APPENDIX UES18-4

AMEP GEOARCHAEOLOGY REPORT (76491.01)

ABLE MARINE ENERGY PARK
(Material Change 2 – TR030006)

Wessex Archaeology

Able Marine Energy Park (AMEP)
Humber Estuary

Stage 2/3 Geoarchaeological Recording and Sub-sampling

Ref: 76491.01

March 2012

ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING

Prepared by:

Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
Wiltshire
SP4 6EB

Prepared for:
Able UK Ltd
Able House
Billingham Reach Industrial Estate
Billingham
Teeside
TS23 1PX

Ref: 76491.01

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ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING PROJECT

Ref: 76491.01

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Principal Author(s):	Jack Russell
Managed by:	Caroline Budd
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ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING

Ref: 76491.01

Summary

Wessex Archaeology was commissioned by Able UK Ltd to undertake the geoarchaeological recording and sub-sampling of boreholes as part of the geotechnical investigations for the Able Marine Energy Park (AMEP).

Samples from three boreholes on the south bank of the Humber at Killingholme Marshes were subject to geoarchaeological recording and sub-sampling. In addition the borehole logs of 77 boreholes have been reviewed and interpreted in order to provide a stratigraphic framework for understanding the sedimentary sequence. The boreholes were reviewed and the samples geoarchaeologically recorded and sub-sampled as part of the archaeological aspect of the Able Marine Energy Park (AMEP) development on behalf of Able UK.

The geoarchaeological review and recording of sediments indicates that Pleistocene and Holocene sediments including glacial (Unit 2), alluvial (Unit 3/4), peat (Unit 5) and estuarine alluvial sediments (Unit 6) of prehistoric archaeological and palaeoenvironmental interest exist in the area of the Deepwater Frontage of the AMEP. It is recommended that Stage 3 assessment and scientific dating is undertaken upon the sampled sediments from boreholes **D12**, **R13** and **R16**. It is envisaged that scientific dating and assessment of palaeoenvironmental remains will provide information to aid in the chronological and archaeological understanding of the AMEP site.

ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING

Ref: 76491.01

Acknowledgements

This phase of geoarchaeological recording and sub-sampling was commissioned by Able UK. The boreholes and samples were collected by Fugro Ltd. The geoarchaeological recording was undertaken at Fugro House Wallingford. Wessex Archaeology would like to thank the staff at Fugro Ltd. and Able UK for their assistance.

The geoarchaeological recording and sub-sampling of borehole samples was carried out by Jack Russell who also compiled this report. Kitty Brandon prepared the illustrations and Caroline Budd managed the project for Wessex Archaeology.

ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING

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ABLE MARINE ENERGY PARK (AMEP)
HUMBER ESTUARY

STAGE 2/3 GEOARCHAEOLOGICAL RECORDING AND SUB-SAMPLING

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1. INTRODUCTION

1.1. Wessex Archaeology (WA) has been commissioned by Able UK to undertake a geoarchaeological review of 77 geotechnical borehole logs (Fugro 2011) and Stage 2/3 geoarchaeological recording and sub-sampling of 6 borehole core samples. This work is being carried out in accordance with the recommendations set out during previous geoarchaeological investigations (Wessex Archaeology 2011a) and within the Written Scheme of Investigation (Wessex Archaeology 2011b).

1.2. The survey for which the boreholes have been undertaken form part of the geotechnical investigations for the Able Marine Energy Park (AMEP). Previous archaeological work for the AMEP has included an Archaeological Desk Based Assessment and walkover survey the results of which are incorporated into Chapter 18 of the Environmental Statement for the AMEP (Able UK *et al*. 2011). Recording and subsampling of 30 vibrocore samples has also been undertaken (Wessex Archaeology 2011b).

1.3. Other relevant surveys that have been undertaken include a geophysical survey in June 2010 by Emu Limited which comprised bathymetry, magnetometer and sub-bottom data. Buro Happold undertook a Geotechnical Interpretation combining information from the geophysical and vibrocore surveys. Sections of each of these three reports were provided to WA as appendices to the Archaeology and Cultural Heritage Desk Study for the AMEP (Humber Field Archaeology 2010) and have been summarised within the previous goarchaeological recording and sub-sampling report (Wessex Archaeology 2011b).

1.4. The location of the 77 boreholes reviewed in this study, are shown on **Figure 1** and in **Appendix 1**. The three boreholes from which the six geoarchaeologically recorded and sub-sampled core samples were derived are shown on **Figure 1**, and in the table below:

Borehole ID	OSGB36 British National Grid	
	Easting	Northing
D12	518711	418720
R13	517710	418801
R16	517854	418777

1.5. The geoarchaeological recording and sub-sampling was undertaken on 27th February 2012 at Fugro House, Wallingford.

1.6. This report summarises the results of the archaeological review of the 77 borehole logs and the geoarchaeological recording and sub-sampling of selected core samples. In addition, the data has been synthesised with the previous

geoarchaeological work, including the geoarchaeological recording and sub-sampling (Wessex Archaeology 2011b) in order to better understand the potential for archaeological remains or sediments of palaeoenvironmental interest within the AMEP.

