Archaeology South-East

ASE

Archaeological Watching Brief Report
Arun Tidal Defences, Littlehampton

NGR: Centred 502225,102175
(TQ 022 021)

ASE Project No: 5671
Site Code: ATD 12

ASE Report No: 2012238
OASIS ID: archaeol6-137953

By Dan Swift

November 2012

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Abstract

Archaeology South-East was commissioned by Halcrow group Ltd to conduct an archaeological watching brief during geotechnical investigations on the River Arun in Littlehampton.

No archaeological finds, features or deposits were seen in the watching brief, only modern made ground and natural deposits.

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1.0 INTRODUCTION

1.1 Site Background

1.1.1 Archaeology South-East (ASE), the contracting division of the Centre for Applied Archaeology (CAA), Institute of Archaeology (IoA), University College London (UCL) was commissioned by Halcrow group Ltd to conduct an archaeological watching brief during geotechnical investigations on the River Arun in Littlehampton (centred on NGR: 502225,102175; Figure 1)

1.2 Geology and Topography

1.2.1 The site consisted of a level stretch of land along the eastern bank of the River Arun in Littlehampton. The British Geological Society website (BGS 2012) lists superficial deposits as Raised Marine Deposits - clay, silt, sand and gravel formed in shallow seas with mainly siliciclastic sediments (comprising of fragments or clasts of silicate minerals) deposited as mud, silt, sand and gravel.

1.2.2 Bedrock geology description: Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Forma. Sedimentary Bedrock formed approximately 71 to 94 million years ago in the Cretaceous Period. Local environment previously dominated by warm chalk seas.They often consist of a calcareous ooze of the microscopic remains of plankton, especially the disc shaped calcite plates or coccoliths that make up the spherical coccolithophores.

1.3 Aims and Objectives

1.3.1 The site required no Written Scheme of Investigation; however, a technical note (Halcrow 2012) listed the following objectives:

The archaeological monitoring will:

• Recover any dateable material that might be thrown up by the investigation

• Establish the archaeological significance of the deposits disturbed by the investigation

• Make a stratigraphic record of the deposits or features exposed

• Produce a report on the stratigraphic sequence of deposits within the exploratory holes and trial pits

1.4 Scope of Report

1.4.1 The scope of the watching brief was to provide archaeological monitoring on geotechnical investigations along the proposed River Arun Tidal Walls scheme in Littlehampton, West Sussex. This document reports on observations made during the investigation with the purpose of informing mitigation against any potential adverse impacts on buried archaeology.

2.0 ARCHAEOLOGICAL BACKGROUND

2.1 The Sussex coastal plain, on which the site is situated, has long attracted human activity due to its fertile and easily worked soils, fresh water from the Rivers Adur and Arun and numerous 'rifes' or tributary streams and proximity to the English Channel and sea routes to the continent.

2.2 Neolithic settlement on the coastal plain and the nearby South Downs is known to have occurred from c. 4,000BC, as dated by C14 at such sites as the extensive flint mine sites around nearby Findon. Aside from monuments such as flint mines, causewayed enclosures and burial mounds, little is understood of Neolithic settlement in the area and 'domestic' sites are largely limited to flint scatters or isolated pits/pit groups, which may have had a symbolic rather than domestic purpose.

2.3 From the Bronze Age, evidence from numerous sites across the coastal plain suggests a landscape which is becoming increasing partitioned and ordered. Surface finds of flint tools and pottery suggest that activity was occurring in the vicinity of the site during the Bronze Age.

2.4 During the Later Iron Age and Romano British periods there is an increasing intensification of activity on the coastal plain as seen through the building of the extensive Chichester Entrenchments, Fishbourne Palace and construction the numerous villa's. This is evidenced through the numerous surface finds, settlements and enclosures and funerary remains.

2.5 There is little evidence for Saxon or medieval activity other than place name evidence

2.6 Littlehampton grew as a town in the 19th century.

3.0 ARCHAEOLOGICAL METHODOLOGY

3.1 Fieldwork Methodology

3.1.1 Several visits were made to the site to monitor the risings from several geotechnical boreholes and hand dug investigation pits at the top of borehole locations made in advance of bore holing.

3.1.2 At an early stage of works it became clear that progress was slow due to on-site constraints, and that made ground was being routinely exposed as opposed to deposits of potential archaeological interest. Through direct discussion with Halcrow and their client the Environment Agency it was decided to drop visits right down in this instance and see only a few selected boreholes along the scheme.

3.1.3 Five visits were made to the site:

Date of Visit	Work at time of visit
18 9 12	Borehole 2
19 9 12	Borehole 5
24 9 12	Borehole 11
25 9 12	Borehole 10
11 10 12	Borehole 16

Table 1: Site visits

3.1.4 Observations were made on standard ASE recording sheets.

3.3 The Site Archive

3.3.1 ASE informed Worthing/Littlehampton Museum prior to the commencement of fieldwork that a site archive would be generated. The site archive is currently held at the offices of ASE and will be deposited with them in due course. The contents of the archive are tabulated below.

Number of Contexts	9
No. of files/paper record	1 file
Digital photographs	17

Table 2: Quantification of site archive

4.0 RESULTS

No archaeological finds, features or deposits were seen in the watching brief, only modern made ground and (redeposited) natural deposits.

4.1 Borehole 2 monitored 18 9 12

Context	Type	Description	Deposit Thickness m	Depth below ground
B2 01	-	Concrete	0.30	-
B2 02	Layer	Modern made ground	0.30	0.30
B2 03	Layer	Redeposited brickearth	0.10	0.40
B2 04	Layer	Chalk (rubble?)	+ 0.50	0.50

Table 3: List of recorded contexts in Borehole 2

4.2 Borehole 5 monitored 19 9 12

Context	Type	Description	Deposit Thickness m	Depth below ground
B5 01	-	Concrete	0.30	-
B5 02	Layer	Modern made ground	+ 0.90	0.30

Table 4: List of recorded contexts in Borehole 5

4.3 Borehole 11 monitored 24 9 12

Context	Type	Description	Deposit Thickness m	Depth below ground
B11 01	-	Concrete	0.10	-
B11 02	Layer	Modern made ground	0.34	0.10
B11 03	Layer	Silty clay	0.36	0.44
B11 04	Layer	Chalk rubble	+ 0.40	0.80

Table 5: List of recorded contexts in Borehole 11

4.4 Borehole 10 monitored 25 9 12

Context	Type	Description	Deposit Thickness m	Depth below ground
B10 01	-	Tarmac	0.05	-
B10 02	Layer	Modern made ground	0.34	0.05
B10 03	Layer	Chalk	0.09	0.39
B10 04	Layer	Gravel (made ground)	0.20	0.48
B10 05	Layer	Chalk	+ 0.40	0.68

Table 6: List of recorded contexts in Borehole 10

4.5 Borehole 16 monitored 11 10 12

Context	Type	Description	Deposit Thickness m	Depth below ground
B16 01	Layer	Topsoil	0.15	-
B16 02	Layer	Natural(?) clay	+ 1.05	0.15

Table 7: List of recorded contexts in Borehole 16

5.0 DISCUSSION AND CONCLUSIONS

5.1 No archaeological finds, features or deposits were seen in the watching brief, only modern made ground and (redeposited) natural deposits.

5.2 The results of the watching brief are consistent with those from other boreholes not monitored in the watching brief (see borehole logs in the appendix of this report) which imply that the area monitored consists of modern made ground to varying depth of between 0.75 and 4.50m below ground surface (BGL).

5.3 As a very general rule (based on the borehole logs – NOT on the observations made during the watching brief) this depth of modern made ground appears to be greater to the south of the area of the scheme (nearer the seafront) and thinner to the north of the scheme.

BIBLIOGRAPHY

BGS 2012 http://mapapps.bgs.ac.uk/geologyofbritain/home.html Accessed 20 11 12

Halcrow 2012 Technical Note: River Arun Tidal Walls, Brief for Archaeological Monitoring of Geotechnical Ground Investigation

ACKNOWLEDGEMENTS

ASE would like to thank Halcrow Group Limited for commissioning the work and for their assistance throughout the project. The watching Brief was conducted by Diccon Hart and Antonio Reis. The figures for this report were produced by Antonio Reis. Darryl Palmer managed the fieldwork and Dan Swift managed the post-excavation process.

HER Summary Form

Site Code	**ATD 12**					
Identification Name and Address	Archaeological Watching Brief Report Arun Tidal Defences, Littlehampton					
County, District &/or Borough	Arun, West Sussex					
OS Grid Refs.	Centred 502225,102175					
Geology	Chalk					
Arch. South-East Project Number	5671					
Type of Fieldwork	Eval.	Excav.	Watching Brief	Standing Structure	Survey	Other
Type of Site	Green Field	Shallow Urban	Deep Urban	Other		
Dates of Fieldwork	Eval.	Excav.	**WB.** 18/9/12-11/10/12	Other		
Sponsor/Client	Halcrow					
Project Manager	Darryl Palmer					
Project Supervisor	Diccon Hart/Antonio Reis					
Period Summary	Palaeo.	Meso.	Neo.	BA	IA	RB
	AS	MED	PM	**Modern**		

Summary

Archaeology South-East was commissioned by Halcrow group Ltd to conduct an archaeological watching brief during geotechnical investigations on the River Arun in Littlehampton.

No archaeological finds, features or deposits were seen in the watching brief, only modern made ground and natural deposits.

OASIS Form

OASIS ID: archaeol6-137953

Project details

Project name	Arun Tidal Defences, Littlehampton
Short description of the project	Archaeology South-East was commissioned by Halcrow Group Ltd to conduct an archaeological watching brief during geotechnical investigations on the River Arun in Littlehampton. No archaeological finds, features or deposits were seen in the watching brief, only modern made ground and natural deposits.
Project dates	Start: 18-09-2012 End: 11-10-2012
Previous/future work	No / Not known
Any associated project reference codes	ATD12 - Sitecode
Type of project	Recording project
Site status	None
Current Land use	Coastland 2 - Inter-tidal
Investigation type	"Watching Brief"

Project location

Country	England
Site location	WEST SUSSEX ARUN LITTLEHAMPTON Arun Tidal Defences, Littlehampton
Postcode	BN17 5DD
Site coordinates	TQ 022 021 50 0 50 48 31 N 000 32 57 W Point

Project creators

Name of Organisation	Archaeology South-East
Project brief originator	Halcrow Group Limited
Project design originator	Halcrow Group Limited
Project director/manager	Darryl Palmer
Project supervisor	Antonio Reis
Project supervisor	Diccon Hart

Type of sponsor/funding body	Client
Name of sponsor/funding body	Halcrow Group Limited

Project archives

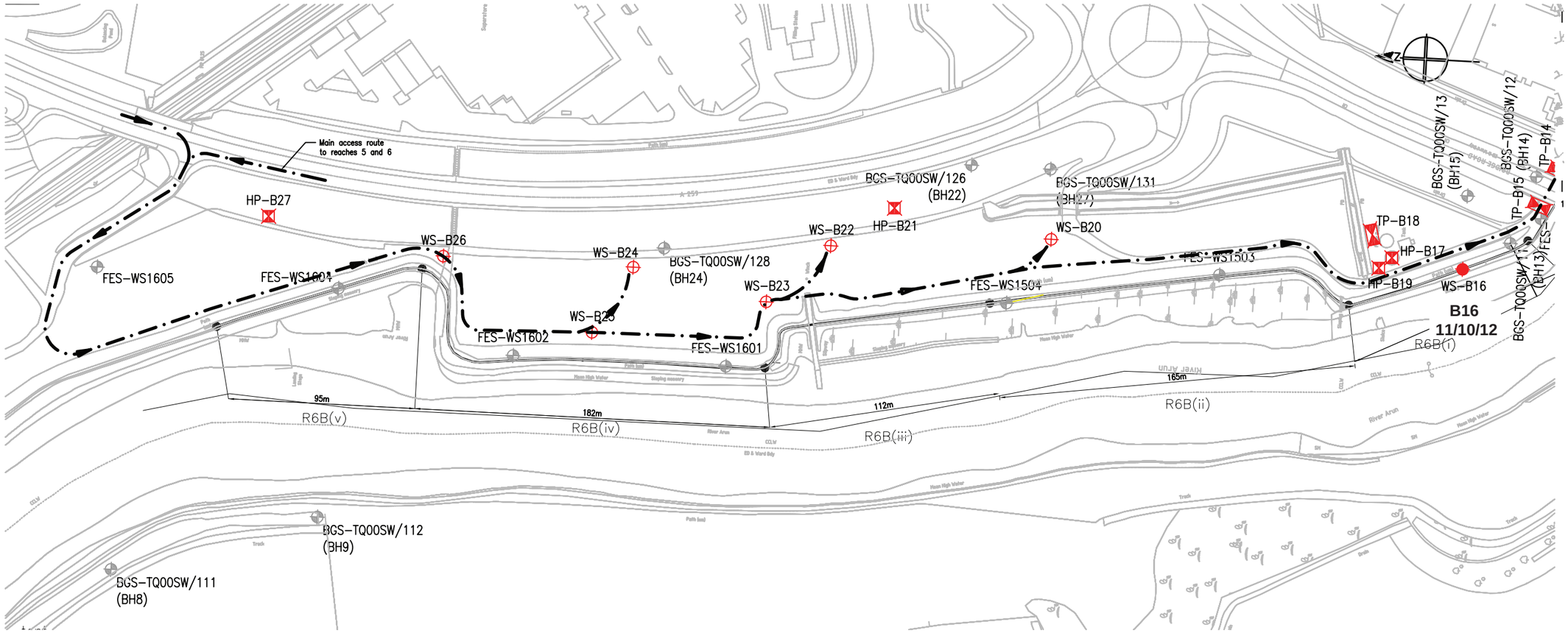
Digital Archive recipient	Littlehampton Museum
Digital Archive ID	ATD 12
Digital Contents	''Stratigraphic''
Digital Media available	"Text"
Paper Archive recipient	Littlehampton Museum
Paper Archive ID	ATD 12
Paper Contents	''Stratigraphic''
Paper Media available	''Context sheet'',''Correspondence'',''Photograph'',''Report''

