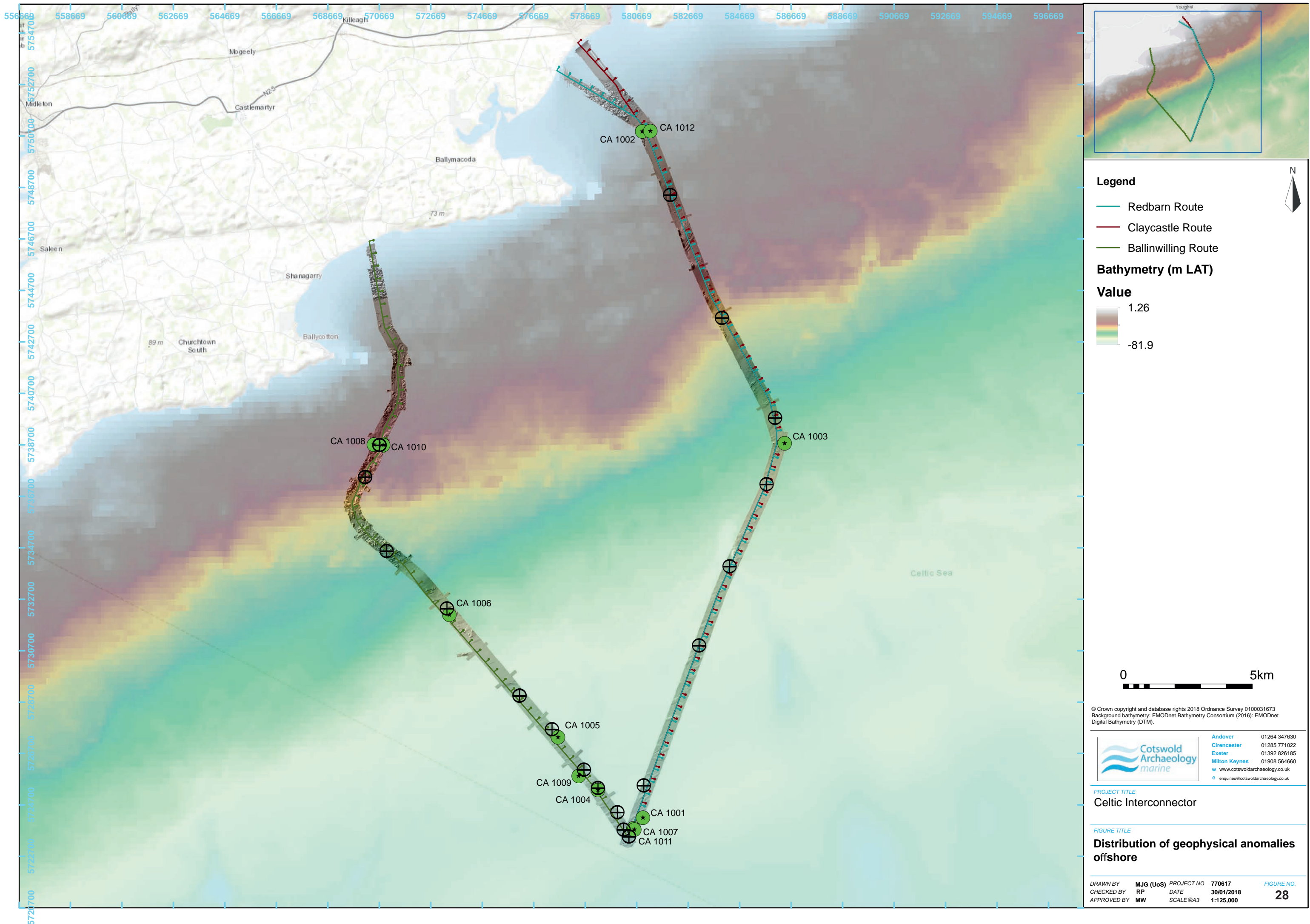


Marine geophysical survey results

- 4.63. The results of the geophysical assessment of marine geophysical survey data in Irish territorial waters (Cotswold Archaeology 2018a) and beyond Irish territorial waters (Headland Archaeology 2015) are presented below.

Geophysical anomalies in Irish territorial waters

- 4.64. Archaeological assessment of the marine geophysical datasets from Irish territorial waters identified 12 anomalies with archaeological potential (see Figure 28 and Table 8; each anomaly location is illustrated in Appendix 2). Other geophysical anomalies identified in the survey data, notably the SSS, consisted of small (<2m) boulders, sometimes with associated scour, in areas where bedrock was not exposed on the surface. These anomalies had no associated magnetic signal so are interpreted as natural in origin.
- 4.65. Of the 12 anomalies identified, only one potential wreck site (**CA1001**) was identified within the CSC. This comprised a large bathymetric high, with associated features visible in the SSS, and a cluster of magnetic anomalies measuring up to 7,682 nanotesla (nT). This anomaly is located on the eastern margin of the Claycastle / Redbarn route close to KP33.
- 4.66. This anomaly was recorded as an unknown wreck in the INFOMAR surveys, measuring c. 91.4m long by 7.3m high at a depth of c. 73m (listed as **CA8** in the DBA (Cotswold Archaeology 2017; see above)). Thus, **CA8** equates to anomaly **CA1001** and is a site of high archaeological potential within the CSC.
- 4.67. Nine anomalies were identified as having medium archaeological potential (**CA1002** to **CA1009**, and **CA1011**). These consist of magnetic anomalies exceeding 25nT sometimes with associated bathymetric or SSS anomalies. These might suggest metallic objects lying on, or just under, the seabed. No corresponding anomalies were identified in the neighbouring SBP surveys, although survey lines rarely coincided directly with the position of these anomalies visible in the surface datasets. Two anomalies (**CA1010** and **CA1012**) were identified as having low archaeological potential.

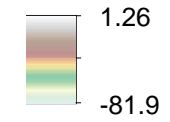


Legend

- Redbarn Route
- Claycastle Route
- Ballinwilling Route

Bathymetry (m LAT)

Value



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Background bathymetry: EMODnet Bathymetry Consortium (2016); EMODnet Digital Bathymetry (DTM).



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PROJECT TITLE

Celtic Interconnector

FIGURE TITLE

Distribution of geophysical anomalies offshore

DRAWN BY	MJG (UoS)	PROJECT NO	770617	FIGURE NO.
CHECKED BY	RP	DATE	30/01/2018	28
APPROVED BY	MW	SCALE	A3 1:125,000	

Table 8 Description of geophysical anomalies identified with archaeological potential

Anomaly	Easting	Northing	Description	Potential
CA1001	580911	5724197	Located on the eastern edge of the survey corridor. Bathymetry shows an elevated feature, 3m in height, with build-up of sediment on its western margin. SSS has partial coverage of the western edge of the anomaly, showing a curved shape and a series of linear features that may relate to infrastructure / rigging. There is an area of enhanced magnetic intensity around the feature, with the highest value recorded as 7682 nT (IRE_MAG_15) suggesting the presence of a large metallic object on the seabed. This is probably a wreck	High
CA1002	580878	5750872	Magnetic anomaly measuring 110nT (IRE_MAG_47). No associated feature in the bathymetry or SSS data, and the position coincides with an area of exposed rock. May be metallic debris located between cracks in the rock	Medium
CA1003	586418	5738751	Magnetic anomaly measuring 53nT (IRE_MAG_13). Bathymetry shows an area of slightly raised seabed but with no features exposed on the surface. SSS shows a small rounded dark reflector, measuring c. 1.5 x 1.5m	Medium
CA1004	579159	5725278	Magnetic anomaly measuring 51nT (IRE_MAG_27). Bathymetry shows a small depression, measuring 9 x 8m containing a SSS dark reflector measuring 2.2 x 0.8 x 0.4m.	Medium
CA1005	580536	5723787	Bathymetric high measuring 23 x 18m. Coincides with two magnetic anomalies within 10m of its edge, measuring 48nT and 21nT (IRE_MAG_32)	Medium
CA1006	573380	5732081	Cluster of magnetic anomalies, measuring up to 45nT (IRE_MAG_21). No anomalies visible in bathymetry or SSS	Medium
CA1007	577604	5727330	Single magnetic anomaly measuring 39nT (IRE_MAG_84), located on the southern edge of a wide area of deepened seabed bathymetry. There are no anomalies visible in the SSS data. Located 68m NW of CA_0011	Medium
CA1008	570816	5738681	Single magnetic anomaly measuring 37nT (IRE_MAG_14), located in an area of fairly smooth seabed (maximum variation of 0.2m). The southern edge of a wide area of deepened seabed bathymetry. There are no anomalies visible in the SSS data	Medium
CA1009	578410	5725821	Single magnetic anomaly measuring 36nT (IRE_MAG_14), located in an area of smooth seabed with no bedrock protrusions. A small dark reflector, measuring 0.8 x 0.7m, is present in the SSS data	Medium

Anomaly	Easting	Northing	Description	Potential
CA1010	570453	5738698	Cluster of magnetic anomalies, the largest measuring 28nT (IRE_MAG_14). Bathymetry shows an area of smooth seabed north of a bedrock exposure, with small boulder-shape anomalies visible in the local area in both the bathymetry and SSS data	Low
CA1011	580567	5723726	Single magnetic anomaly measuring 25nT (IRE_MAG_12), located in an area of elevated seabed with no bedrock protrusions. A small dark reflector, measuring 2.4 x 1.3 x 0.6m is present in the SSS data. Located 68m SE of CA_0007	Medium
CA1012	581200	5750884	Single magnetic anomaly measuring 23nT (IRE_MAG_10), in close proximity to an area of slightly rough seabed as indicated in the bathymetry. No anomalies are visible in the SSS data at this location	Low

Submerged palaeo-landscapes in Irish territorial waters

- 4.68. A review of the SBP seismic survey data in Irish territorial waters has identified 21 areas where features with archaeological potential are present (Figure 29). Illustrations of each area, including corresponding SBP seismic lines, are provided in Appendix 3.
- 4.69. Previous project-specific surveys of adjacent routes (Headland Archaeology 2015) have identified palaeo-channels in close proximity to the southern sector of the Ballinwilling Strand route. Coring associated with these previous route options has identified the nature of the sedimentary sequence in these channels (Wessex Archaeology 2016; see below). Typically, the upper 1-2m of these channel areas contain glacio-marine sediments overlain by surface seabed sediments.

