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In March CONSULTING ON CONSULTING ON CONSISTENCE OF CONSISTENCE OF CONSULTING OF CONSULTING OF CONSISTENCE OF C their Client Bantry Bay arbour Commissioners to carry out a marine ground in estigation at Bantry Inner arbour Co Cork The purpose o the geotechnical ground in estigation as to obtain sufficient geotechnical information in order to assess the suitability on the harbour or urther de elopment□

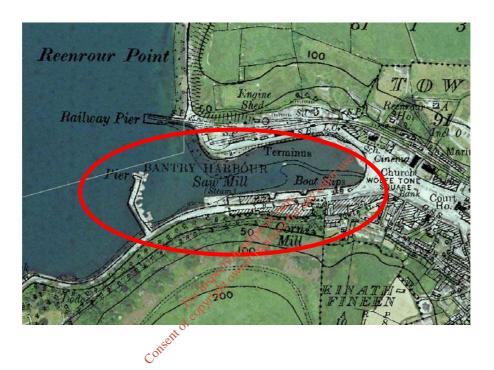
The in estigation hich as specified by RPS Consulting injunction comprised o iteen IIIInumber cable percussion boreholes thirteen IIInumber rotary cored boreholes sixteen III number dynamic probes bathymetric sur eying all associated sampling laboratory OorkOmarine sediment analysis and Cactual reportingOas detailed in the contract specification and bill o uantities The final scope o orks as completed is detailed in Section ____The field_ork _as carried out bet_een _uly and August ____ For inspection purpose only is in the purpose of th only any

This report PC Rp resents the actual records on the field ork and laboratory testing lith respect to the ground in estigation contract undertaken for the Bantry Inner □arbour□ A separate bathymetric sur ey and sub-bottom pro illing o the bedrock □as undertaken as outlined in report P - August - presented in APPENDIX B

□ T□E SITE

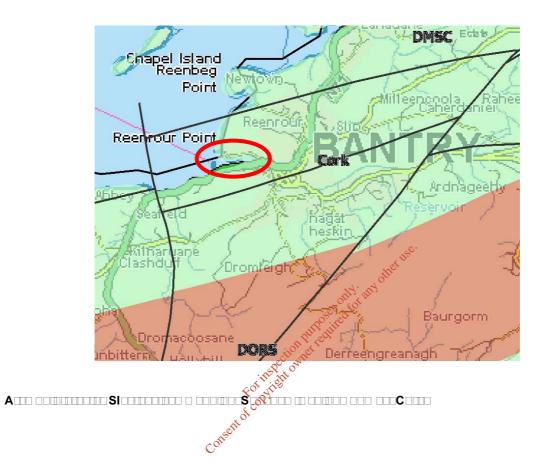
SITE LOCATION DESCRIPTION

The site as ithin Bantry Inner arbour Co Cork located bet een the existing Pier on the N Cork to Killarney Road and the Rail ay Pier on the arbour Road The site as tidal ith ater depths arying from M S to - Im to Chart atum A significant portion o the site as subject to periodic etting and drying go erned by tidal lefels

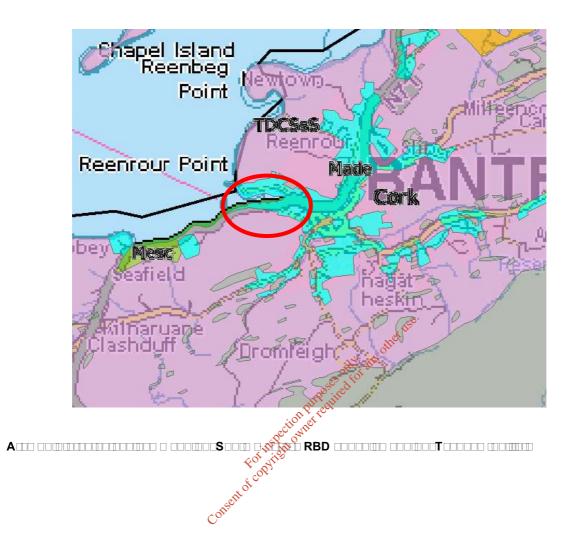




The Geological Sur ey o Ireland mapping Sheet indicated that the geology o the area as characterised by the Reenagough Member KNrg described as massi e and faser bedded SAN STON



O erburden deposits ere expected to consist o made ground made and marine esturine silts and clays Mesc as indicated by subsoil mapping Teagasc



The field ork as carried out in general accordance ith BS COME Code o Practice or Site In estigation and Part OBS COME Method o Tests or Soil or Cifil ngineering Purposes *in situ* Tests etails o the eluipment and plant used are presented belo. The plant as operated from a fack up barge A number o locations ere accessible at lo tide and ere undertaken on land

0				
Cable percussion	ando 🗆		NA	Standard Penetration Test
Boring				□alues and bulk samples
, C				obtained
			et use.	
Rotary Boring	□eltaBase □□□	Symmetrex	Compressed	Standard Penetration Test
			air-mist	□alues and core obtained
		□oublestined core		
		barree mm nominal		
		, drov		
□ynamic Probes	Arch⊡ay Competitor ^{Conse}	[™] □□mm	NA	Super hea⊡y⊡⊡⊡ikg drop
	Competitor			□eight

The exploration locations □ere selected by RPS□and set out rom existing reatures and the co-ordinates pro□ded □

EXPLORATOR OLES

The exploratory holes as completed during the ground in ⊡estigation are listed in the lollo ing table □

T			
Cable Tool Boreholes	□No□	iiim to iiiim	B and B
Cable Tool and Rotary Cored Boreholes	□□No□	□□□m to □□□□m	B B B B B B B B B B B B B B B B B B B
□ynamic Probes	□□No	□□□m to □□□m	P P
		offeries.	

SU AR O EXPLORATOR OLES

The exploration records are presented in **APPENDIX A** and **APPENDIX D** and should be read in conunction ith the included key sheet the records prolide descriptions based on engineers geologists descriptions on the material encountered in accordance with BS and the statement of the indext of the during the indext of the statement of the stat

Ground ater as recorded hen encountered during boring Ground ater leas ere monitored or a period o minutes noting any changes that har may occured

IN SITU TESTIN

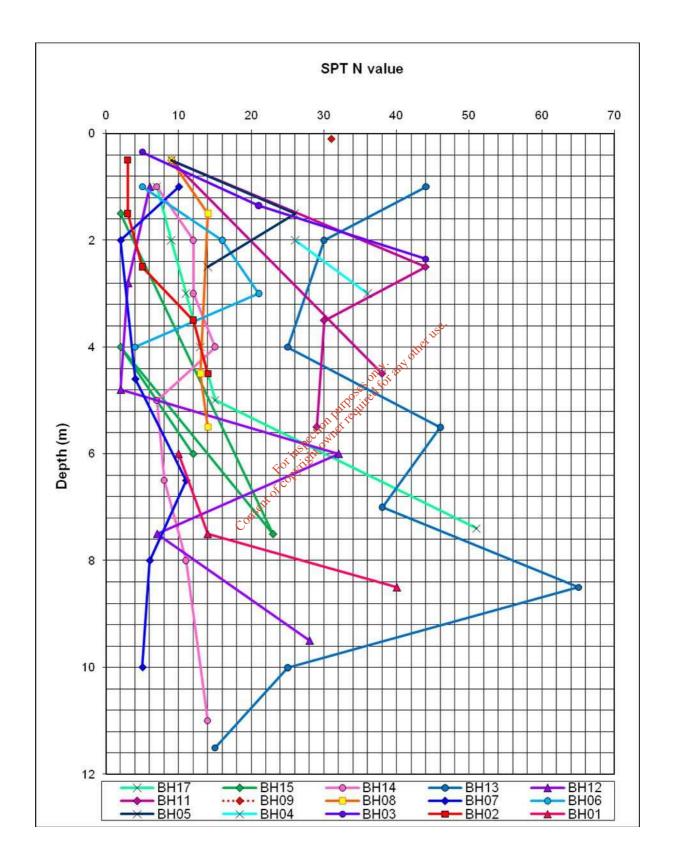
Standard Penetration Test N alues ere carried out in boreholes at mm to mm spacing The results are presented in the exploration records **APPENDIX A** and summarised belo

□ynamic probing □as undertaken recording the blo□s per □□□mm penetration□A □CP S□□ super hea□y rig □as used□

Grad samples □ere taken o□the harbour□marine sediment or en□ironmental assessment and analysis□

T		R
Standard Penetration Test N	No	N ranging From to to
⊡alues		□No□SPTIC and □No□SPT IS□
Bathymetric □ Sub-bottom Proiîle Sur⊡ey	-	Report re P
Grab Samples	□□No	Taken at □IIm depth belo bed le el □
□ynamic Probing	□□No	
		Blo stance for an mm to an mm
	Consent of copy	Tection net

SU AR O IN SITU TESTIN



The distribution o SPT N alues ith depth belo sea bed is presented belo

LABORATOR TESTIN \square

All samples and core Cork examined and logged in accordance ith BS III Testing as scheduled by Priority Geotechnical and appro⊡ed by the □ngineer□Testing □as carried out by PGL in accordance ith BS and Methods o test or soils or ci il engineering purposes and the ISRM suggested methods or rock characterisation testing and monitoring Triaxial testing and oedometer consolidation testing as undertaken by GDO Laboratory Testing Ser ices UK Ltd in accordance ith the rele ant BS