Project bibliography 1

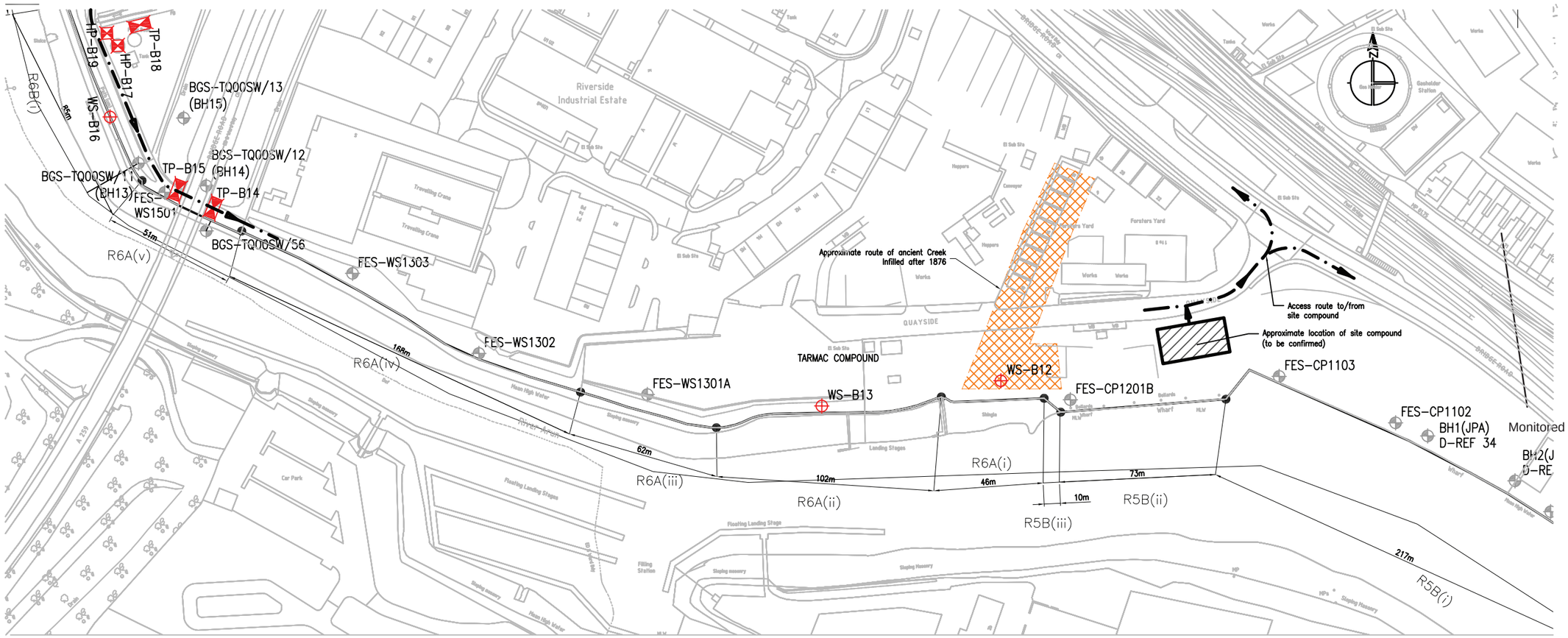
Publication type	Grey literature (unpublished document/manuscript)
Title	Archaeological watching brief report, Arun Tidal Defences, Littlehampton
Author(s)/Editor(s)	Swift, D
Other bibliographic details	ASE Report No: 2012238
Date	2012
Issuer or publisher	ASE
Place of issue or publication	Portslade
Description	grey lit bound rep

Entered by	Dan Swift (d.swift@ucl.ac.uk)
Entered on	21 November 2012

© Archaeology South-East		Arun Tidal Defences	Fig. 1
Project Ref: 5671	Nov 2012	Site location	
Report Ref: 2012238	Drawn by: JLR		

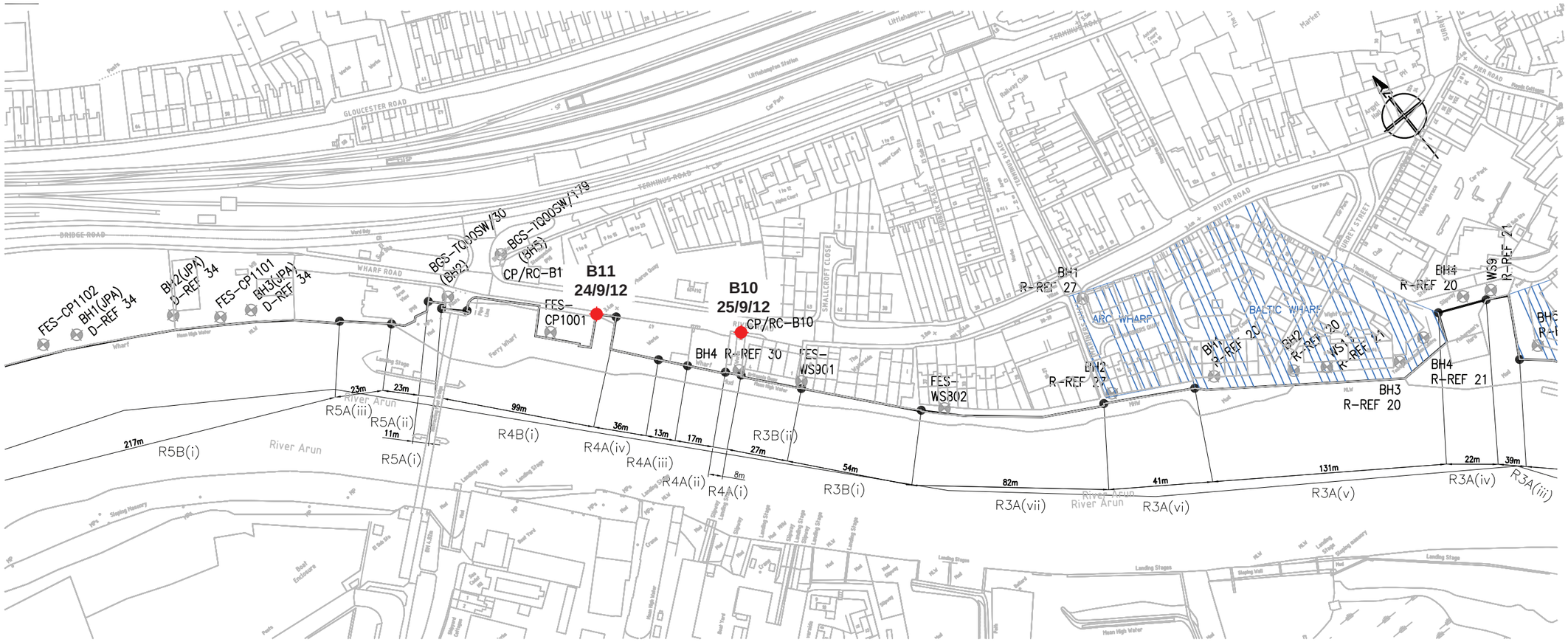


© **Archaeology South-East**		Arun Tidal Defences	Fig. 2
Project Ref: 5671	Nov 2012	Borehole location 1	
Report Ref: 2012238	Drawn by: sht		



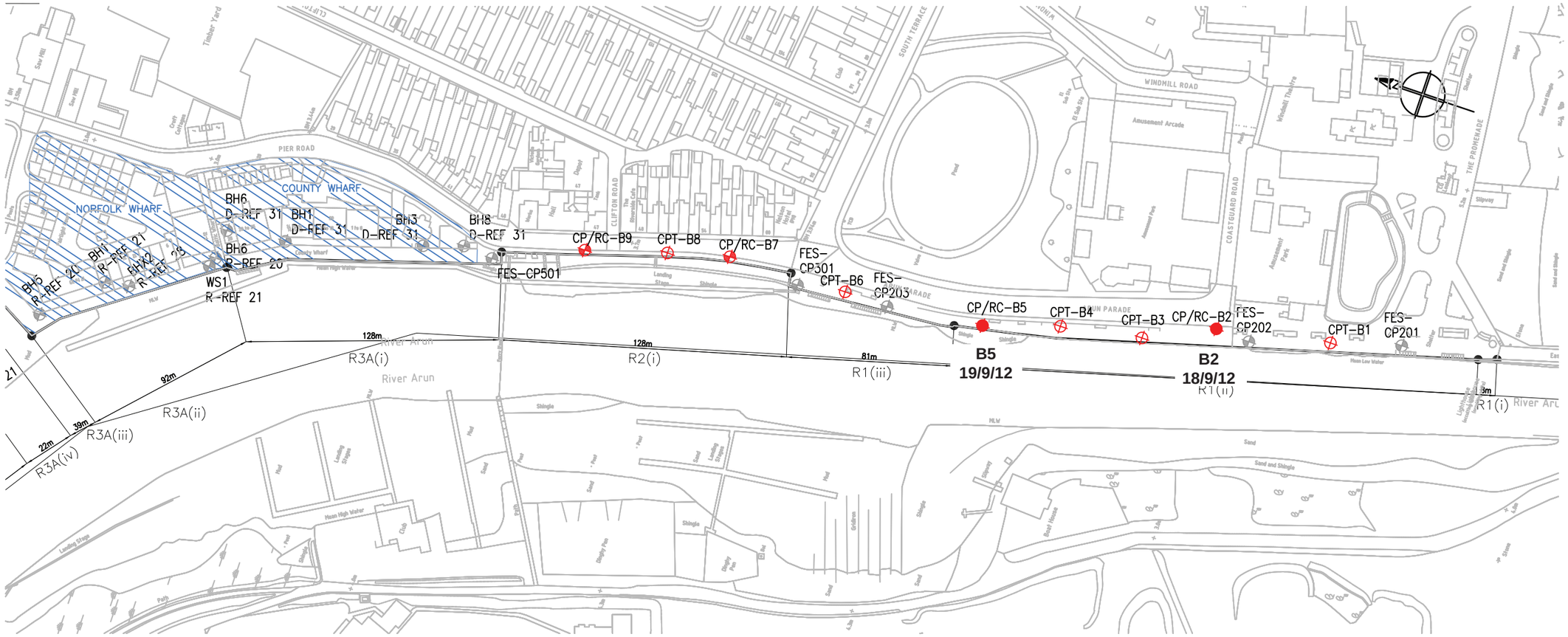
Monitored borehole

© Archaeology South-East		Arun Tidal Defences	Fig. 3
Project Ref: 5671	Nov 2012	Borehole locations 2	
Report Ref: 2012238	Drawn by: st		



Monitored borehole

© **Archaeology South-East**		Arun Tidal Defences	Fig. 4
Project Ref: 5671	Nov 2012	Borehole locations 3	
Report Ref: 2012238	Drawn by: st		



Monitored borehole

© Archaeology South-East		Arun Tidal Defences	Fig. 5
Project Ref: 5671	Nov 2012	Borehole location 4	
Report Ref: 2012238	Drawn by: sht		

B2

B5

© **Archaeology South-East**		Arun Tidal Defences	Fig. 6
Project Ref: 5671	Nov 2012	Selected photographs	
Report Ref: 2012238	Drawn by: JLR		

© **Archaeology South-East**		Arun Tidal Defences	Fig. 7
Project Ref: 5671	Nov 2012	Selected photographs	
Report Ref: 2012238	Drawn by: JLR		

APPENDIX: Borehole Logs

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 10.00m 150mm to 19.75m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 10.00m
Crew/Vessel	S Purvis/R Johnson	**Logged by**	AH
Dates Drilled	Start 18/09/2012 End 26/09/2012	**Compiled by**	clm 21/09/2012
		Approved by	BC 14/11/2012

BOREHOLE No. CPRCB2

Coordinates	502797	E
(National Grid)	101413	N
Ground Level	3.81	m OD

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details: Depth (m) From	To	Type	No.	SPT Blows/N Drive mm: Test	U100 Blows/ Recovery mm: Result	Description of Strata	Depth (Thickness) (m)	Level	Legend
18/09									MADE GROUND: Tarmacadam.	(0.05) 0.05	3.76	
									MADE GROUND: Strong dark grey concrete with 5mm diameter (100mm x 100mm) mesh reinforcement.	(0.17) 0.22	3.59	
									MADE GROUND: Composed of angular coarse gravel sized fragments of chalk with traces of brown reworked comminuted chalk.	(0.98)		
		DRY	1.20	1.65	D	1	S4		MADE GROUND: Composed of white becoming light brown very clayey subangular to subrounded fine and medium gravel and occasional cobble sized chalk and rare subangular medium flint. (Reworked chalk).	1.20	2.61	
			1.20	1.70	B	2						
	1.60	DRY	2.00	2.45	D	3	S6			(1.60)		
			2.00	2.50	B	4						
										2.80	1.01	
	2.90	DRY	3.00	3.45	D	5	S17		Medium dense light grey brown gravelly to very gravelly fine and medium calcareous SAND. Gravel is predominantly subangular locally very angular coarse of flint. Single flint cobble (100mm x 75mm).	(0.70)		
			3.00	3.50	B	6						
18/09	2.90	DRY										
19/09	2.90	DRY								3.50	0.31	
									Medium dense brown and grey brown very sandy angular to subrounded fine to coarse flint GRAVEL with low cobble content. Sand is fine to coarse.			
	3.80	GL	4.00	4.50	B	7	C15					
			4.00	4.50	B	8						
									At 4.50m: Gravel is occasionally rounded.			
			5.00	5.50	B	9			Between 5.00m and 5.50m: Gravel becomes fine to coarse with rare flint cobbles (125mm x			

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
2. Groundwater was encountered at 3.45m during boring and rose to 3.45m after 5 mins,3.45m after 10 mins,3.45m after 15 mins,3.45m after 20 mins.
3. Chiselled from 2.80m to 3.00m (30 mins);chiselled from 6.50m to 6.80m (30 mins);chiselled from 8.20m to 8.60m (60 mins).
4. See separate sheet for installation.

