



TECHNICAL APPENDIX 8.1

KILLEAN WIND FARM: BREEDING BIRD SURVEYS 2022

Report to Renewables Energy Systems Ltd



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Cover photos:

Top left – Black grouse, female © Steve Percival

Top right – Golden eagle, immature. © Steve Percival





TECHNICAL APPENDIX 8-1

KILLEAN WIND FARM: BREEDING BIRD SURVEYS 2022

INTRODUCTION

1. This report presents the results of breeding bird survey work for a proposed wind farm at Killean, near Tayinloan, Argyll. It provides baseline data on the breeding bird populations, activity and flight paths within the vicinity of the proposed development site to inform subsequent ornithological impact assessment.
2. The specific objectives of this work were to:
 - Undertake breeding bird surveys of the proposed development site and its surrounds, to determine the numbers of birds present, and the flight activity of key target species.
 - Use this information to evaluate the importance of the site's breeding bird populations.
3. The surveys have been designed with reference to current NatureScot survey guidance on bird surveys for wind farms (SNH 2017). The surveys were undertaken by Tom Lowe, Stuart Piner and Scott Smith, all highly experienced bird surveyors.
4. Details of the nesting location of a species specially protected from disturbance under Schedule 1 of the Wildlife and Countryside Act are not included in this report but can be found in **Technical Appendix 8-8 Confidential Addendum on Breeding Birds**.

STUDY AREA

5. The site is located about 22km north from Campbeltown in Argyll. The breeding bird survey areas were chosen to include all areas within the possible zone of ornithological influence of the potential wind farm. This included the wind farm site, plus a 500m buffer for the main breeding bird surveys (following NatureScot guidance, SNH 2017) and a 2km buffer for the wider raptor, diver and black grouse surveys (the wider survey area), where access/viewing was possible and where there was potentially suitable habitat. The extents of the survey areas are shown in Figure 1. They are a mix of open moorland and conifer plantation, covering a total area of 8.1km² (core) and 23.0km² (wider). The site lies within the Argyll West and Islands NatureScot Natural Heritage Zone (NHZ 14).





BREEDING BIRD SURVEY METHODS

Core Breeding Bird Surveys

6. The main breeding bird walkover survey followed the standard moorland survey method (Brown and Shepherd 1993) but with two additional visits as recommended in current NatureScot guidance (SNH 2017, Calladine *et al.* 2009). They commenced in April and continued through to July, and were done between 8:30 hours and 18:00 hours. The survey dates were 4-6 April, 24-25 May and 21-22 June and 16-20 July 2022. These surveys covered all of the open (i.e. non-forested) habitat within a buffer zone of 500m around the developable area where access/viewing was possible.
7. All bird locations and behaviour were mapped to 1:10,000 scale, using the standard BTO Common Birds Census notation. All species were recorded. In addition, the survey effort per unit area was standardised to make the surveys as repeatable as possible, recording systematically for approximately 2 hours per km². A route was chosen to ensure that all parts of the study area were covered to within about 100m of the observer, where access was possible. The survey route was plotted onto the survey map as it was carried out.
8. The surveys avoided strong winds, heavy rain, fog and low cloud. Birds were located by walking, listening and scanning by eye and with binoculars. Standard BTO notation will be used to record the birds' activities; singing, calling, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute.
9. The survey data were analysed to determine spatially distinct clusters of records, equivalent to breeding territories (following Brown and Shepherd 1993), with the number of such territories used to calculate the breeding population for each species (Gilbert *et al.* 1998). A record in potentially suitable breeding habitat on a single visit was considered sufficient to indicate a potential breeding attempt.

Raptor and Owl Breeding Surveys

10. As the survey area was considered likely, given its location and the habitats present, to be used by a range of scarce raptors, raptor surveys were undertaken during April-August 2022. Raptor surveys comprised walkovers where access was allowed (within the site land ownership), supplemented by a series of mini-VPs (shorter watches from additional VPs) to cover other areas (looking out from the site itself), to detect displaying or nesting behaviour during the breeding season of raptor species following the methods described in Gilbert *et al.* (1998) and Hardey *et al.* (2013) where access allowed. Surveys recorded all Schedule 1 and Annex I raptor species. This included four surveys visits, undertaken on 11-14 April, 17-19 May, 23-24 June and 15-16 July.

Black Grouse Survey

11. Black grouse surveys were undertaken following the methods outlined in Gilbert *et al.* (1998). All suitable black grouse habitat from within the site boundary (to which access was restricted) was surveyed during April - mid-May. Surveys were carried out on 4-6 April, and 17-24 May. Areas of suitable habitat outwith the site to which access was not possible were scanned with binoculars from the site boundary, from publicly accessible locations and from suitable vantage points within the site. A three-visit survey was undertaken as follows:
 - Visit 1: site visit to assess habitat for black grouse suitability;





- Visit 2: areas of suitable habitat with the potential to support lekking black grouse were visited twice on different mornings to establish presence/absence; and
- Visit 3: any locations where black grouse were recorded as present during the second visit were revisited in order to provide an accurate count of the number of lekking birds present. The survey was undertaken one hour prior to dawn until one hour after dawn.

Vantage Point Surveys

12. Vantage Point surveys were carried out to determine bird flight activity within the wind farm site to assess collision risk. The surveys quantified the bird numbers that could potentially be at risk of collision (including roost flight observations at dawn/dusk). All flight lines of target species were mapped, and the flight height of each flock recorded. Target species included all EU Birds Directive Annex 1 species, Wildlife & Countryside Act (1981) Schedule 1 species and Red-listed birds of Conservation Concern (Stanbury *et al.* 2021), as per NatureScot (SNH 2017).
13. The specific aim of the VP surveys was to collect data on key target species flight activity to enable estimates to be made of:
 - The time spent flying over the survey area
 - The relative use made of different parts of the survey area
 - The proportion of flying time spent at different elevations above the ground.
14. Two vantage points were used to cover the potential wind farm site. The computer-generated viewsheds (using Global Mapper v21) are shown in Figure 1. For each VP, the basic 36 hours' VP surveys from each VP (as set out in NatureScot guidance) were supplemented by a further 24 hours/VP to capture more information on the use of the site by golden eagle. These surveys were spread evenly across the breeding season.
15. All key target species flights (and any other species of specific nature conservation interest) were recorded, irrespective of their distance from the vantage point. Observations were carried out throughout daylight hours but not in periods of severely reduced visibility (<3km).
16. During the VP surveys all key target species flights were mapped and cross-referenced to a standard recording form using a numbering system, and the flight height of each recorded. To estimate flight height as accurately as possible available reference structures were used. Heights were estimated as accurately as possible recorded as a raw estimate, rather than being summarised to height classes. Below 10m estimates were made to 1m, between 10 and 20m to 2m, between 20m and 50m to 5m, and above 50m to 10m. When birds were observed over an extended period, estimates of flight height were recorded every 30 seconds. The activity during each flight was also recorded. Particular attention was paid to any observations of birds at rotor height.



BREEDING BIRD SURVEYS 2022: RESULTS

17. The breeding bird populations recorded in the survey area on each visit are summarised in Table 1, which gives the estimated number of breeding pairs recorded during each survey visit and the overall breeding population estimate for each species.

TABLE 1. Breeding bird numbers in the core Killean survey area recorded during April-July 2022. Numbers given are the number of breeding pairs recorded on each survey visit, and the overall number of breeding pairs.

Species	April	May	June	July	Estimated number of breeding pairs
Canada Goose	1	1	0	0	2
Teal	1	0	0	1	2
Mallard	1	3	1	4	4
Goldeneye	1	0	0	0	1
Red Grouse	4	1	0	0	5
Black Grouse	2	2	0	0	4
Red-throated Diver	0	0	1	1	1
Little Grebe	1	1	0	0	1
Buzzard	0	3	0	3	4
Kestrel	0	0	1	1	1
Snipe	0	1	6	2	6
Common Sandpiper	0	1	0	0	1
Common Gull	0	2	1	0	2
Woodpigeon	0	1	2	5	7
Collared Dove	1	1	0	0	1
Cuckoo	0	7	1	0	7
Skylark	23	63	90	48	116
Swallow	0	0	1	2	3
Tree Pipit	0	1	3	1	4
Meadow Pipit	244	618	549	331	734
Grey Wagtail	1	2	6	3	9
Pied Wagtail	2	1	6	1	9
Wren	25	65	90	99	132
Dunnock	4	5	15	11	23
Robin	18	46	43	22	67
Whinchat	0	1	11	8	17
Stonechat	0	10	11	11	22
Wheatear	0	1	1	0	2
Blackbird	3	7	4	2	15
Song Thrush	6	0	8	8	17
Mistle Thrush	3	2	5	4	9
Grasshopper Warbler	0	2	3	3	5

Species	April	May	June	July	Estimated number of breeding pairs
Sedge Warbler	0	2	0	0	2
Blackcap	0	0	1	0	1
Whitethroat	0	3	1	3	6
Willow Warbler	0	114	80	30	144
Goldcrest	10	8	39	19	53
Great Tit	0	1	3	2	5
Coal Tit	7	12	15	29	46
Jay	1	0	3	5	7
Carrion Crow	0	0	2	0	2
Hooded Crow	3	2	2	8	10
Raven	0	0	0	2	2
Chaffinch	10	54	98	20	130
Goldfinch	1	0	1	1	2
Siskin	0	11	9	12	28
Linnet	0	2	0	3	4
Lesser Redpoll	3	7	22	29	43
Common Crossbill	0	0	1	4	5
Bullfinch	0	0	5	2	7
Reed Bunting	1	10	3	6	17

18. The distributions of the breeding birds of conservation importance within the survey area in 2022 are shown on Figures 2 to 12. The more abundant species (i.e. 10 or more breeding pairs) of conservation interest have been presented separately for clarity.
- **Skylark** (Figure 2) and **Meadow Pipit** (Figure 3) were both abundant over all of the open ground across the survey area.
 - **Wren** (Figure 4) and **Dunnock** (Figure 5) were found mostly within the woodland habitat.
 - **Whinchat** (Figure 6) were found mostly on the open ground in the western part of the survey area.
 - **Song Thrush** (Figure 7), **Willow Warblers** (Figure 8), **Siskin** (Figure 9) and **Lesser Redpoll** (Figure 10) were all found largely with the forested areas.
 - **Reed Bunting** (Figure 11) was another species found mostly on the open ground in the western part of the survey area.
19. Of the other less abundant species of conservation importance (Figure 12), these were widely distributed across the survey area. The waterbodies held red-throated diver, goldeneye and teal, the open moorland on the eastern side of the site red grouse and snipe, common crossbill were found in the forest and the open habitats to the west held cuckoo, tree pipit and grasshopper warbler.
20. Additional species seen during the 2022 breeding bird surveys but not showing any evidence of breeding within the survey area included (peak counts): pink-footed goose (22 – a spring migrant flock over-flying), Greenland white-fronted goose (31 – a late record of this over-wintering species), goosander (2), grey heron (1), hen harrier (1), white-tailed eagle (2), golden eagle (2), osprey (1),



peregrine (2), golden plover (18 – a spring migrant flock), herring gull (1), great black-backed gull (1), black-headed gull (1) and fieldfare (1).

Black Grouse survey results

21. Four black grouse leks were located during the 2022 surveys, two with a peak of two males, on open ground on the western edge of the survey area and on the woodland edge in the central part, and two with single males. The locations of all black grouse records are summarised in Figure 13.

Raptor and diver survey results

22. **Red-throated Diver** – a nest was found within the core breeding bird survey area, though it was unsuccessful this year (no chick was seen). Details and flight lines are given in the Confidential Addendum in TA8-8.
23. **Hen Harrier** – a nest was located during the wider area surveys outside the site boundary. Details and flight lines are given in the Confidential Addendum in TA8-8.
24. **Golden Eagle** – a pair was active within the territory in which the site is located, including nest building, but no eggs were recorded. Details and flight lines are given in the Confidential Addendum in TA8-8.
25. **White-tailed Eagle** – there were 11 records of this species over-flying in April and a further sighting in July (Figure 14), but no evidence of breeding within 2km of the proposed wind farm.
26. **Osprey** - there were three flights of this species recorded over the site during the VP surveys (Figure 14), but no evidence of breeding within the survey area.
27. **Merlin** – there was a single record of a female overflying the site on 17/8/22 during the VP surveys (Figure 14). During the wider surveys the only record was of a single seen flying over potentially suitable breeding habitat 3km south-east from site.
28. **Peregrine** - there were three records of this species overflying during the VP surveys (an adult male and two records of a juvenile, Figure 14), but no evidence of breeding within the core or the wider survey area.

