

Annex 7.5

Able Marine Energy Park:
Hydrogeological, Piling and
Dredging Risk Assessments

(ESI Ltd)

Jonathon Monk
Able UK Limited
Able House
Billingham Reach Industrial Estate
Haverton Hill Road
Billingham
TS23 1PX

4 October 2011

Our Ref: 60417Jmonk002.docx


Dear Jonathon

**Re: Able Marine Energy Park: Hydrogeological, Piling and Dredging Risk Assessments:
modification to design**

Following the modification to the proposed design of the Energy Park, the quay wall is to be set back a further 50m (80m from original position). This will result in a smaller dredging area than considered in our hydrogeological, piling and dredging risk assessments.

ESI confirms that reducing the area of dredging will not have a detrimental effect on our hydrogeological risk assessment. On the basis that the number and method of piling does not change, this will also have no detrimental effect on the piling risk assessment.

Yours sincerely



Robert Sears
TECHNICAL DIRECTOR



Able Marine Energy Park: Hydrogeological, Piling and Dredging Risk Assessments

Able Marine Energy Park: Hydrogeological, Piling and Dredging Risk Assessments

Prepared for

Able UK Ltd
Able House
Billingham Reach Industrial Estate
Billingham
Teesside TS23 1PX

Report reference: 60417R1Rev5, July 2011

Report status: Final Report

Confidential
Prepared by
ESI Ltd

New Zealand House, 160 Abbey Foregate, Shrewsbury, SY2 6FD, UK

Tel +44(0)1743 276100 Fax +44 (0)1743 248600 email esi@esinternational.com

Registered office: New Zealand House, 160 Abbey Foregate, Shrewsbury, SY2 6FD. Registered in England and Wales, number 3212832

Able Marine Energy Park: Hydrogeological, Piling and Dredging Risk Assessments

This report has been prepared by ESI Ltd. (ESI) in its professional capacity as soil and groundwater specialists, with reasonable skill, care and diligence within the agreed scope and terms of contract and taking account of the manpower and resources devoted to it by agreement with its client, and is provided by ESI solely for the internal use of its client.

The advice and opinions in this report should be read and relied on only in the context of the report as a whole, taking account of the terms of reference agreed with the client. The findings are based on the information made available to ESI at the date of the report (and will have been assumed to be correct) and on current UK standards, codes, technology and practices as at that time. They do not purport to include any manner of legal advice or opinion. New information or changes in conditions and regulatory requirements may occur in future, which will change the conclusions presented here.

This report is confidential to the client. The client may submit the report to regulatory bodies, where appropriate. Should the client wish to release this report to any other third party for that party's reliance, ESI may, by prior written agreement, agree to such release, provided that it is acknowledged that ESI accepts no responsibility of any nature to any third party to whom this report or any part thereof is made known. ESI accepts no responsibility for any loss or damage incurred as a result, and the third party does not acquire any rights whatsoever, contractual or otherwise, against ESI except as expressly agreed with ESI in writing.

Principal Author(s)
Ian Farrar

Checked by: Robert Sears

Reviewed by: Robert Sears



Confidential
Prepared by
ESI Ltd

New Zealand House, 160 Abbey Foregate, Shrewsbury, SY2 6FD, UK

Tel +44(0)1743 276100 **Fax** +44 (0)1743 248600 **email** esi@esinternational.com

Registered office: New Zealand House, 160 Abbey Foregate, Shrewsbury, SY2 6FD. Registered in England and Wales, number 3212832

CONTENTS

1	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Scope of Work	1
2	PHYSIOGRAPHIC SETTING.....	3
2.1	Site Setting.....	3
2.2	Site History	3
2.3	Geology.....	3
2.3.1	Regional Geology	3
2.3.2	Local Geology	5
2.4	Hydrology	5
2.4.1	Tides and currents	5
2.4.2	Surface water features.....	6
2.4.3	Surface water abstractions	6
2.5	Hydrogeology	8
2.5.1	Superficial deposits.....	8
2.5.2	Humber Estuary Deposits	8
2.5.3	Chalk.....	8
2.5.4	Outflows	8
2.5.5	Groundwater chemistry.....	12
2.5.6	Groundwater management to prevent saline intrusion	12
2.5.7	Source Protection Zones	13
3	CONCEPTUAL MODEL.....	14
3.1	Regional groundwater.....	14
3.2	Humber Estuary and Chalk aquifer hydraulic heads.....	14
3.3	Thickness of superficial deposits in the PDA	14
3.4	Saline Intrusion	15
3.5	Source Protection Zones and Groundwater Abstractions	15
3.6	Post-Construction Conceptual Model.....	15
4	CONCLUSIONS.....	17
5	REFERENCES.....	18

FIGURES

Figure 1	Location map
Figure 2	Site map
Figure 3	Drift deposits
Figure 4	Top of the Chalk
Figure 5	Solid geology
Figure 6	Surface water and groundwater abstraction and discharge consents
Figure 7	Potentiometric surface of the Chalk
Figure 8	Distribution of chloride ions 1956-1958
Figure 9	Distribution of chloride ions 1975
Figure 10	Distribution of chloride ions 2000 - present
Figure 11	Conceptual site model (east – west)
Figure 12	Conceptual site model (north – south)
Figure 13	PDA zones

TABLES

Table 2.1	Geological Time Scale (South Humber bank Salinity Research Project & Proposed power station).....	3
Table 2.2	Tidal elevations	5
Table 2.3	Tidal abstractions in the vicinity of Able Marine Energy Park.....	7
Table 2.4	Abstraction licences in the vicinity of Able Marine Energy Park.....	10
Table 2.5	Deregulated abstraction licences in the vicinity of Able Marine Energy Park..	11

APPENDICES

Appendix A	Site photographs
Appendix B	Vibrocore cross sections
Appendix C	Vibrocore borehole logs
Appendix D	Able design drawings
Appendix E	Environment Agency abstraction licences

1 INTRODUCTION

1.1 Background

ABLE UK Limited (Able) are proposing to develop a Marine Energy Park comprising a quay and biomass plant with the purpose of supporting the north sea off-shore wind generating industry.

Able has produced an informal pre-application consultation document (Able, 2010). This was submitted to the Environment Agency (EA) who responded by letter dated 6 August 2010. The EA note that the Chalk aquifer in this area has historically been subject to saline intrusion which has affected its quality. A significant amount of work has been undertaken to mitigate the causes of the intrusion and, currently, water quality is not of particular concern to abstractors in the area. The EA is concerned that the development may enhance saline intrusion or cause adverse impacts on water receptors.

The EA has recommended that “detailed characterisation work should be undertaken to develop a robust hydrogeological conceptual model and identify which water features are potentially at risk from the proposed development”. The EA suggests that a hydrogeological risk assessment and a piling and dredging risk assessment could provide the necessary assessment.

On this basis, Able has requested ESI Limited (ESI) to provide a proposal to undertake a hydrogeological and piling and dredging risk assessment to satisfy the EA requirements.

The site

The site is to be located on the south-western bank of the River Humber. The land lies within the flood plain of the Humber Estuary and is flat and low lying. The site overlies the Chalk which is defined as a Principal Aquifer by the EA. However, the Chalk may not be confined in the Proposed Dredging Area (PDA). Recent sub-surface investigations in the PDA encountered alluvial deposits and superficial deposits comprising a significant quantity of chalk.

Proposed construction and dredging

The project involves the construction of a new quay (approximately 1630 m long), mostly of solid construction and built of tabular and sheet driven piles, together with associated onshore facilities to accommodate wind turbine manufacture, assembly and commissioning as well as the associated supply chains.

The front, north and south walls of the new quay will be constructed using driven sheet piles (Appendix D) and are expected to extend at least three metres into the underlying bedrock (Chalk). The walls will be supported a series of anchors on the land side of the quay. The anchors will be buried using a combination of imported fill and dredged estuary deposits with the exact proportion to be determined.

A 60 m wide berthing pocket will be created in front of the quay. All superficial deposits within the berthing pocket above rockhead will be dredged and disposed of within the estuary. The berthing pocket will then be infilled with a suitable aggregate to provide stable footing for jack-up vessels. The approach channel will be dredged to a depth of -9m to -11m CD.

1.2 Scope of Work

The scope of work consists of the following tasks:

- Site visit and discussion of proposed development with Able.
- Collate data available from publically available sources plus any data available from Able.
- Develop a conceptual model of groundwater flow and quality.

- Undertake a qualitative risk assessment of the likely impacts on identified receptors.

2 PHYSIOGRAPHIC SETTING

2.1 Site Setting

The site is located on the south-western bank of the River Humber estuary on the Killingholme Marshes, adjacent to North Killingholme Haven approximately 16 km north-west of Grimsby (Figure 1). It lies due east of the village of East Halton and is approximately 2.4 km north-east of the village of North Killingholme.

The site is within of the Lincolnshire Outmarsh (a former wetland) that was historically drained for agricultural use. The land surface is generally flat with a slight gradient towards the coast to the east.

The area of interest for this study is the Proposed Dredging Area (PDA) located in the River Humber to the east of the site (Figure 2).

2.2 Site History

The historical Landmark maps have shown very little commercial landuse within the site boundary since 1887. However significant changes are shown to have occurred in the surrounding area. These changes include:

- The presence of an oil refinery in the 1974 map directly to the west of the site.
- The building of oil storage depot in the 1965 map to the north of the site.
- The building of the fuel storage area in the 1968 map directly to the south of the site.
- The presence of a sewage works adjacent to western boundary of the site in 1985.

2.3 Geology

2.3.1 Regional Geology

The regional geology comprises Chalk overlain by superficial deposits (Table 2.1) (Berridge & Pattison, 1994).

Table 2.1 Geological Time Scale (South Humber bank Salinity Research Project & Proposed power station)

Geological Period	Geology	Formations	Age	Description
Quaternary	Superficial Deposits	Flandrian, Pleistocene	Recent	Beach Deposits, Coastal Blown Sand, Tidal Flat Alluvium Deposits, and Peat
			Post Glacial	Valley Sand; Low level deposit of the Ancholme Valley
			Glacial	Glacial Till and Glaciofluvial deposits
Cretaceous	Chalk	Upper Cretaceous Lower Cretaceous	Preglacial	Upper Chalk, Middle Chalk with flints, Lower (grey) Chalk without flints and Red Chalk

One of the most marked features of the physical geography in the area is series of parallel low amplitude ridge and valleys, tending to lie in a north / south direction due to the dominant north-south strike of the rocks dominant throughout Lincolnshire.

2.3.1.1 Superficial Deposits

The superficial strata in the region are shown in Figure 3 and are composed of the following deposits:

- Glaciofluvial deposits;
- Glacial Till;
- Tidal Flat Alluvial Deposits;
- Beach Deposits.

The Glaciofluvial deposits lie above of the Chalk and are present at the surface to the east of the Lincolnshire Wolds scarp. These deposits become thinner eastwards towards the coast.

The Glacial Till is composed of sands, silts and clays (BGS Memoir). A principal component of the Till is chalk derived from erosion of the bedrock. The Glacial Till overlies the Glaciofluvial deposits towards the east and according to the literature extends out under the North Sea.

The Tidal Flat Alluvial Deposits are composed of estuarine alluvium, lacustrine alluvium, peat, submerged forest beds, head and blown sand. These deposits are present near to the current position of the Humber Estuary.

Beach and Tidal Alluvial Deposits are present in the Humber Estuary. Tidal currents influence the deposition of gravels, sands and silts. The lower energy environments near the edges of the estuary are dominated by the finer fractions such as clays and silts.

The superficial deposits are not present in significant thicknesses to the west of the Lincolnshire Wolds Scarp where the middle Chalk is exposed.

The Kirmington channel is a major buried channel within the Chalk (Figure 4) which is thought to be a pre-glacial valley enlarged by catastrophic localised escape of glacial meltwaters near the periphery of the Anglian ice sheet (Berridge and Pattison, 1994). It is located 4 km south of Killingholme and trends east-north-east. It is about 8km in length, 2km wide and up to 50m deep.

The Kirmington channel deposits near the village of Kirmington are composed of a series of clays, silts and sands. The top of the sequence consists of red clays that are continuous with the Devensian tills. The lower deposits are shown to be fossiliferous laminated clays (University of Birmingham 1978).

2.3.1.2 The Chalk Series

The Cretaceous rocks are divided into the Upper Chalk Series and the Lower Chalk Series. The Chalk which underlies the district is composed of four stages as follows:

- Upper Chalk;
- Middle Chalk;
- Lower Chalk (Grey Chalk);
- Red Chalk.

The Upper Chalk occurs beneath the superficial deposits which covers a large area in the Humber Valley but is not visible at the surface. Within the area of interest, the Upper Chalk comprises the Flamborough and Burnham Chalk formations. Figure 5 shows the solid geology for the region.

The Middle Chalk occupies nearly the whole of the area covered by Cretaceous rocks exposed at the surface in the Lincolnshire Wolds.

The Lower and Red Chalk which underlie these deposits outcrop considerably further to the south of the area of interest.

Flamborough Chalk Formation

The Flamborough Chalk is defined as all chalk deposits above a marker horizon referred to as the true flint horizon. According to the Berridge and Pattison (1994), the formation does not outcrop in the area and as such is not stratigraphically as well understood as the Burnham Chalk. The maximum thickness of the Flamborough chalk in the region is 120m.

Burham Chalk Formation

The Burnham Chalk Formation is distinguished by the presence of tabular flint bands (continuous or semi-continuous bands). The Chalk caps the Wolds to the east and subcrops beneath the superficial deposits across most of the Lincolnshire Marshes. The maximum recorded thickness is 130m but is only 50m at outcrop.

According to the regional geology map, the Chalk formations dip to the north-east with a gradient of 1%.

2.3.2 Local Geology

Berridge and Pattison (1994) reports that the majority of the Site is underlain by the Burnham and Flamborough Chalk formations. These formations are shown to be covered by glaciofluvial deposits, glacial till, tidal flat alluvial deposits and beach and tidal alluvial deposits. Holocene tidal alluvium deposits are also shown in the PDA.

CEGB (1970) indicates a thicknesses of Glacial Till up to 20 m in the northern area of the Site (from 39 boreholes) and 13.3 m in the north region of the PDA (from 11 boreholes).

In 2010, a site investigation of the PDA in the Humber Estuary drilled 30 cores to a maximum of 6 mbgl using vibrocore drilling technology. The recovered cores showed predominantly sand and gravel deposits with occasional silt and Glacial Till deposits. It should be noted that none of the vibrocores penetrated the top of the Chalk and hence total depth of sediment was unproven.

2.4 Hydrology

The River Humber estuary is approximately 4500m wide. The level of the river bed varies considerably and in some areas shallows to the extent of being exposed at low water. The river is navigable up to and beyond the site. The channel is approximately 13.8 m deep at mean low water of spring tides (CEGB Report). Immingham Oil Terminal can accommodate vessels of up to 290,000 tons to the south of the site (Associated British Ports Website), and the jetty to the north of the site can take 18000 tons. Smaller vessels of up to 15000 tons regularly use the port of Kingston-upon-hull further up the estuary.

2.4.1 Tides and currents

Information on tides is given from "UK National Tide Gauge Network" hosted National Oceanography Centres website. Immingham is listed as a standard port and tide levels are given to a chart datum which is at a level of -3.9 mAOD.

The following information is also indicated in the "National Oceanography Centre" for future tide predictions (highest and lowest predicted tides from 2006 to 2028).

Table 2.2 gives the regular and extreme variations in tide levels relevant to the region of the site.

Table 2.2 Tidal elevations

Tide	Height above chart datum (m)	Height AOD (m)
Highest astronomical tide	7.99	4.09
Mean high water spring tides	7.22	3.32
Mean high water neap tides	5.78	1.88
Mean low water neap tides	2.60	-1.3
Mean low water spring tides	1.04	-2.86
Lowest astronomical tide	0.16	-3.74

2.4.2 Surface water features

The site is located on the Killingholme Marshes which is part of an interconnected complex surface water hydraulic regime. The current regime includes a network of drainage channels that use gravity to control the flow regime. The water discharges to the south of the site and into the Humber Estuary through a tidal gate located within the sea wall and out through an outfall pipe.

2.4.3 Surface water abstractions

The EA has provided limited data for four surface water abstraction licenses located within a rectangular area (8 km x 9 km) centered on the site (Appendix E). These are tidal abstractions, and the four locations are presented in Table 2.3 below and shown on Figure 6.

Data obtained from Landmark also show two surface water abstractions north east of the site. These are licensed to National Power Plc and Powergen Plc and are shown on Figure 6. It is not known if these are currently active.

Table 2.3 Tidal abstractions in the vicinity of Able Marine Energy Park

Licence No.	Name	Use Description	Period Start	Period End	Primary Point Type Description	Point Name	NGR 1 Cartesian	NGR 2 Cartesian	Max Daily Quantity (cubic metres)	Max Annual Quantity (cubic metres)
4/29/09/*T/0010	Immingham Storage Co Ltd	General Washing/Process Washing	01/01	31/12	Tidal	River Humber - Immingham Docks	519360	416460	6546.38	104560
4/29/09/*T/0131	E.On Uk	Non-Evaporative Cooling	01/01	31/12	Tidal	River Humber - N. Killingholme	517430	419530	80000	29300000
4/29/09/*T/0132	Centrica Kps Ltd	General Washing/Process Washing	01/01	31/12	Tidal	River Humber - N.Killingholme	517300	419800	40013	14643600
4/29/09/*T/0132	Centrica Kps Ltd	Evaporative Cooling	01/01	31/12	Tidal	River Humber - N.Killingholme	517300	419800	40013	14643600
AN/029/0009/002	Drax Biomass (Immingham) Limited	Evaporative Cooling	01/04	31/03	Tidal	Humber Estuary (Near Immingham)	518803	417917	48000	17520000

2.5 Hydrogeology

2.5.1 Superficial deposits

The tills and alluvial deposits are the thickest and most widespread superficial deposits in the region. They have a relatively low permeability and are important in that they confine the Chalk and limit recharge over large areas.

Glaciofluvial sands and gravels form important locally water-bearing deposits sporadically across the region and are often overlain by till. Although widely used for private water supply in the past, risk of pollution from surface sources limits their current usage. However, where these relatively high permeability deposits are both saturated and in hydraulic continuity with the Chalk, they can act as an important storage reservoir and significantly increase the transmissivity of the aquifer system. This is particularly important along the confined-unconfined boundary that lies beyond the west of the site at the edge of the Lincolnshire Wolds where superficial deposits lying against the buried cliff are frequently over 10 m thick. (Berridge and Pattison, 1994).

The Kirmington Channel lies towards the south of the site and is filled with relatively low permeability deposits, which act as a barrier to upwards discharge of Chalk groundwater. Its influence on groundwater flow in the Chalk is probably not pronounced as it is orientated approximately parallel to the regional groundwater flow direction (Whitehead E.J., & Lawrence A.R., 2006).

2.5.2 Humber Estuary Deposits

A geological investigation was undertaken of the Humber Estuary by the IGS (now British Geological Survey) in 1968 (University of Birmingham, 1978) with an emphasis on the distribution and structure of various types of estuary bottom sediments.

According to University of Birmingham (1978), the Glacial Till cover in the Estuary to the south of Immingham has been removed and this allows hydraulic continuity between the Estuary and the Chalk aquifer.

Recent Vibrocore logs taken in the river channel have shown significant variation in the thickness and composition of sediments directly overlying the Chalk which will have an impact on hydraulic connectivity between the Estuary and the Chalk aquifer (Appendix C).

2.5.3 Chalk

The Chalk forms a dual porosity aquifer, with primary porosity in the matrix and secondary porosity in the form of solution-enhanced fractures. Fractures, and the solution enhanced fractures in particular, contribute nearly all of the aquifer permeability. The Chalk aquifer system of Lincolnshire includes the Chalk Group, the permeable Lower Cretaceous formations, which are in hydraulic continuity with the Chalk, and the permeable Quaternary deposits (sands, gravels and chalk bearings). The latter provide additional storage to the aquifer system.

2.5.4 Outflows

The main components of outflow from the Lincolnshire Chalk are abstraction, discharge to streams and blow wells, and outflow to sea / estuary. Abstraction is recorded to be the largest outflow and has a significant impact upon the natural outflows (Whitehead E.J., & Lawrence A.R., 2006).

Seasonal springs emerge along the edge of the Lincolnshire Wolds representing overflow from the Chalk where groundwater is flowing from the unconfined aquifer in the west to the confined zone in the east.

Within the confined aquifer, blow wells occur towards to the north of the region (such as at Tetney) where the Glacial Till is thin or permeable and the aquifer is artesian. According to the Berridge and Pattison (1994), many of the blow wells that existed in the past have dried up due to abstraction which has lowered the Chalk piezometric surface.

