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Seaford Head, East Sussex: rapid survey and assessment

Dr Ed Blinkhorn, Richard James, Dr Emily Johnson, Jon Sygrave and Dr Vasilis Tsamis

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SEAFORD HEAD (NHLE 1014523) EAST SUSSEX

A case study for the rapid survey and assessment of a scheduled monument at risk from coastal erosion

Dr Ed Blinkhorn, Richard James, Dr Emily Johnson, Jon Sygrave and Dr Vasilis Tsamis

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SUMMARY
The Seaford Head project was funded by Historic England (HE) as a pilot study for how an archaeological site at threat from coastal erosion, accelerated by climate change, could be rapidly recorded ahead of its loss. The objective was not to deliver an exhaustive preservation by record of the monument, but more of a summary of current knowledge including as much new data as could be generated within the budget. To achieve this, the work included the production of a desk-based assessment and walkover, drone photogrammetry, topographic and geophysical surveys. Revised research aims and proposals for future phases of fieldwork were established, and a scalable cost model produced, showing days worked on each element by various staff members. Due to the volume of data produced, the project also provided an opportunity to assess the Chartered Institute for Archaeologists' (CIfA) digital toolkit for triaging archaeological digital data (CIfA 2020b) ahead of deposition with the Archaeological Data Service (ADS).

A series of digital outreach films and a podcast on the work were funded by the South Downs National Park Authority (SDNPA). The Archaeology South-East (ASE) / University College London (UCL) and SDNPA press offices organised press releases which were taken up by regional and national newspapers, radio and television. The purpose of this digital outreach work was to not only publicise the project and the organisations involved, but to begin to establish the public need/desire for future work on the site. The site owners, Seaford Town Council (STC), helped facilitate the project's delivery and the digital outreach provided an opportunity to involve them in the project outputs along with the National Trust (a major local landowner) and key HE staff. The project will provide an online seminar to HE Regional teams and stakeholders as part of the HE sponsored 'climate change and cultural heritage' webinar series.

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FRONTCOVER IMAGE
View of Seaford Head from south east © Historic England Archive

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1. INTRODUCTION

1.1. Project funding

Archaeology South-East (ASE), a division of the Centre for Applied Archaeology, University College London (UCL), was commissioned by Historic England (HE) to undertake a pilot project at Seaford Head scheduled monument (National Heritage List for England [NHLE] 1014523; Figures 1 and 2), following the submission of a project proposal (ASE 2021a) and subsequent project design (ASE 2021b). A successful internal funding bid by the South Downs National Park Authority's (SDNPA) Cultural Heritage Lead provided additional funding from the SDNPA to produce a series of short films and a podcast to facilitate engagement with members of the public, site owners, local government and heritage professionals.

1.2. Project inception and key dates

In March 2021, a drone video showing a recent cliff collapse at Seaford Head was posted on YouTube (Lambert 2021). Dr Matt Pope (ASE) drew HE's attention to news of the collapse via social media, which prompted discussion between ASE, HE, SDNPA and Seaford Town Council (STC). Following this exchange, ASE submitted a project proposal to HE in July 2021 setting out the scope of the project with an initial budget (ASE 2021a). The HE Heritage Protection Commissions Programme responded on 25th August 2021 and invited ASE to submit a Project Design. The Project Design was duly submitted to HE on 5th October 2021 with a final version issued on 24th November 2021 (ASE 2021b). HE issued a final agreement letter on 8th December 2021. Fieldwork on the project commenced under early agreement between 3rd and 18th November during a period of good weather suitable to fly the remotely piloted aircraft system (RPAS).

1.3. Stakeholders and project support

The project was supported and funded by HE and the SDNPA. STC also supported the project through the Town Clerk's office with staff time and assistance from the Seaford Head Golf Course. Local interested parties included the National Trust, the Sussex Wildlife Trust, the Environment Agency (EA), Natural England and East Sussex County Council.

1.4. Premise of the work

Accelerating climate change is posing an increasing and widespread risk to heritage assets in some coastal, riverine and low-lying settings. The scale of the issue is such that heritage organisations and agencies engaged in the management of historic places and development of heritage policy are seeking new and innovative means to manage and communicate the imminent loss of assets. The Seaford Head Project employed a methodology suitable to the study site to rapidly assess and record a monument at risk of coastal erosion prior to loss. The joint desk-based, aerial, topographic, and geophysical survey approach combined with the development of outreach materials demonstrates a model which is replicable at analogous sites facing

similar threats around the coast of England. Each site has its own unique characteristics and the suite of techniques to be used could be adapted depending on the nature of the site. The project outputs are also designed to provide an initial evidence base on which future projects and funding applications can be built. In doing so, the landscape of Seaford Head will serve as a case study to demonstrate the impact of climate change and coastal landscape processes on heritage, and the project serves as a cost model by which other heritage agencies, landowners and community groups can build a response to threats to heritage at a local level.

1.5. Study area

Seaford Head is an important area of chalk Downland landscape and hosts important heritage assets at risk of loss due to progressive coastal erosion. The site is situated in East Sussex (National Grid Reference [NGR] 549473 097858; Figure 1) within both Lewes District and South Downs National Park. It is owned by the STC and is managed as a nature reserve (by the Sussex Wildlife Trust through a management agreement with STC) and by STC directly as a golf course.

The area of assessment is centred on the Iron Age hillfort on Seaford Head (NHLE 1014523, NGR 549473 097858). The assessment is primarily focussed on the scheduled monument and a 100m strip of clifftop to either side, between Hawks Brow and the western edge of Hope Bottom (the site). A wider nominal study area of 500m width extending for 1km to either side of the quoted NGR has been used to put the site in a wider archaeological and landscape context as appropriate. The location and extent of the magnetometer and resistivity surveys are shown in Figure 13, the topographic and plan orthomosaic in Figures 23-25 and cliff orthomosaic in Figure 27.

1.6. Report structure and approval

This report presents the results of an archaeological desk-based assessment and walkover survey by Richard James with contributions from Dr Ed Blinkhorn on lidar analysis and geophysical survey (comprising fluxgate gradiometer and earth resistance), and a topographic survey of the scheduled monument and RPAS photogrammetry survey of the scheduled monument and cliff edge by Dr Vasilis Tsamis.

The report features a description of the project outreach elements by Dr Emily Johnson, including the press release, short films and podcast and, as far as possible, evaluates public reaction to them.

A series of updated research aims generated by the archaeological and outreach work are presented as a means to shape future fieldwork and outreach projects on the site.

As the project generated a large volume of digital data, an opportunity arose to evaluate the use of CIfA's digital toolkit for triaging archaeological digital data (2020b) and the process through which this is archived with the Archaeological Data Service (ADS), described by Dr Vasilis Tsamis.

A scalable cost model, created by Jon Sygrave, is presented in the final section of the report to inform future projects of the likely cost, expressed in terms of person days and grades.

Figure 1: Site location, contains OS data © Crown copyright [and database right] [2021].

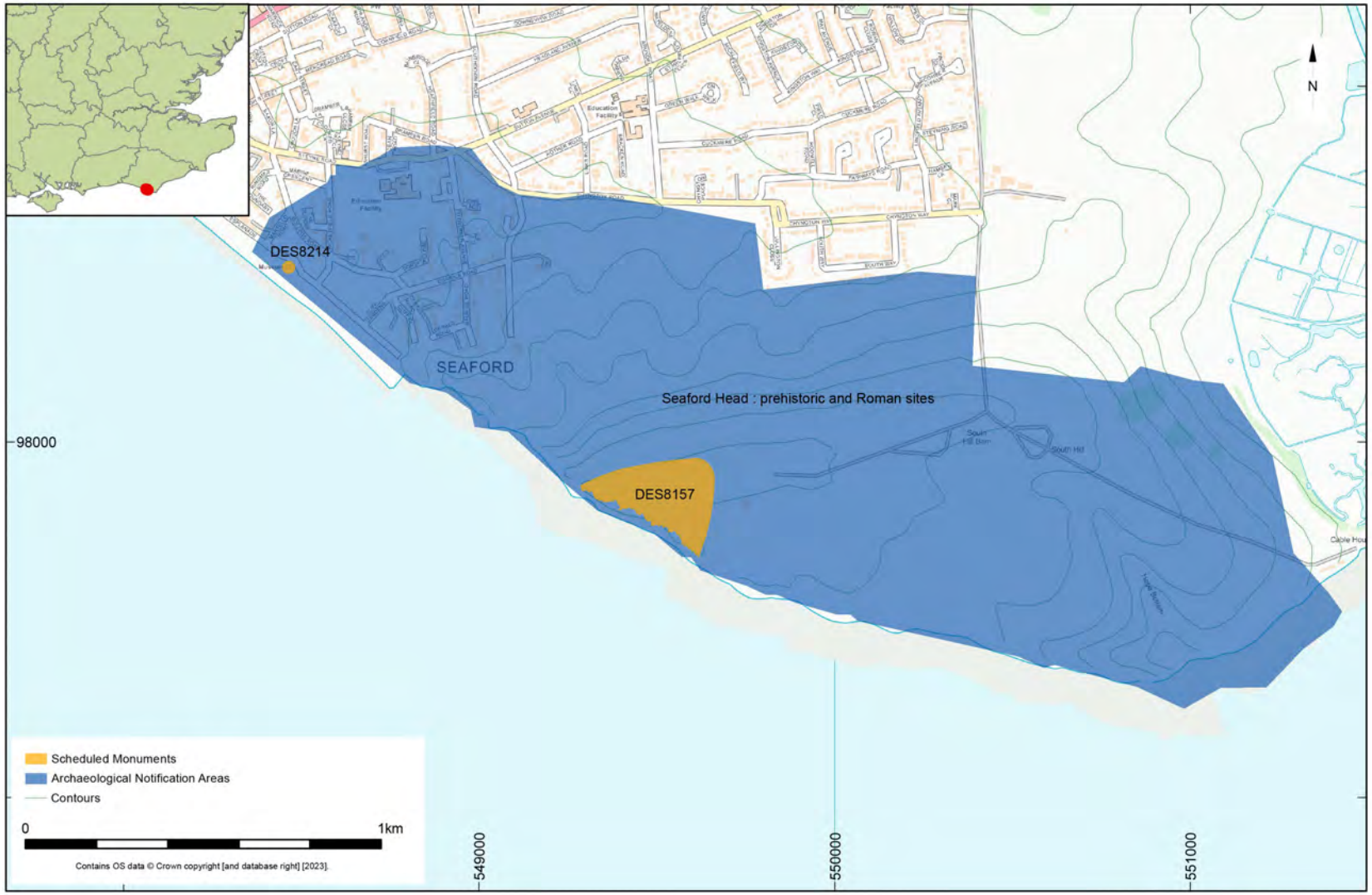

Figure 2: Heritage designations, contains OS data © Crown copyright [and database right] [2021].

2. BACKGROUND

2.1. Geology and landscape

The geology underlying the assessment area is chalk of the Newhaven and Seaford Members (formerly known as Upper Chalk), forming a ridgeline extending from the southern dipslope of the South Downs. This ridgeline is capped by deposits of clay-with-flints, with a deposit of Lambeth Sands at the extreme western edge on Hawks Brow. During prehistory it is thought that the chalk was overlain by thicker deposits of topsoil that supported extensive arable cultivation, although this process degraded them into the thin and dry rendzina soils characteristic of the modern downland.

The site lies within a key part of the Seaford to Beachy Head Site of Special Scientific Interest (SSSI). According to the citation, 'the cliffs and chalk platform beneath, the Greensand reef, and the chalk escarpment at Cow Gap are identified in the Geological Conservation Review as outstanding for their geological and geomorphological interest' (SDNPA 2020).

The site lies within an area which has been the interest of several studies on historic cliff loss, notably Dornbusch (2022).

2.2. Summary of historic land use

The below table summarises the main periods and processes affecting the development of the historic landscape within and around the study area.

Period	Dates	Activity / Land Use
Prehistoric • Palaeolithic • Mesolithic • Neolithic • Bronze Age • Iron Age	*c.* 750,000 BC–AD 43 • *c.* 750,000 BC–*c.* 10,000 BC • *c.* 10,000 BC–*c.* 4,300 BC • *c.* 4,300 BC–*c.* 3,000 BC • *c.* 3,000 BC–*c.* 600 BC • *c.* 600 BC–AD 43	Probable occupation by early and proto-human groups of hunter-gatherers. Probable utilisation of natural woodland resources on the heavier clay-with-flint soils by hunting bands. Early agricultural communities largely invisible other than through their ritual monuments, Bronze Age barrow cemeteries. Occupation by agricultural communities from the Bronze Age through to the Iron Age, leaving field systems and associated settlements and trackways.
Romano-British	AD 43–410	Continuing agricultural use, often re-using earlier field systems. Cemetery to the north of the assessment area suggests localised settlement.
Early Medieval	AD 410–1066	Agricultural use, based on estates perhaps derived from Romano-British originals, coalescing in the 10th century to form the later manorial and parish systems.
Medieval	1066–1540	Extensive use of the downland for sheep pasture.

Period	Dates	Activity / Land Use
Post-Medieval	1540–present	Continuing agricultural use, with sheep eventually replaced by arable. High clifftop location used for warning beacons in the 16th century and signal stations in the 18th and 19th centuries. Extensive military use for battle training in 20th century. Later 20th-century recreational use under STC ownership.

Table 1: Historic Landscape Development.

2.2.1. Palaeolithic (c. 500,000 BC–c. 10,000 BC)

The south-east of England is rich in evidence for the earliest human communities to inhabit Britain, with the region including internationally important sites of Lower Palaeolithic date such as Swanscombe (Kent) and Boxgrove. Traditionally, these discoveries have concentrated within the gravel terrace deposits associated with many of the region's rivers or from the raised beach deposits situated along the base of the dipslope of the South Downs, and largely comprise isolated finds of artefacts, notably hand axes, manufactured by hominid groups. Most of the known Palaeolithic material relates to the Upper Palaeolithic, prior to the last glaciation when modern humans were living in the region and exploiting the abundant natural resources. The South Downs, although heavily wooded, were an attractive area for settlement with the southern combes affording good access to the freshwater and marine resources of the coastal plain, while the northern escarpment provided an ideal vantage point for monitoring animal herds.

The chalk making up Seaford Head is covered with deposits mapped as 'clay-with-flints'. This is a highly heterogenous deposit comprise weathered chalk, remnants of weathered Tertiary cover, deposits infilling solution hollows and larger cavities as well as more generalised clay-rich 'head' deposits. The deposits for this area have not been systematically investigated but might be expected to vary between 0.5m and 3m in depth. These deposits have been found elsewhere to contain Palaeolithic material, mostly hand axes in secondary contexts, but with the potential to contain associated in situ deposits.

2.2.2. Mesolithic (c. 10,000 BC–c. 4,300 BC)

The Mesolithic saw the return of human communities to the South Downs in response to improving post-glacial climatic conditions. The warming climate led to the spread of a succession of woodland types, culminating in a mixed broad-leaved forest dominated by oak but including elm, ash, alder, lime and hazel. Human communities exploited this woodland and the rich resources of the river valleys. Settlements comprised semi-permanent base camps occupied during the winter months and a series of seasonal hunting camps, although evidence for such settlements is scarce and tends to be restricted to the Greensand (e.g. Selmeston, East Sussex). The bulk of the evidence for this period comprises flint scatters, from which three typologically distinct chronological groupings have been recognised. Evidence for the later Mesolithic period is less forthcoming, although it is likely that increasing

clearance of the woodland, together with a certain level of manipulation of animal populations as part of an increasingly efficient hunting strategy laid the foundations for the adoption of agriculture. An increase in settlement is recorded along coastal areas and the downland (Holgate 2003).

2.2.3. Neolithic (c. 4,300 BC–c. 3,000 BC)

The Neolithic saw the development of agriculture and the first evidence for large-scale communal activity. New ideas relating to the domestication of animals, and probably later, the cultivation of cereals, arrived from the European mainland and were adopted by indigenous human communities, together with new technologies such as pottery. Environmental evidence indicates a major phase of woodland clearance taking place at this time, as land was opened up to provide fields and sacred spaces. Evidence for Neolithic settlements is patchy, with a few sites producing pits, although the proximity of these sites to ceremonial monuments and the 'ritual' appearance of the fills may indicate that these are not domestic sites. A much more extensive impression of Neolithic activity is gained from the numerous flint scatters and the distribution of polished stone axes, both of which are concentrated on the chalk downlands.

The most striking evidence for the period exists in the form of ceremonial monuments. The earliest examples comprise earthen long barrows, which are found scattered across the downland. These were both communal burial places and foci for social and ritual gatherings, serving to anchor the community in the landscape. Another early ceremonial site was the causewayed enclosure, with local examples known at Whitehawk (Brighton) and Combe Hill above Jevington. The nature of these sites remains a matter of debate, but activities may well have included excarnation (the exposing of the dead prior to burial), ritual deposition of food and artefacts and use as a meeting place. Ritual activity has also been recognised at a number of flint mines scattered along the Sussex Downs.

2.2.4. Bronze Age (c. 3,000 BC–c. 600 BC)

The Bronze Age is characterized by the introduction of metals, firstly gold and copper and later bronze. The earliest metals are generally associated with a new type of pottery, Beaker Ware, as well as the construction of a new type of ceremonial site, the round barrow. These monuments heralded a new way of thinking about society as they represented the burial of individuals rather than the communal burials of the preceding period. This is probably linked with the emergence of social elites. The barrows are found in large numbers across the chalk downland, often forming linear cemeteries on ridges.

The Middle Bronze Age (from *c.* 1,500 BC) saw a dramatic change in emphasis away from the ceremonial and monumental landscape. Large-scale evidence for farming appeared with the creation of field systems defined by earthwork banks and ditches (and probably hedges). Small, enclosed settlements of round houses representing farmsteads set within groups of paddocks are found across the chalk downs, several of which have been excavated (e.g. Itford Hill, East Sussex).

The Late Bronze Age (from *c.* 1,000 BC) saw further changes with the disappearance of the round barrow burial tradition, the development of a settlement pattern characterised by unenclosed settlements, the creation of major linear earthworks carving the landscape into territories (especially evident in the cross-ridge dykes found on the downland) and the appearance of large, defended enclosures (hillforts). More evidence of settlement in the lowland areas is apparent, particularly on the Sussex Coastal Plain, alongside hoards of metalwork indicative of burgeoning trade networks. Environmental evidence indicates that woodland clearance had reduced tree cover on the eastern Sussex Downs to a level very similar to that of the present day, replacing it with an intensive mixed agricultural system in which sheep were becoming increasingly important. This regime saw the development of large areas of regular planned field systems. The tree cover remained more extensive in the west due to the prevalence of poorer clay soils capping the chalk.

2.2.5. Iron Age (c. 600 BC-AD 43)

The Early and Middle Iron Age (up to *c.* 100 BC) saw a continuation of trends developed in the Late Bronze Age, with increasing numbers of open settlements and defended enclosures evident, the latter perhaps representing focal points for a number of different activities rather than purely acting as military citadels or refuges.

The Late Iron Age saw the abandonment of many of the hillforts, with a handful of major sites dominating the landscape (e.g. The Trundle and Cissbury Ring, West Sussex). These in turn fell out of use, to be replaced by large-scale open sites of high status in the lowlands, bounded by long stretches of ditches and banks called *oppida*, such as at Chichester (the Chichester Dykes). Increasing numbers of settlements are known from this period, including increasingly complex ditched enclosures and the distinctive 'banjo enclosures'. Increasing levels of trade with the Continent, both with native communities and with the expanding Roman Empire, brought a range of fine imports into the area, and the period saw the first evidence for centralized pottery production, including wheel-turned vessels based on the Greensand.

2.2.6. Romano-British (AD 43–c. AD 410)

The Roman invasion of AD 43 saw little immediate change to the landscape of the region. The military presence in the area was slight, and the local tribes were generally pro-Roman. The field systems, round houses and farmsteads of the ordinary population continued in use. The process of Romanisation manifested itself as a lifestyle 'package' further up the social scale, with elements of Roman and local British culture merging to form a comfortable Romano-British hybrid. This is evident in the landscape as a series of villas, rectangular multi-roomed buildings at the centre of large agricultural estates, of which there are a number positioned along the Greensand belt, notably at Eastbourne and Beddingham, together with a variety of other nucleated settlements of unclear character, such as the recent discoveries at Arlington and Wellingham. Many of the villa estates were positioned to exploit a number of different resource zones, and formed the basis of the later medieval manorial and parish systems. Smaller settlements, probably farmsteads, are evident across the Downs, such as Bullock Down to the east.

2.2.7. Early Medieval and Medieval (AD c. 410-1540)

The decline of Roman authority created a power vacuum in which the local Romanised elites competed for power. The chaotic situation coincided with movements of people from the Germanic lands to the east (modern Germany and Denmark), who were able to settle in increasing numbers along the eastern and southern seaboards of England. Sussex was settled by people of Saxon origin, initially on the downland block between the Ouse and Cuckmere rivers. Early Saxon settlements are rare, with most evidence for this period derived from cemeteries, although work at Chalton in Hampshire suggests that the earliest settlements were established on the upper reaches of the chalk dipslope, a situation replicated at Bishopstone in East Sussex. Recent excavation of the outer enclosure at Belle Tout to the east, thought to be an Iron Age defensive hillfort surrounding a Late Neolithic or Bronze Age enclosed settlement and an associated bowl barrow (Scheduled Monument 1002288), has produced a 6th-century date for the bank, although this is difficult to interpret and its context yet to be digested (*pers. comm.* Chris Greatorex). By the 9th century, the original settlements had been abandoned, or had shrunk to individual farmsteads, and new daughter settlements were established both in the valleys along the dipslope and as a string of villages along the Greensand, exploiting the spring line at the foot of the scarp slope. These villages were associated with an expanding system of common fields and had become identified as manorial centres by the time of the Domesday Survey in the late 11th century. From the late 10th century, these estates began to be formalised into a developing system of ecclesiastical parishes.

2.2.8. Post-Medieval (AD 1540–present)

The post-medieval period saw the emergence of a modern market economy. Major changes took place as a result of an increasing population and a more flexible land market, including the sale of former monastic land as a result of the Dissolution. The communal aspects of medieval agriculture began to be replaced by farms run by individuals. The eastern Downs were still largely based around sheep, although flocks were being reduced due to overgrazing. From 1650 onwards, the sheepwalks began to be ploughed up for arable cultivation. The 16th and 17th centuries saw the enclosure of large expanses of common woodland, denying the local communities their traditional rights of exploitation. Improved techniques of water management in the valley bottoms led to the development of water meadows. Most of the arable land had been enclosed piecemeal by the end of the 17th century, resulting in a distinctive landscape of small irregular fields. Many of the smaller farmsteads began to be amalgamated as landowners built up larger estates.

The later 18th century saw the development of 'New Farming'. This saw the heyday of the sheep-corn husbandry system, boosted by the buoyant economy resulting from the Napoleonic Wars. The eastern downs supported a vast sheep flock by 1813. The sheep were partly fed on new fodder crops, resulting in arable encroachment on the downland, and produced regular grid-pattern field systems bounded by hawthorn hedgerows. Much of the downland arable returned to pasture, often derelict, after

1815. A further period of prosperity followed in the 1840s, lasting for thirty years and often referred to as the period of High Farming. More downland disappeared under the plough, particularly on the areas of clay-with-flint.

The onset of the agricultural depression in the 1870s saw a decline in the importance of sheep on the downland. More downland was again lost to the plough, and small farms on marginal land were abandoned or downgraded to a cluster of farm buildings. Further areas of downland were lost to agriculture by the creation of golf courses such as Seaford Head, established in 1887, making it one of the oldest in England. Fortunes rose during the First World War, when home-grown food was required to replace foreign exports, but the inter-war period saw the onset of another period of depression. Descriptions of the Downs during the 1930s often refer to the derelict overgrown appearance of the land. Much of this land was again reclaimed and converted to arable during the Second World War.

In both world wars, the demands of military training became paramount and significant areas along the south coast were militarised and given over to training and defence.

The post-war period has seen the landscape of the South Downs transformed. Most of the remaining open downland, together with pre-existing enclosures, was ploughed and fenced-off to create vast 'prairie' fields. Extensive areas of archaeological features, surviving as earthworks, were destroyed by the plough. This situation is currently partly in reverse, with environmental and heritage-based grant schemes preserving surviving downland and restoring or sympathetically cultivating arable areas. Seaford Head is now used for agriculture, recreation and conservation.

3. PROJECT AIMS

The project aims were set out in the project design (ASE 2021b):

The primary aim of the project is to:

RA1: Develop and deliver an achievable, proportionate, and replicable methodology for the non-intrusive survey of a scheduled monument at risk from continued, rapid costal erosion.

In achieving RA1, a subset of subsidiary aims will be addressed:

RA2: Develop cost modelling guidance based on methodology in RA1 to help inform other heritage agencies and landowners across England on achievable approaches to coastal erosion and climate change where heritage is at significant risk;

RA3: Provide a modern baseline archaeological survey dataset for the nationally important Seaford Head scheduled ancient monument and a better understanding of its environs equally at risk from coastal erosion;

RA4: Detail information allowing for more effective management and understanding of the scheduled monument and threats to it;

RA5: Present a proposed scheme of investigation for ground-truthing identified features considered at risk;

RA6: Communicate the results to local residents and stakeholders and nationally as a methodology to address the rapid survey of heritage assets at risk from rapid coastal erosion.

4. METHODOLOGIES

4.1. Archaeological desk-based assessment and walkover survey

4.1.1. Methodology

The methodology used in the project was detailed in the project design prepared by ASE (2021b) and is as follows:

- Analysis of the East Sussex Historic Environment Record (ESHER) and other datasets such as the Defence of Britain Project and the National Heritage List;
- Review of aerial photographs, lidar and historic mapping to identify new data;
- Walkover survey;
- Analysis of existing archaeological and historical data to provide background context;
- Identify key archaeological features at risk from coastal erosion and other threats.

The results of the assessment and associated data searches are presented in text, gazetteer and map format. The report has been prepared in accordance with published professional standards (CIfA 2020a).

4.1.2. Locating previous excavations

The two previous excavations (Lane Fox 1877; Bedwin 1986) within the hillfort did not have accurate location data. Lane Fox's excavation plan was drawn on top of the recent First Edition Ordnance Survey (OS) mapping and showed the outline of the earthworks and clear breaks/features within them along with location of the Bronze Age tumulus. Bedwin's location only showed an outline version of the earthworks and cliff edge as it was in 1983, but still showed the tumulus and breaks/features in the earthworks. By scaling and triangulating known points (outline of earthworks, major breaks and tumulus location), the ASE drawing office was able to locate the position of the excavations in relation to the current site and cliff edge, as is shown in Figures 3, 23 and 24.

4.2. Lidar commentary

4.2.1. Introduction

The EA National Lidar Programme (online, acc. 2022) includes current and archival datasets with widespread detailed coverage, which facilitate comparisons over time. Lidar data is captured by the EA primarily for flood risk mapping, with high-risk areas prioritised. The historic archive of data therefore focuses on flood plains, urban areas and the coastal zone. The lidar data is only to 1m resolution so may not show fine topographic detail of archaeological features.

By establishing the topographic constraints and archaeological potential of the landscape at an early stage in the project, the extent of features visible on the surface

could be assessed prior to more detailed investigation in the field. This may therefore provide a means to rapidly assess sites with available lidar data for the presence of previously unrecorded archaeological features.

The site, and other coastal locations, present an opportunity to compare 2017 and 2020 datasets which are widely available across England. This section briefly outlines the usefulness of comparative datasets to evidence cliff loss/change.

4.2.2. Methodology

Both 1m Digital Surface Model (DSM) and Digital Terrain Model (DTM) datasets for the Seaford Head landscape were downloaded. The DTM dataset was selected for analysis and raster (.tif) files for the project were merged as a new mosaic raster in ArcGIS 10.8 software. For ease of method replication, 16-direction HillShade relief raster files were created for inspection (e.g. Figure 11) but were not subject to principal component analysis (PCA). As the primary purpose of the exercise was to produce an easily replicable and accessible method, HillShade files were simply stacked in the GIS and visually inspected.

Significant topographic targets were marked up for inspection in the field, as detailed in Section 2.7 below, and included the hillfort earthwork, lynchets to the north-west, the Bronze Age barrow, field systems to the east of the monument, elements of Second World War defence and training within the monument and evidence of prior archaeological investigation. However, the extent of golf course landscaping (manifesting both as a profusion of earthwork features such as tee platforms and bunkers and as a more general smoothing of the ground surface to create greens) and areas of dense scrub masked any other potential features.

To assess the value of comparing datasets, a number of different 3D analytical functions were trialled in ArcGIS 10.8. The most useful expression of change at the site comprised the creation of a new raster image which expressed the value differences in height. This is achievable in several ways, through an algebra expression in the Raster Calculator environment, the Minus tool, or through the ArcGIS Image Analysis window.

4.3. Geophysical survey

4.3.1. Introduction

Fluxgate gradiometer and earth resistance geophysical surveys were undertaken at Seaford Head hillfort as part of the project in order to map buried features within that landscape. The general aim of this programme of geophysical survey was to obtain a better understanding of the archaeological potential of the site and to make a rapid record of subsurface archaeological deposits at risk from continuing pressures from cliff retreat and climate change. Historical modification of the scheduled ancient monument due to being within a golf course is considered to be the main constraint in interpreting the results of the survey.

The results of this fieldwork will allow informed decisions to be made as to the need, nature and scope of any further investigations that might add value to the interpretation and understanding of the site. The surveys aimed to detect anomalies of possible archaeological origin within the boundaries of the survey area, though the features detected were naturally limited to those that produce a measurable response to the instrumentation used.

The British Geological Survey (BGS 2006; 2021) map the geology at the site as comprising chalk of the Newhaven and Seaford Members capped by a superficial deposit of clay-with-flints. The clay-with-flints represents a residual deposit 'formed from the dissolution, decalcification and cryoturbation of bedrock strata' and include various larger clasts deriving from both the chalk and Palaeogene formations; at Seaford Head, they are likely to be Lambeth Group deposits (BGS n.d.). The age of the clay-with-flints exposes it to many glacial cycles with the potential to deform both through periglacial processes, and continuing dissolution – the latter exposed in the cliff section at Seaford Head.

The overall site comprises an area of *c.* 4ha situated on Seaford Head, bounded on all sides by the rampart and ditch from the scheduled ancient monument. The ground conditions are managed by Seaford Head Golf Course and as such the area comprises a mixture of briar, developed grassland, fairways and greens. Infrastructure for the golf course tends to concentrate around tees and greens, though other installations were noted during the surveys. Landscaping was noted across the site, including bunkers and sculpted ground around the course. The coastal path is fenced along the cliff line with wire fencing, and Second World War installations remain visible at the eastern rampart.

The total areas surveyed comprise 3.97ha for the magnetic survey and 0.40ha for the earth resistance survey (Figure 13). The magnetic survey included all accessible areas within the hillfort and a small area traversing the eastern rampart and ditch to include some of the land to the east of the monument. Resistance surveys targeted the Bronze Age barrow in the northwest of the site, and two areas where magnetic survey had produced equivocal results.

The digital archive derived from this project is currently at the ASE Sussex office and will be either be submitted to the ADS as a standalone product or combined with any further archive generated in the event of future fieldwork.

4.3.2. Geophysical survey methodology

Fluxgate gradiometer (magnetometry) and earth resistance surveys were undertaken between Monday 15 September and Thursday 18 November 2021 in cold, overcast or clear, and windy conditions.

4.3.3. Applied geophysical instrumentation

The Fluxgate Gradiometer employed was the Bartington Instrumentation Grad 601-2. The Grad 601-2 has an internal memory and a data logger that store the survey

data. This data is downloaded into a PC and is then processed in a suitable software package.

Grids were set out using a Global Navigation Satellite System (GNSS) instrument (see below) using 30m by 30m grid squares. Each grid was surveyed with 1m traverses and samples were taken every 0.25m.

Data was collected along east-west traverses in a zigzag pattern beginning in the south-east corner of each grid, following the contours of the site.

The resistance survey was carried out using a twin probe array fitted with a Geoscan RM85 data logger. The twin probe array is popular within archaeology and combines convenience with ease of use. The two probes of the array had 0.5m spacing and were connected to two remote probes placed at least thirty times this distance from the array (15m). This is done to lessen the effect on the results of probe separation and to improve depth penetration (Clark 1996, 44). The penetration of the survey is dependent on the probe spacing, usually reaching a depth relative to half the probe space, in this case 0.25m. The grids utilised for the earth resistance survey overlay the 30m by 30m grids used for the magnetometry. Each grid was surveyed with 1m traverses and samples were taken every 1m.

The resistance survey uses an electric current to measure the relative water content of buried features. Features such as pits and ditches contain looser material than the surrounding geology and have an enhanced water-bearing capacity, allowing the current to pass through them more freely. These are measured as low resistance anomalies on the results. Stone and brick wall foundations prove a barrier to the electrical current and are shown as higher resistance anomalies (Gaffney and Gater 2003, 26). Resistance survey relies on detecting differences in water content between archaeological features and the surrounding geology and are ineffective in waterlogged or highly arid conditions. The international system (SI) unit of measurement for resistance is ohms.

4.3.4. Instrumentation used for setting out the survey grid

The survey grid for the site was geo-referenced using a Leica Viva SmartRover. The GNSS receiver collects satellite data to determine its position and uses the mobile phone networks to receive corrections, transmitting them to the RTK Rover via Bluetooth to provide a sub centimetre OS position and height. Each surveyed grid point has an OS position; therefore, the geophysical survey can be directly referenced to the OS National Grid.

