Concept Reference	**685708 037**	**685708 044**	**685708 050**	**685708 054**
				Customer Sample Reference	**WS3**	**WS4**	**WS5**	**WS6**
				Test Sample	**M40**	**M40**	**M40**	**M40**
				Bottom Depth	**0.20**	**0.60**	**0.30**	**0.10**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Arsenic	ICP/OES	2	mg/kg	M	**14**	**12**	**16**	**20**
Cadmium	ICP/OES	1	mg/kg	M	<1	<1	<1	<1
Chromium	ICP/OES	1	mg/kg	M	**10**	**17**	**14**	**14**
Copper	ICP/OES	1	mg/kg	M	**170**	**49**	**73**	**61**
Lead	ICP/OES	1	mg/kg	M	**690**	**340**	**610**	**640**
Mercury	ICP/OES	1	mg/kg	M	**4**	**1**	**1**	<1
Nickel	ICP/OES	1	mg/kg	M	**10**	**16**	**14**	**32**
Selenium	ICP/OES	3	mg/kg	M	<3	<3	<3	<3
Zinc	ICP/OES	1	mg/kg	M	**240**	**160**	**150**	**150**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**685708 005**	**685708 026**	**685708 035**	**685708 038**	**685708 041**
				Customer Sample Reference	**BH1**	**WS1**	**WS2**	**WS3**	**WS3**
				Test Sample	**A40**	**A40**	**A40**	**A40**	**A40**
				Bottom Depth	**1.50**	**0.40**	**2.50**	**0.60**	**1.70**
				Top Depth					
				Date Sampled	**18-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Soil Organic Matter	Calc TOC/0.58	0.1	%	N	**1.6**	**1.1**	**4.9**	**1.9**	**2.1**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**685708 044**	**685708 048**	**685708 052**
				Customer Sample Reference	**WS4**	**WS4**	**WS5**
				Test Sample	**A40**	**A40**	**A40**
				Bottom Depth	**0.60**	**3.00**	**2.00**
				Top Depth			
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Soil Organic Matter	Calc TOC/0.58	0.1	%	N	**3.3**	**0.6**	**2.0**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**685708 001**	**685708 012**	**685708 015**	**685708 026**	**685708 031**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**WS1**	**WS2**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.2**	**0.20**	**1.60**	**0.40**	**0.20**
				Top Depth	**0.1**				
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class		**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Asbestos ID	PLM			SU	N.D.	N.D.	N.D.	N.D.	N.D.

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**685708 037**	**685708 043**	**685708 044**	**685708 050**	**685708 055**
				Customer Sample Reference	**WS3**	**WS4**	**WS4**	**WS5**	**WS6**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**0.20**	**0.30**	**0.60**	**0.30**	**0.50**
				Top Depth					
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Asbestos ID	PLM			SU	N.D.	N.D.	N.D.	N.D.	N.D.

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Suite C

				Concept Reference	**685708 052**
				Customer Sample Reference	**WS5**
				Test Sample	**A40**
				Bottom Depth	**2.00**
				Date Sampled	**19-SEP-2017**
				Matrix Class	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**	
Sulphate (Total)	ICP/OES	0.01	%	N	**0.72**
Sulphur (total)	ICP/OES	0.01	%	N	**1.4**
pH	Probe			U	**8.4**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Suite C

				Concept Reference	**685708 052**
				Customer Sample Reference	**WS5**
				Test Sample	**AR**
				Bottom Depth	**2.00**
				Date Sampled	**19-SEP-2017**
				Matrix Class	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**	
(Water Soluble) Sulphate expressed as SO4	2:1 Extraction/ICP/OES (TRL 447 T1)	0.01	g/l	N	**0.11**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Suite F

				Concept Reference	**685708 009**	**685708 019**	**685708 020**	**685708 021**	**685708 023**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**BH2**	**BH3**
				Test Sample	**A40**	**A40**	**A40**	**A40**	**A40**
				Bottom Depth	**10.50**	**4.00**	**11.85**	**14.85**	**15.00**
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**18-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Sulphate (Total)	ICP/OES	0.01	%	N	**0.47**	**0.27**	**0.59**	**0.58**	**0.44**
Sulphur (total)	ICP/OES	0.01	%	N	**1.2**	**0.35**	**0.80**	**0.71**	**0.88**
pH	Probe			U	**8.3**	**8.5**	**7.8**	**7.6**	**7.7**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Suite F

				Concept Reference	**685708 009**	**685708 019**	**685708 020**	**685708 021**	**685708 023**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**BH2**	**BH3**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**10.50**	**4.00**	**11.85**	**14.85**	**15.00**
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**18-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
(Water soluble) Magnesium	2:1 Extraction/ICP/OES	1	mg/l	N	**22**	**14**	**39**	**40**	**26**
Chloride (2:1)	Discrete Analyser	0.5	mg/l	N	**120**	**680**	**84**	**88**	**41**
Nitrate (2:1)	Discrete Analyser	1.0	mg/l	N	**4.1**	**8.3**	<1.0	<1.0	**2.7**
(Water Soluble) Sulphate expressed as SO4	2:1 Extraction/ICP/OES (TRL 447 T1)	0.01	g/l	N	**0.15**	**0.17**	**0.48**	**0.53**	**0.32**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
BTEX

				Concept Reference	**685708 032**	**685708 044**
				Customer Sample Reference	**WS2**	**WS4**
				Test Sample	**M105**	**M105**
				Bottom Depth	**0.70**	**0.60**
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Total and Speciated USEPA16 PAH

				Concept Reference	**685708 032**	**685708 044**
				Customer Sample Reference	**WS2**	**WS4**
				Test Sample	**M105**	**M105**
				Bottom Depth	**0.70**	**0.60**
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.4**	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.9**	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.8**	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.4**	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.8**	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.4**	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	<0.1
Coronene	GC/MS	0.1	mg/kg	N	<0.1	<0.1
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	**4.6**	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				Concept Reference	**685708 002**	**685708 013**	**685708 015**	**685708 027**	**685708 031**
				Customer Sample Reference	**BH1**	**BH2**	**BH2**	**WS1**	**WS2**
				Test Sample	**M105**	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**0.43**	**0.50**	**1.60**	**0.8**	**0.20**
				Top Depth	**0.37**			**0.6**	
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	**1.2**
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	**0.1**	<0.1	<0.1	**5.1**
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	(9) <1.0
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	**2.9**
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	**1.0**	**0.5**	<0.1	**32**
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	**0.3**	**0.3**	<0.1	**9.3**
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	**2.3**	**1.7**	<0.1	**57**
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	**2.1**	**1.5**	<0.1	**48**
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**1.5**	**0.8**	<0.1	**35**
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	**1.4**	**0.8**	<0.1	**31**
Benzo(b)fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**1.2**	**0.8**	<0.1	**25**
Benzo(k)fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**1.3**	**0.6**	<0.1	**23**
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**1.3**	**0.7**	<0.1	**22**
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**0.8**	**0.4**	<0.1	**9.3**
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**0.4**	**0.1**	<0.1	**4.6**
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	**0.9**	**0.4**	<0.1	**9.2**
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	**0.7**	**14**	**8.5**	<0.1	**320**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				Concept Reference	**685708 037**	**685708 044**	**685708 050**	**685708 054**
				Customer Sample Reference	**WS3**	**WS4**	**WS5**	**WS6**
				Test Sample	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**0.20**	**0.60**	**0.30**	**0.10**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	**0.1**	<0.1	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.2**	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**1.0**	<0.1	**0.5**	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.8**	<0.1	**0.4**	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.2**	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.6**	<0.1	**0.2**	<0.1
Benzo(b)fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.6**	<0.1	**0.2**	<0.1
Benzo(k)fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.6**	<0.1	**0.2**	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	<0.1	**0.2**	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.3**	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.4**	<0.1	<0.1	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	**6.0**	<0.1	**2.1**	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
PCB EC7

				Concept Reference	**685708 032**	**685708 044**
				Customer Sample Reference	**WS2**	**WS4**
				Test Sample	**M105**	**M105**
				Bottom Depth	**0.70**	**0.60**
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Polychlorinated biphenyl BZ#28	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#52	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#101	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#118	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#138	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#153	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0
Polychlorinated biphenyl BZ#180	GC/MS (HR) (MCERTS)	0.05	µg/kg	M	(26) <1.0	(26) <1.0

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Phenols (Speciated)

				Concept Reference	**685708 005**	**685708 015**	**685708 034**	**685708 035**	**685708 040**
				Customer Sample Reference	**BH1**	**BH2**	**WS2**	**WS2**	**WS3**
				Test Sample	**AR**	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**1.50**	**1.60**	**2.0**	**2.50**	**1.50**
				Top Depth			**1.8**		
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Cresols	GC/MS	0.01	mg/kg	U	<0.01	<0.01	<0.01	<0.01	<0.01
Phenol	GC/MS (SIR)	0.01	mg/kg	U	**0.01**	**0.02**	<0.01	<0.01	<0.01
Xylenols	GC/MS	0.01	mg/kg	U	<0.01	<0.01	<0.01	<0.01	<0.01

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Phenols (Speciated)

				Concept Reference	**685708 041**	**685708 046**	**685708 048**	**685708 052**
				Customer Sample Reference	**WS3**	**WS4**	**WS4**	**WS5**
				Test Sample	**AR**	**AR**	**AR**	**AR**
				Bottom Depth	**1.70**	**1.75**	**3.00**	**2.00**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Cresols	GC/MS	0.01	mg/kg	U	<0.01	<0.01	<0.01	<0.01
Phenol	GC/MS (SIR)	0.01	mg/kg	U	<0.01	<0.01	<0.01	<0.01
Xylenols	GC/MS	0.01	mg/kg	U	<0.01	<0.01	<0.01	<0.01

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
TPH

				Concept Reference	**685708 032**	**685708 044**
				Customer Sample Reference	**WS2**	**WS4**
				Test Sample	**M105**	**M105**
				Bottom Depth	**0.70**	**0.60**
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Total Petroleum Hydrocarbons (C35-C40)	GC/FID	1	mg/kg	N	(13) <1	(13) <1
Total Petroleum Hydrocarbons	GC/FID	1	mg/kg	M	**(13) 10**	**(13) 2**

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil

TPH (CWG) with MTBE, BTEX (MCERTS)

				Concept Reference	**685708 005**	**685708 015**	**685708 034**	**685708 035**	**685708 040**
				Customer Sample Reference	**BH1**	**BH2**	**WS2**	**WS2**	**WS3**
				Test Sample	**M105**	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.50**	**1.60**	**2.0**	**2.50**	**1.50**
				Top Depth			**1.8**		
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10	(13) <10	(13) <10	(13) <10	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10	<10
Methyl tert-Butyl Ether	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10	<10
Total Petroleum Hydrocarbons (C5 - C6 aliphatic)	GC/MS (Head Space)(MCERTS)	0.100	mg/kg	N	<0.100	<0.100	<0.100	<0.100	<0.100
Total Petroleum Hydrocarbons (C6-C8 aliphatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C8-C10 aliphatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C10-C12 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C12-C16 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C21-C35 aliphatic)	GCxGC	2	mg/kg	M	(13) <2	**(13) 11**	(13) <2	(13) <2	(13) <2
Total Petroleum Hydrocarbons (C6 - C7 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C7-C8 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C8-C10 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C10-C12 aromatic)	GCxGC	2	mg/kg	M	(13) <2	(13) <2	(13) <2	(13) <2	(13) <2
Total Petroleum Hydrocarbons (C12-C16 aromatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aromatic)	GCxGC	1	mg/kg	M	**(13) 5**	**(13) 9**	**(13) 1**	(13) <1	**(13) 1**
Total Petroleum Hydrocarbons (C21-C35 aromatic)	GCxGC	1	mg/kg	M	**(13) 8**	**(13) 12**	**(13) 2**	(13) <1	(13) <1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
TPH (CWG) with MTBE, BTEX (MCERTS)

				Concept Reference	**685708 046**	**685708 048**	**685708 052**	**685708 055**
				Customer Sample Reference	**WS4**	**WS4**	**WS5**	**WS6**
				Test Sample	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.75**	**3.00**	**2.00**	**0.50**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10	(13) <10	(13) <10	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10
Methyl tert-Butyl Ether	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10	<10
Total Petroleum Hydrocarbons (C5 - C6 aliphatic)	GC/MS (Head Space)(MCERTS)	0.100	mg/kg	N	<0.100	<0.100	<0.100	<0.100
Total Petroleum Hydrocarbons (C6-C8 aliphatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C8-C10 aliphatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C10-C12 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C12-C16 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aliphatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C21-C35 aliphatic)	GCxGC	2	mg/kg	M	(13) <2	(13) <2	(13) <2	(13) <2
Total Petroleum Hydrocarbons (C6 - C7 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C7-C8 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C8-C10 aromatic)	GC/MS (Head Space)(MCERTS)	0.10	mg/kg	N	<0.10	<0.10	<0.10	<0.10
Total Petroleum Hydrocarbons (C10-C12 aromatic)	GCxGC	2	mg/kg	M	(13) <2	(13) <2	(13) <2	(13) <2
Total Petroleum Hydrocarbons (C12-C16 aromatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C16-C21 aromatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C21-C35 aromatic)	GCxGC	1	mg/kg	M	(13) <1	(13) <1	(13) <1	(13) <1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Volatile Organic Compounds (USEPA 624) (MCERTS)

Concept Reference	**685708 040**
Customer Sample Reference	**WS3**
Test Sample	**M105**
Bottom Depth	**1.50**
Date Sampled	**19-SEP-2017**
Matrix Class	**Sandy Soil**

Determinand	Method	LOD	Units	Symbol	
Dichlorodifluoromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Chloromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
Vinyl chloride monomer	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Bromomethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
Chloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Trichlorofluoromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1-Dichloroethylene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Dichloromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
Trans-1,2-Dichloroethylene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1-Dichloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Cis-1,2-Dichloroethylene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
2,2-Dichloropropane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
Chloroform	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Bromochloromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1,1-Trichloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1-Dichloropropene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Carbon tetrachloride	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,2-Dichloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10
1,2-Dichloropropane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Trichloroethylene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Bromodichloromethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Dibromomethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Cis-1,3-Dichloropropene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Trans-1,3-Dichloropropene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1,2-Trichloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,3-Dichloropropane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Tetrachloroethylene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Chlorodibromomethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,2-dibromoethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Chlorobenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1,1,2-Tetrachloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10
Styrene	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
Bromoform	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Isopropyl benzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,1,2,2-Tetrachloroethane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
1,2,3-Trichloropropane	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
n-Propylbenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Bromobenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,3,5-Trimethylbenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Tert-Butylbenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,2,4-Trimethylbenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
Sec-Butylbenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
p-Isopropyltoluene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
2-Chlorotoluene	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
4-Chlorotoluene	GC/MS (Head Space)(MCERTS)	50	µg/kg	U	<50
1,3-Dichlorobenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,4-Dichlorobenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50
1,2-Dichlorobenzene	GC/MS (Head Space)(MCERTS)	50	µg/kg	M	<50

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Semi-Volatile Organic Compounds (USEPA 625)

				Concept Reference	**685708 005**	**685708 015**	**685708 034**	**685708 035**	**685708 040**
				Customer Sample Reference	**BH1**	**BH2**	**WS2**	**WS2**	**WS3**
				Test Sample	**M105**	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.50**	**1.60**	**2.0**	**2.50**	**1.50**
				Top Depth			**1.8**		
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethyl) ether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chlorophenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroisopropyl) ether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2-methyl phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
3/4-Methylphenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Isophorone	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
2-Nitrophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dimethylphenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethoxy) methane	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chloroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5
Hexachlorobutadiene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
4-Chloro-3-methylphenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorocyclopentadiene	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5
2,4,6-Trichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5-Trichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethyl phthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
2,6-Dinitrotoluene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
3-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2
Dibenzofuran	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrotoluene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Diethyl phthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	<0.1	<0.1	<0.1	<0.1
4-Chlorophenyl phenylether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
4-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2
Azobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
4-Bromophenyl phenylether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Pentachlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	**1.1**	**0.5**	<0.1	<0.1	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	**0.4**	**0.3**	<0.1	<0.1	<0.1
Carbazole	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Di-n-butylphthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**1.6**	**1.7**	<0.1	<0.1	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**1.3**	**1.5**	<0.1	<0.1	<0.1
Butyl benzylphthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.9**	**0.8**	<0.1	<0.1	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.8**	**0.8**	<0.1	<0.1	<0.1
Bis (2-ethylhexyl)phthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Di-n-octylphthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	**1.2**	**1.4**	<0.1	<0.1	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.5**	**0.7**	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	**0.4**	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)

				Concept Reference	**685708 005**	**685708 015**	**685708 034**	**685708 035**	**685708 040**
				Customer Sample Reference	**BH1**	**BH2**	**WS2**	**WS2**	**WS3**
				Test Sample	**M105**	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.50**	**1.60**	**2.0**	**2.50**	**1.50**
				Top Depth			**1.8**		
				Date Sampled	**18-SEP-2017**	**15-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**					
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.1**	**0.1**	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	**0.2**	**0.4**	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil

Semi-Volatile Organic Compounds (USEPA 625)

				Concept Reference	**685708 041**	**685708 046**	**685708 048**	**685708 052**
				Customer Sample Reference	**WS3**	**WS4**	**WS4**	**WS5**
				Test Sample	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.70**	**1.75**	**3.00**	**2.00**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethyl) ether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2-Chlorophenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroisopropyl) ether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2-methyl phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
3/4-Methylphenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Hexachloroethane	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Nitrobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Isophorone	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
2-Nitrophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
2,4-Dimethylphenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Bis (2-chloroethoxy) methane	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2,4-Dichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
1,2,4-Trichlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
4-Chloroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5
Hexachlorobutadiene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
4-Chloro-3-methylphenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2-Methylnaphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Hexachlorocyclopentadiene	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.5	(162) <0.5	(162) <0.5	(162) <0.5
2,4,6-Trichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
2,4,5-Trichlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
2-Chloronaphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Dimethyl phthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
2,6-Dinitrotoluene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
3-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2
Dibenzofuran	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrotoluene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Diethyl phthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
4-Chlorophenyl phenylether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
4-Nitroaniline	GC/MS (MCERTS)	0.1	mg/kg	U	(162) <0.2	(162) <0.2	(162) <0.2	(162) <0.2
Azobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
4-Bromophenyl phenylether	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Hexachlorobenzene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Pentachlorophenol	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Carbazole	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Di-n-butylphthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Butyl benzylphthalate	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Bis (2-ethylhexyl)phthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Di-n-octylphthalate	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Soil Analysed as Soil
Semi-Volatile Organic Compounds (USEPA 625)

				Concept Reference	**685708 041**	**685708 046**	**685708 048**	**685708 052**
				Customer Sample Reference	**WS3**	**WS4**	**WS4**	**WS5**
				Test Sample	**M105**	**M105**	**M105**	**M105**
				Bottom Depth	**1.70**	**1.75**	**3.00**	**2.00**
				Top Depth				
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**				
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1	<0.1

Concept Reference: 685708
Project Site: Dolphin Quay
Customer Reference: E-E1667.00

Leachate to BS EN 12457-2 (10:1) Analysed as Water
Waste Acceptance Criteria

				Concept Reference	**685708 032**	**685708 044**
				Customer Sample Reference	**WS2**	**WS4**
				Test Sample	**10:1**	**10:1**
				Bottom Depth	**0.70**	**0.60**
				Date Sampled	**19-SEP-2017**	**19-SEP-2017**
				Matrix Class	**Sandy Soil**	**Sandy Soil**
Determinand	**Method**	**LOD**	**Units**	**Symbol**		
Antimony (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	**3**
Arsenic (Dissolved)	ICP/MS (Filtered)	0.2	µg/l	U	**6.9**	**27**
Barium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	**2**	**2**
Cadmium (Dissolved)	ICP/MS (Filtered)	0.02	µg/l	U	<0.02	<0.02
Chromium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1
Copper (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	**1.4**	**6.3**
Lead (Dissolved)	ICP/MS (Filtered)	0.3	µg/l	U	**1.3**	**1.0**
Mercury (Dissolved)	ICP/MS (Filtered)	0.05	µg/l	U	<0.05	<0.05
Molybdenum (Dissolved)	ICP/MS (Filtered)	1	µg/l	N	<1	**3**
Nickel (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1
Selenium (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	**0.6**	**1.4**
Zinc (Dissolved)	ICP/MS (Filtered)	2	µg/l	U	**3**	**3**
Chloride	Discrete Analyser	1	mg/l	U	**41**	**150**
Fluoride	Discrete Analyser	0.05	mg/l	U	**0.09**	**0.29**
Sulphate	Discrete Analyser	0.5	mg/l	U	**7.9**	**29**
Phenols (Total-Mono)	Colorimetry	0.1	mg/l	U	<0.1	<0.1
Dissolved Organic Carbon	OX/IR	1	mg/l	N	**2**	**3**
Electrical Conductivity	Probe	10	µS/cm	N	**230**	**710**
Total Dissolved Solids	Grav	100	mg/l	N	**140**	**430**

Index to symbols used in 685708-1

Value	Description
10:1	Leachate to BS EN 12457-2 (10:1)
A40	Assisted dried < 40C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
10:1 S	Data for BS EN 12457-2 (10:1)
AR	As Received
N.D.	Not Detected
162	LOD determined by matrix spike recovery
26	LOD raised because the analysis was performed by an alternative technique
13	Results have been blank corrected.
9	LOD raised due to dilution of sample
S	Analysis was subcontracted

M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.
These samples have been analysed exceeding recommended TPH holding times. It is possible therefore that the results provided may be compromised.

Appendix D

Geotechnical Test Results

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

Job No.	Project Name	Programme	
23423	Dolphin Quay	Samples received	21/09/2017
		Schedule received	27/09/2017
Project No.	Client	Project started	28/09/2017
E-E1667	OPUS	Testing Started	10/10/2017

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH1		4.40		D	Grey silty CLAY	30	100	72	28	44	
BH1		9.50		UT	High strength fissured dark grey silty CLAY	26	100	74	28	46	
BH1		12.50		UT	High strength fissured dark grey silty CLAY	28	100	80	31	49	
BH1		15.50		U	Very high strength fissured dark grey silty CLAY	24	97	75	28	47	
BH2		4.80		D	Grey brown MUDSTONE fragments	11					Non-Plastic
BH2		8.50		U	Medium strength fissured dark grey silty CLAY	27	100	67	26	41	
BH2		11.50		UT	High strength slightly fissured dark grey silty CLAY	27	100	78	31	47	
BH2		14.50		UT	Very high strength fissured dark grey silty CLAY	24	100	72	28	44	
BH2		24.00		U	High strength slightly fissured reddish brown mottled bluish grey silty CLAY	26	100	54	21	33	
BH3		5.00		UT	Medium strength slightly fissured dark grey silty CLAY with rare fine shell fragments	30	96	75	28	47	
BH3		9.50		UT	High strength slightly fissured dark grey silty CLAY	26	100	76	26	50	
BH3		12.50		UT	Very high strength fissured dark grey silty CLAY	26	100	79	29	50	

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

Test Report by K4 SOILS LABORATORY
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Checked and Approved

Initials kp

Date: 17/10/2017

UKAS TESTING 2519

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

MSF-5-R1(b)

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

Job No.	Project Name	Programme	
23423	Dolphin Quay	Samples received	21/09/2017
		Schedule received	27/09/2017
Project No.	Client	Project started	28/09/2017
E-E1667	OPUS	Testing Started	10/10/2017

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
BH3		15.50		U	Extremely high strength slightly fissured dark grey slightly sandy silty CLAY with partings of fine grey sand/silt	21	100	57	22	35	
WS3		2.00		D	Gravel slightly gravelly silty CLAY with traces of calcareous deposits (gravel is fmc and angular)	64	66	79	35	44	

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

Test Report by K4 SOILS LABORATORY
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Date: 17/10/2017

UKAS TESTING 2519

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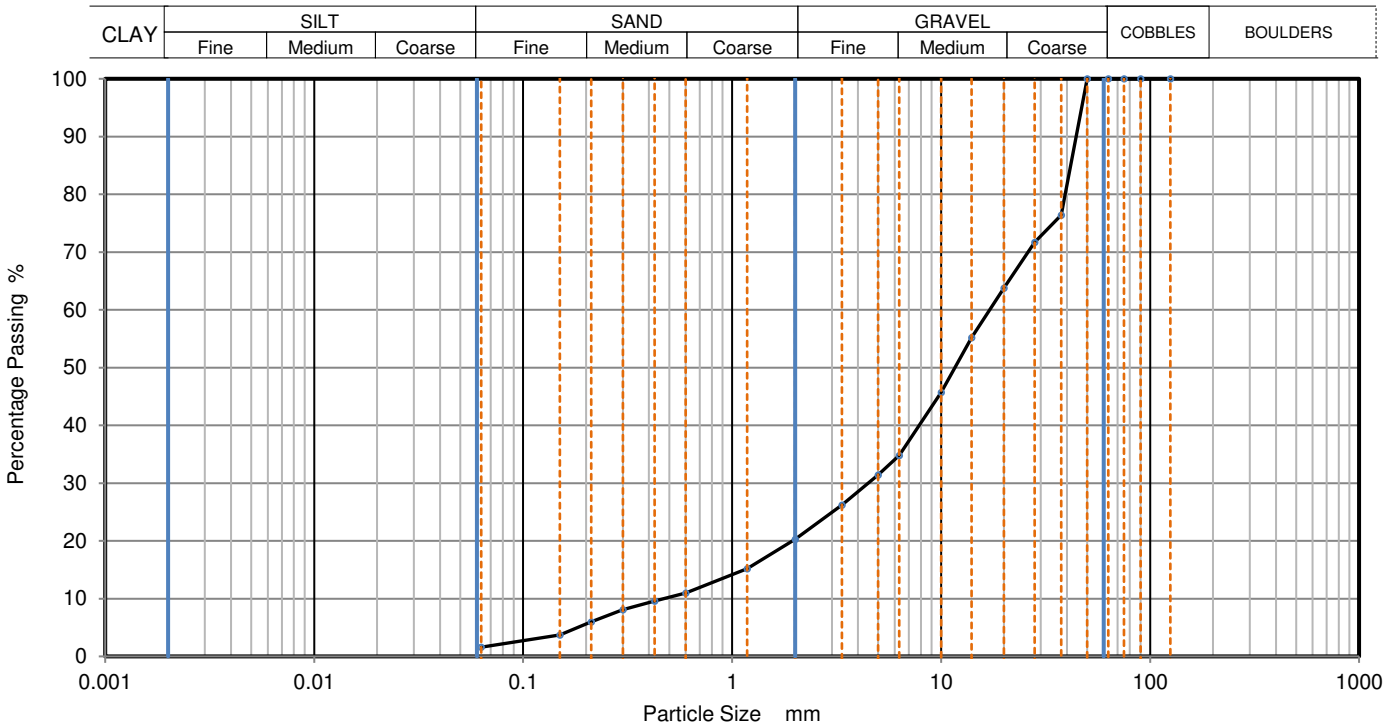
MSF-5-R1(b)

PARTICLE SIZE DISTRIBUTION

Site Name	Dolphin Quay			Job Ref	23423
				Borehole/Pit No.	BH2
				Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	3.00 m
Soil Description	Dark grey sandy GRAVEL (gravel is fmc and sub-angular to sub-rounded)			Depth Base	- m
				Sample Type	B
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	28/09/2017
				Date tested	10/10/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	76		
28	72		
20	64		
14	55		
10	46		
6.3	35		
5	31		
3.35	26		
2	20		
1.18	15		
0.6	11		
0.425	10		
0.3	8		
0.212	6		
0.15	4		
0.063	2		

Dry Mass of sample, g: 2394

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	79.7
Sand	18.7
Fines <0.063mm	1.6

Grading Analysis		
D100	mm	
D60	mm	17.1
D30	mm	4.5
D10	mm	0.471
Uniformity Coefficient		36
Curvature Coefficient		2.5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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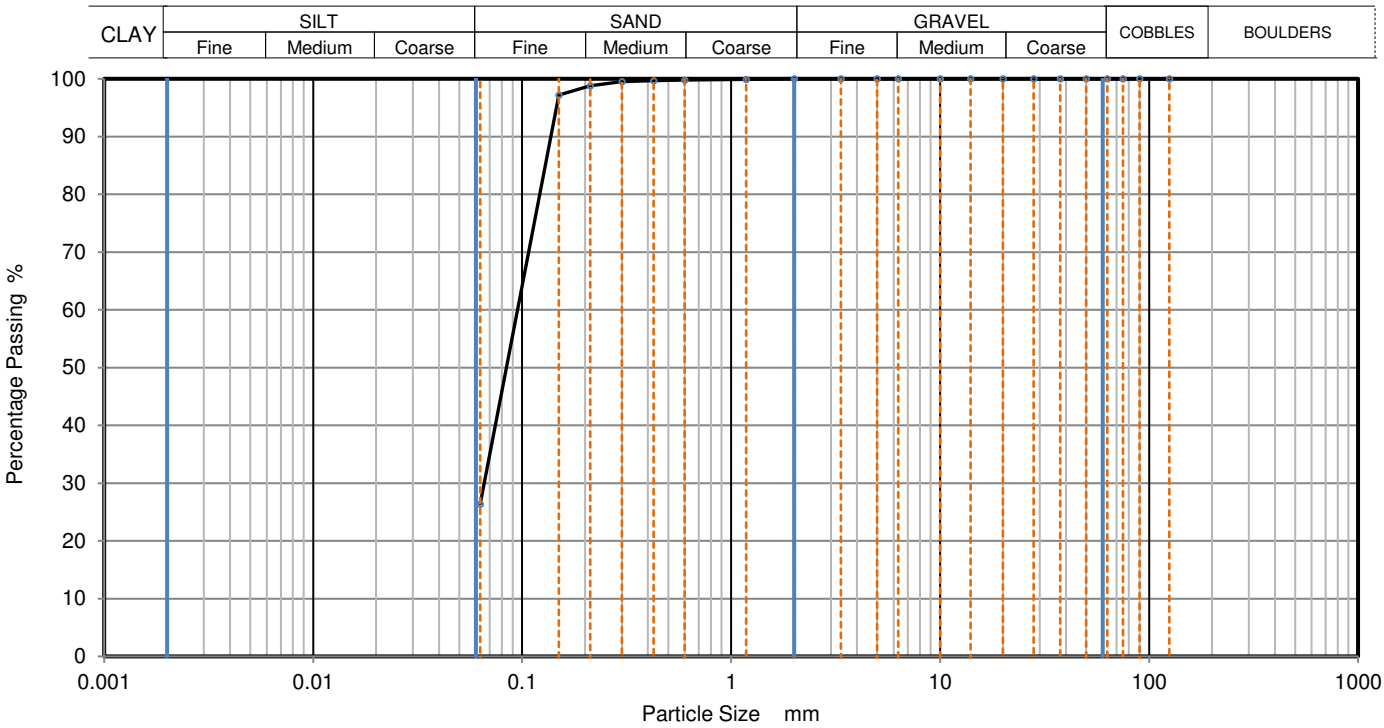
Initials: kp

Date: 17/10/2017

MSF-5-R3

PARTICLE SIZE DISTRIBUTION

Site Name	Dolphin Quay			Job Ref	23423
				Borehole/Pit No.	BH2
Project No.	E-E1667	Client	OPUS	Sample No.	-
				Depth Top	20.50 m
Soil Description	Dark grey very clayey SAND			Depth Base	- m
				Sample Type	B
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	28/09/2017
				Date tested	10/10/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	100		
0.3	100		
0.212	99		
0.15	97		
0.063	26		

Dry Mass of sample, g: 1595

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.0
Sand	73.6
Fines <0.063mm	26.4

Grading Analysis		
D100	mm	
D60	mm	0.0951
D30	mm	0.0658
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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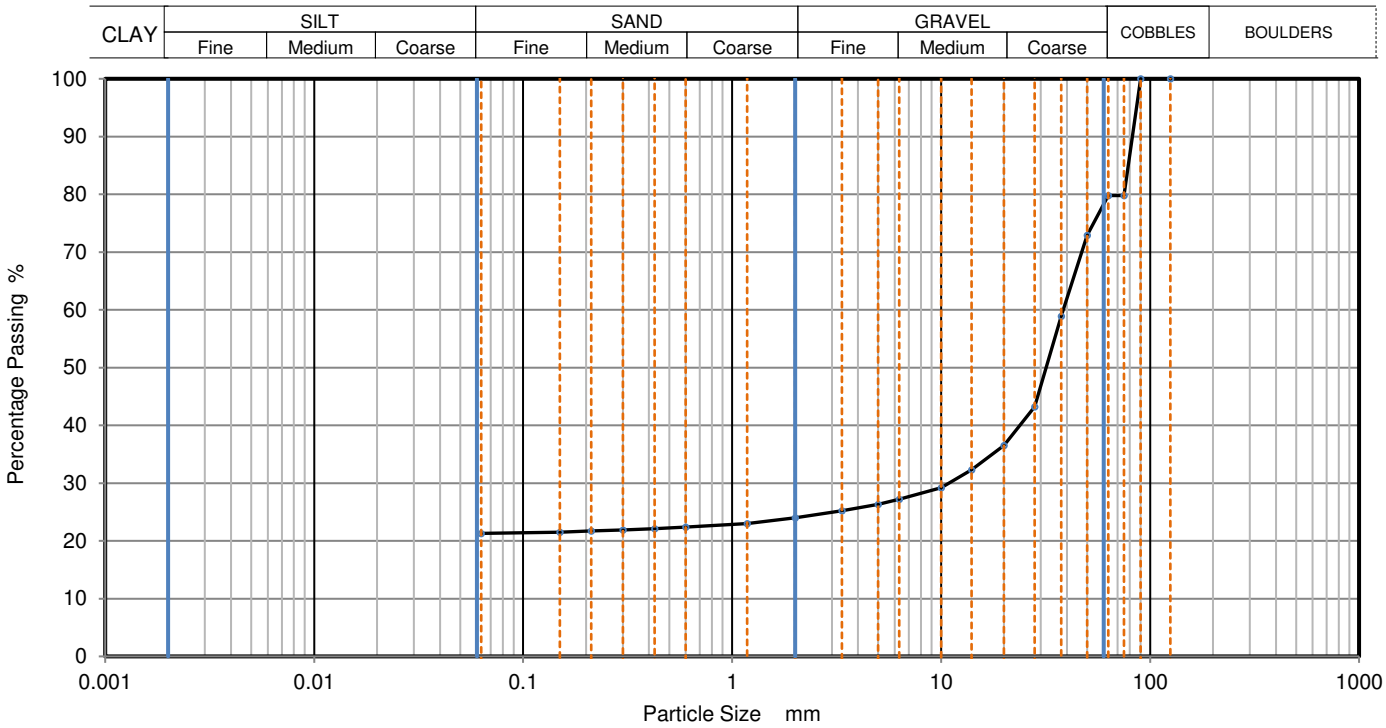
Initials: kp

