

INTERPRETATIVE REPORT ON GROUND INVESTIGATION

At

PORT OF SHOREHAM

For

JOHN PARKER AND SON LTD

OCTOBER 2007

BUREAU VERITAS

For the benefit of business and people

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Distribution Sheet

Our ref: 1004519

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ON GROUND INVESTIGATION

For
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At
PORT OF SHOREHAM

DISTRIBUTION			
Date:	Issued to:	Name:	No:
October 07	Bettridge Turner and Partners	Mr. Ray Larkins	2
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Approval Sheet and Foreword

Our ref: 1004519

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ON GROUND INVESTIGATION

For
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At
PORT OF SHOREHAM

Report Status/Issue No: FINAL		Date of Issue: October 2007
Issued to: JOHN PARKER AND SON LTD		Job No: 1004519
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FOREWORD

This document has been prepared by Bureau Veritas B&I Ltd with all reasonable skill, care and diligence within the terms of the contract with the Client and within the limitations of the resources devoted to it by agreement with the Client.

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1.0 INTRODUCTION

1.1 This report has been prepared upon the instruction of Bettridge Turner and Partners, e-mail dated 1st May 2007, consulting engineers acting on behalf of John Parker and Son Ltd.

1.2 It is proposed to construct a series of portal frame structures with crane facilities for an industrial development located at the old power station site, at Shoreham Harbour.

1.3 As part of the proposed scheme, the Client requested an investigation to assess the ground conditions on the site and to provide information for the design and construction of the proposed structures. The Client also requested testing for Waste Acceptance Criteria (WAC) for materials which may require to be removed from site during the excavation of new foundations.

1.4 The scope of work outlined in Bureau Veritas' offer of 20th April 2007 was based on the Clients requirements, namely:

- Ground Investigation comprising cable percussion boreholes and static Cone Penetration Testing (CPT).
- Geotechnical and contamination (WAC) laboratory testing and an interpretative geotechnical report.

The Offer was accepted by the Client.

1.5 Following completion of the Client's land acquisition negotiations and clearance from the Port of Shoreham, the site was made available for commencement of the fieldwork in early June 2007. The project commenced with the static electric Cone Penetration Testing (CPT): thirteen tests were carried out on 5th and 6th June 2007. Subsequently, from 8th June 2007 to 9th August 2007, nine cable percussion boreholes were drilled on the site. This geotechnical report presents the details of the ground conditions encountered in the boreholes and a geotechnical appraisal of the findings.

1.6 It is understood that Enviros Consulting Limited are carrying out an EIA on behalf of the Client. Bureau Veritas were instructed to carry out additional boreholes and monitoring wells as part of this work. However, this data does not form part of the geotechnical investigation and it will be reported separately by Enviros.

1.7 Attention is drawn to the fact that whilst every effort has been made to ensure the accuracy of the data supplied and any analysis derived from it, the possibility exists of variations in ground and water conditions around and between the exploratory positions. No liability can be accepted for any such variations in these conditions. Furthermore, any recommendations are specific to the development as detailed in this report, and no liability will be accepted should they be used for the design of alternative schemes without prior consultation with Bureau Veritas B&I.

2.0 THE SITE AND GEOLOGY

2.1 The site is situated at Fishersgate, Shoreham Harbour and is centred around National Grid Reference TQ 250 048, as shown on Figure 1.

2.2 The site, which was previously occupied by a power station, is bounded by Shoreham Harbour to the north and Basin Road South to the south, with the sea (English Channel) beyond. The land is believed to be partially reclaimed but is on part of a natural shingle spit which separated the old course of the river Adur from the sea. The majority of the site is currently used as a timber storage facility.

2.3 The general topography of the site is relatively level.

2.4 Reference to the 1:50 000 scale geological map of the area, sheet 318/333 Brighton and Worthing, published by the British Geological Survey, shows the site to be located on the following sequence:

Storm Gravel Beach Deposits	-	Typically consists of flint gravel, locally with cobbles.
Woolwich and Reading Beds	-	Typically consists of red and grey mottled clays with sandy intercalations and rounded flint gravel. A bed of flints commonly marks their base. Beds of lignite, up to 1m thick have been reported in the lower part of the sequence.
Upper Chalk	-	Typically consists of thickly bedded, white, limestone with flints and local nodular bands and marls.

The geological memoir notes that “although it is generally envisaged that the Woolwich and Reading Beds were deposited unconformably on a more or less planar surface of Upper Chalk, the base of these beds is generally highly irregular owing to the development of post-Tertiary solution features in the Chalk surface. The Tertiary

sediments have collapsed into these solution hollows in places, particularly around Brighton and Hove".

2.5 Under a thick mantle of Made Ground, the investigation confirmed the anticipated geology, i.e. Storm Gravel Beach Deposits (Marine Gravel), Woolwich and Reading Beds and Upper Chalk, successively with depth. In addition, Marine Alluvium was locally encountered intercalated with the Gravel Deposits. Furthermore, at the boundary between the Woolwich and Reading Beds and the Upper Chalk, a possible solution feature in the chalk were identified.

2.6 The interface of the chalk with any overlying deposits is typically of an undulating nature. In addition, where the chalk is overlain by other deposits it is not uncommon for the surface to be characterised by the presence of irregular hollows which are termed pipes, swallow holes or solution features. These have resulted from the solution of the chalk by slightly acidic water and they are particularly common at the margins and the base of overlying deposits. These features may be infilled with loose debris which has collapsed into the void; or alternatively any overlying relatively competent materials may be arched over a void. Any change in stress, such as may be brought about by an applied load, vibration, change in groundwater regime or leaking sewers and drains, can initiate collapse settlements of any loose void infill or of any competent material arching over the void.

3.0 GROUND INVESTIGATION

3.1 The fieldwork consisted of thirteen static electric Cone Penetration Tests (CPT's) carried out on 5th and 6th June 2007 and nine cable percussion boreholes carried out from 8th June 2007 to 9th August 2007 at the locations shown on Figure 2.

3.2 Detailed borehole logs are included as Figures A1 to A9 in Appendix A. The logs show the depth and nature of the strata encountered, together with the depth and type of samples recovered, in situ testing and groundwater observations. Reference should be made to these logs for detailed information and a summary only is presented herein.

3.3 Below the block paving and the granular sub-base (BH4, BH5 and BH6), the drillers encountered possible old footings in three of the boreholes, which were recovered after chiselling, as grey, very sandy gravel of brick and concrete.

3.4 Below these and in the remaining boreholes immediately below the block paving, materials identified as Made Ground were found to depths ranging from 2.8m (BH8) to 8.5m (BH7). These materials were variable and comprised sandy to very sandy, locally slightly clayey to very clayey, gravel and gravelly to very gravelly, slightly clayey to clayey, sand, with the gravel being mainly brick and concrete fragments and fine to coarse, subangular to rounded, flint and chert. Locally (in Borehole 9), the Made Ground also comprised soft to very soft, grey, sandy clay. Black ash was also noted in the Made Ground.

3.5 Below the Made Ground, Marine Gravel was encountered in all the boreholes to depths ranging between 9.0m (BH3) and 15.8m (BH2). It consisted of orange-brown and grey, slightly sandy to very sandy, gravel with the gravel being fine to coarse, locally cobbles, sub-angular to rounded, flint and chert. Locally, in Borehole 4, 5 and 8, Marine Alluvium was found intercalated with Marine Gravel. It comprised very soft, black oxidising to grey, gravelly clay, locally with organic content.

3.6 Beneath the Marine Gravel, the Woolwich and Reading Beds were found at depths ranging between 15.8m (BH2) and 24.6m (BH5). They typically comprised stiff to very stiff, locally hard, grey and dark brown, locally gravelly and very gravelly, locally sandy and very sandy, thinly laminated, carbonaceous clay, with laminations and beds of black lignite/coal and traces of disseminated pyrite. In some of the boreholes the

interface between the Woolwich and Reading Beds and the Upper Chalk was marked by a layer of flint cobbles and flint gravel.

3.7 The Upper Chalk was encountered beneath the Woolwich and Reading Beds in all boreholes at depths ranging from 17.2m (BH3) to 24.6m (BH5). The sequence was proved to the base of all boreholes and a maximum depth of 40m below ground level in Borehole 4.

3.8 Cable Percussion drilling in chalk causes degradation of the material during the sampling process. The chalk was recovered as a mixture (in varying proportions) of white and off white chalk silt and chalk gravel with some flint gravel also recorded. Some discolouration of the chalk was noted in the upper levels. In Borehole 5 the chalk was noted to be discoloured, contained clay laminations and had relatively low Standard Penetration Test (SPT) readings. This indicated a possible solution feature which extended to a depth of 30.55m below ground level.

3.9 Groundwater was encountered in the boreholes, as shown in Table A1 and on the borehole logs. However, it should be noted that the groundwater observations are not necessarily indicative of the equilibrium water level in view of the relatively short period the boreholes remained open. Furthermore, the water level beneath the site may vary both seasonally and in the long term and in response to tidal variations.

3.10 A series of static cone penetration tests were carried out on the site using hydraulic penetrometer equipment mounted in a heavy truck ballasted to provide a reaction weight of approximately 18 tonnes. A 7.5 tonne capacity electric cone was used for the tests and the results are included at the rear of Appendix A.

4.0 LABORATORY TESTING

4.1 A geotechnical laboratory testing programme was carried out to provide further information on the subsoil. Unless stated otherwise, these tests were carried out in accordance with BS 1377 "Method of Test for Soils for Civil Engineering Purposes". Bureau Veritas Laboratories has been accredited for specific tests (indicated *) by the United Kingdom Accreditation Services (UKAS). Individual full format reports for these tests are available, if required. The following tests were carried out and the results are presented in Appendix B.

- 11 no. Moisture Content* determinations and Atterberg Limit* classification tests.
- 9 no. Water soluble Sulphate*, pH*, Acid Soluble Sulphate*, Total sulfur* and Chloride* determinations. The Water soluble Sulphate tests were carried out on a 2:1 water:soil extract.
- 5 no. Particle Size Distribution by Wet Sieve Techniques*.
- 9 no. 100mm diameter Quick Undrained Triaxial tests*.

It should be noted that some of the triaxial tests recorded undrained shear strengths which were lower than that measured within the in-situ testing and inferred from the tactile assessment. This is due to the structure and fabric of the soil (presence of discontinuities, bedding planes, fissures etc.) and the presence of rock seams which can result in a lower undrained shear strength being measured.

4.2 The client also required a series of contamination tests and these results are included in Appendix C.

5.0 GEOTECHNICAL DISCUSSION

5.1 General

5.1.1 It is proposed to construct a series of industrial buildings on the Fishergate site at Port of Shoreham. The units are to be of portal frame construction and maximum loads are expected to be up to 1500 kN. The purpose of the geotechnical investigation was to assess the ground conditions on the site with particular reference to the use of piled or shallow foundations.

5.1.2 The exploratory holes have revealed the following general succession of materials at the locations investigated:-

Made Ground	-	Variable mixture of clay, silt, sand and gravel.
Marine Gravel	-	Very loose to dense sandy gravel and gravelly sand.
Woolwich and Reading Beds	-	Stiff to hard clay with lignite beds.
Upper Chalk	-	Chalk.

The water levels recorded in the boreholes during the course of the fieldwork were typically in the range 2m to 6m below ground level. However, the comments made in Section 3 regarding water levels should be borne in mind, particularly the potential effects of tidal variations. Enviros Consulting have arranged for monitoring wells to be installed on the site. It is recommended that readings are taken within these instruments to gain a greater understanding of the groundwater regime and its variation.

5.1.3 The Client has indicated that piled foundations are to be utilised for the larger structures whilst shallow foundations may be considered for the lighter structures. Where medium dense or dense gravels of the Marine Gravel sequence are present close to the surface they would make a competent founding stratum for spread foundations. However, the

Marine Gravel was found to be mantled by Made ground at all borehole locations, typically in excess of 3m in thickness. This amount of Made Ground would not make it practicable or cost effective to install spread foundations bearing on the Marine Gravels.

5.1.4 Although the Made Ground is predominantly of a granular nature it is not a high quality engineered fill and its use as a foundation soil would be subject to a number of concerns, including the following:-

- There is a large variation in the thickness of the Made Ground (2.8m to 8.5m).
- In places the Made Ground is loose and very loose with low Standard Penetration Test (SPT) values.
- Locally the Made Ground contains layers of very soft clay.
- Apparent old buried foundations were encountered at three borehole locations and these will tend to act as buried “hard spots”. A number of the CPT’s were also terminated at shallow depths on obstructions further suggesting the presence of old foundations.

In view of the above there is a significantly increased risk for differential movement to occur if spread foundations were to be placed in the existing Made Ground.

5.1.5 If the smaller, lightweight portal frame structures are not susceptible to differential movement and/or have a reduced lifespan then it may be feasible to construct spread foundations within the higher quality Made Ground. If this option is to be considered further then once the building locations have been finalized it is recommended that supplementary investigations are carried out over the footprint of the specific building location. This will enable the extent, composition and quality of the Made Ground to be assessed and the existence of any buried foundations to be identified, and thus the potential risk for differential settlement to occur at that particular building location.

5.1.6 It may also be feasible to utilise ground improvement techniques such as dynamic compaction or vibroflotation to enhance the areas of poorer quality Made Ground. These techniques would serve to densify loose granular soils and stiffen soft cohesive soils thereby increasing bearing capacity and reducing subsequent settlement. The locations, end use and settlement tolerances of the proposed buildings have yet to be finalised. Once these have been completed this information, together with the contents

of this geotechnical report, can be submitted to specialist ground improvement contractors for them to evaluate whether their particular equipment and techniques would be suitable on this site such that spread foundations for the lightly loaded buildings and ground bearing floor slabs may be adopted.

5.2 Pile Foundations

5.2.1 Where medium dense or dense gravels of the Marine Gravel sequence are present they would potentially be suitable for the installation of end bearing piles. However, there are potential concerns in this respect, as outlined below:

- Occasional bands of very soft clay (Marine Alluvium) were present within the Marine Gravel sequence. These layers are highly compressible and very weak.
- Both the boreholes and the CPT's identified areas of very loose and loose material within the Marine Gravel sequence.
- In places the Marine Gravel and Woolwich and Reading Beds interface is relatively shallow. If the toe of a heavily loaded pile is located towards the base of the Marine Gravel it could lead to over stressing of the underlying Woolwich and Reading Beds increasing the risk of excessive settlement or punching failure.

In view of the above it is considered unlikely that the Marine Gravel will be a suitable founding stratum for piles supporting the major structures. Piles for these buildings will need to be taken through the drift deposits to be founded in the Woolwich and Reading Beds or Upper Chalk.

5.2.2 The in-situ testing has shown the Woolwich and Reading Beds clay to be stiff to hard. All of the deeper CPTs were terminated in this sequence and none of the tests were able to penetrate into the underlying Upper Chalk. This sequence will provide significant support for piled foundations although additional load could be derived by taking the piles deeper, into the underlying Upper Chalk.

5.2.3 Pile dimensions and types will depend upon several factors including loads, pile spacing and settlement tolerances etc. In determining the type of pile to be used on this site, the following points should be considered:

i) The effects of noise, vibrations and ground disturbance on adjoining structures, roads, buried services, etc, particularly if driven piles are considered.

ii) Groundwater was encountered during the drilling operations so it will be necessary to consider the possibility of groundwater ingress from the more permeable materials including the Marine Gravels and Upper Chalk. This may potentially necessitate the use of temporary casing and placing concrete by tremie if conventional cast in-situ bored piles are used.

iii) Traditional bored piles will require temporary support through potentially unstable materials such as the Made Ground and the Marine Gravels. The Woolwich and Reading Beds and the Upper Chalk may also require some temporary support where it is fissured.

iv) The chosen piling system must be capable of penetrating obstructions if encountered. Old foundations were encountered in the Made Ground, lignite bands were encountered in the Woolwich and Reading Beds and large flints were encountered at various levels.

v) Access restrictions depending on the type and size of plant and equipment on the site.

vi) The potential effect of negative skin friction if the Made Ground and underlying cohesive soils settle relative to the pile shaft.

vii) The possible presence of solution features within the Chalk.

5.2.4 Based on the above factors and in view of the ground conditions encountered on this site, it is considered that driven piles are unlikely to be suitable although, if required, advice can be sought from specialist contractors with respect to this issue. Continuous Flight Auger (CFA) piles are also less capable of dealing with buried obstructions such as old foundations. Traditional bored piles have the advantage over driven piles and CFA piles in that obstructions can be removed more readily, and noise and vibrations are typically less significant.

5.2.5 The allowable working load of a pile depends not only upon the ground conditions, but also upon the type of pile and method of installation. When selecting a piling contractor, the primary consideration must be the suitability of his equipment and techniques to deal with the above issues whilst meeting the required criteria for the proposed working loads within the specified settlement tolerances. Once the building locations, structural loadings and settlement tolerances have been finalised it is recommended that the

information, together with this geotechnical report, is forwarded to specialist piling contractors to enable them to determine pile costs and sizes for their particular equipment and techniques.

5.2.6 The Engineer has indicated that 450mm diameter piles have been utilised in the preliminary design of the foundations and he has requested a trial calculation to evaluate the feasibility of this pile type. An idealised or averaged model of the ground profile was prepared using the data from the exploratory holes. Calculations indicate that for the idealised profile a 450mm diameter pile penetrating 15m below the Made Ground could carry a working load of 500 kN. The calculation is based on skin friction only. The end bearing component of the pile would depend upon the location of the pile toe. The harder clays of the Woolwich and Reading Beds could theoretically support a relatively high load. However, if the pile toe is located at the base of the sequence, with a high load, there is a risk of a punching failure or excessive settlement if the pile base over stresses the top of the underlying chalk.

5.2.7 The above capacity assumes an isolated, axially loaded pile and does not allow for negative skin friction which will depend upon the amount of Made Ground at the particular pile location. Once pile layouts have been finalised the potential for group effects should also be checked. It should be noted that although the succession of geological units is the same across the site (Made Ground, Marine Gravel, Woolwich and Reading Beds and Upper Chalk), there are variations in their extent and thickness. When the piling contractor carries out his pile design he should take into account the ground conditions prevailing at each of the specific building locations.

5.3 Floor Slabs

5.3.1 As noted in Section 5.1.4 any structures founded on the Made Ground would be at an increased risk of differential settlement. The extent of any such settlement would depend upon the variation in thickness, extent and composition of the Made Ground and the presence of any hard spots (old foundations) beneath the individual building location.

5.3.2 In areas where higher quality Made Ground is present it may be feasible to use a ground bearing slab particularly if floor loadings are light and potential floor settlements

are not a concern. Where extensive, poor quality made Ground is present or the proposed end use entails high loads or settlement sensitive use (e.g. high racking, operating fork lifts etc.) then floor slabs bearing directly on the Made Ground will be at risk of differential settlement. In this event a suspended floor may be considered.

5.3.3 Once the project has developed further and the layouts, proposed end use and settlement tolerances have been finalised it is recommended that the existing ground investigation data is reviewed to evaluate floor construction requirements. If necessary further shallow investigations should be considered to provide sufficient date on the nature of the Made Ground beneath each individual building location.

5.4 Buried Concrete

5.4.1 Tests were performed on samples recovered from the boreholes in order to assess buried concrete requirements. The tests included water soluble sulphate, acid soluble sulphate, pH, sulphur content and water soluble chloride. The results of the tests have been compared to the guidelines outlined in BRE Special Digest 1, "Concrete in Aggressive Ground.

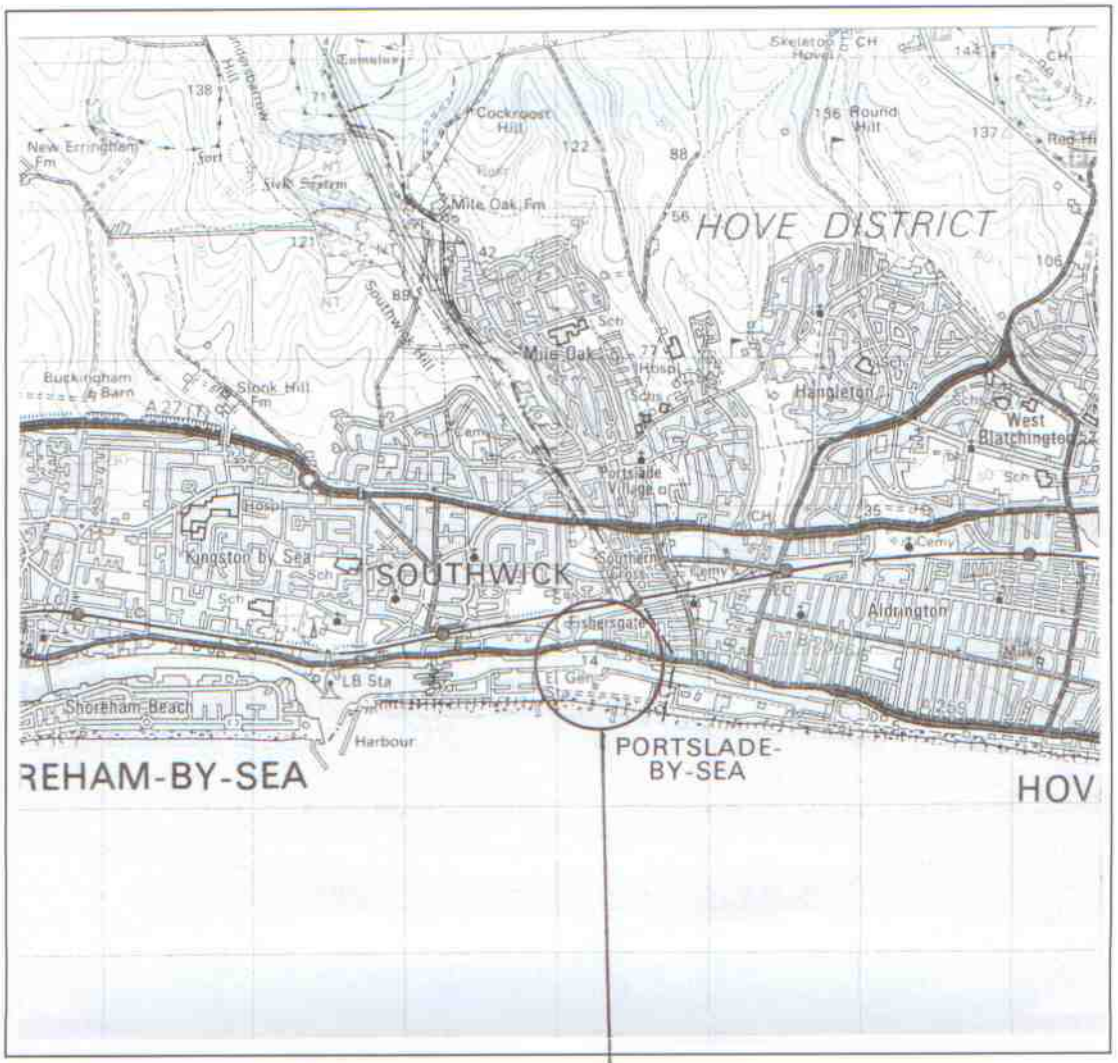
5.4.2 Where natural soils contain sulphate or sulphide compounds or have an elevated acidity, they can have the potential to attack buried concrete. As noted on the borehole logs included in Appendix A, pyrite (iron sulphide) was noted within the Woolwich and Reading Beds.

5.4.3 Elevated sulphate levels were recorded in the samples tested, as indicated in Table B2 of this report. Referring to Table C1 of BRE Special Digest 1, in terms of their water soluble sulphate content, two of the tests fall within Design Sulphate Class DS-3 and one of the tests in Class DS-5. High levels of sulphurous material were also recorded in two of the samples, probably associated with the pyritic material in the soil. All of the samples tested have an oxidisable sulphide content of 0.3% or more, confirming the presence of pyritic material.

5.4.4 Where the available data set has 5 to 9 results Special Digest 1 recommends that the mean of the two highest results is adopted. Nine tests were performed and on this basis the Digest indicates a DS-5 Class and an ACEC Class of AC-5. Special Digest 1 indicates that where 10 or more results are available the mean of the highest 20%

should be taken as the characteristic value. Therefore, consideration could be given to undertaking additional tests with a view to assessing whether it is appropriate to downgrade the classification to for example, DS-4.