2.5.4.1 Groundwater abstractions – public & private

The EA has provided data for groundwater abstraction licenses located within a rectangular area (8 km x 9 km) centered on the site (Appendix E) (Figure 6). There are seven current licenses within this area and details are presented in Table 2.4. It is noted that a number of these licenses cover multiple boreholes under the same license.

All these abstraction wells are located to the south of the site, and all abstract from the Chalk, with the exception of license AN/029/0009/001 (owned by Conocophillips) which abstracts from the Elsham Sand unit, and covers two boreholes to the south west of the site.

Information on the Simon Storage Group Ltd. abstraction borehole identified in the Landmark data to the north-west of the site was not provided by the Environment Agency. It is possible that this license has lapsed.

There are two deregulated water supply boreholes located within the selected area. These locations are authorised to abstract not more than 20 m³/d and no longer need to be licensed. These locations are located to the south and west of the site. Details are presented in Table 2.5 and locations are shown on Figure 6.

There are no recorded private water supplies to the west or north of the site (written correspondence with North Lincolnshire Council) or to the south east, within North East Lincolnshire Council Local Authority boundary.

Table 2.4 Abstraction licences in the vicinity of Able Marine Energy Park

Licence No.	Name	Use Description	Period Start	Period End	Primary Point Type Description	Point Name	NGR 1 Cartesian	NGR 2 Cartesian	Max Daily Quantity (cubic metres)	Max Annual Quantity (cubic metres)
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Borehole At Immingham	519822	415470	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Loco Bore	520303	414913	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Reception Bore	518197	415977	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Timber Yard Bore	518578	416651	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Borehole At Immingham	519822	415470	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Loco Bore	520303	414913	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Reception Bore	518197	415977	5480	1400000
4/29/09/*G/0045	Associated British Ports	Raw Water Supply	01/04	31/03	Groundwater	Timber Yard Bore	518578	416651	5480	1400000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Inland Cavern Bore 1	517760	417440	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Inland Cavern Bore 2	517770	417440	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Riverside Cavern Bore 1	518170	417800	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Riverside Cavern Bore 2	518180	417800	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Inland Cavern Bore 1	517760	417440	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Inland Cavern Bore 2	517770	417440	1056	14000

Licence No.	Name	Use Description	Period Start	Period End	Primary Point Type Description	Point Name	NGR 1 Cartesian	NGR 2 Cartesian	Max Daily Quantity (cubic metres)	Max Annual Quantity (cubic metres)
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Riverside Cavern Bore 1	518170	417800	1056	14000
4/29/09/*G/0129	Conocophillips Ltd	General Use Relating To Secondary Category (Low Loss)	01/01	31/12	Groundwater	Riverside Cavern Bore 2	518180	417800	1056	14000
AN/029/0009/001	Conocophillips Ltd	Process Water	01/01	31/12	Groundwater	Conoco Bore1 S.Killingholme	515730	416670	1700	619000
AN/029/0009/001	Conocophillips Ltd	Process Water	01/01	31/12	Groundwater	Conoco Bore2 S.Killingholme	515620	416950	1700	619000
AN/029/0009/001	Conocophillips Ltd	Process Water	01/01	31/12	Groundwater	Conoco Bore1 S.Killingholme	515730	416670	1700	619000
AN/029/0009/001	Conocophillips Ltd	Process Water	01/01	31/12	Groundwater	Conoco Bore2 S.Killingholme	515620	416950	1700	619000

Table 2.5 Deregulated abstraction licences in the vicinity of Able Marine Energy Park

Licence No.	Name	Use Description	Period Start	Period End	Primary Point Type Description	Point Name	NGR 1 Cartesian	NGR 2 Cartesian	Max Daily Quantity (cubic metres)	Max Annual Quantity (cubic metres)
4/29/09/*G/0030	A J Hepher Ltd	General Farming & Domestic	01/01	31/12	Groundwater	Luxmore Farm Bore Habrough	516600	414300	4.55	409
4/29/09/*G/0030	A J Hepher Ltd	General Farming & Domestic	01/01	31/12	Groundwater	Luxmore Farm Bore Habrough	516600	414300	4.55	409
4/29/09/*G/0074	Chapman	General Farming & Domestic	01/01	31/12	Groundwater	Manor Farm Bore N.Killingholme	514300	417650	4.55	409
4/29/09/*G/0074	Chapman	General Farming & Domestic	01/01	31/12	Groundwater	Manor Farm Bore N.Killingholme	514300	417650	4.55	409

2.5.4.2 Groundwater levels and flow direction

According to the EA and North Lincolnshire Council, there are no regional groundwater level or quality monitoring wells within 3 km of the site.

The British Geological Survey Chalk Aquifer Report (University Of Birmingham, 1987.) provides a regional map showing the location of chalk boreholes and potentiometric contours (Figure 7).

The map shows that on a regional scale groundwater to the north of Louth flows in a north-easterly direction from the unconfined aquifer to the confined aquifer. On a local scale it is reported that groundwater flows can vary significantly due to groundwater abstraction, interaction with the Humber River, Chalk features such as directional preferential fractures and historic erosional features.

This map suggests that the piezometric surface in the Chalk is around 0 maOD as it passes under the Humber Estuary.

2.5.5 Groundwater chemistry

North Lincolnshire Council responded to a data request stating there was not any groundwater chemical data within three kilometers of the site. The EA provided groundwater level and quality data within a 15 km radius of the site. There are no EA locations within 3 km of the site.

North East Lincolnshire Council located three groundwater abstractions within three kilometers of the site. However, groundwater level and chemical data is not available for any of these sites (water samples are taken following blending with mains water).

2.5.6 Groundwater management to prevent saline intrusion

There is a long history of abstraction from the Lincolnshire Chalk aquifer system: the National Record Archive contains records of wells dating back to 1848. During the 1950's the Anglian Water Authority created a series of maps showing chloride concentrations in the area. Chloride concentrations ranged between 30 and 50 mg/l in the vicinity of the site (Figure 8). In 1975 chloride concentrations increased to 500mg/l within the area of the site (Figure 9) due to saline intrusion. Figure 10 shows chloride concentrations from 2000 to the current time, as measured by the EA. Maximum chloride concentrations for 2010 are presented as coloured circles. The majority of the data points lie close to the Humber Estuary with one point, Kirmington, further inland. These data show that, with the exception of Immingham Borehole, the maximum chloride concentration was 286 mg/l at Goxhill Haven Borehole in March 2009. In 2010, again with the exception of Immingham Borehole, concentrations were all below 500 mg/l. At Immingham Borehole, chloride was at a maximum of 5640 mg/l in August 2005 and has been gradually falling ever since. In August 2010 it had fallen to 2750 mg/l. Of the 2 boreholes closest to the Site, Timber Yard Bore currently shows chloride concentrations below 50 mg/l whilst East Halton shows concentrations between 50 and 100 mg/l. These data suggest that, whilst concentrations have not returned to the low values recorded in the 1950's they are lower than the concentrations measured during the 1970's when groundwater abstraction was at its highest.

During the late 1970's, the Anglian Water Authority responded to the saline intrusion issue by commissioning the University of Birmingham to undertake a series of investigations of the aquifer system. The outcome of the investigations was the conclusion that the total licensed quantity of water for abstraction exceeded the average annual recharge (Whitehead E.J., & Lawrence A.R., 2006).

During the 1990's the EA negotiated a reduction in abstraction rates during drought periods. More recently, the EA has developed a regional groundwater strategy for the area and continues to monitor groundwater levels and saline intrusion issues.

2.5.7 Source Protection Zones

The site is not located in a groundwater source protection zone.

3 CONCEPTUAL MODEL

A series of pre-construction and post-construction conceptual models of the proposed dredging area and quay have been developed to assess the risk of saline intrusion into the Principal Aquifer (Chalk) from the Humber Estuary. There are currently five key components that form the basis of the conceptual model. These five components (headings) are described in the text below and the following figures:

- Figure 11 – Conceptual Site Model (east – west);
- Figure 12 – Conceptual Site Model (north – south);
- Figure 13 – Potential Dredging Area (PDA) plan.

3.1 Regional groundwater

The regional groundwater system can be characterised as follows: rainfall recharges the aquifer where the Chalk outcrops in the Lincolnshire Wolds to the west. Groundwater moves northwards and eastwards down the geological dip and becomes confined by the overlying superficial deposits. Groundwater discharges from the confined aquifer by: abstraction from boreholes, upward leakage through more permeable superficial deposits (springs, blow holes, estuary leakage, etc.); and flow towards the North Sea (Figure 11).

3.2 Humber Estuary and Chalk aquifer hydraulic heads

The predicted Humber Estuary tidal ranges in the Immingham area from 2006 to 2028 are +4 maOD to -4 maOD. The regional potentiometric surface of the Chalk is estimated to be close to 0 maOD at the Estuary. The net difference in hydraulic head between the Estuary and the Chalk is, therefore, relatively small. This suggests that there is no significant low permeability strata between the Chalk and the Estuary which would restrict the transfer of water as this would most likely result in much higher heads in the Chalk compared to the Estuary.

Given that water recharges the Chalk inland from the Estuary we would expect a net discharge of water from the Chalk to the Estuary under natural conditions. During periods of high tide, it is possible that the discharge to the Estuary may be replaced by inflows, but the net flow of water would be from the Chalk to the Estuary.

If the potentiometric surface in the Chalk is lowered, via groundwater abstraction inland, it is likely that the hydraulic gradient between the Chalk and the Estuary will be reversed allowing saline water to enter the groundwater system.

3.3 Thickness of superficial deposits in the PDA

The thickness and composition of the superficial deposits varies from north to south of the proposed dredging area (Figure 12). Two hydrogeologically similar zones have been identified after reviewing the vibrocore logs and the top of the Chalk contour map (Figure 13).

The PDA Northern Zone was identified as having an unproven thickness of Glacial Till. Firm to stiff brown clays were recorded in vibrocores VC27, VC28, VC29 & VC30 with thicknesses ranging from 1.44 m to over 4.45 m. This zone constitutes approximately 40% of the PDA.

The PDA Southern Zone contains boreholes with thin Estuarine Alluvial Deposits and thin to negligible Glacial Till. The top of the Chalk was not proven at any locations however gravel composed of chalk was encountered in locations VC5, VC10, VC13, VC16 & VC22. This zone constitutes approximately 60% of the PDA.

The thickness of the superficial between the base of the vibrocores and the chalk was not proven during the investigation.

To the south of the PDA zone is the Kirmington Channel where thicker superficial deposits are encountered that may act as a hydrogeological barrier.

3.4 Saline Intrusion

The Anglian Water Authority historical chloride map has shown that during the 1950's, prior to the redevelopment of the area, saline intrusion was not a significant issue at the site (Figure 8). However, saline intrusion issues were recorded to the north at Skitter Ness and to the south at Grimsby. According to the literature, the primary reason for saline intrusion was the combination of over-abstraction and an exposed Chalk aquifer in the Humber Estuary.

During the 1960's and 1970's, the surrounding area of the site was redeveloped. Prior to 1974, the ConocoPhillips oil refinery was developed to the west of the site. According to the EA, the oil refinery has received a permit to abstract groundwater from four boreholes in the Chalk since 1985, however the date of the first abstraction is currently not known.

The 1975 Anglian Water Authority historical chloride map (Figure 9) shows saline intrusion taking place in the vicinity of the site. According to the literature, it is likely that the saline intrusion was caused by over abstraction.

During the 1980's, the EA took control of managing the saline intrusion issues in the area. The primary tool for managing the saline intrusion was the control of groundwater abstraction permits. During the 1990's the EA negotiated a reduction in abstraction rates during drought periods. More recently, the EA developed a groundwater regional strategy for the area and continues to monitor groundwater levels and quality in the area.

Recent chloride concentration data suggests that concentrations have fallen due to managed abstraction, although they are still elevated compared to levels measured during the 1950's.

3.5 Source Protection Zones and Groundwater Abstractions

The potential dredging area is not located in a source protection zone. The nearest source protection zone is over 1 km to the south and west. Public groundwater abstractions are operated by Anglian Water Services, most of which are located on the eastern edge of the Lincolnshire Wolds where the aquifer is unconfined.

There are four licensed abstraction boreholes within 3 km of the PDA; two licensed to Conoco Phillips, and two licensed to Associated British Ports. The EA has not provided an abstraction license for the Simon Storage Group Ltd. abstraction and it is assumed that this license has lapsed.

There are two unregulated abstractions (which can take up to 20 m³/d of water from the aquifer). These are located to the south and west of the PDA and are over 3.5 km from the PDA.

3.6 Post-Construction Conceptual Model

On the basis of the above information, it is considered unlikely that there is currently a significant barrier to the transfer of water between the Humber Estuary and the Chalk aquifer. Therefore on a site wide basis, the proposed dredging of superficial deposits from the Humber Estuary is unlikely to significantly affect saline intrusion.

On a more detailed basis, the southern part of the PDA (60% of the total PDA area) has predominantly granular superficial deposits where proven. Removal of the top few metres of this material will have little effect on saline intrusion issues.

In the northern part of the PDA (40% of the total PDA area) there is more uncertainty as to the thickness of superficial cover and the strata may be less permeable. We consider this area to be too small within the context of the area from which an abstraction borehole would pull saline water to have any significant effect on saline intrusion to an abstraction well located inland of the Site.

In regards to the proposed piling and construction, the penetration of piling into the Chalk may create preferential pathways. However, the flux of water along these preferential

pathways, should the natural hydraulic gradient be reversed, will be very small compared to the flux through areas where superficial cover is naturally absent or thin and permeable.

It is also noted that the Humber Port Authority already undertake dredging in the Humber Docks such that the small area of proposed additional dredging is unlikely to make any significant difference to saline intrusion.

4 CONCLUSIONS

Able propose to develop a Marine Energy Park comprising a quay with the purpose of supporting the north sea off-shore wind generating industry.

Able has produced an informal pre-application consultation document. This was submitted to the EA who noted that the Chalk aquifer in this area has historically been subject to saline intrusion which has affected its quality. The EA is concerned that the development may enhance saline intrusion or cause adverse impacts on water receptors.

This report presents the evidence that there is currently no significant barrier to the transfer of water between the Humber Estuary and the Chalk aquifer.

Available site investigation data shows that within the Proposed Dredging Area (PDA) much of the area has granular superficial deposits. To the south of the PDA, the superficial deposits are predicted to be thicker in the vicinity of Kirmington Channel.

It is concluded that dredging within the PDA is unlikely to have a significant effect on the transfer of water between the Humber Estuary and the Chalk aquifer.

The installation of piles into the Chalk may open up preferential pathways allowing Estuary water into the Chalk aquifer. However, this will only occur if there is a downwards hydraulic gradient between the Estuary and the Chalk. As the current management strategy is to maintain an upwards hydraulic gradient to prevent saline intrusion, this should not be a significant issue.

5 REFERENCES

ABLE UK Ltd., 2010. Information pre-application consultation document.

Berridge N.G & Pattison J., 1994. Geology of the country around Grimsby and Patrington. Memoir for 1:50000 geological sheets 90 and 91 and 81 and 82 (England and Wales). British Geological Survey.

British Geological Survey, 1991. Patrington Sheet 81, 1:50000 series Solid and Drift Edition.

CEGB (1970), Proposed 4000 M.W. power station at Killingholme Lincolnshire. Civil engineering works volume 1 of 5 oil fired development. C.S.Allott & Sons.

Landmark (2010) Envirocheck report.

Stibblefield C. J., 1964. Ground-water conditions of the Chalk of the Grimsby area, Lincolnshire. Research report no.1. Department of scientific and industrial research. Water Supply Papers of the Geological Survey of Great Britain.

Whitehead E.J., & Lawrence A.R., 2001. A review of the Chalk Aquifer System of Lincolnshire. British Geological Survey.

Whitehead E.J., & Lawrence A.R., 2006. The Chalk Aquifer System of Lincolnshire (RR/06/03). British Geological Survey.

University Of Birmingham, 1978. South Humberbank Salinity Research Project. Final report to Anglian Water Authority. Final report plus appendices, Volumes 1–5.

University Of Birmingham, 1987. Northern and Southern Chalk Modelling Study. Final report to Anglian Water Authority.

FIGURES



Figure 1
Location map

Date	18/10/2010	Drawn	IPF
Scale	1:100,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure1.mxd			



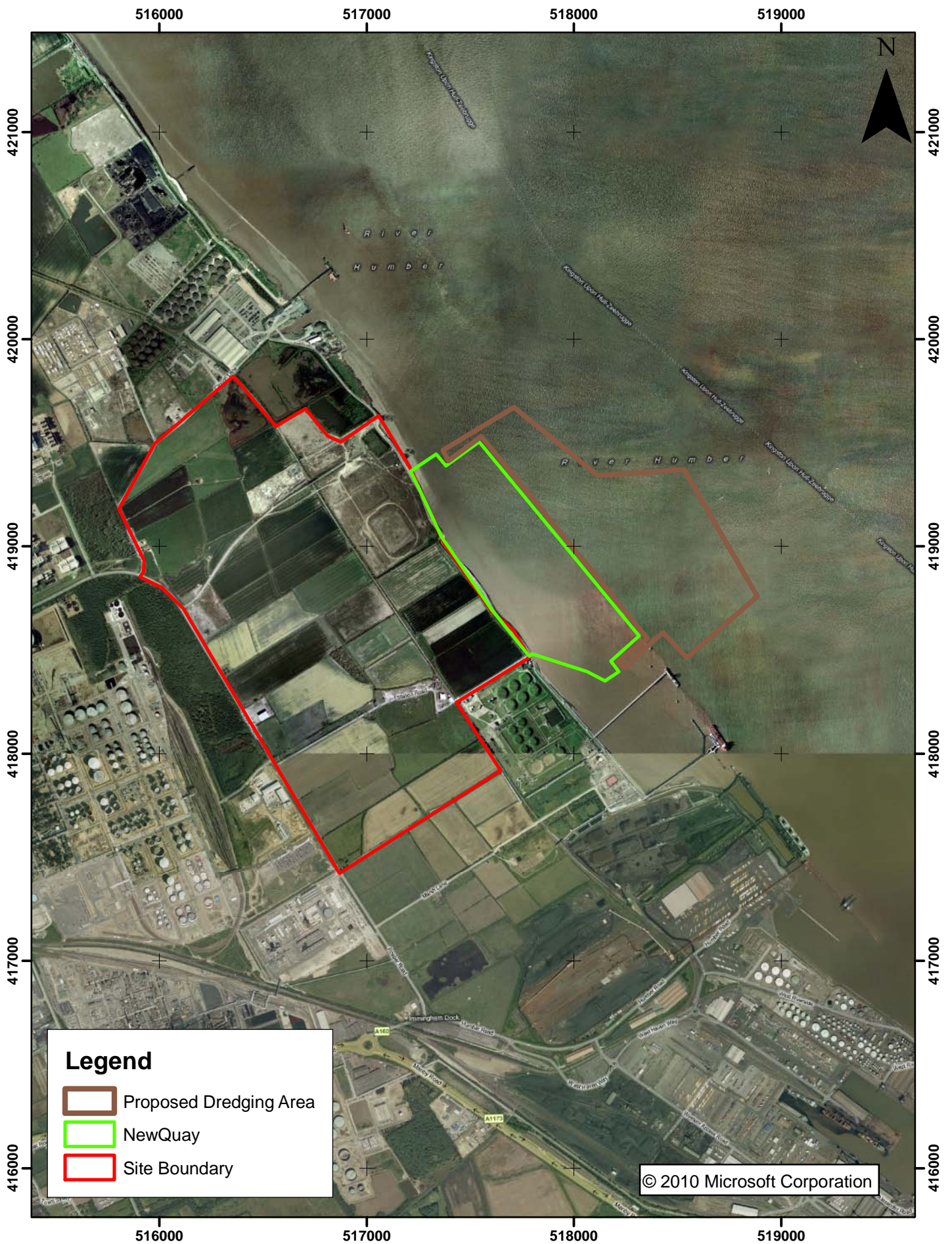


Figure 2
Site map

Date	18/10/2010	Drawn	IPF
Scale	1:24,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure2.mxd			