Date: 17/10/2017

MSF-5-R3

PARTICLE SIZE DISTRIBUTION

Site Name	Dolphin Quay			Job Ref	23423
				Borehole/Pit No.	BH3
				Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	4.00 m
Soil Description	Dark grey very clayey slightly sandy GRAVEL (gravel is fmc and cobble sized sub-angular to sub-rounded)			Depth Base	- m
				Sample Type	B
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	28/09/2017
				Date tested	10/10/2017



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	80		
63	80		
50	73		
37.5	59		
28	43		
20	37		
14	32		
10	29		
6.3	27		
5	26		
3.35	25		
2	24		
1.18	23		
0.6	22		
0.425	22		
0.3	22		
0.212	22		
0.15	22		
0.063	21		

Dry Mass of sample, g: 2814

Sample Proportions	% dry mass
Very coarse	20.2
Gravel	55.8
Sand	2.7
Fines <0.063mm	21.3

Grading Analysis		
D100	mm	
D60	mm	38.4
D30	mm	10.9
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

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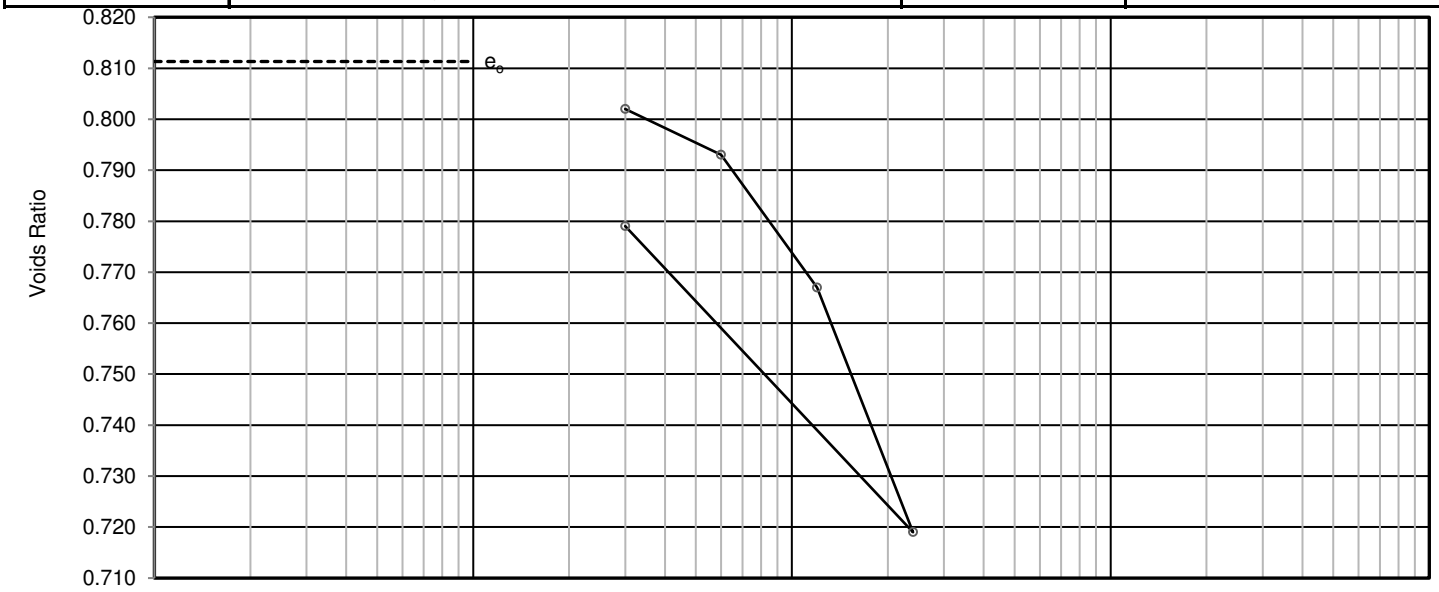
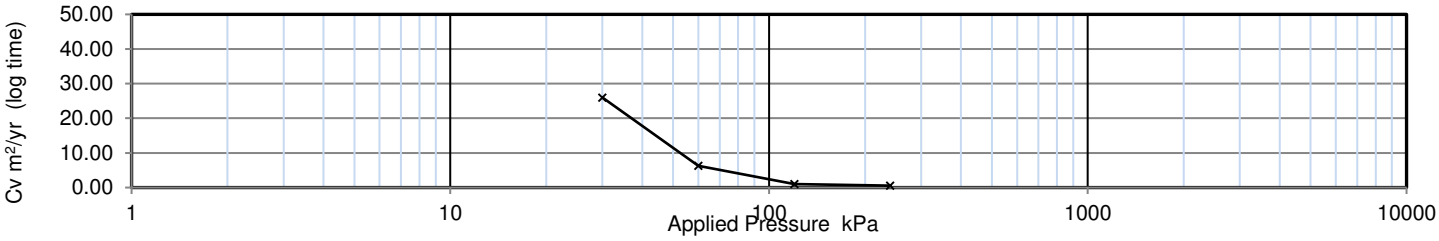
MSF-5-R3

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	23423
				Borehole/Pit No.	BH1
				Sample No.	-
Site Name	Dolphin Quay			Depth Top	4.00 m
Project ID	E-E1667	Client	OPUS	Depth Base	- m
Soil Description	Medium strength slightly fissured dark grey silty CLAY			Sample Type	UT
				Sample Received	21/09/2017
				Schedule received	27/09/2017
				Project Started	28/09/2017
Test Method	BS1377:Part 5: 1990, clause 3			Date Test started	11/10/2017





Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.811	-	-	-	-
30	0.802	0.18	26	26	0.000088
60	0.793	0.17	6.3	6.1	0.0002
120	0.767	0.24	1	1.1	0.0019
240	0.719	0.22	0.55	0.65	0.0024
30	0.779	0.16			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m^3

Specimen details	Initial	Final	
Diameter	75.05	-	mm
Height	18.90	18.56	mm
Moisture Content	29.6	30.1	%
Bulk density	1.93	1.98	Mg/m^3
Dry density	1.49	1.52	Mg/m^3
Voids Ratio	0.811	0.779	
Saturation	98	104	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

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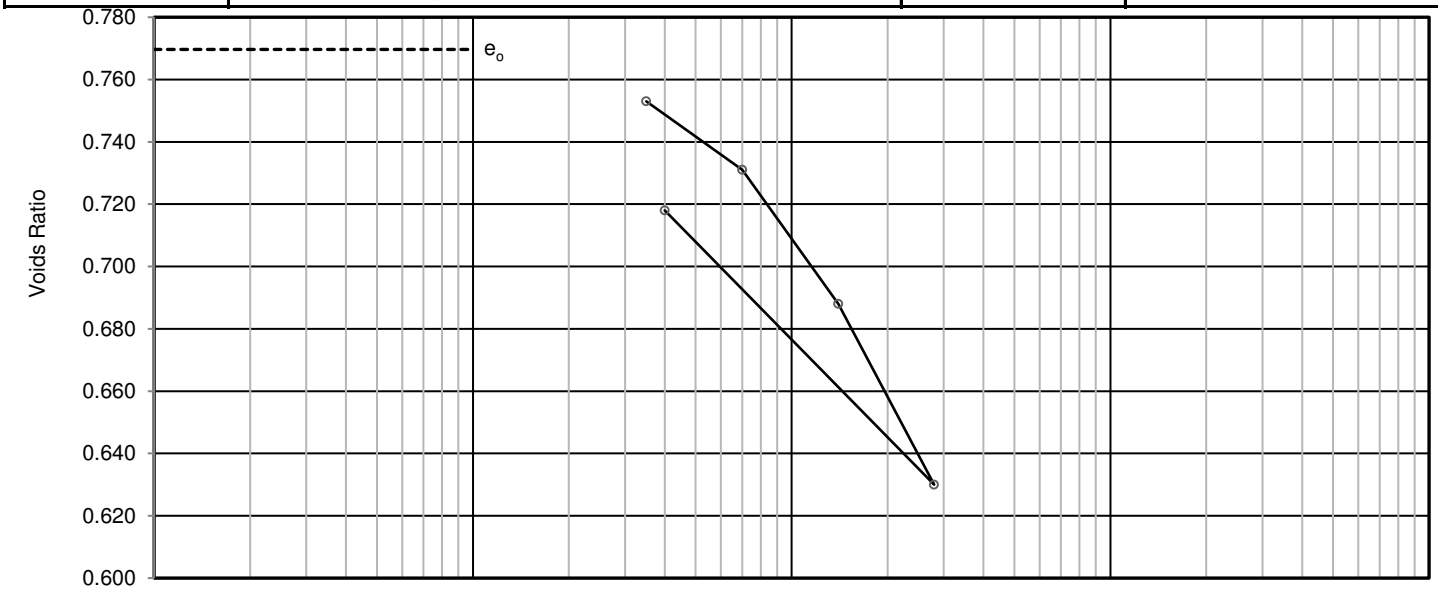
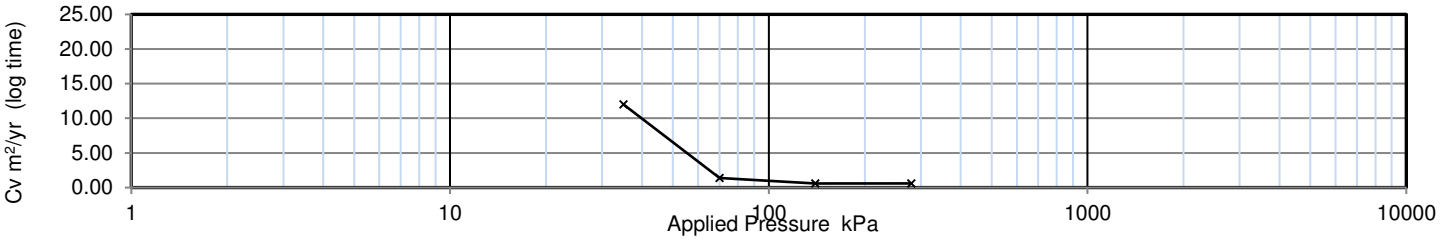
MSF-5-R6

ONE DIMENSIONAL CONSOLIDATION TEST

				Job Ref	23423
				Borehole/Pit No.	BH3
				Sample No.	-
Site Name	Dolphin Quay			Depth Top	5.00 m
Project ID	E-E1667	Client	OPUS	Depth Base	- m
Soil Description	Medium strength slightly fissured dark grey silty CLAY with rare fine shell fragments			Sample Type	UT
				Sample Received	21/09/2017
				Schedule received	27/09/2017
				Project Started	28/09/2017
Test Method	BS1377:Part 5: 1990, clause 3			Date Test started	11/10/2017





Applied Pressure kPa	Voids ratio	Mv m2/MN	Cv (t50, log) m2/yr	Cv (t90, root) m2/yr	Csec
2.0	0.770	-	-	-	-
35	0.753	0.29	12	14	0.00035
70	0.731	0.36	1.4	1.7	0.0014
140	0.688	0.35	0.59	0.93	0.0028
280	0.630	0.25	0.61	0.92	0.0033
40	0.718	0.22			

Preparation

Orientation wthin sample: Vertical

Particle density: assumed 2.70 Mg/m^3

Specimen details	Initial	Final	
Diameter	74.95	-	mm
Height	18.80	18.25	mm
Moisture Content	29.3	30.4	%
Bulk density	1.97	2.05	Mg/m^3
Dry density	1.53	1.57	Mg/m^3
Voids Ratio	0.770	0.718	
Saturation	103	114	%
Average temperature for test	22.0		oC
Swelling Pressure			kPa
Settlement on saturation			%

Remarks

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UKAS TESTING 2519

Checked and Approved

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Date: 17/10/2017

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MSF-5-R6

Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure
Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No.	Project Name	Programme	
23423	Dolphin Quay	Samples received	21/09/2017
		Schedule received	27/09/2017
Project No.	Client	Project started	28/09/2017
E-E1667	OPUS	Testing Started	04/10/2017

Hole No.	Sample Ref	Sample Top	Sample Base	Sample Type	Soil Description	Test Type	Density bulk Mg/m3	Density dry Mg/m3	w %	Length mm	Diameter mm	σ3 kPa	At failure Axial strain %	At failure σ1 - σ3 kPa	At failure cu kPa	At failure Mode	Remarks
BH1		4.00		UT	Medium strength slightly fissured dark grey silty CLAY	UU	1.84	1.41	30	175	105	130	8.0	149	74	B	
BH1		6.50		UT	Medium strength slightly fissured grey silty CLAY	UU	1.77	1.37	29	200	105	130	11.5	103	51	P	Water softened at top
BH1		9.50		UT	High strength fissured dark grey silty CLAY	UU	2.00	1.52	31	76	38	240	4.2	234	117	B	
BH1		12.50		UT	High strength fissured dark grey silty CLAY	UU	1.90	1.49	27	198	105	250	4.00	268	134	B	
BH1		15.50		U	Very high strength fissured dark grey silty CLAY	UU	2.03	1.64	23	192	105	360	6.3	489	245	B	
BH1		18.50		U	Extremely high strength slightly fissured dark grey slightly sandy sltty CLAY	UU	2.08	1.77	18	205	105	370	11.7	651	326	P	
BH2		8.50		U	Medium strength fissured dark grey silty CLAY	UU	1.92	1.52	26	195	105	220	3.1	124	62	B	
BH2		11.50		UT	High strength slightly fissured dark grey silty CLAY	UU	1.85	1.47	26	205	105	230	2.9	174	87	B	
BH2		14.50		UT	Very high strength fissured dark grey silty CLAY	UU	1.99	1.62	23	76	38	340	5.8	572	286	B	
BH2		17.50		U	Very high strength fissured dark grey slightly sandy silty CLAY	UU	2.05	1.73	19	205	105	350	10.2	587	294	P	
BH2		22.50		U	Very high strength fissured dark purple mottled bluish grey slightly sandy silty CLAY	UU	2.24	1.89	18	205	105	450	19.5	413	207	P	
BH2		24.00		U	High strength slightly fissured reddish brown mottled bluish grey silty CLAY	UU	2.18	1.80	21	205	105	480	19.5	278	139	P	
BH3		5.00		UT	Medium strength slightly fissured dark grey silty CLAY with rare fine shell fragments	UU	1.87	1.43	31	198	105	150	8.1	95	48	B	

Legend					
	UU - single stage test (single and multiple specimens)	σ3	Cell pressure	Mode of failure ;	B - Brittle
	UUM - Multistage test on a single specimen	σ1 - σ3	Maximum corrected deviator stress		P - Plastic
	suffix R - remoulded or recompacted	cu	Undrained shear strength, ½ (σ1 - σ3)		C - Compound

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Date: 17/10/2017

UKAS TESTING 2519

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

MSF-5-R7b

Unconsolidated Undrained Triaxial Compression tests without measurement of pore pressure
Summary of Results

Tests carried out in accordance with BS1377:Part 7 : 1990 clause 8 or 9 as appropriate to test

Job No.	Project Name	Programme	
23423	Dolphin Quay	Samples received	21/09/2017
		Schedule received	27/09/2017
Project No.	Client	Project started	28/09/2017
E-E1667	OPUS	Testing Started	04/10/2017

Hole No.	Sample Ref	Sample Top	Sample Base	Sample Type	Soil Description	Test Type	Density bulk Mg/m3	Density dry Mg/m3	w %	Length mm	Diameter mm	σ3 kPa	At failure Axial strain %	At failure σ1 - σ3 kPa	At failure cu kPa	At failure Mode	Remarks
BH3		9.50		UT	High strength slightly fissured dark grey silty CLAY	UU	1.94	1.52	28	205	105	190	8.8	218	109	B	
BH3		12.50		UT	Very high strength fissured dark grey silty CLAY	UU	1.92	1.54	25	76	38	300	5.8	503	251	B	
BH3		15.50		U	Extremely high strength slightly fissured dark grey slightly sandy silty CLAY with partings of fine grey sand/silt	UU	2.09	1.75	20	198	102	310	19.7	492	246	P	
BH3		18.50		U	High strength slightly fissured dark grey silty CLAY with occasional partings of light grey fine sand/silt	UU	2.20	1.79	23	195	102	370	10.8	267	133	B	

Legend
UU - single stage test (single and multiple specimens)
UUM - Multistage test on a single specimen
suffix R - remoulded or recompacted

σ3 Cell pressure
σ1 - σ3 Maximum corrected deviator stress
cu Undrained shear strength, ½ (σ1 - σ3)

Mode of failure ; B - Brittle, P - Plastic, C - Compound

Test Report by K4 SOILS LABORATORY
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Date: 17/10/2017

UKAS TESTING 2519

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MSF-5-R7b

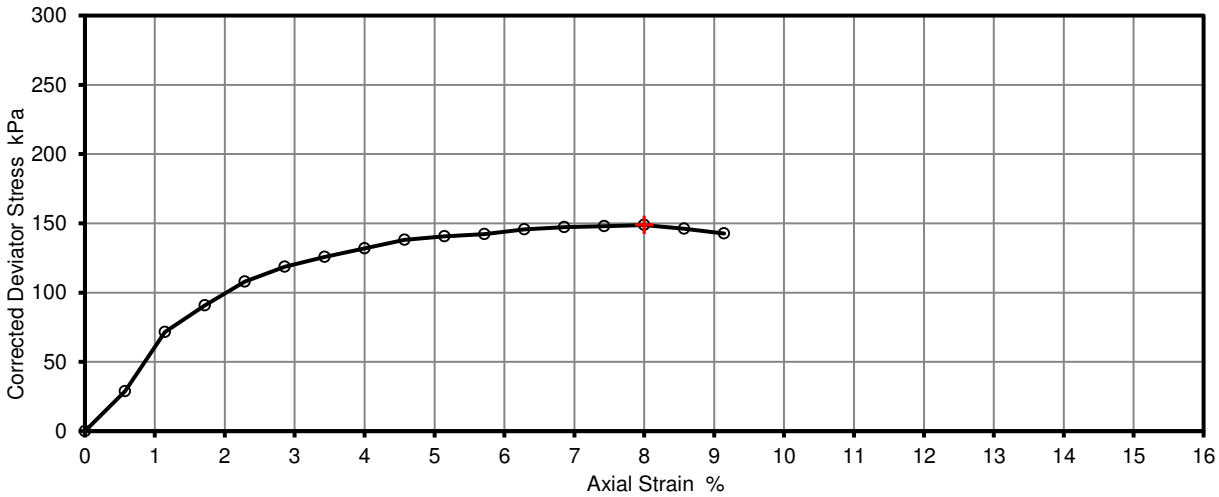
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	4.00 m
Soil Description	Medium strength slightly fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

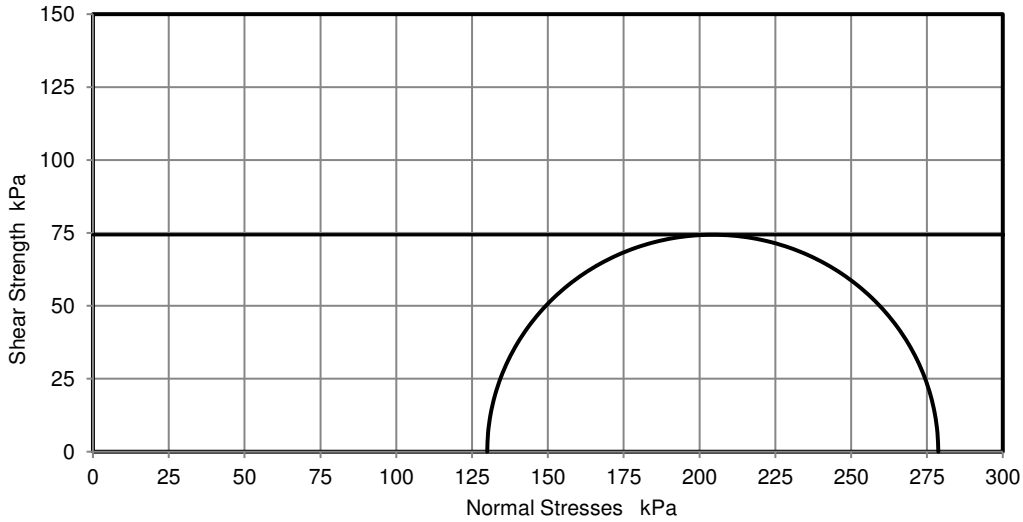
Position within sample

Test Number	1	
Length	175.0	mm
Diameter	105.0	mm
Bulk Density	1.84	Mg/m3
Moisture Content	30	%
Dry Density	1.41	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	130	kPa
Axial Strain	8.0	%
Deviator Stress, (σ1 - σ3)f	149	kPa
Undrained Shear Strength, cu	74	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

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Checked and Approved
Initials: kp
Date 17/10/2017

MSF-5 R7

	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	6.50 m
Soil Description	Medium strength slightly fissured grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	

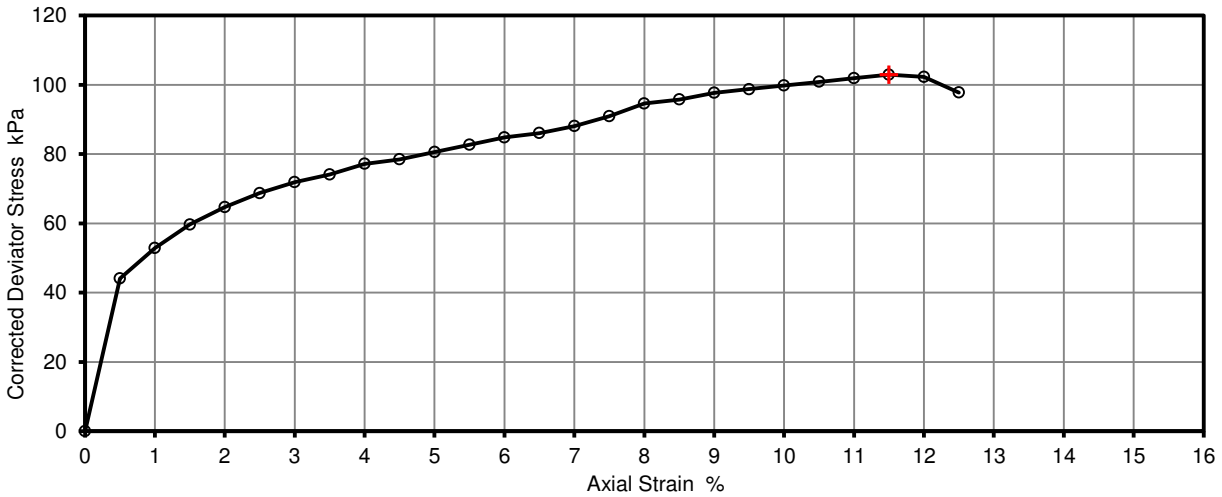
Remarks

Water softened at top

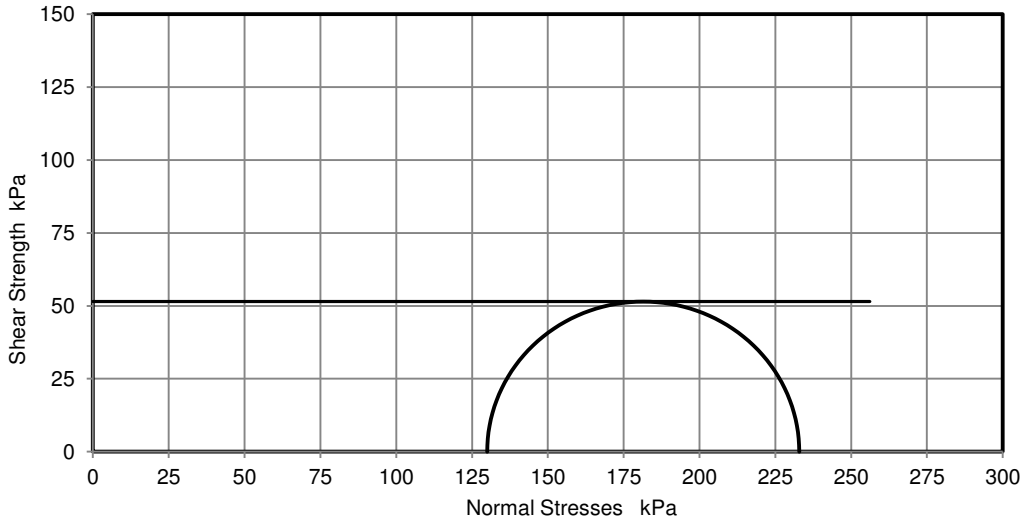
Position within sample

Test Number	1	
Length	200.0	mm
Diameter	105.0	mm
Bulk Density	1.77	Mg/m3
Moisture Content	29	%
Dry Density	1.37	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	130	kPa
Axial Strain	11.5	%
Deviator Stress, (σ1 - σ3)f	103	kPa
Undrained Shear Strength, cu	51	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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

UKAS TESTING 2519

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

Checked and Approved
Initials: kp
Date 17/10/2017

MSF-5 R7

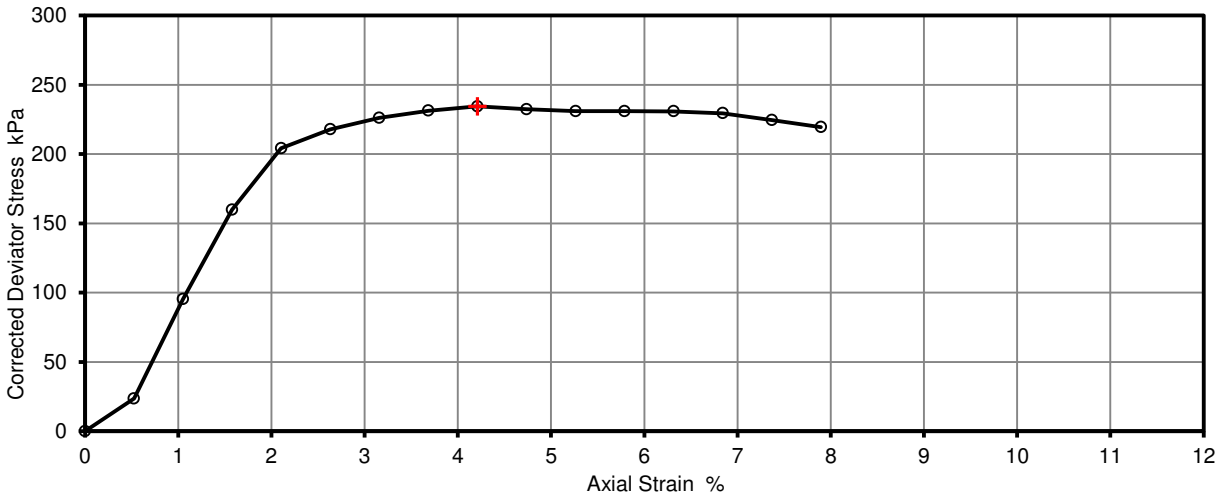
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	9.50 m
Soil Description	High strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	76.0	mm
Diameter	38.0	mm
Bulk Density	2.00	Mg/m3
Moisture Content	31	%
Dry Density	1.52	Mg/m3
Rate of Strain		%/min
Cell Pressure	240	kPa
Axial Strain	4.2	%
Deviator Stress, (σ1 - σ3)f	234	kPa
Undrained Shear Strength, cu	117	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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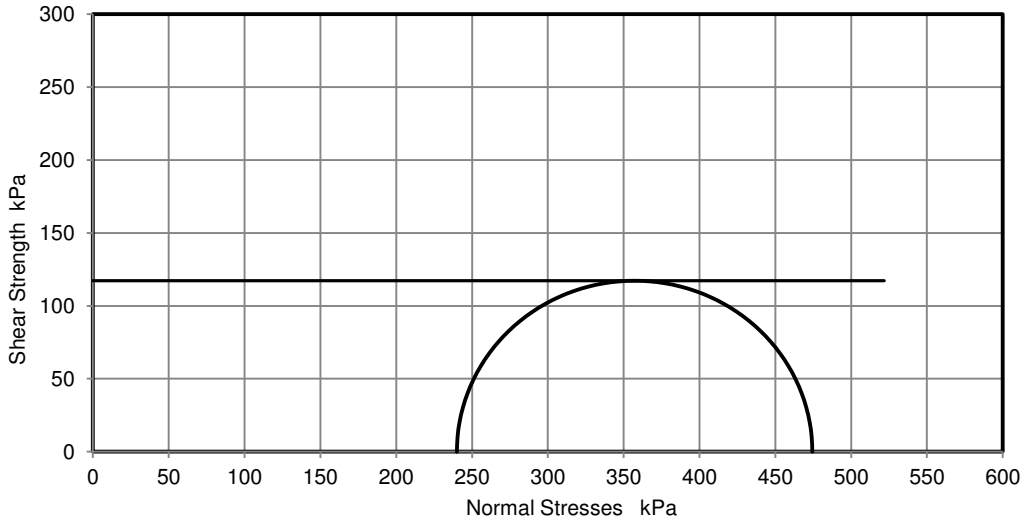

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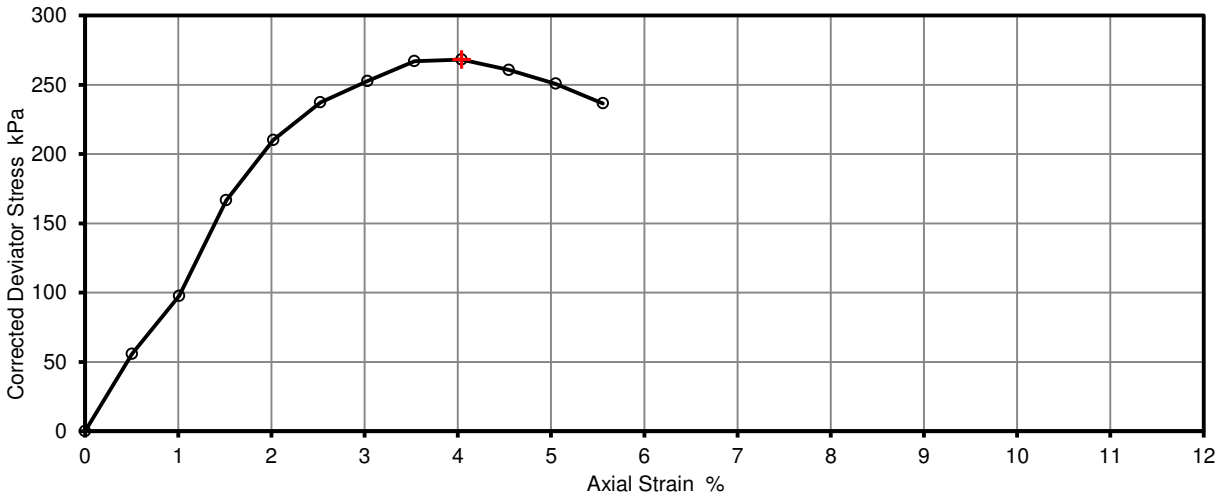
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	12.50 m
Soil Description	High strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	198.0	mm
Diameter	105.0	mm
Bulk Density	1.90	Mg/m3
Moisture Content	27	%
Dry Density	1.49	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	250	kPa
Axial Strain	4.0	%
Deviator Stress, (σ1 - σ3)f	268	kPa
Undrained Shear Strength, cu	134	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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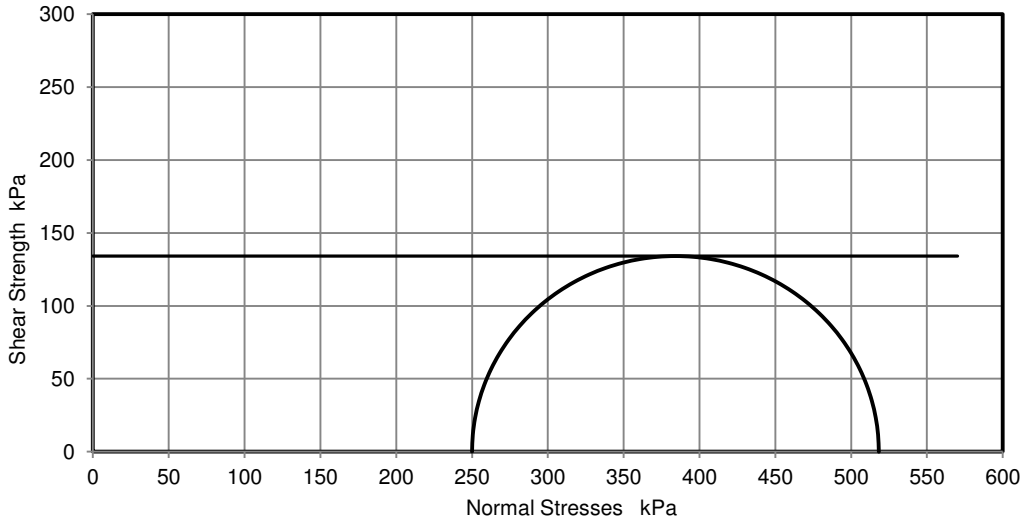