4.3.5. Data processing

All the geophysical data processing was carried out using TerraSurveyor published by DW Consulting.

Magnetometry data was minimally processed and was produced using the following schedule of processing. Due to the very high positive readings of some of the magnetic disturbance, the values were replaced with a dummy value to avoid detrimentally

affecting the dataset when further processed. The first process carried out upon the data was to apply a DESPIKE to the data set which removes the random 'iron spikes' that occur within fluxgate gradiometer survey data. A ZERO MEDIAN TRAVERSE was then applied to survey data. This removes stripe effects within grids and ensures that the survey grid edges match. DESLOPE was used to remove effects from large magnetic interference from outside the site and DESTAGGER was used to remove walking pace errors.

Earth resistance data was processed with the following schedule of processing, a DESPIKE was used to remove any spurious readings. The next step was to pass the results through a HIGH PASS FILTER which removed any low frequency spatial data and then a LOW PASS FILTER was applied, removing high frequency spatial data and enhancing larger weak features.

4.3.6. Data presentation

Data is presented using images exported from TerraSurveyor into ArcGIS 10.8 software and inserted into the geo-referenced site grid. Data is presented as raw and processed data greyscale plots.

4.4. Topographic and photogrammetry survey

4.4.1. Introduction

All works were undertaken in accordance with HE *Metric Survey Specifications for Cultural Heritage* (2015b) and HE *Photogrammetric Applications for Cultural Heritage* (2017a).

4.4.2. Survey specification

The topographic survey was conducted by means of Total Station Theodolite (TST), GNSS and photogrammetric survey with images captured from a RPAS. This was georeferenced by establishing a series of stations (STNs) and ground control points (GCPs) using a Leica TST and GNSS (see section below for details).

All work was conducted in the OS National Grid, with heights calculated as distance above Ordnance Datum (Newlyn) as defined by OSGM15 and OSTN15.

Stations (STNs) and ground control points (GCPs) were located using a Real Time Kinematic (RTK) Global Navigational Satellite System that provides an accuracy of +/-20mm in accordance with metric survey specifications laid down by Historic England (2015).

The metric survey was provided on site by a Leica Captivate Differential Global Navigation Satellite System (dGNSS) survey grade equipment that will work to an accuracy of typically +/-10mm plan accuracy and a +/-20mm height accuracy, although this can be increased when using it to set out control points. A Leica TS16 TST was used to survey the monument. The TS16 has a 1mm +1.5 ppm error when measuring to a prism (standard speed measurement) and a 5" Hz and V angle

measurement error. The TST was used to survey the area inside the earthworks while the GNSS was used for difficult to access areas (e.g. vegetation, obstructions).

The photogrammetric survey was completed achieving an image ground sampling distance of <30mm/px. This is described by HE guidance as being suitable for a reproduction scale of 1:200 or larger (2015b). This reproduction scale provides for the creation of a site plan at level of detail equivalent to Level 3 survey as stated in the HE *Guidance for Understanding the Archaeology of Landscapes* (2017b).

In total 2,141 images were taken and processed into a 3D point cloud and mesh, which was then exported as a DEM, 3D model and orthomosaic image. This revealed the form and extent of the monument along with known and possible new archaeological features. An archaeological interpretation was produced in the form of a contour and hachure plan.

Processing of the survey instrument survey data was undertaken using the Leica Infinity software (version 2.4.1) while processing of the photogrammetry data was done using the latest version of the Agisoft Metashape Professional Software (version 1.7.3).

4.4.3. Instrument specification

The terrestrial survey was undertaken with a Leica Captivate SmartRover GNSS and a Leica Captivate TS16 TST. The GNSS system was used to record all STNs and GCPs and was set to a minimum three-dimensional accuracy of 20mm.

The photogrammetric survey was undertaken with a DJI Mavic 2 Pro equipped with a 20 megapixel Hasselblad L1D-20c camera. The RPAS flew at a height of 40m over the monument and 80m over the sea when in proximity to the cliffs. This enabled features to be recorded to a GSD of <20mm/px.

4.4.4. Collection of data

Prior to the terrestrial and photogrammetric survey commencing, five STNs and 21 GCPs were established with a dGNSS instrument mounted on a tripod. They were established around the perimeter of the site. The DJI Mavic 2 Pro was flown at a height of 40m above the monument. This enabled the survey to achieve an approximate 20mm/px ground sample distance (GSD). Multiple flights were required to cover the entire site including the cliffs. In total, the RPAS conducted six separate flights totalling 102 minutes of survey time. Preliminary aerial photogrammetry survey results were used to inform the topographic survey using a Leica dGNSS and TST.

Using a Leica TST, elevations (spot heights) were taken at 5-metre intervals across the entirety of the surveyed area apart from those locations where vegetation blocked line of sight. Additional readings were taken across the monument recording changes in elevation, breaks of slope, banks, ditches, mounds, street furniture, modern intrusions and pathways. Readings from a Leica dGNSS were taken outside the monument and in particular the areas immediately outside the earthworks.

4.4.5. Data processing

The data collected from the aerial survey was processed using Agisoft Metashape. The project was divided into two parts, the main monument and the cliffs, to minimise processing time. All photographs were aligned to generate 3D sparse clouds, then GCPs were added manually to geolocate the model to an accuracy of <20mm. Following this, the model was further processed into 3D dense cloud and mesh that was used to generate a Digital Elevation Model (DEM).

The data gathered from dGNSS and TST were processed using Leica Infinity. Every daily survey job was processed separately and was exported as a shape file. All survey results were recorded to an accuracy of <20mm. All daily jobs were imported into AutoCAD Map 3D 2019 for final draughting and presentation combining them with the aerial survey orthophoto and DEM.

4.5. Public outreach and press

4.5.1. Introduction

Informing the public of archaeological findings is one of the ways in which public benefit can begin to be realised from archaeological investigation (online CIfA Public Benefit statement 2022; Southport Group 2011). For the Seaford Head project, it was particularly important to be able to communicate that heritage is potentially being lost at a site level and nationally, and to begin to identify and support an engaged community in any future projects.

The programme of outreach undertaken as part of the Seaford Head project was entirely digital. This methodology was developed particularly with the limited budget available and the rapid nature of the survey in mind, which was not suitable for volunteers or site visits during investigations. It was made possible by funding contributions from the SDNPA.

In this section, the aims of the outreach strategy are given, the methods by which various elements and assets were created detailed, and the resulting products evaluated against the aims. Recommendations are given based on the experience of this project and depending on the scope of any future project and skill set within its project team. It is argued that some form of outreach is essential on similar projects, although the scope of this will depend on the specific aims and resources available. Not all outreach elements employed for the Seaford Head project are recommended for future projects and explanations are given below.

4.5.2. Aims

The aims and objectives set for the programme of outreach were limited by the non-interactive scope of current project and the passive nature of the outreach assets created. The aims were as follows:

- To disseminate the methodology and results of the project and the issues raised at the site and nationally to the heritage community and a local and national public audience;

- To inform the public in the management and future of Seaford Head and begin to establish whether there is a public need for future work on the site;

- To evaluate the project's methodology in terms of time, budget and reach, so appropriate public engagement could be factored into future projects using a similar model to Seaford Head.

4.5.3. Audience

At this preliminary stage the audiences we aimed to reach were broad and non-specific but could be separated into two main categories – local and non-local.

The local community includes audiences living nearby and using the site. Using Wessex Archaeology's Audience Segmentation Model (2021, 7), this includes all audiences, although it should be noted that we did not specifically target those that are typically hard-to-reach, could not access the site or were less aware of archaeological or historic sites. For the project, it was assumed that there was generally a low local understanding of the archaeology of Seaford Head. People are often unaware of what archaeology exists on a site, especially if it comprises only below ground archaeology and/or earthworks and is not adequately communicated on site via resources such as information boards and signage, as is the case at Seaford Head. The project is also not aware of any public archaeology project communicating the nature of the site to local people in recent years or a programme in schools.

The non-local audience largely comprises Archaeology Aware individuals, which can include heritage professionals and academics, and non-professional adult and young archaeological enthusiasts (Wessex Archaeology 2021). These are the people most likely to follow our social media channels. To a lesser extent, we hoped to reach Archaeology Unaware adults – those people that might be culturally aware but not currently engaging with archaeology or landscape heritage (ibid.). Our primary aim for non-local audiences was to raise the national issue of climate change-accelerated heritage loss, start a conversation within the heritage sector and communities with at-risk heritage and promote the project as a replicable case study.

4.5.4. Methods

The programme comprised three main elements – press releases, digital assets and social media.

Press releases were written in collaboration with project partners and then edited by the UCL Media Relations team. Multiple drafts were circulated before a final version was agreed upon that satisfied project partners and was most likely to appeal to press outlets. The final draft was circulated under embargo to press outlets, and journalist

requests managed by the UCL Media Relations team. This included a filmed news item broadcast on BBC South East.

The digital assets included three videos recorded and produced by videographer Chip Phillips, and a podcast produced in-house.

Preparation for the videos was led by the SDNPA. It involved meetings with project partners to establish content, format and tone. For the *If You Can Imagine* spoken word performance, ASE archaeologists met with the artist Alinah Azadeh to discuss the results of the project and themes in British prehistory to inform her creative process. Content was recorded by Chip Phillips then drafts of videos were checked by project partners and suggestions made for improvements. A particularly notable example was a change requested in the background music to something more inquisitive and light-hearted, as the original gave the impression of quiet despair when paired with the subject of heritage loss.

The production of the podcast episode was led by ASE as it was to be released as part of our already established Digs Deeper podcast (see online references). Participants were identified to give a mix of different heritage perspectives. This included project partners Anooshka Rawden (SDNPA), Adam Chugg (STC), and Jon Sygrave and Emily Johnson (ASE). Two further guests external to the project were invited, Tom Dommett (National Trust) and Hannah Fluck (then of Historic England). Meetings and correspondence between these six participants identified points for discussion and podcast recording protocol, and then the episode was recorded on Zoom. It was edited in-house by ASE and the final version transcribed to increase accessibility. The edited conversation was used by Chip Phillips to make a teaser video for YouTube featuring some of the main discussion points, which linked to the full podcast episode.

Social media was used throughout the duration of the project to promote the press releases and digital assets. It has also been used for reaction to more ad-hoc content, for example the shortlisting of the project for an Archaeological Achievement Award. The platforms used aimed to target a wide range of social media users and included Facebook, Instagram, Twitter and LinkedIn. An informal social media strategy was developed, comprising a hashtag (#SeafordHeadProject) and establishing partner account handles to facilitate amplification of content across our combined audiences.

5. RESULTS

5.1. Archaeological desk-based assessment and walkover survey

5.1.1. Landscape character

The assessment areas lie within a character area (landscape type) defined in the South Downs National Park Landscape Character Assessment as Open Downland (SDNPA 2020). This character area comprises an open elevated landscape of chalk hills and ridges separated by sinuous dry valleys and scarp slopes. The historic landscape of this character area comprises:

- Large arable fields created in the 20th century from open sheep walk;
- Good preservation of archaeological monuments, notably Bronze Age barrows, field systems, Iron Age hillforts and trackways;
- Scattered settlement pattern of relatively late (18th to 19th century) date.

The Sussex Historic Landscape Character database, curated by the East Sussex Historic Environment Record office (ESHER), identifies the following historic character areas:

- HES10311 – Military/Ancient (Hillfort)/Prehistoric;
- HES10312 – Recreation/Golf Courses;
- HES10313 – Coastal/Cliffs and Beaches;
- HES10314 – Unimproved/Unenclosed/Downland/Medieval;
- HES10315 – Woodland/Regenerated/1845–2010;
- HES10329 – Unimproved/Unenclosed/Downland/Medieval.

5.1.2. Archaeological and historical background – site-specific

A search was made of the NHLE and the ESHER to identify heritage assets located within the 500m study area, excluding the built-up area of Seaford (Figure 3, specific sites referenced by number in bold).

Designated heritage assets

Scheduled Monument (SM)
Hillfort and a bowl barrow on Seaford Head (NHLE Ref. 1014523/ESHER Ref. DES8157; *see* Figure 2).

Non-designated heritage assets

Archaeological Notification Area (ANA)
Seaford Head: prehistoric and Roman sites (ANA338; *see* Figure 2).

Previous archaeological work

The following list summarises all known archaeological work that has taken place within the assessment area or immediately adjacent with their associated ESHER event record number:

1868
John Price (Figure 3, 6)
NGR 549200 098500
Price 1882
Excavation at The Goar/Gore. A supposed tumulus was opened, just above Green Street and to the E of the old cottage. Some trenches were made near it, but with the exception of fragments of Roman pottery and flint flakes, nothing was found (EES9317).

1876
Augustus Lane Fox (Figures 3, 6, 23 and 24)
NGR 549500 097840
Lane Fox 1877
Excavation at Burdyke Hill, Seaford Head. Two broad trenches were excavated within the hillfort, one through the ditch and one through the rampart; in the former, Romano-British pottery sherds and other evidence of RB occupation were found 1.2m above the undisturbed chalk, but nothing below this level, in the latter nothing was found except two flakes (EES9323).

1876
Augustus Lane Fox (Figures 3, 6, 23 and 24)
NGR 549419 097889
Lane Fox 1877
Excavation on the bowl barrow on Seaford Head. Two holes, each 0.3m in diameter and 0.3m deep were found below natural ground level near the centre of the barrow. They contained pottery fragments, broken and polished flint 'celts' (axeheads), flint saws and some charcoal. Other flints, including a barbed and tanged arrowhead were found in other parts of the barrow. There was no trace of a burial (EES9324).

1876
F.G. Hilton Price and John Price
NGR 549501 098473
Price 1882
Excavations within a Romano-British cemetery at The Warren, on the golf course north of the assessment area (EES9317).

1982-1983
UCL Institute of Archaeology (Paul Garwood)
NGR 554760 107050
Garwood 1985
The Cuckmere Valley Project was a multi-period research project designed to study interrelations between environment and culture over time in a regional context. In total, 354ha were field-walked intensively and 38 sites were located or defined (EES17819).

1983
UCL Institute of Archaeology (Owen Bedwin) (Figures 3, 23 and 24)
Bedwin 1986
Trial excavations through the defences of Seaford Head hillfort established a likely Early Iron Age date for its construction. A section through the rampart revealed post-holes at the front – an indication of wooden revetting. Beneath the rampart was a well-defined buried soil, analysis of which showed clear evidence of tillage immediately prior to the hillfort's construction.

Figure 3: HER data and mapped historic features, contains OS data © Crown copyright [and database right] [2021].

2010
Chris Butler Archaeological Services
NGR 549160 098240
Butler 2010
An archaeological desk-based assessment carried out Seaford Head Golf Club in connection with an application for the building of a new club house, improved car parking and other groundworks at the site. The desk-based assessment has established that there is evidence for activity in the immediate area of the site from the Mesolithic through to the Roman period (EES14962).

2012
Wessex Archaeology
Wessex Archaeology 2013
South East Rapid Coastal Zone Assessment Survey, East Sussex Coastal (EES18634).

2013
Historic England
Carpenter, Barber and Small 2013
A survey was carried out to interpret, transcribe and record all archaeological features visible on aerial photographs and lidar for that part of the South Downs that lies within East Sussex. The survey was one of three projects by Historic England designed to characterise the historic environment in sample areas of the South Downs National Park; the survey also stood in as the aerial photographic component of the South East Rapid Coastal Zone Assessment Survey (Skinner 2011) for the stretch of coastline from Beachy Head west to the Sussex Ouse. Key features transcribed in and around Seaford Head included prehistoric field systems, the hillfort, a First World War army camp (South Camp) and Second World War defences. In addition to the published overview report, the detailed mapping is available to view at https://historicengland.org.uk/research/results/aerial-archaeology-mapping-explorer/.

2015
Archaeology South-East
NGR 549160 098500
Blinkhorn 2015
An archaeological watching brief at Florence House, Seaford in advance of the construction of an extension uncovered a small number of features cutting the Palaeogene sands. These comprised three linear features, presumed to be small ditches, although finds (burnt flint) were only recovered from one of these. A small assemblage of lithics was also recovered, mostly deriving from the surface of the Palaeogene sands, but also from the topsoil and subsoil. A number of these indicate earlier (Terminal Palaeolithic – Mesolithic) activity in the vicinity, although the majority are more broadly attributable to the Mesolithic and Early Bronze Age. The presence of this not demonstrably in situ lithic assemblage is suggestive of a localised concentration of archaeological material. Other finds of interest comprise a post-medieval clay tobacco pipe bowl and, more significantly, a sherd of Anglo Saxon pottery – a rare discovery in Seaford (EES17180).

2017
Archaeology Services Lewes
NGR 549000 098260
Fisher 2017
Watching brief on a small domestic rear extension at Hawksdene, Maurice Road, near Seaford Head, East Sussex. The trenches contained no archaeological features of any great age. The nature of the colluvial layers would suggest a natural downslope creep of subsoil which contained some prehistoric flintwork, as well as an abraded sherd from a Bronze Age collared urn, although these were mixed chronologically and not in situ. It was also noted that a large percentage of natural weathered flint was present, indicating a mixed and reworked soil (EES18215).

2019
Oxford Archaeology
Malone 2019
Archaeology on the Edge, a desk-based assessment study identifying heritage assets at risk from coastal erosion along the East Sussex Heritage Coast, including Seaford Head (EES19124).

5.1.3. Summary of historic land use specific to the site

Approximate locations of previous excavations and mapped archaeological features are found in Figure 3, relevant numbers in bold below.

Palaeolithic (c. 500,000 BC–c. 10,000 BC)

Palaeolithic records from the assessment area are generally limited to poorly provenanced findspots of individual hand axes, probably found on the clay-with-flint (**1** and **2**), with some undiagnostic pieces of late palaeolithic date recovered during a watching brief at Florence House (**3**).

Mesolithic (c. 10,000 BC–c.4,300 BC)

Mesolithic evidence within the property is restricted to artefacts, generally flintwork found during archaeological work (**3**, **5** and **6**) including fieldwalking **4**), with no clear evidence for activity or occupation. Nothing of this date was visible during the walkover as the area is now under grass, with just a few small and localised areas of bare ground caused by stock poaching.

Neolithic (c. 4,300 BC–c. 3,000 BC)

Evidence for Neolithic activity within the assessment area is generally restricted to artefacts, found during archaeological work (**3**, **5** and **6**) or as scatters of flintwork during fieldwalking exercises, predominantly in the large field south of South Barn which was formerly under arable cultivation (**4**, **8** and **9**). Some of these flint scatters may represent settlement or other activity sites, representing a shift of settlement away from the river valleys onto the higher, drier soils (Drewett 2003), although no clear evidence for clustering is recorded. A further record relates to a polished flint

axe found at the foot of the cliffs following a collapse in 1993 (7) – the original context this derived from is unknown.

Bronze Age (c. 3,000 BC–c. 600 BC)

There is significant evidence for Bronze Age activity across the assessment area. The monuments fall into two main categories: round barrow(s) and field systems.

Round barrows (Plates 1 and 2)

A bowl barrow is recorded just inside the northern rampart of the Seaford Head enclosure (10), measuring *c.* 18m in diameter and 0.5m high. It was excavated by Augustus Lane Fox (later Pitt-Rivers) in 1876, and originally thought to be a defensive feature controlling an entrance through the enclosure rampart, which he considered to be Roman (Lane Fox 1877). He noted an existing depression in the top, suggesting an earlier undocumented disturbance, and excavated a trench 18 feet (*c.* 5.4m wide) across its length (Figure 6). The mound was not made of chalk, but redeposited clay-with-flint ('tertiary deposit') and topsoil. A sherd of 'British' pottery and a flint scraper were recovered from the body of the mound, and two pits (each *c.* 0.3m in diameter and depth) were found cut into the ground below containing 'British' pottery and broken flint 'celts', presumably flint axe heads, some of which were polished. The mound is very low and not obvious as an archaeological feature and has now been disturbed by a golf (sand) bunker dug into its southern edge.

A second barrow is thought to have existed at The Gore (Florence House) (6), which was excavated in 1868, although no details survive of this work other than the discovery of Roman pottery and a few 'flint flakes'. It is possible that further examples existed, as barrows are often found in cemeteries; the extensive landscaping for the golf course may have masked or destroyed ephemeral barrow mounds, although it is notable that Lane Fox did not identify any during his work that predated the golf course. However, it is unknown what may have been destroyed coastal erosion without record.

Often these sites (where they prove to be genuinely prehistoric) have no evidence for any actual burials, either because the bone has not survived or the burial is not found. Such was the case with the Seaford Head barrow, which blurs the line where a barrow, popularly regarded as a burial monument, becomes a ceremonial enclosure. David Field has interpreted the dense distribution of barrows across the chalk as representing a huge sacred landscape forming a transition 'between the worlds of everyday social activity to the south [the coastal plain and river valleys], and the natural, 'wild' expanse of the Weald to the north' (Field in Garwood 2003, 57).

Field Systems (Plates 3-7)

Two lynchets are visible running along the contour on the steep western slope below the enclosure (34), and the HER records several more to the north. These are undated, but probably contemporary with a series of lynchets forming a field system in Hope Bottom, just east of the assessment area (11), which lidar and the HE 'Aerial Archaeology Mapping Explorer' show to extend into the field south of South Barn as

barely visible ephemeral linear features. Despite their potential size – up to 6m high in some places, such as Salisbury Plain (McOmish et al. 2002) – lynchets were not deliberately created as engineered terracing, rather they are formed by soil creep downslope caused by years of ploughing. The soil gradually works its way down the slope until it accumulates against a boundary feature to form a positive lynchet (derived from the Old English for 'ridge'). The lynchets were used as part of a mixed farming regime, primarily under arable cultivation but with periods of lying fallow and being used for pasture.

Field systems are common on the chalklands, although most examples have been damaged or destroyed by ploughing, with examples like this surviving due to the steepness of the terrain. Holleyman recorded large expanses in the 1930s on the downland above Brighton, most of which are no longer visible as earthworks (Holleyman 1935). The field systems can stretch over large areas, with blocks covering from 1 to 15 sq. km. and may have been constructed as one huge operation or in successive blocks, either by individual communities or as a community enterprise (McOmish et al. 2002). They are often associated with circular platforms interpreted as settlement sites, although none are known within the assessment area.

Dating of field systems is problematic, particularly as few have been examined archaeologically. Drewett (1982) has drawn attention to the problems; dateable material is often in the form of pottery derived from farmyard middens and brought onto the fields during episodes of manuring. This may not be necessary until the existing fertility of the soil within the fields has declined to a point where manuring is required, consequently dating material found in the lynchets may not relate to the earlier phases of use (and may also incorporate earlier material already present in the soil when the lynchets began to form). As a general guide, field systems of this type are usually dated to the Late Bronze Age, Iron Age and Romano-British periods, although fields from particular periods are difficult to distinguish on morphological grounds. Many systems appear to have originated in the Middle or Late Bronze Age, although Early Bronze Age cultivation has been recorded in Wiltshire (McOmish et al. 2002), but fell out of use in the Iron Age and were replaced by different agricultural systems. They were then re-established in the Late Iron Age and Romano-British periods (Bradley and Yates 2007). Individual systems can be short or long-lived.

Specific sites have produced dates across the range; a sectioned lynchet at Bullock Farm produced two phases, Late Bronze Age/Early Iron Age and Romano-British, while an undamaged lynchet at Halnaker Hill produced pottery of Late Bronze Age/Early Iron Age date. Lynchets at Eastwick Barn on the Brighton Bypass appear to have formed in the Early Iron Age, but were soon abandoned, only to be re-used in the Romano-British period with some modifications (Barber et al. 2002) – interestingly, the lynchets produced no evidence for deliberate marking out features beneath them; several flint banks were uncovered but were interpreted as clearance features.

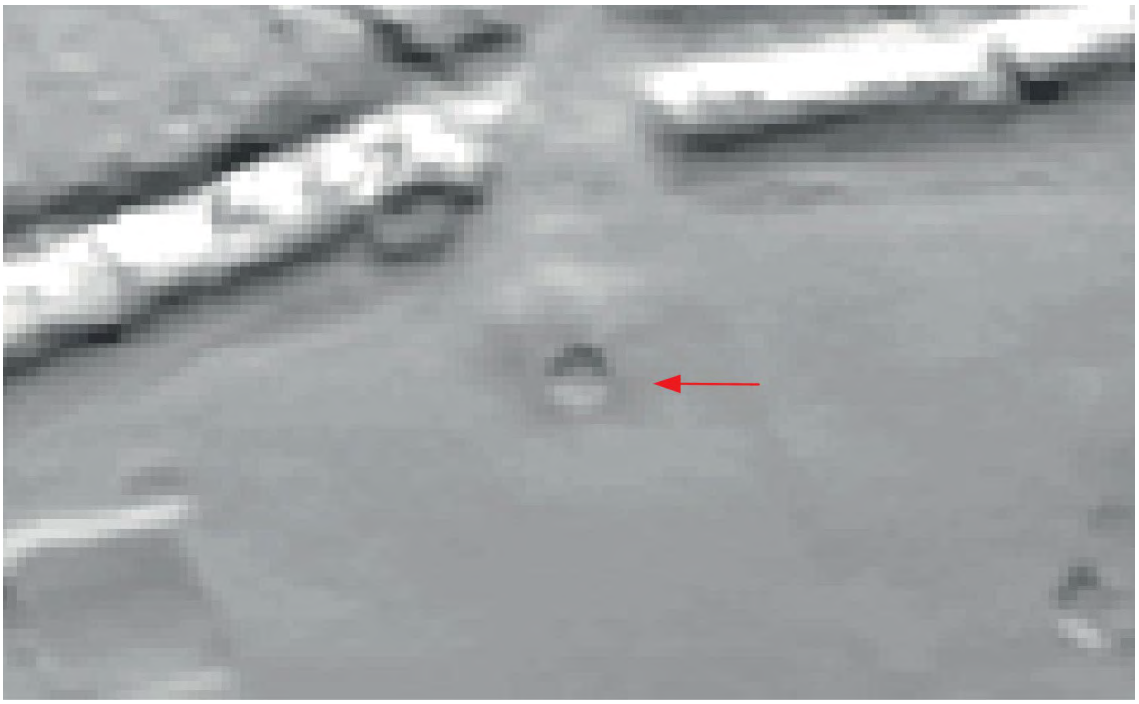

Plate 1: Lidar extract showing barrow (10) just inside the hillfort defences (other features are golf related). © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

Plate 2: Barrow (10) with the rampart to the left, looking east.

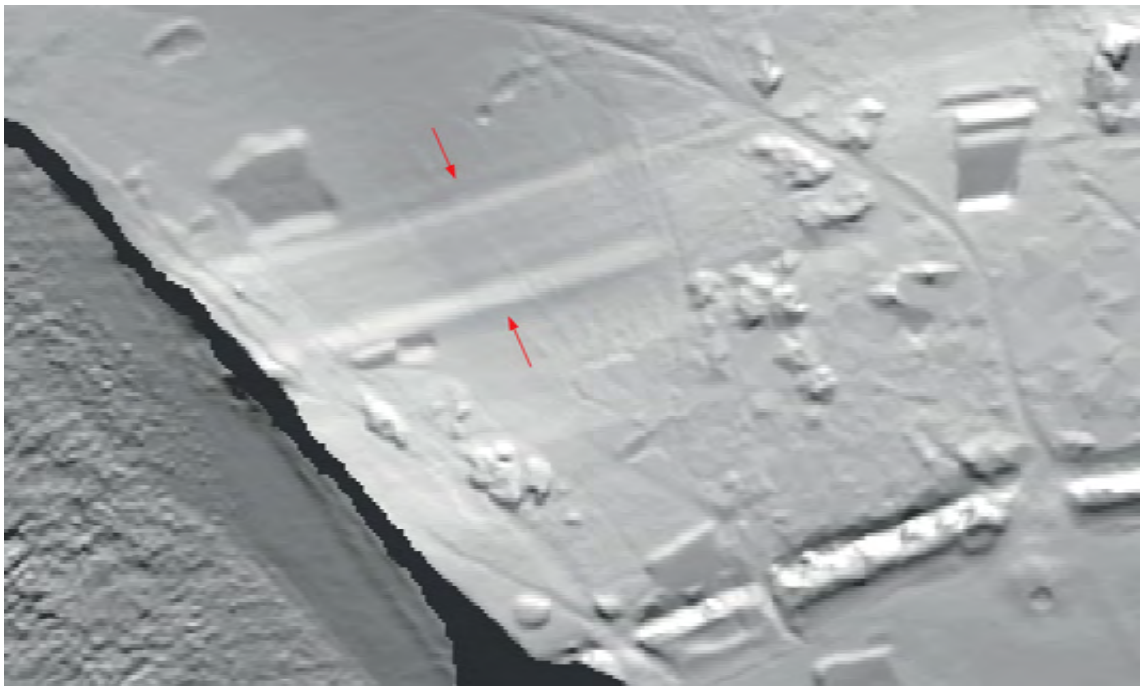

Plate 3: Lynchets (34) on west side of the hillfort, below the rampart and ditch (all other features are golf related or scrub). © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

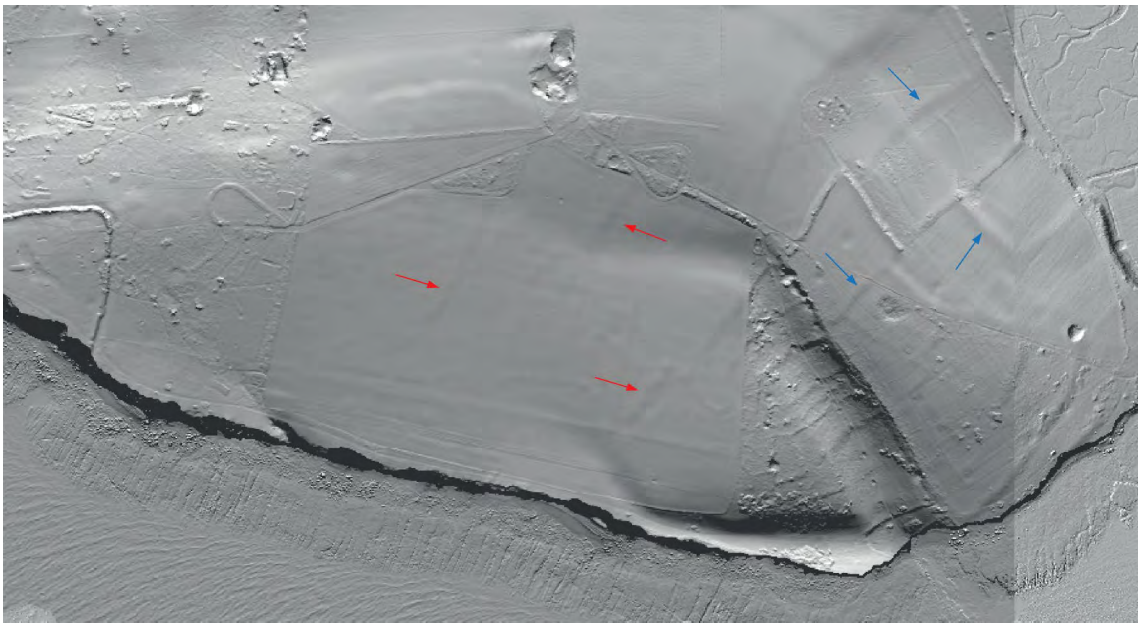

Plate 4: Field system south of South Barn (red arrows), extending from Hope Bottom (11) (blue arrows). © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

Plate 5: Lynchets (34) looking north-east.

Plate 6: Lynchets (34) looking south-east.

Plate 7: Lynchet forming part of field system (11), looking north-west.

Iron Age (c. 600 BC–AD 43)

Seaford Head hillfort (Plates 8-11)

The hilltop on Seaford Head is crowned by a triangular earthwork enclosure, with the northern and eastern sides defined by univallate defences of a single rampart and external ditch and the southern by the actively eroding cliff edge, enclosing approximately four hectares (12). Two breaches/gaps in the northern rampart and one in the eastern may be original entrances, although additional disturbance has occurred from golf landscaping and modern military activity (*see* Pl. 8 where the blue arrow marks where a golf fairway breaches the rampart). The original size and shape of the fort is unknown as early maps indicate a shape similar to the present outline. Augustus Lane Fox examined the enclosure in 1876 and considered it to be Roman due to its shape, as he thought it was too geometric to be of local construction. He subsequently decided it was 'British' following his excavations.

Lane Fox excavated a single trench across the defences '30 yards [*c.* 27m]' from the contemporary cliff edge, measuring 20ft (*c.* 6m) in length and 17in. (*c.* 0.43m wide (Lane Fox 1877, 294). The ditch was 7ft (*c.* 2.1m) deep and primarily filled with 4ft (*c.* 1.2m) of chalk rubble containing no artefacts beneath a layer of 'mould' (dark fill with organic content) containing Roman pottery in the lower 2ft (*c.* 0.6m) and medieval pottery and clay pipe in the upper foot (*c.* 0.3m). The section through the rampart found no artefacts other than a handful of flint flakes which he felt were probably residual ('accidental').