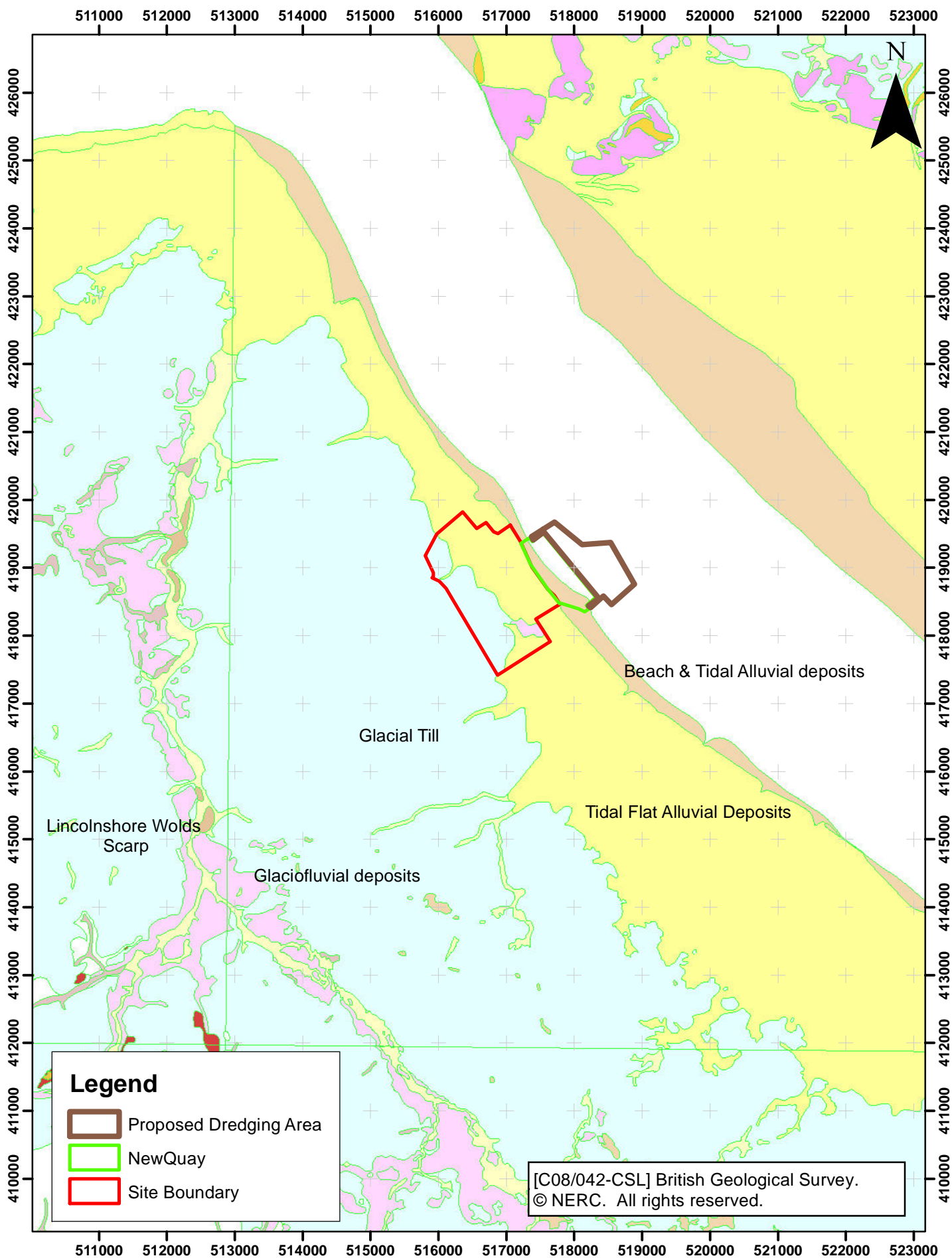


Figure 3
Superficial Deposits

Date	18/11/2010	Drawn	IPF
Scale	1:74,000	Checked	RCS
Original	A4	Revision	1
File Reference	O:\60417\R1\Figure 3		



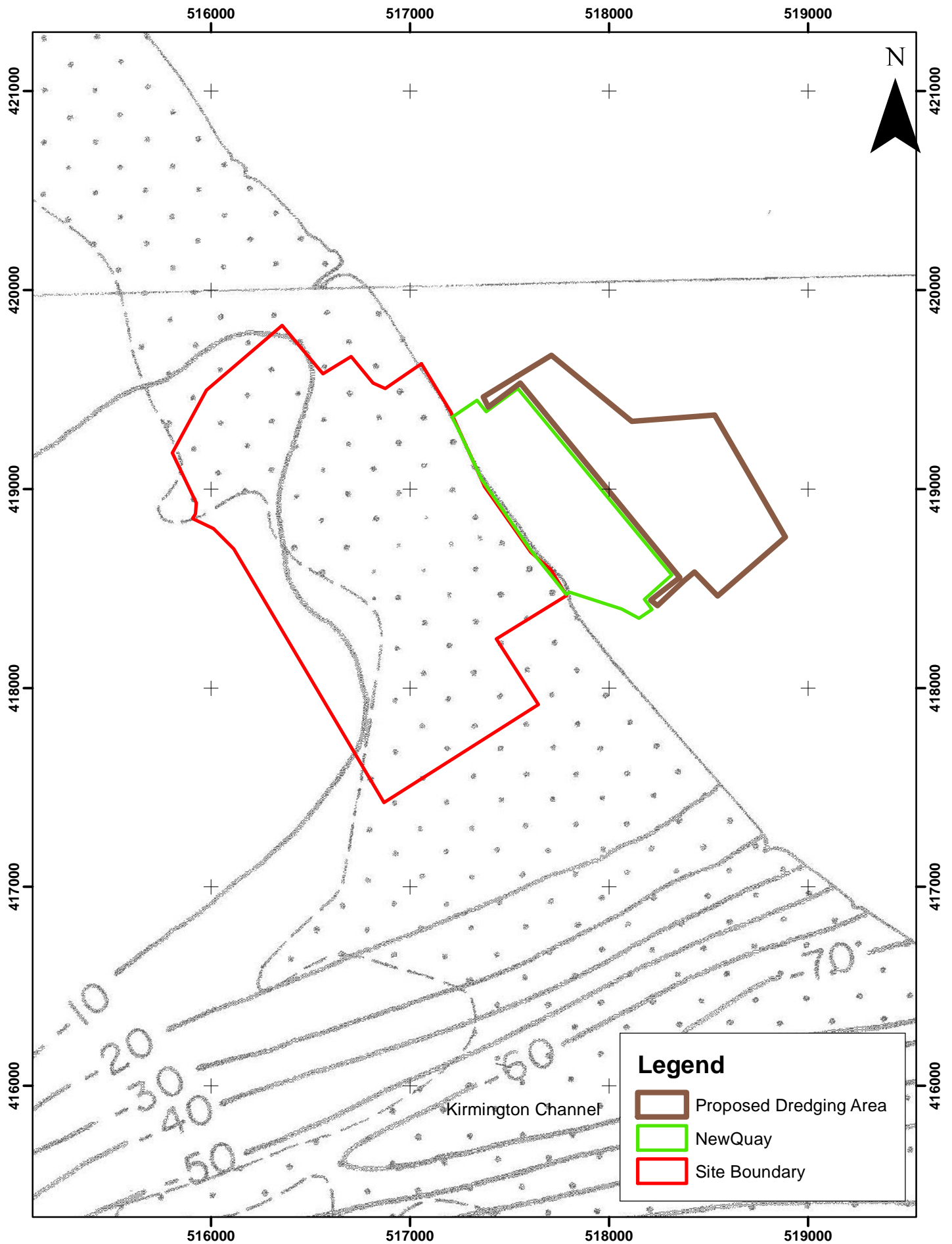


Figure 4
Top of the Chalk

Date	18/11/2010	Drawn	IPF
Scale	1:25,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure 4			



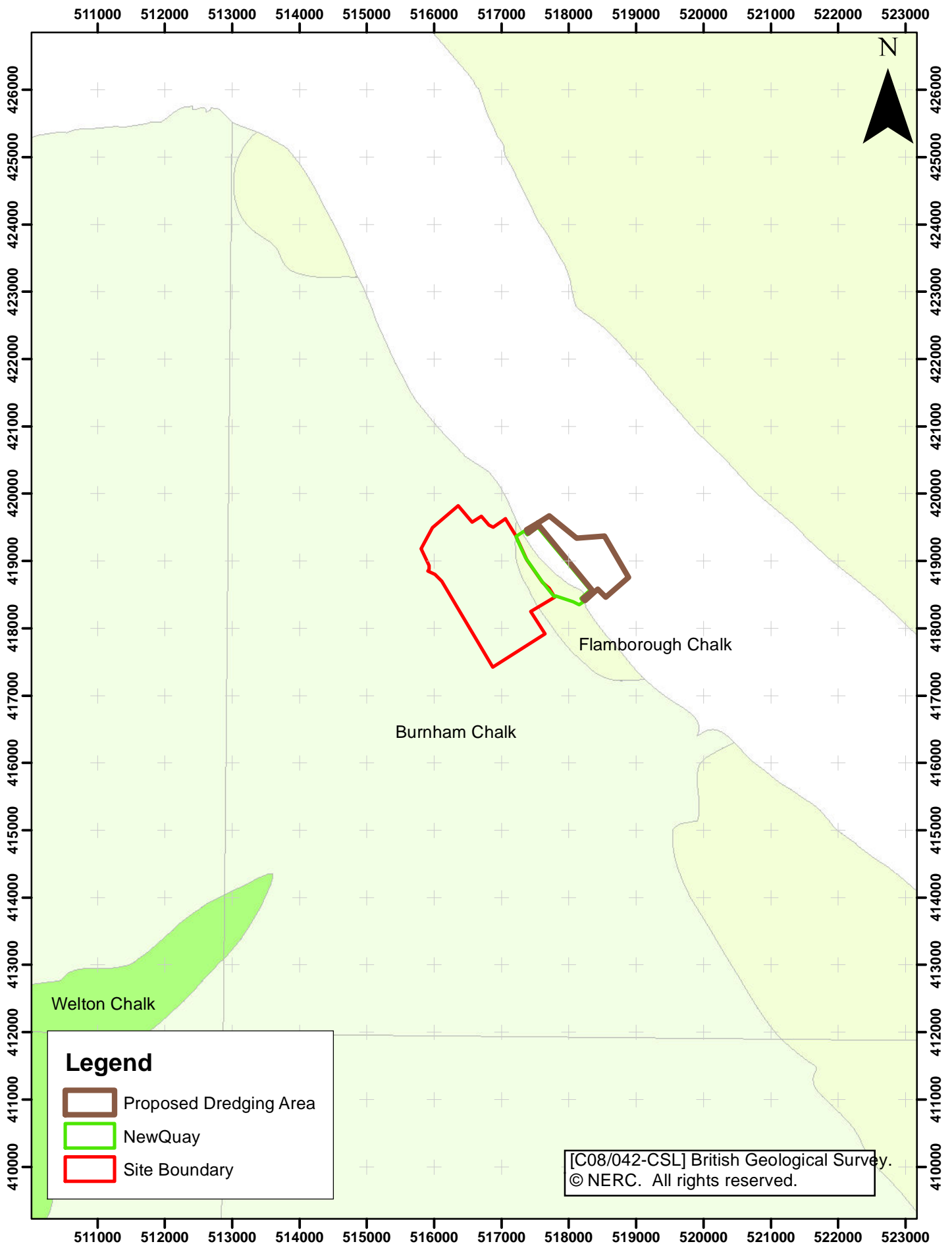


Figure 5
Solid Geology

Date	18/11/2010	Drawn	IPF
Scale	1:74,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure5.mxd			



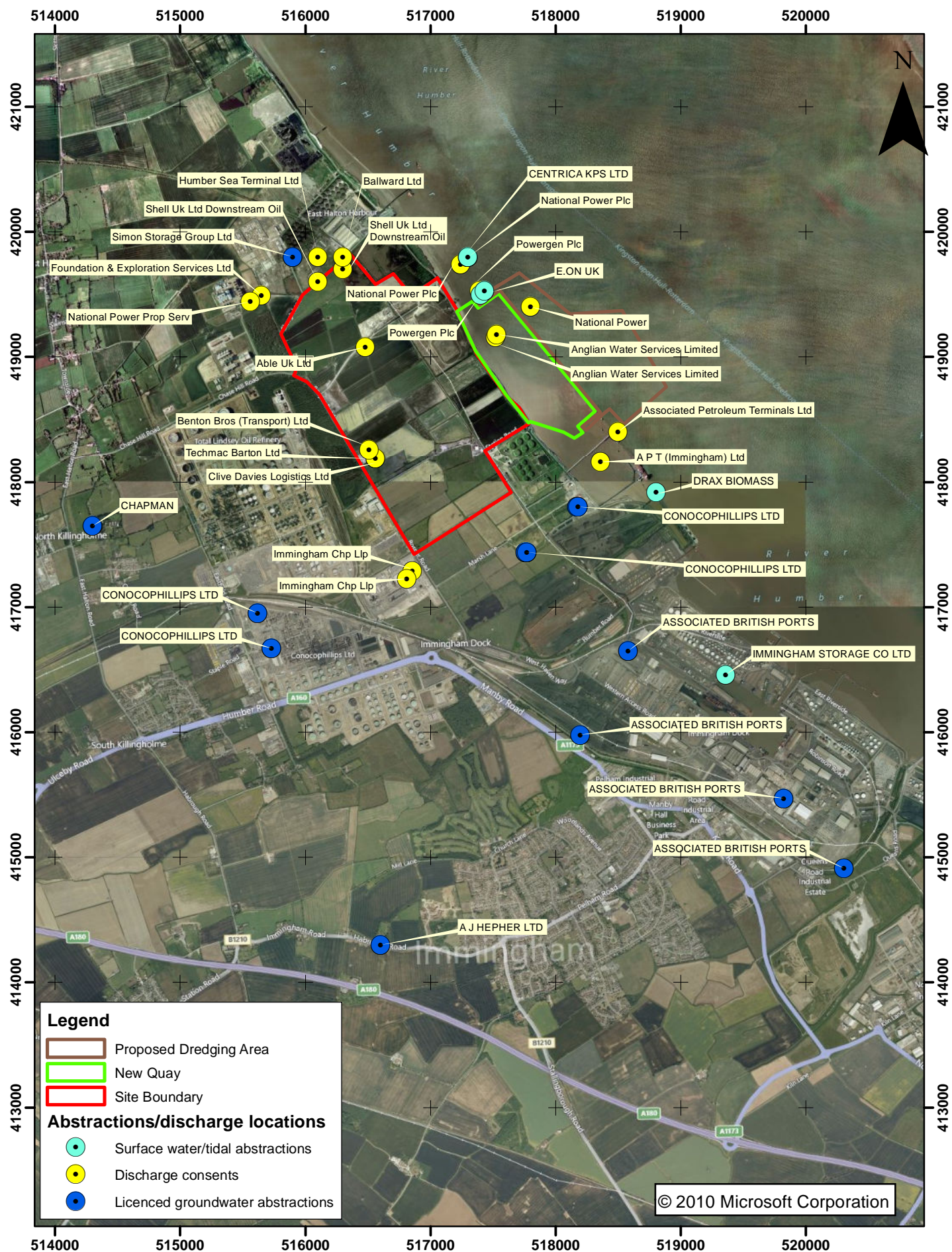


Figure 6
Surface water and groundwater abstraction
and discharge consents

Date	18/07/2011	Drawn	SJW
Scale	1:40,000	Checked	RCS
Original	A4	Revision	2
File Reference			
O:\60417\reports\Figures\Figure 6			



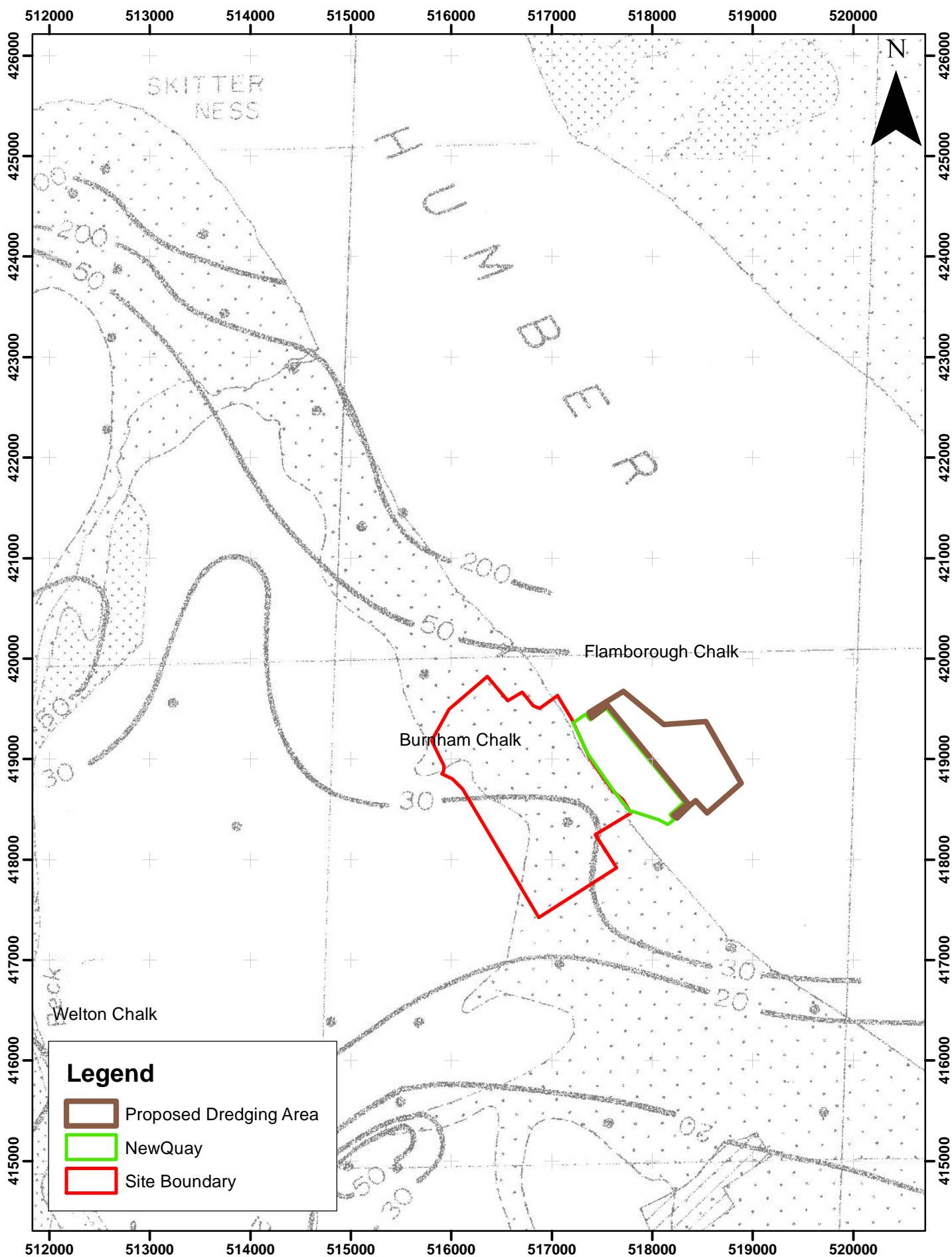


Figure 8
Distribution of chloride ions 1956-1958

Date	18/11/2010	Drawn	IPF
Scale	1:50,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure8.mxd			



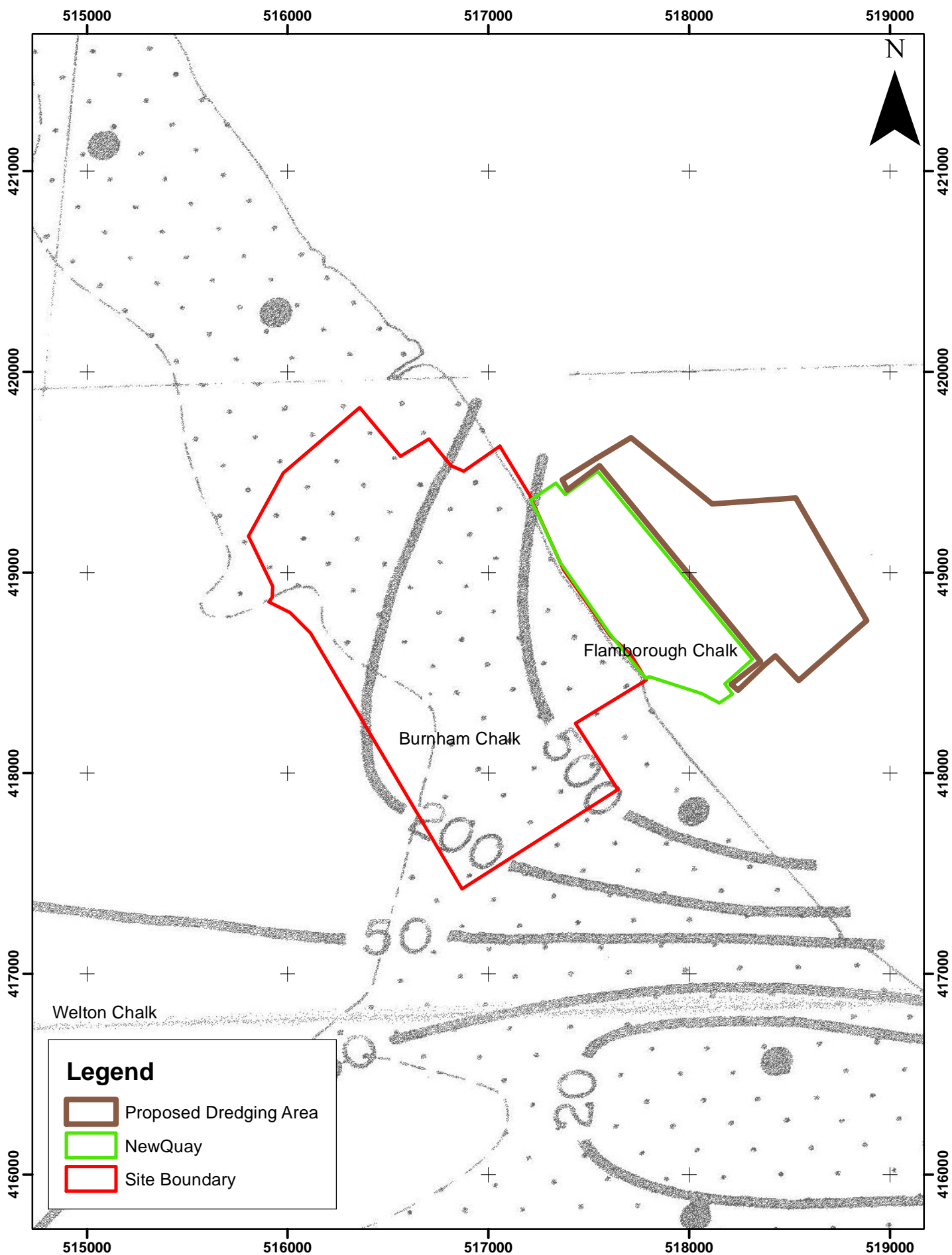


Figure 9
Distribution of chloride ions 1975

Date	18/11/2010	Drawn	IPF
Scale	1:25,000	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\R1\Figure 9.mxd			