1.7. All depths are provided relative to Chart Datum (CD), which is 3.9m below Ordnance Datum (OD).

2. BACKGROUND

Development Background

2.1. The Able Marine Energy Park is a 327 hectare site with a Deep Water Frontage being developed for the manufacturing, commissioning, installation and recycling of offshore wind turbines and also to produce renewable energy from biomass products and potentially other renewable sources.

2.2. The geotechnical survey data reviewed in this report is concerned specifically with the Deep Water Frontage part of the development including a Deepwater Quay, Berthing Pocket (with a maximum dredge depth to rockhead and backfilling to 11m below CD) and a Turning Area and Approach Channel (maintained dredge depth of 9m below CD). The location of these elements of the development and the maximum depth of proposed dredging activity are shown on **Figures 1**, **2** and **3**.

Geological background

2.3. The site currently being investigated is a partly developed stretch of Killingholme Marshes and foreshore on the south side of the River Humber, lying between North Killingholme Haven and Immingham Docks (**Figure 1**). The coastal plain on which the AMEP lies is known as the Outmarsh and is generally low lying up to 13m above CD (9.1m above OD).

2.4. The solid underlying geology is Upper Cretaceous Chalk. The Chalk has an undulating top surface and is also characterised by a highly fractured zone resulting from glacial and periglacial processes. The Chalk beneath the AMEP is divided into two formations: Flamborough Chalk and Burnham Chalk. The younger Flamborough Chalk has identifiable bedding surfaces, distinct marl bands and is without flint. The underlying Burnham Chalk, which subcrops along the eastern part of the site, is thinly bedded and laminated and contains continuous flint bands.

2.5. Overlying the Chalk bedrock are Pleistocene deposits of boulder clay or till. The advance of the last Devensian glacial ice sheet, the maximum extent of which is thought to occur at around 18,000BP covered the AMEP area leaving widespread deposits of stiff brown clays with erratic inclusions. The till within the AMEP area is thought to be the so-called Skipsea till, as described by Berridge *et al*. (1994).

2.6. Locally present are glacially derived moraine and glaciofluvial deposits and post-Glacial lacustrine deposits and peat are also known in poorly drained areas. Post-Glacial and Holocene alluvial deposits are also known in the area relating to deposition within the River Humber and its tributaries (Ellis *et al*. 2001).

2.7. The surface sediments of the Outmarsh comprise Holocene peats and estuarine alluvial and tidal flat deposits of sands, silts and clays relating to Holocene sea level rise and its effect on deposition within the River Humber and surrounding areas (Ellis *et al.* 2001).

3. METHOD

Review of borehole logs

3.1. A geoarchaeological review of the 77 borehole logs (Fugro 2011) was undertaken as part of this work. This included entering the data into a Rockworks database and interpreting the data with regard to it's sedimentological characteristics. The sediments were assigned to the unitary framework (Units 1 to 6) already established for the site (Wessex Archaeology 2011b).

Stage 2/3: Geoarchaeological Recording and Sub-sampling

3.2. Six one metre length, 100mm diameter steel lined piston core samples from three boreholes **D12**, **R13** and **R16** were extruded in the laboratory at Fugro House, Wallingford on the 27th February 2012. The sediments were extruded into plastic core liners and the surfaces cleaned so that sedimentary characteristics of the samples were revealed.

3.3. The basic sedimentary characteristics of the sediments including depositional structure, texture, colour and stoniness according to Hodgson (1976) were recorded. A depth below seabed was recorded for each sediment horizon and the character, structure and form of the sediment described. The detailed sedimentary descriptions of each core section are given in **Appendix 2**.

3.4. Sediment sub-samples were taken where sediments presented the potential to contain palaeoenvironmental remains. A total of 12 sub-samples were taken. The locations and depths below seabed of these sub-samples are given in **Appendix 2**.

3.5. The geoarchaeologically recorded sediments were also grouped into the sedimentary unit system (Units 1 to 6) already established during the earlier geoarchaeological work (Wessex Archaeology 2011b).

3.6. The depth in metres below seabed (m below SB) of the sediment was converted to metres above and below Chart Datum (m above/below CD) using the figures recorded on the borehole logs by Fugro Ltd. (2011). **Figures 2** and **3** show the depths of the sedimentary units recorded referenced in metres below CD.

3.7. The core samples and sub-sampled sediments are currently stored at the offices of Wessex Archaeology, Salisbury.

4. RESULTS

4.1. The results of the geoarchaeological review of geotechnical data and Stage 2/3 recording has shown sediments of geoarchaeological interest across the site. Sediments interpreted as units 1 to 6, based upon the system already developed (Wessex Archaeology 2011b), were identified within the geoarchaeological review.

