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Orkney's Community Wind Farm Project: Hoy - EIA Report

Appendix 7.1

Ornithology Technical Report

ISO 9001 CERTIFIED
UKAS MANAGEMENT SYSTEMS
British Assessment Bureau

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1 INTRODUCTION

This Ornithology Technical Report presents full details of the methods and findings of all field surveys undertaken to identify ornithological interests for the Proposed Development.

Aquatera Ltd was commissioned to undertake ornithological surveys from April 2018 to March 2020; all fieldwork was carried out by appropriately skilled and experienced local surveyors (see Table 1.1).

Table 1.1 List of surveyors

Name	Abbreviation used	Experience
Andrew Upton (Firth Ecology)	AU	16 years' experience in bird fieldwork and impact assessment for more than 25 onshore wind proposals in Orkney and north Scotland
Stuart Williams	SJW	16 years' experience in bird fieldwork for over 20 wind farm developments in Orkney. Also other extensive bird survey experience including raptor and red throated diver monitoring for various statutory bodies and companies.
Nigel Harding	NH	17 years' survey experience having undertaken various ecological and monitoring surveys for RSPB, SNH, JNCC and BTO.

Full details of the methods and findings of each of the surveys (vantage point surveys, breeding bird surveys, focal diver watches and hen harrier roost watches) are presented in Sections 2 to 5 of this report.

The sub-appendices encompassed within this technical report (Appendix 7.1) will be referred to as Appendix A – Appendix E throughout Appendix 7.1, any external appendices referenced in the document will include the appropriate reference (Appendix 7.2 - 7.4).

All figures are shown in Appendix A. VP survey timings and summaries of the flight activity for each species recorded during VP surveys are presented in Appendix B. Appendix C and Appendix D contain details of the timings of breeding bird surveys and focal diver watches, respectively. Finally, Appendix E contains details of the timings and findings of the hen harrier roost watches.

All environmentally sensitive information is contained in a separate confidential annex (see Appendix 7.2: Ornithology Confidential Annex - Environmentally Sensitive Bird Information).

1.1 OVERVIEW OF SURVEYS

A comprehensive suite of bird surveys has been undertaken covering two breeding seasons (2018 and 2019) and two non-breeding season periods (October 2018 to March 2019 and October 2019 to March 2020). These surveys comprised:

- vantage point (VP) surveys to quantify bird flight activity;
- moorland breeding bird surveys (MBS);
- breeding skua surveys;
- scarce breeding birds (raptors and divers);
- focal diver watches; and
- hen harrier roost watches (November 2019 – March 2020).

1.2 SITE DESCRIPTION

The Proposed Development site is located at Wee Fea to the west of Lyness on the island of Hoy, Orkney. The site is predominantly moorland with rough grassland areas in the eastern part and in some parts through the site where areas of moorland have been ploughed out in the past. The Burn of Ore flows east through the site and the Burn of Longigill flows south through the mid-section of the site. Access to the site is via the existing track to Wee Fea off the B9047 road.

The site is adjacent to Hoy Special Protection Area (Area), an extensive site designated for its internationally important populations of breeding birds including red-throated diver (*Gavia stellata*), peregrine falcon (*Falco peregrinus*), Arctic skua (*Stercoraius parasiticus*), great skua (*Stercorarius skua*), great black-backed gull (*Larus marinus*) and breeding seabird species including fulmar (*Fulmarus glacialis*); guillemot (*Uria aalge*); kittiwake (*Rissa tridactyla*); puffin (*Fratercula arctica*); and breeding seabird assemblage.

Scapa Flow proposed SPA (pSPA) is an extensive site located to the east of the Proposed Development, covering the marine waters of Scapa Flow which provides important foraging areas for breeding red-throated diver and aggregations of wintering birds including black-throated diver (*Gavia arctica*); eider (*Somateria mollissima*); goldeneye (*Bucephala clangula*); great northern diver (*Gavia immer*); long-tailed duck (*Clangula hyemalis*); red-breasted merganser (*Mergus serrator*); shag (*Phalacrocorax aristotelis*) and Slavonian grebe (*Podiceps auritus*).

Switha SPA is a small island off South Walls to the east of Hoy, south-east of the Proposed Development, designated for its wintering population of Greenland barnacle goose (*Branta leucopsis*).

1.3 CONSULTATION

The survey scope for each year including the survey types, areas, methods and observation effort was agreed in consultation with SNH.

2 VANTAGE POINT SURVEYS – APRIL 2018 TO MARCH 2020

2.1 INTRODUCTION

Two full years of vantage point (VP) surveys were carried out between April 2018 and March 2020 (inclusive).

2.2 SCOPE OF SURVEY

The key aims of the VP surveys were to quantify the levels of flight activity and its distribution over the survey area. This data can be used to estimate the likely collision risk to these species during the lifetime of the Proposed Development. Data on flight activity patterns and time spent flying within the proposed wind farm area can also be used to assess the potential impact of displacement on the species of conservation importance present within the area. Data collected would enable reliable estimates to be made of:

- the time each target species spends flying over the survey area;
- the relative use of different parts of the survey area by each target species; and
- the proportion of flying time each target species spends at turbine rotor height.

2.3 VP SURVEY AREA AND VP LOCATIONS

The VP survey area used during the first year of surveys (April 2018 – March 2019) is shown in Figure A.1 along with the three VP locations and the six great skua snapshot recording zones. The Ordnance Survey grid references of the VP locations are as follows:

VP1 – HY26772, 93199;
VP2 – HY28021, 92376; and
VP3 – HY30324, 93498.