CA2001

- 4.70. The SBP survey shows a palaeo-channel that splits in the centre of the survey corridor. Both channels show an undulating rock surface. The northern channel base deepens along its northern edge, while the southern channel shows a greater depth, up to 18m below the seabed, and a more symmetrical cross-section. No clear internal reflectors were identified within the channel suggesting a fairly homogenous sediment type. A second facies is visible in the top of each channel immediately underlying the seabed at c. 2m depth.

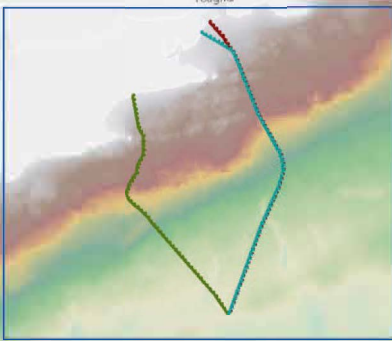
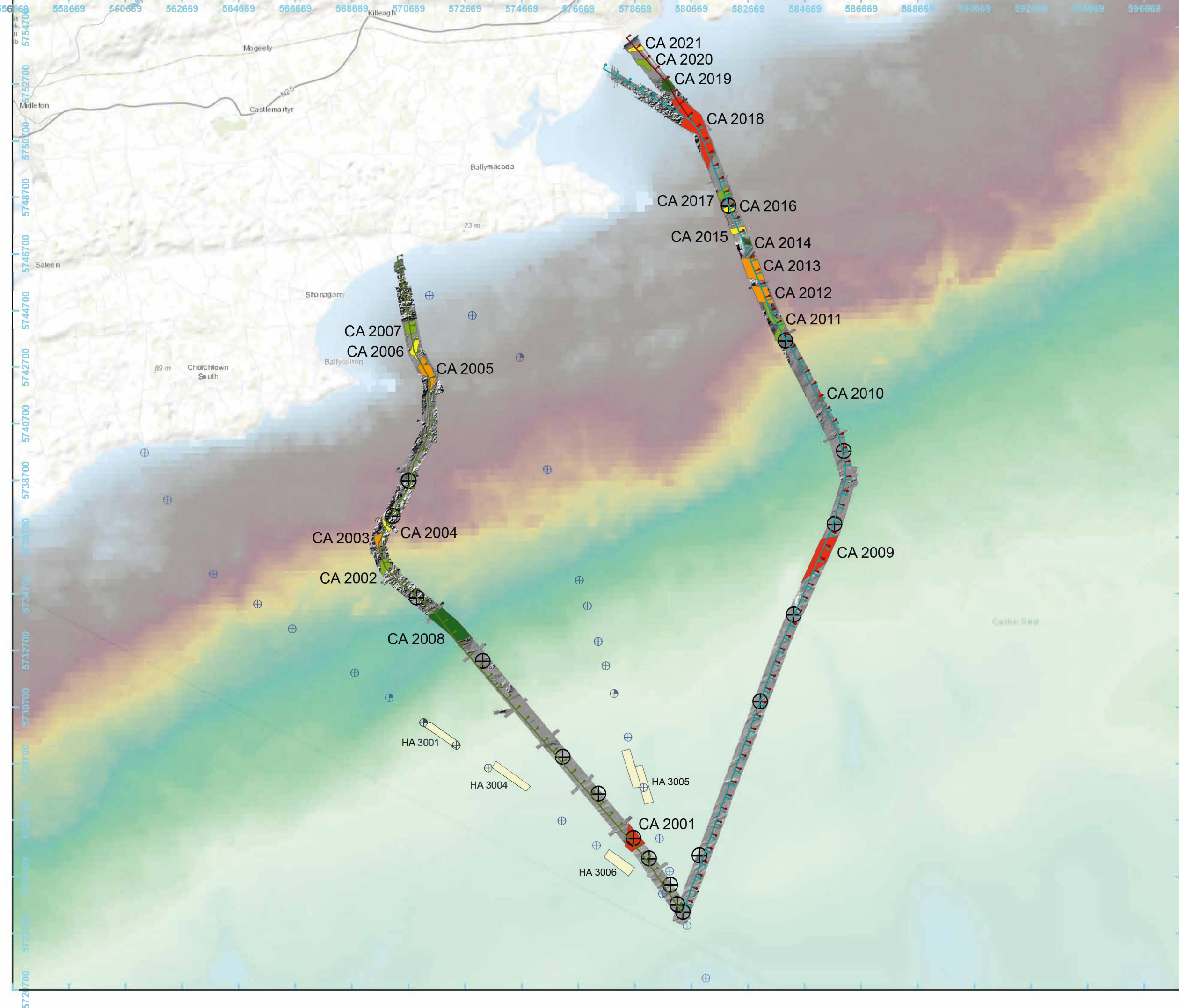
- 4.71. The channel aligns with palaeo-channels identified in surveys undertaken for previous route options on the Celtic Interconnector immediately north and south of the current survey, recorded as HA3005 and HA3006 (Headland Archaeology 2015). Coring of HA3005 identified a sedimentary sequence in cores VC-015 and VC15A consisting of up to 1m of glacio-marine deposits in the upper part of this channel. These cores suggest that this channel contains pre-Holocene sediments and is therefore of low archaeological potential.

CA2002

- 4.72. This feature lies between exposed bedrock, visible on the surface of the seabed. A probable palaeo-channel with a smooth basal profile has been identified in the centre of this area of smooth seabed. A second facies is present near the seabed showing 1-2m of sediment above the palaeo-channel filling this depression between the exposed bedrock. The smooth profile of the exposed rock margins along the southern edge of **CA 2002** also suggest a possible submerged channel.

CA2003

- 4.73. This feature also lies between exposed bedrock visible on the surface of the seabed. A single palaeo-channel is visible in the north-eastern corner of the feature, with two channels visible in the centre of the area suggesting bifurcation around the exposed bedrock visible on the seabed. The southernmost channel can be traced passing through the gap visible in the bedrock, whereas the northernmost channel may run westwards through the gap in the bedrock west of **CA 2003**. The northern channel appears to have internal reflectors suggesting some banding of coarser grained sediments, while the southern channel appears to have some basal gravel deposits built up along the southern margin. Overlying these channels is a veneer of sediment filling most of the space between the exposed bedrock up to 2m in depth. These have an undulating surface and appear to have eroded the upper surface of the underlying channel deposits.



Legend

- Redbarn Route
- Claycastle Route
- Ballinwilling Route
- Previous Coring
- Proposed Coring Locations
- Previously Mapped Palaeochannels

Quaternary Infilled Features highlighted in report (m thickness)

- 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 18

Bathymetry (m LAT)

1.26

-81.9



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Background bathymetry: EMODnet Bathymetry Consortium (2016): EMODnet Digital Bathymetry (DTM).

Cotswold Archaeology marine

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PROJECT TITLE
Celtic Interconnector

FIGURE TITLE
Distribution of palaeochannels and / or infilled basins discussed in report

CA2004

- 4.74. This feature is aligned north-west to south-east and contains a palaeo-channel following the gap between bedrock exposed on the seabed. The channel fill has some internal reflectors suggesting some banding of coarser grained sediments. Overlying the channel fill is a wider veneer of sediments covering the entire space between exposed bedrock between 1 and 2m deep.

CA2005

- 4.75. This feature shows an area where near-surface sediments exceed 2m, with a clearly defined basal seismic reflector up to 8m below the seabed. The survey lines show the bedrock close to the seabed surface in the northern part of the area resulting in a series of shallower fills, with no exposure of bedrock at the seabed surface.

CA2006 & CA2007

- 4.76. Two distinct depressions aligned north-south (**CA 2006**) and east-west (**CA 2007**) are visible, divided by a sub-seabed bedrock ridge. Both contain an undulating rock base with no internal reflectors in the depression fills. The relationship of **CA 2006** to **CA 2005** is unclear from the available datasets.

CA2008

- 4.77. The presence of a near-parallel, probably planar, surface beneath seabed sediments, up to 3m in thickness. There are some reflectors in the near-seabed deposits that might suggest some stratification within these sediments, with deeper deposits possibly being glacially-derived earlier Pleistocene.

CA2009

- 4.78. An intermittent deep reflector was observed in all neighbouring survey lines. This suggested a possible channel up to 13m deep possibly orientated north-east to south-west. Where a seismic reflector could be identified, it suggests an undulating basal profile. It was not possible to distinguish the nature of the overlying sediments within the available seismic data, or if any higher separate facies were present.

CA2010

- 4.79. An intermittent seismic reflector was only visible in a survey line from the eastern side of this corridor. This suggests a possible depression, up to 8m deep, and could represent a laterally more extensive feature similar to **CA 2009**. It was not possible

to distinguish either the nature of the overlying sediments in the available seismic data, or any higher separate facies.

CA 2011 & CA 2012

- 4.80. **CA 2011** shows a meandering palaeo-channel that originates on the southern edge of **CA 2012** and passes south between exposed bedrock, before turning eastwards and then southwest. The channel profile suggests a channel base gradient southward, reaching up to 4m below the seabed. An upper seismic reflector is visible showing a laterally persistent seismic impedance zone.
- 4.81. **CA 2012** is a laterally more extensive depression which may be part of a wider channel area. Similar to **CA 2011** it has two facies visible in the seismic data, though this depression reaches depths of up to 7m.

