Ministry of Defence

Deep Space Advanced Radar Capability (DARC)

Environmental Statement Volume 3: Appendices

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Ministry of Defence

ES Appendix 8.1: UK Habitat Classification and National Vegetation Classification

Contents

Tables

Annexes

Ministry of Defence

Non-technical Summary

This UK Habitat Classification and National Vegetation Classification report has been prepared by Sweco for the Defence Infrastructure Organisation and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks.

The purpose of this report is to detail the methodology and results of the National Vegetation Classification survey and the updated UK Habitat Classification undertaken at the site.

A UK Habitat Classification survey was carried out in November 2022, however, was undertaken outside the optimal botanical survey season.

The grassland was identified as potentially supporting notable or protected flora, and a National Vegetation Classification assessment was recommended during the optimal botanical survey season to establish an accurate ecological baseline of the flora within the grassland habitat.

A National Vegetation Classification survey was undertaken on 13 July 2023 and identified the grassland adjacent to the airstrips as being U4b, *Festuca ovina–Agrostis capillaris–Galium saxatile* grassland, *Holcus-Trifolium* sub community, one of the calcifugous grassland communities.

Despite being acid grassland, the grassland lacks sufficient acid indicator species at a high enough abundance to be classified as the priority habitat lowland dry acid grassland.

Based on the results of the National Vegetation Classification survey, the results of the UK Habitat Classification were updated. Primary broad habitats present on site include modified grassland, other lowland acid grassland, lowland heathland, mixed scrub, bramble scrub, blackthorn scrub, developed land; sealed surface, wet woodland, standing open water and hedgerows.

National Vegetation Classification and UK Habitat Classification

1. Introduction

1.1. A preliminary ecological appraisal comprising a UK Habitat Classification (UKHabs) survey and protected species scoping survey was completed by Sweco UK in 2022 [1].

1.2. The grassland was identified as potentially supporting notable or protected flora, and a National Vegetation Classification (NVC) assessment was recommended during the optimal botanical survey season to establish an accurate ecological baseline of the flora within the grassland habitat.

1.3. A NVC survey was then completed, the results of which were also used to refine and update the UKHabs, as this survey was previously undertaken outside the optimal botanical survey season.

1.4. The purpose of this report is to describe the methodology and results of the NVC survey and UKHabs classification.

2. Methods

Personnel

2.1. This report was produced by Ecologist Leonora Hunt MSc, who has over two years' experience in ecological consultancy. All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under each survey heading below. This report was reviewed by Ecologist Emma Howarth BSc (Hons) who has over two years' experience and approved by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

3. UK Habitat Classification Survey

3.1. The UKHabs survey of the Site was undertaken from the 22nd to 24th of November 2022 by Leonora Hunt MSc (Sweco Ecologist) and Eleanor Unsworth MSc, BSc (Hons) (Sweco Graduate Ecologist). Weather conditions at the time of the survey were mostly rainy with strong wind, with an ambient temperature of approximately 11°C which were considered acceptable for surveying.

3.2. A list of plant species was compiled in accordance with methodology [2] required to establish UK habitat classification types up to level 4. Level 5 was recorded wherever possible, with care to accurately record all habitats of priority importance (if present). Secondary codes were added to polygons where deemed appropriate, taking special care to map mandatory codes for habitat mosaic, complex and origin. Survey was undertaken at the fine scale minimum mapping unit (MMU) of 25m^2 (polygons) and 1m width/5m long (lines). Key ecological features below the MMU in either area or length were mapped as points.

3.3. The results of the NVC survey (detailed below) were used to refine and update the original UKHabs classification.

4. National Vegetation Classification Quadrats

4.1. The NVC survey was carried out by experienced botanist Sophie Barrell MEcol (Hons) ACIEEM, Senior Ecologist with assistance from Leonora Hunt and Claudia Ferreira BSc (Hons) on 13 July 2023. The surveyors undertook quadrat sampling across the grassland habitat. The quadrat locations are shown on drawing 65208061-002-SWE-XX-XX-DR-GS-0002.

4.2. A 2m x 2m quadrat formed the primary recording unit in the grassland; with all species of vascular plant and bryophytes recorded. Ten quadrats were sampled within the homogenous grassland habitat adjacent to the main air strips.

4.3. Separate recording forms were used for each quadrat to document the species present, and the percentage cover of each species was selected using the Domin scale [3] in accordance with NVC guidelines. The Domin scale is shown in Table 1 below.

Table 1. Domin Scale

Domin Scale	Percentage cover
10	91% to 100% cover
9	76% to 90% cover
8	51% to 75% cover
7	34% to 50% cover
6	26% to 33% cover
5	11% to 25% cover
4	4% to 10% cover
3	<4% (many individuals)
2	<4%(several individuals)
1	<4% (few individuals)
X	Outside quadrat but notable nearby species

5. NVC Analysis

5.1. The species lists were checked for presence of any species listed in the Red Data Book [4] indicating degrees of rarity, to determine if any rare or scarce plants occur on site. Botanical Society of Britain and Ireland guidance was consulted for further descriptions of threatened plants likely to be on site [5].

5.2. To determine the vegetation communities on site the community keys and floristic tables in the British Plant Communities Volume 3 [6] were compared with the species frequency (number of quadrats containing a particular species, divided by two as double the standard number of quadrats were assessed) and abundance (range of Domin values for a particular species) established from the quadrats. Species names including scientific and common names are as they appear in Stace 2019 [7], keeping in mind that old names as they appear in Stace 1997 [8] appear in the floristic tables and text. The systematic analysis and assignment of vegetation community's types was undertaken by Leonora Hunt and verified by Sophie Barrell.

6. Results

Desk study

6.1. The West Wales Biodiversity Information Centre biological record data included 61 records of 20 notable plant species within 5km of the site's central grid point including the Environment Wales Act Sch.7 species cornflower (*Centaurea cyanus*), glandular eyebright (*Euphrasia officinalis* subsp*. anglica*), pale dog-violet (*Viola lactea*), purple ramping-fumitory (*Fumaria purpurea*) and small-flowered catchfly (*Silene gallica*), however precise locations were not provided.

UK Habitat Classification

6.2. The results of the UKHabs survey are presented below and on Sweco drawing 65208061-002-SWE-XX-XX-DR-GS-0001.

6.3. The following primary habitat types are present on site:
- Other lowland acid grassland (g1d)
- Modified grassland (g4)
- Lowland heathland (h1a)
- Other native hedgerow (h2a6)
- Non-native and ornamental hedgerow (h2b)
- Dense scrub (h3)
- Blackthorn scrub (h3a)
- West coast blackthorn scrub (h3a5)
- Bramble scrub (h3d)
- Mixed scrub (h3h)
- Other standing water (r1g)
- Other rivers and streams (r2b)
- Wet woodland (w1d)
- Other woodland; mixed (w1h)
- Other coniferous woodland (w2c)
- Buildings (u1b5)
- Other developed land (u1b6)
- Suburban mosaic of developed/natural surface (u1d)
- Arable and horticulture (c1)

6.4. The following secondary codes are present on site:
- Scattered scrub (10)
- Scattered bracken (12)
- Rushes dominant (15)
- Scattered trees (32)
- Line of trees (33)
- Pond (non-priority) (41)
- Freshwater – artificial (49)
- Ditch (50)
- Ruderal or ephemeral (81)
- Waxcap grassland (130)
- Scattered grass (532)
- Introduced shrub (847)

Other lowland acid grassland (g1d)

6.5. The grassland adjacent to the runways, reaching to the northern and southern extremes of the site, are currently managed as hay meadows (Photo 1 and 2).

6.6. Vascular species found here are detailed in Section 7 below. The grassland is bryophyte rich and has a diverse waxcap assemblage (secondary code 130). See the separate fungi report for details [9].

6.7. In wetter places, rushes (*Juncus* spp.) dominate the vegetative community (secondary code 15), while in others, scattered gorse (*Ulex europaeus*) scrub is encroaching (secondary code 10).

Photo 1: Other lowland acid grassland at the northern end of the runway.

Photo 2: Juncus dominated grassland to the north-east of the site.

Modified grassland (g4)

6.8. Sports pitches of modified grassland are present to the south-west of the site. These areas show evidence of constant use and are eroded with bare ground in places.

6.9. These, as well as areas of grassland within the barracks fence line, are maintained at a very short sward height. Species identified include yarrow (*Achillea millefolium*), ribwort plantain (*Plantago lanceolata*) and common sorrel (*Rumex acetosa*).

Lowland heathland (h1a)

6.10. Lowland heathland (a priority habitat) is present on site. This area is located to the north-east, near the site boundary and to the north of the east runway. The area is surrounded by blackthorn (*Prunus spinosa*) scrub. Due to the dense scrub, close access was not possible and a full survey of species present was not undertaken however, the vegetation was dominated by common heather (*Calluna vulgaris*).

Other native hedgerow (h2a6)

6.11. There are four native hedgerows present on the site; two within the western developed area, one along the northern boundary, and one along the southeastern boundary.

6.12. The westernmost hedgerows are heavily managed blackthorn and box (*Buxus sempervirens*) (Photo 3) respectively and are oriented north-south at the edge of a road that slopes downhill toward the site boundary.

6.13. The northernmost hedgerow was inaccessible due to the presence of dense bracken (*Pteridium aquilinum*) and bramble (*Rubus* spp.) within the grassland bordering it, however it appeared to be mainly composed of blackthorn, with bramble and bracken present throughout.

6.14. The hedgerow to the southeast forms a boundary between the site and the C3010. The hedgerow is patchy, and comprises gorse, bramble, hawthorn and blackthorn, with an understorey of bracken. The hedgerow links with scrub to the north and south extent of its length.

Non-native and ornamental hedgerow (h2b)

6.15. The remaining hedgerows are of non-native species and are heavily managed (Photo *4*).

Photo 3: Box hedge

Photo 4: Privet *(Ligustrum* spp.) hedge adjacent to the tennis courts in the south of the site.

Dense scrub (h3)

6.16. There is one area of dense scrub at the north end of the site. The area lies between the northernmost runway and an area of grassland to the north. The dense scrub is bordered by tall gorse, with other scrub plants such as bramble visible, however, due to the height and density of the edges, the prevalence of individual species could not be determined.

Blackthorn scrub (h3a)

6.17. There is an area of blackthorn scrub at the western edge of the site, along the application site, bordered on both sides by paved roads. The vegetation present is dominated by blackthorn, with bramble and gorse covering smaller areas.

6.18. Another small area of blackthorn scrub with scattered trees (secondary code 32) (Photo 5) is to the south-west of the site. The blackthorn scrub with scattered trees surrounds a short ditch within an area of modified grassland fenced at both ends and with a bridge cutting through the middle.

Species present include hawthorn (*Crataegus monogyna*), willow (*Salix* spp.) and the dominant blackthorn.

West coast blackthorn scrub (h3a5)

6.19. There is an area of west coast blackthorn scrub present (Photo *6*) to the north-east, adjacent to the site boundary to the north-east of the eastern runway. The area could not be directly surveyed due to the density of scrub; however the dominance of blackthorn was evident from adjacent habitats.

6.20. An area of west coast blackthorn scrub with scattered trees (secondary code 32) is located to the west of the site, along the western site boundary.

Photo 5: Small patch of blackthorn scrub with scattered trees, in centre of the site.

Photo 6: Transition from bramble scrub in foreground to west coast blackthorn scrub in distance.

Bramble scrub (h3d)

6.21. Dense bramble scrub is present in small to extensive patches across the site, particularly along the western and southern boundaries (Photo 7). In places, there are scattered trees (secondary code 32) of oak (*Quercus* spp.), willow, blackthorn, hawthorn, ash (*Fraxinus excelsior*) and sycamore (*Acer pseudoplatanus)*; scattered bracken (secondary code 12); and scattered grass (secondary code 532) (Photo 8).

Photo 7: Bramble scrub with scattered bracken along the south boundary of the site.

Photo 8: Dense bramble scrub with scattered grass in places.

Mixed scrub (h3h)

6.22. Mixed scrub patches (Photo 9) are present across the site and largely consist of mixed gorse, bramble and blackthorn scrub with some willow present.

6.23. One small area of managed mixed scrub with introduced shrub (secondary code 847) is on the site (Photo 10), within the main barracks area. Species include bramble, blackthorn and bamboo (*Bambusoideae* spp.).

Photo 9: Small patch of mixed scrub.

Photo 10: Mixed scrub with bamboo alongside native species.

Other standing water (r1g)

6.24. Standing water is present at several places across site. A pond (non-priority) (secondary code 41) (Photo 11), approximately 130m^2, is located west of centre and consists of a depression in the ground, surrounded by grassland with an island in the middle and shallowly filled to a depth of approximately 60cm at its deepest point.

6.25. Just south of this is an additional waterbody (Photo 12), identified in November 2022 but almost dry by May 2023. There is no vegetation present and the water is muddy and turbid.

6.26. There are two areas of other standing water; freshwater – artificial (secondary code 49). At the western site boundary is a concrete sided structure, previously used as an Oily Water Interceptor (OWI) (Photo 13), approximately 400m^2. Some vegetation was present, however the water was turbid.

6.27. To the north of the site, surrounded by dense scrub, is a second retired OWI (Photo 14), approximately 170m^2.

6.28. Further details of waterbodies can be found within the Great Crested Newt report [10].

Photo 11: Pond (non-priority) showing island in top right of photo.

Photo 12: A shallow, artificial waterbody.

Photo 13: OWI 1 on the west border of the site.

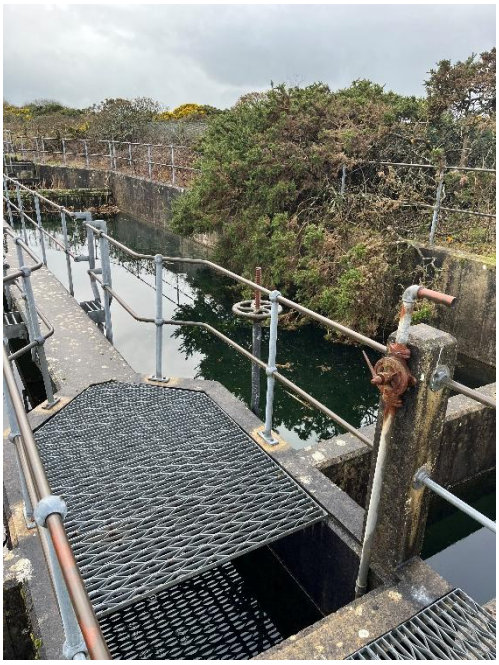

Photo 14: OWI 2 located within dense scrub.

Other rivers and streams; ditch (r2b 50)

6.29. There is one ditch on site (Photo 15). The habitat consists of a ditch and drain, which emerges in the south-east of the site and runs south-east and south along the application site for approximately 0.17km before entering a pipe and going underground again and joining the tributary of the River Solva. The water has low turbidity, however there is no aquatic vegetation present and the water level is shallow.

Photo 15: A ditch running south along the western part of the site.

Developed and sealed surface (u1b)

6.30. A large proportion of the site is developed and sealed surface, including the runways crossing through the centre of the site and the majority of the western side of the site which also contains the buildings. These areas have no vegetation and at the time of survey had no standing water present.

Other developed land (u1b6)

6.31. One area to the east of the centre of the site (Photo 16) is overgrown, previously sealed surface, now broken with a layer of scattered scrub (secondary code 10) and ruderal / ephemeral species (secondary code 81) with bramble, bryophytes and grasses growing throughout, particularly toward the edges.

Photo 16: Sealed surface, now overgrown.

Suburban mosaic of developed/natural surface (u1d)

6.32. Within the main barracks area are a mosaic of houses and gardens. A detailed survey of these areas was not undertaken.

Wet woodland (w1d)

6.33. There is one area of wet woodland with scattered scrub (secondary code 10) (Photo *17*). The area is to the south-west of the site, along the site boundary at the western edge. The area consists of willow dominated woodland with bramble and bracken throughout.

Other woodland – mixed (w1h)

6.34. There is one area of mixed woodland present to the west edge of the site. The area consists of oak (*Quercus* spp.), blackthorn and sycamore, with a density of blackthorn that prevented the area from being fully surveyed.

6.35. Another area of mixed woodland also near the western boundary has scattered scrub (secondary code 10) and includes sycamore, willow and hawthorn with a bramble scrub understorey.

6.36. A line of trees (secondary code 33) (Photo 18) lies to the west of the main barracks area, just north of the main road as it enters the site, and consists of sycamore and hawthorn trees.

Photo 17: Wet woodland with dense understorey of bramble scrub.

Photo 18: Line of trees associated with a bank.

Other coniferous woodland; non-native (w2c 48)

6.37. A small area of non-native coniferous woodland (Photo 19) lies to the south-west of the site bordered by grassland to the east and hardstanding to the west. The trees are mature non-native conifers.

6.38. Two lines of coniferous trees (secondary code 33) are present on site. All are to the south-west of the site within the more developed area of the site, and are non-native pine (*Pinus* sp.) (Photo 20), structured as planted windbreaks.

Photo 19: Non-native conifers.

Photo 20: Non-native line of trees.

Buildings (u1b5)

6.39. The majority of the west side of the site is developed and consists of office areas, commercial and residential buildings.

Arable and horticulture (c1)

6.40. There is one arable field present to the north of the wet woodland bordering the site boundary at the south-western border. As of November 2022, the field appeared to have been recently harvested, with light cover of grasses and remnant crops but no significant growth present.

7. National Vegetation Classification

7.1. The full results of the species found in each quadrat are shown in Table 2 below.

7.2. The overall community of the grassland across all quadrats was assessed as U4, *Festuca ovina–Agrostis capillaris–Galium saxatile* grassland, one of the calcifugous grassland communities. From a review of the floristic tables, the grassland best fits with the *Holcus-Trifolium* sub community, U4b. The grassland composition also has notable affinity with the mesotrophic community MG5 *Cynosurus cristatus – Centaurea nigra* grassland however, the British Geological Society's UK Soil Observatory[1] suggests a mildly acid topsoil, supporting the use of the calcifugous key and the U4b classification.

7.3. The average species richness of vascular plants across the quadrats is 17.

7.4. Despite being acid grassland, the grassland lacks sufficient acid indicator species at a high enough abundance to be classified as the priority habitat lowland dry acid grassland.

7.5. No rare or scarce plants were identified on site, however, bluebells (*Hyacinthoides non-scripta*), a protected species listed in Schedule 8 of the Wildlife and Countryside Act 1981, were recorded within the northern quadrats 4 and 5.

[1] https://mapapps2.bgs.ac.uk/ukso/home.html

Table 2: NVC Results

Site Name: Cawdor **Date:** 13/07/2023 **Surveyors:** SB, LH, CF **Rodwell result:** U4b

Broad Habitat type: Calcifugous grassland **Stand:** 2m x 2m **Weather:** T14C, C7, W2

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Grid Reference	SM 85118 25293	SM 85311 25470	SM 85552 25382	SM 84554 26388	SM 84549 26332	SM 84497 26431	SM 84674 25863	SM 84968 25828	SM 85189 24913	SM 85240 24551
Altitude	112m	110m	107m	109m	109m	110m	105m	105m	110m	107m

Common name	Latin name	Cover (DOMIN scale)										Frequency (divided by 2)	Abundance Range Low - High	
Common bent	*Agrostis capillaris*	5	5	6	7	5	6	5	4	6	5	V	4	7
Sweet vernal grass	*Anthoxanthum odoratum*	6	5	6	5	5	4	5	5	6	5	V	4	6
Red fescue	*Festuca rubra agg.*	7	8	6	5	5	6	7	5	7	5	V	5	8
Cat's ear	*Hypochaeris radicata*	4	3	4	3	1	4	4	3	5	2	V	1	5
Ribwort plantain	*Plantago lanceolata*	3	5	3	1	4	4	3	5	4	4	V	1	5
Springy turf-moss	*Rhytidiadelphus squarrosus*	9	8	7	7	5	6	4	7	8	8	V	4	9
Common knapweed	*Centaurea nigra*	1	1	4	4	1			2	1		III	1	4
Yorkshire fog	*Holcus lanatus*	2			3	3		3	1	3	5	III	1	5
Common feather-moss	*Kindbergia praelonga*		2	3	3	2		4	3	6		III	2	6
Creeping buttercup	*Ranunculus repens*	1	2	1	1				1	3	1	III	1	3
Nipplewort	*Lapsana communis*			1	2	2	3	1			4	III	1	4
False oat grass	*Arrhenatherum elatius*				4	4		5	4	2		II	2	5
Cock's foot	*Dactylis glomerata*			1	4	5	3			2		II	1	5
Field wood rush	*Luzula campestris*				3	3	3	3	4			II	3	4
Common sorrel	*Rumex acetosa*			2	1			1	2		1	II	1	2
Dandelion	*Taraxacum agg.*	1			1			2	1	2		II	1	2
Yellow-rattle	*Rhinanthus minor*	4	4		X					4	2	II	2	4
Field madder	*Sherardia arvensis*	3	5		3				1			II	1	5
Lesser stitchwort	*Stellaria graminea*			3	3	3					3	II	3	3
Germander speedwell	*Veronica chamaedrys*	1			3	3		3				II	1	3
Common bird's foot trefoil	*Lotus corniculatus*	4	3		X		4					I	3	4
White clover	*Trifolium repens*	3	3	2								I	2	3
Common dog-violet	*Viola riviniana*	3			3	2						I	2	3
Creeping soft grass	*Holcus mollis*				3						5	I	3	5
English bluebell	*Hyacinthoides non-scripta*				3	3						I	3	3
Common ragwort	*Jacobaea vulgaris*	1	1									I	1	1
Common meadowgrass	*Poa pratensis sens.lat.*				2				4			I	2	4
Neat feather-moss	*Pseudoscleropodium purum*					3		4				I	3	4
Yarrow	*Achillea millefolium*			1								I	1	1
Common mouse-ear	*Cerastium fontanum*										2	I	2	2
Pignut	*Conopodium majus*				2							I	2	2
Field bindweed	*Convolvulus arvensis*										1	I	1	1
Hawthorn	*Crataegus monogyna*										1	I	1	1
Early Marsh-orchid	*Dactylorhiza incarnata*		1									I	1	1
Common hogweed	*Heracleum sphondylium*				X	1						I	1	1
Creeping tormentil	*Potentilla reptans*		3									I	3	3
Self heal	*Prunella vulgaris*		2									I	2	2
Meadow buttercup	*Ranunculus acris*								1			I	1	1
Lesser trefoil	*Trifolium dubium*			1								I	1	1
Red clover	*Trifolium pratense*		3									I	3	3
Crested dogstail	*Cynosurus cristatus*		X	X								I	0	0
	Number of species	17	18	16	24	19	10	15	17	14	16			

References

[1] Sweco UK Limited, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

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[9] Sweco UK Limited, “Fungi: Project DARC - Cawdor Barracks. Ref. 65208061-SWE-XX-XX-T-J-0005,” 2024.

[10] Sweco UK Limited, “Great Crested Newts: Project DARC - Cawdor. Ref. 65208061-SWE-XX-XX-T-J-0006,” 2024.

Annexes

Annex A UK Habitat Classification

Annex B NVC Quadrat Locations

Ministry of Defence

ES Appendix 8.2: Fungi eDNA Survey

Contents

Tables

Annexes

Non-technical Summary

This fungi survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks in Pembrokeshire.

During a protected species scoping survey undertaken in 2022, numerous fungi species were identified within the grassland habitats, including waxcaps, and the grasslands were considered to have the potential to support a diverse fungal assemblage.

An environmental DNA (eDNA) survey for fungi was undertaken across eleven quadrats on 13 - 15 June 2023, with samples posted to Aberystwyth University on 16 June 2023. The eDNA analysis by Aberystwyth University identified a significant fungi assemblage, including a total of 21 waxcap species, seven species of fungi listed by the International Union for Conservation of Nature (IUCN) as globally vulnerable, and a single species listed on Section 7 of the Environment Act (Wales) 2016. The number and species found mean the site meets the criteria for designation as a site of special scientific interest and is of national importance.

Fungi eDNA Survey

1 Introduction

Project Background

1.1 The survey site (comprising the entire area within the barracks) has been subject to a preliminary ecological appraisal (PEA) comprising a UK Habitat Classification (UK HABS) survey and protected species scoping survey completed by Sweco UK in 2022 [1], see Appendix 8.1 for details.

1.2 The PEA report identified grassland on site with the potential to support a diverse fungal assemblage and further surveys were recommended. This report details the methodology and results of the Fungi eDNA survey undertaken.

2 Methods

Personnel

2.1 Professor Gareth W Griffith from Aberystwyth University was consulted on the methodology for the soil sample collection.

2.2 The survey was undertaken by Richard Webber-Salmon, BSc (Hons) MCIEEM Principal Ecologist, and Emma Howarth BSc (Hons), Ecologist, following the protocol provided by Aberystwyth University.

2.3 This report was produced by Ecologist Emma Howarth who has over two years' experience in ecological consultancy including surveys and mitigation for a range of protected species and in producing ecological impact assessments. This report was reviewed by Ecologist Leonora Hunt MSc who has over two years' experience in ecological consultancy and approved by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' in ecological consultancy and production of ecological impact assessments.

Desk Study

2.4 West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable fungi species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Fungi eDNA Survey

2.5 The soil samples were collected on 13 - 15 June 2023 with samples posted to Aberystwyth University on 16th June 2023. Weather conditions across the survey visits were sunny, breezy, with an ambient temperature of approximately 20ºC. The fungi survey report from Aberystwyth states samples were frozen on 20th July; this is a typo and they were frozen upon receipt on 20th June 2023.

2.6 Survey protocol was established following consultation with Professor Gareth W Griffith from Aberystwyth University and following eDNA fungi sampling protocol[1].

2.7 Quadrat locations were identified prior to the site visit, to ensure they were appropriately distributed across the site. Surveyors used professional judgement during the survey to determine whether these locations were suitable, or if any should be adjusted accordingly. A total of 11 quadrats were used on site, the locations of which are shown in Annex B.

2.8 Each quadrat measured 30m x 30m and was marked out on the ground using tape. Within each quadrat, a total of 36 soil samples were collected using an 18 mm inner diameter auger, from evenly distributed points across the quadrat. Soil samples were pooled together into bags (one bag per quadrat) and stored in a fridge overnight before being sent to Aberystwyth University for eDNA analysis.

2.9 Laboratory analysis of the samples was undertaken by Aberystwyth University. Full methodology with regards to laboratory analysis can be found within Annex A.

3 Results

Desk Study

3.1 The WWBIC biological record data included two records of hazel gloves (*Hypocreopsis rhododendri*), a parasitic fungus listed in accordance with Environment Act (Wales) 2016, associated with hazel and blackthorn, within 5km of the site's central grid point. Both records were located more than 2km from the boundary of the barracks.

Fungi eDNA Survey

3.2 Full detailed results and analysis provided by Aberystwyth University are presented within Annex A.

3.3 A total of 58 species of CHEGD (Clavarioids, Hygrocybe (waxcaps), Entoloma, Geoglossum and relatives, and Dermoloma and relatives) fungi were detected across the 11 quadrats. Quadrat ten had the highest species count, with 34 CHEGD species noted, whilst quadrat four and six had the lowest count with 20 CHEGD species detected.

3.4 Analysis of the fungi communities found that sample [quadrat] 1 was distinct, with the remaining samples falling into two clusters, generally associated with the southern and northern sections of the airfield.

3.5 A total of 21 species of waxcap fungi (Hygrocybe sp.) were detected across all eleven quadrats, with a peak count of 11 species at quadrat 2.

3.6 Species considered to be of conservation importance were detected across all of the quadrats, this includes a total of seven species listed as globally vulnerable by the IUCN Red list [3], three species assessed but not formally published as vulnerable, and one species listed in accordance with Section 7 of the Environment Act (Wales) 2016.

[1] Standards, methodology and protocols for sampling and identification of grassland fungus species Using eDNA from soil samples, Natural England Commissioned Report NECR374, December 2021

3.7 The site meets the species count threshold for consideration as a Site of Special Scientific Interest (SSSI) for four groups of CHEGD fungi [4]. The species counts of qualifying species across the quadrats is shown in Table 1.

3.8 The site is considered to be of national importance at a minimum.

3.9 While the report by Aberystwyth University (Annex A) suggests that traditional fruitbody surveys may identify additional grassland fungi, previous project experience by Sweco has found that fungi eDNA surveys have been proven to identify a far more comprehensive species list of grassland fungi species, identifying many more species than compared with multiple years of traditional fruitbody surveys. Given this, additional fruiting body surveys were not undertaken.

Table 1: Species counts of qualifying species across the quadrats.

	Quadrats											Site-wide Total	Threshold required to meet criteria for SSSI status [4]
	1	2	3	4	5	6	7	8	9	10	11		
Clavarioids	7	7	7	5	5	5	8	7	8	7	7	10	7
Hygrocybe	6	10	7	4	4	6	5	6	6	8	8	19	19
Entoloma	9	6	6	6	7	3	7	9	8	10	7	15	15
Geoglossum	2	2	3	2	1	2	1	1	3	2	2	4	5
Dermoloma	2	2	2	1	2	1	2	2	2	3	2	3	3

References

[1] Sweco, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

[2] West Wales Biodiversity Information Centre, “Data Enquiries,” [Online]. Available: https://www.wwbic.org.uk/data-enquiries/. [Accessed 12 2022].

[3] International Union for Conservation of Nature and Natural Resources, “IUCN Red List of Threatened Species,” [Online]. Available: https://www.iucnredlist.org/.

[4] S. Bosanquet, M. Ainsworth, S. Cooch, D. Genney and T. Wilkins, “Guidelines for the Selection of Biological SSSIs. Part 2: Detailed Guidelines for Habitats and Species Groups. Chapter 14 Non-lichenised fungi.,” Joint Nature Conservation Committee, Peterborough, 2018.

Annexes

Annex A: Assessment of CHEGD fungi at Cawdor Barracks, Pembrokeshire report

Annex B: Fungi eDNA Quadrat Locations

Ministry of Defence

ES Appendix 8.3: Great Crested Newt eDNA survey

Contents

Tables

Annexes

Non-technical Summary

This Great Crested Newt eDNA Survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks, Pembrokeshire.

An initial ecological desk study, UK Habitat Classification survey and protected species scoping survey was carried out in November 2022, to map the habitats present on site and assess their potential to support notable/protected species. The waterbodies on and near to site were identified as having the potential to support amphibian species, and so environmental DNA surveys were recommended to confirm the presence or likely absence of great crested newt (*Triturus cristatus*).

A Habitat Suitability Index (HSI) assessment and environmental DNA surveys for great crested newt were undertaken. All waterbodies were found to have below average or poor suitability for great crested newt. No great crested newt eDNA was detected in any of the waterbodies sampled.

Common toad (*Bufo bufo*) a species listed in accordance with Scheule 7 of the Environment (Wales) Act 2016, palmate newt (*Lissotriton helveticus*) and smooth newt (*Lissotriton vulgaris*) were incidentally recorded on site during other ecology surveys.

Great Crested Newt eDNA survey

1 Introduction

1.1 The Cawdor Barracks site has been subject to a preliminary ecological appraisal (PEA) comprising a UK Habitat Classification survey and protected species scoping survey completed by Sweco UK in 2022.

1.2 The findings of the UK Habitat Classification survey identified habitats suitable for amphibian species. While it was considered a low risk that great crested newt would be present on site, the PEA report recommended environmental DNA (eDNA) surveys for great crested newt (*Triturus cristatus*, GCN) of waterbodies on and within 500m of the site to confirm presence or likely absence.

1.3 The purpose of this report is to describe the methodology and results of the GCN surveys undertaken and detail any other amphibians found on site during site surveys.

Legislation

1.4 The GCN is a European protected species afforded protection in the UK under the Conservation of Habitats and Species Regulations 2017 (as amended) and is fully protected under Schedule 5 of the Wildlife and Countryside Act 1981. Taken together, these pieces of legislation make it an offence to:

- intentionally, deliberately or recklessly capture, kill or injure a GCN
- possess, control or transport GCN
- damage or destroy a resting place or breeding place for GCN
- deliberately disturb wild animals of a European protected species, in particular any disturbance which is likely to:
    - impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or
    - impair their ability in the case of hibernating or migratory species, to hibernate or migrate; or
    - affect significantly the local distribution or abundance of the species to which they belong
    - intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a GCN
    - intentionally or recklessly disturb a GCN while it is occupying a structure or place which it uses for that purpose.

1.5 Some species of amphibians are also listed in accordance with Section 7 of the Environment (Wales) Act 2016. Under the Act Welsh Ministers must take all reasonable steps to maintain and enhance the living organisms and types of habitat included in the lists. Amphibian species listed under the Act are common toad (*Bufo bufo*), natterjack toad (*Epidalea calamita*), and GCN.

2 Methods

Personnel

2.1 This report was produced by Ecologist Leonora Hunt MSc, who has over two years' experience in ecological consultancy. All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under each survey heading below. This report was approved by Gemma Linacre MRes BSc(Hons) MCIEEM, GCN Class licence 1 holder and GCN low impact licence registered consultant who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Zone of Influence

2.2 For GCN, a 500m zone of influence (ZOI) with suitable connective habitat from the site boundary was considered sufficient, based on professional guidelines [1].

Desk Study

2.3 The Multi-Agency Geographic Information for the Countryside (MAGIC) [2] online database was consulted to obtain geographic information on the presence of ponds within 500m of the site boundary.

2.4 West Wales Biodiversity Information Centre (WWBIC) [3] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Great Crested Newt Survey

Habitat Suitability Index

2.5 The Habitat Suitability Index (HSI) assessment covered all ponds identified on MAGIC within the site boundary and within 500m of suitable connective habitat of the site. Additional waterbodies were included within the scope of the assessment as they were identified on site by surveyors. The ponds included within the survey and their associated reference numbers are shown on drawing 65208061-002-SWE-XX-XX-DR-GS-0004 provided at the end of this report).

2.6 The initial HSI assessment was undertaken by Eleanor Unsworth MSc and Leonora Hunt in November 2022, with additional assessments by Courtney Long BSc (Hons), Joshua Stafford

BSc (Hons) MRSB, Claudia Ferreira BSc (Hons), Darren Storey MZool (Hons) MSc ACIEEM and Emma Howarth BSc (Hons) between 25 April 2023 and 02 May 2023, in line with relevant guidelines [4]. The HSI Assessment rated the suitability of the waterbody to support GCN against ten Suitability Indices:

- Geographic location;
- Pond area;
- Pond permanence;
- Water quality;
- Shade;
- Waterfowl effect;
- Fish presence;
- Pond Density;
- Terrestrial habitat; and
- Macrophyte cover.

2.7 Each suitability index was given a score between 0 and 1, with the results calculated to give the overall HSI Score.

2.8 The HSI score was then compared with the following scale to assess suitability for GCN:

- < 0.50 = Poor
- 0.50 - 0.59 = Below average
- 0.60 - 0.69 = Average
- 0.70 - 0.79 = Good
- > 0.80 = Excellent

Presence/Absence eDNA Survey

2.9 Water sample collection was undertaken on waterbodies OWI 1 and 2, P1 and P3 to P7 (identified in Annex A, drawing 65208061-002-SWE-XX-XX-DR-GS-0004). P25 and P26 were also sampled due to visible confirmation of the presence of smooth newt (*Lissotriton vulgaris*) and palmate newt (*Lissotriton helveticus*).

2.10 The ponds surveyed included all those within the site boundary except P2 which was almost dry, P8 which was too small to get samples from and P9 for which there was no access to the water

due to dense scrub. Offsite ponds sampled were ponds P3 to P7, which were those identified on MAGIC during the desk study.

2.11 The remaining offsite ponds were found when conducting the eDNA surveys for other ponds and so were not sampled as kits weren't available. However, an HSI assessment was undertaken. Of these ponds, P10 is within habitat connected to P6, which was sampled. Ponds P11 and P12 were discounted as they were just outside the 500m boundary. Ponds P13 to P20 and P21 to P24 were not surveyed as they are separated from the site by roads. There are also arable fields present between the ponds and the site, in addition to roads, with limited connectivity consisting of narrow hedges, which further decreases the likelihood any amphibians within these ponds would be within the terrestrial habitat within the survey site boundary.

2.12 The sampling was undertaken by Darren Storey (GCN survey class licence reference 2018-34788-CLS-CLS) and Joshua Stafford (GCN class reference 2015-18075-CLC-CLS) with assistance from Leonora Hunt, Emma Howarth and Claudia Ferreira, using SureScreen Scientific eDNA testing kits, in accordance with supplier guidance (Annex A) to test for the presence / likely absence of GCN.

2.13 Water sample collection using this methodology must be undertaken between 15 April and 30 June to be considered valid. The samples were taken on the 24 April 2023 and 17 May 2023, so were therefore undertaken at the appropriate time of year.

2.14 One eDNA kit was used for each water body during eDNA sampling. Water samples were collected from 20 equally distributed sampling points. Samples collected did not contain significant suspended sediment or other particular matter, and water clarity was almost entirely clear within the whirl-pak (bag in which all water samples are mixed together during sample collection).

2.15 Samples were couriered to the SureScreen laboratory for analysis.

Assumptions and Limitations

2.16 Although not all ponds within 500m were sampled for eDNA analysis, by taking samples from the ponds on site and a sample of others outside the site boundary it was considered that this was sufficient to establish if GCN were present on site. This was due to the ponds all being of poor or below average suitability and that a number of barriers to dispersal of GCN were present in the form of arable fields and roads. Although pond P10 was not sampled this is not considered a significant limitation as samples were taken from P6 which is within the same woodland and directly connected so it is considered likely that if present GCN would be using both ponds.

3 Results

Desk Study

3.1 No records of GCN were returned by WWBIC within 5km of the site's central grid point. The records did include 45 records of other amphibians within 5km of the site's central grid point, including 16 records of common toad, thirteen of palmate newt, two of smooth newt and 14 of common frog (*Rana temporaria*).