Specialist en ironmental analysis as undertaken on the marine sediment at UK n ironmental Agency National Laboratory Ser ice The data is presented in APPENDIX C

A summary o tests are detailed belo and presented in APPENDIX C anyotherus

SOIL TESTIN

		, SOL
T	N	
Natural Moisture Content	Rot	Range III to IIII
	Kot copy	
Atterberg Limit	self II	Li Limit III to IIII
C ^o		Plastic Limit to including NP non plastic soils
		Plasticity Index to
Grading analysis		□No⊡hydrometer analysis □as undertaken
Loss on Ignition		
Organic Content		
Undrained Triaxial Compression		C □ □kPa □ □□kPa □ □□ery soાt to □irm□
Shear Box		C □ □kPa to □□kPa
		Φ \Box \Box \Box \Box \Box
Triaxial Compression - CU		C □ □kPa to □kPa
maxial compression - CO		
		Φ \square \square to \square
Oedometer consolidation		-
Marine Sediment Analysis	-	cl□□□□ o□Speciնcation outlines scope o⊡analysis
L		

SU AR O LABORATOR TESTIN UNDERTA EN ON O ERBURDEN SOILS

SU AR O LABORATOR TESTIN UNDERTA EN ON ROC

ROC				
T	N	R		
Point Load Index		MPa to MPa		
Uncontined Uniaxial Compressice Strength UCS		MPa to MPa		

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□ **ROUND CONDITIONS**

The site as characterised by marine estuarine deposits o slightly sandy CLA SILT slightly sandy slightly gracelly organic SILT silty gracelly SAN clayey sandy GRA L silty sandy GRA L and sandy GRA L to depths o sea bed lecel bsl

P AT as encountered at B at a depth o make to make by a ball

Based on the Standard Penetration Test SPT N alues the cohesi e soils ere o ariable strength and described as ery soft to ery stimular ing N alues ranging from to entry to granular depoits ere described as ery loose to dense ith N alues to entry to entry to entry to the strength N alues are to entry to the strength N alues are described as ery loose to dense to the strength N alues to entry to entry the strength N alues are to entry to entry the strength N alues are to entry to entry the strength N alues to entry to entry the strength N alues entry to entry the strength N alues to entry the strength N alues entry entry the

MU STON as encountered at depths o membership by the strength o membership and the strength o membership and the strength o membership and Point Load Indices o membership and

Interbedded MU STON and SAN STON as encountered at depths o m bsl to m bsl and as described as being moderately to the strong haing an Unconfined Compressile Strength o MPa and Point Logon Indices o MPa to MPa to MPa

Interbedded MU STON and LIM STON as encountered at depths o m bsl to bsl and as described as being moderately eak to ery strong Uncononed Compressive Strengths o MPa to MPa and Point Load Indices o MPa to MPa

SILTSTON as encountered at depths o being ballion bollion bollion bollion bollion bollion as described as being ballion to strong halling an Unconfined Compressile Strength o MPa and Point Load Indices o MPa to MPa

Interbedded SILTSTON AN SAN STON as encountered at depths o m bsl to bsl and as described as being moderately eak to ery strong haing Unconfined Compressile Strengths o MPa to MPa and Point Load Indices o MPa to MPa

LIM STON as encountered at depths o model by bole and as described as being moderately strong to strong haing Unconfined Compressile Strengths o MPa to MPa to MPa and Point Load Indices o MPa to MPa

SIIIIII EIIIIII			
Slightly sandy slightly gra⊡elly CLA□	□m to □m	B B B B B B B B B B B B B B B B B B B	
Slightly sandy slightly gra⊡elly SILT	⊡≣m to □□□≣m	B. B	
Slightly sandy slightly gra⊡elly organic SILT	TITEM to TAMAN	B B B B B B B B B B B B B B B B B B B	
Silty ⊡ery gra⊡elly SAN⊡	mto	B B B B B B B and B B	
Clayey sandy GRA⊡□L	strispectant for the text	B and B	
Slightly silty SAN AN GRADL	o× □□□m	B	
Silty ⊡ery sandy GRA⊡L	□□□□m to □□□m	B B B B B B B B B B B B B B B B B B B	
Sandy GRA⊡L	□m to □m	B	
P□AT	□□□m	B	
COBBL S	□□Im to □□Im	B	
MU□STON□	□□□m to □□□□m	BBBBBand B	
MU⊡STON⊡ and SAN⊡STON⊡	□□□m to □□□m	B and B	
MU□STON□ and LIM□STON□	□□m	BII	

SU AR O ROUND CONDITIONS

Stratum Encountered	Range of Depths (m)	Locations
SILTSTON	□□□□m to □□□□m	BBBBBand B
SILTSTON and SAN STON	□□□□m to □□□□1m	B B B B B B B B B A A A B B B B B B B B
SILTSTON SAN STON and	m	B
	□□Im to □□□IIIm	BBBand B

the ground conditions and should be relieled in conlunction lith the sub-bottom profiling

 dra lings presented in APPENDIX B

 5.1 GROUNDWATER

 Ground later las encountered durings protection in the relief of any other re

prolided and presented graphically on the logs presented in APPENDIX A and summarised Consent of as ollo⊡s⊡

Location	Groundwater level, m bgl	Groundwater details
B		-

Under the scope o reporting it as reluired to determine the magnitude o settlements expected It is proposed to place on o rock ill at an imposed loading o kPa Based on the oedometer consolidation test data the follo ing settlements have been calculated

 $\Delta h \Box h x \Delta e \Box \Box e_o \Box$

 \Box here h is the thickness o \Box the strata

e is the initial Doids ratio and

 Δe is the change in \Box oids ratio \Box

		B	B	B	B	B
eo						
	m				v. ovotili	
	m					
e	□ at □□□kPa			NO THE		
∆e	%					
t	m		C Se	CL WITE		
Δt	mm		III III			
TOTAL A	∖t⊡mm	E ST.		T SQL		
C	m□yr		. de IIII			
t _{dr}	m		n ^{ser}			
t	yr					

t $_{dr}$ is the drainage height \Box here GRA \Box L layer underlies the strata the strata thickness and drainage height has been hal \Box d

		B	B	B	B	B	B
eo							
	m						
	m						
e	□ at □□□kPa						
Δe	%						
t	m						
Δt	mm						
TOTAL /	TOTAL ∆t⊡mm						
C	m□yr						
t _{dr}	m						
t⊡	yr						

		B	B	B	B
eo					
	m				Met 115
	m				any of
е	□ at □□□kPa			Se dic	
Δe	%			DIRE CLIP	
t	m		C	MIET D	
Δt	mm		A A PLAN		
TOTAL A	∖t⊡mm		FORM		
C	m□ÿr		nt of and		
t _{dr}	m	Cours			
t	yr				

It can be seen that primary settlement can be expected to range rom ___mm to ___mm This does not include or settlement o the loose GRA L deposits o e er settlement associated ith these layers is expected to be minimal Settlement o the loose silty SAN is expected to be o the order ___mm

The time for $\Box\Box\Box$ consolidation is expected to be \Box aried \Box

[□] Settlement o silty SAN □ □ mm B □ □

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- The site as characteriled by lery solt to lery stillslightly sandy slightly CLA SILT
 ery loose to dense silty lery gralelly SAN and clayey silty lery sandy GRA L to depths o local belo existing sea bed le el bsl
- eak to moderately strong MU STON moderately eak to strong interbedded
 MU STON and SAN STON moderately eak to erry strong interbedded
 MU STON and LIM STON eak to strong SILTSTON moderately eak to
 erry strong interbedded SILTSTON and SAN STON and moderately strong to
 strong LIM STON ere encountered from depths o moderately black
- Ground ater as encountered at a le el o m bsl
- A bathymetric and sub-botton profiling sur ey as undertaken. The interpretation o the data is presented in **APPENDIX B**
- □ Laboratory testing □as undertaken to characterise the soil and rock encountered □
- Settlement under the proposed reference ill is expected to be bet en mm and aried across the site The time for consolidation as highly ariable ith significant time associated ith some of the organic sediment up to years Conserver
- □ Marine sediment analysis □as undertaken the data is presented in APPENDIX C □
- □ A bathymetric sur ey as completed as part o the orks and outlines the rock pro ile Geological longitudinal sections hare been produced from the borehole data to urther characterise the site

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APPENDIX A

EXPLORATOR OLE RECORDS

Key to □xploration □ole Records

Key

Cable Tool Boreholes

B and B

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□ynamic Probes□□CP IS□□

P P And P And And □P□□

B B B B and B B

KEY TO SYMBOLS ON EXPLORATORY HOLE RECORDS

All linear dimensions are in metres or millimetres

Drillers Description

Easily crumbled

DESCRIPTIONS

Friable

SAMPLES U() Undisturbed 102mm diameter sample, () denotes number of blows to drive sampler F- not recovered, P - partially recovered U()F, U()P U38 Undisturbed 38mm diameter sample Piston sample, F - not recovered, P - partially recovered P(F), (P)В Bulk sample - disturbed D Jar Sample - disturbed W Water Sample CBR California Bearing Ratio mould sample CS Chemical Sample for Contamination Analysis Standard Penetration Test S lump sample from split sampler. SPTLS CORE RECOVERY AND ROCK QUALITY TCR Total Core Recovery (% of Core Run) Solid Core Recovery (length of core having at least one full diameter as % of core run) SCR RQD Rock Quality Designation (length of solid core greater than 100mm as % of core run) Where there is insufficient space for the TCR, SCR and RQD, the results may be found in the remarks column Fracture Spacing in mm (Minimum/Average/Maximum) NI - non intact, NR - no recovery AZCL Assumed Zone of Core Loss let USe.