Scale 1:25

TUGRO	Project: LITTLEHAMPTON ARUN TIDAL DEFENCES	Contract No. G120043U
		Figure No. FR1 (1 of 6)

Drilling Method Cable Percussion and Rotary **Equipment** Dando 3000 Knebel **Crew/Vessel** S Purvis/R Johnson **Dates Drilled** Start 18/09/2012 End 26/09/2012	**Borehole Diameter** 200mm to 10.00m 150mm to 19.75m **Casing Diameter** 200mm to 10.00m **Logged by** AH 19/09/2012 **Compiled by** clm 21/09/2012 **Approved by** BC 14/11/2012	**BOREHOLE No.** CPRCB2 **Coordinates** 502797 E **(National Grid)** 101413 N **Ground Level** 3.81 m OD	

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details: Depth (m) From	To	Type	No.	SPT Blows/N Drive mm: Test	U100 Blows/ Recovery mm: Result	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
	4.90	GL	5.00	5.45			C22		75mm).			
			6.00	6.50	B	10			At 6.00m: Probable cobble.	(5.00)		
	6.00	GL	6.00	6.45			C34					
			7.50	8.00	B	11			Between 7.50m and 8.00m: Gravel becomes slightly sandy predominantly coarse with rare flint cobbles (73mm x 80mm).			
	7.40	GL	7.50	7.95			C14					
			8.50		D	12			Probably very weak white structureless CHALK recovered as silt and fine to coarse sand sized comminuted chalk with fine to coarse gravel sized fragments of very weak chalk and angular fine gravel sized fragments of flint.	8.50	-4.69	
	8.90	GL	9.00	9.45	D	13	S16		Below 9.00m: Recovered as very weak to weak subrounded cobble sized fragments (100mm x 125mm) of chalk and flint (75mm x 80mm).	(1.50)		
			9.00	9.50	B	14						
19/09	10.00	TIDAL								10.00	-6.19	
									Extremely weak becoming very weak with depth			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR1 (2 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 10.00m 150mm to 19.75m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 10.00m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson		
Dates Drilled	Start 18/09/2012 End 26/09/2012	**Logged by** AH 19/09/2012	**Compiled by** clm 21/09/2012
		Approved by BC 14/11/2012	

BOREHOLE No. CPRCB2

Coordinates (National Grid)	502797	E
	101413	N
Ground Level	3.81	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
24/09	10.00	9.50							3	low density orange white and locally orange stained and black speckled CHALK. Fractures are extremely closely to closely spaced (<5/25/200) predominantly inclined (5 degrees to 50 degrees) locally with <1mm comminuted chalk veneer, orange staining and slight black speckling to surfaces. (B4/B3)	10.00	-6.19	
									AZCL				
		(100)	10.00	10.75	63	53	53		2	Between 10.24m and 10.40m: Brown / black flint nodule.			
										Between 10.40m and 10.47m: Non intact. Recovered as extremely weak angular fine to coarse gravel sized fragments of chalk.			
									>25	Between 10.47m and 10.75m: Assumed zone of core loss.			
										Between 10.85m and 10.91m: Flint nodule (65mm x 70mm x 90mm).			
		(100)	10.75	12.25	100	83	83		NI	Between 10.11m and 11.14m: Possible tubular flint nodule recovered as subangular fine and medium gravel sized fragments.			
			11.64	11.80	CS	15				Between 11.25m and 11.52m: Extremely weak with orange staining and slight black speckling.			
										Between 11.34m and 11.41m: 1 No. flint nodule (40mm x 60mm).			
										Between 11.83m and 11.98m: Recovered as angular and subangular fine to coarse gravel sized fragments of extremely weak orange chalk.			
										Between 12.11m and 12.13m: 1 No. brown flint (15mm x 20mm).			
	10.00	GL	12.25	12.70				S48	NI	Between 12.25m and 12.41m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown / black flint (up to 30mm x 40mm x 50mm).			
										Between 12.70m and 12.77m: Non intact. Recovered as subangular medium and coarse gravel sized fragments. Possible highly fracture zone.			
			12.78	12.95	CS	16			>25				
		(100)	12.25	13.75	100	100	81		6	Between 13.09m and 13.17m: Rinded flint nodule (40mm x 80mm).			
										Between 13.25m and 13.33m: Recovered as subangular coarse gravel sized fragments with abundant orange staining.			
			13.33	13.45	CS	17			AZCL				
									NI				
										Between 13.66m and 13.69m: 1 No flint nodule (20mm x 70mm).			
										Between 13.75m and 13.85m: Assumed zone of core loss.			
	10.00	GL	13.75	14.02				S28/ 115	NI	Between 13.85m and 14.05m: Recovered as angular fine to coarse gravel sized fragments of brown flint (up to 40mm x50mm x 75mm).			
										Between 14.10m and 14.20m: Recovered as angular fine to coarse gravel sized fragments of black and grey flint (up to 60mm x 60mm x 65mm).			
									NI				
		(100)	13.75	15.25	93	81	81		5	At 14.64m: Possible 3mm to 4mm clay band.			
			14.65	14.87	CS	18				Between 14.87m and 14.93m: Recovered as angular coarse gravel sized fragments (40mm x 40mm x 40mm).	(9.75)		

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR1 (3 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 10.00m 150mm to 19.75m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 10.00m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson		
Dates Drilled	Start 18/09/2012 End 26/09/2012		

Logged by	Compiled by	Approved by
AH	clm	BC
19/09/2012	21/09/2012	14/11/2012

BOREHOLE No. CPRCB2

Coordinates (National Grid)	502797	E
	101413	N
Ground Level	3.81	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No. TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thickness) (m)	Level	Legend
										5	Between 15.13m and 15.25m: Recovered as angular fine to coarse gravel sized fragments of extremely weak orange chalk with abundant comminuted chalk.			
	10.00	GL	15.25-15.48						S50/ 130					
			15.25-15.38		CS	19				NI	Between 15.70m and 15.91m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown flint.			
		(100)	15.25-16.75		100	100	100			5	Between 16.11m and 16.13m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown flint (2mm). Between 16.22m and 16.25m: Recovered as angular fine and medium gravel sized fragments of brown flint (<1mm to 1mm).			
			16.58-16.75		CS	20				NI	Between 16.68m and 16.70m: 1 No. flint nodule (15mm x 20mm diameter). Between 16.75m and 17.00m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown flint and extremely weak chalk.			
	10.00	GL	16.75-17.20						S38	8				
			16.98-17.10		CS	21								
		(100)	16.75-18.25		100	100	89			NI	Between 17.91m and 18.00m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown flint and extremely weak weathered chalk. Between 18.00m and 18.12m: 1 No. subangular brown flint nodule (100mm x 100mm x 120mm).			
24/09	10.00	GL								1				
26/09	10.00	8.40	18.25-18.56						S30/ 160		Between 18.25m and 18.90m: Assumed zone of core loss.			
	10.00	GL								1				
		(100)	18.25-19.75		57	57	57				Between 19.04m and 19.16m: Subhorizontal orange bands (<2mm thick) pervasive through core.			
			18.96-19.20		CS	22				1	Between 19.18m and 19.41m: Recovered as angular and subangular fine to coarse gravel sized fragments of brown flint (<1mm to 2mm) and extremely weak orange chalk.			
26/09	10.00	2.60	19.75-20.06						S34/ 155		Between 19.54m and 19.75m: Recovered as subangular fine to coarse gravel sized fragments of extremely weak chalk with occasional angular fine to coarse gravel sized fragments of brown flint.	19.75	-15.94	
	10.00	8.40									End of Borehole			

Remarks
(See notes & keysheets)

Scale 1:25

	Project LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR1 (4 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 10.00m 150mm to 19.75m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 10.00m
Drill Fluid	Polymer GS550	**Logged by**	AH 19/09/2012
Crew/Vessel	S Purvis/R Johnson	**Compiled by**	clm 21/09/2012
Dates Drilled	Start 18/09/2012 End 26/09/2012	**Approved by**	BC 14/11/2012

BOREHOLE No. CPRCB2

Coordinates	502797	E
(National Grid)	101413	N
Ground Level	3.81	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR1 (5 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 10.00m 150mm to 19.75m
Equipment	Dando 3000 Knebel Polymer GS550		
Crew/Vessel	S Purvis/R Johnson	**Logged by**	AH
Dates Drilled	Start 18/09/2012 End 26/09/2012	**Compiled by**	clm 21/09/2012
		Approved by	BC 14/11/2012

BOREHOLE No. CPRCB2

Coordinates	502797 E
(National Grid)	101413 N
Ground Level	3.81 m OD

Installation Details	Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 50mm slotted section (SL) from 15.00 to 18.00m					
Concrete	0.50	3.31			MADE GROUND
Bentonite Seal				2.80	
			▽▼	3.50	Gravelly SAND
					Sandy GRAVEL
				8.50	CHALK
	14.50	-10.69			
Pea Gravel Filter SL=15.00-18.00m					
	18.50	-14.69			
Bentonite Seal					
	19.75	-15.94		19.75	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush stopcock box cover.
Pipe diameter 50mm to 18.00m, installed on 25/09/2012.

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR1 (6 of 6)

Drilling Method Cable Percussion and Rotary **Equipment** Dando 2000 Knebel **Crew/Vessel** S Pervis/R Johnson **Dates Drilled** Start 19/09/2012 End 26/09/2012	**Borehole Diameter** 200mm to 8.50m 150mm to 20.10m **Casing Diameter** 200mm to 8.50m **Logged by** IS 20/09/2012 **Compiled by** clm 24/09/2012 **Approved by** BC 14/11/2012	**BOREHOLE No.** CPRCB5 **Coordinates** 502770 E **(National Grid)** 101512 N **Ground Level** 3.48 m OD	

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details: Depth (m) From	To	Type	No.	SPT Blows/N Drive mm: Test	U100 Blows/ Recovery mm: Result	Description of Strata	Depth (Thickness) (m)	Level	Legend
19/09									MADE GROUND: Tarmacadam.	(0.05)		
										0.05	3.43	
			0.15		D	2			MADE GROUND: Strong dark grey concrete with 5mm diameter mesh reinforcement (100mm x 100mm).	(0.14)		
										0.19	3.29	
										(0.10)		
										0.29	3.19	
			0.50		B	1			MADE GROUND: Composed of dark brown gravelly fine and medium sand. Gravel is angular and subangular fine and medium flint with occasional fine gravel sized fragments of brick.			
									MADE GROUND: Composed of white silty sandy subangular fine to coarse gravel sized fragments of weak chalk with occasional cobble sized flint fragments (100mm x 100mm) and locally with traces of reworked comminuted chalk.	(1.21)		
			1.00		D	3						
19/09		DRY										
20/09		DRY										
	1.40	DRY	1.50-1.95		D	4	S3			1.50	1.98	
			1.50-2.00		B	5			MADE GROUND: Composed of grey brown clayey sandy angular and subangular fine to coarse gravel sized fragments of flint, chert and very weak white chalk with rare flint cobbles (75mm x 100mm). Sand is fine to coarse.			
										(1.00)		
	2.30	DRY	2.50-2.95		D	6	S7			2.50	0.98	
			2.50-3.00		B	7			MADE GROUND: Composed of white subangular fine to coarse gravel and cobble sized fragments of very weak light brown reworked chalk and rare flint cobbles (100mm x 200mm).			
	3.00	DRY	3.50-3.95		D	8	S4			(2.00)		
			3.50-4.00		B	9						
	4.40	1.00	4.50-4.95		D	10	S27			4.50	-1.02	
			4.50-5.00		B	11			Medium dense yellow brown silty slightly gravelly fine and medium SAND. Gravel is subangular fine and medium flint and chert.	(0.30)		
									Dense brown slightly silty sandy subrounded to rounded fine to coarse flint GRAVEL. Sand is fine to coarse.	4.80	-1.32	

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
2. Chiselled from 5.80m to 6.00m (45 mins);chiselled from 6.30m to 6.50m (45 mins).
3. See separate sheet for installation.
4. Groundwater was encountered at 3.90m during boring and rose to 3.90m after 5 mins,3.90m after 10 mins,3.85m after 15 mins,3.85m after 20 mins.