Great Crested Newt Surveys

3.2 Woodland and scrub habitats on site provide suitable refuge, foraging and overwintering habitats for amphibians, including GCN, while grassland habitats provide foraging potential.

3.3 Waterbodies are described in Table 1 and their locations are shown on Sweco drawing 65208061-002-SWE-XX-XX-DR-GS-0004.

Habitat Suitability Index Assessment (HSI)

3.4 Full details of the HSI assessment are provided as Annex C. Table 1 below provides a summary of the results.

Table 1: Pond references, Descriptions and HSI Results

Pond reference	Description	Grid reference	HSI Score	Pond suitability class
Oily water interceptor (OWI) 1	A concrete sided water tank approximately 660m^2, outside the fenced area of the site and inaccessible from either direction. Despite the turbid water, the tank appeared deep, with some vegetation present.	SM 84617 25265	0.42	Poor
OWI 2	Similar to OWI 1, OWI 2 is a concrete sided water tank, however OWI 2 is located within an area of dense scrub.	SM 85085 26007	0.47	Poor
P1	Approximately 130m^2 with an island in the middle, surrounded by grassland and shallowly filled to a depth of approximately 60cm at its deepest point. The water was turbid, but clear enough that the bottom was visible.	SM 84858 25158	0.39	Poor
P2	Artificial, consisting of a sloping bank on one edge, with the other edge a vertical wall lined in corrugated metal and with a large piece of machinery partly submerged in the middle. No vegetation present and the water was muddy and turbid in November 2022, but nearly dry in April 2023.	SM 84848 25043	0.25	Poor
P3	More an area of wet woodland than pond. Small, shallow area of standing water with a stream running under the road.	SM 84627 25364	0.46	Poor
P4	Irrigation pond. Bulrush (*Typha latifolia*) and rushes (*Juncus* sp.) present.	SM 83986 25616	0.43	Poor

Pond reference	Description	Grid reference	HSI Score	Pond suitability class
P5	Waterbody with both inflow and outflow. Aquatic vegetation including meadowsweet (*Filipendula ulmaria*), watermint (*Mentha aquatica*), rushes, bulrush and horsetail (*Equisetum* sp.) present.	SM 85560 26757	0.51	Below average
P6	Thick with vegetation.	SM 85961 25576	0.50	Below average
P7	Pond at the edge of agricultural field. Small feeder pond adjacent (assessed together).	SM 83706 24153	0.42	Poor
P8	Tiny, shallow, circular pool in grassland.	SM 85681 25981	0.32	Poor
P9	Surrounded by scrub; no access to water. Little to no macrophytes.	SM 85105 25833	0.42	Poor
P10	Pond between arable field and woodland.	SM 85845 25263	0.53	Below average
P11	Small, roadside pond. Thick with algae.	SM 86185 24934	0.52	Below average
P12	Waterbody identified using aerial photography, but no pond present.	SM 86055 24516	N/A	N/A
P13	One of three adjacent ponds set in woodland / scrub.	SM 85557 24047	0.47	Poor
P14	One of three adjacent ponds set in woodland / scrub.	SM 85498 24063	0.48	Poor

Pond reference	Description	Grid reference	HSI Score	Pond suitability class
P15	One of three adjacent ponds set in woodland / scrub.	SM 85493 24012	0.47	Poor
P16	Likely ephemeral, waterlogged area of woodland.	SM 85361 23639	0.27	Poor
P17	Waterlogged area adjacent to arable field. Choked by grasses.	SM 85223 23733	0.59	Below average
P18	Inaccessible.	SM 85149 23527	N/A	N/A
P19	Waterlogged grassland. Some aquatic vegetation.	SM 85207 23557	0.42	Poor
P20	Dry at the time of survey; surrounded by bramble scrub (*Rubus fruticosus*).	SM 85298 23542	0.20	Poor
P21	Waterlogged patch of woodland with algae. Some fly tipping nearby.	SM 83994 26106	0.49	Poor
P22	Inaccessible. Limited connectivity to site.	SM 84399 27067	N/A	N/A
P23	Inaccessible. Limited connectivity to site.	SM 84389 27084	N/A	N/A
P24	Inaccessible. Limited connectivity to site.	SM 84676 27033	N/A	N/A

Pond reference	Description	Grid reference	HSI Score	Pond suitability class
P25	A series of water puddles and pools collected in the deep tyre tracks to the west of the airstrips. Tadpoles were observed in the water confirming the viability of this ephemeral waterbody.	SM 84502 25928	0.38	Poor
P26	A series of water puddles and pools collected in the deep tyre tracks to the north of the airstrips. Tadpoles were observed in the water confirming the viability of this ephemeral waterbody.	SM 84746 26356	0.43	Poor

Presence/Absence eDNA Survey

3.5 The detailed results of the eDNA sample laboratory analysis are attached to this report as Annex B. Table 2 below provides an overview of the results. GCN eDNA was absent from all water bodies sampled.

Table 2. Overview of results

Date sample collected	Pond ref.	Positive/ negative
24 April 2023	OWI 1	Negative
24 April 2023	OWI 2	Negative
24 April 2023	P1	Negative
24 April 2023	P2	Nearly dry – not sampled.
24 April 2023	P3	Negative
24 April 2023	P4	Negative
24 April 2023	P5	Negative
24 April 2023	P6	Negative
24 April 2023	P7	Negative
24 April 2023	P8	Too small - not sampled.
24 April 2023	P9	No access to water for sampling.
17 May 2023	P25	Negative
17 May 2023	P26	Negative

Other Amphibians

3.6 While not specifically surveyed for, at least five common toads were incidentally identified on site under reptile mats during the reptile surveys. The toads were typically found to the north of the site, where grassland meets scrub.

3.7 Incidental observations of palmate newts and smooth newts were recorded during site visits in April 2023 within the onsite waterbodies, including the temporary waterbodies formed in tyre ruts to the northeast and northwest of the site.

References

[1] English Nature, Great Crested Newt Mitigation Guidelines, Peterborough: English Nature, 2001.

[2] MAGIC, “Site Check,” [Online]. Available: https://magic.defra.gov.uk/. [Accessed 1 2022].

[3] West Wales Biodiversity Information Centre, “Data Enquiries,” [Online]. Available: https://www.wwbic.org.uk/data-enquiries/. [Accessed 12 2022].

[4] R. S. Oldham, J. Keeble, M. J. S. Swan and M. Jeffcote, “Evaluating the suitability of habitat for the great crested newt (Triturus cristatus),” *The Herpetological Journal,* vol. 10, no. 4, pp. 143-155, 2000.

Drawings

65208061-002-SWE-XX-XX-DR-GS-0004: Sweco UK Ltd – Waterbodies and survey locations

Ministry of Defence

ES Appendix 8.4: Reptile Survey

Contents

Tables

Non-technical Summary

This reptile survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks in Pembrokeshire.

An initial ecological desk study, UK habitat classification survey and protected species scoping survey was carried out in November 2022, to map the habitats present on site and assess their potential to support notable/protected species. The scrub, heathland and grassland habitats on site were identified as having the potential to support common reptile species.

Reptile surveys were undertaken between 13 April 2023 and 13 July 2023, and identified a low population of slow worm (*Anguis fragilis*), good populations of grass snake (*Natrix helvetica*) and adder (*Vipera berus*), and an exceptional population of common lizard (*Zootoca vivipara*) on site.

Reptile Survey

1. Introduction

1.1. The Cawdor Barracks site has been subject to a preliminary ecological appraisal (PEA) comprising a UK Habitat Classification survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2. The protected species scoping survey identified that the scrub, heathland and grassland habitats on site were suitable for common reptile species and recommended further surveys to establish the ecological baseline for reptiles.

1.3. The purpose of this report is to describe the methodology and results of these surveys.

2. Legislation

2.1. The four common British reptiles, common lizard (*Zootoca vivipara*), slow-worm (*Anguis fragilis*), grass snake (*Natrix helvetica*) and adder (*Vipera berus*) are protected under the Wildlife and Countryside Act 1981 (as amended). They are protected against intentionally or recklessly killing and injuring (but not taking), and against sale.

2.2. The sand lizard (*Lacerta agilis*) and smooth snake (*Coronella austriaca*) are European protected species afforded protection in the UK under the Conservation of Habitats and Species Regulations 2017 (as amended) and are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981. Taken together, these pieces of legislation make it an offence to:

- Intentionally, recklessly or deliberately capture, injure or kill sand lizard or smooth snake
- possess, control or transport sand lizard or smooth snake sell sand lizard or smooth snake or offer or expose for sale or transport for sale
- damage or destroy a resting place or breeding place for sand lizard or smooth snake
- deliberately disturb sand lizard or smooth snake, in particular any disturbance which is likely to:

  - impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or

  - impair their ability in the case of hibernating or migratory species, to hibernate or migrate; or

  - affect significantly the local distribution or abundance of the species to which they belong

  - deliberately take or destroy the eggs of such animals, or

  - damage or destroy a breeding site or resting place of such animals.

- intentionally or recklessly obstruct access to any structure or place used for shelter or protection by sand lizard or smooth snake

- intentionally or recklessly disturb sand lizard or smooth snake while it is occupying a structure or place which it uses for that purpose.

2.3. All native reptiles are also listed under Section 7 of the Environment (Wales) Act 2016. Under the Act, Welsh Minister take all reasonable steps to maintain and enhance the living organisms and types of habitat included in any list published under this section. Conserving biodiversity can include restoring or enhancing a population or habitat.

3. Assumptions and Limitations

3.1. The methodology for assessing population class size provides a rough estimate only; reptiles are cryptic and so it is difficult to get a more accurate idea of population size on a site without longer term study and analysis. The survey methods used do however indicate approximate potential size classes of each species and provide information on which species are present and their distribution across the site. Therefore, this is not considered a limitation when assessing potential impacts to reptiles.

4. Methods

Personnel

4.1. All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under each survey heading below. This report was produced by Ecologist Leonora Hunt MSc who has over two years' experience in ecological consultancy. This report was reviewed by Ecologist Emma Howarth, BSc (Hons) who has over two years' experience and approved by Gemma Linacre MRes BSc(Hons) MCIEEM who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Desk Study

4.2. West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Reptile Survey

4.3. The survey was undertaken by Courtney Long BSc (Hons), Claudia Ferreira BSc (Hons), Darren Storey MZool (Hons) MSc ACIEEM, Eleanor Unsworth MSc, Elliott Burns BSc MSc, Emma Howarth BSc (Hons), Joshua Stafford BSc (Hons) MRSB, Leonora Hunt and Sophie Barrell MEcol (Hons) ACIEEM. The site was surveyed for reptiles using a methodological approach based on guidance produced by the Joint Nature Conservation Committee (JNCC) [3], Amphibian and Reptile Conservation Trust [4] and Froglife [5]. A combination of visual sightings and refuge searching of natural and artificial refuges was employed to detect the presence of reptiles within suitable habitats on site.

4.4. In order to supplement the existing natural refuges, a total of 1,430 artificial refuges (1.0m x 0.5m roofing felt mats) were placed in 286 arrays of five during the week commencing 27 March 2023. The refuges were placed across the site within all suitable reptile habitats present. Positions of refuges were picked to maximise the chances of use by placing them in sheltered sunny positions, and in or near to cover where possible. Annex A shows the locations of the refuges. Refuges were left a minimum of two weeks to bed in, prior to surveys.

4.5. Seven separate site visits (across two to three days where the whole site could not be surveyed in one day) were undertaken between the 13 April 2023 and 13 July 2023. To maximise chances of recording reptiles, surveys were carried out under optimal weather conditions and at times of day when reptiles are most likely to be using the artificial refuges. The dates, times and weather conditions for each of the surveys are included in Table 1 below:

Table 1. Reptile Survey Conditions

Survey	Date	Surveyors	Time	Weather
1	13 April 2023	Courtney Long, Darren Storey, Eleanor Unsworth	08:45 – 19:30	Breezy, slight drizzle at start, cloudy becoming clear, 9ºC
2	19 April 2023	Darren Storey, Emma Howarth, Leonora Hunt	16:15 – 18:15	Breezy, partly cloudy, 16ºC
	20 April 2023		08:15 – 16:45	Breezy, clear, 7ºC - 15ºC
3	25 April 2023	Courtney Long, Joshua Stafford	13:45 – 18:45	Light breeze, partly cloudy, 9ºC
	26 April 2023		11:30 – 16:30	Light breeze, cloudy, 9ºC - 12ºC
4	02 May 2023	Claudia Ferreira, Elliott Burns	13:30 – 18:15	Light breeze, partly cloudy, 13ºC

Survey	Date	Surveyors	Time	Weather
	03 May 2023	Claudia Ferreira, Elliott Burns, Sophie Barrell	10:00 – 13:00	Breezy, cloudy, 12ºC to 14ºC
5	10 May 2023	Claudia Ferreira	15:30 – 18:15	Breezy, partly cloudy, 12ºC
	11 May 2023	Claudia Ferreira, Leonora Hunt	10:00 – 12:00	Breezy, cloudy, light drizzle, 11ºC
	12 May 2023		11:00 – 16:30	Breezy, partly cloudy, 15ºC
6	16 May 2023	Claudia Ferreira, Leonora Hunt, Sophie Barrell	10:45 – 17:30	Light breeze, becoming sunny, 13ºC
	17 May 2023		15:30 – 18:30	Light breeze, sunny, 13ºC
7	11 July 2023	Claudia Ferreira, Courtney Long, Elliott Burns, Leonora Hunt, Sophie Barrell	09:15 – 11:45, 15:30 – 18:45	Breezy, survey halted late morning due to rain, 16ºC
	12 July 2023		09:00 – 17:00	Light breeze, partly cloudy, 16ºC
	13 July 2023		09:00 – 17:30	Light breeze, partly cloudy, 18ºC

4.6. The method for assessing reptile population size on short term studies is taken from Froglife's Advice Sheet 10 [5] and is based on the peak number of adult reptiles seen using refuges on a site. Given the size of the site, the surveys were conducted over multiple days, so the peak count was taken to be per survey rather than per day as detailed in the guidance. Table 2 shows the population size estimates based on peak counts.

Table 2: Population size estimates based on peak adult counts

	Low population	Good population	Exceptional population
Adder	<5	5 - 10	>10
Grass snake	<5	5 – 10	>10

Common lizard	<5	5 – 20	>20
Slow worm	<5	5 – 20	>20

5. Results

Desk study

5.1. The WWBIC biological record data provided 97 records of reptiles within 5km of the site's central grid point, including 15 records of slow worm (*Anguis fragilis*), 43 records of adder (*Vipera berus*), 12 records of grass snake (*Natrix helvetica*) and 27 records of common lizard (*Zootoca vivipara*). One of these records, for grass snake, is within a grid square which includes the site (specific location not provided). All other records were all outside the survey site. Records were in all directions from the site with the majority of them recorded close to the coast to the south, south east and south west.

Reptile survey

5.2. All four species of common reptile (Photos 1 – 4) were recorded on site during the reptile surveys. The full results are shown in Table 3 and Table 4 , and on Annex B, note figures show locations of species recorded not numbers.

Table 3: Reptile survey counts

		Survey Visit						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Common lizard	Female adult	3	4	5	17	12	21	9
	Male Adult	1	10	2	6	19	22	6
	Juvenile	0	12	0	9	18	17	5
	Undetermined	4	4	12	5	0	3	8
Slow worm	Female adult	0	0	0	0	0	0	2
	Male Adult	0	0	0	0	0	0	1
	Juvenile	0	0	0	0	0	0	0
	Undetermined	0	0	0	0	0	0	0
Adder	Female adult	0	0	0	0	0	3	7
	Male Adult	0	1	0	0	2	0	2
	Juvenile	0	0	0	0	2	1	1
	Undetermined	0	0	0	0	0	0	0
Grass snake	Female adult	0	0	1	1	3	2	1
	Male Adult	0	0	0	0	3	2	0
	Juvenile	0	0	1	1	2	8	0
	Undetermined	0	0	0	0	0	2	3

Table 4: Reptile peak adult counts

	Peak adult counts	Population status
Common lizard	43	Exceptional
Slow worm	3	Low
Adder	9	Good
Grass snake	6	Good

Photo 1: Female common lizard surveyed on site 12 May 2023.

Photo 2: Two female slow worms surveyed on site 12 July 2023.

Photo 3: Male grass snake surveyed on site 12 May 2023.

Photo 4: Female adder surveyed on site 16 May 2023.

5.3. While common lizard were more evenly spread across site, the other species of common reptile were concentrated near areas of scrub, typically away from the airstrips and managed grassland. In particular, they were more frequent in the northern areas of the site and along the eastern boundary.

References

[1] Sweco, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

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Annexes: Drawings

Annex A Reptile refuge locations

Annex B Reptile survey results 1

Annex C Reptile survey results 2

Annex D Reptile survey results 3

Annex E Reptile survey results 4

Annex F Reptile survey results 5

Annex G Reptile survey results 6

Annex H Reptile survey results 7

Ministry of Defence

ES Appendix 8.5: Wintering Bird Survey

Contents

Tables

Annexes

Non-technical Summary

This survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks in Pembrokeshire. The purpose of this report is to detail the methodology and results of the wintering bird surveys undertaken at the site.

An initial ecological desk study, UK habitat classification survey and protected species scoping survey was carried out in November 2022, to map the habitats present on site and assess their potential to support notable/protected species. The woodland, scrub, ditches and grassland habitats on site were identified as having the potential to support notable and/or rare wintering bird species.

Wintering bird surveys (WBS) were undertaken between November 2022 and February 2023. The surveys recorded a total of twenty-eight species within the survey area, comprising a mix of common and notable species. Notable species recorded include nine amber-listed Birds of Conservation Concern Wales 4, seven red-listed Birds of Conservation Concern Wales 4, nine species listed in accordance with Section 7 of the Environment (Wales) Act 2016 and four Schedule 1 species listed under the Wildlife and Countryside Act 1981 (as amended).

The site is considered to be important for wintering birds at a County level.

Wintering Bird Survey

1. Introduction

Project Background

1.1. The Cawdor Barracks site has been subject to a preliminary ecological appraisal (PEA) comprising a UK habitat classification (UKHabs) survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2. The protected species scoping survey identified that woodland, scrub, ditches and grassland habitats on site were suitable for notable and/or rare wintering bird species and recommended further survey.

1.3. The purpose of this report is to describe the methodology and results of the wintering bird surveys undertaken.

Legislation and Policy Context

1.4. All wild birds are protected under the Wildlife and Countryside Act (WCA) 1981, making it an offence to intentionally or recklessly kill, injure or take any wild bird.

1.5. 51 bird species are also listed under Section 7 of the Environment (Wales) Act 2016. Under the Act, Welsh Ministers must take all reasonable steps to maintain and enhance the living organisms and types of habitat included in any list published under this section. Conserving biodiversity can include restoring or enhancing a population or habitat.

Assumptions and Limitations

1.6. It is not considered that there are any assumptions and limitations relevant to this report.

2. Methods

Personnel

2.1. All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under each survey heading below. This report was produced by Claudia Ferreira BSc (Hons), Ecologist, who has over two years' experience in ecological consultancy including surveys for a range of protected species and in producing ecological impact assessments. This report was reviewed by Joshua Stafford Bsc (Hons) MRSB Principal Ecologist, an experienced ornithologist, who has over 13 years' experience and by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Desk Study

2.2. West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

2.3. The British Trust for Ornithology (BTO) was contacted for Wetland Bird Survey (WeBS) [3] records of bird assemblages within 10km of the site's boundary.

2.4. Previous ecology reports pertaining to the Cawdor Barracks site were reviewed for the purposes of this report which are as follows:

- Preliminary Ecological Appraisal Report [1]; and
- Strategic Environmental Technical Advisor Stage 4: Ecological Appraisal [4].

Wintering Bird Survey

2.5. To provide a reasonable level of accuracy for determining the population status of wintering birds on the site it was considered that four separate surveys were required for a period of four hours each. Standard British Trust for Ornithology (BTO) species codes and symbols were used to identify bird species, activity and direction of flight, where appropriate [5] [6].

2.6. The visits were undertaken between the 29 November 2022 and 08 February 2023. The WBS were undertaken by experienced ornithologist Philip Dutt BSc (Hons) MCIEEM. The surveys were undertaken during suitable weather conditions as summarised in Table 3.1 below.

Table 1. Breeding Bird Survey Conditions

Survey	Date	Time		Temperature (ºC)		Wind (Beaufort scale)		Cloud cover (Oktas)		Precipitation (mm)	
		Start	End	Start	End	Start	End	Start	End	Start	End
1	29 November 2022	09:00	13:00	5	9	1	2	6	7	0	0
2	14 December 2022	09:00	13:00	-2	-1	1	1	4	6	0	0
3	11 January 2023	08:30	12:30	9	9	1	2	6	8	Light rain	Heavy rain
4	08 February 2023	09:30	12:30	5	9	1	1	6	8	0	0

2.7. The WBS followed a set transect which aimed to include all core habitat types on site, shown in Annex A. The survey area included the whole of the area within the proposed development footprint.

2.8. The transect route was walked slowly and birds were identified by both sight and sound by the ornithologist (no apps or recorders were used), with records of their behaviour taken and recorded onto plans. Standard BTO species codes and symbols were used to record bird species [5]. Activity and direction of flight where appropriate were used as recommended for the Bird Census Techniques [7].

2.9. The conservation status of species is based on evidence of population declines and restriction of range on a local and international scale, as listed on the Conservation Designations for UK Taxa list published by the Joint Nature Conservation Committee (JNCC) [8]. The Birds of Conservation Concern Wales 4 (BoCC) allocates species into the green, amber or red list corresponding to a low to high level of conservation concern respectively. Species information for priority Section 7 of the Environment (Wales) Act 2016 (EWA) species is obtained from the Wales Biodiversity Partnership [9].

2.10. The Pembrokeshire Bird Report 2022 [10] was consulted to estimate county population sizes and assess the status of species of conservation concern within the county.

3. Results

Desk Study

3.1. The WWBIC biological record data included 1,054 individual records of 66 priority bird species within 5km of the site's central grid point. Those of relevance (likely to occur within the site given the habitats present) to the site include fieldfare (*Turdus pilaris*), golden plover (*Pluvialis apricaria*), herring gull (*Larus argentatus*), lapwing (*Vanellus vanellus*), snipe (*Gallinago gallinago*) and redwing (*Turdus iliacus*).

3.2. The WeBS data provided core counts of wetland bird species across five sites within 10km of the site boundary. These are summarised in Table 2 below.

Table 2: Summary of WeBS data.

Site name and associated designated site	Distance to site	Summary of records
Newgale Marsh Close proximity to Ramsey and St David's Peninsula Coast SPA and SSSI Pembrokeshire Marine / Sir Benfro Forol SAC	1.2km south-east	High peak counts of teal (*Anas crecca*), snipe and to a lesser extent, curlew (*Numenius arquata*) and oystercatcher (*Haematopus ostralegus*) were present

Site name and associated designated site	Distance to site	Summary of records
Newgale beach Arfordir Niwgwl - Aber Bach / Newgale - Little Haven Coast SSSI	1.2km south-east	Common scoter (*Melanitta nigra*) were present, with hundreds being recorded during the October, November and December months across the five years of study.
St David`s Airfield Heath SSSI	5.2km to the west	High peak counts of wigeon (*Mareca penelope*), teal and lapwing.
Lecha Farm Ysgeifiog Moor SSSI	3.1km west	Teal were present in relatively high numbers
Dwr Cleifion Not within statutory designated site	7.1km west	Teal were also present in relatively high numbers

3.3. All of the species in Table 2 above are considered to potentially use the habitats present on site to overwinter.

3.4. The proximity of the site to Ramsey and St David's Peninsula Coast Special Protected Area (SPA) and the presence of suitable grassland habitat near to their breeding cliffs, mean the red-billed chough (*Pyrrhocorax pyrrhocorax)* could use the site for foraging, and therefore chough surveys were conducted to determine the site's importance for this WCA Sch 1 species. The results are included within the ES Appendix 8.7 Chough Survey report [11] and therefore this species will not be considered further in this report. St. David's Peninsula Coast SSSI is also in proximity of the site, however the site is designated for its habitats and geological features and therefore will not be further considered in this report.

Wintering Bird Survey

3.5. A total of 28 species were recorded within the survey site boundary, including four WCA Sch 1 listed species, nine Section 7 EWA listed species, seven BoCC red-listed species and nine BoCC amber-listed species. A total of eight species recorded were common and classified as introduced or green listed BoCC, and so are not considered further in this report.

3.6. The full results including their county status within Pembrokeshire, the numbers of individuals recorded on each survey visit and their peak counts are included Table 3 below and shown in Annex B – E inclusive.

Table 3. Results of the Wintering Bird Surveys

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit				Peak Count (date recorded)
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	
AC	Arctic Skua	*Stercorarius parasiticus*	Amber		Yes		Passage migrant	1				1 (28/11/2022)
B.	Blackbird	*Turdus merula*					Breeding resident, passage migrant and winter visitor	5	1	1	4	5 (28/11/2022)
BZ	Buzzard	*Buteo buteo*					Breeding resident	1		2	1	2 (11/01/2023)
C.	Carrion Crow	*Corvus corone*					Breeding resident	7	5	9	2	9 (11/01/2023)
FF	Fieldfare	*Turdus pilaris*	Amber	Yes			Winter visitor and passage migrant		9		3	9 (14/12/2022)
G.	Green Woodpecker	*Picus viridis*	Amber				Rare visitor, bred in past		2			2 (14/12/2022)
HG	Herring Gull	*Larus argentatus*	Red		Yes		Breeding resident and winter visitor	509	7	10	3	509 (28/11/2022)
HS	House Sparrow	*Passer domesticus*	Red		Yes		Breeding resident				1	1 (18/02/2023)
KT	Red Kite	*Milvus milvus*		Yes			Breeding resident, increasing		1			1 (14/12/2022)
L.	Lapwing	*Vanellus vanellus*	Amber		Yes		Breeding resident and winter visitor		5			5 (14/12/2022)
LI	Linnet	*Linaria cannabina*	Red		Yes		Breeding resident and passage migrant	8			1	8 (28/11/2022)

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit				Peak Count (date recorded)
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	
M.	Mistle Thrush	*Turdus viscivorus*	Amber				Breeding resident	1				1 (28/11/2022)
MG	Magpie	*Pica pica*	Amber				Breeding resident	1	1		5	5 (18/02/2023)
MP	Meadow Pipit	*Anthus pratensis*	Red				Breeding resident and passage migrant		1			1 (14/12/2022)
PE	Peregrine	*Falco peregrinus*		Yes			Breeding resident				1	1 (18/02/2023)
PH	Pheasant	*Phasianus colchicus*					Breeding resident	1				1 (28/11/2022)
R.	Robin	*Erithacus rubecula*					Breeding resident	2	1		2	2 (28/11/2022) and 18/02/2023)
RE	Redwing	*Turdus iliacus*		Yes			Winter visitor and passage migrant	2				2 (28/11/2022)
RN	Raven	*Corvus corax*					Breeding resident			2		2 (11/01/2023)
RO	Rook	*Corvus frugilegus*	Red				Breeding resident	30			20	30 (28/11/2022)
S.	Skylark	*Alauda arvensis*	Amber		Yes		Breeding resident and passage migrant	10	2	1	11	11 (18/02/2023)
SC	Stonechat	*Saxicola rubicola*					Breeding resident	3	1		2	3 (28/11/2022)
SG	Starling	*Sturnus vulgaris*	Red		Yes		Breeding resident, winter visitor and passage migrant	2	14	651		651 (11/01/2023)
SN	Snipe	*Gallinago gallinago*	Amber				Winter visitor and passage migrant	7	1	16	2	16 (11/01/2023)

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit				Peak Count (date recorded)
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	
ST	Song Thrush	*Turdus philomelos*			Yes		Breeding resident, passage migrant and winter visitor	1	3		1	3 (14/12/2022)
WP	Woodpigeon	*Columba palumbus*	Amber				Breeding resident	3			1	3 (28/11/2022)
WR	Wren	*Troglodytes troglodytes*					Breeding resident	2	1	1	2	2 (28/11/2022) and 18/02/2023)
Y.	Yellowhammer	*Emberiza citrinella*	Red		Yes		Breeding resident	2				2 (28/11/2022)

Sch 1 – Wildlife and Countryside Act 1981 (as amended) Schedule 1.
EWA 2016 – Environment (Wales) Act 2016 Section 7
BD Annex 1 – European Birds Directive, Annex 1.
BoCC Red – Birds of Conservation Concern Wales 4 - Red listed.
BoCC Amber – Birds of Conservation Concern Wales 4 - Amber listed.

4. Conclusion

4.1. Some birds recorded during the wintering bird survey were common species. These birds were mainly associated with the woodland, trees, and the scrub along the boundaries of the site where many were overwintering.

4.2. Green listed bird species are not assessed as their populations are considered to be of least concern.

4.3. More notable and less common species thought likely to be wintering on site are discussed below. The site is considered to be important for wintering birds at the County level.

WCA Schedule 1 Species

4.4. Four Schedule 1 species were recorded on site during the wintering bird surveys: fieldfare, red kite, peregrine and redwing. The red kite and peregrine were recorded once on visit 2 and visit 4 respectively; two records of redwing were noted during visit 1. Fieldfare was the species recorded the most on site with a total of 12 records across Visit 2 and Visit 4. Given the low records during the surveys, it is considered that these species are unlikely to be dependent on this site but likely to use the habitats on site for foraging as they move through on passage.

Section 7 EWA

4.5. Nine Section 7 EWA species were recorded wintering on site: arctic skua, herring gull, house sparrow, lapwing, linnet, skylark, starling, song thrush and yellowhammer. These species were recorded within the scrub in the east and southeast and within the central grassland areas. The birds were primarily recorded foraging on site with some species like herring gull recorded loafing on site.

Red and Amber Wales 4 Listed Species

4.6. Seven red-listed species were recorded including herring gull, house sparrow, linnet, meadow pipit, rook, starling and yellowhammer.

4.7. Nine amber-listed were recorded included arctic skua, fieldfare, green woodpecker, lapwing, mistle thrush, magpie, skylark, snipe and woodpigeon.

Distribution Across the Site

4.8. The wintering birds were recorded within the grassland and scrub habitats on site. Species recorded within the less dense areas of scrub were magpie, snipe and starling. The majority of the remaining birds were recorded within the long grassland adjacent to the runways.

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[1] Sweco UK Limited, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

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[9] Welsh Government, “Environmental (Wales) Act 2016 - Section 7,” 2016. [Online]. Available: https://www.biodiversitywales.org.uk/environment-wales-act. [Accessed February 2024].

[10] S. B. &. J. Green., Pembrokeshire Bird Report 2022, The Wildlife Trust South and West Wales , 2022.

[11] Sweco UK Limited, “Chough Report,” 2024. [Online].

Annexes: Drawings

Annex A Wintering bird survey transect route

Annex B Wintering bird survey 1

Annex C Wintering bird survey 2

Annex D Wintering bird survey 3

Annex E Wintering bird survey 4

Ministry of Defence

ES Appendix 8.6: Breeding Bird Survey

Contents

Tables

Annexes

Non-technical Summary

This survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks in Pembrokeshire. The purpose of this report is to establish baseline ecological conditions for breeding birds at the site.

An initial ecological desk study, UK habitat classification survey and protected species scoping survey was carried out in November 2022, to map the habitats present on site and assess their potential to support notable/protected species. The woodland, scrub, ditches and grassland habitats on site were identified as having the potential to support notable and/or rare breeding bird species.

Breeding bird surveys (BBS) were undertaken between 22 March 2023 and 13 July 2023. The surveys recorded a total of fifty-eight species within the site boundary, comprising a mix of common and notable species. Notable species recorded include 10 amber-listed Birds of Conservation Concern Wales 4, seventeen red-listed Birds of Conservation Concern Wales 4, fourteen species listed under Section 7 of the Environment (Wales) Act 2016 and three Schedule 1 species listed under the Wildlife and Countryside Act 1981 (as amended).

The site is considered to be important for breeding birds at the County level.

Breeding Bird Survey

1 Introduction

Project Background

1.1 The Cawdor Barracks site has been subject to a preliminary ecological appraisal (PEA) comprising a UK habitat classification survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2 The protected species scoping survey identified that woodland, scrub, ditches and grassland habitats on site were suitable for notable and/or rare breeding bird species and recommended further survey.

1.3 The purpose of this report is to describe the methodology and results of the BBS undertaken.

Legislation

1.4 All wild birds and their active nests are protected under the Wildlife and Countryside Act 1981 (WCA), making it an offence to intentionally or recklessly:

- kill, injure or take any wild bird
- take, damage or destroy a nest of any wild bird while it is being built or in use
- take or destroy the egg of any wild bird

1.5 The nesting season for birds is generally considered to be March to August inclusive, though a number of species extend their breeding season beyond these months. Some species such as barn owl (*Tyto alba*) can breed all year round.

1.6 Birds which are listed under Schedule 1 of the Wildlife and Countryside Act (WCA Schedule 1) are afforded additional protection. As such, it is an offence to intentionally or recklessly:

- disturb bird species listed on Schedule 1 while they are building a nest or are on or near an ‘active’ nest containing eggs or young
- disturb the dependant young of species listed on Schedule 1

1.7 51 bird species are also listed under Section 7 of the Environment (Wales) Act 2016. Under the Act, Welsh Ministers must take all reasonable steps to maintain and enhance the living organisms and types of habitat included in any list published under this section. Conserving biodiversity can include restoring or enhancing a population or habitat.

Assumptions and Limitations

1.8 It is not considered that there are any assumptions and limitations relevant to this report.

2 Methods

Personnel

2.1 All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. The surveys were undertaken by experienced ornithologists: Sophie Barrell MEcol (Hons) ACIEEM and Joshua Stafford BSC (Hons) MRSB Principal Ecologist, assisted by Claudia Ferreira BSc (Hons), Leonora Hunt MSc and Courtney Long BSc (Hons). This report was produced by Claudia Ferreira BSc (Hons), Ecologist, who has over two years' experience in ecological consultancy including surveys for a range of protected species and in producing ecological impact assessments. This report was reviewed by Joshua Stafford BSC (Hons) MRSB Principal Ecologist, an experienced ornithologist, who has over 13 years' experience in consultancy and by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Desk Study

2.2 West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

2.3 Previous ecology reports pertaining to the site and other relevant information, were reviewed for the purposes of this report which are as follows:

- Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks [1]; and
- Strategic Environmental Technical Advisor Stage 4: Ecological Appraisal DIO Cawdor Barracks [3].
- The Pembrokeshire Bird Report 2022 [4] was consulted to estimate county population sizes and assess the status of species of conservation concern within the county.
- Pembrokeshire Avifauna website [5].

Breeding Bird Survey

2.4 The BBS undertaken at the site was based upon the line transect survey methodology utilised by BTO Breeding bird surveys (BBS) [6] and Bird Survey Guidelines produced by the Bird Survey & Assessment Steering Group as per CIEEM good practice guidelines [7] [8] [9].

2.5 Six separate visits were undertaken between 22 March 2023 and 13 July 2023, as recommended by the Bird Survey Guidelines [10]. The surveys were undertaken during suitable weather conditions as summarised in Table 1 below.

Table 1. Breeding Bird Survey Conditions

Survey	Date	Surveyors	Time		Temperature (ºC)		Wind (Beaufort scale)		Cloud cover (Oktas)		Precipitation (mm)	
			Start	End	Start	End	Start	End	Start	End	Start	End
1	22 March 2023	Sophie Barrell Claudia Ferreira	06:20	10:30	11	13	3	4	4	3	0	0
2	04 April 2023	Joshua Stafford Leonora Hunt	05:30	09:30	6	10	1	1	3	2	0	0
3	26 April 2023	Joshua Stafford Courtney Long	05:30	09:30	6	7	1	1	7	4	0	0
4	10 May 2023	Joshua Stafford Claudia Ferreira	05:15	10:15	12	12	1	1	4	6	0	0
5	15 June 2023	Joshua Stafford Sophie Barrell	05:15	10:00	13	20	1	1	2	1	0	0
6	13 July 2023	Sophie Barrell Leonora Hunt	05:15	10:15	15	16	2	2	4	3	0	0

2.6 The BBS followed a set transect which aimed to include all core habitat types within the survey site, shown in Annex A. The survey area included the areas of suitable habitat within the application site and adjacent areas of habitat within survey site. The transect route was walked slowly and birds were identified by both sight and sound (no apps or recorders were used), with records of their behaviour taken and recorded onto plans. Standard BTO species codes and symbols were used to record bird species [11]. Activity and direction of flight where appropriate were used as recommended for the Bird Census Techniques [12].

2.7 Species and activity data were analysed spatially to compare where species were identified during more than one survey visit and therefore are likely to be holding a territory and/or actively breeding in the area. If a bird exhibited breeding activity, such as commuting with nesting material or singing for example, it was judged to be breeding or attempting to breed on site. The survey analysis did not include mapping of territories.

2.8 Field maps and notes of bird sightings were analysed to determine the approximate locations of likely breeding sites, and the numbers of birds encountered, and whether they were likely to be breeding on site, using the following criteria:

- Possible:
  - Species (male/female) observed within possible nesting habitat on site.
  - A male singing in the breeding season but only encountered on one survey visit.

- Probable:
  - Same species of male singing in approximate same location on site for more than one survey visit.
  - Singing male in the breeding season exhibiting territorial behaviour.
  - Visiting probable nest site.
  - Individuals exhibiting agitated behaviour (e.g. alarm calls).

- Confirmed:
  - Observed building a nest or with nesting material in beak.
  - Active nest observed.
  - Adults entering/leaving nest site regularly.
  - Used nest or eggshells noted on site.
  - Distraction display or injury feigning.
  - Adult with dependant young.