GROUNDWATER

<u>V</u>	Groundwater strike
Date/Water	Groundwater level after standing period of Date of shift (day/month)/Depth to work at analysis
	Date of shift (day/month)/Depth to water at end of previous shift shown above the date and depth to water at beginning of shift given below the date
INSITU TESTING	in the states
S	Standard Penetration Test should harrel sampler

0	Standard Penetration Test Seplit barrel sampler
C	Standard Penetration Fest- solid 60° cone
SW	Self Weight Penetration
IVp, HVp (R)	In Situ Vane Test, Hand Vane Test (R) demonstrates remoulded strength
K(F),(C),(R),(P)	Permeability Test
HP	Hand Penetrometer Test

MEASURED PROPERTIES

N Standard Penetration Test - blows required to drive 300mm after seating x/y Denotes x blows for y mm within the Standard Penetration Test x*/y Denotes x blows for y mm within the Standard Penetration Test cu Undrained Shear Strength (kN/m²) CBR Callfornia Bearing Ratio	g drive
---	---------

ROTARY DRILLING SIZES

index Letter	Nominal Diar	neter (mm)
	Borehole	Core
	75	54
	99	76
	120	92
3	. 146	113



Symbols used on Exploratory Hole Records

Key

PRIORI GEOTECHI				Priority Geoter		calite		Drilled By G□ □AK Logged By AM ISC	E	ehole No BH01 eet o o
Pro ect N	ame:			Pro ect No	0.		Co-ords:		Ho	le Type
Bantry Ba	y Inner ⊡a	rbour		PC] - []]]]]N		le Rotary
Client: Ba	antry Bay	□arbou	r Commissioners	Dates:]		Level: - m .			Scale
ell □ □ ater ckɪll Strikes	San	nples	In Situ Testing	Casing	□ Le⊡el	□epth	St	atum Description	1	Legend
	□epth m□	Type SPT	Results	lush	im AO⊡	⊡m⊓				1*X1 * * jc 2 _ 1
		B SPTLS S U SPT B	Diols				ith some cobbles coarse⊡Gra⊺el is i subangular⊡Cobble 	oonisilty sandy GRA IL and shells Sand is line to ne to coarse angular to as are Imm x Imm oonisilty sandy GRA IL gments and lenses of bro	n□	
		SPTLS U SPT SPTLS	Diols No miner				Sand is fine to coal coarse angular to the model of the second second second GRA L atth occa	slightly grarelly silt ser Grarel is line to subangular ong organic odour noted grey ery sandy ery silty sional cobbles and many s ine to coarse Grarel is	hell	
		B U SPT B	blos				ine to coarse⊡ange ⊡ery sott⊡grey⊡slig	ular to subangular⊡	lis	******* ***** ******* ******** ********
		SPTLS U SPT B SPTLS	blo:s				ith some cobbles Sand is the to coar coarse angular to x mm⊡	htly sandy gra⊡elly SILT and many shell [ragments] se⊡Gra⊡el is tine to subrounded⊡Cobbles are ⊡		× 36. × 200 × 36. × 200 × 56.
		U	⊡blo⊡s	PO.		purperiodi net	□ery sott_bro□n_g organic SILT_Gra ine to medium Bro□n_grey_slight organic SILT □ith s	rey⊡slightly gra⊡elly el is angular to subangular y sandy slightly gra⊡elly ome shell ∎agments⊡Sanc el is ine to coarse⊡	·	
		SPT B SPTLS		Consent of co			⊡ery sandy organic Iragments⊡Gra⊡el i to subangular⊡	ense⊡bro⊡n⊡grey⊡ery silt GRA⊡L ⊡th some small s lîne to coarse⊡angular y gra⊡elly organic SILT □		
		B U SPT SPTLS			- = = = = = = = = = = = = = = = = = = =		SILT ith many len	slightly gra elly organic ses o sandy gra el Sand i el is tine to coarse	s	
		B SPT □	N				GRA□□L □ith som to coarse Gra el is	/ ery sandy ery silty e shell ragments Sand is fine to coarse angular to es are mmm x mmm	ine	
		<u> </u>					Co	ontinued next sheet	-	X
oter roundwa itruck I		Type	Results ealed Comment	Casing Hole Info ole opth mm	rmatio	□iamete mm	er Casing Depth	hiselling: epths īm⊡ Time īhh ī⊡ to □īīī □	mm□	Tool Chisel
emarks:	due to obs	struction	Cable percussion termina Borehole terminated at re	e⊡uired depth⊡		Shift D	Pata: Ground⊡ater 	Shilt ddimmiyyyg Casing	Sta	emarks art o⊡Boreł d o⊡Boreh

∃ PRIOR GEOTECH	NICAL				-	Tel ax		eotechnic	alīte		Drilled By G □ AK Logged By AM ISC	B She	ehole No 5 H01 et □o⊡
Pro ect N		rhour					ect No	D .		Co-ords:	10000 N		le Type eïRotary
	ay Inner ⊡ai					Date							
Client: B	antry Bay	arbou	ur Com	nmissio	oners		,.]		Level: - m AO]		
ell □ □ ater ckɪîllStrikes	Sam	nples	In Sit	u Test	ting		Casing [Le⊡el	□epth	Stratu	n Description		Legend
CKIIISuikes		Туре		Resi			lush				-		
				ŏr ⊡mn				-		Chiselled rom Im to eak to moderately striinterlaminated ine grai SILTSTON eatherin Occasional clay inilling ractures xtremely cl dip to degrees surfaces	ong_grey ned SAN STON and ng Slightly eathered o ractures osely spaced racture ith planar smooth		
					NImm r ⊡mm a ⊡mm r	a⊡g				□□□m - □□□m□ ract	ure index - □□□		
»».								-		⊡nd o⊡Bor	ehole at 💷 m		
						-nh ^e	For	aspection Stright own	purpose per real	onty: any offer use.			
						C							
in ater roundwa truck	ater:	TCR ter S	SCR	R	□racture space	Hol		Le el rmatior Casing	⊡iame nm	er Casing □epth □epth	elling: s m Time thr to		Tool Chisel
emarks: uipment		truction	□Boreho ando □□	ole termi	ion termina inated at re aBase □□□ nist ɪtush□	ted at uired o	⊡⊡m depth⊡	S	Shift I	Data: Ground⊡ater Shitt : ∰	a ddimmiyyyy⊡Casing d IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	depth Re Sta ⊡no	emarks rt o⊡Boreh d o⊡Boreho

			T	Priority Geote		cal⊡e		Drilled By G AK Logged By MC SC	B	nole No H02 t o ==
Pro ect N		whour		Pro ect N	0.		Co-ords:	N		e Type
-	y Inner ⊡a			Dates:						Rotary
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ell □ □ ater ktillStrikes		nples	In Situ Testing	Casing ⊡lush	□ Le⊡el īm AO □	□epth	Stra	tum Description		Legend
	□epth Im □	Туре	Results					e⊡black⊡ery silty ⊡ery		
		B					gra⊡elly SAN⊡ ⊡ith r	nany shell		
		SPT								XXX)
		□S						ilty ⊡ery sandy GRA⊡□L ments⊡Sand is tine to		××××
		в						e to medium⊡subrounded		× × ×
		U SPT	⊡blo⊡s N⊡⊡⊡⊡⊡⊡							× × ×
										×·×·×·
							Loose sandv GRA	□L □ith lenses o⊡grey□		××××
		в					gra elly clay and ma	ny shell ragments Sand i el is ine to medium	is	
		CPT					subrounded			
								tly silty ⊡ery sandy GRA⊡ ments⊡Sand is tine to	L	x × x.
		B CPT	N					e to medium subrounded		x × x
		CPT	\mathbf{N}				A USC.			x. X. X. X
							other			× × × ×
		в					Medium dense sand	ly GRA⊡L ⊡ith some she ine to coarse⊡Gra⊡el is	ell	
		CPT				-00 ⁵⁰	or ragments⊡Sand is tine to coarse⊡subar	ngular to subrounded⊡		
						Purpose Purpose Netroqu	×			
						net IIII	Sandy GRA	lenses o⊑grey⊑gra⊡elly c	lav	
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										x × x
		CPT	□□□ lõr □□m m□				Chiselled rom IIIm	tom or _ hours		
							SILTSTONine-gr	ained SAN STON and c casional ossils and calcil		
							□eins □ eathering S			
								ures up to ⊡mm think⊡		
							predominantly non-in	ntact⊡ractures dip ⊡ to nar smooth sur aces □		
								o reco⊡ery⊡		
								acture index - NI□		
							Cor	tinued next sheet		
□ ater	□epth Im □	Туре	Results	Casing		□epth			_	
oundwa ruck		ter S	ealed Comment	Hole Info □ole □epth			er Casing □epth □e	liselling: pths m⊡ Time thh		Tool
				m m		mm mm	iiiim iiii	to to	C	hisel
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APPENDIX B

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Bantry Inner □arbour Bathymetric □ Sub-bottom Pro îile Sur ⊡ey Report re P August

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Bantry Inner Harbour Bathymetric & Sub-bottom Profile Survey Report

August -6th 2009 PH9013 Consent of COPYIER OWNER

Client: Priority Geotechnical Ltd. Unit 12B Owenacurra Business Park Midleton, Co. Cork

Prepared By:

Hydrographic Surveys Ltd., The Cobbles, Crosshaven, Co. Cork.

