

GREM12/001



**LUGGIE'S KNOWE, GREMISTA WIND FARM, LERWICK,
SHETLAND**

**Report on the results of a gouge auger sediment survey and walk
over survey**

For SSE Renewables Developments Ltd

Planning Reference: 2011/224/PPF

LUGGIE'S KNOWE, GREMISTA WIND FARM, LERWICK, SHETLAND

Client:	SSE Renewables Developments Ltd
National Grid Reference:	HU 462 455
Address:	N/A
Parish:	Tingwall, Whiteness and Weisdale
Council	Shetland Islands
Planning Application No	2011/224/PPF
NMRS No	HU44NE 11.01
OASIS No	headland1-142396
SMR No	N/A
HB/SAM No	N/A
Listing Category	N/A
Project Manager	Sorina Spanou
Text	Magnar Dalland
Illustrations	Caroline Norrman
Fieldwork	Abby Mynett & Magnar Dalland
Schedule:	
Fieldwork	20 th – 23 rd November 2012
Report	March 2013

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Report on the results of a gouge auger sediment survey and a walk over survey

An archaeological walk over survey carried out in advance of the construction of the Gremista Wind Farm identified eight sites within a 100m buffer of the wind turbines and associated infrastructure. All of these sites lie outwith the proposed construction footprint. A peat coring survey carried out at the same time recorded a varied peat thickness across the Development Area from less than 0.1m to 2.75m.

1. INTRODUCTION

Gremista Wind Farm is located between the Hill of Gremista and Luggie's Knowe some 4.5km to the north of Lerwick (Illus 1). The proposal is to construct and operate three wind turbines and associated infrastructure, including access tracks, construction compound, laydown areas and on-site control building (Illus 1). Planning permission has been granted for the construction of the wind farm, subject to a number of conditions (Planning Ref. 2011/224/PPF). Condition 11 relates to archaeological issues.

Turbine 1 is located just to the southeast of Luggie's Knowe, a prominent rounded knoll in the north half of the Development Area (*henceforth* DA). Turbine 2 is located on the top of the west-facing slopes in the southwest corner and Turbine 3 is situated on a hill near the southeast corner of the DA (Illus 1).

A Written Scheme of Investigation (WSI) was prepared by Headland Archaeology in consultation with Shetland Amenity Trust; archaeological advisors to Shetland Islands Council. The purpose of the WSI was to define a staged programme of works that would mitigate the impacts of the Gremista Wind Farm on the cultural heritage resources within the DA that would meet, in full, the terms of the archaeological condition.

The fieldwork was carried out from 20th to 23rd November 2012.

1.1 Archaeological Background

The Environmental Statement (Entec 2011, chapter 12: cultural heritage) indicates that there are no known features of cultural heritage interest within the site of the DA which would be affected by the proposed scheme.

There are no designated features within the DA. Non designated sites located at Kebister immediately to the west of the DA, relate to heritage assets excavated or

surveyed during the campaign of archaeological investigations in advance of the construction of the oil rig supply base at Dales Voe (*henceforth* Kebister Project) (Owen and Lowe 1999). The excavations and hillside survey at Kebister in the 1980s recorded a multi-period site. The earliest buildings date to the Bronze Age (1800-500 BC) followed by settlement evidence dating to the Iron Age (c 500 BC- AD 500). Indications of early ecclesiastical settlement subsequently replaced by a medieval tithe barn were also uncovered.

Although the DA lies outside the main focus of the Kebister settlement, a number of features recorded during the Kebister hillside survey (*ibid*) are located within the current site boundary. These include a 460m long segment of a March Dyke, four segments of sub-peat dykes, two turf-built structures, one cairn and a possible hut platform (Illus 2).

1.2 Scope of Archaeological Work

A programme of archaeological work that will mitigate the impacts of the Gremista Wind Farm development on the cultural heritage resource of the DA has been defined in the WSI.

The following adverse impacts on the cultural heritage resource have been identified:

- Direct impacts on unrecorded sites
- Accidental damage of known sites of cultural heritage interest during construction works (due to proximity of construction works to the sites)

Direct impacts on unrecorded sites will be mitigated primarily through a staged programme of archaeological works. Phase I, reported here, focuses on an assessment of the archaeological as well as palaeoenvironmental potential with the aim to aid the design of a mitigation strategy. In particular, Phase I includes the following elements of work:

- gouge auger transect survey across the construction footprint to clarify the nature of below-ground deposits
- a walk over survey within the area of the construction footprint and a 50-100m study area.
- an archaeological watching brief during the geotechnical trial pitting

Risk of accidental direct damage to recorded features due to proximity of construction works will be mitigated by avoidance combined with appropriate use of protective fencing. During Phase I the area of the March Dyke in close proximity to the location of Turbine 2 was marked out and fenced. This also included the area of previously recorded features during the Kebister project; namely a possible hut platform and a turf built structure. Any other sites in proximity to the construction footprint that were identified during the walk over survey were also marked out by means of temporary fencing.