4.2. It was noted during this review that it was not possible, from the borehole logs to differentiate between Unit 3, (silty, gravelly sand of glacial origin), and Unit 4 (silty, gravelly sand of alluvial origin). The two units have therefore been grouped. Also within this report Unit 5 has been assigned only to peat deposits rather than alluvial sediments containing peat. These sedimentary units and the boreholes in which they have been interpreted to occur are shown in the table below.

4.3.

Unit	Description	Boreholes
1	White Chalk (Upper Cretaceous Chalk bedrock).	D01, D04, D06, D07, D10, D13, Q03-Q40, R06, R08, R10, R12, R14, R16, R18, R21-R23
2	Stiff, sandy, gravelly till with gravel inclusions (Skipsea till formation).	D01-D05, D08, D10, D13, Q01-Q40, R01-R23
3/4	Silty and gravelly sands (Glaciofluvial alluvium/alluvium).	D02-D04, D11, Q07, Q09, Q16, Q19, Q20, Q21, Q27, Q32-Q34, Q38, Q39, R06, R11
5	Peat (Terrestrial origin).	R11
6	Holocene sands, silts and clays (Estuarine alluvium).	All except: D01-D05, D09, D13, Q01, Q04, Q07, Q09, Q15, Q16, Q18, Q19, Q23, Q25, Q26, Q30, Q31, Q34, R02, R06, R14, R16, R18, R21

4.4. A selection of the boreholes are shown in profile to illustrate the vertical and horizontal extent of the sedimentary units in **Figures 2** and **3**. The results of the geoarchaeological recording and sampling of the six core samples are given in detail in **Appendix 2**. The stratigraphic position of the core samples are illustrated on **Figure 3** and the results of the geoarchaeological recording are summarised with the results of the geoarchaeological review of the 77 borehole logs below.

Unit 1: Chalk bedrock 9 to 32.95m below CD

4.5. This unit comprised white and cream coloured Chalk with occasional flint inclusions and was identified within 52 of the 77 boreholes. The greatest thickness of this unit was 16m recorded within borehole **Q17** (**Figure 1**). The unit was not fully penetrated in any of the boreholes. The unit was recorded in many of the boreholes as weak, weathered and fractured. This may be the result of Pleistocene glacial and periglacial processes although it was not possible to determine this with any certainty from the borehole logs. No samples from this unit were subject to geoarchaeological recording. The unit is interpreted as Upper Cretaceous Chalk bedrock.

Unit 2: Sandy, gravelly clay 2.25m above CD to 16.45m below CD

4.6. This unit comprised stiff brown sandy gravelly clay and was identified within 68 of the 77 boreholes. The unit was fully penetrated in many of the boreholes and ranged in thickness from 0.7m in boreholes **D04** (**Figure 2**, **Transect 2**) and **D10** (**Figure 2**, **Transect 3**) to 16m in borehole **Q02** (**Figure 2**, **Transect 1**). A number of gravel inclusions were recorded in the borehole logs within the unit including Chalk, sandstone, quartzite, slate, mudstone, dolerite, siltstone, chert, flint and coal. The unit was interpreted as Pleistocene glacial till, probably equivalent to the Devensian Skipsea till as described by Berridge *et al*. (1994).

4.7. A short (0.24m) section of Unit 2 was geoarchaeologically recorded within borehole **R16** from 0.08m above CD to 0.16m below CD (**Figure 3**, **Appendix 2**). The stiff greyish brown clay contained gravel inclusions of varied lithologies, predominantly Chalk and red sandstone. Mottling and occasional roots were observed within the unit indicative of gley soil formation. In addition some molluscan burrows were also noted within the sediment, mostly at its upper, eroded surface. The unit showed some evidence of disturbance due to the coring process at these levels. No sub-samples were taken within this unit due to its disturbed nature. It was also noted that the geotechnical log (Fugro 2011) does not record sediments equivalent to Unit 2 at

this depth although this may be due to the sampling of the sequence and therefore the lack of visible sediment to describe at these depths.

Unit 3/4: Silty and gravelly sands 2.55m above CD to 12.7m below CD

4.8. This unit comprised brown and grey silty sands and gravels and was identified in 18 of the 77 boreholes. Gravel inclusions up to 120mm diameter of Chalk, flint, quartzite, dolerite, sandstone, siltstone and chert were recorded. Occasional organic material was also recorded within the unit. The unit was fully penetrated in the boreholes in which it occurred. The thickness of the unit ranged between 0.5m in boreholes **Q09** (**Figure 1**), **Q27** (**Figure 2**, **Transect 4**) and **R06** (**Figure 1**) and 5.85m in borehole **Q32** (**Figure 2**, **Transect 3**).

4.9. The unit was not subject to geoarchaeological recording and sub-sampling and was interpreted as probable glacial and alluvially derived sediment, as described by Berridge *et al*. (1994).

Unit 5: Peat 2.55 to 1.95m above CD

4.10. This unit comprised very soft brown amorphous peat with occasional lenses of light grey silty clay. The unit occurred in one borehole only, borehole **R11** (**Figure 3**, **Transect 5**) and was 0.6m in thickness. The unit was not subject to geoarchaeological recording. The unit was interpreted as Holocene peat.