2.9 Locations of sightings and analysis of activity/behaviour was used to estimate the numbers of pairs present where breeding was probable or confirmed where a nest was found.

2.10 The conservation status of species is based on evidence of population declines and restriction of range on a local and international scale, as listed on the Conservation Designations for UK Taxa list published by the Joint Nature Conservation Committee [13]. The Birds of Conservation Concern Wales 4 (BoCC) allocates species into the green, amber or red list corresponding to a low to high level of conservation concern respectively. Species information for priority Section 7 of the Environment (Wales) Act 2016 (EWA) species are obtained from the Wales Biodiversity Partnership [14].

3 Results

Desk Study

3.1 The WWBIC biological record data included 1,054 individual records of 66 priority bird species within 5km of the site's central grid point. Specific locations were not provided. Those of relevance to the site, due to the habitats present on site, included dunnock (*Prunella modularis*), grasshopper warbler (*Locustella naevia*), house sparrow (*Passer domesticus*), kestrel (*Falco tinnunculus*), linnet (*Linaria cannabina*), meadow pipit (*Anthus pratensis*), red kite (*Milvus milvus*), skylark (*Alauda arvensis*), starling (*Sturnus vulgaris*), stonechat (*Saxicola rubicola*) and yellowhammer (*Emberiza citrinella*),

3.2 The proximity of the site to the Ramsey and St David's Peninsula Coast Special Protected Area (SPA) and the presence of suitable grassland habitat near to their breeding cliffs, mean the red-billed chough (*Pyrrhocorax pyrrhocorax)* could use the site for foraging, and therefore chough surveys were conducted to determine the site's importance for this Wildlife and Countryside Act 1981 Schedule 1 (WCA Schedule 1) species. The results are included within ES Appendix 8.7 Chough Survey report [15] and therefore this species will not be considered further in this report. St. David's Peninsula Coast SSSI is also in proximity of the site, however the site is designated for its habitats and geological features and therefore will not be further considered in this report.

3.3 The desk study conducted within the Ecological Appraisal DIO Cawdor Barracks noted that the population of skylark (*Alauda arvensis*) is considered to be the largest in Pembrokeshire and one of the three largest in Wales according to notes compiled by skylark surveyor Ian Bullock (Pembrokeshire Warden) and consultations between Pembrokeshire County Council and Natural Resources Wales (NRW) [3]. The breeding population in Pembrokeshire was estimated to be around 5,000 in 2009 [5]. In 2023, counts of up to between 100 and 200 skylarks were recorded in Pembrokeshire across 12 locations [15].

Breeding Bird Survey

3.4 Annex H presents the full list of species recorded, their county status within Pembrokeshire, the numbers or individuals recorded on each survey visit and their breeding codes and breeding status. The BTO breeding status codes included in Annex I correspond to breeding behaviour recorded for each species to demonstrate why the particular breeding status was assigned to each species.

3.5 A total of 58 species were recorded within the survey area during the BBS. Of these species, 12 were confirmed to be breeding on site, 15 were probable breeders, eight were possible breeders, and 17 were not breeding on site. One species was confirmed to be breeding offsite, two possible breeding off site and three probable breeding offsite. Approximately half the total species were common, with 31 species classified as introduced or green listed BoCC Wales 4, and so are not considered further in this report.

3.6 The locations of notable species (BoCC Wales 4, WCA Sch1 EWA) recorded during the BBS are shown in Annex B - G inclusive. Full results for each survey for these notable species are included in Table 2 below.

Table 2. Results of the Breeding Bird Surveys

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit						Breeding status
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	5	6	
BW	Black-tailed Godwit	*Limosa limosa*	Amber	✓	✓		Winter visitor and passage migrant		6					Non-breeding
CH	Chaffinch	*Fringilla coelebs*	Amber				Breeding resident and passage migrant	4	1	2	1	2		Non-breeding
CU	Curlew	*Numenius arquata*	Red		✓		Breeding resident, winter visitor and passage migrant		1	6				Non-breeding
D.	Dunnock	*Prunella modularis*	Amber		✓		Breeding resident	10	2	1	5		7	Non-breeding
GH	Grasshopper Warbler	*Locustella naevia*	Red		✓		Breeding summer visitor and passage migrant			10	3	1	5	Non-breeding
GP	Golden Plover	*Pluvialis apricaria*	Red				Winter visitor and passage migrant	2724		1				Non-breeding
GR	Greenfinch	*Chloris chloris*	Red				Breeding resident and passage migrant	1						Non-breeding
GW	Garden Warbler	*Sylvia borin*	Amber				Breeding summer visitor and passage migrant				2	4		Non-breeding
HG	Herring Gull	*Larus argentatus*	Red		✓		Breeding resident and winter visitor	2	4	1			3	Non-breeding
HM	House Martin	*Delichon urbicum*	Amber				Breeding summer visitor and passage migrant			1	1			Non-breeding

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit						Breeding status
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	5	6	
HS	House Sparrow	*Passer domesticus*	Amber		✓		Breeding resident						20	Probable breeding
K.	Kestrel	*Falco tinnunculus*	Red				Breeding resident	1	1					Possible breeding off site
KT	Red Kite	*Milvus milvus*		✓			Breeding resident, increasing	2						Non-breeding
L.	Lapwing	*Vanellus vanellus*	Red		✓		Breeding resident and winter visitor						3	Non-breeding
LB	Lesser Black-backed Gull	*Larus fuscus*	Red				Breeding summer visitor, passage migrant, and winter visitor	14	1				1	Confirmed breeding
LI	Linnet	*Linaria cannabina*	Red		✓		Breeding resident and passage migrant	4	5	52	27	54	48	Probable breeding
MG	Magpie	*Pica pica*	Amber				Breeding resident	5	5	3	4	5	4	Confirmed breeding
MP	Meadow Pipit	*Anthus pratensis*	Red				Breeding resident and passage migrant	45	17			10	13	Probable breeding
M.	Mistle Thrush	*Turdus viscivorus*	Amber				Breeding resident		1	1				Confirmed breeding off site
PE	Peregrine	*Falco peregrinus*		✓			Breeding resident	1						Non-breeding.
RB	Reed Bunting	*Emberiza schoeniclus*			✓		Breeding resident	1	1					Possible breeding off site

BTO code	Common name	Scientific name	Conservation Status					Individuals Recorded per Visit						Breeding status
			BoCC Wales 4	Sch 1	EWA 2016	BD Annex 1	Status within Pembrokeshire	1	2	3	4	5	6	
RO	Rook	*Corvus frugilegus*	Red				Breeding resident	57	52	10			2	Non-breeding
S.	Skylark	*Alauda arvensis*	Amber		✓		Breeding resident and passage migrant	58	32	53	65	38	41	Confirmed breeding
SG	Starling	*Sturnus vulgaris*	Red		✓		Breeding resident, winter visitor and passage migrant	1	3		8		21	Probable breeding off site
SI	Swift	*Apus apus*	Red				Breeding summer visitor and passage migrant			2				Non-breeding
ST	Song Thrush	*Turdus philomelos*			✓		Breeding resident, passage migrant and winter visitor		1	1				Probable breeding
W.	Wheatear	*Oenanthe oenanthe*	Amber				Breeding summer visitor and passage migrant	15	2	2	1	1	1	Confirmed breeding
WH	Whitethroat	*Sylvia communis*	Red				Breeding summer visitor and passage migrant		3	17	24	23	13	Probable breeding
WW	Willow Warbler	*Phylloscopus trochilus*	Red				Breeding summer visitor and passage migrant		3	8	1	4		Possible breeding
Y.	Yellowhammer	*Emberiza citrinella*	Red		✓		Breeding resident			1	2			Possible breeding
YW	Yellow Wagtail	*Motacilla flava*	Red		✓		Passage migrant, has bred			1				Confirmed breeding

Sch 1 – Wildlife and Countryside Act 1981 (as amended) Schedule 1.

EWA 2016 – Environment (Wales) Act 2016 Section 7
BD Annex 1 – European Birds Directive, Annex 1.
BoCC Red – Birds of Conservation Concern Wales 4 - Red listed.
BoCC Amber – Birds of Conservation Concern Wales 4 - Amber listed.

4 Conclusion

4.1 Notable species recorded within the survey area included 10 amber-listed BoCC Wales 4, 17 red-listed BoCC Wales 4, 14 EWA species and three schedule 1 species. Of these species, six were confirmed to be breeding on and off site, ten were probably breeding, and three were possibly breeding. It was considered that eight species were unlikely to be breeding on site.

4.2 Skylark and meadow pipit are ground-nesting species and significant number of these species were recorded on site breeding within the grassland habitats across the survey site. The peak number of skylarks recorded was 65. Given that it has been estimated that numbers of skylark could be up to 5,000 in Pembrokeshire [5] and that the higher numbers than this were recorded at other sites in Pembrokeshire in 2023 [4], the importance of the skylark populations is considered to be at the county level.

4.3 Several species of waders such as golden plover and black-tailed godwit were recorded during the surveys, these were considered to be on passage and not recorded breeding on site. Large numbers of golden plover were recorded on the first visit in March likely congregating before migrating back to breeding grounds. Also, lapwing were recorded during the last visit in summer and it is considered unlikely this species was breeding on the site, given they were only recorded on a single visit, on one occasion late in the breeding season.

4.4 Within the scrub habitat, records of grasshopper warblers, willow warbler, garden warbler, linnet and whitethroat were noted and therefore this habitat is considered important for these declining warblers. The majority of these birds were recorded within the scrub habitats in the north of the site with a few recorded within the scrub area near the eastern boundary. Stonechat was recorded in high density on site. A few individuals of yellowhammer and mistle thrush were also recorded.

4.5 Peregrine was recorded hunting on site during the first BBS and therefore it is considered that this species was likely on passage.

4.6 The area of woodland, directly adjacent to the west of site, outside the survey and application site, supported a rookery and is possible to support breeding kestrel and sparrowhawk.

4.7 Given the number of species recorded on site, and the presence of notable species, the site is considered to be important for breeding birds at the County level.

References

[1] Sweco, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

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[15] Sweco UK Limited, “Chough Report, Project DARC - Cawdor Barracks. Ref. 65208061-XX-XX-T-J-0010,” 2024.

Annexes

Annex A Breeding bird survey transect route

Annex B – Breeding bird survey 1

Annex C – Breeding bird survey 2

Annex D – Breeding bird survey 3

Annex E – Breeding bird survey 4

Annex F – Breeding bird survey 5

Annex G – Breeding bird survey 6

Annex H – Cawdor breeding bird survey results table

Annex I – BTO breeding status codes

Ministry of Defence

ES Appendix 8.7: Chough Survey

Contents

Tables

Annex

Non-technical Summary

This chough survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks, Pembrokeshire.

A desk study found the proposed development site is located within 1km of Ramsey and St David's Peninsula Coast Special Protection Area, designated for chough (*Pyrrhocorax pyrrhocorax*). The protected species scoping survey undertaken in 2022 found that habitats on site were potential foraging grounds for chough and therefore dedicated surveys were recommended to establish if and how the species may be using the site. The purpose of this report is to describe the surveys undertaken and their findings.

Three chough surveys were undertaken between May and September 2023 in addition to the breeding bird surveys that were also undertaken between March and July 2023 (ES Appendix 8.6). No chough were observed on or adjacent to site in either survey programme.

Chough Survey

1 Introduction

Project Background

1.1 The site has been subject to a preliminary ecological appraisal (PEA) comprising a UK habitat classification survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2 The PEA report identified that the site is located within 1km of Ramsey and St David's Peninsula Coast Special Protection Area (SPA), designated for chough (*Pyrrhocorax pyrrhocorax*).

1.3 Habitats present on site include grasslands (neutral grassland and other acid grassland), offering potential foraging grounds for chough. Chough surveys were therefore recommended to establish if and how the chough may use the site, and how they may be affected by the proposed works.

1.4 The purpose of this report is to describe the methodology and results of the survey undertaken.

2 Methods

Personnel

2.1 All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under the survey heading below. This report was produced by Ecologist Leonora Hunt MSc who has over two years' experience in ecological consultancy. This report was reviewed by Senior Ecologist Sophie Barrell MEcol (Hons) ACIEEM, who has over eight years' experience in ecological consultancy and by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Desk Study

2.2 West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Chough survey

2.3 Chough are unlikely to breed on site but could use the habitats for foraging. The survey timings and number of visits within the Bird Monitoring Methods by the Rare Breeding Birds Panel [3] were used, with surveys timed to coincide with foraging parents or parents teaching juvenile chough to feed. In addition, separate breeding bird surveys [4] were undertaken throughout the usual survey season (March – July) which would likely have identified breeding chough, were they present. The methodology within the guidance [3] was changed as the methodology mainly relates to recording breeding behaviour on cliffs, which is not relevant to the application site.

2.4 Surveys followed a set transect which aimed to include all core habitat types on site. The transect route, the same as the route taken for breeding bird surveys and shown in Annex A, was walked at a slow pace stopping regularly to visually scan the area and listen for chough (no apps or recorders were used).

2.5 Three survey visits (at least two are required by the Bird Monitoring Methods) were undertaken by experienced ornithologists Joshua Stafford BSc (Hons) MRSB or Philip Dutt BSc (Hons) MCIEEM, assisted by Courtney Long BSc (Hons) or Emma Howarth BSc (Hons). The surveys were undertaken during suitable weather conditions as summarised in Table 1 below.

Table 1. Chough Survey Conditions

Survey no.	Date	Time	Weather
1	31 May 2023	09:05 – 11:15	Light breeze, dry, cloudy, 14ºC
2	24 August 2023	08:30 – 10:15	Light breeze, dry, cloudy, 15ºC
3	22 September 2023	09:00 – 11:00	Breezy, dry, cloudy, 12ºC

3 Limitations

3.1 Access to the site was limited on the second survey visit due to training exercises that were underway on the morning of the survey preventing access to certain areas on site. This is considered to be a significant limitation, however, an additional third survey was therefore undertaken to ensure survey effort was sufficient to establish accurate usage of the site by chough. Furthermore, the six breeding bird surveys provide additional information on any presence of choughs on site.

4 Results

Desk study

4.1 The WWBIC biological record data included returned 50 records of chough within 5km of the site's central grid point, however, specific locations were not provided.

Chough survey

4.2 While other common corvid species, comprising mostly mixed flocks of rook (*Corvus Frugilegus*) and jackdaw (*Corvus Monedula*), and occasionally small numbers of carrion crow (*Corvus Corone*), were observed during the surveys, no chough were seen nor heard at any point during the surveys on or adjacent to site.

4.3 The absence of chough is likely due to the tall, dense sward of the grassland, typically considered to be sub-optimal habitat for foraging chough which prefer shorter sward, cattle grazed grassland.

5 Conclusion

5.1 No chough were identified in the species specific surveys reported above. No chough were observed during the general breeding bird surveys (ES Appendix 8.6) or wintering bird surveys (ES Appendix 8.5) undertaken across 2022 and 2023. In a total of eleven independent bird survey efforts, no chough were recorded. As such, chough are considered likely absent from the site and its immediate surroundings.

References

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Ministry of Defence

ES Appendix 8.8: Barn Owl Survey

Contents

Annex

Annex A – Barn Owl Survey Results

Non-technical Summary

This barn owl survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks.

During a protected species scoping survey undertaken in 2022 the grassland habitats and structures on site were identified as offering potential foraging grounds and potential roosting or nesting sites for barn owl, and further surveys were recommended.

On-site scoping and investigative field barn owl surveys were undertaken on 6 June 2023 to classify the foraging habitat types, assess structures for their suitability to support roosting or breeding barn owls, and establish how barn owl may be using the site.

The site largely comprised poor to sub optimal barn owl foraging habitat, however several pockets of optimal habitat were identified, comprising more tussocky grassland with no encroaching scrub.

A barn owl roost site was identified on a building on site. This was evidenced by a single barn owl pellet, indicating this site was not a well-used roost site and used only occasionally.

No suitable barn owl nesting sites were identified on site.

Barn Owl Survey

1 Introduction

Project Background

1.1 The site has been subject to a preliminary ecological appraisal (PEA) comprising a UK habitat classification survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2 Habitats present on site include grasslands (neutral grassland and other acid grassland), potentially offering suitable foraging grounds for barn owl (*Tyto alba*). In addition, buildings and structures on site had the potential to provide suitable roosting or nesting habitat for barn owl. Therefore, a barn owl survey was recommended to establish how barn owls may use the site. The purpose of this report is to describe the methodology and results of this survey.

Legislation

1.3 All wild birds and their active nests are protected under the Wildlife and Countryside Act 1981 (as amended), making it an offence to intentionally or recklessly:

- kill, injure or take any wild bird
- take, damage or destroy a nest of any wild bird while it is being built or in use
- take or destroy the egg of any wild bird

1.4 Barn owls are known to breed all year round.

1.5 Barn owls are listed under Schedule 1 of the Wildlife and Countryside Act and are afforded additional protection. As such, it is an offence to intentionally or recklessly:

- disturb bird species listed on Schedule 1 while they are building a nest or are on or near an ‘active’ nest containing eggs or young
- disturb the dependant young of species listed on Schedule 1

2 Methods

Personnel

2.1 All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. Surveyor names and qualifications are stated under each survey heading below. This report was produced by Ecologist Leonora Hunt MSc, who has over two years’ experience in ecological consultancy. This report was reviewed by Senior Ecologist Sophie Barrell MEcol (Hons) ACIEEM, who has over eight years’ experience in ecological consultancy and by Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years’ experience in ecological consultancy and production of ecological impact assessments.

Desk Study

2.2 West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of protected/notable habitats and species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Barn Owl Survey

2.3 The barn owl survey was carried out following relevant guidance produced by the Barn Owl Trust [3] and Shawyer [4].

2.4 The barn owl survey protocol included the following steps:

1. Stage 1 on-site scoping survey – site walkover to broadly record those habitats and features which may upon more detailed inspection (at stage 2) be identified as potential nest sites (PNS), active roost sites (ARS), temporary roost sites (TRS) and potential foraging or commuting habitat;
2. Stage 2 investigative field survey - investigation of the features identified in stage 1 to identify PNS, ARS, TRS and to classify foraging habitat types as Type 1, 2 or 3 as detailed below;
    i. Type 1 (optimal for barn owl foraging)
    ii. Type 2 (sub-optimal and of transient value to barn owl)
    iii. Type 3 (poor habitat for barn owl prey)

2.5 The barn owl survey carried out on 6 June 2023 comprised stage 1 on-site scoping survey and stage 2 investigative field surveys of the site by Sophie Barrell and Joshua Stafford BSc (Hons) MRSB (barn owl class licence CL29/00321). Weather conditions at the time of the survey (08:00 – 11:00) were dry, partly cloudy, with an ambient temperature of approximately 12°C. A stage 3 survey was not required as no PNS were found.

2.6 The surveyors undertook a site walkover to classify the foraging habitat types. The survey also included a detailed search from the ground of all structures within the survey area shown in Annex A for signs of roosting or nesting barn owl including pellets, droppings (whitewash), moulted feathers, suitable nesting areas, eggs, eggshells, or live or dead barn owls. Any barn owl signs were recorded and mapped.

3 Results

Desk study

3.1 The WWBIC biological record data included returned 70 records of barn owl within 5km of the site's central grid point, however no specific locations were provided.

Barn Owl Survey

3.2 The scoping survey identified a single structure, at grid reference SM 84935 25025, in use as a barn owl Temporary Roost Site due to the identification of a single barn owl pellet (Photos 1 and 2). There was a suitable perch at the top of the north-east wall, below the eaves of the building roof. The presence of only a single pellet indicates this roost site is not well-used.

Photo 1: Building with TRS. Owl pellet found on corrugated metal sheet.

Photo 2: Barn owl pellet.

3.3 The stage 2 investigative field survey found that the areas of grassland immediately adjacent to the airstrips were sub optimal, while the dense scrub to the north and southwest were poor habitat. Optimal areas of habitat were located to the south of the main runway, to the middle east of the site and along the north-western edge of the site, comprising more tussocky grassland and the absence of encroaching scrub.

3.4 No suitable barn owl nesting sites were identified on site during the survey, and therefore no Stage 3 assessment was required.

3.5 The results of the survey are shown on Annex A.

References

[1] Sweco UK Limited, “Preliminary Ecologial Appraisal Report: Project DARC - Cawdor Barracks. 65208061-SWE-ZZ-XX-T-J-0001,” 2023.

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Ministry of Defence

ES Appendix 8.9: Bat Activity Remote Monitoring Survey

Ministry of Defence

Contents

Tables

Annexes

Annex A - Remote Monitoring Conditions

Annex B – Remote Monitoring Results

Annex C - Static Locations

Annex D - Bat heat map

Annex E - Lesser Horseshoe Map

Annex F - Greater Horseshoe Map

Annex G - Barbastelle Map

Annex H - Leisler's Map

Annex I - Serotine Map

Annex J - Nathusius' Pipistrelle Map

Annex K - Myotis Species Map

Annex L - Natterer's Map

Annex M - Daubenton's Map

Non-technical Summary

This bat activity survey report has been prepared by Sweco for the Ministry of Defence and relates to the design and planning of a proposed deep-space radar site at Cawdor Barracks, Pembrokeshire.

The purpose of this report is to detail the methodology and results of the bat activity surveys undertaken at the site.

During the species scoping survey carried out in November 2022, habitats on site were considered suitable to have moderate and high suitability for commuting and foraging bat species, and therefore further bat activity surveys were recommended. No roosting features were identified within the application site boundary, so no roost surveys were required.

Bat remote monitoring activity surveys were carried out each month from April to October 2023. These surveys identified at least 12 bat species using the site, including some of Wales's rarest bat species such as barbastelle and greater horseshoe bats.

Within the site, bats appeared to preferentially use the eastern and northern boundaries for foraging and commuting purposes, although high numbers were also noted within the grassland habitats in more central parts of the site, and within the northwest section of the airfield. Fewer bats were recorded within the southern part of the site.

Bat Activity Survey

1 Introduction

Project Background

1.1 The site has been subject to a preliminary ecological appraisal comprising a UK Habitat Classification survey and protected species scoping survey completed by Sweco UK in 2022 [1].

1.2 The findings of the protected species scoping survey identified habitats suitable for foraging and commuting bat species. Further surveys were recommended for foraging and commuting bats. This report details the methodology and results of the bat activity surveys undertaken.

Legislation

1.3 All bat species belonging to the Vespertilionidae and Rhinolophidae families are European protected species and are afforded protection in the UK under the Conservation of Habitats and Species Regulations 2017 (as amended). In addition, these species are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Taken together, these pieces of legislation make it an offence to:

- intentionally, deliberately or recklessly capture, take, kill or injure any bat;
- possess, control or transport any bat;
- damage or destroy a resting place or breeding place for bats;
- deliberately disturb bats, in particular any disturbance which is likely to:
  - impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or
  - impair their ability to hibernate (or migrate in the case of migratory species); or
  - affect significantly the local distribution or abundance of any bat species
- intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a bat; or
- intentionally or recklessly disturb a bat while it is occupying a structure or place which it uses for that purpose.

1.4 Eight number of species of bat are also listed under Section 7 of the Environment (Wales) Act 2016. Under the Act, Welsh Ministers must take all reasonable steps to maintain and enhance the living organisms and types of habitat included in any list published under this section. Conserving biodiversity can include restoring or enhancing a population or habitat.

2 Methods

Personnel

2.1 All surveyors used to establish baseline information have been trained or were supervised by experienced surveyors with extensive knowledge in the particular survey being undertaken. This report was produced by Emma Howarth, BSc (Hons), Ecologist, who has over two years' experience in ecological consultancy including surveys and mitigation for a range of protected species and in producing ecological impact assessments. This report was reviewed by Leonora Hunt MSc, Ecologist who has over two years' experience and Gemma Linacre MRes BSc (Hons) MCIEEM, who has over 13 years' experience in ecological consultancy and production of ecological impact assessments.

Desk Study

2.2 West Wales Biodiversity Information Centre (WWBIC) [2] was contacted in December 2022 for details of any records of bat species within 5km of the site's central national grid reference. Only records of protected species from within the last 10 years are considered within this report.

Habitat Suitability Assessment

2.3 The protected species scoping survey undertaken on 22 to 24 of November 2022 by Leonora Hunt and Eleanor Unsworth MSc, BSc (Hons), including a habitat suitability assessment that assessed all habitats within the site boundary and was undertaken in line with the current survey guidance by the Bat Conservation Trust [3]. In which habitats were assigned a suitability status as per Table 1 below:

Table 1. Suitability of Commuting and Foraging Habitats for Bats

Suitability	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	Habitat that could be used by small numbers of commuting bats, but isolated. Suitable but isolated habitat that could be used by small numbers of foraging bats.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting. Habitat that is connected to the wider landscape that could be used by bats for foraging.
High	Continuous, high-quality habitat that is well-connected to the wider landscape that is likely to be used regularly by commuting bats. High-quality habitat that is well-connected to the wider landscape that is likely to be used regularly by foraging bats. Site is close and connected to well-known roosts.

Remote Monitoring Survey

2.4 Twelve Batlogger M2 static bat detectors were placed around the site. The locations were selected based on professional judgement, in locations across the site, to cover a variety of habitats and to get a relatively even distribution. Emma Howarth and Darren Storey MZool (Hons) MSc ACIEEM placed the static detectors out on site. The locations of these are shown in Annex C.

2.5 In line with the Bat Conservation Trust survey guidelines [3], current at the time of the survey, for a site of moderate suitability each remote monitoring detector recorded a period that was a minimum of five consecutive nights, over each month from April 2023 – October 2023 inclusive. Detectors were programmed to record bat calls from 30 minutes before dusk to 30 minutes after dusk each night over the duration of their deployment.

2.6 Bat calls recorded during the most favourable five nights, in terms of weather, per recording period were analysed using BatExplorer (2.1.4.0). Calls were analysed by Emma Howarth, Leonora Hunt, Courtney Long BSc (Hons), Eleanor Unsworth MSc, Darren Storey, and Claudia Ferreira BSc (Hons).

2.7 The weather conditions for the five nights analysed during each of the remote monitoring periods are presented in Annex A.

Survey Limitations

2.8 As per guidance [3], transect surveys are usually undertaken alongside remote monitoring surveys. However, due to the size of the site, it would not be possible to cover the entire site during a single transect survey. Therefore, professional judgement was used, and additional static detectors were placed out on site as an alternative to conducting transect surveys. Remote monitoring captures more data than the snapshot picked up during transects, and therefore the absence of transect surveys is not considered to be a limitation.

2.9 Some static detectors did not always record for the entire good weather period and therefore in these instances, sub-optimal weather days were analysed. Details are provided within Annex A with regards to the alternative days selected for analysis.

2.10 During the April monitoring period, the SD card in static 0429 corrupted and did not record any data. Due to various reasons, including the vast volume of noise data which filled up the SD cards earlier than anticipated, certain statics did not record a full consecutive five days. These included static 0619 in June (which captured a total of two nights of data), 0431 and 0432 in July (recorded three and four nights respectively), 0427 and 0431 in August (recorded four and two nights respectively), 0426, 0428 and 0431 in September (recorded three, four and two nights respectively) and 0426, 0428 and 0431 in October (0426 recorded one night, whilst 0428 and 0431 recorded two nights each). In these instances, any available data was analysed, although the weather was sub-optimal. These are not considered to be significant limitations due to the number of other static detectors placed around the site that did record the optimal weather period, and the fact that it was not the same static each time, therefore optimal data was still collected from each static detector the majority of the time across the entire monitoring period.

3 Results

Desk Study Results

3.1 The WWBIC biological data included 223 records of bats within 5km of the site's central grid point. Species recorded included barbastelle (*Barbastella barbastellus*), serotine (*Eptesicus serotinus*), Daubenton's bat (*Myotis daubentonii*), whiskered bat (*Myotis mystacinus*), Natterer's bat (*Myotis nattereri*), noctule (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*). Specific locations were not provided.

Habitat Suitability Assessment Results

3.2 Scrub habitats in the north and east of the site were considered to provide habitat of a high suitability for commuting and foraging bats, while the majority of the site which consists of more open grassland areas with scattered scrub provided moderate suitability habitat.

Remote Monitoring Survey

3.3 Annex D Bat Heat Map shows the distribution of all bat species recorded across all monitoring periods on site. Drawings for each species have also been created to show the distribution of bat species across the site, these are included on Annex E – Annex M.

3.4 Table 2 below summarises the total number of bats recorded each month by each static. Image 1 below shows the total number of bat calls recorded per species across all of the monitoring periods. More detailed species results from each remote monitoring survey period are summarised within tables in Annex B.

Table 2. Total bats recorded each month across each static.

Month	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
April	52	86	232	0	366	193	215	79	279	43	136	80
May	132	286	524	307	390	282	124	279	845	1	6	188
June	491	671	334	547	1037	2742	601	1030	695	803	0	218
July	59	980	493	268	19	53	0	352	379	0	0	339
August	147	199	250	24	43	77	0	26	54	203	0	0
September	11	51	7	8	5	4	8	11	0	4	0	26
October	0	3	0	6	2	3	3	0	0	0	0	0
Total	**892**	**2276**	**1840**	**1160**	**1862**	**3354**	**951**	**1777**	**2252**	**1054**	**142**	**851**

3.5 The static bat detector with the highest numbers of bats recorded over all monitoring periods was 0432 with a total of 3,354 calls. Static 0622 recorded the lowest number of calls overall, with a total of 142 calls, with no bats being recorded between the June-October monitoring periods. Both of these statics were located within the more central part of the site, with static 0622 located within close proximity to the firing range. These two statics are only located approximately 230m apart, within similar habitat.

3.6 Bats were most commonly recorded along the eastern and northern boundaries of the site, although they were also regularly recorded within the grassland sections of the airfield, particularly the north-western arm of the airfield, and the more central part of the site near static 0432. Fewer bats were recorded within the southern part of the site.

3.7 Of the months recorded, June had the highest number of calls, with a total of 9,169 calls, whilst October had the least with only 17 calls across all of the statics.

3.8 A total of at least 12 bat species were recorded on site, these include:

- Common pipistrelle
- Soprano pipistrelle
- Nathusius' pipistrelle (*Pipistrellus nathusii*)
- Social calls from common pipistrelle, soprano pipistrelle and pipistrelle species
- Noctule
- Leisler's bat (*Nyctalus leisleri*)
- *Nyctalus* species[1]
- Serotine
- *Myotis* species[1]
- Daubenton's bat
- Natterer's bat
- Brown long eared
- Greater horseshoe
- Lesser horseshoe
- Barbastelle

3.9 Of the bats recorded on site, barbastelle, greater horseshoe, noctule, Nathusius' pipistrelle and serotine bats are all listed on the rarest category within Wales [4].

3.10 Barbastelle bats were recorded a total of four times on site, once in July on 0429 (to the north of the main runway), and three times in September on both 0427 and 0428, which were located in the east of the site in close proximity to scrub.

3.11 Greater horseshoe bats were recorded a total of 162 times across the survey period, and most commonly utilised the eastern and northern boundaries, as shown on Annex F. They were recorded every month except August and October.

3.12 Both serotine and Nathusius' pipistrelle bats were recorded in low numbers in only three and two months respectively. Serotine were recorded predominantly utilising the north-western part of the site, and although Nathusius' pipistrelle were recorded along this northern scrub, they also made use of the eastern boundary.

3.13 Noctule were recorded more than any other bat species, with a total of 8,135 calls over all monitoring periods. They were recorded every month except October, with a peak call count of 1,716 on static 0432 in the June monitoring period. They appear to make regular use of the site as they were recorded hundreds of times each month, with the exception of September where there were only recorded a total of 28 times.

3.14 Common pipistrelle and soprano pipistrelle bat species were also recorded making regular use of the site. They were recorded on site every month across all of the monitoring periods.

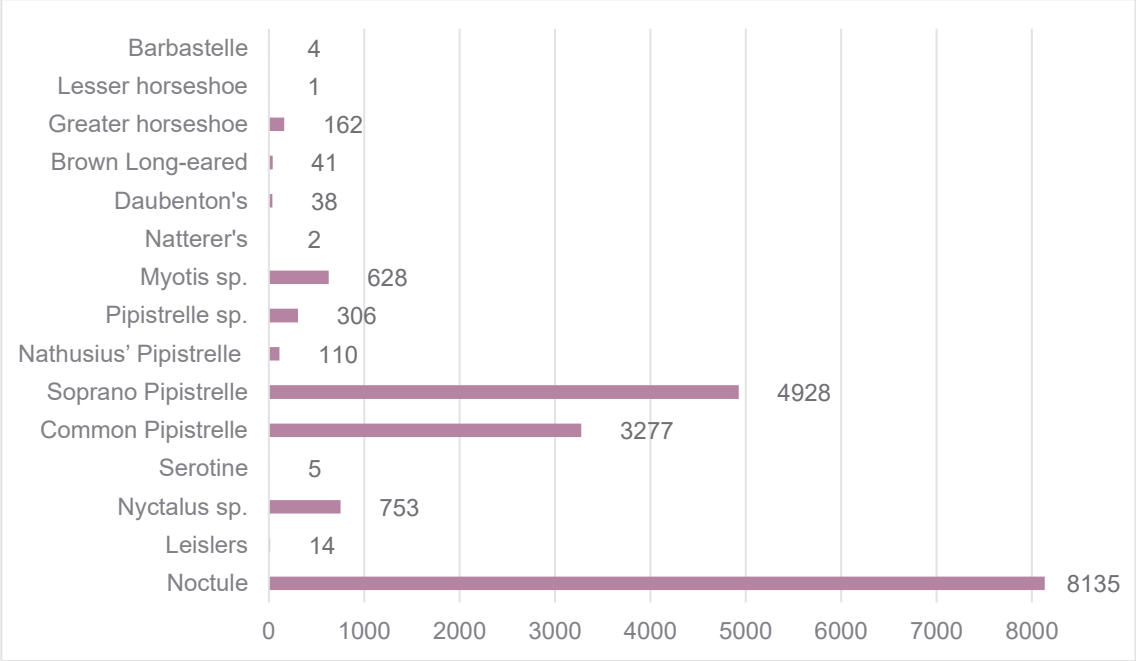


Image 1. Total bat calls for each bat species across all of the monitoring periods.

[1] This includes all species within this genus as calls between these species are similar, and sometimes hard to differentiate between.

4 Conclusion

4.1 Bat activity, particularly of the rare species listed above, is concentrated to the north and east of the survey site at the scrub boundary habitats, although common pipistrelle, soprano pipistrelle, as well as Myotis sp. to a lesser degree, were frequent towards the grassland habitats at the centre of the survey site.

4.2 Whilst bats are utilising the survey site, they are not roosting there. Therefore, the survey site is considered to be of county importance for bats.

References

[1] Sweco, “Preliminary Ecological Appraisal Report, Project DARC - Cawdor Barracks. Ref. 65208061-ZZ-XX-T-J-0001,” Sweco, 2023.

[2] West Wales Biodiversity Information Centre, “Data Enquiries,” [Online]. Available: https://www.wwbic.org.uk/data-enquiries/. [Accessed 12 2022].

[3] J. Collins, Ed., Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd ed., London: The Bat Conservation Trust., 2016.

[4] S. Wray, D. Wells, E. Long and T. Mitchell-Jones, “Valuing Bats in Ecological Impact Assessment,” *In Practice,* pp. 23-25, 2010.

Annexes

Annex A - Remote Monitoring Weather Conditions

Annex B – Remote Monitoring Results

Annex C - Static Locations

Annex D – All Species Bat Map

Annex E - Lesser Horseshoe Map

Annex F - Greater Horseshoe Map

Annex G - Barbastelle Map

Annex H - Leisler's Map

Annex I - Serotine Map

Annex J - Nathusius' Pipistrelle Map

Annex K - Myotis Species Map

Annex L - Natterer's Map

Annex M - Daubenton's Map

Ministry of Defence

ES Appendix 8.10: Habitat Regulations Assessment - Screening

Contents

Tables

Images

Annexes

Habitats Regulations Assessment

1 Introduction

Background

1.1 Jacobs has been commissioned by the Ministry of Defence (MOD) to undertake an environmental assessment, including a Habitats Regulations Assessment (HRA) screening for the proposed deep-space radar site at Cawdor Barracks, southwest Wales (hereafter referred to as the 'application site'). The application site is within 1km of Ramsey and St David's Peninsula Coast Special Protection Area (SPA), and St David's SPA and Special Area of Conservation (SAC).

1.2 The Deep-space Advanced Radar Capability (DARC) is a United States Space Force (USSF) led programme that aims to set up three geographically dispersed radar sites to increase global Space Domain Awareness with one based in the US, one in the UK and one in Australia. The proposed development will include the construction of transmission (Tx) and receiving (Rx) arrays, support and operation buildings, radar platforms, security fencing, and associated internal roads.

1.3 This HRA fulfils the requirements of Article 6(3) of the Habitats Directive and covers the first stage (screening) of the HRA process which identifies any Likely Significant Effects (LSEs) from the proposed development on the national site network (see Section 1.5).

The Habitats Directive and European/Ramsar Sites

1.4 The EU Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (hereafter referred to as the Habitats Directive) was adopted in 1992, and the latest amendments to the Directive were published on 13 May 2013. The primary aim of the Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed in the Annexes to the Directive at a favourable conservation status. It also introduces robust protection for those habitats and species of European importance.

1.5 The Habitats Directive includes, under Article 3, provision for the designation of Special Areas of Conservation (SACs) for habitats listed on Annex I and for species listed on Annex II. SPAs are classified under Article 4 of the Birds Directive (Directive 2009/147/EC on the conservation of wild birds (codified version of Directive 79/409/EEC)). Together SACs and SPAs make up the UK's national site network of nature protection areas. The Habitats Directive provides protection for SPAs classified under the Birds Directive, as well as SACs (Section 2: Requirement for HRA). The national site network previously formed part of the EU's Natura 2000 ecological network and the SPAs and SACs are often referred to as 'European sites'.

