ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of

ENGLISH HERITAGE

Scarborough Castle
Scarborough
North Yorkshire

geophysical surveys

report 2378
April 2010

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted at Scarborough Castle in order to inform the ongoing management of the site. The works comprised geomagnetic and earth resistance survey of approximately 3ha of the outer bailey.

1.2 The works were commissioned by English Heritage and conducted by Archaeological Services Durham University.

Results

1.3 The surveys have detected a range of anomalies across the site, which have helped to characterise former landuse in different areas. The techniques have been complementary, with some features being detected by one or other technique and other features being recorded by both.

1.4 The surveys have provided additional information regarding the nature and location of some previously identified features, adding value to existing knowledge. A number of geophysical anomalies have also been detected which have little or no surface expression, and which are not depicted on previous plans of the headland. These anomalies may therefore reflect previously unknown features, which may have archaeological or historic potential.

1.5 Several of the more prominent anomalies relate to the RAF and Coastguard's use of the headland in the first half of the 20th century. Landscaping works for a football field in the 1920s have also been identified geophysically. Other anomalies almost certainly relate to earlier, post-medieval, military uses and quarrying, whilst others may reflect previously unrecorded buildings, for example.

1.6 The long and varied landuse of the headland has resulted in a relatively noisy site, magnetically, which together with the landscaping has provided a challenging environment in which to detect and identify weaker anomalies which might be associated with the more subtle features that might be expected on prehistoric settlement sites. A number of previously unidentified features could however relate to such occupation.

2. Project background

Location (Figures 1 & 2)

2.1 The study area comprised the northern and eastern part of the outer bailey at Scarborough Castle in North Yorkshire (NGR centre: TA 0493 8919). The castle occupies a prominent headland encircled by cliffs between Scarborough's north and south bays. The site is a Scheduled Monument (No. 13300) 'Scarborough Castle: Iron Age settlement, Roman signal station, Anglo-Scandinavian settlement & chapel, 12th-century enclosure castle and 18th-century battery'.

2.2 Detailed geomagnetic and earth resistance surveys were undertaken across approximately 3ha of the headland adjacent to the seaward cliffs.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the study area and so inform the ongoing management of the site. It was considered that evidence regarding the early occupation of the headland, particularly the location of the Bronze Age/Iron Age settlement, would be of greatest value for the ongoing care and maintenance of the site, which continues to be affected by erosion of the sandstone cliffs around its northern and eastern sides.

Methods statement

2.4 The surveys were undertaken in accordance with a scope and specification provided by English Heritage (Appendix) and with national standards and guidelines (para. 5.1 below).

2.5 Since the survey area lay within a Scheduled Monument the surveys were undertaken in accordance with a licence granted by English Heritage under Section 42 of the Ancient Monuments and Areas Act 1979 (as amended by the National Heritage Act 1983).

Dates

2.6 Fieldwork was undertaken between 8th and 11th March 2010. This report was prepared for 14th April 2010.

Personnel

2.7 Fieldwork was conducted by Duncan Hale and Richie Villis (Supervisor). Data processing and report preparation was by Duncan Hale, the Project Manager, with illustrations by David Graham and Janine Watson.

Archive/OASIS

2.8 The site code is **SCA10**, for **S**carborough **CA**stle 20**10**. The survey archive will be supplied on CD to English Heritage in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-75611**.

Acknowledgements

2.9 Archaeological Services Durham University is grateful for the assistance of English Heritage personnel, both on site and in York, for facilitating this scheme of works.

3. Historical and archaeological background

3.1 The most prominent feature on the headland is the 12th-century keep of the enclosure castle, however, this is a multi-period site which also contains the buried remains of a Bronze Age/Iron Age settlement, a Roman signal station, an 11th-century chapel and an 18th-century gun battery, amongst many other features.