CA 2013

- 4.82. This contains a wide east-west orientated area of multiple seismic reflectors between areas of bedrock exposed on the seabed. The profile suggests a possible channel with a build-up of probable sand / gravel on the margins, possibly indicating a prograding channel system. In the centre of the area a later phase of channelization might also be evident, possibly implying basal Pleistocene deposits with later, probably early Holocene, channel incision.

CA 2014

- 4.83. A pair of depressions is visible in the seismic survey, up to 3m deep, beneath an area of raised seabed. These features are not present in the western side of the survey corridor where the seabed is c. 2-3m lower. This might be interpreted as earlier bedforms buried beneath the present seabed surface, which consists of east-west aligned ripple bedforms in north-south aligned longitudinal ribbons. Alternatively, shallow, wide channel areas might be preserved here beneath the area containing raised bedforms, but these may have been eroded where the seabed is lower to the west. The seismic profiles show sands overlying what is likely to be finer-grained sediments in the depressions themselves. The base of the depressions appears to be smooth with poor reflectance, probably indicating that this is not a bedrock surface.

CA 2015

- 4.84. A clearly defined east-west palaeo-channel is visible, which deepens along its southern edge.

CA 2016

- 4.85. A clearly defined east-west palaeo-channel is visible, with a flat basal profile, a curved boundary on its southern edge and a more gradual profile on the northern side. Some parallel reflectors are visible within the channel fill.

CA 2017

- 4.86. This feature is poorly defined within the seismic data but shows a zone of sub-surface features that may be dunes or other elongated bedforms, as currently exposed on the seabed between **CA 2017** and **CA 2016**. The area is covered by east-west orientated ripples in an area of elevated seabed.

CA 2018

- 4.87. This area is characterised by a series of deep incisions, up to 13m, of the bedrock surface. Internal reflectors suggest zones of coarser-grained sediments, particularly in the northern sector of this area. There appears to be an erosive upper surface below the seabed. A series of sinuous erosion features are present in the adjacent exposed bedrock, which suggests channels flow into **CA 2018**, implying that this is possibly part of a more extensive channel complex that may extend up to **CA 2021**.

CA 2019

- 4.88. This feature is located north of **CA 2018** and shows a series of northward-dipping reflectors. These may indicate a pro-grading channel system of sands and gravels, with the main channel present in the centre of the area.

CA 2020

- 4.89. This feature is located north of **CA 2020** and may also represent a continuation of the channel system found in **CA 2018** and **CA 2019**. A pair of dipping reflectors appear to show the margins of a channel, up to 6m deep, in the centre of this area.

CA 2021

- 4.90. This area contains a south-dipping seismic reflector that probably marks the northern limit of the system visible in **CA 2018** to **CA 2020**.

Geophysical anomalies from the Irish territorial limit out to the Irish/UK median line

- 4.91. Analysis of the marine geophysical datasets from the Irish territorial limit out to the Irish/UK median line identified 156 anomalies with archaeological potential (Headland Archaeology 2015). Other geophysical anomalies identified in the survey data consisted of isolated boulders that were assessed by the survey contractor as having no archaeological potential (Osiris 2014).
- 4.92. Of the 156 anomalies identified, no features of high archaeological potential were identified.
- 4.93. Five anomalies were identified as having medium archaeological potential (**HA2041**, **HA2051**, **HA2052**, **HA2067** & **HA2082**; Fig. 30). Three of these medium anomalies were represented only in the SSS data (**HA2052**, **HA2067** & **HA2082**), whilst **HA2041** consisted of a SSS anomaly that corresponded with magnetic anomaly **HA5049** (Fig.31), and **HA2051** consisted of a SSS anomaly that corresponded with bathymetric anomaly **HA4000** (Fig. 32).

HA2041

- 4.94. An irregularly shaped raised reflector with an associated high magnetic signal of 1,617.26nT (**HA5049**). It measures 7.09 x 1.80m and stands up to 1.05m above the surrounding seabed. It is located 232m east of the proposed cable centre. The feature may be representative of the partially exposed hull of a wreck and is therefore assigned medium archaeological potential.

HA2051

- 4.95. Large area of raised seabed, 35m long and up to 15m wide, with a maximum height of 1.51m above the surrounding seabed. The feature exhibits some evidence of complex structure at the perimeters, is clearly visible in the 2m binned bathymetry (**HA4001**) and, despite lacking a magnetic return, may represent a wreck site. The feature is situated 220m west of the proposed cable centre. Another feature exhibiting complex morphology is located 28m to the north and maybe associated (**HA2052**).

HA2052

- 4.96. A small area of complex reflectors and shadow in the vicinity of a possible wreck (**HA2051**). The largest element is 0.74 x 0.37m and stands 0.29m above the

surrounding seabed. It is situated 28m to the north of **HA2051**, a possible wreck. There are no magnetic anomalies associated with this feature.

HA2067

- 4.97. A significant distribution of hard reflectors, shadows and scour over a 20m x 12m area. The feature contrasts with the numerous and common rock outcrops seen across the study area, and may represent a concentration of anthropogenic material, possibly wreck. The feature is 124m west of the proposed cable route centre.

HA2082

- 4.98. A complex, discrete area of reflectors and shadows over a 10 x 7m distance, contrasting with the morphology of rock heads and boulder clusters seen elsewhere in the study area. The feature is interpreted as being likely to represent a concentration of anthropogenic material that will require further investigation to understand in more detail and is therefore ascribed medium archaeological potential. **HA2082** is located 32m west of the proposed cable centre line.
- 4.99. The remaining 151 geophysical anomalies from the Irish territorial limit out to the Irish/UK median line were identified as having low archaeological potential and are not discussed further.

Submerged palaeo-landscapes from the Irish territorial limit out to the Irish/UK median line

- 4.100. A review of the SBP seismic survey data has identified seven areas (**HA3001-HA3007**; Fig. 33) where features with archaeological potential are present along the Irish EEZ out to the Irish/UK median line.

HA3001-HA3002

These two features have been cut into the bedrock. The data suggest that they are in-filled with marine sediment. However, it is possible that pre-inundation units associated with the relict fluvial channel could survive but they have not been resolved by the geophysical survey.

HA3003-HA3006

- 4.101. These features are likely to be representative of the same two channel features extending across both legs of the inshore cable route options, based on their similar

morphology and positions. They exhibit a more complex sequence of channel cuts and fills within a larger and deeply incised channels, with **HA3006** being approximately 300m in diameter.

HA3007

- 4.102. This feature is a deep channel approximately 4.7km in width and is infilled with a main sedimentary unit above the channel base which is at a depth of up to 30m. This unit is overlain by gravels and then marine sands, which are continuous across the remaining extent of this part of the study area. Within the deep channel feature these upper units vary in depths, with some nested channels reaching up to 10m below seabed.

Summary

- 4.103. To summarise, the analysis of the marine geophysical survey data identified 12 geophysical anomalies in Irish territorial waters (Cotswold Archaeology 2018a), only one of which is a probable wreck (**CA1001**) of high archaeological potential. Of the remaining eleven anomalies, nine are considered of medium potential (**CA1002-9, CA1011**) and the remaining two are considered of low potential (**CA1010 & CA1012**).
- 4.104. 156 geophysical anomalies were identified from the Irish territorial limit out to the Irish / UK median line, none of which are considered to be of high potential. Five of the anomalies are considered to be of medium potential (**HA2041, HA2051, HA2052, HA2067 & HA2082**), while 151 are considered of low archaeological potential.
- 4.105. A review of the SBP seismic survey data in Irish territorial waters identified 21 areas with features of archaeological potential. Eight palaeo-channels are located along the Ballinwilling Strand corridor, and ten are located along the Claycastle / Redbarn corridor. Along the Claycastle route there is high potential for a nearshore submerged channel system that may contain deposits with archaeological potential. These are likely to comprise submerged peats or estuarine deposits, which would correspond with the inter-tidal submerged forest peat deposits found at the Claycastle landfall site.
- 4.106. Previous assessments of glacio-marine deposits associated with some of the offshore palaeo-channels have suggested that the deposits are pre-Holocene and

are therefore of low archaeological potential. The cores taken from palaeo-channels identified previously indicate that these channels are of low archaeological potential.

- 4.107. A review of the SBP seismic survey data from the Irish territorial limit out to the Irish / UK median line identified seven areas with features of archaeological potential. All seven areas have been interpreted as palaeo-channels that intersect the CSC in several locations and extend beyond the data area.
- 4.108. Relative to the length of the route in Irish territorial waters, the density of geophysical anomalies identified along it is sparse, so the potential to encounter unknown archaeological sites and features is considered low.
- 4.109. The potential to encounter unknown archaeological sites from the Irish territorial limit out to the Irish / UK median line is also considered low. Although there was a density of geophysical anomalies along this part of the route, they mostly represented features of low archaeological potential. Furthermore, no wrecks were confirmed in the geophysics.