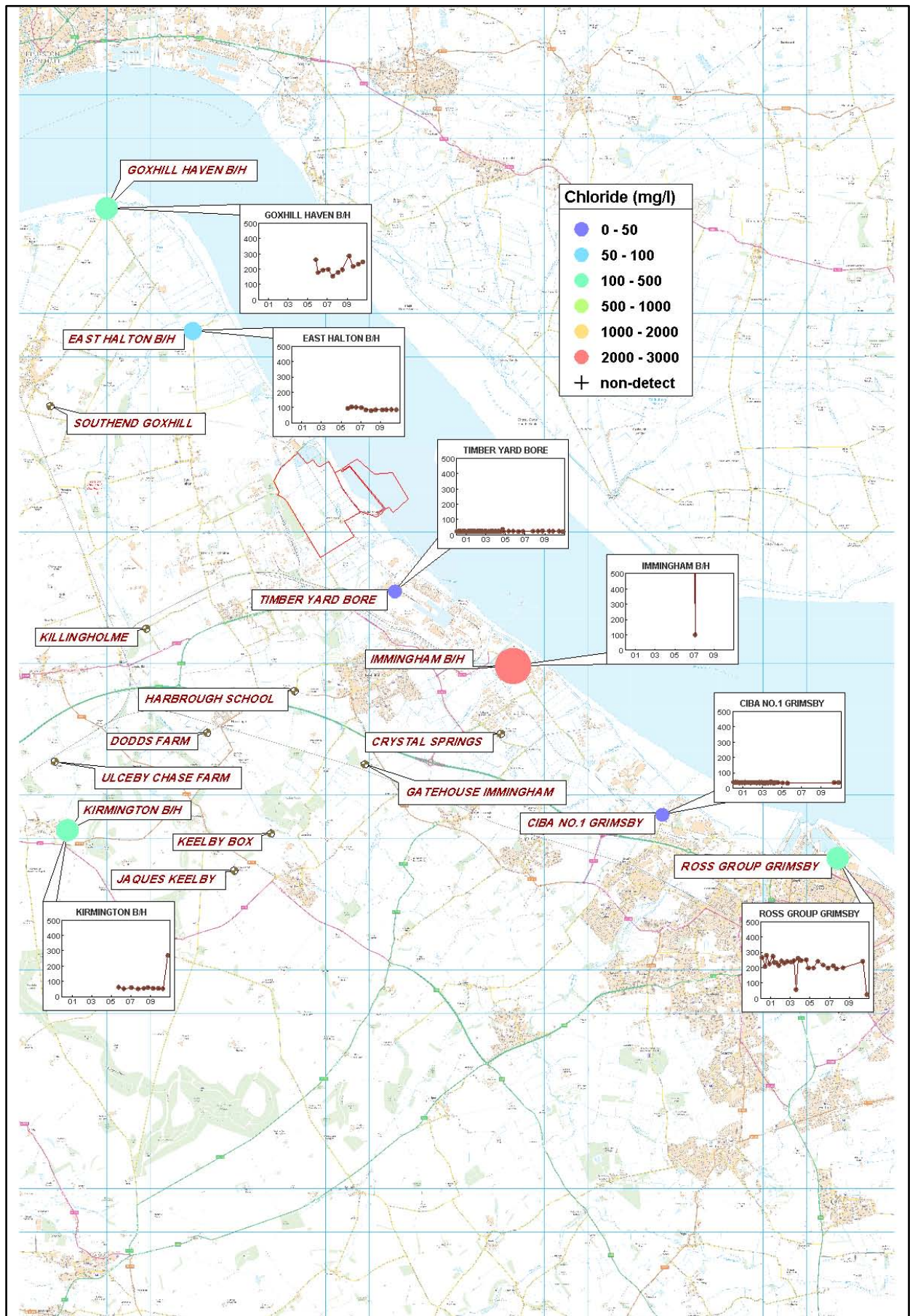
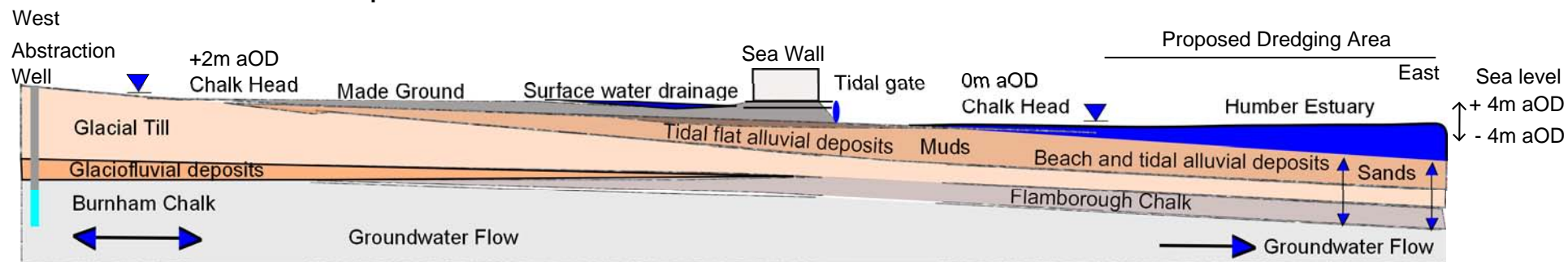


Figure 10
Distribution of chloride ions 2000 – current time

Date	Mar 2011	Drawn	RCS
Scale	NTS	Checked	GEC
Original	A4	Revision	1
File Reference O:\60417\Reports\Figures\Figure 10.doc			



Pre-construction conceptual model



Post-construction conceptual model

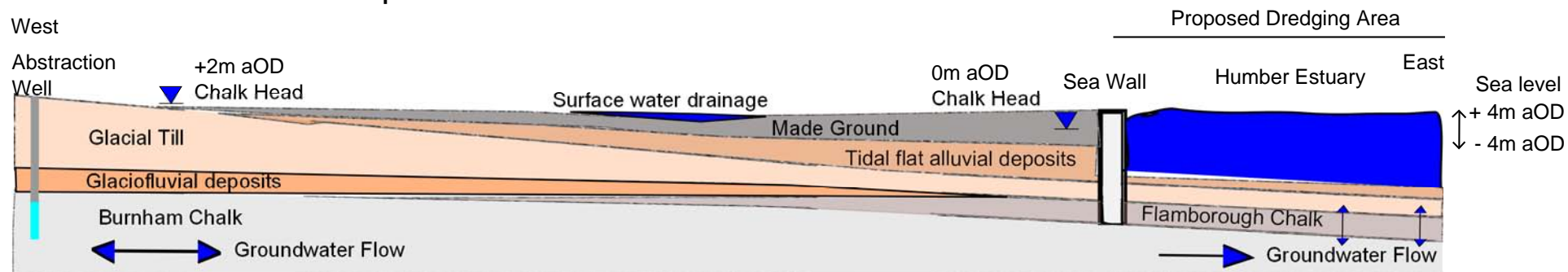
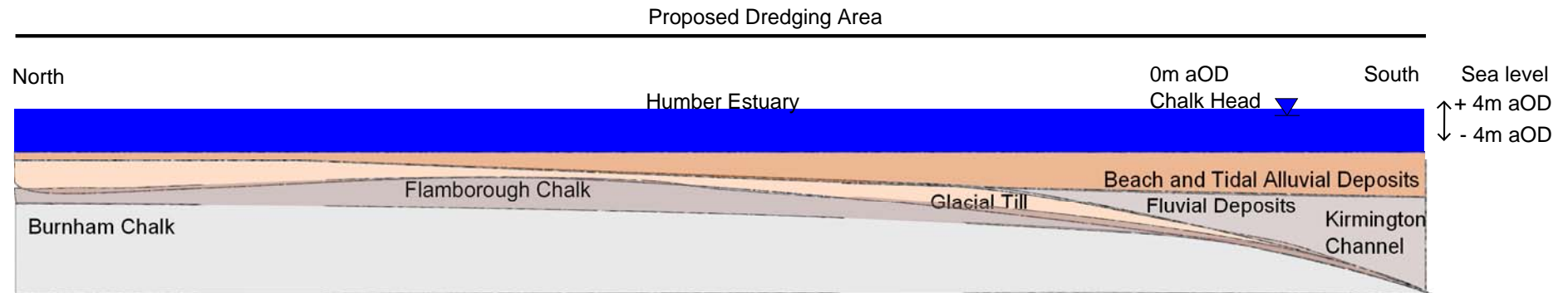


Figure 11
Conceptual site model (east -west).

Date	18/11/10	Drawn	IPF
Scale	dns	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\Reports\Figure11.svg			



Pre-construction conceptual model



Post-construction conceptual model

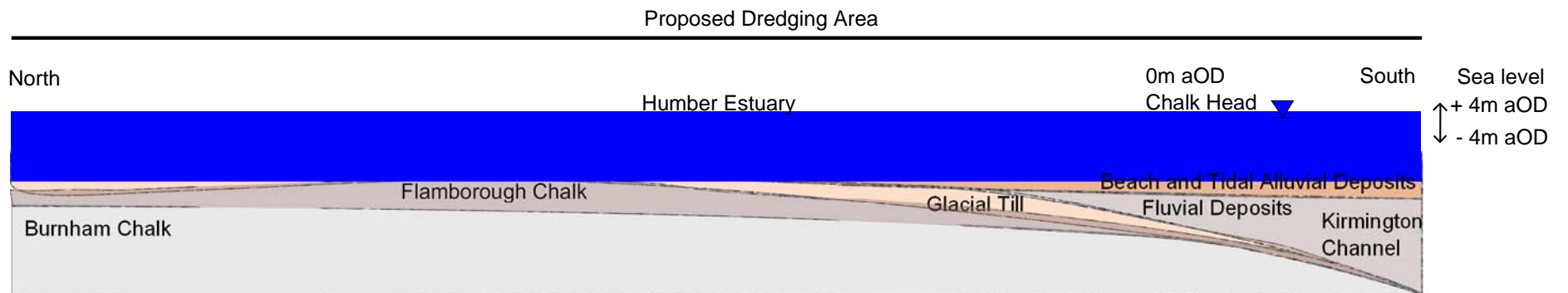


Figure 12
Conceptual site model (north - south).

Date	18/11/10	Drawn	IPF
Scale	dns	Checked	RCS
Original	A4	Revision	1
File Reference O:\60417\Reports\Figures \ Figure 12.svg			



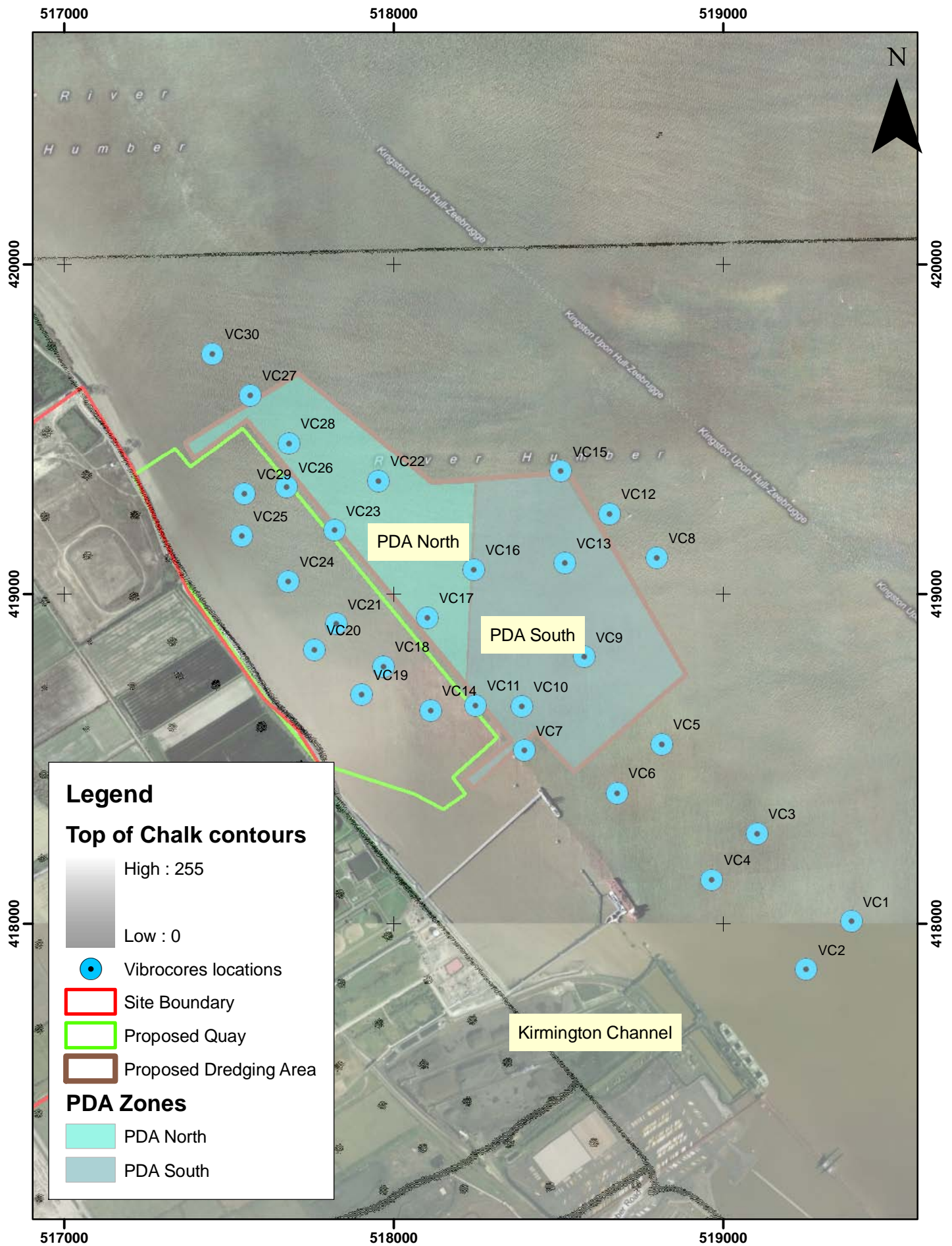


Figure 13
PDA Zones

0 125 250 500 Meters

Date	18/11/2010	Drawn	IPF
Scale	1:15,114	Checked	RCS
Original	A4	Revision	1
File Reference	C:\0047\R1\Figure 13		



APPENDICES

APPENDIX A

Site photographs



Looking north of the Humber Estuary from the lighthouse.



Looking south of the Humber Estuary from the lighthouse.



Looking north of the Humber Estuary from the bridge at the north of the site (Freight Jetty).



Looking south of the Humber Estuary from the lighthouse (Oil Jetty).