3.2 The headland's long and varied history has been described in detail elsewhere (York University 1999). A detailed earthwork survey was undertaken by English Heritage in 1998, the report for which also included a site history and summary account of previous archaeological research (Pearson 1999). The following summary is based on information in the specification (Appendix) and Pearson's report:

3.3 Evidence for the earliest use of the headland was found during the excavation of the site of the Roman signal station in the 1920s, when a large number of pits were excavated which contained bronze axes and tools, items of shale and bronze jewellery and a quantity of Iron Age pottery. The Roman signal station at Scarborough is one of a chain established along the Yorkshire coast; other sites include Huntcliff, Goldsborough, Ravenscar and Filey. The Scarborough example comprises a square ditched enclosure surrounding the foundations of a walled courtyard-type structure. In the interior of the courtyard are the remains of a massive square structure with foundation walls 3.2m wide, which has been interpreted as the masonry support for a timber super-structure. Excavated evidence suggests that the signal station was constructed around AD 370 and occupied almost continually up until the 5th century.

3.4 The early medieval chapel of St Mary is a two-cell structure uncovered during the 1920s excavation of the signal station and partly incorporates the walls of the station. Additional stone footings represent the addition of a house in the 16th century.

3.5 The significance of the castle changed over the centuries, with a period of decline during the 15th and 16th centuries. However, its strategic importance came to the fore again during the two Civil Wars of the 1640s, and during and after the second Jacobite rising of 1745. The barracks were last occupied by regular troops in 1878 (Mould 1978) though the castle grounds continued in use for training purposes.

3.6 In addition to the above, the various military and non-military uses of the headland in relatively recent times all have the potential to contribute features and objects to the near-surface geophysical map of the site. These later uses and activities are documented by York University (1999) and by Pearson (1999), and include:

- 1851 cultivated areas and grazing
- Scarborough Cricket Club, until 1863
- c.1885 coastguard station
- 1890s rifle ranges
- 1893 naval reserve building and gun batteries
- 1904 bungalow housing a hydrophone
- 1912 a pageant for which a large stand was erected
- 1914 the bungalow was destroyed by German naval bombardment and then rebuilt on the same spot
- 1920s football ground with running track around

- 1930s temporary campsite
- Second World War RAF direction-finding station
- other 20th century buildings have included those for the Royal Observer Corps, the St John's Ambulance and the YMCA

4. Landuse, topography and geology

4.1 At the time of fieldwork the survey area was open meadow grassland with mown paths in the outer bailey of the castle forming part of the English Heritage visitor site. The survey area was bounded on the north and east by a substantial steel post-and-mesh fence. A maintained, grassed footpath lay c.3m inside the fence. One large concrete platform was present in the north of the area while several smaller concrete bases and inspection covers were noted around the eastern edge of the survey area. Park benches and a display board were present in the north and east respectively. Despite the fine weather, small areas of boggy ground and standing water were noted in the northern half of the survey area.

4.2 The castle occupies a headland with steep slopes down to Marine Drive and the sea below. The topography of the summit plateau is variable; the land slopes gently south-east from the highest point at around 86m OD in the inner bailey, down to 67m OD at the south end of the curtain wall. The survey area covered ground between 74-82m OD and was generally level with the exception of earthworks, which were present throughout.

4.3 The underlying solid geology of the area is Oxfordian (Upper Jurassic) Hambleton Oolite, a sandy limestone, which is overlain by Devensian till.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2002).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, it was known that cut features such as ditches and pits would be present on the site, and that built features such as trackways, wall-footings and fired structures (for example ovens and hearths) might also be present.

5.4 Given the anticipated nature and depth of targets and the non-igneous geological environment of the study area, two complementary geophysical survey techniques were considered appropriate: geomagnetic and earth electrical resistance survey. The selected geomagnetic technique, fluxgate gradiometry, involves the use of hand-held magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features. Given the proximity of buildings, wire fences and services, and the likely presence of wall-footings and tracks, an electrical resistance survey was also considered appropriate. Earth electrical resistance survey can be particularly useful for mapping stone and brick features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features, which retain more moisture, will provide relatively low resistance values.