APPENDIX VI OFFSHORE TARGETS AS THEY
RELATE TO PROPOSED BOREHOLES

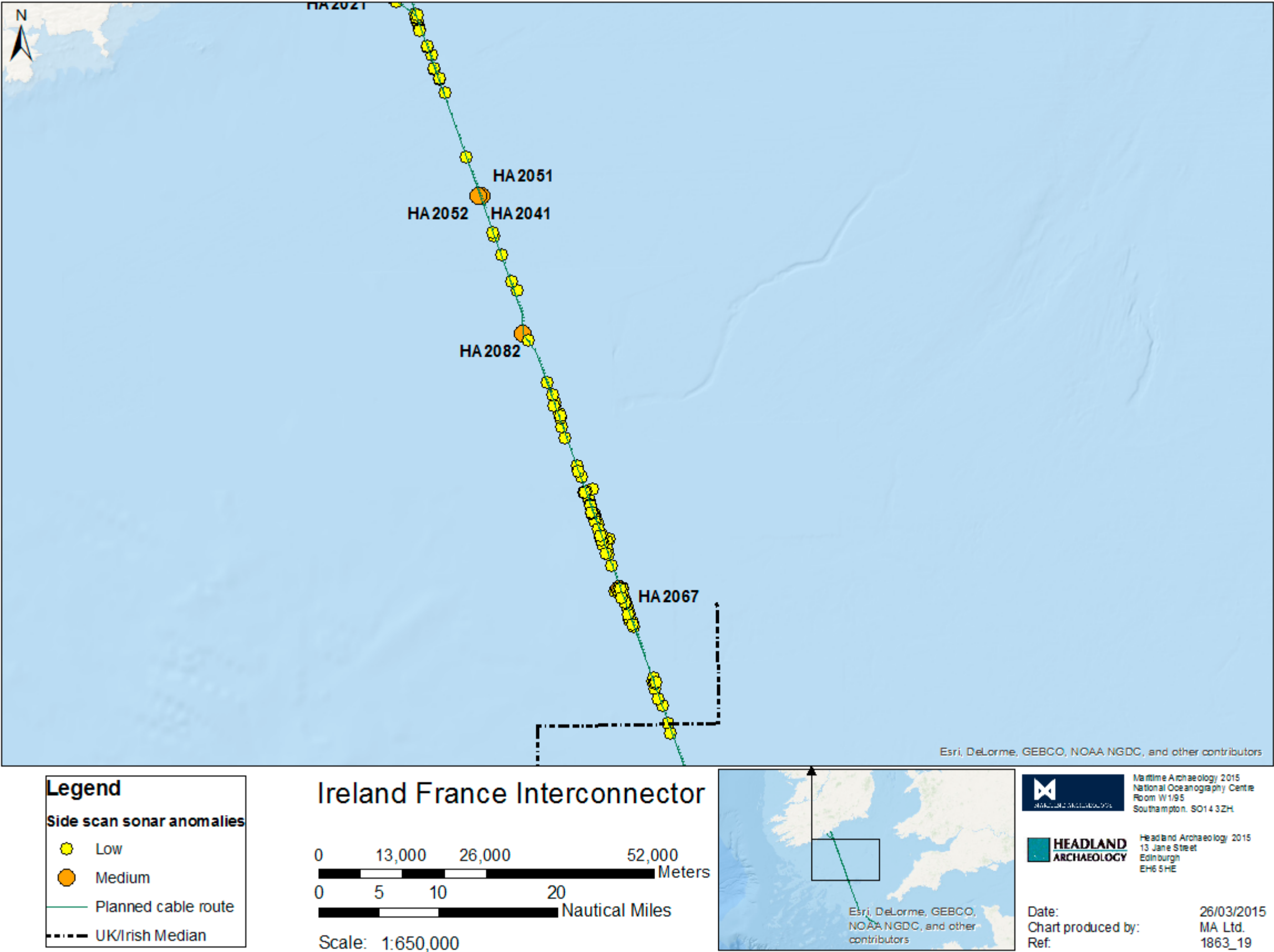


FIGURE 30
Side scan sonar anomalies from Irish territorial limit out to the Irish / UK median

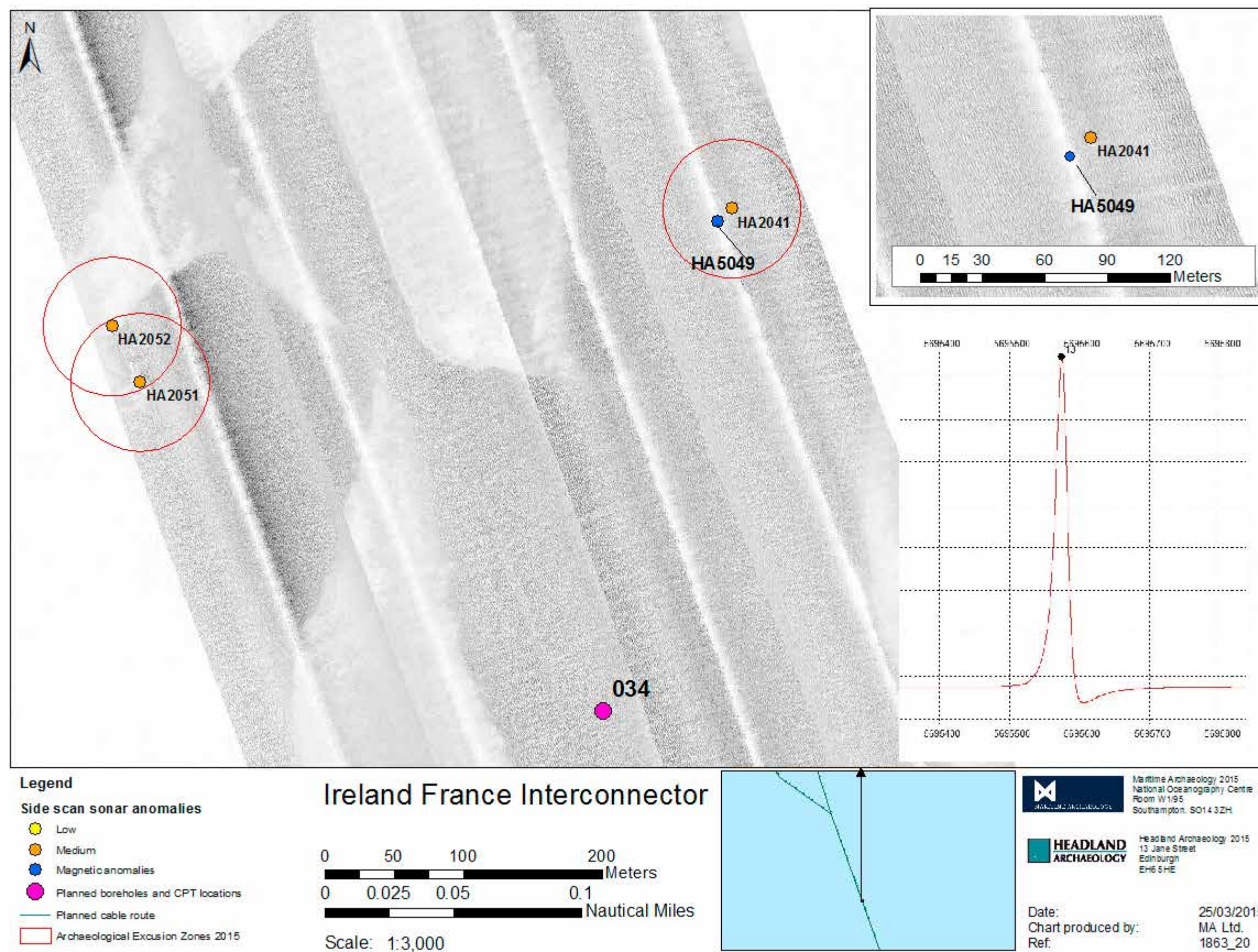


FIGURE 31

Magnetic anomaly HA5049 with a high amplitude of 1,617nT, and which correlates with side scan anomaly HA2041