APPENDIX B

Vibrocore cross sections



VC1

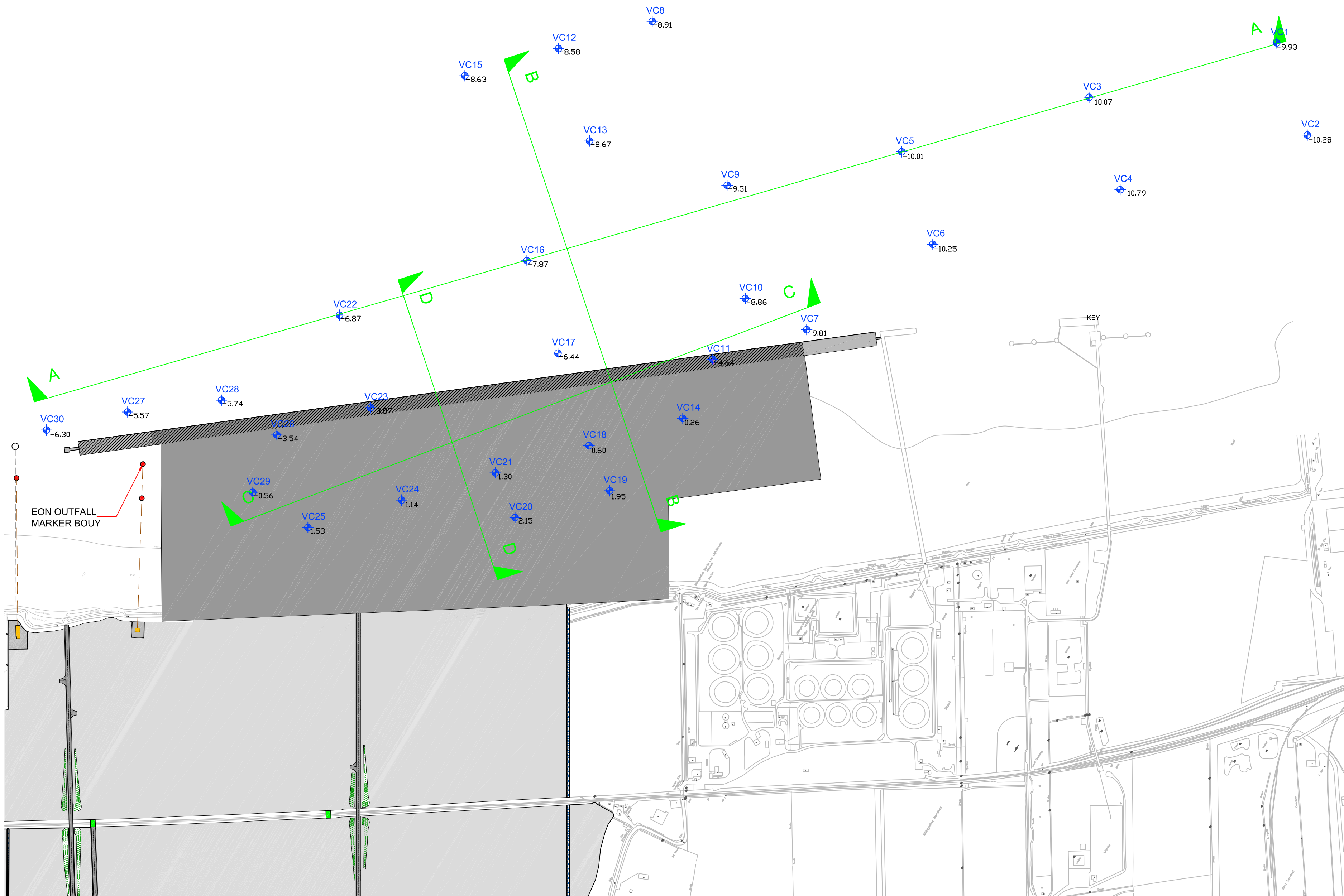
Proposed Vibrocore Location

A

Line of cross-section

-9.93

River Bed Level



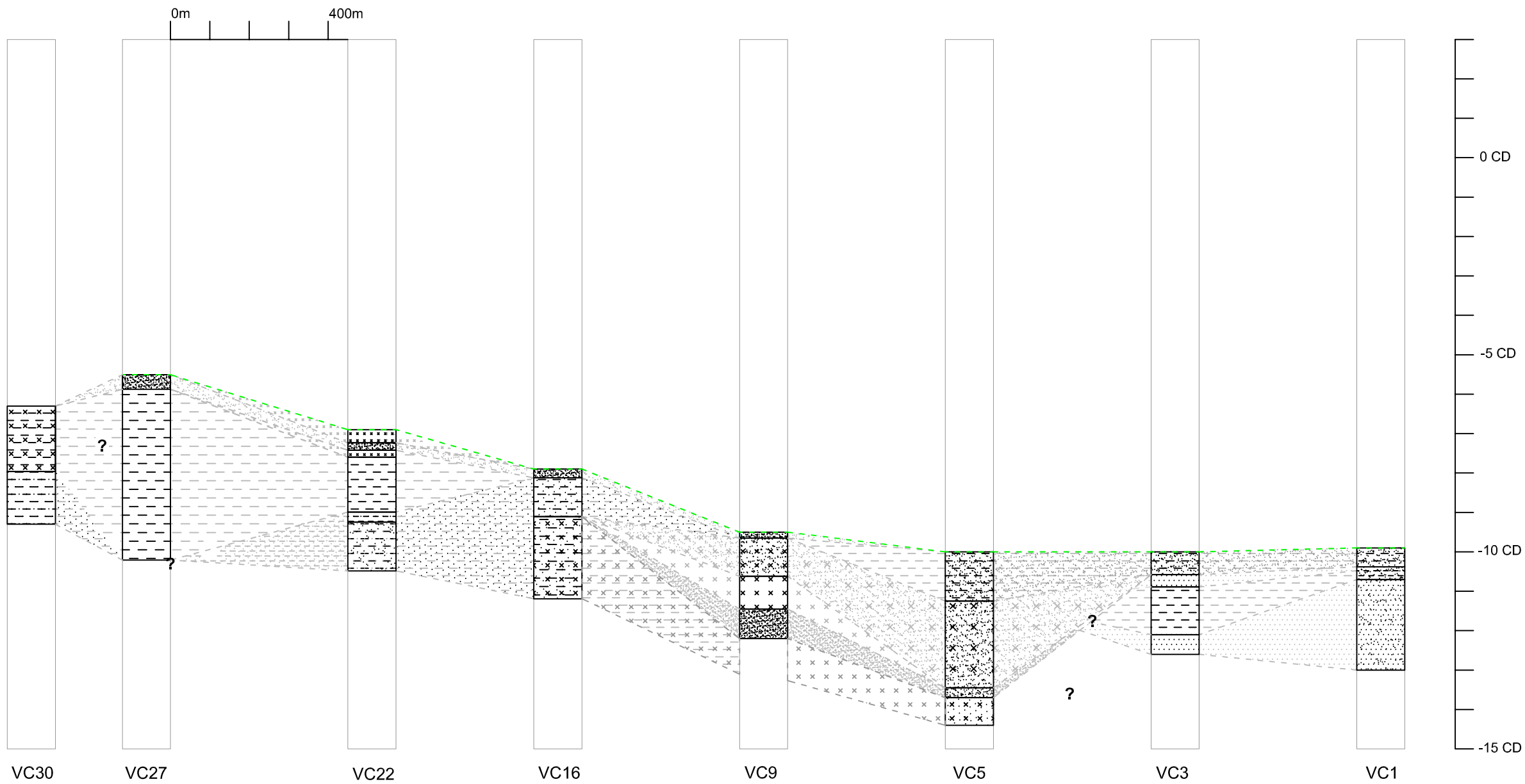
A	24/08/10	Preliminary Issue	JD	RC	RC
Rev	Date	Description	By	Chk	App

Able UK Ltd
Able House
Billingham
Teeside UK
TS23 1PX

Tel: +44-(0)1642 806080
Fax: +44-(0)1642 655655
email: info@ableuk.com
www.ableuk.com

Project:	ABLE Marine Energy Park
Client:	ABLE UK Ltd
Title:	Vibrocore Borehole Location Plan

AS BUILT			
Scale:	Drawn By	Checked By	Approved By
1:5000@A2	J. Dawes	R. Cram	R. Cram
Date:	24/08/10	24/08/10	24/08/10
Drawing No.	KI - 09003		Revision: A



KEY

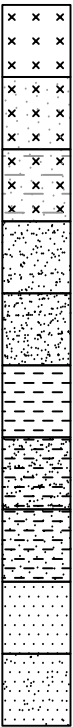
For location of cross-sections please see Drawing No. AME - 09003 A

— River Bed Contour

BLACK - Logged stratigraphy

GREY - Inferred stratigraphy

Sediments



SILT

gravelly SILT

clayey gravelly SILT

SAND

gravelly SAND

CLAY

sandy CLAY

gravelly CLAY

GRAVEL

SAND & GRAVEL

B	03-12-10	Amendments from final logs	JD	JM	RC
A	04-08-10	Preliminary Issue	JD	JM	RC
Rev	Date	Description	By	Chk	App



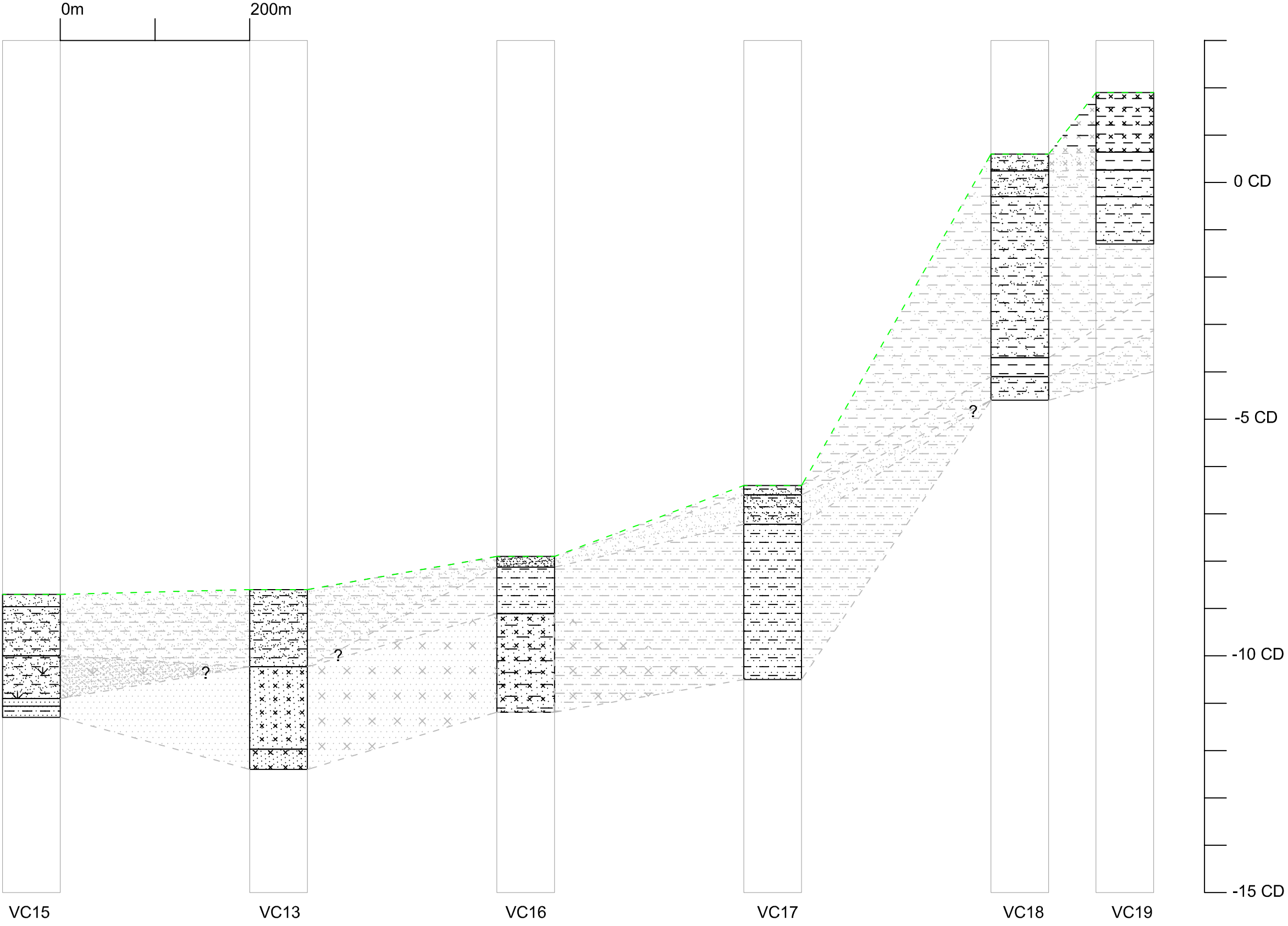
Able UK Ltd
Able House
Billingham
Teesside UK
TS23 1PX

Tel: +44-(0)1642 806080
Fax: +44-(0)1642 655655
email: info@ableuk.com
www.ableuk.com

Project:	ABLE Marine Energy Park
Client:	ABLE UK Ltd
Title:	Vibrocore Cross-Section A

PRELIMINARY

Scale:	Drawn By	Checked By	Approved By
As Shown	J. Dawes	J. Monk	R. Cram
Date:	04-08-10	04-08-10	04-08-10
Drawing No.	Revision:		
AME - 09004			B



KEY

For location of cross-sections please see Drawing No. AME - 09003 A

River Bed Contour

BLACK

- Logged stratigraphy

GREY

- Inferred stratigraphy

Sediments

gravelly SILT

SAND

GRAVEL

silty GRAVEL

CLAY

gravelly CLAY

sandy CLAY

peaty sandy CLAY

silty CLAY

B	03-12-10	Amendments from final logs	JD	JM	RC
A	04-08-10	Preliminary Issue	JD	JM	RC
Rev	Date	Description	By	Chk	App

able

www.ableuk.com

Able UK Ltd

Able House

Billingham

Teesside UK

TS23 1PX

Tel: +44-(0)1642 806080

Fax: +44-(0)1642 655655

email: info@ableuk.com

www.ableuk.com

Project:

ABLE Marine Energy Park

Client:

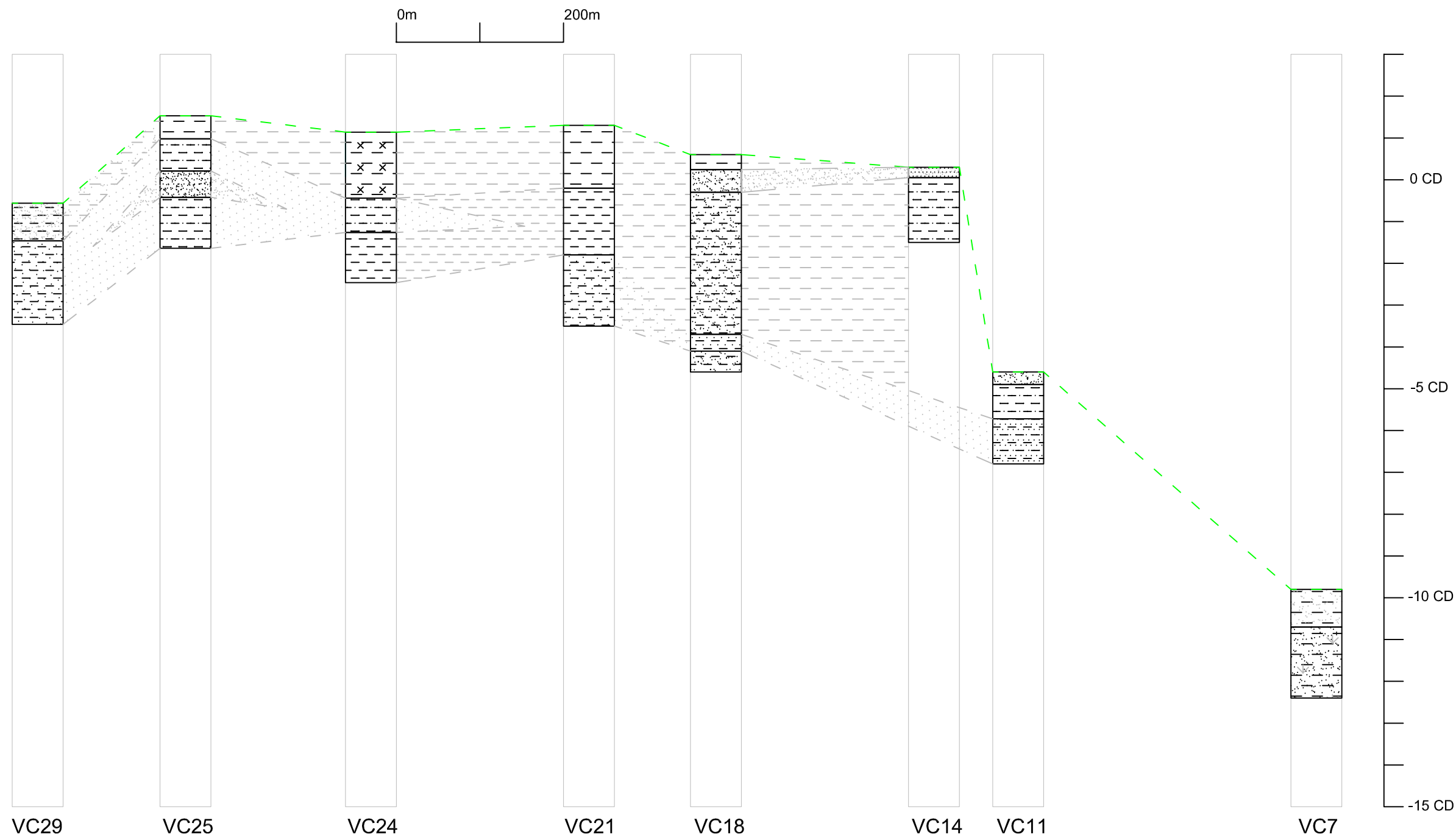
ABLE UK Ltd

Title:

Vibrocore Cross-Section B

PRELIMINARY

Scale:	Drawn By	Checked By	Approved By
As Shown	J. Dawes	J. Monk	R. Cram
Date:	04-08-10	04-08-10	04-08-10
Drawing No.	AME - 09005		Revision: B



KEY

For location of cross-sections please see Drawing No. AME - 09003 A

- River Bed Contour
- BLACK - Logged stratigraphy
- GREY - Inferred stratigraphy

Sediments

- SAND
- GRAVEL
- CLAY
- gravelly CLAY
- sandy CLAY
- slightly peaty sandy CLAY
- silty CLAY

B	03-12-10	Amendments from final logs	JD	JM	RC
A	04-08-10	Preliminary Issue	JD	JM	RC
Rev	Date	Description	By	Chk	App



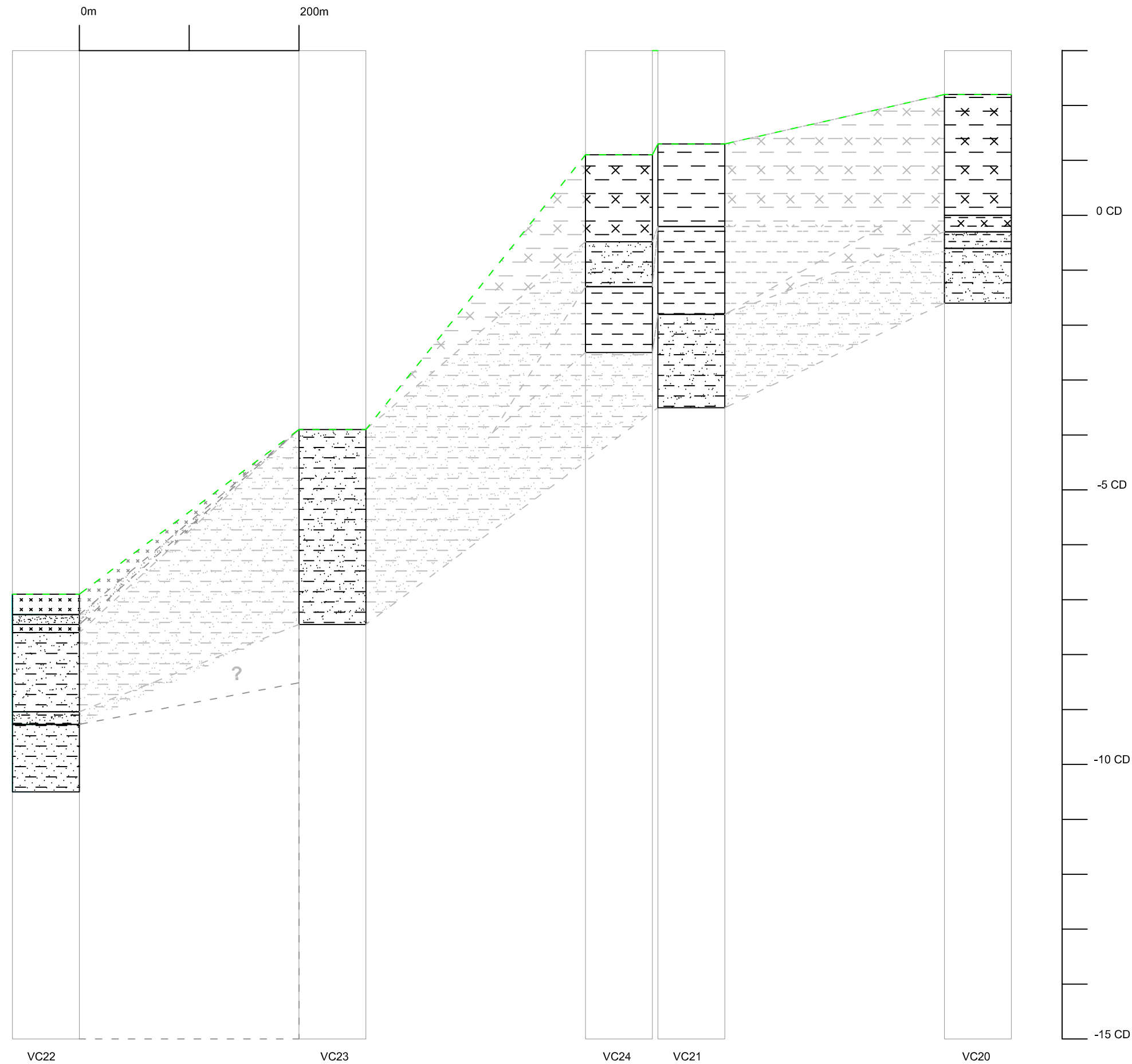
able UK Ltd
Able House
Billingham
Teesside UK
TS23 1PX
www.ableuk.com

Tel: +44-(0)1642 806080
Fax: +44-(0)1642 656655
email: info@ableuk.com
www.ableuk.com

Project:	ABLE Marine Energy Park
Client:	ABLE UK Ltd
Title:	Vibrocore Cross-Section C

PRELIMINARY

Scale:	Drawn By	Checked By	Approved By
As Shown	J. Dawes	J. Monk	R. Cram
Date:	04-08-10	04-08-10	04-08-10
Drawing No.	AME - 09006		Revision: B



KEY

For location of cross-sections please see Drawing No. AME - 09003 A

River Bed Contour

BLACK

- Logged stratigraphy

GREY

- Inferred stratigraphy

Sediments

XXXXXX

XXXXXX

XXXXXX

SILT

XX XX

XX XX

XX XX

clayey SILT

.....

.....

.....

SAND

.....

.....

.....

CLAY

.....

.....

.....

gravelly CLAY

.....

.....