Vantage Point Survey Results

29. The rates of bird flight movement observed across the survey area during the vantage point surveys from the two VPs are summarised in Table 2. This gives the monthly mean flight rates observed, and the total number of flights recorded during the survey period. Key species flight lines are shown in Figure 14 and in the Confidential Addendum in TA8-8.



TABLE 2. Bird flight rates recorded over the Killean breeding bird survey area during April – August 2022 vantage point surveys. N = 60 hours total observation at each of two VPs.

Species	Flight rate (birds/hour)					Total number of flights	% flights at rotor height
	Apr	May	Jun	Jul	Aug		
Pink-footed Goose	1.05	-	-	-	-	22	0%
Greenland White-fronted Goose	1.48	-	-	-	-	31	100%
Red Grouse	-	-	-	0.03	-	1	0%
Red-throated Diver	-	0.24	0.69	0.89	0.37	56	84%
White-tailed Eagle	0.52	-	-	0.03	-	12	50%
Hen Harrier	0.10	0.16	0.07	0.06	0.24	15	40%
Sparrowhawk	0.29	0.08	0.21	0.11	0.29	22	50%
Buzzard	1.48	1.00	0.90	0.63	1.18	120	68%
Golden Eagle	1.24	0.08	-	0.26	0.49	49	85%
Osprey	-	0.08	-	0.03	-	3	100%
Kestrel	0.10	-	-	-	0.98	26	50%
Merlin	-	-	-	-	0.04	1	100%
Peregrine	0.10	-	-	-	0.04	3	100%
Golden Plover	0.48	-	-	-	-	10	100%
Snipe	-	0.12	0.14	0.11	-	9	100%
Common Gull	0.19	0.48	-	0.09	-	19	26%
Herring Gull	-	0.04	-	-	-	1	100%
Great Black-backed Gull	0.05	0.04	-	0.06	-	4	100%
Black-headed Gull	-	-	-	0.03	-	1	100%

Conservation Evaluation of Breeding Bird Populations

30. The conservation value of the breeding bird populations was determined using the criteria specified in Table 3 (from Percival 2007). This includes the criteria adopted by NatureScot in Guidelines for Selection of Biological SSSIs (Drewitt *et al.* 2020), using 1% of the resource to define international and national importance (Frost *et al.* 2021). An additional category of regional importance was assigned for species approaching the threshold for national importance and those for which the survey area held a notable concentration in a county context. A further category of 'local importance' was used for species that did not reach regional importance but were still of some ecological value. This included all species on the red or amber lists of the 'Birds of Conservation Concern v.5' (Stanbury *et al.* 2021) that did not reach national or regional importance at the development site. National (GB) and International wintering waterfowl baseline populations have been taken from the most recently published population figures (Frost *et al.* 2021) from the national Wetland Birds Survey and other species from Woodward *et al.* (2020). In addition, listing on Annex 1 of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside and UK/Scottish BAP priority species were all considered in the evaluation process.



TABLE 3. Definition of terms relating to the conservation value of the ornithological receptors at the site.

Sensitivity	Definition
VERY HIGH	Cited interest of SPAs, SACs and SSSIs. Cited means mentioned in the citation text for the site as a species for which the site is designated (SPAs/SACs) or notified (SSSIs).
HIGH	Other species that contribute to the integrity of an SPA or SSSI. A local population of more than 1% of the national population of a species. EU Birds Directive Annex 1, EU Habitats Directive priority habitat/species and/or W&C Act Schedule 1 species. Ecologically sensitive species, e.g. large birds of prey or rare birds (<300 breeding pairs in the UK).
MEDIUM	Regionally important population of a species, either because of population size or distributional context. UK BAP priority species (if not covered above), red-listed species of conservation concern.
LOW	Any other species of conservation interest, e.g. species listed on the Birds of Conservation Concern not covered above. Scottish BAP priority species (if not covered above).

TABLE 4. Conservation evaluation of the breeding bird populations in the KJillean survey area, 2022.

Species	Breeding pairs 2022	EU Ann 1	W and C Act Sch 1	Red [R]/Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Canada Goose	2						Nil
Teal ³	2			A			Low
Mallard	4			A			Low
Goldeneye ⁴	1		✓	R			High
Red Grouse ¹	5				✓		Medium
Black Grouse ³	4			R	✓	✓	Medium
Red-throated Diver ³	1	✓	✓			✓	High
Little Grebe ³	1						Nil
Buzzard ²	4						Nil
Kestrel	1			A		✓	Low
Snipe ²	6			A			Low
Common Sandpiper ²	1			A			Low
Common Gull ²	2			A			Low
Woodpigeon	7			A			Low
Collared Dove	1						Nil
Cuckoo ^{2,5}	7			R	✓	✓	Medium
Skylark	116			R	✓	✓	Medium
Swallow	3						Nil
Tree Pipit	4			R	✓	✓	Medium



Species	Breeding pairs 2022	EU Ann 1	W and C Act Sch 1	Red [R]/ Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Meadow Pipit	734			A			Low
Grey Wagtail ²	9			A			Low
Pied Wagtail	9						Nil
Wren	132			A			Low
Dunnock	23			A	✓		Medium
Robin	67						Nil
Whinchat ²	17			R			Low
Stonechat ²	22						Nil
Wheatear ¹	2			A			Low
Blackbird	15						Nil
Song Thrush	17			A	✓	✓	Medium
Mistle Thrush	9			R			Low
Grasshopper Warbler	5			R	✓	✓	Medium
Sedge Warbler	2			A			Low
Blackcap	1						Nil
Whitethroat	6						Nil
Willow Warbler	144			A			Low
Goldcrest	53						Nil
Great Tit	5						Nil
Coal Tit	46						Nil
Jay	7						Nil
Carrion Crow	2						Nil
Hooded Crow	10					✓	Low
Raven ³	2						Nil
Chaffinch	130						Nil
Goldfinch	2						Nil
Siskin	28					✓	Low
Linnet	4			R	✓	✓	Medium
Lesser Redpoll	43				✓	✓	Medium
Common Crossbill	5		✓				Low
Bullfinch	7			A	✓	✓	Medium
Reed Bunting	17			A	✓	✓	Medium

Note: superscripts indicate contribution to the JNCC breeding bird assemblage score for the main habitat within the survey area, 'Upland moorland and grassland with waterbodies'.



31. Three high value species were recorded breeding within the core breeding bird survey area during 2022, goldeneye, red-throated diver and common crossbill. All are specially protected under Schedule 1 of the Wildlife and Countryside Act, and red-throated diver is additionally listed on Annex 1 of the EU Birds Directive.
32. Twelve breeding species were classed as medium conservation value: red grouse, black grouse, cuckoo, skylark, tree pipit, dunnoek, song thrush, grasshopper warbler, linnet, lesser redpoll, bullfinch and reed bunting. All were classed as medium value because of their listing on the UK Biodiversity Action Plan list of priority species.
33. A further 18 breeding species were classed as low sensitivity, through their listing on RSPB *et al.*'s (Stanbury *et al.* 2021) amber lists of birds of conservation concern and/or the Scottish Biodiversity List.
34. The overall conservation value of the breeding bird community in 2022, measured from the core survey data as the breeding bird assemblage score, was 37.5. This just below the threshold for national importance (40) for the main habitat within the survey area, 'Upland moorland and grassland with water bodies' (Drewitt *et al.* 2020). The core survey area therefore supports a regionally important breeding bird community.
35. The evaluation of the conservation importance of the non-breeding species observed during these surveys is given in Table 5. This included one very high value species (Greenland white-fronted goose, linked to the Kintyre Goose Roosts SPA – see 2021-22 winter report (**Technical Appendix 8-3**) for a more detailed assessment of this wintering species), seven high value species (white-tailed eagle, hen harrier, golden eagle, osprey, merlin, peregrine and golden plover), all EU Annex 1/Wildlife and Countryside Act Schedule 1 species), one medium value (herring gull, a UK BAP priority species), present in regionally important numbers), and four additional low value species (through their red/amber listing). All these species were seen only infrequently in generally low numbers during the breeding bird surveys.

TABLE 5. Conservation evaluation of the non-breeding bird populations in the Killean survey area, 2022.

Species	Peqk count 2022	EU Ann 1	W and C Act Sch 1	Red [R]/ Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Pink-footed Goose	22			A			Low
White-fronted Goose	31			R	✓	✓	Very high
Goosander	2						Nil
Grey Heron	1						Nil
White-tailed Eagle	2	✓	✓	A		✓	High
Hen Harrier	1	✓	✓	R		✓	High
Golden Eagle	2	✓	✓			✓	High
Osprey	1	✓	✓	A		✓	High
Merlin	1	✓	✓	R		✓	High
Peregrine	2	✓	✓			✓	High
Golden Plover	18	✓				✓	High
Herring Gull	1			R	✓	✓	Medium
Great Black-backed Gull	1			A			Low
Black-headed Gull	1			A			Low





Species	Peak count 2022	EU Ann 1	W and C Act Sch 1	Red [R]/ Amber [A] List	UK BAP priority sp	Scottish BAP sp	Conservation Value
Fieldfare	1			R			Low





**Killeen Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 1

**Survey areas, VP locations
and viewsheds**

KEY:

- ⊕ Indicative turbines
- VP locations
- - - Wider survey area (2km buffer)
- · - · - Breeding bird survey area (core)
- VP1 viewshed
- VP2 viewshed