2. OBJECTIVES AND METHODOLOGY

2.1 Objectives

The archaeological objective of the assessment (Phase I) was to clarify the archaeological and palaeoenvironmental potential of the below-ground deposits throughout those parts of the DA where impacts had been identified (the construction footprint and associated infrastructure).

In particular, preliminary field investigations were undertaken in order to determine the thickness, extent and nature of peat deposits across the DA as well as to assess the presence/absence, condition and extent of upstanding archaeology.

2.2 Methodology

2.2.1 Auger Survey

Manual gouge auger transects were recorded around the three turbine bases and associated infrastructure (Illus 1) at approximately 10-20m intervals (turbine bases) or 20-40 m intervals (access road). This enabled the recording of the extent of the peat deposits within the area. Information gained from the gouge auger transects added to previous peat mapping within the area (e.g. Owen & Lowe, 1999). At each auger point (AP) the type and thickness of peat sediments encountered were recorded together with the presence of any visible plant macrofossils such as bryophytes, seeds and wood fragments. The locations of all APs were surveyed in the field using dGPS.

The environmental archaeologist monitored the geotechnical trial pits works, and recorded the depth and nature of sediments present. These data were added to the transect data.

All recording was according to IfA standards and guidance. All environmental samples will be given unique numbers and all recording was undertaken on *pro forma* record cards.

2.2.2 Sampling Strategy

Radiocarbon dating samples were taken from the base of two of the thickest peat deposits (AP11, AP26) in order to provide dates for the beginning of peat accretion in these areas. These dates could be compared with others from this area (e.g. Owen & Lowe, 1999) to refine our knowledge of peat spread across this area.

2.2.4 Walk over and marking out survey

The line of the proposed road corridor and the areas of compounds and turbine bases including a 100m buffer zone were walked by the author (Magnar Dalland). The survey was guided by a dGPS with the proposed wind farm layout and a geo-referenced version of the Kebister hillside survey pre-loaded. The location of all features recorded during the Kebister Project in the 1980s that fell within the 100m study area was visited and the features re-surveyed.

Once a site was located it was recorded and the position was surveyed to within 5cm accuracy using the dGPS. The site, including a 5m buffer-zone was then fenced off, using wooden posts and blue rope.

Digital photographs were taken of the general landscape and all recorded features were listed in a photographic register. Record shots of archaeological contexts had a metric scale visible.

The weather conditions during the survey were partly overcast and mainly dry.

3. RESULTS

3.1 Auger Survey (*Abby Mynett*)

3.1.1 Fieldwork

In total, 27 auger points (APs) were taken at locations across the construction footprint. A sedimentary record was made for each core recovered. All of the auger points were surveyed in the field, by dGPS to record both the position and the OD heights of the current peat surface. At two of the deepest core points (AP 11 and 26) samples were taken for radiocarbon dating.

3.1.2 Peat coverage

Illustration 3 shows a contour map of the peat thickness within the DA. The map was created using Surfer10 based on a combination of the data from the auger survey, peat thickness within the test pits, previous peat mapping data (Owen & Lowe 1999) and the results of a recent peat probing survey carried out by engineers (pers comm Sam Graham, SSE) .

The full results of the auger survey are provided in Table 1.

3.1.3 Results

Three main lithostratigraphic units were encountered across the site (Table 1) comprising a blanket peat (Unit 1); peaty clay (Unit 2); and a bottom gravel layer (Unit 3). Unit 3 was only recovered at the base of one core (AP1).

Unit 1 consisted of a blanket peat that was seen in all of the cores taken. The peat was medium to dark brown, reddish in places, with abundant remains of sedge (*Carex* sp.) throughout. A number of the cores also contained small wood fragments.

Unit 2 underlay the blanket peat and comprised a peaty clay. This was a much darker colour than the overlying peat. This deposit again contained abundant remains of sedge (*Carex* sp.) though less frequent than in the blanket peat above. Small wood fragments were also noted in a large numbers of the cores.

Unit 3 was recovered from only one core (AP1) and consisted of a gravelly stony till.

The blanket peat (*Unit 1*) was observed to be a monocotyledon peat, which in a number of locations (AP2, AP6, AP8, and AP9) was also found to contain occasional wood fragments. The monocotyledon plant fragments within the peat show the former growth of plants such as grasses, likely to represent sedge species (*Carex* sp.) growing on the peat surface. The small number of cores that were found to contain wood fragments suggests a largely treeless environment.