.....

sandy CLAY


XX XX

XX XX

XX XX

silty CLAY

B	03-12-10	Amendments from final logs	JD	JM	RC
A	04-08-10	Preliminary Issue	JD	JM	RC
Rev	Date	Description	By	Chk	App



Able UK Ltd

Able House

Billingham

Teesside UK

TS23 1PX

Tel: +44-(0)1642 806080

Fax: +44-(0)1642 655655

email: info@ableuk.com

www.ableuk.com

Project:

ABLE Marine Energy Park

Client:

ABLE UK Ltd

Title:

Vibrocore Cross-Section D

PRELIMINARY

Scale:	Drawn By	Checked By	Approved By
As Shown	J. Dawes	J. Monk	R. Cram
Date:	04-08-10	04-08-10	04-08-10
Drawing No.	AME - 09007		Revision: B

APPENDIX C

Vibrocore borehole logs

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC01 Sheet 1 of 1				
Ground Level -9.93m CD Hole Type VC		Coordinates 519385.10 E, 418006.20 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft grey mottled dark grey slightly sandy CLAY. Sand is fine and medium.					D001 0.06-0.15						
Brown and dark grey silty very gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of chalk and flint.		0.48	-10.41								
from 0.67m to 0.72m 1 No persistent thin (<40mm) bed of soft dark grey silt		0.80	-10.73		L003 0.76-0.96						
					D004 1.00-1.20						
Light brown silty fine to coarse SAND and subangular to rounded fine to medium occasionally coarse GRAVEL of chalk and light brown flint.											
from 1.61m to 1.67m 1 No impersistent thick (<60mm) lense of light brown fine to coarse sand											
from 2.15m to 2.17m 1 No persistent thin (<20mm) lense of brown fine and medium sand											
from 2.90m sand is medium to coarse					D005 2.90-3.10						
Exploratory hole complete at 3.10 m.		3.10	-13.03								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:10:31											
Form No. SI EXP HOLE LOG						Issue/Revision No. 1.03			Issue Date 04/06/2009		
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC02 Sheet 1 of 1			
Ground Level -10.28m CD Hole Type VC		Coordinates 519255.00 E, 417855.10 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Soft locally firm dark grey slightly sandy SILT. Sand is fine to coarse.		0.30	-10.58	B001 0.00-0.50							
Grey and brown silty very gravelly fine to coarse SAND. Gravel is subangular to rounded fine to coarse of chalk and flint.		0.48	-10.76								
Yellowish brown and light brown fine to coarse SAND and subangular to subrounded occasionally rounded fine to medium rarely coarse GRAVEL of chalk and light grey flint. from 0.69m to 0.82m recovered as light brown slightly gravelly fine to coarse sand. Gravel is subrounded fine to medium of chalk from 1.00m to 1.20m light grey and light brown		1.20	-11.48								
Light grey and light brown fine to coarse SAND and angular to subrounded fine to medium GRAVEL of chalk and light brown flint. at 1.23m 1 No medium gravel sized pocket of light brown fine to medium sand at 1.48m 3 No angular to subangular coarse gravel sized fragments of black flint from 1.57m to 1.61m 1 No coarse gravel sized pocket of dark brown and black fine to coarse sand with medium organic content at 1.75m 1 No angular medium gravel sized pink shell fragment		2.22	-12.50	D002 1.80-2.00							
Firm to stiff high strength grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of chalk and flint. from 3.35m to 3.67m gravelly. Gravel is angular to subrounded fine to medium of chalk, flint and white shell fragments at 3.54m 1 No subrounded coarse gravel sized bivalve shell from 3.80m to 3.94m with frequent angular to subangular fine gravel sized fragments of shell from 5.00m to 5.25m very high strength from 5.25m to 5.35m and 5.45m to 5.58m gravelly. Gravel is angular to subrounded fine to medium of chalk, flint and white shell fragments at 5.52m 1 No subangular coarse gravel sized fragment of sandstone		5.60	-15.88	L003 5.00-5.25							
Stiff locally firm brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium rarely coarse of chalk, flint and quartzite. With occasional fine to medium gravel sized pockets of black silt. at 5.77m 1 No subrounded coarse gravel sized fragment of sandstone		6.00	-16.28	D004 5.85-6.00							
Exploratory hole complete at 6.00 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:10:53											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC03 Sheet 1 of 1			
Ground Level -10.07m CD Hole Type VC		Coordinates 519091.00 E, 418279.30 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft dark grey mottled grey slightly sandy CLAY. Sand is fine and medium. from 0.33m to 0.50m 1 No possible thin bed of brown slightly silty fine to coarse sand at 0.52m 1 No subrounded coarse gravel sized fragment of chalk		0.58	-10.65	D001	0.40-0.55						
		0.89	-10.96								
Brown and light grey sandy subangular to subrounded fine to medium occasionally coarse GRAVEL of chalk and light brown flint. With low cobble content. Cobbles are subangular to subrounded of chalk and black flint.				L002	1.60-1.83						
Stiff high strength brown slightly gravelly CLAY. Gravel is subangular to rounded fine to medium of chalk, sandstone and mudstone. at 1.91m 1 No persistent thin (<20mm) lense of brown fine to medium sand from 1.96m to 2.10m recovered as light brown slightly gravelly fine to coarse sand. Gravel is subrounded fine to medium of chalk		2.10	-12.17	D003	1.83-2.00						
Light grey and light brown sandy subangular to rounded fine to medium GRAVEL of chalk and occasional flint. Sand is fine to coarse. at 2.16m, 2.38m and 2.45m 1 No persistent thin (<15mm) lense of firm brown mottled light brown silt		2.60	-12.67								
Exploratory hole complete at 2.60 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:11:11											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC04 Sheet 1 of 1			
Ground Level -10.79m CD Hole Type VC		Coordinates 518961.80 E, 418126.20 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Reddish brown and brown slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine of chalk.		0.14	-10.93	D001 0.14-0.30 L002 0.30-0.55							
Soft extremely low strength locally firm dark grey slightly sandy SILT. Sand is fine and medium.		0.65	-11.44								
Dark grey and brown slightly silty fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of flint and chalk. from 1.10m to 1.20m with low cobble content. Cobbles are subangular to subrounded of chalk and sandstone		1.40	-12.19								
Light grey and brown sandy angular to subangular fine to coarse GRAVEL of chalk, light brown flint and sandstone. Sand is fine to coarse.		2.70	-13.49	D003 2.85-3.00 L004 3.00-3.25							
Firm to stiff high strength brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, light brown flint and rare sandstone. from 3.30m to 4.00m stiff. Gravel is fine to medium at 3.93m and 3.97m 2 No persistent thin (<10mm) lenses of brown fine to medium sand Exploratory hole complete at 4.10 m.		4.10	-14.89								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:11:28											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC05 Sheet 1 of 1				
Ground Level -10.01m CD Hole Type VC		Coordinates 518797.90 E, 418551.40 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft dark grey and brown sandy CLAY. Sand is fine to medium. at 0.85m 1 No persistent thick lense of black silty peat from 0.85m to 1.25m with frequent persistent thin to thick lenses of fine to medium brown sand		1.25	-11.26	D001 0.20-0.80							
Brown and grey slightly silty fine to coarse SAND with frequent persistent thick lenses of black peat and fine to medium brown sand. Slight organic odour. from 3.00m to 3.35m very clayey		3.45	-13.46	D002 3.00-3.35							
Grey slightly silty slightly gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to medium of chalk.		3.70	-13.71								
Stiff very pale grey and white sandy gravelly SILT. Gravel is subangular to subrounded fine to medium of chalk.		4.40	-14.41	L003 4.10-4.30							
Exploratory hole complete at 4.40 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:11:45											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC06 Sheet 1 of 1				
Ground Level -10.25m CD Hole Type VC		Coordinates 518667.70 E, 418399.30 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Reddish brown and brown very silty fine to medium SAND. Soft locally firm greyish brown and dark grey clayey sandy SILT. Sand is fine to coarse. With occasional to frequent persistent thick (<50mm) lenses of brown fine to coarse sand.		0.26	-10.51	B001 0.00-0.40							
					D002 1.80-2.00						
Light brown slightly silty fine to coarse SAND with frequent persistent lenses (<50mm) of black pseudofibrous peat. Slight organic odour.		3.20	-13.45								
Firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to rounded fine to medium of chalk, flint and shell fragments.		4.50	-14.75	D003 4.50-4.68							
					L004 4.68-4.90						
Light brown slightly silty fine to coarse SAND. Exploratory hole complete at 5.30 m.		4.90	-15.15								
		5.30	-15.55								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:12:02											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward					Exploratory Hole Log			Hole ID. VC07 Sheet 1 of 1			
Ground Level -9.81m CD Hole Type VC		Coordinates 518384.50 E, 418530.60 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft black and dark grey slightly sandy CLAY.		0.90	-10.71	D001 0.80-1.00 L002 1.00-1.25 D003 1.25-1.40							
Soft extremely low strength brown and dark brown sandy CLAY with frequent persistent lenses (<10mm) of black pseudofibrous peat. (Slight organic odour noted).				D004 2.10-2.30							
Exploratory hole complete at 2.60 m.		2.60	-12.41								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:12:18											
Form No. SI EXP HOLE LOG		Issue/Revision No. 1.03		Issue Date 04/06/2009							
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC08 Sheet 1 of 1			
Ground Level -8.91m CD Hole Type VC		Coordinates 518764.00 E, 419127.80 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft brown mottled dark grey sandy SILT. Sand is fine and medium.											
Light brown and brown silty fine to medium SAND.		0.45	-9.36								
from 0.80m to 0.92m very clayey				D001	0.80-1.00						
from 0.92m to 0.95m 1 No thin (<30mm) lense of dark grey pseudofibrous peat				B002	1.70-2.00						
from 2.55m to 2.75m 5 No persistent thin (<10mm) lenses of black amorphous peat				L003	2.75-3.00						
from 3.10m to 4.70m with occasional impersistent thin (<10mm) lenses of black amorphous peat				B004	3.00-3.20						
				B005	3.00-3.50						
				D006	3.80						
				L007	4.00-4.15						
Exploratory hole complete at 4.70 m.		4.70	-13.61								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:12:36											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
SOIL ENGINEERING A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC09 Sheet 1 of 1					
Ground Level -9.51m CD Hole Type VC		Coordinates 518554.70 E, 418822.80 N National Grid Inclination Vertical											
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation		
				Details	Dia.	TCR	SCR	ROD					
Reddish brown and brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse of black flint.		0.15	-9.66	D001	0.15-0.35								
Soft brown and dark grey sandy CLAY with frequent persistent lenses (<20mm) of black amorphous peat. Sand is fine to medium. from 0.67m to 0.74m 1 No thin bed (<70mm) of reddish brown slightly gravelly fine to coarse sand. Gravel is subangular to subrounded fine to medium of red sandstone and chalk		1.12	-10.63										
Soft locally firm extremely low to very low brown mottled dark brown slightly sandy SILT. Sand is fine and medium.				L002	1.65-1.85								
				L003	2.05-2.25								
Brown and grey slightly silty slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to medium occasionally coarse of chalk and flint. from 2.50m to 2.70m with occasional impersistent lenses (<10mm) of black amorphous peat		2.25	-11.76	D004	2.25-2.40								
Exploratory hole complete at 2.70 m.		2.70	-12.21										
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key													
Log Print Date And Time: 10/11/2010 09:12:57													
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009					
SOIL ENGINEERING A trading name of VINCI Construction UK Limited													

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC10 Sheet 1 of 1				
Ground Level -8.86m CD Hole Type VC		Coordinates 518374.60 E, 418671.40 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft brown and dark grey sandy CLAY. Sand is fine to coarse. from 0.80m to 1.00m 1 No thin bed of soft black silt from 1.60m to 1.80m 1 No thin bed of brown slightly silty fine to coarse sand				D001 0.20-0.40							
				L002 1.50-1.70							
		1.90 -10.76	L003 1.90-2.00								
Firm to stiff low strength brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk, mudstone, sandstone and flint. from 1.90m to 2.20m 2 No coarse gravel sized pockets of black fine to coarse sand		2.25 -11.11	D004 2.25-2.35								
Stiff very pale grey and white sandy gravelly SILT. Gravel is subangular to subrounded fine to medium of chalk. Exploratory hole complete at 3.20 m.		3.20 -12.06									
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:13:18											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC11 Sheet 1 of 1	
Ground Level -4.64m CD		Coordinates 518233.10 E, 418664.30 N National Grid							
Hole Type VC		Inclination Vertical							

Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Brown gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse of flint and sandstone.		0.30	-4.94	D001 0.30-0.45 D002 0.45-0.55 L003 0.75-1.00							
Firm to stiff high to very high strength reddish brown mottled light bluish grey slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of chalk and mudstone. from 1.00m to 1.12m with occasional coarse gravel sized pockets of black sandy silt. Sand is fine to medium		1.12	-5.76	L004 1.00-1.12 D005 1.12-1.25 D006 1.25-1.35 L007 1.35-1.58							
Stiff locally firm high strength brown mottled grey gravelly CLAY. Gravel is subangular to rounded fine to medium rarely coarse of chalk, flint, sandstone and mudstone.		2.20	-6.84	D008 2.00-2.20							
Exploratory hole complete at 2.20 m.											


NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

Log Print Date And Time: 10/11/2010 09:13:41

Form No. SI EXP HOLE LOG Issue/Revision No. 1.03 Issue Date 04/06/2009 A trading name of VINCI Construction UK Limited

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward					Exploratory Hole Log			Hole ID. VC12 Sheet 1 of 1			
Ground Level -8.58m CD Hole Type VC		Coordinates 518617.90 E, 419263.90 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Reddish brown and brown slightly gravelly fine to coarse SAND. Gravel is subrounded to rounded fine occasionally medium of chalk.		0.40	-8.98								
Soft to firm brown and light brown sandy CLAY. Sand is fine to coarse. from 0.45m to 0.50m 3 No medium to coarse gravel sized pockets of black pseudofibrous peat. (Slightly organic odour noted) at 0.80m 1 No persistent thick lamination (<15mm) of black amorphous peat from 0.95m to 1.00m 3 No subrounded to rounded coarse gravel sized fragments of flint from 1.50m to 1.70m silty with frequent persistent thick laminations (<10mm) of black amorphous peat at 1.65m 1 No subrounded medium gravel sized fragment of chalk from 2.00m to 2.40m 1 No thin bed of soft black slightly sandy silt. Sand is fine to medium				L001 1.20-1.45							
				D002 1.80-2.00							
				L005 3.70							
Brown slightly silty fine to coarse SAND. from 4.10m to 4.30m slightly gravelly. Gravel is subangular to subrounded fine to medium of chalk		3.90	-12.48								
		4.30	-12.88	D004 4.15							
Exploratory hole complete at 4.30 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:14:03											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name		South Humber Channel Marine Studies		Exploratory Hole Log		Hole ID.				
Project No.		F15842				VC13				
Engineer		Roger Tym & Partners				Sheet 1 of 1				
Client		Yorkshire Forward								
Ground Level		-8.67m CD		Coordinates		518487.80 E, 419111.70 N National Grid				
Hole Type		VC		Inclination		Vertical				
Description of Strata		Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery		In Situ Test Details	Installation
					DetailsDia.		TCR	SCR	RQD	
Soft very low strength brown and dark grey very sandy CLAY. Sand is fine to coarse. from 0.20m to 0.30m and 0.70m to 0.80m 2 No persistent thin (<100mm) beds of black amorphous peat					D001	0.80-1.00				
					L002	1.30-1.55				
from 1.55m to 1.63m with black slightly sandy angular to subrounded fine to medium gravel of chalk and white shell fragments. Sand is fine to coarse			1.63	-10.30	D003	1.90-2.00				
Firm to stiff very light grey slightly sandy gravelly SILT. Gravel is subangular to subrounded fine to medium of chalk. from 2.15m to 2.40m yellowish brown mottled white from 2.60m to 2.70m greenish grey mottled white					L004	3.00-3.25				
White slightly sandy silty subangular fine to coarse GRAVEL of chalk with low cobble content. In places with light grey and light brown staining (Possible structureless chalk - Grade Dc).			3.37	-12.04						
Exploratory hole complete at 3.80 m.			3.80	-12.47						
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key										
Log Print Date And Time: 10/11/2010 09:14:19										
Form No. SI EXP HOLE LOG Issue Revision No. 1.03 Issue Date 04/06/2009										
A trading name of VINCI Construction UK Limited										

Project Name		South Humber Channel Marine Studies		Exploratory Hole Log		Hole ID.						
Project No.		F15842				VC14						
Engineer		Roger Tym & Partners				Sheet 1 of 1						
Client		Yorkshire Forward										
Ground Level		0.26m CD		Coordinates		518097.40 E, 418655.30 N National Grid						
Hole Type		VC		Inclination		Vertical						
Description of Strata		Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
					Details		Dia.	TCR	SCR	RQD		
Brown and dark grey slightly sandy very clayey subangular to rounded fine to coarse GRAVEL of sandstone and chalk. Sand is fine to coarse.			0.25	0.01	D001 0.00-0.25							
					L002 0.25-0.48							
Firm to stiff low strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded to rounded fine to medium of chalk, sandstone, flint and mudstone.					D003 0.80-1.00							
at 0.65m decomposed wood (<10mm)					L004 1.00-1.15							
					D005 1.60-1.80							
Exploratory hole complete at 1.80 m.			1.80	-1.54								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key												
Log Print Date And Time: 10/11/2010 09:14:35												
Form No. SI EXP HOLE LOG Issue Revision No. 103 Issue Date 04/06/2009												
A trading name of VINCI Construction UK Limited												

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC15 Sheet 1 of 1			
Ground Level -8.63m CD Hole Type VC		Coordinates 518470.80 E, 419399.90 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Reddish brown and brown slightly gravelly slightly silty fine to coarse SAND. Gravel is subrounded to rounded fine to medium of white gastropods.		0.26	-8.89	D001	0.30-0.40						
Soft to firm brown and dark brown sandy CLAY. Sand is fine to coarse. at 0.31m and 0.49m 2 No persistent thick (<30mm) laminations of black amorphous peat		1.30	-9.93	L002	1.30-1.55						
Soft very low strength dark brown very sandy CLAY with persistent thick laminations of black amorphous peat.				D003	1.80-2.00						
Dark grey and brown sandy very silty angular to subangular fine to coarse GRAVEL of flint and chalk. Sand is fine to coarse. at 2.30m 2 No subangular to subrounded coarse gravel sized fragments of chalk		2.20	-10.83	D004	2.15-2.25						
Dark brown clayey very sandy subangular to subrounded fine to coarse GRAVEL of chalk and rare flint. Sand is fine to coarse.		2.36	-10.99	B005	2.36-2.50						
Exploratory hole complete at 2.60 m.		2.60	-11.23								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:14:49											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC16 Sheet 1 of 1				
Ground Level -7.87m CD Hole Type VC		Coordinates 518210.60 E, 419095.60 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Reddish brown and brown slightly gravelly very clayey fine to coarse SAND. Gravel is subrounded to rounded fine occasionally medium of chalk. Firm to stiff brown mottled dark grey gravelly CLAY. Gravel is subangular to subrounded fine to medium occasionally coarse of chalk, sandstone and flint.		0.25	-8.12	D001 0.00-0.25 L002 0.25-0.50 D003 0.50-0.70 L004 0.70-0.95							
Very stiff, very high strength, grey mottled light brown slightly sandy clayey gravelly SILT. Gravel is subangular to subrounded fine to medium of chalk.		1.30	-9.17	D005 1.20-1.30 D006 1.80-2.00 L007 2.10-2.35							
Exploratory hole complete at 3.40 m.		3.40	-11.27								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:15:02											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC17 Sheet 1 of 1	
Ground Level -6.44m CD		Coordinates 518080.50 E, 418943.50 N National Grid							
Hole Type VC		Inclination Vertical							

Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Firm brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to medium of chalk. Sand is fine with rare pockets of greenish grey clayey peat (20mm).		0.20	-6.64	D001 0.00-0.20 B002 0.20-0.60							
Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of chalk, flint and sandstone. from 0.32m to 0.35m 1 No very thin bed of firm brown sandy clay. Sand is fine to medium		0.82	-7.26	D003 0.60-0.80							
Firm to stiff medium strength slightly sandy slightly gravelly CLAY. Sand is fine and medium. Gravel is subangular to rounded fine to medium of chalk, sandstone, flint and mudstone. from 0.90m to 1.00m sandy from 1.29m to 1.32m 1 No pocket (60mm) of brown slightly clayey fine to coarse sand from 2.39m to 2.62m light grey mottled brown and gravelly. Gravel is subangular to subrounded fine and medium of chalk				L004 1.55-1.80 D005 1.80-2.00							
				L006 2.80-2.90 D007 2.90-3.00 L008 3.00-3.26							
Exploratory hole complete at 4.10 m.		4.10	-10.54								

NOTES: All depths in metres, all diameters in millimetres.
 See header sheet for details of boring, progress and water.
 For details of abbreviations, see key

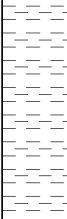

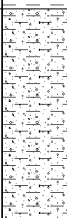
Log Print Date And Time: 10/11/2010 09:15:17

Form No. SI EXP HOLE LOG Issue/Revision No. 1.03 Issue Date 04/06/2009 A trading name of VINCI Construction UK Limited


Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC18 Sheet 1 of 1			
Ground Level 0.60m CD Hole Type VC		Coordinates 517950.30 E, 418791.30 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Very soft dark greenish brown sandy CLAY. Sand is fine to medium.				D001	0.10-0.30						
Brown gravelly very clayey fine to coarse SAND. Gravel is angular to subangular fine and medium of flint, chalk and mudstone.		0.36	0.24	D002	0.70-0.90						
Firm brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is angular to subangular fine and medium of flint and chalk.		0.90	-0.30	L003	1.10-1.25						
from 1.75m to 2.00m medium strength				L004	1.75-2.00						
from 3.10m to 3.20m stiff				D002	2.90						
Stiff locally firm brown slightly gravelly CLAY. Gravel is subrounded to rounded fine and medium of chalk, flint, sandstone and mudstone.		4.30	-3.70								
Firm brown slightly gravelly sandy CLAY. Gravel is subangular to subrounded fine to coarse of chalk, flint and sandstone. Sand is fine to coarse.		4.70	-4.10	D005	5.00-5.20						
Exploratory hole complete at 5.20 m.		5.20	-4.60								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:15:32											
Form No. SI EXP HOLE LOG						Issue/Revision No. 1.03					
Issue Date 04/06/2009						A trading name of VINCI Construction UK Limited					