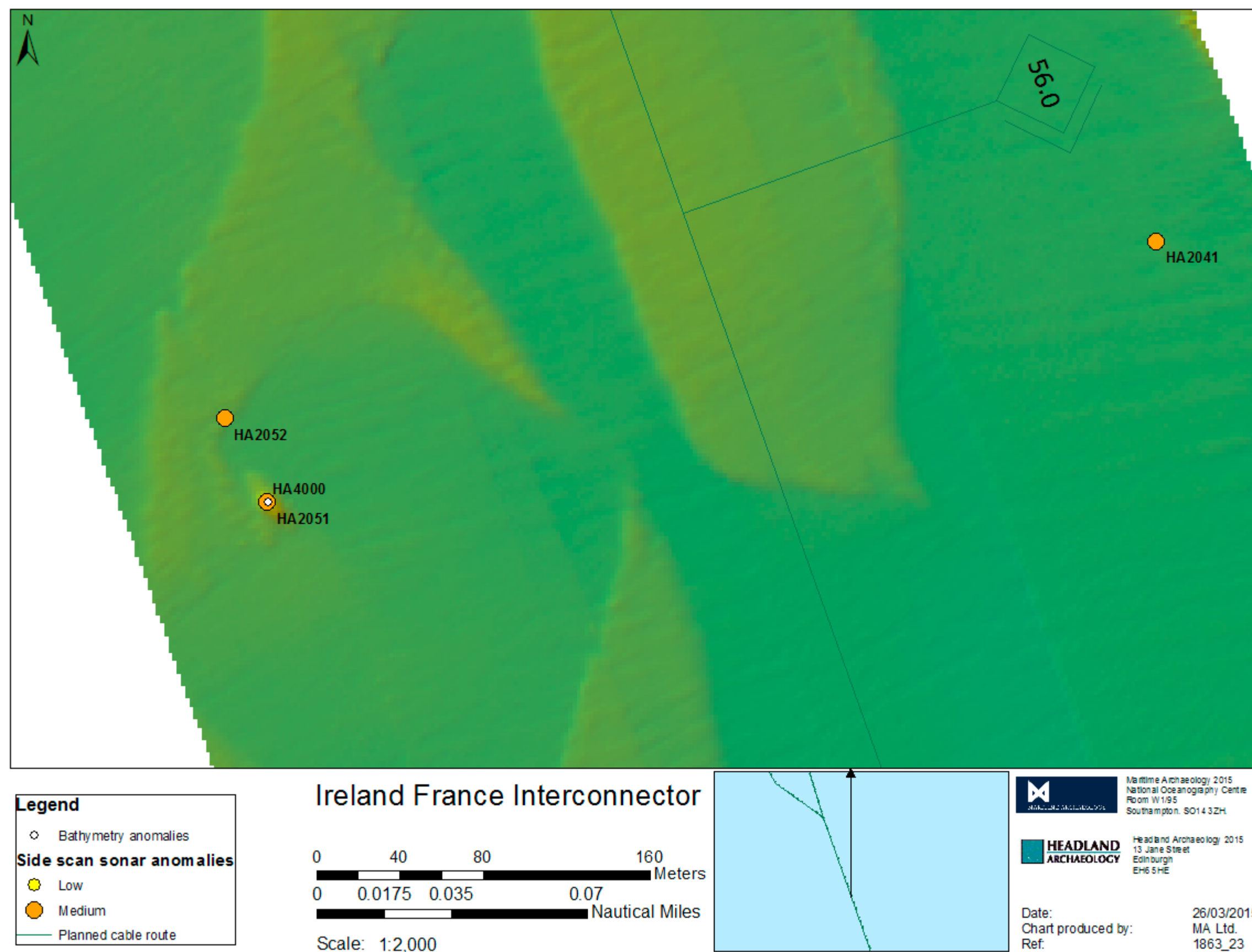
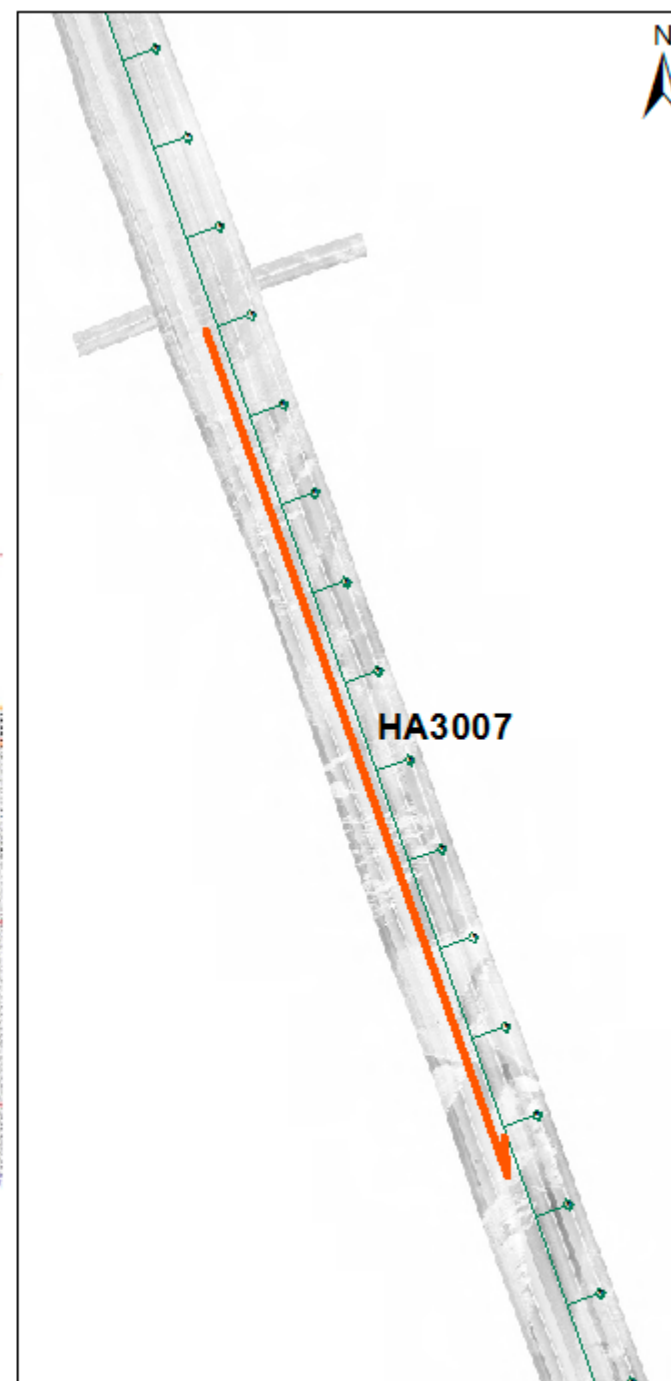
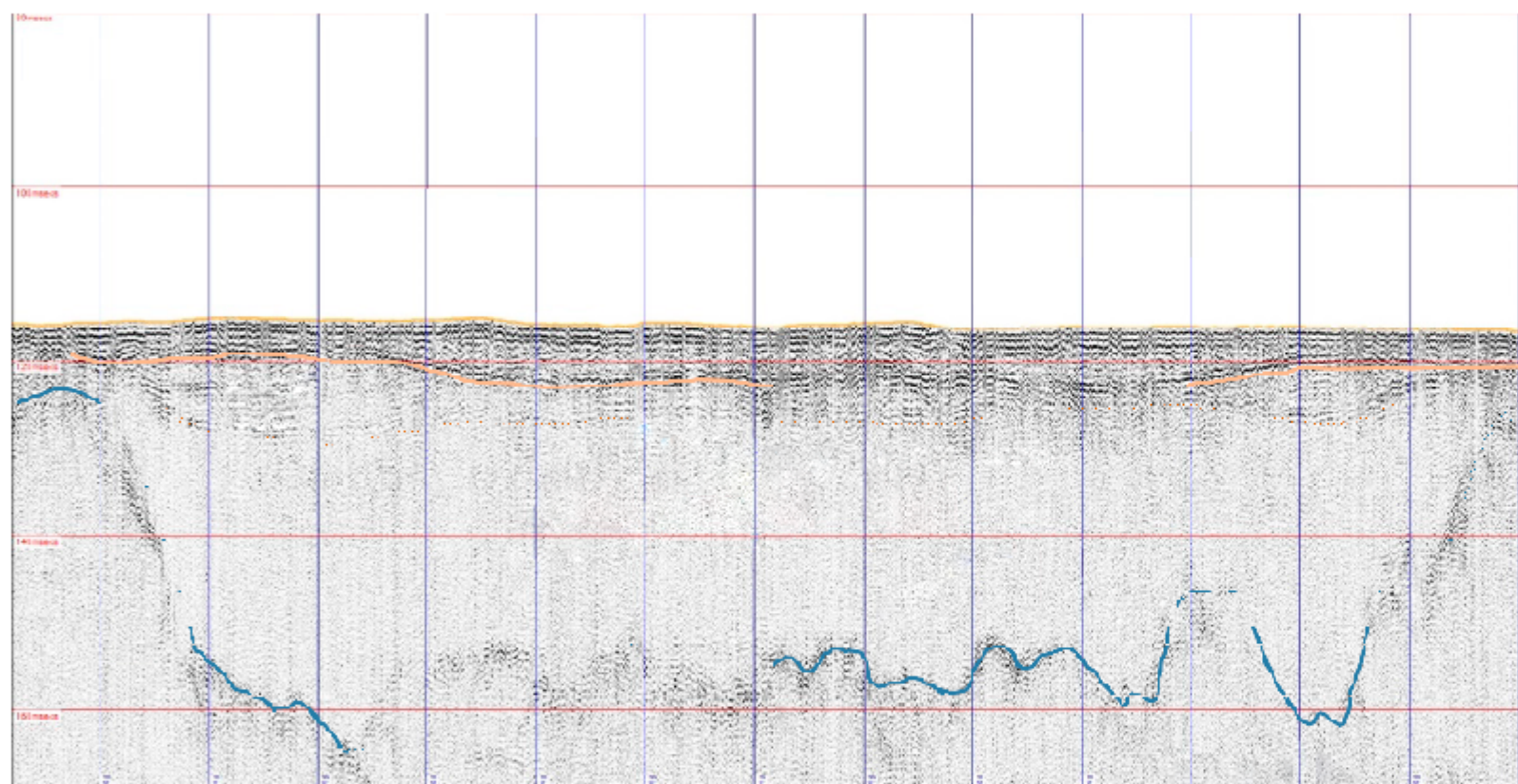


FIGURE 32

HA4000, a discrete raised feature that correlates with HA2051 and is interpreted as medium archaeological potential



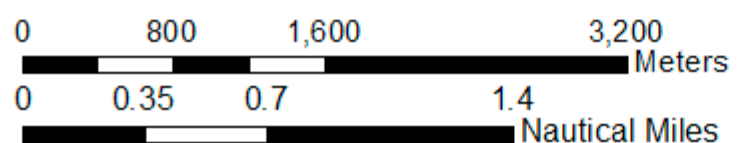
HA3007



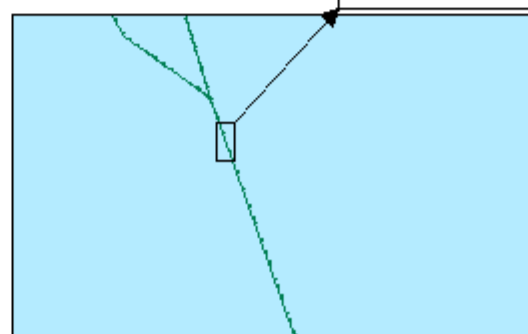
Legend

- Sub bottom anomalies
- Planned cable route

Ireland France Interconnector



Scale: 1:40,000



Maritime Archaeology 2015
National Oceanography Centre
Room W1/95
Southampton, SO14 3ZH



Headland Archaeology 2015
13 Jane Street
Edinburgh
EH6 5HE

Date:
Chart produced by:
Ref:

26/03/2015
MA Ltd.
1863_22

FIGURE 33

Cross-section of feature HA3007, comprising a 4.7km wide channel identified just beyond Irish territorial waters

Geotechnical investigation results

4.110. Archaeological assessment has been undertaken of three geotechnical investigations, including Irish territorial waters and the proposed landfall locations (Cotswold Archaeology 2019a), a hand auger survey of peat deposits at Claycastle beach (Cotswold Archaeology 2019b), and from the Irish territorial limit out to the Irish / UK median (Wessex 2016).