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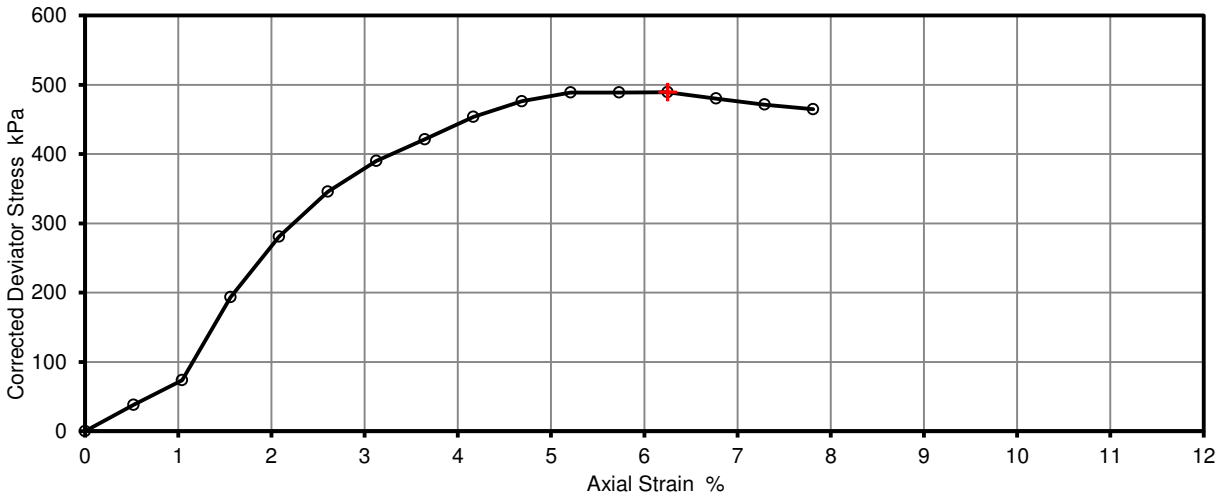
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	15.50 m
Soil Description	Very high strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	192.0	mm
Diameter	105.0	mm
Bulk Density	2.03	Mg/m3
Moisture Content	23	%
Dry Density	1.64	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	360	kPa
Axial Strain	6.3	%
Deviator Stress, (σ1 - σ3)f	489	kPa
Undrained Shear Strength, cu	245	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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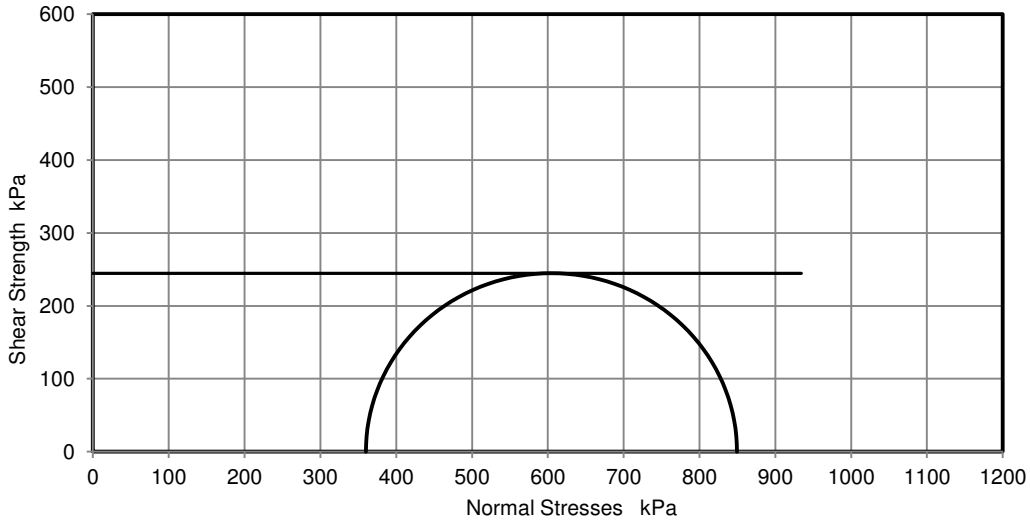

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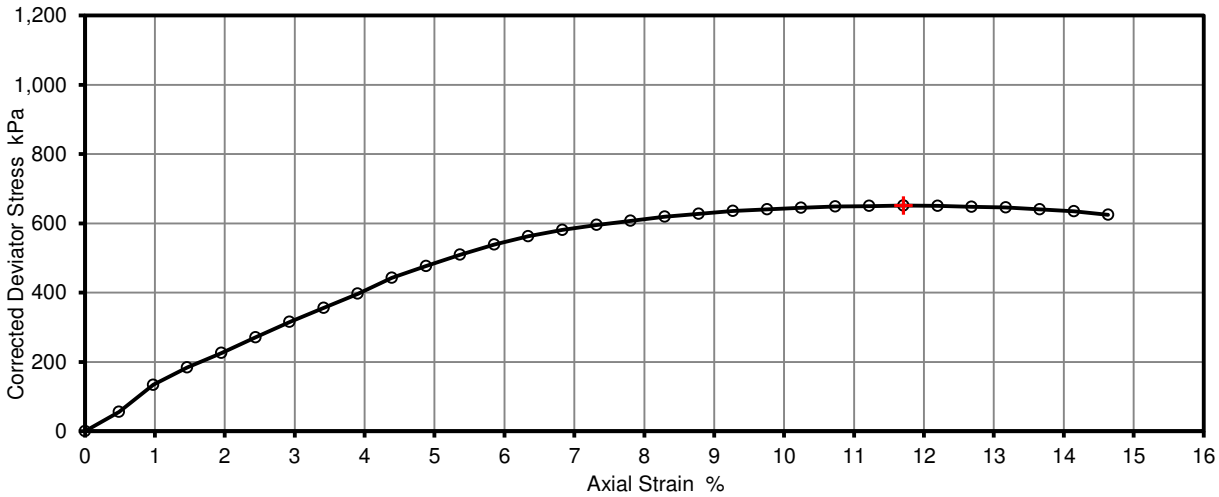
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	18.50 m
Soil Description	Extremely high strength slightly fissured dark grey slightly sandy sltty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

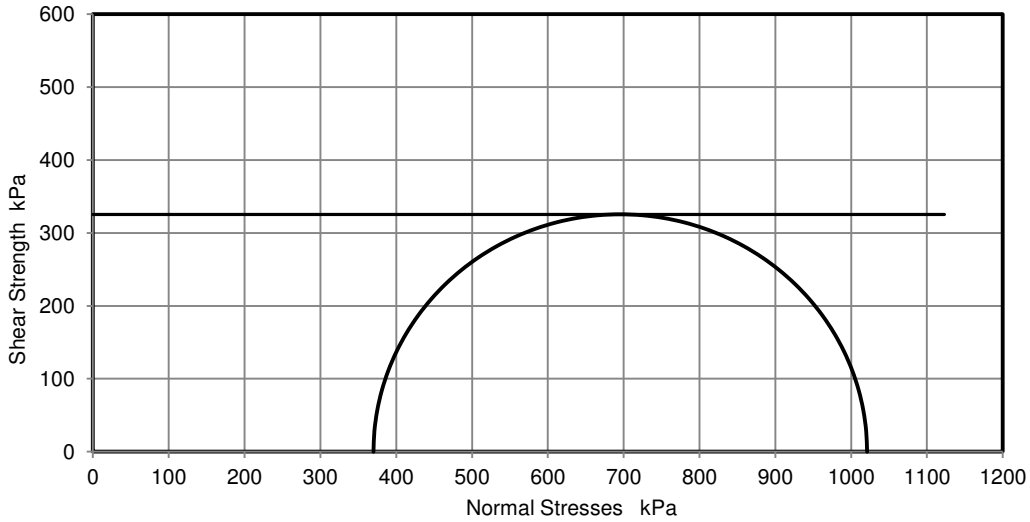
Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	2.08	Mg/m3
Moisture Content	18	%
Dry Density	1.77	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	370	kPa
Axial Strain	11.7	%
Deviator Stress, (σ1 - σ3)f	651	kPa
Undrained Shear Strength, cu	326	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



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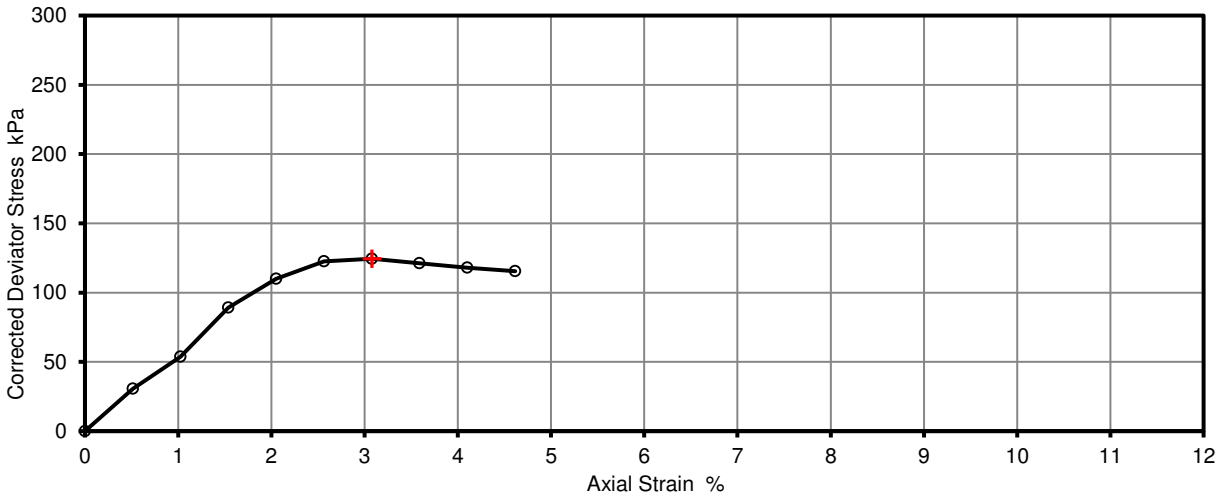
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	8.50 m
Soil Description	Medium strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	195.0	mm
Diameter	105.0	mm
Bulk Density	1.92	Mg/m3
Moisture Content	26	%
Dry Density	1.52	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	220	kPa
Axial Strain	3.1	%
Deviator Stress, (σ1 - σ3)f	124	kPa
Undrained Shear Strength, cu	62	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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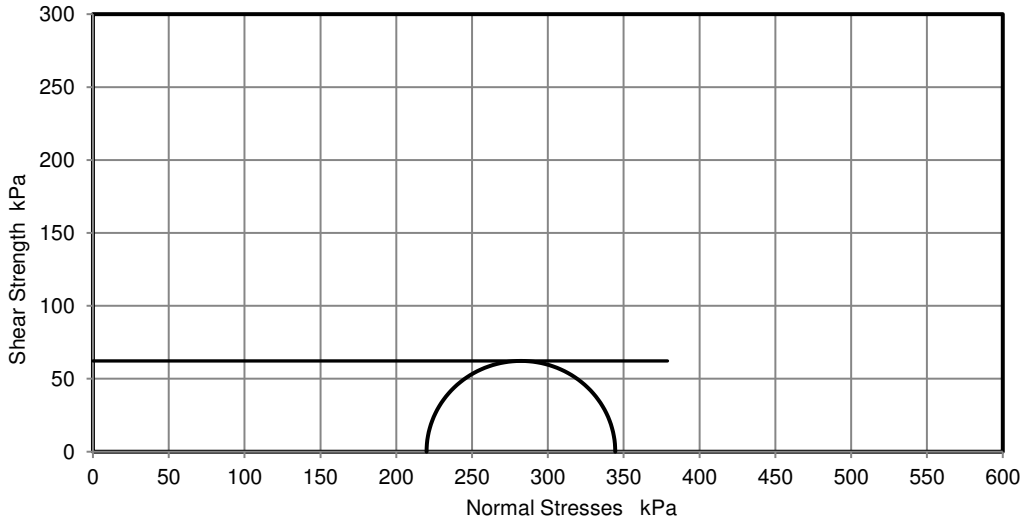

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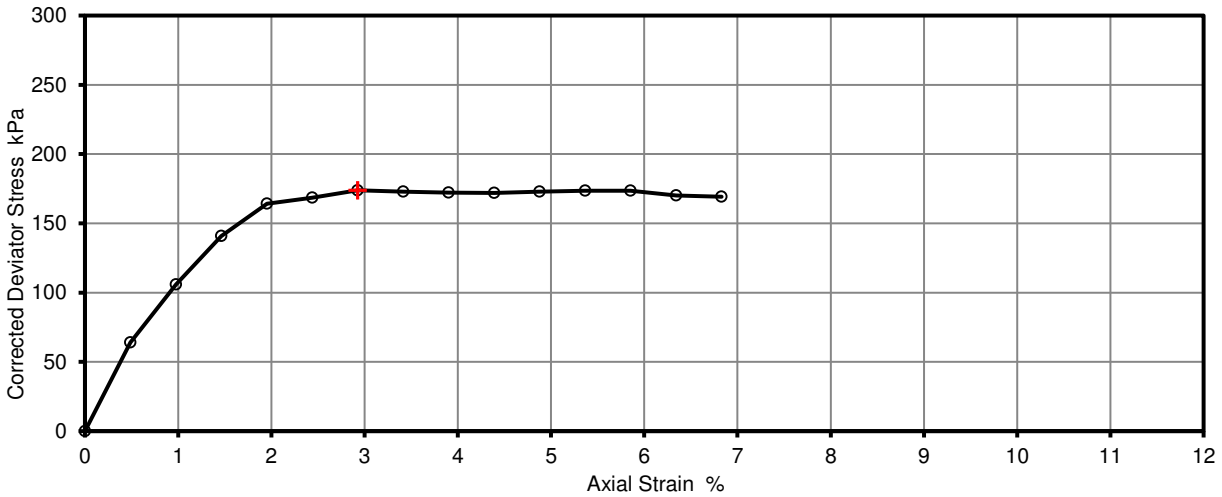
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	11.50 m
Soil Description	High strength slightly fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	1.85	Mg/m3
Moisture Content	26	%
Dry Density	1.47	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	230	kPa
Axial Strain	2.9	%
Deviator Stress, (σ1 - σ3)f	174	kPa
Undrained Shear Strength, cu	87	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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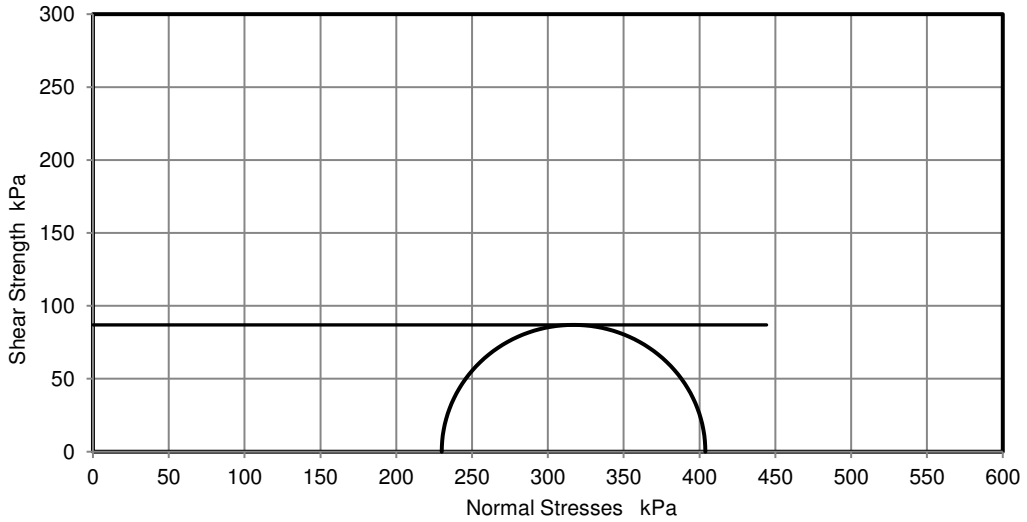

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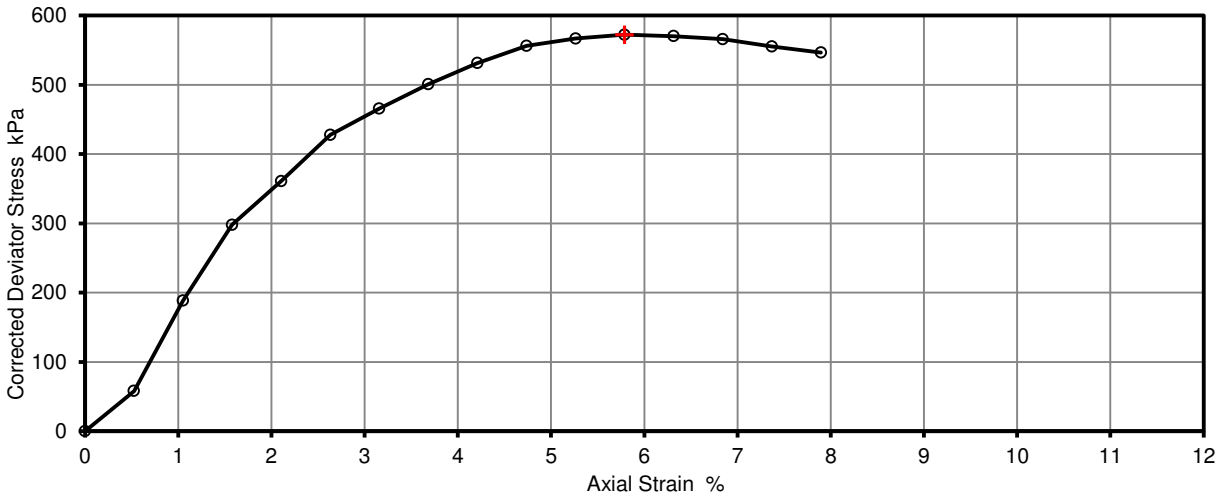
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	14.50 m
Soil Description	Very high strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	76.0	mm
Diameter	38.0	mm
Bulk Density	1.99	Mg/m3
Moisture Content	22	%
Dry Density	1.62	Mg/m3
Rate of Strain		%/min
Cell Pressure	340	kPa
Axial Strain	5.8	%
Deviator Stress, (σ1 - σ3)f	572	kPa
Undrained Shear Strength, cu	286	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



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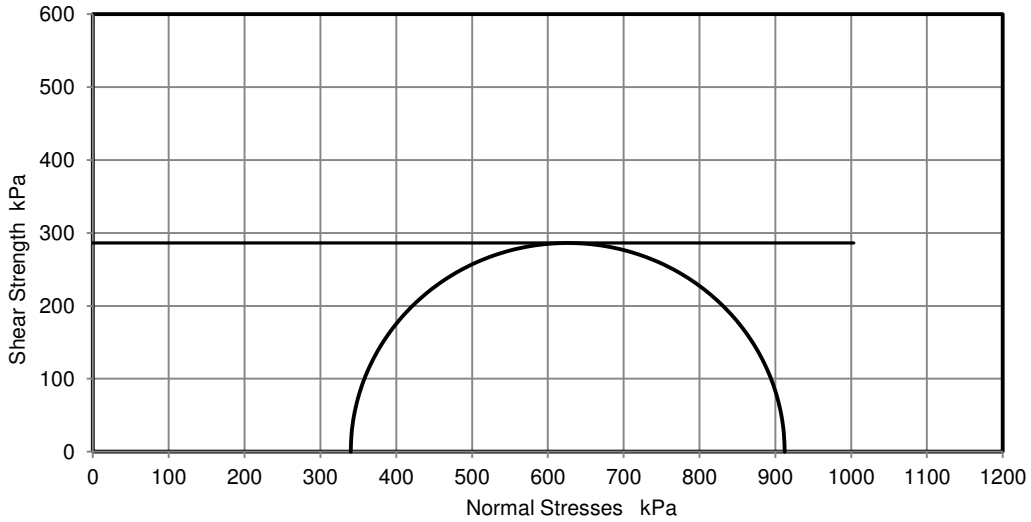

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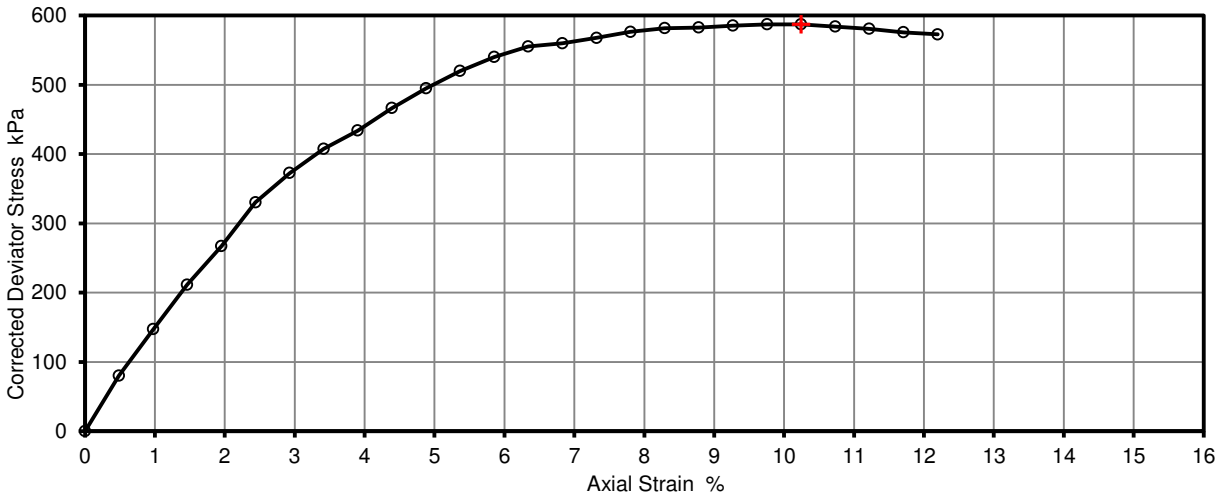
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	17.50 m
Soil Description	Very high strength fissured dark grey slightly sandy silty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	2.05	Mg/m3
Moisture Content	19	%
Dry Density	1.73	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	350	kPa
Axial Strain	10.2	%
Deviator Stress, (σ1 - σ3)f	587	kPa
Undrained Shear Strength, cu	294	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



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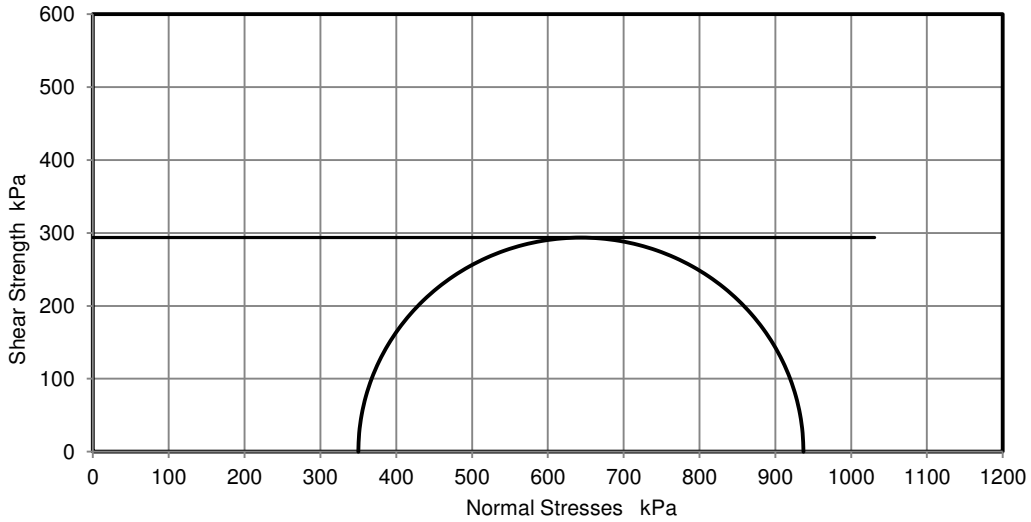

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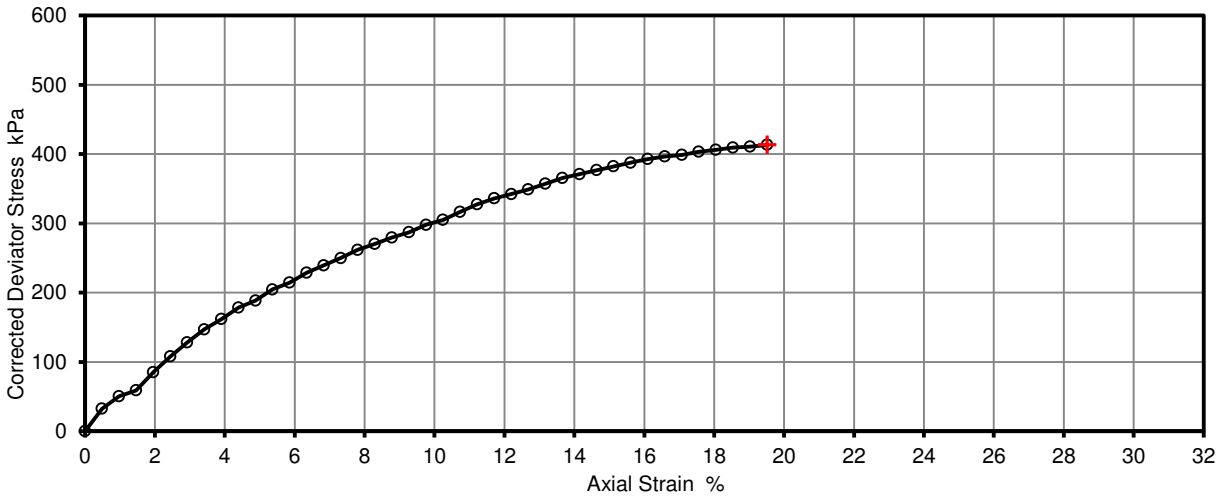
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	22.50 m
Soil Description	Very high strength fissured dark purple mottled bluish grey slightly sandy silty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	2.24	Mg/m3
Moisture Content	18	%
Dry Density	1.89	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	450	kPa
Axial Strain	19.5	%
Deviator Stress, (σ1 - σ3)f	413	kPa
Undrained Shear Strength, cu	207	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



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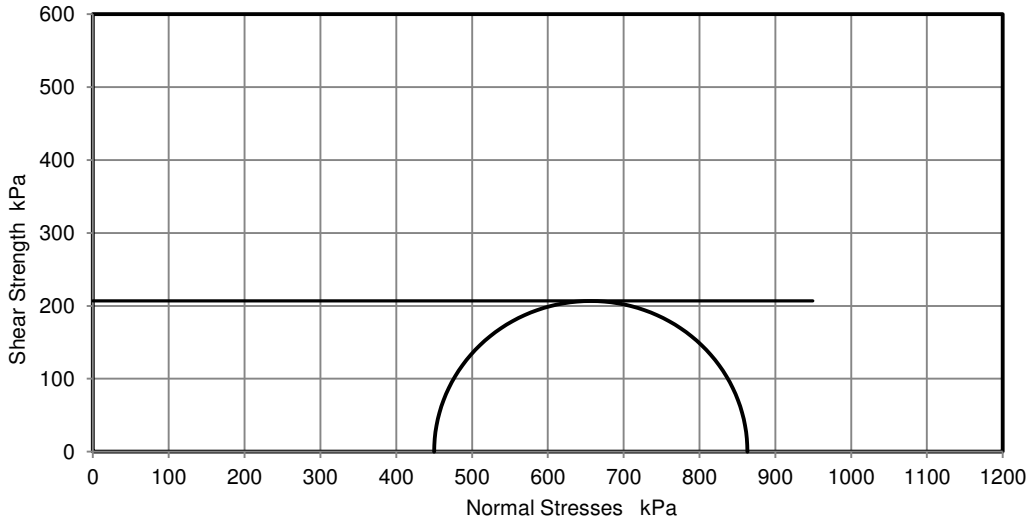

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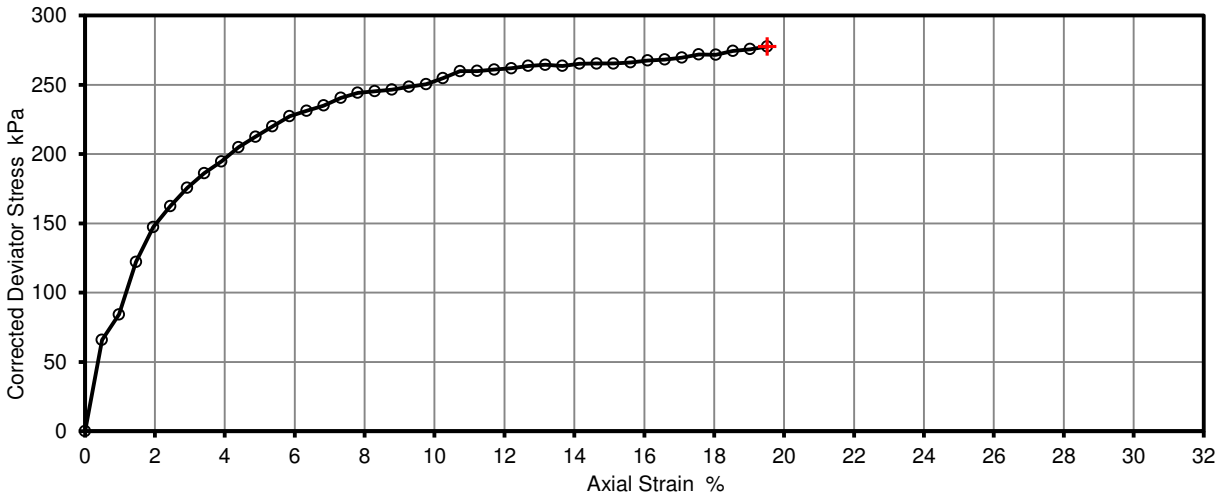
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	24.00 m
Soil Description	High strength slightly fissured reddish brown mottled bluish grey silty CLAY			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	05/10/2017

Remarks

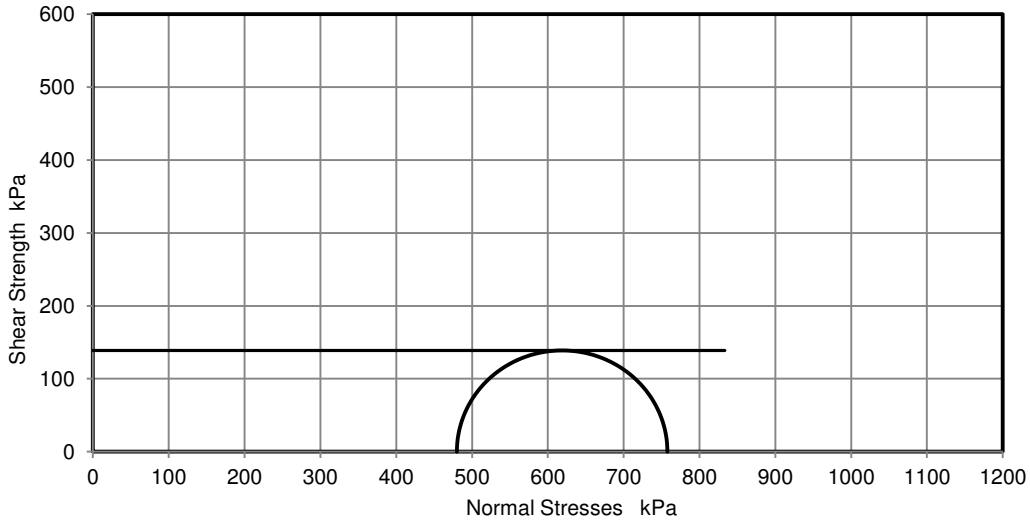
Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	2.18	Mg/m3
Moisture Content	21	%
Dry Density	1.80	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	480	kPa
Axial Strain	19.5	%
Deviator Stress, (σ1 - σ3)f	278	kPa
Undrained Shear Strength, cu	139	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377. This is provided for information only.