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3.1 Bathymetric Results	
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Appendix One Equipment List and Specifications	
Appendix One Equipment List and Specifications List of Dra lings For inspection performance HS 3 Bathymetry HS 3 A Trac plot and Cross-section Location Plot	
HS 3 Bathymetry	Scale 1:
HS 3 A Trac plot and Cross-section Location Plot	Scale 1:
HS 3 B III Interpreted Sediment Thic Iness	Scale 1:
HS 3 C III Interpreted Roc Head levels CD	Scale 1:
HS 3 D Sub-bottom Cross-sections	Scale 1:

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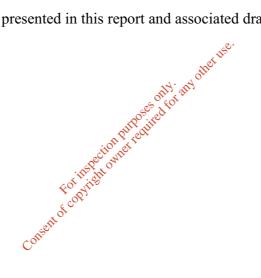
1. Introduction:

Hydrographic Surveys Ltd. was instructed by Priority Geotechnical Ltd, to undertake a bathymetric and sub-bottom profiling survey in Bantry Bay Inner Harbour. See drawing HS83_A/09 for survey line locations. The survey was undertaken on 6th August 2009.

The main objectives of the geophysical survey were:

- To determine bathymetric levels to Chart Datum.
- To determine the depth to rock and overburden thickness

Results of the survey are presented in this report and associated drawings



2. Methodology

Horizontal Control:

Horizontal control and grid was provided by DGPS using satellite broadcast corrections. The navigation unit used was the Trimble DGPS 132 model which provides sub-metre accuracy. The DGPS position was interfaced and logged to Hypack survey software which provides real-time line guidance and continuous logging of position.

The weather conditions were good throughout the acquisition period. Health and safety standards were adhered to at all times.

2.2 Vertical Datum

only any other us Datum for the survey is Chart Datum as specified by the Client.

Tides were measured at Bantry Harbour using a Valeport 740 model vented tide gauge. This was installed on the pier in Banty and recorded tidal height every 5 minutes for the duration of the survey. The tidal height results were reduced to Chart datum using a TBM of +4.31m CD.

2.3 Bathymetric Survey

The ODOM hydrotrac digital echo sounder, used in high frequency mode, was used to record seabed levels in both digital and analogue form. The echosounder has a resolution of 0.01m and is calibrated on site by the bar-check method. The sounder was also interfaced into the Hypack 2008 survey software thereby providing a digital record with related position fixes.

Survey lines were undertaken along predetermined survey lines as specified by the client in drawing IBM0188_T_02_REVA.dwg.

2.4 Sub-bottom Profile Survey

The sub-bottom profiling survey was carried out using the Tritech Seanet System-SeaKing Sub-bottom Profiler. The SeaKing System utilizes CHIRP pulses as it wave source.

Positioning and line guidance were provided using the trimble DGPS unit and Hypack survey software as outlined in sections 2.1 above.

The bathymetric and sub-bottom profile surveys were undertaken concurrently.

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3. Results

3.1 Bathymetric Result

The results from the bathymetric survey are plotted in Drawing HS: 83/09. Contours have been added at 0.5m interval.

From the results it is clear the seabed deepens north and west of the pier outside the harbour. As one would expect much of the inner harbour is very shallow, lying above CD and dries out at Low Tide. The -1.5m contour covers the entire eastern section of the harbour. The southern survey line adjacent to the southern bank/wall ranges from -0.3m to -1.9 m CD. The northern bank ranges from 0m to -1.7 m CD with a raised embankment extending out towards the centre of the harbour at the corner adjacent to the north section of XS9 (See HS: 83 A/09).

3.2 Sub-bottom Profiling Results Constant on the client above As requested by the client, survey line track plots with interpreted depth of sediment above rock level have been plotted in drawing HS: 83 B/09. Due to a number of possible reasons a reflector representing rockhead was not identified in all of the survey lines. This may be due to reduced signal penetration and/or noise in some areas of the survey, signal absorption in the dense clay/peat layers or insufficient property contrast between two layers.

Where rockhead has not been identified, the depth of the deepest interpreted reflector has been plotted on Drawing HS: 83 B/09.

The interpreted rockhead levels were reduced to Chart Datum and plotted on Drawing HS: 83 C/09. It appears rock is closest to the surface along the eastern boundary of the

survey. In the rest of the harbour, where rock was interpreted it generally lies 4.1m-7.1m below the seabed surface. Rock levels appear to deepen moving towards the mouth and outside the harbour lying upto 11.7m below the seabed surface.

As requested, the results of this survey are also presented in cross-section form in chart: HS: 83_D/09. Sub-bottom profile interpretation was undertaken with the aid of Borehole information provided by Priority Geotechnical ltd. Logs were provided for the following Boreholes: BH05, BH08, BH09, BH10 and BH15. Boreholes that were crossed by/ or were adjacent to surveys lines have been added to the cross-sections.

A total of five independent reflectors were interpreted in the profiles. A near surface reflector has been marked in red and generally lies within 1m of the surface. This is likely to represent unconsolidated, seawater saturated sediments.

Silt, Sand and Clay layers have been interpreted funderlying the surface layer with a Silt/Peat and Cobble layer present on Cross-section 13 to the east of the survey boundary. Rockhead has been interpreted directly below this Silt/peat and cobble layer on Cross-section 13.

Generally on the other cross-sections additional layers of Silts and Peats were interpreted before a rockhead layer.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Hydrographic Surveys Ltd., while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface. Appendix One

Equipment List and Specifications

Equipment List and Technical Specifications

Navigation

Trimble AgDGPS 132. This unit provides sub-metre differential position accuracy. The L-band satellite receiver uses a Trimble developed, sensitive design to provide coverage across the entire satellite footprint.

Bathymetry

ODOM Hydrotrac digital echosounder

Hypack 2008 survey software.

The navigation can be interfaced into this software package to provide real-time line .ude . .ude . .ude . .or pupper out of any other use. .or insection out of the any other use. guidance and continuous logging of position in both Latitude and Longitude and Irish National Grid.

Valeport model 740 with vented transducer purposed

Sub-Bottom Profiler

Tritech Seanet System-SeaKing Sub-bottom Profiler. The SeaKing System utilizes CHIRP pulses as its wave source. SeaNet Pro was utilized as Data acquisition software and interfaced with the Trimble AgDGPS 132 output.