Unit 2 also contained a monocotyledon-rich peat. The peat was a lot more saturated and clayey and contained more frequent wood fragments than the overlying peat. Two cores (AP25 and AP27) located on the hillside were found to have small flecks of charcoal in their lower peaty clayey layer (*Unit 2*) which could indicate burning of vegetation at some point on the peat surface.

3.1.4 Discussion

The sedimentary sequence identified within the construction footprint of the DA at Gremista shows the development of blanket peat (*Unit 1*) from an initial peaty clay layer (*Unit 2*) overlying till (*Unit 3*). It is unknown exactly when this peat started to accumulate but radiocarbon dating from the Kebister Project (Owen & Lowe, 1999) provided an earliest date of *c* 4000 BP for the basal peats (Illus 3).

Small bands of charcoal deposited during the early formation of blanket peat were observed in two locations (AP25 and AP27). There is no dating evidence for these peats; however, based on the dates for peat formation found at Kebister (*ibid*) it is likely that the basal peats from which the charcoal fragments were recovered date to the Late Neolithic/Early Bronze Age. These charcoal layers may be either non-anthropogenic (e.g. Patterson *et al* 1987) or anthropogenic such as muir-burning or domestic sources (e.g. Tipping and Milburn, 2000). Fossitt (1996) notes that incidents producing high frequencies of charcoal on the Western Isles are often linked to periods of open landscapes and blanket peats. Thus there is a possibility fire may have been used as a way of managing and/or trying to contain the spread of blanket peat growth (Hobbs and Gimingham, 1984).

Both *Units 1* and *2* contained monocotyledon plant fragments comprising sedge remains (*Carex* sp.). These indicate a wet, boggy and open local environment during

peat development and accumulation. Local woodland would have been sparse as demonstrated by the type of peat recovered and the low incidences of wood fragments preserved in the peat deposits. The lower peat contained wood fragments which may indicate the presence of trees on the hillside at the onset of the blanket peat formation at around 4000 BP.

The thickest peat deposits (up to 2.75m) were identified in AP5 on the location of the proposed construction compound (Illus 3). At AP1, c. 45m to the north of AP5, the peat was only 0.2m thick, which shows a highly variable peat thickness, probably as a result of the undulating underlying topography.

The thinner peats are largely confined to the southwestern part of the DA while the thickest peat deposits are located within a small area at the northern extent of the DA. The peat thickness reflects to some degree the topography of the area; for example, an area of over 2m thick peat located near the centre of the DA is located in an oval depression along a small stream. The thick peat to the north may be formed in a hollow in the underlying terrain forming a small peat basin. The 2.75m thick peat at this point may represent an unbroken peat sequence covering the last 4000 years. This could provide data for a palaeoenvironmental study. However the reconstruction of the past vegetation, land-use and environment of the area has already been carried out as part of the Kebister Project (Owen and Lowe 1999) and it is likely that a study of a peat sequence so close to Kebister would not add any significant new information.

There are no active peat cuttings in the DA but a number of old peat cuttings were seen along the west side. They were all overgrown and appear to be over 50 years old.

3.1.5 Conclusions

- No archaeological features or finds were encountered during the auger survey.
- Radiocarbon dates have been taken at two locations, if deemed necessary for further works.
- The thickest peat deposits were encountered in two areas; to the north and centre of the DA (up to 2.75 m).
- Peat thickness data may reflect topographical factors. Accordingly, the distribution of upstanding sites (see below section 3.3) is partly affected by peat coverage

3.2 *Monitoring of Geotechnical Test Pitting (Abby Munnett)*

Seven test pits, approximately 50 m apart, were excavated along the proposed northern access track (Illus 3). These pits were approximately 2m x 2m and were excavated down to bedrock. The peat thickness was recorded in all of the trenches and a watching brief was undertaken to ensure that no archaeological remains were present in or below the peat layers.

No archaeological remains were identified in any of the test pits excavated. The peat thickness was highly variable across the pits, from the minimum of 0.70m in TP4 to a maximum of 2.40m in TP1 (see Appendix 2).

3.3 Walkover Survey

3.3.1 Results

A total of nine sites were recorded (Appendix 3). All except Site 9 were located in the vicinity of the March Dyke on the west-facing hillside (Illus 4). Five of these (Sites 4-8), were features recorded during the 1980s Kebister Project (Owen and Lowe 1999); comprising two sub-peat dykes (Sites 5 and 6); the March Dyke (Site 4); a turf-built enclosure (Site 7); and a possible hut platform (Site 8). Two of the features recorded during the Kebister hillside survey that fell within the 100m study area, a sub-peat dyke and a small enclosure (E2, Illus 2) could not be confirmed during the present survey.