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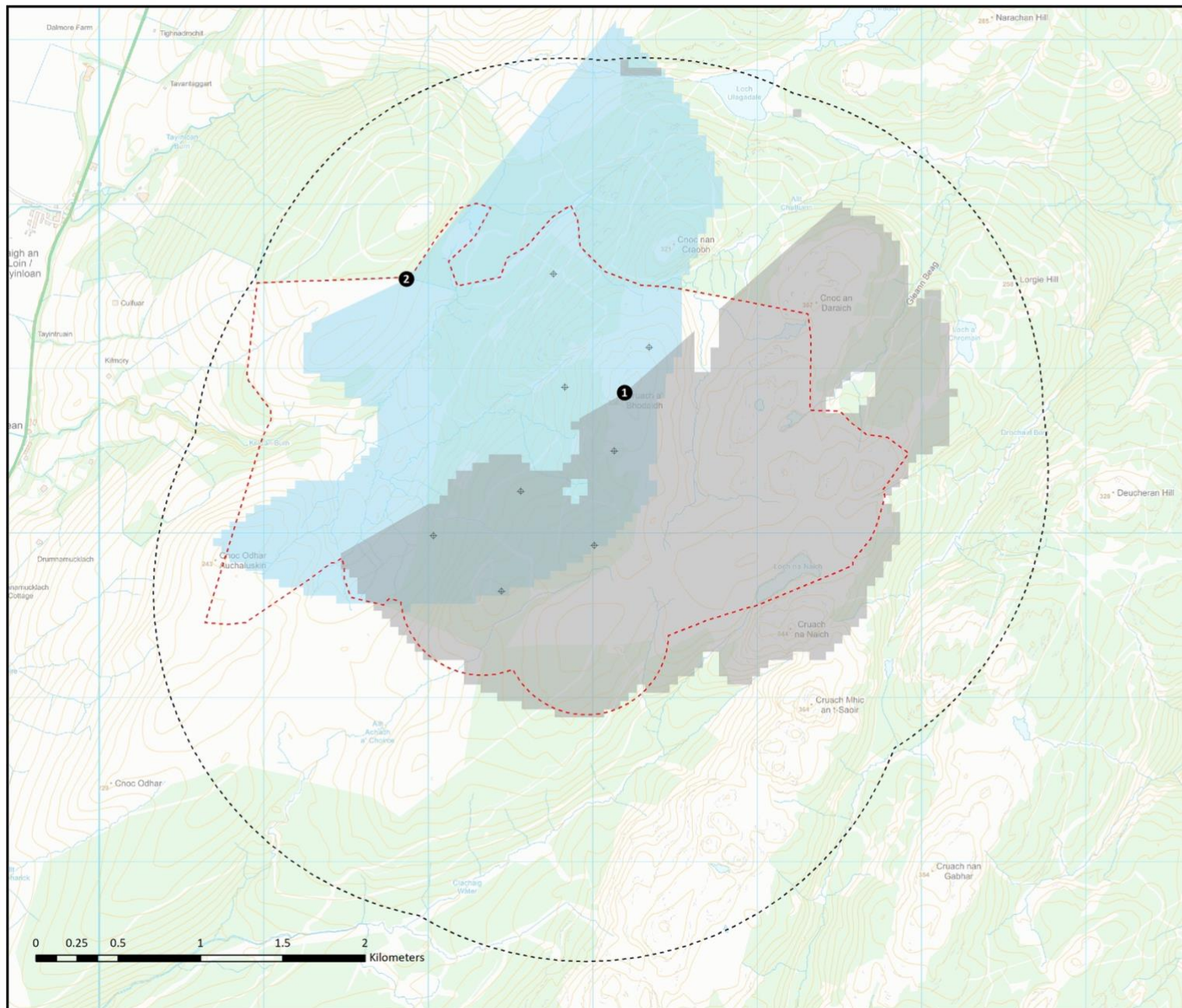
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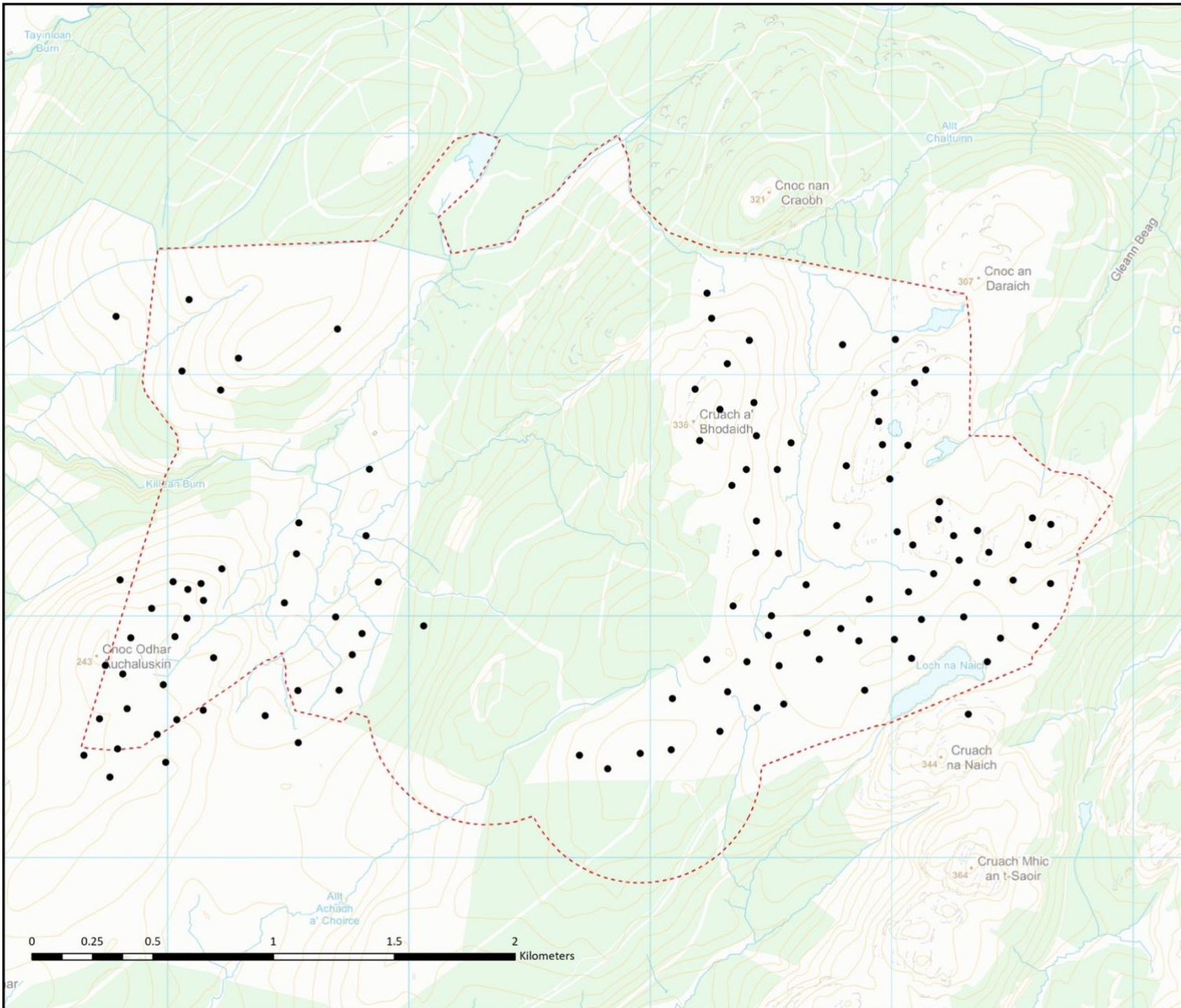
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**BREEDING BIRDS
2022**

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**Killlean Wind Farm:
Breeding Bird
Surveys 2022**

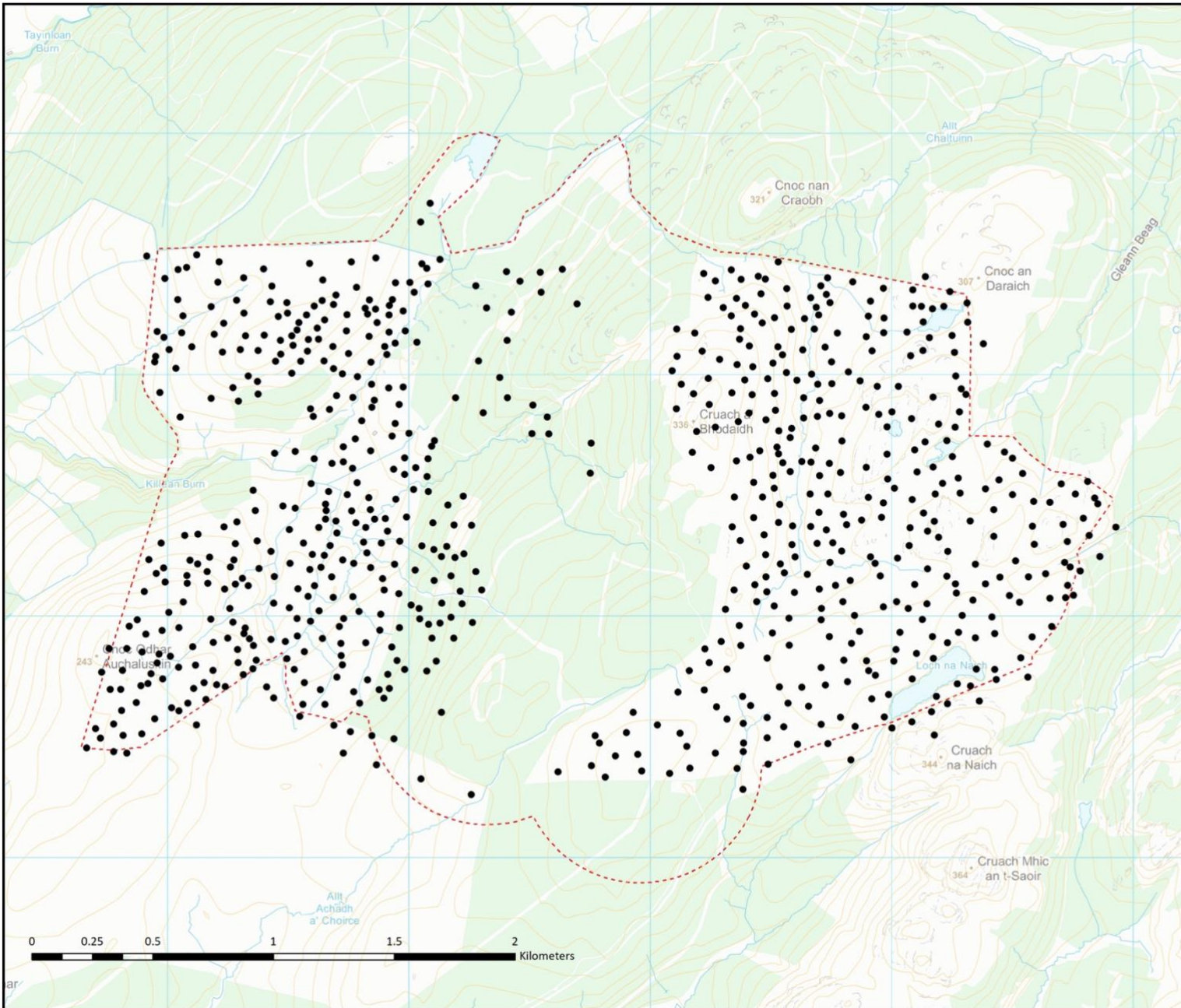
FIGURE 2

**Distribution of Breeding
Skylark**

- KEY:**
- Appox. breeding locations
 - ▭ Breeding bird survey area (core)



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**Killan Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 3

**Distribution of Breeding
Meadow Pipit**

KEY:

- Approx. breeding locations
- ▭ Breeding bird survey area (core)



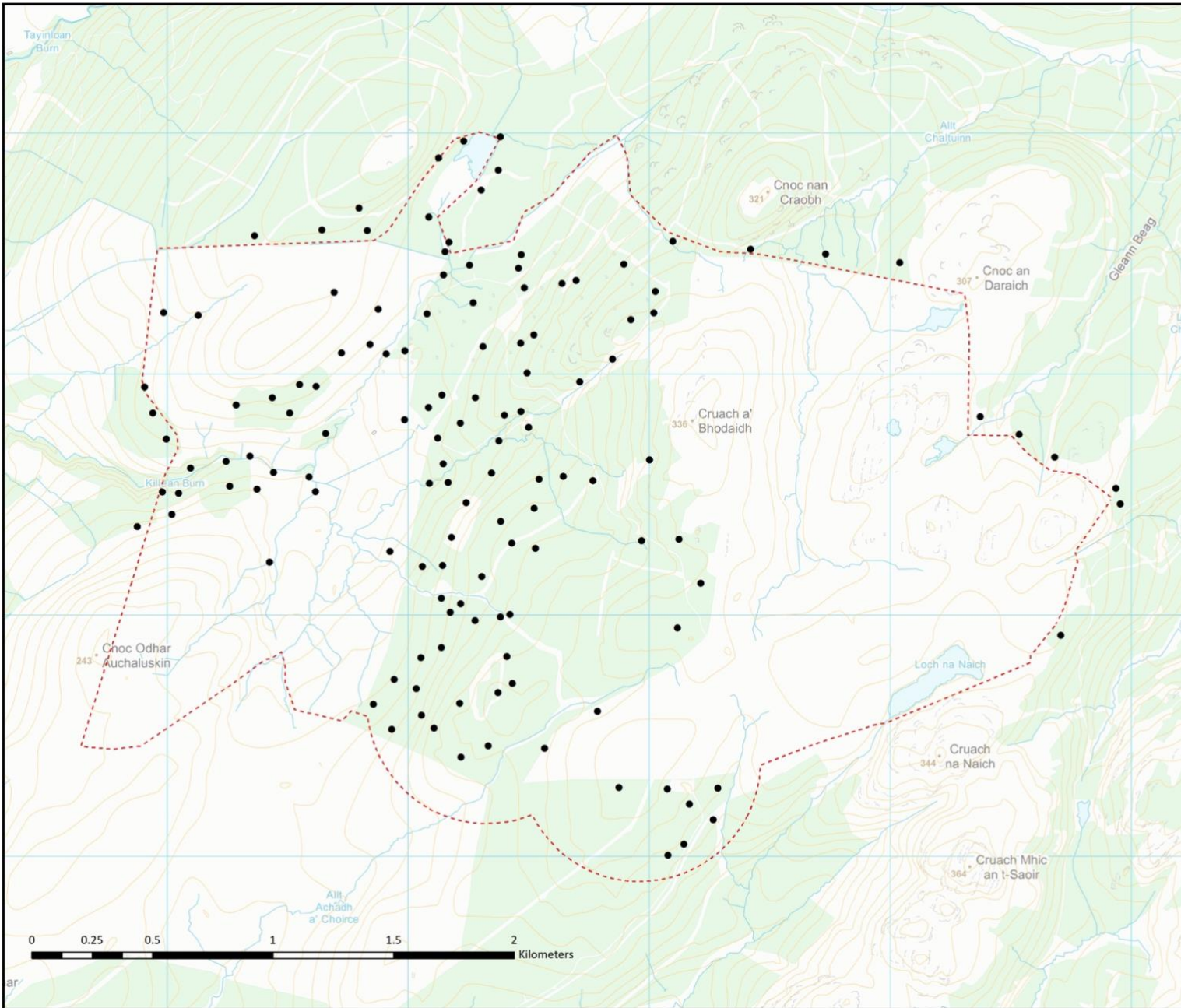
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**BREEDING BIRDS
2022**