The proposed development area was reduced in size before the second year of surveys commenced in April 2019. The area surveyed in year 2 (April 2019 to March 2020) is shown in Figure A.2. The reduced survey area meant that VP2 was no longer required. The position of VP3 remained unchanged and the position of VP1 was shifted slightly to the east. The flight recording buffer area was altered slightly and more great skua snapshot recording zones (ten) were implemented to provide greater spatial resolution compared to 2018. The OS grid references of the VP locations are as follows:

VP1 – HY27347, 92965; and
VP3 – HY30324, 93498.

The visible areas (viewsheds) within 2 km of the VPs in which observations could be made are shown in Figure A.3 and Figure A.4 for years 1 and 2, respectively. The viewsheds were calculated based on the lowermost height reached by the rotor blade tips (ground level +15 m) from a viewing height of 1 m (head height of seated observer). Visibility was artificially truncated at 2 km however it should be noted that observations of larger species such as red-throated divers were often recorded far beyond the 2 km area. Due to the topography, it was possible to reliably record observations of hen harrier and white-tailed eagle up to 2.5 km from VP3. The view from VP3 was up along the valley of the Burn of Ore, framed by the summits of Binga Fea and the east end of Wee Fea, both of which lay at 2.0 km - 2.5 km from the VP. The eye of the observer was therefore easily drawn out beyond 2 km and it was clear that watches from VP3 detected a considerable amount of hen harrier flight at risk height beyond the 2 km cut-off, much of which was within the wind farm buffer.

2.4 TARGET SPECIES

2.4.1 Primary target species

Primary target species for the breeding season VP surveys included the Hoy SPA qualifying interests of red-throated diver, peregrine and Arctic skua, plus the scarcer raptors such as white-tailed eagle (*Haliaeetus albicilla*), hen harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*) and merlin (*Falco columbarius*).

The non-breeding season primary target species were hen harrier; peregrine; white-tailed eagle; Greenland barnacle goose (Switha SPA qualifying interest); long-tailed duck; common goldeneye; red-breasted merganser (all Scapa Flow pSPA qualifying interests); whooper swan (*Cygnus cygnus*) and any other Annex 1 species or Scapa Flow pSPA qualifying interests.

2.4.2 Secondary species

An alternative snapshot count recording method was required for three secondary species (great skua; great black-backed gull and fulmar (all Hoy SPA qualifying interests) as it was not possible to record the flight activity of these species in the same detail as the primary target species due to the very high frequency of birds in flight simultaneously (particularly great skuas) and the nature of flight behaviour of these species with a high proportion of birds flying around within rather than transiting through the area (see Section 2.5.2).

2.5 VP SURVEY METHOD

Information on bird flight activity was collected during timed watches from the selected VPs conducted in accordance with SNH guidance (SNH, 2017). The main objective of the VP surveys was to quantify the levels of flight activity and types of flight behaviour of each species, particularly those of conservation importance, within the survey area throughout the breeding and non-breeding season periods.

2.5.1 Primary target species

Standard VP survey methodology was used to record primary target species flight activity. During each watch, the following recording method was used to record flight activity:

The viewing arc was scanned constantly until a primary target species was detected in flight. Whenever a bird was detected in or near the overall flight buffer (the overall risk zone), it was followed until it ceased flying or was lost from view. The time the bird was initially detected was recorded along with the duration of the flight within the flight buffer (recorded to the nearest 15 seconds). The route followed by the bird was plotted in the field onto a 1:25,000 (or larger scale) map, with the direction of flight indicated. Time spent within each recording height band was estimated. In 2018, flying elevation was classified into four recording height bands:

- <20 m;
- 20 – 150 m;
- 150 – 200 m; and
- >200 m.

In 2019, flight height was classified into six recording height bands, allowing a more detailed assessment. The six recording height bands were:

- < 15 m;
- 15 – 50 m;
- 50 – 100 m;
- 100 – 150 m;
- 150 – 200 m; and
- >200m.

2.5.2 Snapshot counts

The very high frequency of great skua flights in the survey area meant that the standard VP survey method of mapping individual flight lines was not suitable for recording the multiple birds often in the air at any one time. Therefore, an alternative snapshot count recording method was implemented for three secondary species (great skua; great black-backed gull and northern fulmar). Snapshot counts were undertaken at the end of each 5-minutes (except when a primary target species was being followed or written up). During each snapshot count, the number of individuals of each species flying at risk height within pre-defined recording zones was recorded during one or two relatively rapid sweeps across the viewing arc. Individual birds were counted only once and allocated to the at-risk height band within the recording zone in which they were first detected. In 2018, two recording zones at each VP were used (Figure A.1) and two at-risk height bands were used: 20 – 150 m and 150 – 200 m. Birds in flight below the minimum risk height band were not recorded to keep the snapshot scans manageable and as brief and relevant as possible. In 2019, more detailed spatial and height resolution data were recorded. Four recording zones were used from VP1 and six recording zones from VP3 (Figure A.2). Flight heights were attributed to four at-risk height bands, these were: 15 – 50 m; 50 – 100 m; 100 – 150 m and 150 – 200 m.

The snapshot counts give a sample of the density of birds flying at risk height within each recording zone, which can be converted to flight distance using an average flight speed and extrapolated across the breeding season. This method is often used to record species for offshore wind farm monitoring as in Band (2012) which also states its applicability for use at onshore wind farms using VP survey data to generate the required data on bird density.

2.6 OBSERVATION EFFORT

Full details of dates, times, duration of each watch and weather conditions for each watch are shown in Table B.1 to Table B.4. Observations were carried out in a range of weather conditions and spread throughout daylight hours each month, in order to cover the full range of times that target species could potentially be active including the dawn and dusk periods.