A further four sites were recorded during the present survey. The sites included a possible sub-peat dyke (Site 1), a rectangular structure (Site 2), a possible hut platform (Site 3), and a possible cairn (Site 9). The cairn was located at the highest summit within the DA some 350m to the southeast of Sites 1-8 (Illus 4).

3.3.3 Discussion

Kebister is a good example of Shetland's rich cultural heritage. It is a multi-period site with well preserved archaeological remains ranging from the Bronze Age through to the early 19th century. Extensive surveys carried out during the excavations at Kebister in the 1980s demonstrated that the core of the settlement lay near the shores of Dales Voe but with a halo of archaeological structures spreading up the hill towards the east.

Some of the easternmost structures recorded during the Kebister survey fall within the western parts of the DA.

Most of the DA is covered in mature heather; this makes it hard to recognize slight archaeological features. Parts of the DA are also largely covered by peat which can mask less prominent archaeological features. The peat resource in the area has been exploited in the past for fuel as indicated by numerous old peat-cuttings located on the west-facing slopes. Peat cutting has not completely removed the peat in this area it may be the reason why the peat is generally thinner along the west side of the DA (Illus 3).

There was clear evidence of old peat-cuttings on the west-facing hillside. These cuttings create features that sometimes can be misidentified as the remnants of built structures. However, peat-cutting is generally done in strips running down slope to

drain water from the peat face. They therefore generally appear as straight-sided sunken rectangles aligned down slope. Therefore any features that fit the description above were interpreted as peat cuttings and were not recorded as discrete archaeological sites.

The most substantial feature is the 1100m long March Dyke (Site 4) associated with Handigarth, an abandoned early 19th century settlement located some 180m to the west of the DA (Illus 2). For most of its length it stands proud of the surrounding peat and is clearly visible on the ground. The other dykes recorded in the area (Sites 1, 5 and 6, Illus 4) are less visible. These are on a roughly east to west alignment and are classified as sub-peat dykes; interpreted as remnants of prehistoric field boundaries.

Site 2 is a rectangular structure aligned across the hillside and there was a slight indication of a bank along its west (down hill) side which may indicate that this is a small turf-built structure.

Sites 3 and 8 have both been identified as possible hut-platforms. They are both defined by a slight but marked scoop into the hillside with a corresponding terrace down slope forming a sub-circular, level area. Site 3 is covered in heather and is less well-defined than Site 8 that was recorded during the Kebister Project. A small test trench was excavated in the interior at the time exposing a layer of medium-sized stones. The layer was thought to have been anthropogenic in origin (Owen and Lowe 1999, p 35).

Site 7 is a turf-built enclosure first recorded during the Kebister Project (*ibid*) (S15, Illus 2). At the time, a trench was excavated across its bank. The section indicated that it was a turf-built enclosure (*Ibid*, p 29).

Site 9 is located on the summit of a hill towards the south-east corner of the area and in close proximity to the proposed Turbine 3 (Illus 4). It is defined by a low mound, some 12m in diameter and 0.2m high with a dished interior. The edge of the mound is clearly defined to the east, north and west but is ill-defined to the south. The feature is not prominent but this may be due to the surrounding peat cover. There is hardly any peat on the top of the mound while the ground immediately to the north is covered in 1.6m deep peat (AP27, Illus 3). This may suggest that the feature is partly sub-merged in peat and that it may originally have been more prominent. The feature is interpreted as a possible cairn although further work is required in order to evaluate its character and extent.

4. CONCLUSIONS

4.1 Statement of Potential

The results of the gouge auger transect survey indicate that peat thickness varies between 0.1m up to 2.75m within the DA (Illus 2). Peat coverage is generally thinner on the south-west side of the DA, in the vicinity of Turbine 1. The thickest peat deposits are found to the north, in the area of the site compound and control building; around the centre; and towards the proposed location of Turbine 3 in the southern corner of the DA.

The distribution of known (Kebister Project) and, newly discovered (Headland walk over survey), sites corresponds well to the abovementioned peat distribution (Illus 3 and 4). The general assumption is that there is low potential for undiscovered, buried archaeological sites in areas of thin (up to 1 m thick) or no peat coverage as the results of the walk over survey show that these survive well as upstanding features (e.g. area to the west of Turbine 2).

Conversely, it is possible that areas of thicker peat coverage mask archaeological sites. Nevertheless, the distribution of sites indicates a focus on the lower, west-facing slopes of Dales Voe around the prehistoric and medieval structures excavated during the Kebister Project in the 1980s. Assuming a focal area near the shore, the upper areas covered by the current DA present a lower archaeological potential.