BUREAU VERITAS	Location	Port of Shoreham		Job No.	1004519
				Sheet	1 of 1
	By: AM	Checked:	Approved:	Date	September-07



The Site

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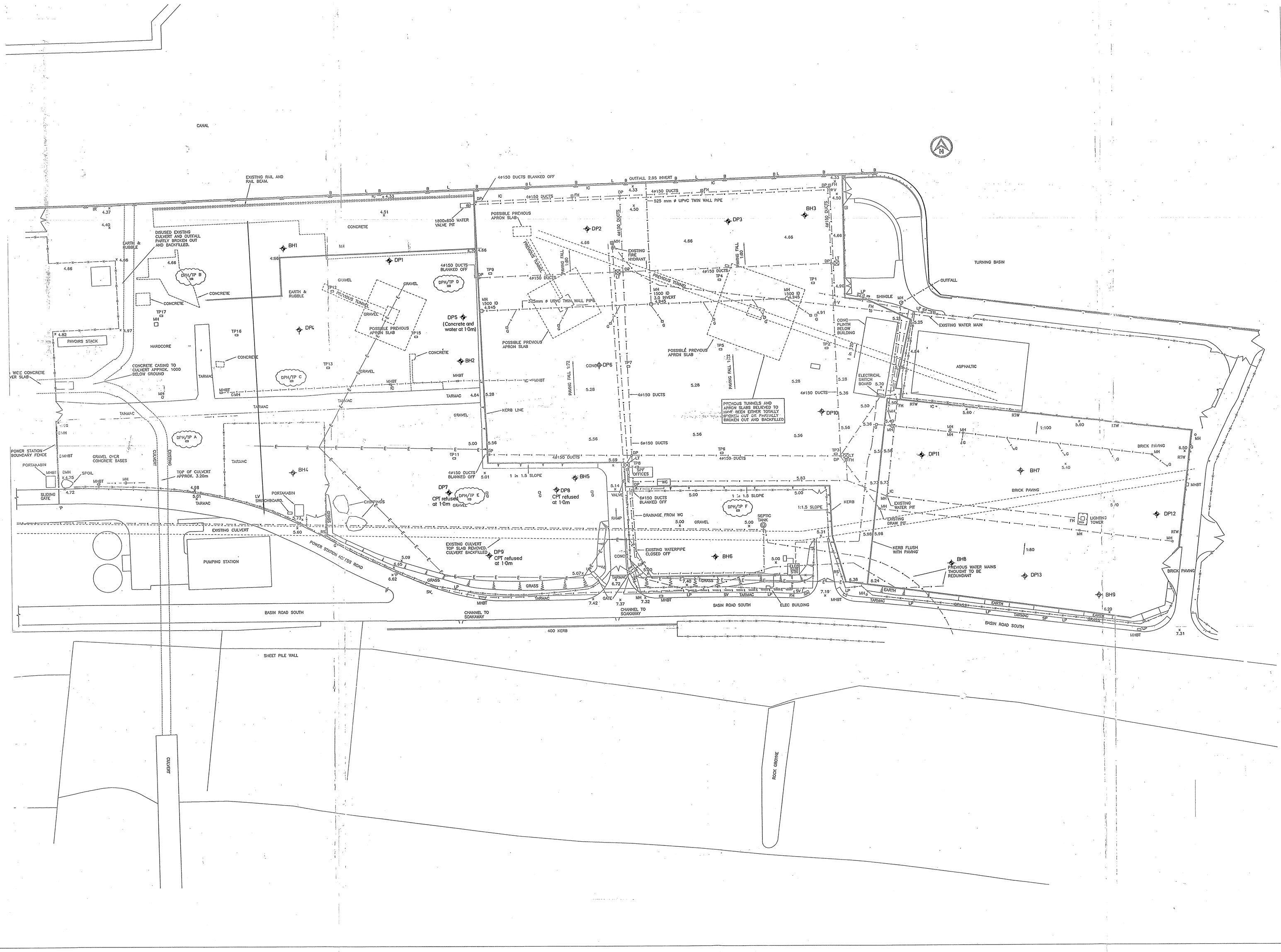
Site Location Plan

Scale	1:50 000
Figure	1



Notes

1. DO NOT SCALE THIS DRAWING.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.

KEY

- DPH/TP A — PROPOSED DYNAMIC PROBE / TRIAL PIT
- TP1 — PREVIOUS TRIAL PIT
- EXISTING ELECTRICAL CABLES
- EXISTING WATER MAIN
- EXISTING SURFACE WATER DRAINAGE
- EXISTING FOUL WATER DRAINAGE
- EXISTING TELECOM
- LT — LIGHTING TOWER
- DP — DRAW PIT
- V — VALVE
- FH — FIRE HYDRANT (CAST, TYPE 2 BS750) INCLUDING NEW PCC PIT AND M.D. COVER
- M — MANIFOLD PIT
- MH — MANHOLE
- SP — SIGNPOST
- RTW — RETAINING WALL
- B — BOLLARD
- L — LADDDER
- G — GULLY
- LP — LAMP POST

Rev.	Description	App.	Chk.	Dm.	Date
	DRAWN			GJC	SEPT.07

Client: BETRIDGE, TURNER & PARTNERS

Project: PORT OF SHOREHAM

Drawing Title: EXPLORATORY HOLE LOCATION PLAN

Bureau Veritas Consulting Ltd.,
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Status: FINAL

File Path: G:\Jobs\10045191\CAD\Drawing2.dwg

Scale: 1:500 APPROX. @A0 Discipline: GEOTECHNICAL

Drawing Number: GMBX 0142 FIG.2

Revision:

APPENDIX A

Fieldwork Records

APPENDIX A1

Borehole Records

KEY TO BOREHOLE AND TRIAL PIT LOGS

Samples

D	Small disturbed sample
B	Bulk disturbed samples (bar indicates sample range)
U	Driven 'undisturbed' sample, 100mm nominal diameter (U100) 0.45m length, with number of blows shown adjacent, U* denotes no recovery.
P	Undisturbed piston sample (bar indicates sample range)
W	Water sample
ICBR	In-situ California Bearing Ratio sample
T	Air tight plastic container sample
J	Glass Jar Sample
V	Vial sample

Tests

S	Standard penetration test (S - Split Spoon)
C	Standard penetration test (C - Cone)
N=	Standard penetration test (S/C) 'N' Value (number of blows for 300mm full penetration)
80/150mm	Number of blows/total penetration for standard penetration test (S/C), accompanied by defining blow counts
50/50SP	As above for seating penetration drive only
Vh	In-situ hand vane test in kN/m^2
Vb	In-situ borehole shear vane test in kN/m^2
IDEN	Position of in-situ density test
CBR	In-situ CBR test (%)
ppm=	Parts per million of flammable gas as methane equivalent
pp	Pocket Penetrometer reading in kg/cm^2
PID	Photo Ionisation Detector reading
FID	Flame Ionisation Detector reading

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 13.50m, 150 to 30.00m	BOREHOLE NUMBER **BH1**
Method: Cable Percussion	Casing Dia. (mm): 150 to 30.00 m	
Date Started: 11/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			0.50	D					Loose, brown-black, very gravelly, slightly clayey SAND becoming clayey with depth. Gravel is fine to coarse, sub-angular and sub-rounded chert, brick, concrete and black ash becoming fine to coarse, sub-angular flint and fine sub-angular chalk. (MADE GROUND)	
			1.00	D	S	N = 6				
			1.00 - 2.00	B						
			1.50	D				(3.50)		
			2.00	D	S	N = 7				
			2.50	D						
			3.00	D	S	N = 8				
			3.15	W						
			3.50	D				3.50		
			3.50 - 4.00	B					Medium dense, orange-brown and grey, slightly sandy GRAVEL. Gravel is fine to medium angular to sub-angular and coarse sub-angular to rounded flint. Some flint cobbles. (MADE GROUND?)	
			4.00	D	S	N = 13		(0.90)		
			4.50	D				4.40		
			5.00	D	S	N = 4			Very loose, brown becoming brown-grey with depth, gravelly, slightly clayey SAND and sandy, slightly clayey GRAVEL. Gravel is fine to medium sub-angular and coarse sub-angular to angular flints. (MADE GROUND?)	
		5.00						(1.10)		
		5.30	5.50	D				5.50		
			6.00	D		U = 35			Soft(?), slightly sandy, very gravelly CLAY with occasional small peds of chalk. Gravel is fine to medium sub-angular and coarse sub-angular to angular flints. (MADE GROUND?)	
			6.00 - 6.45	U*				(0.80)		
		6.30						6.30		
			6.50	D					Medium dense, orange-brown and grey, slightly sandy becoming sandy with depth, GRAVEL. Gravel is fine to medium angular to sub-angular and coarse sub-angular to rounded flint. Locally with some flint cobbles. (MARINE GRAVEL)	
			7.00	D	S	N = 21				
			7.00	B						
			7.50	D						
			8.00	D	S	N = 20				
			8.00	B						
			8.50	D						
			9.00	D	S	N = 13		(5.50)		
			9.00	B						
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used to advance hole from 13.4m to 14.8m (1 1/2hrs).
3. Water strikes at 6.30m rising to 5.3m in 20 minutes and at 17.3m rising to 5.0m in 20 minutes.
4. Bentonite seal placed between 15.30m and 17.30m on completion of drilling.
5. Water added between 3.5m and 6.3m to assist with drilling through granular material.

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A1

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 13.50m, 150 to 30.00m	BOREHOLE NUMBER **BH1**
Method: Cable Percussion	Casing Dia. (mm): 150 to 30.00 m	
Date Started: 11/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	D	S	N = 20			Medium dense, orange-brown and grey, slightly sandy becoming sandy with depth, GRAVEL. Gravel is fine to medium angular to sub-angular and coarse sub-angular to rounded flint. Locally with some flint cobbles.	
			10.50	D						
			11.00	D						
			11.50	D	C	N = 20			(MARINE GRAVEL)	
			12.00	D				11.80	Stiff to very stiff, grey becoming dark brown with depth, thinly laminated, slightly gravelly, carbonaceous CLAY. Laminations are of black lignite and gravel is medium to coarse sub-rounded chert. Locally traces of disseminated pyrite. (WOOLWICH AND READING BEDS)	
			12.50	D				(1.60)		
			13.00	D		U = 40				
			13.00 - 13.45	U						
			13.50	D				13.40	LIGNITE/COAL recovered as black tabular fine to coarse GRAVEL and carbonaceous CLAY. (WOOLWICH AND READING BEDS)	
			14.00	D				(1.40)		
			14.50	D		U = 50				
			14.50 - 14.60	U						
			15.00	D				14.80	Stiff to very stiff, grey becoming dark brown with depth, thinly laminated, slightly gravelly, carbonaceous CLAY. Laminations are of black lignite and gravel is medium to coarse sub-rounded cherts. Locally traces of disseminated pyrite. (WOOLWICH AND READING BEDS)	
			15.50	D				(1.70)		
			16.00	D		U = 75				
			16.00 - 16.45	U						
			16.50	D				16.50	Very weak orange-brown SANDSTONE and stiff light grey marly CLAY. (WOOLWICH AND READING BEDS)	
			17.00	D				(0.80)		
		▽ 17.30	17.30	W				17.30	Chalk recovered as: off-white, gravelly SILT and silty GRAVEL. Gravel is weak, medium to coarse, off-white CHALK and fine to medium angular to sub-angular flints, occasional flint cobbles. Local yellow staining. (UPPER CHALK)	
			17.50	D	S	N = 23				
			18.00	D						
			18.50	D						
			19.00	D	S	N = 23				
			19.50	D						

Continued on next sheet

General Remarks:

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A1

Client: **Bettridge Turner**			Hole Diameter (mm): 200 to 13.50m, 150 to 30.00m		BOREHOLE NUMBER **BH1** Sheet 3 of 3
Method: Cable Percussion			Casing Dia. (mm): 150 to 30.00 m		
Date Started: 11/07/07	Co-ordinates E N		Ground Level (m AOD)	Ref. No: 1004519	

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					Chalk recovered as: off-white, gravelly SILT and silty GRAVEL. Gravel is weak, medium to coarse, off-white CHALK and fine to medium angular to sub-angular flints, occasional flint cobbles. Local yellow staining. (UPPER CHALK)	
			20.50	D	S	N = 31				
			21.00	D						
			21.50	D						
			22.00	D	S	N = 24				
			22.50	D						
			23.00	D						
			23.50	D	S	N = 26		(12.70)		
			24.00	D						
			24.50	D						
			25.00	D	S	N = 27				
			25.50	D						
			26.00	D						
			26.50	D	S	N = 24				
			27.00	D						
			27.50	D						
			28.00	D	S	N = 27				
			28.50	D						
			29.00	D						
			29.50	D	S	N = 47SP				
			29.97	D						

General Remarks:

End of Borehole at 30.00 m

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A1

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 19.50m, 150 to 30.00m	BOREHOLE NUMBER **BH2**
Method: Cable Percussion	Casing Dia. (mm): 150 to 27.00 m	
Date Started: 27/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
0.30	BH2		0.50	B				(0.60) 0.60	Block paving and tarmac over granular sub-base. (Drillers Description)	
1.00			1.00	B				(0.40) 1.00	Hardcore. (Drillers Description)	
								(0.90) 1.90	Recovered as dark grey, sandy GRAVEL. Gravel is fine to coarse, sub-angular and some cobbles of brick and concrete fragments. One piece of metal observed. (MADE GROUND)	
			2.00	B	C	N = 15		(0.90) 2.80	Medium dense, dark grey, slightly sandy, slightly clayey GRAVEL. Gravel is fine to coarse, sub-angular and some cobbles of brick and concrete fragments. (MADE GROUND)	
			2.50	D						
			3.00	B	C	N = 15				
			3.50	D						
			4.00	B	S	N = 24		(4.70)	Medium dense, dark grey, sandy and clayey GRAVEL, becoming very sandy and very clayey with depth. Locally dark grey, very gravelly, clayey SAND and grey, very gravelly, sandy CLAY. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded chert. Some rounded chert cobbles. One piece of wire observed. (MADE GROUND?)	
			4.50	D						
			5.00	B	C	N = 16				
			5.50	D						
			6.00	B	C	N = 10				
			6.50	D						
7.00			7.00	B	C	N = 13				
			7.50	D				7.50	Medium dense becoming dense with depth, orange-brown and grey, slightly sandy GRAVEL becoming very sandy from 12m. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded chert. Locally with many rounded chert cobbles. (MARINE GRAVEL)	
8.00			8.00	B	C	N = 18				
			8.50	D						
			9.00	B	C	N = 29				
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used to advance borehole at 1m for 2hrs, 15.8m for 2hrs, 19.1m for 2hrs and at 19.4m for 3hrs.
3. Water level at start of shift 5.2m to 5.8m (varies).
4. 50mm diameter monitoring well installed at 7m.

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A2

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 19.50m, 150 to 30.00m	BOREHOLE NUMBER **BH2**
Method: Cable Percussion	Casing Dia. (mm): 150 to 27.00 m	
Date Started: 27/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	B	C	N = 36			Medium dense becoming dense with depth, orange-brown and grey, slightly sandy GRAVEL becoming very sandy from 12m. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded chert. Locally with many rounded chert cobbles.	
			10.50	D						
			11.00	B						
			11.50	D	C	N = 47		(8.30)		
			12.00	B					(MARINE GRAVEL)	
			13.00	B	C	N = 46				
			13.50	D						
			14.00	B						
			14.50	D	C	N = 39				
			15.00	B						
			16.00	D	S	N = 46/SP		15.80 (0.90)	Very stiff, grey, very sandy, very gravelly CLAY. Gravel is fine, white and medium to coarse, angular to sub-angular, flints. Locally with traces of disseminated pyrite and fragments of lignite. (WOOLWICH AND READING BEDS)	
			17.00	D				16.70	Hard grey, slightly gravelly, carbonaceous CLAY. Gravel is fine, white and medium to coarse, angular to sub-angular, flint. (WOOLWICH AND READING BEDS)	
			17.55 - 18.00	U		U = 72				
18.00			18.00	D				(2.40)		
			19.00	D	S	N = 50/SP		19.10 (0.90)	Recovered (after chiselling) as medium and coarse flint (?)GRAVEL. (WOOLWICH AND READING BEDS)	

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A2

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 19.50m, 150 to 30.00m	BOREHOLE NUMBER **BH2**
Method: Cable Percussion	Casing Dia. (mm): 150 to 27.00 m	
Date Started: 27/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 3 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D				20.00	Very stiff, grey, very sandy, very gravelly CLAY. Gravel is fine, white and medium to coarse, angular to sub-angular, flints. Locally with traces of disseminated pyrite and fragments of lignite. (WOOLWICH AND READING BEDS)	
			20.50	D				(0.80)		
21.00			21.00		S	N = 17		20.80	Chalk recovered as: yellow-grey gravelly SILT. Gravel is fine to coarse, angular and sub-angular flint. Occasional thin laminations of light grey CLAY. (UPPER CHALK)	
								(1.20)		
			22.00	D	S	N = 25		22.00	Chalk recovered as: cream, gravelly SILT. Gravel is weak, fine to coarse, sub-angular, cream CHALK and locally fine to coarse, sub-angular flint. (UPPER CHALK)	
			23.00	D						
			23.50		S	N = 24				
			24.00	D						
			25.00	D	S	N = 39				
			26.00	D				(8.00)		
			26.50		S	N = 43				
			27.00	D						
			28.00	D	S	N = 31				
			29.00	D						
			29.50		S	N = 39				

General Remarks:

End of Borehole at 30.00 m

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A2

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 11.00m, 150 to 30.00m	BOREHOLE NUMBER **BH3**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 08/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
								(0.30)	Brick and tarmac pavement.	
								0.30		
			0.50	D					Medium dense orange/brown sandy GRAVEL. Sand is angular fine to coarse chert. Gravel is sub-angular to sub-rounded, fine to coarse chert, ash and slag. (MADE GROUND)	
			1.00	D B	C	N = 15				
			1.50	D						
			2.00	D	C	N = 12		(3.50)		
			2.50	D						
			3.00	D	C	N = 12				
			3.50	D						
								3.80		
			4.00	D	C	N = 11		(0.70)	Medium dense, coarse sub-rounded GRAVEL and COBBLES of chert. (MARINE GRAVEL)	
			4.50	D				4.50		
								(0.50)	Medium dense(?), grey very silty, slightly gravelly fine SAND. (MARINE GRAVEL)	
			5.00	D	C	N = 14		5.00		
			5.50	D					Medium dense orange/brown sandy GRAVEL. Gravel is fine to medium sub-angular and coarse sub-rounded to rounded chert. (MARINE GRAVEL)	
			6.00	D B	C	N = 16				
			6.50	D						
			7.00	D	C	N = 10		(4.00)		
			7.50	D						
			8.00	D	C	N = 18				
			8.50	D						
			9.00	D		U = 100		9.00		
			9.00 - 9.45	U					Stiff to very stiff fissured black/brown CLAY with shaley lignite layers and rare rounded medium chert gravel. (WOOLWICH AND READING BEDS)	
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used at varying levels to advance hole from 9m to 17m (1hr).
3. Water level at start of shift - 2.0m - 3.0m.
3. Borehole backfilled with arisings, 2m bentonite seal placed above chalk.

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A3

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 11.00m, 150 to 30.00m	BOREHOLE NUMBER **BH3**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 08/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	D	S	N = 20			Stiff to very stiff fissured black/brown CLAY with shaley lignite layers and rare rounded medium chert gravel.	
			10.50	D						
			11.00	D					(WOOLWICH AND READING BEDS)	
								(4.50)		
			11.50	D		U = 25				
			11.50 - 11.95	U						
			12.00	D						
			12.50	D						
			13.00	D						
			13.50 - 13.95	U		U = 45		13.50		
			13.50	D					Black shaley LIGNITE and black carbonaceous SILT/CLAY. (WOOLWICH AND READING BEDS)	
			14.00	D						
			14.50	D	S	N = 62/245mm		(2.00)		
			15.00	D						
			15.50	D				15.50	Very stiff fissured black/brown CLAY with rare angular fine to coarse flint gravel at base. (WOOLWICH AND READING BEDS)	
			16.00	D		U = 100				
			16.00 - 16.45	U				(1.50)		
			16.50	D						
			17.00	D				17.00 (0.20) 17.20	Dark grey, gravelly CLAY. Gravel is of fine to coarse angular flint. (WOOLWICH AND READING BEDS)	
			17.50	D	S	N = 29			Chalk (recovered as yellow/pale grey SILT with occasional angular medium gravel flints). (UPPER CHALK)	
			18.00	D				(1.80)		
			18.50	D						
			19.00	D	S	N = 30		19.00	Chalk recovered as: white slightly gravelly SILT with occasional flints. (UPPER CHALK)	
			19.50	D						

Continued on next sheet

General Remarks:

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A3

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 11.00m, 150 to 30.00m	BOREHOLE NUMBER **BH3**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 08/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 3 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					Chalk recovered as: white slightly gravelly SILT with occasional flints.	
			20.50	D	S	N = 31				
			21.00	D						
			21.50	D					(UPPER CHALK)	
			22.00	D	S	N = 32				
			22.50	D						
			23.00	D						
			23.55	D	S	N = 38				
			24.00	D						
			24.50	D				(11.00)		
			25.00	D	S	N = 33				
			25.50	D						
			26.00	D						
			26.50	D	S	N = 50/180mm				
			27.00	D						
			27.50	D						
			28.00	D	S	N = 36				
			28.50	D						
			29.00	D						
			29.50	D	S	N = 38				

General Remarks:

End of Borehole at 30.00 m

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A3

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 31.00m		BOREHOLE NUMBER **BH4**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.00 m		Sheet 1 of 4
Date Started: 21/07/07	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &		
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	(Thickness) (m)	Description of Strata	Legend
0.20								(0.30)	Block paving and tarmac. (Drillers Description)	
0.50			0.50	B				0.30	Hardcore. (Drillers Description)	
			1.00	B				(0.80)		
								1.10	Recovered (after chiselling) as grey, very sandy GRAVEL. Gravel is fine to coarse, sub-angular, brick and concrete fragments. (Possible old footing:Drillers Description)	
								(0.60)		
								1.70	Loose to medium dense dark brown to black, sandy becoming slight silty with depth, GRAVEL. Gravel is fine to coarse, angular to sub-rounded and some cobbles of brick, concrete fragments and chert. (MADE GROUND)	
			2.00	B	C	N = 13				
			2.50	D				(1.80)		
			3.00	B	S	N = 4				
			3.50	D				3.50	Very soft(?), grey-light grey mottled, gravelly CLAY. Gravel is fine, angular to sub-angular and medium to coarse, sub-angular to rounded, chert. (MARINE ALLUVIUM?)	
			4.00	B	C	N = 18		(0.60)		
			4.50	D				4.10	Medium dense becoming dense with depth, orange-brown and grey, slightly sandy GRAVEL becoming very sandy with depth. Gravel is fine to medium, angular to sub-angular and coarse sub-rounded to rounded, flint. At 6.0m with rare flint cobbles and some coarse rounded gravel of lignite. (MARINE GRAVEL)	
			5.00	B	C	N = 17				
			5.50	D						
			6.00	B	S	N = 21				
			6.50	D						
7.00			7.00	B	C	N = 31				
			7.50	D						
8.00			8.00	B	C	N = 25		(7.80)		
			8.50	D						
			9.00	B	C	N = 32				
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used to advance borehole for 3 hours at 1.10m.
3. Water levels at start of shift 5.5m-5.8m (varies).
4. 50mm diameter monitoring well installed at 7.0m.