A breakdown of survey effort per VP per month is presented in Table 2.1.

Table 2.1 Summary of VP survey observation effort undertaken per VP per month

Year	Month (hrs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2018	-	-	-	6	6	6	9	9	6	6	6	6
2019	6	6	6	9	12	15	VP1 - 13.25/ VP3 - 15	VP1 - 16.75/ VP3 - 15	6	6	6	6
2020	6	6	6	-	-	-	-	-	-	-	-	-

2.7 DEFINITIONS OF FLIGHTS AT RISK

The 'birds flying through a risk window' model (SNH, 2000) was used to calculate collision risk estimates for red-throated diver. For red-throated diver, flights considered to be potentially at risk were those observed passing at risk height through a notional risk window. The vertical height of the risk window is the airspace suspended at 15 m – 150 m above ground which is the recording height bands in the field encompassing 15 m to 150 m that most closely match the rotor swept height of the dimensions of a generic turbine model with a worst-case design envelope of 13.9 m minimum blade tip height and 149.9 m maximum blade tip height. The risk window for red-throated diver was orientated approximately north-south, perpendicular to the predominant axis of flight lines observed which corresponds to east-west movements of red-throated divers flying between breeding lochans and foraging areas in Scapa Flow. The width of the risk window was 1,550 m which corresponds to the width of the wind farm across the general flight direction of the birds.

The 'birds using the wind farm airspace' model (SNH, 2000) was used to calculate collision risk estimates for peregrine, hen harrier, white-tailed eagle, great skua and great black-backed gull. For these species, flight lines were considered as potentially at risk of collision if they passed at risk height within the wind farm buffer area which is the area within a surrounding buffer of 250 m around each of the proposed turbine locations except for T6 where a 200 m buffer was used to keep the boundary within the VP recording area.

2.8 SURVEY FINDINGS

Flight activity by nine primary target species was recorded during the VP surveys; these were:

- Red-throated diver;
- Peregrine;
- Hen harrier;
- Merlin;
- White-tailed eagle;
- Golden eagle;
- Short-eared owl;
- Arctic skua; and
- Whooper swan.

No Greenland barnacle goose (Switha SPA qualifying interest) or long-tailed duck, red-breasted merganser (in winter) or common goldeneye (all Scapa Flow pSPA qualifying interests) were recorded.

Only data from VP1 and VP3 are presented.

Two secondary species were commonly recorded during snapshot counts; these were great skua and great black-backed gull. Fulmars were very scarce across the survey area, with single birds in only two snapshot counts from Year 1 and eight from Year 2.

A summary of the flight activity recorded is presented in the following sections.

2.8.1 Red-throated diver

Breeding season (April to September)

All red-throated diver flight lines recorded during VP surveys in Year 1 and Year 2 are shown in Appendix 7.2 Ornithology Confidential Annex with details of each flight line presented in Annex 1 Red-throated Diver Data.

Red-throated divers were recorded from April through to the first week in September. Across the whole visible area, there were 44 flights (56 birds) from 36 VP hours in Year 1 and 189 flights (238 birds) from 69 VP hours in Year 2.

Thus, flight activity rates per hour were c.2.2 x higher in Year 2 than in Year 1, probably due in part to the higher numbers present around the Proposed Development in 2019, combined with the more successful breeding season then. The calculated risk was in line with this, with 1.8 x greater risk calculated in Year 2.

Many of the flights were broadly east-west transit flights along the Burn of Ore and the Sky Fea – Wee Fea ridge, although transit birds also took other directions. There were noticeable looping flights at times in the vicinity of potential breeding waters.

2.8.2 Peregrine

All peregrine flight lines recorded during VP surveys in Year 1 and Year 2 are shown in Figure A.5 and Figure A.6, respectively, with details of each flight line presented in Table B.5 and Table B.6.

Breeding season (March to August)

No peregrine flights were recorded during the 2018 breeding season. Eleven peregrine flight lines (total 12 birds) were recorded throughout the 2019 breeding season with four flights at risk through the wind farm buffer. One flight was also recorded in March 2020 however this did not pass through the wind farm buffer.

Non-breeding season (September to February)

Five peregrine flight lines were recorded in the 2018/19 non-breeding season between October and February with a female and unaged bird recorded at risk height through the wind farm buffer. Five peregrine flight lines were also recorded in the 2019/20 non-breeding season between late September and January with two unaged birds recorded at risk height through the wind farm buffer.

2.8.3 Hen harrier

All hen harrier flight lines recorded during VP surveys in Year 1 and Year 2 are shown in Appendix 7.2 Ornithology Confidential Annex with details of each flight line presented in Annex 2 Hen Harrier Data.

The rates of detection from VPs in the whole survey area were remarkably constant across the breeding and non-breeding seasons when both years were averaged, with 1.60 birds per hour in the breeding season (April – August) and 1.51 birds per hour in the non-breeding season (September – March). This masks differences between years, in which

the 2019 breeding season had a higher rate of detections than 2018, but the 2018/19 non-breeding season had a higher rate of detections than 2019/20, as follows:

- 1.39 birds per hour: 2018 April – August
- 1.71 birds per hour: 2018/19 September – March
- 1.82 birds per hour: 2019 April – August
- 1.31 birds per hour: 2019/20 September – March

However, there was much larger variation through the year in terms of the numbers of birds at risk height, and the amount of time spent flying at risk height. Rates of detection of birds flying at more than 15 m above ground (at any point in their flight path) were much higher in the breeding season, which had an average of 0.30 birds per hour at risk height across the two years, compared to 0.08 birds per hour for the non-breeding seasons. This translated into higher risk within the wind farm buffer during the breeding season, so that 75 % of the observed risk occurred in the breeding season and, when the longer daylight hours were factored in, this was extrapolated to 86 % of the annual calculated risk.