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR2 (1 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 8.50m 150mm to 20.10m
Equipment	Dando 2000 Knebel	**Casing Diameter**	200mm to 8.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Pervis/R Johnson		
Dates Drilled	Start 19/09/2012 End 26/09/2012		

Logged by	Compiled by	Approved by
IS	clm	BC
20/09/2012	24/09/2012	14/11/2012

BOREHOLE No. CPRCB5

Coordinates (National Grid)	502770	E
	101512	N
Ground Level	3.48	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or U100 Blows/ Rec. mm or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
											(1.80)		
	5.90	1.00	6.00-6.50		B 12			C34					
			6.60		D 13					Probably structureless CHALK recovered as white and yellow white subangular fine to coarse gravel sized fragments of very weak chalk in a comminuted chalk matrix.	6.60	-3.12	
											(0.90)		
	5.90	1.00	7.50-7.95		D 14			S15			7.50	-4.02	
			7.50-8.00		B 15					Probably weak to very weak CHALK recovered as white and yellow white angular and subangular predominantly coarse gravel and cobble sized fragments of weak chalk and fine to medium gravel sized fragments of flint.			
											(1.00)		
20/09	8.50	3.70									8.50	-5.02	
26/09	8.50	6.10							AZCL	Extremely weak becoming very weak with depth low density orange white, orange stained and black speckled CHALK. Fractures are extremely closely to very closely spaced (5/20/60) predominantly inclined 5 degrees to 60 degrees closed tight surfaces stained orange and black speckled. (B5)			
		(100)	8.50-9.60		64	0	0		>25	Between 8.50m and 8.90m: Assumed zone of core loss. Between 8.90m and 9.10m: Recovered as silty very angular to subrounded fine to coarse gravel sized fragments of extremely weak orange chalk and brown flint.			
	8.00		9.60-10.05					S15	3	Between 9.10m and 9.40m: Possible non intact zone. Recovered as angular medium and coarse gravel sized fragments of extremely weak orange chalk and comminuted chalk. Moderate orange staining and slight to moderate brown speckling.			
			10.00-10.16		C 16					Between 9.40m and 9.55m: Recovered as gravelly comminuted chalk. Gravel is subangular fine to coarse of extremely			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR2 (2 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 8.50m 150mm to 20.10m
Equipment	Dando 2000 Knebel	**Casing Diameter**	200mm to 8.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Pervis/R Johnson		
Dates Drilled	Start 19/09/2012 End 26/09/2012		

Logged by	Compiled by	Approved by
IS	clm	BC
20/09/2012	24/09/2012	14/11/2012

BOREHOLE No. CPRCB5

Coordinates	502770	E
(National Grid)	101512	N
Ground Level	3.48	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type	TCR %	No.	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
		(100)	9.60	11.10		100		13	13			>25	weak orange chalk and occasional very angular fine to coarse brown flint. Between 9.55m and 9.60m: 1 No. possible subangular to well rounded brown flint. Between 9.87m and 10.00m: Recovered as subangular fine to coarse gravel sized fragments of grey brown flint. Between 10.16m and 10.20m: 1 No. subrounded coarse gravel sized grey brown flint (35mm x 35mm x 40mm). Between 10.20m and 11.10m: Zone of possible extremely closely spaced to very closely spaced randomly orientated fractures with much orange staining and slight brown speckling.	(4.80)		
	8.00		11.10	11.48						S37/ 230		AZCL	Between 11.10m and 11.20m: Assumed zone of core loss. Between 11.20m and 11.90m: Recovered as silty very angular to subrounded fine to coarse gravel sized fragments of extremely weak orange chalk with occasional very angular fine to coarse gravel sized grey brown flint.			
		(100)	11.10	12.60		93		0	0			>25 4	Between 11.90m and 11.96m: Very angular to subangular medium and coarse gravel sized grey brown flint (up to 50mm x 50mm x 60mm). Between 12.10m and 12.15m: 1 No. embedded flint (40mm x 70mm). Between 12.40m and 12.60m: Recovered as subangular fine to coarse gravel sized fragments of extremely weak to weak orange chalk. Between 12.60m and 12.65m: Assumed zone of core loss. Between 12.65m and 13.03m: Possible zone of very closely spaced fractures inclined 40 degrees to 60 degrees planar to undulating rough surfaces stained orange and speckled black.			
	8.00		12.60	12.97						S39/ 220						
		(100)	13.30	13.43	C	17							Between 13.20m and 13.30m: Recovered as very angular fine to coarse gravel sized fragments of brown flint (up to 18mm x 25mm x 40mm) with abundant comminuted chalk (drill induced).	13.30	-9.82	
			12.60	14.10		97		71	66			8	Extremely weak to weak low to medium density cream white and locally orange stained and black speckled CHALK. Fractures are very closely spaced (80/100/200) predominantly subhorizontal to inclined 60 degrees closed clean with slight orange and brown staining and slight black speckling. (B4/B3) Between 13.91m and 13.95m: 1 No. embedded black brown flint (45mm x 70mm).			
			13.97	14.10	C	18										
	8.00		14.10	14.55						S32		AZCL 6	Between 14.10m and 14.30m: Assumed zone of core loss. Between 14.54m and 14.76m: Recovered as angular and subangular fine to coarse gravel sized fragments of weak orange chalk and brown flint 1mm.			
		(100)	14.10	15.60		87		61	59			>25	Between 14.99m and 15.07m: 1 No. cobble sized brown flint.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR2 (3 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	Borehole Diameter	200mm to 8.50m 150mm to 20.10m
Equipment	Dando 2000 Knebel	Casing Diameter	200mm to 8.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Pervis/R Johnson		
Dates Drilled	Start 19/09/2012 End 26/09/2012		

Logged by	Compiled by	Approved by
IS	clm	BC
20/09/2012	24/09/2012	14/11/2012

BOREHOLE No. CPRCB5

Coordinates	502770	E
(National Grid)	101512	N
Ground Level	3.48	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From To	Type	No.	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			15.47-15.60	C	19			8				
	8.00		15.60-15.85				S30/100	AZCL NI	Between 15.60m and 15.70m: Assumed zone of core loss. Between 15.70m and 16.02m: Recovered as subangular to subrounded fine to coarse gravel sized fragments of dark brown flint and extremely weak chalk with abundant comminuted chalk (drill induced). Between 16.12m and 16.22m: Recovered as angular to subrounded fine to coarse gravel sized grey brown flint.			
		(100)	15.60-17.10	93	93	83		6		(6.80)		
			16.85-17.01	C	20							
	8.00		17.10-17.41				S37/155		Between 17.39m and 17.50m: Recovered as very angular fine to coarse gravel sized brown flint and subangular fine to coarse gravel sized fragments of extremely weak chalk.			
		(100)	17.10-18.60	100	100	91		9				
			17.94-18.10	C	21				Between 18.27m and 18.37m: Recovered as very angular and angular fine to coarse gravel sized grey brown flint.			
	8.00		18.60-18.77				S27/18	AZCL	Between 18.60m and 18.70m: Assumed zone of core loss. Between 18.70m and 19.05m: Recovered as very angular to subangular fine to coarse gravel sized fragments of grey brown flint.			
			19.15-19.41	C	22							
		(100)	18.60-20.10	93	93	82		10	Between 19.56m and 19.70m: Brown flint nodule recovered as angular fine to coarse gravel sized fragments (up to 70mm x 90mm). Between 19.89m and 19.81m: 1 No. brown flint nodule (20mm x 20mm). Between 19.95m and 19.98m: 1 No. flint nodule (30mm x 20mm).			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	Project: LITTLEHAMPTON ARUN TIDAL DEFENCES	Contract No. G120043U Figure No. FR2 (4 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 8.50m 150mm to 20.10m
Casing Diameter	200mm to 8.50m	**BOREHOLE No.**	**CPRCB5**
Equipment	Dando 2000 Knebel	**Coordinates**	502770 E
(National Grid)	101512 N	**Drill Fluid**	Polymer GS550
Ground Level	3.48 m OD	**Crew/Vessel**	S Pervis/R Johnson
Logged by	IS	**Compiled by**	clm
Approved by	BC	**Dates Drilled**	Start 19/09/2012 End 26/09/2012
	20/09/2012		24/09/2012
	14/11/2012		

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
26/09	8.50	15.20	20.10	20.39				S26/ 135					
	8.00									End of Borehole	20.10	-16.62	

Remarks
(See notes & keysheets)

Scale 1:25

	Project LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR2 (5 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	**BOREHOLE No.** **CPRCB5**
Equipment	Dando 2000 Knebel Polymer GS550	200mm to 8.50m 150mm to 20.10m	**Coordinates** 502770 E **(National Grid)** 101512 N **Ground Level** 3.48 m OD
Crew/Vessel	S Pervis/R Johnson	**Logged by** IS 20/09/2012	**Compiled by** clm 24/09/2012
Dates Drilled	**Start** 19/09/2012 **End** 26/09/2012		**Approved by** BC 14/11/2012

Installation Details	Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 75mm slotted section (SL) from 16.60 to 19.60m					
Concrete	0.50	2.98			MADE GROUND
Grout			▽▼	4.50	
				4.80	Silty gravelly SAND
					Sandy GRAVEL
				6.60	CHALK
	15.10	-11.62			
Bentonite Seal	16.10	-12.62			
Gravel Filter					
SL=16.60-19.60m					
	20.10	-16.62		20.10	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush stopcock box cover.
Pipe diameter 75mm to 19.60m, installed on 26/09/2012.

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR2 (6 of 6)

Drilling Method: Cable Percussion	Borehole Diameter: 150mm to 0.80m	Casing Diameter:	**BOREHOLE No. CPRCB6**
Equipment: Dando 2000			Coordinates: 502765 E
			(National Grid): 101569 N
Crew/Vessel: S Purvis	Logged by: IS	Compiled by: clm	Ground Level: 3.57 m OD
Dates Drilled: Start 02/10/2012	02/10/2012	08/10/2012	Approved by: BC
End 02/10/2012			14/11/2012

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details: Depth (m) From	To	Type	No.	SPT Blows/N Drive mm: Test	U100 Blows/ Recovery mm: Result	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
02/10									MADE GROUND: Tarmacadam.	(0.13)		
										0.13	3.44	
									MADE GROUND: Reinforced concrete (5mm diameter 200mm mesh).	(0.17)		
										0.30	3.27	
									MADE GROUND: Composed of yellow brown sandy angular to subangular fine to coarse flint gravel. Sand is fine to coarse. At 0.30m: Plastic membrane.	(0.50)		
02/10		DRY										
									End of Borehole	0.80	2.77	

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 0.80m depth and rescanned using the CAT to check for services. Service encountered at 0.80m trending north-west south east across pit.
2. The borehole was backfilled on completion with materials arising.
3. Groundwater not encountered during boring.

Scale 1:25

TUGRO	Project: LITTLEHAMPTON ARUN TIDAL DEFENCES	Contract No. G120043U
		Figure No. FR3 (1 of 1)

Drilling Method: Cable Percussion & Rotary	Borehole Diameter: 200mm to 4.50m, 150mm to 30.60m	Casing Diameter: 200mm to 4.50m	**BOREHOLE No. CPRCB6A**
Equipment: Dando 2000, Knebel			Coordinates: 502764 E
Drill Fluid: Polymer GS550			(National Grid): 101575 N
Crew/Vessel: S Purvis/M McKinney	Logged by: AH 05/10/2012	Compiled by: clm 08/10/2012	Ground Level: 3.57 m OD
Dates Drilled: Start 03/10/2012, End 10/10/2012		Approved by: BC 14/11/2012	

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or U100 Blows/ Rec. mm or Fracture Index	Description of Strata	Depth (Thickness) (m)	Level	Legend
03/10												MADE GROUND: Tarmacadam.	(0.14) 0.14	3.43	
												MADE GROUND: Concrete. At 0.30m: Plastic membrane.	(0.16) 0.30	3.27	
			0.50		B	1						MADE GROUND: Composed of yellow sandy angular to subrounded fine to coarse gravel of flint. Sand is fine to coarse.			
			0.50		ES	2									
			0.50		D	3							(0.50)		
													0.80	2.77	
			1.00		D	4						MADE GROUND: Composed of dark brown and black clayey sandy angular to subangular fine to coarse gravel of flint with occasional cobble sized fragments of concrete, single fragment of clinker and 5mm diameter mesh reinforcement.	(0.40)		
			1.00-1.00		ES	5									
			1.00		B	6									
		DRY	1.20-1.70		D	7				S13			1.20	2.37	
			1.20-1.70		B	8						MADE GROUND: Composed of firm brown slightly sandy gravelly clay with rare cobble sized fragments of brick. Gravel is very angular to subrounded fine to coarse of flint, brick and concrete. Sand is fine to coarse.	(0.80)		
			1.70		D	9									
	1.90	DRY	2.00-2.45		D	10				S10			2.00	1.57	
			2.00-2.50		B	11						Possible MADE GROUND: Composed of white and brown mottled silty subangular fine to coarse gravel and rare cobble sized fragments of extremely weak to weak chalk in a comminuted chalk matrix.			
			2.50		D	12									
			2.50-3.00		B	13							(1.55)		
	2.90	DRY	3.00-3.45		D	14				S11					
			3.00-3.50		B	15									
			3.50		D	16									
			3.50-4.00		B	17							3.55	0.02	
												Light brown silty sandy very angular to subrounded fine to coarse GRAVEL of flint and weak chalk with rare chalk cobbles. Sand is fine to coarse. (Possibly reworked).	(0.45)		
	3.90	DRY	4.00-4.45		D	18				S17			4.00	-0.43	
			4.00-4.50		B	19						Probably extremely weak structureless CHALK recovered as clayey slightly sandy subangular fine to coarse gravel and cobble sized fragments of weak chalk and rare flint in a comminuted chalk matrix.	(0.50)		
03/10	4.50	TIDAL											4.50	-0.93	
10/10	4.50	2.70									AZCL	Probably extremely weak CHALK with many flint nodules recovered as angular and subangular coarse gravel and cobble sized fragments of brown and dark brown flint (up to 70mm x 90mm x 110mm).			
		(90)	4.50-5.10		83	0	0				NI	Between 4.50m and 4.60m: Assumed zone of core loss. Between 5.00m and 5.10m: 1No. subrounded cobble of weak weathered chalk (60mm x	(0.60)		

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
2. Chiselled from 3.60m to 3.90m (30 mins).
3. See separate sheet for installation.
4. Groundwater was encountered at 4.50m during boring and rose to 4.45m after 5 mins,4.40m after 10 mins,4.35m after 15 mins,4.35m after 20 mins.