Irish territorial waters

4.111. A total of 85 nearshore and foreshore investigations were undertaken, ranging in elevation height from 11m to -83m LAT, in Irish territorial waters and at the proposed landfall locations (refer back to Fig. 4 & Fig. 34; Table 13) (Cotswold Archaeology 2019a). 12 of the 85 investigations were undertaken at the three landfall locations (Ballinwilling Strand, Redbarn beach and Claycastle beach) monitored by IAC Archaeology (2018; Table 13).

4.112. The assessment of the marine vibrocore logs from the 2018 geotechnical investigations (Cotswold Archaeology 2019a) identified the following broad stratigraphic units within the cores:

- Marine sand with shell;
- Gravels and sand; and
- Compacted, probably over-consolidated, glacially-derived deposits including diamictons, clays and sub-glacial/outwash sand horizons.

4.113. No peats or possible palaeosol horizons were identified in either the marine vibrocores or the core photos and were not alluded to in the sediment logs. The predominance of marine and glacial deposits suggests that these cores have low geo-archaeological potential and would therefore not require any geo-archaeological recording to assess palaeo-environmental potential.

Table 9 Site investigation locations 2018

Core ID	Easting (UTM29N)	Northing (UTM29N)	Elevation (m LAT)
BW2-BH-1 *	570265	5746647	6.73
BW2-BH-2 *	570282	5746588	-0.37
BW2-BH-3	570308	5746478	0.47

Core ID	Easting (UTM29N)	Northing (UTM29N)	Elevation (m LAT)
BW2-CPT _ VC-1	570565	5745468	-7.67
BW2-CPT _ VC-2	570861	5744335	-15.21
BW2-TP1 *	570276	5746622	0.67
BW2-TP2 *	5701291	5746565	-0.87
BW2-VC-03	571125	5742899	-22
BW2-VC-04	571384	5741478	-30
BW2-VC-04A	571370	5741484	-30
BW2-VC-05	571216	5740019	-37
BW2-VC-05A	571212	5740030	-37
BW2-VC-06	570672	6738649	-43
BW2-VC-07	569960	5737329	-44
BW2-VC-07A	569976	5737337	-45
BW2-VC-08	569690	5736341	-51
BW2-VC-08A	569697	5736346	-51
BW2-VC-09	569934	5735736	-56
BW2-VC-10	571694	5733975	-63
BW2-VC-10A	571696	5733990	-64
BW2-VC-11	572695	5732677	-67
BW2-VC-12	573710	5731495	-72
BW2-VC-12A	573696	5731498	-72
BW2-VC-13	574690	5730363	-76
BW2-VC-14	575680	5729235	-80
BW2-VC-14A	575667	5729236	-79
BW2-VC-15	576671	5728105	-80
BW2-VC-15A	576672	5728122	-81
BW2-VC-16	577661	5726978	-79
BW2-VC-16A	577661	5726991	-80
BW2-VC-17	578648	5725853	-80
BW2-VC-18A	579520	5724639	-83
CL-BH-1 *	578387	5754308	3.33
CL-BH-2 *	578432	5754258	0.57

Core ID	Easting (UTM29N)	Northing (UTM29N)	Elevation (m LAT)
CL-BH-3	578496	5754176	-0.37
CL-CPT _ VC-2	579848	5752527	-6.97
CL-CPT _ VC-3	580198	5752043	-9.99
CL-CPT_VC-1	579150	5753381	-2.41
CL-CPT_VC-1A	549145	5753381	-2.41
CL-TP1 *	578396	5754300	2.19
CL-TP2 *	578440	5754248	0.73
CL-VC-02	579850	5752523	-7
CL-VC-04	581068	5750805	-19
CL-VC-05	581605	5749403	-28
CL-VC-06	582128	5748005	-31
CL-VC-07	582686	5746622	-34
CL-VC-08	583224	5745213	-38
CL-VC-09	583876	5743864	-47
CL-VC-10	584605	5742559	-55
CL-VC-11	585334	5741240	-62
CL-VC-11A	585338	5741252	-62
CL-VC-12	585963	5739899	-70
CL-VC-12A	585985	5739902	-70
CL-VC-13	586010	5738424	-70
CL-VC-13A	586017	5738432	-70
CL-VC-14	585566	5736988	-71
CL-VC-14A	585582	5736997	-71
CL-VC-15	584999	5735629	-74
CL-VC-16	584413	5734225	-77
CL-VC-16A	584411	5734234	-77
CL-VC-17	583827	5732859	-75
CL-VC-17A	583849	5732857	-75
CL-VC-18	583306	5731435	-78
CL-VC-18A	583317	5731444	-79
CL-VC-19	582793	5730032	-80

Core ID	Easting (UTM29N)	Northing (UTM29N)	Elevation (m LAT)
CL-VC-19A	582807	5730041	-80
CL-VC-20	582268	5728624	-80
CL-VC-20A	582280	5728632	-80
CL-VC-21	581747	5727218	-80
CL-VC-21A	581739	5727227	-80
CL-VC-22	581231	5725809	-80
CL-VC-23	580710	5724399	-82
CL-VC-23A	580722	5724409	-82
CL-VC-23B	580709	5724399	-82
CL-VC-24	580359	5723405	-82
CL-VC-24A	580374	5723413	-83
RB-BH-1 *	577557	5753240	4.2
RB-BH-2 *	577621	5753202	-0.05
RB-BH-3	577819	5753080	-0.53
RB-BH-4	577795	5753003	-0.07
RB-CPT _ VC-1	578504	5752678	3.1
RB-CPT _ VC-2	580009	5751736	11.03
RB-TP1 *	577581	5753228	1.61
RB-TP2 *	577683	5753162	-1.56
RB-VC-02A	580027	5751726	-15

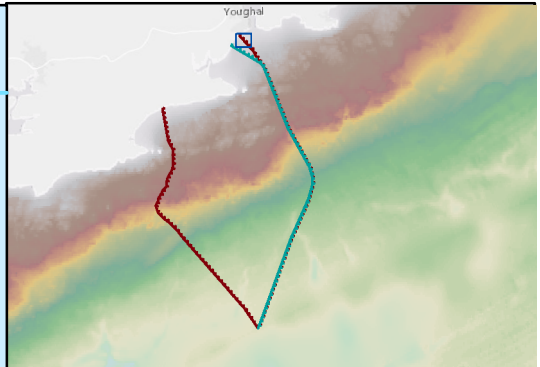
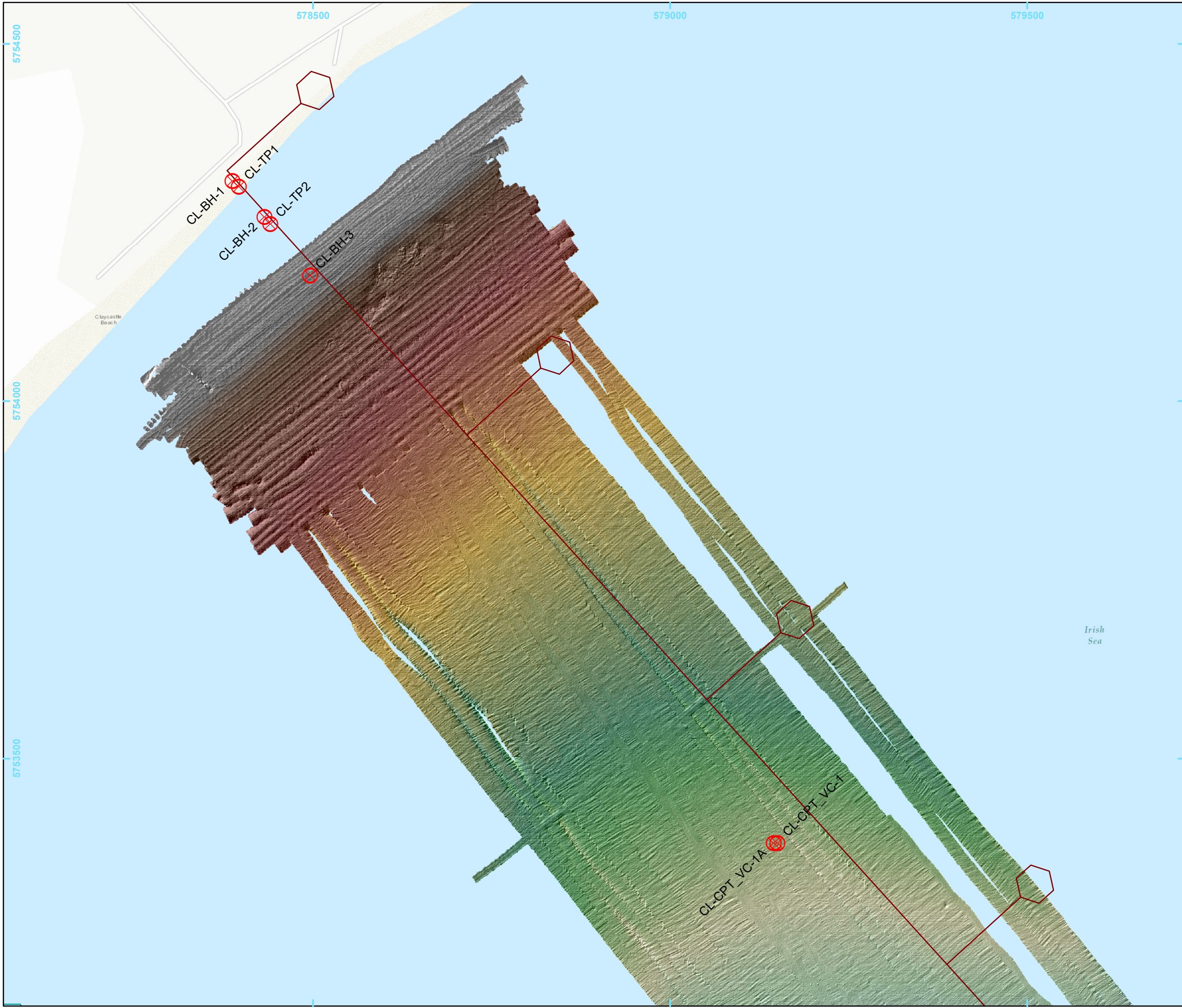
* monitored by IAC Archaeology

4.114. The nearshore / foreshore cores were identified as having higher geo-archaeological potential. These demonstrated the presence of similar stratigraphic units as those identified in the marine cores, along with the presence of:

- Peat horizons (including the submerged forests identified at Claycastle (Cotswold Archaeology 2017)); and
- Estuarine clay.