Unit 6 Sand, silt and clay 2.15m above CD to 13.45m below CD

4.11. This unit comprised grey sands, silts and clays and was identified in 44 of the 77 boreholes. The unit ranged in thickness between 0.45m in borehole **R04** (**Figure 1**) and 6m in borehole **R07** (**Figure 2**, **Transect 2**). Occasional gravel inclusions were recorded within the borehole logs comprising a range of lithologies including, Chalk, flint, quartzite, dolerite, siltstone, coal and sandstone. Occasional organic inclusions were recorded including wood.

4.12. The geoarchaeological recording identified grey and brown sands, silts and clays assigned to Unit 6 within core sections from boreholes **D12**, **R13** and **R16** (**Appendix 2**, **Figure 3**). The sediments within all three boreholes contained horizontal interbedded structures indicative of tidally induced deposition (tidal rhythmites). Molluscan burrows were also common with a whole Tellin/Scrobicularia type bivalve noted within borehole **R13** at 4.26m above CD. The unit was interpreted as Holocene estuarine alluvium and tidal flat deposits.

5. DISCUSSION AND RECOMMENDATIONS

5.1. The sequence of sediments recovered from the 77 vibrocore locations indicates; Chalk bedrock (Unit 1) overlain by Devensian glacial till (Unit 2), glacial and alluvially derived silty, gravels and sands (Unit 3/4), Holocene peat (Unit 5) and Holocene estuarine alluvial and tidal flat deposits (Unit 6).

5.2. The surface of Unit 1 marks the extent of archaeological potential in the area. Prehistoric archaeological material may occur at this surface or in the overlying units. Above Unit 1 the glacial till (Unit 2), is thought to have been deposited during the latter part of the Devensian period around the time of the Devensian glacial maximum *c*. 18,000BP a period of human absence of Britain (due to the severely cold climate) and the Unit is therefore considered unlikely to contain any *in situ* archaeological remains.

5.3. During this period, sea levels are thought to have been up to 120m lower than that of today (Siddall *et al.* 2003) which would have exposed the entirety of the AMEP area as land. The surface of Unit 2 could potentially contain *in situ* archaeological material. The gley soil recorded at the surface of this unit within borehole **R16** demonstrates the possibilty of survival of both palaeoenvironmental and archaeological material at this level.

5.4. Unit 3/4, sands and gravels of glacial and alluvial origin may contain archaeological remains although are likely to be reworked within these types of sediments.

5.5. Units 5 and 6 represent the best potential for the preservation of *in situ* archaeological remains. It is likely that Unit 5, peat relates to deposition within a saltmarsh environment. Peat deposits have been recorded in the surrounding area elevated between 3.9m above CD to 6.1m below CD and radiocarbon dated to between 6970±100BP to 2552±120BP (Berridge *et al* 1994). Units 5 and 6 are at present undated in the area but given their elevation and probable mode of deposition (saltmarsh, estuarine and tidal flats), when related to the known sea level rise in the area (Long *et al.* 1998, Shennan and Horton 2002), they are considered likely to have been deposited from the later prehistoric periods (Neolithic or Bronze age) to more recent historic periods.

5.6. Within Unit 6, the types of archaeology which may be present include foreshore infrastructure such as fish traps or jetties, or even boat or ship remains. The well known remains of the Bronze age Ferriby boats were first discovered in 1937 *c*.15km northwest of the site within similar deposits (Foreman 2004).

5.7. It is recommended that the sediments that have been geoarchaeologically recorded and sub-sampled (**Appendix 2**) are subjected to Stage 3 palaeonvironmental assessment and scientific dating as set out in the Written Scheme of Investigation (Wessex Archaeology 2011a). This would include assessment for:

- Pollen
- Diatoms
- Forminifera
- Ostracods
- Plant macrofossils and charcoal
- Insects
- Molluscs
- ^{14}C dating

5.8. If present it is envisaged that these palaeoenvironmental remains in conjunction with scientific dating would help enhance the archaeological understanding of the sedimentary sequence, particularly regarding the later prehistoric Humber wetland environments in the AMEP area.

5.9. It is noted that there are a number of geotechnical and geophysical datasets relating to the AMEP project and it is possible that geoarchaeological interpretation of these may further enhance the archaeological and palaeoenvironmental interpretation of the area. As a first stage, an assessment of the quality, size and scope of these datasets and their potential archaeological utility would be necessary.