Further excavations took place in 1983 (Bedwin 1986 – *see* Figures 3, 23 and 24 for an approximate location of Lane Fox and Bedwin's trenches). One trench (Trench A) was excavated across the rampart and ditch immediately south of the existing south-eastern gap, with a second trench (Trench B) examining the external ditch just north of the western gap. The former is still visible as a linear depression in the rampart *c.* 1m from the cliff edge (Pl. 8). The ditch was found to be wide and flat-bottomed, 1.8-2m deep, with a low counterscarp bank and contained sherds of flint-gritted pottery dated to the early Iron Age (although subsequently suggested to be of Late Bronze Age date – Hamilton and Manley 1997). The rampart comprised a succession of dump deposits producing no clearly dateable artefacts, and a series of postholes were interpreted as evidence for a timber revetment on its external edge. The stratigraphy in Trench A, and later soil analysis by Dr R. MacPhail, showed that the rampart had been constructed on top of ground, 'with clear evidence of tillage right up to the point of hill fort construction' (Bedwin 1986, 31). This was the first time that such an association had been made and evidences the cultivation of a poor soil, derived from clay-with-flints (Bedwin 1986, 31).

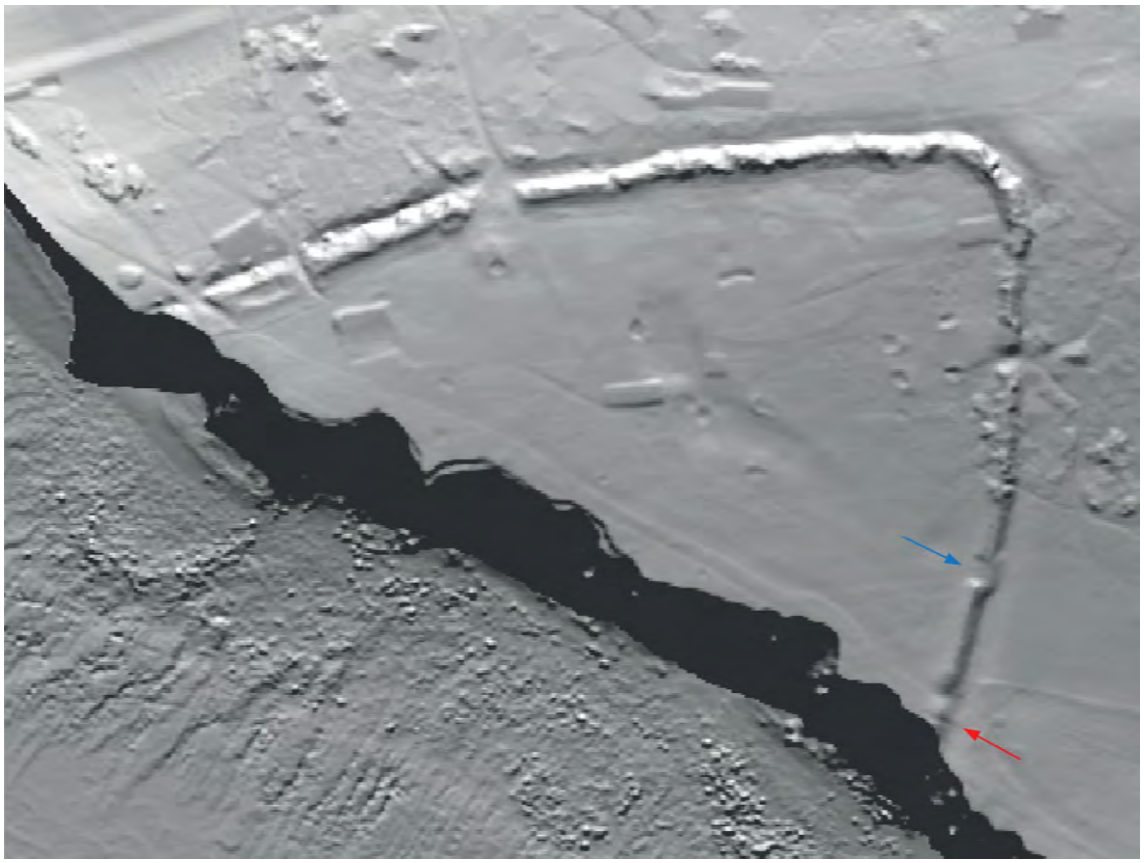

Plate 8: Hillfort (12). Bedwin's Trench A across the rampart on the cliff edge shown by red arrow; golf fairway shown by blue arrow. © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

Plate 9: Hillfort (12), south end of the eastern defences, looking north towards golf green.

Plate 10: Hillfort (12), west end of northern rampart looking east.

Plate 11: Hillfort (12), south-east end showing Bedwin's Trench A, looking west.

In terms of landscape context, it appears that Seaford Head has always been a coastal site; assessments of the marine topography have indicated that the seabed between Peacehaven and Eastbourne dives steeply downwards just a kilometre offshore to form a massive cliff over 30m in height. This strongly suggests that this was the extent of the coastline at the time of the hillfort construction and that the current rapid rate of cliff erosion is relatively recent (Greatorex 2001). This theory has recently been tested and supported by work based on the analysis of Beryllium-10 (10Be), which suggested erosion rates of less than 60mm per year until relatively recently (Hurst et al. 2016). Whatever its context, it is likely to have acted as a focal point for prehistoric communities in the area.

Romano-British (AD 43–c. AD 410)

Roman activity on Seaford Head is attested by finds of Roman pottery by both Lane Fox and Bedwin during their excavations within the enclosure (**14**), the context of which is unknown. However, the presence of a cemetery on the golf course just north of the assessment area and the likely continuity of use of the lynchet field systems into this period suggests a settlement site located in the wider area, though probably not on the higher plateau. A more unusual find was a gold medal issued in honour of Antonia, daughter of the triumvir Marcus Antonius, found in the shingle at the base of the cliffs in 1882 (**13**), presumably a casual loss eroded from the cliff top.

Early Medieval and Medieval (AD c. 410–1540)

Archaeological evidence for the pre-Conquest period is limited to a single sherd of grass- and quartz-tempered pottery of probable 6th- to 7th-century date found in a watching brief at Florence House (**15**).

The assessment area appears to have been within the manor of Chyngton, an estate granted to Michelham Priory by its founder, Gilbert de Aquila, in the early 13th century, although the placename is first attested in 1180 (Bannister 1999; Glover 1975). The manor was centred on the existing Chington Farm to the north of the assessment area, set within its open arable fields (laines) with marshland pasture down in the Cuckmere valley and Seaford Head used as upland sheepwalk (Bannister 1999). Recent excavations on the outer enclosure at Belle Tout, thought to be Iron Age in date, have provided a medieval/early post-medieval date, and it is likely that these enclosures can be interpreted as sheep pens/stock enclosures, originally suggested by Herbert Toms in the early 20th century (pers. comm. Chris Greatorex). It is possible, therefore, that the hillfort at Seaford Head was used in a similar manner at this time.

The only clear medieval evidence within the assessment area are two sherds of 12th- to 14th-century pottery found during a watching brief near the golf clubhouse (**16**).

Post-Medieval Period (AD 1540–present) (Plates 12-20)

While the post-medieval period was a more peaceful time than in earlier centuries when nearby Seaford was destroyed several times by French raids, external threats

prompted the establishment of two beacon sites on the top of Seaford Head from at least the 16th century, one within the fort (18) and one to the north-east (17). A watch house is also recorded in the 17th century (19), possibly associated with the beacons which had to be continuously manned during times of alert; they were replaced in 1795 by an admiralty signal station (Butler 2007). A lime kiln is also recorded at that time (20), presumably dug into the steep northern slope; the context is unclear given the remote location, but perhaps it was intended to provide lime for dressing the acidic Clay-with-Flint subsoil rather than supplying building lime to Seaford. Several chalk pits scattered around the assessment area, probably of 19th-century date, may be considered in a similar light (22 and 23).

Two large military camps were established east of Seaford during the First World War, with the South Camp located just north of the assessment area (25). Two areas of crenelated trenching in Hope Gap are likely to be associated training features, and others may exist unrecognised under scrub (26).

The coastal strip at Cuckmere Haven contains an almost intact system of anti-invasion defences, and Seaford Head was used for training tank crews during the Second World War with a network of concrete 'tank roads', many of which still survive (27, 31). The range itself (28) was made up of a series of trenches containing moving targets, all of which have been backfilled and are no longer visible due to post-war ploughing. A control room was located on the cliff at the south-eastern edge of the assessment area (29), this is still visible as a partly buried concrete bunker accessed by two opposed entrances protected by a blast wall (Pl. 12 - blue arrow). A further concrete structure was built into the north-eastern corner of the hillfort ditch (32 – not evident on lidar due to the extent of scrub) and appears to have housed equipment, possibly a powerhouse for a gun control radar for the heavy anti-aircraft battery that was located on the golf course but removed in 2004, or it may have housed the generator associated with the larger radar powerhouse (a similar building was recorded at Brancaster, Sins 2011). An associated concrete slab with holdfasts is situated immediately inside the rampart, and the radar itself is believed to have been under the modern civil aviation navigation beacon. A rectangular terrace just outside the south-eastern entrance of the hillfort (Pl. 12 - yellow arrow) formerly held an associated military hut; its 11m by 6m size would fit a standard Nissen hut (37). The radar site was protected by lines of barbed wire defences, plotted by the HER and HE from aerial photographs (ESHER MES23752; HE Aerial Archaeology Mapping Explorer), but with no surviving physical elements (30). Further defensive features may exist in the form of shallow linear gullies located to the east and north of the hillfort (33) – these are interpreted as possible anti-landing trenches. This is plausible, as one of the key elements of the opening stages of the German invasion plan for Britain (Operation Sealion) was to use airborne troops (paratroopers and glider-borne infantry) to capture the downland behind the proposed invasion beaches. However, the system is far less regular and extensive than known systems elsewhere (e.g. Itford Hill south of Lewes and Ladies Mile in Brighton), perhaps due to the presence of the tank training areas and the hillfort would have been an obstacle in its own right; though the standard Luftwaffe troop-carrier, the DFS230, was much smaller than Allied gliders, carrying only 9 soldiers, and could land within just 20m of its target. Further wartime features not on the HER have been plotted by Historic England from air photographic evidence (HE Aerial Archaeology Mapping Explorer),

these comprise mostly areas of wire fencing but include ditches along the cliff edge now lost to erosion and former anti-glider ditches subsequently backfilled and obscured under the extensive scrub that lies east of the hillfort (Figure 3).

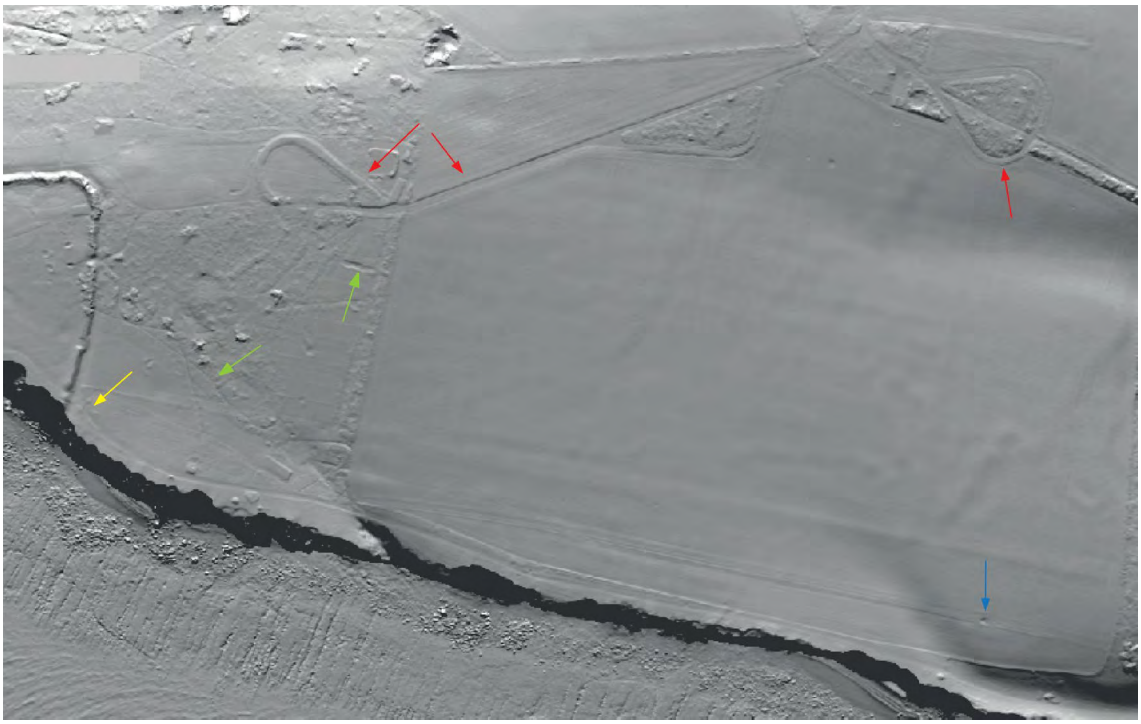

Plate 12: Military features: tank roads (red), control bunker for tank range (blue), ?anti-glider ditches (green), hut base (yellow). © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

Plate 13: Control bunker (29), looking east.

Plate 14: Control bunker (29), looking south-east.

Plate 15: Radar powerhouse, exterior looking north.

Plate 16: Radar powerhouse interior, looking north.

Plate 17: Concrete slab associated with radar site, looking east.

Plate 18: Terrace for former military building (37), looking south-east.

Plate 19: Possible anti-glider ditch (33), looking east.

Undated Features

Apart from the lynchets to the west of the hillfort, the HER also records undated pits and a ditch excavated at Florence House (35) and undated flint flakes of probable prehistoric date recovered from within the hillfort (36).

5.1.4. Historic mapping (Figures 4-10)

Historic maps show little detail for this area of coast, a reflection of its history as open sheep pasture.

Thomas Yeakell and William Gardner's 'Great Survey' of 1778–83 (Figure 4) shows the hillfort as a gentle curving rampart on the clifftop within the sheepwalk, with the unenclosed open arable strips of Chinting (now Chyngton) Farm to the north. A fort on Seaford beach is shown in front of a remnant of the old course of the River Ouse, and halfway between the two is a feature labelled 'Chinting Castle'. This does not refer to the hillfort, but to the small square structure which appears to have been located at the foot of Hawks Brow. Chinting Castle appears to have existed from at least 1717 but is thought to have been abandoned by 1795 (Walk Seaford) and does not appear on any later OS mapping. It seems possible both may have been part of an early post-medieval coastal fortification system.

The hillfort is not shown at all on the Seaford Tithe map of 1839, which is not unusual as these maps were intended to show land that was titheable rather than a detailed record of the topography; each surveyor made his own decision as to what he considered relevant.

The OS maps show a generally similar plan of the fort and are notable mainly for charting the onward creep of the cliff edge. The first edition map was surveyed in 1872 and produced in 1874 (Figure 5), just five years before Lane Fox investigated the site in 1877. Lane Fox improved upon the 1874 plan of the fort by surveying two lines through the monument to draw conclusions about line of sight and the original height of the ramparts (Lane Fox 1877, 289-90). Lane Fox also annotated the existing OS map, changing its title from 'Roman Camp' to 'Camp' to indicate his conclusion that it was a 'British' construction and not Roman, and adding the Bronze Age Barrow, where the OS just marks it as a bend in the 275' contour (Lane Fox 1877, Figure 6).

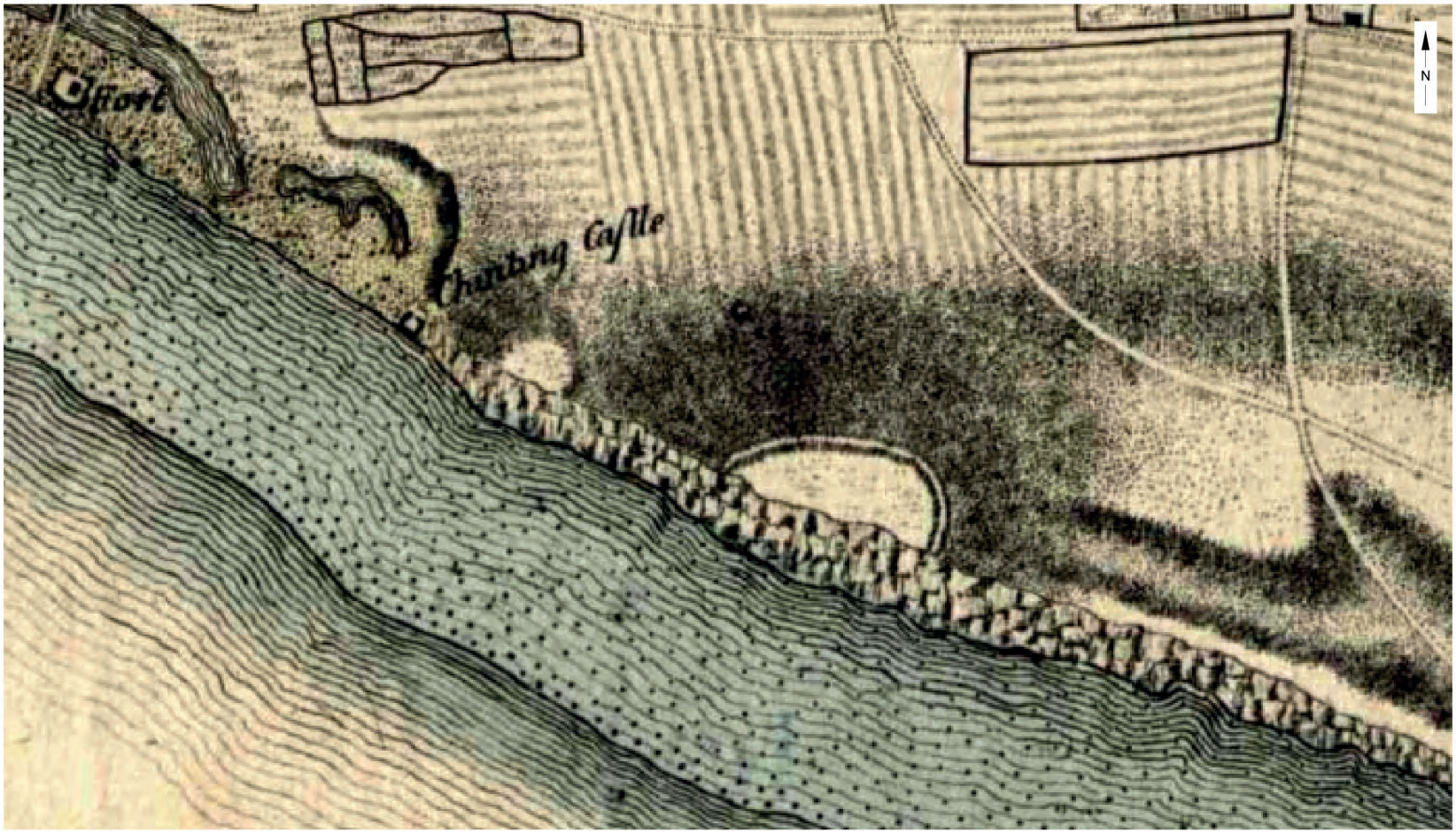

Figure 4: Yeakell and Gardner, 1778–83 © database right Landmark Information Group Ltd. (All rights reserved 2023*).*

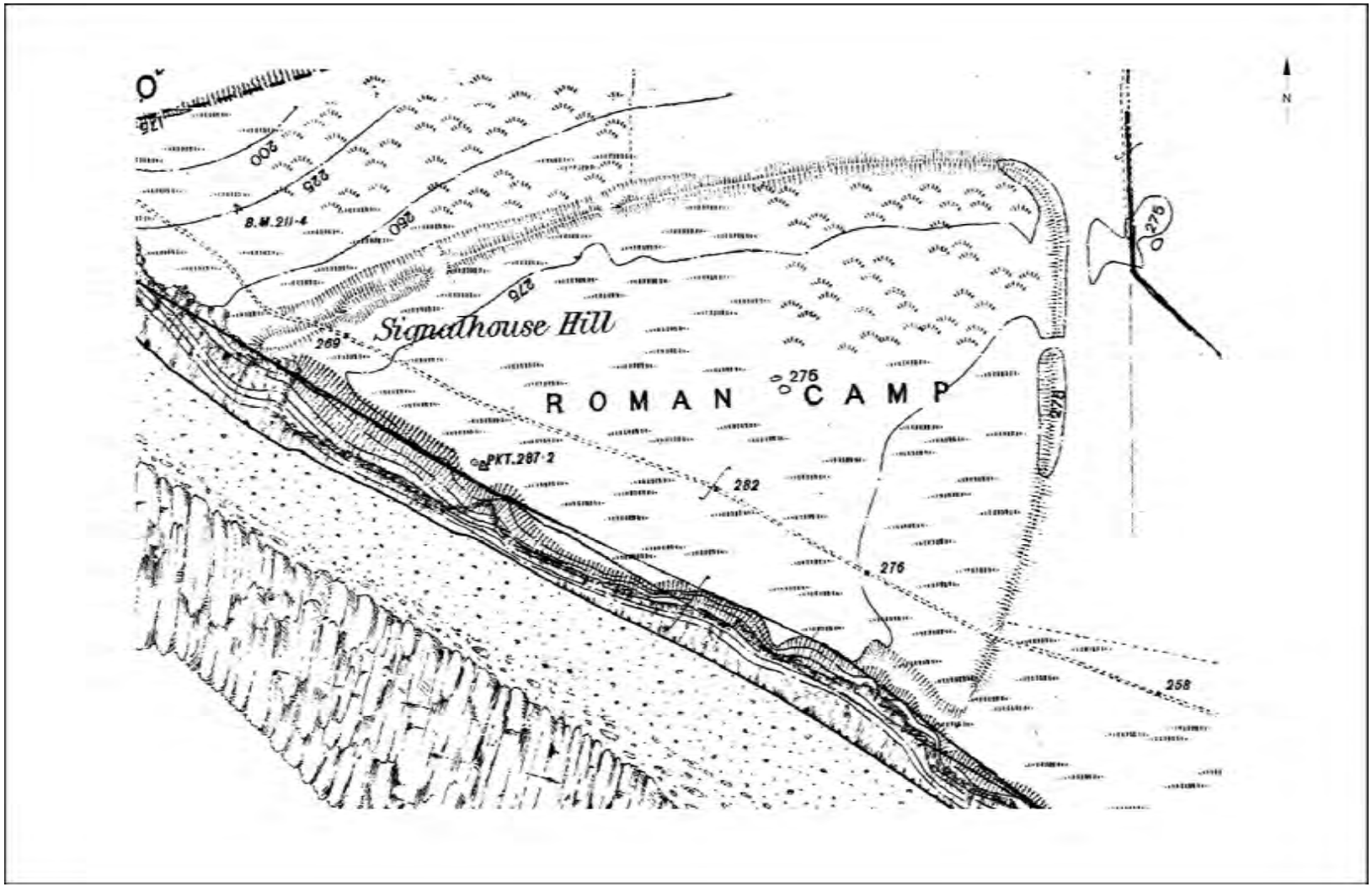

Figure 5: OS 25-inch, 1874 © database right Landmark Information Group Ltd. (All rights reserved 2023).

Figure 6: Lane Fox 1877 (after Lane Fox 1877)

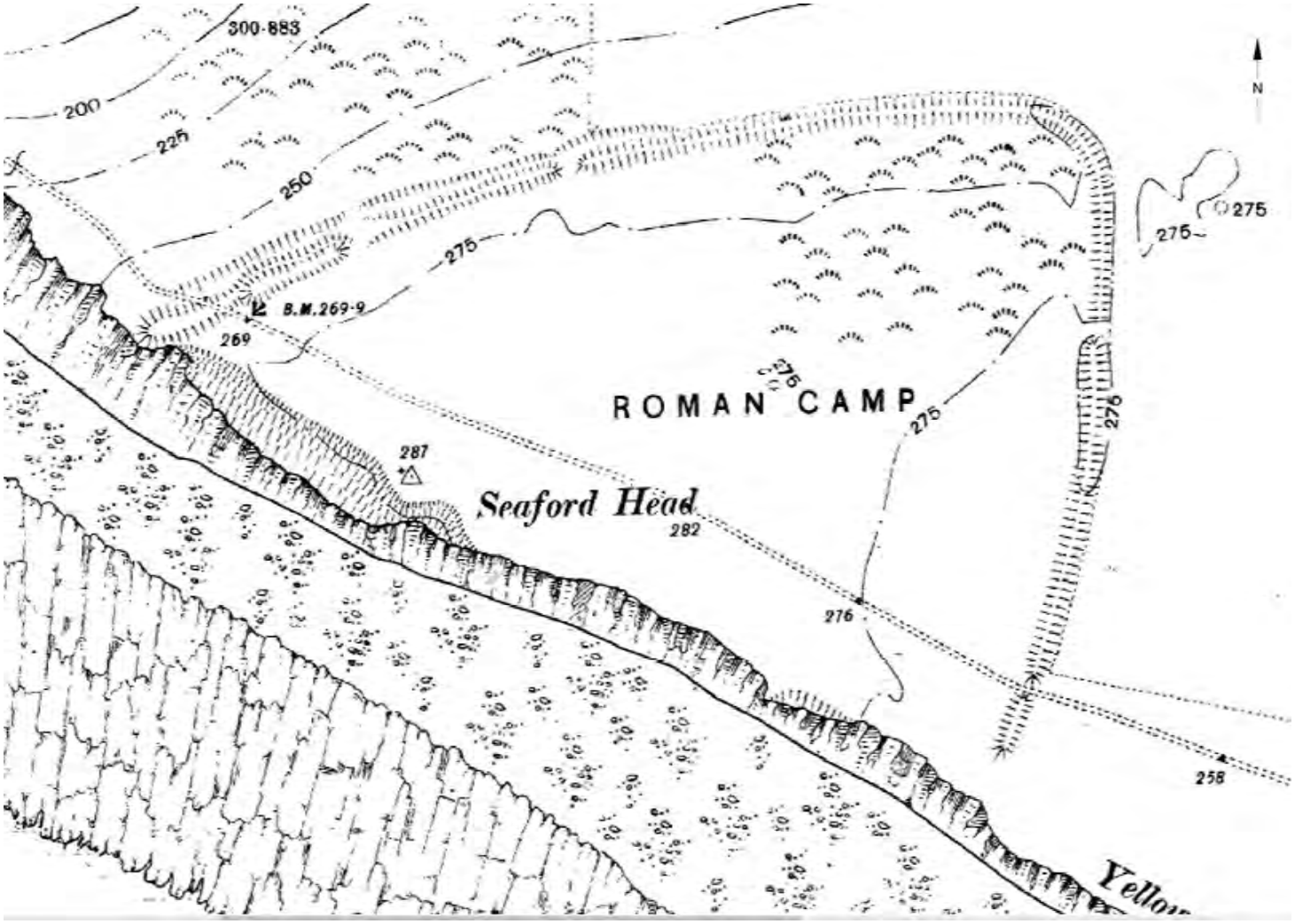

Figure 7: OS 25-inch, 1899 © database right Landmark Information Group Ltd. (All rights reserved 2023*).*

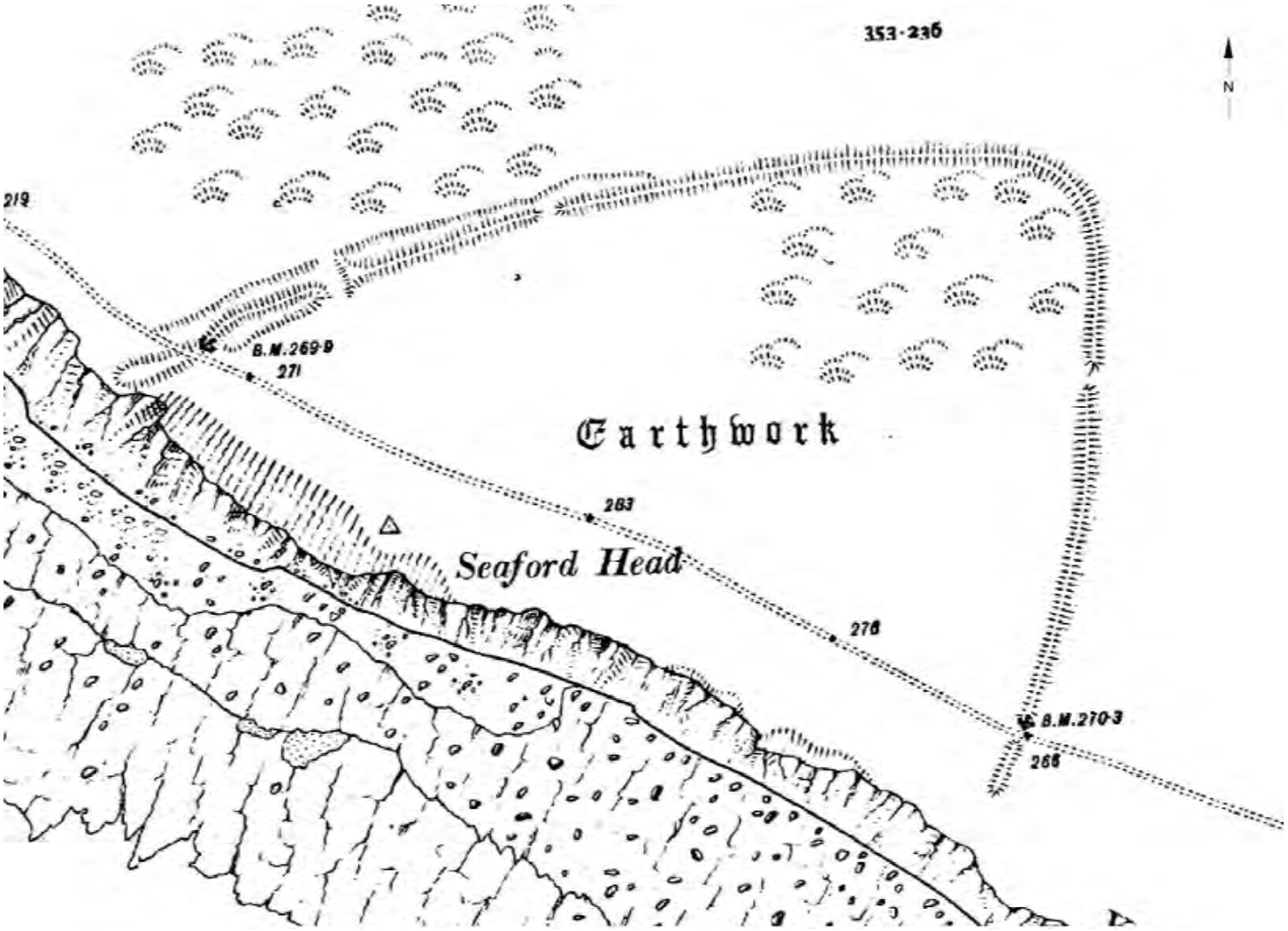

Figure 8: OS 25-inch, 1910 © database right Landmark Information Group Ltd. (All rights reserved 2023*).*

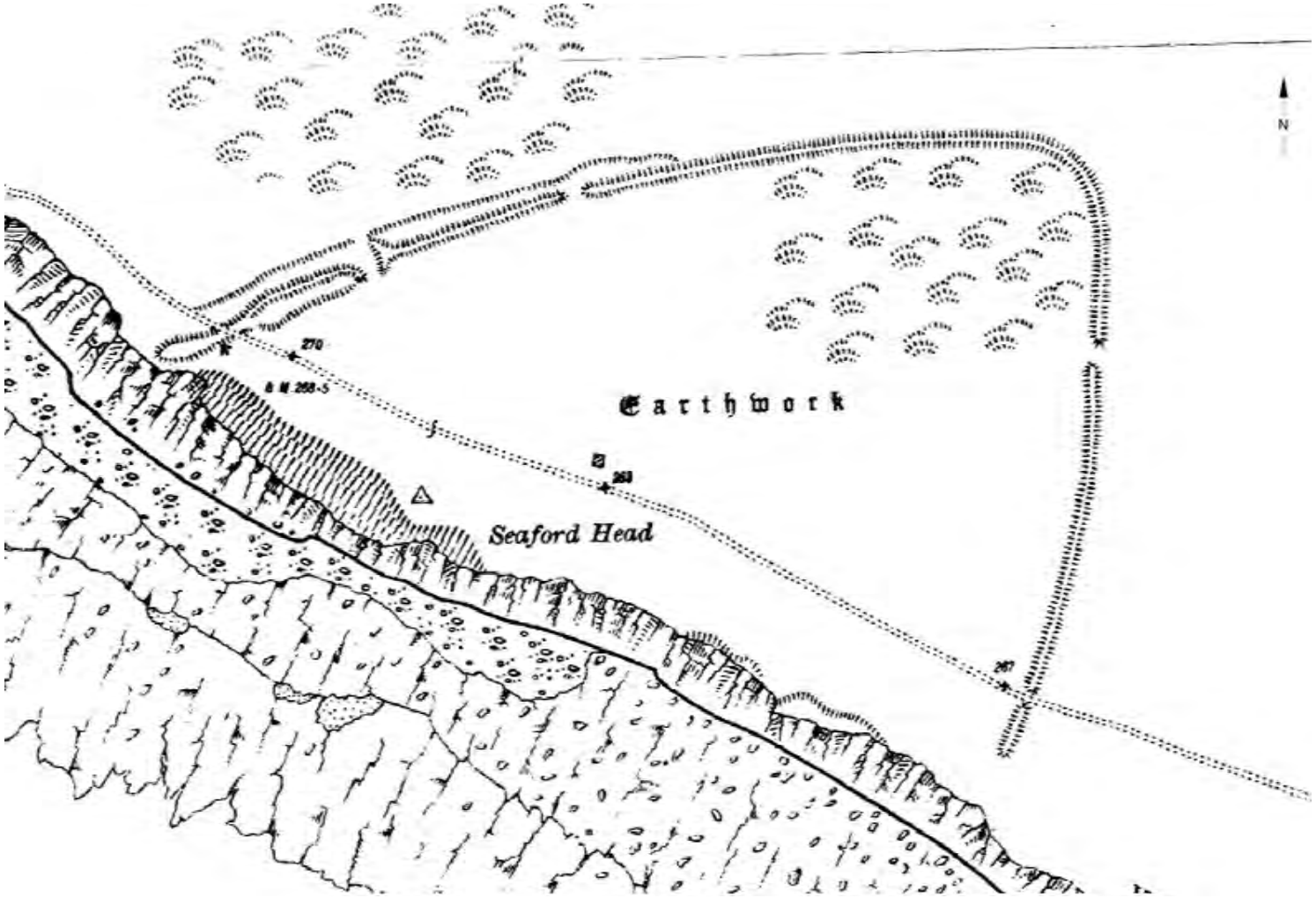

Figure 9: OS 25-inch, 1927 © database right Landmark Information Group Ltd. (All rights reserved 2023*).*