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**Killan Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 4

**Distribution of Breeding
Wren**

KEY:

- Appox. breeding locations
- Breeding bird survey area (core)



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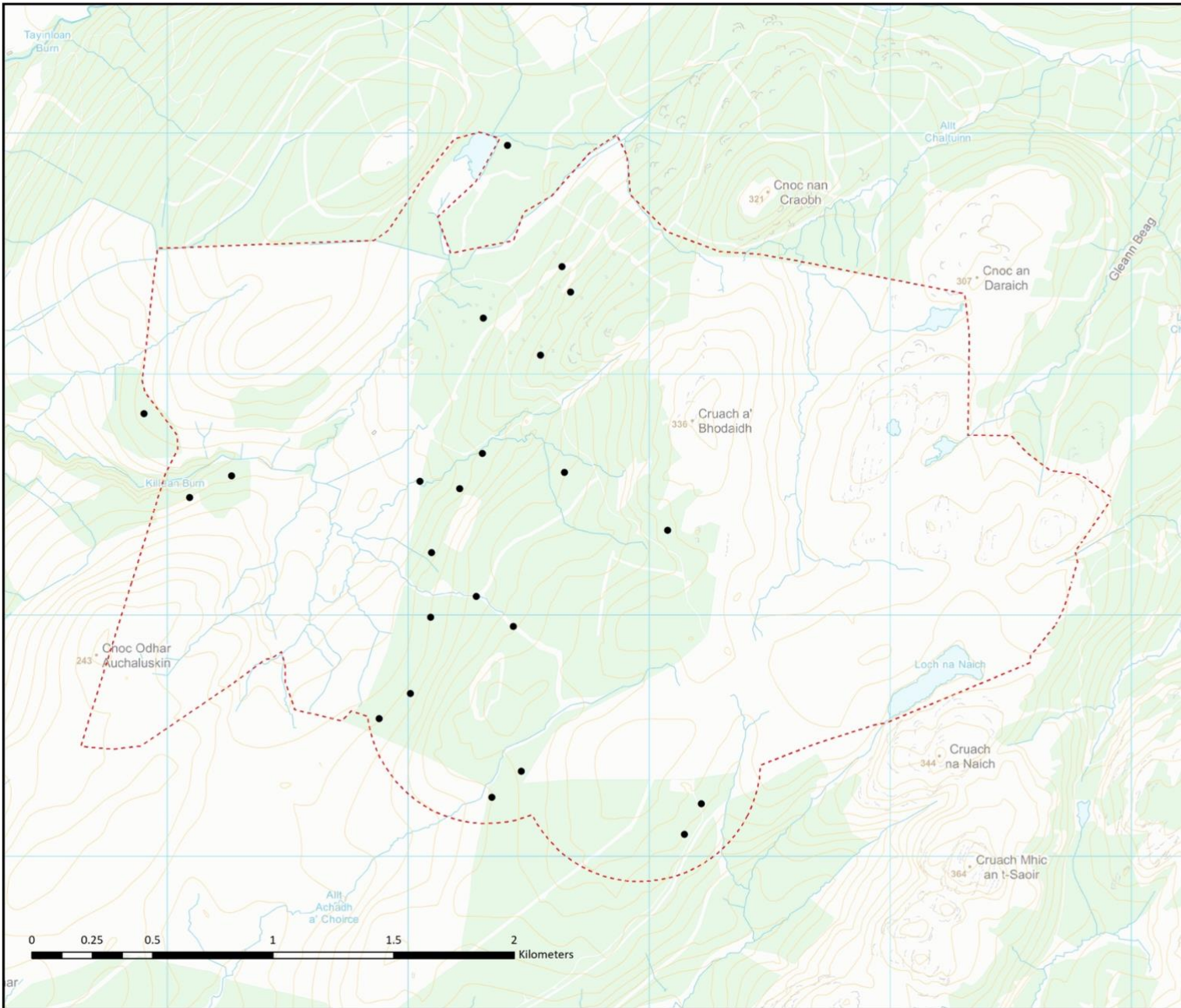
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**BREEDING BIRDS
2022**

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**Killalea Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 5

**Distribution of Breeding
Dunnock**

KEY:

- Appox. breeding locations
- Breeding bird survey area (core)



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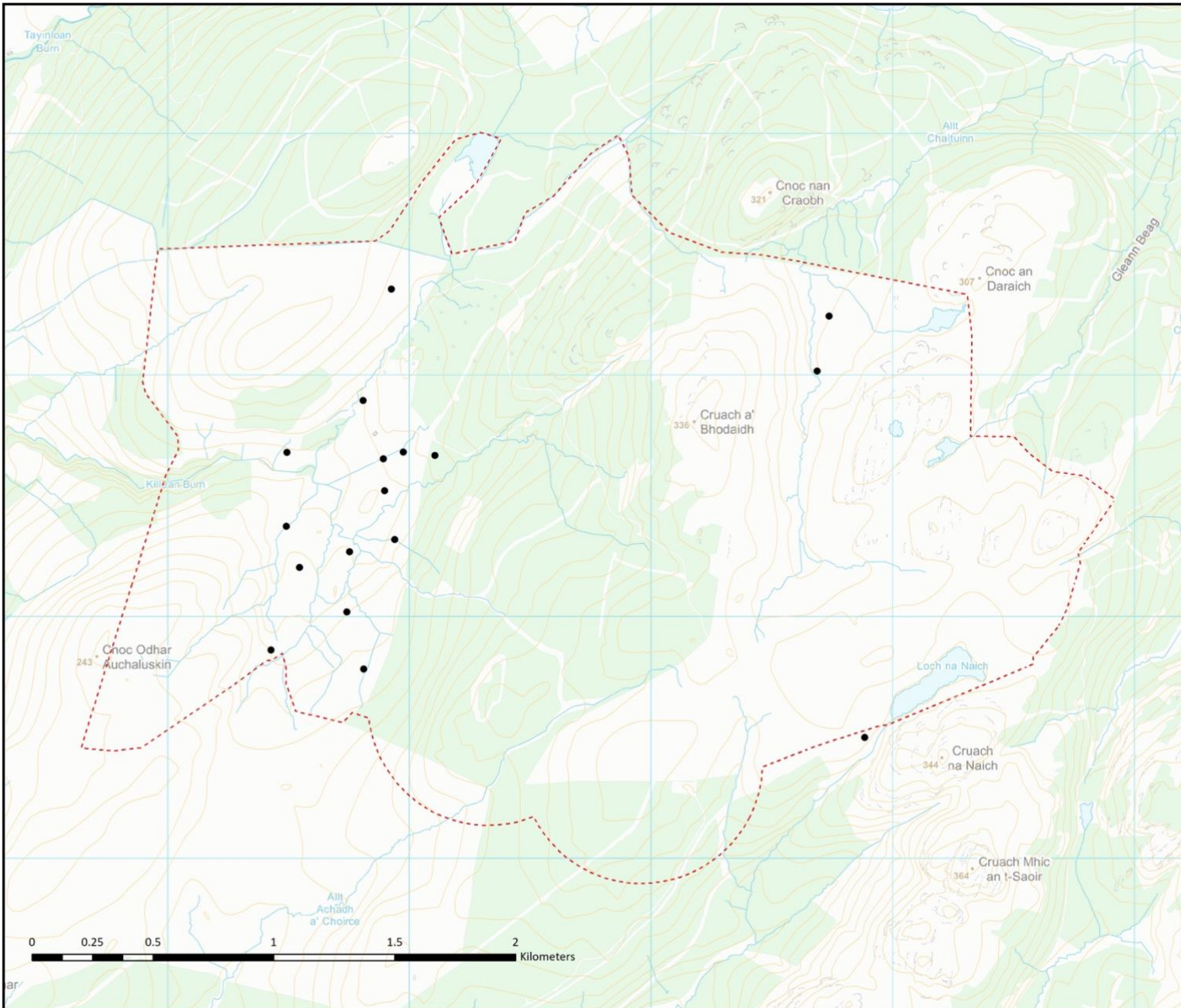
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Drawing number: KL2022-1

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killean Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 6

**Distribution of Breeding
Whinchat**

KEY:

- Appox. breeding locations
- ▭ Breeding bird survey area (core)



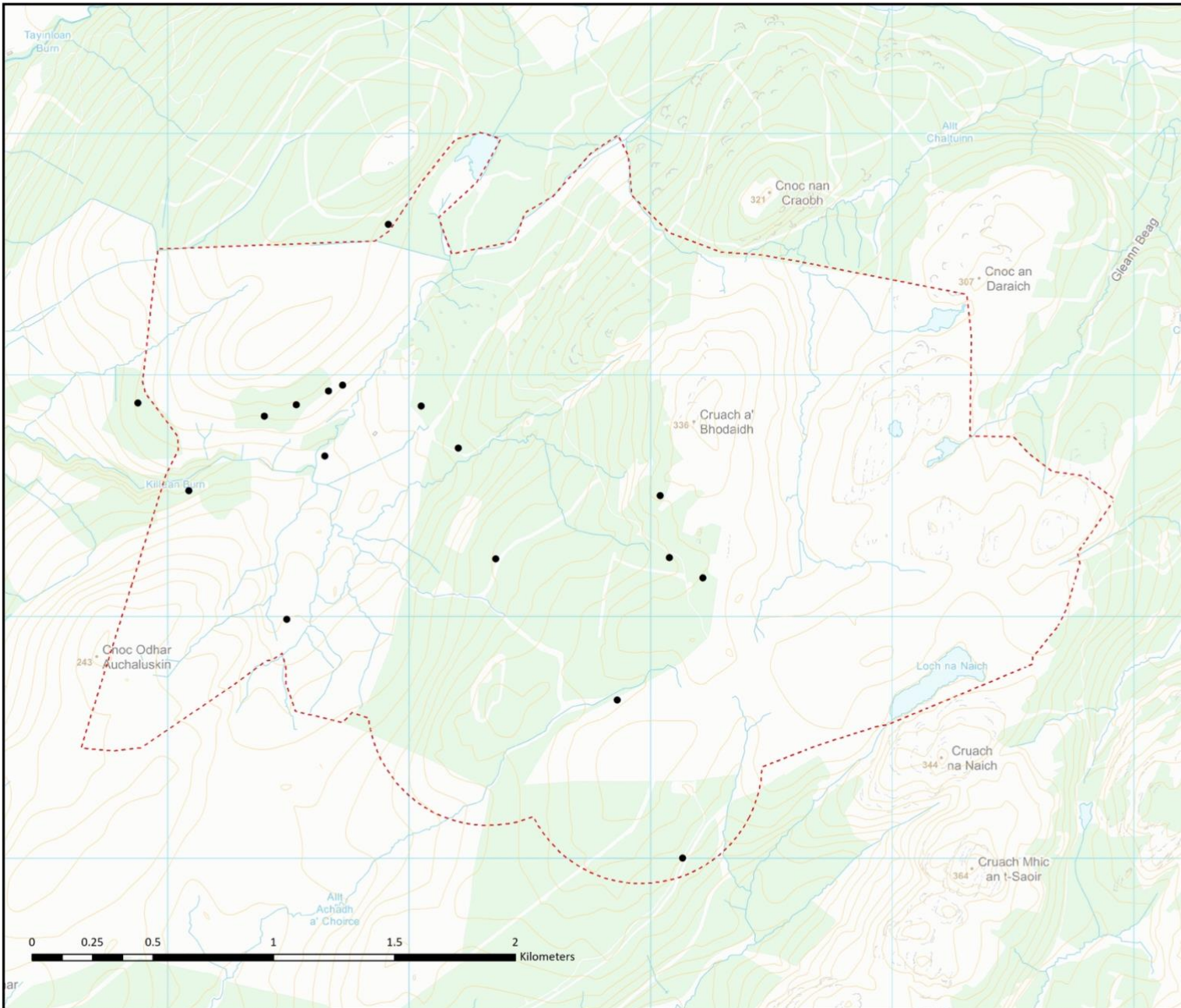
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PROJECT NUMBER: KL2022-1	

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**BREEDING BIRDS
2022**

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**Killlean Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 7

**Distribution of Breeding
Song Thrush**

- KEY:**
- Approx. breeding locations
 - ▭ Breeding bird survey area (core)