1.6 Whilst not a European site designation, wetland sites designated under the Convention on Wetlands of International Importance, known as Ramsar sites, are also relevant as they are afforded the same level of protection as European sites under domestic policy and treated in the same way as the national site network.

Summary of the Proposed Development

1.7 The proposed development comprises the construction of transmission and receiving arrays, support and operation buildings, radar platforms, security fencing, and associated roads. Full details are provided in Chapter 3 of the Environmental Statement (ES).

1.8 Construction is due to commence in April 2027 and is anticipated to take approximately 21 months to complete.

1.9 Construction will be within the bounds of the existing airfield at Cawdor, not beyond the existing hard standing and grassland surrounding the airstrips.

Ecological Surveys

1.10 To inform the environmental assessment of the proposed development, a UK Habitat Classification (UKHab) survey and protected species scoping survey were undertaken in November 2022, with further protected species surveys undertaken in 2023.

1.11 The following resulting reports and documents have been used to inform this HRA:

- Project DARC – Cawdor Barracks: Wintering Birds, Appendix 8.5 (Sweco UK Limited, 2024)
- Project DARC – Cawdor Barracks: Breeding Birds, Appendix 8.6 (Sweco UK Limited, 2024)
- Project DARC – Cawdor Barracks: Chough, Appendix 8.7 (Sweco UK Limited, 2024)
- Project DARC – Cawdor Barracks: Bat Activity Survey, Appendix 8.9 (Sweco UK Limited, 2025)

Radiation Effects on Wildlife

1.12 Professor Hugh Griffiths of University College London was commissioned to consider the effects of the radiation hazards of the DARC radar transmitter arrays to establish the risks towards wildlife. The resulting report ‘Evaluation of Radiation Hazards Associated with the DARC Radar’ (Griffiths, 2024), included as Appendix 15.1 to ES Chapter 15, has been used to inform this HRA.

2 Requirement for HRA

Introduction

2.1 The Habitats Directive is transposed into British legislation via the Conservation of Habitats and Species Regulations 2017 (as amended) (hereafter referred to as the Habitat Regulations). The most recent update was in 2019 as a result of the UK leaving the EU.

2.2 The Habitats Regulations require that an Appropriate Assessment (AA) be undertaken by a Competent Authority where any plan or project not directly connected with or necessary to the management of the European/Ramsar site (i.e. a SAC or SPA, or candidate or potential SAC/SPA, or a Ramsar site), is likely to have a significant effect either individually or in combination with other plans or projects. HRA is the process, which includes an AA, whereby a Competent Authority comes to a conclusion as to whether there is no adverse effect on site integrity from a plan or project. HRA refers to the process that includes the Competent Authority's conclusions with respect to the AA test concerning site integrity, and the AA must be undertaken '*in view of the site's conservation objectives'* as specified within the Habitat Regulations. With respect to this HRA, the Competent Authority will be the Ministry of Defence.

The HRA Process

2.3 The HRA process comprises four main stages and establishes whether the proposal:

- is directly connected with or necessary for site management for nature conservation;
- is likely to have a significant effect on the site; and
- will adversely affect the site's integrity.

2.4 If the assessment ascertains that the proposal would adversely affect site integrity and the Competent Authority still wishes to consent the proposal, consideration of alternative solutions is required. If no alternative solutions are available, a proposal may be carried out for Imperative Reasons of Overriding Public Interest as indicated by Article 6(4) of the Habitats Directive. Compensatory measures *'should be considered only when the application of other safeguards, such as mitigation measures, is not sufficient'* (European Commission, 2007).

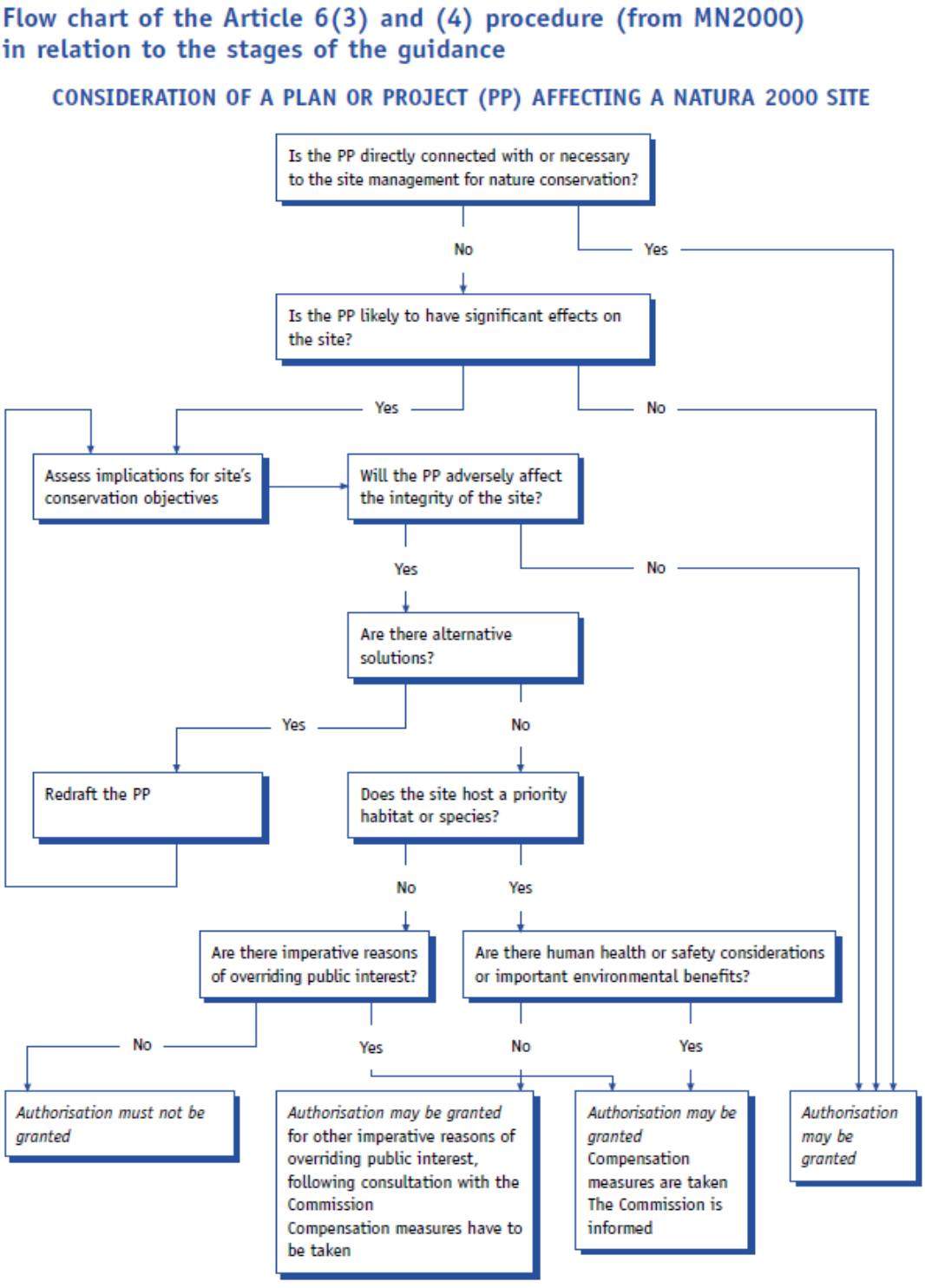
2.5 The four stages of the HRA process (Diagram 1, (European Commission, 2001) are as follows:

- Stage One – Screening (should be undertaken in all cases).
- Stage Two – Appropriate Assessment.
- Stage Three – Alternative Solutions.
- Stage Four – Imperative Reasons of Overriding Public Interest (IROPI) and including, in certain circumstances, compensatory measures.

2.6 It should be noted that not all stages may be required in the HRA process. If the screening stage determines that a plan or project is unlikely to have significant effects on a European/Ramsar site, subsequent stages are not required.

2.7 The HRA process is shown on Image 1 below (European Commission, 2001).

Image 1: the HRA process



Stage One: Screening

2.8 Screening identifies the potential effects on a European/Ramsar site from a project or plan, either alone or in combination with other projects or plans and considers whether these effects are likely to be significant.

2.9 The screening assessment is a test of the 'likelihood' of effects occurring rather than a 'certainty' of effects occurring. In accordance with the Waddenzee Judgement [ECJ case C-127/02], a likely significant effect is one that cannot be ruled out on the basis of objective information. This is underpinned by the precautionary principle which is enshrined in law in the Habitats Directive, and the test of something as being *'beyond reasonable scientific doubt'*, as presented in the Waddenzee Judgement. Paragraph 49 of the same judgement adds *'…where a plan or project… is likely to undermine the site's conservation objectives, it must be considered likely to have a significant effect on that site. The assessment of that risk must be made in the light inter alia of the characteristics and specific environmental conditions of the site concerned by such a plan or project'.* The Sweetman case (European Court of Justice C-258/11) reinforced and further refined the Waddenzee Judgement ruling that *'the question is simply whether the plan or project concerned is capable of having an effect. It is in that sense that the English 'likely to' should be understood.'*

2.10 The People Over Wind Judgement (European Court of Justice C-323/17) clarifies the stage in the HRA process when mitigation measures can be taken into account when assessing impacts on a European site. The ruling is that: *'…in order to determine whether it is necessary to carry out, subsequently, an appropriate assessment of the implications, for a site concerned, of a plan or project, it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects of the plan or project on that site.'* However, any measure that forms part of an application which can reasonably be regarded as 'standard practice' or 'best practice' or is provided as a legislative requirement to protect the wider environment and not specifically for European sites and have a high degree of certainty that the measure will be effective in avoiding an impact including on a European site, can be considered at the screening stage.

Stage Two: Appropriate Assessment (AA)

2.11 If the Stage One Screening process determines that the project or plan (either alone or in combination with other plans or projects) is associated with impacts which are 'likely to have a significant effect' upon a European/Ramsar site, the HRA process proceeds to Stage Two appropriate assessment (AA).

2.12 An AA considers the effect of the project or plan, either alone or in combination with other projects or plans, on the integrity of the European/Ramsar site, with respect to the site's structure and function, and its conservation objectives. Under the provisions of Article 6(3) of the Habitats Directive the objective is to ascertain that the integrity of the site will not be adversely affected.

2.13 Site integrity is defined as *'the coherence of the site's ecological structure and function across its whole area, or the habitats, complex of habitats or populations of species for which the site is or will be classified'* (European Commission, 2018). The decision as to whether a site is not adversely affected focuses on and is limited to the conservation objectives for the site (European Commission, 2018).

2.14 In carrying out an AA, mitigation measures, aimed at minimising or avoiding the negative effect of a plan or project during its operation or after its completion, may be considered as an integral part of the plan or project (European Commission, 2018). The Competent Authority must be certain that the mitigation proposed would remove/avoid the negative effects of the plan or project. It must be clear, therefore, what the mitigation measures are, how they would reduce or avoid the effects, and the details of how and by whom they would be implemented/managed, and the timescale involved. In addition, the mitigation measures would require monitoring and enforcement, and procedures to rectify effects where measures have not been successful.

Stage Three: Alternative Solutions

2.15 Stage Three is required when no adverse effect on site integrity (AESI) cannot be ascertained. It examines alternative ways of achieving the objectives of the project or plan, that may avoid an AESI on the European/Ramsar site. Guidance (European Commission, 2007) indicates that all alternatives must be analysed. This could involve alternative locations or routes, different scales or designs of development, or alternative processes.

Stage Four: Imperative Reasons of Overriding Public Interest (IROPI)

2.16 Where no alternative solutions exist and where adverse effects remain, an assessment is undertaken of the IROPI to determine whether a project or plan should proceed. Where it is determined that there are IROPI it would be necessary to design, implement, manage and monitor compensation measures *"to offset the negative impact of a project and to provide compensation corresponding precisely to the negative effects".*

Guidance

2.17 In undertaking this HRA the following guidance was referred to:

- Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (European Commission, 2001);
- Communication from the Commission on the Precautionary Principle (European Commission, 2000);
- Guidelines on the Implementation of the Birds and Habitats Directives in Estuaries and Coastal Zones (European Commission, 2011);
- Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (European Commission, 2018); and
- Habitats Regulations Assessments: Protecting a European Site (Welsh Government, 2021)

3 Stage One (Screening)

Introduction

3.1 This section details the Stage One Screening of the HRA process, which comprises the following:

- determining whether the proposed development is directly connected with or necessary to the management of a European/Ramsar site;
- identifying the potential for effects on European/Ramsar sites; and
- assessing the significance of any potential effects on European/Ramsar sites.

European/Ramsar Sites with Potential Effects from the Proposed Development

3.2 For the assessment of the proposed development, relevant European and Ramsar sites were identified by looking for potential effect pathways, particularly with regards to disturbance and pollution. An initial search radius of 10km from the site boundary was used, a distance chosen based on best professional judgement. Six sites were identified within 10km of the proposed development, to be considered within the screening assessment (Figure 8.A.1, Annex A):

- Ramsey and St David's Peninsula Coast SPA;
- St David's SAC;
- Pembrokeshire Marine SAC;
- North West Pembrokeshire commons SAC;
- Cleddau Rivers SAC;
- West Wales Marine SAC;

3.3 In line with standard methodology and following the results of the Bat Activity Surveys for the proposed development, SACs designated for bat species located within 30km, have been included within the assessment. The assessment identified two SACs located within 30km designated on behalf of their bat interest.

- Pembrokeshire Bat Sites and Bosherston Lakes SAC: and
- North Pembrokeshire Woodlands SAC

3.4 Given the proposals, an assessment of impacts on sites within 10km was considered sufficient for the purposes of this assessment. The exception was the consideration of Manx shearwater (*Puffinus puffinus*) which is a qualifying feature of the Skomer, Skokholm and the Seas off Pembrokeshire SPA, located approximately 15km for the proposed development. This is because the Local Planning Authority (LPA) raised the possibility of migratory species flying over the site.

3.5 No source-receptor pathways to other European/Ramsar sites could be identified and therefore there is no potential for LSEs on any other European/Ramsar site.

3.6 Qualifying interests, conservation objectives and site vulnerabilities are presented in Table 1 below (European Site Details).

Table 1: European Sites with Potential for ISE`s from the Proposed Development

Site Name and Designation	Area (ha)	Distance and Direction from Site	Description
UK9014062 Ramsey and St David's Peninsula Coast SPA	846.24	669m SW	• During the breeding season the area regularly supports chough Pyrrhocorax pyrrhocorax. The site supports at least 3.2% of the GB breeding population. No count period specified.
UK0013045 St David's SAC	939.9	709m SW	• Vegetated sea cliffs of the Atlantic and Baltic coasts for which this is considered to be one of the best areas in the United Kingdom. • European dry heaths for which this is considered to be one of the best areas in the United Kingdom. • Floating water-plantain *Luronium natans* for which this is considered to be one of the best areas in the United Kingdom.
UK0013116 Pembrokeshire Marine SAC	138,066.4	756m SW	• Sandbanks which are slightly covered by sea water all the time for which the area is considered to support a significant presence. • Estuaries for which this is considered to be one of the best areas in the United Kingdom.
UK0030229 North West Pembrokeshire commons SAC	248.9	4458m W	• Northern Atlantic wet heaths with *Erica tetralix* for which the area is considered to support a significant presence. • European dry heaths for which this is considered to be one of the best areas in the United Kingdom.
UK0030074 Cleddau Rivers SAC	751.7	4549m SE	• Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation for which the area is considered to support a significant presence. • Active raised bogs for which the area is considered to support a significant presence. • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) for which the area is considered to support a significant presence.
UK0030397 West Wales Marine SAC	737,717.4	4947m W	• Situated off the coast of Wales from the Llŷn peninsula in the north, to Pembrokeshire in the south-west, the West Wales Marine SAC has been identified as an area of importance for harbour porpoise. The site is three times the size of Snowdonia National Park, covering 7,377 km^2.

Site Name and Designation	Area (ha)	Distance and Direction from Site	Description
Skomer, Skokholm and the Seas off Pembrokeshire SPA	166,800	13,050m SW	The islands of Skomer and Skokholm support the largest concentration of breeding seabirds in England and Wales, including: • European storm petrel (*Hydrobates pelagicus*) with 4.1% of the GB population as of 1995. • Chough with 1.2% of the GB population. No count period specified. • Short-eared owl (*Asio flammeus*) with 0.6% of the GB population. No count period specified. • Manx shearwater (*Puffinus puffinus*) with 56.9% of the global population as of the late 1990s. • Atlantic puffin (*Fratercula arctica*) with 1.1% of the global population as of the late 1990s. • Lesser black-backed gull (*Larus fuscus*) with 16.4% of the biogeographical population (mean 1993–1997). • Seabird assemblage of international importance.
North Pembrokeshire Woodlands SAC	313.8	16,080m NE	A network of woodland and other habitats along the Afon Clydach and Afon Nyfer containing extensive areas of ancient woodland. • Old sessile oak woods *Ilex* and *Blechnum* in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) • Barbastelle bat **(***Barbastella barbastellus*)
Pembrokeshire Bat Sites and Bosherston Lakes SAC	121.26	20,055m SE 24,078m NE	A network of sites across Pembrokeshire that are important maternity, transitory and hibernation sites for greater horseshoe bats (*Rhinolophus ferrumequinum*) as well as the Bosherston Lakes, which are an outstanding shallow marl lake system. • Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • Greater horseshoe bat (*Rhinolophus ferrumequinum*) • Lesser horseshoe bat (*Rhinolophus hipposideros*) • Otter (*Lutra lutra*)

Conservation Objectives

3.7 Screening for likely significant effects and the Appropriate Assessment will consider the implications of the proposed development in the context of the conservation objectives for the sites listed in Table 1.

3.8 Detailed conservation objectives for European sites located within the identified zone of influence(s) from the proposed development are provided. Where sites are a significant distance from the proposed development, a less detailed breakdown of the conservation objectives has been provided.

Table 2: Conservation objectives for internationally designated sites.

Site Name and Designation	Conservation Objectives
Ramsey and St David's Peninsula Coast SPA	The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • Cliff and crevice vegetation will occur naturally on suitable cliff sections throughout the site. • The vegetation will be composed of native plants such as sea spurrey (*Spergularia rupicola)* and rock samphire (*Crithmum maritimum).* • The establishment of non-native plants such as Hottentot fig (*Carpobotus edulis)* will be discouraged. • The factors affecting the feature are under control. • Maritime grassland will occupy at least x% of the total site area (to be set). • The following plants will be common in the maritime grassland: thrift (*Armeria maritima),* spring squill (*Scilla verna)* and sea plantain (*Plantago maritima)* • Competitive species indicative of under-grazing, particularly cocksfoot (*Dactylis glomerata)*, bracken *(Pteridium aquilinum)* and western gorse (*Ulex gallii)* will be kept in check. • The factors affecting the feature are under control. • Maritime heathland will occupy at least x% of the total site area (to be set). • The following plants will be common in the maritime heathland: heather (*Calluna vulgaris)*; bell heather (*Erica cinerea)* and spring squill (*Scilla verna)*. • Competitive species indicative of under-grazing, particularly bracken and gorse (*Ulex europaeus)* will be kept in check. • The breeding population of chough (*Pyrrhocorax pyrrhocorax*) is at least 11 pairs. • Breeding success averages at least 2.5 chicks/pair • Sufficient suitable habitat is present to support the populations. • The factors affecting the feature are under control
St David's SAC	The vision for this feature is for it to be in a favourable conservation status, where all of the following conditions are satisfied: • Cliff and crevice vegetation will occur naturally on suitable cliff sections throughout the site. • The vegetation will be composed of native plants such as sea spurrey (*Spergularia rupicola)* and rock samphire (*Crithmum maritimum).* • The establishment of non-native plants such as Hottentot fig (*Carpobotus edulis)* will be discouraged. • The factors affecting the feature are under control. • Maritime grassland will occupy at least x% of the total site area (to be set). • The following plants will be common in the maritime grassland: thrift (*Armeria maritima)*; spring squill (*Scilla verna)* and sea plantain (*Plantago maritima)*

Site Name and Designation	Conservation Objectives
	• Competitive species indicative of under-grazing, particularly cocksfoot (*Dactylis glomerata)*, bracken *(Pteridium aquilinum)* and western gorse (*Ulex gallii)* will be kept in check. • The factors affecting the feature are under control. • Maritime heathland will occupy at least x% of the total site area (to be set). • The following plants will be common in the maritime heathland: heather (*Calluna vulgaris)*; bell heather (*Erica cinerea)* and spring squill (*Scilla verna)*. • Competitive species indicative of under-grazing, particularly bracken (*Pteridium aquilinum)* and gorse (*Ulex europaeus)* will be kept in check. • The breeding population of chough (*Pyrrhocorax pyrrhocorax*) is at least 11 pairs. • Breeding success averages at least 2.5 chicks/pair • Sufficient suitable habitat is present to support the populations. • The factors affecting the feature are under control
Pembrokeshire Marine SAC	The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when: • Its natural range and areas it cover within that range are stable or increasing, and • The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and • The conservation status of its typical species is favourable. The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when: • Population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and • The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.
North West Pembrokeshire Commons SAC	The conservation status of a natural habitat is the sum of the influences acting on it and its typical species that may affect its long-term natural distribution, structure and functions as well as the long-term survival of its typical species. The conservation status of a natural habitat will be taken as favourable when: • Its natural range and areas it cover within that range are stable or increasing, and • The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and • The conservation status of its typical species is favourable. The conservation status of a species is the sum of the influences acting on the species that may affect the long-term distribution and abundance of its populations. The conservation status will be taken as 'favourable' when:

Site Name and Designation	Conservation Objectives
	• Population dynamics data on the species indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and • The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and • There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.
Cleddau Rivers SAC	Each conservation objective is a composite statement defining a site-specific aspiration for each designated feature. This composite statement contains clauses that correspond to all the elements of FCS, namely: For habitat features: • Extent should be stable in the long term, or where appropriate increasing*; • Quality (including in terms of ecological structure and function) should be being maintained, or where appropriate improving; • Populations of the habitat's typical species must be being maintained or where appropriate increasing*; • Factors affecting the extent and quality of the habitat and its typical species (and thus affecting the habitat's future prospects) should be under appropriate control. For species features: • The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term; • The distribution of the population should be being maintained; • There should be sufficient habitat, of sufficient quality, to support the population in the long term; • Factors affecting the population or its habitat should be under appropriate control.
West Wales Marine SAC	The focus of the conservation objectives for harbour porpoise sites is on addressing pressures that affect site integrity and would include: • Killing or injuring significant numbers of harbour porpoise (directly or indirectly); • Preventing their use of significant parts of the site (disturbance / displacement); • Significantly damaging relevant habitats; or • Significantly reducing the prey base.
Skomer, Skokholm and the Seas off Pembrokeshire SPA	The overarching conservation objective for the protected features of this site is to ensure that their condition is maintained or enhanced: • The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term. • The distribution of the population should be being maintained, or where appropriate increasing. • There should be sufficient habitat, of sufficient quality, to support the population in the long term. • Factors affecting the population or its habitat should be under appropriate control.

Site Name and Designation	Conservation Objectives
North Pembrokeshire Woodlands SAC	The overarching conservation objective for the protected features of this site is to ensure that their condition is maintained or enhanced: • The extent, natural processes and composition of the old sessile oak woods; • The area, quality and composition of the alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior*; • The availability and natural processes of habitats supporting barbastelle bat populations; • No increase in disturbance, no loss of roosting sites and the maintenance of bat activity,
Pembrokeshire Bat Sites and Bosherston Lakes SAC	The overarching conservation objective for the protected features of this site is to ensure that their condition is maintained or enhanced: • The extent and quality of the water-based habitats and macrophyte communities; • The breeding population roost distribution; • The winter and intermediate population roost distribution and population; • The maternity roost population size and productivity; • Availability of bat fly-ways and feeding areas (up to 16km), including links to roosts outside of the SAC.

Screening

3.9 The construction and operational phases of the proposed development could result in a variety of potential impacts which could directly or indirectly affect European sites and/or qualifying features such as:

- injury/mortality;
- habitat loss;
- disturbance (e.g. noise, vibration, radiation, movement and lighting); and
- changes in water quality (e.g. pollution).

3.10 The potential impacts were used to identify LSEs on the European sites in terms of the sites' conservation objectives from the construction and operation activities of the proposed development, presented in Section 1. The screening process considered:

- potential for effects pathways between the site and the proposed development during the construction and operating phases; and
- the ecological characteristics of the qualifying interests taking into consideration the sites' conservation objectives.

3.11 Additional information has been modelled in relation to potential disturbance impacts upon sensitive species. Table 3 provides the noise modelling results at the Ramsey and St David's Peninsula Coast SPA during the construction phase. Table 4 shows the modelled noise levels during operation. Two locates were modelled at the SPA: at ground level (0m above grade) at x = 184311.9, y = 222918.4; and at 10m above grade i.e. the cliff face, at x = 18245, y = 222871.1. These noise levels were modelled as per the methodology provided in Chapter 7 (Noise and Vibration).

Table 3. Predicted construction noise levels at Ramsey and St David's Peninsula Coast SPA (unmitigated) during daytime works (07:00 – 19:00 weekdays, 07:00 – 13:00 Saturdays) and night-time works (23:00 – 07:00)

	Predicted construction noise level, dB $L_{Aeq,T}$ in each assessment period/programme month (rounded to nearest integer)												
	Month 1	**Month 2**	**Month 3**	**Month 4**	**Month 5**	**Month 6 - 7**	**Month 8 - 9**	**Month 10**	**Month 11 - 13**	**Month 14 - 15**	**Month 16 - 18**	**Month 22**	**Night-works (months 4 – 18)**
0m above grade	41	43	44	**44**	**43**	**44**	**47**	**47**	**46**	**45**	**41**	**35**	**28**
10m above grade	30	33	33	**34**	**33**	**33**	**36**	**35**	**35**	**33**	**29**	**24**	**18**

Table 4. Noise modelling results at Ramsey and St David's Peninsula Coast SPA during operation of the proposed Development

	Predicted construction noise level, dB $L_{Aeq,}$T in each assessment period/programme month (rounded to nearest integer)							
	Normal	**Bowtie/Scan High**	**Normal with temporary auxiliary power**	**Bowtie/scan with temporary auxiliary power**	**Normal – micro siting north**	**Normal – micro siting east**	**Normal – micro siting south**	**Normal – micro siting west**
0m above grade	19	22	22	**24**	**18**	**19**	**19**	**19**
10m above grade	6	10	13	**14**	**7**	**7**	**7**	**7**

3.12 Table 5 provides the screening of European sites with potential for LSE from the construction and/or operation of the proposed development.

3.13 To inform the screening, survey data and the ecological characteristics of qualifying interests have been considered.

Table 5. Screening of LSE's on Identified Designated Sites

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
UK9014062 Ramsey and St David's Peninsula Coast SPA	669m SW	Breeding chough (*Pyrrhocorax pyrrhocorax)*	**Disturbance/loss of habitat – construction & operation** Potential impacts upon chough through disturbance whilst foraging within the boundary of the application site from construction activities, and loss of habitat during construction and operation phase were initially identified. However, chough surveys conducted in 2023 did not record any chough on site and therefore it has been concluded that chough are not utilising the application site, see Appendix 8.7. **Radiation - operation** Potential for impacts during the operational phase through radiation given close proximity of the designated site has also been ruled out. Radiation modelling analysis has concluded that there will be no impact on birds within the SPA due to the angle of the beam (minimum height 67m above horizon line of dishes at 660m) and the decreasing temperature transference of the radar beam at distance (negligible at 660m), see Appendix 15.1. **Noise – construction & operation** Given the distance between the application site and the designated site, analysis has shown that noise levels on and on top of the cliffs, both during construction and operation will be below the defined low impact threshold of 55dB(A) (⩽36 dB $LA_{eq,}T$ during construction works and ⩽14 dB $LA_{eq,}T$ during operation on the cliff face where nests are located) and so would not disturb chough or any other wildlife using the designated site. See Tables 3 and 4 above.	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
			Emissions - construction Given the distance between the application site and the SPA the potential impacts from emissions during the construction phase were scoped out from requiring any assessment. See Chapter 6 of the ES for full details. There will be no emissions during operation.	
UK0013045 St David's SAC	709m SW	Habitats including: • Vegetated sea cliffs of the Atlantic and Baltic Coasts • Northern Atlantic wet heaths with *Erica tetralix* • European dry heaths • Alkaline fens Plant: floating water plantain *Luronium natans*	**Loss of qualifying feature (habitats) - construction** The construction footprint is limited to the existing airfield and surrounding grassland. No habitats listed as qualifying species will be directly impacted during the construction or operational phase. **Pollution - construction & operation** Floating water plantain could be impacted through hydrological pollution pathways. Pollution prevention methods are required by law and are therefore considered avoidance by design. Best practice construction methods will be followed and a pollution prevention plan produced. The plan will form part of the Construction and Environmental Management Plan (CEMP) and will be a specification in the contract for the proposed development. In addition, best practice construction methods will be used, including the use of appropriate pollution controls (i.e. Guidance for Pollution Prevention (GPPs) (NIEA; DEFRA; SEPA; NRW, 2021)). During operation, any water runoff will be captured by a new surface water drainage network including SuDS, thus ensuring there will be no hydrological pollution pathways. These will be maintained through a drainage management strategy.	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
UK0013116 Pembrokeshire Marine SAC	756m SW	Habitats including: • Sandbanks which are slightly covered by sea water all the time • Estuaries • Mudflats and sandflats not covered by seawater at low tide • Coastal lagoons • Large shallow inlets and bays • Reefs • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* • Submerged or partially submerged sea caves Fish species: • Allis shad (*Alosa alosa)* • Shad (*Alosa fallax)* • River lamprey (*Lampetra fluviatilis)* • Sea lamprey (*Petromyzon marinus)* Mammals:	**Loss of qualifying feature (habitats) - construction** The construction footprint is limited to the existing airfield and surrounding grassland. No habitats listed as qualifying features of the SAC will be directly impacted during the construction or operational phase. **Pollution - construction & operation** Aquatic/marine habitats, fish, aquatic mammals, and plants could be impacted through hydrological pollution pathways. Pollution prevention methods are required by law and are therefore considered avoidance by design. They will follow best practice construction methods with creation of a pollution prevention plan. The plan will form part of the CEMP and will be a specification in the contract for the proposed development. In addition, best practice construction methods will be used, including the use of appropriate pollution controls (i.e. GPPs). During operations, any water runoff will be captured by a new surface water drainage network thus ensuring there will be no hydrological pollution pathways. these will be maintained through a drainage management strategy. **Radiation - operation** The proposed dishes have a minimum angle of 5 degrees above the horizon. As such, radiation during the operational phase will be a minimum of 76m above the horizon line 756m from the proposed dishes and therefore cannot target any designated features.	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
		• Grey seal) *Halichoerus grypus)* • Otter (*Lutra lutra)* • Harbour porpoise (*Phocoena Phocoena)* • Bottle-nosed dolphin (*Tursiops truncates)* Plants: • Shore dock (*Rumex rupestris)*		
UK0030229 North West Pembrokeshire commons SAC	4,458m W	Habitats: • Northern Atlantic wet heaths with (*Erica tetralix)* • European dry heaths • Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) • Transition mires and quaking bogs • Alkaline fens Invertebrates: • Marsh fritillary (*Euphydryas Aurinia)* Plants:	**Loss of qualifying feature (habitats) - construction** The construction footprint is limited to the existing airfield and surrounding grassland. No habitats listed as qualifying species will be directly impacted during the construction or operational phase. **Pollution - construction & operation** Floating water plantain and habitats could be impacted through hydrological pollution pathways. Pollution prevention methods are required by law and are therefore considered avoidance by design. They will follow best practice construction methods with the creation of a pollution prevention plan. The plan will form part of the CEMP and will be a specification in the contract for the proposed development. In addition, best practice construction methods will be used, including the use of appropriate pollution controls (i.e. GPPs).	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
		• Water plantain (*Luronium natans)*	During operations, any water runoff will be captured by a new surface water drainage network thus ensuring there will be no hydrological pollution pathways. This will be maintained through a drainage management strategy. **Radiation - operation** The proposed dishes have a minimum angle of 5 degrees above the horizon. As such, radiation during the operational phase will be a minimum of 400m above the horizon line 4.5km from the proposed dishes and therefore cannot target any designated features.	
UK0030074 Cleddau Rivers SAC	4,549m SE	Habitats: • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation • Active raised bogs • Degraded raised bogs still capable of natural regeneration • Alluvial forests with alder (*Alnus glutinosa)* and ash (*Fraxinus excelsior)* (*Alno-Padion, Alnion incanae, Salicion albae*) Fish species:	**Loss of qualifying feature (habitats) - construction** The construction footprint is limited to the existing airfield and surrounding grassland. No habitats listed as qualifying species of the SAC will be directly impacted during the construction or operational phase. **Pollution - construction & operation** Fish, aquatic mammals and habitats could be impacted through hydrological pollution pathways. Pollution prevention methods are required by law and are therefore considered avoidance by design. They will follow best practice construction methods with the creation of a pollution prevention plan. The plan will form part of the CEMP and will be a specification in the contract for the proposed development. In addition, best practice construction methods will be used, including the use of appropriate pollution controls (i.e. GPPs).	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
		• Allis shad (*Alosa alosa)* • Bullhead *Cottus gobio)* • River lamprey (*Lampetra fluviatilis)* • Brook lamprey (*Lampetra planeri)* • Sea lamprey (*Petromyzon marinus)* • Atlantic salmon (*Salmo salar)* Mammals: • Otter (*Lutra lutra)*	During operations, any water runoff will be captured by a new surface water drainage network thus ensuring there will be no hydrological pollution pathways. This will be maintained through a drainage management strategy. **Radiation - operation** The proposed dishes have a minimum angle of 5 degrees above the horizon. As such radiation at operational phase will be a minimum of 407m above the horizon line 4.5km from the proposed dishes and therefore cannot target any designated features.	
UK0030397 West Wales Marine SAC	4947m W	Mammals: • Harbour porpoise (*Phocoena Phocoena)*	**Pollution - construction & operation** Harbour porpoise could be impacted through hydrological pollution pathways. Pollution prevention methods are required by law and are therefore considered avoidance by design. They will follow best practice construction methods with the creation of a pollution prevention plan. The plan will form part of the CEMP and will be a specification in the contract for the proposed development. In addition, best practice construction methods will be used, including the use of appropriate pollution controls (i.e. GPPs). During operations, any water runoff will be captured by a new surface water drainage network thus ensuring there will be no hydrological pollution pathways. This will be maintained through a drainage management strategy.	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
			Radiation - operation The proposed dishes have a minimum angle of 5 degrees above the horizon. As such radiation at operational phase will be a minimum of 442m above the horizon line 4.9km from the proposed dishes and therefore cannot target any designated features.	
UK2007898576 **Skomer, Skokholm and the Seas off Pembrokeshire SPA**	13,050m SW	Birds • European storm petrel (*Hydrobates pelagicus*) • Chough (*Pyrrhocorax pyrrhocorax*) • Short-eared owl (*Asio flammeus*) • Manx shearwater (*Puffinus puffinus*) • Atlantic puffin (*Fratercula arctica*) • Lesser black-backed gull (*Larus fuscus*) • Seabird assemblages	**Radiation - operation** Potential for impacts during the operational phase through radiation from the development site has been ruled out. Radiation modelling analysis has concluded that there will be no impact on birds within the SPA due to the angle of the beam (minimum height will be over 1.1km above horizon line of dishes at 13km) and the decreasing temperature transference of the radar beam at distance (negligible at 13km), see Appendix 15.1. Any bird migrating over the site will not be affected by radiation as i) the beam will be narrow and close to the dish (7cm wide at 10m), thus limiting potential exposure time, and ii) the decreasing temperature transference of the radar beam at a distance, see Appendix 15.1. Temperature transference is negligible under all modelled scenarios. **Injury/mortality to Manx shearwater – construction & operation** The dishes will have flat paint and so it is anticipated that there will be no glare or reflected light from them. The lighting scheme during operation will include minimal lighting which will not be constant but only used when needed.	

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
			This lighting we be associated with buildings and entrance gates and so will not cause reflection from the antenna dishes. The development will not therefore distract or attract any travelling Manx shearwater resulting in collisions or confusion.	
UK0030227 North Pembrokeshire Woodlands SAC	16,080m NE	Old sessile oak woods Ilex and Blechnum in the British Isles • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* • Barbastelle bat (*Barbastella barbastellus*)	**Disturbance/loss of habitat – construction & operation** There is the potential for disturbance impacts upon bat species whilst foraging within the site from construction activities. However, construction activities are located approximately 100m from the boundary of the airfield, where the species are using the airfield site boundary hedgerows/scrub habitat. No routine works are proposed during the night, although there is a possibility of nighttime working if there are minor delays during a critical activity (such as a concrete pour) that cannot be stopped. If works are required during dark periods, this is likely to be during the winter as the days are shorter, but bats will be in hibernation and not impacted by nighttime working. Also, measures will be put in place to limit nighttime disturbance if needed during bat active periods, such as minimising light spill and only focused on the small areas of working, where needed. **Radiation - operation** Any bat foraging or commuting around the site will not be affected by radiation as i) the beam will be narrow and close to the dish (7cm wide at 10m), thus limiting potential exposure time, and ii) the decreasing temperature transference of the radar beam at a distance, see Appendix 15.1. Temperature transference is negligible under all modelled scenarios.	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
UK0014793 Pembrokeshire Bat Sites and Bosherston Lakes SAC	20,055m SE 24,078m NE	• Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. • Greater horseshoe bat *(Rhinolophus ferrumequinum*) • Lesser horseshoe bat (*Rhinolophus hipposideros*) • Otter (*Lutra lutra*)	**Disturbance/loss of habitat – construction & operation** There will be no direct impacts to habitats comprising this designated site. There will also be no loss of habitat used by greater horseshoe or lesser horseshoe bats within the airfield. The bat activity surveys recorded only one call of lesser horseshoe bat using the site indicating that this is not functionally linked habitat for the species and the development will not result in a significant impact upon regional populations of this species. The bat activity surveys recorded greater horseshoes using the site 162 times, with calls recorded throughout the survey period (April and October 2023), except August and October. This equals around 6.5 calls per night of survey and suggests the airfield is of low significance for this species. The majority of the calls were recorded along the eastern and northern edges of the site, these habitats will not be impacted by the proposals and landscaping proposals have been put forward to enhance the habitats here and strengthen the habitat corridors through tree and scrub planting. No bat roosts were recorded on the site. Furthermore, given the distance from the site to the SAC, it is not deemed to be a vital area of functionally linked habitat. See Appendix 8.9. There are potential disturbance impacts upon bat species whilst foraging within the site from construction activities. However, construction activities are located approximately 100m from the boundary of the airfield, where the species are	No potential for LSE during construction or operation. AA (HRA Stage 2) is not required.