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7. APPENDIX 1 BOREHOLE LOCATIONS

Borehole ID	OSGB36 British National Grid	
	Easting	Northing
D01	517652	419532
D02	517710	419436
D03	517826	419322
D04	518016	419244
D05	518048	418879
D06	518289	419254
D07	518445	419177
D08	518228	419068
D09	518179	418719
D10	518417	418834
D11	518572	418961
D12	518711	418720
D13	518344	418581
D14	518595	418621
Q01	517414	419368
Q02	517337	419364
Q03	517358	419382
Q04	517463	419354
Q05	517554	419334
Q06	517522	419436
Q07	517511	419482
Q08	517553	419462
Q09	517587	419420
Q10	517587	419359
Q11	517650	419342
Q12	517651	419282
Q13	517714	419265
Q14	517712	419204
Q15	517776	419190
Q16	517775	419131
Q17	517842	419112
Q18	517840	419052
Q19	517906	419034
Q20	517865	418942
Q21	517932	418926
Q22	517929	418865
Q23	517997	418848
Q24	517993	418789
Q25	518059	418773
Q26	518054	418710
Q27	518123	418692
Q28	518119	418632
Q29	518185	418617
Q30	518184	418556

Borehole ID	OSGB36 British National Grid	
	Easting	Northing
Q31	518250	418538
Q32	518160	418465
Q33	518220	418483
Q34	518287	418493
Q35	518199	418421
Q36	518158	418362
Q37	518048	418377
Q38	517989	418439
Q39	517876	418535
Q40	518203	418501
R01	517336	419274
R02	517505	419379
R03	517370	419151
R04	517482	419247
R05	517458	419137
R06	517630	419217
R07	517461	419008
R08	517608	419089
R09	517583	418957
R10	517755	419062
R11	517557	418832
R12	517730	418932
R13	517710	418801
R14	517706	419132
R15	517729	418663
R16	517854	418777
R17	517832	418642
R18	517461	419433
R19	517979	418618
R20	517988	418516
R21	518129	418589
R22	518102	418457
R23	517952	418779

8. APPENDIX 2 GEOARCHAEOLOGICAL DESCRIPTIONS

Borehole D12

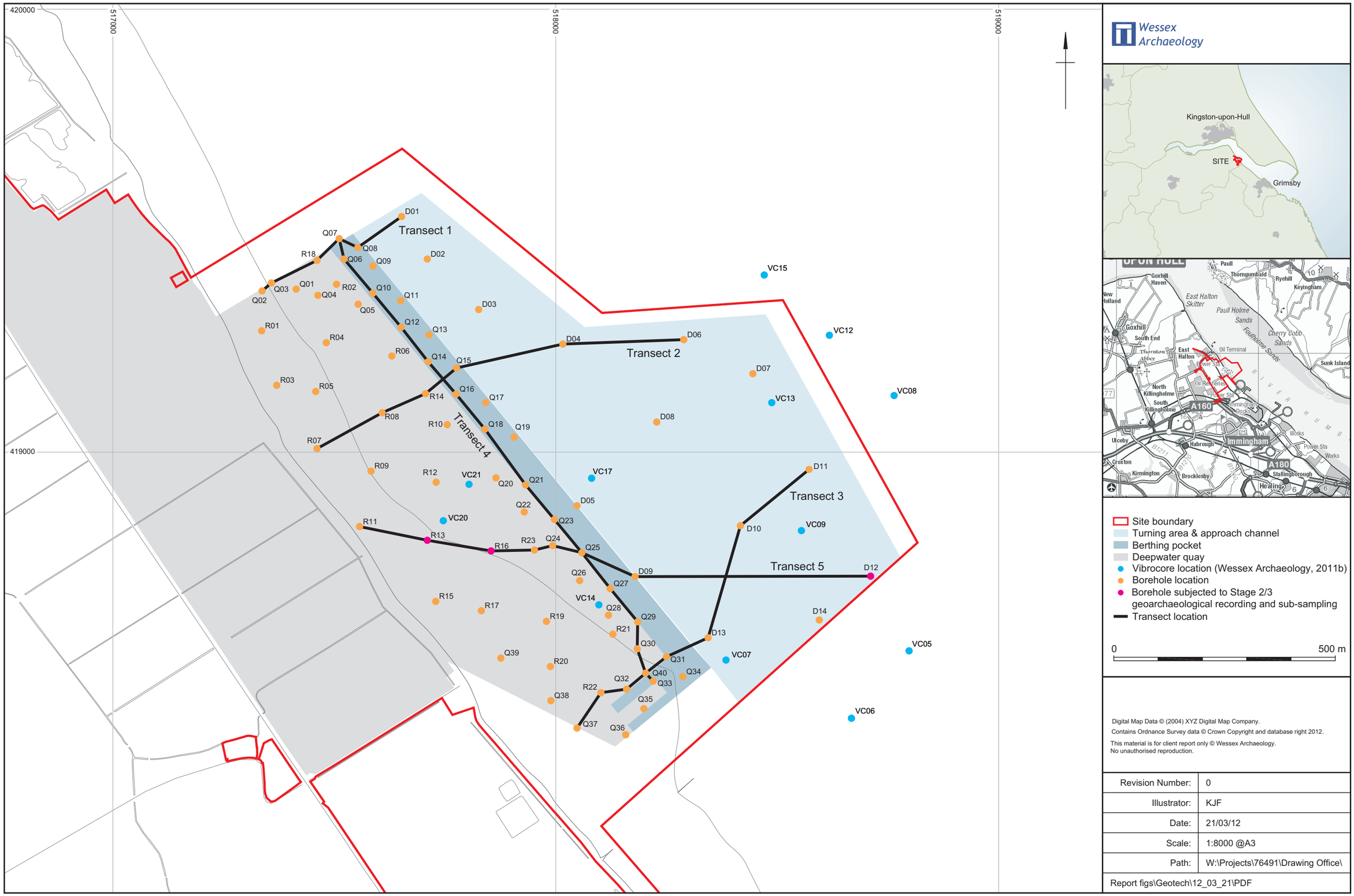
Depth mbSB		Depth mbCD		Sediment description of core sample: P2, 1-2m below SB)	Sample (mbSB)	Unit
from	to	from	to			
1	1.64	10.4	11.04	10YR 3/2 Very dark greyish brown silty SAND. Firm. Wet. Sand is fine to medium grained. Very occasional small up to 20mm diameter subrounded Chalk pebbles. The finer grained silt is darker (10YR 4/1 Grey) and in slightly wavy and convoluted although predominantly horizontally bedded bands and lenses alternate with fine sand beds - tidal rhythmites. The sequence fines upwards. At 1.00 to 1.09m there appear to be infilled molluscan burrows. Frequent fine broken molluscs up to 1mm diameter. Has oxidised on outer surfaces post coring. **Estuarine alluvium/ tidal flats**	1.1 1.35 1.6	6