Whilst the most exposed areas of the landscape are less likely to have been inhabited or cultivated in the past, it has to be noted that there are types of sites that are often located on hill tops, such as burial cairns. It is not certain at present whether Site 9 in the vicinity of Turbine 3 represents that type of monument or other, as part of the site may be submerged in peat.

4.2 Assessment of direct and indirect impacts on recorded sites

Eight sites were located within the 100m study area; all lying in areas of up to 1m peat coverage and all outwith the construction footprint of the proposed wind farm; therefore, there will be no direct impacts upon these sites by construction. The nearest sites to the construction footprint are Sites 6, 7 and 8 (in the vicinity of Turbine 2). It is proposed that accidental damage to these sites due to their proximity to construction (especially Site 8) is mitigated by micrositing T2, combined with appropriate use of protective fencing. The client (SSE Renewables Developments Ltd) has confirmed that T2 can be microsited to 446033E 1145315N in order to avoid accidental damage to the above sites.

Site 9 is located outwith but in close proximity to Turbine 3. The risk of accidental direct damage to this site will be mitigated primarily by avoidance and protective fencing.

5. REFERENCES

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6. APPENDICES

Appendix 1: Site Gazetteer

Site 1: *Possible sub-peat dyke* Pic: GREM12-001-01b
HU 46179 45703 - 46204 45699

A possible sub-peat dyke is located on the upper west-facing slopes of Kebister. It is defined by a slight ridge in the heather, aligned east-west. The feature can be traced over a distance of 26m. It is up to 0.3m high and 1.5m wide.

Site 2: *Rectangular structure* Pic: GREM12-001-02a
HU 46179 45646

A rectangular structure is located 55m to the south of Site 1. It is visible as a rectangular sunken area aligned across the slope, north-east to south-west and measuring some 5.8m by 2.8m. The entrance is likely to be at the north-east end which is less well defined.

Site 3: *Possible hut-platform* Pic: GREM12-001-04a
HU 46189 45640

A possible hut-platform is located less than 10m to the south-east of Site 2. It is visible as a slight curving scoop into the hillside with a corresponding bulge down slope forming an almost level sub-circular area some 3m by 4m.

Site 4: *March dyke* Pic: GREM12-001-07
NMRS: HU44NE 11.01

HU 46120 45660 to 45910 45252 (within site boundary)

The March Dyke is associated with Handigarth, an abandoned settlement located some 180m to the west of the site boundary. It was fully surveyed during the excavations at Kebister in the 1980s (Owen and Lowe 1999). It is approximately 1100m long of which some 460m lies within the site boundary. The dyke is built from turf and stone, and is some 1.2m wide and up to 0.4m high.

Site 5: *Sub-peat dyke* Pic: GREM12-001-08a
NMRS: HU44NE 10

HU 45984 45442 to 45951 45450

A 35m long segment of a sub-peat dyke is located some 60m inside the March Dyke. It is 1.2m wide and up to 0.25m high and aligned east-west. The dyke was fully surveyed during the excavations at Kebister in the 1980s (*Ibid* Illus 27).

Site 6: *Sub-peat dyke* Pic: GREM12-001-09b
NMRS: HU44NE 10

HU 45965 45361 to 45906 45390 (within site boundary)

This dyke roughly parallel with and located some 80m to the south of Site 6. It is 1.5m wide and up to 0.2m high. The dyke was fully surveyed during the excavations at Kebister in the 1980s and extends beyond the site boundary to the west (*Ibid*).

Site 7: *Turf-built enclosure* Pic: GREM12-001-10b

NMRS: HU44NE 10

HU 45986 45347

A sub-rectangular enclosure is located some 15m outside the March Dyke. It measures some 7m by 4m internally and is defined by low banks 1.7m to 2m wide and 0.1m high. The entrance is located at the northwestern corner. There are remains of a cross-bank located towards the west end of the structure. The feature was surveyed during the excavations at Kebister in the 1980s (*Ibid*). At the time a slot was cut through the bank of the enclosure that indicated that it was turf-built.

Site 8: *Possible hut-platform* Pic: GREM12-001-11b

NMRS: HU44NE 10

HU 45957 45270

A possible hut-platform is located outside the March Dyke on the north side of a knoll some 75m to the south of Site 8. It is defined by a scoop into the hillside with a corresponding bulge down slope forming a near level area some 7m by 6m. The feature was recorded during the excavations at Kebister in the 1980s (*Ibid*). A small trench in the interior was excavated at the time exposing a layer of medium stones. The layer was thought to be anthropogenic in origin indicating that this is a man-made feature.