Site Name	Distance/Connectivity to the Application Site	Qualifying Features	Potential Effects and Commentary	Screening Conclusion
			using the airfield site boundary hedgerows/scrub habitat. No routine works are proposed during the night, although there is a possibility of nighttime working if there are minor delays during a critical activity (such as a concrete pour) that cannot be stopped. If works are required during dark periods, this is likely to be during the winter as the days are shorter, but bats will be in hibernation and therefore will not be impacted by nighttime working. Also, measures will be put in place to limit nighttime disturbance, if needed during bat active periods, such as minimising light spill and only focused on the small areas of working, where needed. **Radiation - operation** Any bat feeding or commuting around the site will not be affected by radiation as i) the beam will be narrow and close to the dish (7cm wide at 10m), thus limiting potential exposure time, and ii) the decreasing temperature transference of the radar beam at a distance, see Appendix 15.1. Temperature transference is negligible under all modelled scenarios.	

4 Screening Conclusion

4.1 The proposed development has no potential for LSEs on nearby European sites and their qualifying features. The proposed development will also have no in-combination LSEs, with other plans or projects, on nearby European sites. Therefore, an Appropriate Assessment (HRA Stage 2) is not required.

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Annex A

Figure 8.A.1 European and Ramsar Designated Sites within 10km and 30km of the application site

Ministry of Defence

Chapter 8 Annexes

Ministry of Defence

Contents

Ministry of Defence

Appendix 8.9 - Annex D All species bat map

Appendix 8.9 - Annex E Lesser Horseshoe Map

Appendix 8.9 - Annex F Greater Horseshoe Map

Appendix 8.9 - Annex G Barbastelle Map

Appendix 8.9 - Annex H Leislers Map

Appendix 8.9 - Annex I Serotine Map

Appendix 8.9 - Annex J Nathusius' Pipistrelle Map

Appendix 8.9 - Annex K Myotis species Map

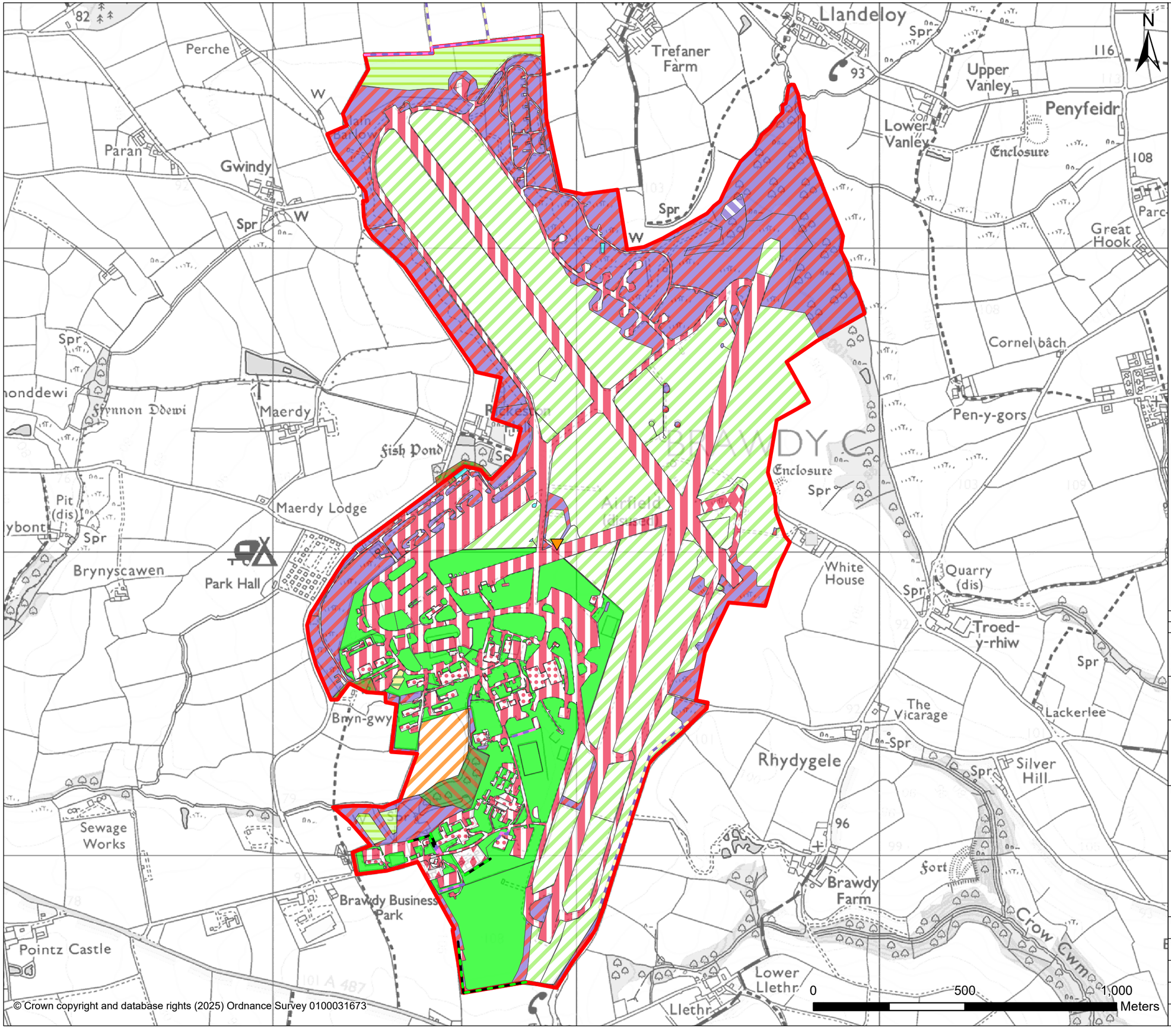
Appendix 8.9 - Annex L Natterer Map

Appendix 8.9 - Annex M Daubenton's Map

Appendix 8.10 - Annex A European and Ramsar Designated Sites

Ministry of Defence

Appendix 8.1 - Annex A UK Habitat Classification



Legend

- Site boundary

UKHab Survey

- c1 - Arable and horticulture
- g1d - Other lowland acid grassland
- g3c - Other neutral grassland
- g4 - Modified grassland
- h1a - Lowland heath
- h3 - Dense scrub
- r1 - Standing open water and canals
- u1b - Developed land; sealed surface
- u1b5 - Buildings
- u1b6 - Other developed land
- u1d - Suburban mosaic of developed and natural surface
- w1d - Wet woodland
- w1h - Other woodland; mixed
- w2c - Other coniferous woodland
- h2a - Native hedgerow
- h2b - Other hedgerow
- w1g6 - Line of trees

Rev	Date	Amendment Details	Dr'n	Chk'	App'
P01	05.03.2025	FIRST ISSUE	PK	EH	GL

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SWECO

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Ministry of Defence

Project Title

PROJECT DARC – CAWDOR

Drawing Title

UK HABITAT CLASSIFICATION

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:12,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0001

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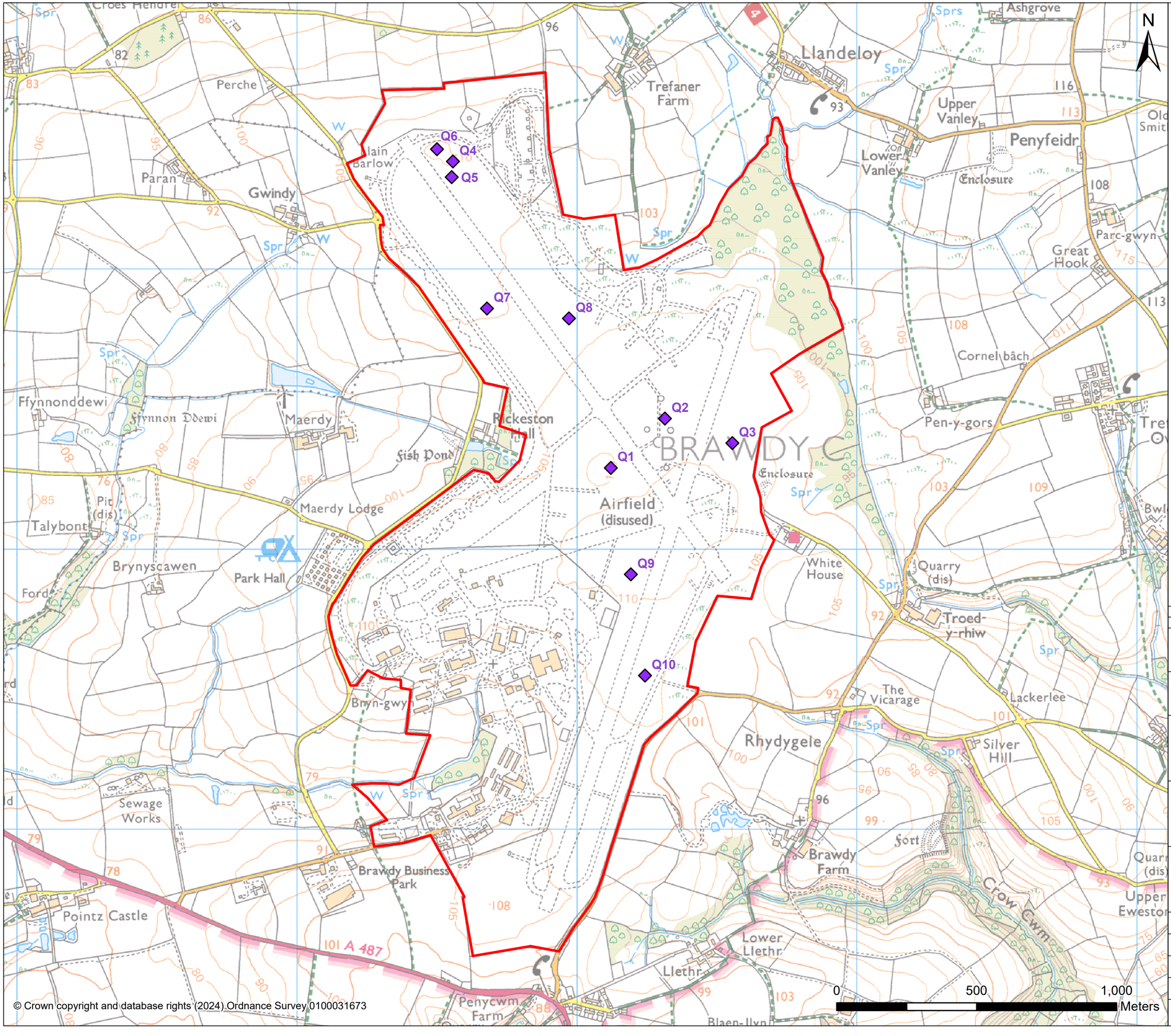
Appendix 8.1 - Annex B NVC Quadrat Locations



Legend

- Site boundary
- NVC quadrat location

Rev	Date	Amendment Details	Dr'n	Chk'	App'
P01	04.03.2024	FIRST ISSUE	PK	EH	GL

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Project Title

PROJECT DARC – CAWDOR

Drawing Title

NVC QUADRAT LOCATIONS

Project Stage

STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number

65208061-002-SWE-XX-XX-DR-GS-0002

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Appendix 8.2 - Annex A Assessment of CHEGD fungi at Cawdor Barracks

Assessment of CHEGD fungi at Cawdor Barracks, Pembrokeshire

Report to Richard Webber-Salmon (SWECO UK Ltd.)

Andrew P Detheridge, Dan Batts & GarethW Griffith
DLS, Aberystwyth University
November 2023

Pooled soil core samples were collected from eleven 0.09ha (30x30m) quadrats (36 cores per quadrat; using 18mm inner diameter auger) by Richard Webber-Salmon (SWECO) on 16th June 2023. Soil samples were kept in a fridge after collection and sent by 24hr courier to Aberystwyth where they were frozen on 20th July.

Sample weight ranged from 724 to 1048g (mean 916.6g) and soil moisture ranged from 14% to 20% (mean 16.9%). No details of exact sample location were provided beyond the fact that they were taken from grassland areas adjacent to the runways at the site (Fig. 1).

Following freeze-drying and grinding to 0.5mm, DNA was extracted using the Qiagen Powersoil kit and PCR amplification/sequencing/bioinformatic analysis were undertaken according to the protocol described by Detheridge et al. (2021).

A total of 58 species of CHEGD fungi (CHEGD=6:13:15:21:3) were detected across the 11 quadrats, the best and worst quadrats (in terms of numbers of CHEGD species) respectively being CAW10 (CHEGD=4:8:10:9:3=34) and CAW06 (CHEGD 4:6:3:6:1=20) (Tables 1,2).

Seven species listed as Globally Vulnerable (=VU) by IUCN were detected, alongside three species assessed but not yet formally published as Vulnerable (=[VU]) and one species listed in Section 7 of the Environment (Wales) Act 2016 (" living organisms of principal importance for the purpose of maintaining and enhancing biodiversity in relation to Wales"). These species of conservation importance were detected in all quadrats, the number ranging from two (CAW05) to six (CAW02, CAW03 and CAW11).

The relative abundance of CHEGD fungi as a percentage of all the soil fungi present (ca 2,200 species) was around 30% for all quadrats (26.6% to 39.7%). Use of a multivariate method (Principle Coordinates Ordination; Fig. 2) to determine whether there was any pattern differences within the overall fungal community and the CHEGD community alone across the 11 quadrats did suggest that CAW01 was distinct with the other quadrats falling into two clusters, each of five quadrats. Possibly these cluster can be related to different parts of the airfield. However, the clusters did not reflect any clear patterns in relation to the conservation importance of the different fungi present.

The numbers of waxcaps (Hygrophoraceae) present (21 in total) exceed the threshold (19 spp.) that merits consideration as SSSI (Bosanquet et al., 2018). The threshold is also reached of exceeded for the other four groups of CHEGD fungi, namely C13/E15/G6/D3 (against threshold of C7,E15,G5,D3), further highlighting the conservation importance of this site. The guidelines of Bosanquet et al. (2018) also note the importance of paying particular attention to globally threatened species (as denoted by those marked as VU or[VU] (i.e. IUCN global Red List). Based on the criteria of Rald (1985) (Table 2), focusing only on waxcaps (Hygrophoraceae; 21 spp. detected), the site is of national importance at a minimum (missing the threshold for international importance (22 spp.) by one.

This site is clearly special and note that only 0.4% of the site was assessed via eDNA (1 ha of ca. 250 ha). It merits a fruitbody survey of the whole site in 2024, which would very likely discover additional grassland fungi. A fruitbody survey would also confirm whether grassland fungi of conservation concern are present across both fields (as suggested by the eDNA data) or concentrated in particular areas.

Another reason to recommend a fruitbody survey is that SSSI notification requires the detection of mature individuals (ie fruitbodies), an additionally reason for recommending a fruitbody survey. The eDNA data herein will be of assistance in focusing such survey effort.

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Griffith, G.W., Gamarra, J.P., Holden, E.M., Mitchel, D., Graham, A., Evans, D.A., Evans, S.E., Aron, C., Noordeloos, M.E., Kirk, P.M., 2013. The international conservation importance of Welsh 'waxcap' grasslands. Mycosphere 4, 969–984.

Rald, E., 1985. Vokshatte som indikatorarter for mykologisk vaerdifulde overdrevslokaliteter. Svampe 11, 1-9.

Fig. 1. Map of the RAF Brawby/Cawdor Barracks site. Exact location of each quadrat is not known but they are all in the grassland areas surrounding the runways.

Table 3. Waxcap assessment of Rald (1985) as adapted by Vesterholt et al (Vesterholt et al., 1999)

Conservation value	**Single visit *Hygrocybe* taxa**	**Total *Hygrocybe* taxa**
Internationally important	15(?)+	22+
Nationally important	11-14	17-21
Regionally important	6-10	9-16
Locally important	3-5	4-8
Of no importance	1-2	1-3

Table 1. List of species detected via eDNA analysis. Relative abundance of each species in each quadrat is shown (as % of total fungal sequences), as is number of species for each of the CHEGD groups for each quadrat.

	Family	Species	IUCN RDL	Count	Cumul Tot	Mean	Max	Min	CAW01	CAW02	CAW03	CAW04	CAW05	CAW06	CAW07	CAW08	CAW09	CAW10	CAW11
G01	Geoglossaceae	Geoglossum_fallax		8	1.409%	0.176%	0.511%	0.019%	0.057%	0.019%	0.218%	0.062%		0.196%		0.511%	0.067%	0.280%	
G02	Geoglossaceae	Glutinoglossum_pseudoglutinosum		10	2.093%	0.209%	0.450%	0.006%	0.080%	0.006%	0.373%		0.066%	0.424%	0.033%	0.407%	0.450%	0.178%	0.076%
G03	Geoglossaceae	Hemileucoglossum_sp		10	1.895%	0.189%	0.451%	0.013%	0.087%	0.349%	0.122%	0.075%	0.013%	0.362%		0.022%	0.164%	0.250%	0.451%
G04	Geoglossaceae	Microglossum_olivaceum	S7	2	0.007%	0.004%	0.004%	0.003%			0.004%						0.003%		
G05	Geoglossaceae	Trichoglossum_hirsutum		1	0.002%	0.002%	0.002%	0.002%											0.002%
G06	Geoglossaceae	Trichoglossum_walteri	VU	10	32.414%	3.241%	9.894%	0.199%	1.443%	0.199%	9.894%	7.011%	1.396%	1.664%	3.702%		0.989%	5.211%	0.903%
		UNIDENTIFIED GEOGLOSSACEAE	27.3%	11	14.206%	1.291%	2.687%	0.294%	1.196%	1.043%	0.504%	0.569%	2.566%	2.687%	0.864%	1.943%	0.294%	1.009%	1.531%
C01	Clavariaceae	Camarophyllopsis_atrovelutina		11	31.040%	2.822%	6.173%	0.369%	0.369%	1.664%	2.921%	4.324%	5.906%	1.109%	4.452%	0.418%	6.173%	2.191%	1.514%
C02	Clavariaceae	Camarophyllopsis_schulzeri	[VU]	10	26.171%	2.617%	4.682%	0.424%	0.694%	3.400%	4.682%	3.665%		1.596%	2.786%	1.907%	2.496%	4.521%	0.424%
C03	Clavariaceae	Clavaria_californica		1	0.003%	0.003%	0.003%	0.003%											0.003%
C04	Clavariaceae	Clavaria_falcata		11	3.275%	0.298%	0.794%	0.089%	0.089%	0.107%	0.339%	0.475%	0.141%	0.794%	0.101%	0.286%	0.221%	0.551%	0.171%
C05	Clavariaceae	Clavaria_flavipes		11	5.504%	0.500%	1.589%	0.023%	0.203%	0.132%	0.470%	0.055%	0.023%	1.589%	0.889%	0.232%	0.603%	0.982%	0.327%
C06	Clavariaceae	Clavaria_fumosa		1	0.459%	0.459%	0.459%	0.459%							0.459%				
C07	Clavariaceae	Clavaria_tenuipes		1	0.010%	0.010%	0.010%	0.010%											0.010%
C08	Clavariaceae	Clavulinopsis_corniculata		2	0.027%	0.014%	0.016%	0.011%								0.011%	0.016%		
C09	Clavariaceae	Clavulinopsis_helvola		11	39.112%	3.556%	14.608%	0.345%	14.608%	5.278%	1.811%	1.298%	5.904%	1.216%	4.387%	1.813%	0.345%	1.880%	0.572%
C10	Clavariaceae	Clavulinopsis_luteoalba		8	7.333%	0.917%	3.199%	0.006%	3.199%	1.131%	0.006%		1.678%		0.868%	0.264%	0.110%	0.078%	
C11	Clavariaceae	Hodophilus_variabilipes		1	0.040%	0.040%	0.040%	0.040%						0.040%					
C12	Clavariaceae	Ramariopsis_crocea		7	0.277%	0.040%	0.136%	0.002%	0.020%	0.073%	0.019%				0.136%		0.002%	0.022%	0.005%
C13	Clavariaceae	Ramariopsis_flavescens		2	0.107%	0.054%	0.103%	0.004%										0.004%	0.103%
		UNIDENTIFIED CLAVARIACEAE	22.6%	11	33.059%	3.005%	6.681%	1.052%	1.271%	1.052%	3.241%	3.389%	4.473%	6.681%	2.488%	3.840%	2.833%	1.954%	1.838%
E01	Entolomataceae	Clitopilus_baronii		10	0.267%	0.027%	0.052%	0.004%	0.042%	0.052%	0.004%	0.009%	0.051%		0.020%	0.008%	0.036%	0.024%	0.021%
E02	Entolomataceae	Entocybe_nitida		7	0.032%	0.005%	0.009%	0.003%	0.003%	0.003%		0.006%	0.003%		0.009%	0.005%		0.004%	
E03	Entolomataceae	Entoloma_asprellum		4	0.022%	0.006%	0.012%	0.003%			0.003%		0.004%				0.003%	0.012%	
E04	Entolomataceae	Entoloma_byssisedum		1	0.002%	0.002%	0.002%	0.002%											0.002%
E05	Entolomataceae	Entoloma_chloropolium		1	0.019%	0.019%	0.019%	0.019%									0.019%		
E06	Entolomataceae	Entoloma_conferendum		11	1.965%	0.179%	1.102%	0.038%	0.038%	1.102%	0.174%	0.081%	0.119%	0.074%	0.095%	0.054%	0.077%	0.068%	0.082%
E07	Entolomataceae	Entoloma_dysthales		4	0.019%	0.005%	0.008%	0.002%	0.003%							0.002%	0.008%	0.006%	
E08	Entolomataceae	Entoloma_infula		2	0.011%	0.005%	0.007%	0.003%	0.003%							0.007%			
E09	Entolomataceae	Entoloma_insidiosum		1	0.010%	0.010%	0.010%	0.010%										0.010%	
E10	Entolomataceae	Entoloma_kristiansenii		1	0.004%	0.004%	0.004%	0.004%										0.004%	
E11	Entolomataceae	Entoloma_mirum		7	0.079%	0.011%	0.023%	0.002%	0.023%	0.009%		0.015%	0.013%		0.005%	0.002%			0.013%
E12	Entolomataceae	Entoloma_porphyrophaeum	VU	2	0.021%	0.011%	0.019%	0.002%								0.019%			0.002%
E13	Entolomataceae	Entoloma_pratulense		5	0.150%	0.030%	0.066%	0.003%	0.025%		0.051%				0.004%		0.003%	0.066%	
E14	Entolomataceae	Entoloma_proterum		11	0.558%	0.051%	0.193%	0.003%	0.036%	0.040%	0.018%	0.018%	0.037%	0.083%	0.193%	0.024%	0.003%	0.033%	0.074%
E15	Entolomataceae	Entoloma_sericeum		11	0.808%	0.073%	0.361%	0.007%	0.023%	0.007%	0.028%	0.028%	0.010%	0.361%	0.014%	0.123%	0.087%	0.089%	0.039%
		UNIDENTIFIED ENTOLOMATACEAE	25.2%	11	1.334%	0.121%	0.361%	0.026%	0.068%	0.145%	0.361%	0.097%	0.032%	0.207%	0.026%	0.065%	0.091%	0.070%	0.173%
H01	Hygrophoraceae	Cuphophyllus borealis		3	0.075%	0.025%	0.069%	0.002%	0.069%								0.002%	0.004%	
H02	Hygrophoraceae	Cuphophyllus_cinerellus		4	5.304%	1.326%	2.625%	0.559%		1.133%	0.987%	2.625%							0.559%
H03	Hygrophoraceae	Cuphophyllus_pratensis		3	1.932%	0.644%	1.543%	0.048%	0.341%							1.543%	0.048%		
H04	Hygrophoraceae	Cuphophyllus russocoriaceus		1	0.004%	0.004%	0.004%	0.004%										0.004%	
H05	Hygrophoraceae	Cuphophyllus_virgineus		5	2.230%	0.446%	1.907%	0.044%	0.054%		0.131%	0.044%		1.907%				0.093%	
H06	Hygrophoraceae	Gliophorus_irrigatus		2	0.240%	0.120%	0.126%	0.115%		0.126%							0.115%		
H07	Hygrophoraceae	Gliophorus_psittacinus		10	18.222%	1.822%	7.244%	0.005%	2.223%	0.005%	0.059%	0.049%	3.631%		0.567%	1.936%	0.006%	2.501%	7.244%
H08	Hygrophoraceae	Gliophorus_reginae	VU	1	0.007%	0.007%	0.007%	0.007%		0.007%									
H09	Hygrophoraceae	Hygrocybe cantharellus		4	0.700%	0.175%	0.350%	0.027%		0.027%				0.048%				0.275%	0.350%
H10	Hygrophoraceae	Hygrocybe_ceracea		6	2.667%	0.445%	0.770%	0.004%	0.770%	0.246%	0.608%		0.642%		0.004%	0.396%			
H11	Hygrophoraceae	Hygrocybe_chlorophana		1	0.488%	0.488%	0.488%	0.488%											0.488%
H12	Hygrophoraceae	Hygrocybe_citrinovirens	VU	1	0.005%	0.005%	0.005%	0.005%							0.005%				
H13	Hygrophoraceae	Hygrocybe_conica		3	0.128%	0.043%	0.117%	0.003%						0.003%			0.117%		0.008%
H14	Hygrophoraceae	Hygrocybe_glutinipes		11	40.117%	3.647%	8.992%	0.035%	0.113%	3.384%	0.372%	1.782%	3.301%	5.064%	4.214%	0.035%	8.992%	4.542%	8.319%
H15	Hygrophoraceae	Hygrocybe_insipida		9	6.573%	0.730%	3.295%	0.004%	0.016%	0.004%	1.158%	0.008%			0.313%	3.295%	0.037%	0.304%	1.438%
H16	Hygrophoraceae	Hygrocybe_miniata		2	0.095%	0.047%	0.071%	0.024%						0.071%				0.024%	
H17	Hygrophoraceae	Hygrocybe_phaeococcinea	VU	2	0.062%	0.031%	0.050%	0.011%		0.050%								0.011%	
H18	Hygrophoraceae	Hygrocybe_quieta	[VU]	3	0.090%	0.030%	0.083%	0.002%	0.005%							0.002%			0.083%
H19	Hygrophoraceae	Hygrocybe_reidii		2	0.024%	0.012%	0.020%	0.005%		0.020%			0.005%						
H20	Hygrophoraceae	Hygrocybe_subpapillata	VU	4	8.414%	2.104%	4.900%	0.170%		4.900%	2.884%			0.170%					0.461%
H21	Hygrophoraceae	Porpolomopsis_calyptriformis	VU	1	0.509%	0.509%	0.509%	0.509%			0.509%								
D01	Tricholomataceae	Dermoloma_bellerianum		1	0.003%	0.003%	0.003%	0.003%										0.003%	
D02	Tricholomataceae	Dermoloma_cuneifolium		9	27.584%	3.065%	9.701%	0.093%	0.260%	0.442%	0.820%		0.093%		1.518%	9.701%	4.100%	4.408%	6.241%
D03	Tricholomataceae	Dermoloma_magicum	[VU]	11	20.606%	1.873%	6.924%	0.091%	0.091%	1.165%	6.924%	6.396%	2.394%	0.210%	0.241%	0.582%	0.277%	0.979%	1.349%

Table 2. Further details including the other fungi detected. The number of fungal sequences obtained per quadrat was ca. 115,000 for each quadrat.

		Cumulative Tot	Mean	Max	Min	CAW01	CAW02	CAW03	CAW04	CAW05	CAW06	CAW07	CAW08	CAW09	CAW10	CAW11
%Relative Abundance (as % of all fungi)	Geoglossales	52.026%	4.730%	11.115%	1.616%	2.863%	1.616%	11.115%	7.718%	4.040%	5.333%	4.599%	2.883%	1.967%	6.928%	2.963%
	Clavariaceae	146.418%	13.311%	20.451%	4.967%	20.451%	12.837%	13.490%	13.206%	18.125%	13.024%	16.565%	8.773%	12.799%	12.182%	4.967%
	Entolomataceae	5.301%	0.482%	1.359%	0.253%	0.263%	1.359%	0.640%	0.253%	0.268%	0.725%	0.365%	0.309%	0.328%	0.384%	0.407%
	Hygrophoraceae	87.886%	7.990%	18.950%	3.591%	3.591%	9.902%	6.708%	4.508%	7.579%	7.263%	5.102%	7.207%	9.317%	7.758%	18.950%
	Dermoloma	48.193%	4.381%	10.283%	0.210%	0.351%	1.607%	7.745%	6.396%	2.487%	0.210%	1.759%	10.283%	4.377%	5.390%	7.590%
	CHEGD	339.825%	30.893%	39.698%	26.555%	27.520%	27.320%	39.698%	32.081%	32.497%	26.555%	28.390%	29.456%	28.788%	32.644%	34.877%
SPECIES COUNT	Geoglossales	6	3.7	5	2	4	4	5	3	3	4	2	3	5	4	4
	Clavariaceae	13	7.0	9	5	7	7	7	5	5	6	8	7	8	8	9
	Entolomataceae	15	7.1	10	3	9	6	6	6	7	3	7	9	8	10	7
	ophoraceae	21	7.1	11	4	8	11	8	5	4	6	5	6	7	9	9
	Dermoloma	3	1.9	3	1	2	2	2	1	2	1	2	2	2	3	2
	CHEGD	58	26.8	34	20	30	30	28	20	21	20	24	27	30	34	31
	Number of VU, [VU] or S7 species	11	4.3	6	2	4	6	6	3	2	4	4	4	4	4	6
Aphelidiomycota		1	0.00%	0.00%	0.00%	0.00%								0.00%		
Ascomycota		11	515.21%	46.84%	57.19%	40.77%	44.11%	44.86%	48.59%	47.11%	49.53%	57.19%	40.77%	46.10%	45.52%	48.77%	42.66%
Basidiomycota		11	440.14%	40.01%	45.49%	35.10%	39.64%	37.08%	41.58%	39.01%	39.47%	35.10%	37.32%	42.18%	45.49%	40.04%	43.21%
Blastocladiomycota		5	0.04%	0.01%	0.02%	0.00%		0.00%	0.02%	0.01%	0.00%						0.01%
Chytridiomycota		11	7.80%	0.71%	1.45%	0.18%	0.47%	0.21%	0.51%	0.59%	0.18%	0.91%	0.99%	0.85%	0.78%	0.86%	1.45%
Entorrhizomycota		10	0.45%	0.04%	0.30%	0.00%	0.00%	0.01%	0.05%	0.01%	0.01%	0.00%	0.01%		0.03%	0.01%	0.30%
Fungi_phy_Incertae_sedis		11	0.63%	0.06%	0.16%	0.01%	0.07%	0.06%	0.02%	0.03%	0.01%	0.16%	0.02%	0.07%	0.06%	0.13%	0.03%
Glomeromycota		11	3.62%	0.33%	0.47%	0.24%	0.32%	0.24%	0.32%	0.29%	0.36%	0.47%	0.33%	0.35%	0.31%	0.28%	0.37%
Kickxellomycota		11	0.30%	0.03%	0.06%	0.01%	0.01%	0.02%	0.03%	0.06%	0.02%	0.03%	0.01%	0.04%	0.02%	0.02%	0.03%
Mortierellomycota		11	76.84%	6.99%	15.30%	2.30%	6.69%	11.36%	5.46%	7.06%	4.87%	2.30%	15.30%	6.20%	4.11%	5.02%	8.48%
Mucoromycota		11	27.42%	2.49%	5.44%	1.39%	5.44%	3.10%	1.62%	2.76%	2.22%	2.02%	3.12%	1.53%	1.39%	2.76%	1.46%
Rozellomycota		11	21.16%	1.92%	3.04%	1.20%	2.74%	2.03%	1.52%	2.53%	3.04%	1.20%	1.23%	1.91%	1.73%	1.78%	1.45%
X		11	2.69%	0.24%	0.56%	0.12%	0.18%	0.14%	0.12%	0.16%	0.17%	0.20%	0.19%	0.56%	0.43%	0.21%	0.34%
Zoopagomycota		2	0.01%	0.00%	0.00%	0.00%								0.00%	0.00%		
unclassified_Fungi		11	3.67%	0.33%	0.89%	0.11%	0.33%	0.89%	0.16%	0.39%	0.12%	0.42%	0.70%	0.21%	0.13%	0.11%	0.21%
%ID Species				73.77%	79.44%	69.01%	77.69%	70.23%	79.00%	76.35%	69.43%	69.63%	72.73%	79.44%	69.01%	75.80%	72.20%
% ID Genus				93.73%	95.84%	89.35%	93.64%	94.42%	94.23%	93.75%	89.35%	92.16%	95.84%	94.86%	94.23%	95.73%	92.86%
% ID Family				95.57%	97.36%	93.24%	95.73%	97.36%	95.08%	94.87%	93.24%	95.07%	96.77%	96.64%	94.73%	96.48%	95.32%
Fungi Total			1,267,502	115,227	170,395	93,250	95,690	101,062	93,250	103,432	110,998	95,344	105,796	160,685	124,734	106,116	170,395
Non Fungi Total			38,675	3,516	8,250	879	879	1,603	8,250	2,561	2,058	3,288	2,177	4,712	4,347	1,529	7,271
Barcode Total			1,432,563	130,233	196,897	106,564	106,564	112,458	110,767	116,001	122,807	108,847	118,136	181,033	140,920	118,133	196,897
% Fungi				97.10%	99.09%	91.87%	99.09%	98.44%	91.87%	97.58%	98.18%	96.67%	97.98%	97.15%	96.63%	98.58%	95.91%
% Accepted Seqs				91.21%	92.06%	90.23%	90.62%	91.29%	91.63%	91.37%	92.06%	90.62%	91.40%	91.36%	91.60%	91.12%	90.23%
Shannon Taxon				4.76	5.16	4.51	4.51	4.68	4.73	4.61	4.63	5.16	4.72	4.95	4.63	4.84	4.93
Inv Simpson Taxon				45.29	70.58	29.36	29.36	47.18	38.91	42.80	47.41	70.58	46.25	47.95	36.99	48.35	42.48
Taxon Count				859.09	1183	704	704	756	789	755	726	918	783	1021	869	946	1183
Shannon OTU				4.79	5.19	4.55	4.55	4.70	4.75	4.64	4.67	5.19	4.73	4.98	4.65	4.87	4.96
Inv Simpson OTU				45.61	70.95	29.65	29.65	47.46	39.08	43.30	48.33	70.95	46.34	48.25	37.09	48.64	42.60
OTU Count				882.36	1214	726	726	780	810	769	745	945	801	1049	893	974	1214

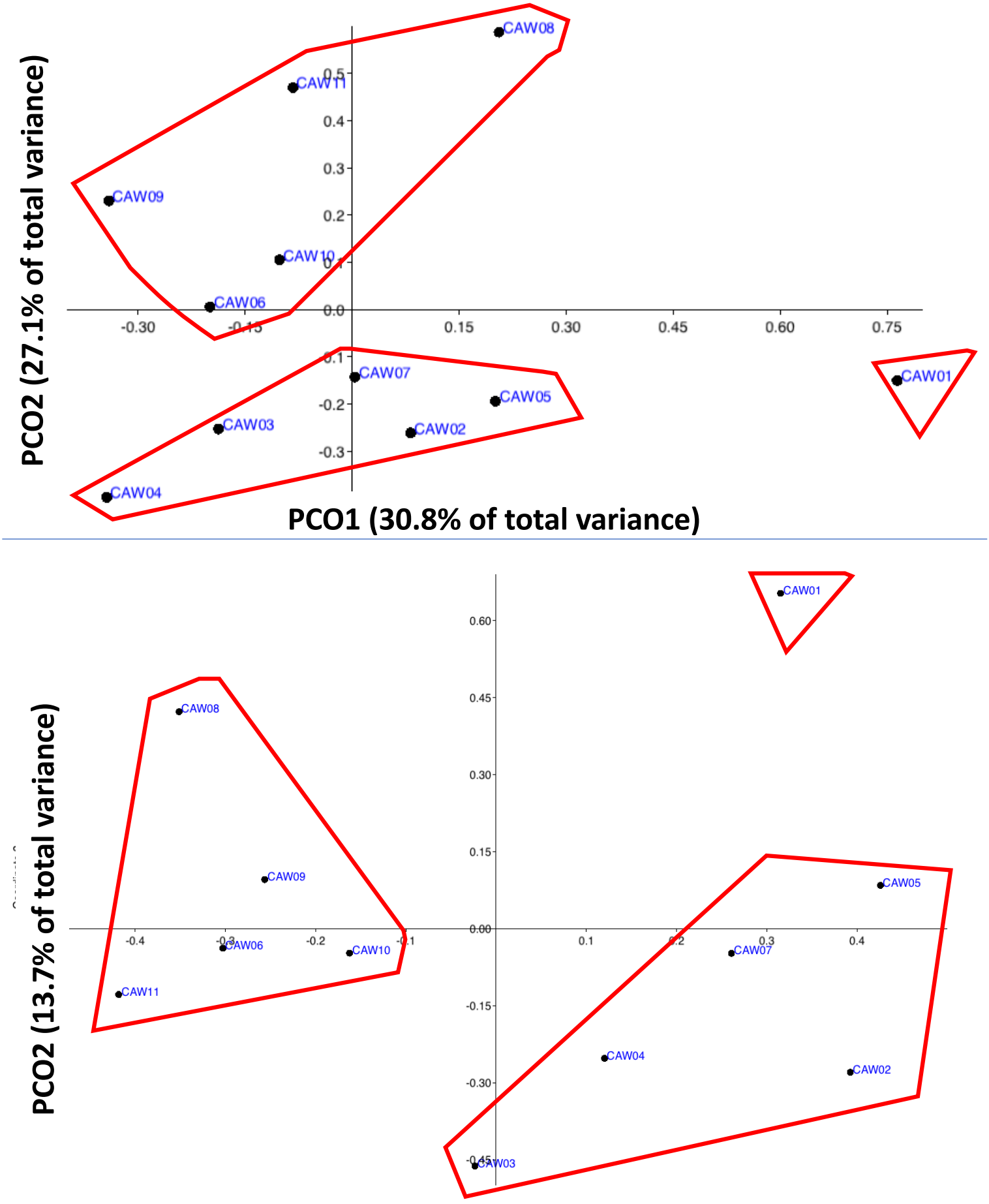

Fig. 2. Principal Coordinates Ordination (PCO) of the whole fungal communities (upper plot; ca. 2200 spp.) or the CHEGD fungal community in the 11 quadrats (lower plot; 58spp). Quadrats with more similar fungal communities cluster more closely together. The quadrats fell into three groups as indicated by the red polygons, with CAW01 being a clear outlier in both ordinations.