Field methods

5.5 A 20m grid was established across the survey area and related to existing EH control stations using a Leica GS50 global positioning system (gps) and post-processing software. Stn 19 was taken as the only true OS position on site by an EH-contracted survey team from Greenhatch Group. Our gps survey coordinates for Stn 19 were found to be 41mm north-east of those recorded by Greenhatch shortly after our fieldwork. The location of our survey area has been adjusted accordingly.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was 0.03nT, the sample interval 0.25m and the traverse interval 1m, thus providing 1,600 sample measurements per 20m grid unit.

5.7 Measurements of earth electrical resistance were determined using Geoscan RM15D resistance meters with a mobile twin probe separation of 0.5m and MPX15 multiplexers to enable 'parallel twin' data collection. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was set to 0.1ohm, the sample interval to 1m and the traverse interval to 1m, thus providing 400 sample measurements per 20m grid unit.

5.8 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.9 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of both raw (minimally processed) and filtered data. The greyscale images, trace plots and interpretations are presented in Figures 3-4. In the greyscale images, positive magnetic/high resistance anomalies are displayed as dark grey and negative magnetic/low resistance anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla/ohm, as appropriate. Palette bars with the filtered images relate the greyscale intensities to standard deviations rather than absolute values.

5.10 The following basic processing functions have been applied to the geomagnetic data (Figure 3A):

clip	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.
destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25m x 0.25m intervals.

5.11 The following filter has been applied to the geomagnetic data (Figure 3B):

low pass filter	(with Gaussian weighting) to remove high frequency, small-scale spatial detail, such as some near-surface ferrous debris; for enhancing larger weak features.

5.12 The following basic processing functions have been applied to the earth resistance data (Figure 3A):

add	adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges.
destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
despike	locates and spikes in data due to poor contact resistance.
interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the data have been interpolated to 0.25m x 0.25m intervals.

5.13 The following filter has been applied to the earth resistance data (Figure 3B):

high pass filter	(with Gaussian weighting) to remove low frequency, large-scale spatial detail, such as geological background in resistance surveys

6. Interpretation and discussion

Interpretation: anomaly types

6.1 Colour-coded geophysical interpretation plans are provided. Geomagnetic anomalies are labeled '**m1**', '**m2**' etc on Figure 3C. Three types of geomagnetic anomaly have been distinguished in the data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches.
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids.
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

6.2 Resistance anomalies are labeled '**r1**', '**r2**' etc on Figure 3C. Two types of resistance anomaly have been distinguished in the data:

high resistance	regions of anomalously high resistance, which may reflect foundations, tracks, paths and other concentrations of stone or brick rubble.
low resistance	regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches.

Interpretation: features

6.3 Colour-coded archaeological interpretation plans are provided (Figure 3D); one is overlain on the 1999 RCHME earthwork survey.

6.4 Many discrete dipolar magnetic anomalies have been detected across the survey area. These almost certainly reflect items of near-surface ferrous and/or fired debris, for example horseshoes and brick/tile fragments, and in most cases have little or no archaeological significance. In this instance, given the site's long and varied landuse history, such anomalies are also likely to reflect materials associated with firing ranges, campsites, earth-moving works and various above- and below-ground structures. A sample of these anomalies is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

6.5 Some of the larger dipolar magnetic anomalies correspond to features noted on the ground during survey, including an inspection cover (**m1**), concrete pads (**m2-6**) and a display panel (**m7**), while others reflect sub-surface targets. Although not observed on the ground, two further large dipolar magnetic anomalies (**m8**, **m9**) appear to reflect inspection covers or chambers associated with a drain shown on an early 20th-century sketch (Scarborough Borough Council nd). Linear positive magnetic anomalies (**m10**) and low resistance anomalies (**r1**) correspond to the course of the drain.