Site 9: *Possible cairn* Pic: GREM12-001-14b

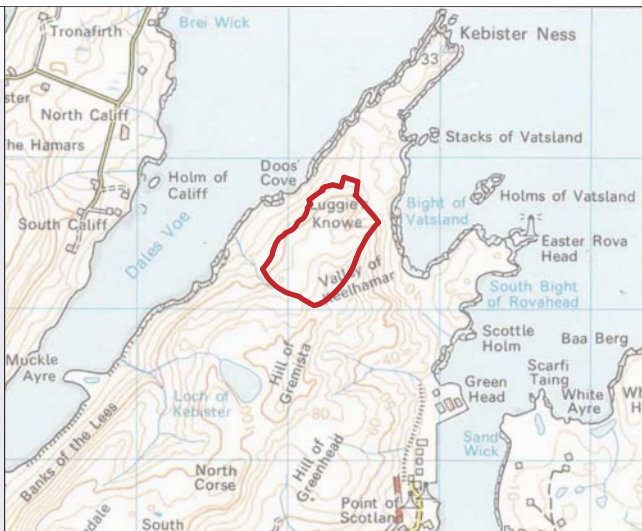
HU 46309 45181

A possible cairn is located on the summit of a hill at the southern end of the area. The feature is defined by a low mound, some 12m in diameter and 0.2m high with a dished interior. The edge of the mound is clearly defined to the east, north and west but is less clear to the south. The top of the mound has hardly any peat cover while the area to the north is covered by thick peat deposits. At AP 27 less than 10m to the north of the feature the peat thickness was 1.68m. This may indicate that the feature is partly sub-merged in peat and that it was originally much more prominent than it is now.