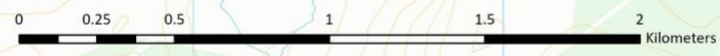
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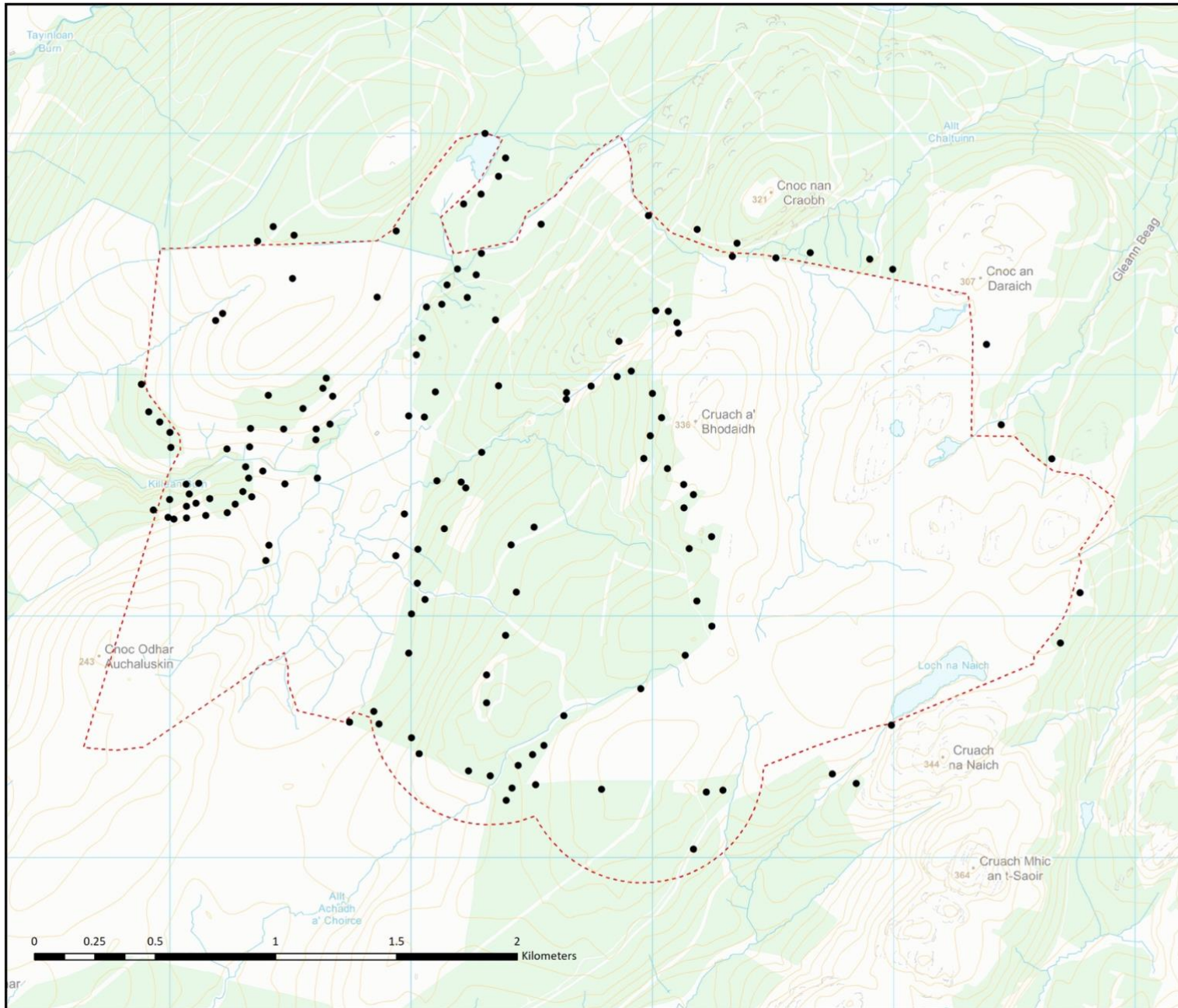
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REFERENCE NUMBER	KL2022-1		

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killan Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 8

**Distribution of Breeding
Willow Warbler**

KEY:

- Appox. breeding locations
- Breeding bird survey area (core)



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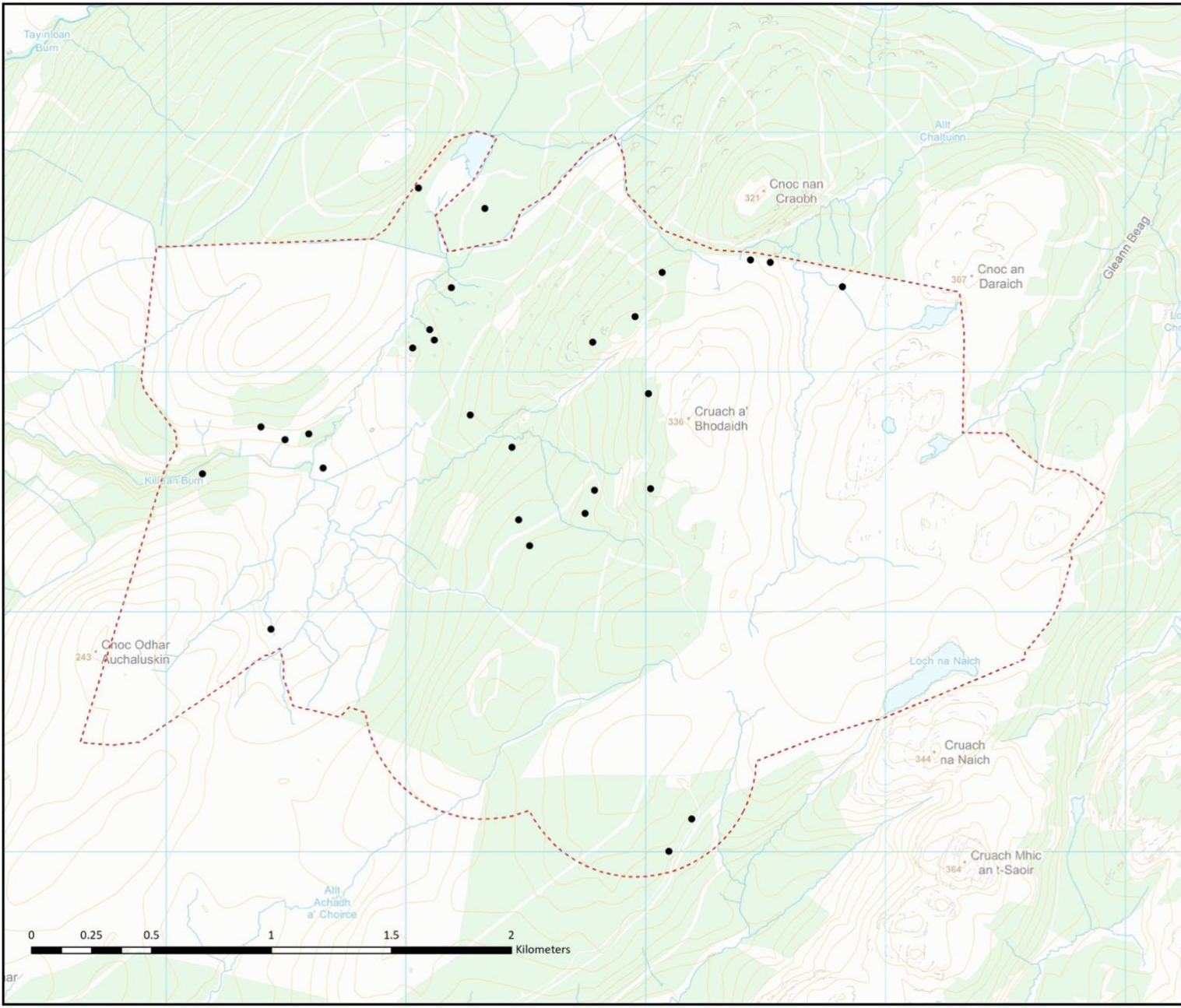
ISSUED DATE: N/A | EXPIRES DATE: N/A

DRAWING NUMBER: KL2022-1

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killean Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 9
**Distribution of Breeding
Siskin**

- KEY:**
- Appox. breeding locations
 - ▭ Breeding bird survey area (core)



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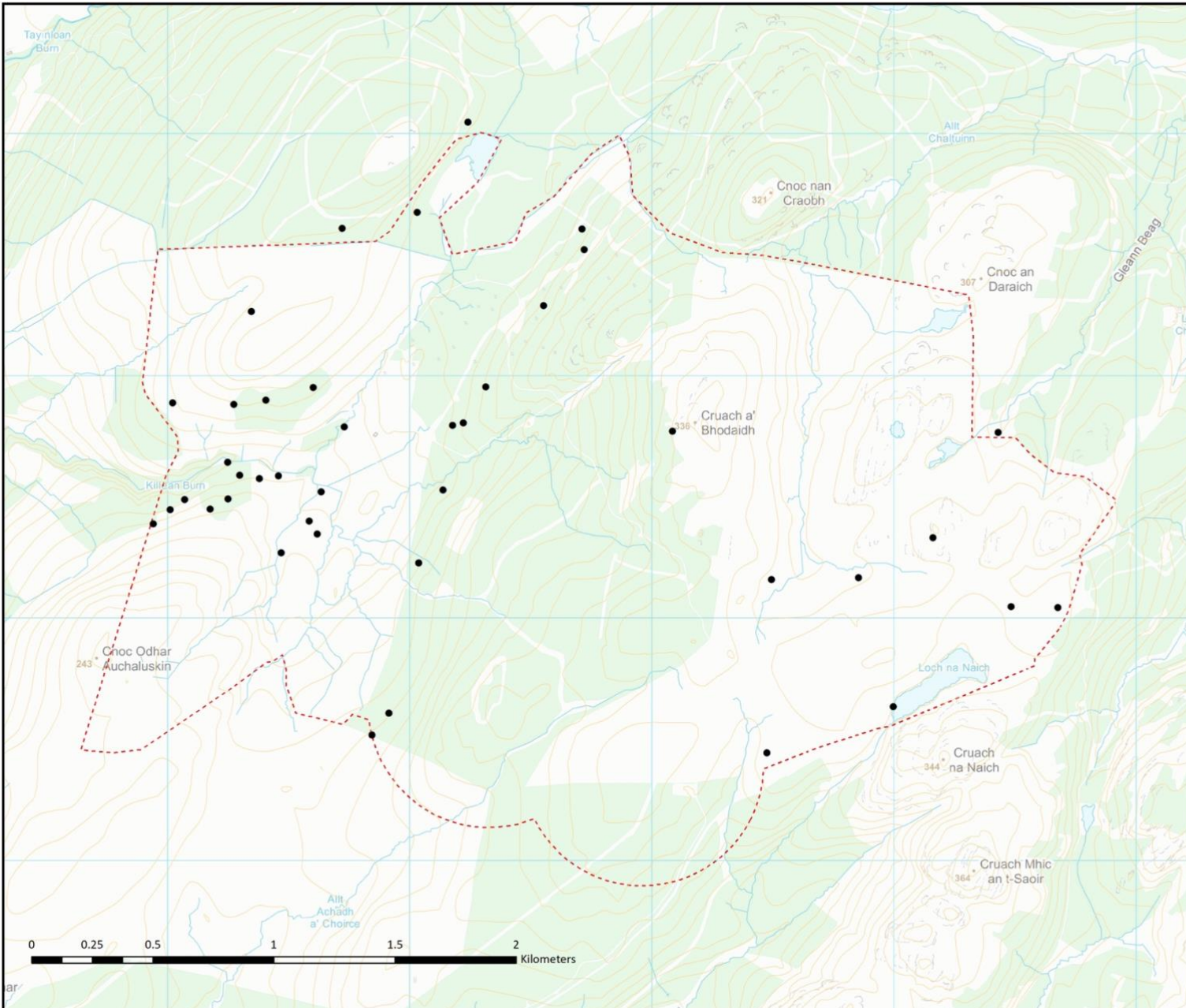
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KL2022-1

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killean Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 10

**Distribution of Breeding
Lesser Redpoll**

KEY:

- Appox. breeding locations
- Breeding bird survey area (core)



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PROJECT NO: N/A DRAWING NO: N/A