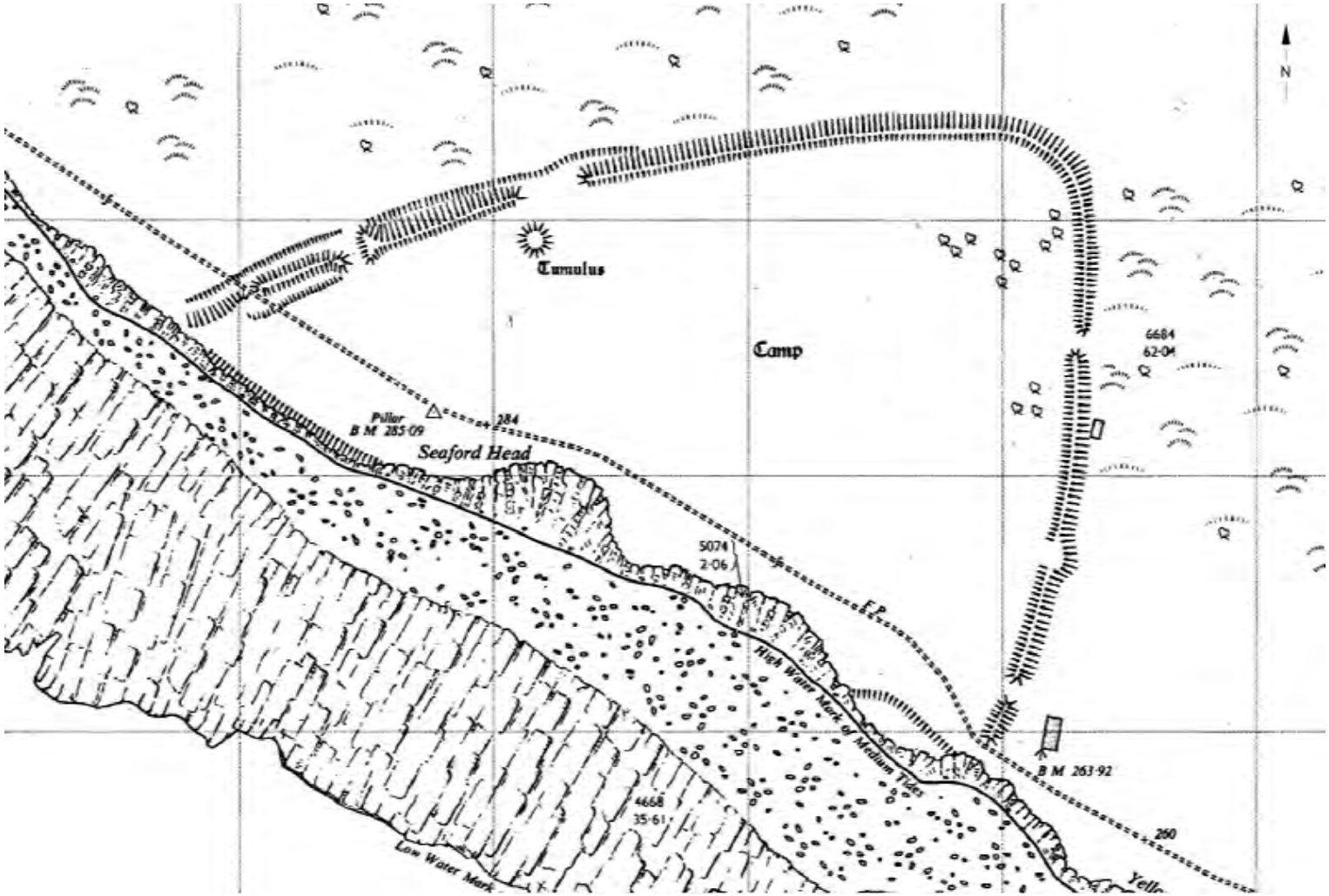

Figure 10: OS 25-inch, 1963-64 © database right Landmark Information Group Ltd. (All rights reserved 2023*).*

A small structure within the fort on the 1927 edition (*see* Figure 9) probably relates to the golf course, while the 1963–64 edition (*see* Figure 10) shows the radar station powerhouse within the eastern ditch and the associated hut nearer the cliff. This is also the first edition to map the bowl barrow.

The 1874 edition shows the north-western corner of the hillfort labelled as Signalhouse Hill. This is likely to be associated with the admiralty signal station established on the hill in 1795, replacing the earlier system of fire beacons (Butler 2007). However, no visible trace of this installation exists either on lidar or on the ground.

When Bedwin came to excavate his trenches, he assumed that the trench Lane Fox had excavated across the eastern ramparts had already fallen into the sea (Bedwin 1986, Figures 2 and 27). However, this does not appear to have been the case (4.1.2) and in fact Bedwin's Trench A now appears closer to the cliff edge than that of Lane Fox (*see* Figures 2, 22 and 23).

Historic maps and OS mapping have been researched and rectified by Dornbusch to investigated cliff line retreat in a series of papers (Dornbusch et al. 2006, 2008 and Dornbusch 2022). Of note are two estate maps by de Ward (1624) and Baley (1764) that cover the Seaford Head area; both show the area of the hillfort with the label 'Castle' (Dornbusch 2022, 4-5).

5.2. Lidar commentary (Figures 11 and 12)

5.2.1. Results

Figure 12 illustrates the product of the comparative analysis. It shows degrees of erosion or aggradation at the monument using the EA 1m lidar datasets of between 2017 and 2020 and quantifies that change in metres. As the figure is the product of the comparison of two vertically acquired datasets over heavily textured terrain (i.e. the cliff-edge protrudes and overhangs), it is difficult to ascertain at what height the loss is from at the cliff-edge. This could indicate a trend towards cliffs becoming more vertical with loss occurring at lower levels as opposed to cliff edge retreat at the top.

The monument is expressed as a roughly triangular area, delineated by locally higher values which represent foliage growth. Patches of loss (0-1m) to the north and east of the monument are the result of both changing foliage growth and the processing functions used to create the DTMs.

Erosion at the cliff-edge is highly variable but is more significant in the vicinity of the monument and to the east than it is to the west. This coincides with the extent of the clay-with-flints superficial geological deposits. Two significant areas of loss are seen to coincide with the rampart and ditch of the hillfort; the counterpart aggradation of material on the beach below are seen to have survived an unknown degree of marine action. This is likely to be the outcome of a recent cliff fall in the western extent of the hillfort in October 2018 (@PaulGee 2018). Further cliff falls have occurred in the vicinity of the hillfort since the 2020 lidar data set, notably just to the west in March 2021 (Lock 2021).

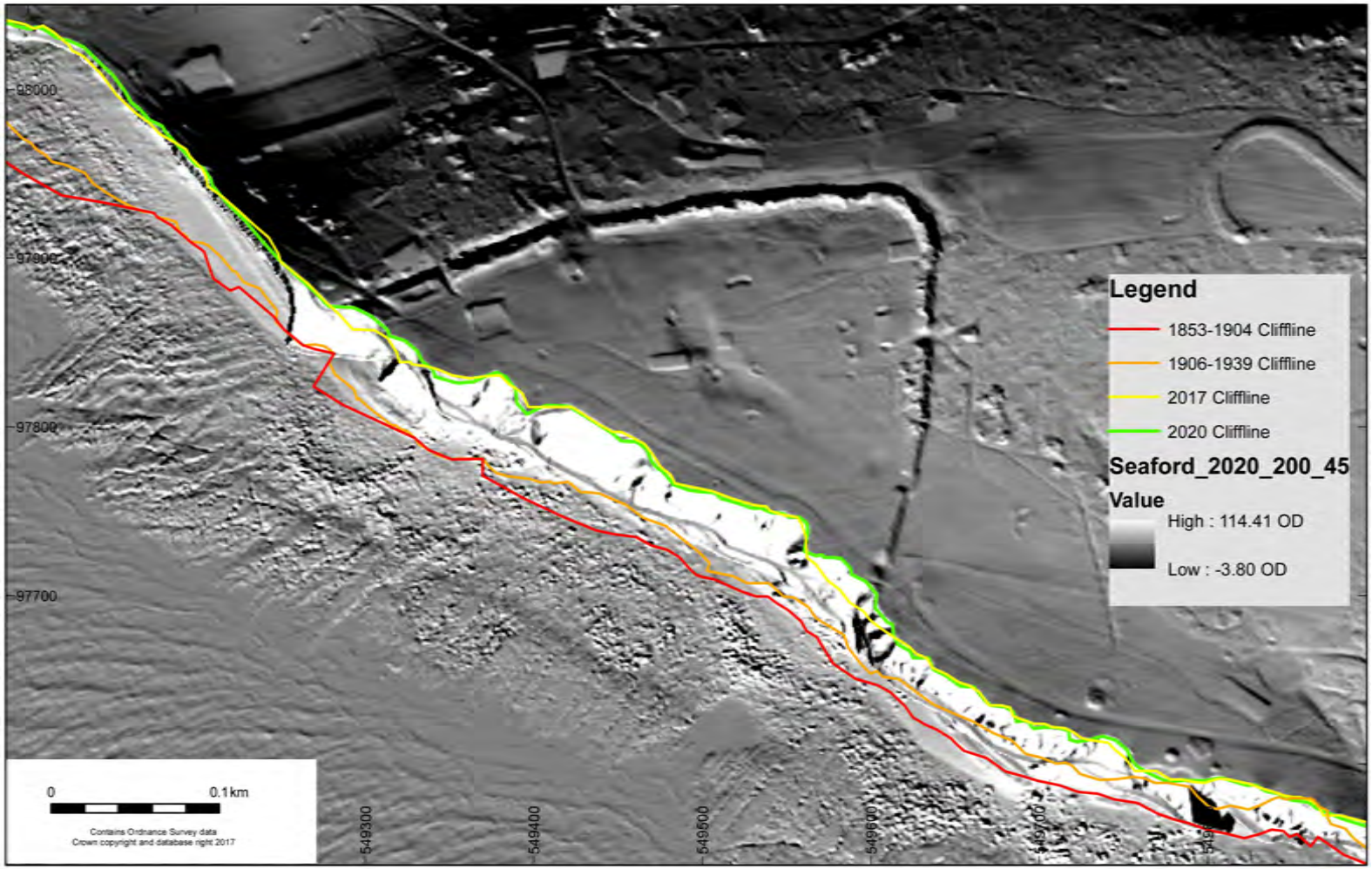

Figure 11: 2020 1m lidar. © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

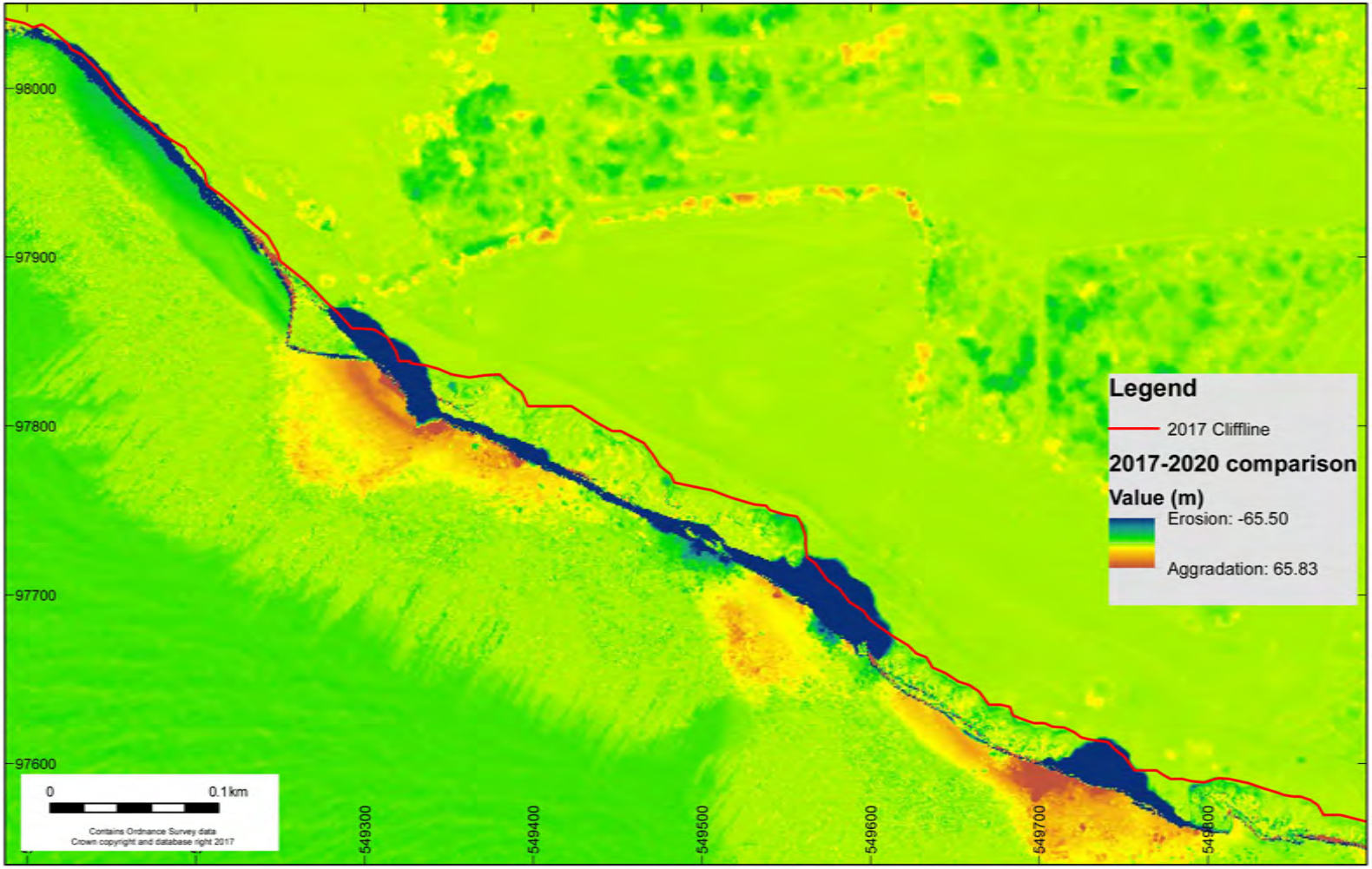

Figure 12: Comparison of 2017 and 2020 lidar datasets. © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

5.2.2. Discussion and conclusion

The comparison dataset which visualises the recent rate of cliff recession at Seaford Head is a valuable tool that can be replicated at any site with comparable lidar datasets. By illustrating recent erosion, the coincidence of this with both the superficial geology and significant earthworks of the monument was revealed. It further serves as an evocative illustration of the threats to coastal heritage, complemented by footage of loss focussing on the chalk cliff, and contextualises the archaeological monument in that landscape.

Erosion of the coastal landscape around Seaford Head has been the subject of much previous research (Dornbusch et al. 2006, 2008; Stavrou et al. 2011; Hurst et al. 2016; Dornbusch 2022). Dornbusch et al. (2006) and Dornbusch (2022) rectified retreating cliff lines from historic mapping, orthophotographs and lidar data to examine historic cliff loss rates over the last 400 years, concluding that the majority of erosion occurred during the later 19th and 20th centuries, decreasing in the later 20th century. Hurst et al. (2016) further substantiate this explanation by using in situ concentrations of 10Be which 'provide a versatile geochronometer for geomorphic studies, facilitates dating of surface exposure and the deposition and burial of sediments and estimation of weathering and erosion rates' (ibid.). Hurst et al. conclude that for most of the Holocene, retreat rates were between 2–6 $cm \cdot y^{-1}$ and contrast dramatically with historical records of rapid retreat at 22–32 $cm \cdot y^{-1}$ at the same sites during the last 150 years (ibid.). Stavrou et al. (2011) present an assessment along the cliff section between Brighton Marina and Portobello, East Sussex, and establish a methodology by which areas susceptible to shoreline recession and cliff instability can be determined using the Digital Shoreline Analysis System extension for ArcGIS. Similar to Dornbusch et al. (2008), they determine that cliff retreat has declined through time but associate this with cliff stability measures and coastal protection. It seems likely that the cliffs at Seaford have remained relatively stable since they were left at their high stand at the end of the Eemian interglacial (*c.* 115,000 yrs BP), with the majority of erosion caused by wave action occurring during the later 19th and 20th centuries, decreasing in the later 20th century.

The method briefly outlined above does not replace geotechnical approaches to cliff retreat and is not intended to represent anything other than a blunt comparison. Rather, it is conceived that by simply visualising loss, sites and landscapes can be evaluated rapidly in areas where detailed work on retreat does not exist, and as an output the image can draw together the twin concerns of climate change and heritage loss.

The HillShade function when used alone does produce a valuable product in producing rapid output for field assessments. However, the recommendation for multimethod lidar analysis by Challis et al. (2011), and explored in detail by Historic England, should be borne in mind for analogous projects.

5.3. Geophysical survey

5.3.1. Summary

Geophysical survey of the whole interior of Seaford Head Hillfort has yielded a dataset which has both promise and is difficult to interpret with confidence. Current use as a golf course is represented amongst the anomalies identified in the surveys and the underlying cap of clay-with-flints superficial geology is also probably represented. Archaeological signatures are therefore sandwiched between widespread landscaping including both importation of sediments and truncation, and a geological substrate which can deform and produce variable magnetic responses.

Dipolar responses reflect a mixture of golfing and leisure infrastructure, though other ferrous anomalies probably derive from other activity. A concentration of ferrous responses in the north-east of the site may reflect proximity to a Second World War installation. A number of linear magnetic anomalies (both positive and negative) conform to a west-south-west by east-north-east alignment with occasional perpendicular counterparts. These are of obscure origin and may be of result of geological patterning or modern activity. Magnetic disturbance in the south-east of the survey plot is likely of geological origin and coincides with thickening clay-with-flints deposits as seen in the cliff section. Elsewhere, magnetic disturbance is represented by areas of enhanced magnetism, either in patches or more linear in form. Some of these coincide with golf course features whereas others are probably geological in origin.

The architecture of the golf course is reflected inconsistently in the magnetic plot, with elements represented as dipolar, positive or negative anomalies. Across the plot, frequent small and discrete, but occasionally strong, positive magnetic anomalies are found which may be archaeological in origin. Of most interest is the complex of linear and positive anomalies associated with the Bronze Age barrow. These may reflect its previous investigation (Lane Fox 1877), though could equally represent preserved unexcavated features.

Statement of indemnity

Geophysical survey is the collection of data that relate to subtle variations in the form and nature of soil and which relies on there being a measurable difference between buried archaeological features and the natural geology. Geophysical techniques do not specifically target archaeological features and anomalies noted in the interpretation do not necessarily relate to buried archaeological features. As a result, magnetic and earth resistance detail survey may not always detect sub-surface archaeological features. This is particularly true when considering earlier periods of human activity, for example those periods that are not characterised by sedentary social activity.

5.3.2. Geophysical survey results (Figures 13-21)

<u>Survey limitations</u>

Physical obstructions encountered on site comprise vegetation and benches while topographical constraints that may have affected the data collection comprised golf course infrastructure, various areas of sloping topography, and the rampart at the east of the monument. The effectiveness of magnetometer surveys depends on a contrast between the absolute magnetic susceptibility of the topsoil to the underlying subsoil (Clark 1996). Features can be difficult to detect where there has been significant primary silting or development of significant overburden such as the landscaping in evidence at the site. Areas where physical obstructions form a barrier to survey, or a health and safety issue, were omitted. The site lies over clay-with-flints geology overlying chalk, the response of magnetometer survey to this being considered good (Historic England 2008).

The surveys were undertaken during cold and occasionally windy weather but without great changes in temperature. Periods of rainy weather in the preceding weeks meant earth resistance readings were, consequently, within a normal range.

The interpretation of both the fluxgate gradiometer results and the earth resistance results should be read in conjunction with the figures at the end of the report.

Fluxgate gradiometer anomaly types

Specific examples of anomaly types may be numbered in the figures and text but not all anomalies are numbered. The geophysical survey identified the following anomaly types.

Positive magnetic anomalies

Positive anomalies generally represent cut features that have been in-filled with magnetically enhanced material such as pits or ditches. These anomalies have been categorized by magnetic field strength: strong (>5nT) – coloured dark green; moderate (1-5nT) –green; and weak (<1nT) –light green).

Negative magnetic anomalies

Negative anomalies generally represent buried features such as banks or compacted ground that have a depleted magnetic signature in comparison to the background geology.

Magnetic disturbance

Magnetic disturbance is generally associated with interference caused by modern ferrous features such as fences, gates and service pipes or cables. Elsewhere it is the result of the changing nature of the underlying geology.

Magnetic debris

Low amplitude magnetic debris consists of a number of dipolar responses spread over an area and is indicative of ground disturbance.

Dipolar/bipolar anomalies

Dipolar anomalies are positive anomalies with an associated negative response. These anomalies are usually associated with discrete ferrous objects or may represent buried kilns or ovens. Bipolar anomalies consist of alternating responses of positive and negative magnetic signatures. Interpretation will depend on the strength of these responses; modern pipelines and cables typically produce strong bipolar responses.

Earth resistance anomaly types

The types of features likely to be identified are discussed below.

High resistance anomalies

These are areas where the current from the array has passed less easily due to relative scarcity of water content. They may relate to stone or brick foundations or rubble in an archaeological context though differently permeable materials will also produce high resistance anomalies.

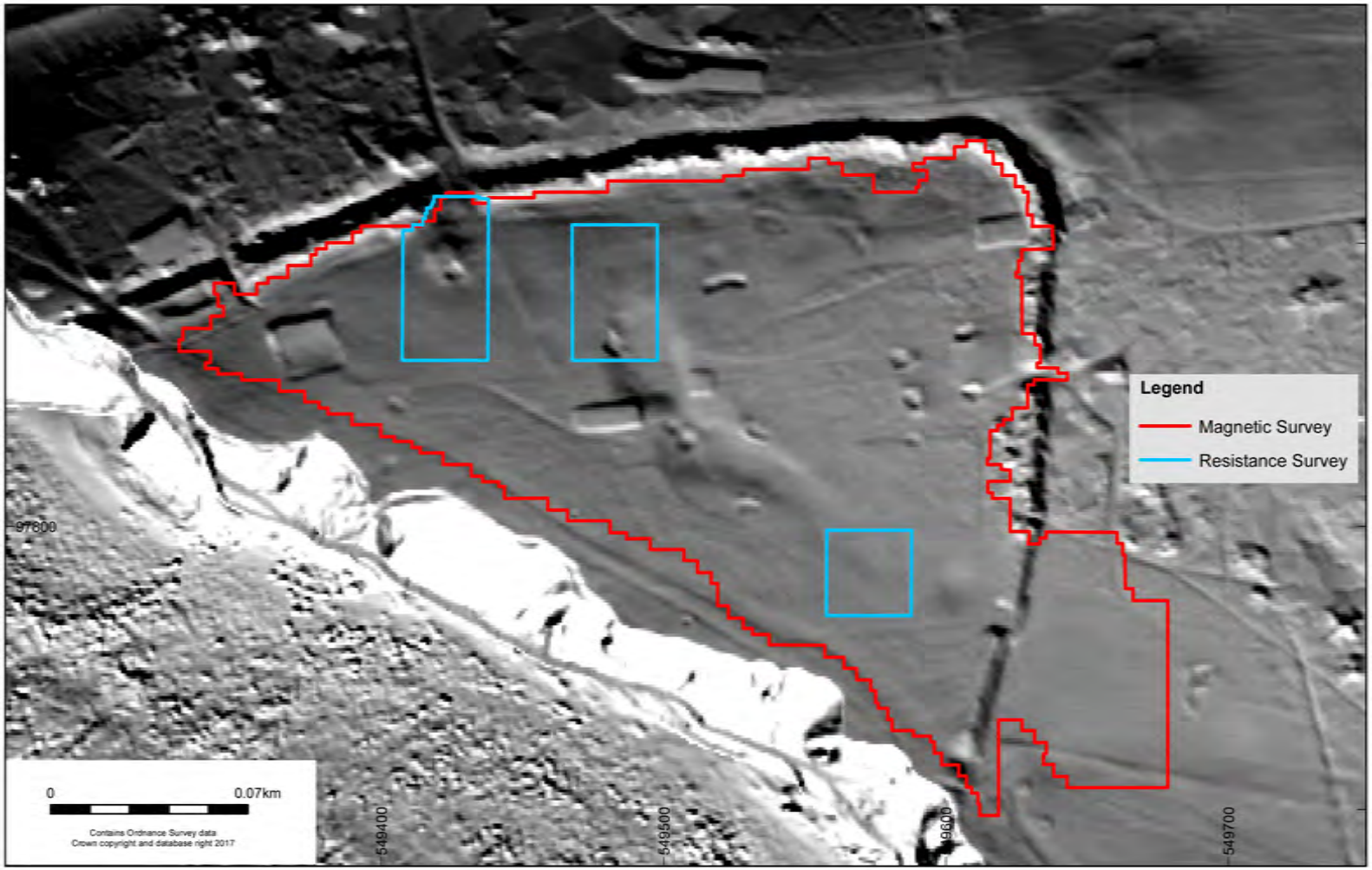

Figure 13: Location of geophysical surveys. © Environment Agency copyright and/or database right 2020. All rights reserved. Reproduced under Open Government Licence v.3.0.

Low resistance anomalies

These are areas where the current from the array has passed more easily due to relative abundance of water content. They may relate to cut features in an archaeological context though the increase in moisture content may equally result from diverse geological and landscape processes.

Fluxgate gradiometer survey interpretation (Figures 14-17)

Given the land use at the site and the probable variations in the underlaying clay-with-flints geology, extrapolating confident interpretations from the data is problematic. While the dataset is not particularly magnetically noisy, modern ferrous interference has masked some areas, while the importation of material to landscape the golf course has similarly masked potential archaeological or geological responses with magnetically homogenous data. Excavation to create bunkers and fairways may also account for some of the anomalies.

A curvilinear positive anomaly (Figure 17, m1) at the northern edge of the Bronze Age tumulus respects the form of the monument. It is accompanied by a small positive anomaly to the immediate south, located within the bunker dug into that side of the tumulus. To the south and south-west of the tumulus, a curvilinear trend in the data (Figure 17, m2) describes a partial circle amongst small positive anomalies, though it is unclear whether this group reflects buried archaeological features.

In the eastern half of the plot, a small number of semi-circular positive anomalies (Figure 17, m3) each measure *c.* 6 m in diameter, which could represent archaeological features, or perhaps former bunker locations. Given the lack of earthworks in these locations and no clear landscaping, an archaeological origin seems more likely. Across the plot, though more apparent in the north-east corner of the monument, small positive anomalies (Figure 17, m4) may also represent buried archaeology.

Negative anomalies are restricted to locations with surviving hollows (Figure 17, m5), the response reflecting the removal of superficial soils and geology.

At the south-east of the monument, a linear trend (Figure 17, m6) describes the outer perimeter of the hillfort rampart and the rampart itself is discernible in the data immediately west, albeit marked by very subtle changes. Immediately east of the rampart, a closely arranged group of linear trends (Figure 17, m7) oriented roughly north-west to south-east stands out, though its origins are obscure.

Elsewhere, linear trends (Figure 17, m8) are weak but widespread across the site, many of which are oriented east-north-east to west-south-west. Some perpendicular counterparts can also be found though the distribution is not regular. These may derive from continued deformation of the clay-with-flints geology, either through solution processes or more superficial drainage erosion. An exception to this may be a group in the north-west of the site (Figure 17, m9), potentially associated with positive anomalies, which may have other origins.

Of the dipolar responses, the great majority can be assigned to fencing (along the southern edge), small modern ferrous responses, or golf infrastructure – in this case bunkers (Figure 17, m10). Irrigation systems do not seem to produce any characteristic responses despite being visible at each putting green location. The exception to this are the strong dipolar responses (Figure 17, m11) at the centre east of the monument which likely relates to Second World War activity, partially preserved in briar by the monument rampart.

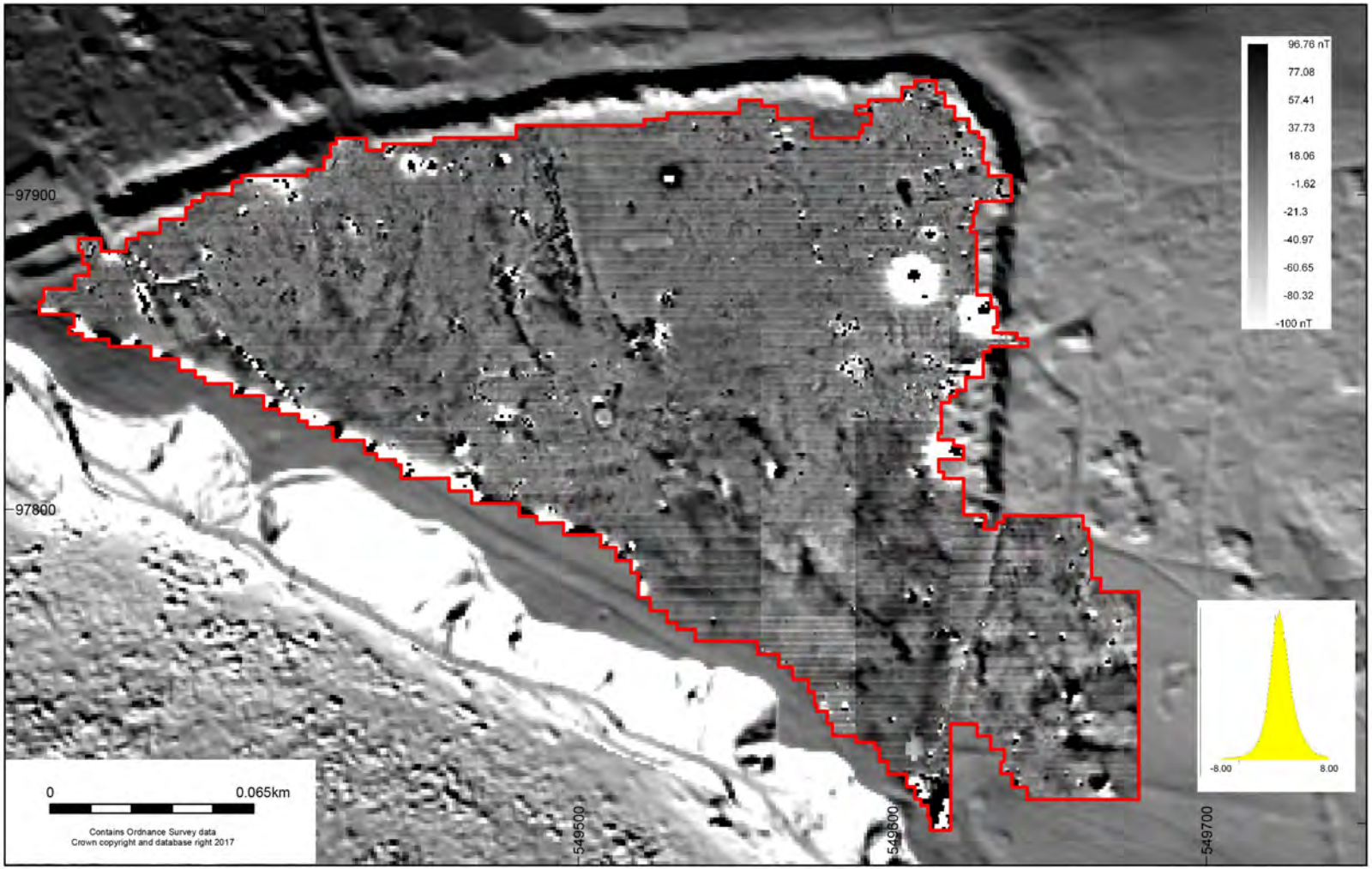

Figure 14: Raw magnetometer data.