4.115. The following cores were identified as having potential from the three landfall / nearshore sites:

- **BW2-BH3**
- **RB-CPT_VC-1**
- **CL-BH1**
- **CL-BH3**
- **CL-CPT_VC-1A**



Legend

- 2018 Sample Locations
- Redbarn Route
- Claycastle Route
- Ballinwilling route

Bathymetry (m LAT)

High : 1.41

Low : -3.12083

0 200m

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PROJECT TITLE

Celtic Interconnector project

FIGURE TITLE

Geotechnical Site Investigations

Claycastle

DRAWN BY	MJG (UoS)	PROJECT NO	17758	FIGURE NO.
CHECKED BY	MW	DATE	25/01/2019	34
APPROVED BY	xx	SCALE@A3	1:5,000	

Ballinwilling Strand

BW2-BH3

- 4.116. At 1.5 - 2.0m (-2.0 to -2.5m LAT) the geology is described (by Next GeoSolutions) as a 'red (2.5Y 4/8) CLAY with frequent plant remains (wood) and pockets of gravel. Plant remains are intact. Gravel is fine to medium, rounded'. This deposit may be comparable to the deposit recorded by IAC Archaeology (2018: 3.2.1; Plate 1) in BW2-BH1 where a 'very loose brown slightly clayey silty fine to medium sand with occasional medium to coarse sub-rounded gravel and occasional stains of organic matter' was encountered at 5.5-10.9m (1.23 to -4.17m LAT). Although this deposit was noted in the field it was, unfortunately, not recovered in the borehole and therefore no physical samples were retained to permit geo-archaeological assessment (Fig. 35).

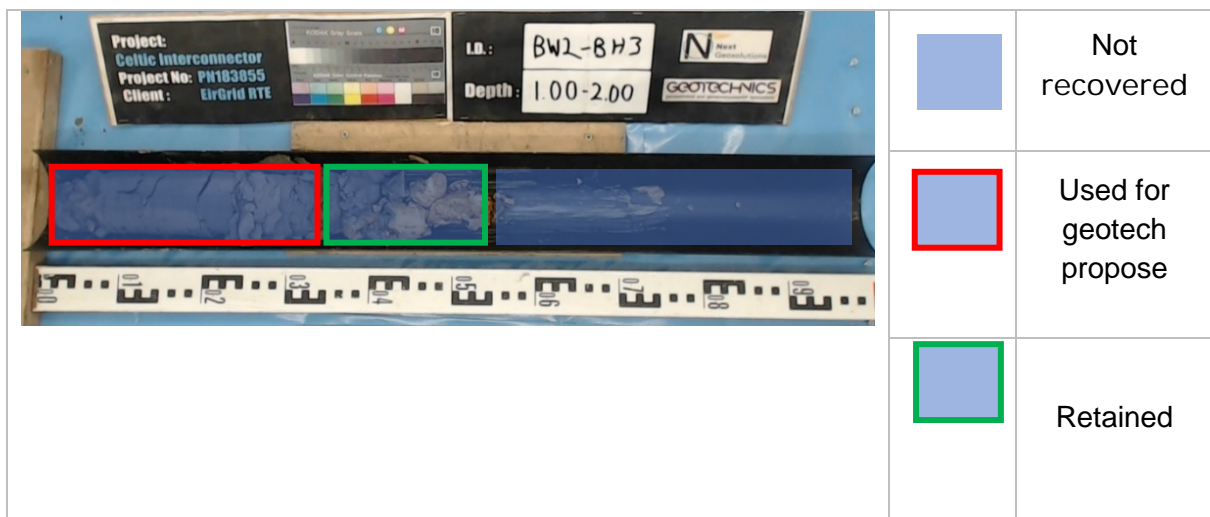


Figure 35 Samples from BW2-BH3 (from Next GeoSolutions)

Redbarn beach

RB-CPT_VC-1

- 4.117. The geological description noted the presence of a thin peat recorded at 3.3 - 3.5m (-6.4 to -6.6m LAT) overlying probable Till. The core photographs, however, do not show the presence of a peat horizon. Next GeoSolutions account for this discrepancy by stating that the only organic matter encountered was related to smears of clayey organic matter on the walls of the SPT sampler (Fig. 36). The core was therefore deemed to have no geo-archaeological potential.



Figure 36 Samples from RB-CPT-VC-1 (from Next GeoSolutions)

Claycastle beach

CL-BH1

4.118. At 4.5 - 6.0m the geological description (supplied by Next GeoSolutions) was of a 'dense dark brown (7.5YR 3/4) to black (10 YR 2/1) slightly gravelly, slightly sandy PEAT with frequent decayed plant material'. This peat deposit is part of the submerged forest located on the foreshore (Cotswold Archaeology 2018b) and was monitored by IAC Archaeology (2018; 3.4.1).

4.119. All the material from 4.5 - 5.0m in Shelby tube P4 was used for geotechnical testing purposes; the only retained sample from 5.0 - 5.45m consisted of a deposit described as sands with organic matter within SPT4. There was no sample recovery at 5.5 - 6.0m, but the next sample recovered, at 6.0m, contained no evidence of peat, thus providing a maximum potential depth for the base of the peat (of 6m) and a thickness of up to 1.5m (Fig. 37).

CL-BH2

4.120. This core was taken adjacent to the known exposure of the submerged forest and was also encountered in CL-TP2 (see IAC Archaeology 2018). The recorded sequence was:

- 0.00 - 0.90m: Loose brown (10YR 5/3) gravelly slightly silty fine to medium SAND. Gravel is fine to coarse and sub-angular to sub-rounded of various lithologies;
- 0.90 - 1.50m: Grey silty sand with pockets of silt with rare spongy pseudo-fibrous peat and pseudo-fibrous spongy plant and wood remains. Intense organic odour;
- 1.50 - 3.40m: Very loose grey (2.5Y 5/1) to olive brown (2.5Y 4/4), slightly silty fine to coarse organic SAND with amorphous and fibrous peat;
- 3.40 - 6.50m: Very soft grey (2.5Y 5/1) to greenish grey (GLE Y1 5/1) slightly sandy silty CLAY. Between 4.50 - 5.00m a band of slightly gravelly slightly sandy clayey silt, and at 6.00m a light grey (10YR 7/2) slightly gravelly very sandy very silty CLAY. Gravel is fine to coarse, sub-rounded to sub-angular of mudstone.



Figure 37 Samples from CL-BH1 (from Next GeoSolutions)

4.121. The adjacent core (**CL-TP2**) confirmed that the peat deposit was between 0.25m and 1.80m, overlying sand with shell fragments. This could indicate that the peat represents an extension of the peat over previous riverine / marine sand deposits and could therefore potentially provide a useful Late Holocene sea level index point (SLIP). There was no sample retention of the peat deposits suitable for geo-archaeological recording.

CL-BH3

4.122. A further extension of the submerged forest was recorded, with a possible basal palaeosol preserved at the base of the sequence. The geological description (supplied by Next GeoSolutions) for the section of interest, 8.3 - 9.1m (-7.9 to -8.7m LAT), was:

- 8.30 - 8.50m: Black (10YR 2/1) spongy clayey fibrous PEAT;
- 8.50 - 8.80m: Firm grey (2.5 5/1) soft (12 kPa) very gravelly very sandy CLAY with blocks of pseudo-fibrous spongy plant remains;
- 8.80 - 9.10m: Reddish brown (2.5YR 4/3) slightly silty slightly clayey very gravelly fine to medium SAND. Gravel is fine to coarse, sub-rounded to rounded meta-sandstone (low grade) quartz and flint.

4.123. The samples from this core that were available for the depths of interest were limited to 8.20 - 8.50m and 8.80 - 9.00m (Fig. 38); the remainder were either destructively tested or not retained. The core photos do not show a distinct peat horizon; Next GeoSolutions confirmed that the only rare evidence of spongy clayey fibrous peat was encountered at about 8.3m.