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC19 Sheet 1 of 1			
Ground Level 1.95m CD Hole Type VC		Coordinates 517893.10 E, 418707.10 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Very soft to soft thickly laminated brown and dark grey slightly sandy silty CLAY with some pockets (10-60mm) of brown fine and medium sand. Sand is fine and medium. (Slight organic odour noted). from 1.00m to 1.26m slightly gravelly. Gravel is angular fine and medium of flint				D001 0.00-0.35							
				B002 0.35-1.00							
				D003 1.00-1.26							
		1.26	0.69	L004 1.26-1.52							
Soft very low strength grey and brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of chalk and flint.		1.64	0.31	L005 1.52-1.64							
				D006 1.65-1.80							
				D007 1.80-2.00							
Firm brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of mudstone, sandstone, chalk and flint. from 1.78m to 1.86m 1 No pocket (80mm) of grey clayey fine to coarse sand		2.20	-0.25								
Firm very low strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of chalk, chert, flint and mudstone.				L008 2.90-3.00							
Exploratory hole complete at 3.20 m.		3.20	-1.25								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:15:47											
Form No. SI EXP HOLE LOG Issue/Revision No. 1.03 Issue Date 04/06/2009											
A trading name of VINCI Construction UK Limited											


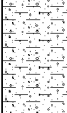
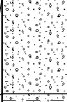
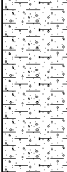
Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC20 Sheet 1 of 1			
Ground Level 2.15m CD Hole Type VC		Coordinates 517746.10 E, 418845.20 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Very soft dark grey mottled brown silty CLAY with some lenses (10-45mm) of brown clayey fine and medium sand. (Organic odour noted). from 1.45m to 1.70m extremely low strength from 1.77m to 2.00m with some shell fragments				D001	0.30-0.70						
				D002	1.00-1.15						
				L003	1.45-1.70						
				L004	1.77-2.00						
Soft to firm grey silty CLAY with many pockets of black pseudofibrous peat. (Organic odour noted).		2.20	-0.05								
		2.50	-0.35								
Firm brown sandy organic CLAY with many pockets (60-80mm) of black fibrous plant material. Sand is fine.		2.80	-0.65								
Firm to stiff brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine and medium of chalk, flint and mudstone. at 2.87m 1 No pocket (20mm) of black fibrous peat at 3.46m 1 No pocket (50mm) of grey fine and medium sand				D005	3.60-3.80						
Exploratory hole complete at 3.80 m.		3.80	-1.65								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
<div> <div>Log Print Date And Time: 10/11/2010 09:16:01</div> <div> <div>Form No. SI EXP HOLE LOG</div> <div>Issue/Revision No. 1.03</div> <div>Issue Date 04/06/2009</div> </div> <div> <div>SOIL ENGINEERING</div> <div>A trading name of VINCI Construction UK Limited</div> </div> </div>											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC21 Sheet 1 of 1			
Ground Level 1.30m CD Hole Type VC		Coordinates 517804.30 E, 418927.40 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Very soft thickly laminated dark grey and brown CLAY. Organic odour noted. from 1.15m to 1.25m with some lenses of brown clayey fine sand (20-45mm)		1.50	-0.20	D001 0.00-0.50							
L002 1.75-2.00											
D003 2.00-2.40											
Soft to firm low strength brown CLAY with many medium to coarse gravel sized pockets (5-20mm) of black and brown kelp, seaweed and plant remains. (Strong organic odour noted). from 2.60m to 2.68m thick laminations of reddish brown and light brown decayed plant matter from 2.88m to 3.00m sandy to very sandy		3.10	-1.80	L004 2.88-3.00							
D005 3.10-3.30											
L006 3.32-3.62											
Firm to stiff high strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine and medium of chalk, flint, mudstone and chert. from 3.85m to 4.00m very clayey fine and medium sand from 4.42m to 4.55m sandy with some pockets (50mm) of clayey fine and medium sand		4.80	-3.50								
Exploratory hole complete at 4.80 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:16:18											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC22 Sheet 1 of 1			
Ground Level -6.87m CD Hole Type VC		Coordinates 517917.40 E, 419367.70 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Very soft to soft dark grey and brown sandy SILT. Sand is fine. (Organic odour noted).											
Brown fine and medium SAND.		0.37	-7.24	D001	0.37-0.55						
Very soft dark grey slightly sandy clayey SILT. Sand is fine. (Organic odour noted).		0.55	-7.42								
		0.70	-7.57	D004	0.70						
Firm to stiff high strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine and medium of flint, chalk and mudstone.					L002 1.00-1.30						
		2.14	-9.01								
Firm to stiff brown mottled grey and white slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of chalk. (Transitional boundary)		2.37	-9.24								
Stiff light greyish brown sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of chalk.											
Exploratory hole complete at 3.60 m.		3.60	-10.47								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:16:33											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
SOIL ENGINEERING A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies						Exploratory Hole Log				Hole ID. VC23						
Project No. F15842																
Engineer Roger Tym & Partners																
Client Yorkshire Forward										Sheet 1 of 1						
Ground Level -3.87m CD						Coordinates 517787.30 E, 419215.60 N National Grid										
Hole Type VC						Inclination Vertical										
Description of Strata						Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install ation
									Details	Dia.	TCR	SCR	ROD			
<p>Firm to stiff medium strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of chalk, chert, flint and mudstone. from 0.25m to 0.40m sandy</p> <p>from 1.70m to 2.00m low strength</p> <p>from 2.88m to 3.00m 1 No subrounded cobble of sandstone (120mm)</p>							<p>3.55</p>	<p>-7.42</p>	D001	0.00-0.45						
									L002	0.48-0.68						
									B003	0.60-1.00						
									D004	1.00-1.25						
									D005	1.25-1.50						
									L006	1.70-2.00						
									D007	2.20-2.50						
									L008	3.00-3.30						
Exploratory hole complete at 3.55 m.																
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key																
Log Print Date And Time: 10/11/2010 09:16:47																
Form No. SI EXP HOLE LOG Issue Revision No. 103 Issue Date 04/06/2009																
A trading name of VINCI Construction UK Limited																

Project Name		South Humber Channel Marine Studies		Exploratory Hole Log		Hole ID.						
Project No.		F15842				VC24						
Engineer		Roger Tym & Partners										
Client		Yorkshire Forward				Sheet 1 of 1						
Ground Level		1.14m CD		Coordinates		517657.20 E, 419063.40 N National Grid						
Hole Type		VC		Inclination		Vertical						
Description of Strata		Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
					Details		Dia.	TCR	SCR	RQD		
Very soft dark grey slightly sandy silty CLAY. (Strong organic odour)					D001 0.00-0.50 B002 0.00-1.00							
from 0.75m with occasional pockets (10-25mm) of brown clayey sand					D003 1.00-1.50							
from 1.50m to 1.58m with occasional subrounded medium gravel of flint and mudstone			1.58	-0.44	L004 1.70-2.00							
Firm to stiff medium strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular to rounded fine and medium of chalk, flint, chert, sandstone and mudstone.			2.40	-1.26	L005 2.00-2.16							
from 2.20m to 2.34m silty					B006 2.40-3.00							
Firm to stiff brown CLAY.					D007 3.00-3.30							
from 3.10m to 3.27m 1 No thin bed of brown clayey fine to coarse sand												
from 3.56m to 3.60m slightly sandy. Sand is fine to coarse		3.60	-2.46									
Exploratory hole complete at 3.60 m.												
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key												
Log Print Date And Time: 10/11/2010 09:17:01												
Form No. SI EXP HOLE LOG Issue/Revision No. 1/03 Issue Date 04/06/2009												
A trading name of VINCI Construction UK Limited												

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC25 Sheet 1 of 1			
Ground Level 1.53m CD Hole Type VC		Coordinates 517510.10 E, 419199.50 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Very soft dark grey CLAY. (Organic odour noted).				D001	0.00-0.40						
Firm to stiff high strength brown slightly sandy slightly gravelly CLAY with occasional pockets (10-40mm) of brown clayey fine and medium sand. Sand is fine to coarse. Gravel is subangular to subrounded fine to medium of chalk and sandstone. from 0.85m to 0.88m 1 No very thin bed of grey silt (possibly drilling induced)		0.55	0.98	D002	0.55-0.80						
				L003	0.89-1.00						
				L004	1.00-1.30						
Brown very clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of chalk and flint.		1.32	0.21	D005	1.32-1.70						
Firm to stiff brown slightly sandy slightly gravelly CLAY with rare pockets (10-30mm) of brown fine and medium sand. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse of chalk, flint, chert and sandstone. from 2.00m to 2.10m with occasional thick laminations of fine and medium sand		1.95	-0.42								
Exploratory hole complete at 3.17 m.		3.17	-1.64								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:17:16											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											


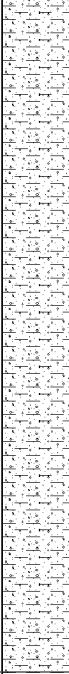
Project Name South Humber Channel Marine Studies		Exploratory Hole Log		Hole ID.	
Project No. F15842				VC26	
Engineer Roger Tym & Partners				Sheet 1 of 1	
Client Yorkshire Forward					
Ground Level -3.54m CD		Coordinates 517640.20 E, 419351.60 N National Grid			
Hole Type VC		Inclination Vertical			

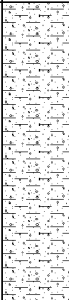
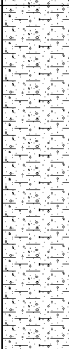
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
				Details	Dia.	TCR	SCR	ROD			
Very soft thinly laminated grey slightly gravelly silty CLAY. Gravel is subangular fine to coarse of chalk, mudstone and flint.				D001	0.00-0.40						
Firm brown silty slightly gravelly CLAY. Gravel is subangular fine to coarse of mudstone, chalk and flint.		1.05	-4.59	D002	1.05-1.20						
Grey slightly sandy slightly gravelly clayey organic SILT. Sand is fine to coarse. Gravel is subangular fine to coarse of chalk, mudstone and flint.		1.26	-4.80	L003	1.40-1.52						
Stiff medium strength brown thinly laminated slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone, chalk, flint and mudstone.		1.40	-4.94	L004	1.52-1.72						
Exploratory hole complete at 3.70 m.		3.70	-7.24	D005	3.60-3.70						

NOTES: All depths in metres, all diameters in millimetres.
See header sheet for details of boring, progress and water.
For details of abbreviations, see key

Log Print Date And Time: 10/11/2010 09:17:31

Form No. SI EXP HOLE LOG
Issue/Revision No. 1.03
Issue Date 04/06/2009
A trading name of VINCI Construction UK Limited

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC27 Sheet 1 of 1				
Ground Level -5.57m CD Hole Type VC		Coordinates 517523.30 E, 419638.20 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	RQD			
Brown clayey very gravelly fine to coarse SAND. Gravel is subangular fine to coarse of chalk.		0.45	-6.02	D001	0.00-0.45						
D002 L003				0.45-0.53 0.53-0.83							
Stiff brown medium to high strength slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of flint, mudstone and chalk.		4.90	-10.47	D004	4.77-4.90						
Exploratory hole complete at 4.90 m.											
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:17:44											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

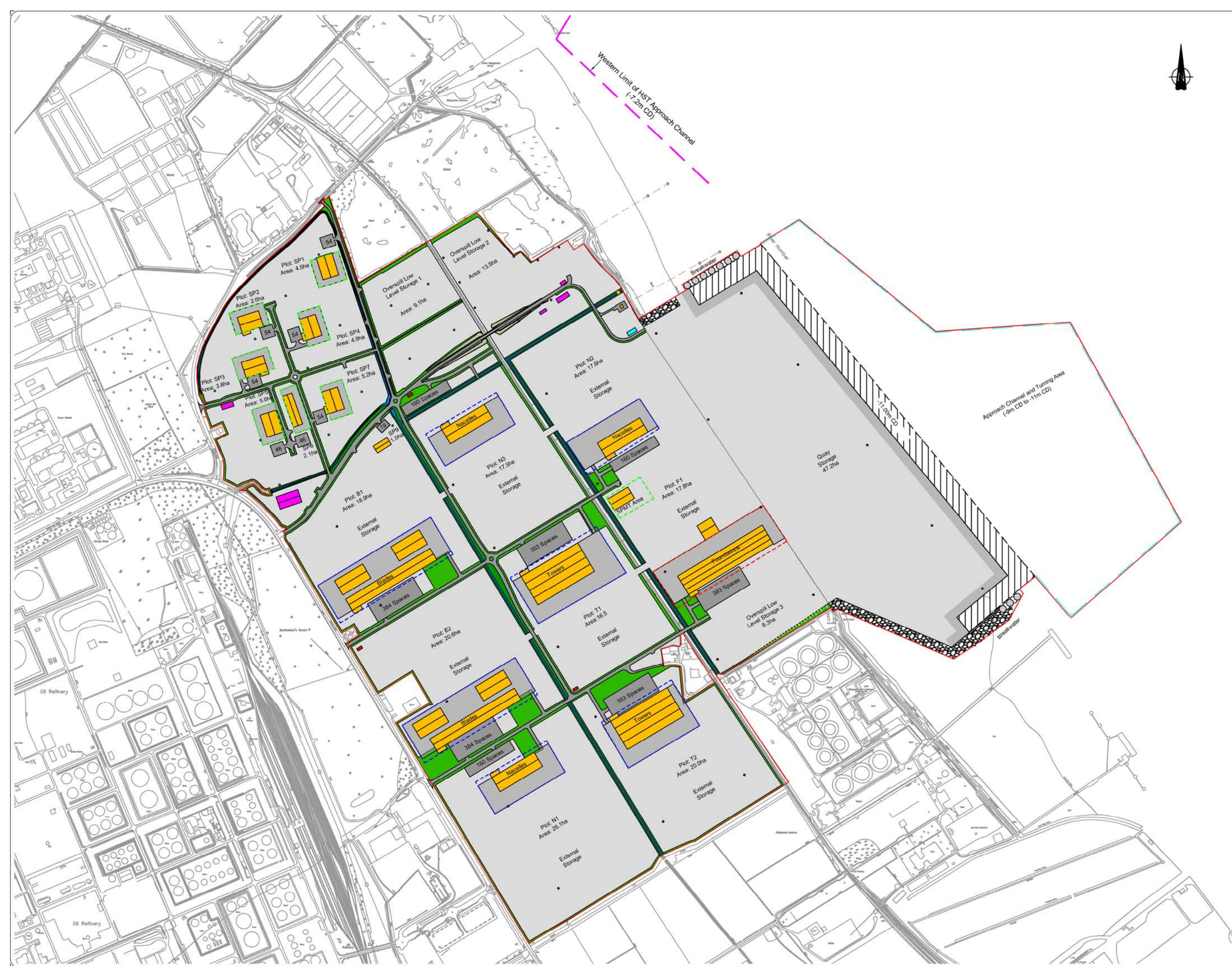
Project Name		South Humber Channel Marine Studies		Exploratory Hole Log		Hole ID.						
Project No.		F15842				VC28						
Engineer		Roger Tym & Partners				Sheet 1 of 1						
Client		Yorkshire Forward										
Ground Level		-5.74m CD		Coordinates		517643.10 E, 419485.60 N National Grid						
Hole Type		VC		Inclination		Vertical						
Description of Strata		Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Installation
					Details	Dia.	TCR	SCR	RQD			
Soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of chalk, mudstone and flint. from 0.50m to 0.70m low to medium strength			2.00	-7.74	D001	0.00-0.25						
					D002	0.25-0.50						
					L003	0.50-0.70						
					D004	0.70-0.80						
					L005	1.00-1.15						
Stiff to very stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of chalk, mudstone and flint. from 3.00m to 3.40m mottled grey from 4.08m high strength			4.30	-10.04	D006	1.90-2.00						
					L007	4.08-4.30						
Exploratory hole complete at 4.30 m.												
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key												
Log Print Date And Time: 10/11/2010 09:17:58												
Form No. SI EXP HOLE LOG					Issue Revision No. 1.03			Issue Date 04/06/2009				
A trading name of VINCI Construction UK Limited												

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log			Hole ID. VC29 Sheet 1 of 1				
Ground Level -0.56m CD Hole Type VC		Coordinates 517514.00 E, 419333.40 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Very soft grey slightly sandy CLAY.		0.90 	-1.46 	D001	0.00-0.50						
D002				0.50-0.90							
L003				1.00-1.10							
B005				1.00-2.00							
L004				1.42-1.70							
D006				2.00-2.25							
D007				2.25-2.50							
Firm to stiff high strength brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to medium locally coarse of chalk, flint and mudstone.		2.90 	-3.46 	Exploratory hole complete at 2.90 m.							
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:18:11											
Form No. SI EXP HOLE LOG				Issue/Revision No. 1.03				Issue Date 04/06/2009			
A trading name of VINCI Construction UK Limited											

Project Name South Humber Channel Marine Studies Project No. F15842 Engineer Roger Tym & Partners Client Yorkshire Forward				Exploratory Hole Log				Hole ID. VC30 Sheet 1 of 1			
Ground Level -6.30m CD Hole Type VC		Coordinates 517406.00 E, 419761.90 N National Grid Inclination Vertical									
Description of Strata	Legend	Depth Below G.L.	Datum Level	Sampling		Blow Count And Sample Recovery				In Situ Test Details	Install- ation
				Details	Dia.	TCR	SCR	ROD			
Soft to firm grey and brown thinly laminated slightly sandy slightly gravelly organic silty CLAY. Sand is fine to coarse. Gravel is subangular fine to medium of chalk. from 0.00m to 0.30m very soft from 0.65m to 1.00m clayey silt				D001 0.00-0.30 L002 0.65-1.00 D003 1.00-1.35							
Stiff brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of chalk, flint and mudstone. from 1.83m to 2.00m medium strength		1.66	-7.96	D004 1.66-1.83 L005 1.83-2.00 D006 2.67-2.85 L007 2.85-3.00							
Exploratory hole complete at 3.00 m.		3.00	-9.30								
NOTES: All depths in metres, all diameters in millimetres. See header sheet for details of boring, progress and water. For details of abbreviations, see key											
Log Print Date And Time: 10/11/2010 09:18:27											
Form No. SI EXP HOLE LOG		Issue/Revision No. 1.03		Issue Date 04/06/2009		SOIL ENGINEERING A trading name of VINCI Construction UK Limited					

APPENDIX D

Able Design Drawings



KEY

- Limit of deviation for siting of building upto 50m high.
- Limit of deviation for siting of building upto 25m high.
- Limit of deviation for siting of building upto 15m high.
- 48 Space Car Park
- Stone Surfacing
- Concrete Surfacing
- Rock Revetment
- Existing Lighting Column (21-30m High)
- Proposed Lighting Column (55m High)
- Existing Cooling Water Intake
- Existing Cooling Water Outfall
- Existing Mooring Dolphin
- Existing Building
- Building
- Electric Substation
- HMRC Office
- Berthing Pocket

B	23/12/10	General Amendments	JH	RC	RC
A	15/12/10	Preliminary Issue	JH	RC	RC
Rev	Date	Comments	Drw	Chk	App

ABLE UK Ltd
ABLE House
Birmingham
Telford
TS23 1PX

Tel: +44(0)1642 900080
Fax: +44(0)1642 655555
email: info@ableuk.com
www.ableuk.com

Project: ABLE Marine Energy Park

Client: ABLE UK Ltd

Title: Figure 4.2
Indicative Site Plan

PRELIMINARY

Scale:	1:5,000@A1	Drawn:	J Harris	Checked:	R Cram	Approved:	R Cram
Date:	15/12/2010	Date:	15/12/2010	Date:	15/12/2010	Revision:	B
Drawing No:	Figure 4.2						

APPENDIX E

Environment Agency Permits

Please quote this number in all correspondence about this licence



**ENVIRONMENT
AGENCY**

LICENCE TO ABSTRACT WATER

The Environment Agency ("the Agency") grants this licence to:

**E.ON UK
Killingholme Power Station
Chase Hill Road
North Killingholme
Grimsby
North East Lincolnshire
DN40 3LU**

("the licence holder")

This licence authorises the licence holder to abstract water from the source of supply described in the Schedule of Conditions to this licence and subject to the provisions of that Schedule. The licence became effective on the relevant date shown below and shall remain in force until revoked.

.....	Date of issue	08 February 2006
Jacqui Murphy	Date effective	06 January 2006
Team Leader, Regulation (Water Resources)	Date of expiry	
Environment Agency	Date of original issue	23 August 1990
Waterside House	(if this document is a reissue or revision of the licence originally granted for this abstraction)	
Waterside North		
Lincoln LN2 5HA		

LICENCE HOLDERS AND SUCCESSORS: Please read the notes on the licence cover. These contain important information, including about how you must act quickly to succeed to the licence if you become a new occupier of land it relates to.