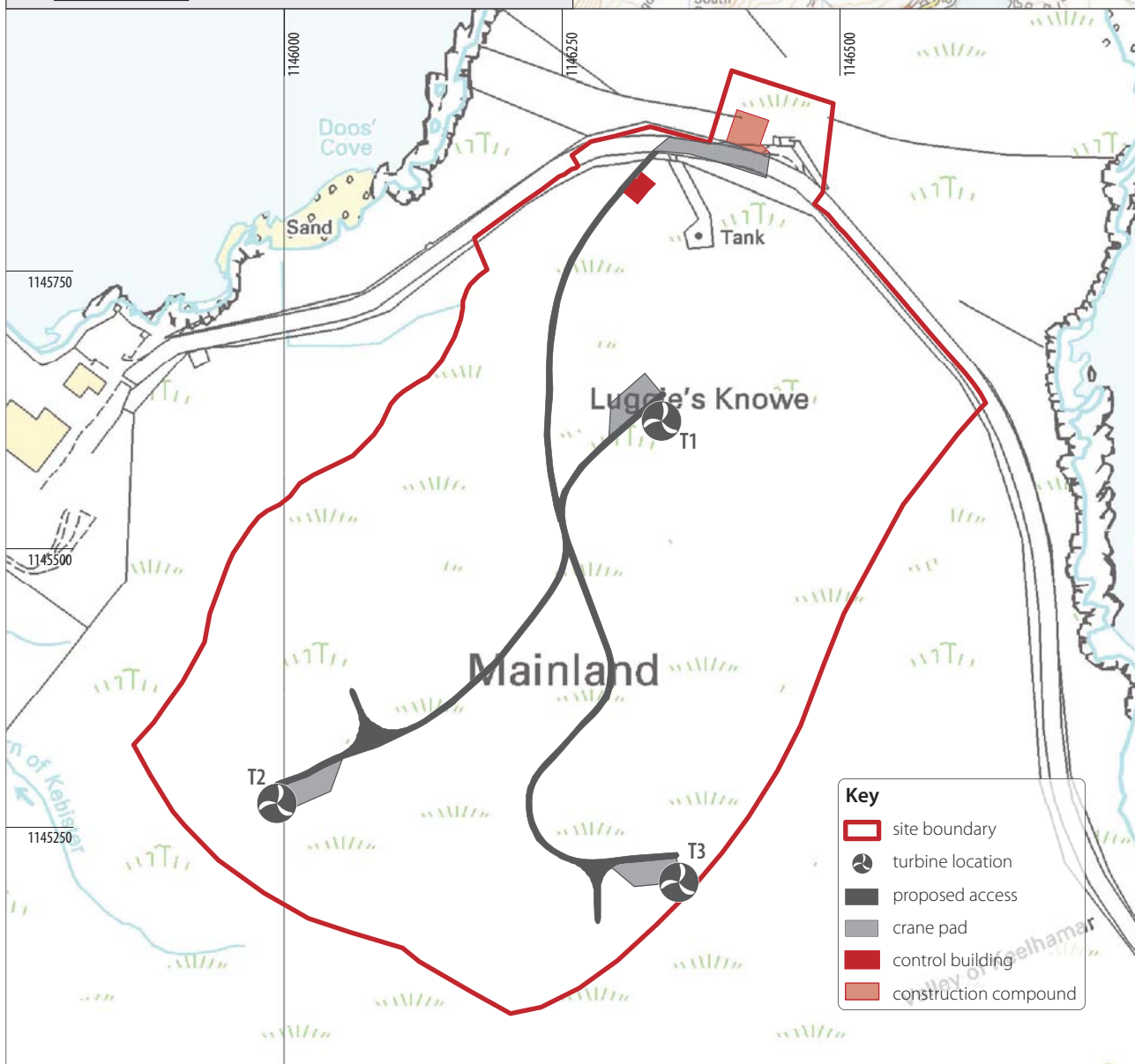
Appendix 2: Illustrations



Gremista
Shetland



0 100km



- Key**
- site boundary
 - turbine location
 - proposed access
 - crane pad
 - control building
 - construction compound

Reproduced using 1976 OS 1:50,000 Landranger Series no. 4 and digital client data. Ordnance Survey © Crown copyright 2012. All rights reserved. Licence no. AL 100013329

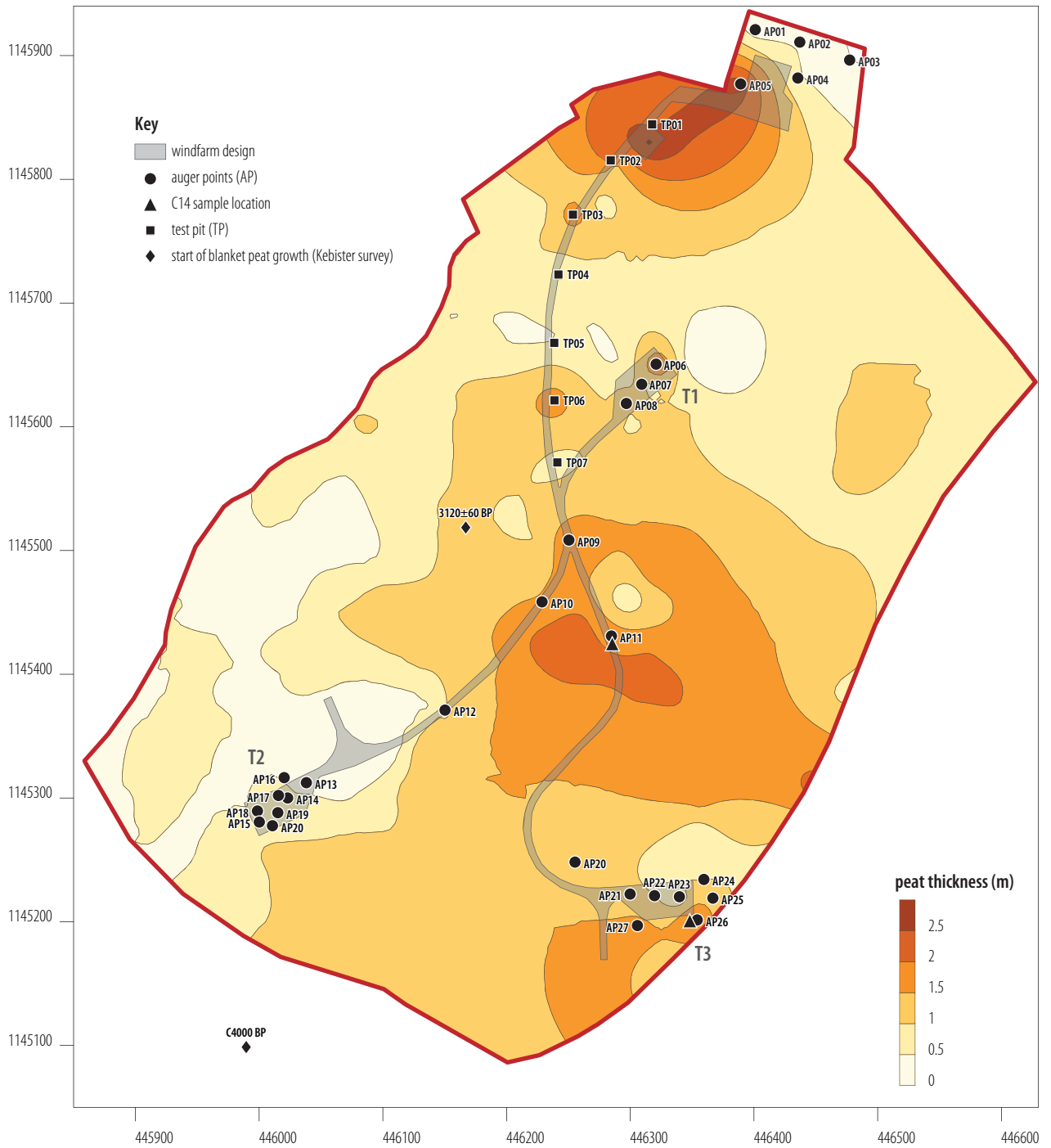
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0 300m