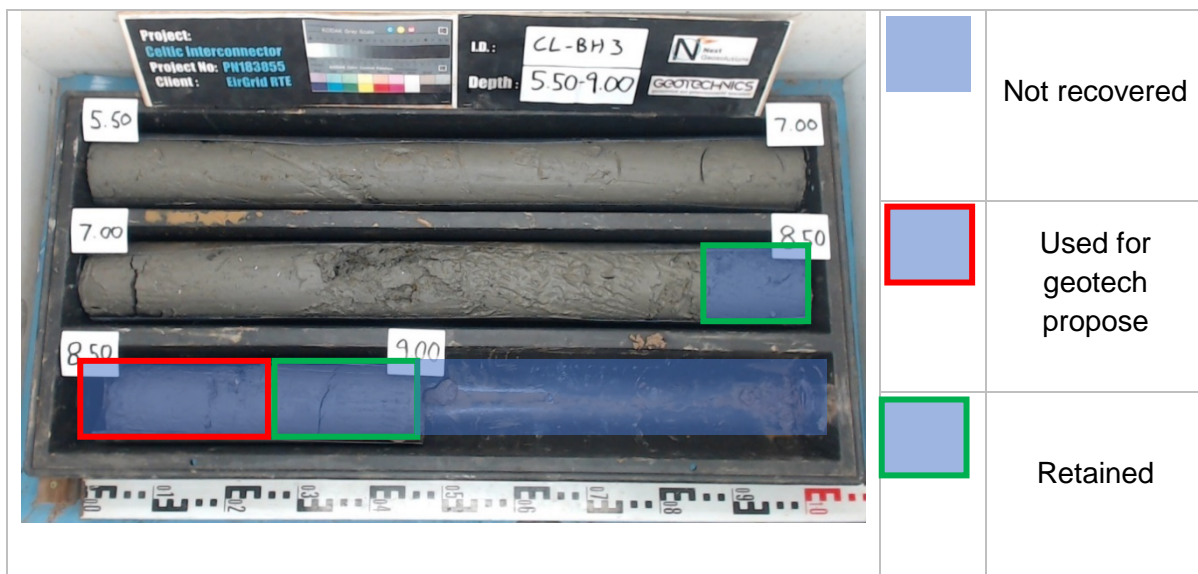


Figure 38 Samples from CL-BH3 (from Next GeoSolutions)

CL-CPT_VC-1A

4.124. The geological logs recorded clays with shells and occasional organic matter at 1.6 - 5.5m (-4.0 to -7.9m LAT). Next GeoSolutions confirmed that there was no evidence

of peat present and only occasional evidence of amorphous organic matter was highlighted. This core appears to contain a series of clays representing estuarine deposits (Fig. 39). Core **CL-CPT_VC-1**, immediately adjacent to this vibrocore, contained a similar sedimentary sequence.

4.125. The DBA and updated descriptions from Next GeoSolutions, resulted in the identification of four core sections from Claycastle beach where sediment was retained that might hold palaeo-environmental potential:

- CL-BH1: 5.00-5.45m;
- CL-BH3: 8.20-9.00m;
- CL-CPT-VC1A 1.6-2.5m; and 3.50-4.50m

4.126. These cores sections were sent to CA for geo-archaeological recording. The results have been tabulated and are presented below (Tables 10, 11 & 12)

		Not recovered
		Used for geotech propose
		Retained

Figure 39 Samples from CL-CPT_VC-1A (from Next GeoSolutions)

Geoarchaeological recording results

4.127. Geoarchaeological descriptions of the samples from each of the three core samples are provided below.

CL-BH1: 5.00 - 5.45m

4.128. A single bulk sample was obtained and confirmed the presence of a woody peat. The elevation of the peat suggests it is probably an onshore extension of the submerged

forest deposits encountered on the foreshore and observed in CL-BH2 and CL-TP2 (see IAC Archaeology 2018). The sample may be suitable for an assessment of the waterlogged plant remains but would be of little use for other techniques such as pollen as the sample only represents a single bulk sample.

Table 10 Geoarchaeological description of CL-BH1

Depth in core	Depth (m LAT)	Description	Interpretation
5.00 - 5.45m	-1.67 to -2.12m	10YR 1/1 peat, some fibrous ?root remains and also small wooden ?twigs.	Peat

CL-BH3: 8.20 - 9.00m

4.129. The core sections available represent an estuarine deposit overlying a probable Late Pleistocene Glacial Till. The estuarine deposit was only sampled between 8.20 - 8.50m but contained distinct laminations which may relate to rhythmite deposition within a saltmarsh or mudflat environment. Broken shell could point towards the nearby presence of a channel with higher flow rates leading to the deposition of broken shell during periods of flooding. The base of the sequence, which could indicate a transgressive surface, was not sampled. The core, however, might have palaeo-environmental potential for understanding the environment of deposition associated with the deposits at 8.20 - 8.50m, especially if the organic material within the core is suitable for radiocarbon dating.

Table 11 Geoarchaeological description of CL-BH3

Depth in core	Depth (m LAT)	Description	Interpretation
8.20 - 8.50m	-5.57 to -8.87m	10YR 7/3 No mottles silty clay, finely laminated, stoneless, broken shell at 8.28 and 8.43m, 1-2%, organics, slightly laminated but not full core width, at 8.28, 8.33, 8.37, 8.43, 8.46, 8.51 and 8.57m. Base not reached	Estuarine deposit
8.50 - 8.80m	-8.87 to -9.17	GAP	
8.80 - 9.00m	-9.17 to -9.37	10YR 5/4 1-2% fine mottle, very dense (?over consolidated) 10YR 6/6 clay, finely laminated, sub-rounded to rounded / tabular stones, 10-40mm, very slightly stony, no shell, no organics, base not reached	Possible Glacial Till

CL-CPT-VC1A 1.60 - 2.50m and 3.50 - 4.50m

- 4.130. The top and base of the 1.60 - 2.50m section was not marked, so it is assumed that the coarser sand-rich horizon is the top of this core section. This is supported by the fact that the underlying Shelby sample is composed of clay with no sand inclusions.
- 4.131. The core contained a long estuarine sequence, although the base of this sequence was not reached. The coarsening of the grain size in the core suggests a transition towards a higher energy environment and the proximity of channels and / or the littoral zone. The basal clays are likely to represent intertidal environments.
- 4.132. The presence of intact bivalve molluscs in this deposit suggests a low energy environment and could also be diagnostic, relating to establishing the indicative elevation of this deposit, as well as providing good potential for radiocarbon dating.
- 4.133. Overlying organics are likely to reflect saltmarsh or reedbed deposits. Some organics could be dated if deemed appropriate taphonomically (i.e. not roots). This core provides the potential to date the change in estuarine conditions which might provide a palaeo-landscape context for the onshore submerged forest.
- 4.134. If dating is successful, this core could also provide a sea level record if coupled with foraminifera, diatom and pollen assessments.

Table 12 Geoarchaeological description of CL-CPT-VC1A

Depth in core	Depth (m LAT)	Description	Interpretation
1.60 - 1.625m	-4.01 to -4.035m	10YR2/1 No mottles, sandy silt loam, stoneless, small shell (<5mm), 1-2%, no visible organics, Abrupt boundary to:	Estuarine deposit
1.625 - 1.685m	-4.035 to -4.095m	10YR4/1 No mottles, sandy clay, rounded tabular stones, slightly stoney, up to 15mm, bivalve shell (up to 8mm), 2%, no visible organics. Sharp boundary to:	Estuarine deposit
1.825 - 2.50m	-4.095 to -4.91m	10YR4/1 No mottles, silt loam, stoneless (very rare), broken bivalve shell, 1.75, 2.26 and 2.38m. fine organics present at 2.14, 2.20m, with vertical rooting between 2.33-2.42m. Base not reached	Estuarine deposit
2.50 - 3.50m	-4.91 to -5.91m	GAP	

Depth in core	Depth (m LAT)	Description	Interpretation
3.50 - 4.50m	-5.91 to -6.91m	10YR 5/1 no mottles, clay, stoneless, intact bivalves up to 25mm, both horizontal and vertical orientation, but not articulated, 3.60-3.66 and 3.77m, 1% small organic at 3.52 and 3.75m. Base not reached	Estuarine deposit

Palaeo-environmental potential

- 4.135. The three cores subjected to geo-archaeological recording display good potential for understanding the Holocene palaeo-landscape of the Claycastle area. Onshore and offshore cores confirm the presence of estuarine deposits, which correlate with the channel area identified previously in the assessment of the marine geophysical survey data. The submerged forest deposits appear to extend from their intertidal exposures up to the location of **CL-BH1** and may be up to 1.6m in thickness (see Table 10).
- 4.136. Both the peat and estuarine deposits have the potential to provide material suitable for radiocarbon dating. Coupled with assessments of waterlogged plant remains, molluscs, pollen, diatoms and foraminifera, these cores could provide an important insight into the timing of marine transgression and regression in this area of southeast Ireland.
- 4.137. The geotechnical samples from **CL-CPT-VC1A** and **CL-BH3** provide sufficient material for an assessment of the changing sedimentary sequence. The sample from **CL-BH1** (coupled with **CL-BH2**) demonstrate the extent of the submerged forest but provide insufficient material for palaeo-environmental assessment.

Foreshore geotechnical investigations at Claycastle beach

- 4.138. A hand auger survey was conducted at Claycastle beach (Fig. 28; Cotswold Archaeology 2019b) to investigate further the exposed peat deposits (Cotswold Archaeology 2018a).

Previous research on Claycastle beach

- 4.139. Previous environmental research, conducted in 2001 by Delahunty (2002), investigated the peat deposits at Claycastle beach. Two core samples were taken from Ballyvergan Marsh and from Youghal Strand in order to investigate historical changes in local vegetation. The Youghal Strand Core (SC) was extracted in the

area of interest, at 51° 56.020 N; 07° 51.545 W. The SC revealed almost two metres of peat deposit above sediments consisting of grey silt. The peat deposit was radiocarbon (¹⁴C) dated and the deepest peat from the core was dated to c. 4,555 years before present (BP) (3488-3242 BC OxCal). Dates obtained from the SC were calibrated by using the OxCal 4.3 program with 95% probability (OxCal 2019; Table 13).

Table 13 Strand core (SC) 14C data (Delahunty 2002 fig. 3, appendix B).

Depth	Date C14 BP / ID	Date OxCal. 95%	Period
12cm	1920±35 N45297	2-210 AD	Iron Age
86cm	3115±35 N45298	1488-1281 BC	Middle Bronze Age
120cm	3870±34 N45296	2768-2210 BC	Early Bronze Age
180cm	4555±35 N45295	3488-3241 BC	Early Neolithic

- 4.140. The pollen diagram for the SC suggests that at Youghal the landscape was covered by woodland that formed more than 5,000 years ago amid a freshwater ecosystem inland of the Atlantic Ocean. The changing climate had a significant impact on the woodland cover; around the first century A.D., the landscape was possibly affected by flooding. Consequently, the local woodlands were submerged, and a brackish environment was created northward into the low-lying land (Delahunty 2002, 88).