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

UKAS TESTING 2519

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

Checked and Approved
Initials: kp
Date 17/10/2017

MSF-5 R7

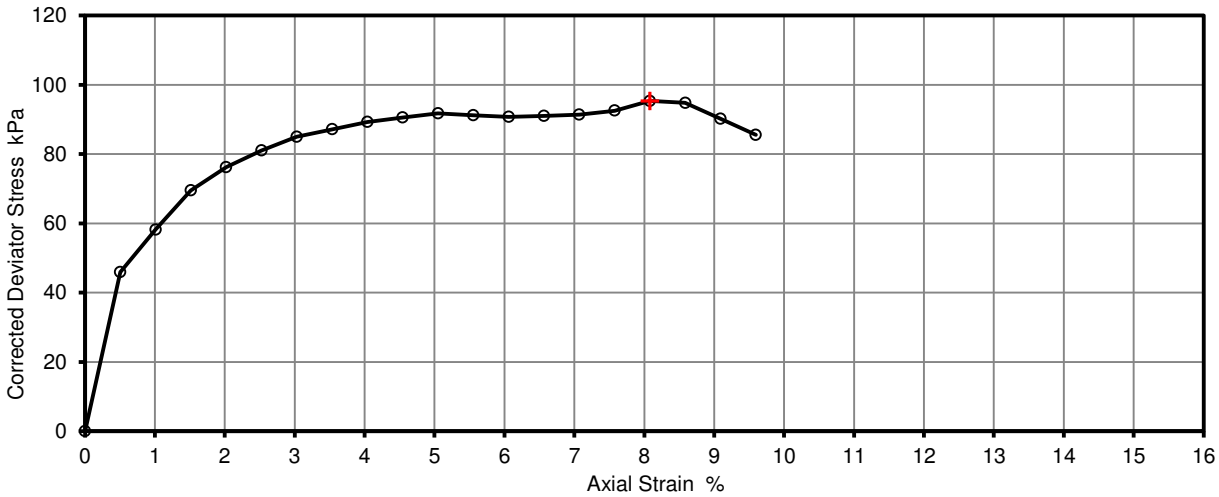
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	5.00 m
Soil Description	Medium strength slightly fissured dark grey silty CLAY with rare fine shell fragments			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

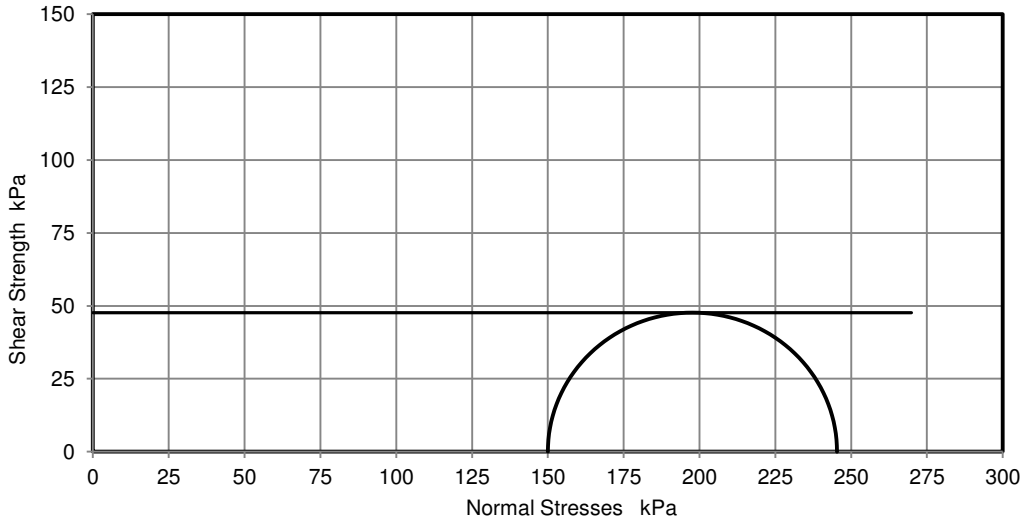
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	105.0	mm
Bulk Density	1.87	Mg/m3
Moisture Content	31	%
Dry Density	1.43	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	150	kPa
Axial Strain	8.1	%
Deviator Stress, (σ1 - σ3)f	95	kPa
Undrained Shear Strength, cu	48	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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MSF-5 R7

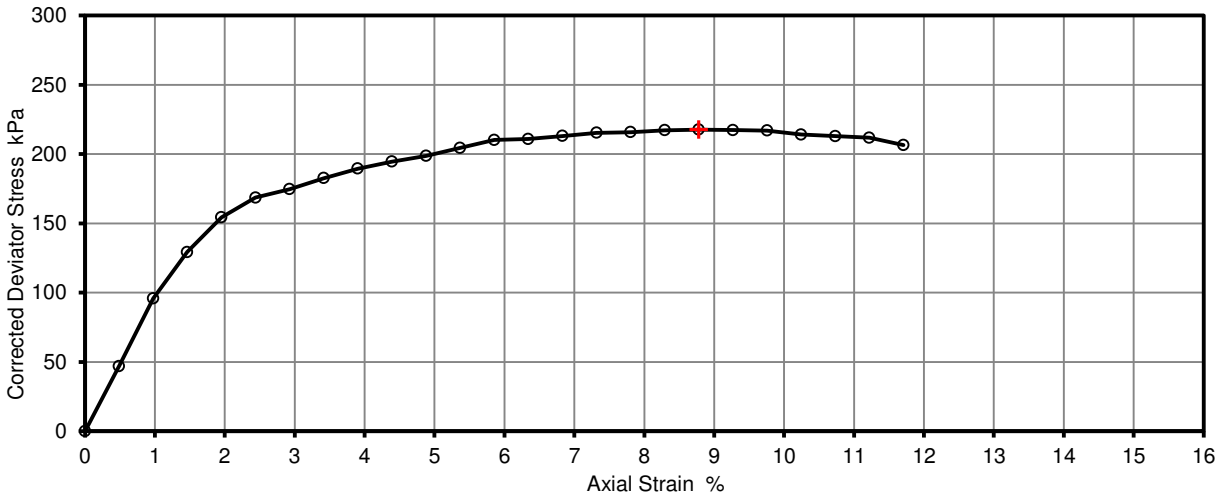
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	9.50 m
Soil Description	High strength slightly fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

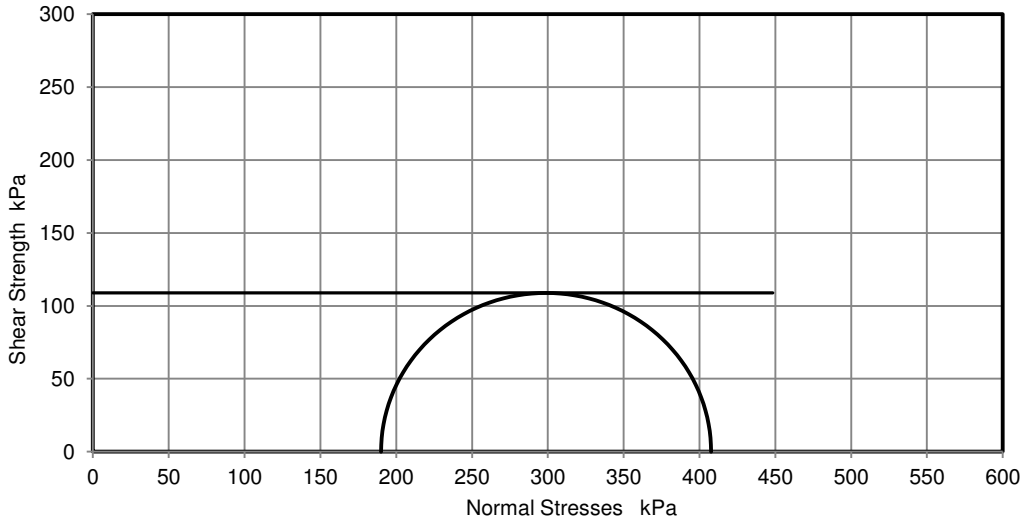
Position within sample

Test Number	1	
Length	205.0	mm
Diameter	105.0	mm
Bulk Density	1.94	Mg/m3
Moisture Content	28	%
Dry Density	1.52	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	190	kPa
Axial Strain	8.8	%
Deviator Stress, (σ1 - σ3)f	218	kPa
Undrained Shear Strength, cu	109	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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MSF-5 R7

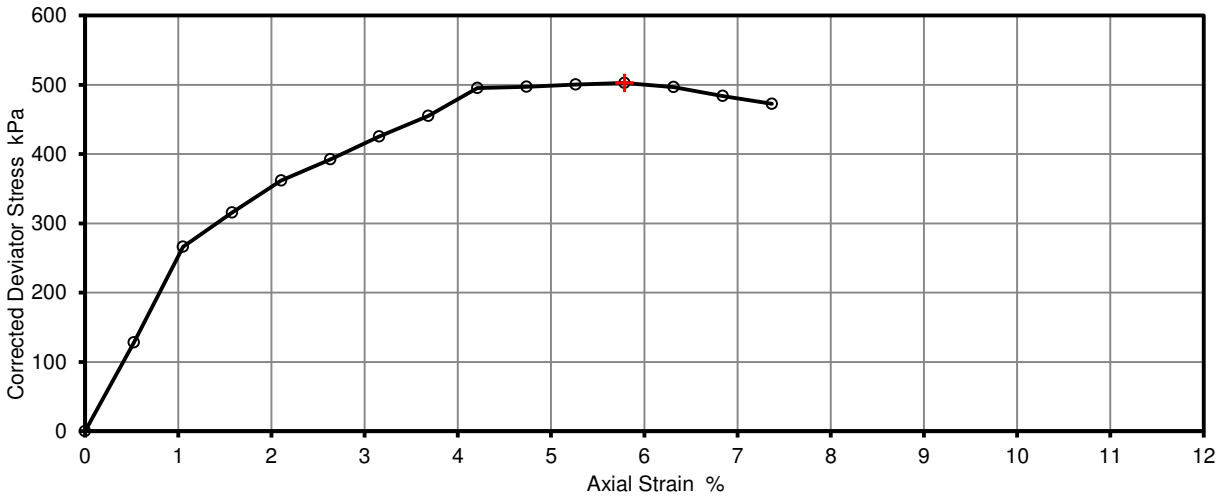
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	12.50 m
Soil Description	Very high strength fissured dark grey silty CLAY			Depth Base	- m
				Sample Type	UT
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	04/10/2017

Remarks

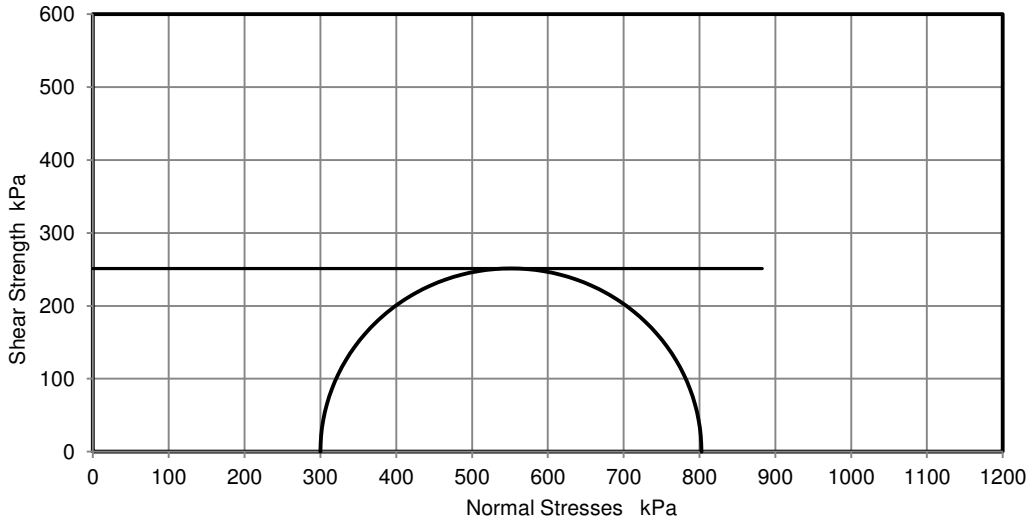
Position within sample

Test Number	1	
Length	76.0	mm
Diameter	38.0	mm
Bulk Density	1.92	Mg/m3
Moisture Content	25	%
Dry Density	1.54	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	300	kPa
Axial Strain	5.8	%
Deviator Stress, (σ1 - σ3)f	503	kPa
Undrained Shear Strength, cu	251	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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MSF-5 R7

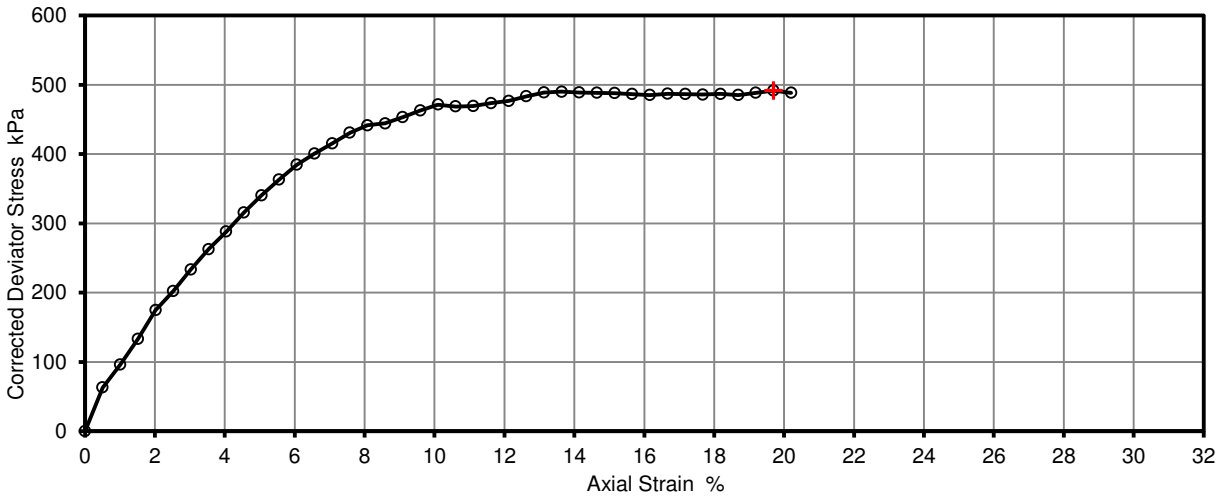
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	15.50 m
Soil Description	Extremely high strength slightly fissured dark grey slightly sandy silty CLAY with partings of fine grey sand/silt			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	05/10/2017

Remarks

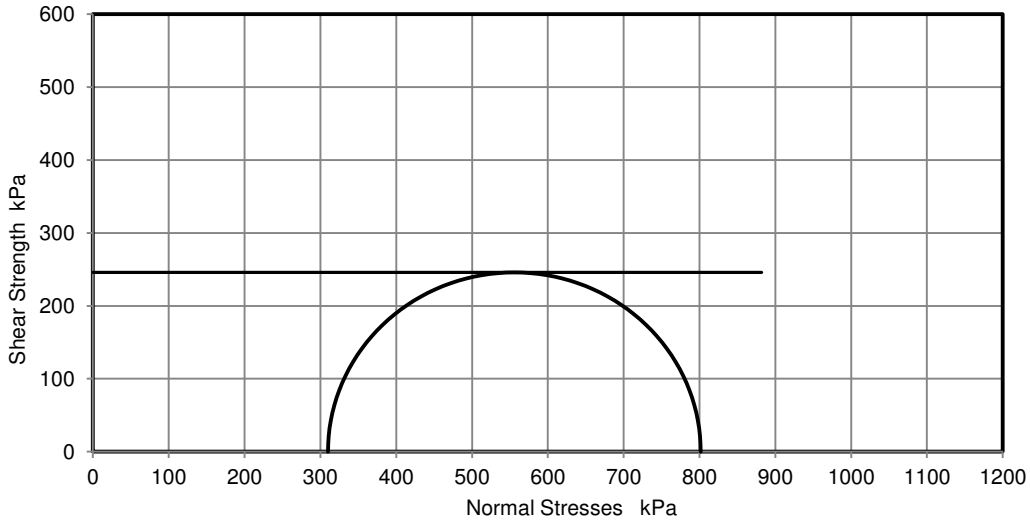
Position within sample

Test Number	1	
Length	198.0	mm
Diameter	102.0	mm
Bulk Density	2.09	Mg/m3
Moisture Content	20	%
Dry Density	1.75	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	310	kPa
Axial Strain	19.7	%
Deviator Stress, (σ1 - σ3)f	492	kPa
Undrained Shear Strength, cu	246	kPa ½(σ1 - σ3)f
Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

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MSF-5 R7

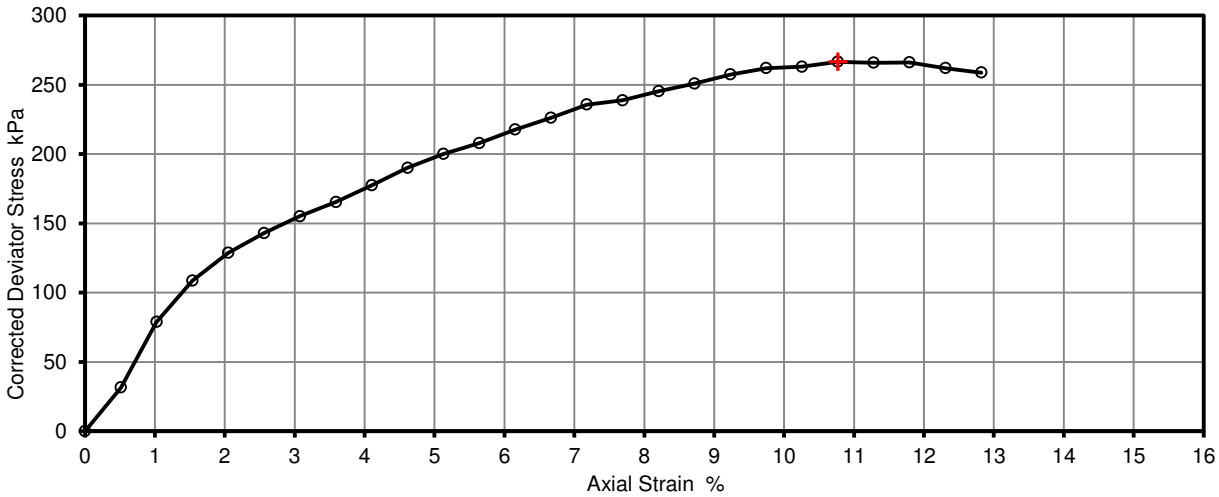
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project No.	E-E1667	Client	OPUS	Depth Top	18.50 m
Soil Description	High strength slightly fissured dark grey silty CLAY with occasional partings of light grey fine sand/silt			Depth Base	- m
				Sample Type	U
				Samples received	21/09/2017
				Schedules received	27/09/2017
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen			Date of test	05/10/2017

Remarks

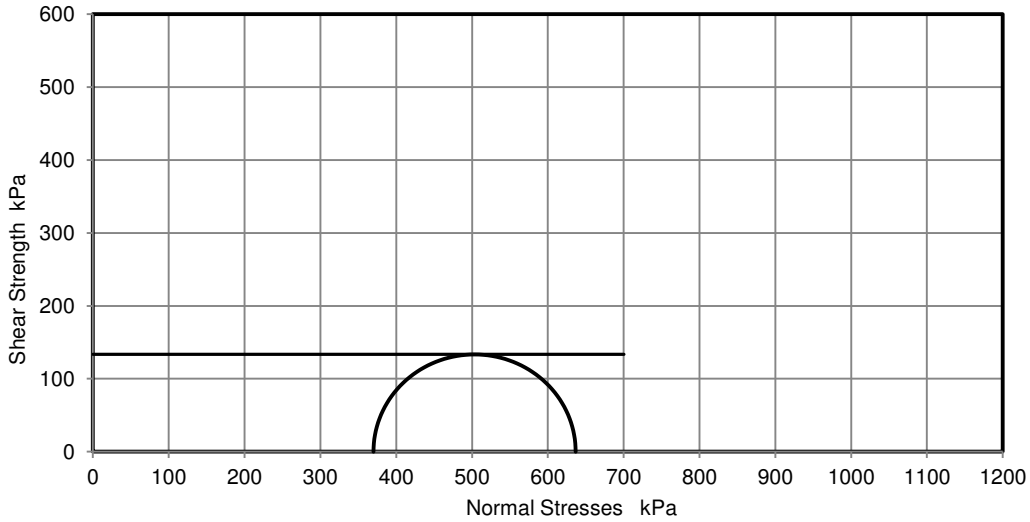
Position within sample

Test Number	1	
Length	195.0	mm
Diameter	102.0	mm
Bulk Density	2.20	Mg/m3
Moisture Content	23	%
Dry Density	1.79	Mg/m3
Rate of Strain	2.0	%/min
Cell Pressure	370	kPa
Axial Strain	10.8	%
Deviator Stress, (σ1 - σ3)f	267	kPa
Undrained Shear Strength, cu	133	kPa ½(σ1 - σ3)f
Mode of Failure	Brittle	

Deviator Stress v Axial Strain



Mohr Circles



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Date 17/10/2017

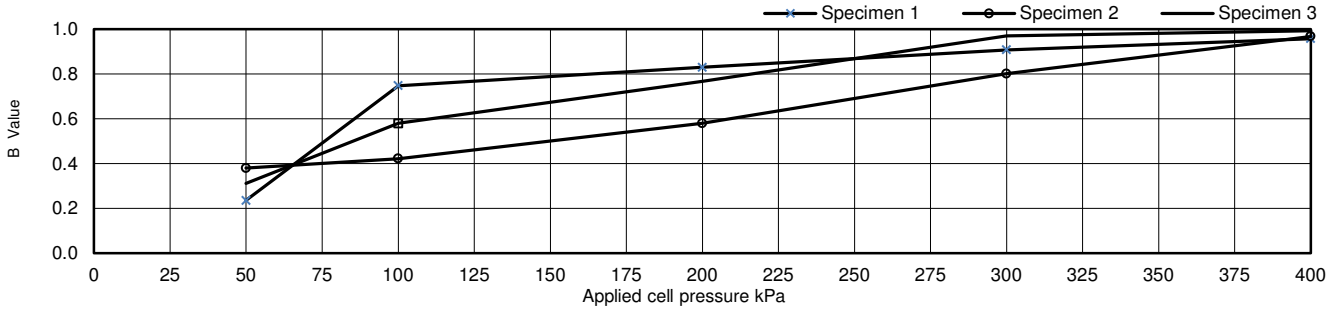
MSF-5 R7

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	4.00
Soil Description	Medium strength slightly fissured dark grey silty CLAY			Sample Type	UT
				Samles received	21-09-17
				Schedule received	27-09-17
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	04-10-17

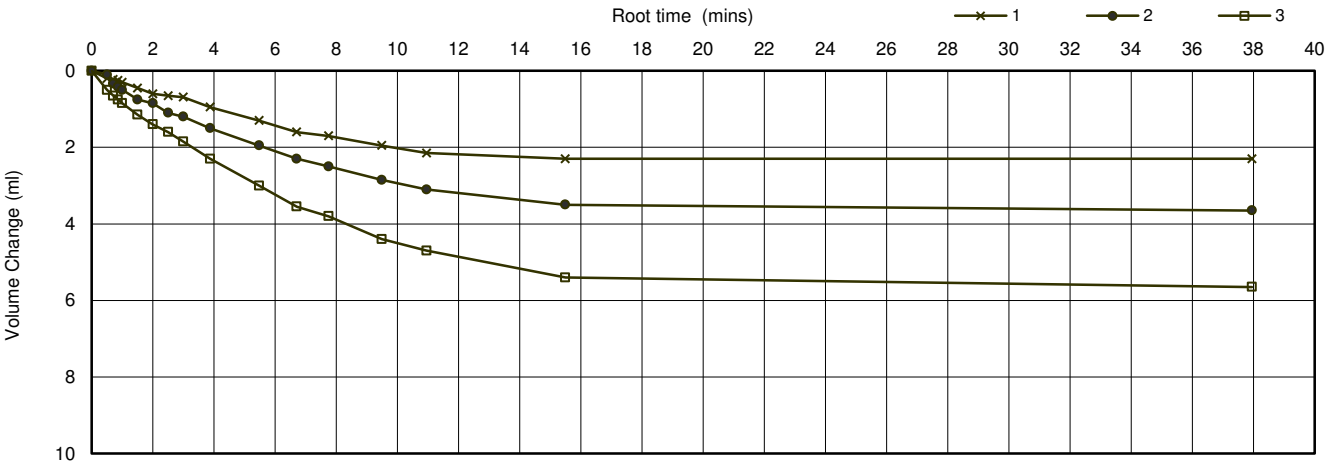
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.0	76.0	76.0
	Diameter	mm	38.0	38.0	38.0
	Bulk Density	Mg/m³	1.98	1.99	1.97
	Water Content	%	30.8	28.7	28.5
	Dry density	Mg/m³	1.52	1.54	1.53
Final	Bulk Density	Mg/m³	1.92	1.92	1.92
	Water Content	%	31.5	28.9	28.6
	Dry density	Mg/m³	1.46	1.46	1.46

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell and back pressure
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	400	400	400
Final pore water pressure	kPa	290	290	290
Final B Value		0.96	0.97	0.99



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		365	430	505	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		65	130	205	kPa
	Pore pressure at start of consolidation		351	418	498	kPa
	Pore pressure at end of consolidation		300	301	299	kPa
	Pore pressure dissipation at end of consolidation		99	99	100	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.27	0.27	0.27	m2/year
	Coefficient of Compressibility	Mvi	0.49	0.34	0.31	m2/MN
	Coefficient of Permeability (calculated)	kvi	4.1E-11	2.8E-11	2.6E-11	m/s



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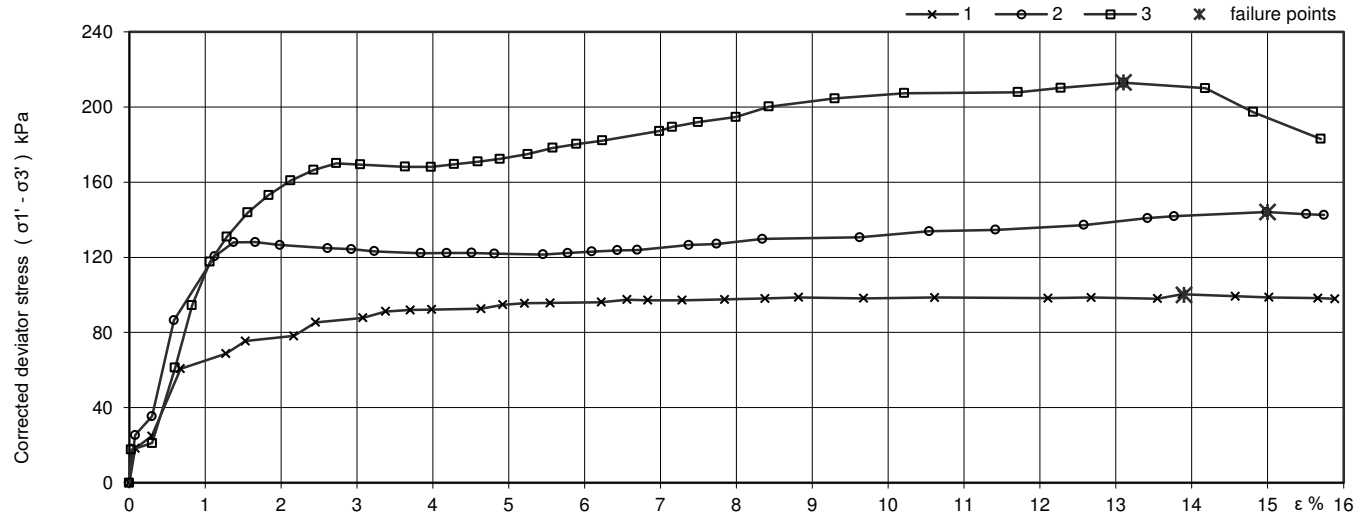
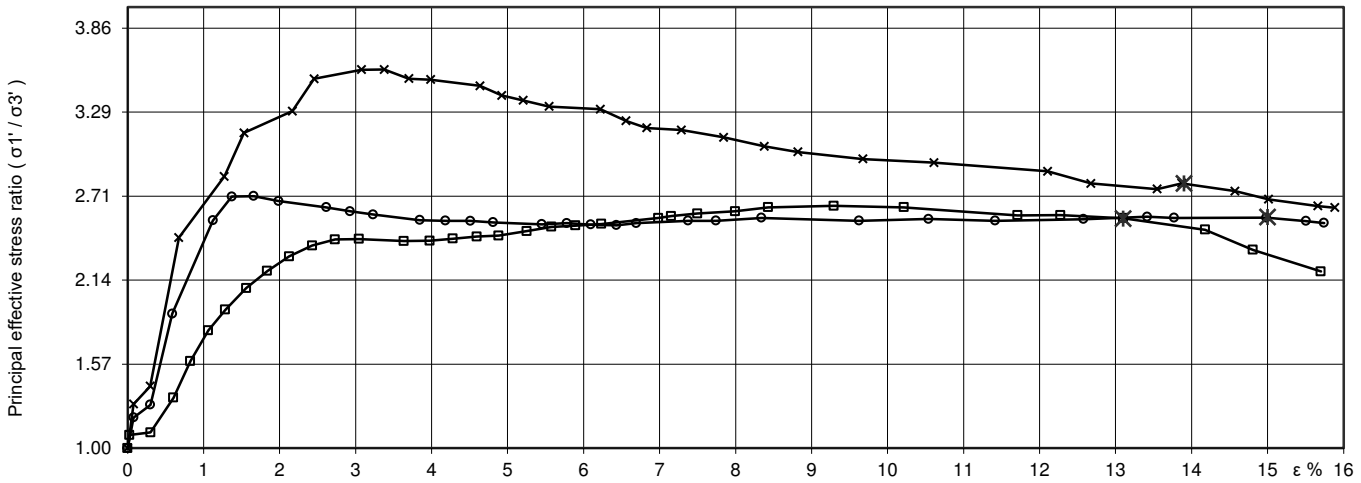
Checked and Aproved

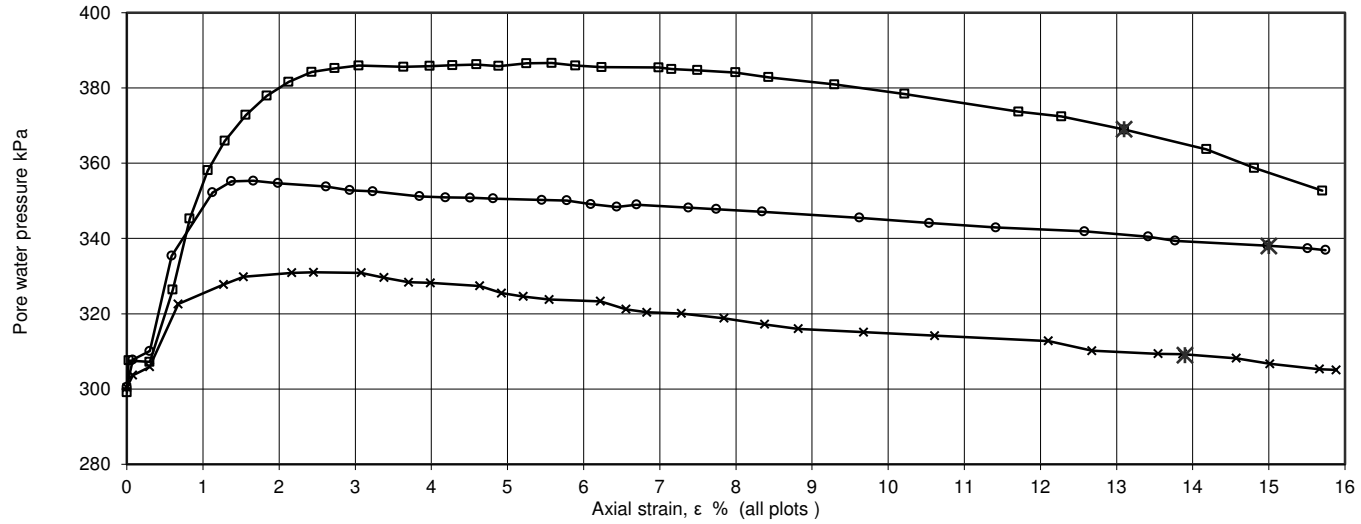
Initials kp

Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	4.00
Compression stages - graphical data				Sample Type	UT
				Schedule received	27/09/207
				Date started	04-10-17







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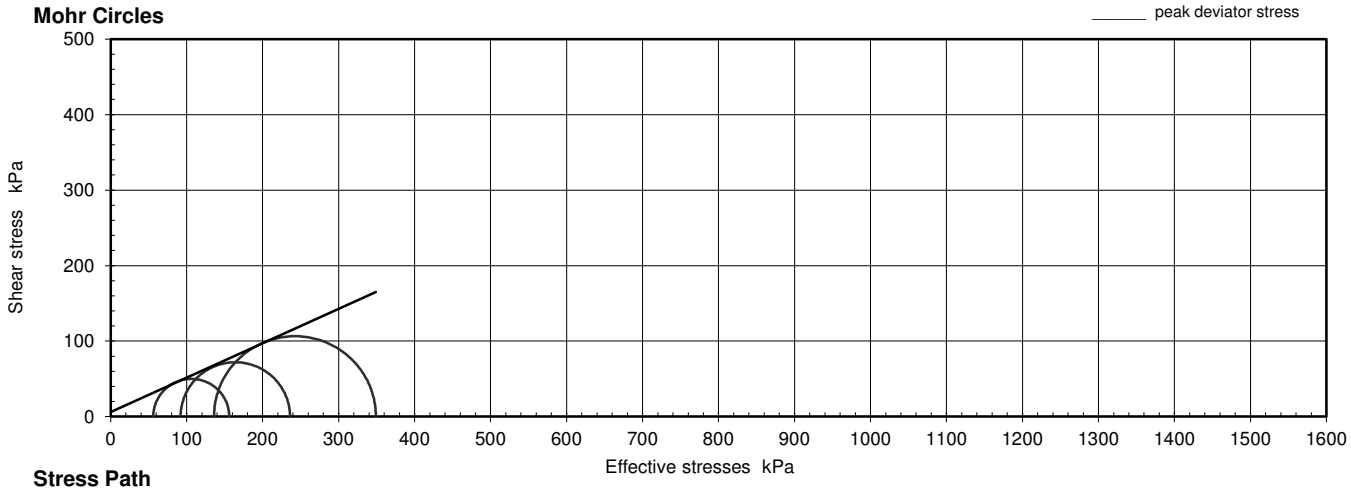
Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	4.00
Compression stages - table of results and interpretation				Sample Type	UT
				Schedule received	27-09-17
				Date started	04-10-17

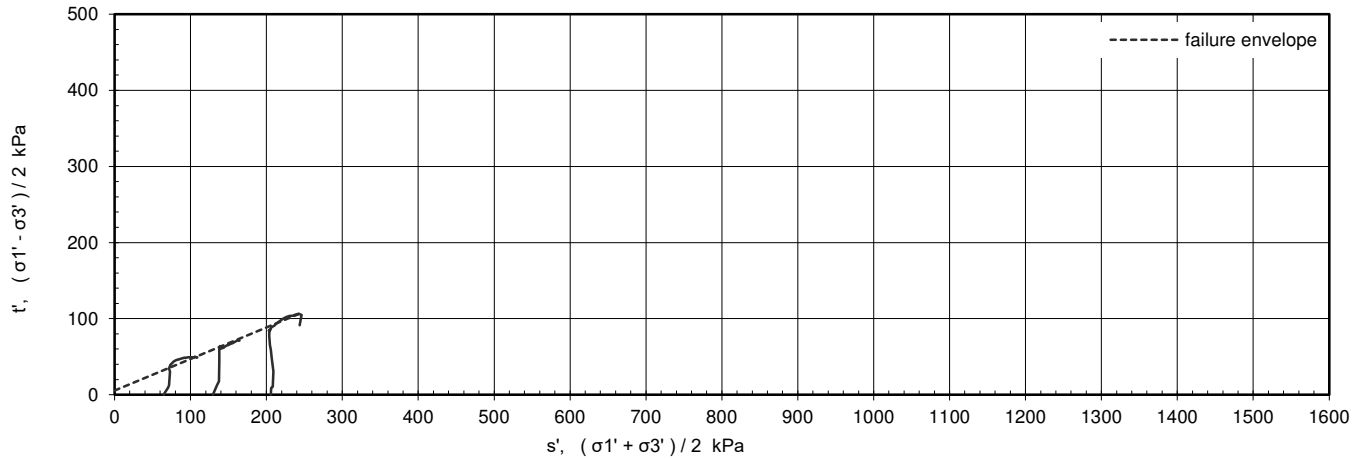
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	365	300	65	0.70	13.9	2.80	100	309	56	156	0.09
2	430	300	130	0.70	15.0	2.57	144	338	92	236	0.26
3	505	300	205	0.70	13.1	2.56	213	369	136	349	0.33

Mohr Circles

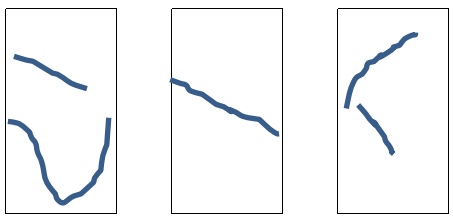


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	5.7	-
	Ø '	degrees	24.5	-

Mode of failure



Plastic Plastic Plastic

Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.3 mm thick rubber membrane/

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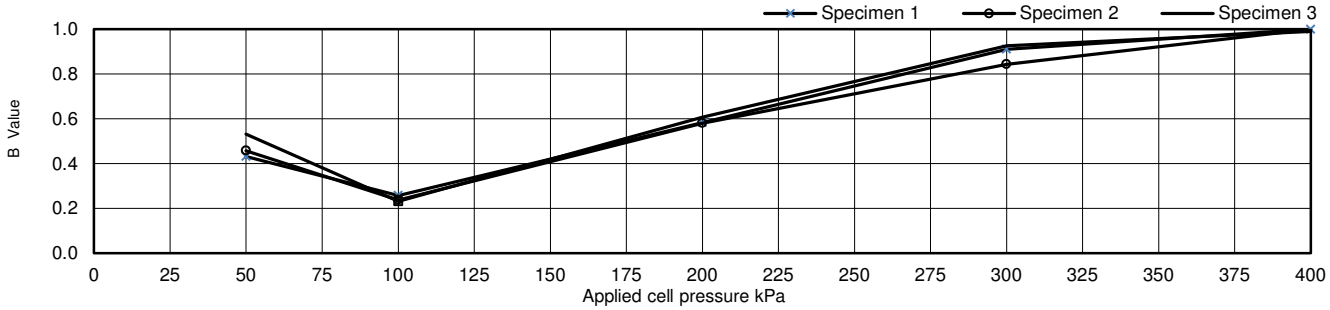
Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	5.00
Soil Description	Medium strength slightly fissured dark grey silty CLAY with rare fine shell fragments			Sample Type	UT
				Samles received	21/09/207
				Schedule received	27/09/207
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	13-10-17