Breeding season (April to August)

The rates of observed risk in the 2019 breeding season were nearly double those in 2018, which may have been partly due to the presence of four females along the Burn of Ore in 2019 compared to three in 2018. However, the monthly pattern of breeding season risk was similar in both years, with relatively high risk in April (birds setting up territories), a lull in May (females incubating) and an extended peak in June and July. This peak appeared to be weather-related, since there were two watches in June/July each year when conditions were warm with light winds, and conducive to soaring, which apparently encouraged the harriers to circle up high. In 2018, morning watches from VP1 on 2nd July and VP3 on 19th July generated 40 % of the season's observed risk. In 2019, afternoon watches from VP3 on 28th June and VP1 on 16th July generated 54 % of the season's observed risk.

Non-breeding season (September to March)

There was no observed risk in the 2018/19 non-breeding season, when only two birds were seen at more than 15 m above ground, both of them well away from the wind farm buffer. In the 2019/20 non-breeding season most of the observed risk was due to birds interacting with each other on two watch days – in early October (including at least one juvenile) and again in late March (when fine weather encouraged early territorial activity).

2.8.4 Merlin

All merlin flight lines recorded during VP surveys in Year 1 and Year 2 are shown in Figure A.7 and Figure A.8, respectively, with details of each flight line presented in Table B.7 and Table B.8.

Breeding season (April to July)

Nine merlin flight lines were recorded during the 2018 breeding season with male and female birds seen between April and August. A single sighting of a male bird was recorded in July 2019. No flight activity was recorded within the wind farm buffer area in either breeding season.

Non-breeding season (August to March)

No merlin flight activity was recorded in the 2018/19 non-breeding season. Five flight lines were recorded in the 2019/20 non-breeding season between August and March with a single flight recorded at risk through the wind farm buffer.

2.8.5 White-tailed eagle

All white-tailed eagle flight lines recorded during VP surveys in Year 1 are shown in Figure A.9 and in Year 2 are shown in Figure A.10 and Figure A.11 with details of each flight line presented in Table B.9 and Table B.10.

Breeding season (February to August)

Three white-tailed eagle flight lines were recorded during the 2018 breeding season, none of these were within the wind farm area. In the 2019 breeding season, 17 white-tailed eagle flights were recorded with six at risk height through the wind farm buffer area. Of the flights at risk height through the wind farm buffer area, two of these were adult birds, the rest were immatures. In the partially covered 2020 breeding season, four white-tailed eagle flight lines were recorded with three adult birds recorded at risk height through the wind farm buffer area.

Non-breeding season (September to January)

Two flight lines were recorded during the 2018/19 non-breeding season, both first-year birds, outwith the wind farm buffer area. In the 2019/20 non-breeding season, four white-tailed eagle flights were recorded with a single adult male flight recorded at risk through the wind farm buffer area.

2.8.6 Golden eagle

No golden eagle flight activity was recorded during the first year of surveys. Ten golden eagle flight lines were recorded in Year 2 between April and September 2019 with all flight lines shown in Figure A.12 and Figure A.13 with details of each flight line presented in Table B.11.

Breeding season (February to August)

Nine flight lines were recorded during the 2019 breeding season with two flight lines (a second year bird) recorded at risk height through the wind farm area.

Non-breeding season (September to January)

Only one flight line was recorded during the 2019/20 non-breeding season however this was outwith the wind farm buffer area.

2.8.7 Short-eared owl

All short-eared owl flight lines recorded during VP surveys in Year 1 are shown in Figure A.14 and in Year 2 are shown in Figure A.15 and Figure A.16 with details of each flight line presented in Table B.12 and Table B.13.

Breeding season (April to August)

Four short-eared owl flight lines were recorded during the 2018 breeding season, all below risk height or beyond the flight buffer. Seventeen short-eared owl flight lines were recorded in the 2019 breeding season with two flights at risk height within the wind farm buffer area.

Non-breeding season (September to March)

No short-eared owl flight activity was recorded in either non-breeding season period.

2.8.8 Arctic skua

Breeding season (April to August)

One Arctic skua flight line was recorded in the 2018 breeding season and one flight line (two birds) was recorded in the 2019 breeding season; these flight lines are shown in Figure A.17 and Figure A.18 with details of each flight line in Table B.14 and Table B.15.

Both of these flight lines passed through the wind farm buffer area at risk height.

2.8.9 Whooper swan

Non-breeding season (October to March)

Two whooper swan flight lines (nine birds and 12 birds, all adults) were recorded in the 2018/19 non-breeding season and one flight line (two adults and three juveniles) was recorded in the 2019/20 non-breeding season; these flight lines are shown in Figure A.19 and Figure A.20 with details of each flight line in Table B.16 and Table B.17.

One of the flight lines in 2018/19 and the flight line in 2019/20 passed through the wind farm buffer at risk height.

2.8.10 Great skua

Great skua was the most numerous species in flight within the survey area and a snapshot count method had to be used to record them (see Section 2.5.2 above). Birds were seen from April to September, with a handful of stragglers into early October in 2019.

Up to 16 birds could be found at risk height within one snapshot count from either VP, although 70 – 80 % of snapshot counts each year had from zero – two birds only. In both years flight activity peaked in August and the overall calculated risk each year was remarkably similar (within 3 %) despite the different sub-division of the flight buffer into individual flight zones. This reflects the closeness of the numbers of AOTs each year and the similarity of their distribution.

There were birds in transit all across the survey area, but the contribution of the local breeding birds was clear in the pattern of flight activity rates in the 2019 flight recording zones, which appeared to be broadly in line with the density of territories within each zone.