6.6 A particularly large and intense magnetic anomaly (**m11**) near the northern limit of the survey area almost certainly reflects a structure which was too deep to be detected by the particular resistance probe configuration used in this instance. This structure is almost certainly a 1960s Cold War bunker used by the Royal Observer Corps (ROC) and the Home Defence Unit (HDU). Another large intense anomaly (**m12/r2**), 15m south of the Roman signal station ditch, reflects the hexagonal concrete kerb foundation of a Second World War RAF HF/DF tower (high-frequency radio direction-finding antenna), onto which a timber frame would have been mounted. Some HF/DF towers had a brick blast-wall surround, rubble from which would give rise to the other smaller geomagnetic and resistance anomalies immediately around the tower. The site of the tower and possible rubble correspond to earthworks N12 and N13 identified by Pearson (1999); the site of the tower is shown on a Ministry of Works plan of 1947 (see Pearson 1999). The site of a second possible HF/DF tower has been detected magnetically (**m12a**) near the southern corner of the survey area.

6.7 Three chains of intense dipolar magnetic anomalies (**m13-15**) crossing the survey area reflect the presence of pipes and cables, two of which were also detected as low resistance anomalies (**m13/r3**, **m14/r4**) heading east and north-east from the north end of the Inner Bailey; these may both relate to the RAF/coastguard use of the headland. The third chain (**m15**) is almost certainly a ferrous pipe but is not evident in the resistance data, indicating its greater depth from the surface; this pipe exits the western causeway of the Roman signal station and turns south then east around the outside of the station ditch to a point beyond the perimeter fence.

6.8 Many of the other anomalies detected by the geophysical surveys also reflect relatively recent activities and features. Other components of the Second World War RAF post have been detected geophysically, some of which survive as slight earthworks. In the north of the site a curvilinear positive magnetic anomaly (**m16**) and associated low resistance anomaly (**r5**) reflect the course of a former track, which led to a coastguard station beyond the survey area and now demolished. A second track has been similarly detected (**m17/r6**) to the west and south of the Roman signal station. On the south side of this track, opposite the signal station, a small, well-defined rectilinear positive magnetic anomaly (**m18**) broadly corresponds to the location of a small building shown on the 1947 plan (see Pearson 1999); the anomaly is approximately 10m east of a small earthwork platform (N17). Further south, in the southernmost part of the survey area, a 1920s coastguard station is shown on the 1947 plan. The geomagnetic survey here is dominated by a concentration of intense dipolar magnetic anomalies (**m19**), which in this instance almost certainly reflects a significant amount of ferrous debris, since some high resistance anomalies can still be defined here. The rectilinear high resistance anomaly **r7** almost certainly reflects the foundations for this earlier coastguard building. Immediately west of this anomaly is a high resistance/intense magnetic anomaly (**r8/m20**), which corresponds to the site of an air-raid shelter. These features were also identified as earthworks, N4-8 (Pearson 1999).

6.9 To the north and east of the coastguard station several other magnetic and resistance anomalies form rectilinear shapes (for example **r9/m21**), some possibly associated with other buildings or with earthwork platforms for buildings which were not completed (see Pearson 1999).

6.10 Further anomalies created as a result of 20th-century activity include large resistance anomalies associated with substantial landscaping works. Plans for the construction of a football field in the 1920s, which are thought to have comprised three pitches surrounded by a running track (Pearson 1999), were never completed but the slope in the northern part of the outer bailey was cut into during levelling operations and the spoil stored in low mounds to the south. Pearson (1999) suggests that some spoil from the 1921-25 excavations of the signal station may have been added to these mounds. High resistance anomalies (**r10**) reflect the cut scarp around the northern end of the sports field while other resistance anomalies (**r11-13**) and concentrations of dipolar magnetic anomalies (**m22**, **m23**) reflect extensive spoilheaps; the two large, northerly, dipolar anomalies at **m23** correspond to two iron stanchion loops on top of the spoilheap, used for bracing a former exercise post just to the north (earthwork features Q4, Q5; Pearson 1999). Although there is virtually no surface expression, the resistance and magnetic anomalies at **r14/m24** may reflect a shallow depression which was backfilled and levelled using rubble and spoil from the cut operation. The southern end of the football field has not been identified in the geophysical surveys. However, the southern part of the anomalies for track **m10/r1** and drain **m17/r6** broadly correspond to where the southern part of the east side of the sports field would have been.