Scale 1:25

TUGRO	Project: LITTLEHAMPTON ARUN TIDAL DEFENCES	Contract No. G120043U
		Figure No. FR4 (1 of 8)

Drilling Method Cable Percussion & Rotary **Equipment** Dando 2000 Knebel **Drill Fluid** Polymer GS550 **Crew/Vessel** S Purvis/M McKinney **Dates Drilled** Start 03/10/2012 End 10/10/2012	**Borehole Diameter** 200mm to 4.50m 150mm to 30.60m **Casing Diameter** 200mm to 4.50m **Logged by** AH 05/10/2012 **Compiled by** clm 08/10/2012 **Approved by** BC 14/11/2012	**BOREHOLE No.** CPRCB6A **Coordinates** 502764 E **(National Grid)** 101575 N **Ground Level** 3.57 m OD	

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No. TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
											60mm x 90mm).			
	4.50	2.70	5.10-5.25						S50/ 75		Between 5.00m and 5.10m: 1 No. subrounded cobble of weak weathered chalk (60mm x 60mm x 90mm).	5.10	-1.53	
		(80)	5.10-6.60		13	0	0			AZCL	Extremely weak to very weak orange and locally black speckled low density CHALK. Fractures are very closely to closely spaced (20/60/150) predominantly subvertical to inclined 20 degrees to 90 degrees planar smooth closed and tight with slight to moderate orange staining and moderate brown speckling to surfaces. (B4/B3). Between 5.10m and 6.40m: Assumed zone of core loss. Between 5.10m and 6.40m: Assumed zone of core loss.			
										NI	Between 6.40m and 6.60m: Recovered as subangular fine to coarse gravel sized fragments of very weak orange chalk and comminuted chalk and very angular and subangular coarse gravel sized fragments of brown and dark brown flint. Between 6.60m and 7.10m: Assumed zone of core loss.			
	4.50	2.70	6.60-7.05						S1					
		(90)	6.60-7.35		33	0	0			AZCL				
										NI				
			7.35-7.42		C	20								
		(90)	7.35-8.10		100	0	0			>25				
											Between 8.05m and 8.10m: Recovered as very angular medium and coarse gravel sized fragments of dark brown flint and comminuted chalk. Between 8.10m and 8.95m: Assumed zone of core loss.			
	4.50	2.70	8.10-8.55						S10	AZCL				
		(90)	8.10-9.60		43	0	0			>25				
											Between 9.60m and 9.90m: Assumed zone of core loss.			
										AZCL				
		(80)	9.60-10.35		60	0	0							

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR4 (2 of 8)

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 4.50m 150mm to 30.60m	**Casing Diameter** 200mm to 4.50m	**BOREHOLE No.** CPRCB6A
Equipment Dando 2000 Knebel			**Coordinates** 502764 E **(National Grid)** 101575 N **Ground Level** 3.57 m OD
Drill Fluid Polymer GS550 **Crew/Vessel** S Purvis/M McKinney **Dates Drilled** Start 03/10/2012 End 10/10/2012	**Logged by** AH 05/10/2012	**Compiled by** clm 08/10/2012	**Approved by** BC 14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From To	Type	No.	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
				TCR %	SCR %			>25				
	4.50	2.70	11.00-11.45				S17	AZCL				
		(80)	10.35-11.10	93	0	0		>25				
			10.90-11.05	C	21				Between 11.10m and 11.15m: Assumed zone of core loss. Between 11.15m and 11.21m: Very angular coarse gravel and cobble sized fragments (60mm x 60mm x 100mm) of dark brown flint.	(12.30)		
								AZCL				
								4				
		(90)	11.10-12.60	97	0	0		>25	Between 11.81m and 11.85m: 40mm flint nodule.			
								AZCL	Between 12.60m and 12.65m: Assumed zone of core loss.			
			12.92-13.08	C	22				Between 12.82m and 12.92m: Recovered as subangular medium and coarse gravel of very weak chalk with slight orange staining and moderate brown speckling on >2 surfaces.			
		(90)	12.60-14.10	97	60	60		6				
			13.85-13.95	C	23							
	4.50	2.70	14.10-14.55				S47	AZCL	Between 14.10m and 14.20m: Assumed zone of core loss.			
								7				
		(70)	14.10-15.60	93	77	77			Between 14.72m and 14.99m: Recovered as subangular fine to coarse gravel sized fragments of chalk and comminuted chalk with very angular fine to coarse gravel sized fragments of dark brown flint.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR4 (3 of 8)

Drilling Method	Cable Percussion & Rotary	Borehole Diameter	Casing Diameter	BOREHOLE No.	CPRCB6A
Equipment	Dando 2000 Knebel	200mm to 4.50m 150mm to 30.60m	200mm to 4.50m	Coordinates (National Grid)	502764 E 101575 N
Drill Fluid	Polymer GS550			Ground Level	3.57 m OD
Crew/Vessel	S Purvis/M McKinney	Logged by	Compiled by	Approved by	
Dates Drilled	Start 03/10/2012 End 10/10/2012	AH 05/10/2012	clm 08/10/2012	BC 14/11/2012	

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
												>25				
												AZCL	Between 15.60m and 15.75m: Assumed zone of core loss.			
			16.24	16.40	C	25							Between 16.18m and 16.21m: 1 No. tubular dark brown flint nodule (25mm x 25mm x 60mm).			
		(80)	15.60	17.10	90	90	79					10	Between 16.33m and 16.36m: 1 No. dark brown flint nodule (30mm x 30mm).			
	4.50	2.70	17.10	17.55						S51						
			17.28	17.55	C	26								17.40	-13.83	
		(90)	17.10	18.60	100	100	100						Very weak low to medium density grey white and locally black speckled CHALK. Fractures are medium spaced (100/400/1000) subhorizontal to inclined 20 degrees planar smooth closed tight with slight orange and grey staining and slight brown black speckling to surfaces. (B2 / A2).			
												4	Between 18.75m and 18.82m: Dark brown and grey flint recovered as angular coarse gravel sized fragments. Between 18.97m and 19.01m: 1 No. dark brown flint nodule (40mm x 50mm).			
		(90)	18.60	20.10	100	100	100						Between 19.23m and 19.30m: 2 No. dark brown flint nodules (50mm x 40mm and 60mm x 40mm). Between 19.34m and 19.37m: 1 No. dark brown flint nodule (30mm x 40mm).			
			20.00	20.10	C	27										

Remarks
(See notes & keysheets)

Scale 1:25

	Project	Contract No.
TUGRO	LITTLEHAMPTON ARUN TIDAL DEFENCES	G120043U
		Figure No. FR4 (4 of 8)

304/03

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 4.50m 150mm to 30.60m	**Casing Diameter** 200mm to 4.50m	**BOREHOLE No.** CPRCB6A
Equipment Dando 2000 Knebel			**Coordinates** 502764 E (National Grid) 101575 N
Drill Fluid Polymer GS550			**Ground Level** 3.57 m OD
Crew/Vessel S Purvis/M McKinney	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled Start 03/10/2012 End 10/10/2012	05/10/2012	08/10/2012	14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
	4.50	2.70	20.10-20.32						S50/75					
			20.38-20.51	C		28					Between 20.50m and 20.57m: Dark brown flint nodule recovered as subangular fine to coarse gravel sized fragments.			
		(90)	20.10-21.60	87		87		87		2				
										AZCL	Between 21.23m and 21.40m: Recovered as subangular to subrounded fine to coarse gravel sized fragments of extremely weak orange weathered chalk and dark brown flint (60mm x 80mm x 70mm). Between 21.40m and 21.60m: Assumed zone of core loss.			
		(90)	21.60-23.10	100		100		100		1	Between 21.72m and 21.76m: 1 No. dark brown flint nodule (40mm x 50mm). Between 21.94m and 22.00m: 1 No. subangular cobble sized dark brown flint. Between 22.40m and 22.44m: 1 No. dark brown flint nodule (20mm x 40mm).			
	4.50	2.70	23.10-23.55						S50					
			23.50-23.69	C		29					Between 23.76m and 23.81m: Very angular fine to coarse gravel sized fragments of dark brown black flint.			
		(70)	23.10-24.60	90		90		90						
			24.00-24.32	C		30						(13.20)		
										AZCL	Between 24.32m and 24.41m: 1 No. very angular and subangular cobble sized fragment of black flint (60mm x 75mm x 80mm). Between 24.45m and 24.60m: Assumed zone of core loss. Between 24.75m and 24.79m: 1 No. dark brown flint nodule (30mm x 35mm).			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR4 (5 of 8)

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 4.50m 150mm to 30.60m	**Casing Diameter** 200mm to 4.50m	**BOREHOLE No.** CPRCB6A
Equipment Dando 2000 Knebel			**Coordinates** 502764 E **(National Grid)** 101575 N **Ground Level** 3.57 m OD
Drill Fluid Polymer GS550 **Crew/Vessel** S Purvis/M McKinney **Dates Drilled** Start 03/10/2012 End 10/10/2012	**Logged by** AH 05/10/2012	**Compiled by** clm 08/10/2012	**Approved by** BC 14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
		(60)	24.60-26.10		100	100	100			Between 25.21m and 25.32m: Recovered as subangular medium and coarse gravel sized fragments of very weak chalk and dark brown flint.			
			25.67-26.00		C	31							
			26.00-26.10		C	32							
	4.50	2.70	26.10-26.45					S50/ 210					
									2	Between 26.40m and 26.46m: Very angular medium and coarse gravel sized fragments of black flint.			
		(0)	26.10-27.60		100	100	100			Between 27.04m and 27.07m: 1 No. black flint nodule (30mm x 40mm). Between 27.21m and 27.24m: Probable cobble sized flint nodule.			
			27.36-27.60		C	33							
		(60)	27.60-29.10		100	100	99			Between 27.60m and 27.65m: 1No.black flint nodule (50mm x 50mm). Between 27.69m and 27.75m: Recovered as subangular medium and coarse gravel sized fragments of very weak chalk and dark brown and black flint.			
										Between 28.51m and 28.55m: 1 No. flint nodule (20mm x 70mm).			
	4.50	3.80	29.10-29.55 29.19-29.32		C	34		S53					
									4	Between 29.63m and 29.67m: Recovered as very angular and subangular coarse gravel sized fragments of black flint.			
		(80)	29.10-30.60		90	90	90						

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR4 (6 of 8)

Drilling Method	Cable Percussion & Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 30.60m
Equipment	Dando 2000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/M McKinney		
Dates Drilled	Start 03/10/2012 End 10/10/2012		

Logged by	Compiled by	Approved by
AH	clm	BC
05/10/2012	08/10/2012	14/11/2012

BOREHOLE No. CPRCB6A

Coordinates	502764	E
(National Grid)	101575	N
Ground Level	3.57	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			30.16	30.45	C	35				Between 30.23m and 30.26m: 1 No. bivalve shell (25mm x 30mm).			
										Between 30.45m and 30.60m: Assumed zone of core loss.			
10/10	4.50	4.50							AZCL				
			30.60	31.05				S48					
	4.50	4.80								End of Borehole	30.60	-27.03	

Remarks
(See notes & keysheets)

Scale 1:25

	Project LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR4 (7 of 8)

304/03

Drilling Method	Cable Percussion & Rotary	**Borehole Diameter**	**BOREHOLE No.** CPRCB6A
Equipment	Dando 2000 Knebel Polymer GS550	200mm to 4.50m 150mm to 30.60m	**Coordinates** 502764 E **(National Grid)** 101575 N **Ground Level** 3.57 m OD
Crew/Vessel	S Purvis/M McKinney	**Logged by** AH	**Compiled by** clm
Dates Drilled	**Start** 03/10/2012 **End** 10/10/2012	05/10/2012	08/10/2012
		Approved by BC	14/11/2012

Installation Details		Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 75mm slotted section (SL) from 24.00 to 30.00m	Concrete	0.50	3.07			MADE GROUND
	Grout	1.00	2.57			
	Bentonite Seal				3.55	
				▽▼	4.00	Silty sandy GRAVEL
						CHALK
		23.50	-19.93			
	Gravel Filter SL=24.00-30.00m					
		30.60	-27.03		30.60	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush stopcock box cover.
Pipe diameter 75mm to 30.00m, installed on 11/10/2012.