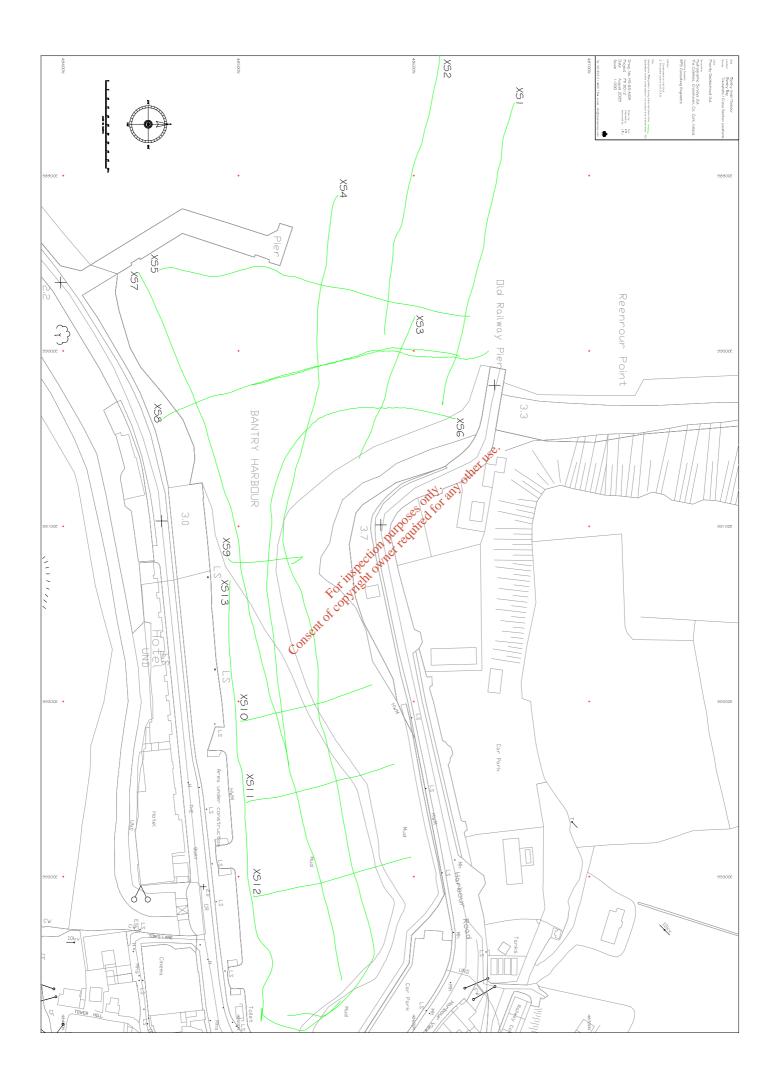
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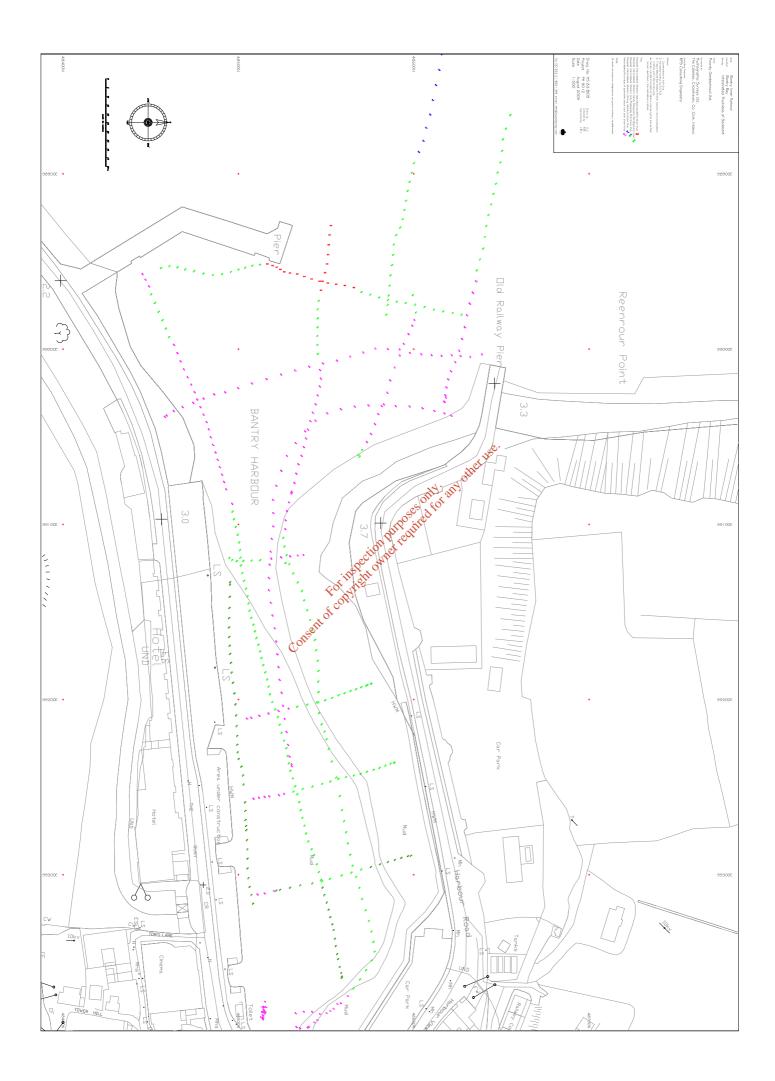
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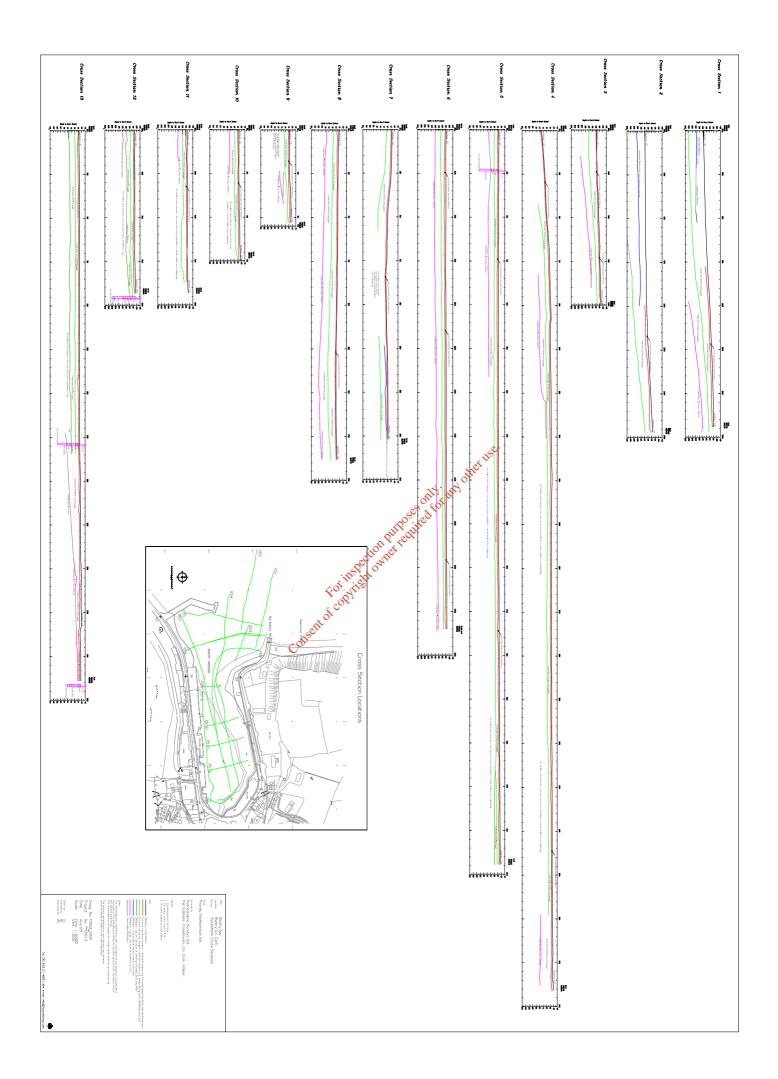
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APPENDIX C

LABORATOR RESULTS

Key to Laboratory Results

Key

Natural Moisture Content Atterberg Limit Grading analysis Loss on Ignition Organic Content Undrained Triaxial Compression Shear Box Triaxial Compression - CU Oedometer consolidation Marine Sediment Analysis UCS Point Load Consent Content Consent of Content Content of Cont

KEY TO SYMBOLS ON LABORATORY TEST RESULTS SHEETS

U P TWS B D W pH SO ₃ SO ₃ + CI PI <425 LL PL MC NP Y _b Y _d Ps U/D U/C T/M 100/38 REM TST V DSB RSB RSB RSB RS G ₃ G ₁ -G ₃ C C Φ Φ L SB RSB RS G ₃ G ₁ -G ₃ C C Qpt Nat Std Hvy Vib CBR Sat m.c. MCV	Undisturbed Sample Piston Sample Bulk Sample - Disturbed Jar Sample - Disturbed Water Sample Acidity/Alkalinity Index % - Total Sulphate Content (acid soluble g/tr - Water Soluble Sulphate (Water or Calcareous Reaction Chloride Content Plasticity Index % of material in sample passing 425 mic Liquid Limit Plastic Limit Water Content Non Plastic Bulk Density Dry Density Particle Density Undrained/Drained Triaxial Single Stage/Multistage Triaxial Single Stage/Multistage Triaxial Single Stage/Multistage Triaxial Single Stage/Multistage Triaxial Sample Diamate (mm) Remoulded Triaxial Test Specimen Triaxial Suction Test Vane Tasto Drained Shear Box Residual Shear Box Fifective Cohesion Intercept Angle of Shearing Resistance - Degrees Effective Angle of Shearing Resistance Strain at Failure Failed under 1st Load Failed under 1st Load Failed under 1st Load Failed under 1st Load Failed under 1st Load Standard Compaction - 2.5kg Rammer Heavy Compaction - 4.5kg Rammer Heavy Compaction Value	2:1 Aqueous Soil Extract)
		Figure

	Natural Moisture Content/Atterberg Limits Summary BS 1377 : Part 2 : 1990 : Clause 3	Job Ref
 Location	Bantry Bay Inner Harbour	PC9030

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	МС	LL	PL	PI	% Pas 425
BH01	8	1.5	D	Very sandy very silty GRAVEL with occasional cobbles	28				
BH01	11	2	В	Very sandy very silty GRAVEL with occasional cobbles		72	47	25	76.2
BH01	12	2.5	D	Slightly gravelly sandy organic SILT	79				
BH01	14	3	В	Slightly gravelly sandy SILT		73	41	32	88.8
BH01	16	3.5	D	Slightly sandy gravelly SILT with some cobbles	60				
BH01	18	4	В	Slightly sandy gravelly SILT with some cobbles		96	55	41	44.9
BH01	20	4.5	D	Slightly gravelly organic SILT	22				
BH01	23	5.5	D	Slightly sandy slightly gravely organic SILT	76				
BH01	24	6	В	Very silty very sandy GRAVEL		135	88	47	82.5
BH01	26	6.5	D	Slightly gravelly organic SILT	119				
BH01	27	7	В	Slightly gravelly organic SILT		131	79	52	67.8
BH01	29	7.5	D	sant ^{o Slightly} gravelly organic SILT	73				
BH01	31	8	В	Very sandy very silty GRAVEL		72	48	24	67.6
BH02	1	0	В	Very silty very gravelly SAND		64	38	26	70.7
BH02	2	0.5	D	Very silty very gravelly SAND	30				
BH03	1	0	В	Very silty very sandy GRAVEL		72	49	23	67
BH03	3	0.35	D	Slightly sandy slightly organic SILT	52				
BH04	1	С	В	Slightly gravelly sandy SILT		84	53	31	96.6
BH04	3	0.5	D	Slightly gravelly sandy organic SILT	73				
BH04	11	2.5	В	Slightly gravelly slightly sandy CLAY		47	27	20	96.1
BH04	12	2.5	D	Slightly gravelly slightly sandy CLAY	33				
BH04	16	3.5	D	Slightly sandy gravelly CLAY	13				