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A4

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 31.00m	BOREHOLE NUMBER **BH4**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.00 m	
Date Started: 21/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 4

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	B	C	N = 37			Medium dense becoming dense with depth, orange-brown and grey, slightly sandy GRAVEL becoming very sandy with depth. Gravel is fine to medium, angular to sub-angular and coarse sub-rounded to rounded, flint. At 6.0m with rare flint cobbles and some coarse rounded gravel of lignite.	
			10.50	D						
			11.00	B						
			12.00	B	S	N = 24		11.90	(MARINE GRAVEL)	
			12.50	D					Stiff to very stiff, and locally hard, light grey, thinly laminated, locally slightly gravelly, (carbonaceous) CLAY becoming dark brown with depth. Laminations are of black lignite and gravel is medium and coarse, sub-angular, mudstone/siltstone. Occasional root traces. (WOOLWICH AND READING BEDS)	
			13.00	D						
			13.55 - 14.00	U		U = 58				
			14.00	D						
			15.00	D	S	N = 29				
			16.00	D						
			16.55 - 17.00	U		U = 56				
			17.00	D				(10.60)		
			18.00	D						
			18.05 - 18.50	U		U = 64				
			19.00	D						
			19.50		S	N = 34				

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A4

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 31.00m	BOREHOLE NUMBER **BH4**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.00 m	
Date Started: 21/07/07 Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519 Sheet 3 of 4

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					Stiff to very stiff, and locally hard, light grey, thinly laminated, locally slightly gravelly, (carbonaceous) CLAY becoming dark brown with depth. Laminations are of black lignite and gravel is medium and coarse, sub-angular, mudstone/siltstone. Occasional root traces.	
			21.00	D						
			21.05 - 21.50	U		U = 58			(WOOLWICH AND READING BEDS)	
22.00			22.00	D						
			22.50		S	N = 53		22.50	Firm(?) dark grey, sandy, gravelly becoming very gravelly with depth, CLAY. Gravel is fine to coarse, angular, flint. (WOOLWICH AND READING BEDS)	
			23.00	D				(1.30)		
			24.00	D	S	N = 14		23.80 (0.25) 24.05	Recovered as some angular flint cobbles and rare coarse angular flint gravel. (WOOLWICH AND READING BEDS)	
25.00			25.00	D				(1.45)	Chalk recovered as: light grey-yellow mottled, slightly gravelly SILT. Gravel is occasional fine, angular flint. (UPPER CHALK)	
			25.50		S	N = 26		25.50	Chalk recovered as: off white, slightly gravelly SILT. Gravel is weak, fine and medium, sub-rounded, off white CHALK and locally flint. Occasional thin laminations of light grey clay. (UPPER CHALK)	
			26.00	D						
			27.00	D	S	N = 27				
			28.00	D				(5.50)		
			28.50		S	N = 38				
			29.00	D						

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A4

Client: **Bettridge Turner**		Hole Diameter (mm): 200 to 24.00m, 150 to 31.00m	BOREHOLE NUMBER **BH4**
Method: Cable Percussion		Casing Dia. (mm): 150 to 29.00 m	Sheet 4 of 4
Date Started: 21/07/07	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &		
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	(Thickness) (m)	Description of Strata	Legend
			30.00	D	S	N = 38			Chalk recovered as: off white, slightly gravelly SILT. Gravel is weak, fine and medium, sub-rounded, off white CHALK and locally flint. Occasional thin laminations of light grey clay.	
31.00			31.00	D				31.00	(UPPER CHALK)	
									End of Borehole at 31.00 m	

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A4

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 40.00m		BOREHOLE NUMBER **BH5**
Method: Cable Percussion	Casing Dia. (mm): 150 to 39.00 m		Sheet 1 of 4
Date Started: 17/07/07	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
0.20	BH5							(0.30) 0.30	Block paving and tarmac. (Drillers Description)	
0.50								(0.70)	Hardcore. (Drillers Description)	
			1.00	B				1.00		
			1.50	D	C	N = 28		(0.40) 1.40	Recovered (after chiselling?) as sandy GRAVEL. Gravel is fine to coarse, sub-angular brick and concrete fragments. Concrete cobbles noted. (POSSIBLE OLD FOOTING: DRILLERS DESCRIPTION)	
			2.00	B						
			2.50	D	C	N = 7		(1.60)	Loose and medium dense, sandy GRAVEL. Gravel is fine to coarse, sub-angular to rounded, chert and brick fragments. Fibrous textile material observed. (MADE GROUND)	
			3.00	B				3.00		
			3.50	D	C	N = 19		(0.40) 3.40	Grey sandy SILT. (Drillers Description) (MARINE ALLUVIUM)	
			4.00	B					Loose to medium dense, becoming dense to very dense with depth, orange-brown and grey, slightly sandy becoming sandy with depth, GRAVEL. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded flint. (MARINE GRAVEL)	
			4.50	D	C	N = 11				
			5.00	B						
			5.50	D	C	N = 9				
			6.00	B						
			6.50	D	C	N = 15				
7.00			7.00	B						
			7.50	D	C	N = 23				
			8.00	B						
			8.50	D	C	N = 29				
			9.00	B						
			9.50	D	C	N = 63		(12.00)		

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Water depths at beginning of shifts 5.2m - 7.2m (varies).
3. 50mm diameter monitoring well installed at 7.0m.

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A5

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 40.00m	BOREHOLE NUMBER **BH5**
Method: Cable Percussion	Casing Dia. (mm): 150 to 39.00 m	
Date Started: 17/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 4

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &		
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	(Thickness) (m)	Description of Strata	Legend
			10.00	B					Loose to medium dense, becoming dense to very dense with depth, orange-brown and grey, slightly sandy becoming sandy with depth, GRAVEL. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded flint.	
			11.00	B	C	N = 34				
			11.50	D						
			12.00	B					(MARINE GRAVEL)	
			12.50	D	C	N = 41				
			13.00	B						
			14.00	B	C	N = 47				
			15.00	D B						
			15.50		C	N = 26		15.40	Stiff to very stiff, light grey becoming grey-brown with depth, thinly laminated CLAY. Laminations are of black lignite. At 16.0m slightly gravelly. Gravel is fine to coarse, angular to sub-rounded, chert. Locally with traces of disseminated pyrite and lenses of yellow very weak siltstone. (WOOLWICH AND READING BEDS)	
			16.00 16.05 - 16.50	B U		U = 58				
			16.50	D						
			17.00	D						
			17.50		S	N = 39		(4.80)		
			18.00	D					At 20.0m becoming very weak, light brown, thinly laminated, SILTSTONE/MUDSTONE with occasional thin laminations of lignite.	
			19.00 19.05 - 19.50	D U		U = 56				

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A5

Client: **Bettridge Turner**

Hole Diameter (mm): 200 to 24.00m, 150 to 40.00m

Method: Cable Percussion

Casing Dia. (mm): 150 to 39.00 m

Date Started: 17/07/07 | Co-ordinates E N | Ground Level (m AOD) | Ref. No: 1004519

BOREHOLE NUMBER BH5 Sheet 3 of 4

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D				20.20	Stiff to very stiff, light grey becoming grey-brown with depth, thinly laminated CLAY. Laminations are of black lignite. At 16.0m slightly gravelly. Gravel is fine to coarse, angular to sub-rounded, chert. Locally with traces of disseminated pyrite and lenses of yellow very weak siltstone.	
			20.50		S	N = 50				
			21.00	D						
			21.55 - 22.00	U		U = 62		(2.85)	Stiff and very stiff, dark brown-black, extremely closely fissured, carbonaceous CLAY. (WOOLWICH AND READING BEDS)	
22.00			22.00	D						
			23.00	D	S	N = 48		23.05		
								(1.55)	Very stiff, dark grey, slightly gravelly CLAY. Gravel is medium and coarse, angular and sub-angular flint. (WOOLWICH AND READING BEDS)	
			24.00	D						
			24.50		S	N = 16		24.60		
25.00			25.00	D					Chalk recovered as: off-white and grey, locally yellow, gravelly SILT, locally SILT and GRAVEL. Gravel is fine to coarse, sub-rounded CHALK and locally fine to coarse, sub-angular flint with occasional flint cobbles. Thin laminations of light grey CLAY. (POSSIBLE SOLUTION FEATURE?)	
			26.00	D	S	N = 12				
			27.00	D						
			27.50		S	N = 11		(5.95)		
			28.00	D						
			29.00	D	S	N = 14				

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A5

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 40.00m	BOREHOLE NUMBER **BH5**
Method: Cable Percussion	Casing Dia. (mm): 150 to 39.00 m	
Date Started: 17/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 4 of 4

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			30.00	D					Chalk recovered as: off-white and grey, locally yellow, gravelly SILT, locally SILT and GRAVEL. Gravel is fine to coarse, sub-rounded CHALK and locally fine to coarse, sub-angular flint with occasional flint cobbles. Thin laminations of light grey CLAY.	
			30.50		S	N = 23		30.55		
			31.00	D					Chalk recovered as: off-white, locally yellow SILT. Locally with rare fine and medium flint gravel.	
			32.00	D	S	N = 38			(UPPER CHALK)	
			33.00	D						
			33.50		S	N = 37				
			34.00	D						
			35.00	D	S	N = 36		(9.45)		
			36.00	D						
			36.50		S	N = 40				
			37.00	D						
			38.00	D	S	N = 33				
			39.00	D						
			39.50		S	N = 38				

General Remarks:

End of Borehole at 40.00 m

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A5

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 30.00m	BOREHOLE NUMBER **BH6**
Method: Cable Percussion	Casing Dia. (mm): 150 to 28.50 m	
Date Started: 11/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
								(0.50)	Block paving and tarmac. (Drillers Description)	
			0.50	B				0.50 (0.30)	Stoney fill. (Drillers Description)	
			1.00	B				0.80 (1.10)	Recovered as grey, very sandy GRAVEL. Gravel is fine to coarse, sub-angular, brick and concrete fragments. (Possible Old Footing - Drillers Description)	
			2.00	B	S	N = 12		1.90	Medium dense becoming loose, dark grey-black, becoming dark grey-brown very sandy GRAVEL becoming sandy and very clayey with depth. Gravel is fine to coarse and occasional cobbles of sub-angular to rounded chert. Black ash, sand and one concrete fragment noted. (MADE GROUND)	
			2.50	D				(1.60)		
			3.00	B	S	N = 7				
			3.50	D				3.50	Medium dense becoming dense, orange-brown and grey, slightly sandy GRAVEL. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded, chert. Occasional chert cobbles. With dark to light brown sand with layer of SILT between 7.20m and 8.10m. (Drillers Description) (MARINE GRAVEL)	
			4.00	B	S	N = 17				
			4.50	D						
			5.00	B	C	N = 29				
			5.50	D						
			6.00	B	C	N = 19				
			6.50	D						
			7.00	B	C	N = 37				
			7.50	D						
			8.00	B	C	N = 38				
			8.50	D						
			9.00	B	C	N = 36		(10.70)		
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used for 3hrs at 0.80m to advance borehole - possible old foundation?.
3. Water level at start of shift at 4.2m below ground level.
4. Bentonite seal placed between 21m and 24m on completion of drilling.

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A6

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 30.00m	BOREHOLE NUMBER **BH6**
Method: Cable Percussion	Casing Dia. (mm): 150 to 28.50 m	
Date Started: 11/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	B	C	N = 49			Medium dense becoming dense, orange-brown and grey, slightly sandy GRAVEL. Gravel is fine to medium, angular to sub-angular and coarse, sub-rounded to rounded, chert. Occasional chert cobbles. With dark to light brown sand with layer of SILT between 7.20m and 8.10m. (Drillers Description)	
			10.50	D						
			11.00	B	C	N = 39				
			11.50	D					(MARINE GRAVEL)	
			12.00	B	C	N = 40				
			12.50	D						
			13.00	B	C	N = 56				
			13.50	D						
			14.00	B						
			14.55 - 15.00	U		U = 56		14.20	Stiff to very stiff and locally hard, light grey thinly laminated CLAY. At 15.0m with lenses of light grey-light brown mudstone/siltstone. (WOOLWICH AND READING BEDS)	
			15.00	D						
			16.00	D	S	N = 32		(4.30)		
			17.00	D						
			17.55 - 18.00	U		U = 64				
			18.00	D				18.50		
			19.00	D	S	N = 38		(1.00)	Stiff, dark brown-black, thinly laminated, carbonaceous CLAY with laminations of black lignite. (WOOLWICH AND READING BEDS)	
								19.50	Very stiff, locally hard, light grey thinly laminated CLAY. Locally with bands of very	

Continued on next sheet

General Remarks:

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A6

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 24.00m, 150 to 30.00m	BOREHOLE NUMBER **BH6**
Method: Cable Percussion	Casing Dia. (mm): 150 to 28.50 m	
Date Started: 11/07/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 3 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					stiff, brown-grey, very sandy CLAY. Detail 19.50m - 21.50m : (WOOLWICH AND READING BEDS)	
			20.55	U		U = 86		(2.00)		
			21.00	D						
								21.50	Very stiff, dark grey, becoming brown with depth, extremely closely fissured, slightly gravelly becoming very gravelly with depth, CLAY. Gravel is fine to coarse, angular and sub-angular flint. (WOOLWICH AND READING BEDS)	
			22.00	D	S	N = 54				
			23.00	D				(2.70)		
			23.50		S	N = 30				
			24.00	D						
								24.20	Chalk recovered as: white silty fine to coarse GRAVEL of weak chalk. (UPPER CHALK)	
			25.00	D	S	N = 17		(1.80)		
			26.00	D				26.00	Chalk recovered as: white silty fine to coarse GRAVEL of weak chalk. (UPPER CHALK)	
			26.50		S	N = 27				
			27.00	D						
			28.00	D	S	N = 37		(4.00)		
			29.00	D						
			29.50		S	N = 28				

General Remarks:

End of Borehole at 30.00 m

Driller:	AD
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A6

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 10.00m, 150 to 30.00m	BOREHOLE NUMBER **BH7**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 18/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			0.50	D				(0.40) 0.40	Brick, tarmac and granular sub-base.	
								(0.40) 0.80	Brickwork - apparent old wall/foundation.	
			1.00	D B	C	N = 4		(0.20) 1.00	Dark brown, slightly silty, gravelly fine SAND. Gravel is sub-angular fine to coarse chert and brick fragments. (MADE GROUND)	
			1.50	D					Very loose, very dark grey, slightly clayey, very silty fine SAND of ash with sub-angular to sub-rounded, fine to coarse chert and ash gravel. (MADE GROUND)	
			2.00	D B	C	N = 4				
			2.50	D				(3.00)		
			3.00	D B	C	N = 2				
			3.50	D						
			4.00	D B	C	N = 15		4.00	Medium dense, orange/brown, slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded chert. Occasional sub-rounded chert cobbles and brick cobbles at base. (MADE GROUND)	
			4.50	D						
		5.00 ▽	5.00	D B	C	N = 13				
			5.50	D						
			6.00	D	C	N = 13				
			6.50	D				(4.50)		
			7.00	D	C	N = 11				
			7.50	D						
			8.00	D	C	N = 13				
			8.50	D				8.50	Medium dense, slightly sandy GRAVEL. Gravel is sub-angular fine to coarse chert with occasional sub-rounded chert cobbles. (MARINE GRAVEL)	
			9.00	D	C	N = 17		(1.50)		
			9.00 - 9.50	B						
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Water strike at 18.5m, rose to 5.0m in 20 minutes.
4. Bentonite seal placed between 16.5m and 18.5m on completion of drilling.

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A7

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 10.00m, 150 to 30.00m	BOREHOLE NUMBER **BH7**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 18/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &		
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	(Thickness) (m)	Description of Strata	Legend
			10.00	D		U = 50		10.00	Stiff to hard, fissured, thinly laminated dark grey-black CLAY with shaley black/brown lignite. (WOOLWICH AND READING BEDS)	
			10.00 - 10.45	U						
			10.50	D						
			11.00	D						
			11.50	D		U = 55				
			11.50 - 11.95	U				(3.50)		
			12.00	D						
			12.50	D						
			13.00	D		U = 55				
			13.00 - 13.45	U						
			13.50	D				13.50	Stiff to very stiff and locally hard, thinly laminated dark grey CLAY and black LIGNITE. (WOOLWICH AND READING BEDS)	
			14.00	D						
			14.50	D		U = 55		(2.00)		
			14.50 - 14.95	U						
			15.00	D						
								15.50	Very stiff, dark grey, thickly laminated CLAY with a little lignite. Driller noted flints at base of stratum. (WOOLWICH AND READING BEDS)	
			16.00	D	S	N = 41				
			16.50	D						
			16.60	D						
			17.00	D				(3.00)		
			17.50	D	S	N = 41				
			18.00	D						
		▽ 18.50	18.50	D				18.50	CHALK recovered as: yellow/grey sandy gravelly SILT. Gravel is angular fine to coarse chalk with occasional flint cobbles. (UPPER CHALK)	
			19.00	D	S	N = 10				
			19.50	D						

Continued on next sheet

General Remarks:

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A7

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 10.00m, 150 to 30.00m	BOREHOLE NUMBER **BH7**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 18/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 3 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					CHALK recovered as: yellow/grey sandy gravelly SILT. Gravel is angular fine to coarse chalk with occasional flint cobbles.	
			20.50	D	S	N = 16				
			21.00	D						
			21.50	D						
			22.00	D	S	N = 11				
			22.55	D						
			23.00	D						
								(9.50)		
			23.50	D	S	N = 11				
			24.00	D						
			24.50	D						
			25.00	D	S	N = 10				
			25.50	D						
			26.00	D						
			26.50	D	S	N = 15				
			27.00	D						
			27.50	D						
			28.00	D	S	N = 21		28.00	Chalk recovered as: off white silty fine to coarse angular GRAVEL of weak chalk. (UPPER CHALK)	
			28.50	D						
			29.00	D				(2.00)		
			29.50	D	S	N = 22				

General Remarks:

End of Borehole at 30.00 m

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A7

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m	BOREHOLE NUMBER **BH8**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 13/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 1 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
								(0.50)	Brick, tarmac and granular sub-base. pavement.	
			0.50	D				0.50		
			1.00	D B	C	N = 24		(1.30)	Medium dense, dark brown, clayey, silty gravelly fine to coarse SAND. Gravel is sub-angular fine to coarse brick, flints and concrete. (MADE GROUND)	
			1.50	D						
			2.00	D B	C	N = 50/285mm		1.80		
			2.50	D				(1.00)	Very dense, black, silty, gravelly fine to coarse SAND of ash. Gravel is sub-rounded fine to coarse flint ash and some wood fragments. (MADE GROUND)	
			3.00	D B	C	N = 11		2.80		
			3.50	D					Medium dense to loose, orange/brown sub-rounded medium to coarse sandy GRAVEL and fine angular GRAVEL. Gravel is of chert. (MARINE GRAVEL?)	
		4.00 ▽	4.00	D	C	N = 14				
		4.50 ▽	4.50	D						
			5.00	D	C	N = 13		(4.00)		
			5.50	D						
			6.00	D	C	N = 6				
			6.55	D						
			7.00	D		U = 45		6.80		
			7.00 - 7.45	U*				(0.50)	Very soft(?) black slightly sandy organic CLAY with rare rounded medium gravel. (MARINE ALLUVIUM)	
		7.30 ▽	7.00	B				7.30		
			7.50	D					Loose, orange/brown sub-rounded, medium to coarse sandy GRAVEL and angular fine gravel. (MARINE GRAVEL)	
			8.00	D	C	N = 8				
			8.50	D						
			9.00	D	C	N = 8				
			9.50	D				(4.70)		

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Chiselling technique used to advance hole from 1m to 2.8m (2hrs).
3. Water strike at 7.30m rose to 4.0m in 20 minutes and at 21m rose to 4.5m in 20 minutes.
4. Bentonite seal placed between 19m and 21m on completion of drilling.

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A8

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m	BOREHOLE NUMBER **BH8**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m	
Date Started: 13/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	D	C	N = 10			Loose, orange/brown sub-rounded, medium to coarse sandy GRAVEL and angular fine gravel.	
			10.50	D					Driller noted flint cobble at 11.5m.	
			11.00	D					(MARINE GRAVEL)	
			11.50	D	C	N = 50/20mm				
			12.00	D				12.00		
			12.50	D				(1.30)	Loose, orange/brown/grey clayey sandy GRAVEL. Gravel is sub-rounded medium to coarse with angular fine gravel. (MARINE GRAVEL)	
			13.00	D	C	N = 9		13.30		
			13.50	D					Firm becoming stiff and very stiff, dark grey closely laminated CLAY with shaley lignite and traces of pyrite. (WOOLWICH AND READING BEDS)	
			14.00	D						
			14.50	D U		U = 100				
			15.00	D						
			15.50	D				(4.20)		
			16.00	D	S	N = 24				
			16.50	D						
			17.00	D						
			17.50	D U		U = 100		17.50		
			18.00	D					Stiff to very stiff, becoming harder with depth, black closely laminated CLAY and lignite. Layer of black sub-angular flint gravel at base of stratum. (WOOLWICH AND READING BEDS)	
			18.50	D						
			19.00	D		U = 100				
			19.00 - 19.45	U*				(3.50)		
			19.00	B						
			19.50	D						

Continued on next sheet

General Remarks:

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A8

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m		BOREHOLE NUMBER **BH8**
Method: Cable Percussion	Casing Dia. (mm): 150 to 29.50 m		Sheet 3 of 3
Date Started: 13/06/07	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			20.00	D					Stiff to very stiff, becoming harder with depth, black closely laminated CLAY and lignite. Layer of black sub-angular flint gravel at base of stratum.	
			20.50	D U		U = 100				
		▽ 21.00	21.00	D				21.00	CHALK recovered as: yellow/pale grey SILT with occasional flint cobbles. (UPPER CHALK)	
			21.50	D						
			22.00	D	S	N = 20				
			22.50	D						
			23.00	D						
			23.50	D	S	N = 17				
			24.00	D						
			24.50	D						
			25.00	D	S	N = 14				
			25.50	D				(9.00)		
			26.00	D						
			26.50	D	S	N = 17				
			27.00	D						
			27.50	D						
			28.00	D	S	N = 20				
			28.50	D						
			29.00	D						
			29.50	D	S	N = 20				

End of Borehole at 30.00 m

General Remarks:

Driller:	IM
Logged:	GS
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A8

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m		BOREHOLE NUMBER **BH9**
Method: Cable Percussion	Casing Dia. (mm): 150 to 30.00 m		Sheet 1 of 3
Date Started: 19/06/07	Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
								(0.40) 0.40	Block paving over tarmac and granular sub-base. (Drillers Description)	
			0.50	D					Dense becoming loose with depth, sandy GRAVEL and gravelly SAND. Gravel is fine to coarse chert and brick fragments. Some brick cobbles. At 1.50m and 2.0m, sand consists of black ash. (MADE GROUND)	
			1.00	D	S	N = 35				
			1.00 - 3.00	B						
			1.50	D						
			2.00	D	S	N = 16		(3.10)		
			2.50	D						
			3.00 - 4.50	B	S	N = 7				
			3.00	D						
			3.50	D				3.50		
			4.00	D	S	N = 2			Soft grey sandy CLAY. At 3.50m very gravelly with gravel being fine to coarse chert. (MADE GROUND)	
		4.40 ▽						(1.30)		
			4.50	D						
		4.90 ▽						4.80		
			5.00	D	S	N = 4			Very loose, silty, grey fine SAND with 5mm to 10mm peds of chalk - one nail seen. (MADE GROUND)	
			5.50	D				(0.90)		
			6.00	D	S	N = 1		5.70		
			6.50	D					Very soft, grey becoming dark grey, CLAY with rare coarse gravel of cherts and small (5mm to 10mm) peds of chalk. (MADE GROUND)	
			7.00	D	C	N = 5		(1.30)		
		7.00 ▽						7.00		
			7.50	D				(0.50)	Loose slightly clayey grey sub-angular to sub-rounded fine to coarse GRAVEL of flint. (MARINE GRAVEL)	
				B				7.50		
			8.00	D	C	N = 10			Loose becoming medium dense, orange-brown becoming grey with depth, flint GRAVEL, locally COBBLES. Gravel is fine to medium sub-angular and coarse sub-rounded to rounded. (MARINE GRAVEL)	
			8.50	D						
			9.00	D	C	N = 11				
				B				(3.60)		
			9.50	D						

Continued on next sheet

General Remarks:
1. Inspection pit excavated by hand prior to commencement of drilling.
2. Water strike at 7m, rising to 4.40m in 20 minutes and at 21.5m rising to 4.7m in 20 minutes.
3. Chiselling techniques used to advance hole between 11.1m and 11.4m (1hr) and between 17.7m and 19m (1 1/2 hours).
4. Bentonite seal placed between 19.5m and 21.5m on completion of drilling.