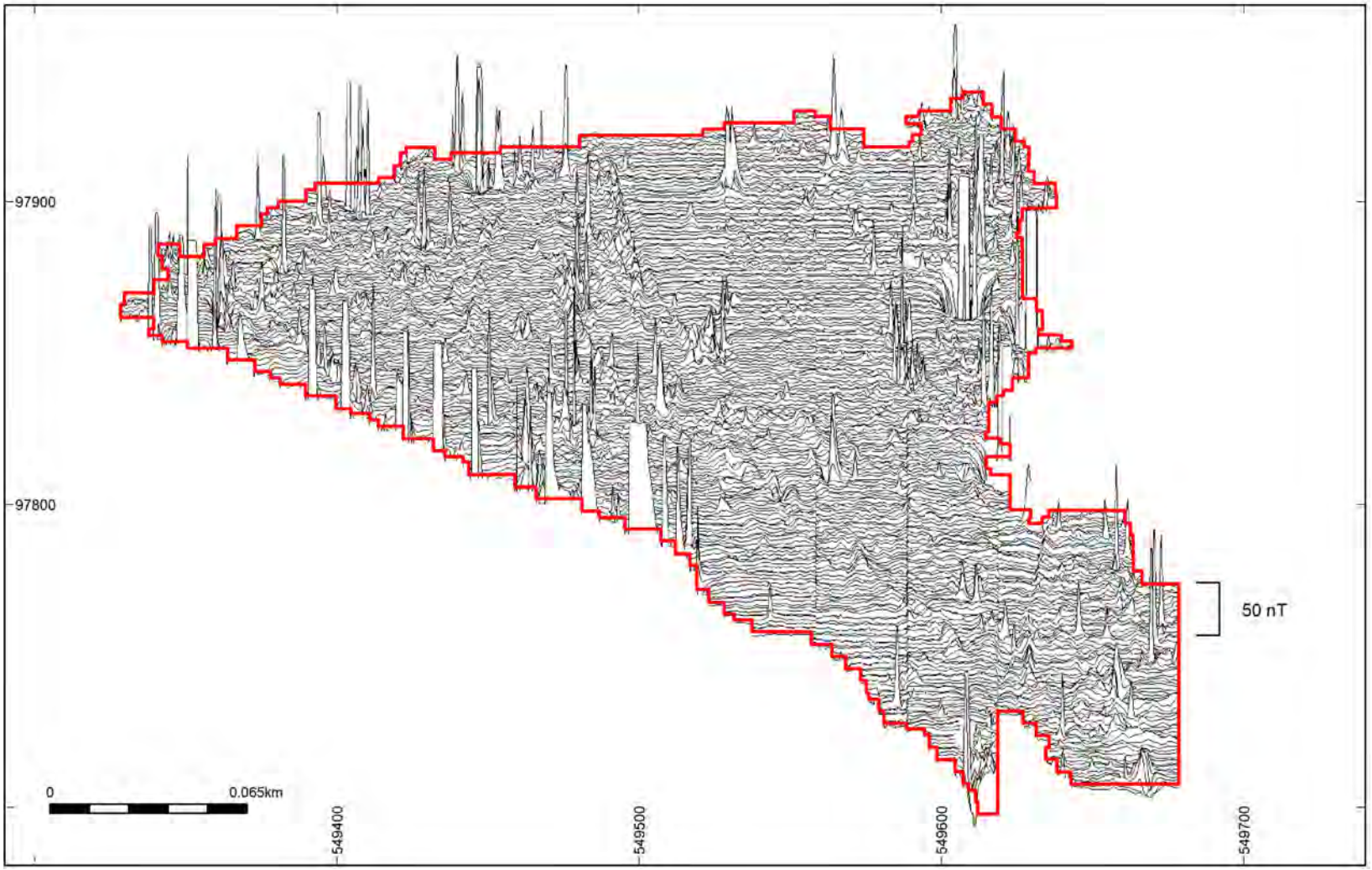

Figure 15: Raw magnetometer data with trace plot.

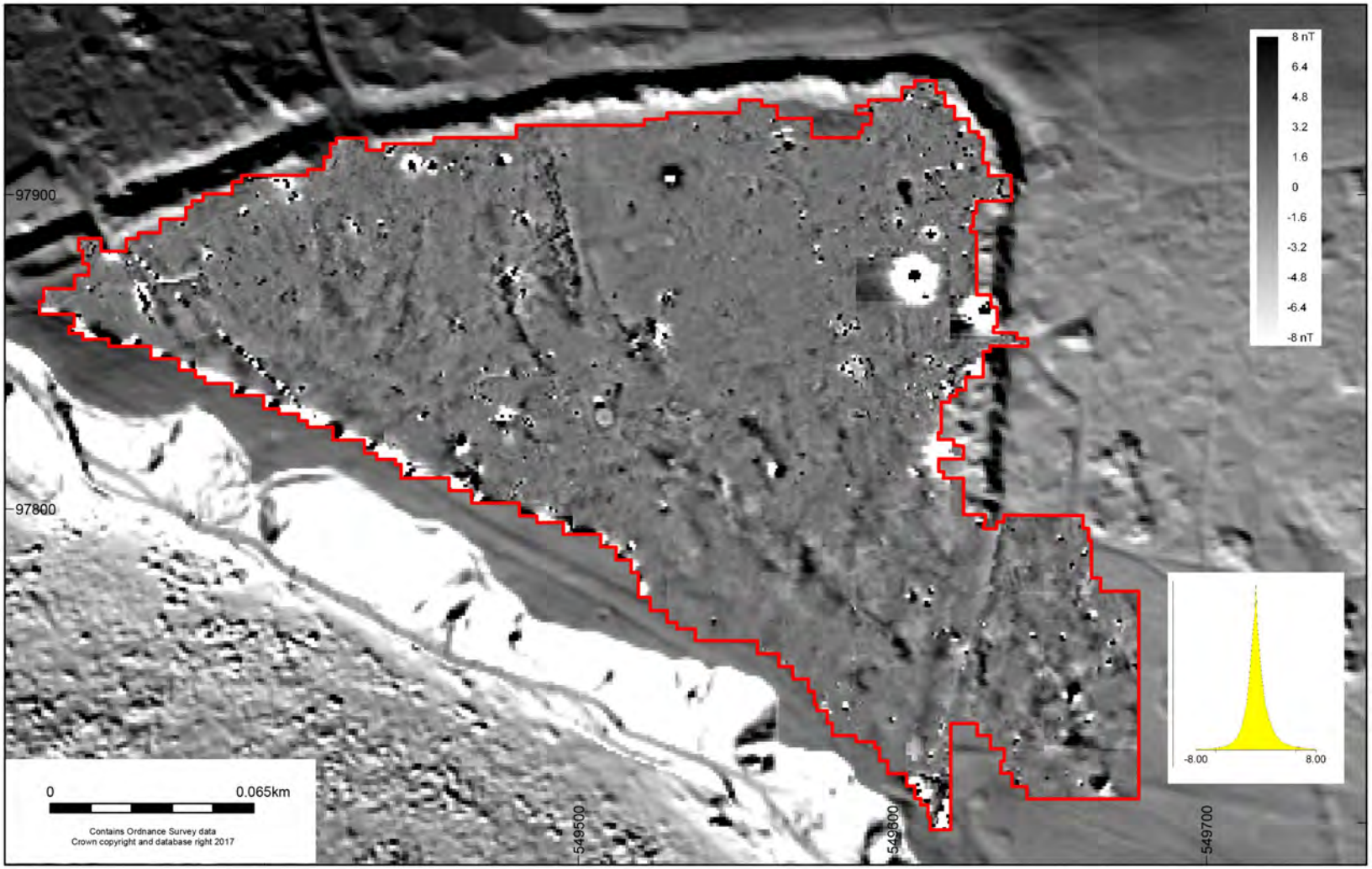

Figure 16: Processed magnetometer data.

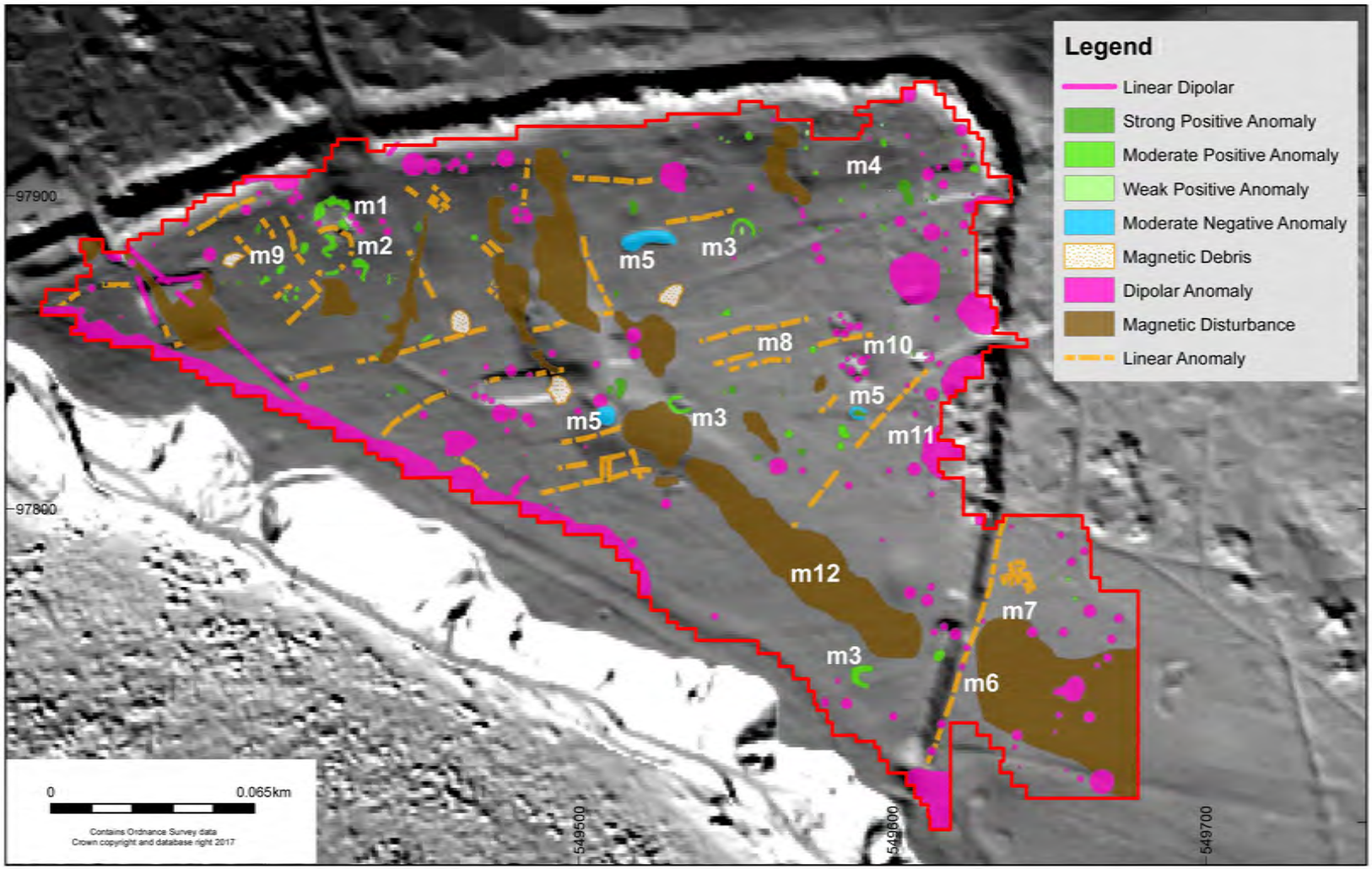

Figure 17: Interpreted magnetometer data.

Across the site (e.g. *see* Figure 17, m12), patches of magnetic disturbance may be attributed to a variety of origins. Given their size, distribution, and orientation which frequently mirrors or is perpendicular to linear trends, many of these are likely to be geological in origin. Others may reflect landscaping at the golf course. The strength of some of these anomalies, forming fairly discrete entities, influenced the selection of two of the three areas chosen for earth resistance survey.

Earth resistance survey interpretation (Figures 18-20)

Unfortunately, the earth resistance survey did not produce results which provide much clarification to the magnetic survey and is mostly influenced by modern landscaping.

High resistance anomaly (Figure 20, r1) is situated in the south-east half of the Bronze Age barrow and in part, reflects the bunker dug into it, though the influence of material or disturbance from previous excavations cannot be ruled out. Its partner low resistance anomaly more accurately describes the edge of the earthwork. Located on the north-west edge of the barrow, but not marked, is a marginally higher resistance curvilinear response that may be the result of previous excavations, or perhaps reflect archaeological material. Changing density and thickness of the earthwork and surrounding soils may be reflected as this group of anomalies.

To the east, a small area was undertaken to clarify a zone of magnetic disturbance characterised by two series of linear, mostly positive anomalies. Unfortunately, only a small group of anomalies (Figure 20, r2) was revealed, which coincided with the edge of a landscape feature (shallow hollow) and did not consistently describe its edge.

Similarly, magnetic disturbance evident in the south-east of the monument was not better understood by resistance survey, with only marginally higher resistance discrete anomalies (Figure 20, r3) exhibited. These contrast with the fairly strong magnetic responses, although the area surveyed was perhaps too small and improperly placed to be of significant use.

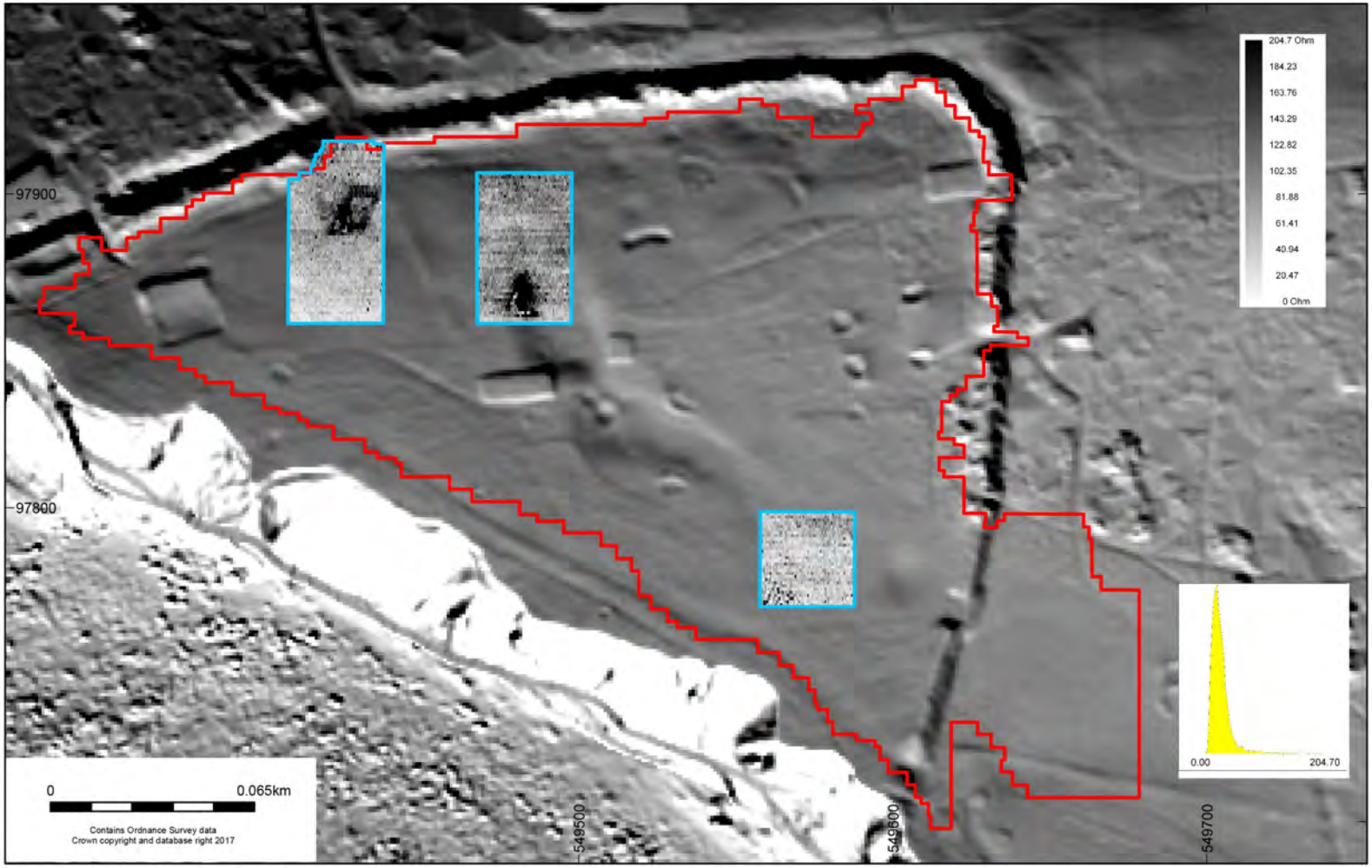

Figure 18: Raw resistivity data.

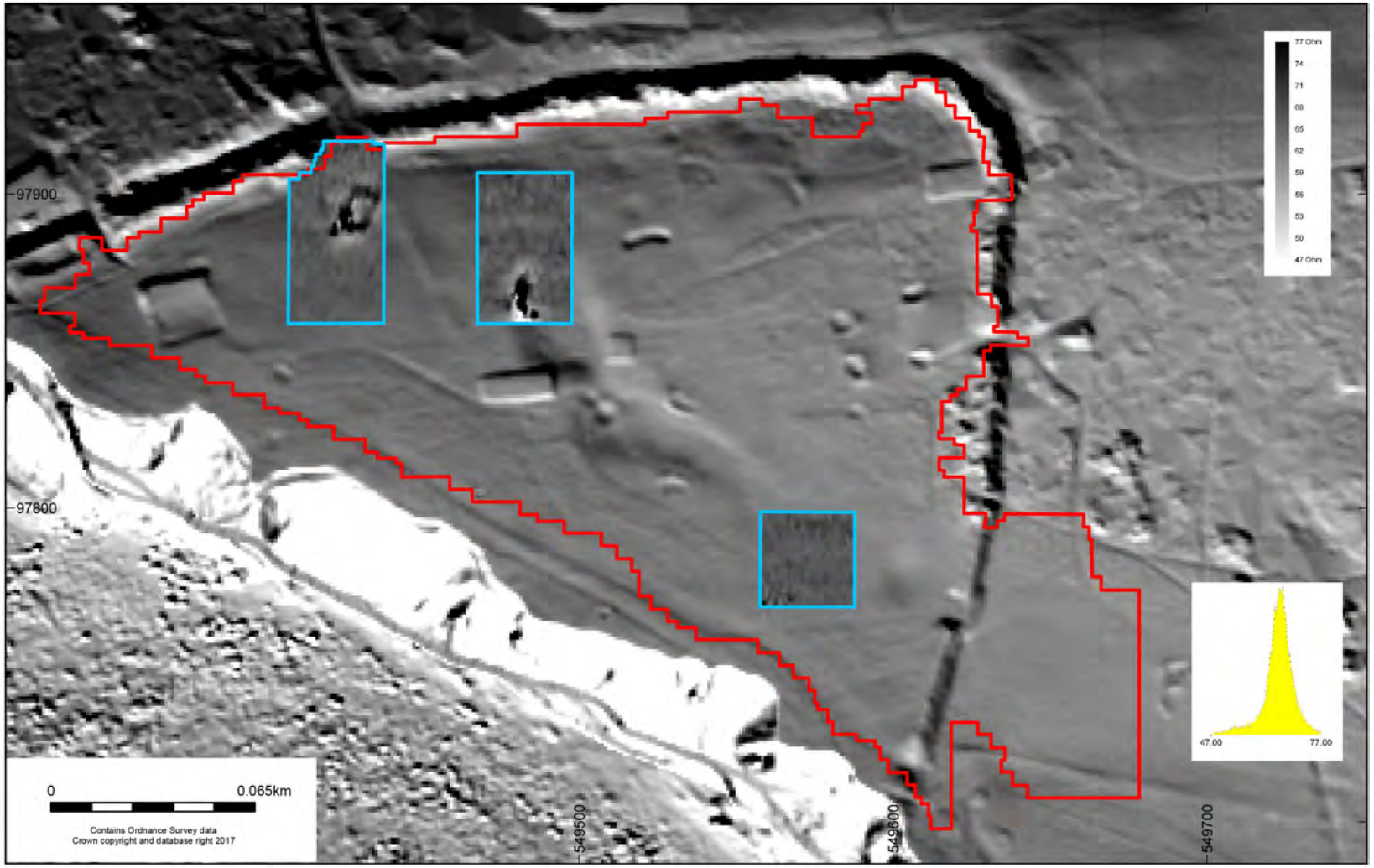

Figure 19: Processed resistivity data.

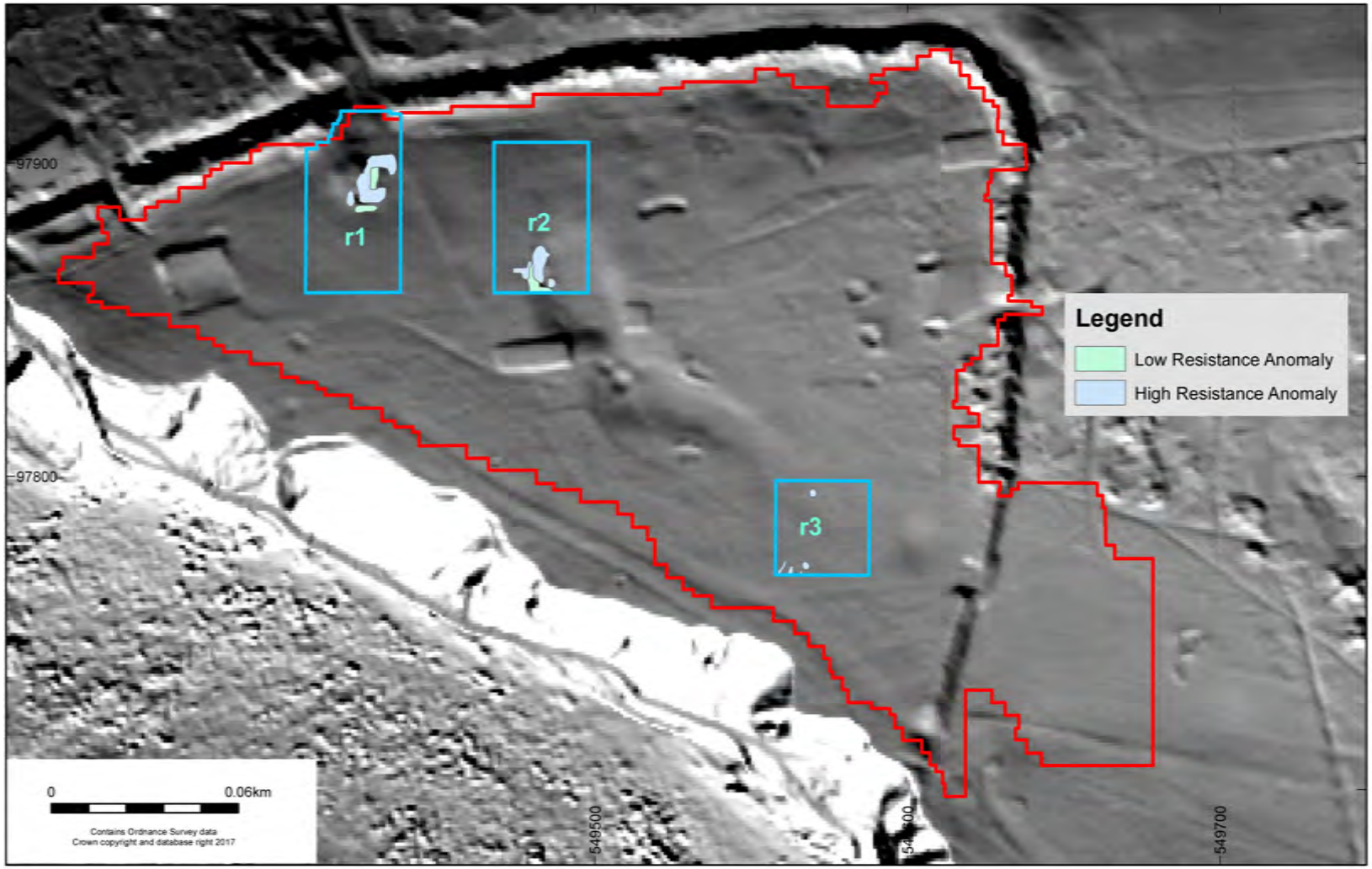

Figure 20: Interpreted resistivity data.

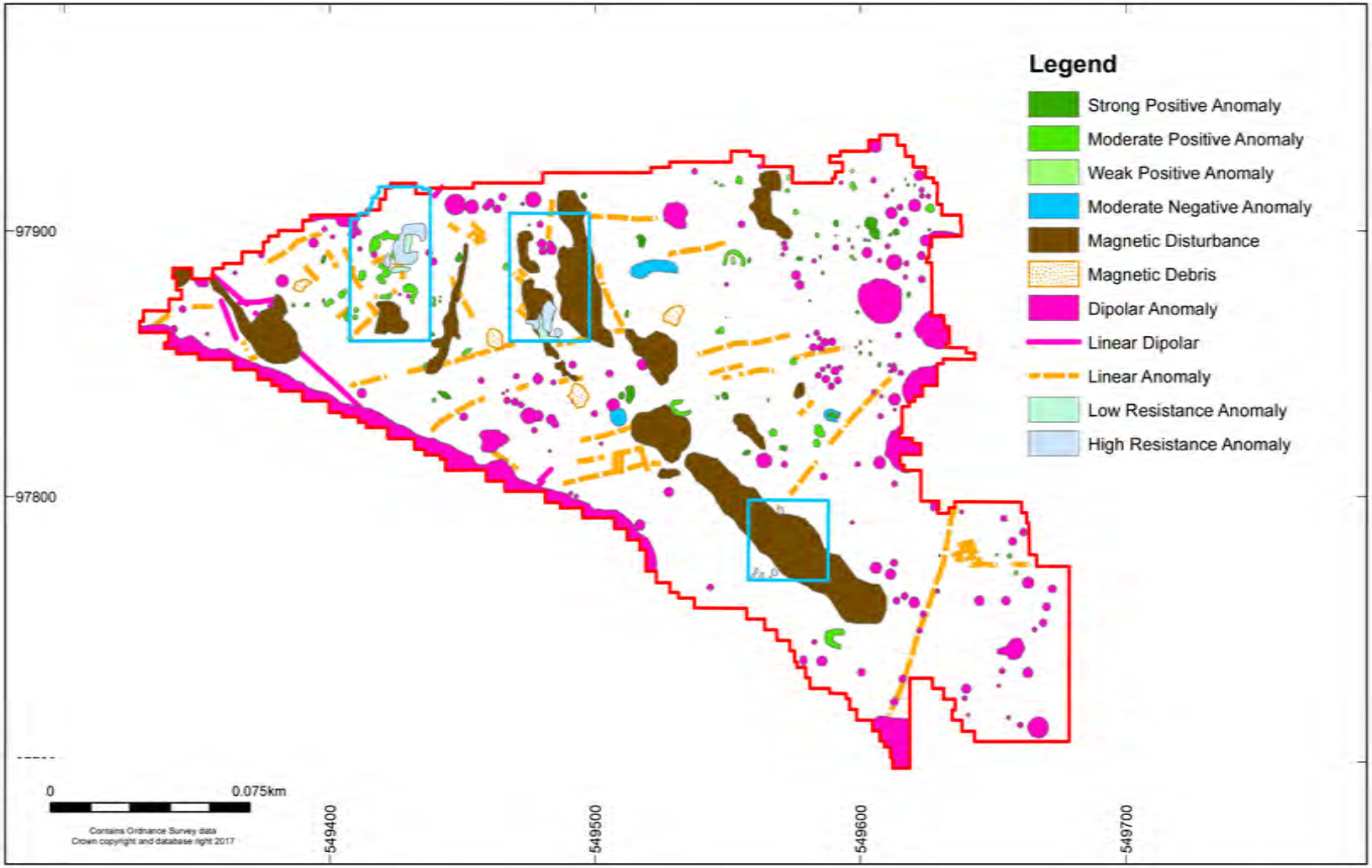

Figure 21: Combined geophysical survey interpreted.

5.4. Topographic and photogrammetry survey (Figures 22-35)

5.4.1. Aerial survey

The aerial survey was conducted on Wednesday 3 November and Friday 5 November 2021. Due to bad RPAS flying weather, we did not conduct survey on Thursday 4 November. The survey identified the general site topography, the surviving earthworks of the univallate hillfort and bowl barrow, a Second World War reinforced concrete structure and a square platform within the eastern ditch of the hillfort (Figures 22-25).

The surveyed area is part of a functioning golf course and has been subject to widespread landscaping to create sand traps, greens, fairways and artificial mounds. This landscaping has created a largely artificial surface through the centre of the monument, potentially obscuring more subtle earthworks which may have been present (Figures 23-25).

The aerial survey identified a topographic high point inside the earthworks, close to the cliff edge in the centre of the monument (Figures 23-25); this appears to be a natural high point that may have been intentionally targeted for the location of the hillfort. However, its prominence may have been enhanced through anthropogenic means; a dark layer observed in the cliff survey in that area could suggest a buried midden or agricultural layer (5.4.2). It also illustrated the abrupt drop in elevation on the west side, outside of the hillfort and the location of a series of lynchets. They are depicted with hachures around the north-west side of the monument (Figures 23-25). The earthworks continue around the site but are masked to the north by vegetation and to the west by the modern pathway and erosion (Figure 24). However, they can be identified on the cliff edge in the west (Figure 29) and more faintly in the east (Figure 35).

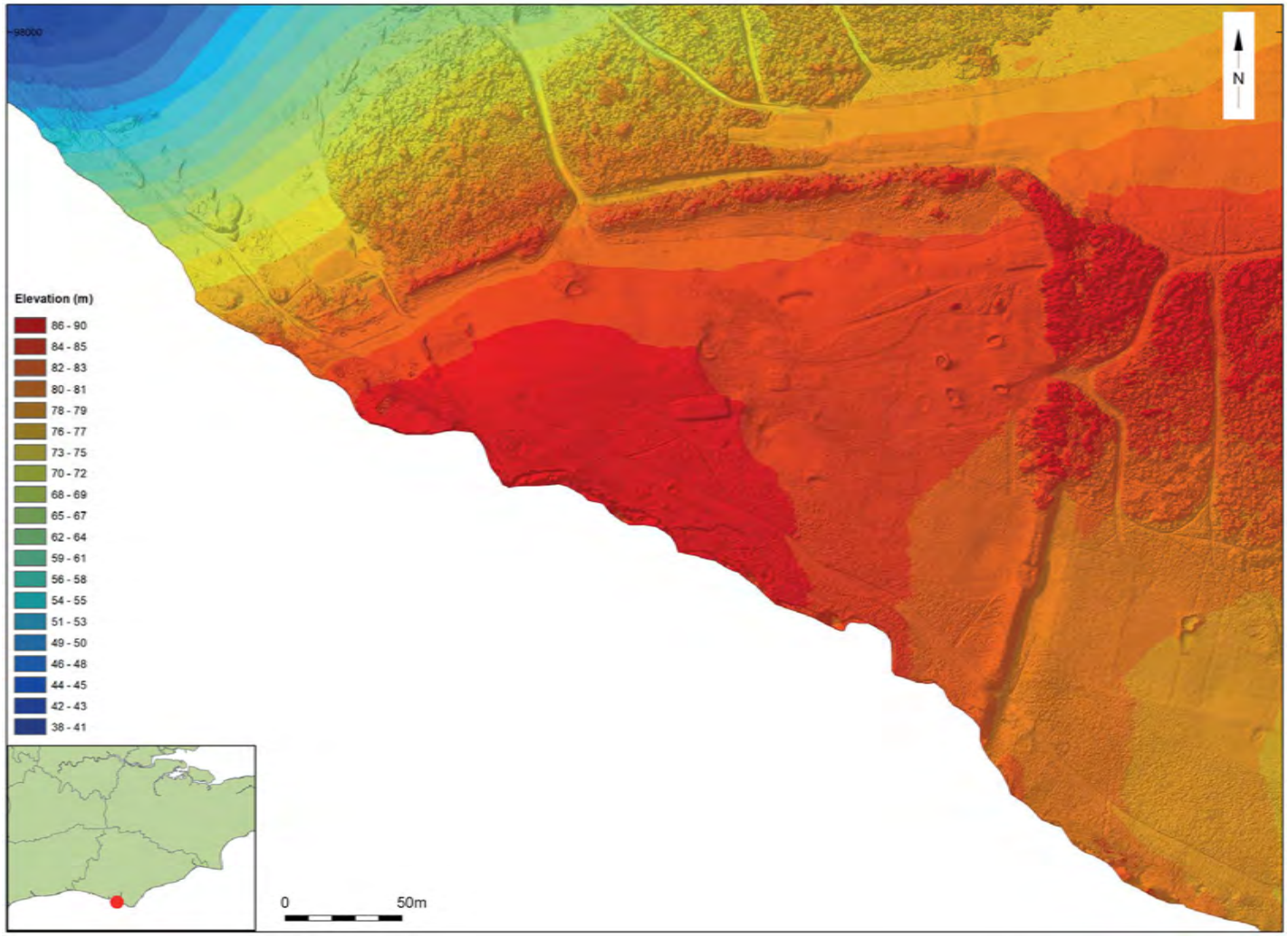

Figure 22: Digital Elevation Model.