Location		
	Bantry Bay Inner Harbour	PC9030

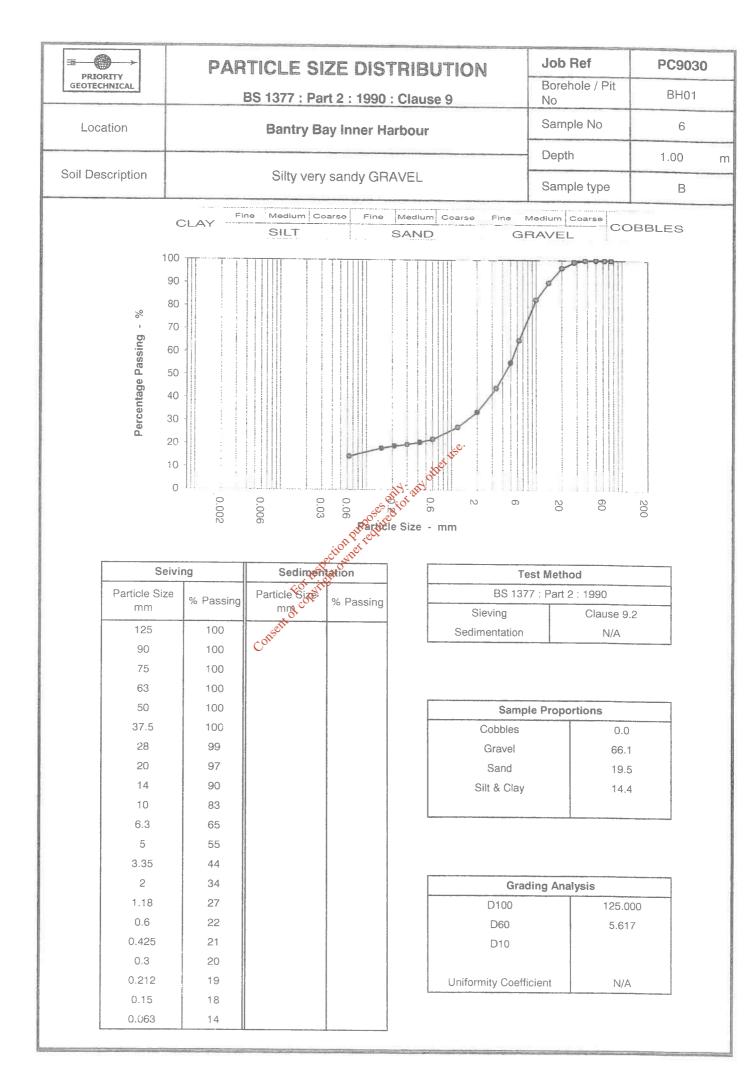
Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	МС	LL,	PL	PI	% Pas 425
BH05	1	0	В	Slightly gravelly SILT		44	NP	NP	77.1
BH05	4	1	D	Slightly gravelly slightly sandy CLAY	29				
BH05	5	1.5	В	Slightly gravelly slightly sandy SILT		42	27	15	98.
BH05	7	2	D	Slightly gravelly slightly sandy CLAY	35				
BH05	10	3	D	COBBLES with much gravel	32				
BH05	11	3.5	В	COBBLES with much gravel		35	21	14	55.5
BH05	12	4	D	COBBLES with much gravel	17				
BH06	2	1.5	В	Slightly gravelly sandy Clary with some cobbles	21				
BH07	2	1.5	В	01 5.0	33	72	45	27	51
BH07	10	3.5	В		48	67	42	25	68.
BH07	13	4.15	D	Very Shipevery gravelly SAND For Shipe of Shipevery gravelly SAND Slightly sandy SILT	81				
BH07	23	8	D	Slightly sandy SILT	39				
BH07	25	8.5	В	Slightly sandy SILT	37	45	29	16	100
BH07	28	9.45	D	Slightly sandy SILT	39				
BH08	9	2	D	Slightly sandy gravelly CLAY with some cobbles	34				
BH08	10	2.5	D	Slightly sandy slightly gravelly organic SILT	90				
BH08	12	3	В	Slightly sandy slightly gravelly organic SILT		105	73	32	88.3
BH08	14	3.5	D	Slightly sandy slightly gravelly organic SILT	85				
BH08	17	4.5	D	Slightly sandy slightly gravelly organic SILT	26				
BH08	19	5	В	Slightly sandy slightly gravelly organic SILT		42	28	14	84.4
BH08	20	5.5	D	CLAY	29				
BH08	22	6	В	CLAY		41	23	18	41.3

PRIORITY GEOTECHNICAL	Natural Moisture Content/Atterberg Limits Summary BS 1377 : Part 2 : 1990 : Clause 3	Job Ref
Location	Bantry Bay Inner Harbour	PC9030

Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	ΡI	% Pas 425
BH11	5	1	В	Slightly sandy slightly gravelly CLAY		39	22	17	67.9
BH11	7	6	В	Slightly sandy slightly gravelly CLAY		34	21	13	62.9
BH12	2	1.5	В	Slightly gravelly sandy SILT	65	67	44	23	90.4
BH12	3	2	D	Slightly gravelly sandy SILT	73				
BH12	9	3	D	Sandy organic SILT	91				
BH12	10	3.5	В	Sandy organic SILT	118	117	81	36	97.8
BH12	19	7	В	Slightly sandy slightly gravelly SILT	28	38	24	14	93.
BH12	20	7.5	D	Slightly sandy slightly gravelly CLAY	29				
BH12	21	7.5	D	Slightly sandy slightly gravelly CLAY	30				
BH13	2	1.5	В	Slightly sandy gravelly CLAY with	17	31	19	12	65
BH14	2	1.5	В	Very satty very gravelly SAND with	32	38	NP	NP	85.
BH14	6	5	D	Slightly gravelly sandy organic SILT	65				
BH14	8	5.95	D	Slightly gravelly sandy organic SILT	93				
BH14	9	6	В	Slightly gravelly sandy organic SILT	100	111	72	39	95.
BH14	17	9	В	Slightly gravelly slightly sandy CLAY	33	43	26	17	93.:
BH15	4	1.5	D	Slightly gravelly slightly sandy SILT	24				
BH15	7	2.5	В	Slightly sandy organic SILT		90	48	42	90.
BH15	8	2.5	D	Slightly sandy slightly organic SILT	49				
BH15	13	3.5	D	Slightly sandy organic SILT	78				
BH15	3	4	В	Slightly gravelly slightly sandy SILT		62	41	21	92
BH15	17	4.5	D	Silty PEAT	132				
BH15	20	5.5	В	Slightly gravelly sandy organic SILT		111	66	45	91.

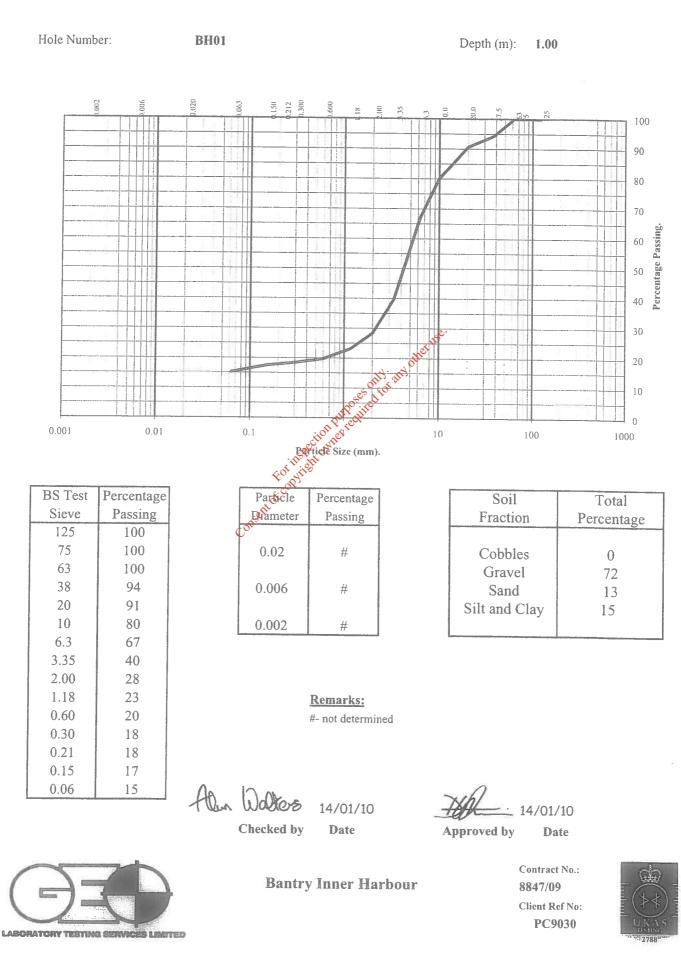
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Location				Ban	try Bay Inner Harbour			P	C9030)	
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	Hole ID	Sample Ref	Depth (m)	Sample Type	Sample Description	MC	LL	PL	PI	% Pas 425	
	BH15	21	5.5	D	Slightly gravelly sandy organic SILT	82					
	BH15	23	6.5	D	Slightly gravelly CLAY	26					
	BH15	25	7.5	В	Slightly gravelly slightly sandy SILT with many cobbles		44	29	15	96.1	
	BH15	26	7.5	D	Slightly gravelly slightly sandy CLAY with many cobbles	31					
	BH17	7	7.1	В	Slightly sandy gravelly CLAY with some cobbles		35	23	12	53	
	BH17	8	7.4	D	Slightly sandy gravelly SILT with some cobbles	24					