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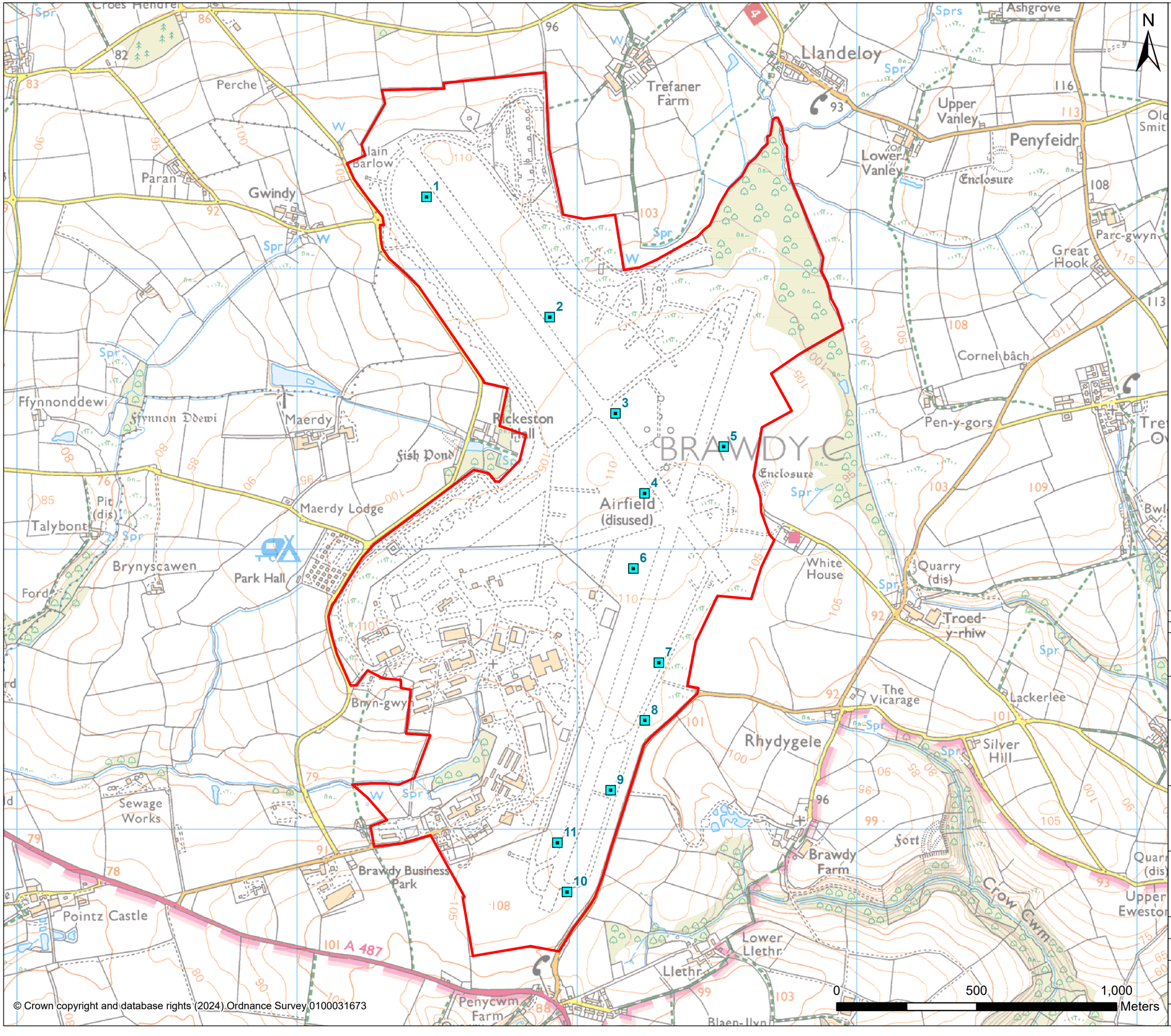
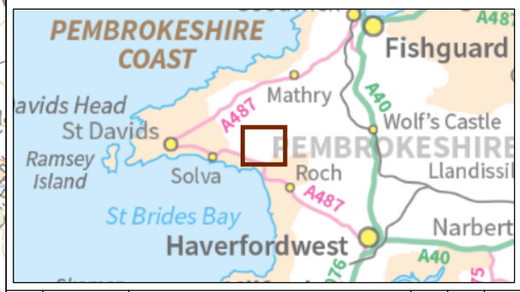
Appendix 8.2 - Annex B Fungi eDNA Quadrat Locations



Legend

- Site boundary
- Fungi quadrat location



Rev	Date	Amendment Details	Dr'n	Chk'	App'
P01	04.03.2024	FIRST ISSUE	PK	LH	GL

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2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
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SWECO

Client

Ministry of Defence

Project Title

PROJECT DARC – CAWDOR

Drawing Title

FUNGI EDNA QUADRAT LOCATIONS

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
RM	EH	LH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0003

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Appendix 8.3 - Annex A SureScreen Scientifics Sampling Methodology

SureScreen Scientifics

Great Crested Newt (GCN) Form

SureScreen Scientifics
Morley Retreat
Church Lane
Morley
Derbyshire
DE7 6DE

Tel: +44 (0)1332 292003
Email: edna@surescreen.com
Web: www.surescreenscientifics.com

Previous Inhabitation *Please Tick*

- Within 1 Year ☐
- Within 2 Years ☐
- Within 3 Years ☐
- Unknown ☐

Your Details

Name:_____

Company:_____

Address:_____

_____

_____

Tel:_____

Email:_____

_____

Purchase Order:_____

Please include a PO for this work, work will not be started until a valid PO has been received.

Profiles and Tests *Please Tick*

- Standard Service (10 Working Days) ☐
- Fast Track Service (3 Working Days) ☐

Site Details

Site Name:_____

_____

_____

County:_____

O/S Reference:_____

_____

Nearest Settlement:_____

_____

Sampling Date:_____

Sampling Time:_____

% Pond Accessible:_____

Internal Ref:_____

_____

Relevant Notes

Instructions for sampling GCN eDNA

- ☐ Identify 20 sampling sites around the perimeter of the pond. Space these as evenly as possible and include vegetative areas and areas likely to contain Great Crested Newts.
- ☐ Wearing the sterile gloves provided, take samples from the 20 sites. Use the ladle to take the samples from at least 10cm deep, ensuring the sediment at the bottom of the pond is not disturbed.
- ☐ Transfer each ladle full of water to the Whirl-pak bag provided. Once all sites have been sampled, roll the top of the bag over and shake the Whirl-pak bag vigorously to mix.
- ☐ Swap to the second pair of sterile gloves
- ☐ Using the pipette provided transfer 15ml of the water from the Whirl-Pak bags to each of the preservative filled sample tubes.
- ☐ Ensure the tube lids are tight and not cross threaded and shake each vigorously to mix.
- ☐ Place the tubes back in the cardboard rack and place inside the bag provided.
- ☐ Place the bag and tubes back in the box for transport back to the laboratory.
- ☐ Samples should be kept refrigerated where possible to reduce the risk of DNA degradation
- ☐ Please note, kit components are single use only and must not be reused for any other samples.
- ☐ Before sending kits back please ensure each individual form is completed.

Lab sample ID: 31668

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Appendix 8.3 - Annex B1 SureScreen Scientifics GCN eDNA Results

SureScreen Scientifics

Folio No: E16781
Report No: 1
Purchase Order: 65208061-002
Client: SWECO
Contact: Emma Howarth

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 24/04/2023
Date Reported: 04/05/2023
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
2307	Cawdor - OWI 2	SM 84616 25268	Pass	Pass	Pass	Negative	0
2308	Cawdor - P7	SM 83707 24152	Pass	Pass	Pass	Negative	0
2309	Cawdor - OWI 1	SM 85086 26007	Pass	Pass	Pass	Negative	0
2311	Cawdor - P4	SM 83985 25602	Pass	Pass	Pass	Negative	0
2312	Cawdor - P5	SM 85562 26755	Pass	Pass	Pass	Negative	0
2313	Cawdor - P1	SM 84859 25158	Pass	Pass	Pass	Negative	0
2314	Cawdor - P3	SM 84611 25381	Pass	Pass	Pass	Negative	0

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Chris Troth **Approved by:** Chelsea Warner

METHODOLOGY

The samples detailed above have been analysed for the presence of GCN eDNA following the protocol stated in DEFRA WC1067 'Analytical and methodological development for improved surveillance of the Great Crested Newt, Appendix 5.' (Biggs et al. 2014). Each of the 6 sub-sample tubes are first centrifuged and pooled together into a single sample which then undergoes DNA extraction. The extracted sample is then analysed using real time PCR (qPCR), which uses species-specific molecular markers to amplify GCN DNA within a sample. These markers are unique to GCN DNA, meaning that there should be no detection of closely related species.

If GCN DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If GCN DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample between the date it was made to the date of analysis. Degradation of the spiked DNA marker may lead indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result: **Presence of GCN eDNA** [Positive/Negative/Inconclusive]
Positive: GCN DNA was identified within the sample, indicative of GCN presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.
Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for GCN presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared

positive. 0/12 indicates negative GCN presence.
Negative: GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of GCN absence, however, does not exclude the potential for GCN presence below the limit of detection.

Ministry of Defence

Appendix 8.3 - Annex B2 SureScreen Scientifics GCN eDNA Results

SureScreen Scientifics

Folio No: E17014
Report No: 1
Purchase Order: 65208061-002
Client: SWECO
Contact: Emma Howarth

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 28/04/2023
Date Reported: 11/05/2023
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
2306	Cawdor - P6	SM 8596 2557	Pass	Pass	Pass	Negative	0

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Chris Troth **Approved by:** Jackson Young

METHODOLOGY

The samples detailed above have been analysed for the presence of GCN eDNA following the protocol stated in DEFRA WC1067 'Analytical and methodological development for improved surveillance of the Great Crested Newt, Appendix 5.' (Biggs et al. 2014). Each of the 6 sub-sample tubes are first centrifuged and pooled together into a single sample which then undergoes DNA extraction. The extracted sample is then analysed using real time PCR (qPCR), which uses species-specific molecular markers to amplify GCN DNA within a sample. These markers are unique to GCN DNA, meaning that there should be no detection of closely related species.

If GCN DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If GCN DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample between the date it was made to the date of analysis. Degradation of the spiked DNA marker may lead indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result: **Presence of GCN eDNA** [Positive/Negative/Inconclusive]
Positive: GCN DNA was identified within the sample, indicative of GCN presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.
Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for GCN presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared positive. 0/12 indicates negative GCN presence.
Negative: GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of GCN absence, however, does not exclude the potential for GCN presence below the limit of detection.

Ministry of Defence

Appendix 8.3 - Annex B3 SureScreen Scientifics GCN eDNA Results

SureScreen Scientifics

Folio No: E17457
Report No: 1
Purchase Order: PO-23-652-00900
Client: SWECO
Contact: Leonora Hunt

TECHNICAL REPORT

ANALYSIS OF ENVIRONMENTAL DNA IN POND WATER FOR THE DETECTION OF GREAT CRESTED NEWTS (TRITURUS CRISTATUS)

SUMMARY

When great crested newts (GCN), *Triturus cristatus*, inhabit a pond, they continuously release small amounts of their DNA into the environment. By collecting and analysing water samples, we can detect these small traces of environmental DNA (eDNA) to confirm GCN habitation or establish GCN absence.

RESULTS

Date sample received at Laboratory: 17/05/2023
Date Reported: 31/05/2023
Matters Affecting Results: None

Lab Sample No.	Site Name	O/S Reference	SIC	DC	IC	Result	Positive Replicates
3354	Cawdor 65208061 - Tracks NW	SM 843 261	Pass	Pass	Pass	Negative	0
3355	Cawdor 65208061 - Tracks NE	SM 847 263	Pass	Pass	Pass	Negative	0

If you have any questions regarding results, please contact us: ForensicEcology@surescreen.com

Reported by: Gabriela Danickova **Approved by:** Jackson Young

METHODOLOGY

The samples detailed above have been analysed for the presence of GCN eDNA following the protocol stated in DEFRA WC1067 'Analytical and methodological development for improved surveillance of the Great Crested Newt, Appendix 5.' (Biggs et al. 2014). Each of the 6 sub-sample tubes are first centrifuged and pooled together into a single sample which then undergoes DNA extraction. The extracted sample is then analysed using real time PCR (qPCR), which uses species-specific molecular markers to amplify GCN DNA within a sample. These markers are unique to GCN DNA, meaning that there should be no detection of closely related species.

If GCN DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If GCN DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent risk of contamination. True positive controls, negative controls and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared and reported. Stages of the DNA analysis are also conducted in different buildings at our premises for added security.

SureScreen Scientifics Ltd is ISO9001 accredited and participate in Natural England's proficiency testing scheme for GCN eDNA testing. We also carry out regular inter-laboratory checks on accuracy of results as part of our quality control procedures.

INTERPRETATION OF RESULTS

SIC: **Sample Integrity Check** [Pass/Fail]
When samples are received in the laboratory, they are inspected for any tube leakage, suitability of sample (not too much mud or weed etc.) and absence of any factors that could potentially lead to inconclusive results.

DC: **Degradation Check** [Pass/Fail]
Analysis of the spiked DNA marker to see if there has been degradation of the kit or sample between the date it was made to the date of analysis. Degradation of the spiked DNA marker may lead indicate a risk of false negative results.

IC: **Inhibition Check** [Pass/Fail]
The presence of inhibitors within a sample are assessed using a DNA marker. If inhibition is detected, samples are purified and re-analysed. Inhibitors cannot always be removed, if the inhibition check fails, the sample should be re-collected.

Result: **Presence of GCN eDNA** [Positive/Negative/Inconclusive]
Positive: GCN DNA was identified within the sample, indicative of GCN presence within the sampling location at the time the sample was taken or within the recent past at the sampling location.
Positive Replicates: Number of positive qPCR replicates out of a series of 12. If one or more of these are found to be positive the pond is declared positive for GCN presence. It may be assumed that small fractions of positive analyses suggest low level presence, but this cannot currently be used for population studies. In accordance with Natural England protocol, even a score of 1/12 is declared positive. 0/12 indicates negative GCN presence.
Negative: GCN eDNA was not detected or is below the threshold detection level and the test result should be considered as evidence of GCN absence, however, does not exclude the potential for GCN presence below the limit of detection.

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Appendix 8.3 - Annex C HSI Results

SWECO

HSI Scores

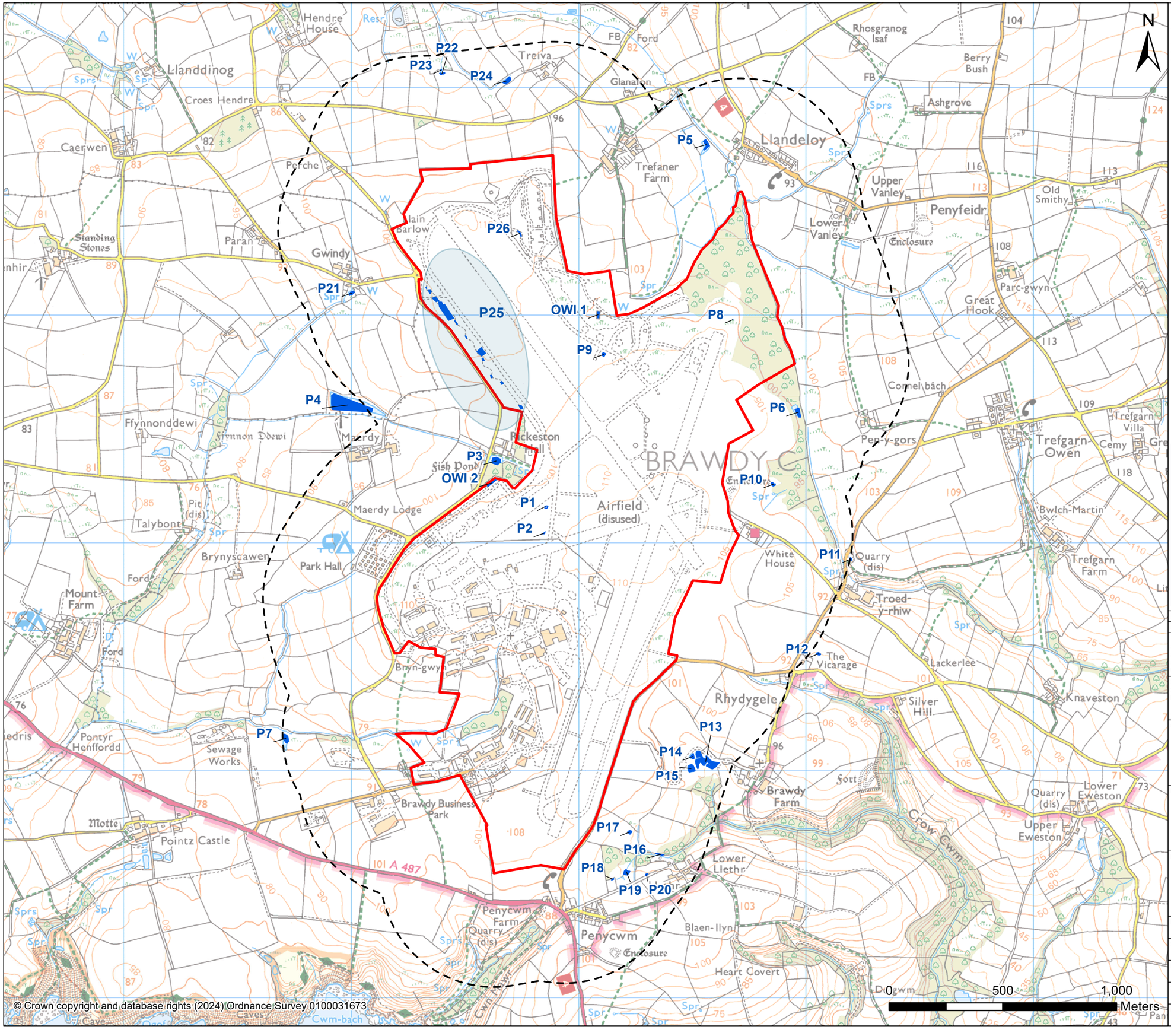
PROJECT NAME	PROJECT NUMBER
Project Darc - Cawdor	65208061

Suitability Index	Pond Reference													
	OWI 1	OWI 2	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
SI1 - Location	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	NO POND PRESENT
SI2 - Pond area	0.6	0.6	0.2	0.2	0.92	N/A	1	0.6	0.98	0.2	0.2	0.6	0.4	
SI3 - Pond Drying	0.9	0.9	1	0.5	0.5	0.9	0.5	1	0.9	0.1	1	0.5	0.9	
SI4 - Water quality	0.33	0.33	0.67	0.01	1	1	1	0.67	0.33	0.33	0.67	1	1	
SI4 - Shade	1	1	1	1	0.3	1	1	0.4	1	0.2	0.2	0.65	1	
SI6 - Fowl	1	1	0.67	1	0.67	0.67	0.67	1	0.67	1	1	1	0.67	
SI7 - Fish	1	1	1	1	1	0.33	1	0.67	0.67	1	1	1	1	
SI8 - Ponds	0.9	0.9	0.9	0.9	1	1	1	1	1	1	1	1	1	
SI9 - Terr'l Habitat	0.33	1	0.33	0.33	1	0.67	0.67	1	0.33	1	1	1	0.67	
SI10 - Macrophytes	0.3	0.3	0.3	0.3	0.5	0.4	0.5	1	0.4	0.9	0.7	0.85	0.9	
HSI	0.42	0.47	0.39	0.25	0.46	0.43	0.51	0.50	0.42	0.32	0.42	0.53	0.52	
Pond suitability	Poor	Poor	Poor	Poor	Poor	Poor	Below average	Below average	Poor	Poor	Poor	Below average	Below average	

Suitability Index	Pond Reference													
	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26
SI1 - Location	0.01	0.01	0.01	0.01	0.01	INACCESSIBLE	0.01	0.01	0.01	INACCESSIBLE	INACCESSIBLE	INACCESSIBLE	0.01	0.01
SI2 - Pond area	N/A	0.6	0.98	0.4	0.6		0.4	0.2	0.6				1	0.2
SI3 - Pond Drying	0.9	0.9	1	0.9	1		0.1	0.1	1				0.1	0.5
SI4 - Water quality	1	1	1	0.01	1		0.67	0.01	0.67				0.33	0.67
SI4 - Shade	1	1	0.2	0.2	1		1	0.2	0.2				1	1
SI6 - Fowl	0.67	0.67	0.67	1	1		1	1	1				0.67	1
SI7 - Fish	0.33	0.33	0.67	1	1		1	1	1				1	1
SI8 - Ponds	1	1	1	1	1		1	1	1				1	1
SI9 - Terr'l Habitat	1	1	1	1	1		0.67	1	1				1	1
SI10 - Macrophytes	0.6	0.5	0.6	0.3	0.8		1	0.3	0.9				0.3	0.35
HSI	0.47	0.48	0.47	0.27	0.59		0.42	0.20	0.49				0.38	0.43
Pond suitability	Poor	Poor	Poor	Poor	Below average		Poor	Poor	Poor				Poor	Poor

Ministry of Defence

Appendix 8.3 - Waterbodies within 500m



Rev	Date	Amendment Details	Dr'n	Chk'	App'
P01	04.03.2024	FIRST ISSUE	PK	EH	GL

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2nd Floor Quay 2, 139 Fountainbridge
Edinburgh, EH3 9QG
Tel: +44 (0)131 550 6300
www.sweco.co.uk

SWECO

Client

Ministry of Defence

Project Title

PROJECT DARC – CAWDOR

Drawing Title

WATERBODIES WITHIN 500M

Project Stage
STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:16,000	65208061-002	P01

Drawing Number
65208061-002-SWE-XX-XX-DR-GS-0004

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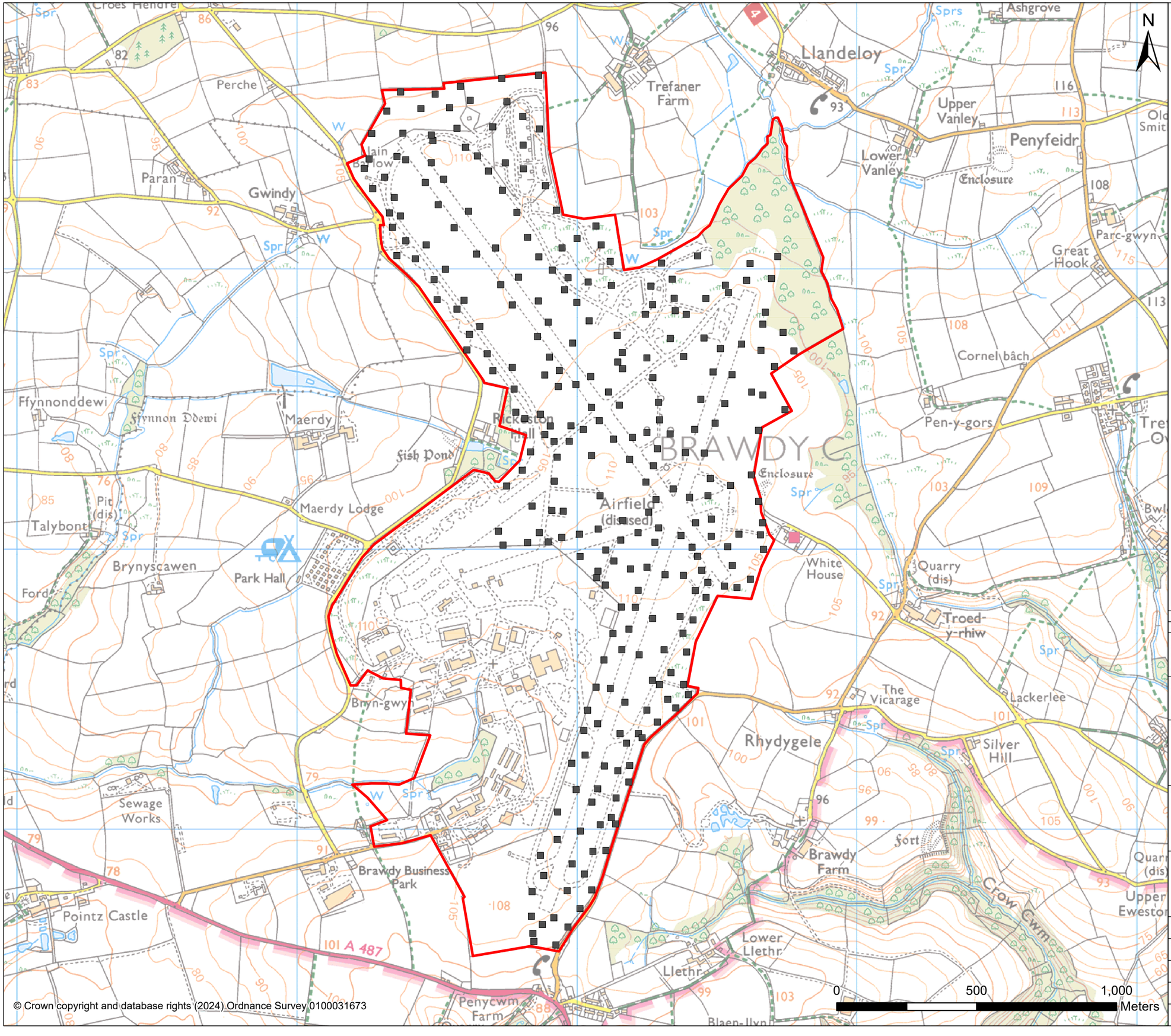
Appendix 8.4 - Annex A Reptile refuge locations



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REPTILE REFUGE LOCATIONS

Project Stage

STAGE 3

Status	Status Description
S2	FOR INFORMATION

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PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number

65208061-002-SWE-XX-XX-DR-GS-0005

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Appendix 8.4 - Annex B Reptile survey results 1

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (12/04/2023)

- Common Lizard (Zootoca vivipara)

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REPTILE SURVEY RESULTS 1

Project Stage	
STAGE 3	

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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number 65208061-002-SWE-XX-XX-DR-GS-0006

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Appendix 8.4 - Annex C Reptile survey results 2

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (19/04/2023)

- Adder (Vipera berus)
- Common Lizard (Zootoca vivipara)

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REPTILE SURVEY RESULTS 2

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0007

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Appendix 8.4 - Annex D Reptile survey results 3

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (25/04/2023)

- Common Lizard (Zootoca vivipara)
- Grass Snake (Natrix helvetica)

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Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0008

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Appendix 8.4 - Annex E Reptile survey results 4

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (04/05/2023)

- Common Lizard (Zootoca vivipara)
- Common Toad (Bufo bufo)
- Grass Snake (Natrix helvetica)

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Drawing Title

REPTILE SURVEY RESULTS 4

Project Stage			
STAGE 3			
Status: S2	Status Description: FOR INFORMATION		
Drawn: PK	Designed: LH	Checked: EH	Approved: GL
Sheet Size: A3	Scale: 1:13,000	Sweco Ref: 65208061-002	Revision: P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0009

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Appendix 8.4 - Annex F Reptile survey results 5

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (11/05/2023)

- Adder (Vipera berus)
- Common Lizard (Zootoca vivipara)
- Common Toad (Bufo bufo)
- Grass Snake (Natrix helvetica)

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REPTILE SURVEY RESULTS 5

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0010

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Appendix 8.4 - Annex G Reptile survey results 6

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (17/05/2023)

- Adder (Vipera berus)
- Common Lizard (Zootoca vivipara)
- Grass Snake (Natrix helvetica)

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REPTILE SURVEY RESULTS 6

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	LH	EH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0011

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Appendix 8.4 - Annex H Reptile survey results 7

N

Legend

- Site boundary
- Reptile mat location

Reptile Survey Result (11/07/2023)

- Adder (Vipera berus)
- Common Lizard (Zootoca vivipara)
- Grass Snake (Natrix helvetica)
- Slow worm (Anguis fragilis)

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REPTILE SURVEY RESULTS 7

Project Stage
STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number 65208061-002-SWE-XX-XX-DR-GS-00012

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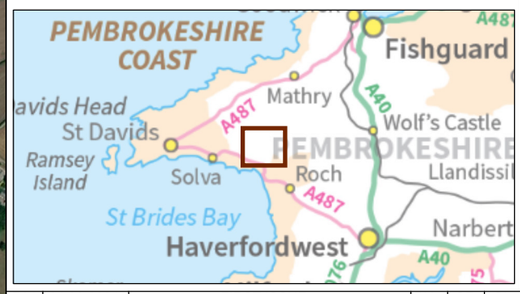
Appendix 8.5 - Annex A Wintering bird survey transect route

Legend

- Site boundary
- Transect route



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PROJECT DARC – CAWDOR

Drawing Title

WINTERING BIRD SURVEY TRANSECT ROUTE

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	EH	CF	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0013

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Appendix 8.5 - Annex B Wintering bird survey 1

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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WINTERING BIRD SURVEY 1

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0014

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Appendix 8.5 - Annex C Wintering bird survey 2

Legend

- Site boundary

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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WINTERING BIRD SURVEY 2

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0015

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Appendix 8.5 - Annex D Wintering bird survey 3

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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BREEDING BIRD SURVEY 3

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	EH	CF	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0021

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Appendix 8.5 - Annex E Wintering bird survey 4

Legend

- Site boundary

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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WINTERING BIRD SURVEY 4

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STAGE 3			
Status: S2	Status Description: FOR INFORMATION		
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Sheet Size: A3	Scale: 1:13,000	Sweco Ref: 65208061-002	Revision: P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0017

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Appendix 8.6 - Annex B Breeding bird survey 1

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4
- Schedule 1

Rev	Date	Amendment Details	Dr'n	Chk'	App'
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Status	Status Description
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

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Appendix 8.6 - Annex C Breeding bird survey 2

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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BREEDING BIRD SURVEY 2

Project Stage: STAGE 3

Status	Status Description
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

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Appendix 8.6 - Annex D Breeding bird survey 3

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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BREEDING BIRD SURVEY 3

Project Stage: STAGE 3

Status	Status Description
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Drawn	Designed	Checked	Approved
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0021

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Appendix 8.6 - Annex E Breeding bird survey 4

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

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Sheet Size: A3	Scale: 1:13,000	Sweco Ref: 65208061-002	Revision: P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0022

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Appendix 8.6 - Annex F Breeding bird survey 5

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4

Rev	Date	Amendment Details	Dr'n	Chk'	App'
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BREEDING BIRD SURVEY 5

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	EH	CF	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0023

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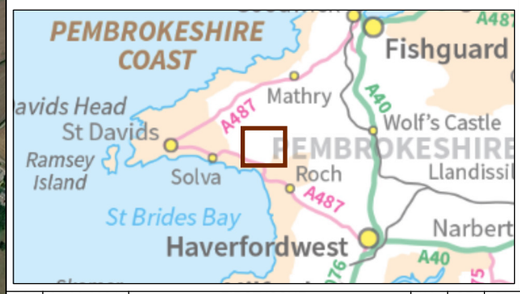
Appendix 8.6 - Annex G Breeding bird survey 6

Legend

- Site boundary
- Direction of travel

Bird Survey Results

- Red BOCC Wales 4
- Amber BOCC Wales 4



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BREEDING BIRD SURVEY 6

Project Stage

STAGE 3

Status	Status Description
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PK	EH	CF	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number 65208061-002-SWE-XX-XX-DR-GS-0024

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Appendix 8.6 - Annex H Cawdor breeding bird survey results table

Site Name: Project DARC - Cawdor Barracks
Project No: 65208061
Survey: Breeding Bird Surveys
Date of Survey: From 22/03/2023 to 13/06/2023
Surveyor(s): Sophie Barrell and Joshua Stafford

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BTO code	Common name	Scientific name	BOCC	Sch 1	EWA 2016	BD Annex 1	Conservation Status within Pembrokeshire	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Breeding codes	Breeding Status within survey area
B.	Blackbird	*Turdus merula*					Breeding resident, passage migrant and winter visitor	11	9	9	12	10	11	P, T	Probable breeding
BC	Blackcap	*Sylvia atricapilla*					Breeding summer visitor, passage migrant and winter visitor				3		1	T	Probable breeding
BT	Blue Tit	*Cyanistes caeruleus*					Breeding resident		1				2	FL	Confirmed breeding
BW	Black-tailed Godwit	*Limosa limosa*	Amber	Yes	Yes		Winter visitor and passage migrant		6					F	Non-breeding
BZ	Buzzard	*Buteo buteo*					Breeding resident	2			2		1	P	Probable breeding off site
C.	Carrion Crow	*Corvus corone*					Breeding resident	43	19	41	17	3	5	H	Possible breeding off site
CC	Chiffchaff	*Phylloscopus collybita*					Breeding summer visitor, passage migrant and winter visitor		5	8	3	4	2	P, T	Probable breeding
CD	Collared Dove	*Streptopelia decaocto*					Breeding resident				2		1	H	Possible breeding
CG	Canada Goose	*Branta canadensis*					Breeding resident			2				F	Non-breeding
CH	Chaffinch	*Fringilla coelebs*	Amber				Breeding resident and passage migrant	4	1	2	1	2		P, T	Probable breeding
CU	Curlew	*Numenius arquata*	Red		Yes		Breeding resident, winter visitor and passage migrant		1	6				M	Non-breeding
D.	Dunnock	*Prunella modularis*	Amber		Yes		Breeding resident	10	2	1	5		7	FL, P, T	Confirmed breeding
FP	Feral pigeon	*Columba livia domestica*					Breeding resident						4	F	Non-breeding
GH	Grasshopper Warbler	*Locustella naevia*	Red		Yes		Breeding summer visitor and passage migrant			10	3	1	5	T, N	Probable breeding
GO	Goldfinch	*Carduelis carduelis*					Breeding resident and passage migrant			7	7			H	Possible breeding
GP	Golden Plover	*Pluvialis apricaria*	Red				Winter visitor and passage migrant	2724		1				M	Non-breeding
GR	Greenfinch	*Chloris chloris*	Red				Breeding resident and passage migrant	1						F	Non-breeding
GT	Great Tit	*Parus major*					Breeding resident	1		1	3	1	1	FL	Confirmed breeding
GW	Garden Warbler	*Sylvia borin*	Amber				Breeding summer visitor and passage migrant				2	4		T	Probable breeding
HG	Herring Gull	*Larus argentatus*	Red		Yes		Breeding resident and winter visitor	2	4	1			3	F	Non-breeding
HM	House Martin	*Delichon urbicum*	Amber				Breeding summer visitor and passage migrant			1	1			B	Probable breeding off site
HS	House Sparrow	*Passer domesticus*	Amber		Yes		Breeding resident						20	P	Probable breeding
J.	Jay	*Garrulus glandarius*					Breeding resident						1	F	Non-breeding
JD	Jackdaw	*Coloeus monedula*					Breeding resident	21	23	6	11	1	6	FL	Confirmed breeding
K.	Kestrel	*Falco tinnunculus*	Red				Breeding resident	1	1					S	Possible breeding off site
KT	Red Kite	*Milvus milvus*		Yes			Breeding resident, increasing	2						F	Non-breeding
L.	Lapwing	*Vanellus vanellus*	Red		Yes		Breeding resident and winter visitor						3	U	Non-breeding
LB	Lesser Black-backed Gull	*Larus fuscus*	Red				Breeding summer visitor, passage migrant, and winter visitor	14	1				1	F	Non-breeding

Site Name: Project DARC - Cawdor Barracks
Project No: 65208061
Survey: Breeding Bird Surveys
Date of Survey: From 22/03/2023 to 13/06/2023
Surveyor(s): Sophie Barrell and Joshua Stafford

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BTO code	Common name	Scientific name	BOCC	Sch 1	EWA 2016	BD Annex 1	Conservation Status within Pembrokeshire	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Breeding codes	Breeding Status within survey area
LI	Linnet	*Linaria cannabina*	Red		Yes		Breeding resident and passage migrant	4	5	52	27	54	48	FF, FL	Confirmed breeding
LW	Lesser Whitethroat	*Sylvia curruca*					Breeding summer visitor and passage migrant			1	2			T	Probable breeding
MA	Mallard	*Anas platyrhynchos*					Common winter visitor, passage migrant and breeder	2						F	Non-breeding
MG	Magpie	*Pica pica*	Amber				Breeding resident	5	5	3	4	5	4	T	Probable breeding
MP	Meadow Pipit	*Anthus pratensis*	Red				Breeding resident and passage migrant	45	17			10	13	T, FF	Confirmed breeding
M.	Mistle Thrush	*Turdus viscivorus*	Amber				Breeding resident		1	1				T	Probable breeding
PE	Peregrine	*Falco peregrinus*		Yes			Breeding resident	1						F	Non-breeding
PH	Pheasant	*Phasianus colchicus*					Breeding resident	6	2	1	3	2	4	FL	Confirmed breeding
PW	Pied Wagtail	*Motacilla alba*					Breeding resident and passage migrant	2	2	1				H	Possible breeding
R.	Robin	*Erithacus rubecula*					Breeding resident	4	9	9	9	5	1	P, T	Probable breeding
RB	Reed Bunting	*Emberiza schoeniclus*			Yes		Breeding resident	1	1					H	Possible breeding
RO	Rook	*Corvus frugilegus*	Red				Breeding resident	57	52	10			2	ON	Confirmed breeding off site
RW	Reed Warbler	*Acrocephalus scirpaceus*					Breeding summer visitor and passage migrant					1		H	Possible breeding
S.	Skylark	*Alauda arvensis*	Amber		Yes		Breeding resident and passage migrant	58	32	53	65	38	41	T, ON	Confirmed breeding
SC	Stonechat	*Saxicola rubicola*					Breeding resident	14	18	21	36	21	8	S, FL, FF	Confirmed breeding
SD	Stock Dove	*Columba oenas*					Breeding resident		1		1	1	3	H	Possible breeding
SG	Starling	*Sturnus vulgaris*	Red		Yes		Breeding resident, winter visitor and passage migrant	1	3		8		21	P, T	Probable breeding off site
SH	Sparrowhawk	*Accipiter nisus*					Breeding resident	1	1					F	Non-breeding
SI	Swift	*Apus apus*	Red				Breeding summer visitor and passage migrant			2				F	Non-breeding
SL	Swallow	*Hirundo rustica*					Breeding summer visitor and passage migrant						14	F	Non-breeding
SM	Sand Martin	*Riparia riparia*					Breeding summer visitor and passage migrant	1						F	Non-breeding
ST	Song Thrush	*Turdus philomelos*			Yes		Breeding resident, passage migrant and winter visitor		1	1				T	Probable breeding
SW	Sedge Warbler	*Acrocephalus schoenobaenus*					Breeding summer visitor and passage migrant		2		6	1	11	FL, FF	Confirmed breeding
W.	Wheatear	*Oenanthe oenanthe*	Amber				Breeding summer visitor and passage migrant	15	2	2	1	1	1	T	Probable breeding
WH	Whitethroat	*Sylvia communis*	Red				Breeding summer visitor and passage migrant		3	17	24	23	13	FL	Confirmed breeding
WP	Woodpigeon	*Columba palumbus*					Breeding resident	8	33	26	12	5		P, T	Probable breeding
WR	Wren	*Troglodytes troglodytes*					Breeding resident	6	1	2	7	3	7	FL	Confirmed breeding
WW	Willow Warbler	*Phylloscopus trochilus*	Red				Breeding summer visitor and passage migrant		3	8	1	4		P, T	Probable breeding
Y.	Yellowhammer	*Emberiza citrinella*	Red		Yes		Breeding resident			1	2			H, S	Possible breeding
YW	Yellow Wagtail	*Motacilla flava*	Red		Yes		Passage migrant, has bred			1				H	Possible breeding

Common and scientific names in this list were sourced from BOU British List 9th Report (2017)
Sch 1 - Wildlife and Countryside Act 1981 (as amended) Schedule 1.
EWA 2016 - Environment (Wales) Act 2016 Section 7
BD Annex 1 - European Birds Directive, Annex 1.
BoCC Red - Birds of Conservation Concern Wales 4 - Red listed.
BoCC Amber - Birds of Conservation Concern Wales 4 - Amber listed .