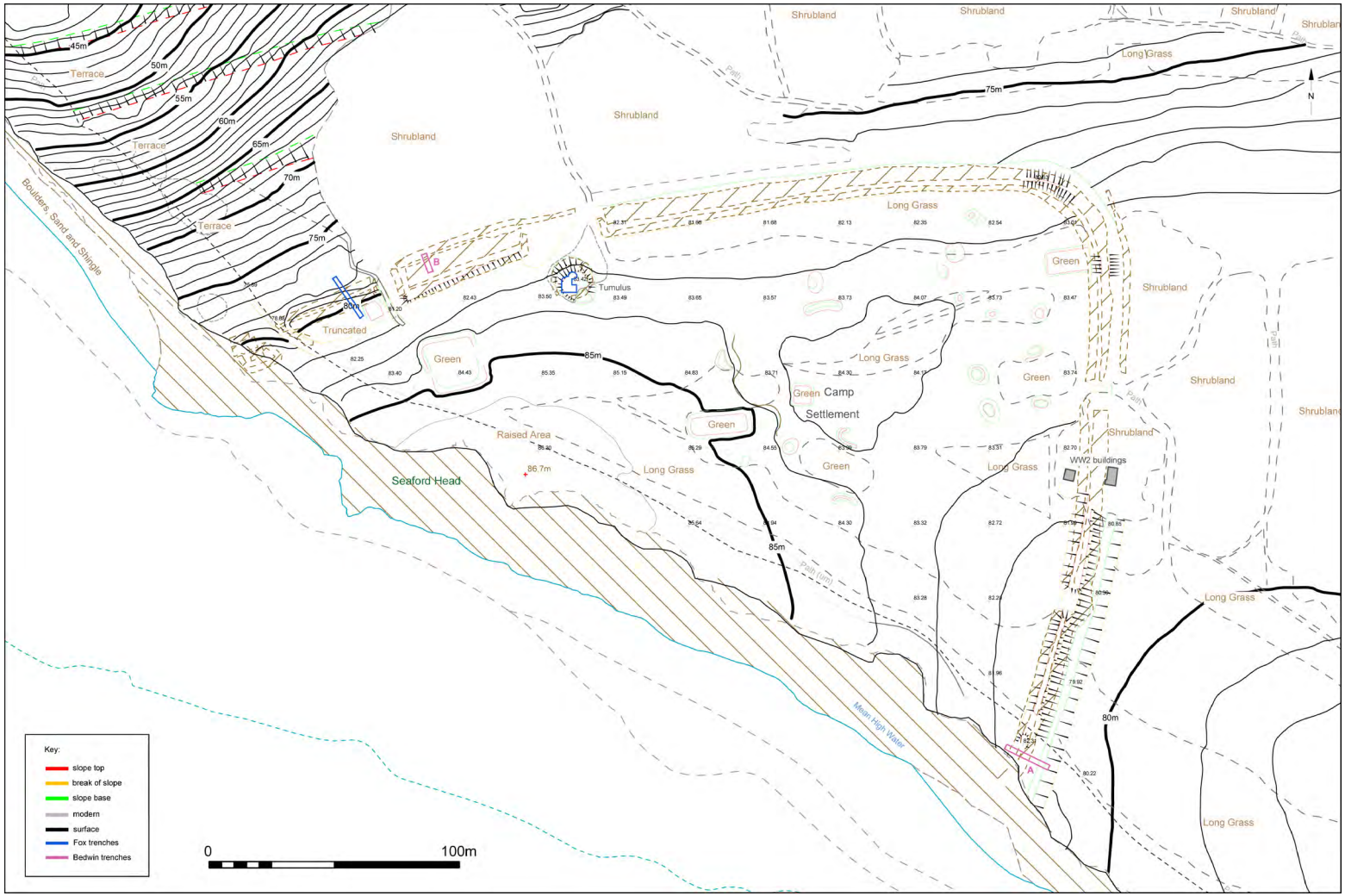

Figure 23: General topographic plan with contours and hachuring.

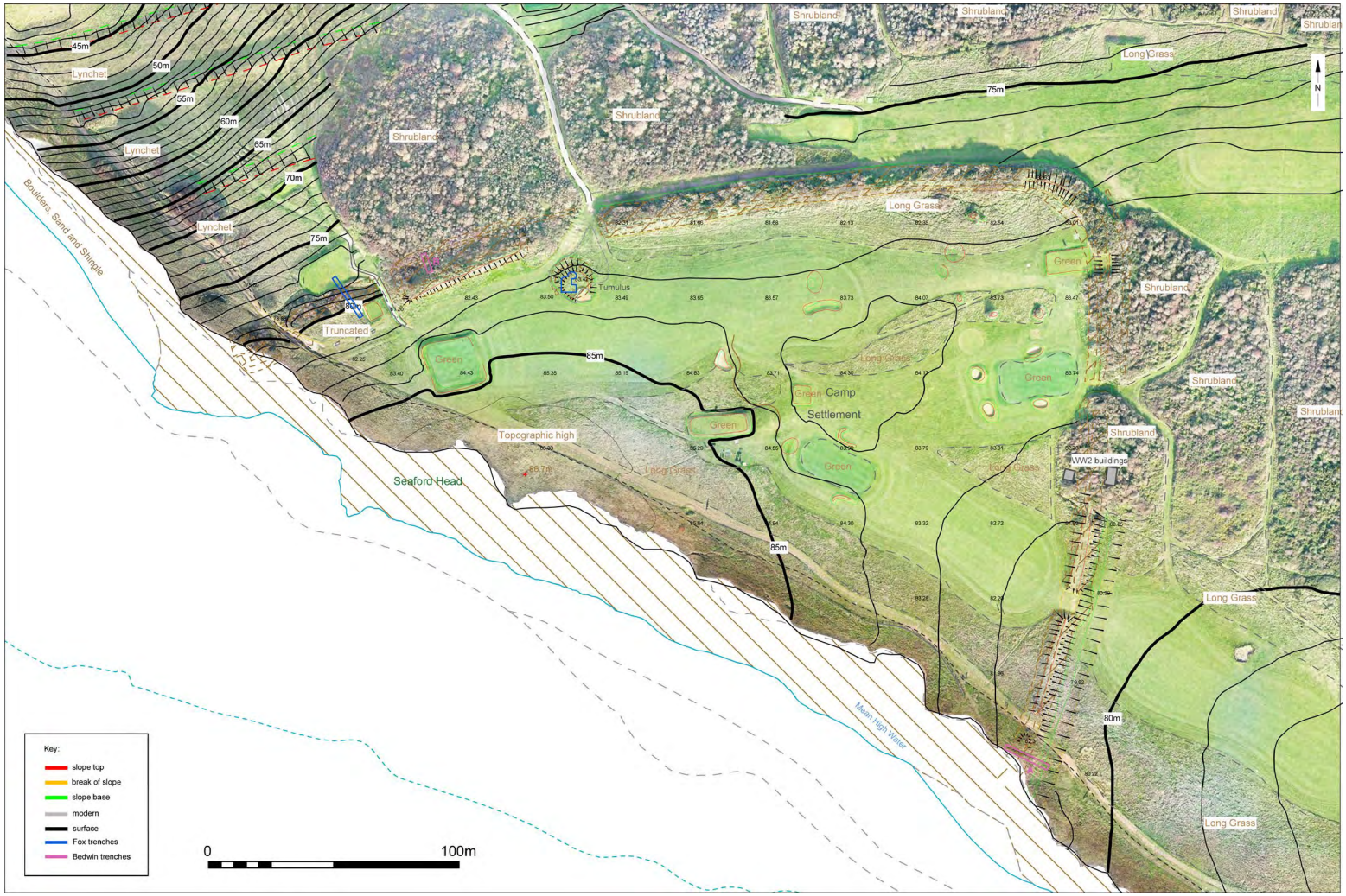

Figure 24: Topographic, photogrammetry and hachuring site plan.

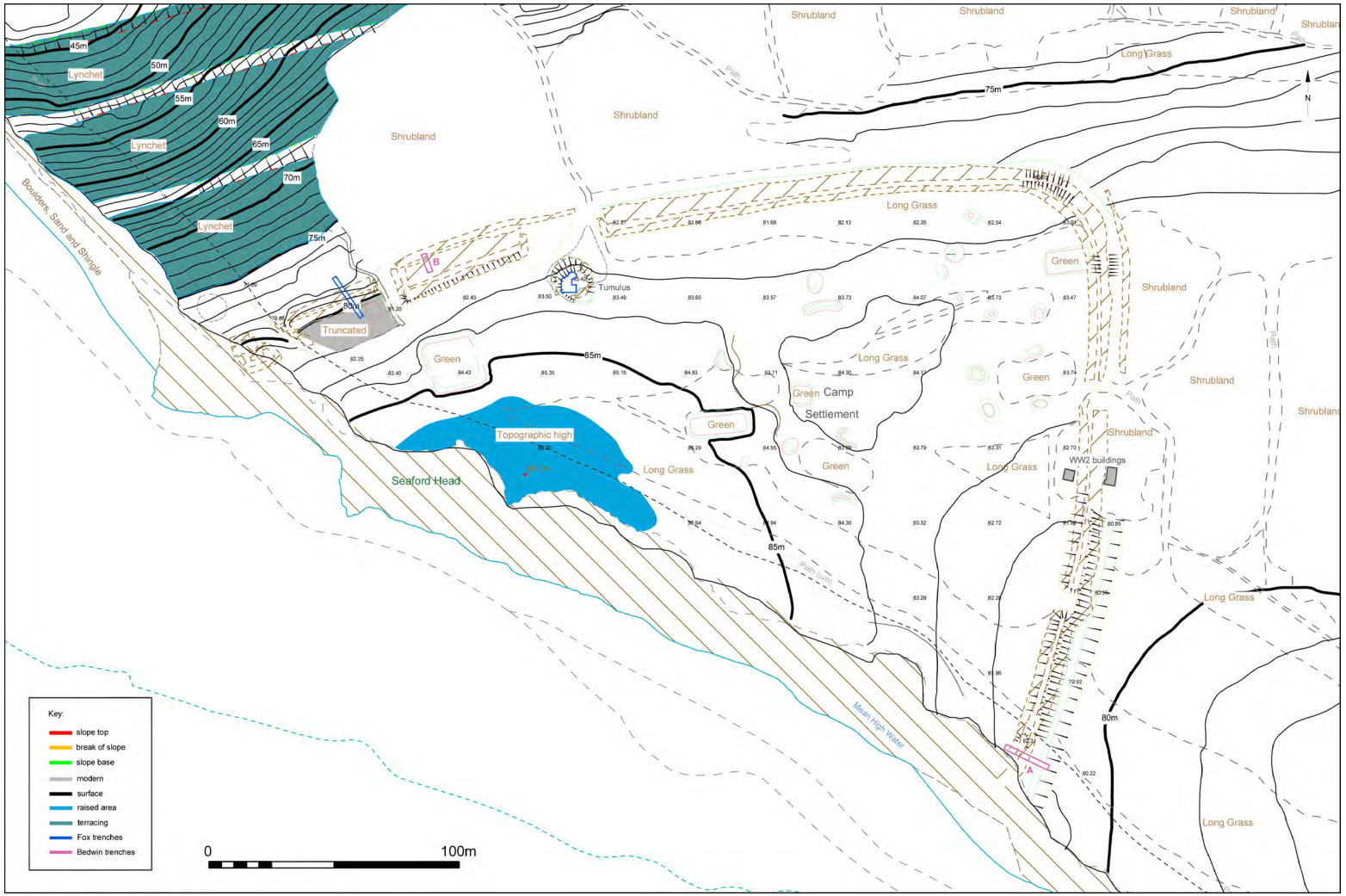

Figure 25: Topographic high and lynchets.

5.4.2. Cliff survey (Figures 26-35)

The aerial survey created scaled orthomosaic images of the cliff and observable features (bold numbered in brackets below and shown on figures), encompassing the monument and sections through the north and east ramparts. The cliff orthomosaic identified the series of lynchets (Figure 28, **1**) west of the monument, previously detected by topographic and aerial photographic surveys and referred to by Lane Fox and Bedwin. However, at the point of the cliff, the lynchets do not seem to be formed of great thicknesses of accumulated soil; overburden above the chalk bedrock is less than a metre thick. The location of the northern rampart bank (**2**) and ditch (**3**) along with a possible second exterior ditch or natural feature (**4**) and a probable natural solution feature (**5**) is shown clearly in Figure 29. Clear structure can be observed within the bank and ditch fills; the clarity of this view is likely to be due to a recent cliff fall in the area and is markedly different to the eastern rampart ditch and bank (Figure 35). Further probable solution features (**5**) east of the northern rampart ditch and bank are shown in Figures 30 and 31. These measured mostly *c.* 1.5-3.5m wide and *c.* 5m deep but varied greatly, from less than a metre wide and deep to over 5m wide and *c.* 5m deep. They are interpreted as solution features due to their scale, irregular bases and similar reddish fill denoting probable clay-with-flints. Whilst the majority are unlikely to be archaeological in nature, they could have acted as capture points for archaeological deposits and finds, as well as the overlying clay-with-flints. Corresponding with the topographic high point (Figures 24 and 25), a 65m wide dark brown deposit (Figure 32, **6**) can be seen and could relate to midden deposit or an agricultural soil as observed by Bedwin to the east (1986, 31). The view of this layer is partially obscured by an area of slumping which may be masking further details. In contrast to the northern side of the monument, the eastern extent appears to have a better preserved depth of clay-with-flints deposit, observed as a *c.* 1.5m thick reddish brown layer (Figure 33, **7**). Within this probable clay-with-flints deposit towards the east is a paler layer, probably natural in origin, some 21m metres in length (Figure 34, **8**). Deposits (**7**) and (**8**) are most likely geological in origin and formed during the Quaternary. Their potential for early prehistoric archaeology has yet to be tested. In contrast to the northern rampart ditch and bank, the properties of the eastern rampart bank (**9**) and ditch (**10**) are difficult to observe (Figure 35). This could be due to several factors, including the morphology of the cliff edge creating an oblique angle at the point of the ditch and bank. Likely without a recent cliff fall in this area, the deposits have become weathered and homogenous in appearance. A greater quantity of vegetation was also observed in the eastern extent of the survey, again suggesting this area has not been subject to recent cliff fall.

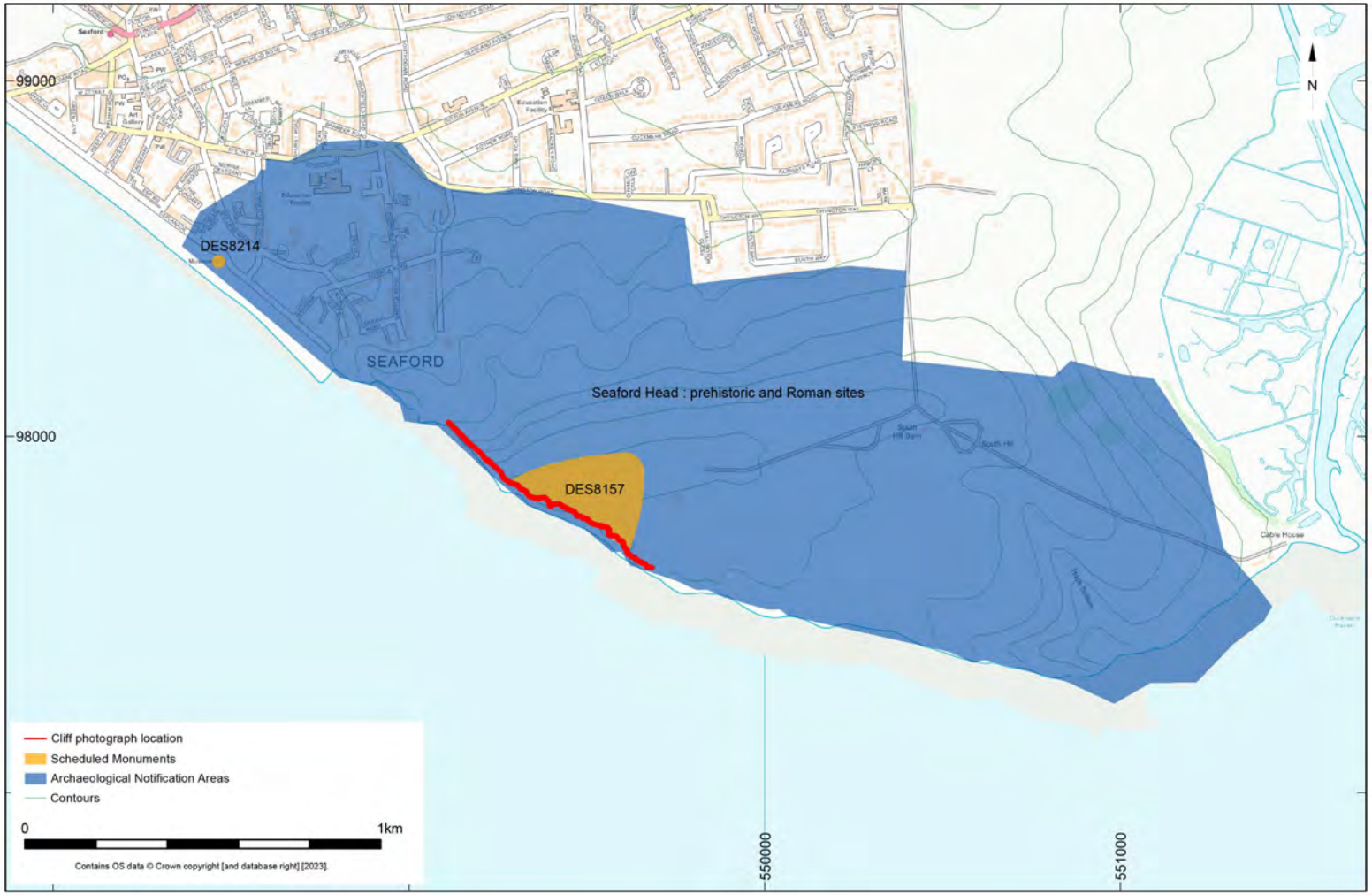

Figure 26: Cliff section location.

Figure 27: Overall cliff section.

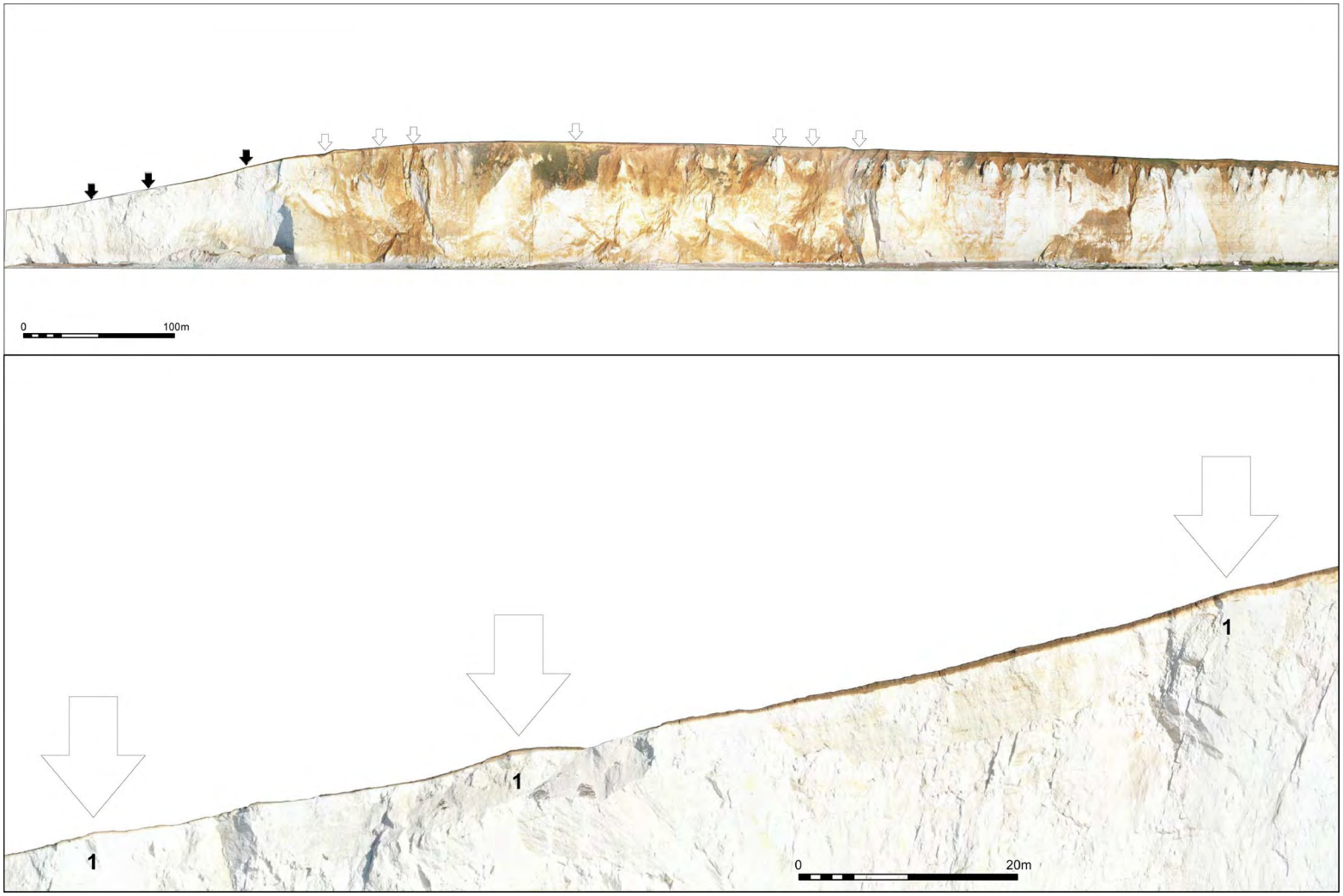

Figure 28: General cliff view and lynchets.

Figure 29: Northern rampart ditch and bank.

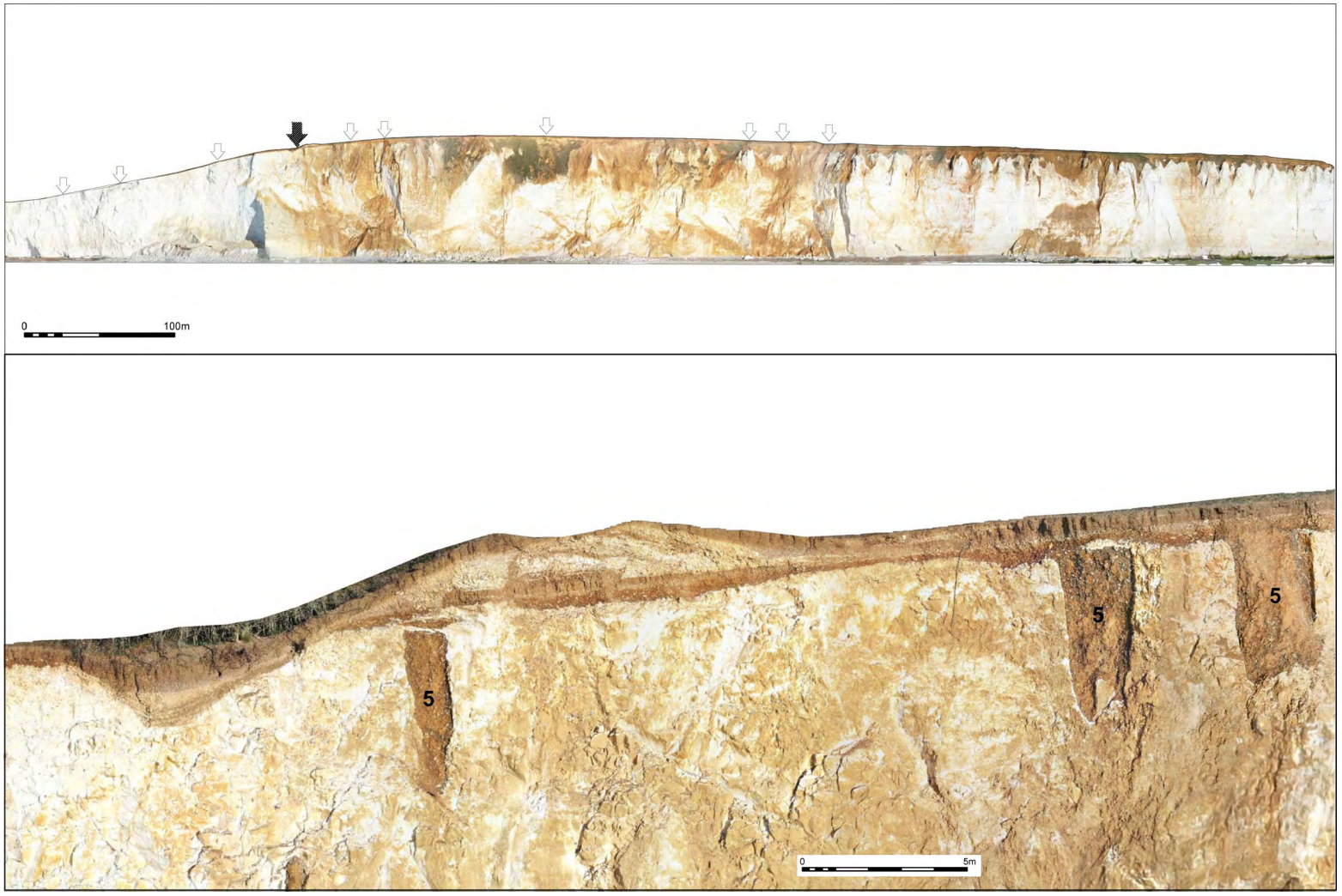

Figure 30: Northern rampart bank and ditch with three solution features.

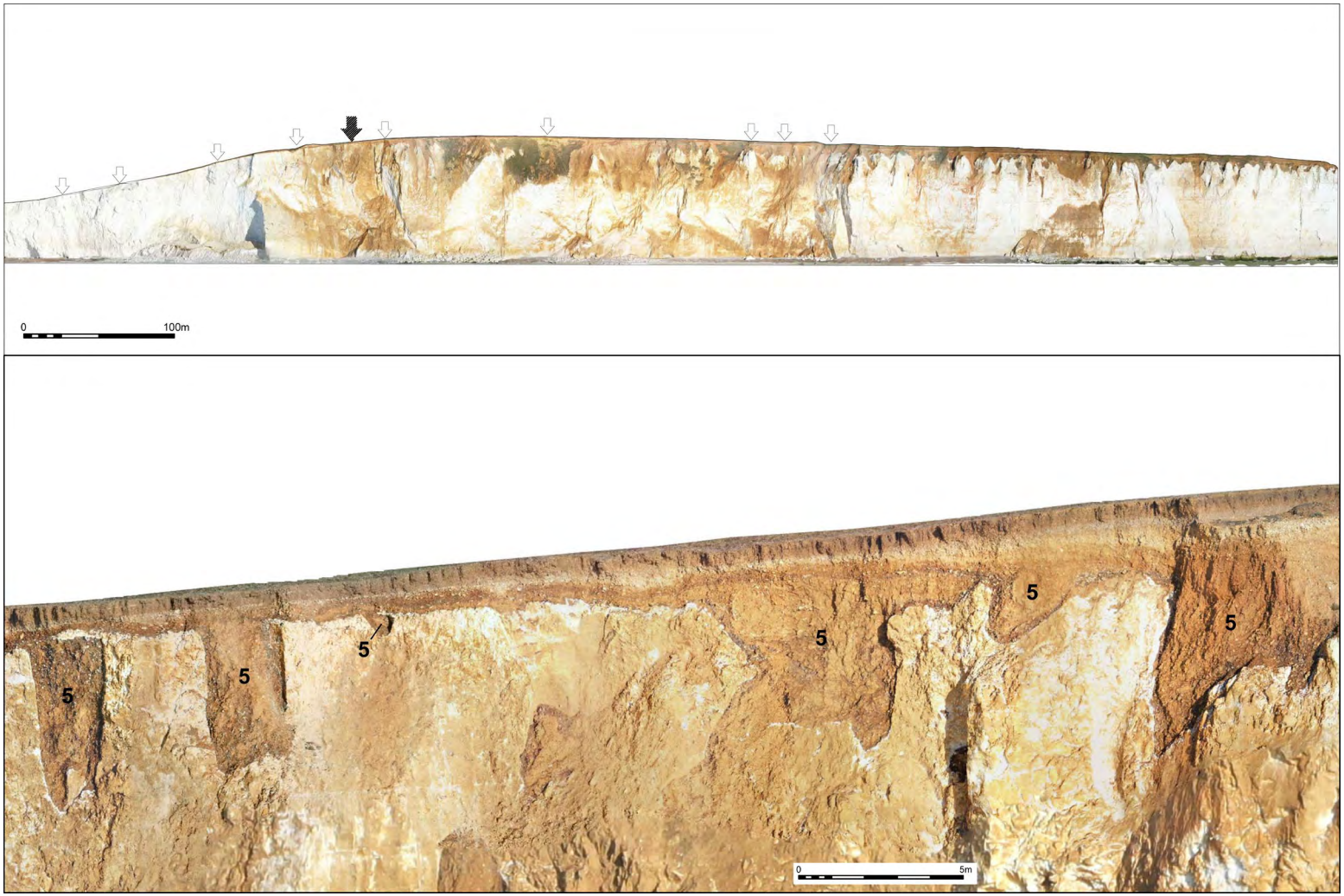

Figure 31: Solution features east of the northern rampart ditch and bank.

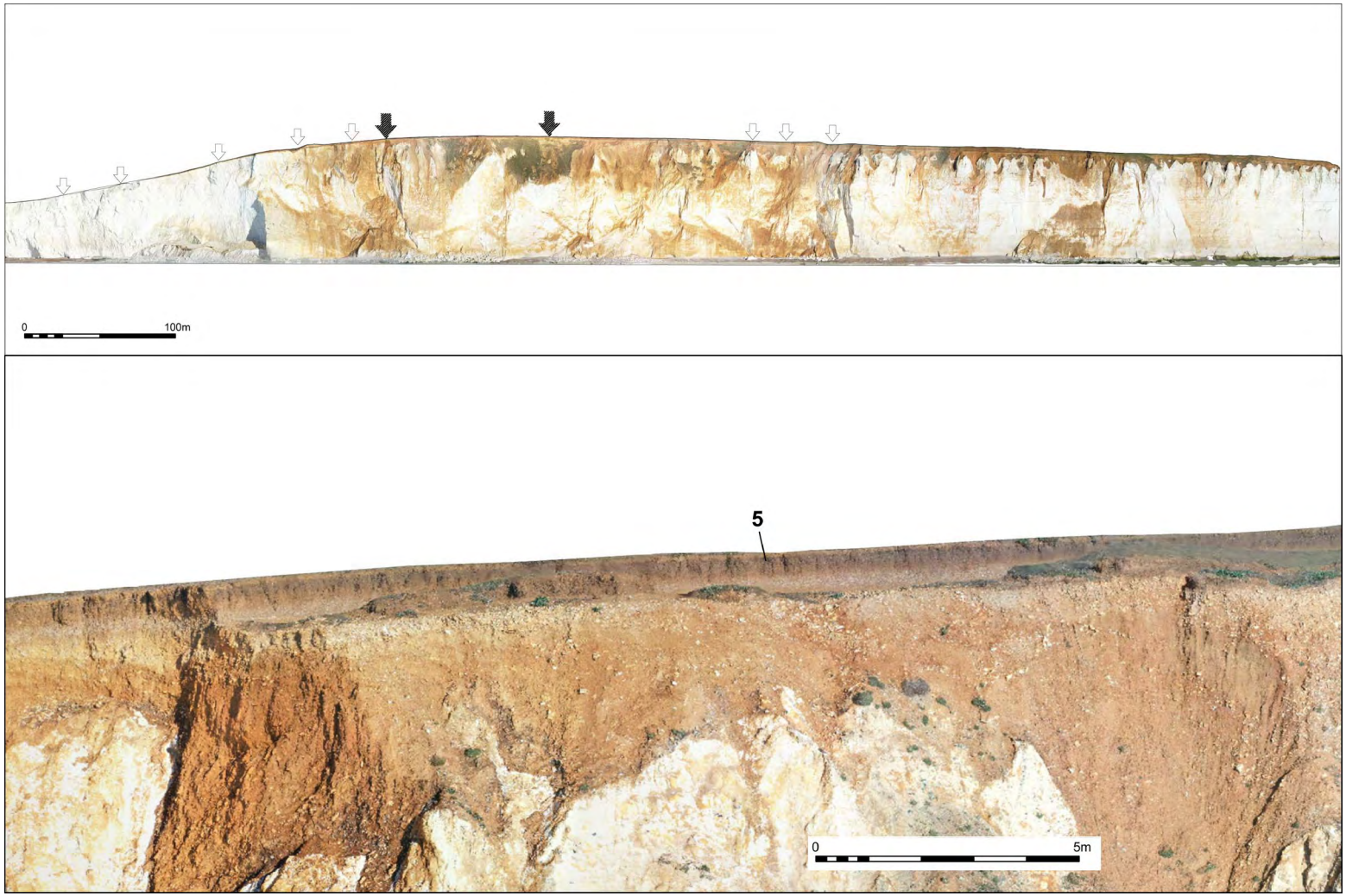

Figure 32: Dark layer.