6.11 Well-defined resistance anomalies (**r15**) immediately north of the Roman signal station almost certainly reflect the foundations for a bungalow and hydrophone built in 1904, destroyed by German naval bombardment in 1914 and rebuilt on the some spot. This building was probably serviced by the cable/pipe **m13/r3**. A more diffuse low resistance anomaly (**r16**) could reflect a former track associated with the building.

6.12 Another possible cable trench has been detected as both a low resistance anomaly (**r17**) and as adjacent positive/negative magnetic anomalies (**m25**) immediately north of an existing grass track across this area. An intense dipolar magnetic anomaly (**m7**) on the south side of the track reflects a visitor information panel.

6.13 In the central-western part of the survey area, a rectilinear high resistance anomaly (**r18**) probably reflects the foundation of the eastern end of a substantial building. The building is immediately north of the Second World War RAF track **m17/r6** and the possible track **r16** to the bungalow, and may be contemporary with either. This building appears to be too far east to correspond to the possible RAF accommodation block shown on the 1947 plan.

6.14 A well-defined, L-shaped, low resistance anomaly (**r19**) to the north of the former bungalow is not evident in the magnetic survey, like the possible track **r16** above. Such anomalies typically reflect soil-filled features and often have a corresponding positive magnetic anomaly reflecting decayed organic or burnt materials within the fill. The resistance anomaly here almost certainly reflects a cut feature retaining more moisture than the surrounding soil, which in this instance may have been backfilled soon after excavation, with the same material, before alteration of that material or incorporation of magnetically-enhanced material.

6.15 A number of resistance anomalies (**r20**) were detected at the north-eastern corner of the football field. The anomalies, of both high and low resistance, are very weak and have been included in this interpretation largely due to their apparently regular

shape; amorphous anomalies of similar magnitude would probably not attract attention. These anomalies could possibly reflect traces of wall-footings and soil-filled features such as beam-slots or gullies. An oval high resistance anomaly (**r21**), surrounded by a narrow low resistance anomaly, was also detected just beyond the sports field. This corresponds to earthwork feature R4 and could possibly reflect a floor or base for a structure, with a gulley around it.

6.16 In the north-west of the survey area, both high and low resistance anomalies (**r22**, **r23**) and a concentration of dipolar magnetic anomalies (**m26**) have been detected. The low resistance anomaly at **r22** broadly corresponds to the edge of a shallow depression (Pearson's earthwork feature I8) containing an area of high resistance and ferrous/fired materials. This appears to confirm Pearson's suggestion of a possible quarry site partially backfilled (1999, 27). The anomalies at **r23** to the immediate south-west are similar in nature, probably reflecting stone and/or building rubble, in this instance centred on a small mound (earthwork K13).

6.17 In addition to the probable cable trench (**m14/r4**), track (**m16/r5**) and the edge of the football field (**r10**) to the north-east of these features, there is also a prominent bank aligned north-south. The bank, which turns west at its northern end, has been detected as both magnetic and resistance anomalies (**m27/r24**). The geophysical surveys indicate the remains of a possible further bank heading west from the main bank, and also that the main bank continued southwards, beyond the current survey extent. The bank is undated but may have formed part of a military compound around a 19th-century gun battery (Pearson 1999).

6.18 Many other small anomalies have been recorded by the geophysical surveys, however, to varying degrees, the intensity of the ferrous 'noise' across the site and the geology and landscaping of the site have hindered their interpretation as features of likely archaeological potential. Some very weak positive magnetic anomalies (**m28**) south of the Roman signal station are in this category. It is possible that such subtle anomalies reflect the remains of soil-filled features such as ring-ditches and pits but such an interpretation is tentative. Similarly, a few other miscellaneous possible features have been included on the interpretation figures.

7. Conclusions

7.1 Geomagnetic and earth resistance surveys have been undertaken over 3ha in the northern and eastern parts of the outer bailey at Scarborough Castle.

7.2 The surveys have detected a range of anomalies across the site, which have helped to characterise former landuse in different areas. The techniques have been complementary, with some features being detected by one or other technique and other features being recorded by both.