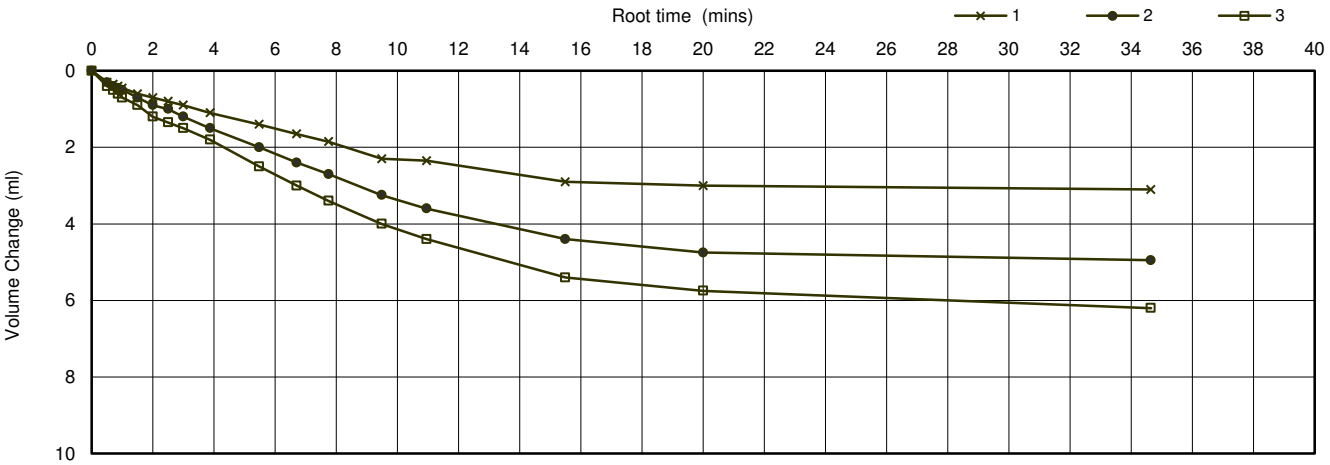
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.2	76.2	76.2
	Diameter	mm	38.1	38.1	38.1
	Bulk Density	Mg/m³	1.93	1.94	1.95
	Water Content	%	28.9	28.1	28.1
	Dry density	Mg/m³	1.50	1.51	1.52
Final	Bulk Density	Mg/m³	1.94	1.94	1.94
	Water Content	%	29.7	27.6	27.1
	Dry density	Mg/m³	1.50	1.50	1.50

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell and back pressure
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	400	400	400
Final pore water pressure	kPa	290	290	290
Final B Value		1.00	1.00	0.99



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		375	450	525	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		75	150	225	kPa
	Pore pressure at start of consolidation		358	445	513	kPa
	Pore pressure at end of consolidation		295	299	298	kPa
	Pore pressure dissipation at end of consolidation		108	101	101	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.28	0.28	0.28	m2/year
	Coefficient of Compressibility	Mvi	0.55	0.38	0.32	m2/MN
	Coefficient of Permeability (calculated)	kvi	4.7E-11	3.2E-11	2.7E-11	m/s



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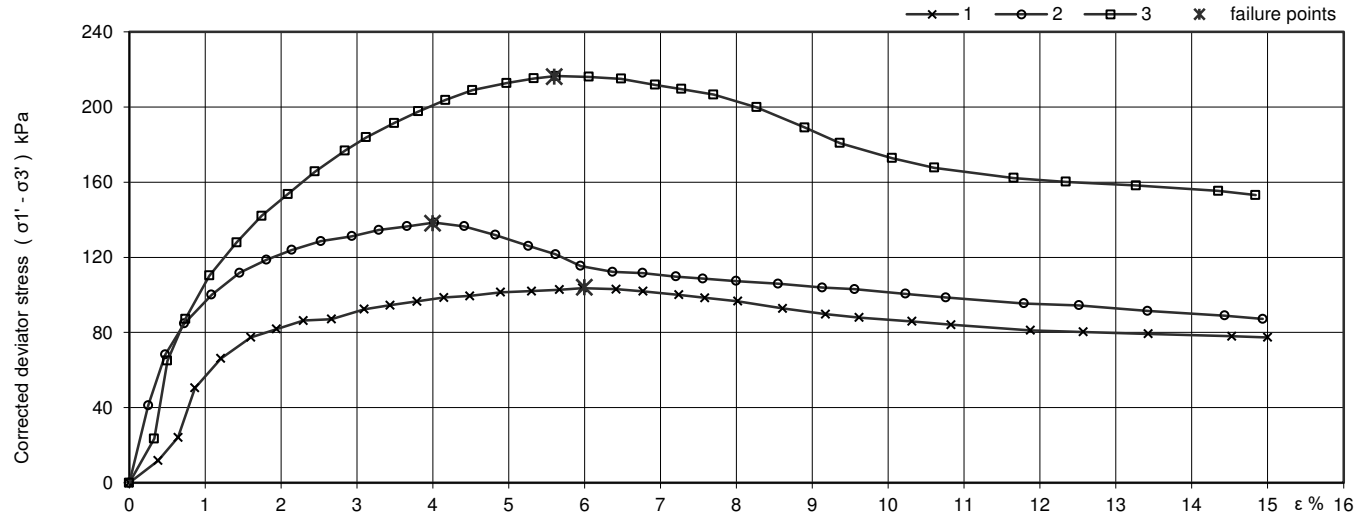
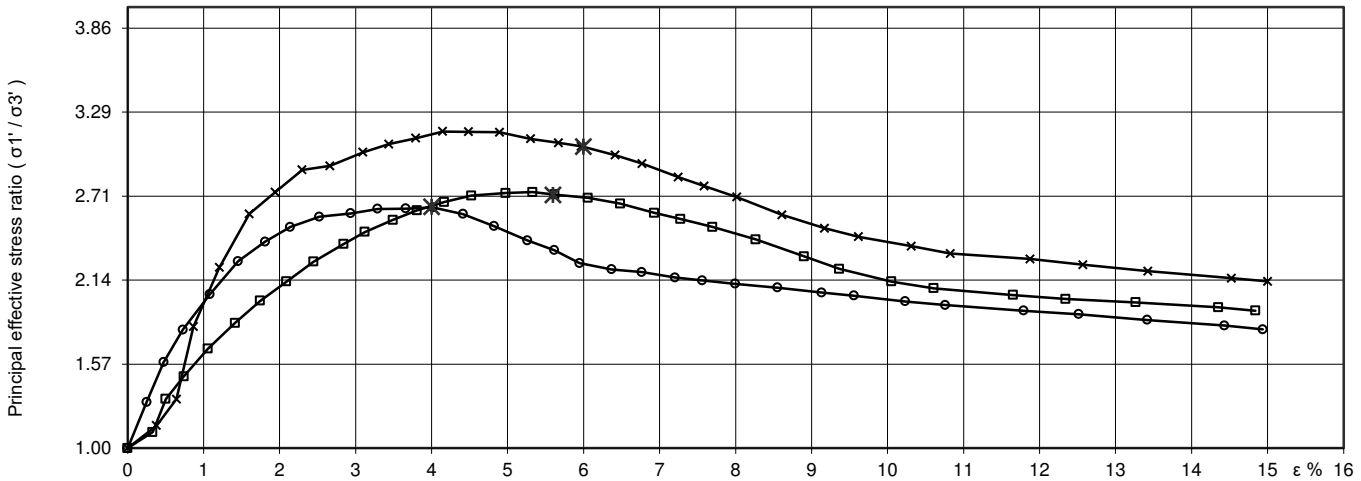
Checked and Aproved

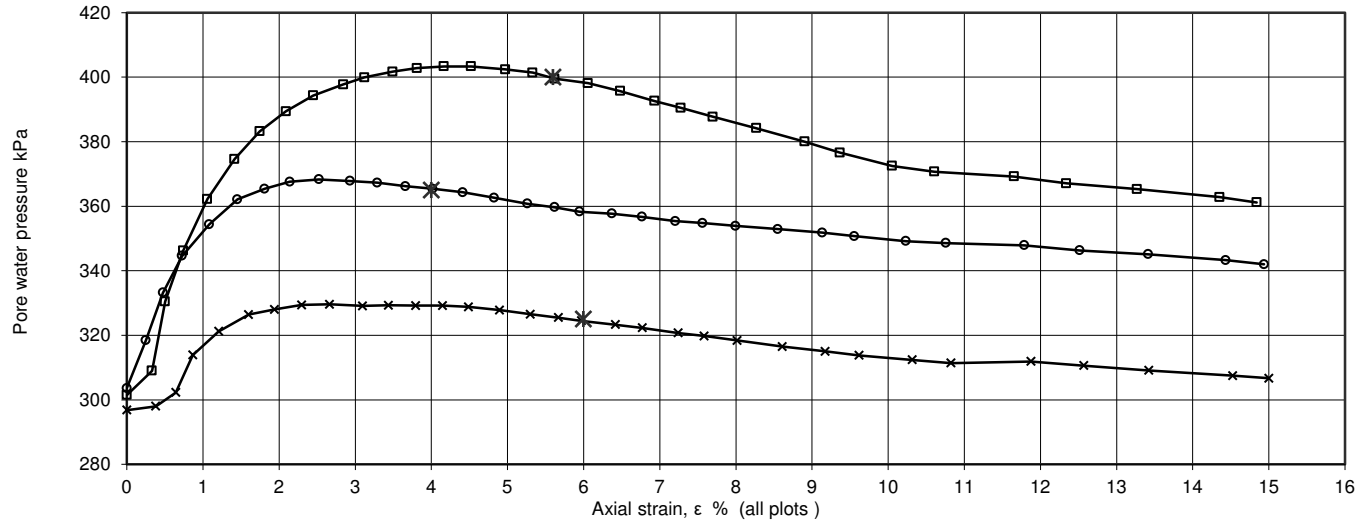
Initials kp

Date 26-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	5.00
Compression stages - graphical data				Sample Type	UT
				Schedule received	27-09-17
				Date started	13-10-17







Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
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Checked and Aproved

Initials **kp**

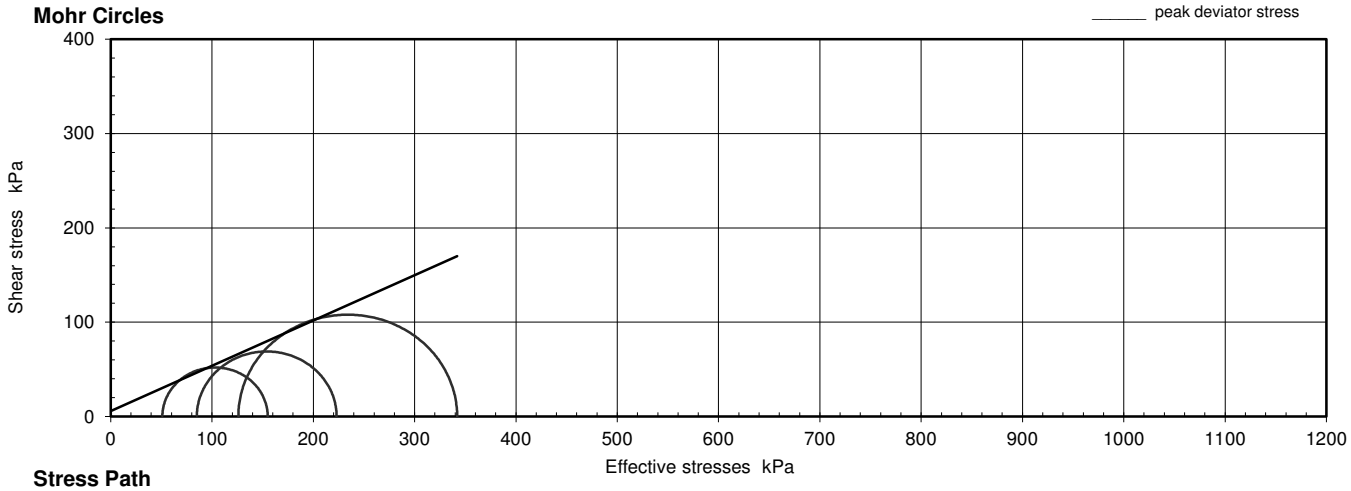
Date 26-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	5.00
Compression stages - table of results and interpretation				Sample Type	UT
				Schedule received	27-09-17
				Date started	13-10-17

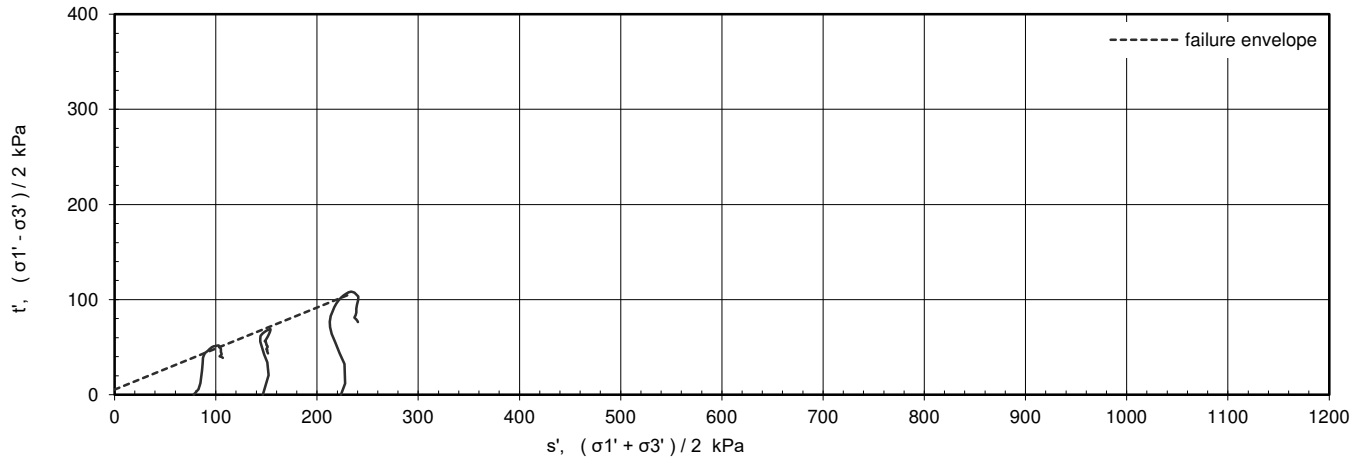
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	375	300	75	0.70	6.0	3.05	104	325	51	154	0.27
2	450	300	150	0.70	4.0	2.64	138	365	85	223	0.45
3	525	300	225	0.70	5.6	2.72	216	400	126	342	0.45

Mohr Circles

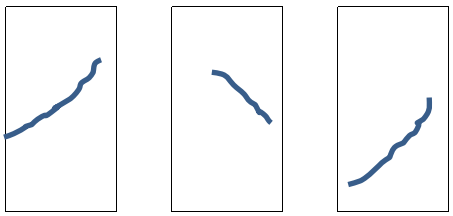


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	6.1	-
	Ø '	degrees	25.6	-

Mode of failure



Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.3 mm thick rubber membrane/

Test Report by K4 SOILS LABORATORY
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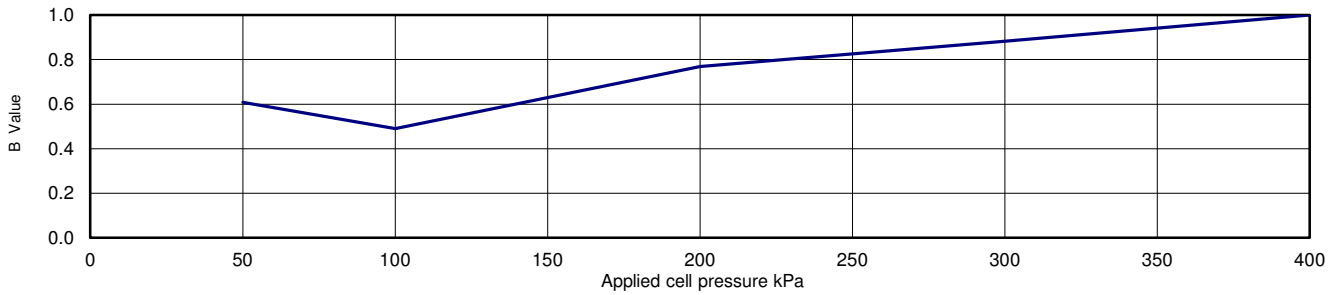
Date 26-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure (Multistage test on a single specimen)			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	OPUS	Depth m	8.50
Soil Description	Medium strength fissured dark grey silty CLAY			Sample Type	U
				Date Scheduled	27.09.2017
Test Method	Multistage test based on BS1377 : Part 8 : 1990, clauses 1 to 6 and 7			Date Started	04.10.2017

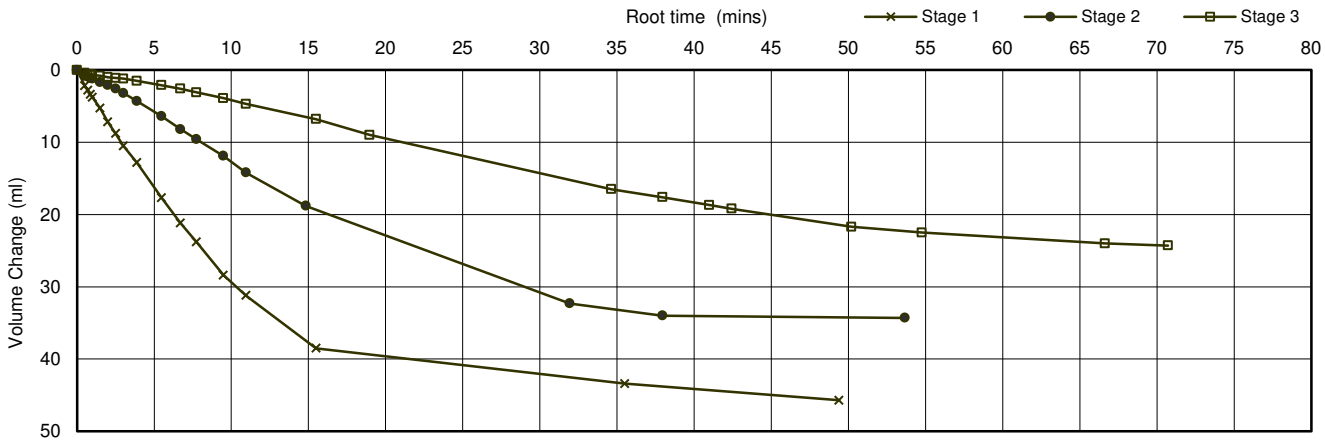
Specimen Type/Preparation	UNDISTURBED As BS 1377

Specimen Details		Initial	Final
Height	mm	205.0	
Diameter	mm	104.0	
Bulk Density	Mg/m³	2.03	1.99
Water Content	%	28.5	26.5
Dry density	Mg/m³	1.58	1.57

Saturation Details	Method of Saturation	
	Increments of cell and back pressure	
Cell pressure increments	100	kPa
Differential Pressure	10	kPa
Final Cell Pressure	400	kPa
Final pore water pressure	290	kPa
Final B Value	1.00	



Consolidation Details	Drainage Conditions		from one end and radial boundary			
	Stage No.		1	2	3	
	Cell Pressure applied		410	520	630	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		110	220	330	kPa
	Pore pressure at start of consolidation		399	429	438	kPa
	Pore pressure at end of consolidation		300	295	300	kPa
	Pore pressure dissipation at end of consolidation		101	104	100	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.49	0.45	0.44	m2/year
	Coefficient of Compressibility	Mvi	0.247	0.145	0.100	m2/MN
	Coefficient of Permeability (calculated)	kvi	3.8E-11	2.0E-11	1.3E-11	m/s



Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
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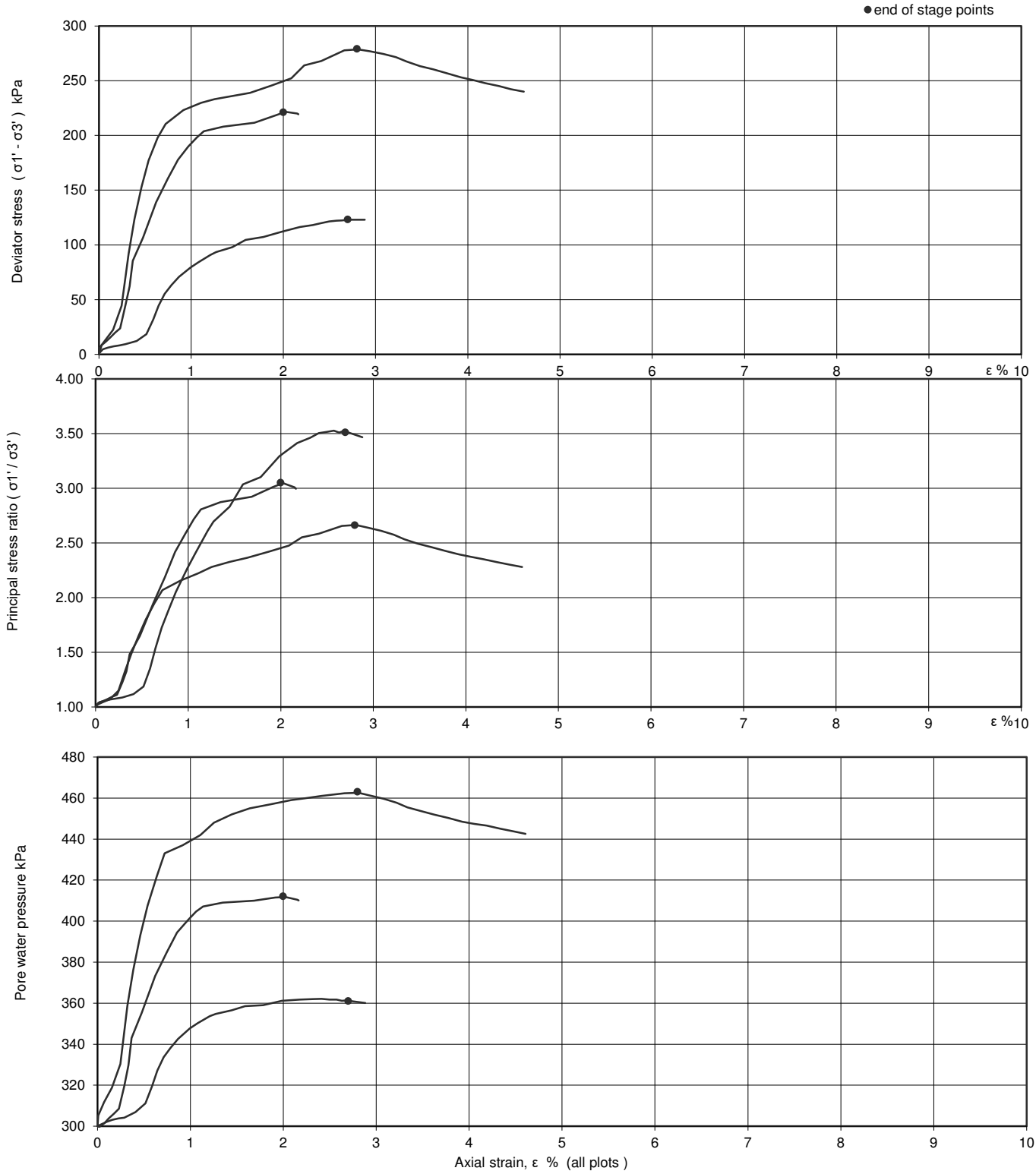
Checked and Aproved
Initials kp
Date 30-10-2017

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure (Multistage test on a single specimen)				Job Ref	23423
					Borehole/Pit No.	BH2
Site Name	Dolphin Quay				Sample No.	-
Project ID	E-E1667	Client	OPUS	m	Depth m	8.50
Compression stages - graphical data					Sample Type	U
					Date Started	04.10.2017



Test Report by K4 SOILS LABORATORY **Unit 8 Olds Close Olds Approach** **Watford Herts WD18 9RU** **Tel: 01923 711 288** **Email: James@k4soils.com**	**Checked and Aproved** **Initials** **kp** **Date** 30-10-2017
MSF-5-R32 *Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)*	Sheet No. 1 0f 3

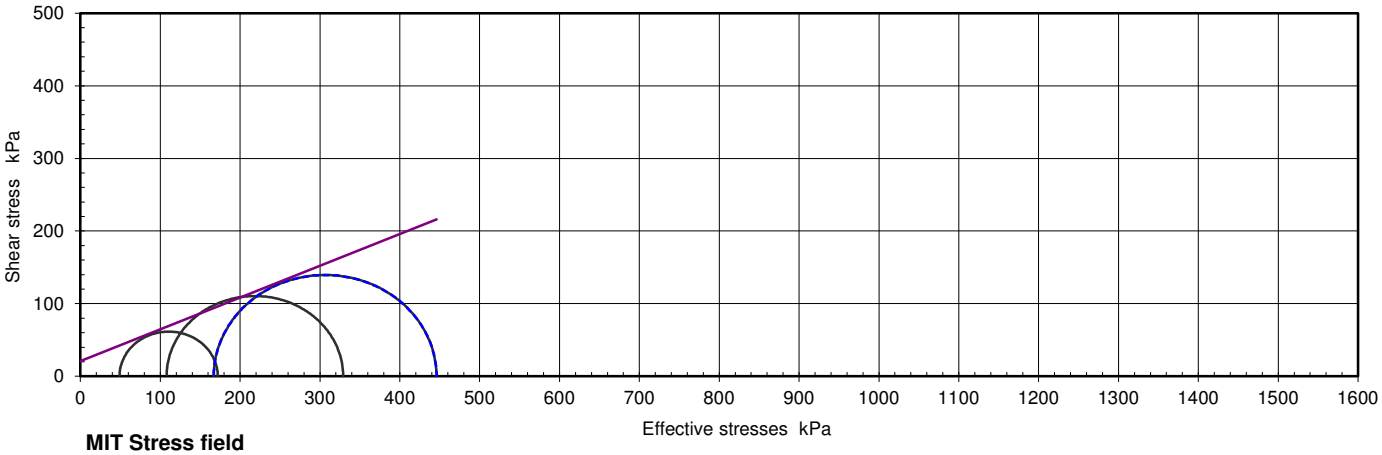
	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure (Multistage test on a single specimen)				Job Ref	23423
					Borehole/Pit No.	BH2
Site Name	Dolphin Quay				Sample No.	-
Project ID	E-E1667	Client	OPUS	m	Depth m	8.50
Compression stages - table of results and interpretation					Sample Type	U
					Date Started	04.10.2017

End of stage criterion : Maximum effective principal stress ratio

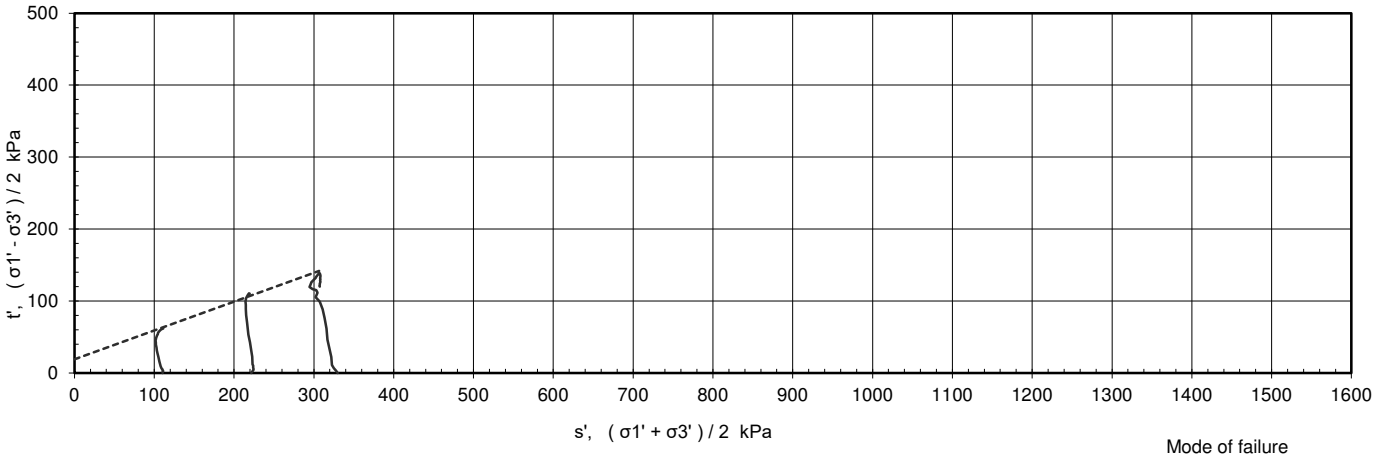
Stage	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	410	300	110	11.00	2.7	3.51	123	361	49	172	0.49
2	520	300	220	1.10	2.0	3.05	221	412	108	330	0.50
3	630	300	330	1.10	2.8	2.66	279	463	167	446	0.58
Conditions at Maximum Deviator Stress					2.8	2.66	279	463	167	446	0.58

Mohr Circles

_____ peak stress ratio _ _ _ _ peak deviator stress (final stage)

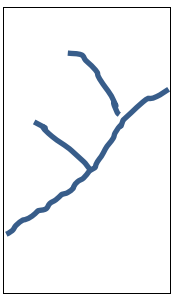


MIT Stress field



Shear Strength Parameters			Linear regression	Manual re-assessment
at peak stress ratio	c '	kPa	20.8	-
	Ø '	degrees	23.6	-

Mode of failure



Remarks

General	Deviator stresses corrected for area change, vertical side drains and 0.3 mm thick rubber membrane/
Stage 1	
Stage 2	
Stage 3	

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
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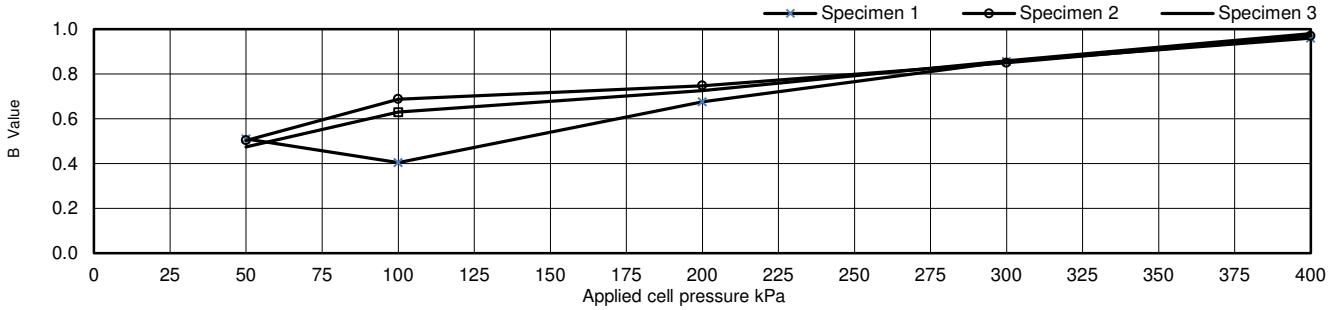
Checked and Aproved
Initials **kp**
Date 30-10-2017

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	9.50
Soil Description	High strength fissured dark grey silty CLAY			Sample Type	UT
				Samles received	21-09-17
				Schedule received	27-09-17
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	10-10-17

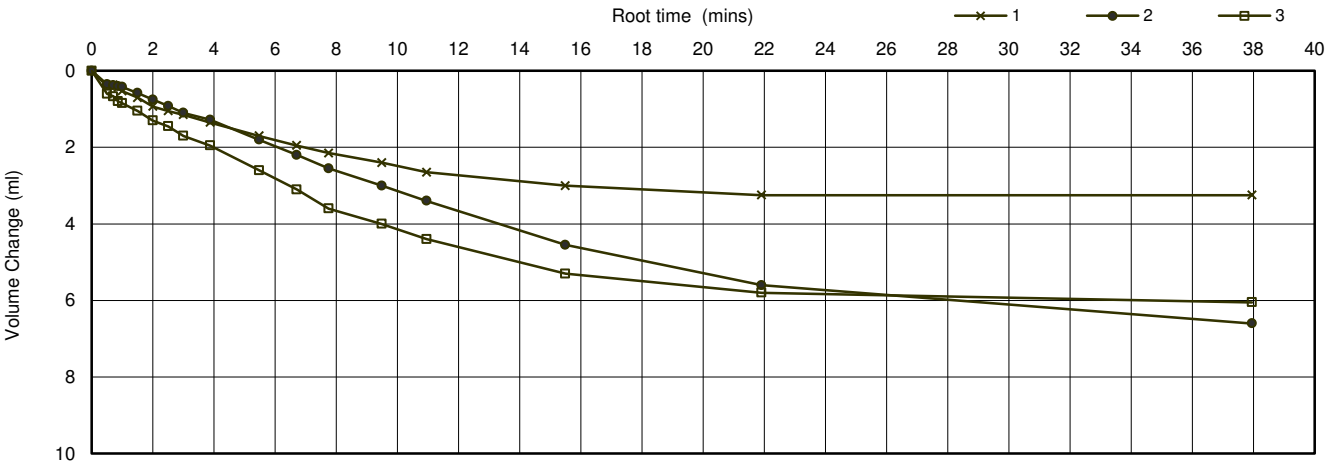
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.2	76.2	76.2
	Diameter	mm	38.1	38.1	38.1
	Bulk Density	Mg/m³	1.98	1.97	1.98
	Water Content	%	29.9	28.1	27.0
	Dry density	Mg/m³	1.52	1.54	1.56
Final	Bulk Density	Mg/m³	1.92	1.92	1.92
	Water Content	%	31.5	28.3	26.8
	Dry density	Mg/m³	1.46	1.46	1.46

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell pressure only
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	400	400	400
Final pore water pressure	kPa	290	290	390
Final B Value		0.96	0.97	0.98



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		420	540	660	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		120	240	360	kPa
	Pore pressure at start of consolidation		397	527	639	kPa
	Pore pressure at end of consolidation		295	306	303	kPa
	Pore pressure dissipation at end of consolidation		105	97	99	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.35	0.27	0.28	m2/year
	Coefficient of Compressibility	Mvi	0.34	0.32	0.19	m2/MN
	Coefficient of Permeability (calculated)	kvi	3.7E-11	2.7E-11	1.7E-11	m/s



Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
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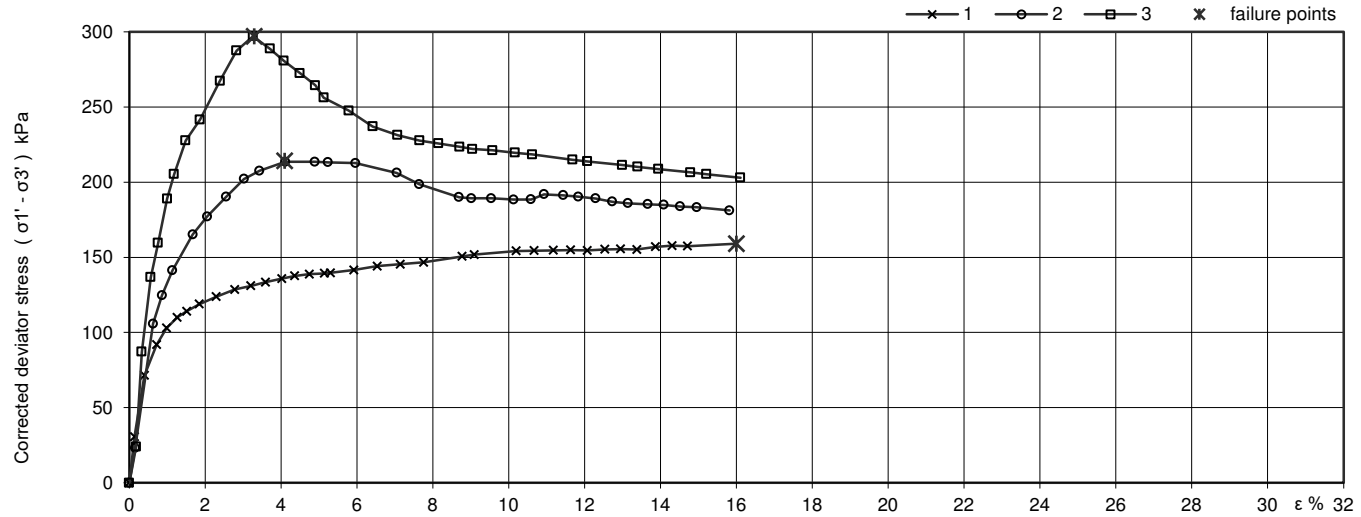
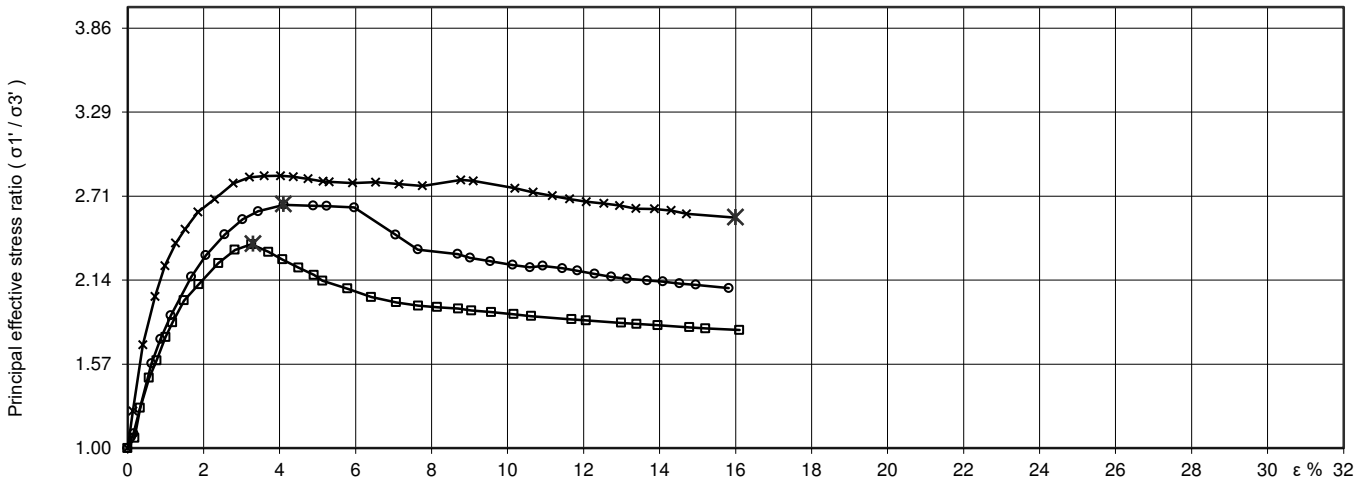
Checked and Aproved

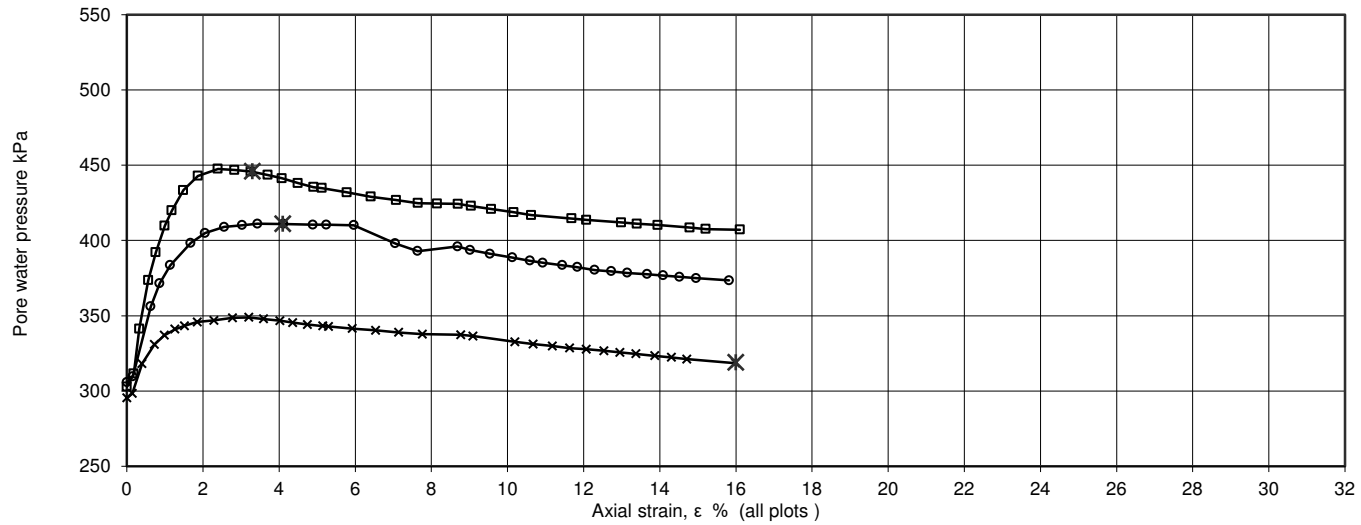
Initials kp

Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	9.50
Compression stages - graphical data				Sample Type	UT
				Schedule received	27-09-17
				Date started	10-10-17







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Checked and Aproved

Initials kp

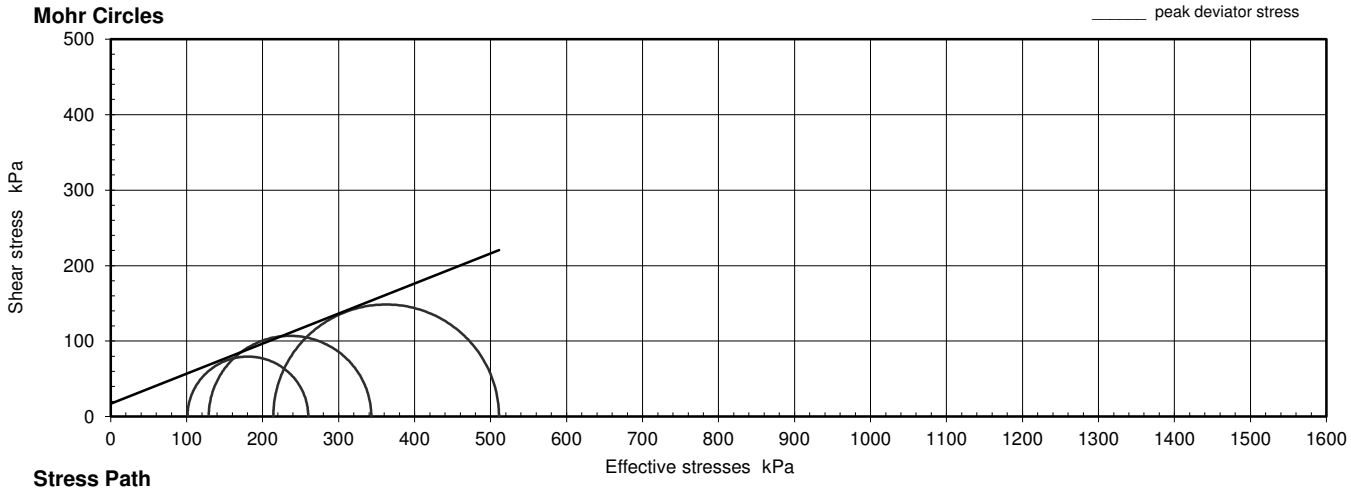
Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH1
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	9.50
Compression stages - table of results and interpretation				Sample Type	UT
				Schedule received	27-09-17
				Date started	10-10-17

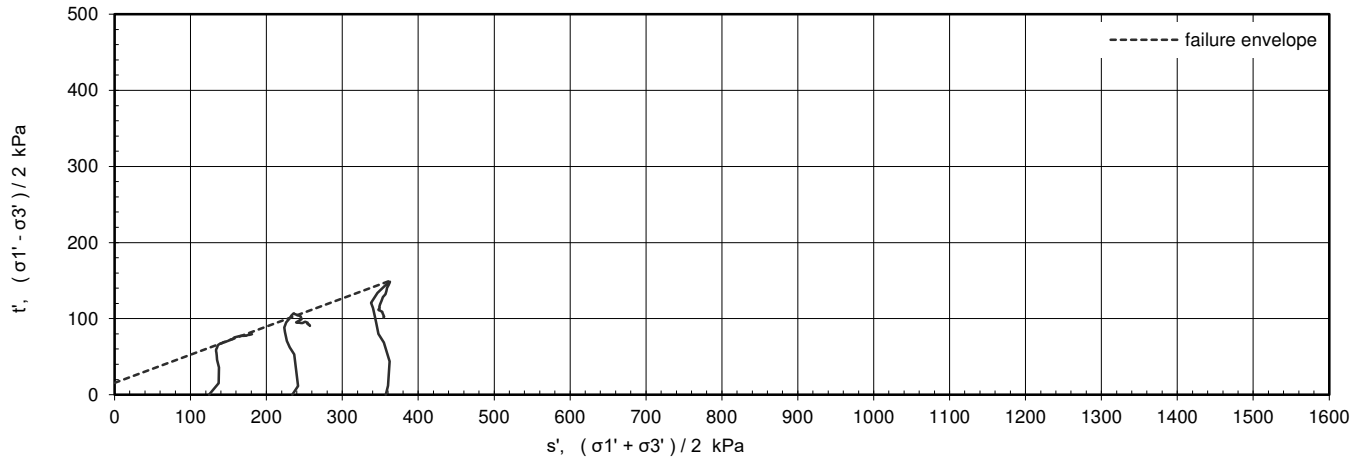
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	420	300	120	0.55	16.0	2.57	159	319	101	260	0.15
2	540	300	240	0.70	4.1	2.66	214	411	129	343	0.49
3	660	300	360	0.70	3.3	2.39	297	446	214	511	0.48

Mohr Circles

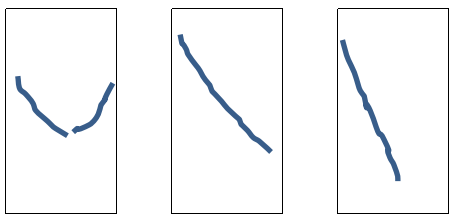


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	16.7	-
	Ø '	degrees	21.7	-

Mode of failure



Plastic Plastic

Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.3 mm thick rubber membrane/

Specimen 3 386

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Unit 8 Olds Close Olds Approach
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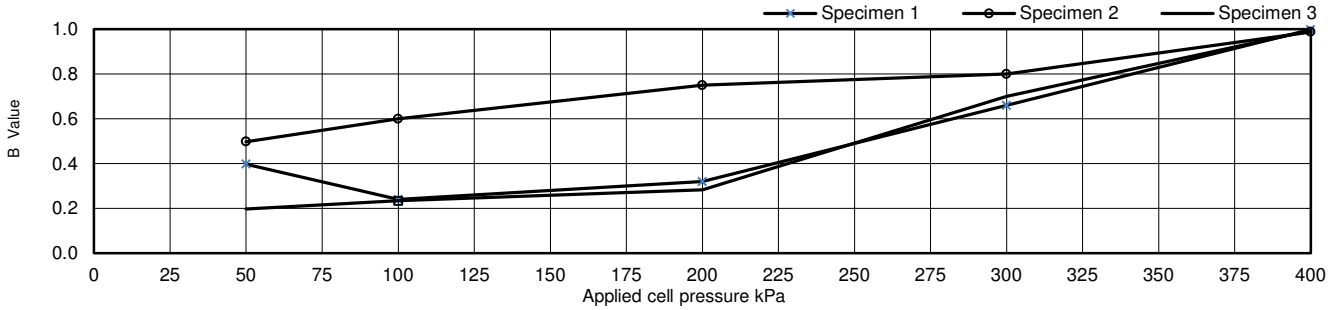
Initials kp
Date 23-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	12.50
Soil Description	Very high strength fissured dark grey silty CLAY			Sample Type	UT
				Samles received	21-09-17
				Schedule received	27-09-17
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	18-10-17

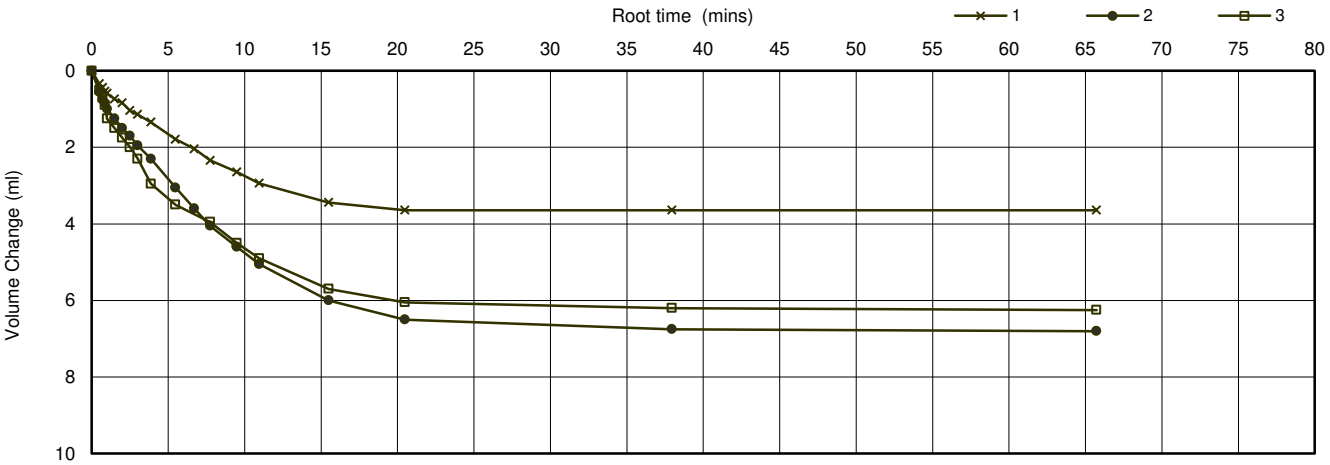
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.2	76.2	76.2
	Diameter	mm	38.1	38.1	38.1
	Bulk Density	Mg/m³	1.98	2.00	1.98
	Water Content	%	25.9	25.4	24.7
	Dry density	Mg/m³	1.57	1.60	1.58
Final	Bulk Density	Mg/m³	1.95	1.95	1.95
	Water Content	%	29.0	26.8	26.0
	Dry density	Mg/m³	1.51	1.51	1.51

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell pressure only
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	400	400	400
Final pore water pressure	kPa	290	290	290
Final B Value		1.00	0.99	1.00



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		450	600	750	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		150	300	450	kPa
	Pore pressure at start of consolidation		424	595	723	kPa
	Pore pressure at end of consolidation		297	304	299	kPa
	Pore pressure dissipation at end of consolidation		102	99	100	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.16	0.16	0.16	m2/year
	Coefficient of Compressibility	Mvi	0.31	0.24	0.16	m2/MN
	Coefficient of Permeability (calculated)	kvi	1.5E-11	1.2E-11	7.8E-12	m/s



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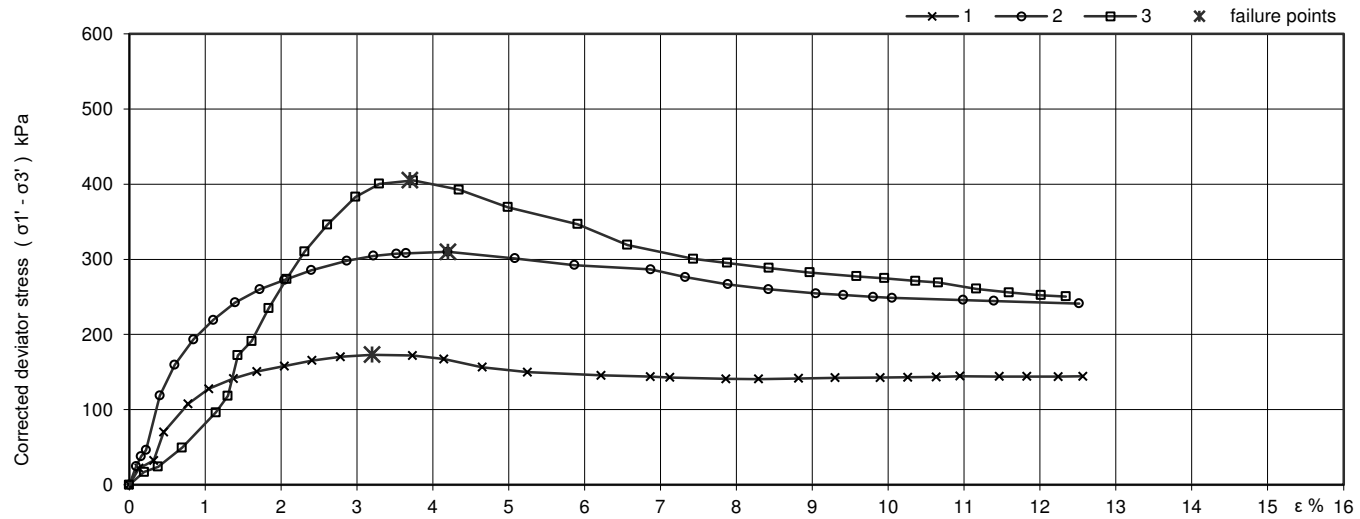
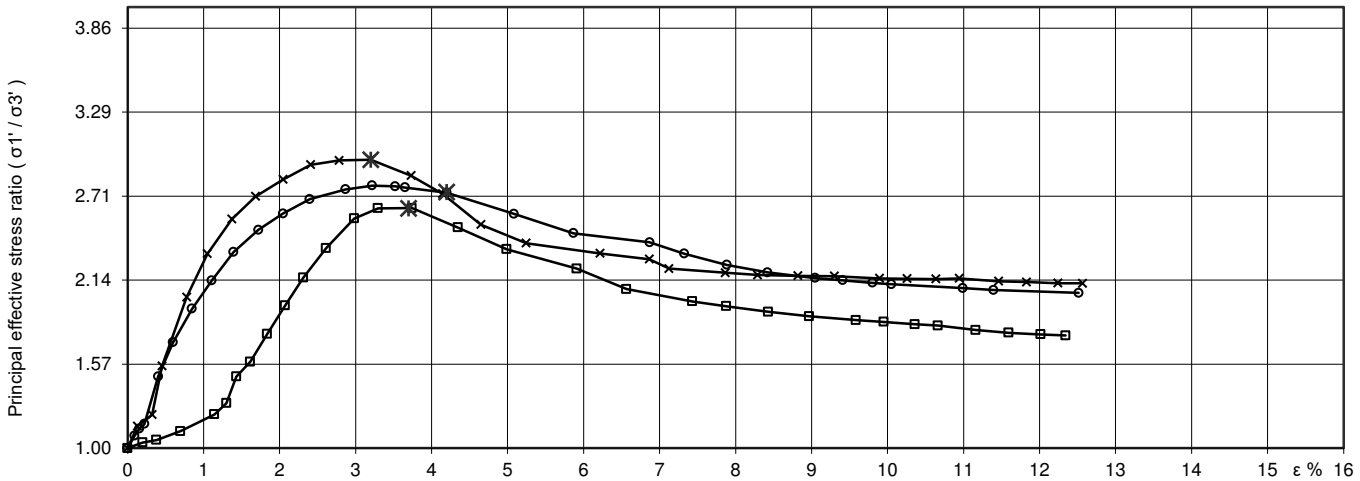
Checked and Aproved

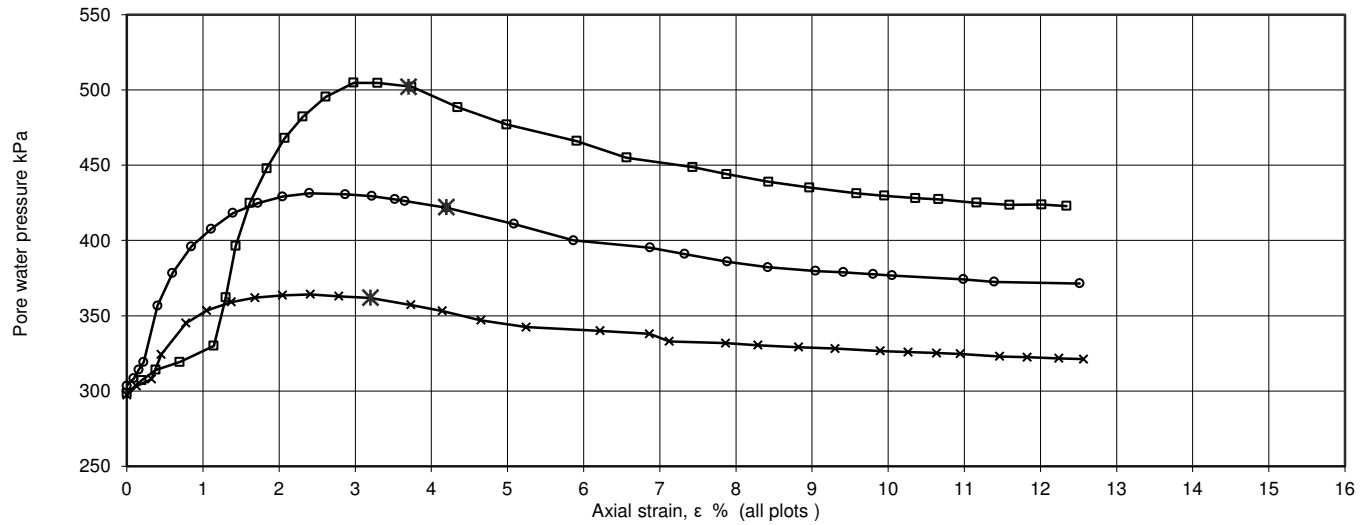
Initials kp

Date 30-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	12.50
Compression stages - graphical data				Sample Type	UT
				Schedule received	27-09-17
				Date started	18-10-17







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Initials **kp**

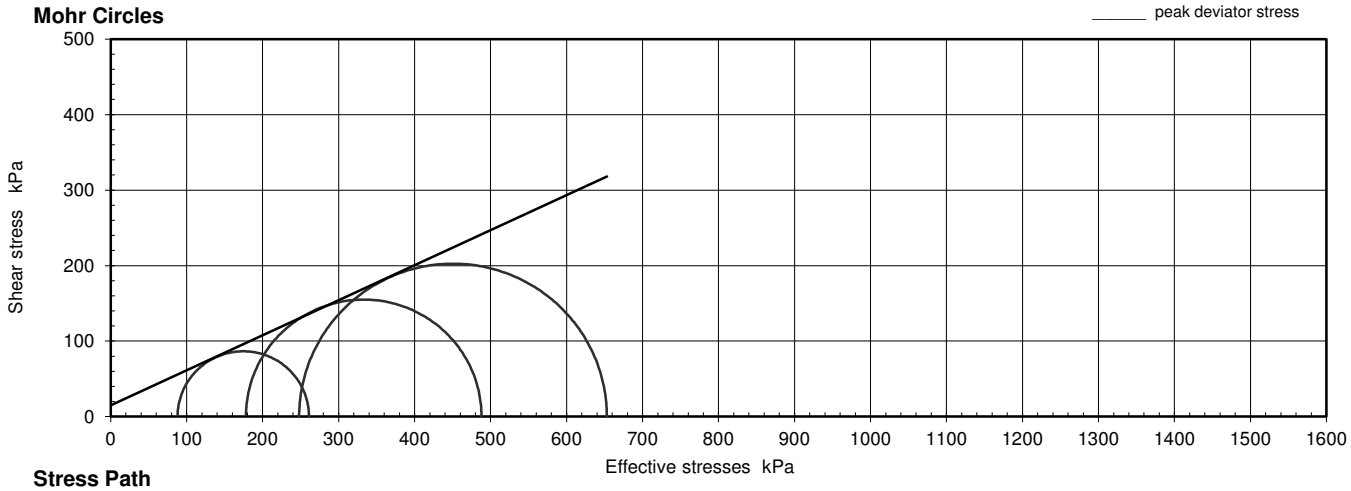
Date 30-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Dolphin Quay	Depth m	12.50
Compression stages - table of results and interpretation				Sample Type	UT
				Schedule received	27-09-17
				Date started	18-10-17

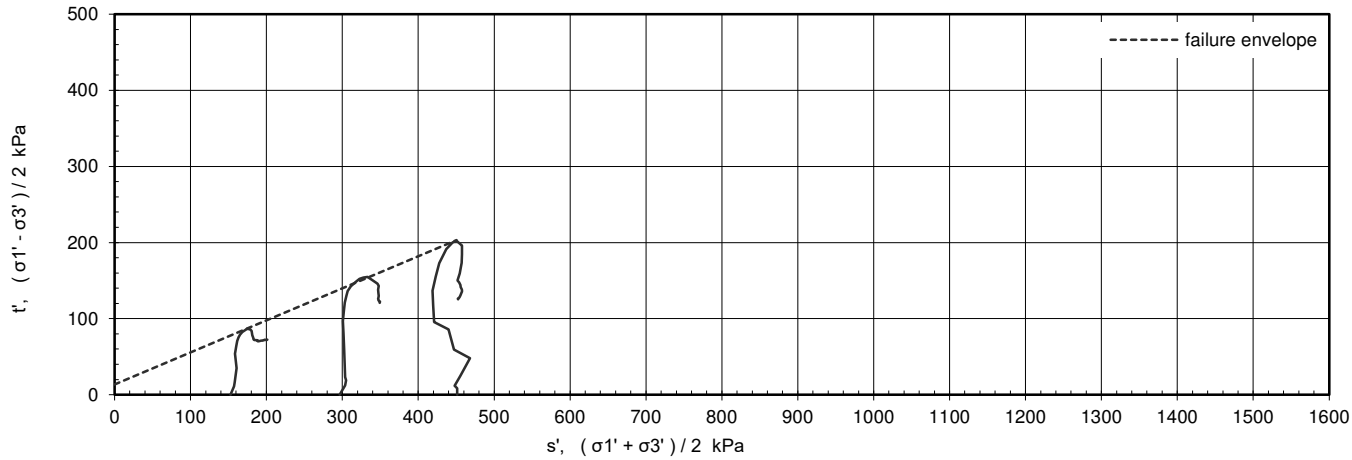
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	450	300	150	0.40	3.2	2.96	173	362	88	261	0.37
2	600	300	300	0.40	4.2	2.74	310	422	178	488	0.38
3	750	300	450	0.40	3.7	2.63	405	502	248	653	0.50

Mohr Circles

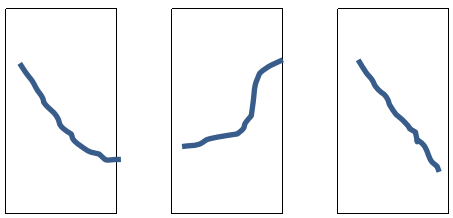


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	15	-
	Ø '	degrees	24.9	-

Mode of failure



Brittle Brittle Brittle

Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.3 mm thick rubber membrane/

Test Report by K4 SOILS LABORATORY
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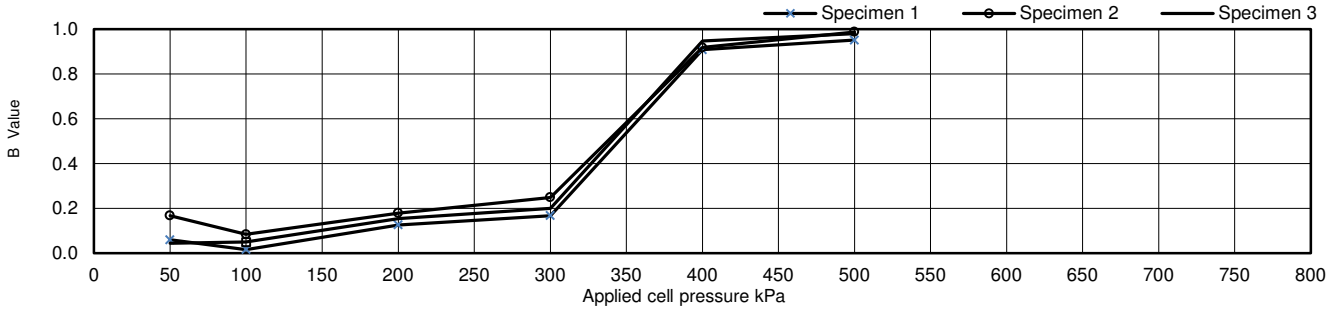
Checked and Aproved
Initials kp
Date 30-10-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	14.50
Soil Description	Very high strength fissured dark grey silty CLAY			Sample Type	UT
				Samles received	21-09-17
				Schedule received	27-09-17
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	26-10-17

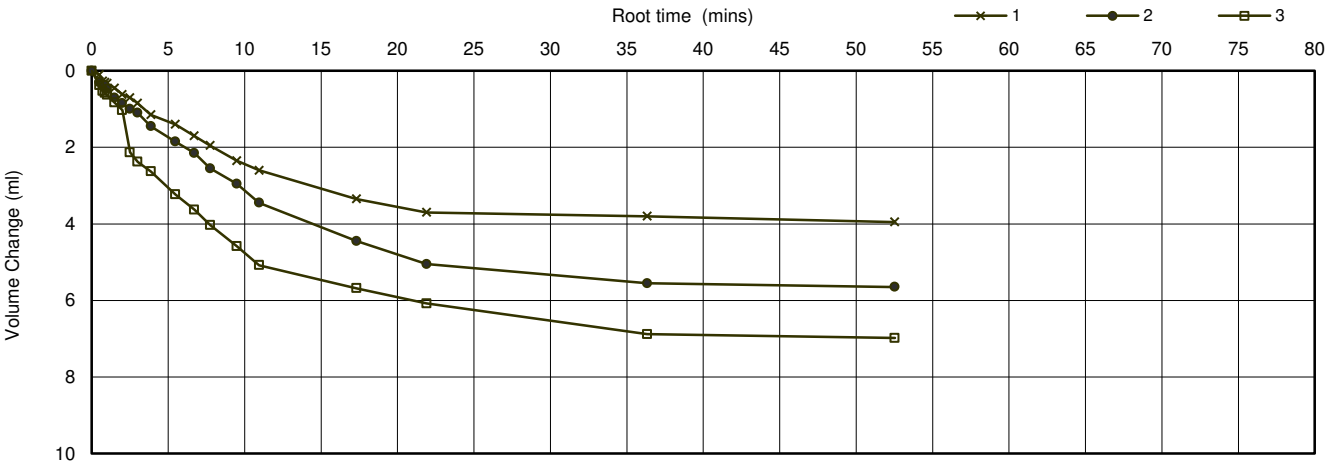
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.2	76.2	76.2
	Diameter	mm	38.1	38.9	38.1
	Bulk Density	Mg/m³	2.01	1.95	2.05
	Water Content	%	23.6	22.8	21.3
	Dry density	Mg/m³	1.63	1.59	1.69
Final	Bulk Density	Mg/m³	1.99	1.99	1.99
	Water Content	%	26.6	23.5	21.8
	Dry density	Mg/m³	1.57	1.57	1.57

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell and back pressure
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	500	500	500
Final pore water pressure	kPa	290	290	290
Final B Value		0.95	0.99	0.98



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		470	640	810	kPa
	Back Pressure applied		300	300	300	kPa
	Effective Pressure		170	340	510	kPa
	Pore pressure at start of consolidation		466	635	790	kPa
	Pore pressure at end of consolidation		304	301	300	kPa
	Pore pressure dissipation at end of consolidation		97	100	100	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.11	0.11	0.11	m2/year
	Coefficient of Compressibility	Mvi	0.26	0.19	0.15	m2/MN
	Coefficient of Permeability (calculated)	kvi	8.8E-12	6.2E-12	5.1E-12	m/s