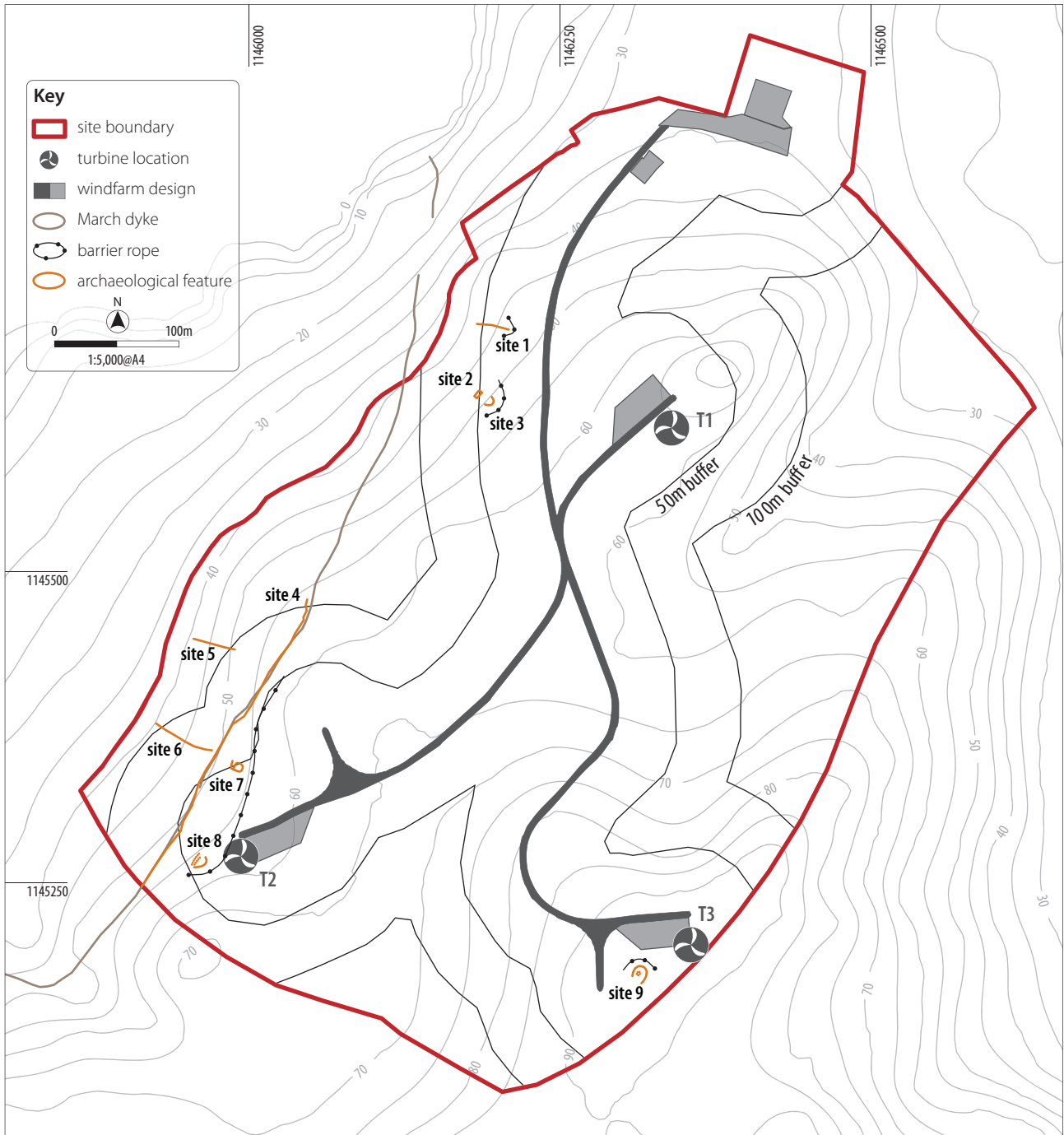
Illus 1
Site location





Illus 3

Peat thickness. Contour plot created using Surfer10 based on a combination of the data from the auger survey, peat thickness within the test pits, previous peat mapping data (Owen & Lowe, 1999) and a peat probing survey carried out by Sam Graham, SSE.



Illus 4

Archaeological features recorded during the walkover survey