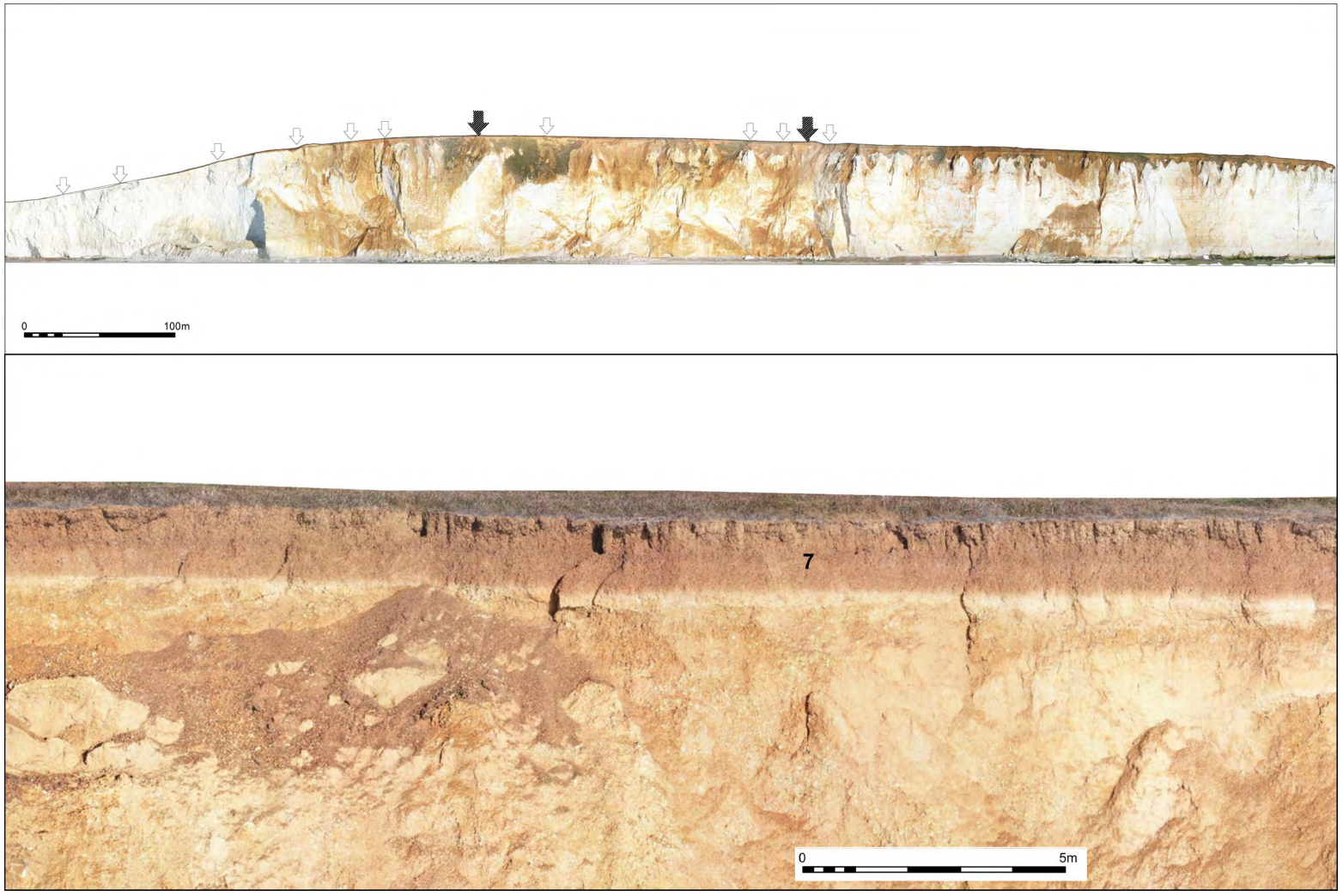

Figure 33: Reddish-brown layer.

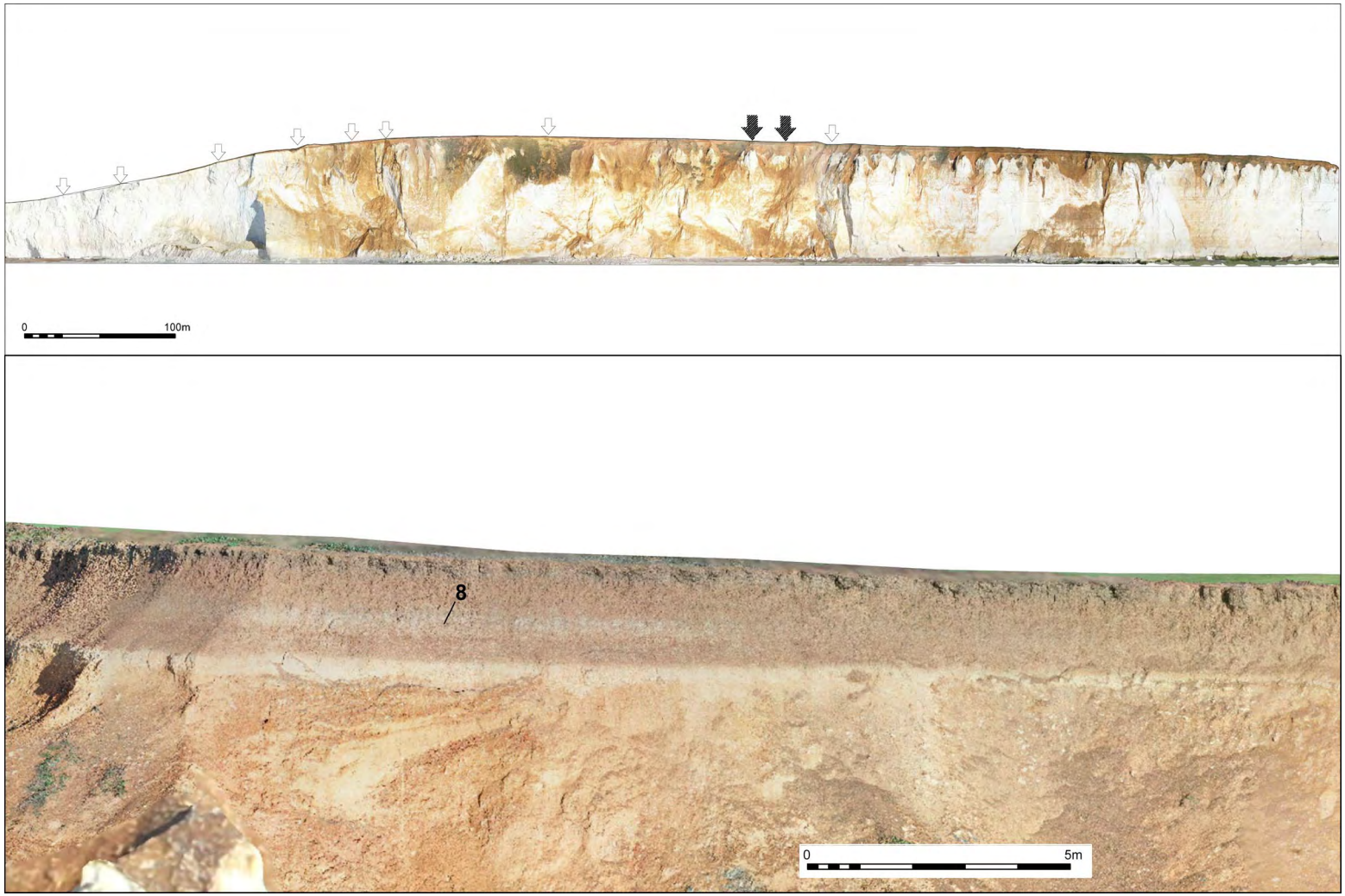

Figure 34: Light layer.

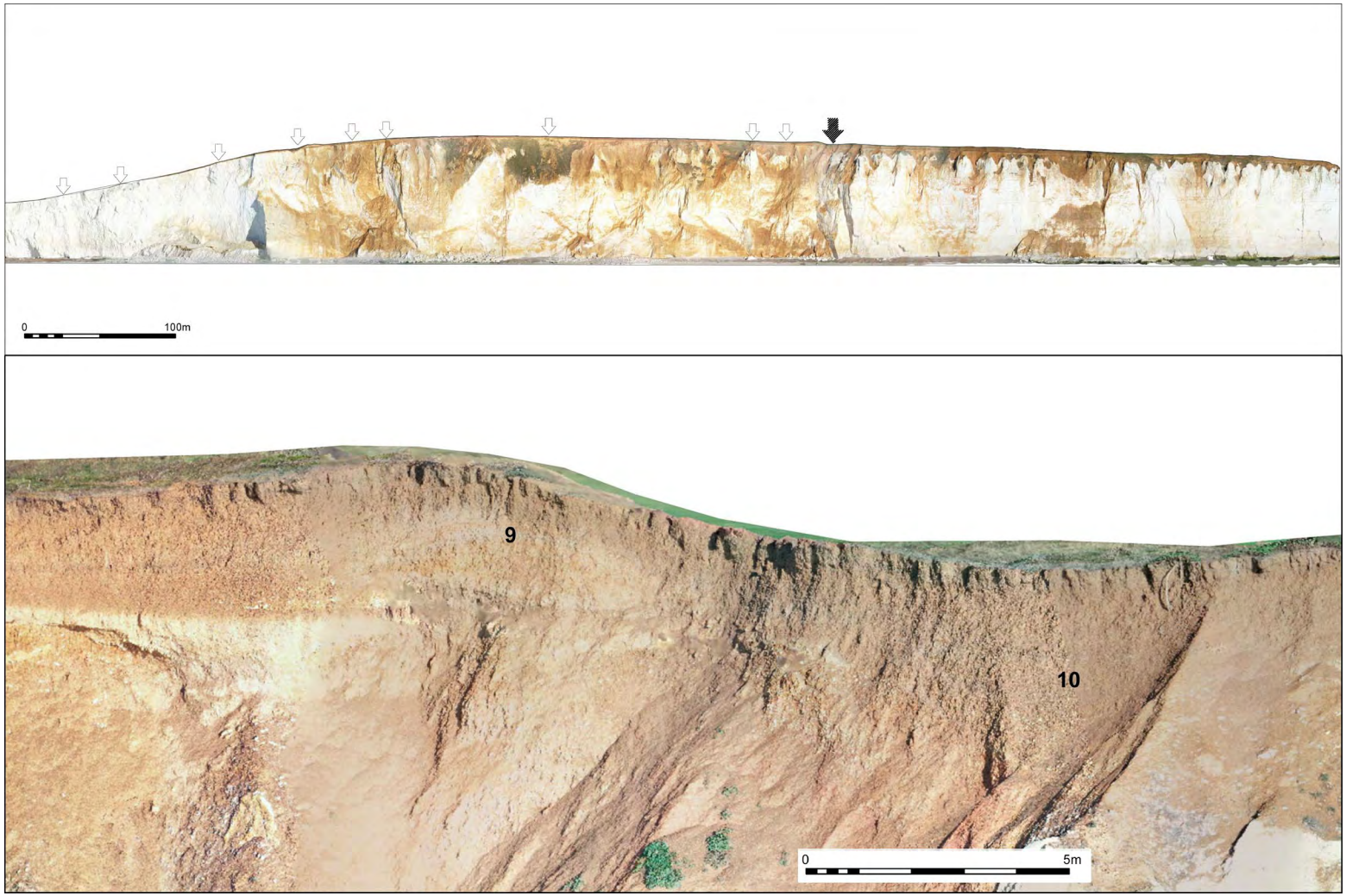

Figure 35: Eastern rampart bank and ditch.

5.4.3. Terrestrial survey

The terrestrial survey was conducted from Monday 15 November to Thursday 18 November 2021. It focused on features identified on the aerial survey defining the extent of the hillfort. Known features like the bowl barrow, bank and ditch, Second World War building and platform were recorded along with modern landscaping, street furniture and changes in vegetation.

Since proximity to the cliffs was not possible due to health and safety risks, the modern footpath was the limit of the ground survey (*see* Figure 23). Spot heights were recorded every 5m in order to be compared with the aerial survey data should there be a value discrepancy.

5.5. Outreach and press

5.5.1. Press release

Two press releases were created during the project's timeframe.

Press release 1 (UCL 2021): 'Using drones to capture coastal heritage before it's lost'.

This first release in December 2021 announced the project and introduced the site and its background. This release was highly collaborative; each project partner was quoted in the article.

The press release's reach included local take up via BBC South East Today and in local papers like *The Argus*, who uploaded part of the press release online (Lock 2021). However, more could have been done to reach local papers to increase local dissemination.

National or non-local reach included coverage in *The Telegraph* (Capurro 2022), although national press uptake was low.

Press release 2 (UCL 2022): Archaeological features identified at Seaford Head site

This release was created to coincide with the launch of the digital outreach assets and the project results.

5.5.2. Digital outreach assets

The digital assets were well-received, especially the spoken word performance, which was the most engaged-with asset and seemingly had the biggest impact based on the comments (Table 2). For the films, our insights are limited as they were not hosted on ASE's channel.

Asset	Views/ Listens	Likes	Comments
Introduction video	500	10	0
Results video	649	14	Kudos for clear presentation of the work and subject, along with methods. For a distant viewer, though, a locator map would be helpful, along with hints at the ways the layers of survey can inform present-day site conservation and future questions that the archaeology could possibly answer, or at least speak to.
If You Can Imagine, a spoken word performance by Alinah Azadeh	741	25	Wow, what rich, and poignant, wise, musings. I feel awakened out of an indifferent slumber! Thank you Alinah for drawing attention to history in the making all around us. I feel awake.... Beautiful and thought provoking! Thank you xxx amazing, thank you!
Podcast Teaser video	86	2	0 relevant, just promotions
Podcast	313	1	0

Table 2: Engagement metrics and comments on each digital outreach asset.

More insights are available for the podcast as it was hosted on ASE's Soundcloud. Of the 313 listens, 172 were from the UK, with listens coming from London (n=25), Cardiff (n=18), Seaton (n=8), Brighton (n=7), Seaford itself (n=6) and Eastbourne (n=5). Although these numbers are low, it was rewarding to see uptake in Seaford itself and the surrounding area, and Seaton, a coastal town in South Devon.

5.5.3. Social media

As stated in the methodology, social media was used to promote all digital assets, amplify the press releases and report ad-hoc project news.

6. CONCLUSIONS

6.1. Geophysical survey

Although widespread anomalies are evident across the geophysical survey plots, little entirely convincing evidence for archaeological features was identified given the widespread landscaping. Significant changes in both magnetometry and resistance readings were observed in the field while traversing modern features, especially with the resistance meter probes where probable sand was indicated on fairway earthworks. The anomalies identified above are therefore somewhat unreliable markers of archaeological material or features.

Similarly, the changing deposition of clay-with-flints across the monument, thickening to the east and originating close to the west of the western rampart, may influence responses across the plot. Solution features seen in the cliff profile, revealed by recent erosion, indicate continued deformation of geological formations at the site. It can be expected that some anomalies may derive from deformation at the surface of the superficial geology through natural processes and rework magnetically susceptible material into linear arrangements.

Anomalies that may indicate archaeological features in the magnetometry data are limited to positive anomalies, though it is conceivable that some of the magnetic disturbance may include an anthropogenic origin. These are all of an equivocal archaeological origin and may represent pits or shallow ditches. However, they may also be the result of changes in the superficial (and perhaps solid) geology.

A comparable survey was undertaken by Historic England at Cissbury Ring near Worthing in West Sussex (Payne 2001), which found that results were partially masked on the clay-with-flints deposits. As with Seaford Head hillfort, the results at Cissbury Ring produced an 'unclear geophysical response' due to a complex land use history and relatively recent disturbance of the site. Correspondence of modern earthworks at Seaford Head was found to be good though waned over the rampart, perhaps due to walking errors.

The geophysical surveys indicated that further survey would unlikely yield more interesting results due to disturbance and masked responses, but that potential targets for excavation do exist. These comprise elements of the Bronze Age barrow, numerous discrete positive anomalies, and areas of magnetic disturbance the origins of which are uncertain and would merit clarification. Although the surveys do not greatly contribute to the understanding of prehistoric Seaford Head hillfort, they do illustrate the difficulties that some coastal heritage sites face as climate change forces difficult decisions about the management of their decline. The geophysical results contrast with the evidence apparent in the cliff section, which shows sections through ditches, ramparts, and possible midden features and pits. The latter are difficult to distinguish from solution processes on the geology and can only be determined by intrusive methods.

6.2. Topographic and photogrammetry survey

6.2.1. Discussion

Combining two different topographic survey methodologies was beneficial in identifying possible features, mitigating risk and facilitating a fast turnaround of preliminary results.

Although the aerial survey was impacted by bad weather for a day, its fast-measuring techniques, quick contour maps and access to otherwise inaccessible areas provided informative results. In addition, it identified potential areas of interest for the terrestrial topographic and geophysical surveys.

Terrestrial aerial survey

The scheduled monument has been used as a golf course since 1887 and was requisitioned by the military in 1940 for food production. Its usage as a golf course has greatly affected what can be identified on the surface. Its numerous existing sand traps and golf mounds along with flattened areas and landscaping has created modern truncations and changes to the surveyed area that mask almost all earlier human activity. This includes parts of the bank and ditch, which have been flattened for golf course function (*see* Figure 23) along with enabling views of Seaford.

The aerial survey however did identify a topographic high raised area *c*. 1m above neighbouring areas, measuring approximately 200m long and 65m wide, close to the north-west entrance of the monument (*see* Figure 25). This area is south of the bowl barrow and its location provided the best visibility of the surrounding landscape.

Although lying outside the hillfort enclosure, the aerial survey identified at least three lynchets on the monument's north-west side (*see* Figure 25). Every lynchet marks a 5m drop in elevation creating at least three terraces surrounding the west side of the monument. No evidence of possible related field systems was identified to the immediate east of the monument.

The terrestrial topographic survey did not reveal any new information but did provide an accurate record of existing features and modern truncations.

Cliff side aerial survey

One of the clearest and most interesting features identified during the cliff side survey was the northern rampart ditch and bank (*see* Figures 29 and 36). This area had apparently been subject to relatively recent cliff fall, as shown by areas of clean chalk, the face around the features appearing near vertical, a clear boundary between chalk and feature, and details within the features being discernible and not masked by weathering. This image warrants further investigation and comparative research with existing data from other contemporary Iron Age hillforts. It also shows strong similarities with Bedwin's section drawing through the bank in the east of the monument (Bedwin 1986, 28; Figure 37).

One possible interpretation of the image is that the land surface/soil horizon at the time of construction was not stripped and is preserved beneath the bank (Figure 36, a). Bedwin recorded a similar land surface to the east (Bedwin 1986, 28-9, context 22) that had been built upon and truncated by post holes to form a rampart with a possible palisade.

Figure 36: Northern rampart bank and ditch interpretation.

Bedwin's land surface proved to contain evidence of tillage; therefore, if it is preserved in the west of the site then similar evidence may be present here. In the northern rampart image, there appears to be a vertical ?revetted edge of the bank formed by a possible palisade (*see* Figure 36, **b**). In Bedwin's section in the east, a post hole (context 19) truncates the contemporary land surface (context 22) and the first construction deposit of the bank (context 20) appears vertical against it (Bedwin 1986, 28; Figure 37). The northern rampart image shows spoil tip lines from the construction of the bank (*see* Figure 36, **c**), as they are in Bedwin's section to the east (ibid.; Figure 37). It appears that a greater height of the palisade was maintained during the collapse of the northern bank, but this could represent a single post hole rather than a continuous feature, whereas in Bedwin's section, the collapse of the bank does not appear to have retained much of the potential revetment created by the palisade (ibid.; Figure 37). Given the ditch and bank extend inland away from the cliff edge, it would be possible to safely excavate and test this assumption at a point inland to the east.

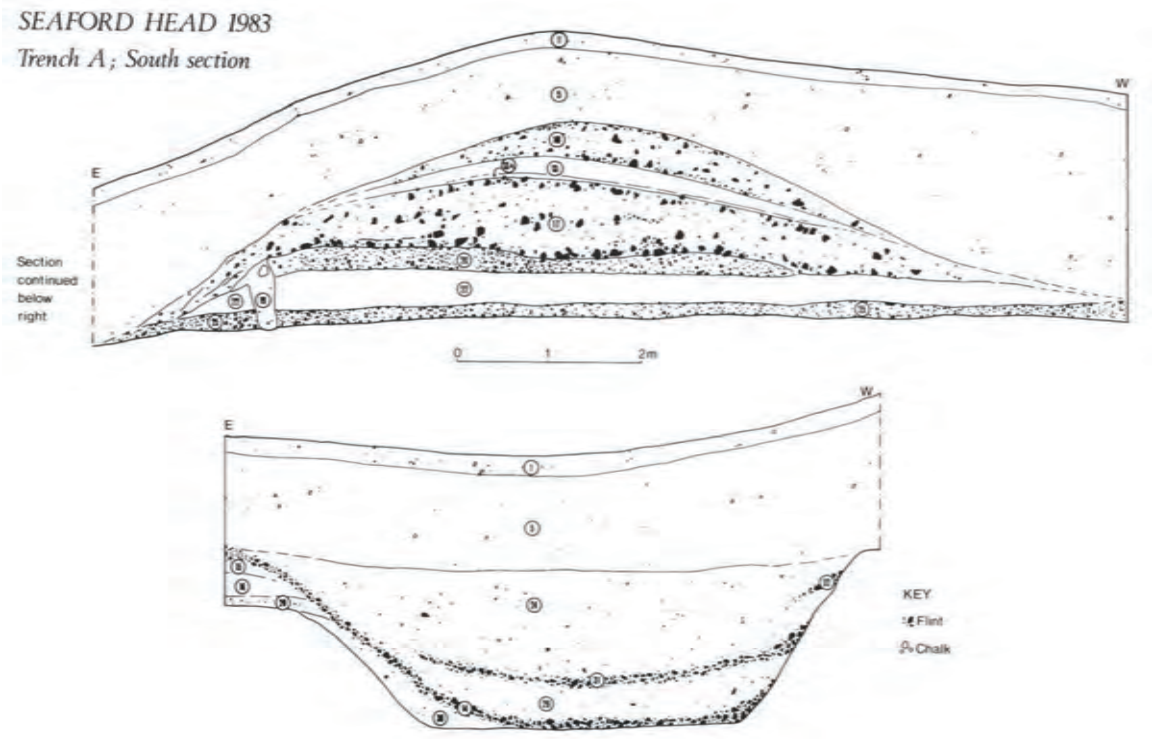

Figure 37: Section of eastern rampart ditch and bank, after Bedwin 1986.

6.2.2. Conclusion

In conclusion, the data gathered from the topographical survey confirmed the existence of the ditch and bank circling the monument, the existence of the bowl barrow and Second World War building while providing up-to-date aerial images. It also identified a large, raised area inside the north-west side of the hillfort along with the existence of at least three terraces on the west side outside of the monument.

Aerial survey of the cliffs identified the ditch and bank features on the north and east sides alongside numerous large features cut through the natural chalk. A layer of dark brown soil was identified on the cliff edge that extends for at least 65m. It can be associated with organic material and its location coincides with the raised area inside the hillfort. Towards the east side of the hillfort and in proximity to the east bank, there is a light yellowish-brown layer that extends for approximately 21m.

6.2.3. Implications

The combination of an aerial survey, using an RPAS and conventional survey instruments, proved successful and informative. Data from the aerial photographs create accurate results for an informative approach on what to capture using conventional survey instruments.

Although weather and light conditions can raise obstacles for when an aerial survey can take place, planning mitigates those risks. The aerial survey results can then inform additional work and guide the geophysical survey locations.

Although the EA has made freely accessible lidar data (2022), it would be beneficial for future projects to include aerial lidar capture with drones on a site-by-site basis. Technology has reached the point where such a task can be done with better results than the ones currently offered free. Although sites that are covered with vegetation (like Seaford Head) and trees may still require traditional survey.

6.3. Public engagement and press discussion and evaluation

Based on the metrics available above, and qualitative analysis of the process, each of the elements of the programme of outreach will be assessed.

6.3.1. Press release

It was incredibly useful to work with the UCL Media Relations team on the press releases. The project team wrote a better press release and garnered better national and local coverage (the BBC television report) with their support. This will not always be possible for other organisations running similar projects but should be recommended if available. This could be something that the HE media relations team could offer as part of future funding offers.

The numerous partners on the project led to long lead times in the collaboration on press releases. This should be factored in if projects have similarly complex teams, and time should be allowed to circulate many drafts before completion.

It should be noted that press releases, though managed by UCL Media Relations, took far more project time than had been anticipated or costed for. This included time to respond to information requests from the media, undertake interviews both remotely and on site, and attend site uncosted to conduct interviews.

When the story was taken up by the various media bodies, it was difficult to keep control of its direction. The media relations team made the initial contact, but it was then down to the project team to get the story across and try to control the telling of it. Local press were more likely to take the press release verbatim or edit and embellish without discussion with the project team. National press had a clear idea of what they thought the public would engage with and tailored the story to this, often wanting to focus on archaeological discovery rather than wider issues of heritage loss. Ideally, the project team would have had media training or continued media relations support to do this, but this was not possible for this scale of project.

In hindsight, the focus should have been very much targeted at local papers, in addition to trying to attract national attention, which is the remit of UCL Media Relations. The response from local outlets was not the desired result, but they are perhaps the most efficient method for dissemination of results and messages to the local community. Given the difference between local and national press response, it may have been better to write separate press releases for each of these audiences, but again the limited scope of the project prohibited this.

6.3.2. Digital assets

The video content produced by Chip Phillips was excellent, and if a project can afford to employ a videographer, it would be highly recommended. That said, if the budget cannot stretch to this, much can be done with limited equipment depending on the expertise of the project team.

The spoken word performance was by far the most engaged-with digital asset in terms of watch numbers and comments. The way in which Alinah Azadeh was able to take archaeological findings and tackle the difficult subjects of belonging and heritage loss clearly resonated with the community. Again, this is highly recommended if the budget allows.

The podcast produced by ASE was an incredibly important conversation to record. Even the host of the podcast, Emily Johnson, felt that it truthfully changed the way she thinks of archaeology. While the original plan was to record and film this discussion live to make the teaser video, from a podcast perspective the audio quality was almost certainly better and the editing easier by having it recorded virtually on Zoom. Basic equipment was used, including a separate recording on each of the participants' mobile phones, and the quality was more than adequate. By recording remotely, time and expenses were saved as well as carbon emissions, in terms of travel.

One unforeseen aspect of the podcast was creating a transcript of the discussion to increase accessibility for those with audio impairments. As this was a particularly long podcast episode, with multiple people speaking and with technical language used, this took longer than expected even using the automatic transcription feature on Adobe Premiere Pro.

6.3.3. Social media

In-depth analysis of social media reach is beyond the scope of this report; however, it should be noted that its use was the main avenue by which the project team promoted these assets and the press release. Social media had the best engagement and reach when all partners were working in sync with each other, amplifying each other's content. It is essential to have an already established social media account to use, or to amplify, unless there is a highly active community in a group. If project teams do not have access to social media accounts with established followings, dissemination via, for example, one of HE's social media channels would be a desirable solution.

6.3.4. Dissemination

The outreach assets created for the Seaford Head project were rooted in dissemination and were a very passive form of public engagement. As stated above, this was a necessity based on the rapid nature of the survey and the testing of the method.

Nevertheless, these assets possibly could have better disseminated to local communities, as it is likely that our reach was largely an already Archaeology Aware audience (i.e. followers on ASE social media or podcast followers), rather than the community living by or using the site. Local news outlets, both online and hardcopy, would likely have been good targets for the efforts. This would be a useful point of discussion with the UCL and HE Media Relations teams, who are often geared towards attracting large scale national attention rather than focusing locally or regionally.

6.3.5. Recommendations

Projects wishing to follow a similar model to Seaford Head should employ a programme of outreach. The scope of this will depend on the nature of the site, the desired audience to reach, the project budget, any in-house expertise in media relations, social media, video editing and so forth, and equipment for use in content capture (video, audio, images). The type of digital assets created should also take into consideration when planning the methods of publication and dissemination. Longform videos and podcasts should only be attempted if there is an established YouTube channel or podcast to host them, or at the very least social media accounts in the project team with good followings to publicise them. Shortform, portrait videos posted directly to established social media channels may be the most cost-effective way to utilise video content.

Recommendations are given below based on the outreach programme employed for Seaford Head, but this is by no means exhaustive.

Funding for outreach

The outreach undertaken at Seaford Head was made possible by a contribution from the SDNPA and was not included as part of the HE grant for the work. HE should consider the requirement for public engagement within their funded research projects, the extent to which this should be undertaken, the support they could offer

and who will fund this aspect of the project. Having an external partner such as the SDNPA contribute to the project created a stronger bid and helped form a partnership between ASE/UCL, HE, SDNPA and STC to deliver the work. However, not every project will have such an external contribution and HE should consider including an allowance for outreach and dissemination within grants for similar projects.

Press release and/or dissemination of findings

At the very least, some sort of notification of the project and/or publication of findings is strongly encouraged. This option has the lowest cost and equipment and technical knowledge requirements of the project team. Project access to social media accounts with established followings will certainly increase reach, but a lack of this could be mitigated for by using a collaborator or funder account.

Potential reach is also expanded by using a Media Relations team, if possible, but it is important to specifically target local news outlets to reach local communities. Local press outlets often have less resources and may be more willing to run stories verbatim. If a project does make national press, the focus of it could be hard to control. Consider the time it will take to respond to requests from the press in project funding.

If your project has multiple partners, then consider the time it will take to agree joint press releases.

Historic England should consider offering media relations support when funding projects, especially for small groups or organisations without access to internal resources. This would potentially increase the impact of HE's funding and allow better control over media output.

The time costed to create the press release should also include time to respond to press requests once published. This could possibly include travel to site for interviews. It should be noted that some requests ultimately will not result in a story, but still cost project time.

Digital assets

If a platform for online dissemination exists, videos are an excellent way to publicise findings in an interesting way, especially in addition to a press release. The best results will be gained if there is budget for a videographer and for an artist to in some way interpret the results. However, low budget shortform portrait videos for dissemination on social media channels like Facebook and Instagram (Reels), TikTok and YouTube (shorts) may be shot solely on a smart phone, if basic skills for storyboarding, recording, editing and publishing exist within the project team.

A podcast episode should only be attempted if this could contribute to an existing podcast series. Recording virtually via Zoom will help keep equipment, time and travel costs low, audio quality adequate and the editing process easier, especially with multiple guests. Skills in podcast storyboarding, recording and editing are essential and could be sourced externally if they do not exist in the project team.

7. DISCUSSION

7.1. Introduction

Seaford Head is a visually dramatic and archaeologically important site. As a case study for this type of project, it offered a perfect opportunity to test the methodology for replicable, rapid assessment and see what can be discovered on such a short timescale and small budget. The results of the project facilitate initial exploration of the impacts that coastal erosion might have on the heritage at risk, the management of the site and the community.

7.2. Testing the methodology

The primary aim for the Seaford Head project was to: *Develop and deliver an achievable, proportionate, and replicable methodology for the non-intrusive survey of a scheduled monument at risk from continued, rapid costal erosion* (RA1). The results suggest that the project has achieved this aim (see also Section 8), and that it was completed despite some challenges from the landscape of Seaford Head, which bodes well for other sites wishing to replicate this project that may have similar concerns. Landscaping associated with the management of the golf course and previous use of the site for Second World War defences hindered the results of the geophysical survey; nevertheless, we were able to draw meaningful conclusions from the data. With coastal erosion already limiting the total area of the site that could be surveyed, the necessary use of RPAS provided incredibly useful data to support the ground-based survey. Again, for sites on similarly precarious cliff-top locations where the monument is already partially lost, this project and methodology has shown there is still important data that can be gathered. It could even be said that the exposure of the site in the cliff edge helped improve our understanding of the site, so where the site allows and the equipment is available, this should certainly be included in the methodology.

7.3. Advances in archaeological understanding

The results of the survey and the research that supported it were enlightening despite the rapid nature of the project and provide a context for management and a springboard for future investigations on the site.

The research and survey firstly facilitated a better understanding of the history of loss on the site and a contextualisation of previous excavations. Studies by Dornbusch (2022) suggest that most of the erosion caused by wave action has occurred during the later 19th and 20th centuries. Therefore, the original extent of the hillfort may have been much closer to how the site is today than previously thought by Lane Fox, who postulated that 'the destruction of at least one half of this camp, by the erosion of the cliffs by the sea' (1877, 287). Bedwin's investigations also assumed much more extensive loss had already taken place, thinking that Lane Fox's trench across the eastern rampart had been lost due to cliff erosion, but this does not seem to be the case based on our surveys (4.1.2, *see* Figures 3, 23 and 24). This increased understanding of what has been lost and how recently; additionally, identifying the

locations of previous excavations has a huge impact on future management plans for the site and any further archaeological investigation.

The surveys have raised at least three new research questions relating to archaeological features and deposits on the site. The remarkably clear image of the northern rampart ditch and bank (*see* Figure 36) and its similarity to Bedwin's section through the ditch and bank to the east (Bedwin 1986, 28; *see* Figure 37) suggests that the site could contain detailed information relating to the construction of hillfort. The image of the northern ditch suggests that the bank could be built on a preserved land surface like the one recorded by Bedwin in the east (1986, 28). This suggests that a preserved land surface exists on the site at least in the areas covered by the bank, if not more widespread, with the potential for further study as to the previous land use immediately prior to hillfort construction. The dark layer observed in the cliff image (*see* Figure 32) could also relate to this or could be evidence of midden deposits related to site occupation. Although the geophysical survey was hampered by golf course landscaping, importation of material (sand) and the clay-with-flints geology, numerous positive anomalies were identified, notably several close to the Bronze Age barrow. Evidence of contemporary Bronze Age activity close to the barrow could be of great value in investigating how the ceremonial interacted with the more mundane in Bronze Age society and how land use evolved on the site especially given that the hillfort is thought to be of such an early date. These new research questions show just how much archaeological understanding can be gained by even a rapid survey like the methodology developed and delivered for this project.

7.4. Heritage at risk

Despite these new questions, and the revelation that what has already been lost may be less than originally assumed, the risk to the heritage of Seaford Head was thrown into stark relief by this project.