2.8.11 Great black-backed gull

Great black-backed gull was recorded from VP watches using the snapshot count method in the 2018 and 2019 breeding seasons (April to August) and in the 2019/20 non-breeding season (September to March). It was treated as a non-target species in the 2018/19 non-breeding season.

During the breeding season a maximum of three great black-backed gulls were seen during any one snapshot count, but the majority of snapshots had zero birds. The gulls were recorded particularly infrequently from VP1, where less than half of the three-hour watches had any at all. They were more frequent from VP3, and recorded in all of the watches from there, producing a clear spatial distribution of breeding season activity that was evident in both years.

Great black-backed gulls were less frequent overall in the non-breeding season, but more evenly spread across the flight buffers, so that the rate of sightings from VP1 was greater than during the breeding season, whilst at VP3 it was less.

In both seasons, activity was highest along the eastern edge of the flight buffers, away from the Proposed Development and this was most marked in the breeding season.

3 BREEDING BIRD SURVEYS

3.1 INTRODUCTION

All breeding bird surveys were carried out by appropriately skilled and licensed surveyors (see Table 1.1). The following breeding bird surveys were undertaken:

- moorland breeding bird surveys (MBS);
- breeding skua surveys; and
- scarce breeding birds (raptors and divers).

Full details of the methods and findings of each survey are presented here.

3.2 MOORLAND BREEDING BIRDS

3.2.1 Survey area and method

As per SNH guidance (SNH, 2017), an adapted Brown and Shepherd (1993) method based on recommendations set out in Calladine *et al* (2009) was followed with four survey visits undertaken at least seven days apart, covering the whole breeding season from mid-April to early July. This method is suitable for many moorland and open country species including waders, skuas, gulls, red grouse *Lagopus lagopus scoticus* and some wildfowl species however SNH does not recommend the method for surveying moorland passerines.

The Moorland Bird Survey (MBS) area for each year is shown in Figure A.21 and Figure A.22. The survey area included a 500 m surrounding buffer around each of the nominal outermost turbine locations envisaged in each year and, in 2019, a 500 m surrounding buffer around the two potential access track route options from the public roads. Changes to the layout after feedback from the first year of bird survey meant changes to the survey boundary between years, extending it marginally to the north-east, to the south-east as far as the road, and pulling back considerably from the west and south. The area covered in 2018 was about 10.1 km^2 (taking four man-days per visit) and in 2019 about 8.0 km^2 (taking two to three man-days per visit).

On each visit, all suitable ground within the survey area was approached to within about 100 m aided by use of a large-scale map with a 100 m grid overlaid, and a hand-held GPS. This coverage was not possible for one section of rough grassland fields beside the road (between the ruined buildings of Gear and Hillcrest), where access was restricted; these were viewed from the field boundaries at distances of up to 250 m from their central point. The overall direction and precise route of the survey in each area differed between visits, but the ground coverage was always maintained.

All breeding bird species were recorded, except for meadow pipit *Anthus pratensis*, which was abundant across the survey area in both years.

Additional information on breeding waders was gathered during the VP watches, when any obvious wader territories (displaying birds) were marked on maps or described. However, these results mainly confirmed the distributions from the MBS surveys; the only extra territory was one of Golden Plover, occupied early in 2019.

The interpretation of the field results was aimed towards identifying actual territories, rather than simply all points where birds were seen on the ground. This was considered particularly important for curlew, given that this is a red list species (Eaton *et al*. 2015). Curlews are very mobile during survey work and birds moving about were watched carefully in order to allocate them to pairs and to separate out adjacent pairs – this was not always straightforward, given the

distances over which they could fly, sometimes singly as well as together in a pair. The drawing of key flight paths was useful in later interpretation where distinction between pairs had not been definite in the field. It was helpful to identify curlews as male or female – based on bill length – but this was not always possible. From the pattern of movements recorded, likely territory centres were estimated for each visit. No curlew nests were found and marking territories was very much a best estimate, but occasionally the location of a territory centre could be marked with more confidence where a bird alarmed persistently around the surveyor. For both survey years there were four visits, each with its own curlew distribution estimated as above, and somewhat different between the survey visits. However, at the end of the season it was possible to group clusters of territory positions together, and a breeding pair was assumed where territories had been marked within 500 m of each other from two or more of the visits. The final pair locations marked on the maps in Figure A.21 and Figure A.22 are based on the approximate mid-point of each cluster of territories, or near where the majority of visits were recorded if a cluster was heavily skewed.

The snipe distributions shown on Figure A.23 and Figure A.24 involved the mapping of displaying birds, plus two locations where snipe were flushed from within about 100 m of each other on two different visits. Displaying birds were marked even if only detected on one of the four visits – none were seen more than twice in the same area from the MBS visits, although some were confirmed by observations from the VPs. It is known that this survey method does not enable a full census for snipe (Brown and Shepherd, 1993).

3.2.2 Differences from published method and survey limitations

There were a number of differences from the published method as detailed below, however these are deemed unlikely to have resulted in any significant limitations to the survey findings.

The original Brown and Shepherd (1993) method applies to open moorland but was here extended to include the enclosed rough fields and the strip of pine plantation at the eastern edge of the survey area.

During one or two man-days each year the maximum recommended wind speed of Beaufort Force 4 was exceeded for parts of the day – this is almost inevitable at some point during any extended bird survey work in Orkney and was not considered to have noticeably affected the survey results.