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

Shoreham Port

BUREAU VERITAS

FIG A9

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m	BOREHOLE NUMBER **BH9**
Method: Cable Percussion	Casing Dia. (mm): 150 to 30.00 m	
Date Started: 19/06/07 — Co-ordinates E N	Ground Level (m AOD) — Ref. No: 1004519	Sheet 2 of 3

Backfill/Well Depth (m)	Backfill/Well Legend	Water Depth (m)	Samples Depth (m)	Samples Type	In Situ Tests Type	In Situ Tests Results	Reduced Level (mAOD)	Depth & (Thickness) (m)	Description of Strata	Legend
			10.00	D B	C	N = 15			Loose becoming medium dense, orange-brown becoming grey with depth, flint GRAVEL, locally COBBLES. Gravel is fine to medium sub-angular and coarse sub-rounded to rounded.	
			11.00	D				11.10	(MARINE GRAVEL)	
			11.40	D				(0.30) 11.40	Fine grained SANDSTONE/SILTSTONE recovered as cobbles and coarse gravel. (WOOLWICH AND READING BEDS)	
			11.50 11.50 - 11.95	D U		U = 70			Stiff to very stiff, extremely closely fissured grey-brown laminated CLAY with very thin laminations of shaley lignite and with medium to coarse rounded cherts at top. (WOOLWICH AND READING BEDS)	
			12.00	D						
			12.50	D				(2.90)		
			13.00 13.00 - 13.45	D U		U = 58				
			13.50	D						
			14.00	D						
			14.50 14.50 - 14.95	D U		U = 64		14.30	Stiff to very stiff, grey brown laminated CLAY with thin beds of lignite. (WOOLWICH AND READING BEDS)	
			15.00	D						
			15.50	D						
			16.00 16.00 - 16.45 16.00 - 16.50	D U* B		U = 50		(3.40)		
			16.50	D						
			17.00	D						
			17.50 17.50 - 17.70 17.75	D U D		U = 20		17.70	LIGNITE recovered as black, tabular, fine to coarse gravel. (WOOLWICH AND READING BEDS)	
			18.50	D				(1.30)		
			19.00 19.00 - 19.45	D U		U = 100		19.00	Stiff, extremely closely fissured, dark grey CLAY. At 21m with a little yellow fine sand, some fine to coarse gravel of flint, some cobbles of flint and traces of pyrite. Layer of coarse sub-angular GRAVEL of flint and	
			19.50	D					*Continued on next sheet*	

General Remarks:

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A9

Client: **Bettridge Turner**	Hole Diameter (mm): 200 to 12.00m, 150 to 30.00m	BOREHOLE NUMBER **BH9** Sheet 3 of 3
Method: Cable Percussion	Casing Dia. (mm): 150 to 30.00 m	
Date Started: 19/06/07 Co-ordinates E N	Ground Level (m AOD)	Ref. No: 1004519

Backfill/Well		Water	Samples		In Situ Tests		Reduced	Depth &	Description of Strata	Legend
Depth (m)	Legend	Depth (m)	Depth (m)	Type	Type	Results	Level (mAOD)	(Thickness) (m)		
			20.00	D				(2.50)	flint cobbles at base of stratum. Detail 19.00m - 21.50m : (WOOLWICH AND READING BEDS)	
			20.50	D		U = 76				
			20.50 - 20.95	U						
			21.00	D						
		▽ 21.50	21.50	D				21.50	Chalk recovered as: yellow gravelly SILT. Gravel is weak, coarse, yellow CHALK and fine to coarse, angular to sub-angular gravel of flint. (UPPER CHALK)	
			22.00	D	S	N = 21		(1.00)		
			22.50	D				22.50	Chalk recovered as: off-white, slightly gravelly SILT (locally mainly SILT). Gravel is weak, medium to coarse, white CHALK. A little medium to coarse gravel of flint and occasional flint cobbles. Local brown staining. (UPPER CHALK)	
			23.00	D						
			23.50	D	S	N = 14				
			24.00	D						
			24.50	D						
			25.00	D	S	N = 15				
			25.50	D						
			26.00	D						
			26.50	D	S	N = 14		(7.50)		
			27.00	D						
			27.50	D						
			28.00	D	S	N = 15				
			28.50	D						
			29.00	D						
			29.50	D	S	N = 17				
			29.95	D						

End of Borehole at 30.00 m

General Remarks:

Driller:	MP
Logged:	AM
Checked:	
Appr'd:	

BOREHOLE RECORD

Scale 1:50

For explanation of symbols and abbreviations see Key Sheet

BUREAU VERITAS

Shoreham Port

FIG A9

PORT OF SHOREHAM

TABLE A1

Groundwater Observations During Drilling

Borehole No.	Date	Time	Depth (m b.g.l.)		
			Borehole	Casing	Water
BH1	11/07/07	0	6.3	6.0	6.3
BH1	11/07/07	5 minutes	6.3	6.0	5.8
BH1	11/07/07	10 minutes	6.3	6.0	5.5
BH1	11/07/07	20 minutes	6.3	6.0	5.3
BH1	12/07/07	0	17.3	14.5	17.3
BH1	12/07/07	5 minutes	17.3	14.5	9.2
BH1	12/07/07	10 minutes	17.3	14.5	6.8
BH1	12/07/07	15 minutes	17.3	14.5	5.7
BH1	12/07/07	20 minutes	17.3	14.5	5.0
BH7	20/06/07	0	18.5	10.5	18.5
BH7	20/06/07	5 minutes	18.5	10.5	10.7
BH7	20/06/07	10 minutes	18.5	10.5	7.2
BH7	20/06/07	15 minutes	18.5	10.5	5.8
BH7	20/06/07	20 minutes	18.5	10.5	5.0
BH8	14/06/07	0	7.3	7.0	7.3
BH8	14/06/07	5 minutes	7.3	7.0	5.2
BH8	14/06/07	10 minutes	7.3	7.0	4.3
BH8	14/06/07	20 minutes	7.3	7.0	4.0

PORT OF SHOREHAM

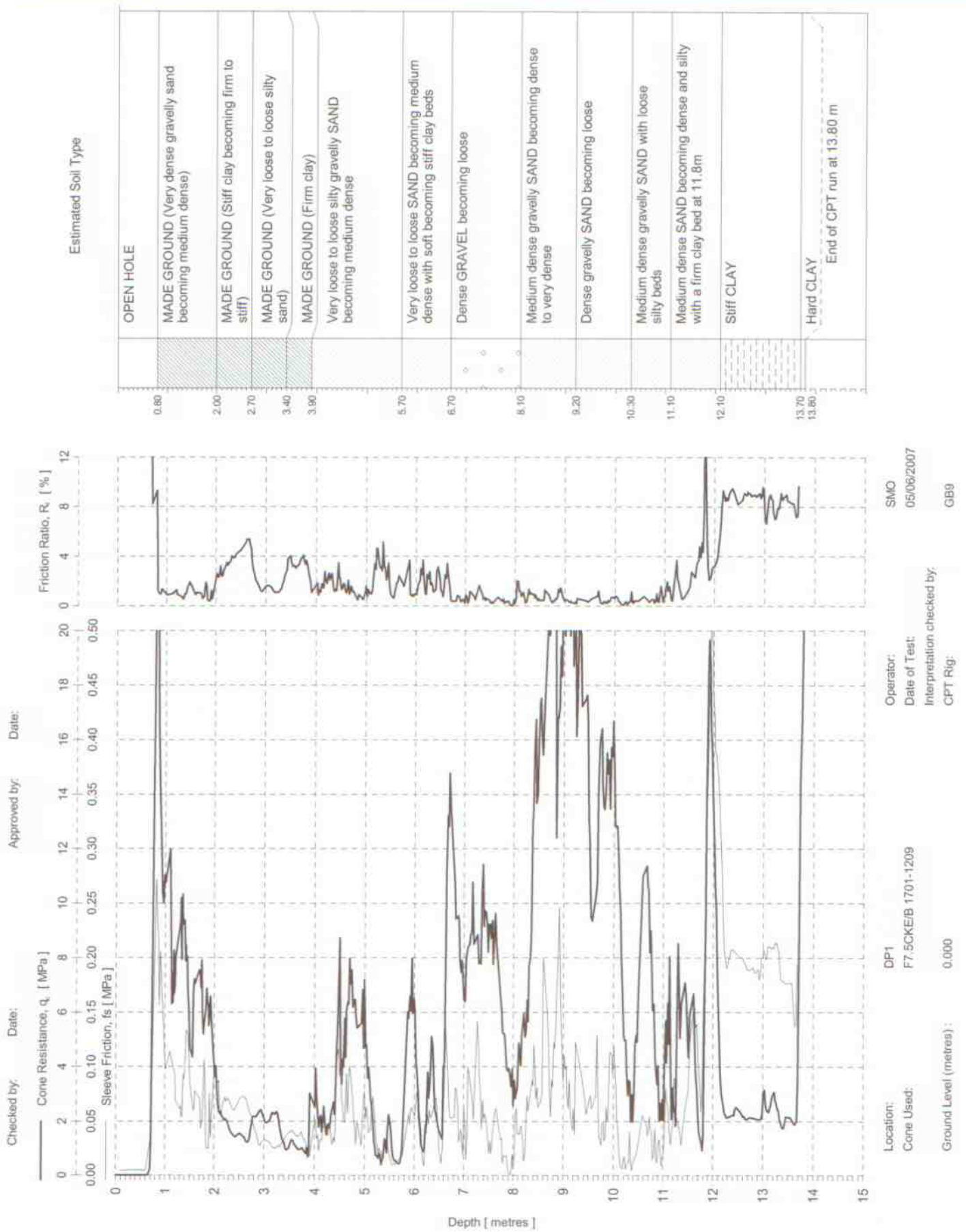
TABLE A1

Groundwater Observations During Drilling

Borehole No.	Date	Time	Depth (m b.g.l.)		
			Borehole	Casing	Water
BH8	15/06/07	0	21.0	13.5	21.0
BH8	15/06/07	5 minutes	21.0	13.5	12.0
BH8	15/06/07	10 minutes	21.0	13.5	8.5
BH8	15/06/07	15 minutes	21.0	13.5	6.5
BH8	15/06/07	20 minutes	21.0	13.5	4.5
BH9	19/06/07	0	7.0	7.0	7.0
BH9	19/06/07	5 minutes	7.0	7.0	5.9
BH9	19/06/07	10 minutes	7.0	7.0	4.9
BH9	19/06/07	15 minutes	7.0	7.0	4.6
BH9	19/06/07	20 minutes	7.0	7.0	4.4
BH9	20/06/07	0	21.5	13.0	21.5
BH9	20/06/07	5 minutes	21.5	13.0	8.7
BH9	20/06/07	10 minutes	21.5	13.0	5.6
BH9	20/06/07	15 minutes	21.5	13.0	4.9
BH9	20/06/07	20 minutes	21.5	13.0	4.7

APPENDIX A2

Static Cone Penetration Tests

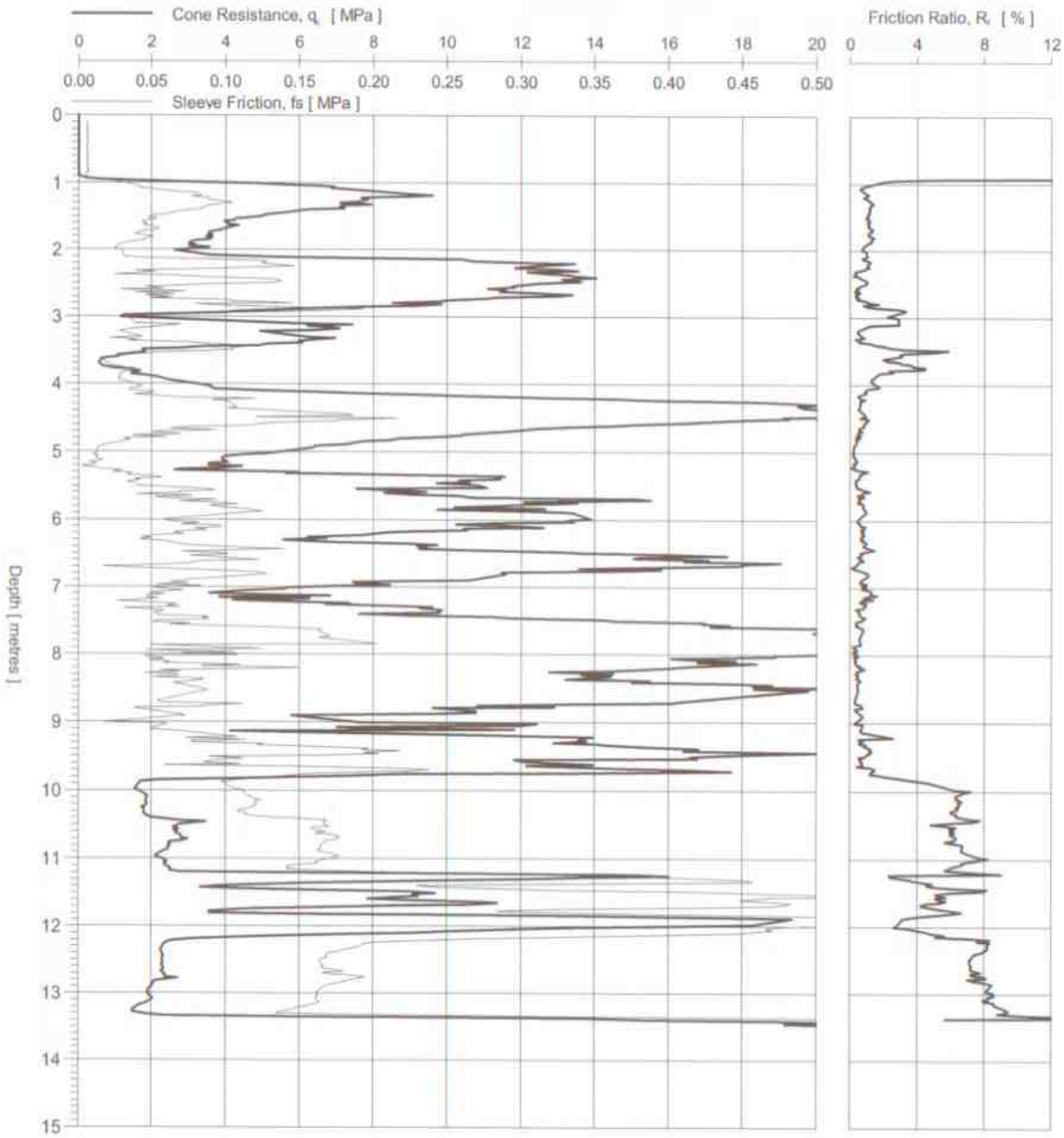

Estimated Soil Type
OPEN HOLE
MADE GROUND (Very dense gravelly sand becoming medium dense)
MADE GROUND (Stiff clay becoming firm to stiff)
MADE GROUND (Very loose to loose silty sand)
MADE GROUND (Firm clay)
Very loose to loose silty gravelly SAND becoming medium dense
Very loose to loose SAND becoming medium dense with soft becoming stiff clay beds
Dense GRAVEL becoming loose
Medium dense gravelly SAND becoming dense to very dense
Dense gravelly SAND becoming loose
Medium dense gravelly SAND with loose silty beds
Medium dense SAND becoming dense and silty with a firm clay bed at 11.8m
Stiff CLAY
Hard CLAY
End of CPT run at 13.80 m
0.80
2.00
2.70
3.40
3.90
5.70
6.70
8.10
9.20
10.30
11.10
12.10
13.70
13.80
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by: Date: Approved by: Date:
Location: DP1
Cone Used: F7.5CKE/B 1701-1209
Ground Level (metres) : 0.000
Operator: SMO
Date of Test: 05/06/2007
Interpretation checked by:
CPT Rig: GB9

Contract No:CPT071142

STATIC CONE PENETRATION TEST DP2

BUREAU VERITAS
SHOREHAM HARBOUR

Checked by: Date: Approved by: Date:

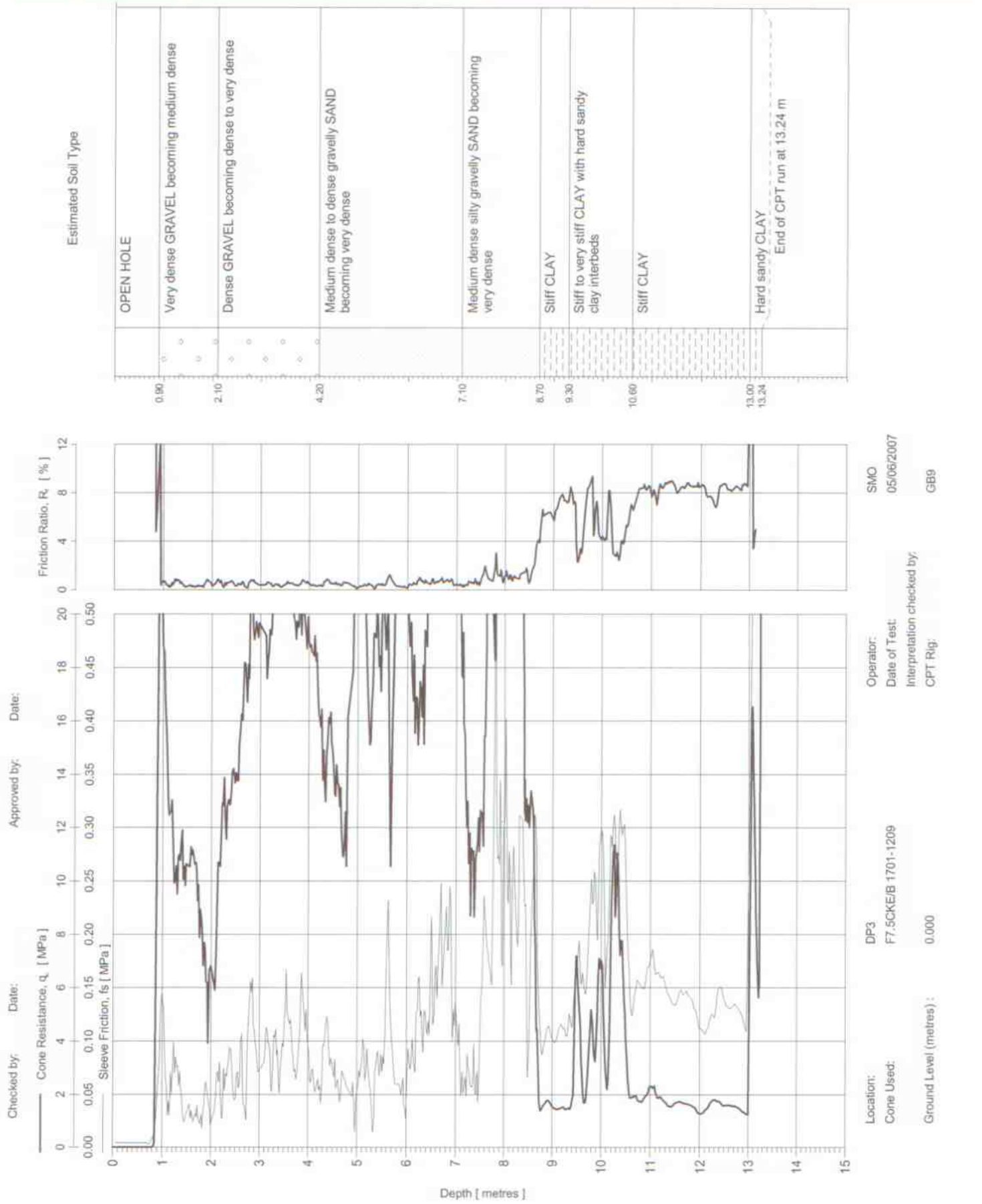


Estimated Soil Type

	OPEN HOLE
0.90	Medium dense SAND becoming loose
2.10	Dense gravelly SAND becoming medium dense with a firm clay bed at 3.0m
3.40	Stiff CLAY with a very loose silty sand bed at 3.5m
3.80	
4.40	Loose to medium dense gravelly SAND becoming dense to very dense
	Dense gravelly SAND, with occasional medium dense beds, becoming very dense gravelly SAND
7.90	Dense gravelly SAND, locally medium dense, with a hard sandy clay bed at 9.2m
9.80	Stiff CLAY
11.20	Very stiff CLAY with hard sandy beds and occasional dense silty sand beds
12.10	Stiff CLAY
13.30	Hard sandy CLAY
13.49	End of CPT run at 13.49 m

Location:	DP2	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

TUGRO

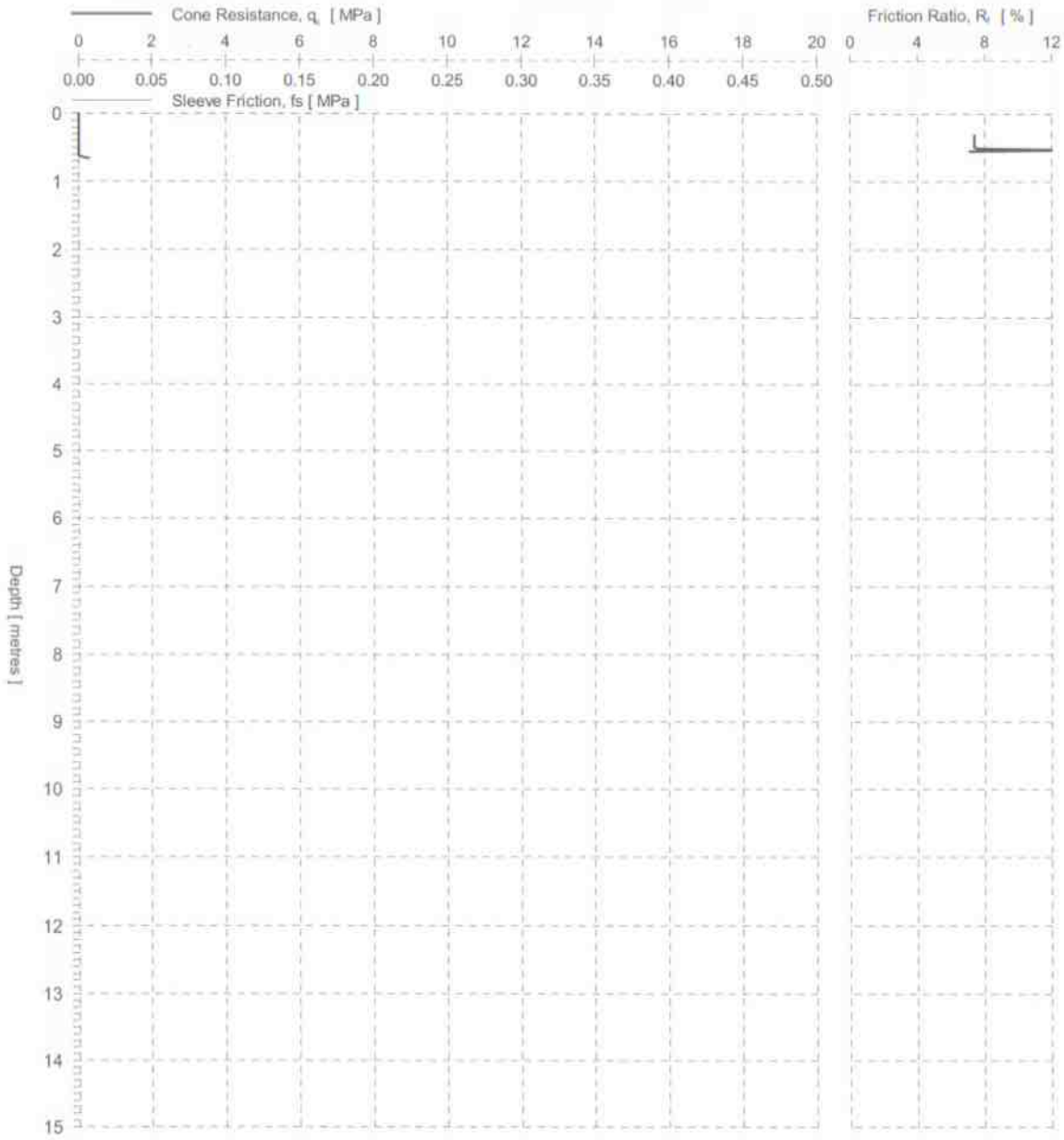

Estimated Soil Type
OPEN HOLE
Very dense GRAVEL becoming medium dense
Dense GRAVEL becoming dense to very dense
Medium dense to dense gravelly SAND becoming very dense
Medium dense silty gravelly SAND becoming very dense
Stiff CLAY
Stiff to very stiff CLAY with hard sandy clay interbeds
Stiff CLAY
Hard sandy CLAY
End of CPT run at 13.24 m
0.90
2.10
4.20
7.10
8.70
9.30
10.60
13.00
13.24
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by:
Date:
Approved by:
Date:
Operator:
SMO
Date of Test:
05/06/2007
Interpretation checked by:
CPT Rig:
GB9
Location:
DP3
Cone Used:
F7.5CKE/B 1701-1209
Ground Level (metres) :
0.000