7.3 The surveys have provided additional information regarding the nature and location of some previously identified features, adding value to existing knowledge. A number of geophysical anomalies have also been detected which have little or no surface expression, and which are not depicted on previous plans of the headland. These anomalies may therefore reflect previously unknown features, which may have archaeological or historic potential.

7.4 Several of the more prominent anomalies relate to the RAF and Coastguard's use of the headland in the first half of the 20th century. Landscaping works for a football field in the 1920s have also been identified geophysically. Other anomalies almost certainly relate to earlier, post-medieval, military uses and quarrying, whilst others may reflect previously unrecorded buildings, for example.

7.5 The long and varied landuse of the headland has resulted in a relatively noisy site, magnetically, which together with the landscaping has provided a challenging environment in which to detect and identify weaker anomalies which might be associated with the more subtle features that might be expected on prehistoric settlement sites. A number of previously unidentified features could however relate to such occupation.

8. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*. Technical Paper **6**, Institute of Field Archaeologists

Mould, D, 1978 *Remember Scarborough 1914!* Hendon Publishing

Pearson, T, 1999 *Scarborough Castle, North Yorkshire: survey report*. Archaeological Investigation Report Series AI/11/1999, English Heritage

Scarborough Borough Council nd *No title (Plan showing drainage runs and manholes across the castle)* 1:500 manuscript plan in bundle C1907/01

Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice.* Archaeology Data Service, Arts and Humanities Data Service

York University 1999 *A management and conservation plan for Scarborough Castle*. Unpublished report, York University

Appendix: Project scope and specification

2.1 DESCRIPTION OF SCOPE

Geophysical Survey at Scarborough Castle, Scarborough, North Yorkshire.

Summary

A geophysical survey using magnetic, earth resistance is required at Scarborough Castle (NGR TA 0493 8919) and its environs to assist with the ongoing management of the site. Tenders are invited for this work, to be concluded with a report by 12th March 2010.

Background

Scarborough Castle is situated on a prominent cliff-top location over looking the town of Scarborough, North Yorkshire. The monument is a multi-period site containing, in addition to the 12th century enclosure castle, the buried remains of a Bronze Age/Iron Age settlement, a Roman signal station, the site of an 11th century chapel and a 18th century gun battery. Evidence for the earliest use of the site came from the excavation of the site of the Roman signal station in the 1920s. During the course of the excavation a large number of pits were uncovered which contained bronze axes and tools also items of shale and bronze jewellery and a quantity of Iron Age pottery. The Roman signal station at Scarborough is one of a chain of such established along the Yorkshire coast: other sites include Huntcliff, Goldsborough, Ravenscar and Filey. The Scarborough example comprises a square ditched enclosure surrounding the foundations of a walled courtyard type structure; with corner tower bases. The interior of the courtyard are the remains of a massive square structure with foundation walls 3.2m wide which has been interpreted as the masonry support for a timber super-structure. Excavated evidence suggests that the signal station was constructed around 370AD and occupied almost continually up until the 5th century. The early medieval chapel of St Mary is a two cell structure uncovered during the 1920s excavation of the signal station and partly incorporates the walls of the station. Additional stone footings represent the addition of a house in the 16th century.

Archaeology

Whilst having a rich archaeological history associated with the castle and the Roman signal station, there is the potential for significant areas of unexcavated archaeology on the headland. Any information regarding the early occupation of the headland, particularly location of the Bronze Age/Iron Age settlement would be of greatest value for the ongoing care and maintenance of the site (Figure 1). This is of particular concern as the sandstone cliff to the east and north of the site will continue to be effected be erosion.

Site conditions

Scarborough Castle (centred on NGR TA 0493 8919) lies on a headland with steep slopes bounding the site falling to Marine Drive and the sea below. The topography of the site varies, but is largely level throughout the areas required for survey. The survey area is down to meadow grass interspersed mown paths. The site sits on an outcrop of sandstone and Limestone of Upper Jurassic in date The summit slopes gently south-east from he highest area at around 87m OD in the inner bailey to the lowest at 67m OD at the south end of the curtain wall.