A key difference from the published method relates to the survey time allowed – the original Brown and Shepherd (1993) method envisaged a constant-effort walkover at about 90 minutes per square kilometre, or about 4 km^2 per working day, and this was also said to have been adhered to in Calladine et al (2009). Within this overall allocation there is meant to be time to not only investigate habitat features away from the planned route, but also to check back to ascertain whether individual birds had already been counted, and even to stop and scan every 100 m. However, progress was much slower on Hoy, averaging at about 200 minutes per km^2 in 2018 and 160 minutes per km^2 in 2019. This was partly due to the number of birds present within the area as well as due to the topography and terrain, with steep slopes and some extremely tussocky vegetation to walk through. Certain species, especially curlew, also had to be watched for up to several minutes at a time in order to see how they moved about the site and interacted with other individuals to try to ensure that double-counting did not occur. Similar ground coverage times have been found at other Orkney sites by the same surveyors. The upshot of slower survey work is that the results should be more comprehensive and accurate, which is desirable for impact assessment, although they may not be directly comparable to surveys from elsewhere that adhere to the published timing.

Due to the long survey days, the start times began before the recommended start time of 08:30 or overran the finish time of 18:00 on many of the survey days. However, this is not an issue in terms of recording birds, since most species are likely to be more detectable earlier in the morning, or during the evening, than in the middle of the day. Indeed, the reason for not recommending survey work outside of 08:30–18:00 is specifically to avoid known busier periods, so

as to sample from the part of the day with a more constant, albeit lower, rate of detectability. Such an approach may be advantageous for surveys intending to compare wader densities over large areas, but is not necessary in impact assessment, where the prime requirement is to quantify the numbers of each species as best as possible.

3.2.3 Findings

Four survey visits were carried out in each of 2018 and 2019 between late April and 1st July; the dates, times and weather conditions during each survey are shown in Table C.1 and Table C.2.

Overall summary maps showing the distribution of species considered likely to have bred within the survey area in each year have been compiled based on the observations across the four survey visits. The locations of breeding waders are shown in Figure A.21 to Figure A.24, open ground species (red grouse, stonechat and wheatear) are shown in Figure A.25 and Figure A.26 and gulls are shown in Figure A.27 and Figure A.28. All locations of breeding skuas recorded during MBS surveys are shown in Figure A.29 to Figure A.31. The breeding locations of skylark *Alauda arvensis*, which were very frequently recorded and widely distributed across the survey area in both years have not been mapped. Also, those species that are either incompletely covered in MBS survey (such as greylag goose and some passerines) or were mostly confined to the burnsides, scrub and plantation well away from most of the proposed turbines have not been mapped since mapping their distributions is not considered particularly informative to the impact assessment.

The birds of open ground (excluding skuas and raptors) recorded in each year are shown in Table 3.1, which shows the numbers found and, where appropriate, their density across each year's survey area.

Table 3.1 Moorland breeding birds – open ground species likely to have bred within the survey area

Species		Conservation status (BoCC (Eaton et al, 2015))	2018		2019	
Common name	Scientific name		Overall estimate	Density (from 10.1 km^2)	Overall estimate	Density (from 8.0 km^2)
Greylag goose	*Anser anser*	Amber list	8 nests/broods	-	13 nests/broods	-
Red grouse	*Lagopus lagopus scoticus*	Amber list	6	0.6 per km^2	3	0.4 per km^2
Oystercatcher	*Haematopus ostralegus*	Amber list	1	0.1 per km^2	8	1.0 per km^2
Lapwing	*Vanellus vanellus*	Red list	3	0.3 per km^2	3	0.4 per km^2
Golden plover	*Pluvialis apricaria*	Green list	2	0.2 per km^2	3	0.4 per km^2
Curlew	*Numenius arquata*	Red list	14	1.4 per km^2	18	2.2 per km^2
Dunlin	*Calidris alpina*	Amber list	4	0.4 per km^2	5	0.6 per km^2
Snipe	*Gallinago gallinago*	Amber list	24	2.4 per km^2	17	2.1 per km^2
Redshank	*Tringa totanus*	Amber list	1	0.1 per km^2	2	0.2 per km^2
Black-headed gull	*Chroicocephalus ridibundus*	Amber list	2 individuals	-	12 individuals	-

Species		Conservation status (BoCC (Eaton et al, 2015))	2018		2019	
Common name	Scientific name		Overall estimate	Density (from 10.1 km^2)	Overall estimate	Density (from 8.0 km^2)
Common gull	*Larus canus*	Amber list	5 pairs	-	58 individuals	-
Great Black-backed gull	*Larus marinus*	Amber list	1 pair	-	2 pairs	-
Herring gull	*Larus argentatus*	Red list	12 pairs	-	13 pairs	-
Skylark	*Alauda arvensis*	Red list	207	20 per km^2	97	12 per km^2
Stonechat	*Saxicola torquatus*	Green list	15	1.5 per km^2	7	0.9 per km^2
Wheatear	*Oenanthe oenanthe*	Green list	3	0.3 per km^2	2	0.2 per km^2
Twite	*Linaria flavirostris*	Red list	1 bird detected	-	-	-

The waders found only at low densities tended to be restricted to specific habitats at the edges of the survey area where they were often clustered e.g. lapwing and redshank in the lower fields and golden plover and dunlin on the highest ridges.

Many of the differences between years can be explained by the difference in survey area boundary between years. For instance, the higher numbers of oystercatchers, black-headed gulls and common gulls in 2019 were largely due to the inclusion of fields at the eastern edge of the survey area, which held much higher densities of oystercatchers and an additional gull colony than the open moorland. The higher curlew density in 2019 was also due to the inclusion of more rough grassland fields at the eastern edge.