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR4 (8 of 8)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 0.95m
Casing Diameter		**BOREHOLE No.**	**CPRCB9**
Equipment	Dando 2000	**Coordinates**	502747 E
Drill Fluid	Polymer GS550	**(National Grid)**	101687 N
Crew/Vessel	S Purvis	**Ground Level**	3.48 m OD
Dates Drilled	Start 01/10/2012	**Logged by**	IS 01/10/2012
	End 01/10/2012	**Compiled by**	clm 10/10/2012
		Approved by	BC 14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)		Description of Strata	Depth (Thick-ness) (m)	Level	Legend
01/10										MADE GROUND: Tarmacadam.	(0.10)		
											0.10	3.38	
										MADE GROUND: Reinforced concrete. (5mm diameter mesh reinforcement).	(0.15)		
											0.25	3.23	
										MADE GROUND: Composed of yellow brown slightly silty sandy subangular and subrounded fine to coarse flint gravel.	(0.55)		
											0.80	2.68	
01/10		DRY								MADE GROUND: Composed of brown silty slightly clayey angular to subrounded locally rounded fine to coarse flint gravel.	(0.15)		
											0.95	2.53	
										End of Borehole			

Remarks (See notes & keysheets)

1 Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 0.95m depth and rescanned using the CAT to check for services. An unknown service was encountered at 0.95m and the borehole was abandoned and relocated as CPRCB9A.

2 The borehole was backfilled on completion with materials arising.

3 Groundwater not encountered during boring.

Scale 1:25

	Project LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR5 (1 of 1)

304/03

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m	**Casing Diameter** 200mm to 7.40m	**BOREHOLE No.** CPRCB9A
Equipment Dando 2000 Knebel			**Coordinates** 502747 E **(National Grid)** 101686 N **Ground Level** 3.48 m OD
Crew/Vessel S Purvis/R Johnson **Dates Drilled** Start 04/10/2012 End 08/10/2012	**Logged by** AH 05/10/2012	**Compiled by** clm 08/10/2012	**Approved by** BC 14/11/2012

Date & Time	Casing Depth (m)	Depth to Water (m)	Sample Details: Depth (m) From	To	Type	No.	SPT Blows/N Drive mm: Test	U100 Blows/ Recovery mm: Result	Description of Strata	Depth (Thickness) (m)	Level	Legend
04/10									MADE GROUND: Tarmacadam.	(0.10)		
										0.10	3.38	
									MADE GROUND: Reinforced concrete. (5mm diameter mesh).	(0.15)		
										0.25	3.23	
			0.50		B	1			MADE GROUND: Composed of yellow brown slightly silty sandy angular and subangular fine to coarse flint gravel. Sand is fine to coarse.	(0.55)		
			0.50		D	2						
			0.50		ES	3						
										0.80	2.68	
			1.00		B	4			Probable MADE GROUND: Composed of brown clayey sandy angular to rounded fine to coarse flint gravel with occasional gravel sized pockets of dark grey clay and rare cobble sized flint fragments. Sand is fine to coarse.	(0.40)		
			1.00		D	5						
			1.00		ES	6						
		GL	1.20-1.65		D	7	S19			1.20	2.28	
			1.20-1.70		B	8			Medium dense brown very sandy angular to well rounded fine to coarse flint GRAVEL. Sand is fine to coarse.			
	1.90	GL	2.00-2.45		D	9	S18					
			2.00		D	10						
			2.00-2.50		B	11				(2.30)		
			2.50-3.00		B	12						
	3.00	GL	3.00-3.45		D	13	S18					
			3.00		D	14						
			3.00-3.50		B	15						
			3.50-4.00		B	16				3.50	-0.02	
									Medium dense brown grey slightly gravelly to gravelly fine to coarse SAND. Gravel is very angular to well rounded fine to coarse flint.			
	3.90	GL	4.00-4.45		D	17	S19					
			4.00		D	18				(1.10)		
			4.00-4.50		B	19						
			4.60		D	20				4.60	-1.12	
									Very soft to soft grey brown to brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of flint. Sand is fine to coarse.			
	4.60	GL	5.00-5.45		D	21	S9					

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
2. Chiselled from 2.70m to 2.80m (30 mins);chiselled from 8.00m to 8.30m (30 mins).
3. See separate sheet for installation.
4. Groundwater not encountered during boring.

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR6 (1 of 8)

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m	**Casing Diameter** 200mm to 7.40m	**BOREHOLE No.** CPRCB9A
Equipment Dando 2000 Knebel			**Coordinates** 502747 E **(National Grid)** 101686 N
Drill Fluid Polymer GS550			**Ground Level** 3.48 m OD
Crew/Vessel S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled Start 04/10/2012 End 08/10/2012	05/10/2012	08/10/2012	14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or U100 Blows/ Rec. mm or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			5.00		D	22								(1.40)		
			5.00-5.50		B	23										
			5.50-6.00		B	24										
			6.00-6.45		B	25								6.00	-2.52	
			6.00		D	26							Soft orange brown slightly sandy slightly gravelly CLAY. Gravel is subangular fine to coarse of extremely weak chalk and flint. Sand is fine to coarse.			
			6.00-6.50		B	27										
	6.00	GL	6.00-6.45							S8				(0.50)		
			6.50-7.00		B	28								6.50	-3.02	
			7.00		D	29							Probably extremely weak brown white CHALK recovered as silty very angular to subrounded fine to coarse gravel and cobble sized fragments of chalk and flint.			
			7.50-8.00		B	30								(2.00)		
	7.40	GL	7.50-7.95							S33						
			8.00-8.50		B	31										
04/10	7.40	GL														
05/10	7.40	2.10										AZCL	Extremely weak low density orange white and black speckled CHALK. Fractures are very closely spaced (10/30/100) inclined 40 degrees to 80 degrees planar smooth generally clean surfaces orange stained and black speckled. (B4/A4) Between 8.50m and 8.95m: Assumed zone of core loss. Between 9.00m and 9.08m: 3No coarse gravel sized flint nodules. Between 9.30m and 9.90m: Assumed zone of core loss.	8.50	-5.02	
		(0)	8.50-9.30		44	0	0					NI				
	8.50	2.10	9.30-9.75							S1		AZCL				
		(20)	9.30-10.30		60	0	0						Between 9.90m and 12.10m: Recovered as very angular and subangular medium and coarse gravel sized fragments of chalk and flint.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR6 (2 of 8)

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m	**Casing Diameter** 200mm to 7.40m	**BOREHOLE No.** CPRCB9A
Equipment Dando 2000 Knebel			**Coordinates** 502747 E **(National Grid)** 101686 N
Drill Fluid Polymer GS550			**Ground Level** 3.48 m OD
Crew/Vessel S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled Start 04/10/2012 End 08/10/2012	05/10/2012	08/10/2012	14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No. TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
										NI				
		(40)	10.30	11.55		70	0	0		>25 AZCL	Between 10.30m and 10.40m: Recovered as very angular medium and coarse gravel sized fragments of flint. Between 10.70m and 10.80m: Recovered as very angular medium and coarse gravel sized fragments of flint. Between 10.80m and 10.85m: Assumed zone of core loss.			
	8.50	2.10	12.00	12.45					S36		Between 11.45m and 11.59m: Recovered as very angular fine to coarse gravel sized fragments of flint.	(6.80)		
		(30)	11.55	12.30		75	53	53						
			12.00	12.17	C		32							
			12.17	12.30	C		33			>25				
		(30)	12.30	13.80		93	67	67		AZCL	Between 13.70m and 13.80m: Assumed zone of core loss.			
		(50)	13.80	15.30		100	93	93		9	Between 14.01m and 14.10m: Recovered as very angular fine to coarse gravel sized fragments of flint. Between 14.20m and 14.23m: Possible flint nodule recovered as angular fragments. Between 14.24m and 14.30m: Dark brown flint nodule. Between 14.50m and 14.57m: Dark brown flint nodule.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR6 (3 of 8)

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m	**Casing Diameter** 200mm to 7.40m	**BOREHOLE No.** CPRCB9A
Equipment Dando 2000 Knebel			**Coordinates** 502747 E **(National Grid)** 101686 N
Drill Fluid Polymer GS550			**Ground Level** 3.48 m OD
Crew/Vessel S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled Start 04/10/2012 End 08/10/2012	05/10/2012	08/10/2012	14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			15.09	15.23	C	34										
05/10	8.50	6.30											Between 15.25m and 15.30m: Dark brown flint nodule.	15.30	-11.82	
08/10	8.50 8.50	2.70 2.10	15.30	15.75						S44			Very weak low density locally medium density white and locally orange and black speckled CHALK. Fractures are closely to medium spaced (100/300/500) inclined 60 degrees to 90 degrees planar smooth closed locally grey stained and black speckled. (B4/B3)			
			15.57	15.75	C	35						6	Between 15.30m and 15.34m: Recovered as very angular fine to coarse gravel sized fragments of flint.			
		(60)	15.30	16.80	73	73	73						Between 15.82m and 15.92m: Recovered as very angular fine to coarse gravel sized fragments of flint.			
													Between 16.40m and 16.94m: Assumed zone of core loss.			
												AZCL				
			16.94	17.21	C	36							Between 17.31m and 17.34m: Recovered as very angular fine to coarse gravel sized fragments of flint.			
		(50)	16.80	18.30	91	91	91						Between 17.84m and 17.94m: Recovered as very angular fine to coarse gravel sized fragments of flint.			
			18.21	18.30	C	37										
	8.50	2.70	18.30	18.75						S36		3	Between 18.71m and 18.76m: Recovered as very angular coarse gravel sized fragments of brown flint.	(6.10)		
		(50)	18.30	19.80	100	100	100						Between 19.18m and 19.25m: Recovered as very angular and subangular fine to coarse gravel sized fragments of brown flint.			
			19.40	19.58	C	38							Between 19.59m and 19.69m: Recovered as very angular and subangular fine to coarse gravel sized fragments of brown flint and chalk.			
												AZCL				

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR6 (4 of 8)

304/03

Drilling Method Cable Percussion & Rotary **Equipment** Dando 2000 Knebel **Drill Fluid** Polymer GS550 **Crew/Vessel** S Purvis/R Johnson **Dates Drilled** Start 04/10/2012 End 08/10/2012	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m **Casing Diameter** 200mm to 7.40m **Logged by** AH 05/10/2012 **Compiled by** clm 08/10/2012 **Approved by** BC 14/11/2012	**BOREHOLE No.** CPRCB9A **Coordinates** 502747 E **(National Grid)** 101686 N **Ground Level** 3.48 m OD	

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			20.18-20.45	C	39									
		(30)	19.80-21.30	90	90	90				3	Between 20.66m and 20.82m: Cobble sized flint nodule.			
											Between 21.30m and 21.40m: Assumed zone of core loss.			
	8.50	2.70	21.30-21.75						S32	AZCL				
											Very weak medium density grey white and locally black speckled CHALK. Fractures are medium to widely spaced (100/500/1000) subhorizontal to inclined 20 degrees planar smooth clean locally stained grey and black speckled. (B3/B2)	21.40	-17.92	
			21.94-22.20	C	40									
		(0)	21.30-22.80	93	93	93								
			23.43-23.72	C	41						Between 23.34m and 23.40m: Recovered as very angular and subangular fine to coarse gravel sized fragments of brown black flint.			
		(20)	22.80-24.30	100	100	91					Between 23.83m and 23.89m: Recovered as very angular and subangular fine to coarse gravel sized fragments of brown flint.			
	8.50	2.70	24.30-24.65						S50/ 200					
			24.30-24.60	C	42									

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR6 (5 of 8)

304/03

Drilling Method Cable Percussion & Rotary	**Borehole Diameter** 200mm to 8.50m 150mm to 30.30m	**Casing Diameter** 200mm to 7.40m	**BOREHOLE No.** CPRCB9A
Equipment Dando 2000 Knebel			**Coordinates** 502747 E **(National Grid)** 101686 N
Drill Fluid Polymer GS550			**Ground Level** 3.48 m OD
Crew/Vessel S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled Start 04/10/2012 End 08/10/2012	05/10/2012	08/10/2012	14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
		(20)	24.30-25.80	100	100	100						
									Between 25.46m and 25.48m: 2No medium and coarse gravel sized flint nodules.			
								3	Between 25.85m and 26.44m: 4No coarse gravel sized flint nodules.	(8.90)		
			26.05-26.24	C	43							
		(10)	25.80-27.30	100	100	96						
			27.03-27.18	C	44							
08/10	8.50	4.80										
	8.50	2.70	27.30-27.45				S50/ 75					
		(20)	27.30-28.80	100	75	75						
			29.12-29.42	C	45							
			29.42-29.80	C	46							
		(20)	28.80-30.30	100	100	100						
			29.98-30.20	C	47							

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR6 (6 of 8)

Drilling Method	Cable Percussion & Rotary	**Borehole Diameter**	200mm to 8.50m 150mm to 30.30m
		Casing Diameter	200mm to 7.40m
Equipment	Dando 2000 Knebel	**BOREHOLE No.**	**CPRCB9A**
Drill Fluid	Polymer GS550	**Coordinates** (National Grid)	502747 E 101686 N
Crew/Vessel	S Purvis/R Johnson	**Ground Level**	3.48 m OD
Dates Drilled	Start 04/10/2012 End 08/10/2012	**Logged by** / **Compiled by** / **Approved by**	AH / clm / BC 05/10/2012 / 08/10/2012 / 14/11/2012

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
											30.30	-26.82	
										End of Borehole			

Remarks
(See notes & keysheets)

Scale 1:25

	Project LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR6 (7 of 8)

304/03

Drilling Method	Cable Percussion & Rotary	**Borehole Diameter**	**BOREHOLE No.** CPRCB9A
Equipment	Dando 2000 Knebel Polymer GS550	200mm to 8.50m 150mm to 30.30m	**Coordinates** 502747 E **(National Grid)** 101686 N **Ground Level** 3.48 m OD
Crew/Vessel	S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled	**Start** 04/10/2012 **End** 08/10/2012	05/10/2012	08/10/2012	14/11/2012

Installation Details	Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 75mm slotted section (SL) from 23.50 to 29.50m					
Concrete	0.50	2.98			MADE GROUND
Bentonite Pellets				1.20	
					Sandy GRAVEL
				3.50	
					Gravelly SAND
				4.60	
					Sandy gravelly CLAY
				6.50	
					CHALK
	23.00	-19.52			
Gravel Filter SL=23.50-29.50m					
	30.30	-26.82		30.30	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush lockable stopcock box cover.
Pipe diameter 75mm to 29.50m, installed on 09/10/2012.