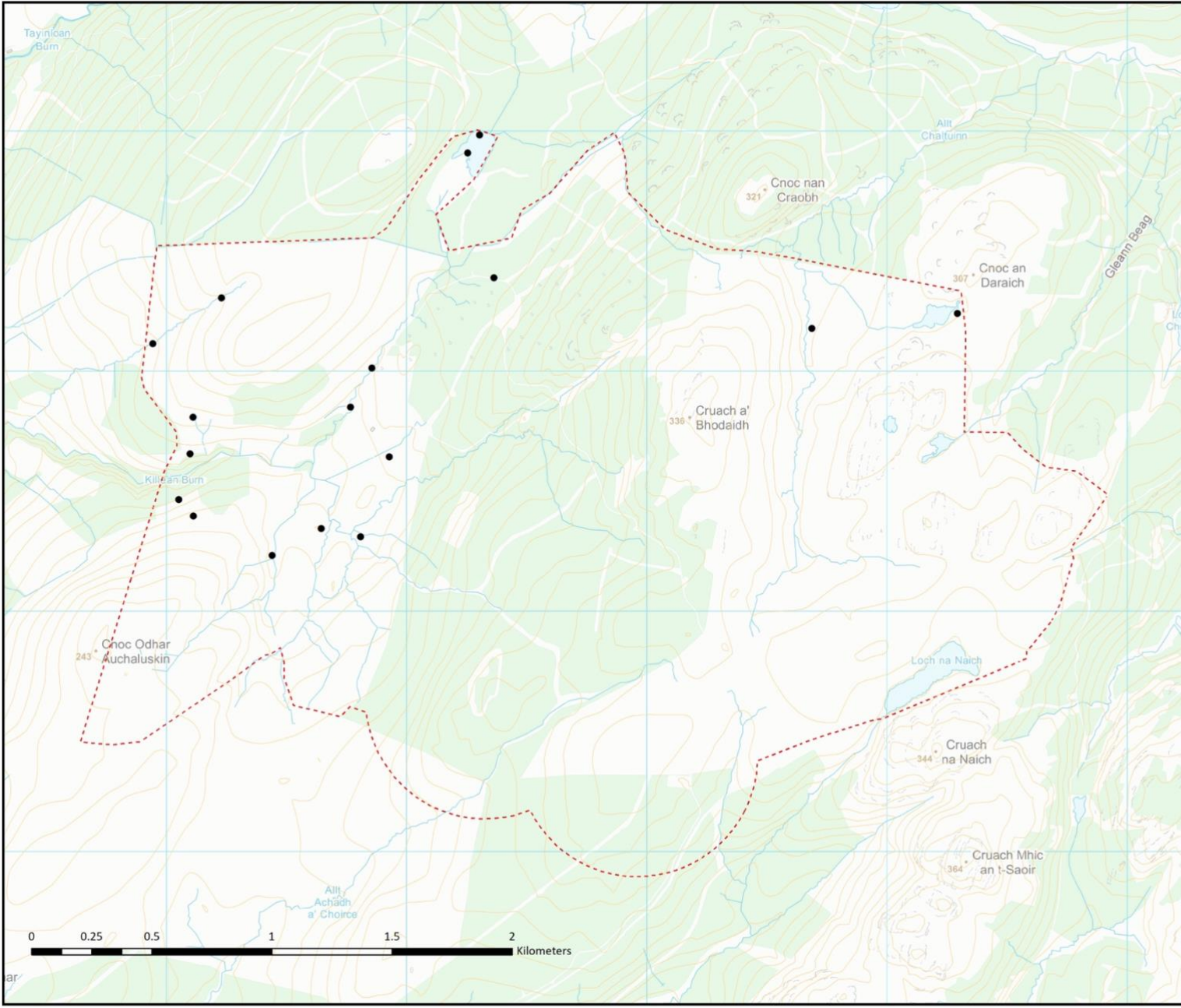
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SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killean Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 11

**Distribution of Breeding
Reed Bunting**

- KEY:**
- Approx. breeding locations
 - ▭ Breeding bird survey area (core)



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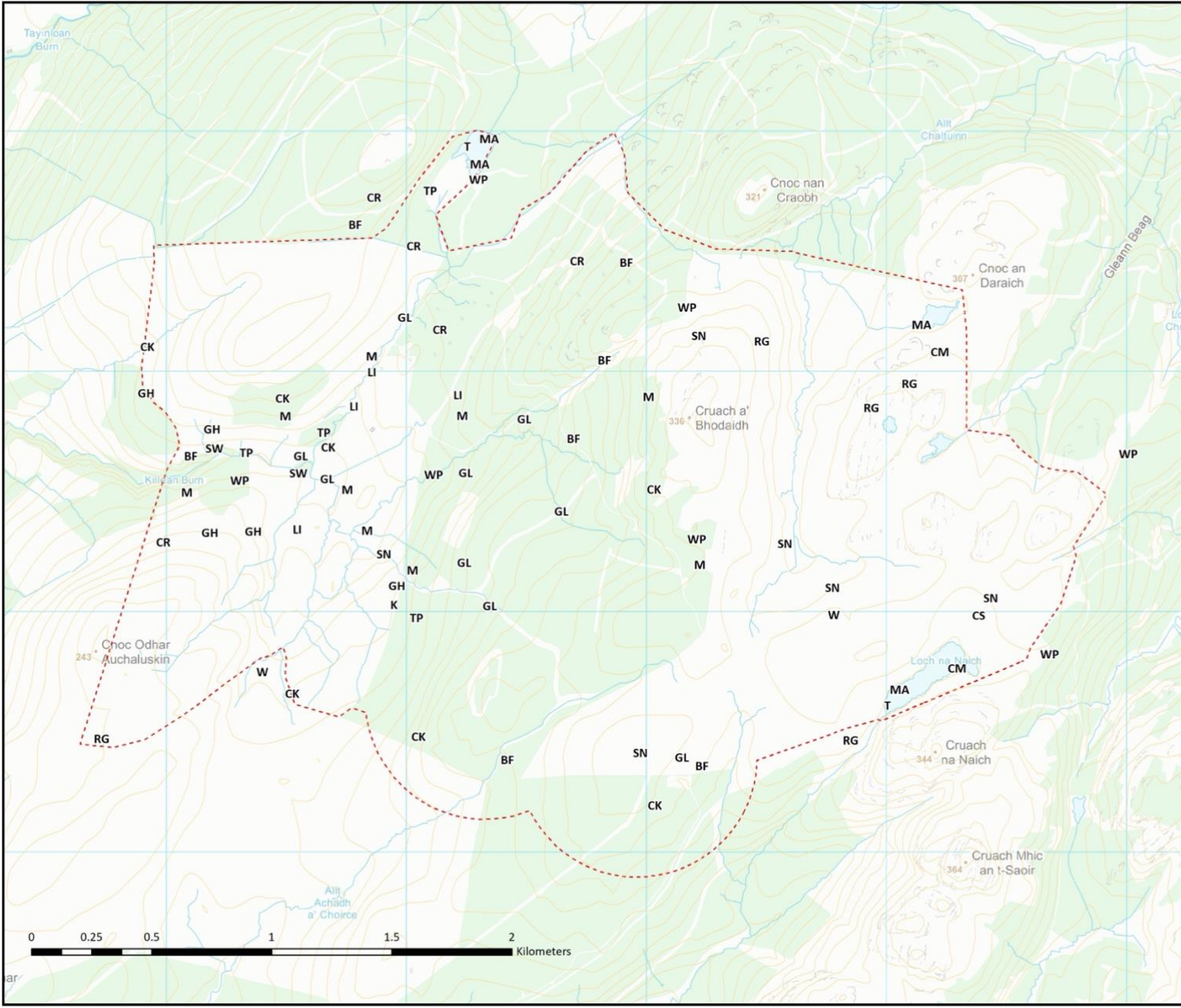
LAYOUT DATE: N/A | T. LAYOUT NO.: N/A

DRAWING NUMBER: KL2022-1

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killan Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 12

**Distribution of Other
Breeding Species**

- KEY:**
- Breeding bird survey area (core)
 - Approx. breeding locations:
 - BF - Bullfinch
 - CK - Cuckoo
 - CM - Common Gull
 - CR - Common Crossbill
 - CS - Common Sandpiper
 - GH - Grasshopper Warbler
 - GL - Grey Wagtail
 - K - Kestrel
 - LI - Linnet
 - M - Mistle Thrush
 - MA - Mallard
 - RG - Red Grouse
 - SN - Snipe
 - SW - Sedge Warbler
 - T - Teal
 - TP - Tree Pipit
 - W - Wheatear
 - WP - Woodpigeon



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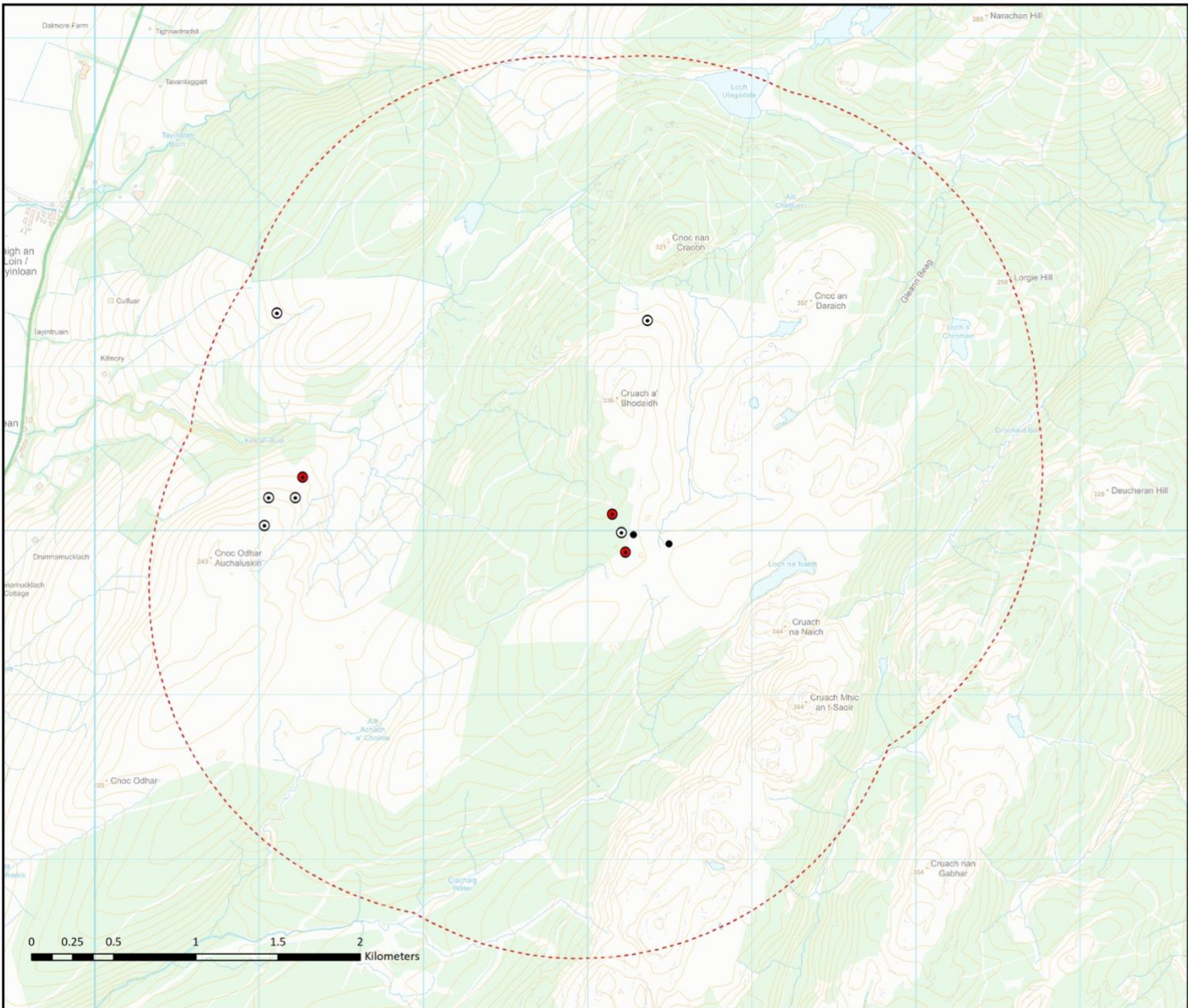
DATE: N/A 1: N/A

PROJECT NO: KL2022-1

SCALE - 1:15,000 @ A3

**BREEDING BIRDS
2022**

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**Killeen Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 13

**Distribution of Black
Grouse Leks**

KEY:

- Black Grouse Survey Area
- Black Grouse Records**
- Other records (singles)
- ⊙ Single male lek
- Two-male lek