Contract No:CPT071142

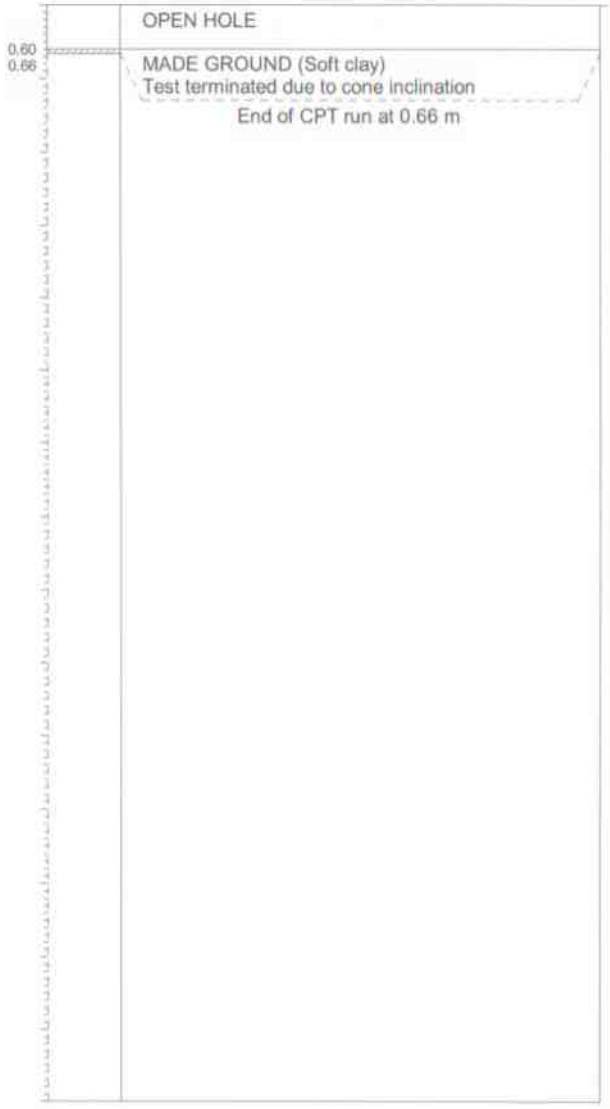
STATIC CONE PENETRATION TEST DP4

BUREAU VERITAS
SHOREHAM HARBOUR

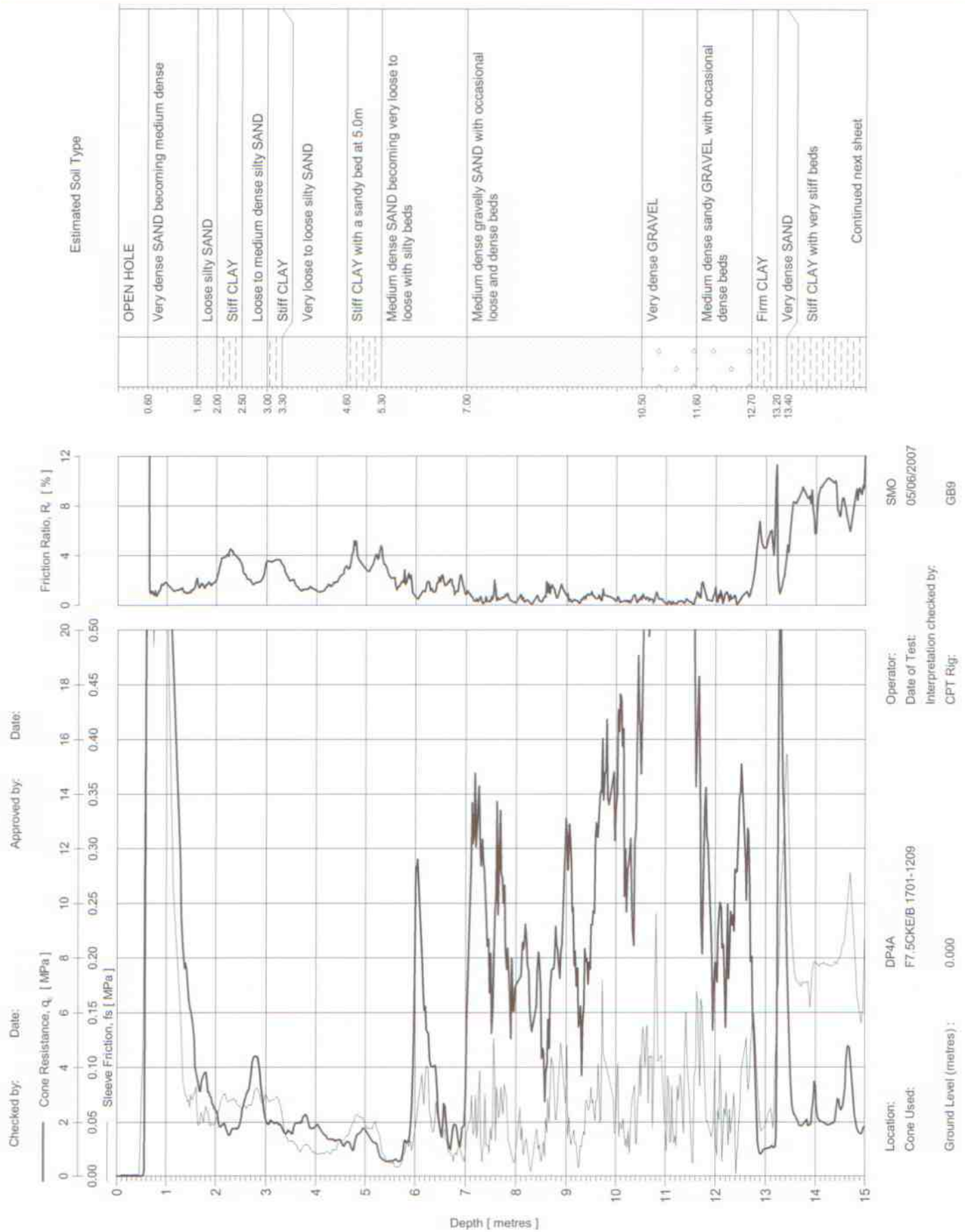
Checked by: Date: Approved by: Date:



Estimated Soil Type



Location:	DP4	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

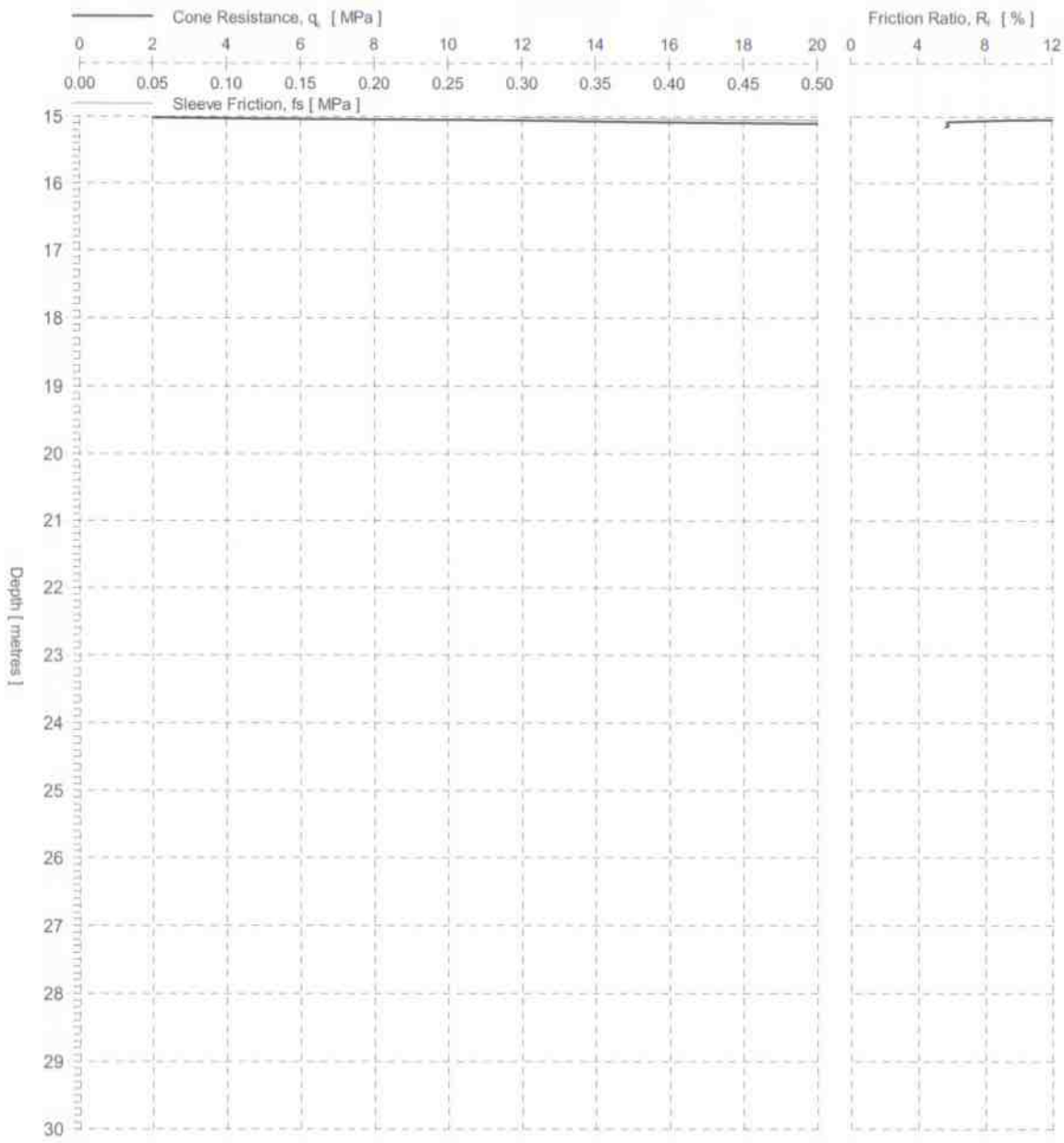

Estimated Soil Type
OPEN HOLE
Very dense SAND becoming medium dense
Loose silty SAND
Stiff CLAY
Loose to medium dense silty SAND
Stiff CLAY
Very loose to loose silty SAND
Stiff CLAY with a sandy bed at 5.0m
Medium dense SAND becoming very loose to loose with silty beds
Medium dense gravelly SAND with occasional loose and dense beds
Very dense GRAVEL
Medium dense sandy GRAVEL with occasional dense beds
Firm CLAY
Very dense SAND
Stiff CLAY with very stiff beds
Continued next sheet
0.60
1.60
2.00
2.50
3.00
3.30
4.60
5.30
7.00
10.50
11.60
12.70
13.20
13.40
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by: Date:
Approved by: Date:
Operator: SMO
Date of Test: 05/06/2007
Interpretation checked by:
CPT Rig: GB9
Location: DP4A
Cone Used: F7.5CKE/B 1701-1209
Ground Level (metres) : 0.000

Contract No:CPT071142

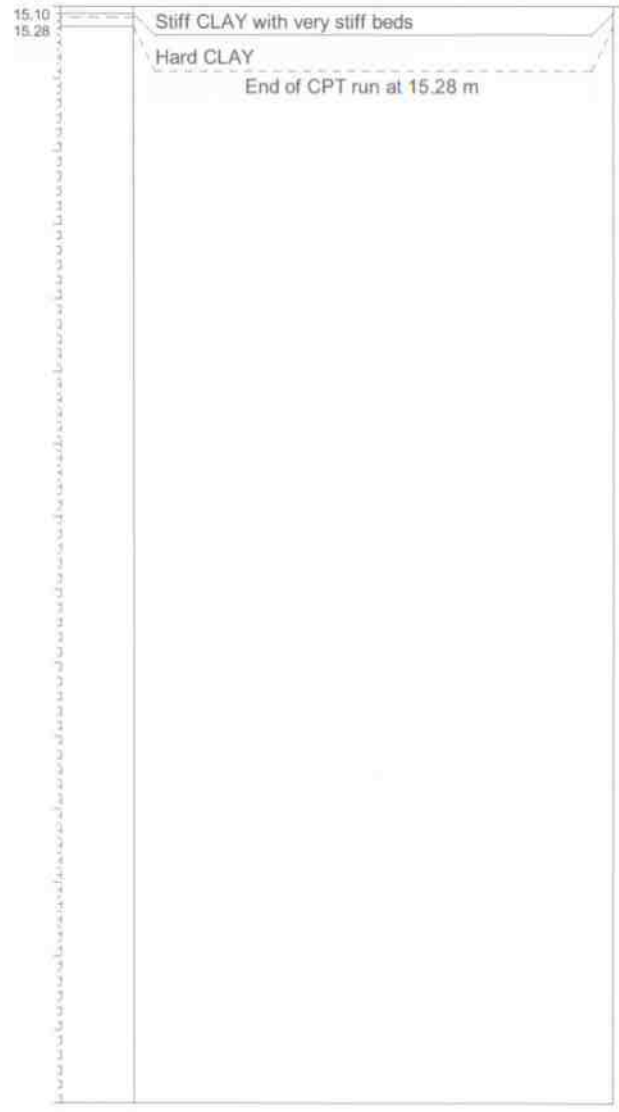
STATIC CONE PENETRATION TEST DP4A

BUREAU VERITAS
SHOREHAM HARBOUR

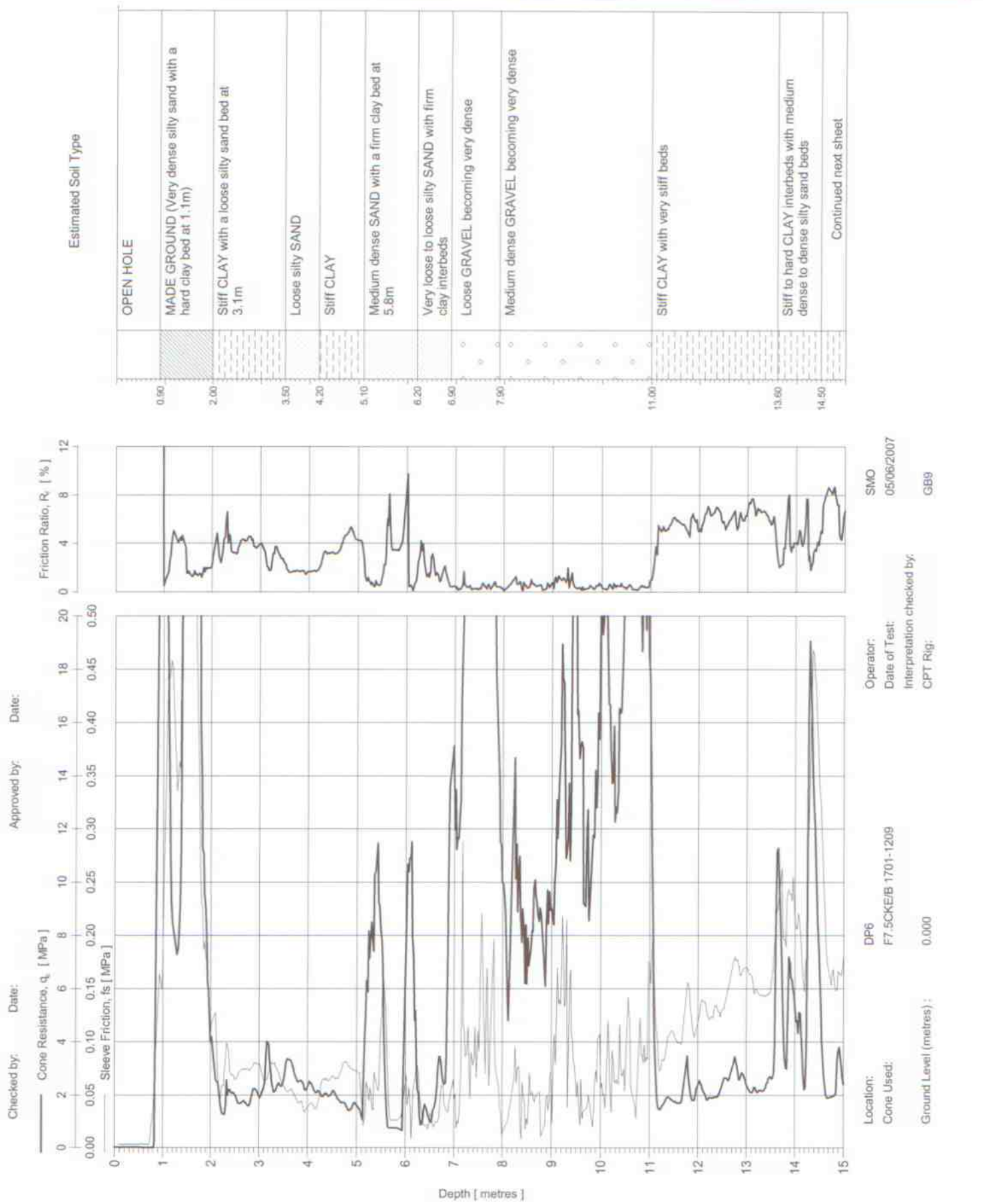
Checked by: Date: Approved by: Date:



Estimated Soil Type



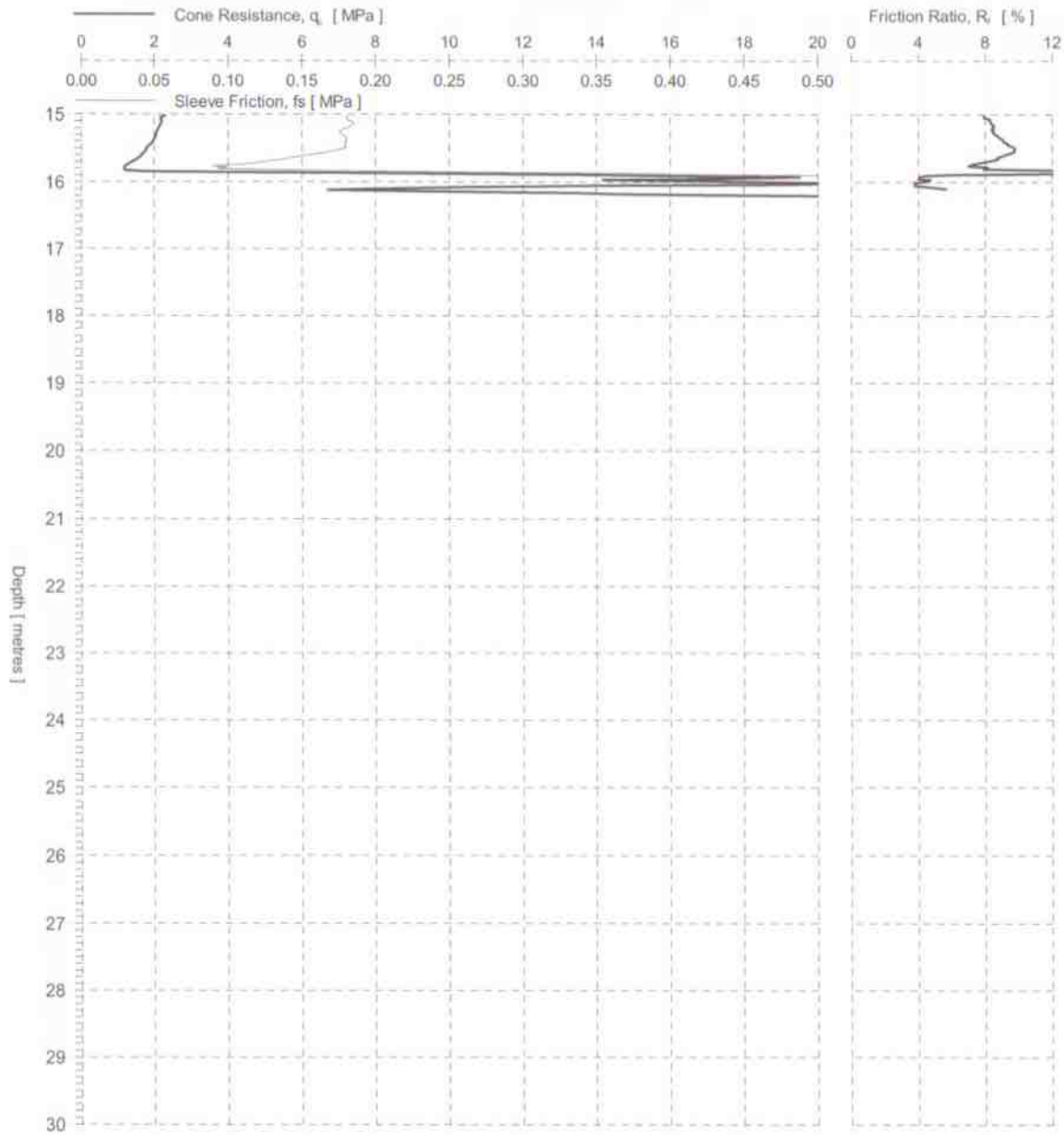
Location:	DP4A	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9


Estimated Soil Type
OPEN HOLE
MADE GROUND (Very dense silty sand with a hard clay bed at 1.1m)
Stiff CLAY with a loose silty sand bed at 3.1m
Loose silty SAND
Stiff CLAY
Medium dense SAND with a firm clay bed at 5.8m
Very loose to loose silty SAND with firm clay interbeds
Loose GRAVEL becoming very dense
Medium dense GRAVEL becoming very dense
Stiff CLAY with very stiff beds
Stiff to hard CLAY interbeds with medium dense to dense silty sand beds
Continued next sheet
0.90
2.00
3.50
4.20
5.10
6.20
6.90
7.90
11.00
13.60
14.50
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by: Date: Approved by: Date:
Location: DP6
Cone Used: F7.5CKE/B 1701-1209
Ground Level (metres) : 0.000
Operator: SMO
Date of Test: 05/06/2007
Interpretation checked by:
CPT Rig: GB9

Contract No:CPT071142

STATIC CONE PENETRATION TEST DP6

Checked by: Date: Approved by: Date:



Estimated Soil Type



Location:	DP6	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

BUREAU VERITAS
SHOREHAM HARBOUR

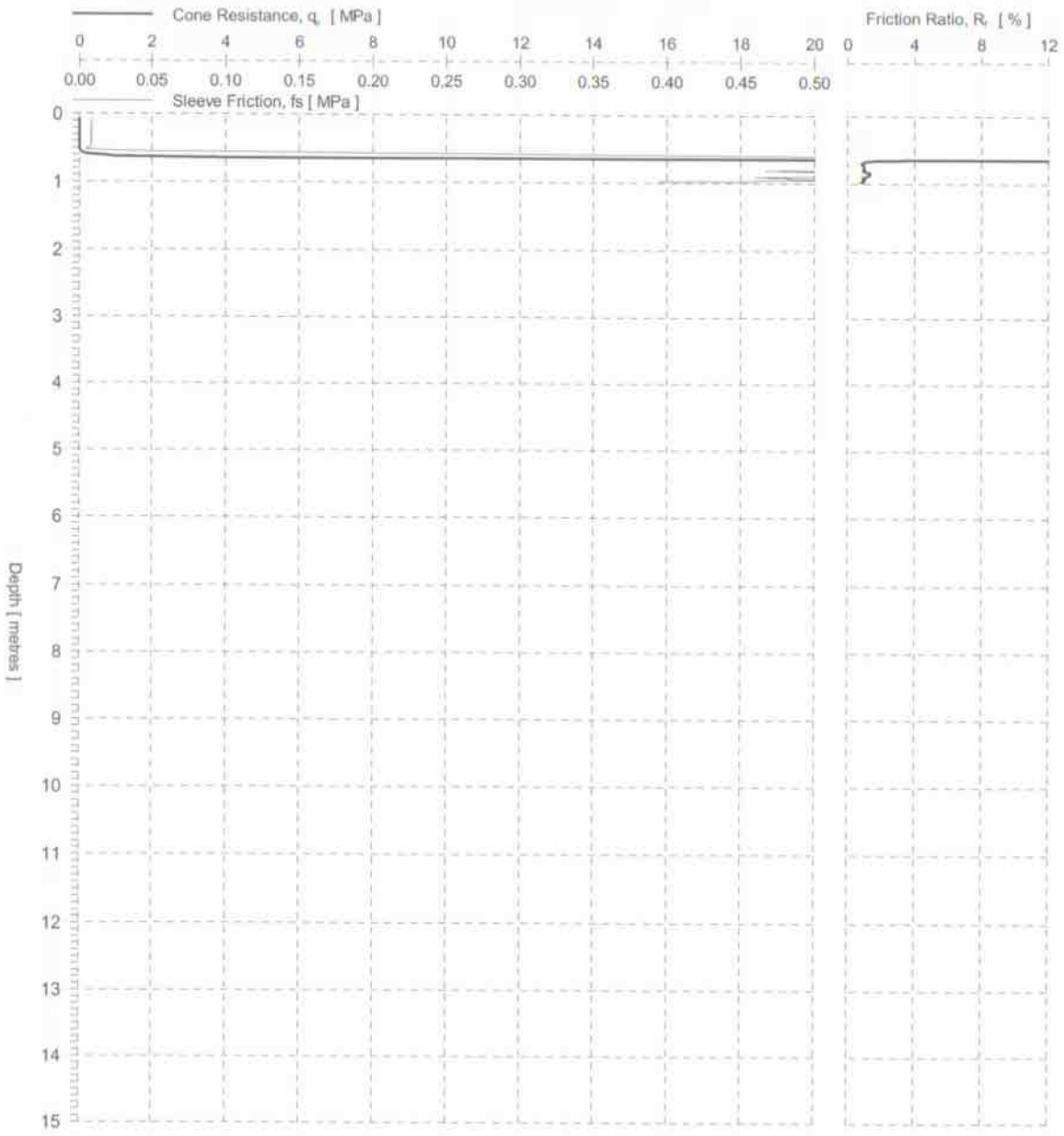
FUGRO

Contract No.CPT071142

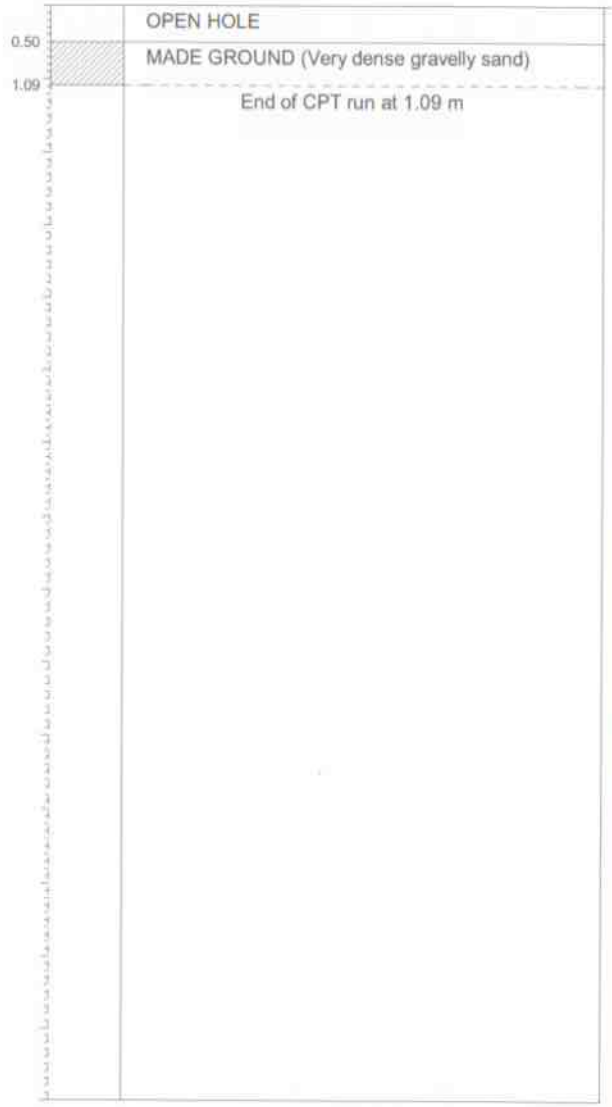
STATIC CONE PENETRATION TEST DP7

BUREAU VERITAS
SHOREHAM HARBOUR

Checked by: Date: Approved by: Date:



Estimated Soil Type



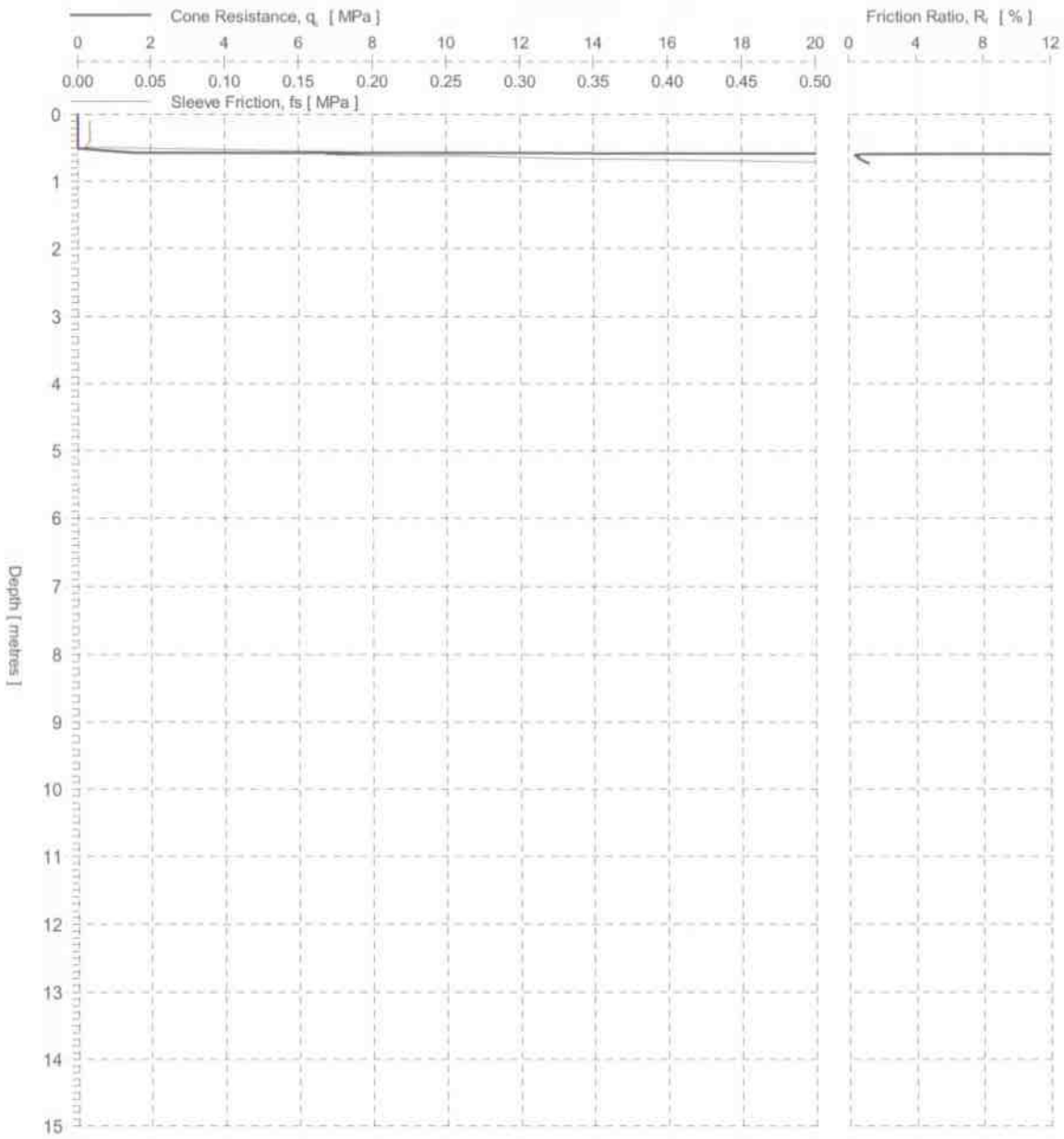
Location:	DP7	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	06/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

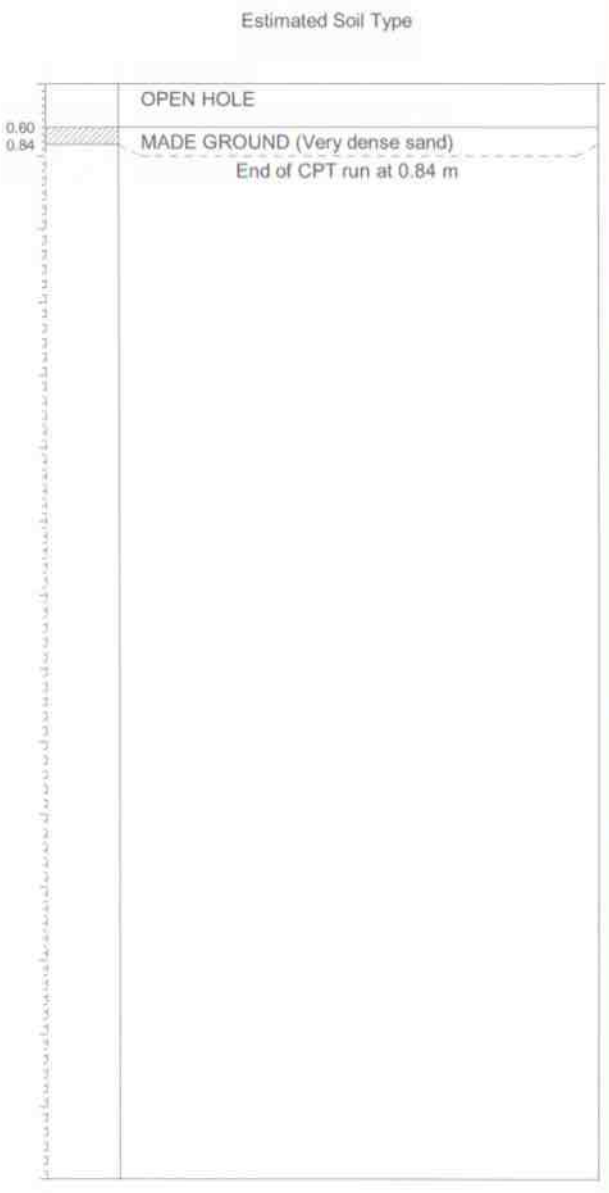
FUGRO

Contract No:CPT071142

STATIC CONE PENETRATION TEST DP8

Checked by: Date: Approved by: Date:





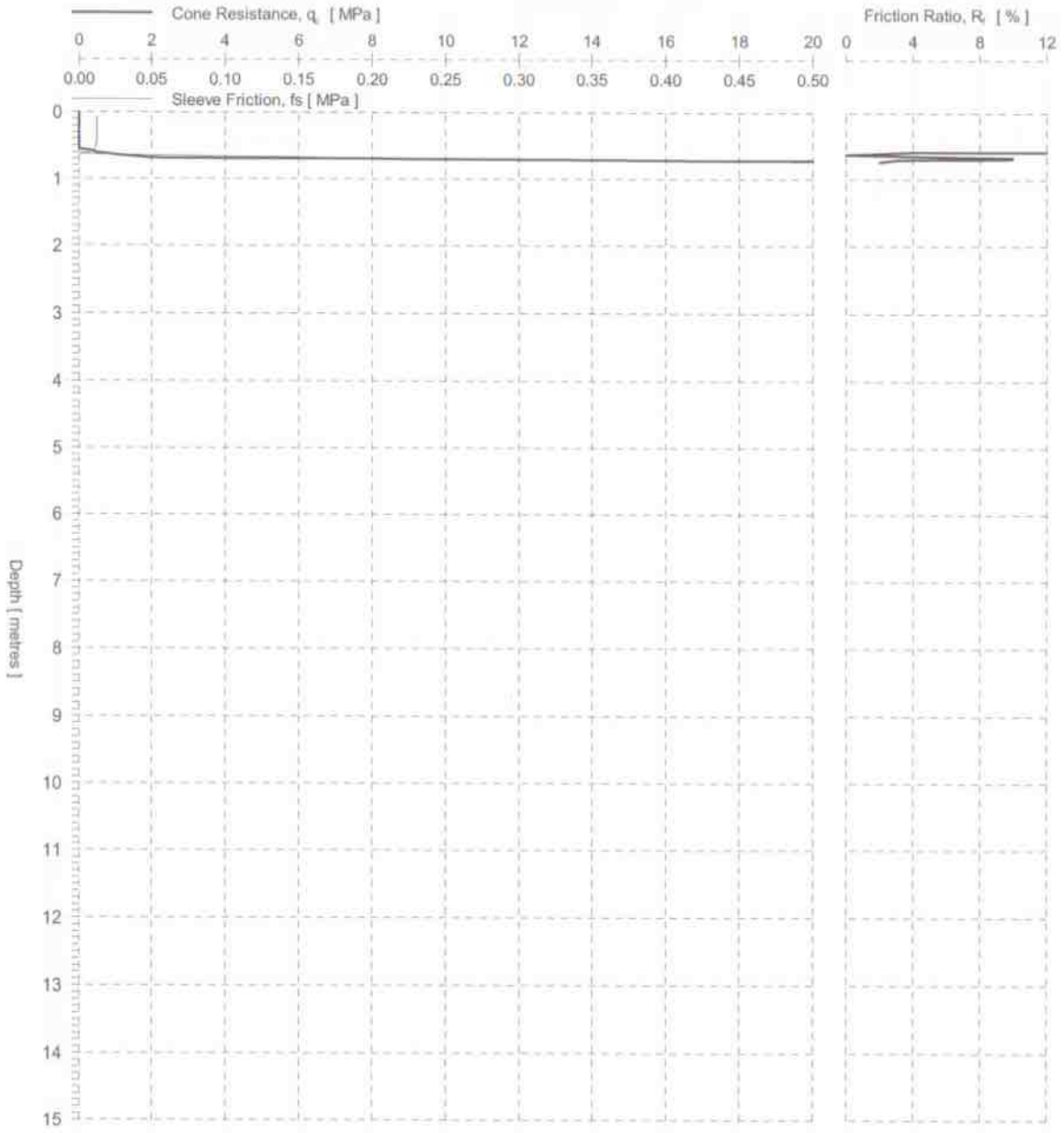
Location:	DP8	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

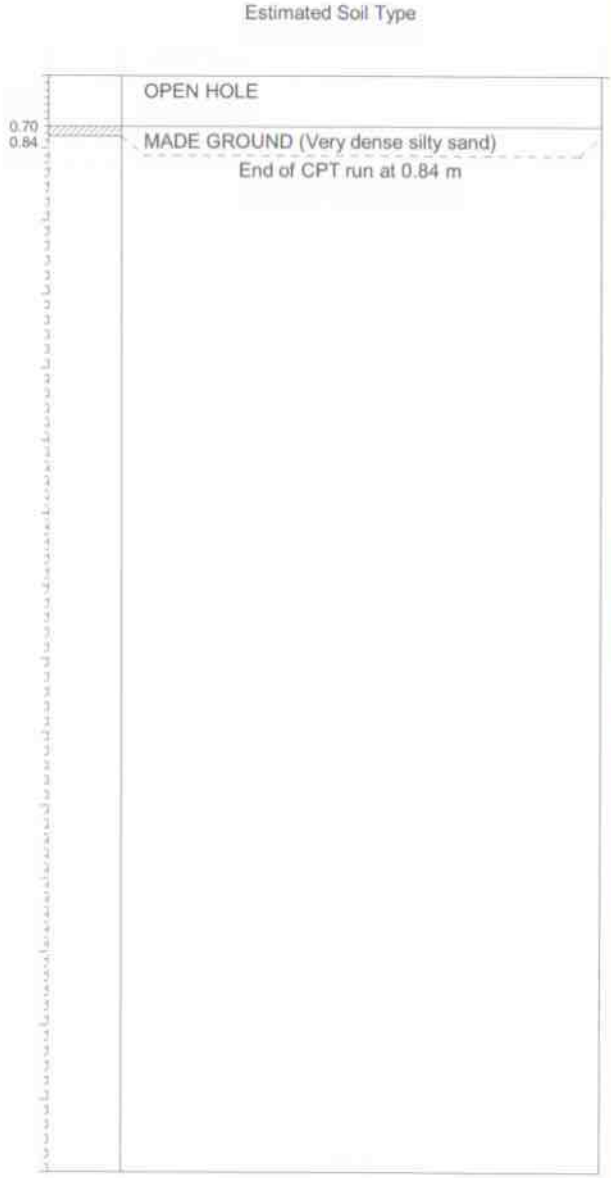
BUREAU VERITAS
SHOREHAM HARBOUR

FUGRO

Contract No:CPT071142

Checked by: Date: Approved by: Date:





Location:	DP9	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	06/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

STATIC CONE PENETRATION TEST DP9

BUREAU VERITAS
SHOREHAM HARBOUR

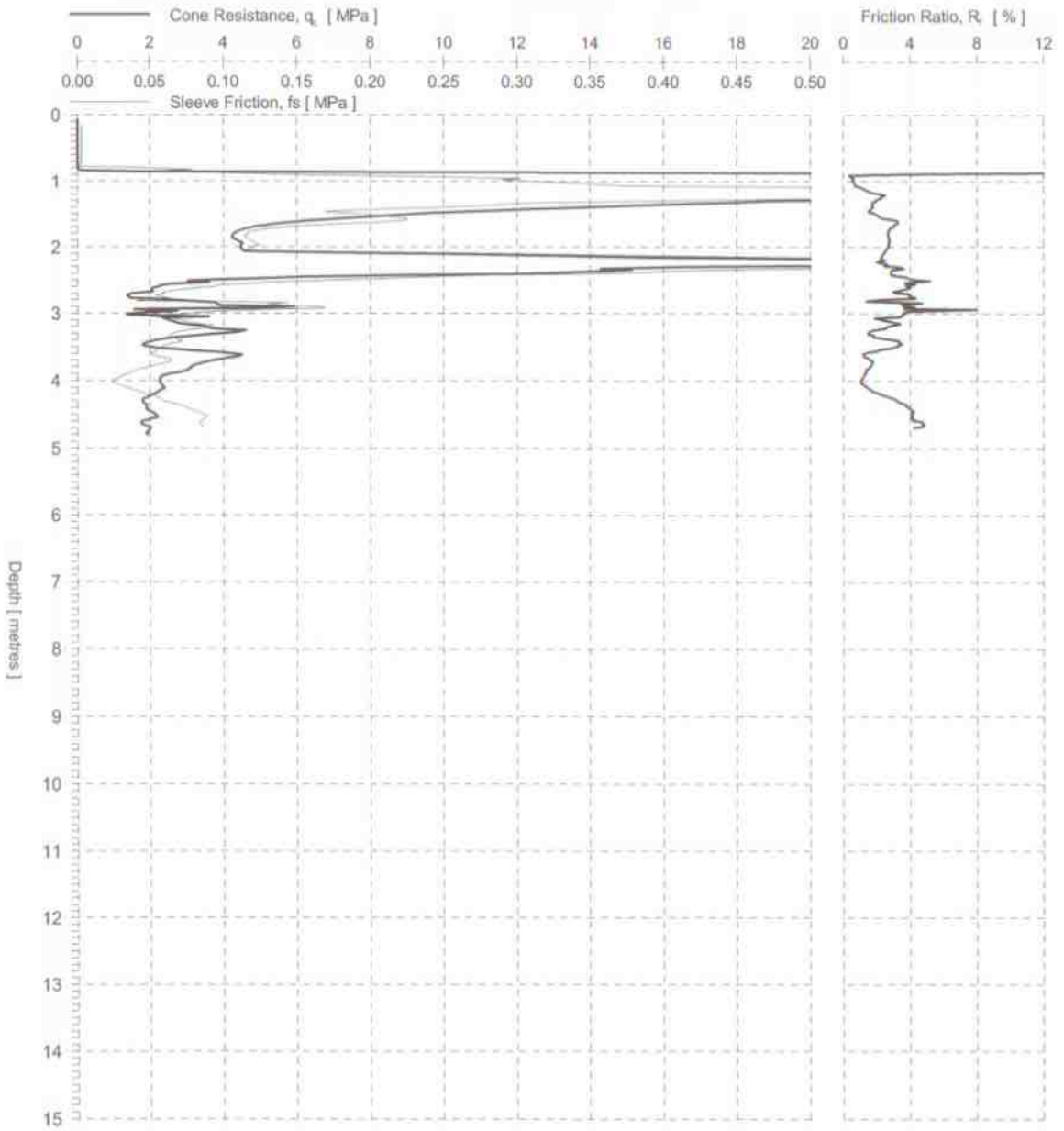
FUGRO

Contract No:CPT071142

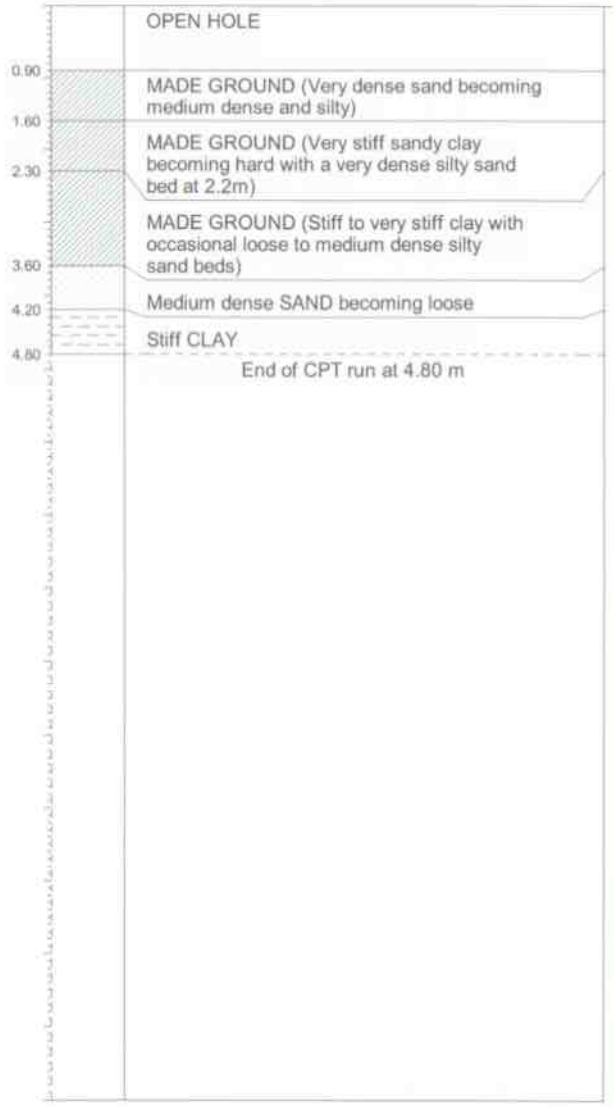
STATIC CONE PENETRATION TEST DP10

BUREAU VERITAS
SHOREHAM HARBOUR

Checked by: Date: Approved by: Date:

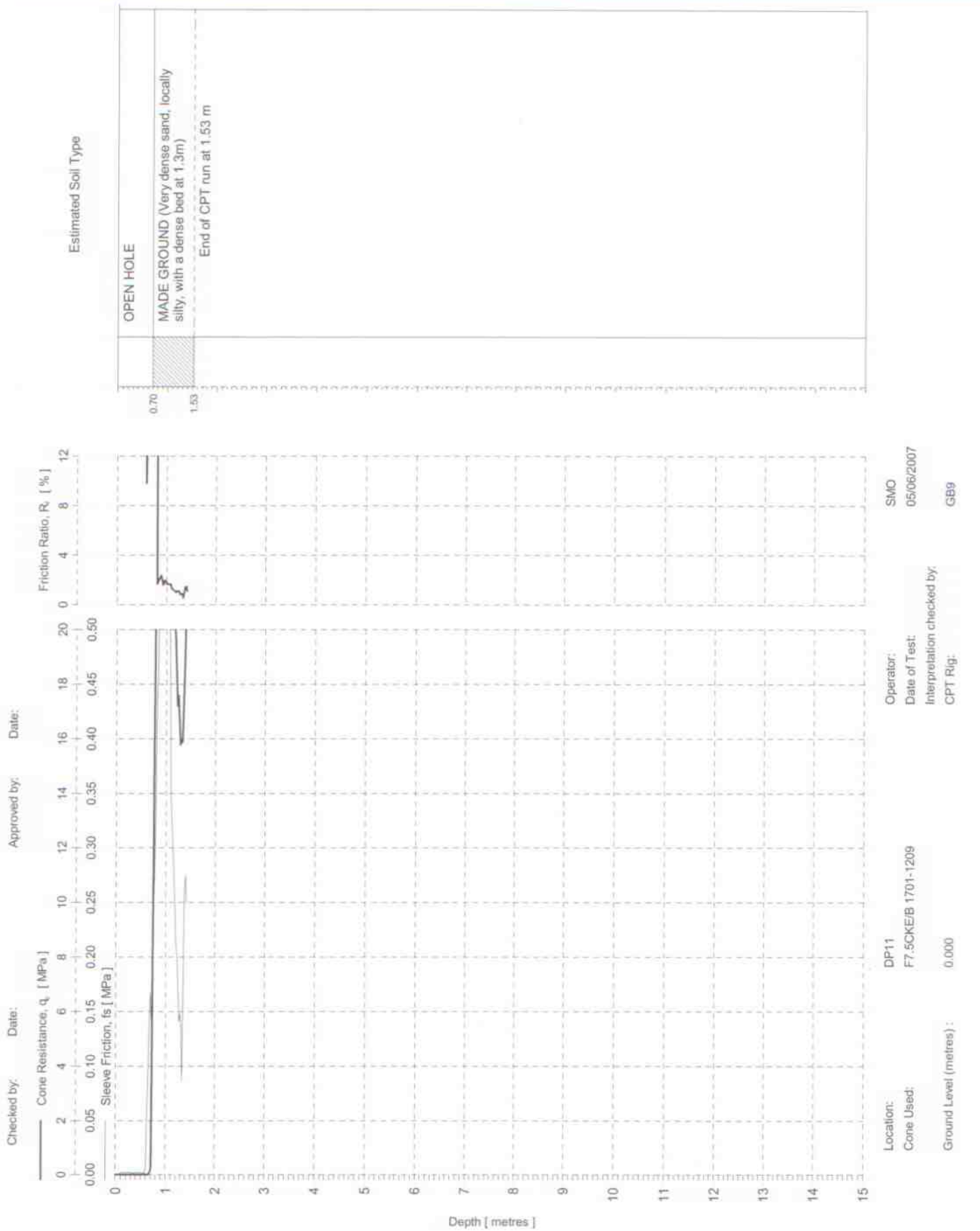


Estimated Soil Type

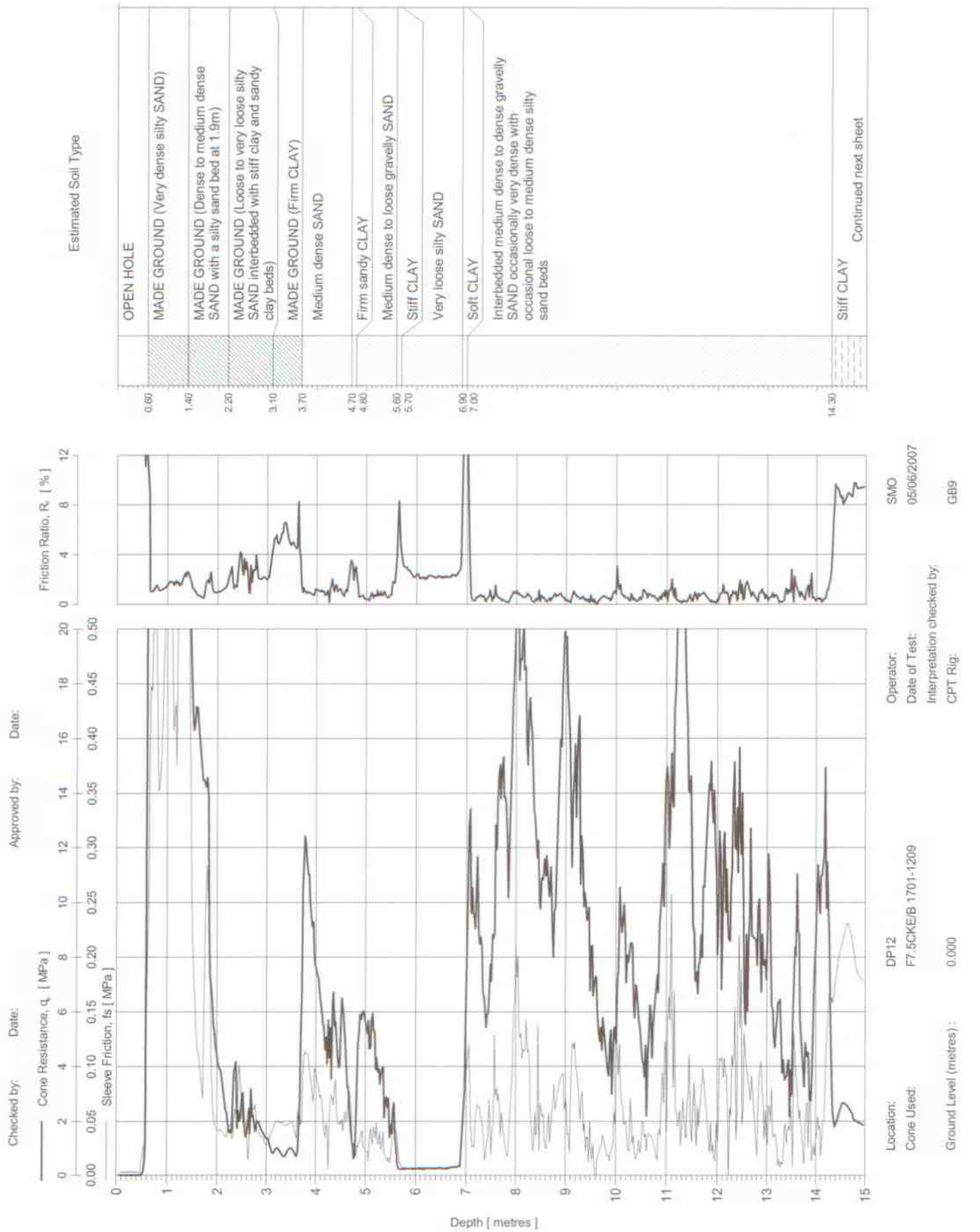


Location:	DP10	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

FUGRO



STATIC CONE PENETRATION TEST DP11

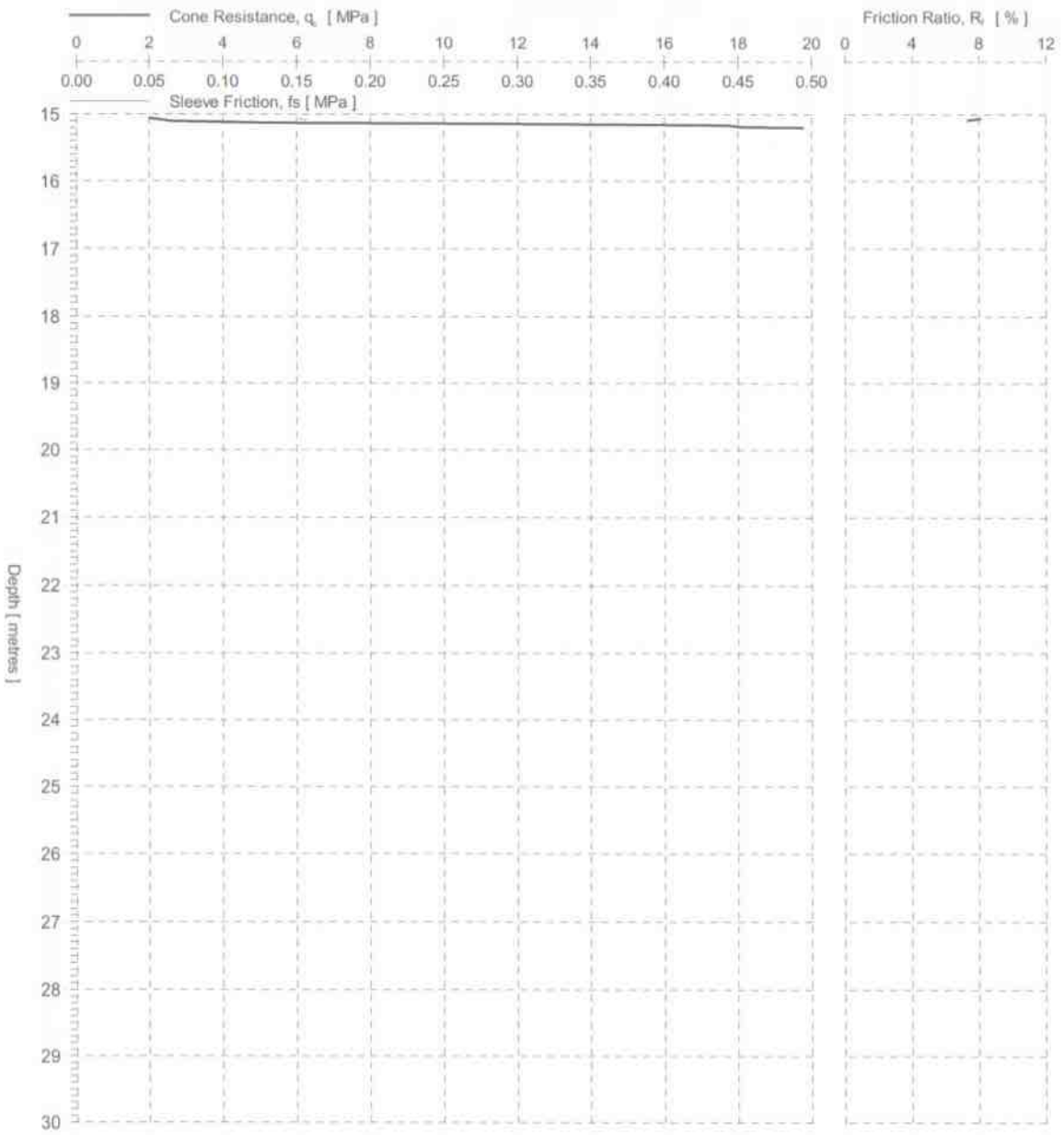

Estimated Soil Type
OPEN HOLE
MADE GROUND (Very dense silty SAND)
MADE GROUND (Dense to medium dense SAND with a silty sand bed at 1.9m)
MADE GROUND (Loose to very loose silty SAND interbedded with stiff clay and sandy clay beds)
MADE GROUND (Firm CLAY)
Medium dense SAND
Firm sandy CLAY
Medium dense to loose gravelly SAND
Stiff CLAY
Very loose silty SAND
Soft CLAY
Interbedded medium dense to dense gravelly SAND occasionally very dense with occasional loose to medium dense silty sand beds
Stiff CLAY
Continued next sheet
0.60
1.40
2.20
3.10
3.70
4.70
4.80
5.60
5.70
6.90
7.00
14.30
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by:
Date:
Approved by:
Date:
Location:
DP12
Cone Used:
F7.5CKE/B 1701-1209
Ground Level (metres) :
0.000
Operator:
SMO
Date of Test:
05/06/2007
Interpretation checked by:
CPT Rig:
GB9

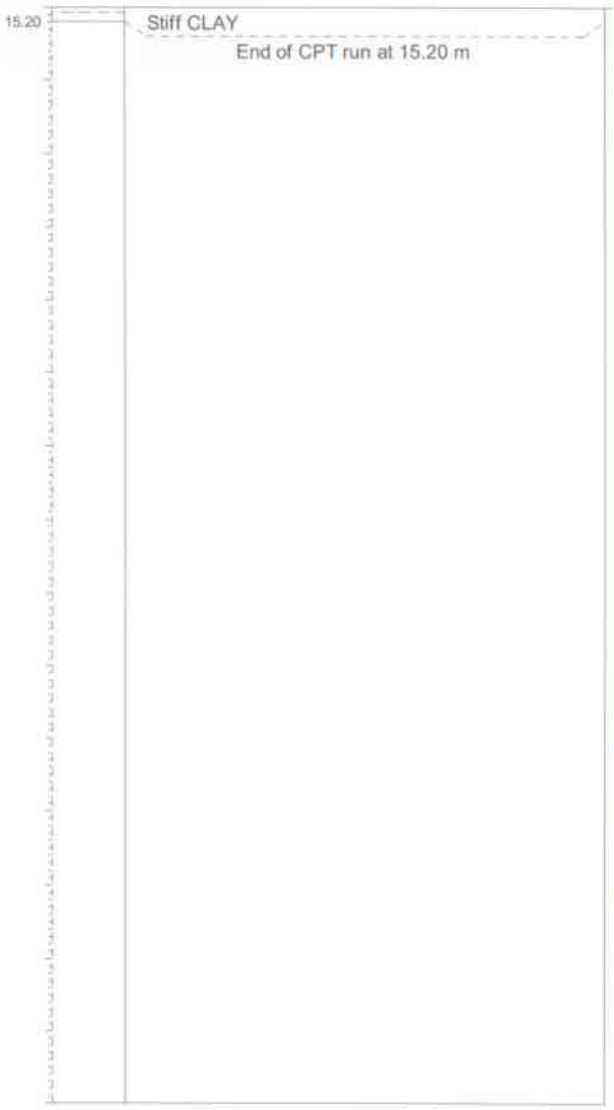
Contract No.CPT071142

STATIC CONE PENETRATION TEST DP12

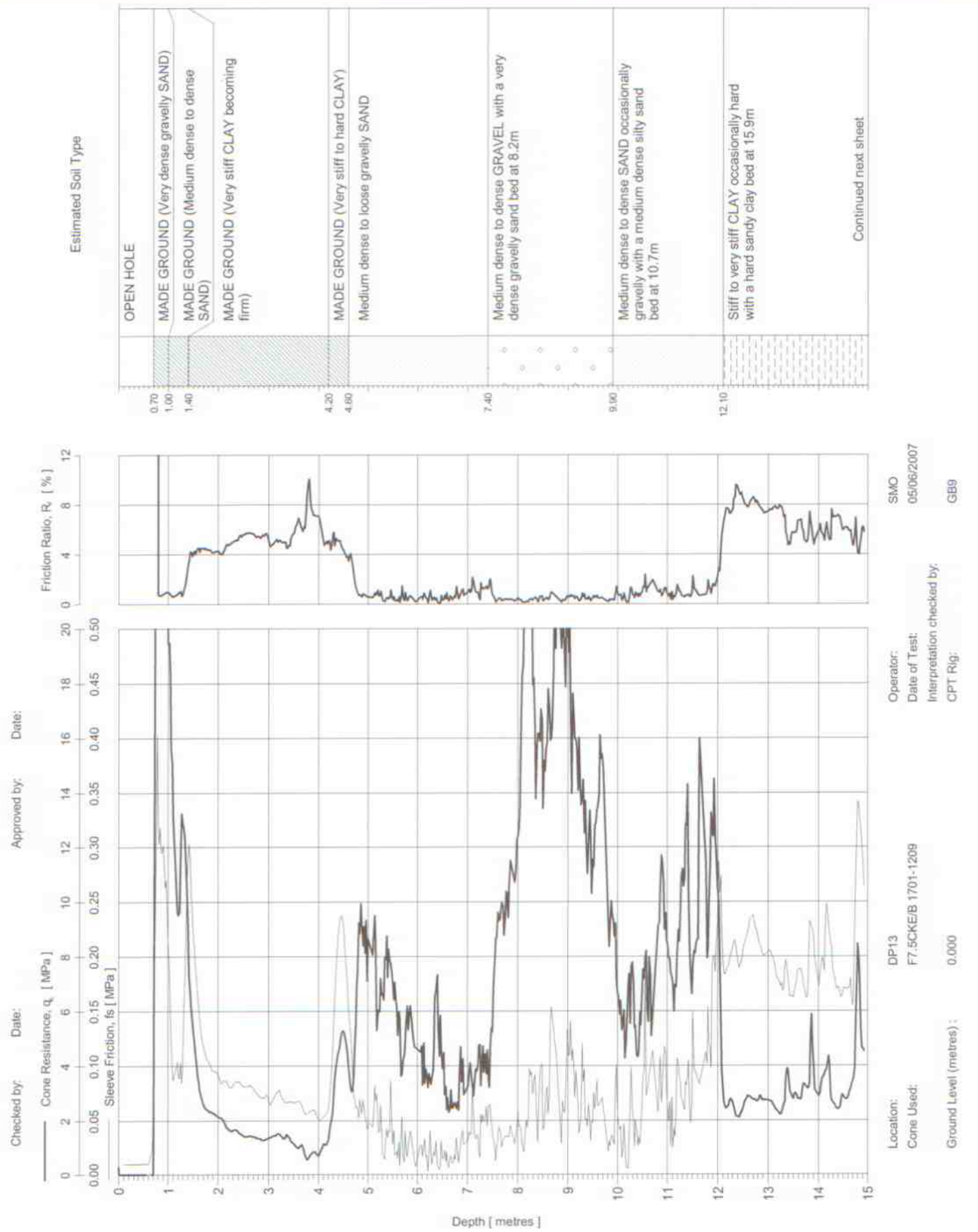
BUREAU VERITAS
SHOREHAM HARBOUR

Checked by: Date: Approved by: Date:



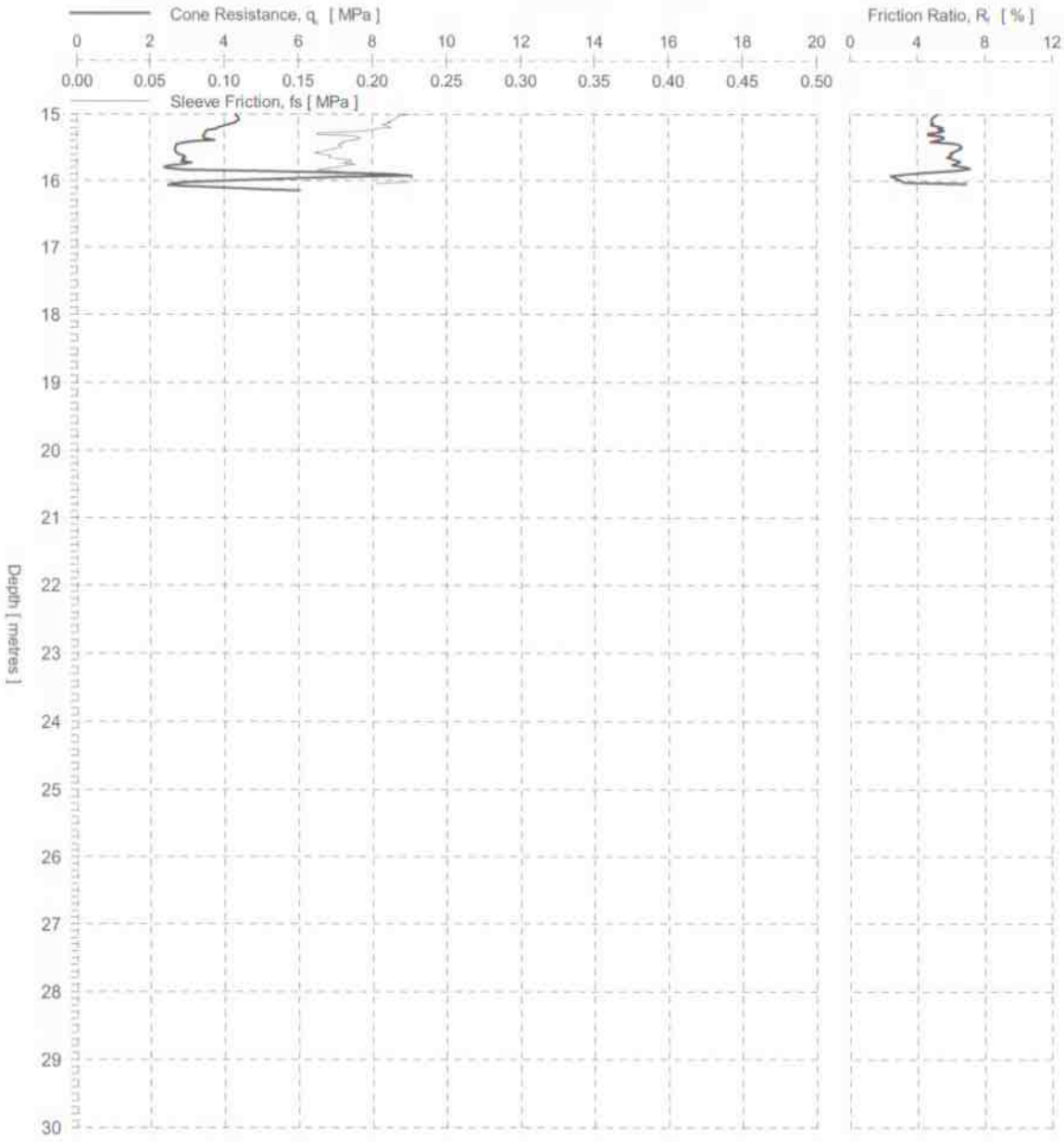


Location:	DP12	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

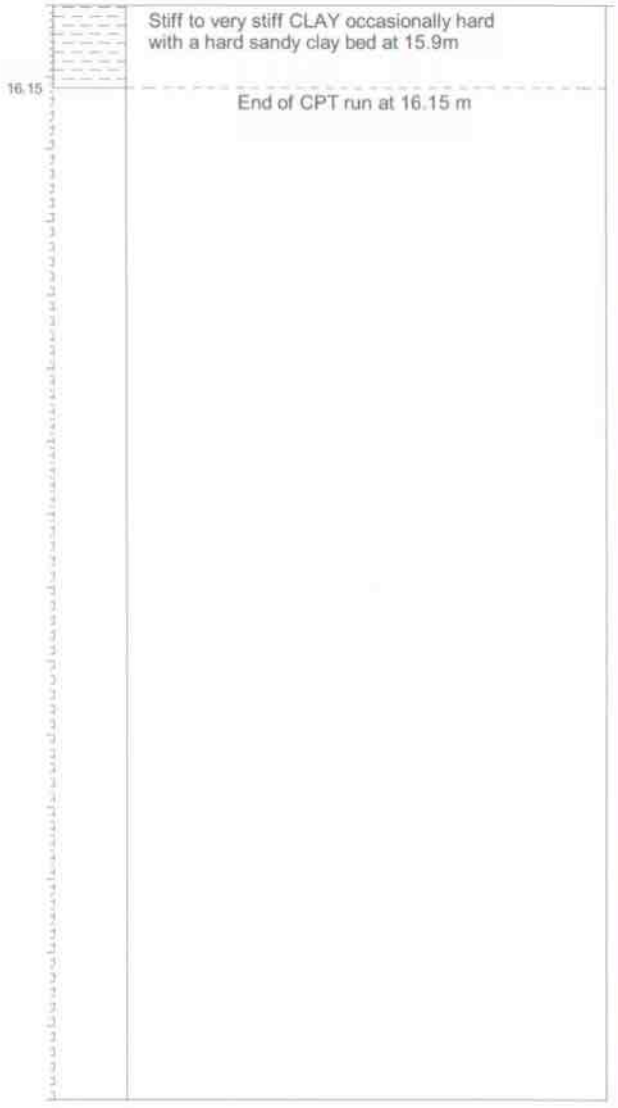

Estimated Soil Type
OPEN HOLE
MADE GROUND (Very dense gravelly SAND)
MADE GROUND (Medium dense to dense SAND)
MADE GROUND (Very stiff CLAY becoming firm)
MADE GROUND (Very stiff to hard CLAY)
Medium dense to loose gravelly SAND
Medium dense to dense GRAVEL with a very dense gravelly sand bed at 8.2m
Medium dense to dense SAND occasionally gravelly with a medium dense silty sand bed at 10.7m
Stiff to very stiff CLAY occasionally hard with a hard sandy clay bed at 15.9m
Continued next sheet
0.70
1.00
1.40
4.20
4.60
7.40
9.90
12.10
Friction Ratio, Rf [%]
Cone Resistance, qc [MPa]
Sleeve Friction, fs [MPa]
Depth [metres]
Checked by:
Date:
Approved by:
Date:
Location: DP13
Cone Used: F7.5CKE/B 1701-1209
Ground Level (metres) : 0.000
Operator: SMO
Date of Test: 05/06/2007
Interpretation checked by:
CPT Rig: GB9

Contract No.CPT071142

Checked by: Date: Approved by: Date:



Estimated Soil Type



STATIC CONE PENETRATION TEST DP13

BUREAU VERITAS
SHOREHAM HARBOUR

Location:	DP13	Operator:	SMO
Cone Used:	F7.5CKE/B 1701-1209	Date of Test:	05/06/2007
		Interpretation checked by:	
Ground Level (metres) :	0.000	CPT Rig:	GB9

FUGRO

APPENDIX B

Laboratory Tests Results (Geotechnical)

PORT OF SHOREHAM

TABLE B1

Atterberg Limit and Moisture Content Test Results

BH No.	Depth (m)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Classification
BH3	9.00-9.45	59	97	61	36	ME
BH3	13.50-13.95	40	90	29	61	CV/CE
BH3	16.00-16.45	40	78	32	46	CV
BH4	13.55-14.00	21	N/A	24	N/A	N/A
BH4	18.05-18.50	27	56	27	29	CH
BH5	21.55-22.00	37	83	30	53	CV
BH6	20.55-21.00	28	80	26	54	CV
BH7	11.50-11.95	28	62	24	38	CH
BH8	14.50-14.95	28	62	27	35	CH
BH9	11.50-11.95	26	65	22	43	CH
BH9	19.00-19.45	19	59	29	30	CH

PORT OF SHOREHAM

TABLE B2

Sulphate and pH Test Results

Borehole No.	Depth (m)	Water Soluble Sulphate (by 2:1 water:soil extract) (g/l)		pH Value	Acid Soluble Sulphate (%)		Sulphur Content (%)	Total Potential Sulphate Content (% SO_4)	Water Soluble Chloride (%)
		as SO_3	as SO_4		as SO_3	as SO_4			
BH3	9.00-9.45	1.58	1.89	6.4	0.32	0.38	1.26	3.78	0.39
BH3	13.50-13.95	1.99	2.39	3.8	2.26	2.71	21.80	65.4	0.32
BH3	16.00-16.45	0.27	0.33	8.4	0.04	0.05	0.60	1.80	0.01
BH4	18.05-18.50	0.29	0.35	8.7	0.05	0.06	1.87	5.61	0.20
BH5	21.55-22.00	0.14	0.16	9.0	0.01	0.01	0.74	2.22	0.01
BH6	20.55-21.00	0.10	0.12	8.4	0.03	0.03	0.11	0.33	0.03
BH8	14.50-14.95	0.66	0.79	6.5	0.10	0.12	0.34	1.02	0.18
BH9	11.50-11.95	0.48	0.58	8.1	0.10	0.12	0.67	2.01	0.32
BH9	19.00-19.45	6.83	8.20	2.5	5.18	6.22	20.70	62.10	0.09

PORT OF SHOREHAM

TABLE B3

105mm Single Stage Quick Undrained Triaxial Test Results

BH No.	Depth (m)	Bulk Density (Mg/m^3)	Moisture Content (%)	Cell Pressure (kN/m^2)	Undrained Shear Strength C_u (kN/m^2)
BH3	13.50-13.95m	1.84	40	250	36
BH3	16.00-16.45m	1.80	40	290	52
BH4	13.55-14.00m	2.11	21	250	121
BH4	18.05-18.50m	1.99	27	330	71
BH5	21.55-22.00m	1.90	37	390	56
BH7	11.50-11.95m	2.00	28	210	87
BH8	14.50-14.95m	1.99	28	260	85
BH9	11.50-11.95m	2.06	26	210	78
BH9	19.00-19.45m	2.06	19	350	158

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maidstone@uk.bureauveritas.com

BUREAU VERITAS

UKAS TESTING
0187

TEST REPORT

SIEVE ANALYSIS TEST REPORT

BS 1377-2 : 1990

Report No. MDM10097114

Client:	Bettridge Turner and Partners		
Address:	89 King St, Maidstone, Kent ME14 1BG		
Site:	Shoreham Port		
Location:	BH3 @ 6.0m	Lab. Ref.	10097114
Date Sampled:	1/6/2007	Client Ref.	1004519
Sampled from:	Ex Site	Mass (kg):	22.7