Borehole R13

Depth mbSB		Depth maCD		Sediment description of core samples: P1, 0-1m; P2, 1-2m; P3, 2-3m below SB	Sample (mbSB)	Unit
from	to	from	to			
0	0.1	4.3	4.2	10YR 4/2 Dark greyish brown clayey SILT. Soft. Wet. One whole (valves still attached) Tellin/Scrobicularia type bivalve mollusc at 0.04m. Gradual 60mm boundary. **?Recent estuarine alluvium**		6
0.1	0.26	4.2	4.04	10YR 4/2 Dark greyish brown slightly clayey sandy SILT. Soft. Wet. Horizontally bedded with fine sand layers up to 3mm in thickness. Some of these are lenticular and wavy -tidal rhythmites. **Estuarine alluvium/tidal flats**	0.2	6
0.26	1	4.04	3.3	GAP		
1	1.62	3.3	2.68	10YR 4/2 Dark greyish brown slightly clayey sandy SILT. Soft to firm. Wet. Horizontally bedded with fine sand layers up to 3mm in thickness. Some of these are lenticular and wavy - tidal rhythmites. Molluscan burrows from 1.30 to 1.38m. **Estuarine alluvium/tidal flats**	1.1 1.25 1.50	6
1.62	2	2.68	2.3	GAP		
2	2.75	2.3	1.55	10YR 4/2 Dark greyish brown slightly clayey sandy SILT. Soft to firm (slightly firmer than 1 to 1.62m). Wet. Horizontally bedded with fine sand layers up to 3mm in thickness. Some of these are lenticular and wavy - tidal rhythmites. Molluscan burrows from 2.10 to 2.15 and 2.59 to 2.65m. Disturbed with wax infilling from 2.68 to 2.75m. **Estuarine alluvium/tidal flats**	2.1 2.25 2.45 2.60	6

Borehole R16

Depth mbSB		Depth maCD		Sediment description of core samples: P1, 0-1m; P2, 1-2m below SB)	Sample (mbSB)	Unit
from	to	from	to			
0	0.67	1.7	1.03	10YR 4/1 Dark grey sandy SILT. Wet. Soft. Horizontally bedded fine sand layers up to 3mm in thickness. Tidal rhythmites. Some are lenticular and wavy. Occasional small ?molluscan burrows from 0.19 to 0.23m. Finely broken shell up to 1mm diameter. **Estuarine alluvium/tidal flats**	0.10 0.60	6
0.67	1	1.03	0.7	GAP		
1	1.55	0.7	0.15	10YR 4/1 Dark grey sandy SILT. Wet. Soft. Horizontally bedded fine sand layers up to 3mm in thickness. Tidal rhythmites. Some are lenticular and wavy. . Finely broken shell up to 1mm diameter. **Estuarine alluvium/tidal flats**	1.1 1.5	6
1.55	1.62	0.15	0.08	10YR 3/2 Very Dark greyish brown silty SAND. Sand is medium to coarse grained. Frequent small to medium up to 25mm diameter subrounded to subangular pebbles of various litholgies including flint, sandstone, shale and granite. Contains degraded organic remains. **Alluvium**	1.6	?6
1.62	1.86	0.08	-0.16	10YR 4/2 Dark greyish brown sandy CLAY. Stiff. Mottled grey/brown. Frequent small up to 10mm diameter rounded to angular pebbles of mixed lithologies including Chalk, red sandstone. 10mm diameter molluscan burrow from 1.62 to 1.72m infilled with dark grey sandy clay and degraded organics. Mottled grey/brown. Small root 1-2m diameter fro 1.65 to 1.67m. Heavily disturbed from 1.75 to 0.86m. **Glacial till and eroded gley soil horizon**		2