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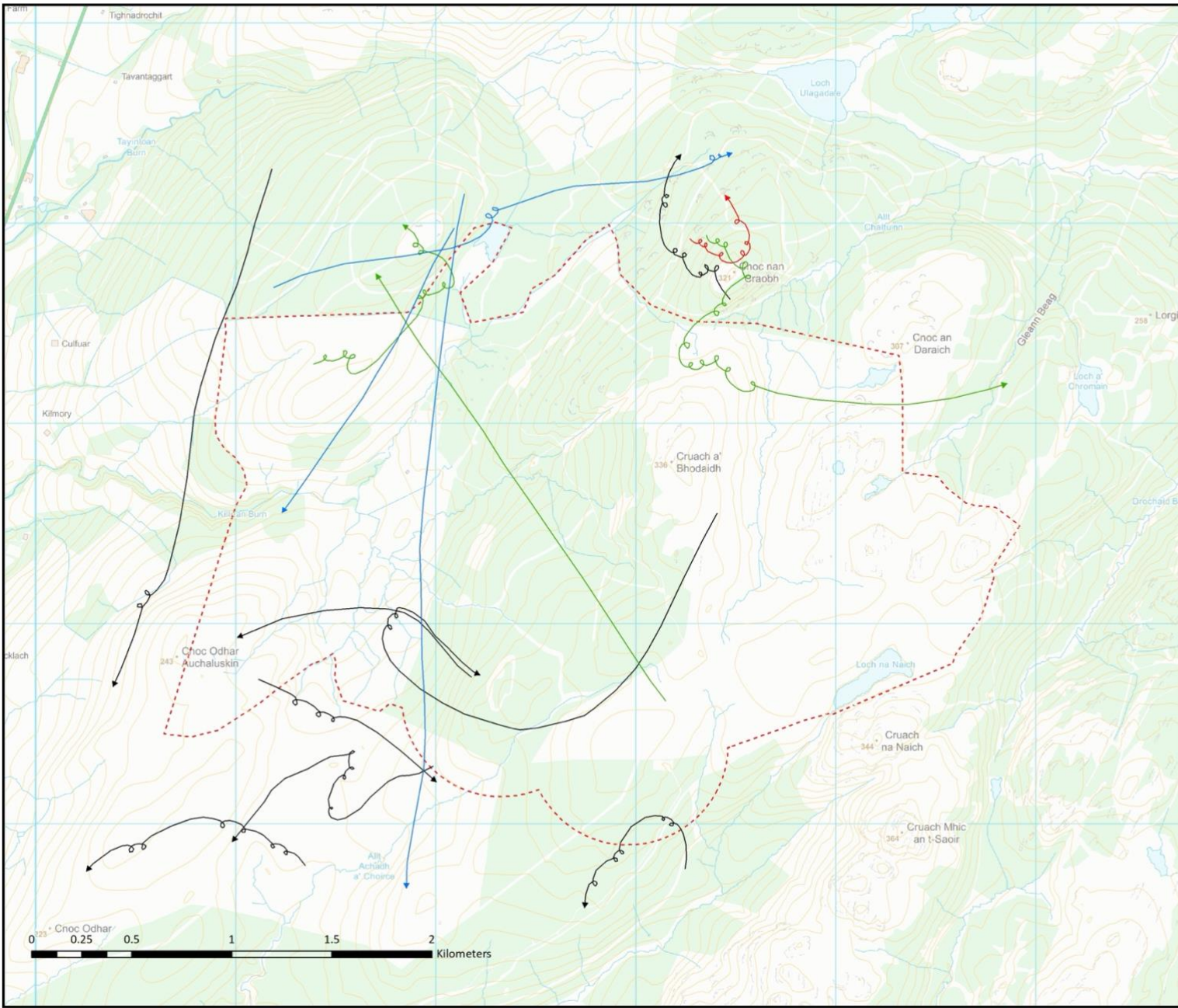
PROJECT NO: N/A DRAWING NO: N/A

REVISIONS: KL2022-1

SCALE - 1:22,000 @ A3

**BREEDING BIRDS
2022**

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**Killalea Wind Farm:
Breeding Bird
Surveys 2022**

FIGURE 14

**VP Survey Flight Lines:
Other Scarce Raptors**

KEY:

Flight lines:

- Merlin
- Osprey
- Peregrine
- White-tailed Eagle
- Breeding bird survey area (core)



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DATE: N/A

PROJECT NUMBER: KL2022-1

SCALE - 1:18,000 @ A3

**BREEDING BIRDS
2022**

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CONCLUSIONS

36. The 2022 breeding bird surveys showed that the survey area supported a range of upland breeding species of importance, including three species specially protected from disturbance under Schedule 1 of the 1981 Wildlife and Countryside Act (goldeneye, red-throated diver and common crossbill). Red-throated diver is additionally listed on Annex 1 of the EU Birds Directive.
37. Four black grouse leks were identified, two of up to two males and two single-male leks. The two leks that were used repeatedly (the two with up to two males) were not specifically tied to a single location but occurred in a range of locations.
38. The site was also used regularly by several scarce raptor species, including golden eagle, white-tailed eagle and hen harrier. None of these were breeding within or in close proximity to the site in 2022.
39. The initial proposed turbine locations have already been modified to move them further from the eagle site and locating more turbines within the forestry rather than the open moorland habitat preferred by this species. This has additionally reduced the potential impact of the wind farm on red-throated diver and hen harrier (moving turbines away from the open moorland in the eastern part of the survey area).
40. The following recommendations are made for the buffering of wind turbine locations in the site design process and other mitigation to avoid disturbance impacts:
 - **Red-throated diver** – potential diver breeding lochs should be avoided by a minimum 300m buffer to avoid disturbance to breeding birds during the operational phase. Buffers of at least 500m would be required to avoid the possibility of any disturbance to breeding divers during construction (Ruddock and Whitfield 2007). Alternatively, this could be mitigated by timing of construction works to avoid all works within 500m of any loch being actively used by breeding divers (and where there was line of sight between the works and the lochs) during March-August, if that were possible.
 - **Golden eagle** – initial recommendations for site design to reduce impacts on this species were produced following eagle range modelling, to move turbines away from areas preferred by the eagles into the afforested areas. This has now been implemented in the current site design. The 2022 breeding season surveys have shown that this species regularly uses the site, though there was no evidence of this pair breeding this year. This species (and other Schedule 1 species such as hen harrier and merlin) would need to be included in the Breeding Bird Protection Plan in case they did breed within/in proximity to the site during the construction period.
 - **Goldeneye** – a pair may have bred in the area. The recommended diver buffer around its loch would be sufficient to avoid any potential disturbance to this species as well.
 - **Common crossbill** – the only potential impact on this forest species would be through felling. Pre-felling surveys should be undertaken as part of a Breeding Bird Protection Plan to inform the need for any mitigation following Forestry Commission Scotland (2006) guidance, and managed by an Ecological Clerk of Works.
 - **Black grouse** – given that the black grouse leks recorded during the 2022 surveys were small (peak two males) and transient (rather than tied to a specific location), applying specific buffers would not be likely to be the most effective mitigation for this species. Instead it is recommended that any black grouse leks located during construction should be buffered by 750m, and no construction activity allowed before 09:00 between April and May. This species should also be included in the Habitat Management Plan.



41. Given that the survey area supports a range of upland breeding birds and is also used for foraging by several important protected raptor species, it is recommended that as well as implementing these measures, a Habitat Management Plan should be implemented to accommodate any displaced birds.

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Appendix 1. Vantage Point Survey Data

Survey Information

Date	Vantage Point No	Start time	Finish time	Weather	Observer
22/03/2022	2	09:00	12:00	cloud 1/8, wind SE 4, 10C, vis very good	Tom Lowe
23/03/2022	1	11:00	14:00	cloud 0, wind SE 2, 10C, vis very good	Tom Lowe
06/04/2022	2	15:10	16:40	cloud 6/8, wind WSW 4, 7C, vis excellent	Tom Lowe
07/04/2022	1	08:45	11:45	cloud 7/8, wind NNW 4, 4C, vis excellent	Tom Lowe
07/04/2022	1	11:45	13:45	cloud 7/8, wind NNW 4, 5C, vis excellent, snow shower	Tom Lowe
07/04/2022	1	14:15	17:15	cloud 6/8, wind NNW 4, 6C, vis excellent	Tom Lowe
08/04/2022	2	09:00	12:00	cloud 1/8, wind NNW 2, 4C, vis very good	Tom Lowe
08/04/2022	2	12:30	15:30	cloud 1/8, wind NNW 3, 8C, vis very good	Tom Lowe
16/05/2022	2	11:45	14:45	cloud 8/8, wind ESE 4, 11C, showers, vis good	Tom Lowe
16/05/2022	2	15:15	16:15	cloud 8/8, wind ESE 4, 11C, drizzle, vis good	Tom Lowe
23/05/2022	2	10:40	13:40	6-8/8 cloud, 3-1 W wind, very good vis	Stuart Piner
23/05/2022	2	14:10	17:10	5-7/8 cloud, 1-2 WNW wind, very good vis	Stuart Piner
23/05/2022	2	17:40	20:40	4-8/8 cloud, 2-1 WNW - NW wind, very good vis	Stuart Piner
24/05/2022	1	07:30	10:30	cloud 7/8, wind WNW 2, 10C, vis good	Tom Lowe
24/05/2022	1	11:00	14:00	cloud 7/8, wind WNW 2, 11C, vis very good	Tom Lowe
24/05/2022	1	17:00	20:00	cloud 7/8, wind W 4, 11C, vis very good, showers	Tom Lowe
25/05/2022	2	08:30	09:00	cloud 8/8, wind WSW 4, 9C, vis good	Tom Lowe
25/05/2022	1	18:10	20:40	6-8/8 cloud, 4 W wind, very good vis, brief shower	Stuart Piner
20/06/2022	2	11:00	14:00	cloud 6/8, wind SW 3, 14C, vis good, heat-haze	Tom Lowe
20/06/2022	2	14:30	17:30	cloud 0, wind W 3, 16C, vis good, heat haze	Tom Lowe
20/06/2022	2	18:00	21:00	cloud 3/8, wind W 2, 15C, vis good, heat haze until 19:00	Tom Lowe
21/06/2022	1	15:30	18:30	8/8 cloud, 3-1 WSW wind, ok - very good vis	Stuart Piner
21/06/2022	1	19:00	21:30	8/8 cloud, 1-2 WSW - WNW wind, good - ok vis	Stuart Piner
15/07/2022	1	12:00	15:00	cloud 5/8, wind NW 4, 15C, vis very good	Tom Lowe
15/07/2022	1	15:30	18:30	cloud 2/8, wind NW 4, 16C, vis very good	Tom Lowe
15/07/2022	1	19:00	22:00	cloud 2/8, wind NW 4, 15C, vis very good	Tom Lowe
16/07/2022	1	05:30	08:30	cloud 8/8, wind WSW 1, 12C, vis excellent	Tom Lowe
16/07/2022	1	12:30	15:30	cloud 8/8, wind SSE 2, 15C, vis very good	Tom Lowe
16/07/2022	1	16:00	19:00	cloud 8/8, wind SSE 3, 15C, vis very good	Tom Lowe
17/07/2022	2	05:30	08:30	cloud 8/8, wind SW 2, 16C, vis very good	Tom Lowe
18/07/2022	2	12:25	15:25	0/8 cloud, 3 SW wind, excellent vis	Stuart Piner
18/07/2022	2	15:55	18:55	0-2/8 cloud, 3-1 variable wind, excellent vis	Stuart Piner
18/07/2022	2	19:25	22:25	6-7/8 cloud, 1-3 variable wind, very good vis	Stuart Piner
19/07/2022	2	05:30	08:00	8-3/8 cloud, 3-1 variable wind, very good vis	Stuart Piner
20/07/2022	2	12:15	14:45	8/8 cloud, 2-3 NW wind, very good - ok - very good vis, brief period of light rain	Stuart Piner
15/08/2022	2	14:00	17:00	cloud 8/8, wind WNW 2, 18C, vis good	Tom Lowe
15/08/2022	2	18:00	21:00	cloud 8/8, wind NW 1, 16C, vis good	Tom Lowe
16/08/2022	1	14:00	17:00	cloud 8/8, wind NNW 3, 15C, vis good, cloud finally lifting	Tom Lowe
16/08/2022	1	17:30	20:30	cloud 7/8, wind NNW 3, 15C, vis very good	Tom Lowe
17/08/2022	1	06:00	09:00	cloud 8/8, wind ENE 3, 11C, vis very good	Tom Lowe
17/08/2022	1	09:30	11:30	cloud 7/8, wind ESE 4, 15C, vis very good	Tom Lowe
17/08/2022	1	12:00	15:00	cloud 8/8, wind ENE 3, 15C, vis very good	Tom Lowe
17/08/2022	1	15:30	17:00	cloud 8/8, wind SSE 2, 15C, vis very good	Tom Lowe
18/08/2022	2	05:30	08:30	cloud 8/8, wind S 3, 14C, vis excellent	Tom Lowe