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR6 (8 of 8)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.00m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson		
Dates Drilled	Start 25/09/2012 End 01/10/2012	**Logged by** AH 26/09/2012	**Compiled by** clm 27/09/2012
		Approved by BC 14/11/2012	

BOREHOLE No. CPRCB10

Coordinates	502361	E
(National Grid)	102140	N
Ground Level	3.27	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or U100 Blows/ Rec. mm or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
25/09												MADE GROUND: Tarmacadam.	(0.07)		
													0.07	3.20	
												MADE GROUND: Composed of dark grey brown silty very sandy subrounded to rounded fine to coarse gravel of flint and rare chalk. Sand is fine to coarse.	(0.27)		
			0.30		ES	1									
			0.30		B	2									
			0.30		D	3							0.34	2.93	
			0.50		ES	4							(0.06)		
			0.50		D	4A						MADE GROUND: Composed of subangular coarse gravel sized fragments of weak chalk.	0.40	2.87	
													(0.25)		
													0.65	2.62	
												MADE GROUND: Composed of dark grey brown silty sandy subangular to subrounded fine to coarse gravel of flint with rare coarse gravel sized fragments of brick. Sand is fine to coarse.	(0.30)		
													0.95	2.32	
			1.00		D	5							(0.18)		
			1.00		D	5A									
													1.13	2.14	
		DRY	1.20-1.65		D	6				S40		MADE GROUND: Composed of subangular coarse gravel and occasional cobble sized fragments of weak chalk with a little reworked chalk.			
			1.20-1.70		B	7									
			1.20		D	7A									
												MADE GROUND: Composed of clayey slightly sandy subangular and subrounded fine to coarse gravel of flint, chalk and occasional brick. Sand is fine to coarse.	(0.87)		
												MADE GROUND: Composed of orange slightly clayey sandy very angular to subangular fine to coarse gravel sized fragments of flint, red brick and extremely weak orange weathered chalk. Sand is fine to coarse.			
	2.00	DRY	2.00-2.45		D	8				S12			2.00	1.27	
			2.00-2.50		B	9									
			2.00		D	9A						Probably structureless CHALK recovered as orange and mottled brown silty sandy subangular and subrounded fine to coarse gravel and occasional cobble sized fragments of flint and weak orange weathered chalk.			
	3.00	DRY	3.00-3.45		D	10				S17			(2.00)		
			3.00-3.50		B	11									
			3.00		D	11A									
	4.00	DRY	4.00-4.45		D	12				S15			4.00	-0.73	
			4.00		D	13A						Probably structureless CHALK recovered as orange white slightly sandy gravelly comminuted chalk. Gravel is subangular and subrounded fine to coarse of extremely weak to weak orange weathered chalk and very angular and subangular fine to coarse gravel of flint.	(0.50)		
25/09	4.50	4.25											4.50	-1.23	
28/09	4.50	DRY									AZCL	Extremely weak low density white orange and locally black speckled CHALK. Fractures are very closely spaced (10/20/60) undulating rough closed and clean surfaces locally stained orange brown and brown speckled. (B4) Between 4.50m and 4.60m: Assumed zone of core loss.			
		(100)	4.50-5.00		80	0	0				NI				

Remarks (See notes & keysheets)

1. Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.
2. The borehole was backfilled on completion with bentonite pellets.
3. Groundwater was encountered at 4.50m during boring and rose to 4.35m after 5 mins,4.35m after 10 mins,4.30m after 15 mins,4.25m after 20 mins.
4. Chiselled from 1.80m to 2.00m (30 mins).
5. See separate sheet for installation.

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR7 (1 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.00m	**Casing Diameter**	200mm to 4.50m
Equipment	Dando 3000 Knebel				
Drill Fluid	Polymer GS550				
Crew/Vessel	S Purvis/R Johnson	**Logged by**	AH	**Compiled by**	clm
Dates Drilled	Start 25/09/2012 End 01/10/2012		26/09/2012		27/09/2012
		Approved by	BC		14/11/2012

BOREHOLE No. CPRCB10

Coordinates	502361	E
(National Grid)	102140	N
Ground Level	3.27	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			5.33	5.49	C	14						>25	Between 4.60m and 5.00m: Recovered as subrounded fine to predominantly coarse gravel sized fragments of extremely weak orange chalk. Between 4.80m and 4.90m: Recovered as comminuted chalk with very angular fine to coarse gravel sized fragments of grey brown flint. Between 5.00m and 5.25m: Recovered as subrounded fine to predominantly coarse gravel sized fragments of extremely weak orange chalk and comminuted chalk with occasional flint fragments.	(1.10)		
		(100)	5.00	6.50	40	23	43					AZCL	Extremely weak to weak low to medium density white and locally orange and black speckled CHALK. Fractures are extremely closely to very closely spaced (10/60/200) predominantly inclined 5 degrees to subvertical planar smooth closed clean with slight orange staining and slight to moderate brown speckling to surfaces. (B4 / B5).	5.60	-2.33	
	4.50	DRY	6.50	6.95							S33		Between 5.60m and 6.50m: Assumed zone of core loss. Between 6.50m and 6.60m: Recovered as angular and subangular fine to coarse gravel sized fragments of grey brown flint. Between 6.60m and 6.80m: Recovered as subangular fine to coarse gravel sized fragments of extremely weak orange chalk and abundant comminuted chalk. Between 6.90m and 7.00m: Recovered as subangular fine to coarse gravel sized fragments of weak orange chalk. Possible zone of very closely spaced fractures. Between 7.00m and 7.05m: Very angular and subangular fine to coarse gravel sized grey brown flint. Between 7.58m and 8.00m: Recovered as angular and subangular fine to coarse gravel sized fragments of extremely weak orange chalk. Possibly very closely fractured.			
		(100)	6.50	8.00	100	23	23					>25	Between 7.60m and 7.70m: Very angular dark brown flint nodule (90mm x 40mm). Between 7.78m and 7.87m: With occasional subrounded fine to coarse gravel sized fragments of dark brown flint. 8.00m and 8.10m: Recovered as angular and subangular fine to coarse gravel sized fragments of extremely weak chalk and angular fine to coarse grey brown flint. Between 8.41m and 8.49m: 1 No.cobble sized flint nodule (60mm x 70mm x 80mm). Between 8.50m and 8.95m: Possible zone of very closely spaced fractures. Between 8.61m and 8.71m: 1 No. cobble sized brown flint nodule (100mm x 100mm x 120mm). Between 8.95m and 9.30m: Recovered as angular and subangular fine to coarse gravel sized fragments of orange chalk and comminuted chalk. Between 9.30m and 9.50m: Assumed zone of core loss.			
			8.30	8.41	C	15										
		(100)	8.00	9.50	87	8	8									
28/09	4.50	GL										AZCL				
01/10	4.50 4.50	GL	9.50	9.71						S50/ 75			Between 9.57m and 9.77m: Recovered as subangular fine to coarse gravel sized fragments of grey chalk and comminuted chalk.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR7 (2 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.00m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson	**Logged by**	AH
Dates Drilled	Start 25/09/2012 End 01/10/2012	**Compiled by**	clm 27/09/2012
		Approved by	BC 14/11/2012

BOREHOLE No. CPRCB10

Coordinates	502361	E
(National Grid)	102140	N
Ground Level	3.27	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
		(100)	9.50	11.00			95	35	31			Between 10.16m and 10.21m: Recovered as very angular fine to coarse gravel sized dark brown flint and communited chalk.			
			10.93	11.00	C	16					>25				
	4.50	GL	11.00	11.25						S50/ 100					
			11.50	11.62	C	17						Between 11.36m and 11.52m: Recovered as subangular fine to coarse gravel sized fragments of weak chalk and dark brown flint.	(11.40)		
		(100)	11.00	12.50	100	100	100					Between 11.63m and 11.66m: Recovered as angular fine to coarse gravel sized dark brown flint.			
												Between 11.96m and 12.06m: Brown black flint nodule (40mm x 60mm x 100mm).			
												Between 12.35m and 12.50m: Recovered as subangular fine to coarse gravel sized fragments of chalk and comminuted chalk.			
	4.50	GL	12.50	12.95						S40	AZCL	Between 12.50m and 12.55m: Assumed zone of core loss.			
											>25				
		(100)	12.50	14.00	97	97	92								
			13.91	14.00	C	18					3				
	4.50	GL	14.00	14.24						S50/ 85		Between 14.14m and 14.19m: Recovered as angular fine to coarse gravel sized fragmentsof dark brown flint.			
												Between 14.53m and 14.58m: Recovered as fine to coarse gravel sized fragments of dark brown flint.			
		(100)	14.00	15.50	100	27	25								
											>25	Between 14.96m and 15.00m: Dark brown flint nodule.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR7 (3 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.00m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson		
Dates Drilled	Start 25/09/2012 End 01/10/2012		

Logged by	Compiled by	Approved by
AH	clm	BC
26/09/2012	27/09/2012	14/11/2012

BOREHOLE No. CPRCB10

Coordinates	502361	E
(National Grid)	102140	N
Ground Level	3.27	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	TCR %	No.	SCR %	RQD %	SPT Blows /N	Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thickness) (m)	Level	Legend
			15.40	15.50	C		19						Between 15.15m and 15.19m: Dark brown flint nodule. Between 15.25m and 15.40m: Possible zone of very closely spaced fractures.			
												AZCL	Between 15.50m and 15.70m: Assumed zone of core loss.			
		(100)	15.50	17.00		87	20		17			>25	Between 15.70m and 15.75m: Recovered as subangular fine to coarse gravel sized fragments of chalk and rare dark brown flint. Between 16.00m and 16.25m: Recovered as angular and subangular fine to coarse gravel sized fragments of chalk and occasional dark brown flint.			
	4.50	GL	17.00	17.18						S50/ 70			Very weak low to medium density grey white and rare black speckled CHALK. Fractures are closely spaced (20/120/500) predominantly subhorizontal planar rough closed clean with slight orange and brown staining and brown speckling to surfaces. (B3) Between 17.12m and 17.15m: Bivalve shell fragments (2mm to 3mm thick). Between 17.22m and 17.24m: 1 No. flint nodule (15mm x 20mm).	17.00	13.73	
			17.09	17.35	C		20									
		(100)	17.00	18.50		100	100		80			9		(3.00)		
			18.55	18.88	C		21									
		(100)	18.50	20.00		100	100		85							
			19.50	19.70	C		22									
01/10	4.50	GL												20.00	16.73	
													End of Borehole			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR7 (4 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.00m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/R Johnson		
Dates Drilled	Start 25/09/2012 End 01/10/2012		

Logged by	Compiled by	Approved by
AH	clm	BC
26/09/2012	27/09/2012	14/11/2012

BOREHOLE No. CPRCB10

Coordinates	502361	E
(National Grid)	102140	N
Ground Level	3.27	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
	4.50	GL	20.00	20.35				S50/ 195			20.00	-16.73	

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR7 (5 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	**BOREHOLE No.** **CPRCB10**
Equipment	Dando 3000 Knebel Polymer GS550	200mm to 4.50m 150mm to 20.00m	**Coordinates** 502361 E **(National Grid)** 102140 N **Ground Level** 3.27 m OD
Crew/Vessel	S Purvis/R Johnson	**Logged by** AH	**Compiled by** clm	**Approved by** BC
Dates Drilled	**Start** 25/09/2012 **End** 01/10/2012	26/09/2012	27/09/2012	14/11/2012

Installation Details	Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 50mm slotted section (SL) from 16.50 to 19.50m					
Concrete	0.50	2.77			MADE GROUND
Cement/Bentonite Grout				2.00	CHALK
			▽▼		
	15.00	-11.73			
Bentonite Seal	16.00	-12.73			
Gravel Filter SL=16.50-19.50m					
	20.00	-16.73		20.00	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush lockable stopcock box cover.
Pipe diameter 50mm to 19.50m, installed on 01/10/2012.