Test Report by K4 SOILS LABORATORY
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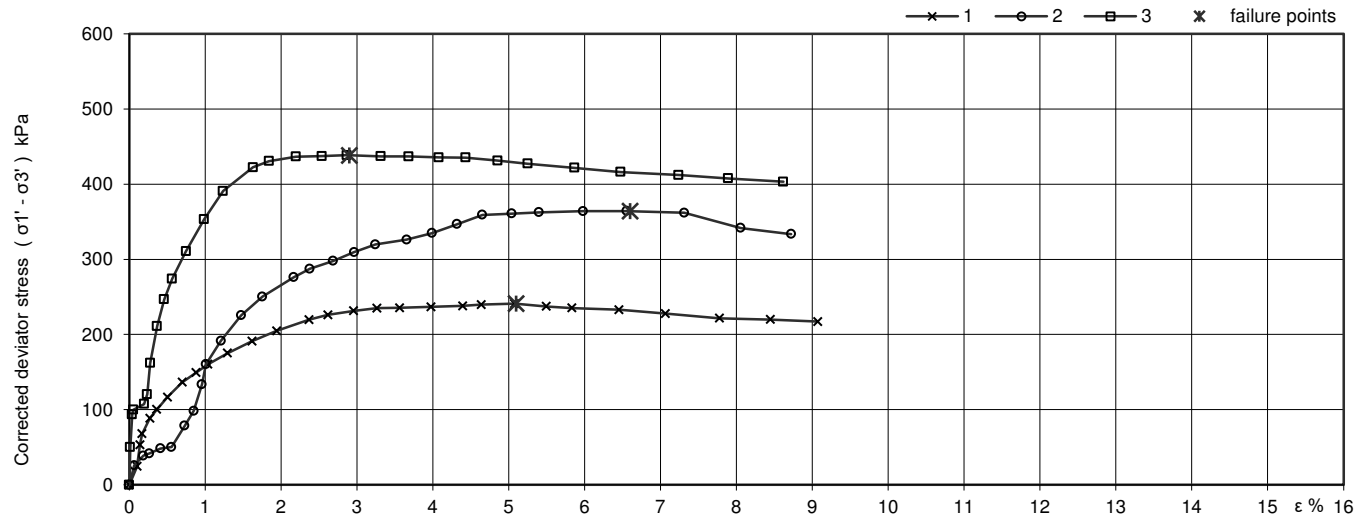
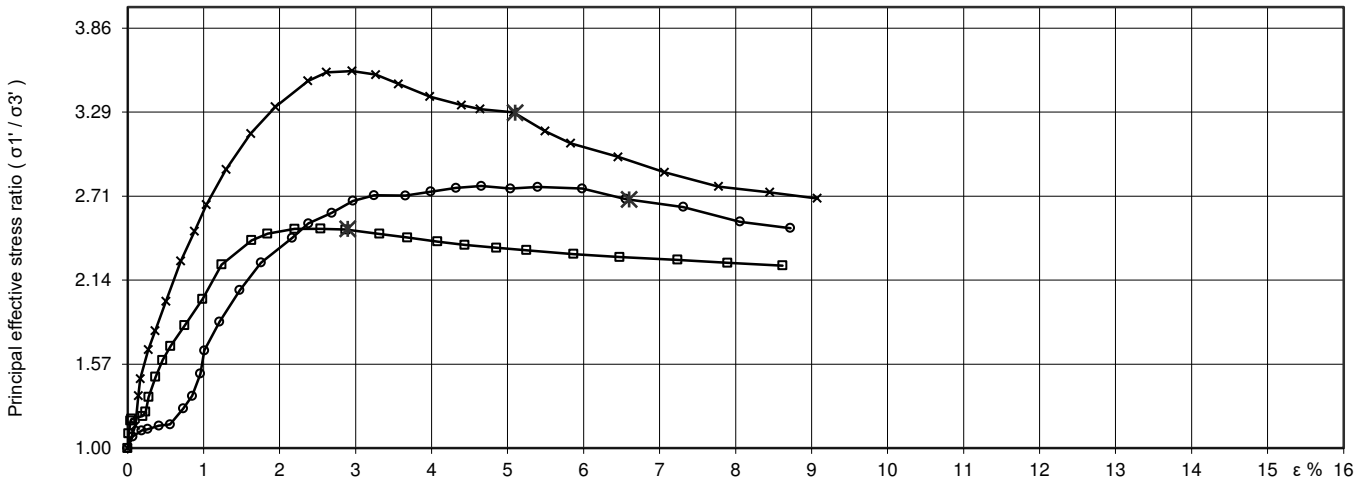
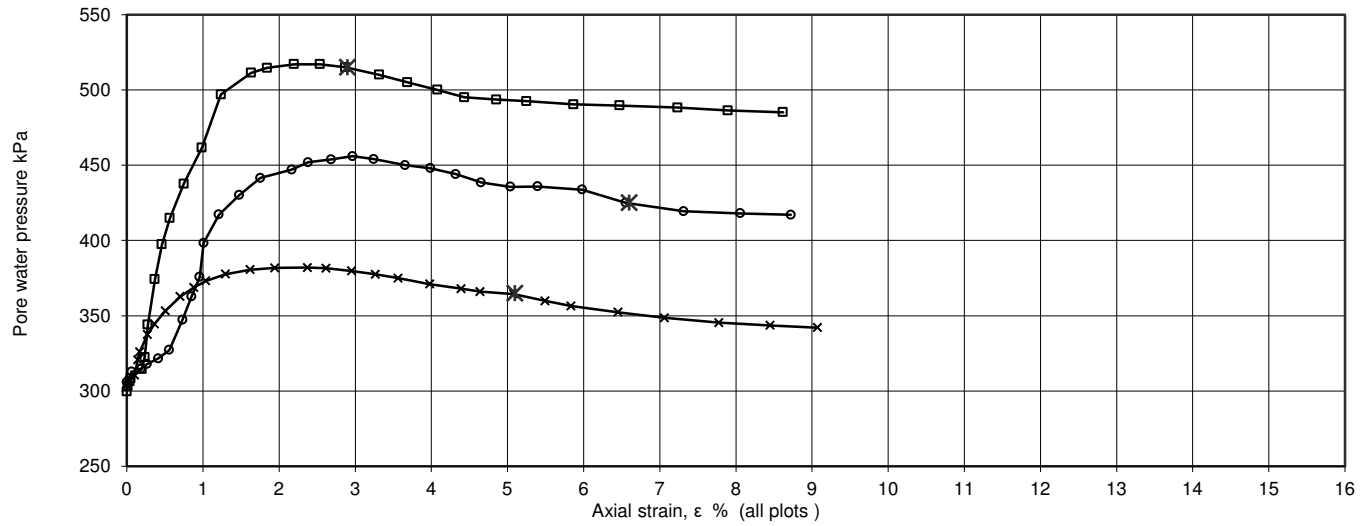
Initials kp

Date 03-11-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	14.50
Compression stages - graphical data				Sample Type	UT
				Schedule received	21-09-17
				Date started	26-10-17







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Initials **kp**

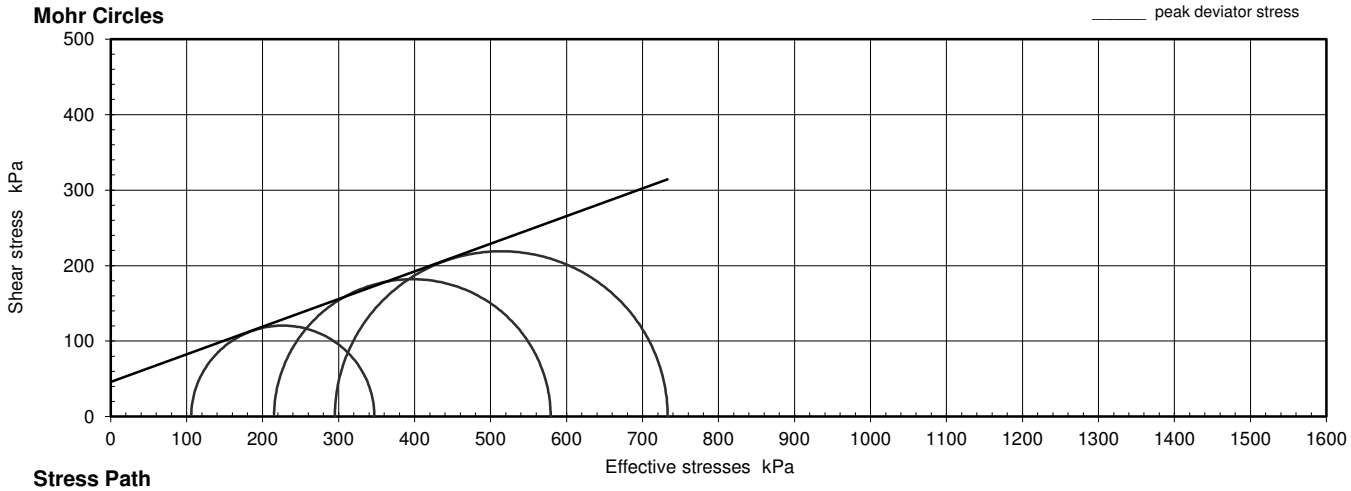
Date 03-11-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH2
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	14.50
Compression stages - table of results and interpretation				Sample Type	UT
				Schedule received	21-09-17
				Date started	26-10-17

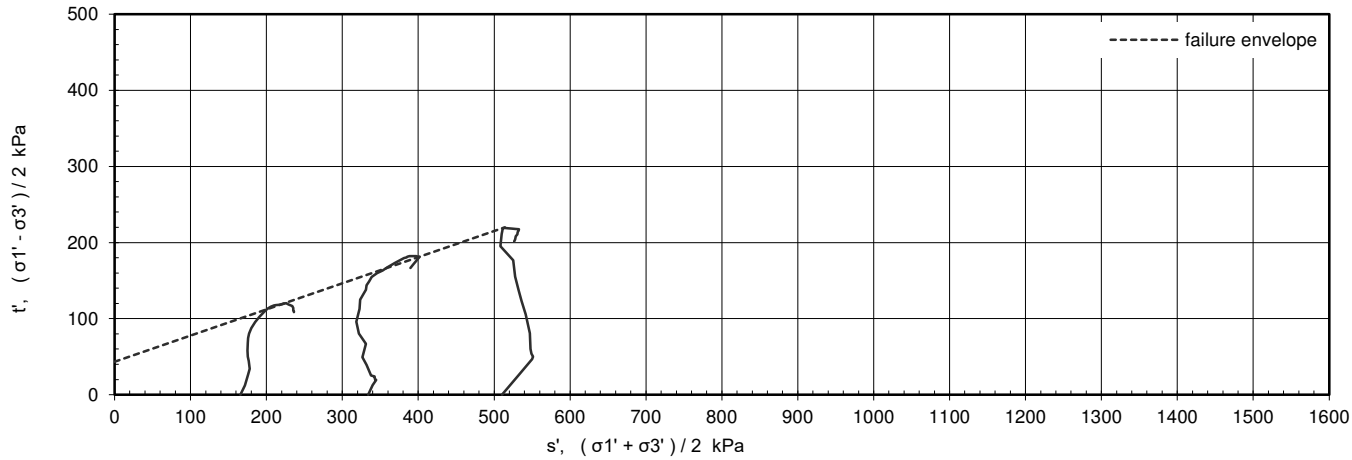
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	470	300	170	0.28	5.1	3.28	241	365	106	346	0.25
2	640	300	340	0.28	6.6	2.69	364	425	215	579	0.33
3	810	300	510	0.28	2.9	2.49	438	515	295	733	0.49

Mohr Circles

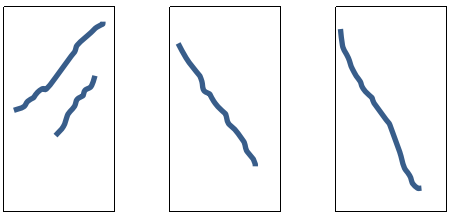


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	46.2	-
	Ø '	degrees	20.1	-

Mode of failure



Brittle Brittle Brittle

Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.25 mm thick rubber membrane/

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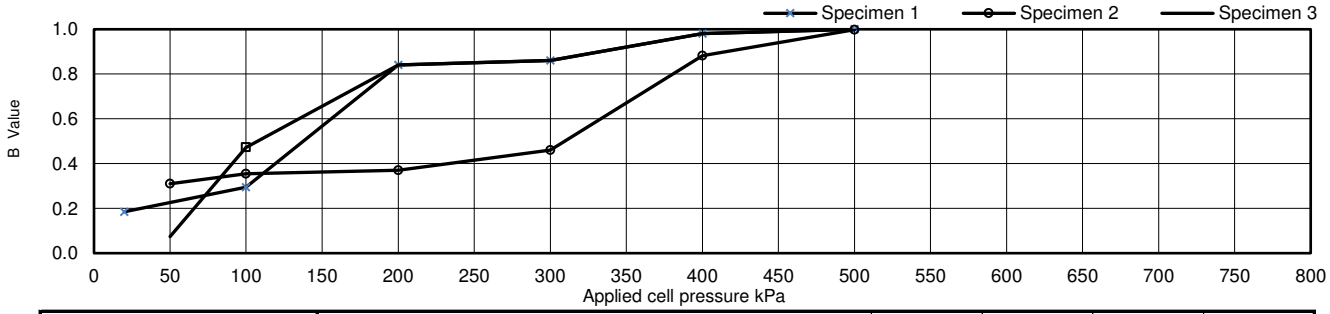
Date 03-11-17

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	15.50
Soil Description	Extremely high strength slightly fissured dark grey slightly sandy silty CLAY with partings of fine grey sand/silt			Sample Type	U
				Samles received	21/09/20217
				Schedule received	27/09/2017
Test Method	BS1377 : Part 8 : 1990, clauses 1 to 7			Date started	02/11/2017

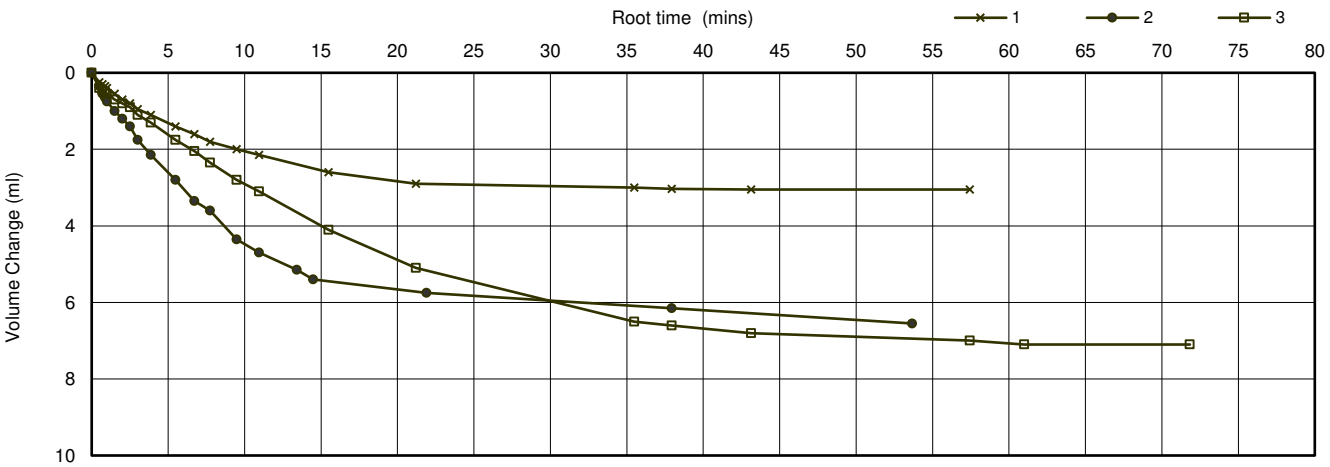
Specimen Type/Preparation	Undisturbed As BS 1377

Specimen Details			1	2	3
Initial	Height	mm	76.2	76.2	76.2
	Diameter	mm	38.1	38.1	38.1
	Bulk Density	Mg/m³	2.03	2.00	2.05
	Water Content	%	23.5	21.7	23.3
	Dry density	Mg/m³	1.65	1.64	1.67
Final	Bulk Density	Mg/m³	1.99	1.99	1.99
	Water Content	%	26.2	24.6	23.9
	Dry density	Mg/m³	1.58	1.58	1.58

Saturation Details		1	2	3
Method		Increments of cell and back pressure	Increments of cell and back pressure	Increments of cell and back pressure
Cell pressure increments	kPa	100	100	100
Differential Pressure	kPa	10	10	10
Final Cell Pressure	kPa	500	500	500
Final pore water pressure	kPa	390	390	390
Final B Value		1.00	1.00	1.00



Consolidation Details	Specimen No.		1	2	3	
	Drainage Conditions		Radial+1 end	Radial+1 end	Radial+1 end	
	Cell Pressure applied		580	760	940	kPa
	Back Pressure applied		400	400	400	kPa
	Effective Pressure		180	360	540	kPa
	Pore pressure at start of consolidation		568	713	920	kPa
	Pore pressure at end of consolidation		399	400	401	kPa
	Pore pressure dissipation at end of consolidation		101	100	100	%
Consolidation parameters (see note to BS1377 : pt 8, clause 6.3.4)	Coefficient of Consolidation	Cvi	0.11	0.11	0.11	m2/year
	Coefficient of Compressibility	Mvi	0.19	0.22	0.14	m2/MN
	Coefficient of Permeability (calculated)	kvi	6.5E-12	7.5E-12	4.9E-12	m/s



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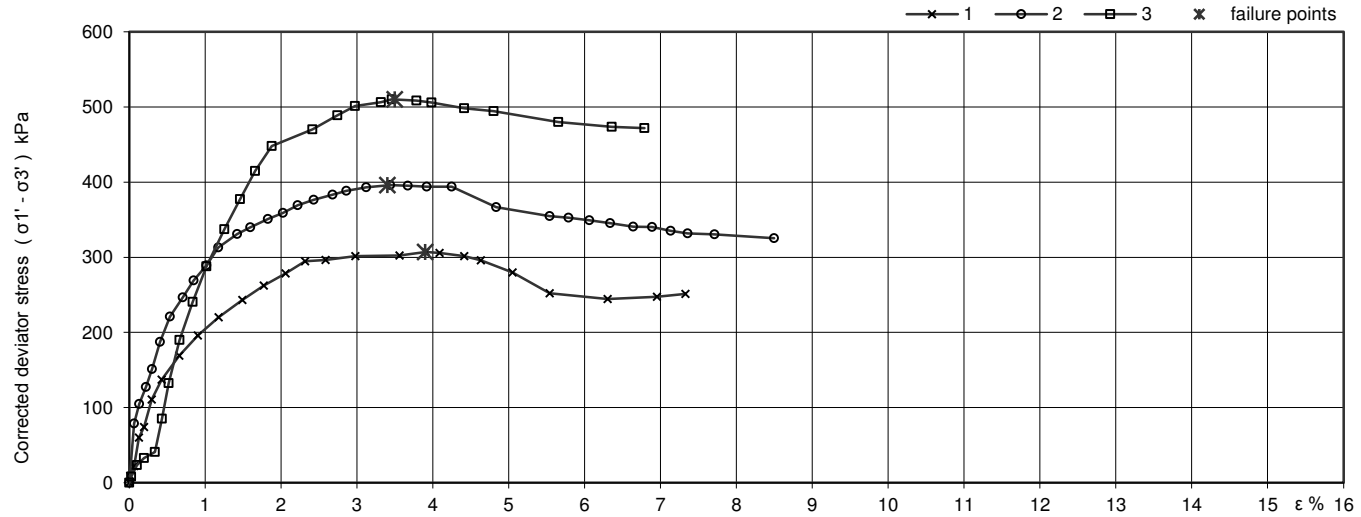
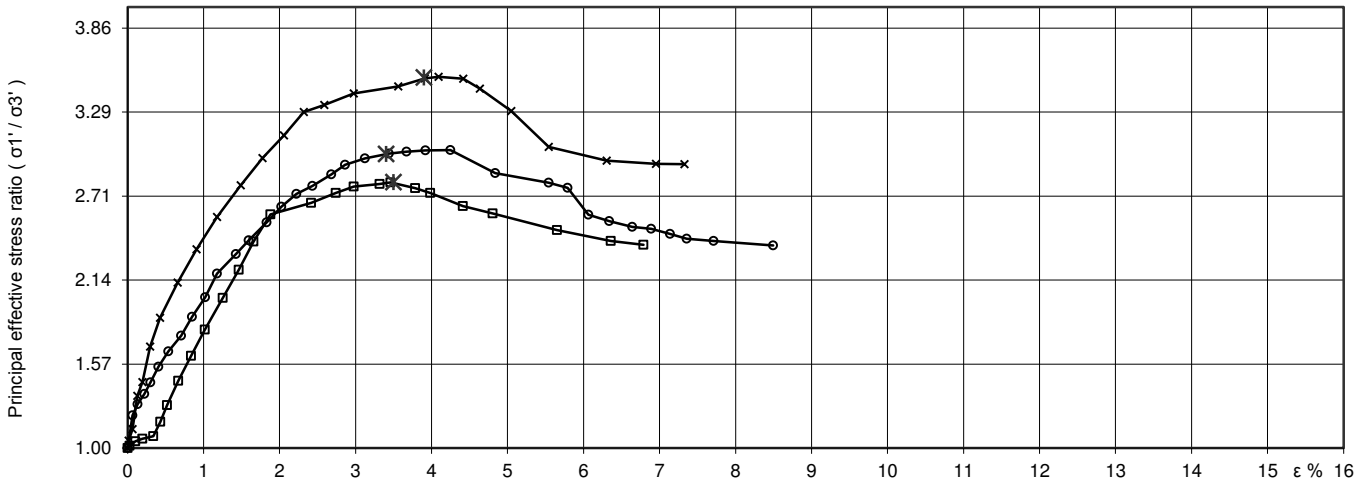
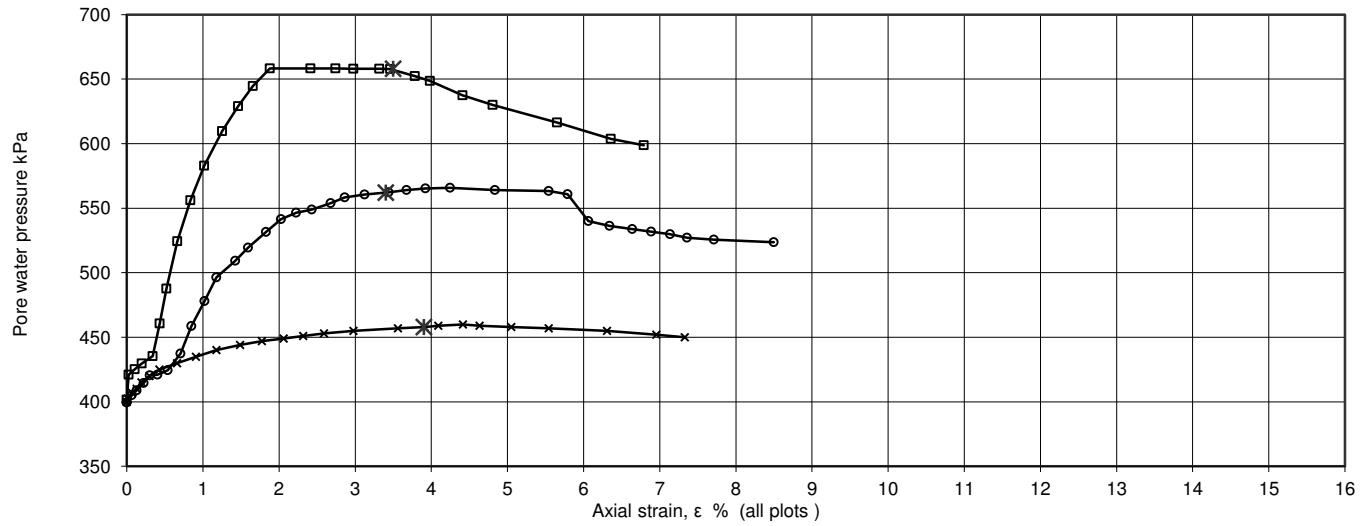
Date 15/11/2017

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	15.50
Compression stages - graphical data				Sample Type	U
				Schedule received	27/09/2017
				Date started	02/11/2017







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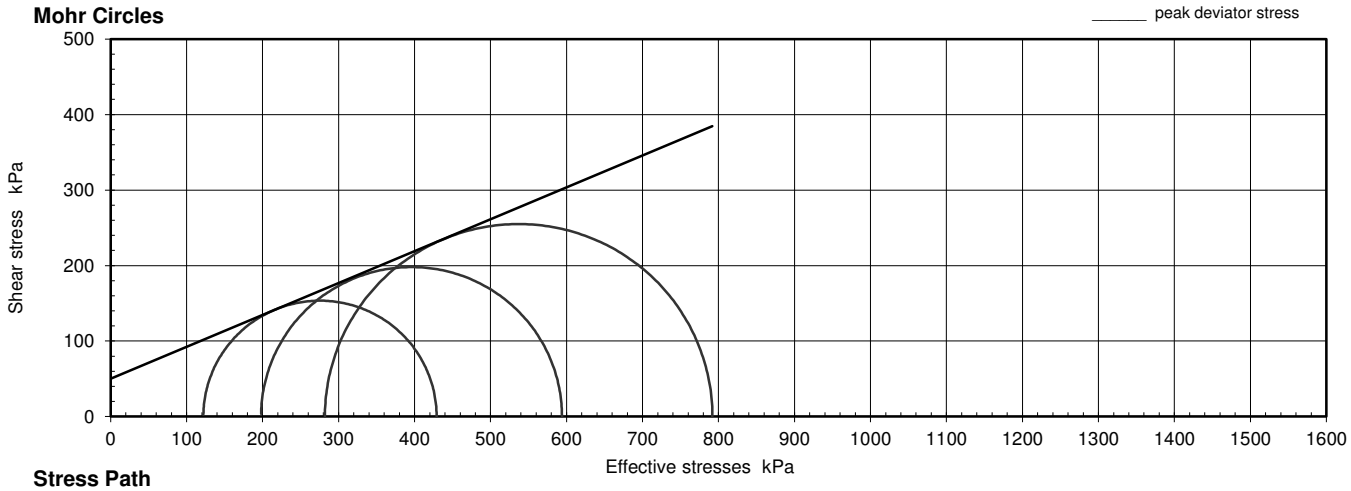
Date 15/11/2017

	Consolidated Undrained Triaxial Compression Test with measurement of pore pressure			Job Ref	23423
				Borehole/Pit No.	BH3
Site Name	Dolphin Quay			Sample No.	-
Project ID	E-E1667	Client	Opus	Depth m	15.50
Compression stages - table of results and interpretation				Sample Type	U
				Schedule received	27/09/2017
				Date started	02/11/2017

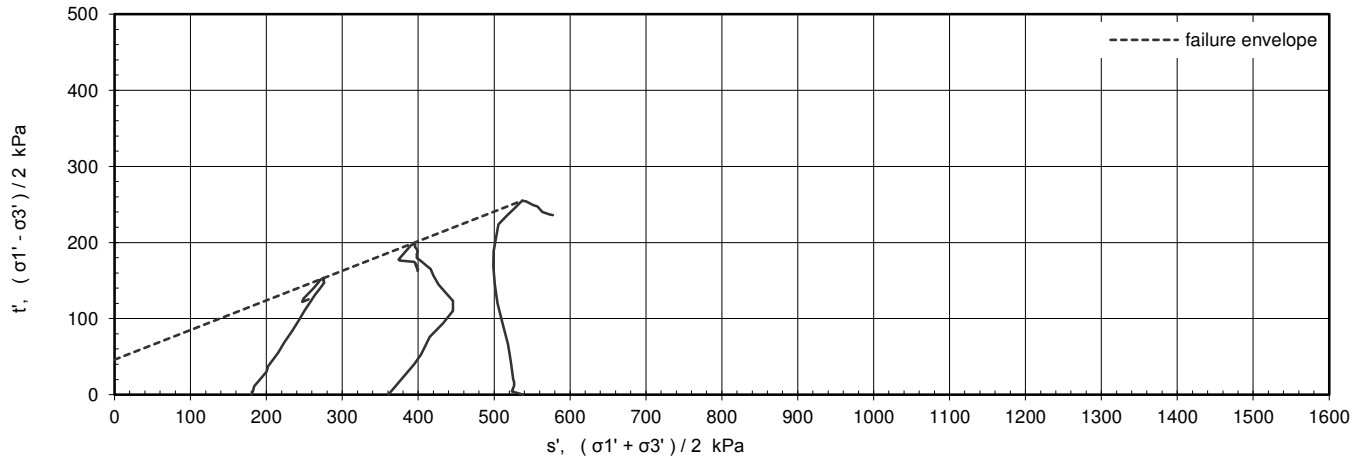
Failure criterion : Maximum deviator stress

Specimen	Cell pressure kPa	Initial pwp kPa	Initial σ3' kPa	Rate of strain %/hr	Axial strain, εf %	(σ1' / σ3') f	(σ1' - σ3') f kPa	uf kPa	σ3' f kPa	σ1' f kPa	Af
1	580	400	180	0.30	3.9	3.52	307	458	122	429	0.19
2	760	400	360	0.30	3.4	3.00	396	562	198	594	0.41
3	940	400	540	0.30	3.5	2.81	510	658	282	792	0.50

Mohr Circles

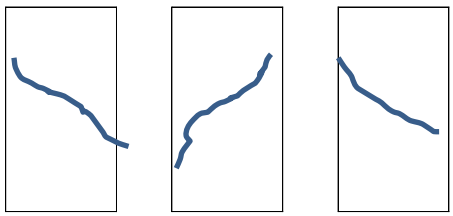


Stress Path



Shear Strength Parameters			Linear regression	Manual re-assessment
At Maximum deviator stress	c '	kPa	49.5	-
	Ø '	degrees	22.9	-

Mode of failure



Brittle Brittle Brittle

Remarks

General Deviator stresses corrected for area change, vertical side drains and up to 0.22 mm thick rubber membrane/

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Date 15/11/2017

Appendix E

Soil Contamination Assessment Criteria, Methodology and Statistical Results

Opus Methodology for the Screening of Soils in Terms of the Risk to Human Health

Legislative Background

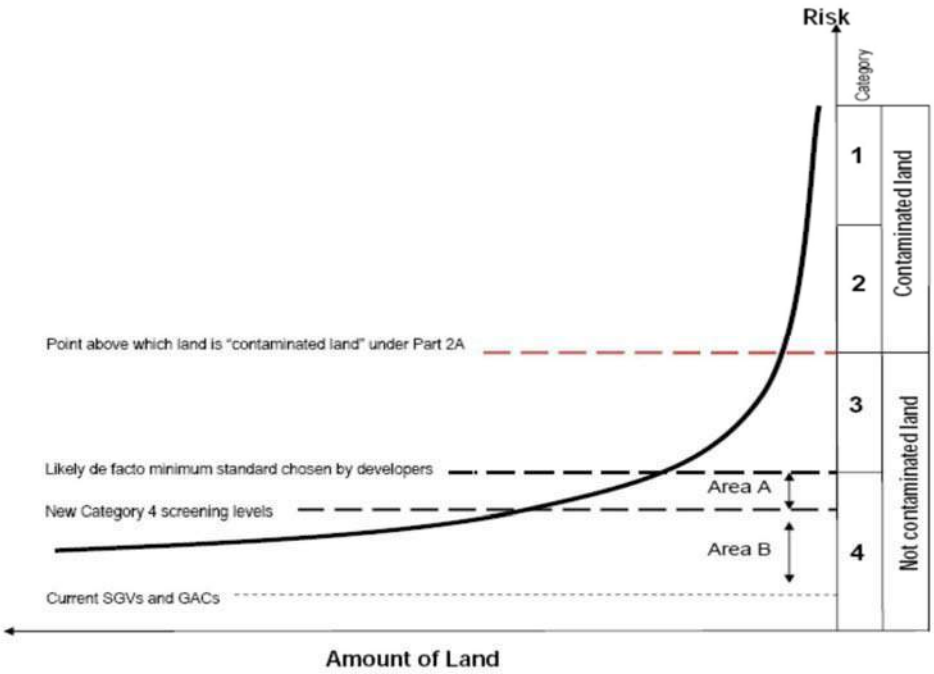
The legislative framework for the regulation of contaminated land is contained in Part 2A of the Environmental Protection Act 1990, which was implemented in the Contaminated Land (England) Regulations 2000 (and subsequent amendments). This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The basis of the UK contaminated land policy is the 'Suitable for Use' approach, which states that land should be suitable for its current use and made suitable for any new use as official permission (through the planning process) is given for that use.

Under Part 2A of the Environmental Protection Act 1990, contaminated land is defined as land where 'significant harm' is being caused or there is a 'significant possibility of such harm' being caused or where 'significant pollution of controlled waters' is being caused, or there is a 'significant possibility of such pollution' being caused. For contaminated land to occur under Part 2A, a **contaminant linkage** must exist i.e. there must be a **contaminant,** a relevant **receptor** and a plausible **migration pathway** by which the contaminant can impact the receptor.

In 2012, the Part 2A Statutory Guidance was revised and this introduced four categories of land to assist in defining risk to human health from contaminated land. With respect to contaminants that pose a risk to human health, statutory contaminated land comprises Category 1 (where significant harm is being caused) and Category 2 (where significant possibility of such harm (SPOSH) is being caused). Category 3 is land not capable of being determined as SPOSH and Category 4 is uncontaminated.

Under the National Planning Policy Framework (NPPF) introduced in England in 2012, land should be suitable for its new use taking the effects of ground contamination into consideration. To this end, adequate site investigation should be undertaken and prepared by competent persons. After remediation, as a minimum, land should be incapable of being determined as Part 2A contaminated land. Where a site is affected by contamination, responsibility for securing safe development rests with the developer and/or landowner.

The Defra impact assessment report accompanying the revised Part 2A Statutory Guidance indicated that most developers will want to ensure that under the planning regime their land is safely within Category 4 and this is the approach adopted by Opus in the preparation of this report (see below):



Published Human Health Generic Assessment Criteria

To assist with the implementation of Part 2A and contamination assessments under the planning process, Defra commissioned a research project to derive new Category 4 Screening Levels (C4SLs). In 2014, Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead for six categories of land use, namely:

- Residential with home-grown produce;
- Residential without home-grown produce;
- Allotments;
- Commercial;
- Public open space 1 (public land near residential properties i.e. grassed area outside residential housing); and
- Public open space 2 (public land away from residential properties i.e. public parks).

The C4SLs differ from the earlier Soil Guideline Values (SGVs) in that they are considered by Defra to be more pragmatic (albeit still strongly precautionary) and indicate the concentration of a contaminant in soil that would potentially pose a *'low risk'* to human health, whereas the SGVs are considered indicative of *'minimal risk'*.

In 2015, Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) published additional generic assessment criteria (GAC), referred to as Suitable 4 Use Values (S4ULs). These S4ULs replaced the earlier LQM/CIEH human health GAC (2nd Edition) that were published in 2009.

The C4SLs and S4ULs both utilise updated exposure parameters from those used in version 1.06 of the Environment Agency's Contaminated Land Exposure Assessment (CLEA) model. CLEA version 1.06 was also used to derive the following other human health GAC:

- Environment Agency SGVs (*either withdrawn or superseded by the C4SLs and S4ULs*);
- EIC/AGS/CL:AIRE publication 'Soil Generic Assessment Criteria for Human Health Risk Assessment', dated January 2010; and
- Atkins ATRISK^{soil} Soil Screening Values dated January 2015.

Whilst the C4SLs and S4ULs both use updated exposure parameters, they differ in that C4SLs have utilised Low Levels of Toxicological Concern (LLTC) in their derivation, whereas S4ULs use Health Criteria Values (HCVs). As a consequence of using LLTC the C4SLs are indicative of a '*low risk'* to human health, whereas the S4ULs, SGVs, EIC/AGS/CL:AIRE and Atkins ATRISK^{soil} GAC (which use HCVs), are all considered indicative of *'minimal risk'* to human health.

With respect to the consumption of home produce grown in contaminated soil, the C4SLs have adopted the 90th percentile consumption rates for the 'top two' produce types, but mean consumption rates for the remaining four produce types, in contrast with the S4ULs, SGVs, EIC/AGS/CL:AIRE and Atkins ATRISK^{soil} approach, which applies the 90th percentile consumption rates to all produce types.

Despite the differences in approach (e.g. *low risk* / *minimal risk* and produce consumption rates), all the above referenced GAC lie comfortably within Category 4 of the Part 2A Statutory Guidance, indicating that for the contaminant of concern, the land is uncontaminated and incapable of being determined under Part 2A.

Opus Tier 1 Soil Screening Values

The Tier 1 human health risk assessment methodology employed by Opus in this report is as follows:

Firstly, reference has been made to the published C4SLs. However, for compounds where there are no C4SLs available, reference has also been made to following other published GAC in the following descending order of preference:

- LQM/CIEH S4ULs for Human Health Risk Assessment dated 2015 *[Copyright Land Quality Management Limited reproduced with permission; Publication No. S4UL3028. All rights reserved];*
- EIC/AGS/CL:AIRE GAC; and
- Atkins ATRISK^{soil} Soil Screening Values.