However, there were noticeably fewer stonechats in 2019 and the big drop in skylark numbers recorded is likely to have been at least partly real. The exceptionally dry, sunny weather early in the 2018 breeding season may have had a positive effect on stonechats and on the detectability (at least) of skylarks. The apparent decline for red grouse is less certain, since the counting for these relies on flushing birds at close quarters, which can be rather random events when walking at 200 m spacing. Greylag goose numbers each year are based on encountering nests or young broods along the route – actual numbers could have been multiples of those shown (e.g. three times, or more) given that birds on nests only flush when approached closely.

In addition, there were several duck, passerine and near-passerine species found along the Burn of Ore, attracted to the water or the willow and gorse scrub alongside it. Some of these species were also found in willows or gorse elsewhere, and in 2019 the Wee Fea plantation and the pond to the north of it was included within the MBS survey area. The species from the burn and plantation are shown in Table 3.2. All of the proposed turbine positions are at 300 m, or more, from these areas.

The Burn of Heldale and its associated scrub was part of the 2018 survey area, but since this lies at more than a kilometre from any part of the Proposed Development, and is out of view from it beyond Binga Fea, the birds seen there are not included in the table.

A few pairs of rock dove *Columba livia*, swallow *Hirundo rustica* and starling *Sturnus vulgaris* were also present in abandoned buildings at the very eastern edge of the 2019 survey area – these are not included.

Table 3.2 Moorland breeding birds – waterside and scrub species likely to have bred within the survey area

Species		Conservation status	2018 burn and scrub	2019 burn and scrub	2019 Wee Fea plantation and pond
Common name	Scientific name				
Mallard	*Anas platyrhynchos*	Amber list	2 broods	1 pair	1 in July
Tufted duck	*Aythya fuligula*	Green list	-	-	1 pair in April
Red-breasted merganser	*Mergus serrator*	Green list	1 pair	4 in July	-
Little grebe	*Tachybaptus ruficollis*	Green list	-	-	1 pair in April
Woodpigeon	*Columba palumbus*	Green list	-	1 pair	1 pair
Cuckoo	*Cuculus canorus*	Red list	1 – 2	-	1
Hooded crow	*Corvus cornix*	Green list	2 pairs	1	1 nest
Coal tit	*Periparus ater*	Green list	-	-	1 – 2 pairs
Willow warbler	*Phylloscopus trochilus*	Amber list	6 singing	13-14 singing	1 singing
Sedge warbler	*Acrocephalus schoenobaenus*	Green list	1	5 singing	-
Goldcrest	*Regulus regulus*	Green list	-	-	1 singing
Wren	*Troglodytes troglodytes*	Green list	4 singing	5 singing	3 singing
Blackbird	*Turdus merula*	Green list	1	2 – 3 pairs	1 – 2 pairs
Robin	*Erithacus rubecula*	Green list	-	3 singing	2 singing
Pied wagtail	*Motacilla alba yarrellii*	Green list	-	1 – 2	-
Chaffinch	*Fingilla coelebs*	Green list	-	-	3 singing
Greenfinch	*Chloris chloris*	Green list	-	-	1 singing
Linnet	*Linaria flammea*	Red list	-	1 – 2	-
Lesser redpoll	*Acanthis cabaret*	Red list	-	1 pair	1 singing
Siskin	*Spinus spinus*	Green list	-	-	1 singing
Reed bunting	*Emberiza schoeniclus*	Amber list	5 males	3 – 4	-

As was the case for the open ground species, there are clear differences between years along the Burn of Ore and in the nearby scrub but, in this case, willow warbler, sedge warbler and robin were more prominent in 2019 than 2018.

The sighting of a pair of red-breasted mergansers on the dam early in 2018, then a female flying down the upper burn indicated a likely breeding attempt that year; in 2019 there were three observations of single birds flying along the burn from VP3, followed by four birds at the dam on 1st July, and again breeding may have been attempted.

3.3 BREEDING SKUA SURVEYS

3.3.1 Survey area and method

The survey area for skuas included the MBS area (see Section 3.2.1 above) plus a further 500 m buffer outside of that (Figure A.29 and Figure A.30). As was the case for the MBS survey areas, changes to the proposed layout after feedback from SNH following the first year of bird survey meant changes to the skua survey boundary between years, extending it marginally to the north-east and pulling back considerably from the south-west. Because skuas are restricted to moorland for breeding, there was no additional skua buffer along the eastern side of the MBS area (which comprises fields and roads) in either survey year.

In 2019 the southern edge of the skua buffer was extended slightly to encompass the whole of the dense great skua colony to the east of Binga Fea, rather than cutting across it, so as to provide better context for the occurrence of skuas in relation to the Proposed Development site. The area of the skua buffer was an additional 4.8 km^2 in 2018 and 5.4 km^2 in 2019. In 2019 this survey required about two man-days per visit, slightly less in 2018. Specific skua survey out to 1 km is not a standard SNH survey requirement but has been carried out in similar form at several Orkney wind farm proposals to date.

The method followed the recommended skua survey technique by Gilbert et al (1998), approaching to within 500 m of all points on the ground and recording skua pairs or individuals perched on the ground that did not fly away out of the survey area if disturbed. These ground locations were mapped on large-scale field maps as Apparently Occupied Territories (AOTs). In addition, birds that circled around a small area persistently and did not fly away were also regarded as AOTs.

Three visits were made from late May to the end of June in each survey year. In 2019, two additional follow-up productivity visits were made in August to check for fledged young over a large proportion of the skua and MBS survey areas including all of the ground closest to the Proposed Development.

In addition to skuas, any golden plovers and dunlin were also recorded, since the skua buffer represented the main habitat for these species around the proposal – there were very few of either species within the 500 m buffer of the MBS areas.