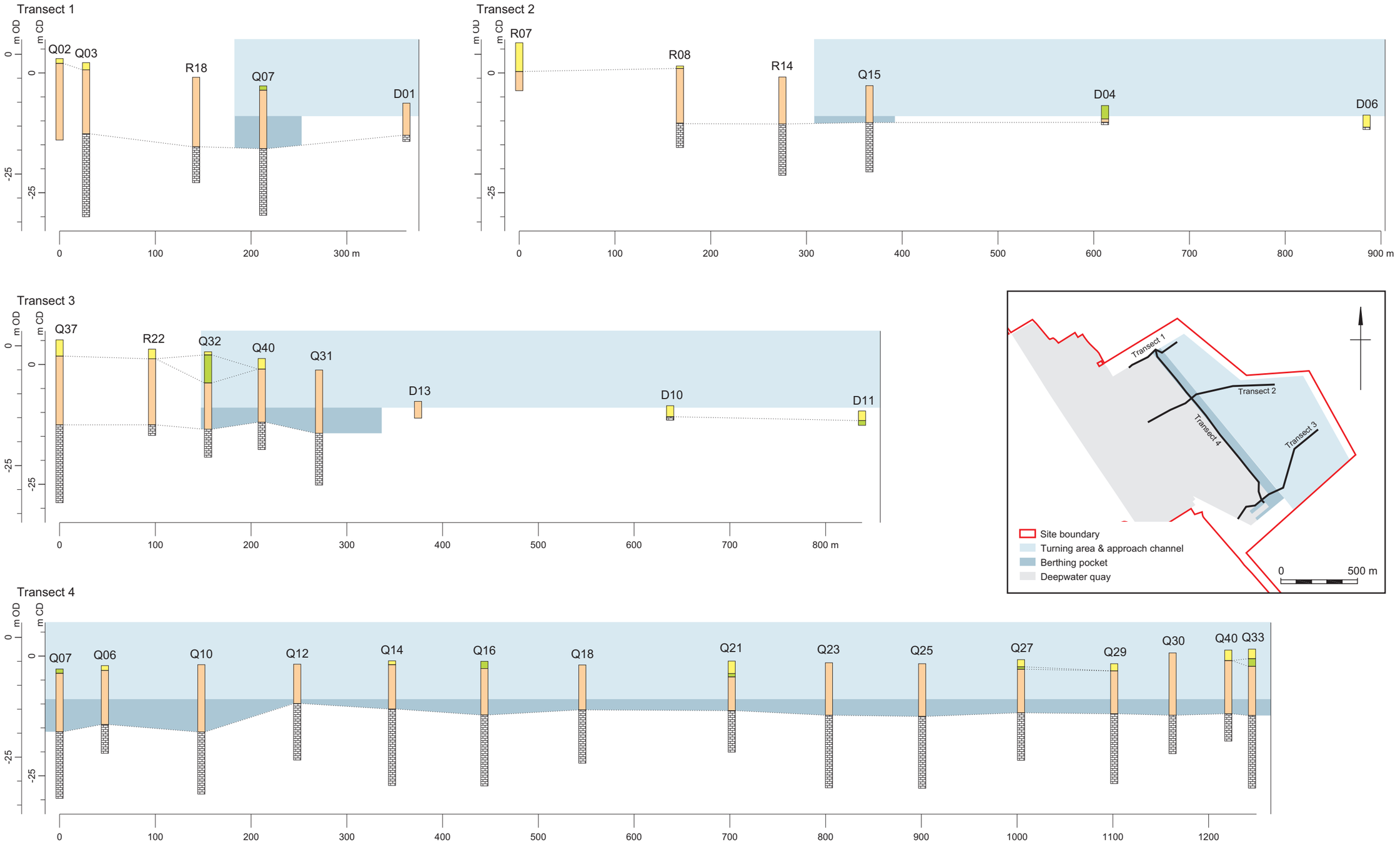
Site boundary
Turning area & approach channel
Berthing pocket
Deepwater quay
Vibrocore location (Wessex Archaeology, 2011b)
Borehole location
Borehole subjected to Stage 2/3 geoarchaeological recording and sub-sampling
Transect location

0 500 m

Revision Number:	0
Illustrator:	KJF
Date:	21/03/12
Scale:	1:8000 @A3
Path:	W:\Projects\76491\Drawing Office\
Report figs\Geotech\12_03_21\PDF	

Site, transect and borehole location

Figure 1



Wessex Archaeology

Turning Area & Approach Channel maintained dredge depth – 9m CD (-12.9m OD)

Berthing pocket, possible over dredge for Turning Area & Approach Channel, max dredge depth to Rockhead