Utilising the above referenced sources, Opus has compiled a database of published human health GAC, referred to as Opus Tier 1 Soil Screening Values (SSVs) and is currently using Version 2016.1 dated 21 November 2016. This database comprises GAC for 131 individual contaminants, of which 19 are inorganic and 112 organic substances.

Using Version 1.071 of the CLEA model, Opus has replicated the published GAC for organic contaminants at 1.0%, 2.5% and 6% soil organic matter (SOM) contents. In order to assess natural soils which can have a much lower SOM content than 1%, Opus has also derived Tier 1 SSVs at 0.25% SOM content for selected commonly occurring contaminants, so as to provide a sufficiently conservative output.

These GAC relate solely to the protection of human health from chronic exposure to contaminants in soil. The risks to other receptors (e.g. controlled waters, ecology and property) needs to be considered separately.

The GAC are based on a sandy loam soil type, except the ATRISK^{soil} values at 1% SOM which are based on a sand soil type (as defined in Environment Agency Science Report SC050021/SR3 dated 2009). For all substances it has been assumed that 100% of the intake would reach the systemic circulation (i.e. is 100% bioavailable).

The GAC for organic contaminants assume that non-aqueous phase liquid (NAPL) / free phase contamination is not present. Where the GAC exceeds the aqueous solubility or the saturated vapour concentration, the lower of these saturation limits is also presented in brackets. The soil saturation concentration is the theoretical concentration at which soil vapour and/or pore water have become fully saturated. This can indicate that NAPL is likely to be present. However, for contaminants that are strongly sorbed to soils (i.e. have high Koc) and that have a low aqueous solubility and vapour pressure, exceedance of the soil saturation concentration does not necessarily imply that NAPL is present. The presence of NAPL therefore needs to be considered qualitatively before applying these GAC.

In addition, the Tier 1 SSVs do not consider the additive or synergistic effects of any compounds.

Depending upon the conceptual site model for a given piece of land, exceedance of an Opus Tier 1 SSV may indicate that a **potential contaminant linkage** exists. In such circumstance this would indicate a requirement for further assessment, such as supplementary investigation and/or detailed quantitative risk assessment (DQRA). In the absence of further assessment, a **significant contaminant linkage** may be deemed to exist requiring remediation of the contamination on human health protection grounds.

Opus UK Generic Assessment Criteria Summary Table for Metals and Inorganics (Sheet 1 of 1)
Version 2016.1 dated 21 November 2016

	Substance	CAS No.	Opus Tier 1 Soil Screening Values (mg/kg)						Source
			Residential With	Residential Without	Allotments	Commercial	POS resi	POS park	
No.	Metals								
1	Antimony	7440-36-0	110	550*	45	7500*	-	830	ATRISK^{soil} (EIC/AGS/CL:AIRE*)
2	Arsenic	7440-38-2	37	40	49	640	79	170	C4SL
3	Barium	7440-39-3	43	1,300*	-	22,000*	-	1,600	ATRISK^{soil} (EIC/AGS/CL:AIRE*)
4	Beryllium	7440-41-7	1.7	1.7	35	12	2.2	63	S4UL
5	Boron	7440-42-8	290	11,000	45	240,000	21,000	46,000	S4UL
6	Cadmium	7440-43-9	22	150	3.9	410	220	880	C4SL
7	Chromium III	7440-47-3	910	910	18,000	8,600	1,500	33,000	S4UL
8	Chromium VI	18540-29-9	21	21	170	49	21	250	C4SL
9	Copper	7440-50-8	2,400	7,100	520	68,000	12,000	44,000	S4UL
10	Lead	7439-92-1	200	310	80	2,300	630	1,300	C4SL
11	Elemental mercury	7439-97-6	1.2	1.2	21	58 (26)	16	30 (26)	S4UL
12	Inorganic mercury	7439-97-6	40	56	19	1,100	120	240	S4UL
13	Methylmercury	22967-92-6	11	15	6	320	40	68	S4UL
14	Molybdenum	7439-98-7	75	670*	-	17,000*	-	790	ATRISK^{soil} (EIC/AGS/CL:AIRE*)
15	Nickel	7440-02-0	130	180	53	980	230	800	S4UL
16	Selenium	7782-49-2	250	430	88	12,000	1,100	1,800	S4UL
17	Vanadium	7440-62-2	410	1,200	91	9,000	2,000	5,000	S4UL
18	Zinc	7440-66-6	3,700	40,000	620	730,000	81,000	170,000	S4UL
No.	Other								
19	Cyanide (free)	74-90-8	34	34	34	34	34	34	ATRISK^{soil}

Notes

1. These GAC relate solely to the protection of human health from chronic exposure to contaminants in soil. The risks to other receptors (e.g. controlled waters, ecology and property) needs to be considered separately.
2. Reference should also be made to the accompanying Opus Methodology for the Screening of Soils in Terms of the Risk to Human Health.
3. The above GAC are based on a sandy loam soil type, except the ATRISK^{soil} values at 1% SOM which are based on a sand soil type (as defined in Environment Agency Science Report SC050021/SR3)
4. Where the GAC exceeds the aqueous solubility or the saturated vapour concentration, the lower of these saturation limits is also presented in brackets. Soil concentrations above soil saturation may indicate that NAPL is present.
5. - = denotes that no GAC has currently been derived.

Source

DEFRA / CL:AIRE SP1010 Category 4 Screening Levels (C4SLs) dated 24 September 2014.

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EIC/AGS/CL:AIRE publication 'Soil Generic Assessment Criteria for Human Health Risk Assessment', dated January 2010.

Atkins ATRISK^{soil} Soil Screening Values dated January 2015.

Opus UK Generic Assessment Criteria Summary Table for Organics (Sheet 1 of 12)
Residential With the Consumption of Homegrown Produce - Version 2016.1 dated 21 November 2016

	Substance	CAS No.	Opus Tier 1 Soil Screening Value (mg/kg)				Source
	SOM		0.25%	1%	2.5%	6%	
No.	PAHs						
1	Naphthalene	91-20-3	0.68	2.3	5.6	13	S4UL
2	Acenaphthylene	208-96-8	46	170	420	920	S4UL
3	Acenaphthene	83-32-9	56	210	510	1100	S4UL
4	Fluorene	86-73-7	44	170	400	860	S4UL
5	Phenanthrene	85-01-8	25	95	220	440	S4UL
6	Anthracene	120-12-7	630	2,400	5,400	11,000	S4UL
7	Fluoranthene	206-44-0	83	280	560	890	S4UL
8	Pyrene	129-00-0	180	620	1,200	2,000	S4UL
9	Benzo(a)anthracene	56-55-3	2.7	7.2	11	13	S4UL
10	Chrysene	218-01-9	5.6	15	22	27	S4UL
11	Benzo(b)fluoranthene	205-99-2	1.2	2.6	3.3	3.7	S4UL
12	Benzo(k)fluoranthene	207-08-9	42	77	93	100	S4UL
13	Benzo(a)pyrene (coal tar surrogate marker approach)	50-32-8	5.0	5.0	5.0	5.0	C4SL
14	Benzo(a)pyrene	50-32-8	1.2	2.2	2.7	3.0	S4UL
15	Indeno(1,2,3-cd)pyrene	193-39-5	12	27	36	41	S4UL
16	Dibenz(ah)anthracene	53-70-3	0.14	0.24	0.28	0.30	S4UL
17	Benzo(ghi)perylene	191-24-2	230	320	340	350	S4UL
No.	BTEX & MTBE						
18	Benzene	71-43-2	0.084	0.20	0.48	0.87	C4SL
20	Toluene	108-88-3	43	130	290	660	S4UL
21	Ethylbenzene	100-41-4	15	47	110	260	S4UL
23	o-Xylene *	95-47-6	19	60	140	330	S4UL
22	m-Xylene *	108-38-3	18	59	140	320	S4UL
24	p-Xylene *	106-42-3	18	56	130	310	S4UL
25	MTBE	1634-04-4	27	49	84	160	EIC/AGS/CL:AIRE
No.	Banded TPH						
26	Aliphatic C5-C6	-	25	42	78	160	S4UL
27	Aliphatic >C6-C8	-	40	100	230	530	S4UL
28	Aliphatic >C8-C10	-	7.5	27	65	150	S4UL
29	Aliphatic >C10-C12	-	34 (12)	130 (48)	330 (120)	760 (280)	S4UL
30	Aliphatic >C12-C16	-	280 (5.9)	1,100 (24)	2,400 (59)	4,300 (140)	S4UL
31	Aliphatic >C16-C35	-	26,000 (2.1)	65,000 (8.5)	92,000 (21)	110,000	S4UL
32	Aliphatic >C35-C44	-	26,000 (2.1)	65,000 (8.5)	92,000 (21)	110,000	S4UL
33	Aromatic C5-C7	-	0.084	0.2	0.48	0.87	C4SL Benzene
34	Aromatic >C7-C8	-	43	130	290	660	S4UL Toluene
35	Aromatic >C8-C10	-	9.3	34	83	190	S4UL
36	Aromatic >C10-C12	-	19 (9.7)	74 (37)	180 (90)	380 (220)	S4UL
37	Aromatic >C12-C16	-	38	140	330	660	S4UL
38	Aromatic >C16-C21	-	74	260	540	930	S4UL
39	Aromatic >C21-C35	-	500	1,100	1,500	1,700	S4UL
40	Aromatic >C35-C44	-	500	1,100	1,500	1,700	S4UL
41	Aliphatic & Aromatic > C44	-	1,100	1,600	1,800	1,900	S4UL
No.	HALOGENATED ORGANICS						
42	Bromobenzene	108-86-1	-	0.87	2.0	4.7	EIC/AGS/CL:AIRE
43	Bromodichloromethane	75-27-4	-	0.016	0.03	0.061	EIC/AGS/CL:AIRE
44	Bromoform	75-25-2	-	2.8	5.9	13	EIC/AGS/CL:AIRE
45	Chlorobenzene	108-90-7	-	0.46	1.0	2.4	S4UL
46	Chloroethane	75-00-3	-	8.3	11	18	EIC/AGS/CL:AIRE
47	Chloroethene (Vinyl chloride)	75-01-4	-	0.00064	0.00087	0.0014	S4UL
48	Chloromethane	74-87-3	-	0.0083	0.0098	0.013	EIC/AGS/CL:AIRE
49	2-Chloronaphthalene	91-58-7	-	3.7	9.2	22	EIC/AGS/CL:AIRE
50	1,2-Dichlorobenzene	95-50-1	-	23	55	130	S4UL
51	1,3-Dichlorobenzene	541-73-1	-	0.40	1.0	2.3	S4UL
52	1,4-Dichlorobenzene	106-46-7	-	61	150	350	S4UL
53	1,1-Dichloroethane	75-34-3	-	2.4	3.9	7.4	EIC/AGS/CL:AIRE
54	1,2-Dichloroethane	107-06-2	-	0.0071	0.011	0.019	S4UL
55	1,1-Dichloroethene	75-35-4	-	0.23	0.40	0.82	EIC/AGS/CL:AIRE
56	cis-1,2-Dichloroethene	156-59-2	-	0.11	0.19	0.37	EIC/AGS/CL:AIRE

Notes

1. These GAC relate solely to the protection of human health from chronic exposure to contaminants in soil. The risks to other receptors (e.g. controlled waters, ecology and property) needs to be considered separately.
2. Reference should also be made to the accompanying Opus Methodology for the Screening of Soils in Terms of the Risk to Human Health.
3. The above GAC are based on a sandy loam soil as defined in Environment Agency Science Report SC050021/SR3 dated January 2009
4. The GAC for organics assume that NAPL is not present. The presence of NAPL therefore needs to be considered qualitatively before applying these GAC. Risks from NAPL may need to be considered separately.
5. Where the GAC exceeds the aqueous solubility or the saturated vapour concentration, the lower of these saturation limits is also presented in brackets. Soil concentrations above soil saturation may indicate that NAPL is present.
6. - = denotes that no GAC has currently been derived.
7. * = where the xylene result has not been split into isomers compare the total xylene concentration to the lowest xylene isomer concentration as an initial screen.

Source

DEFRA / CL:AIRE SP1010 Category 4 Screening Levels (C4SLs) dated 24 September 2014.

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EIC/AGS/CL:AIRE publication 'Soil Generic Assessment Criteria for Human Health Risk Assessment', dated January 2010.

Atkins ATRISK^{soil} Soil Screening Values dated January 2015.

Opus UK Generic Assessment Criteria Summary Table for Organics (Sheet 2 of 12)
Residential With the Consumption of Homegrown Produce - Version 2016.1 dated 21 November 2016

	Substance	CAS No.	Opus Tier 1 Soil Screening Value (mg/kg)				Source
	SOM		0.25%	1%	2.5%	6%	
No.	HALOGENATED ORGANICS (continued)						
57	trans-1,2-Dichloroethene	156-60-5	-	0.19	0.34	0.70	EIC/AGS/CL:AIRE
58	Dichloromethane	75-09-2	-	0.58	0.98	1.7	EIC/AGS/CL:AIRE
59	1,2-Dichloropropane	78-87-5	-	0.024	0.042	0.084	EIC/AGS/CL:AIRE
60	Hexachlorobenzene	118-74-1	-	1.8 (0.2)	3.3 (0.5)	4.9	S4UL
61	Hexachloroethane	67-72-1	-	0.20	0.48	1.1	EIC/AGS/CL:AIRE
62	Pentachlorobenzene	608-93-5	-	5.8	12	22	S4UL
63	1,1,1-Trichloroethane	71-55-6	-	8.8	18	39	S4UL
64	1,1,2-Trichloroethane	79-00-5	-	0.60	1.2	2.7	EIC/AGS/CL:AIRE
65	1,1,1,2-Tetrachloroethane	630-20-6	-	1.2	2.8	6.4	S4UL
66	1,1,2,2-Tetrachloroethane	79-34-5	-	1.6	3.4	7.5	S4UL
67	1,2,3,4-Tetrachlorobenzene	634-66-2	-	15	36	78	S4UL
68	1,2,3,5-Tetrachlorobenzene	634-90-2	-	0.66	1.6	3.7	S4UL
69	1,2,4,5-Tetrachlorobenzene	95-94-3	-	0.33	0.77	1.6	S4UL
70	Tetrachloroethene	127-18-4	-	0.18	0.39	0.90	S4UL
71	Tetrachloromethane (Carbon tetrachloride)	56-23-5	-	0.026	0.056	0.13	S4UL
72	1,2,3-Trichlorobenzene	87-61-6	-	1.5	3.6	8.6	S4UL
73	1,2,4-Trichlorobenzene	120-82-1	-	2.6	6.4	15	S4UL
74	1,3,5-Trichlorobenzene	108-70-3	-	0.33	0.81	1.9	S4UL
75	Trichloroethene	79-01-6	-	0.016	0.034	0.075	S4UL
76	Trichloromethane (Chloroform)	67-66-3	-	0.91	1.7	3.4	S4UL
77	Trichloromethylbenzene	98-07-7	-	0.00016	-	0.0017	ATRISK^{soil}
78	Propylbenzene	103-65-1	-	34	82	190	EIC/AGS/CL:AIRE
79	Iso-propylbenzene (Cumene)	98-82-8	-	11	27	64	EIC/AGS/CL:AIRE
80	1,2,4-Trimethylbenzene	95-63-6	-	0.35	0.85	2.0	EIC/AGS/CL:AIRE
81	Styrene	100-42-5	-	8.1	19	43	EIC/AGS/CL:AIRE
No.	PHENOL & CHLOROPHENOLS						
82	Phenol	108-95-2	54	120	200	380	S4UL
83	Chlorophenols	-	-	0.87	2.0	4.5	S4UL
84	2,4-Dimethylphenol	105-67-9	-	19	43	97	EIC/AGS/CL:AIRE
85	2-Methylphenol (o-cresol)	95-48-7	-	78	-	-	ATRISKsoil
86	3-Methylphenol (m-cresol)	108-39-4	-	77	-	-	ATRISKsoil
87	4-Methylphenol (p-cresol)	106-44-5	-	77	-	-	ATRISKsoil
88	2-, 3- & 4-Methylphenol (total cresols) $	-	-	80	180	400	EIC/AGS/CL:AIRE
89	Pentachlorophenol	87-86-5	-	0.22	0.52	1.2	S4UL
No.	PESTICIDES						
90	Aldrin	309-00-2	-	5.7	6.6	7.1	S4UL
91	Dieldrin	60-57-1	-	0.97	2.0	3.5	S4UL
92	Atrazine	1912-24-9	-	3.3	7.6	17.4	S4UL
93	Dichlorovos	62-73-7	-	0.032	0.066	0.14	S4UL
94	Endosulfan - alpha	959-98-8	-	7.4	18	41	S4UL
95	Endosulfan - beta	33213-65-9	-	7.0	17	39	S4UL
96	Hexachlorocyclohexane - alpha	319-84-6	-	0.23	0.55	1.2	S4UL
97	Hexachlorocyclohexane - beta	319-85-7	-	0.085	0.20	0.46	S4UL
98	Hexachlorocyclohexane - gamma	58-89-9	-	0.060	0.14	0.33	S4UL
No.	PHTHALATES						
99	Bis(2-ethylhexyl) phthalate	117-81-7	-	280 (8.7)	610 (22)	1,100 (52)	EIC/AGS/CL:AIRE
100	Butyl benzyl phthalate	85-68-7	-	1,400 (26)	3,300 (65)	7,200 (150)	EIC/AGS/CL:AIRE
101	Diethyl phthalate	84-66-2	-	120 (14)	260 (29)	570 (65)	EIC/AGS/CL:AIRE
102	Di-n-butyl phthalate	84-74-2	-	13 (4.7)	31 (11)	67 (27)	EIC/AGS/CL:AIRE
103	Di-n-octyl phthalate	117-84-0	-	2,300 (33)	2800 (82)	3,100 (200)	EIC/AGS/CL:AIRE
No.	EXPLOSIVES						
104	2,4-Dinitrotoluene	121-14-2	-	1.5	3.2	7.2	EIC/AGS/CL:AIRE
105	2,6-Dinitrotoluene	606-20-2	-	0.78	1.7	3.9	EIC/AGS/CL:AIRE
106	2,4,6-Trinitrotoluene	118-96-7	-	1.6	3.7	8.1	S4UL
107	RDX	121-82-4	-	120	250	540	S4UL
108	HMX	2691-41-0	-	5.7	13	26	S4UL
No.	OTHER						
109	Biphenyl	92-52-4	-	66 (34)	160 (84)	360 (200)	EIC/AGS/CL:AIRE
110	Carbon disulphide	75-15-0	-	0.14	0.29	0.62	S4UL
111	Tributyl tin oxide	56-35-9	-	0.25	0.59	1.3	EIC/AGS/CL:AIRE
112	Hexachlorobutadiene	87-68-3	-	0.29	0.70	1.6	S4UL

Notes

1. These GAC relate solely to the protection of human health from chronic exposure to contaminants in soil. The risks to other receptors (e.g. controlled waters, ecology and property) needs to be considered separately.
2. Reference should also be made to the accompanying Opus Methodology for the Screening of Soils in Terms of the Risk to Human Health.
3. The above GAC are based on a sandy loam soil type, except the ATRISK^{soil} values at 1% SOM which are based on a sand soil type (as defined in Environment Agency Science Report SC050021/SR3)
4. The GAC for organics assume that NAPL is not present. The presence of NAPL therefore needs to be considered qualitatively before applying these GAC. Risks from NAPL may need to be considered separately.
5. Where the GAC exceeds the aqueous solubility or the saturated vapour concentration, the lower of these saturation limits is also presented in brackets. Soil concentrations above soil saturation may indicate that NAPL is present.
6. - = denotes that no GAC has currently been derived.
7. $ = The derived GAC is based on the lowest of the individual isomers of methylphenol

Source

DEFRA / CL:AIRE SP1010 Category 4 Screening Levels (C4SLs) dated 24 September 2014.

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EIC/AGS/CL:AIRE publication 'Soil Generic Assessment Criteria for Human Health Risk Assessment', dated January 2010.

Atkins ATRISK^{soil} Soil Screening Values dated January 2015.

Human Health Generic Screening Assessment

Client	Wilson Home Developments Ltd
Project Ref	E-E1667.00
Site Name	Dolphin Quay
Contaminants	Metals, metalloids, Phenols, PAH, TPH, BTEX, MTBE
End Use Scenario	Residential without Plant Uptake
Date	01 December 2017
Assessed	LJE
Checked/Approved	CDS

Opus International Consultants (UK) Ltd
Opus International Consultants (UK) Ltd, Modulus House,
Salterns Lane,
Fareham
Hampshire,
PO16 0QS

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health Residential with Plant Uptake			**Hole ID**	BH1	BH2	BH2	WS1	WS2	WS3	WS4	WS5	WS6
			Depth	0.37 - 0.43	0.5	1.6	0.6 - 0.8	0.2	0.2	0.6	0.3	0.1
			Strata	MG	MG	MG	MG	MG	MG	MG	MG	MG
Arsenic	40	C4SL	mg/kg	26	12	17	7	12	14	12	16	20
Boron	11000	S4UL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Cadmium	150	C4SL	mg/kg	2	<1.0	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium Total	910	C4SL	mg/kg	19	20	24	16	14	10	17	14	14
Chromium VI	21	C4SL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Copper	7100	S4UL	mg/kg	150	140	260	21	57	170	49	73	61
Cyanide Total	34	ATRISKsoil	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead	310	C4SL	mg/kg	230	1100	420	160	710	690	340	610	640
Mercury	56	S4UL	mg/kg	<1.0	4	1	1	2	4	1	1	<1.0
Nickel	180	S4UL	mg/kg	67	15	32	11	14	10	16	14	32
Selenium	430	S4UL	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Zinc	40000	S4UL	mg/kg	440	580	380	47	190	240	160	150	150

Highlighted concentrations have exceeded their generic screening value

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health			**TP / BH No**	BH1	BH2	BH2	WS1	WS2	WS3	WS4	WS5	WS6
Residential with plant uptake			**Depth**	0.37 - 0.43	0.5	1.6	0.6 - 0.8	0.2	0.2	0.6	0.3	0.1
1.0% SOM			**Strata**	MG	MG	MG	MG	MG	MG	MG	MG	MG
Determinand	**Screening Value**	**Source**	**Units**									
Naphthalene	2.3	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	1.2	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	2,900	S4UL	mg/kg	<0.1	0.1	<0.1	<0.1	5.1	0.1	<0.1	<0.1	<0.1
Acenaphthene	3,000	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	<1.0	<0.1	<0.1	<0.1	<0.1
Fluorene	2,800	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	2.9	<0.1	<0.1	<0.1	<0.1
Phenanthrene	1,300	S4UL	mg/kg	0.3	1	0.5	<0.1	32	0.5	<0.1	0.2	<0.1
Anthracene	31,000	S4UL	mg/kg	<0.1	0.3	0.3	<0.1	9.3	<0.1	<0.1	<0.1	<0.1
Fluoranthene	1500	S4UL	mg/kg	0.1	2.3	1.7	<0.1	57	1	<0.1	0.5	<0.1
Pyrene	3700	S4UL	mg/kg	0.1	2.1	1.5	<0.1	48	0.8	<0.1	0.4	<0.1
Benzo(a)anthracene	11	S4UL	mg/kg	<0.1	1.3	0.7	<0.1	22	0.5	<0.1	0.2	<0.1
Chrysene	30	S4UL	mg/kg	0.2	1.4	0.8	<0.1	31	0.6	<0.1	0.2	<0.1
Benzo(b)fluoranthene	3.9	S4UL	mg/kg	<0.1	1.2	0.8	<0.1	25	0.6	<0.1	0.2	<0.1
Benzo(k)fluoranthene	110	S4UL	mg/kg	<0.1	1.3	0.6	<0.1	23	0.6	<0.1	0.2	<0.1
Benzo(a)pyrene	3.2	C4SL	mg/kg	<0.1	1.3	0.7	<0.1	22	0.5	<0.1	0.2	<0.1
Indeno(1,2,3-cd)pyrene	45	S4UL	mg/kg	<0.1	0.8	0.4	<0.1	9.3	0.3	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene	0.31	S4UL	mg/kg	<0.1	0.4	0.1	<0.1	4.6	0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	360	S4UL	mg/kg	<0.1	0.9	0.4	<0.1	9.2	0.4	<0.1	<0.1	<0.1

Highlighted concentrations have exceeded their generic screening value

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health			**TP / BH No**	BH1	BH2	WS2	WS2	WS3	WS4	WS4	WS5	WS6
Residential with plant uptake			**Depth**	1.5	1.6	2	2.5	1.5	1.75	3	2	0.5
2.5% SOM			**Strata**	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium
Determinand	**Screening Value**	**Source**	**Units**									
Aliphatic >C5 - C6	78	S4UL	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aliphatic >C6 - C8	230	S4UL	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aliphatic >C8 - C10	65	S4UL	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aliphatic >C10 - C12	330	S4UL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aliphatic >C12 - C16	2400	S4UL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aliphatic >C16 - C21	92000	S4UL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aliphatic >C21 - C34	92000	S4UL	mg/kg	<2.0	11	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Aromatic >C5 - C7	1.90	C4SL Benzene	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aromatic >C7 - C8	1900	S4UL Toluene	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aromatic >C8 - C10	110	S4UL	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Aromatic >C10 - C12	590	S4UL	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Aromatic >C12 - C16	2300	S4UL	mg/kg	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Aromatic >C16 - C21	1900	S4UL	mg/kg	5	9	1	<1.0	1	<1.0	<1.0	<1.0	<1.0
Aromatic >C21 - C35	1900	S4UL	mg/kg	<2.0	11	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0

Highlighted concentrations have exceeded their generic screening value

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health			**TP / BH No**	BH1	BH2	WS2	WS2	WS3	WS4	WS4	WS5	WS6
Residential with plant uptake			**Depth**	1.50	1.60	2.00	2.50	1.50	1.75	3.00	2.00	0.50
2.5% SOM			**Strata**	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium
Determinand	**Screening Value**	**Source**	**Units**									
Benzene	1.6	C4SL	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	1900	S4UL	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	190	S4UL	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
o-Xylene *	210	S4UL	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m-Xylene *	190	S4UL	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MTBE	120	EIC/AGS/CL:AIRE	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Highlighted concentrations have exceeded their generic screening value

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health	**TP / BH No**
Residential with plant uptake	**Depth**
2.5% SOM	**Strata**

Determinand	**Screening Value**	**Source**	**Units**
1,1,1,2-Tetrachloroethane	6.40	S4UL	mg/kg
1,1,1-Trichloroethane	39.0	S4UL	mg/kg
1,1,2,2-Tetrachloroethane	7.50	S4UL	mg/kg
1,1,2-Trichloroethane	2.70	EIC/AGS/CL:AIRE	mg/kg
1,1-Dichloroethane	7.40	EIC/AGS/CL:AIRE	mg/kg
1,1-Dichloroethylene			mg/kg
1,1-Dichloropropene			mg/kg
1,2,3-Trichloropropane			mg/kg
1,2,4-Trimethylbenzene	2.00	EIC/AGS/CL:AIRE	mg/kg
1,2-Dichlorobenzene	130	S4UL	mg/kg
1,2-Dichloroethane	0.019	S4UL	mg/kg
1,2-Dichloropropane	0.084	EIC/AGS/CL:AIRE	mg/kg
1,2-dibromoethane			mg/kg
1,3,5-Trimethylbenzene			mg/kg
1,3-Dichlorobenzene	2.30	S4UL	mg/kg
1,3-Dichloropropane			mg/kg
1,4-Dichlorobenzene	350	S4UL	mg/kg
2,2-Dichloropropane			mg/kg
2-Chlorotoluene			mg/kg
4-Chlorotoluene			mg/kg
Bromobenzene	4.70	EIC/AGS/CL:AIRE	mg/kg
Bromochloromethane			mg/kg
Bromodichloromethane	0.061	EIC/AGS/CL:AIRE	mg/kg
Bromoform	13.0	EIC/AGS/CL:AIRE	mg/kg
Bromomethane			mg/kg
Carbon tetrachloride	0.13	S4UL	mg/kg
Chlorobenzene	2.40	S4UL	mg/kg
Chlorodibromomethane			mg/kg
Chloroethane	18.0	EIC/AGS/CL:AIRE	mg/kg
Chloroform			mg/kg
Chloromethane	0.013	EIC/AGS/CL:AIRE	mg/kg
Cis-1,2-Dichloroethylene			mg/kg
Cis-1,3-Dichloropropene			mg/kg
Dibromomethane			mg/kg
Dichlorodifluoromethane			mg/kg
Dichloromethane	1.70	EIC/AGS/CL:AIRE	mg/kg
Isopropyl benzene	64.0	EIC/AGS/CL:AIRE	mg/kg
S-Butylbenzene			mg/kg
Styrene	43.0	EIC/AGS/CL:AIRE	mg/kg
T-Butylbenzene			mg/kg
Tetrachloroethene	0.90	S4UL	mg/kg
Trans-1,2-Dichloroethene	0.70	EIC/AGS/CL:AIRE	mg/kg
Trans-1,3-Dichloropropene			mg/kg
Trichloroethene	0.075	S4UL	mg/kg
Trichlorofluoromethane			mg/kg
Vinyl chloride	0.0014	S4UL	mg/kg
n-Propylbenzene			mg/kg
p-Isopropyltoluene			mg/kg

Highlighted concentrations have exceeded their generic screening value

Project Name:	**Dolphin Quay**
Project Reference:	**E-E1667.00**

General Screening Suite - Human Health			**TP / BH No**	BH1	BH2	WS2	WS2	WS3	WS3	WS4	WS4	WS5
Residential with plant uptake			**Depth**	1.50	1.60	2.00	2.50	1.50	1.70	1.75	3.00	2.00
2.5% SOM			**Strata**	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium	Alluvium
Determinand	**Screening Value**	**Source**	**Units**									
Naphthalene	5.6	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	4,600	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	4,700	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	3,800	S4UL	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	1500	S4UL	mg/kg	1.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	35000	S4UL	mg/kg	0.4	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	1600	S4UL	mg/kg	1.6	1.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	3800	S4UL	mg/kg	1.3	1.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	14	S4UL	mg/kg	0.9	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	31	S4UL	mg/kg	0.8	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	4	S4UL	mg/kg	1.2	1.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	110	S4UL	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene	3.2	C4SL	mg/kg	0.5	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-cd)pyrene	46	S4UL	mg/kg	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(a,h)anthracene	0.32	S4UL	mg/kg	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene	360	S4UL	mg/kg	0.2	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Client/client ref: Wilson House Developments Ltd
Project ref: E-E1667.00
Site ref: Dolphin Quay
Data description: Made Ground
Contaminant(s): Lead, PAH
Test scenario: Planning
Date: 1 December 2017
User details: Opus International Consultants

	Lead	Benzo(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(a)pyrene	Dibenz(a,h)anthracene				
Critical concentration, C_c	**200**	**7.2**	**15**	**2.6**	**2.2**	**0.24**				
Notes										
Sample size, n	9	9	9	9	9	9	0	0	0	0
Sample mean, $\bar{x}$	544.444444	2.76666667	3.81666667	3.11111111	2.76666667	0.60555556	No Data	No Data	No Data	No Data
Standard deviation, s	290.392455	7.22487024	10.2038289	8.21872016	7.22487024	1.50217435				
Number of non-detects	0	**4**	**3**	**4**	**4**	**5**				
Set non-detect values to:	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit	Half detection limit
Outliers?	No	Yes	Yes	Yes	Yes	Yes				
Distribution	Normal	Non-normal	Non-normal	Non-normal	Non-normal	Non-normal				
Statistical approach	Auto: One-sample t-	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto: Chebychev	Auto	Auto	Auto	Auto

Test scenario:	Planning: is true mean lower than critical concentration (μ < Cc)?				**Evidence level required:**		**95%**	Use Normal distribution to test for outliers		
t statistic, t_0 (or k_0)	3.558402832	-1.840863511	-3.287981424	0.18656595	0.235298344	0.730052851				
Upper confidence limit (on true mean concentration, μ)	724.444018	13.2641598	18.6424864	15.0526347	13.2641598	2.78816428				
Evidence level	**0%**	**77%**	**92%**	**0%**	**0%**	**0%**				
Base decision on:	evidence level	evidence level	evidence level	evidence level	evidence level	evidence level				
Result	**μ ≥ Cc**	**μ ≈≥ Cc**	**μ ≈≥ Cc**	**μ ≥ Cc**	**μ ≥ Cc**	**μ ≥ Cc**				
Select dataset	○ Y	○ Y	○ Y	○ Y	○ Y	◉ Y	○ Y	○ Y	○ Y	○ Y

Back to data | **Go to outlier test** | **Go to normality test** | **Show individual summary**

Appendix F

Conditions and Limitations

OPUS INTERNATIONAL CONSULTANTS (UK) LTD

SITE INVESTIGATIONS

CONDITIONS AND LIMITATIONS

1. The report is confidential to the clients stated in the report and has been prepared to their instructions for their own purposes and it is not permitted to disclose this report to other parties (except NHBC, Local Authority, the Client's own Solicitors and Professional Advisers) without the prior consent of Opus International Consultants (UK) Ltd.

2. The copyright of this report remains the property of Opus International Consultants (UK) Ltd.

3. No liability for the contents of this report is accepted to any parties other than the client stated in the report. No parties other than the client stated in the report should rely upon this report.

4. Attention is drawn to the fact that, whilst every effort is made to ensure the accuracy of the data and any conclusions derived from it, the possibility exists of variations in ground conditions around and between trial pits. No liability can be accepted for such variations or for agreed sampling rates/trial hole frequency.

5. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.

6. No liability can be accepted for any services or other below ground items unless clearly shown on a plan to us in advance of any site works.

7. In accepting instructions to carry out site investigations it is assumed by us that our clients have all necessary permissions from existing owners and/or other authorities for such works to proceed. No liability is accepted for any claims arising as a result of anything contrary to this.

8. It is also assumed that a suitable clear access to the site is available for the required equipment and plant.

9. All holes are normally back-filled with excavated material compacted by its own weight only. Any excess spoil will be spread evenly around the direct area of excavation.

10. No chemical analysis of samples will be carried out unless specifically stated otherwise in the text of this report. Where fill, disturbed soil or an unfavourable earlier land usage is identified by the investigation the client is advised to have chemical analysis carried out subsequently. In any event no liability is accepted in respect of pollution. Similarly for radon and naturally occurring chemicals and gases.

11. Unless stated otherwise any desk study into the site history will be limited to information readily available at the Local Reference Library.

12. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations probably apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.

13. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement, Short Form Agreement 2002 applies.

14. Laboratory testing where carried out is usually undertaken by sub-contract laboratories. No liability is accepted arising from any errors or omissions on the part of such laboratories.

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