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Appendix 8.6 - Annex I BTO breeding status codes

Breeding Status Codes

Non-breeding	
F	**F**lying over
M	Species observed but suspected to be still on **M**igration
U	Species observed but suspected to be s**U**mmering non-breeder
Possible breeder	
H	Species observed in breeding season in suitable nesting **H**abitat
S	**S**inging male present (or breeding calls heard) in breeding season in suitable breeding habitat
Probable breeding	
P	**P**air observed in suitable nesting habitat in breeding season
T	Permanent **T**erritory presumed through registration of territorial behaviour (song etc) on at least two different days a week or more part at the same place or many individuals on one day
D	Courtship and **D**isplay (judged to be in or near potential breeding habitat; be cautious with wildfowl)
N	Visiting probable **N**est site
A	**A**gitated behaviour or anxiety calls from adults, suggesting probable presence of nest or young nearby
I	Brood patch on adult examined in the hand, suggesting **I**ncubation
B	Nest **B**uilding or excavating nest-hole
Confirmed breeding	
DD	**D**istraction-**D**isplay or injury feigning
UN	**U**sed **N**est or eggshells found (occupied or laid within period of survey)
FL	Recently **FL**edged young (nidicolous species) or downy young (nidifugous species). Careful consideration should be given to the likely provenance of any fledged juvenile capable of significant geographical movement. Evidence of dependency on adults (e.g. feeding) is helpful. Be cautious, even if the record comes from suitable habitat.
ON	Adults entering or leaving nest-site in circumstances indicating **O**ccupied **N**est (including high nests or nest holes, the contents of which can not be seem) or adults seen incubating
FF	Adult carrying **F**aecal sac or **F**ood for young
NE	**N**est containing **E**ggs
NY	**N**est with **Y**oung seen or heard

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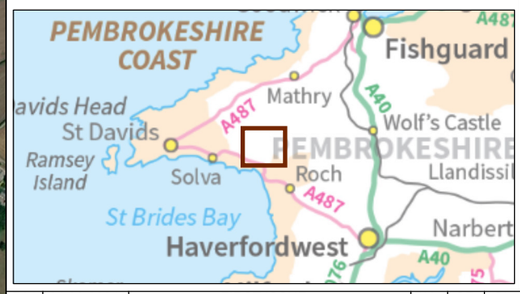
Appendix 8.6 & 8.7 - Annex A Breeding bird survey transect route

Legend

- Site boundary
- Transect route



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BREEDING BIRD SURVEY TRANSECT ROUTE

Project Stage: STAGE 3

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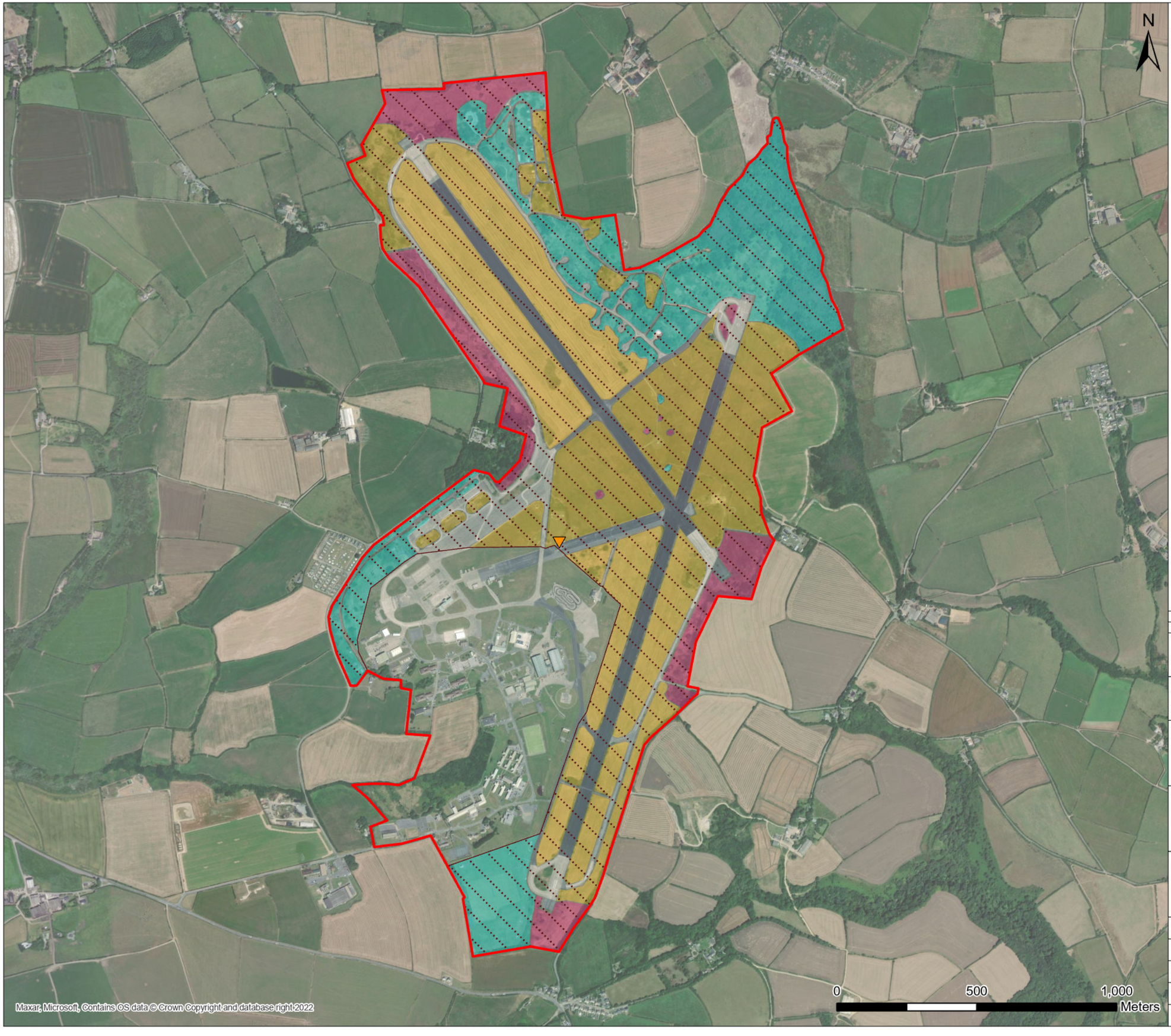
Appendix 8.8 - Annex A Barn Owl Survey Results

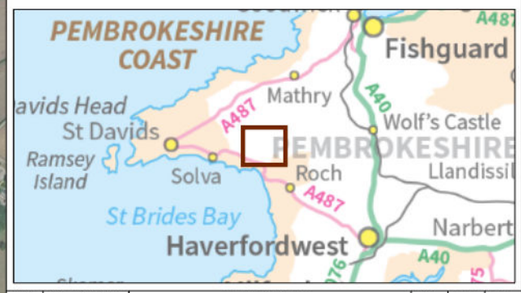


Legend

- Site boundary
- Survey Area
- Barn Owl Temporary Roost Site (TRS) (barn owl pellet found)

Habitat Type

- Type 1: Optimal
- Type 2: Sub-Optimal
- Type 3: Poor



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Drawing Title

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STAGE 3

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Appendix 8.9 - Annex A Remote Monitoring Weather Conditions

Remote Monitoring Weather Conditions

Some static detectors did not always record for the entire good weather period, and therefore in these instances, sub-optimal weather days were analysed. Details provided within tables below.

***Table 1.** Bat Remote Monitoring Conditions (Best 5 Nights) – April 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
25 April	7	6	0	0	48%	45%	3	4
26 April	11	10	0	0	93%	100%	5	3
27 April	11	11	0.4	0	100%	45%	5	5
28 April	12	10	0	0	89%	32%	4	3
29 April	11	11	0	0	23%	83%	3	4
Alternative date for statics 0619 and 0625 that did not record past 28 April								
24 April	8	4	0.3	0	100	8	5	3

***Table 2.** Bat Remote Monitoring Conditions (Best 5 Nights) – May 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
16 May	10	10	0	0	4%	23%	3	2
17 May	13	11	0	0	86%	31%	3	3
18 May	12	11	0	0	51%	70%	2	4
19 May	12	10	0	0	49%	31%	5	3
20 May	12	11	0	0	27%	14%	3	3

***Table 3.** Bat Remote Monitoring Conditions (Best 5 Nights) – June 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
20 June	14	15	0	0	51%	49%	3	4
21 June	15	15	0	0	49%	29%	4	3
22 June	15	15	0	0	4%	18%	2	1
23 June	15	16	0	0.1	33%	68%	3	4
24 June	17	17	0	0	85%	99%	5	4
Alternative dates for static 0619 that only recorded for a total of two days								
15 June	15	16	0	0	27%	11%	1	4
16 June	15	16	0	0	24%	17%	2	2

***Table 4.** Bat Remote Monitoring Conditions (Best 5 Nights) – July 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
18 July	15	14	0.1	0	69%	20%	5	4
19 July	15	14	0.1	0.1	89%	89%	4	4
20 July	14	13	0	0.1	38%	83%	2	4
21 July	16	15	0.1	0	72%	100%	5	7
22 July	16	15	0.5	0	100%	100%	6	5
Alternative dates for statics that did not record the above monitoring period								
13 July[1]	16	15	0	0.8	0%	100%	4	7
14 July[2]	15	14	0.1	1.9	80%	71%	7	8
15 July[3]	15	14	0.1	0.6	78%	67%	9	7
16 July[4]	15	13	0.9	0.2	72%	78%	6	4
17 July[5]	15	14	0.1	1.7	48%	100%	4	5

***Table 5.** Bat Remote Monitoring Conditions (Best 5 Nights) – August 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
22 August	16	16	0	0.7	63%	77%	4	3
23 August	17	6	0	0	76%	48%	3	3
24 August	17	15	0	0	85%	79%	3	4
25 August	16	14	0.6	0	55%	73%	4	5
26 August	16	15	0	0.4	18%	94%	2	4
Alternative dates for statics that did not record the above monitoring period								
17 August[6]	19	16	0	0	83%	100%	3	4
18 August[7]	17	17	1.4	0	100%	68%	6	6
19 August[8]	17	17	0.1	0.1	71%	71%	4	4
20 August[9]	17	17	0	0	34%	80%	4	5
21 August[10]	17	16	0.2	0	73%	45%	5	4

[1] Statics 0431, 0432 used this date
[2] Statics 0429, 0431, 0432 used this date
[3] Statics 0429, 0431, 0432, 0433 used this date
[4] Statics 0429, 0432, 0433, 0581 used this date
[5] Statics 0426, 0427, 0428, 0429, 0433, 0581 used this date
[6] Statics 0426, 0427, 0428, 0431, 0432, 0622 used this date
[7] Statics 0426, 0427, 0428, 0431, 0432, 0622 used this date
[8] Statics 0426, 0427, 0428, 0432, 0622 used this date
[9] Statics 0426, 0427, 0428, 0432, 0622 used this date
[10] Statics 0426, 0428, 0432, 0622 used this date

***Table 6.** Bat Remote Monitoring Conditions (Best 5 Nights) – September 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
26 September	15	14	0	0	12%	39%	5	6
27 September	15	14	0.1	0	100%	44%	8	5
28 September	14	13	0.9	0	100%	9%	5	4
29 September	14	15	0	0	5%	49%	3	4
30 September	15	16	0	0	100%	100%	6	3
Alternative dates for statics that did not record the above monitoring period								
22 September[11]	13	10	0.1	0	73%	34%	5	3
23 September[12]	15	16	0	1.9	100%	100%	6	6
24 September[13]	16	15	3.9	0	100%	37%	7	6
25 September[14]	15	16	0	1.6	81%	100%	5	6

***Table 7.** Bat Remote Monitoring Conditions (Best 5 Nights) – October 2023*

Date (2023)	Temp (°C) Start	Temp (°C) End	Rain (mm) Start	Rain (mm) End	Cloud Cover Start	Cloud Cover End	Wind (Beaufort) Start	Wind (Beaufort) End
13 October	12	10	0.1	0	57%	86%	32	27
14 October	10	10	0.1	0	83%	89%	27	14
15 October	10	8	0	0	28%	95%	14	21
16 October	11	11	0	0	51%	68%	30	39
17 October	13	14	0.1	0.1	100%	81%	42	41
Alternative dates for statics that did not record the above monitoring period								
12 October[15]	14	16	0	0.3	100%	100%	13	41

[11] 0426, 0428, 0431 used this date
[12] 0426, 0428, 0431 used this date
[13] 0426, 0428 used this date
[14] 0428, 0581, 0619, 0625 used this date
[15] 0426, 0428, 0431

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Appendix 8.9 - Annex B Remote Monitoring Results

Remote Monitoring Results

***Table 1.** Bat Remote Monitoring Results – April 2023 Monitoring Period*

Species	Static Number											
	0426	**0427**	**0428**	**0429**	**0431**	**0432**	**0433**	**0581**	**0618**	**0619**	**0622**	**0625**
Noctule	46	69	208		355	191	212	61	268	42	133	29
Nyctalus sp.							1			1		
Common Pipistrelle	3	3	2		6		1	4	1			1
Soprano Pipistrelle	3	11	5		5	2	1	1	4		2	
Nathusius' Pipistrelle		1										
Myotis sp.		1	2					7	6		1	3
Brown Long-eared		1										
Greater horseshoe			15					6				47

***Table 2.** Bat Remote Monitoring Results – May 2023 Monitoring Period*

Species	Static Number											
	0426	**0427**	**0428**	**0429**	**0431**	**0432**	**0433**	**0581**	**0618**	**0619**	**0622**	**0625**
Noctule	81	217	439	156	192	251	71	175	816	1	5	144
Nyctalus sp.							10	2				8
Common pipistrelle social call			1		2							
Soprano pipistrelle social call					1							
Common Pipistrelle	31	20	60	92	44	15	16	75	9			18
Soprano Pipistrelle	16	33	17	46	150	2	9	24	8			15
Nathusius' Pipistrelle	1		1			2	1	1				2
Pipistrellus species							2	1				
Myotis sp.	1	15	2	5		9	2	1	3		1	1
Brown Long-eared		1	2	2		2	12		9			
Greater horseshoe	2		2	6	1	1	1					

Table 3. Bat Remote Monitoring Results – June 2023 Monitoring Period

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Noctule	3	114	154	82	265	1716	139	30		18		143
Leisler's					7				1			
Nyctalus sp.						30			339	41		4
Common pipistrelle social call									1	2		
Common Pipistrelle	98	45	72	153	250	390	329	593	89	265		42
Soprano Pipistrelle	388	427	77	213	230	458	127	380	213	473		19
Nathusius' Pipistrelle	1		1		3	56		7				4
Pipistrellus species					267	6						
Myotis sp.	1	79	16	52	13	86	6	13	51	1		1
Daubenton's				31	2							
Brown Long-eared			1	1						3		
Greater horseshoe		6	13	15				7	1			5

Table 4. Bat Remote Monitoring Results – July 2023 Monitoring Period

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Noctule		94	245	225	14	47		4	245			164
Leisler's		1							3			
Nyctalus sp.		313	1									
Serotine									2			1
Common Pipistrelle	8	54	98	9	4	1		87	45			102
Soprano Pipistrelle	51	327	116	22	1	2		239	74			54
Nathusius' Pipistrelle		13										
Pipistrellus species			1					17	2			4
Myotis sp.		172	13	4		3		1	5			11
Natterer's		2										
Daubenton's				3								1
Brown Long-eared			2	2								

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Greater horseshoe		4	17	2				4	3			2
Barbastelle				1								

***Table 5.** Bat Remote Monitoring Results – August 2023 Monitoring Period*

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Noctule	17	62	141		4	16				3		
Pipistrelle social call		5										
Common Pipistrelle	23	23	15	1	7	12		2	14	19		
Soprano Pipistrelle	88	105	84	23	29	46		24	39	180		
Nathusius' Pipistrelle	3		8		2	2						
Myotis sp.	15	4	2		1				1	1		
Daubenton's	1											
Brown Long-eared						1						

Table 6. Bat Remote Monitoring Results – September 2023 Monitoring Period

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Noctule	1	20				1	3	1				2
Leisler's												1
Nyctalus sp.												3
Serotine												1
Common Pipistrelle	2	3	2	1	1	1	3	2				7
Soprano Pipistrelle	6	16	2	6	2	2	1	7		4		11
Nathusius' Pipistrelle			1									
Pipistrellus species			1									
Myotis sp.	1	9		1	1		1					
Barbastelle		2	1									
Brown Long-eared					1			1				
Lesser horseshoe	1											

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Greater horseshoe		1										1

Table 7. *Bat Remote Monitoring Results – October 2023 Monitoring Period*

Species	Static Number											
	0426	0427	0428	0429	0431	0432	0433	0581	0618	0619	0622	0625
Leisler's					1							
Serotine							1					
Common Pipistrelle				1	1	2						
Soprano Pipistrelle		3		3		1	1					
Myotis sp.				2			1					

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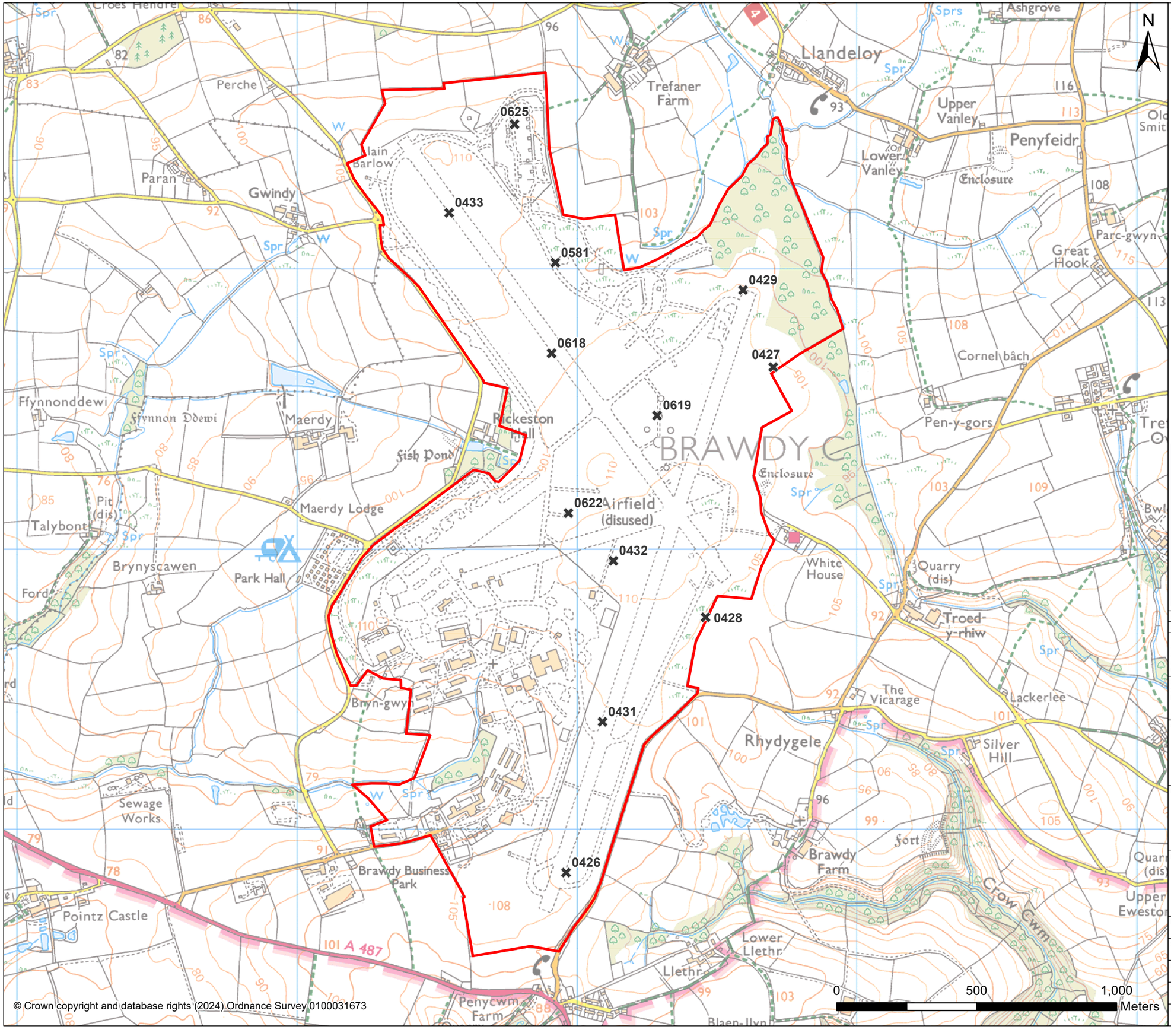
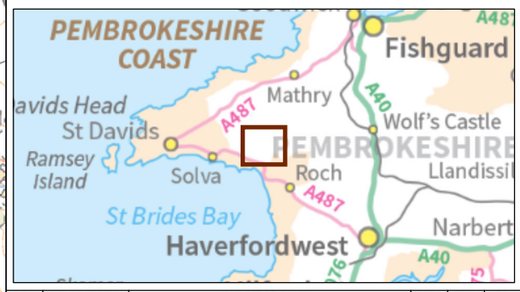
Appendix 8.9 - Annex C Static Locations



Legend

- Site boundary
- Static location



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Drawing Title

STATIC LOCATION

Project Stage

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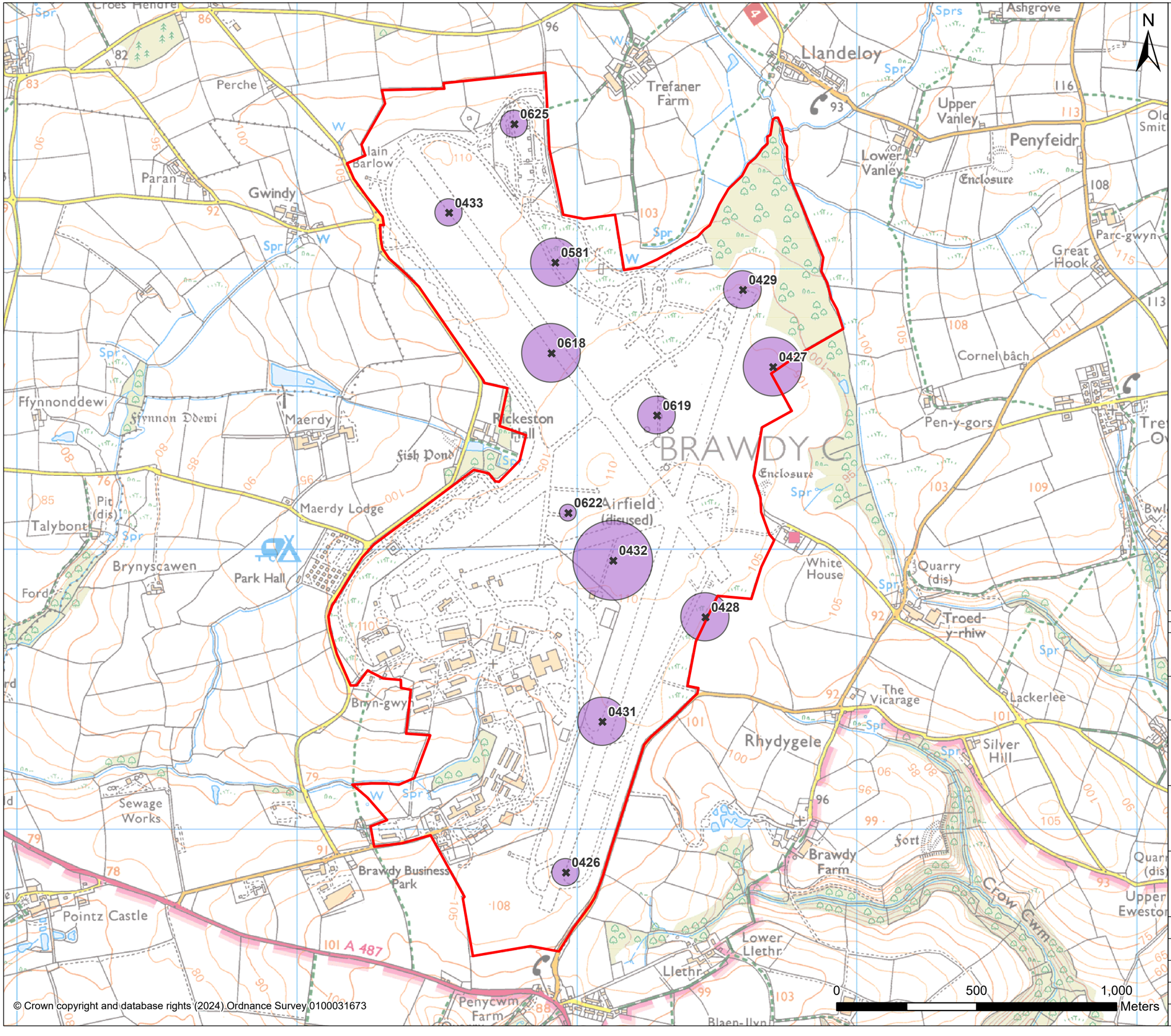
Appendix 8.9 - Annex D All species bat map



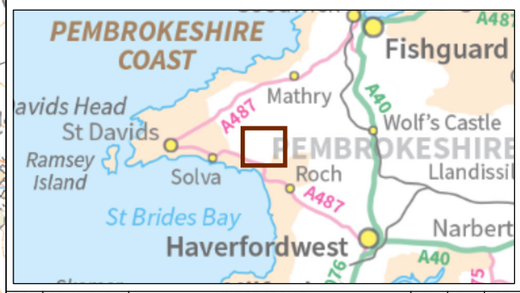
Legend

- Site boundary
- Static location

All bat species across entire survey period

Total number:

- ≤ 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000
- 2001 - 2500
- ≥ 2501



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Drawing Title

ALL SPECIES BAT MAP

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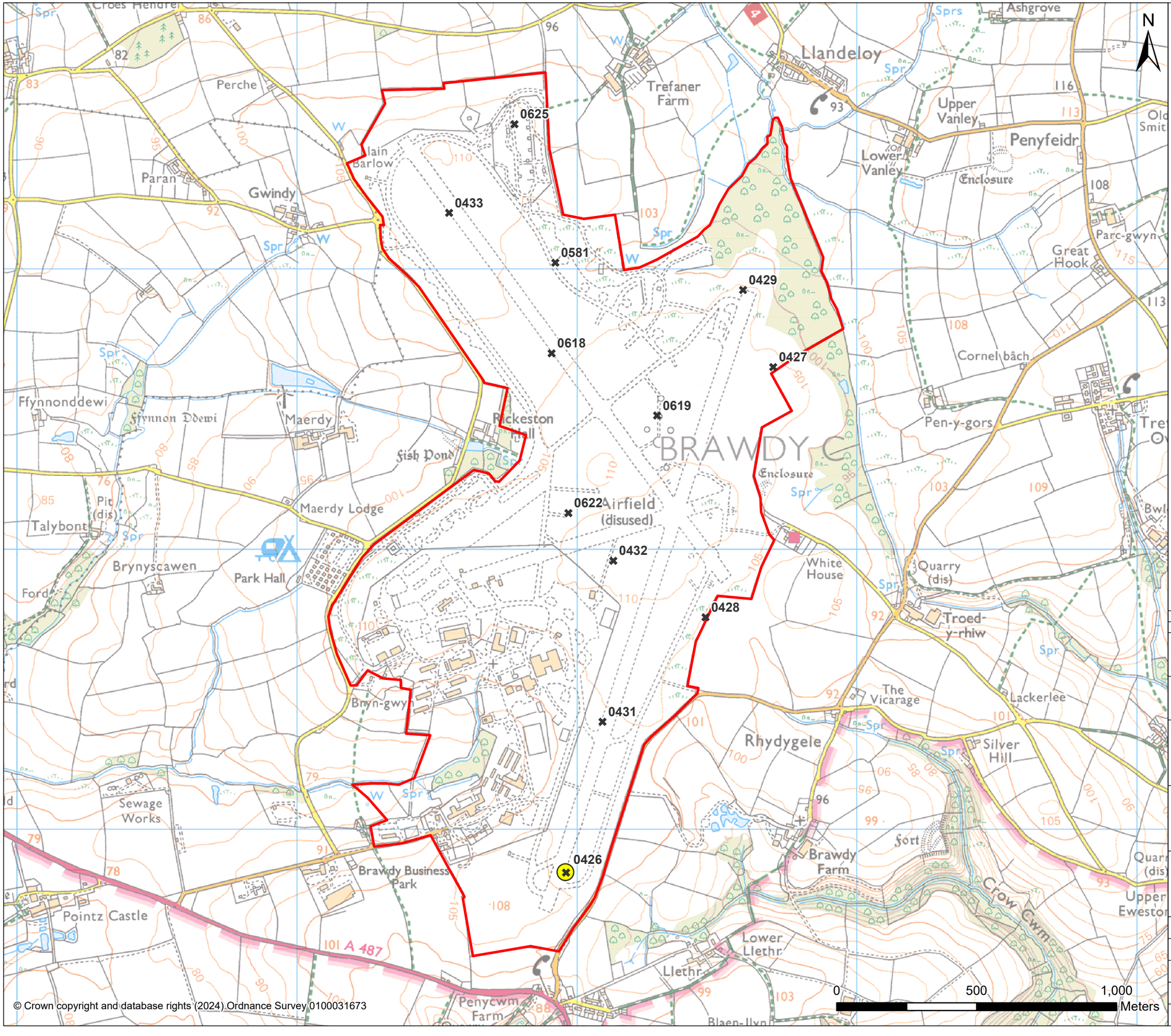
Appendix 8.9 - Annex E Lesser Horseshoe Map

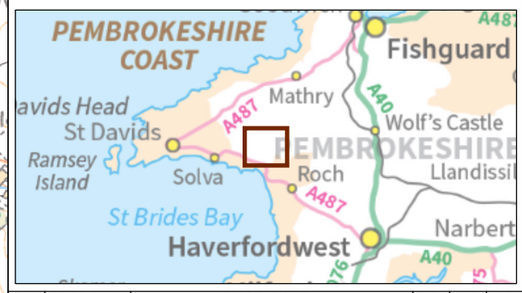


Legend

- Site boundary
- Static location

Lesser horseshoe bat – entire survey period

- Total number: 1



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LESSER HORSESHOE MAP

Project Stage

STAGE 3

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PK	EH	LH	GL

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A3	1:13,000	65208061-002	P01

Drawing Number 65208061-002-SWE-XX-XX-DR-GS-0028

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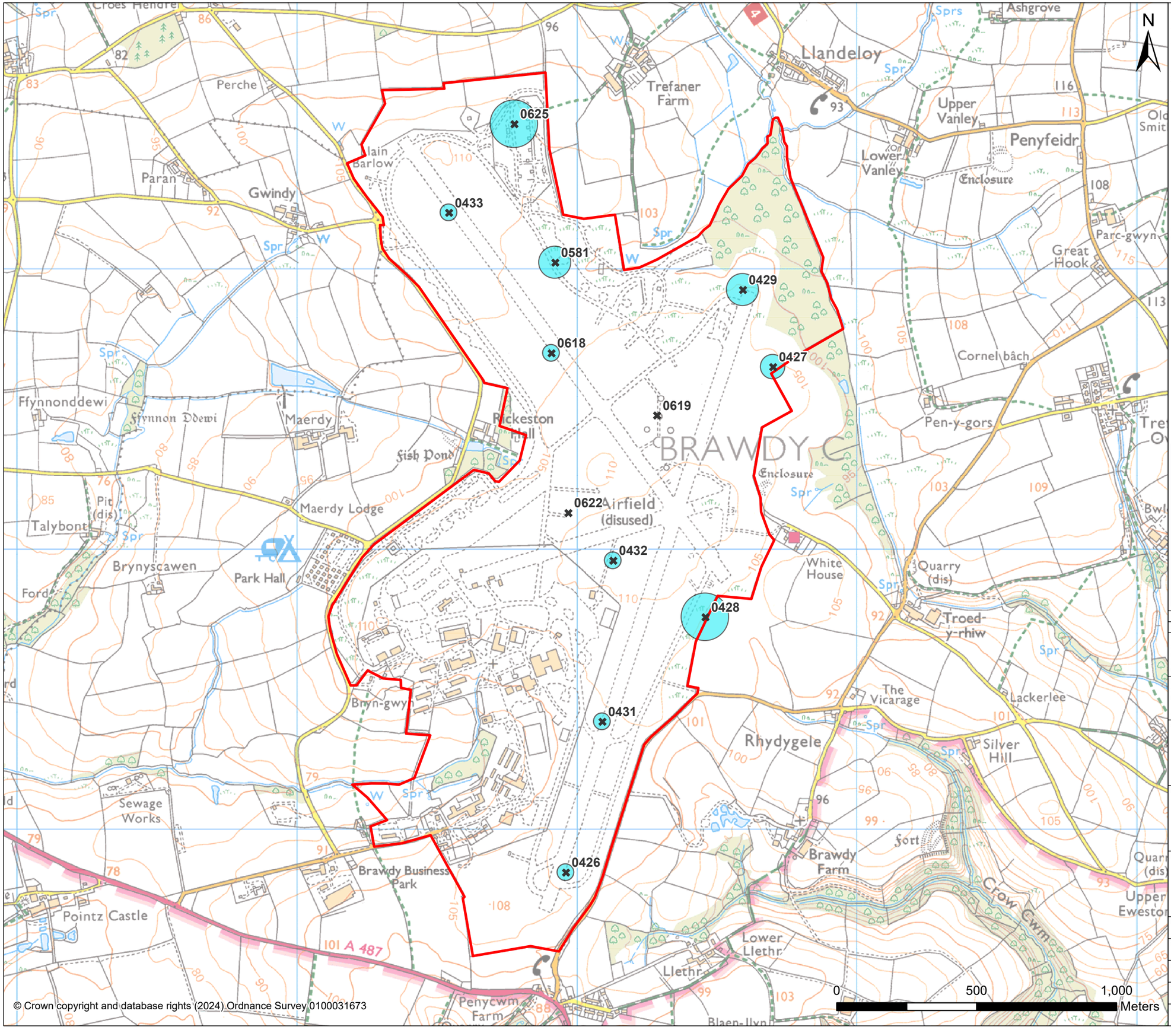
Appendix 8.9 - Annex F Greater Horseshoe Map