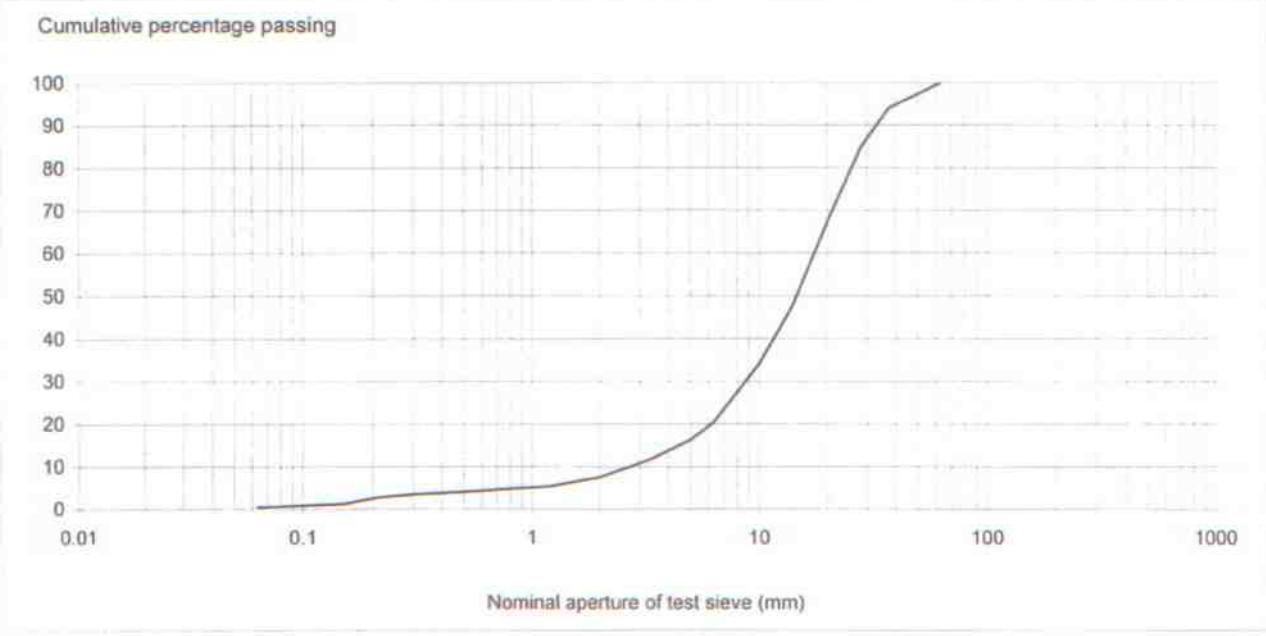
Visual Description: Brown slightly sandy GRAVEL

Material Specification: Not Known

Date received: 2/8/2007
Sample type: Bulk
Method of Preparation: BS 1377 : Parts 1 & 2 : 1990
Date Tested: 17/082007
Sampled by: Client

Remarks:

SIEVE ANALYSIS		
BS Sieve (mm)	Passing (%)	Material Specification
125		
75		
63	100	
50	97	
37.5	94	
28	85	
20	67	
14	48	
10	34	
6.3	20	
5.0	16	
3.35	12	
2.00	8	
1.18	5	
0.600	4	
0.425	4	
0.300	4	
0.212	3	
0.150	1	
0.063	0	



Certified that the Particle Size Distribution was determined in accordance with BS 1377-2 : 1990, Method 9.2

Signed _____ K D Baah - Section Manager
for and on behalf of Bureau Veritas Laboratories

Date Reported: 21/8/2007

Form 510 Ver.4 11/97

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Telephone: +44 (0) 1622 776500
Facsimile: + 44 (0) 1622 687267
maidstone@uk.bureauveritas.com

BUREAU VERITAS

UKAS TESTING 0187

TEST REPORT

SIEVE ANALYSIS TEST REPORT

BS 1377-2 : 1990

Report No. MDM10097122

Client:	Bettridge Turner and Partners		
Address:	89 King St, Maidstone, Kent ME14 1BG		
Site:	Shoreham Port		
Location:	BH7 @ 9.0-9.5m	Lab. Ref.	10097122
Date Sampled:	1/6/2007	Client Ref.	1004519
Sampled from:	Ex Site	Mass (kg):	21.1

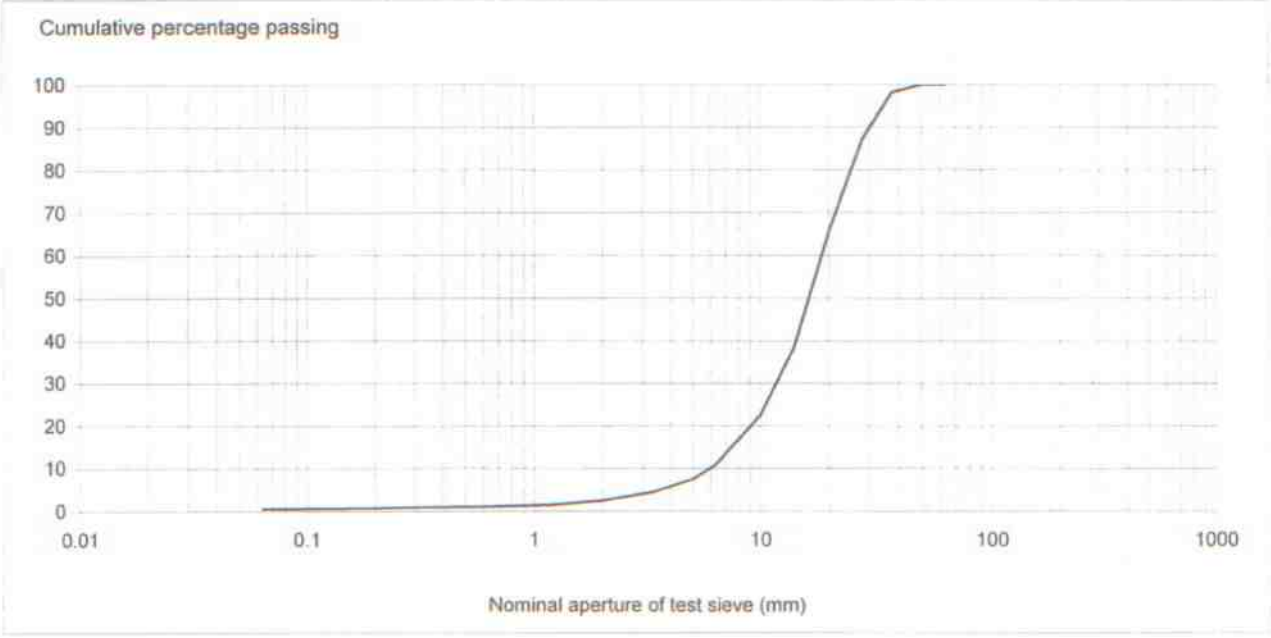
Visual Description: Brown GRAVEL

Material Specification: Not Known

Date received: 2/8/2007
Sample type: Bulk
Method of Preparation: BS 1377 : Parts 1 & 2 : 1990
Date Tested: 17/082007
Sampled by: Client

Remarks:

SIEVE ANALYSIS		
BS Sieve (mm)	Passing (%)	Material Specification
125		
75		
63		
50	100	
37.5	98	
28	87	
20	66	
14	38	
10	23	
6.3	11	
5.0	8	
3.35	5	
2.00	3	
1.18	2	
0.600	1	
0.425	1	
0.300	1	
0.212	1	
0.150	1	
0.063	1	



Certified that the Particle Size Distribution was determined in accordance with BS 1377-2 : 1990, Method 9.2

Signed K D Baah - Section Manager
for and on behalf of Bureau Veritas Laboratories

Date Reported: 21/8/2007

Form S10 Ver.4 11/97

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maidstone@uk.bureauveritas.com

BUREAU VERITAS

UKAS TESTING 0187

TEST REPORT

SIEVE ANALYSIS TEST REPORT

BS 1377-2 : 1990

Report No. MDM10097124

Client:	Bettridge Turner and Partners		
Address:	89 King St, Maidstone, Kent ME14 1BG		
Site:	Shoreham Port		
Location:	BH8 @ 3.0m	Lab. Ref.	10097124
Date Sampled:	1/6/2007	Client Ref.	1004519
Sampled from:	Ex Site	Mass (kg):	13.7

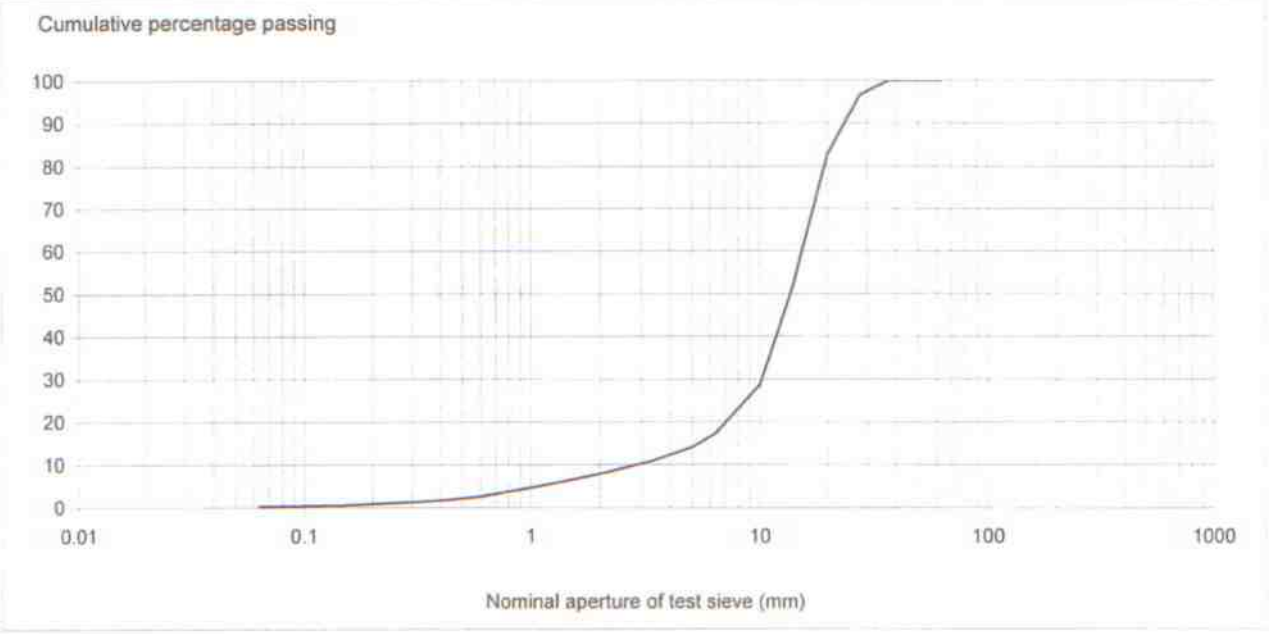
Visual Description: Brown slightly sandy GRAVEL

Material Specification: Not Known

Date received: 2/8/2007
Sample type: Bulk
Method of Preparation: BS 1377 : Parts 1 & 2 : 1990
Date Tested: 17/082007
Sampled by: Client

Remarks:

SIEVE ANALYSIS		
BS Sieve (mm)	Passing (%)	Material Specification
125		
75		
63		
50		
37.5	100	
28	97	
20	83	
14	52	
10	29	
6.3	17	
5.0	14	
3.35	11	
2.00	8	
1.18	5	
0.600	3	
0.425	2	
0.300	1	
0.212	1	
0.150	1	
0.063	0	



Certified that the Particle Size Distribution was determined in accordance with BS 1377-2 : 1990, Method 9.2

Signed _____ K D Baah - Section Manager
for and on behalf of Bureau Veritas Laboratories

Date Reported: 21/8/2007

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maidstone@uk.bureauveritas.com

BUREAU VERITAS

UKAS TESTING 0187

TEST REPORT

SIEVE ANALYSIS TEST REPORT

BS 1377-2 : 1990

Report No. MDM10097118

Client:	Bettridge Turner and Partners		
Address:	89 King St, Maidstone, Kent ME14 1BG		
Site:	Shoreham Port		
Location:	BH9 @ 7.5m	Lab. Ref.	10097118
Date Sampled:	1/6/2007	Client Ref.	1004519
Sampled from:	Ex Site	Mass (kg):	17.2

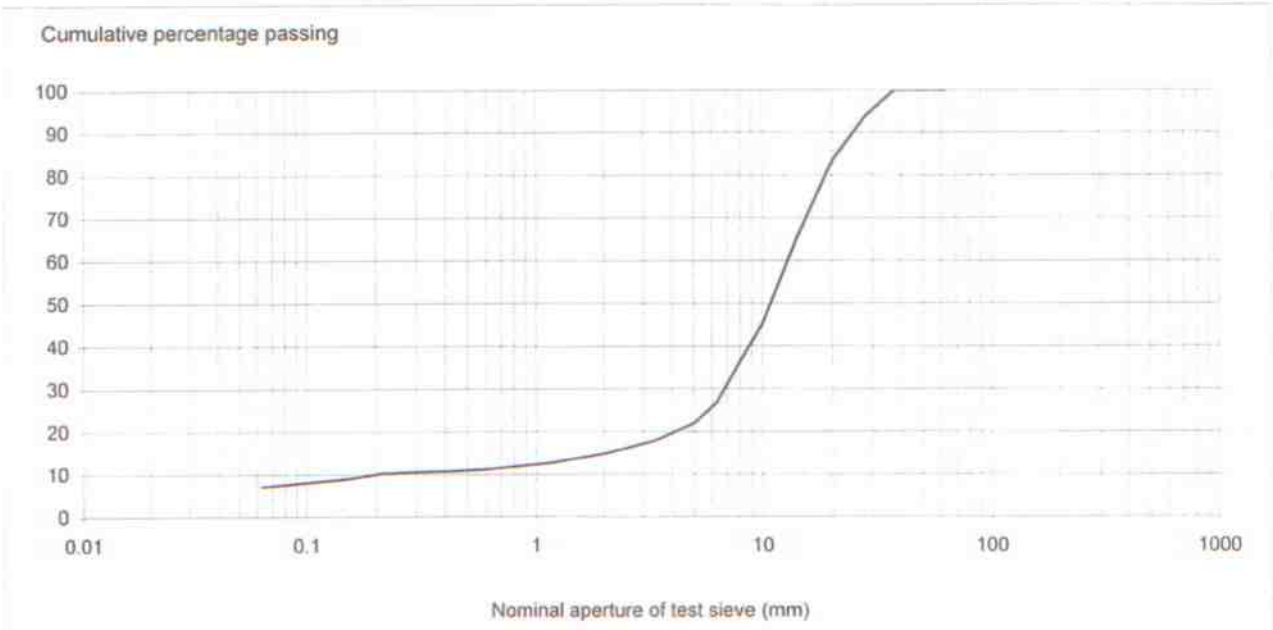
Visual Description: Brown/grey clayey GRAVEL

Material Specification: Not Known

Date received: 2/8/2007
Sample type: Bulk
Method of Preparation: BS 1377 : Parts 1 & 2 : 1990
Date Tested: 17/082007
Sampled by: Client

Remarks:

SIEVE ANALYSIS		
BS Sieve (mm)	Passing (%)	Material Specification
125		
75		
63		
50		
37.5	100	
28	94	
20	83	
14	65	
10	45	
6.3	27	
5.0	22	
3.35	18	
2.00	15	
1.18	13	
0.600	11	
0.425	11	
0.300	11	
0.212	10	
0.150	9	
0.063	7	



Certified that the Particle Size Distribution was determined in accordance with BS 1377-2 : 1990, Method 9.2

Signed _____ K D Baah - Section Manager
for and on behalf of Bureau Veritas Laboratories

Date Reported: 21/8/2007

Form S10 Ver.4 11/97

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BUREAU VERITAS

UKAS TESTING 0187

TEST REPORT

SIEVE ANALYSIS TEST REPORT

BS 1377-2 : 1990

Report No. MDM10097119

Client:	Bettridge Turner and Partners		
Address:	89 King St, Maidstone, Kent ME14 1BG		
Site:	Shoreham Port		
Location:	BH9 @ 10.0m	Lab. Ref.	10097119
Date Sampled:	1/6/2007	Client Ref.	1004519
Sampled from:	Ex Site	Mass (kg):	18.9

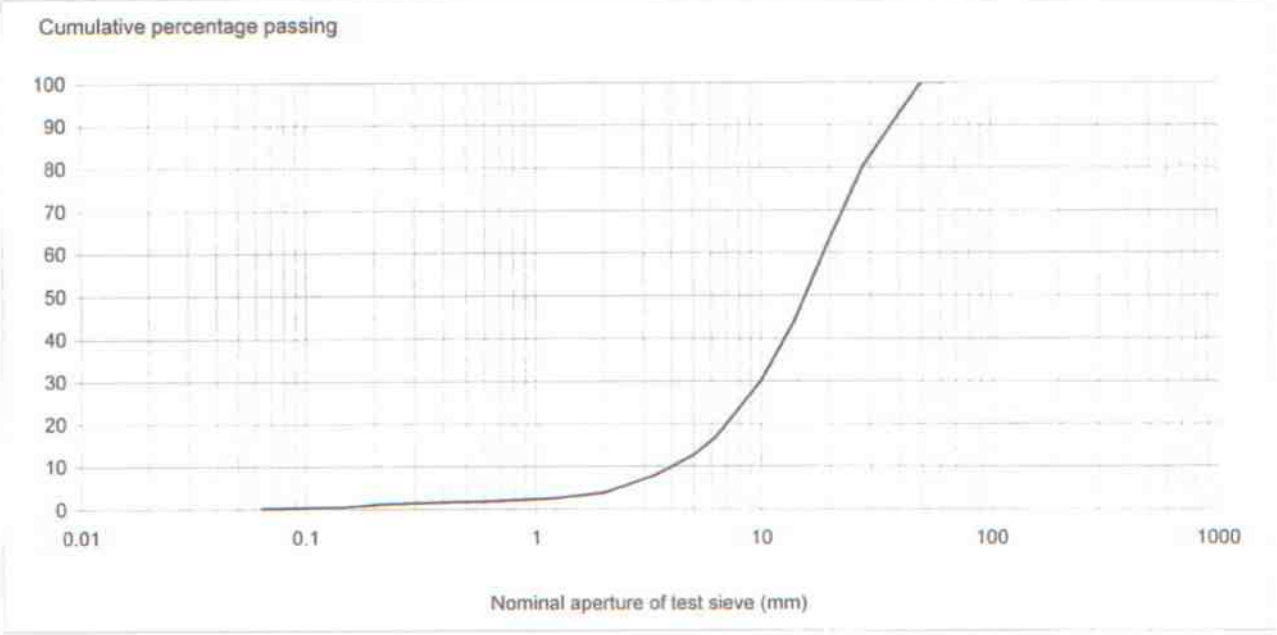
Visual Description: Brown GRAVEL

Material Specification: Not Known

Date received:	2/8/2007
Sample type:	Bulk
Method of Preparation:	BS 1377 : Parts 1 & 2 : 1990
Date Tested:	17/082007
Sampled by:	Client

Remarks:

SIEVE ANALYSIS		
BS Sieve (mm)	Passing (%)	Material Specification
125		
75		
63		
50	100	
37.5	91	
28	81	
20	63	
14	44	
10	30	
6.3	17	
5.0	13	
3.35	8	
2.00	4	
1.18	3	
0.600	2	
0.425	2	
0.300	2	
0.212	1	
0.150	1	
0.063	0	



Certified that the Particle Size Distribution was determined in accordance with BS 1377-2 : 1990, Method 9.2

Signed _____ K D Baah - Section Manager
for and on behalf of Bureau Veritas Laboratories

Date Reported: 21/8/2007

Form S10 Ver 4 11/97

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APPENDIX C

Waste Classification Assessments

APPENDIX C – WASTE CLASSIFICATION

1. General

1.1 Bureau Veritas was commissioned by Bettridge Turner & Partners on behalf of John Parker and Son Ltd to undertake a Waste Classification assessment as part of a geotechnical Investigation at Fishersgate, Port of Shoreham in Shoreham, West Sussex. It is understood that the proposed works will involve the removal of material that will not be greater than 3000m^3 to facilitate the future redevelopment of the site. The investigation was undertaken in accordance with the Bureau Veritas proposal dated 23rd April 2007 and revised 21st June 2007.

2. Background

2.1 Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste type. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

2.2 Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not, i.e. the hazard assessment.

2.3 Certain contaminants (e.g. asbestos, diesel) have prescribed concentration thresholds that if breached will render the material hazardous waste. Thus, in the first instance the concentrations of plausible contaminants within the soil should be identified. Results of this assessment should help to determine the likely fate of the soil (re-use elsewhere or disposal) and whether or not the soil is hazardous or non-hazardous.

2.4 Dependent on the results of the hazard assessment advise can be given as to the likely options available for a given waste and any further testing or assessment that may be required.

2.5 Hazardous waste will likely require landfilling (subject to 'passing' further WAC testing) or off site treatment; non hazardous waste may be suitable for re-use rather than landfilling in which case reduced or no further testing is likely to be required.

3. Waste Classification Assessment

3.1 A brief summary of the findings from the investigations undertaken at the site are presented below.

3.2 An overview of the available Landmark environmental data (Enviroscreen) was undertaken as part of this summary. This data indicates the previous land use and development of the site and

details of the surrounding land up to 0.1km radius, including information on residential or commercial/industrial land use.

3.3 From the historical land use section it has been established that the site has potentially been used for electricity production, weapons & ammunition and an unspecified factory or works. Off site there have been numerous potentially contaminative activities including various mineral (predominantly sand and gravels) extractions, electrical substations and a Power Station located east and west of the site.

3.4 There are no recorded contemporary trade entries identified in the Enviroscreen report within 0.1km of the site.

3.5 Contaminants from these activities may include poly aromatic hydrocarbons (PAH), polychlorinated biphenyls, heavy metals, asbestos, volatile organic compounds (VOCs), Total Petroleum Hydrocarbons (TPH), asbestos, total phenols and total cyanide. The suite of contaminants analysed for was based on the current and historic land uses and Contaminated Land Report CLR 8: Potential contaminants for the assessment of contamination in land.

3.6 The Enviroscreen data are attached to this report at the rear of Appendix C.

3.7 An Environmental Scientist attended site at various times corresponding to when the cable percussion driller was in the Made Ground. The visits were carried out between 15th June and 30th July 2007 to obtain samples. Eight Made Ground samples and two Clay samples were recovered from the cable percussion exploratory locations. The following table corresponds sample numbers with borehole locations;

Sample Number	Borehole Location
Sample 1	BH8
Sample 2	BH7 – Made Ground
Sample 3	BH7 – Clay
Sample 4	BH9
Sample 5	BH6 – Made Ground
Sample 6	BH6 – Clay
Sample 7	BH1
Sample 8	BH5
Sample 9	BH4
Sample 10	BH2

Detailed borehole logs are included as Appendix A.

3.8 Composite soil samples of the Made Ground were collected from boreholes BH1, BH2, BH4, BH5, BH6, BH7, BH8 and BH9 and natural Clay samples were collected from BH6 and BH7. All samples were placed in laboratory prepared vessels with a minimum of headspace and labelled accordingly. The samples were then placed in cool boxes with ice packs and despatched to a UKAS and MCERTs accredited laboratory. Four representative samples were scheduled for a scope of testing that was based on the site and surrounding land uses over time as discussed above. The laboratory results for this site are attached to this report (ref:GLC0010301 and GLC0010730/2).

3.9 The following determinants were all reported below their respective laboratory method detection limit in all samples; selenium, speciated polyaromatic hydrocarbons, diesel range organics, gasoline range organics, PCB, speciated volatile organic compounds total cyanide, total phenols and asbestos. Of the contaminants detected, there are no significant contaminant concentrations of concern within any of the samples analysed in respect of waste classification. The hazard assessment was undertaken using the 'Waste Soils Characterisation Assessment Tool' (CATWASTEsoil). From this assessment all samples obtained from the boreholes can be classified as non hazardous waste. The organic matter content was reported above 3% (maximum limit for inert waste) in five of the ten samples. The highest organic matter was noted as 6.2% in Sample 6 obtained from the Clay in BH6. Given the elevated organic content in five of the ten samples and the manner in which the material will arise (pile arisings) it is unlikely that any of the material will be classified as inert. Waste Acceptance Criteria testing was undertaken on Samples 2, 4, 6 and 7. The results from this analysis confirmed that this material would not be classified as inert given the elevated dissolved organic carbon, chromium, nickel, zinc and total sulphate (SO^4) identified in Sample 6.

3.10 Therefore with respect to waste classification, the waste to be removed from site is likely to be suitable for disposal at a site exempt from the requirement to hold a waste management licence or a PPC non-hazardous landfill.

3.11 A copy of this report and results should be sent to the proposed receiving site operator prior to any removal of material to the site in question.