The geophysical survey requirement

The objective of the survey is to attempt to define and characterise any detectable archaeology contained within within the areas indicated on Figure 1.

Specification

1. An area of approximately 2 hectares (maximum extent), indicated by shading on Figure 1, is to be covered by both magnetic and earth resistance survey where practical.
2. A temporary survey grid should be established over the site and accurately measured in to permanent landmarks or discreetly positioned permanent marker pegs by the geophysical survey team. The temporary survey grid should be removed after the completion of fieldwork unless other arrangements have been agreed to facilitate further work on the site. Location measurements, provided in the final survey report, should allow the temporary survey grid to be exactly relocated from readily identifiable landmarks or marker pegs if necessary. In addition, the location of the temporary survey grid should be co-registered to the Ordnance Survey National Grid and any permanent markers established at the site.
3. The magnetometer survey is to be conducted with a fluxgate gradiometer or similar instrument and readings must be recorded at intervals of 0.25m x 1.0m. Traverses (with readings at 0.25m intervals) should be orientated approximately north-south.
4. The earth resistance survey will use either the Twin Electrode (Twin Probe) configuration with a mobile probe spacing of 0.5m, or a wheeled resistivity square array system with probe spacings of 0.75m. Readings should be recorded at 1.0m x 1.0m intervals. Every effort should be made to ensure that a uniform dataset is acquired in which discontinuities of measurement levels at grid edges are minimised.
5. The fieldwork must be concluded and 10 copies of a full report provided by 12th March 2010**.** A copy of the raw geophysical data, the final report text, figures and associated electronic drawing files must also be supplied to the English Heritage Geophysics Team in an appropriate, mutually compatible electronic format. English Heritage reserves the right to include appropriate reports in its Research Department Report Series.
6. All fieldwork, data processing and reporting must follow recommendations set out by English Heritage (2008).
7. Fieldwork on site must be conducted with a high degree of professionalism; in particular, every courtesy and consideration should be extended to the health and welfare of staff and visitors on site. Extreme care must be taken to avoid trip hazards caused by trailing equipment leads or survey grid markers during the conduction of the survey. Contractors will be responsible for preparing a Risk Assessment prior to the commencement of work.

Access

To be arranged in consultation with Dr Mark Douglas, English Heritage Properties Curator, (tel. 01904 601896, mob. 07824 837219, mark.douglas@english-heritage.org.uk). Any permission for the installation of permanent marker pegs is to be obtained prior to commencement of fieldwork.

Section 42 Licence

To be provided for the chosen contractor by English Heritage.

Maps

Digital mapping will be provided to the successful contractor for the creation of figures in the final report.

References

Scarborough Castle, North Yorkshire; Archaeological Investigation Report

English Heritage 2008 *Geophysical survey in archaeological field evaluation*, 2nd edn. English Heritage, Swindon