The slow historic rates of erosion reported by Dornbusch (2022) cannot be used to accurately predict future loss. This is due to several factors including rising sea levels and increased storm activity causing greater wave action/impact, and the increasing frequency of extreme weather events causing notable periods of drought that dry and crack the chalk, which are followed by periods of intense rainfall increasing water action and loading weight. Predicting the magnitude of the impact caused by these factors is impossible, but it is known that they are increasing in intensity and frequency and that they play a role in cliff collapse. The archaeological survey completed as part of this project will allow us to monitor that loss with greater clarity going forwards.

When considering the loss of the monument, there is a need to think about the parts of the monument which are dangerous to access, despite not currently being 'lost'. The existing cliff edge is not straight and cracks are visible in the ground just south of the coastal footpath. The risk of excavating in this area is difficult to quantify but is certainly greater than walking the footpath in terms of time spent in a risky area and impact to ground stability through the movement of soil/fill. For this reason, any future hand-excavation on the site should be conducted a safe distance away from the cliff edge. The area adjacent to the cliff edge holds significant risk for excavation, but

this could be mitigated through careful use of a long-arm mechanical excavator and aerial planning of any uncovered features, alongside sieving spoil for artefacts.

The risk of cliff collapse impacts the future management of the site, notably the route of the coastal path, which forms part of the soon to be completed *c.* 2,700-mile England Coastal Path, and the current positioning of two of the greens of the STC-owned Seaford Head Golf course. Both traverse or sit within the scheduled monument and would require scheduled monument consent to alter.

7.5. Community engagement

The Seaford Head project also offered an important opportunity to evaluate the degree to which a rapid project could raise awareness of an at-risk heritage site to a public generally unaware of its archaeological significance. The deep history of the site is little known amongst the local populace. The site is more prominently used for activities where the archaeological features are simply part of the landscape, particularly by golfers, dog walkers and hikers. Communicating our results to local residents, stakeholders and to a national audience was one of the original research aims for the project and, significantly, was only made possible by additional funding from the SDNPA.

As part of the project, lots of high-quality digital content and outreach material were produced that were excellent vehicles for disseminating the project and the results. However, it could be argued that a lot of this did not reach the local communities we were targeting. The press releases found some uptake by local journalists, particularly the BBC South East Tonight television news piece, but print and online media seemed more ambivalent to the story, and these outlets could have been targeted more specifically and intensively. It is hard to measure local engagement with the digital assets, but the piece featuring Alinah Azadeh certainly elicited the best local response based on the comments. Arguably, working with a locally recognised artist increased reach to those communities. It can also be said that sharing these to local community groups online and in-person would have helped impact more local people, for which it would help to have a community contact.

Three major conclusions can be made from the programme of outreach employed by this project.

The first is that some form of public dissemination of results is an essential part of such a project and should be funded. This is a crucial first step to creating a meaningful community project later, and content created in this initial phase will retain its usefulness for future projects.

The second is that projects looking to replicate this methodology should be aware that much can be done with less expense, equipment, and expertise, especially if targeted more specifically to a local audience (6.3.5.). This relies heavily on the project team having access to a platform with an established following or having a contact within local news media and/or the community with such networks.

The third and perhaps most significant conclusion is that the team was perhaps pre-emptive in attempting such an ambitious programme of digital outreach before assessing the potential for engagement with the community. Fredheim and Watson's report on public benefit in development-led archaeology (2023, 24-25) suggests that the public's needs and potential for public benefit should be identified and then the scope of opportunities for delivering public benefit determined at evaluation. Arguably this rapid survey represents that evaluation, and the potential for public engagement should be assessed following this initial data gathering exercise. This phase of investigation could also be used to make connections and build relationships, assess audience composition and potential for increasing active participation in the historic environment (e.g. using HEn's 2023 audience segmentation model), all with an eye towards a future funding bid that has a much larger community component.

While the local community might be less engaged with Seaford Head's archaeological significance, they are certainly aware of the impact of coastal erosion on the wider landscape in which it sits. Seaford town, immediately west of the site, is prone to flooding from both the River Ouse and the sea with the beach requiring regular recycling and recharging to maintain the defence (EA 2023). The maintenance of current sea defences and beach management at Cuckmere Haven and valley to the west of the site have also been the subject of much debate (Cuckmere Haven SOS 2023). Coastal erosion is an emotive issue when associated with housing or loved places, which could theoretically be protected through sea defences. However, Seaford Head with its huge cliffs and risk of erosion through drought/flood as well as wave action is beyond reasonable defence measures. Loss at Seaford Head feels more inevitable and beyond the control of human agency and discussion as to the impact of costal erosion on this site is therefore free of some of the more political aspects faced by other locations.

7.6. Conclusion

In conclusion, this project has shown the rapid assessment methodology is a viable and useful data gathering exercise that can be used to inform ongoing projects at Seaford Head, whether that be non-archaeological asset management, ongoing archaeological investigation in advance of heritage loss and/or a community project tied to the site.

8. REVISED RESEARCH AIMS

8.1. Research aims set out in the project design (ASE2021b)

The primary aim of the project was to:

RA1: Develop and deliver an achievable, proportionate, and replicable methodology for the non-intrusive survey of a scheduled monument at risk from continued, rapid costal erosion.

The project achieved this aim by:

- Drawing together current archaeological and geomorphological knowledge of the site;
- Creating an accurate topographic survey of the monument to record the site in detail and measure future loss;
- Identifying potential archaeological features through remote sensing and photogrammetry survey;
- Disseminating the project results to the public and considering future public need, outreach and community involvement;
- Using this combined knowledge to draw new conclusions and propose future research.

In achieving RA1, a subset of subsidiary aims has been addressed:

RA2: Develop cost modelling guidance based on methodology in RA1 to help inform other heritage agencies and landowners across England on achievable approaches to coastal erosion and climate change where heritage is at significant risk.

A cost model is presented as part of this report showing the actual time spent on various aspects of the project in relation to the original budget. The headline findings were that engagement with the press and the production and editing of the report required more time than anticipated.

RA3: Provide a modern baseline archaeological survey dataset for the nationally important Seaford Head scheduled ancient monument and a better understanding of its environs equally at risk from coastal erosion.

The project provided a baseline archaeological survey dataset for the scheduled monument, including discussion as to current understanding of cliff loss in the area. It was not intended to be an exhaustive investigation and further survey and archaeological excavation would be needed to provide a fuller understanding of the site's archaeology.

RA4: Detail information allowing for more effective management and understanding of the scheduled monument and threats to it.

The report has summarised current understanding of cliff loss at the site and the level of impact caused by previous land use at the site, namely Second World War defences and structures and the development of the golf course, its landscaping and the importation of material (sand) to the site.

RA5: Present a proposed scheme of investigation for ground-truthing identified features considered at risk.

The project has identified potential archaeological features and deposits which could provide specific avenues for further investigation at the site, notably potential preservation of earthwork/palisade construction in the east that appears to seal a buried land surface, a potential midden or preserved soil in the centre and numerous geophysical positive anomalies which could be ground truthed through future excavation.

The project, and this report, also begins to summarise the information required (in terms of archaeology, threat/need and public interest) to support a future funding bid and formed a partnership (ASE/UCL/ STC/ HE?/SDNPA) to deliver a future project at the site.

RA6: Communicate the results to local residents and stakeholders and nationally as a methodology to address the rapid survey of heritage assets at risk from rapid coastal erosion.

The project communicated the results and issues surrounding the project through press releases which resulted in items in printed and online news outlets, local radio, and television, supported by social media content. A further written news item was published in Current Archaeology (2022). A series of films was produced and promoted by the project partners. A podcast was recorded as part of the *ASE Digs Deeper* podcast series. A seminar for a technical audience is planned where the results of the project and the implications they have for future projects can be discussed. ASE/UCL/STC already have a funding bid pending for a subsequent project in the area which would use media created during this project.

8.2. Relevant research frameworks

The following research topics/questions have been identified for any future work at the site from the following national and regional research frameworks:

- HERA: Historic England Research Agenda (2017c)
- RffLA: Research framework for London Archaeology (MoLA 2002)
- SERF: South East Research Framework (2011)
- SRFftHE: Solent-Thames: Research Framework for the Historic Environment (Hey and Hind 2014)

8.2.1. Palaeolithic-Modern

- What are the likely impacts of climate change adaptation measures, such as flood prevention or managed coastal retreat, on the historic environment, and

how can we mitigate the potential harm or make best use of these opportunities? *[HERA, 30 #adapt]*

- What can an understanding of past changes to the environment and to human activity contribute to the wider discussion about environmental change, particularly climate change? *[HERA, 30 #adapt]*

8.2.2. Bronze Age-Iron Age

- Is it sensible or productive to regard the region as a unit rather than associating Sussex with southern England and Kent and Surrey with eastern England? There would seem to be different histories of hillfort use, and different ceramic histories too. *[SERF, 5 notes]*
- Identifying the roles that ringforts played in the developing settlement hierarchy of the late Bronze Age, and their relationship, if any, with the few succeeding early Iron Age sites of hillfort type such as Caesar's Camp on Wimbledon Common (AGL 2000, Gz MT1) or Warren Farm, Upminster (AGL 2000, Gz HV1)
- The extent to which forts have Bronze Age origins and their role at that period form part of the larger issue of the purpose of hillforts, which might have been for reunions, ritual and for refuge. *[SRFftHE, 10.5.6]*
- The level of attack on and burning of hillforts should be established, and the context of burning requires more careful consideration. Was burning always evidence of attack, or might it have been due to ritual cleansing or even to deliberate modification of the defences by the occupants? *[SRFftHE, 10.12.6]*
- What function did hillforts perform, and what was their relationship with their hinterlands? *[SERF, 13]*
- Is there evidence of those who built the first hillforts of the South East, and of those who lived in the environs of the hillforts when they were in operation? *[SERF, 12]*

8.3. Revised research aims

8.3.1. Archaeology

RRA1: Is there evidence of earlier prehistoric activity on the site associated with the exploitation of the clay-with-flints resource?

RRA2: Is there further evidence of the former Bronze Age landscape at the site, how does this relate to the barrow and what can uncovered about the interaction between the ceremonial and more mundane in Bronze Age society? Are the geophysical anomalies recorded adjacent to barrow in the east of the site related to this?

RRA3: Is a preserved buried soil, similar to that recorded by Bedwin in the east of the site, present under the western bank? And can it inform on the site's land use and palaeoenvironment prior to the hillfort construction?

RRA4: Does the darker band observed in section along the central topographic high point in the centre of the monument relate to a potential buried soil or occupation area?

RRA5: Does the western bank contain surviving features associated with the Iron Age defences and can these inform on the construction techniques employed?

RRA6: Do archaeological features and finds relating to the hillfort construction and occupation survive beneath the golf course landscaping and are these related to geophysical anomalies recorded during the survey?

8.3.2. Geomorphology and coastal erosion

RRA7: Can a greater understanding of historic and future cliff loss at the site be determined with the assistance of geologists and geomorphologists?

RRA8: Do early Holocene or Pleistocene deposits survive below mean high tide and the wave cut platform?

8.3.3. Outreach and public engagement

RRA9: Can engagement with the local community determine public need in terms of local heritage loss and priorities for its study and preservation?

RRA10: Can a community archaeology response be designed to meet the needs of local residents and site users? And can this be formalised in an archaeological management plan?

RRA 11: Can the archaeological response be embedded locally through publicity, education and events and can this build to a national audience?

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APPENDICES

Appendix 1: Gazetteer of Heritage Assets (Figure 3)

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
1	MES4		549300 097800	Seaford Head: Palaeolithic hand axes	A small ovate hand axe, made on a flake, is in Cambridge Museum of Archaeology and Anthropology. Label on implement reads 'found on hill above golf links, 1912', and must refer to Seaford Head. A Lower Palaeolithic hand axe was found on Seaford Head near the barn (TQ 494 979) by Mr John Gould, then of Ardingly College. It was still in his possession in 1968.	Palaeolithic
2	MES1723		549000 097000	Seaford Head: Palaeolithic axe	A Palaeolithic hand axe and an unretouched flake implement from Seaford Hill, Seaford.	Palaeolithic
3	MES26584		549160 098490	Florence House, Seaford: Prehistoric Flints	A small assemblage of worked flint, comprising 112 pieces, was recovered during a watching brief. A similar amount of unworked burnt flint, totalling 142 pieces, was also recovered during groundworks. The assemblage comprises no diagnostic tools, although based on technological assessment of the assemblage pieces ranging from the end of the Palaeolithic to the Early Bronze Age are present.	Palaeolithic – Bronze Age
4	MES16		550000 097000	Seaford Head: Mesolithic/ Neolithic flints	1/2 mile by 1/4 mile stretch of ploughsoil south of South Hill Barn and west of Hope Bottom, an area of clay-with-flints, has yielded many Mesolithic and Neolithic flint implements.	Mesolithic-Neolithic
5	MES37089		549010 098260	Hawksdene, Seaford: Mesolithic-Bronze Age finds	An assemblage of Mesolithic to Bronze Age flint was recovered during a watching brief at Hawksdene, Seaford. Bronze Age pottery was also recovered.	Mesolithic-Bronze Age
6	MES1700		549200 098500	The Gore: ?barrow, Romano-British pottery	A supposed tumulus was opened in 1868 at the Gore, just above Green Street (centred TV 495987) and to the E of the old cottage. Some trenches were made near it, but except for fragments of Roman pottery and flint flakes, nothing was found. The Gore is so described on a map of the Sutton Estate by Thos Marchant, 1772.	Mesolithic-Romano-British

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
7	MES7208		549400 097700	Seaford Head: Neolithic axe	Following a cliff fall in 1993 a Neolithic polished flint axe was recovered from the beach below Seaford Head. The axe shows no evidence of use and may therefore have been a votive offering.	Neolithic
8	MES34369		550410 097770	South Hill, Seaford: worked flint scatter	Struck flint collected by Edmund Jarzembowski.	Neolithic-Bronze Age
9	MES1715		550300 097800	Southill Barn: flintwork concentration	The area of ploughed land running from the 11th green of Seaford Golf Links past Southill Barn down to the scrub bordering the upper section of Hope Gap was carefully examined by W J Mortimore and E D Arundell from 1948-51 who found the following implements:- A broken perforated hammerstone; 100 scrapers; 36 borers; 17 horned scrapers; 3 end scrapers; 5 rimers; 6 chisels; 9 saws; 6 strike-a-lights; 9 polished celts (all broken); 2 mullers; 1 quartzite hammerstone; 1 circular hammerstone; 1 pick (9in. long); 2 crescentic flints; a leaf-shaped arrowhead; 2 discoidal knives; 2 petit-tranchet arrowheads; a thumb scraper; 3 small conical cores of Mesolithic character, and many other worked implements. Other than a few Roman sherds no pottery was found. Two of the implements found by Arundell and Mortimore in 1950 were sickle-flints sufficiently rare to deserve separate notice. Both had secondary chipping. The butt end of a large ground and polished celt was found by Mortimore *c.* 1952 on South Hill. It is of red flint of a kind not found in Britain according to the Geological Museum.	Neolithic-Romano-British
10	MES1704	1014523	549420 097890	Seaford Head: Bronze Age bowl barrow	Bowl barrow, 14 paces in diameter and 2ft high opened by Pitt-Rivers in 1876. Two holes, each 1ft in diam. and 1ft deep were found below natural ground level near the centre of the barrow. They contained pottery fragments, broken and polished flint celts, flint saws and some charcoal. Other flints, including a barbed and tanged arrowhead were found in other parts of the barrow. There was no trace of a burial. The Barrow now has a roughly circular mound *c.* 18m in diameter and 0.5m high.	Bronze Age
11	MES15440		551020 097780	South Hill and Hope Bottom: Field system	Rectilinear field system visible as a series of low lynchets.	Bronze Age - Romano-British

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
12	MES1699	1014523	549450 097810	Seaford Head: Iron Age hillfort	Camp. Considered by General Pitt Rivers to be a British promontory fort of which at least half had been destroyed by cliff erosion. Excavated in 1876 by Pitt Rivers and Park Harrison. They cut two broad trenches, one through the ditch and one through the rampart; in the former they found Romano-British pottery sherds and other evidence of Romano-British occupation 4ft above the undisturbed chalk, but nothing below this level; in the latter nothing was found except two flakes. The NW side contains two entrances, the E side has an entrance in the middle. Water may have been procured from a natural spring at the bottom of the slope to the N. It is shown as complete in 1587 when, as Burdyck Hill, it was the site of two Armada beacons, but it has suffered coastal erosion resulting in the collapse of the whole of the SW portion of the fort into the sea. The remaining portion of the work is in fair condition although it has been mutilated in parts by wartime activities and the construction of fairways, tees and so forth. There are a number of gaps in the rampart, one of which, in the E side of the fort at TV 4962 9788, is possibly an original entrance but it has been badly mutilated. There is no ground evidence of habitation within, but RAF photos show possible hut circles at TV 49489785 and TV 49539784.	Iron Age
13	MES1698		549410 097740	Seaford Head Hillfort: Roman medal	A gold medal of Antonia, daughter of Mark Antony, was found in the shingle below high-water mark (near the Camp at Seaford). In 1882 it was believed to be in the possession of J. Maxfield Smith of Lewes.	Roman
14	MES36848		549520 097850	Seaford Head: Roman Occupation	An excavation carried out by General Pitt Rivers in the 19th century uncovered Roman Pottery sherds and evidence of Romano British occupation at Seaford Head univallate fort.	Romano-British

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
15	MES26583		549160 098490	Florence House, Seaford: Saxon Sherd	A watching brief was undertaken in 2015. A sherd of Anglo-Saxon pottery was recovered during the watching brief. It consists of a slightly abraded bodysherd tempered with abundant fine quartz with sparse organic (grass/chaff), calcareous (voids) inclusions to 1mm and very rare, rounded flint grits. The sherd is low-fired with an oxidised exterior and reduced interior. A date between the mid-6th and 7th centuries is most likely though a larger assemblage would be needed to be certain.	Early Medieval
16	MES37090		549010 098260	Hawksdene, Seaford: Medieval Pottery	Two sherds of medieval pottery spanning the mid-12th to 14th century were recovered during a watching brief.	Medieval
17	MES19392		549880 097950	Seaford Head Beacon: Beacon	16th-century beacon at Seaford Head identified in Kitchen, F. 1986 'The Ghastly War Flame' in Sussex Archaeological Collections 1986.	Post-Medieval (16th century)
18	MES36850		549510 097840	Burdyck Hill, Seaford Head: 16th century Beacons (Site of)	Seaford Head - It is shown as complete in 1587 when, as Burdyck Hill, it was the site of two Armada beacons, but it has suffered coastal erosion resulting in the collapse of the whole of the SW portion of the fort into the sea.	Post-Medieval (16th century)
19	MES29480		549160 097930	The Watch House, Seaford: 17th Building (site of)	A building noted as Ye Watch House on a map of 1636.	Post-Medieval (17th century)
20	MES29482		549100 097960	The Host, Seaford: 17th century Lime Kiln (site of)	A Lime Kiln noted as Ye Host on a map of 1636.	Post-Medieval (17th century)
21	MES37091		549010 098260	Hawksdene, Seaford: Post-Medieval Finds	A tobacco stem fragment and a single 20th-century pottery sherd as well as marine shell were recovered during a watching brief	Post-Medieval (17th-20th century)
22	MES23847		549730 098110	Seaford Head: 19th century quarry	"Old chalk pit" recorded on 1st edition OS.	Post-Medieval (19th century)
23	MES23848		549360 098190	Seaford Head: 19th century quarry	"Old chalk pit" recorded on 1st edition OS.	Post-Medieval (19th century)
24	MES26585		549160 098490	Florence House, Seaford: Post-Medieval Finds	During a watching brief undertaken in 2015 a small number of finds dating to the post-medieval period were recovered. The finds were made up of two pottery sherds, two tile fragments and a clay pipe fragment.	Post-Medieval

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
25	MES17183		550310 098640	South Camp: First World War army camp	Site of an army camp of the First World War named South Camp.	Post-Medieval (First World War)
26	MES23836		550760 097690	Hope Gap: First World War training trenches	Two sets of crenulated trenches exposed by scrub clearance. Likely associated with nearby First World War training camps.	Post-Medieval (First World War)
27	MES7857		550167 098108	Track To South Hill Barn: 20th century tank road	Tank road to South Hill Barn, extant.	Post-Medieval (Second World War)
28	MES7858		550320 097696	South Hill: Second World War firing range	Second World War firing range, removed, at South Hill Barn.	Post-Medieval (Second World War)
29	MES7859		550549 097482	East of Seaford Head: Control post	Second World War control post, extant but buried.	Post-Medieval (Second World War)
30	MES23752		549560 097830	Seaford Head: Second World War defences	Barbed wire defences visible on aerial photos 1942-44.	Post-Medieval (Second World War)
31	MES23762		550600 097690	South Hill: Second World War road	Site of Second World War firing range road.	Post-Medieval (Second World War)
32	MES23834		549630 097810	Seaford Head: Second World War bunker	Remains of Second World War concrete bunker / pillbox. Engine room recorded from Second World War database (ESX250814) as Reinforced concrete building with machinery plinth (generator?).	Post-Medieval (Second World War)
33	MES34932		549700 097700	East of Seaford Head: Second World War Complex of anti-landing trenches (site of)	Complex of anti-landing trenches shown on German aerial photograph of British defences.	Post-Medieval (Second World War)
34	MES1705		549440 098070	Church Lands, Seaford Head: Undated Lynchets	The remains of two faint contour lynchets exist on the W side of Seaford Head but no field pattern is visible.	Undated
35	MES26582		549160 098490	Florence House, Seaford: Undated Features	During a watching brief undertaken in 2015 two pits and a ditch all of which were undated were identified.	Undated

Site No.	ESHER Ref.	NHLE Ref.	NGR	Name	Comment	Date
36	MES36849		549610 097920	Seaford Head: Undated flakes	Two undated flakes were recorded during a 19th-century excavation at Seaford Head univallate fort.	Undated
37	-		549621 097694	Former building platform	Rectangular terrace, measuring 11m by 6m, located outside the south-east corner of the hillfort. North end is being eroded by the path. Constructed in Second World War for a military hut, now demolished.	Post-Medieval (Second World War)

Appendix 2: Scalable Cost Model

Introduction

The overarching aim of the project was to develop and deliver an achievable, proportionate and replicable methodology for the non-intrusive survey of a scheduled monument at risk from continued, rapid costal erosion. It is assumed for the purposes of this model that potential sites would be like Seaford Head in that they have had little work undertaken on them despite being a known heritage asset, or that recent erosion had led to a previously unknown site being exposed. Sites which have been subject to recent, or extensive historic, study are assumed to already have a baseline record. As with the Seaford Head project, it is assumed that limited funding would be available for the initial study. Potential projects would need to provide a baseline study of a site, but this must be achievable within the boundaries of such a limited budget. Initial projects cannot hope to be able to fully investigate sites but need to build the justification for further work, both in terms of curator approval and future funding. The baseline archaeological study of a site is therefore considered to include the following:

- A clear summary of all existing available heritage information for the site;
- A statement as to why the site is at risk; this doesn't need to be complex and could simply direct the reader to existing data;
- An accurate survey of the site showing its current extent so that future loss can be measured.

Additional surveys could then be added to enhance understanding of the site, its archaeological potential and the nature of the potential loss. In the case of Seaford Head, the drone survey of the cliff edge showed the complexity of the ditch and bank/palisade remains while the geophysical survey identified anomalies which could relate to archaeological features. These surveys add information and more clearly establish the extent of archaeological remains being lost.

The baseline archaeological survey elements would provide evidence to a curator that loss was occurring and the nature of that loss. However, funding for more extensive survey/excavation would still need to be sought. Funding bodies who derive their budgets from HM Treasury must establish a public need to do so either through existing aims and objectives, such as those set out by HE (HE 2017c) or the National Lottery Heritage Fund (NLHF 2023). Applications to the NLHF need to establish a public need for the work to be undertaken and clear community benefits, including volunteering and training opportunities. The baseline project should therefore include some form of public engagement both to communicate benefits paid for by the public purse and to begin to engage communities so that a clear public need for any future work can be established.

As a minimum, projects should seek to inform the local community of the results of the work through public engagement elements such as press releases, websites and social media. These could be enhanced through events, workshops, volunteering opportunities and so forth, as could be offered or afforded by the project organiser.

A site could be archaeologically valuable, but if the public need for further work cannot be established, then future funding such as from the NLHF may not be available. Given the potential scale of loss associated with coastal sites, it is anticipated that not all such projects could be funded; therefore, baseline studies, such as the pilot project at Seaford Head, are likely to become the means by which curators and funding bodies triage applications to identify the most archaeologically important and those with the greatest public need.

Project Organisation

Projects could be instigated and/or run by a variety of organisations:

- Local voluntary groups;
- Local authorities;
- Landowners;
- Charities;
- Archaeological contractors;
- Curators.

Funding could also be derived from a number of sources:

- Historic England;
- National Lottery Heritage Fund;
- Charities;
- Landowner;
- Local authority.

However projects are instigated or managed, it is assumed that experienced volunteers and/or heritage professionals would be needed to deliver a project to the required standards of the curator, be that HE or local authority, and to those set out by CIfA. It is highly likely, as was the case for the Seaford Head project, that the delivery would involve a number of organisations such as the landowner, archaeological contractor, local authority and so forth. The establishment of a partnership between several organisations to deliver the project can be a strength that should be clearly expressed within any subsequent report. Strong partnerships can indicate a greater chance of success and project legacy.

Project Breakdown for the Seaford Head project

The below table details the days spent on the various project tasks (based on a standard 7.5 hours per working day), as set out in the project design (ASE 2021b). Day rates will vary across organisations, and some tasks may even be accommodated through voluntary work, so the below table shows each task by grade to which an organisation could attribute their own day rates. In terms of providing scalability, the area surveyed and the techniques employed are set out in Section 4. Techniques could vary depending on the nature of the site and the extent of existing data, but the main Task Stages are set out below.

Task Stage	Task details	Staff*	Allocated Days
Stage 1	*Project Set Up*		
1.1	Liaison with partners, access, documentation production.	PM SA	2.25 0.5
Stage 2	*Desk-Based Assessment and Walkover*		
2.1	Management.	PM	1
2.2	Site visit and walkover survey.	SA PM	1 1
2.3	East Sussex Record Office visit: compilation of relevant site and landscape records.	SA	1
2.4	Collation of OS and historical mapping.	SA	0.5
2.5	Collation of HER data.	SA	0.5
2.6	Lidar analysis: processing and output of Environment Agency 2017 and 2020 data.	SA	2
2.7	Report production.	SA	3
2.8	Report illustration.	DO	0.5
2.9	Report editing.	PM	0.75
2.10	Licence and assent applications.	PM	0.25
Stage 3	RPAS Survey		
3.1	Management.	PM	0.5
3.2	Flight plan and RAMs preparation.	SA	0.75
3.3	RPAS survey of Seaford Head hillfort, cliffs, and surrounding landscape.	SA AA	2 2
3.4	RPAS survey data processing and text production.	SA DO	2 0.5
3.5	Editing.	PM	0.5

Task Stage	Task details	Staff*	Allocated Days
Stage 4	Topographic Survey		
4.1	RAMS, Management and location figure production.	PM DO	1 0.5
4.2	Collation of historical survey data: production of composite plan.	SA	0.25
4.3	Topographical survey: interpretative survey of physical topography at Seaford Head hillfort.	SA AA	7 7
4.4	Topographical survey results processing: production of text and figures illustrating interpreted results, edit.	SA DO PM	2 0.5 0.75
Stage 5	Geophysical Survey		
5.1	RAMS, management and location figure production.	PM DO	0.5 0.5
5.3	Fluxgate gradiometerr/ground resistance survey.	SA AA	4 8
5.4	Geophysical survey data processing: production of figures illustrating interpreted results, edit.	SA DO PM	4 0.5 0.75
Stage 6	Outreach and Engagement		
6.1	Production of four films (*see* 6.3) – SDNPA Outreach Programme, funded by SDNPA.	N/A	N/A
6.2	Podcast set up, storyboarding and participant discussions.	SA PM SA	1.5 1 1
6.3	Podcast recording and editing.	SA PM SA	1 0.5 1

Task Stage	Task details	Staff*	Allocated Days
6.4	Podcast uploading, promotion on social media and monitoring.	SA DO PM	2 0.5 0.5
Stage 7	Report Production		
7.1	Final report compilation, illustration and editing.	SA SA SA PM DO	4 4 4 2 1.5
7.2	Cost modelling guidance.	PM	2
7.3	Archiving.	SA	2.5
Stage 8	Seminars		
8.1	Preparation for two seminars.	PM SA SA SA SA	1 1 0.5 0.5 0.5
8.2	Delivery of two seminars.	PM SA SA SA SA	1 1 0.5 0.5 0.5

Table 1: Seaford Head project task breakdown (*Staff grades: PM – Project Manager; SA – Senior Archaeologist/Project Officer; DO – Drawing Office; AA – Assistant Archaeologist).

Seaford Head project budget comment

The predicted budget for elements associated with known archaeological techniques, such as the desk-based assessment, topographic and geophysical surveys were achieved, but there were two areas where budget was exceeded:

- Press and public engagement (*see* 6.3);
- Scope of work with funding body.

Whilst the scope of work had been defined in the project design (ASE 2021b) and agreed in advance, there remained a disparity between the funding body and the project as to the extent of the work that would take place in this initial phase and how

it would be reported upon. This is due to the project and subsequent report not being of a standard format and because the project was seeking to provide a template for a rapid study leading to future phases of work as opposed to a detailed standalone research project.

For future projects, curators and funders should clearly establish the scope of works with all parties where new formats of project work and reporting are employed.

Project breakdown for baseline future project

The baseline study elements which should be included as a minimum are as follows and detailed in Table 2:

- A clear summary of all existing available heritage information for the site;
- A statement as to why the site is at risk (this doesn't need to be complex and could simply direct the reader to existing data);
- An accurate survey of the site showing its current extent so that future loss can be measured;
- Public engagement through press releases, websites, social media.

Task no.	Task details	Staff*	Allocated Days
Stage 1	Project Set Up		
1.1	Liaison with partners, access, documentation production.	PM SA	3 1
Stage 2	Data Gathering, Walkover and Basic Survey and Reporting		
2.1	Management.	PM	1
2.2	Site visit, walkover and basic survey.	SA PM S	1 1 1
2.3	East Sussex Record Office visit: compilation of relevant site and landscape records.	SA	1
2.4	Collation of OS and historical mapping.	SA	0.5
2.5	Collation of HER data.	SA	0.5
2.6	lidar analysis and consideration of current erosion risk and rates from existing studies.	SA	2

2.7	Report production.	SA	3
2.8	Report illustration.	DO	2
2.9	Report editing.	PM	1
2.10	Licence and assent applications.	PM	0.25
Stage 3	**Outreach and Engagement**		
3.1	Press release, social media.	SA PM	2 1
Stage 4	**Archiving**		
4.1	Archiving.	SA	1
Stage 5	**Next Steps**		
5.1	Liaison with partners, curators and funders documentation production.	PM SA	3 1

Table 2: Baseline future project task breakdown. (*Staff grades: PM – Project Manager; SA – Senior Archaeologist/Project Officer; DO – Drawing Office; AA – Assistant Archaeologist).

Appendix 3: Archiving digital data

ASE use of a digital management plan and archiving following HE guidelines

Archaeology South-East has data collection, data management and data processing procedures in place that comply with industry standards. In particular, the capture of digital data in the field and their management comply with ASE geomatics (ASE 2021c) and RPAS standards (ASE 2021d). Both documents are compliant with RCIS (2014), CIfA (2014, 2020b) and HE (2015a, 2015b, 2017a).

The Seaford Head project captured topographic data using conventional survey instruments along with aerial photogrammetry files that generated large amounts of data. Since ASE has been working with such files for years, there were established procedures for what is to be collected, stored and archived.

A digital data plan was formed at the beginning of the project for which files were to be retained, stored and archived. ASE data management conventions and HE file names were already in place, however, the Dig Digital guide (CIfA 2020b) proved invaluable.

Although the guide provides a generalised account on how to proceed with data capture and its archiving requirements, the appendices were precise and clear on which files and formats are considered for long term archiving. The list is extensive and helps with reducing unnecessary file size.

The document introduces and explains the need for thinking about the way data is captured and saved before going on site. Such approach was adopted for Seaford Head from the beginning. This enabled the realisation that the size of the digital archive would be extremely large and costly. Having adopted a digital management plan, utilised existing data collection and management procedures within ASE and following the Dig Digital file saving glossary (ibid.) has enabled the reduction of the archive size by at least 40%. Thus, the archiving costs were reduced and the archived data were easily accessible.

The above exercise proved that the procedures in the Dig Digital guide (ibid.) have a tangible impact on the data archived in reducing size and costs. They also showed that by depositing such data with approved digital data archiving providers gives ease of access to multiple users.

An area of uncertainty is curating large data sets and in effect, removing the processing stage from being included in archiving. Metadata and raw files are enough to replicate the results in the future, however, this relies on proficient use of the appropriate software. Users will be able to yield results, but being able to replicate the same outputs will be challenging.

The Seaford Head project produced approximately 1TB of raw data in the form of images for photogrammetry and video footage of the cliffs. Following established data capture procedures and utilising the approved data formats for archiving reduced the

file size to 498GB. This meant that although still expensive to archive, a large project would be viable.

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