Survey Data



TA 8-1 KILLEAN WIND FARM: BREEDING BIRD SURVEYS 2022

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
2	22/03/2022	09:45	PE	1	ENE	50	hunt/soar	170	juv
2	22/03/2022	10:05	GP	10	NE	90		180	
2	22/03/2022	10:22	EA	1	ENE	55	hunt	40	ad
1	23/03/2022	11:06	EA	1	S	60	soar/hunt	1260	ad male, displayed just N of forestry, landed on moor
1	23/03/2022	11:21	EA	1	ENE	45	hunt	480	ad female, landed by male
1	23/03/2022	11:50	EA	1	SSW	8	hunt	230	ad male, same as 1
1	23/03/2022	13:05	EA	1	S	15	hunt	270	ad female, same as 3, landed in tall tree in isolated little stand of fives
1	23/03/2022	13:47	EA	1	WSW	105	soar	660	ad female, same as 9
2	06/04/2022	16:30	EA	1	NE	45	hunt	370	usual ad female, damage in left wing/tail
1	07/04/2022	08:50	WE	1	N	60	hunt	170	juv, same as yesterday on BK survey
1	07/04/2022	09:02	EA	1			hunt	200	juv, off map, over Beinn Bhreac
1	07/04/2022	10:55	EA	1	ENE	45	hunt	40	juv, lost behind ridge
1	07/04/2022	11:30	EA	1	SSW	115	hunt	1020	juv, prob same as previous sightings
1	07/04/2022	12:16	WE	1	WNW	125	soar	170	juv, prob same as 4
1	07/04/2022	12:52	EA	1	NE	78	hunt/soar	1020	juv, same as 6
1	07/04/2022	13:16	HH	1	ENE	30	soar/hunt	190	female
1	07/04/2022	13:18	HH	1	NE	20	soar	90	male, joined female, both lost behind ridge
1	07/04/2022	14:52	EA	1	SSE	85	soar/display	400	ad female, sky-dancing
1	07/04/2022	15:15	WE	1	SSW	80		160	ad
1	07/04/2022	17:12	WE	1	ENE	70	hunt	110	off map
2	08/04/2022	09:23	NW	31	W	90	roost/migrate	80	off map
2	08/04/2022	09:28	WE	1	WSW	75	soar	200	ad, off map
2	08/04/2022	09:53	WE	2	NNW	300	soar/display	220	imms, lost as specks to NE after a further 5mins
2	08/04/2022	10:18	EA	1	NW	40	hunt	250	ad, circled then stooped onto forest at cNR 708 422 then back up - came onto map at 10:21, lost over ridge
2	08/04/2022	10:28	EA	1	NE	170	hunt/soar	1920	juv
2	08/04/2022	10:38	EA	1	SSW	125	soar/display	720	ad female, usual ad female, ignored juv and went to see off 12, lost both to south
2	08/04/2022	10:40	EA	1	NNE	115	hunt/soar	600	ad female, presumed same as 8
2	08/04/2022	10:49	EA	1	SSW	165	display/soar	480	ad male
2	08/04/2022	11:08	PG	22	NW	450	migrate	450	
2	08/04/2022	11:27	EA	1	NNW	50	hunt	130	juv, same as 9
2	08/04/2022	11:50	WE	1	SSW	49	roost/migrate	160	imm, landed in tree, white in the tail
2	08/04/2022	12:42	WE	1	NW	20	hunt	80	imm, flew from tree
2	08/04/2022	12:53	EA	2	SSW	220	soar/display	960	ads, pair, male occasionally sky dancing
2	08/04/2022	13:58	EA	2	NNW	40	hunt	280	ads, same as 4
2	08/04/2022	14:01	PE	1	NNW	155		150	ad male
2	08/04/2022	14:28	WE	1	ESE	13	hunt	60	imm, prob same as 2
2	08/04/2022	14:57	WE	1	WSW	13	hunt	160	imm, same as 12, lost in haze
2	08/04/2022	15:07	EA	2	ENE	48	hunt	480	ads, same as 8
2	08/04/2022	15:18	EA	2	NW	108	hunt/soar	500	ads, same as 16, off map
2	23/05/2022	11:01	HH	2	SW	38		840	ringtails (2cy?)
2	23/05/2022	13:45	EA	1	circle N	55		270	adult, mobbed by C
2	23/05/2022	16:36	EA	1	circle S	125	display	660	adult, inner primaries or outer secondary missing from right wing
2	23/05/2022	20:18	HH	1	NE	20		30	ringtail
1	24/05/2022	08:03	RH	2	E	45	prospecting	80	landed, swam around perimeter, no diving
1	24/05/2022	09:10	RH	2	NNE	40		250	same as 2, pair in circling display flight then landed to feed
1	24/05/2022	11:58	HH	1	WSW	3	hunt	160	female
1	24/05/2022	13:48	RH	2	WSW	15	prospecting	40	same as 7, landed
1	24/05/2022	18:52	OP	1	ENE	70	soar/hunt	310	went on to hover over Loch Ulagadale
1	24/05/2022	19:40	OP	1	SSW	100		290	same as 4
2	20/06/2022	19:33	RH	1	E	80		110	
2	20/06/2022	20:15	RH	2	NNW	65	display	290	lead bird doing slow flapping
1	21/06/2022	16:41	HH	1	SSW	15	hunt	230	adult male
1	21/06/2022	19:39	RH	1	NNW	15		70	landed
1	21/06/2022	20:07	RH	2	NNW	25		70	landed, aggressive interaction with bird already on loch
1	21/06/2022	20:12	RH	1	circle	15		70	flew from loch (presumably bird originally on loch)
1	21/06/2022	20:33	RH	2		13		110	circle dover loch
1	21/06/2022	20:50	RH	1		13		90	circled over towards Loch

TA 8-1 KILLEAN WIND FARM: BREEDING BIRD SURVEYS 2022

VP	Date	Time	Species	Count	Direction of flight	Flight height (m)	Activity	Time bird observed (sec)	Notes
1	15/07/2022	13:28	EA	1	SSW	100	soar	370	imm, 2cy/3cy with white tail and full crop
1	15/07/2022	13:35	EA	1	SSW	60	soar/display	350	ad, off map soared, sky-danced, landed on ridge at NR 720 473
1	15/07/2022	13:51	EA	1	NNE	145	soar	660	imm, same as 6, 2cy
1	15/07/2022	13:51	EA	1	NNE	90	soar	290	ad male, saw off 2cy then brief display, then soaring
1	15/07/2022	13:54	EA	1	N	95	soar	120	ad female, joined 9 (presumed mate) - both soaring off map for another 8 mins, lost c500m SSE
1	15/07/2022	13:58	EA	1	SSW	85	soar	320	ad male, up in response to approach by 2cy
1	15/07/2022	14:01	EA	1	SSW	70	soar	260	ad female, same as 13:35, joined 11 (presumed mate), briefly then back NNE, lost behind trees
1	15/07/2022	20:22	RH	1	NW	60		90	landed
1	15/07/2022	20:28	RH	1	W	110	feed	190	
1	16/07/2022	06:03	RH	2	SW	40		130	pair, landed
1	16/07/2022	06:10	RH	1	SSW	60	feed	200	same as 1
1	16/07/2022	06:38	RH	2	ESE	80		170	different pair, landed on Loch Ulagadale
1	16/07/2022	06:59	HH	1	WNW	3	hunt	290	2cy male, lost behind foreground trees
1	16/07/2022	08:12	RH	1	NNE	40		120	landed
1	16/07/2022	08:20	RH	1	NE	50	display	350	prob same as 8, landed again
1	16/07/2022	12:56	WE	1	NNE	275	soar	400	imm
1	16/07/2022	13:27	RH	2	NNW	60		130	pair, landed (at the same time, song audible to the SE - Loch na Naich?)
1	16/07/2022	13:47	RH	1	ENE	85	feed	220	headed off towards sea (off map)
1	16/07/2022	13:57	RH	2	SSE	40		160	same as 11, landed again
1	16/07/2022	14:09	RH	2	SSE	50		120	same as 14
1	16/07/2022	14:31	RH	1	SSE	35		100	landed
1	16/07/2022	14:42	RH	1	SSE	150		160	
1	16/07/2022	15:11	HH	1	WSW	2	hunt	570	female, tried hard to catch MA duckling at W end of loch, eventually landed
1	16/07/2022	16:00	RH	1	SSE	35		110	landed to join mate
1	16/07/2022	16:02	RH	1	SSE	40		170	landed
1	16/07/2022	16:18	RH	1	NE	35	flushed	120	flushed by fisherman, landed with pair
1	16/07/2022	16:25	RH	1	SSE	60		150	3rd bird flew off, pair started singing/display on water
1	16/07/2022	16:34	RH	2	SW	40	display	170	pair, same as 1, exaggerated flapping over presumed failed nest site (Loch Luireach). Landed on Naich
1	16/07/2022	16:37	RH	1	SW	45		130	prob same as 4, landed on Loch na Naich
1	16/07/2022	16:55	RH	3	NNW	90	display	220	same as 5 and 6, all landed after wailing display flight
1	16/07/2022	17:01	EA	1	SW	9	hunt	20	ad, off map, flew from tree at NR 714 471 where been since 12:30
1	16/07/2022	17:45	RH	2	SSW	85		170	
2	18/07/2022	13:29	HH						sub adult male circling to north of site
2	18/07/2022	16:00	EA	1	circle N	175		170	adult
2	18/07/2022	17:31	OP	1	SW	45		70	
2	20/07/2022	14:37	RH	1	ENE	40		50	adult
2	15/08/2022	14:21	RH	1	WNW	75	feed	60	
2	15/08/2022	16:29	HH	1	E	29	soar/hunt	80	female, lost in trees
1	16/08/2022	15:17	HH	1	SE	26	hunt	240	juv, lost over ridge
1	16/08/2022	15:21	EA	1	NNE	43	hunt	790	2cy, usual wandering immature, dropped at forest edge NNE of VP, hovering, but then carried on
1	16/08/2022	15:53	EA	1	WSW	45	hunt	310	2cy, same as 21
1	16/08/2022	16:09	EA	1	SSE	38	hunt	250	2cy, same as 23
1	16/08/2022	16:25	EA	1	ESE	100	soar/display	310	ad male, sky-danced over crag then landed on ledge
1	16/08/2022	16:34	EA	1	SSW	6	hunt	45	ad male, same as 29, lost behind ridge
1	16/08/2022	18:33	EA	1	WSW	65	hunt	560	2cy
1	16/08/2022	18:37	HH	1	NNE	45	mobbing	220	mobbing EA
1	16/08/2022	19:02	EA	1	S	44	hunt	130	ad, landed in tree
1	16/08/2022	19:47	RH	1	NNW	25		110	landed
1	17/08/2022	06:14	RH	1	SE	35	to preen	50	
1	17/08/2022	07:10	RH	1	ENE	65		60	
1	17/08/2022	07:45	RH	1	NW	35	feed/display	60	landed with 10, displayed in response
1	17/08/2022	09:45	RH	1	SE	40	feed	230	
1	17/08/2022	09:53	HH	1	ENE	18	hunt	290	juv
1	17/08/2022	09:54	RH	2	SSE	250		250	
1	17/08/2022	11:18	EA	1	SSE	21	hunt	340	2cy, landed in tree
1	17/08/2022	12:05	PE	1	SE	98	soar	700	juv
1	17/08/2022	12:05	ML	1	SE	60	mobbing	140	female
1	17/08/2022	12:30	RH	1	NNW	120	feed	150	
1	17/08/2022	12:44	EA	1	SW	65	hunt	80	ad, mobbed by BZ
1	17/08/2022	13:12	EA	1	S	103	hunt/soar	550	2cy
1	17/08/2022	13:12	HH	1	SSW	20	mobbing	120	mobbing EA
1	17/08/2022	13:48	EA	1			roost		ad, perched on summit of Bheinn Bheac
1	17/08/2022	14:43	EA	1	ENE	3	flushed/mob	30	same as 13:48, off map
1	17/08/2022	14:43	HH	1	ENE	3	flushed/mob	30	same as 13:48, off map