Sedimentary Units

Unit 1 | Unit 5

Unit 2 | Unit 6

Unit 3/4

Date:	28/03/12	Revision Number:	1
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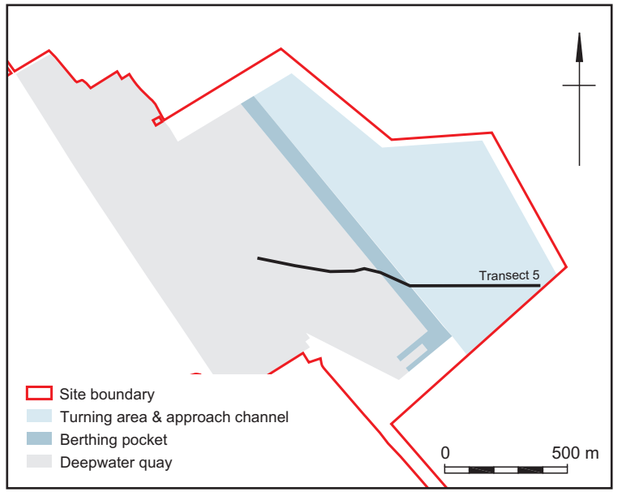
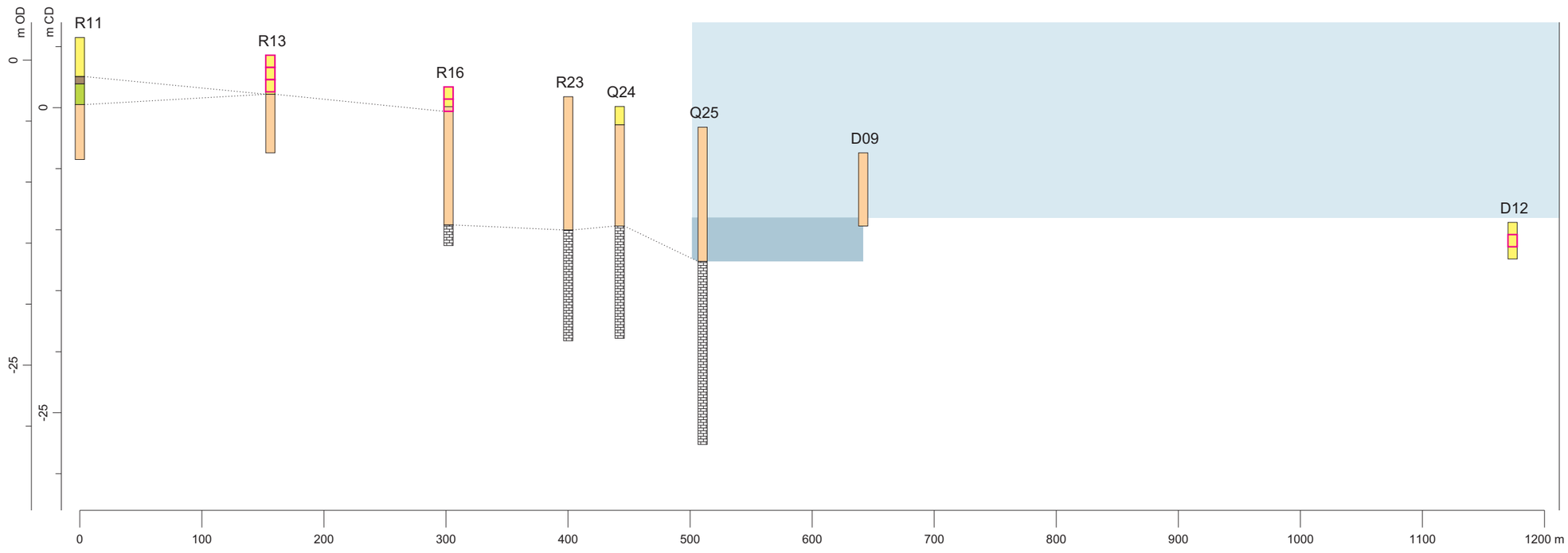
Path:	W:\Projects\76491\Drawing Office\Report figs\Geotech\12_03_21		

Transects 1, 2, 3 and 4

Figure 2



Transect 5



Wessex Archaeology

Turning Area & Approach Channel maintained dredge depth – 9m CD (-12.9m OD)

Berthing pocket, possible over dredge for Turning Area & Approach Channel, max dredge depth to Rockhead

Sedimentary Units

Unit 1
Unit 2
Unit 3/4
Unit 5
Unit 6

Core section Stage 2/3 recorded and sub-sampled

Date:	28/03/12	Revision Number:	1
Scale:	1:4000 horizontal, 1:400 vertical (inset 1:25,000) @A3	Illustrator:	KJF
Path:	W:\Projects\76491\Drawing Office\Report figs\Geotech\12_03_21		

WESSEX ARCHAEOLOGY LIMITED.
Registered Head Office: Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB.
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk
Regional offices in **Edinburgh**, **Rochester** and **Sheffield**
For more information visit **www.wessexarch.co.uk**