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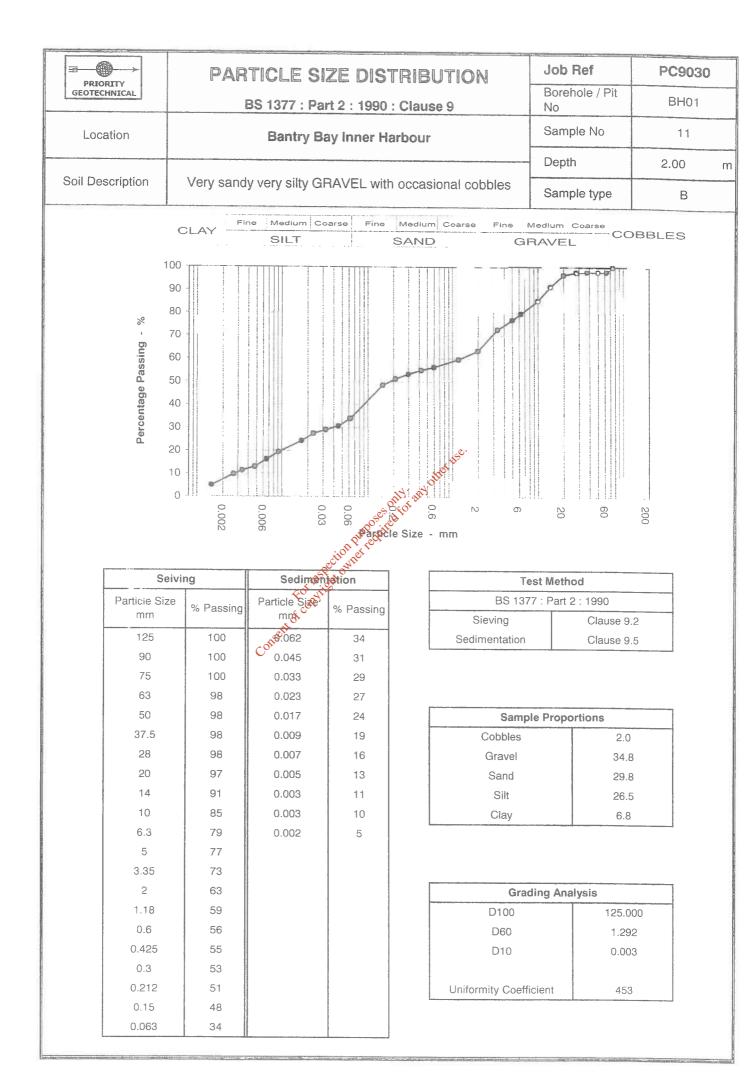
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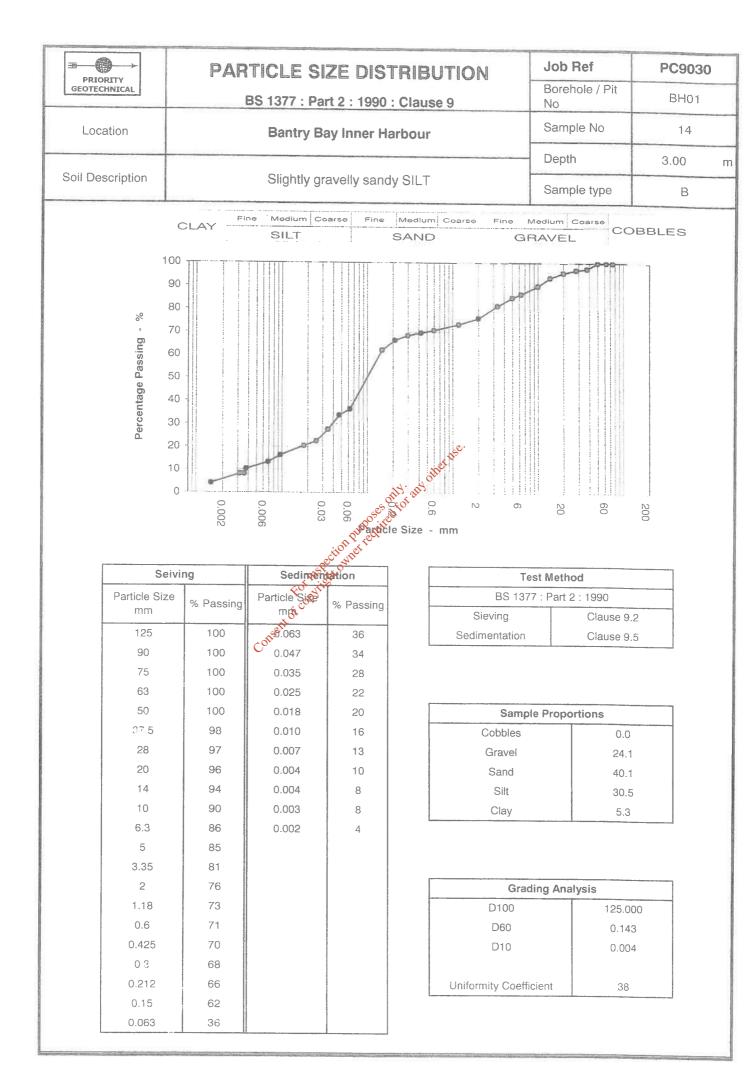
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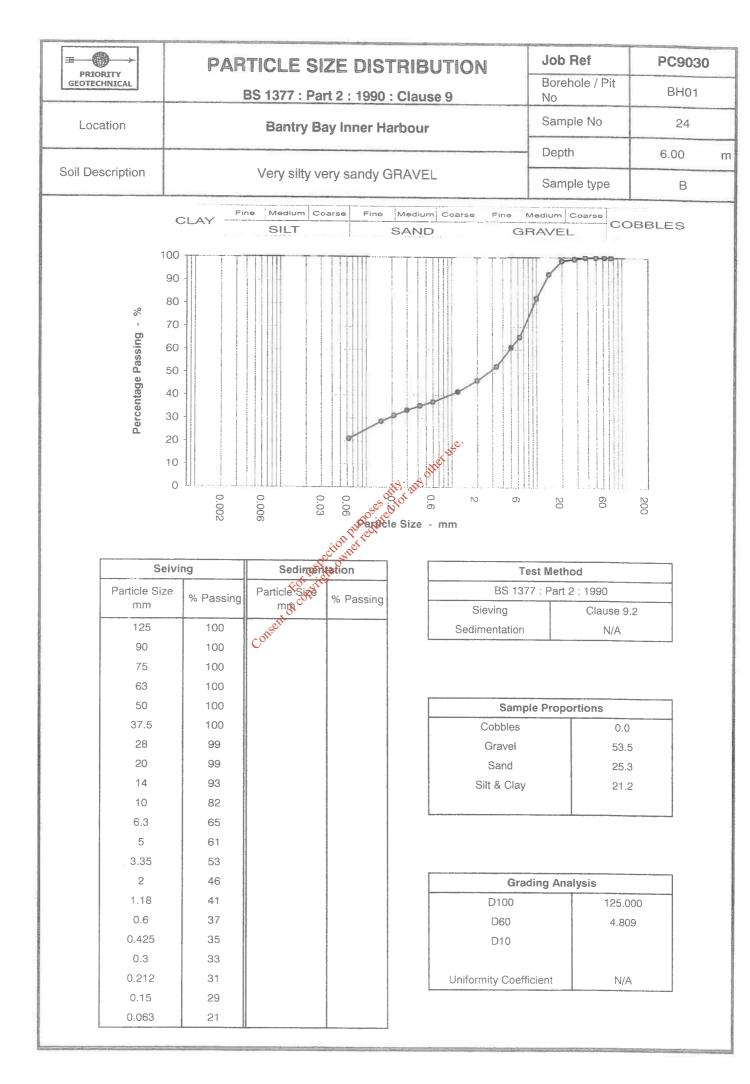