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U **Figure No.** FR7 (6 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.10m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/M McKinney		
Dates Drilled	Start 24/09/2012 End 03/10/2012	**Logged by** **Compiled by** **Approved by**	AH 26/09/2012 clm 27/09/2012 BC 14/11/2012

BOREHOLE No. CPRCB11

Coordinates	502324	E
(National Grid)	102178	N
Ground Level	3.29	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No.	TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or U100 Blows/ Rec. mm or Fracture Index	Description of Strata	Depth (Thickness) (m)	Level	Legend
24/09												MADE GROUND: Concrete paving slab.	(0.05)		
													0.05	3.24	
												MADE GROUND: Yellow fine to medium sand.	(0.10)		
													0.15	3.14	
												MADE GROUND: Light brown type 1 sub base.	(0.05)		
			0.36		D	A							0.20	3.09	
												MADE GROUND: Composed of firm brown slightly gravelly sandy clay. Gravel is subangular to subrounded fine to coarse of brick, chalk and flint. Sand is fine to coarse.	(0.16)		
			0.50		B	1							0.36	2.93	
			0.50		D	2							(0.10)		
			0.50		D	2A							0.46	2.83	
			0.50		ES	3							(0.38)		
												MADE GROUND: Composed of dark brown slightly gravelly fine to coarse sand. Gravel is subangular to subrounded fine to coarse of flint, brick and rare ceramics.	0.84	2.45	
			1.00		B	4							(0.36)		
			1.00		D	4A									
			1.00		ES	5									
		DRY	1.20-1.65		D	5				S47		MADE GROUND: Composed of weak and medium strong cobbles of white chalk with some light brown reworked chalk.	1.20	2.09	
			1.20-1.70		B	6									
			1.20		D	6A									
												MADE GROUND: Composed of brown and white grey slightly sandy slightly gravelly reworked chalk with subangular to subrounded cobbles of weak grey and white chalk (200mm x 300mm x 350mm).	(0.80)		
												Very soft to soft brown and brown grey sandy gravelly CLAY with rare subrounded cobbles of chalk (60mm x 80mm x 100mm). Gravel is subangular fine to coarse of flint and weak white chalk. Sand is fine to coarse.			
	2.00	DRY	2.00-2.45		D	7				S8			2.00	1.29	
			2.00-2.50		B	8									
			2.00		D	8A									
												Soft becoming firm with depth brown mottled orange brown very sandy gravelly CLAY. Gravel is subangular to subrounded fine to coarse of flint. Sand is fine to coarse. Between 2.00m and 2.50m: With occasional gravel of extremely weak to weak weathered chalk.	(0.70)		
			2.50		D	9									
													2.70	0.59	
												Grey mottled brown slightly clayey slightly gravelly fine to coarse SAND. Gravel is very angular and subangular fine and medium of black and brown flint.	(0.30)		
			2.90		D	10									
	3.00	DRY	3.00-3.45		D	11				S14			3.00	0.29	
			3.00-3.50		B	12									
			3.00		D	12A									
												Probably structureless CHALK recovered as orange white silty subangular fine to coarse gravel and occasional cobble sized fragments of extremely weak orange weathered chalk.			
24/09	3.50	3.70													
													(1.50)		
25/09	3.50	2.05													
			4.00		D	13						Between 4.00m and 4..50m: With very angular fine to coarse gravel of brown flint.			
			4.00		D	A									
	4.00	DRY	4.00-4.45							S19					
25/09	4.50	2.20													
													4.50	-1.21	
02/10	4.50	2.00										Probably extremely weak CHALK. No recovery. Between 4.50m and 6.40m: No recovery. Assumed zone of core loss.			
		(100)	4.50-5.10		0	0	0								

Remarks (See notes & keysheets)

1 Prior to boring a Cable Avoidance Tool (CAT) survey was carried out. An inspection pit was hand-dug to 1.20m depth and rescanned using the CAT to check for services. Services were not located.

2 Groundwater was encountered at 3.80m during boring and rose to 3.75m after 5 mins,3.75m after 10 mins,3.75m after 15 mins,3.70m after 20 mins.

3 Chiselled from 1.40m to 1.70m (45 mins).

4 See separate sheet for installation.

Scale 1:25

FUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR8 (1 of 6)

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.10m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/M McKinney		
Dates Drilled	Start 24/09/2012 End 03/10/2012	**Logged by** AH 26/09/2012	**Compiled by** clm 27/09/2012
		Approved by BC 14/11/2012	

BOREHOLE No. CPRCB11

Coordinates (National Grid)	502324	E
	102178	N
Ground Level	3.29	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No. TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
	4.50	GL	5.10	5.55					S11	AZCL		(1.90)		
		(70)	5.10	6.60	13	0	0			NI	Extremely weak locally weak low density brown white and locally black speckled CHALK. Fractures are very closely spaced (10/20/100) inclined 60 degrees to subvertical planar smooth closed and clean surfaces stained brown and black speckled. (B4/A4)	6.40	-3.11	
	4.50	GL	6.60	7.05					S13	AZCL	Between 6.60m and 7.25m: Assumed zone of core loss.			
		(80)	6.60	8.10	57	0	0			NI	Between 7.25m and 8.10m: Recovered as subangular to subrounded fine to coarse gravel sized fragments of extremely weak chalk with abundant orange staining and black speckling. Possible highly fractured zone.			
			7.95	8.05	C	15				>25				
	4.50	GL	8.10	8.55					S24	AZCL	Between 8.10m and 8.45m: Assumed zone of core loss.			
		(60)	8.10	8.85	53	0	0			>25	Between 8.45m and 8.85m: Recovered as subangular to subrounded fine to coarse gravel sized fragments of extremely weak chalk and rare brown flint.			
		(60)	8.85	9.60	40	40	40			AZCL	Between 8.85m and 9.30m: Assumed zone of core loss.			
										NI	Between 9.30m and 9.60m: Cobble sized dark brown flint nodule.			
		(50)	9.60	10.35	80	64	64			AZCL	Between 9.60m and 9.75m: Assumed zone of core loss. Between 9.75m and 9.86m: Recovered as very angular to subangular medium and coarse gravel sized fragments of brown flint.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR8 (2 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	Borehole Diameter	200mm to 4.50m 150mm to 20.10m
Equipment	Dando 3000 Knebel	Casing Diameter	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/M McKinney		
Dates Drilled	Start 24/09/2012 End 03/10/2012	Logged by Compiled by Approved by	AH 26/09/2012 clm 27/09/2012 BC 14/11/2012

BOREHOLE No. CPRCB11

Coordinates (National Grid)	502324 102178	E N
Ground Level	3.29	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	TCR %	No.	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
			10.22	10.35	C		16				NI	Between 10.35m and 10.50m: Assumed zone of core loss.			
		(50)	10.35	11.10		80	32	32			AZCL >25		(8.50)		
	4.50	GL	11.10	11.55						S47	AZCL	Between 11.10m and 11.35m: Assumed zone of core loss.			
		(60)	11.10	11.85		67	40	40			>25	Between 11.65m and 11.85m: Recovered as gravelly comminuted chalk.			
											AZCL	Between 11.85m and 12.10m: Assumed zone of core loss.			
		(50)	11.85	12.60		60	13	13			>25	Between 12.27m and 12.35m: Recovered as very angular to subangular fine to coarse gravel sized fragments of dark brown flint.			
			12.35	12.45	C		17					Between 12.60m and 12.80m: Assumed zone of core loss.			
											AZCL	Between 12.80m and 12.86m: Dark brown flint nodule.			
		(40)	12.60	14.10		87	30	30			NI	Between 13.05m and 13.09m: Recovered as very angular and angular fine to coarse gravel sized fragments of flint.			
												Between 13.46m and 13.50m: Dark brown flint nodule.			
02/10	4.50	6.80										Between 14.10m and 14.30m: Assumed zone of core loss.			
03/10	4.50	2.60	14.10	14.34						S50/	AZCL				
	4.50	GL								91					
			14.45	14.56	C		18					Between 14.69m and 14.76m: Recovered as angular and very angular fine to coarse gravel sized fragments of brown flint.			
		(70)	14.10	15.60		87	47	47							
												Weak low to medium density brown white and locally black speckled CHALK.	14.90	-11.61	

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	Project: LITTLEHAMPTON ARUN TIDAL DEFENCES	Contract No. G120043U Figure No. FR8 (3 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.10m	**Casing Diameter**	200mm to 4.50m
Equipment	Dando 3000 Knebel				
Drill Fluid	Polymer GS550				
Crew/Vessel	S Purvis/M McKinney	**Logged by**	**Compiled by**	**Approved by**	
Dates Drilled	Start 24/09/2012 End 03/10/2012	AH 26/09/2012	clm 27/09/2012	BC 14/11/2012	

BOREHOLE No. CPRCB11

Coordinates	502324	E
(National Grid)	102178	N
Ground Level	3.29	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery Depth (m) From	To	Type	No. TCR %	SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
										25	Fractures are closely to medium spaced (60/100/400) subhorizontal to subvertical planar smooth closed predominantly clean surfaces locally stained orange brown and brown speckled with rare striations. (B3/A3 to B2/A2) Between 15.11m and 15.25m: Recovered as subangular fine to coarse gravel sized fragments of weak chalk and dark brown flint.			
			15.76-15.90		C	19								
		(60)	15.60-17.10		100	100		100		6	Between 16.18m and 16.22m: Recovered as very angular fine to coarse gravel sized fragments of dark brown flint. Between 16.29m and 16.37m: Cobble sized dark brown flint fragment. Between 16.84m and 16.86m: Dark brown flint nodule.			
	4.50	GL	17.10-17.53						S50/ 275		Between 17.10m and 17.25m: Recovered as subangular coarse gravel sized fragments of weak chalk and dark brown flint.	(5.20)		
			17.65-17.80		C	20				7	Between 17.80m and 17.81m: Possible thin mudstone parting.			
		(70)	17.10-18.60		80	80		80			At 18.13m: Possible flint nodule. Between 18.22m and 18.30m: Recovered as angular coarse gravel sized fragments of weak chalk and dark brown flint. Between 18.30m and 18.60m: Assumed zone of core loss.			
										AZCL				
		(60)	18.60-20.10		100	95		95		8	Between 19.00m and 19.12m: Recovered as subangular fine to coarse gravel sized fragments of weak chalk and dark brown black flint. Between 19.31m and 19.42m: Recovered as very angular to subangular fine to coarse gravel sized fragments of dark brown flint and occasional weak chalk.			
			19.42-19.57		C	21								
										NI				
										7	Between 19.81m and 19.87m: 2No dark brown flint nodules.			

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR8 (4 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.10m
Equipment	Dando 3000 Knebel	**Casing Diameter**	200mm to 4.50m
Drill Fluid	Polymer GS550		
Crew/Vessel	S Purvis/M McKinney		
Dates Drilled	Start 24/09/2012 End 03/10/2012		

Logged by	Compiled by	Approved by
AH	clm	BC
26/09/2012	27/09/2012	14/11/2012

BOREHOLE No. CPRCB11

Coordinates (National Grid)	502324	E
	102178	N
Ground Level	3.29	m OD

Date & Time	Casing Depth (m)	Water Depth (m) (Flush Return) %	Sample/Core Recovery: Depth (m) From	To	Type TCR %	No. SCR %	RQD %	SPT Blows /N Core Size (mm)	Result or Fracture Index	Description of Strata	Depth (Thick-ness) (m)	Level	Legend
03/10	4.50	4.10	20.10	20.46				S50/ 210					
	4.50	GL								End of Borehole	20.10	-16.81	

Remarks
(See notes & keysheets)

Scale 1:25

TUGRO	**Project** LITTLEHAMPTON ARUN TIDAL DEFENCES	**Contract No.** G120043U
		Figure No. FR8 (5 of 6)

304/03

Drilling Method	Cable Percussion and Rotary	**Borehole Diameter**	200mm to 4.50m 150mm to 20.10m
Equipment	Dando 3000 Knebel Polymer GS550		
Crew/Vessel	S Purvis/M McKinney	**Logged by**	AH
Dates Drilled	Start 24/09/2012 End 03/10/2012	**Compiled by**	clm 27/09/2012
		Approved by	BC 14/11/2012

BOREHOLE No. CPRCB11

Coordinates	502324	E
(National Grid)	102178	N
Ground Level	3.29	m OD

Installation Details	Installation Depth (m)	Level m OD	Water Strikes	Strata Depth (m)	Strata Details
Instrumentation: 50mm slotted section (SL) from 16.60 to 19.60m					
Concrete	0.50	2.79			MADE GROUND
Bentonite Seal				1.20	
					Sandy gravelly CLAY
				2.70	
				3.00	Clayey gravelly SAND
			▽▼		CHALK
	16.10	-12.81			
Gravel Filter SL=16.60-19.60m					
	20.10	-16.81		20.10	Base of Hole

Remarks
(See notes & keysheets)

▽ Water Strike

▼ Water Rise

Not to Scale

Flush lockable stopcock box cover.
Pipe diameter 50mm to 19.60m, installed on 03/10/2012.

FUGRO

Project
LITTLEHAMPTON ARUN TIDAL DEFENCES

Contract No. G120043U

Figure No. FR8 (6 of 6)

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