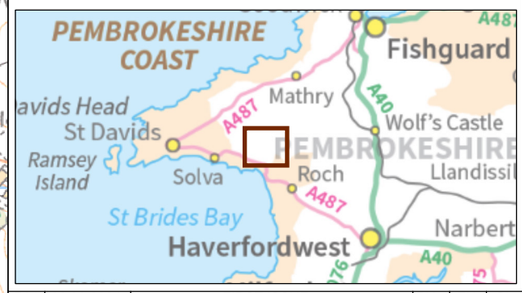
Legend

- Site boundary
- Static location

Greater horseshoe bat – entire survey period

Total number:

- 1 - 4
- 5 - 11
- 12 - 23
- 24 - 55



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GREATER HORSESHOE MAP

Project Stage

STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	EH	LH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number

65208061-002-SWE-XX-XX-DR-GS-0029

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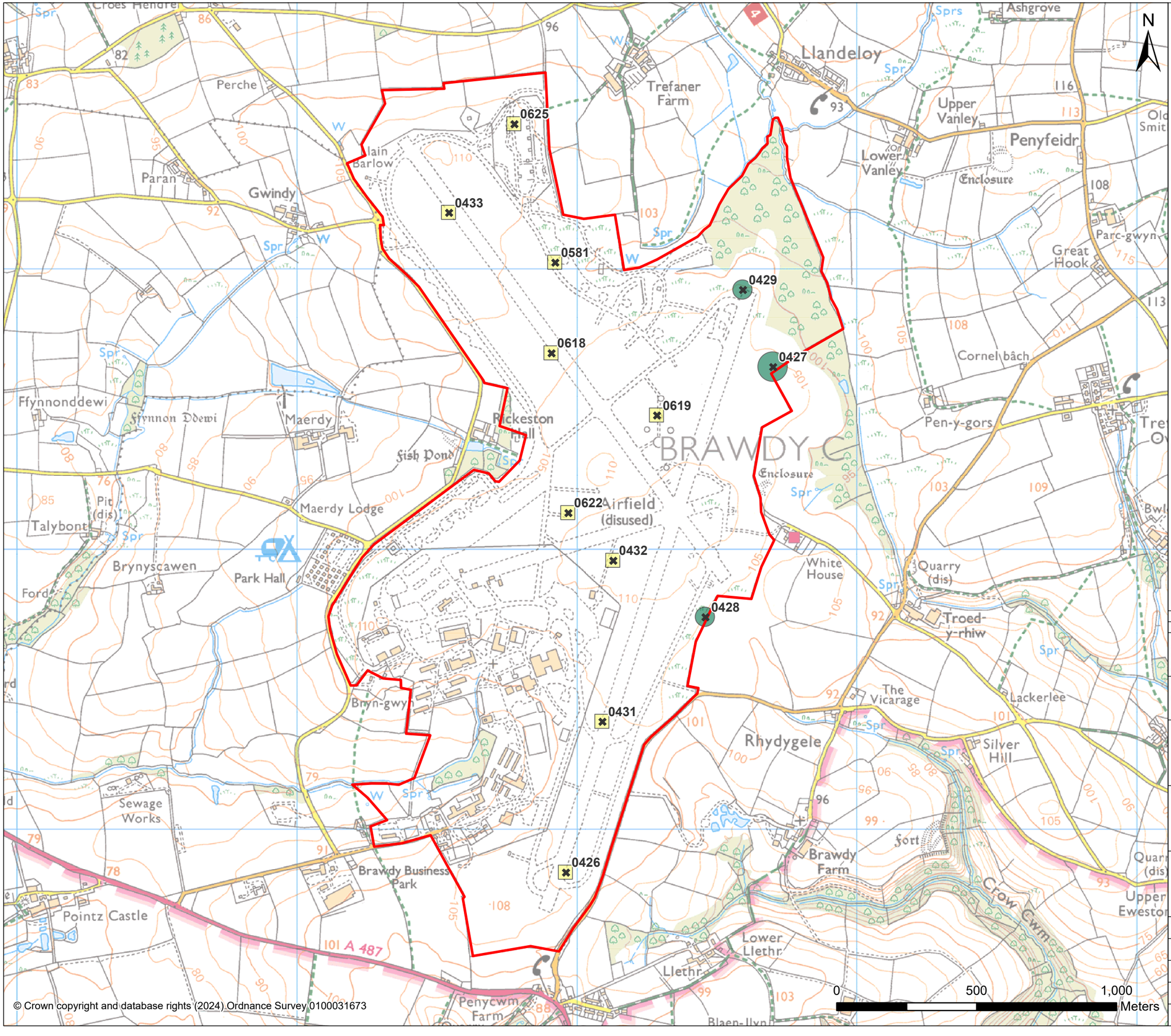
Appendix 8.9 - Annex G Barbastelle Map



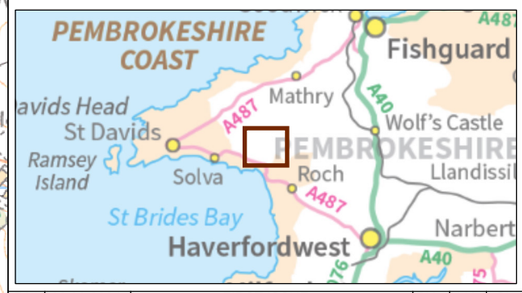
Legend

- Site boundary
- Static location

Barbastelle bat – entire survey period

Total number:

- 0
- 1
- 2



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BARBASTELLE MAP

Project Stage

STAGE 3

Status	Status Description
S2	FOR INFORMATION

Drawn	Designed	Checked	Approved
PK	EH	LH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

Drawing Number

65208061-002-SWE-XX-XX-DR-GS-0030

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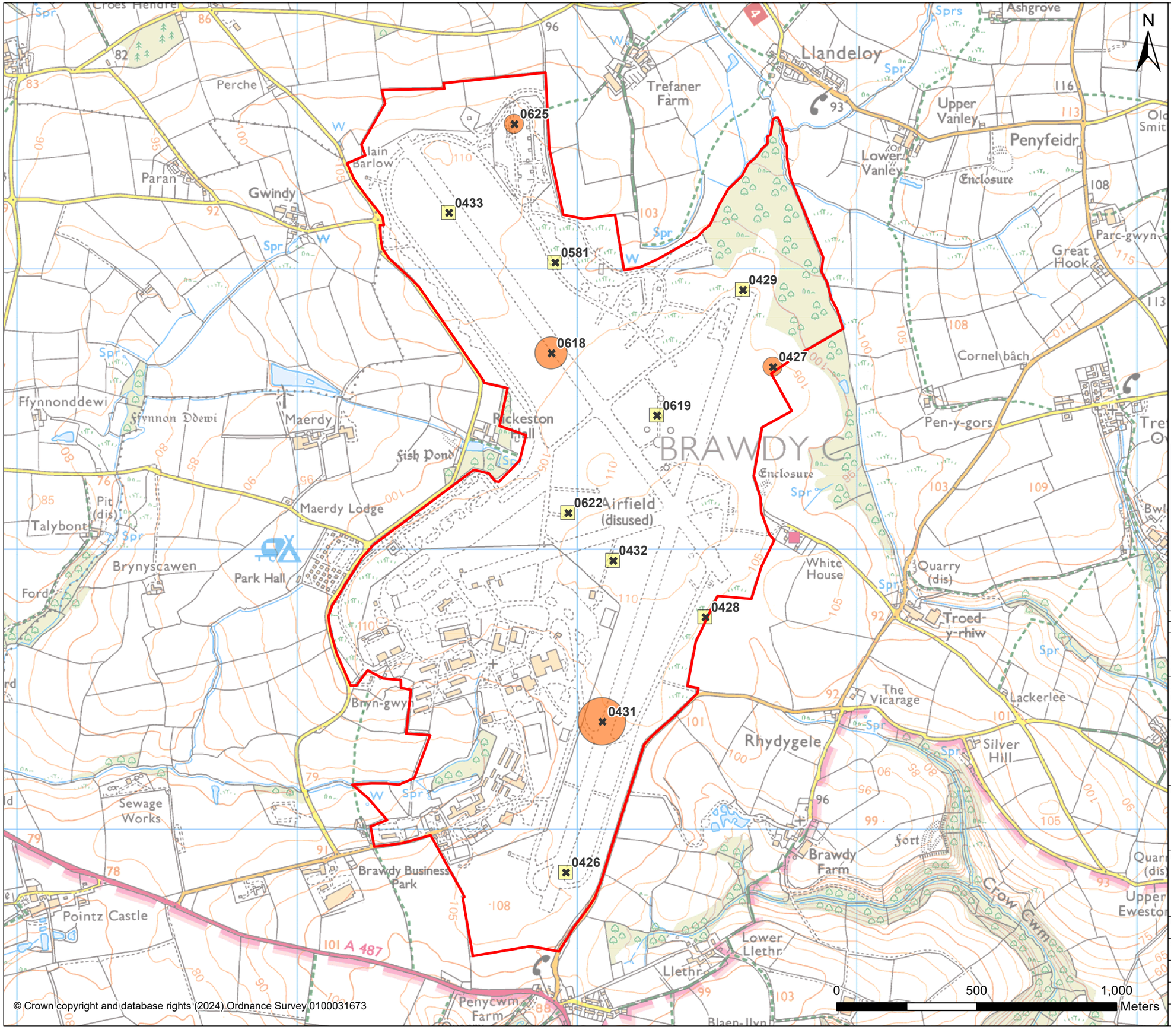
Appendix 8.9 - Annex H Leislers Map



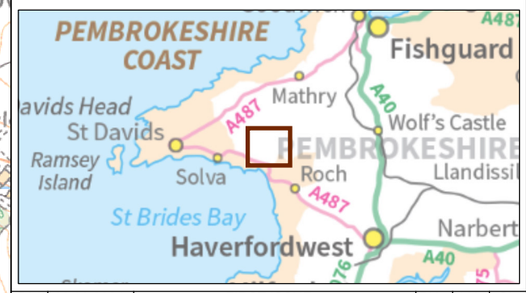
Legend

- Site boundary
- Static location

Leisler's bat – entire survey period

Total number:

- 0
- 1
- 4
- 8



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LEISLER'S MAP

Project Stage: STAGE 3

Status	Status Description
S2	FOR INFORMATION

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A3	1:13,000	65208061-002	P01

Drawing Number: 65208061-002-SWE-XX-XX-DR-GS-0031

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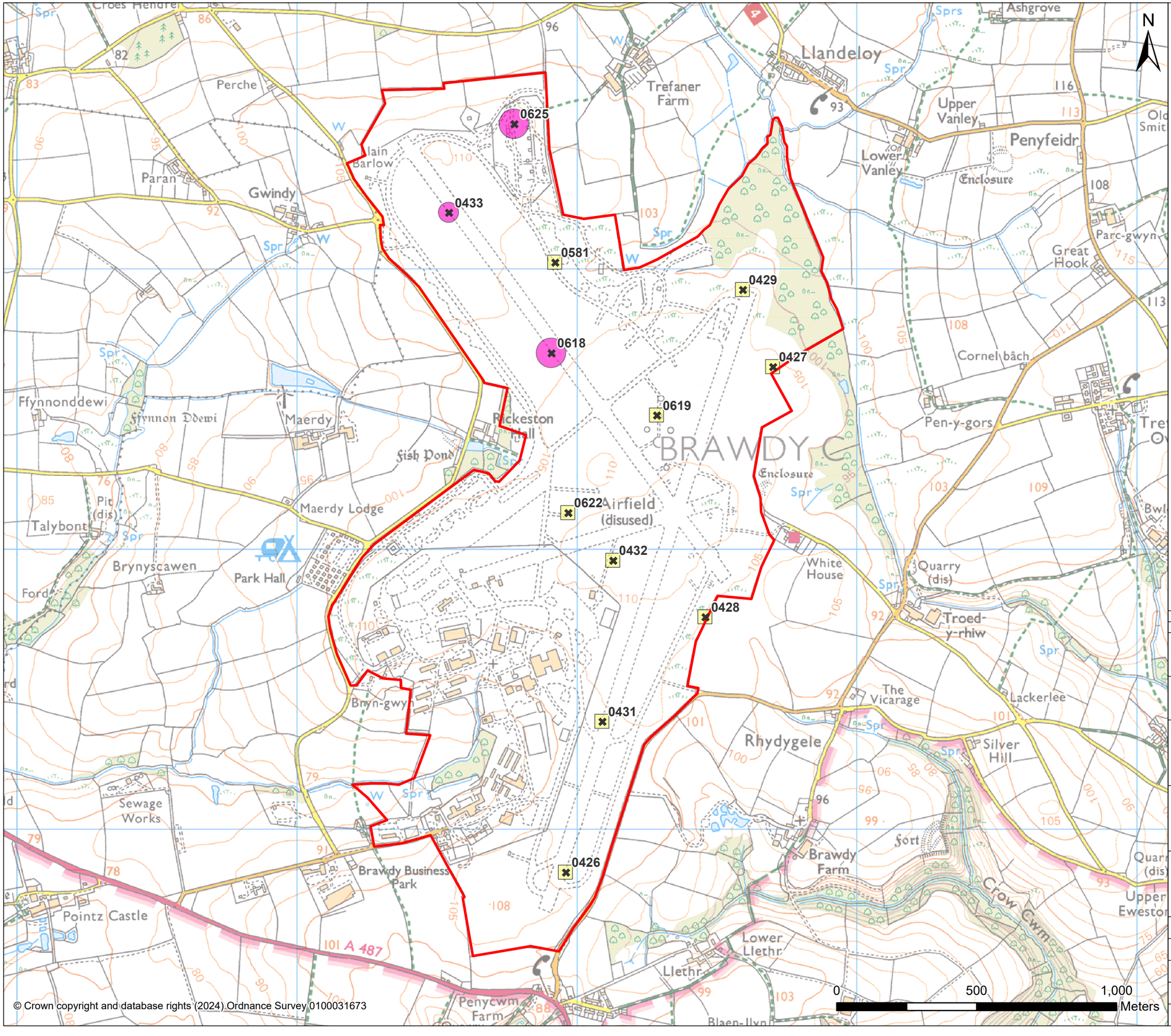
Appendix 8.9 - Annex I Serotine Map



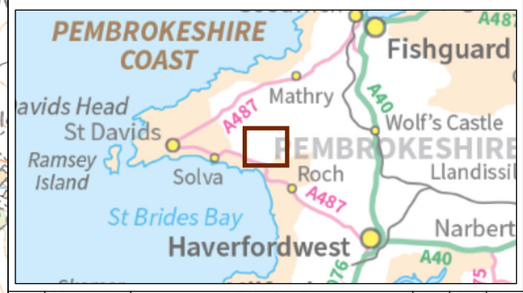
Legend

- Site boundary
- Static location

Serotine bat – entire survey period

Total number:

- 0
- 1
- 2



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SEROTINE MAP

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Drawn	Designed	Checked	Approved
PK	EH	LH	GL

Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

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65208061-002-SWE-XX-XX-DR-GS-0032

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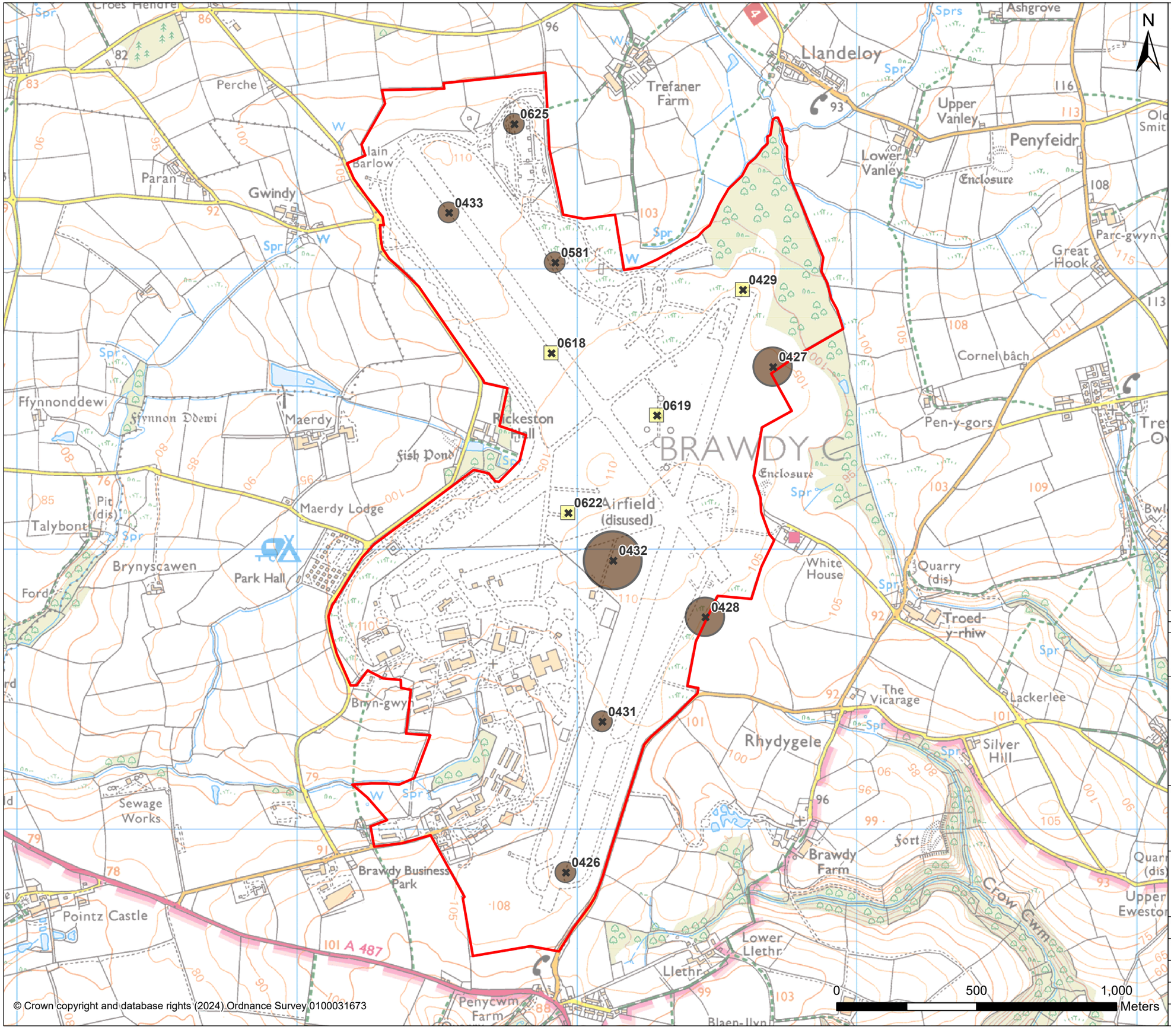
Appendix 8.9 - Annex J Nathusius' Pipistrelle Map



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NATHUSIUS' PIPISTRELLE MAP

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PK	EH	LH	GL

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A3	1:13,000	65208061-002	P01

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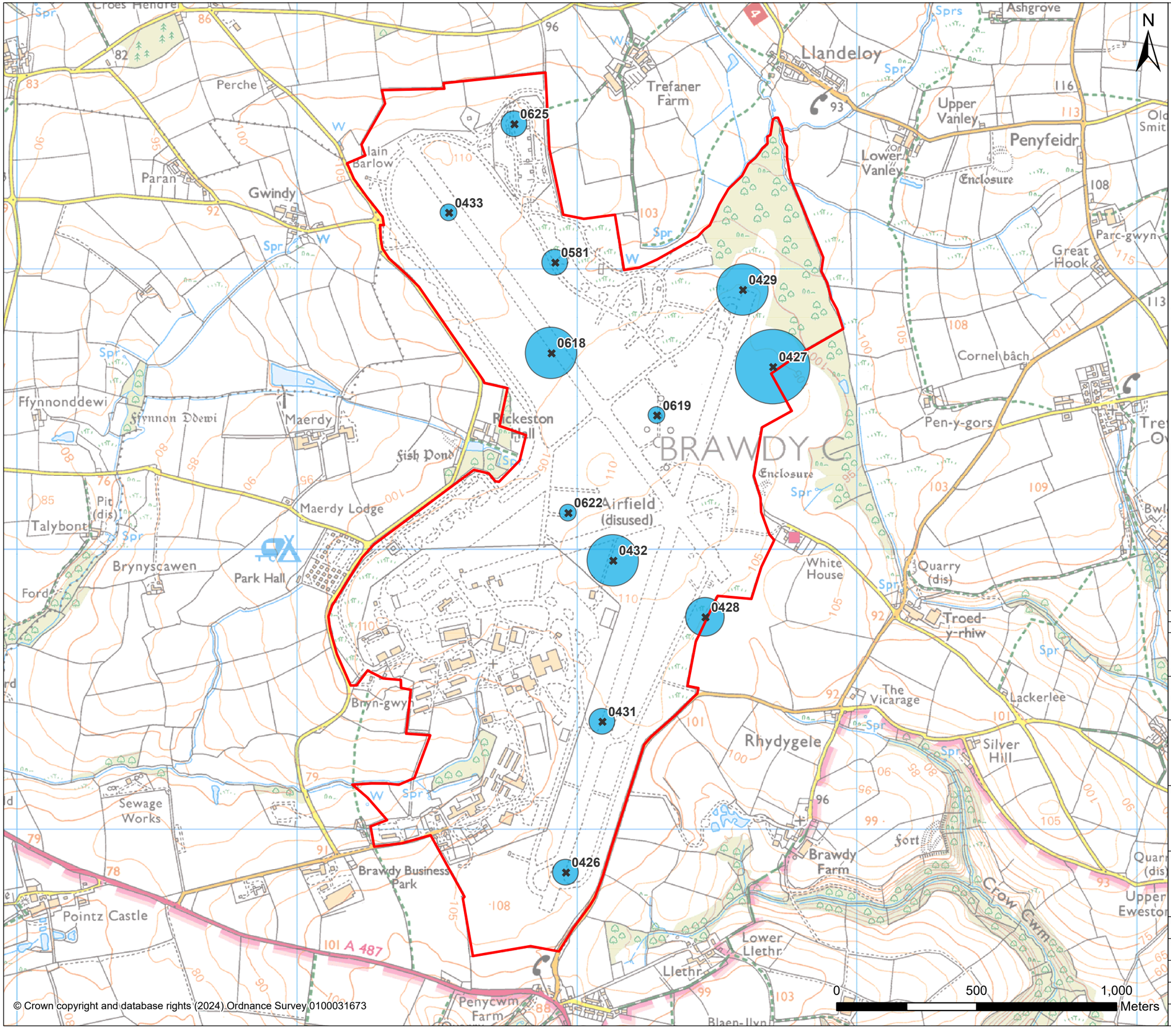
Appendix 8.9 - Annex K Myotis species Map



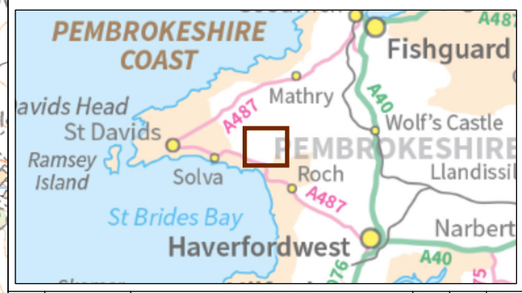
Legend

- Site boundary
- Static location

Myotis bat – entire survey period

Total number:

- 2 - 10
- 11 - 22
- 23 - 35
- 36 - 98
- 99 - 280



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MYOTIS SPECIES MAP

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Status	Status Description
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Sheet Size	Scale	Sweco Ref	Revision
A3	1:13,000	65208061-002	P01

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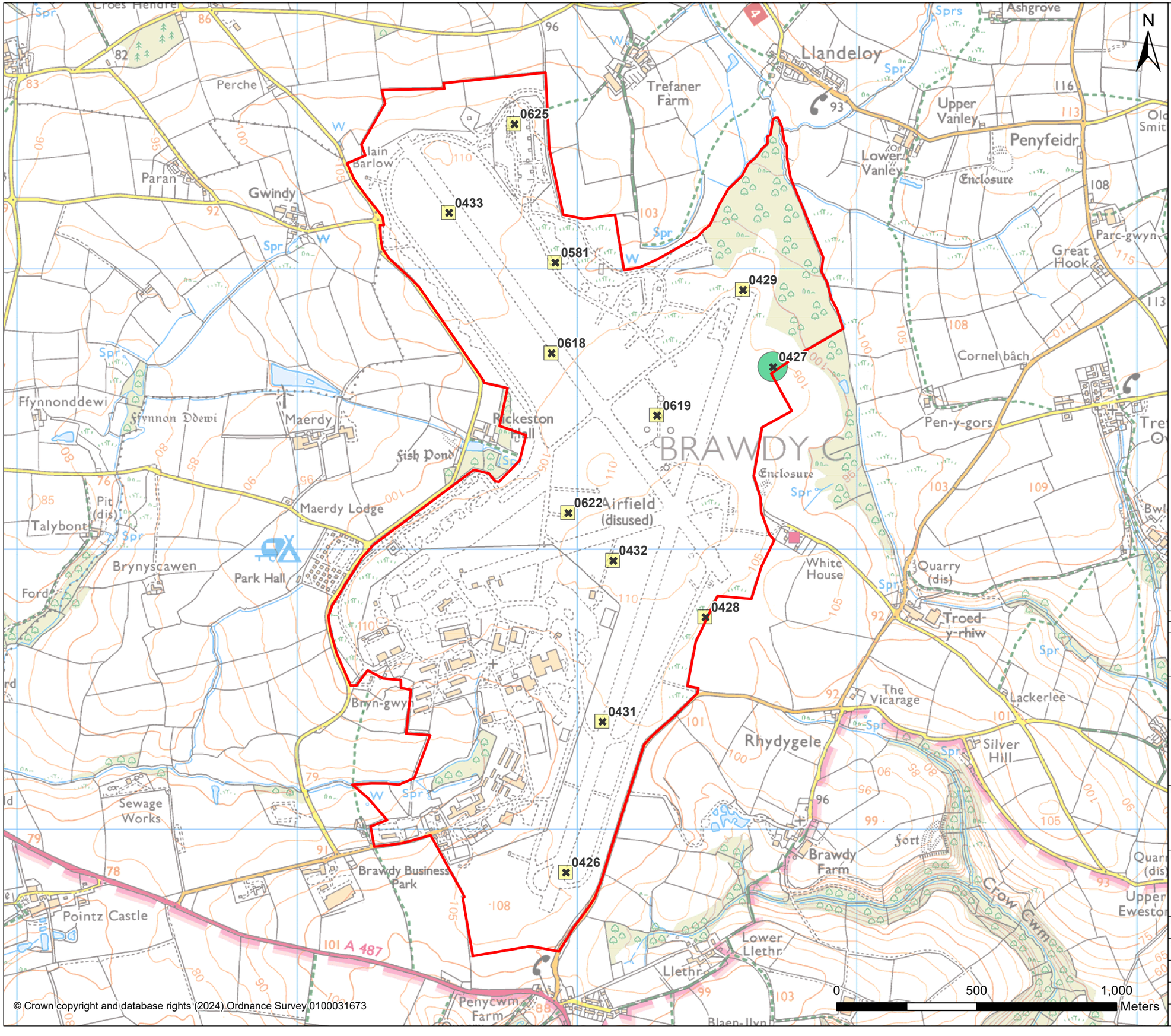
Appendix 8.9 - Annex L Natterer Map



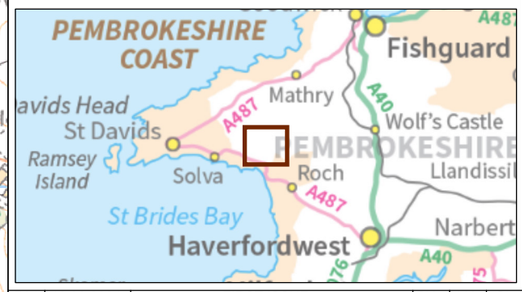
Legend

- Site boundary
- Static location

Natterer's bat – entire survey period

Total number:

- 0
- 2



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NATTERER'S MAP

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A3	1:13,000	65208061-002	P01

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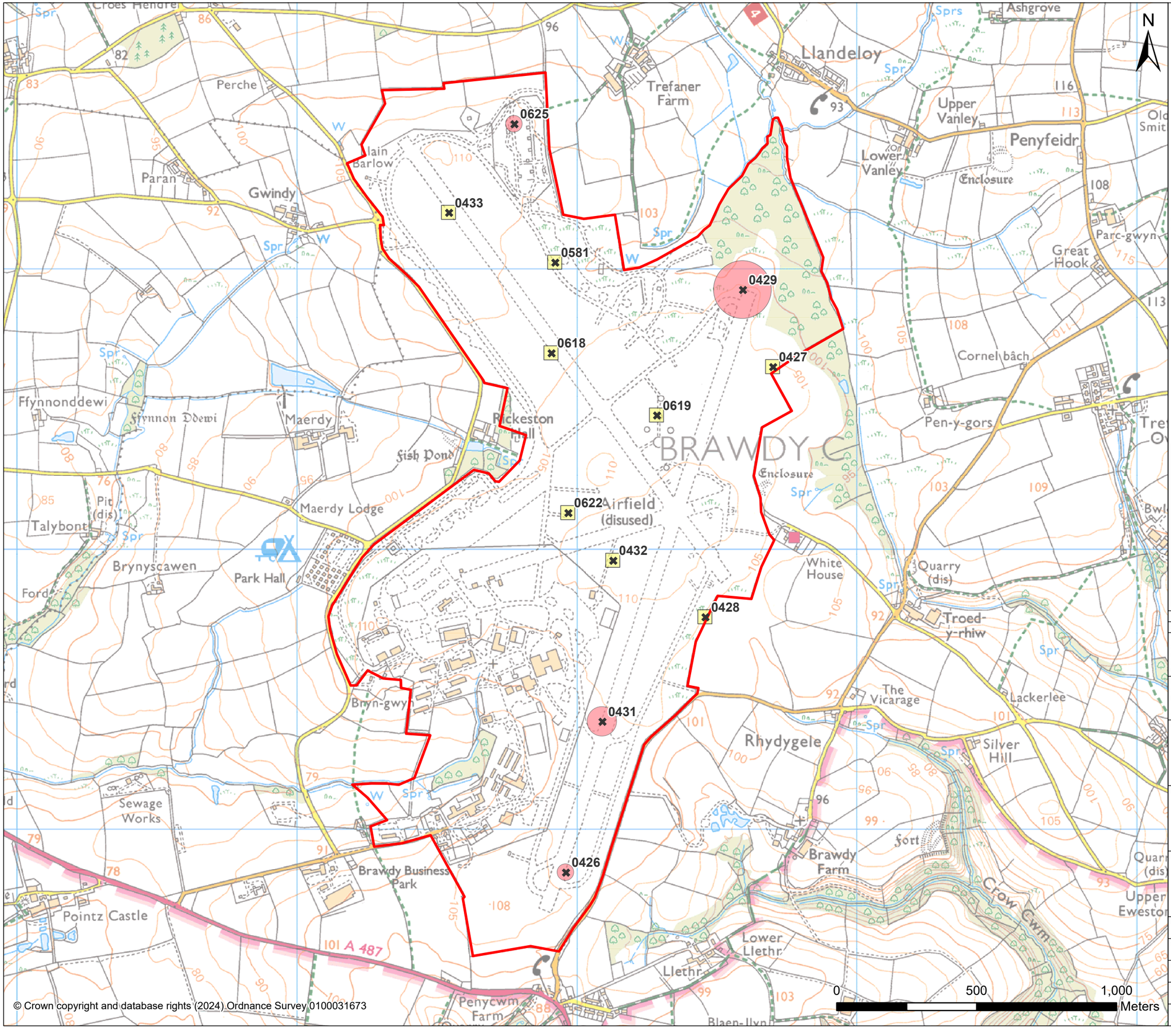
Appendix 8.9 - Annex M Daubenton’s Map



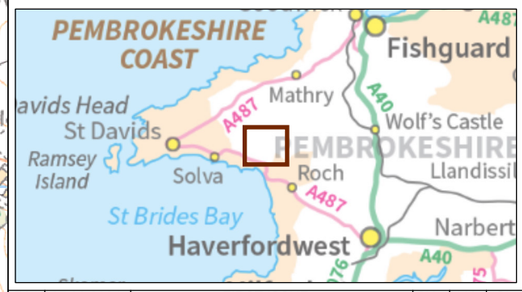
Legend

- Site boundary
- Static location

Daubenton's bat – entire survey period

Total number:

- 0
- 1
- 2
- 34



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DAUBENTON'S MAP

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A3	1:13,000	65208061-002	P01

Drawing Number

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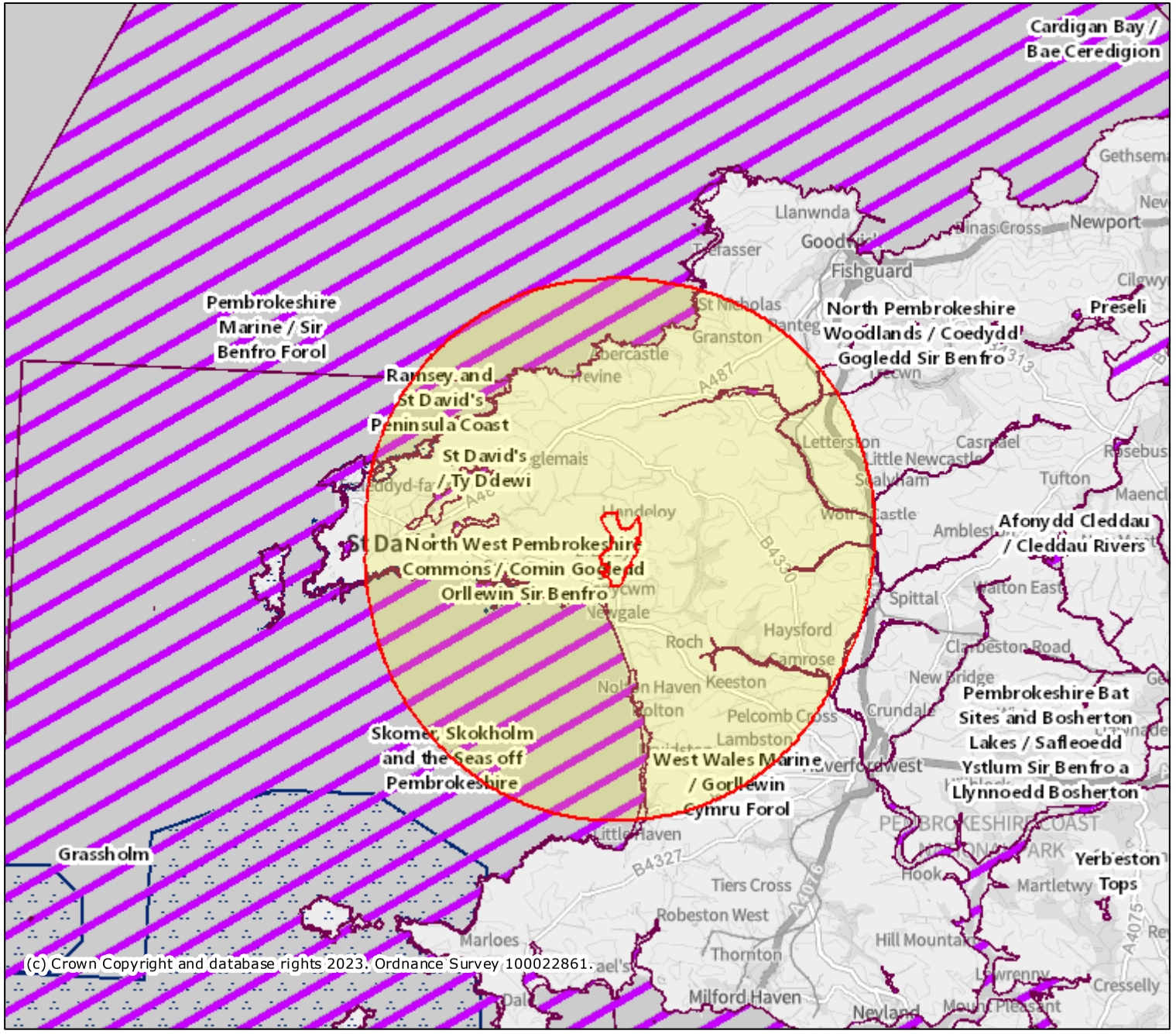
Appendix 8.10 - Annex A European and Ramsar Designated Sites

10 km map



Legend

- Ramsar Sites (Wales)
- Special Areas of Conservation (Wales)
- Special Protection Areas (Wales)

Projection = OSGB36
xmin = 120700
ymin = 191900
xmax = 246500
ymax = 261200

0 5 10
km

Map produced by MAGIC on 13 March, 2023.