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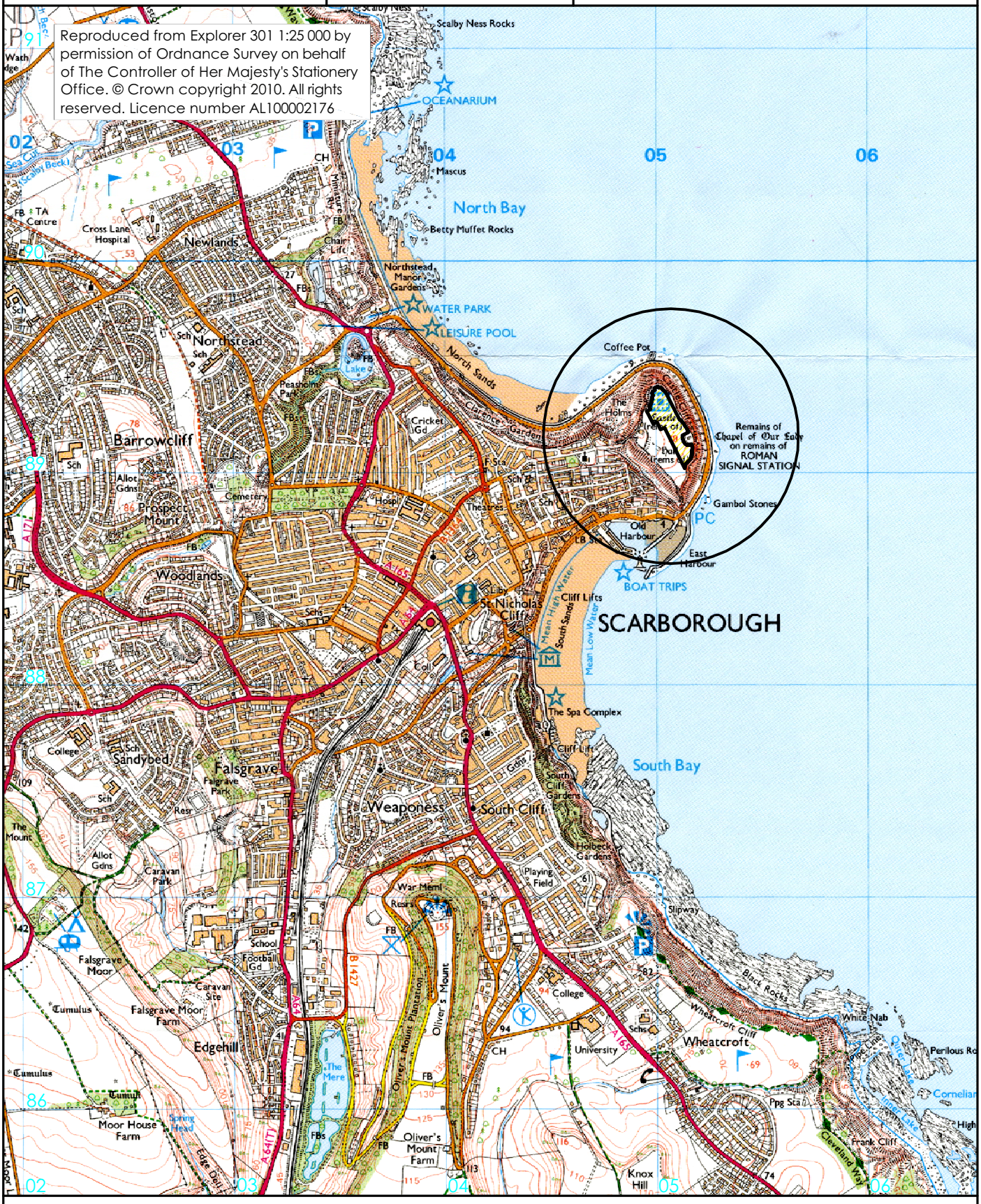
Figure 1: Site location



site location

0 1km

scale 1:25 000 for A4 plot

survey outline

Marine Drive

Inner Bailey

Outer Bailey

Roman signal station and Chapel of Our Lady

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0 75m
scale 1:1500 for A3 plot

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Figure 2: Study area, including RCHME earthwork plan

A magnetic survey

B filtered magnetic survey

C geophysical interpretation

D archaeological interpretation

A - geophysical survey
- magnetic survey
- resistance survey

B - filtered geophysical survey
- magnetic survey
- resistance survey

C - geophysical interpretation
- dipolar magnetic anomaly
- positive magnetic anomaly
- negative magnetic anomaly
- high resistance anomaly
- low resistance anomaly

D - archaeological interpretation
- soil-filled feature
- structural feature
- pipe / cable
- track

A resistance survey

B filtered resistance survey

C geophysical interpretation

D archaeological interpretation with RCHME earthwork survey

scale 1:1000 for A0 plot

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Figure 3: Geophysical survey results and interpretations

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Figure 4:
Trace plots of geophysical data

Geomagnetic

60.90nT/cm

0 50m
scale 1:1000

Electrical resistance

25.80 ohm/cm

0 50m
scale 1:1000