An abstraction licence confers valuable rights. The licence should be kept safe and its existence disclosed on any sale or change of occupation of the land to which it relates.

Note: References to "the map" are to the map, which is attached to this licence.
References to "the drawing" are to the drawing, which is attached to this licence.
References to "the Agency" are to the Environment Agency or any successor body.

Environment Act 1995
Water Resources Act 1991
Water Resources (Succession to Licences) Regulations 1969
Water Resources (Licences) Regulations 1965

SCHEDULE OF CONDITIONS

1. SOURCE OF SUPPLY

Inland water known as the River Humber at North Killingholme, Glanford, North East Lincolnshire.

2. POINT OF ABSTRACTION

At the following National Grid Reference at the cross marked on the map:

National Grid Reference	As marked on map	Source
TA 1743 1953	A	River Humber

3. MEANS OF ABSTRACTION

River intake pipe and pumps of a total maximum output not exceeding 1,110 litres per second.

4. PURPOSE OF ABSTRACTION

Industrial (cooling).

5. LAND ON WHICH LICENCE AUTHORISES USE OF WATER

The area of land shown outlined in red on the map.

6. PERIOD OF ABSTRACTION

All year

7. MAXIMUM QUANTITY OF WATER TO BE ABSTRACTED DURING THE SPECIFIED PERIOD

3,996 cubic metres per hour
 80,000 cubic metres per day
 29,300,000 cubic metres per year
 At an instantaneous rate not exceeding 1,110 litres per second

Note - a day means any consecutive period of 24 hours and a year means the 12 month period beginning on 1 January and ending on 31 December.

8. MEANS OF MEASUREMENT OF WATER ABSTRACTED

- a) The licence holder shall use a meter to measure quantities of water abstracted.
- b) The licence holder shall provide and install the meter before any abstraction takes place.
- c) The licence holder shall position and install the meter in accordance with any written directions given by the Agency.
- d) The licence holder shall maintain the meter in a condition so as to measure quantities of water abstracted accurately and efficiently, shall calibrate it regularly, in accordance with the recommendations of the manufacturer or at any time when required by the Agency, and shall replace it as necessary. The licence holder shall retain evidence of current certification for inspection by the Agency.
- e) The Agency may have regard to its *Abstraction Metering Good Practice Manual* (or equivalent guidance) in directing where the meter should be located or how it should be installed, in determining whether the meter measures accurately and/or efficiently and/or is properly maintained and/or in judging whether it is necessary to require repair or replacement of the meter.

9. RECORDS

- a) The licence holder shall take and record readings of the meter specified in condition 8 for water abstracted from the point of abstraction at the same time each day during the whole of the period during which abstraction takes place or as otherwise approved in writing by the Agency.
- b) A copy of the record or summary data from it shall be sent to the Agency within 14 days of 31 December in each year or within 14 days of being so directed in writing by the Agency.
- c) Each record shall be kept and be made available during all reasonable hours for inspection by the Agency for a period of not less than 7 years.

Please quote this number in all correspondence about this licence



**ENVIRONMENT
AGENCY**

LICENCE TO ABSTRACT WATER

The Environment Agency ("the Agency") grants this licence to:-

**ConocoPhillips Ltd
Portman House
2 Portman Street
London
W1H 6DU**

("the licence holder")

This licence authorises the licence holder to abstract water from the source of supply described in the Schedule of Conditions to this licence and subject to the provisions of that Schedule. The licence became effective on the relevant date shown below and shall remain in force until revoked.

.....
Susan Glover

**Acting Team Leader Regulatory
(Water Resources)**

Environment Agency
Waterside House
Waterside North
Lincoln LN2 5HA

Date of issue 28 June 2004

Date effective 15 July 2003

Date of expiry

Date of original issue 08 May 1985
(if this document is a reissue or revision of the licence
originally granted for this abstraction)

LICENCE HOLDERS AND SUCCESSORS: Please read the notes on the licence cover. These contain important information, including about how you must act quickly to succeed to the licence if you become a new occupier of land it relates to.

An abstraction licence confers valuable rights. The licence should be kept safe and its existence disclosed on any sale or change of occupation of the land to which it relates.

Note: References to "the map" are to the map, which is attached to this licence.
References to "the drawing" are to the drawing, which is attached to this licence.
References to "the Agency" are to the Environment Agency or any successor body.

Environment Act 1995
Water Resources Act 1991
Water Resources (Succession to Licences) Regulations 1969
Water Resources (Licences) Regulations 1965

SCHEDULE OF CONDITIONS

1. SOURCE OF SUPPLY

Underground strata (chalk) in South Killingholme, North Lincolnshire.

2. POINTS OF ABSTRACTION

At the following National Grid References at the crosses marked on the map:

National Grid Reference	As marked on map	Site name
TA 1817 1780	A	Riverside Cavern
TA 1818 1780	B	Riverside Cavern
TA 1776 1744	C	Inland Cavern
TA 1777 1744	D	Inland Cavern

3. MEANS OF ABSTRACTION

a) Four interchangeable submersible pumping units.

i) Two submersible pumps with a maximum output not exceeding 1.9 litres per second.

ii) Two submersible pumps with a maximum output not exceeding 4.2 litres per second.

b) Four boreholes as listed below.

Borehole	Total Depth (metres)	Sealed Depth (metres)	Diameter (millimetres)
A	206	top of chalk	305
B	206	top of chalk	305
C	187	top of chalk	305
D	187	top of chalk	305

c) Abstraction shall be by means of submersible pumps at each location as show in condition 3 b) and capable of abstracting at all aquifer levels.

4. PURPOSE OF ABSTRACTION

Industrial processing. Removal of seepage water from two liquid propane gas storage caverns.

5. LAND ON WHICH LICENCE AUTHORISES USE OF WATER

The areas of land shown outlined in red on the map.

6. PERIOD OF ABSTRACTION

All year.

7. MAXIMUM QUANTITY OF WATER TO BE ABSTRACTED DURING THE SPECIFIED PERIOD

1,056 cubic metres per day

14,000 cubic metres per year

Note - a day means any consecutive period of 24 hours and a year means the 12 month period beginning on 1 January and ending on 31 December.

8. MEANS OF MEASUREMENT OF WATER ABSTRACTED

- a) The licence holder shall use a meter for each pump to measure quantities of water abstracted.
- b) The licence holder shall provide and install the meters before any abstraction takes place.
- c) The licence holder shall position and install the meters in accordance with any written directions given by the Agency.
- d) The licence holder shall maintain the meters in a condition so as to measure quantities of water abstracted accurately and efficiently, shall calibrate them regularly, in accordance with the recommendations of the manufacturer or at any time when required by the Agency, and shall replace them as necessary. The licence holder shall retain evidence of current certification for inspection by the Agency.
- e) The Agency may have regard to its *Abstraction Metering Good Practice Manual* (or equivalent guidance) in directing where the meters should be located or how they should be installed, in determining whether the meters measure accurately and/or efficiently and/or are properly maintained and/or in judging whether it is necessary to require repair or replacement of the meters.

9. RECORDS

- a) The licence holder shall take and record readings of the meters specified in condition 8 for water abstracted from each separately identified point of abstraction at the same time each day during the whole of the period during which abstraction takes place or as otherwise approved in writing by the Agency.
- b) A copy of the record or summary data from it shall be sent to the Agency within 14 days of 31 December in each year or within 14 days of being so directed in writing by the Agency.
- c) Each record shall be kept and be made available during all reasonable hours for inspection by the Agency for a period of not less than 7 years.

Please quote this number in all correspondence about this licence



**ENVIRONMENT
AGENCY**

LICENCE TO ABSTRACT WATER

The Environment Agency ("the Agency") grants this licence to:-

**Centrica KPS Limited
Millstream
Maidenhead Road
Windsor
Berkshire
SL4 5GD**

("the licence holder")

This licence authorises the licence holder to abstract water from the source of supply described in the Schedule of Conditions to this licence and subject to the provisions of that Schedule. The licence became effective on the relevant date shown below and shall remain in force until revoked.

.....
Jacqui Murphy
Team Leader Regulation (Water Resources)
Environment Agency
Waterside House
Waterside North
Lincoln LN2 5HA

Date of issue 16 January 2006

Date effective 28 October 2005

Date of expiry

Date of original issue 08 January 1992
(if this document is a reissue or revision of the licence originally granted for this abstraction)

LICENCE HOLDERS AND SUCCESSORS: Please read the notes on the licence cover. These contain important information, including about how you must act quickly to succeed to the licence if you become a new occupier of land it relates to.

An abstraction licence confers valuable rights. The licence should be kept safe and its existence disclosed on any sale or change of occupation of the land to which it relates.

Note: References to "the map" are to the map, which is attached to this licence.
References to "the drawing" are to the drawing, which is attached to this licence.
References to "the Agency" are to the Environment Agency or any successor body.

Environment Act 1995
Water Resources Act 1991
Water Resources (Succession to Licences) Regulations 1969
Water Resources (Licences) Regulations 1965

SCHEDULE OF CONDITIONS

1. SOURCE OF SUPPLY

Inland water known as the River Humber in North Killingholme, North Lincolnshire.

2. POINT OF ABSTRACTION

At the following National Grid Reference at the cross marked on the map:

National Grid Reference	As marked on map	Source
TA 1730 1980	A	River Humber

3. MEANS OF ABSTRACTION

- a) Gravity feed to pump house.
- b) Two pumps of a maximum output not exceeding 460 litres per second each pump.

4. PURPOSE OF ABSTRACTION

- a) Industrial cooling associated with electricity generation.
- b) Industrial backwashing of cooling system.

5. LAND ON WHICH LICENCE AUTHORISES USE OF WATER

The areas of land shown outlined in red on the map.

6. PERIOD OF ABSTRACTION

All year.

7. MAXIMUM QUANTITY OF WATER TO BE ABSTRACTED DURING THE SPECIFIED PERIOD

a) Cooling

1,650 cubic metres per hour
 39,600 cubic metres per day
 14,493,600 cubic metres per year
 At an instantaneous rate not exceeding 460 litres per second

b) Backwashing

413 cubic metres per day
 150,000 cubic metres per year
 At an instantaneous rate not exceeding 460 litres per second.

Note - a day means any consecutive period of 24 hours and a year means the 12 month period beginning on 1 January and ending on 31 December.

8. MEANS OF MEASUREMENT OF WATER ABSTRACTED

- a) The licence holder shall use a meter for each pump to measure quantities of water abstracted.
- b) The licence holder shall provide and install the meters before any abstraction takes place.
- c) The licence holder shall position and install the meters in accordance with any written directions given by the Agency.
- d) The licence holder shall maintain the meters in a condition so as to measure quantities of water abstracted accurately and efficiently, shall calibrate them regularly, in accordance with the recommendations of the manufacturer or at any time when required by the Agency, and shall replace them as necessary. The licence holder shall retain evidence of current certification for inspection by the Agency.
- e) The Agency may have regard to its *Abstraction Metering Good Practice Manual* (or equivalent guidance) in directing where the meters should be located or how they should be installed, in determining whether the meters measure accurately and/or efficiently and/or are properly maintained and/or in judging whether it is necessary to require repair or replacement of the meters.

9. RECORDS

- a) The licence holder shall take and record readings of the meters specified in condition 8 for water abstracted for each separately identified purpose at the same time each day during the whole of the period during which abstraction takes place or as otherwise approved in writing by the Agency.
- b) A copy of the record or summary data from it shall be sent to the Agency within 14 days of 31 December in each year or within 14 days of being so directed in writing by the Agency.
- c) Each record shall be kept and be made available during all reasonable hours for inspection by the Agency for a period of not less than 7 years.

Application No:	NPS/WR/002956	Licence Serial No:	AN/029/0009/001
-----------------	---------------	--------------------	-----------------

Please quote the serial number in all correspondence about this licence



**Environment
Agency**

FULL LICENCE TO ABSTRACT WATER

The Environment Agency ("the Agency") grants this licence to:-

CONOCOPHILLIPS LIMITED ("the Licence Holder")

Portman House
2 Portman Street
London
W1H 6DU

Registered Company number: 00529086.

This licence authorises the Licence Holder to abstract water from the source of supply described in the Schedule of Conditions to this licence and subject to the provisions of that Schedule. The licence becomes effective on the relevant date shown below and shall remain in force until revoked/the date of expiry shown below.

Signed

K A Mawer

Team Leader (Water Resources)
National Permitting Service, Cardiff

Date of issue 22 March 2010

Date effective 1 April 2010

Date of expiry 31 March 2018

Environment Agency
Permitting Support Centre
Water Resources
PO Box 4209
Sheffield
S9 9BS

The licence should be kept safe and its existence disclosed on any sale of the property to which it relates. Please read the 'important notes' on the cover to this licence.

Note: References to "the map" are to the map, which is attached to this licence.
References to "the drawing" are to the drawing, which is attached to this licence
References to "the Agency" are to the Environment Agency or any successor body.

Environment Act 1995
Water Resources Act 1991 as amended by the Water Act 2003
Water Resources (Abstraction and Impounding) Regulations 2006

SCHEDULE OF CONDITIONS

1. SOURCE OF SUPPLY

Underground strata, (Elsham Sandstone), South Killingholme North Lincolnshire.

2. POINTS OF ABSTRACTION

At National Grid References TA 15730 16670 and TA 15620 16950 at the points marked "A" and "B", respectively on the map.

3. MEANS OF ABSTRACTION

A submersible pump from each of the boreholes detailed below:

Borehole	Total depth (metres)	Sealed/ steel cased depth (metres below ground level)	Diameter (mm)	Pump capacity (litres per second)
A	184.5	0.0 – 167.5	406	20
		182.5 – 184.5	254	
B	188.0	0.0 – 171.0	406	20
		186.0 – 188.0	254	

4. PURPOSE OF ABSTRACTION

Industrial processing, specifically for use in the refinery process and including the heating of that process as stream.

5. PERIOD OF ABSTRACTION

All year

6. MAXIMUM QUANTITIES OF WATER TO BE ABSTRACTED DURING THE SPECIFIED PERIOD

71 cubic metres per hour

1,700 cubic metres per day

619,000 cubic metres per year

At an instantaneous rate not exceeding 20 litres per second.

Note: An hour means any period of 60 consecutive minutes, a day means any period of 24 consecutive hours and a year means any period of 12 consecutive months.

7. MEANS OF MEASUREMENT OF WATER ABSTRACTED

The Licence Holder shall use one meter for each separately identified point of abstraction to measure quantities of water abstracted. The Licence Holder shall provide and install the meters before any abstraction takes place. The Licence Holder shall position and install the meters in accordance with any written directions given by the Agency. The Licence Holder shall maintain the meters in such a condition, and if necessary replace them, so as to measure quantities of water abstracted accurately and efficiently. The Licence Holder shall calibrate them regularly, in accordance with the recommendations of the manufacturer or at any time required by the Agency, and shall replace them as necessary. The Licence Holder shall retain evidence of current certification for inspection by the Agency.

The Agency may have regard to its *Abstraction Metering Good Practice Manual* (or equivalent guidance) in directing any of the following: where the meters should be located or how they should be installed; whether the meters measure accurately, and/or efficiently and/or are properly maintained; whether it is necessary to require repair or replacement of the meters.

8. RECORDS

The Licence Holder shall take and record readings of the meters specified in condition 7 at the same time each month during the whole of the period during which abstraction is authorised or as otherwise approved in writing by the Agency.

A copy of the record or summary data from it shall be sent to the Agency within 28 days after 31st March in each year or within 28 days of being so directed in writing by the Agency.

Each record shall be kept and be made available during all reasonable hours for inspection by the Agency for at least 7 years.

9. FURTHER PROVISIONS

- 9.1 i) If the level of the water in the aquifer as measured by the Agency in their borehole at National Grid Reference TA 12900 15800 (reference 7/042) is equal to or less than 4 metres AOD at any time during the period 1 January to 30 June inclusive of that year then abstraction will be restricted to 500,000 cubic metres for that year.

- ii) If the level of the water in the aquifer, as measured by the Agency at the above borehole (reference 7/042), remains greater than 4 metres AOD for the period 1 January to 30 June inclusive of that year, but subsequently falls to be equal to or less than 4 metres AOD at any time in the period 1 July to 31 December of that year, then the maximum abstraction allowed in the following year will be restricted to 500,000 cubic meters, unless the aquifer experiences the conditions detailed in Condition 9.1 iii).
 - iii) If the level of water in the aquifer, as measured by the Agency at the above borehole (reference 7/042), is greater than 10 metres AOD on 31 March of the year or within the 3 month period preceding 31 March and as agreed with the Agency in which abstraction is restricted as a result of condition 9.1 ii), then the restriction detailed in 9.1 ii) is lifted.
- 9.2 i) The Licence Holder shall take and record readings of water level at the borehole at South Killingholme, National Grid Reference TA 15760 16750 in order to monitor water levels in the chalk aquifer. Readings shall be taken on the same day each month, during the whole of the period during which abstraction is authorised or as otherwise approved by in writing by the Agency. The following information should be recorded:
- Date
 - The water level below ground level
 - Any relevant notes
- ii) The Licence Holder shall forward the recorded data specified in Condition 9.2 i) to the Agency on a monthly basis within 14 days of each reading being taken.
- 9.3 i) The Licence Holder is to take a weekly sample of the abstracted water from the delivery pipe from each of the boreholes referred to in Condition 3 to determine the chloride content of the abstracted water.
- ii) The Licence Holder is to maintain detailed records of the analyses for chloride content of the samples specified above, and to submit monthly returns of such analyses to the Agency.
- iii) No abstraction shall take place when the chloride ion concentration in the water, as indicated by the results of sampling specified in Condition 9 ii) at the above two boreholes, is greater than or equal to 200 parts per million.

REASONS FOR CONDITIONS

Note: the following information is provided for information only. It does not form part of the licence.

Condition 9.1 i): To allow time for the aquifer to recover in a year when the control level of 4 metres AOD has been breached in the first half of the calendar year. It will also allow time for the Licence Holder to plan a reduced abstraction regime, so that the maximum abstraction volume is not surpassed and the conditions of the licence are not breached.

Condition 9.1 ii): To allow continued abstraction at the higher rate when the control level of 4 metres AOD is not breached until the latter half of the year. This will prevent breach of licence conditions if greater than 500,000 cubic metres has already been abstracted at the time the control level is breached. It will also allow time for the aquifer to recover during the following year.

Condition 9.1 iii): To allow continued abstraction at the higher rate, in a year in which abstraction has been restricted under Condition 9.1 ii), but which has been followed by a winter of considerable recharge to the aquifer which has already allowed water levels in the aquifer to recover to a satisfactory level.

All conditions detailed under Condition 9.1 are to ensure that the water resources of the Elsham Sandstone aquifer are protected, and to ensure that there will be no derogation of other users or uses of the water.

Condition 9.2: To ensure the continued monitoring of water levels in the chalk aquifer to ascertain and monitor the effects of this licensed abstraction on the water resources of the aquifer.

Condition 9.3: To protect the resources of the Elsham Sandstone aquifer from saline intrusion.

IMPORTANT INFORMATION

For the purpose of Conditions 9.1, 9.2 and 9.3 the Licence Holder shall contact:

Technical Specialist (Groundwater and Contaminated Land)
Environment Agency
Waterside House
Waterside
North Lincoln
Lincoln
LN2 5HA

Telephone: 01522 785 814

The Licence Holder shall use water abstracted under the terms of this licence in an efficient manner. The Agency will have regard to its Guidance on Water Efficiency (or equivalent guidance) in determining whether water is being used efficiently and any measures required to meet this condition. This is in accordance with the Agency's responsibilities under the Water Resources Act 1991 to secure the proper use of water (Section 19(1)(b)).

Licence serial number	Issue date	Expiry date	Summary of changes
4/29/9/G/124	3 June 1980	2 June 1982	Original licence.
4/29/9/G/124	15 July 1982	15 July 1987	Replacement of the original licence with increased quantities.
4/29/09/G/124	2 July 1987	1 July 1997	Renewal of the above licence on the same terms.
4/29/09/*G/0124	1 July 1997	31 July 2002	Renewal of the above licence on the same terms.
4/29/09/*G/0145	3 December 2002	31 March 2010	Replacement of the above licence on the same terms. Reduced time limit applied due to uncertainty over the availability of water and the long term effects of abstraction.
4/29/09/*G/0145	28 June 2004	31 March 2010	Licence Holder name change.



Environment
Agency

MAP ACCOMPANYING LICENCE NUMBER

AN/029/0009/001

22 March 2010

Scale: 1:10,000

© Crown copyright All rights reserved Environment Agency, 100026380, 2009