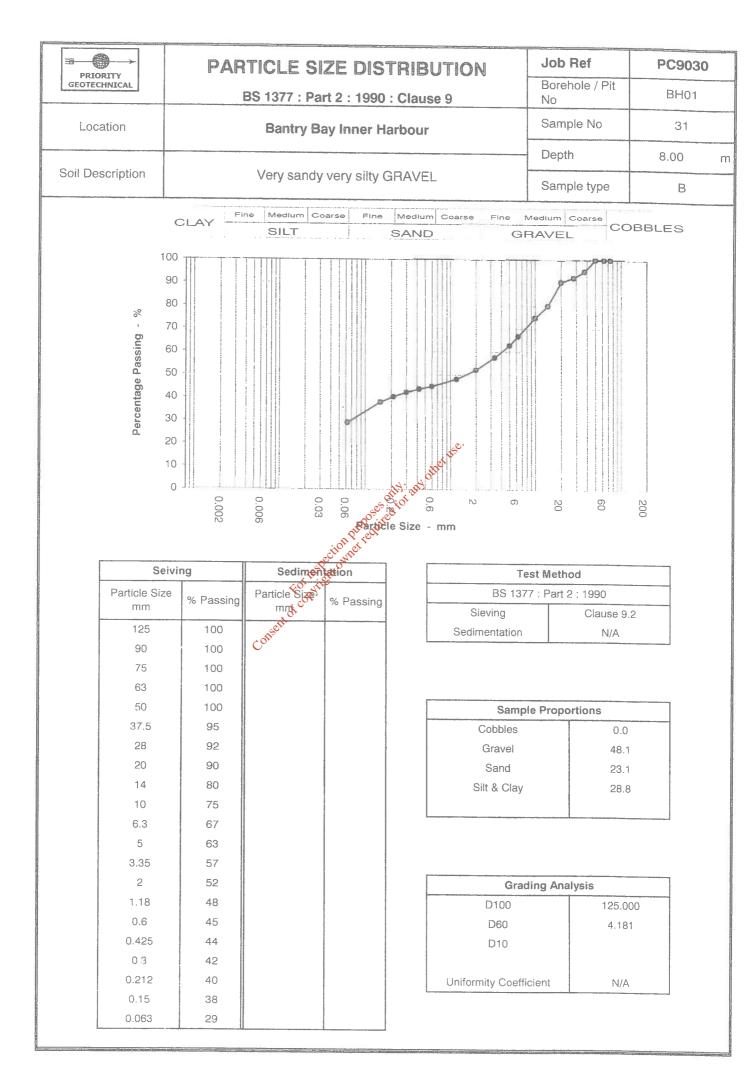
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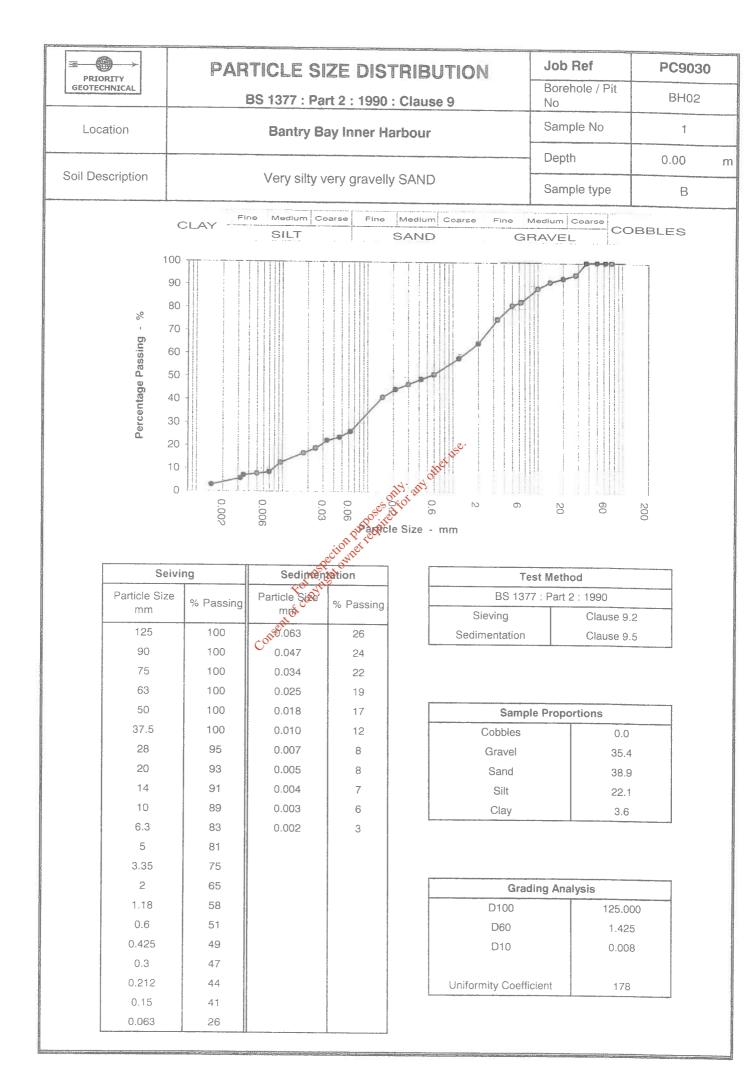
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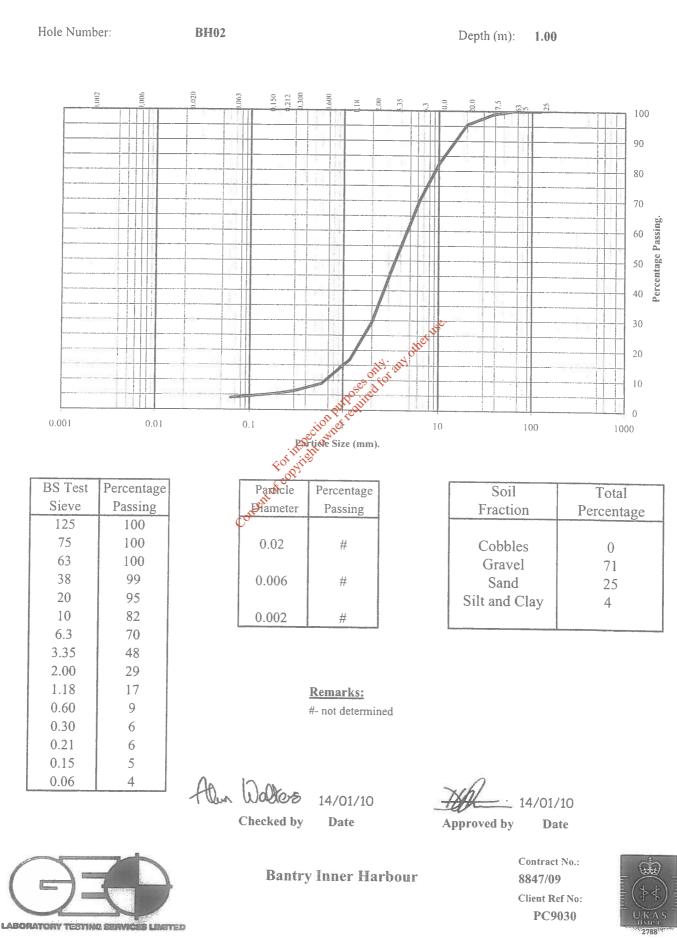






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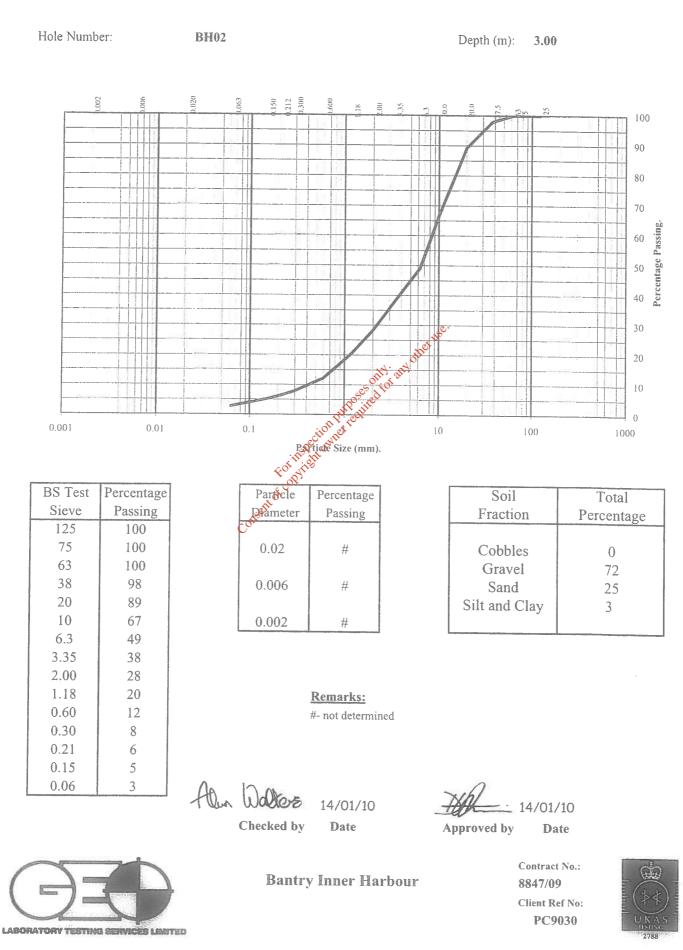


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