3.3.2 Differences from published method and survey limitations

The skua field survey followed the published method without any particular limitations. However, interpretation of the maps from the three visits differed slightly from the published recommendation, which is simply to take the highest of the three AOT counts as the population estimate. For the surveys here the figures used are those agreed with SNH for inclusion in the national skua census, for which survey work was mainly carried out in 2019, but also incorporates data from 2018 from south-west Hoy (including part of the 2018 skua buffer around this proposal).

In 2018 a contiguous area, almost as large again, was surveyed for skuas covering much of the moorland to the south of Heldale Water. In this expanded area the highest count was in early June, with a total of 564 AOT, as used in the official census figures. Of these, 346 were within the 2018 skua survey buffer (just seven fewer than in the late May count) and of these, 266 were within the 2019 skua survey buffer. The late June visit in 2018 revealed a marked change in distribution from the earlier two visits, with birds in several areas apparently having moved to new areas so that the density distribution was quite different. This last visit was therefore discounted, although in some localities it had the highest numbers. The late May and early June distributions were much more similar.

In 2019 all the visits had broadly similar numbers, and the early June count was the highest, with 251 AOT in the current proposal skua buffer. This coincided closely with the dates of the single counts carried out by SNH and RSPB staff elsewhere on Hoy in 2019.

3.3.3 Findings

Three counts were made in each of 2018 and 2019 between late May and late June; the dates, times and weather conditions during each survey are shown in Table C.3 and Table C.4 in Appendix C.

Overall summary maps showing the distribution of skua AOTs have been compiled based on the final AOT numbers each year (see Section 3.3.2 above). The distributions recorded in 2018 and 2019 are shown in Figure A.29 and Figure A.30, respectively, and both years combined are shown on Figure A.31. The distribution for both years is shown relative to the 2019 skua survey buffer; an additional 80 great skua AOTs were found to the west and south-west of this in 2018, in the larger area covered that year. The AOT locations in both years are not exact (since few nests were found) and showed some variation between visits within each year. The 2018 distribution is simply that which was found on the early June visits (5th – 8th June). The 2019 distribution was arrived at by first marking the AOTs from all three visits, then counting as the 'final' AOTs those where birds were present close together on all three, or on any two, visits. In 2019 it was possible to reasonably interpret this to arrive at 251 AOTs (the early June total) whilst not including any of the locations where birds were seen just once.

Table 3.3 Breeding skuas within the MBS and skua buffer areas

Species	Year	Visit 1 AOT count	Visit 2 AOT count	Visit 3 AOT count	Overall AOT count	Overall AOT count within 2019 survey buffer
Great skua	2018	353	346	278	**346**	**266**
Great skua	2019	224	251	233	**251**	**251**
Arctic skua	2018	1	0	0	**1**	
Arctic skua	2019	0	0	0	**0**	

The checks for fledged young in 2019 were sample checks, covering about 180 AOTs (72 % of the total) including all those closest to the Proposed Development.

A total of only 18 fledged chicks were found, at a productivity rate of just 0.1 young per AOT.

Between the two productivity visits, two of the fledged youngsters from the first visit had been predated. This appeared to be by a large raptor in both cases, with the remains consisting of wings attached to the breastbone, the keel not merely notched but almost entirely pecked away. A young golden eagle had been seen during VP watches from early August, once diving tentatively at an adult great skua on the ground, and this bird, or perhaps one of the resident white-tailed eagles, was probably responsible.

3.4 SCARCE BREEDING BIRDS (RAPTORS AND DIVERS)

3.4.1 Breeding raptors survey area and method

The survey area for breeding raptors covered a 2 km surrounding buffer around the nominal outermost turbine locations of the Proposed Development (see Figure 2.50 in Appendix 7.2 Ornithology Confidential Annex).

The Hardey et al (2006) method recommends that at least three visits are carried out at key times during the breeding season to check for signs of occupancy and to locate nests (April to June). A fourth visit is needed at successful or ongoing nest sites to check for fledged young. All areas of suitable habitat were identified and checked, mainly by watches from suitable vantage points, to look for signs of breeding activity at each stage of the breeding season. Breeding activity includes displaying birds, territorial behaviour, nest building (hen harrier only), adults carrying prey and fledged young. Walk-through ground searches were made (especially for merlin) if there had been no signs of occupancy on the first two visits.

A key advantage for surveying at this site was the long-term recording of breeding raptors on Hoy that has been carried out by volunteers over a decade or more. The Aquatera team of surveyors have been involved in this voluntary effort and therefore had an established understanding of the suitable habitat in the vicinity and the likely raptor breeding distributions. Four (2018) and six (2019) key areas for checking were identified within the 2 km survey buffer (see areas R1 to R6 in Figure 2.50 in Appendix 7.2 Ornithology Confidential Annex). In 2018, area R5 was covered by the main VP2 and did not require additional specific raptor watches. The key habitat in area R6 was within view of the main VP1 or main VP3 in both years; only one small stretch in the middle was out of sight from the main VPs; an extra raptor watch was undertaken here in 2018 and it was one of the key areas for specific raptor work in 2019.

Three scarce raptor species were potentially present in the survey area: hen harrier, merlin and short-eared owl. The timings of the recommended survey visits for all these species overlap, and in both years the survey timetable was broadly in line with these.

From the watches, signs of breeding activity were recorded on the first three visits and locations marked on field maps. A fourth follow-up visit was made to all sites with ongoing nests. Similar follow-up visits were made to the nests located during main VP watches or during the MBS walkovers.

3.4.2 Breeding raptors differences from published method and survey limitations

The first visits to each raptor area in April were later than the mid-April cut-off specified for hen harrier and short-eared owl in Hardey et al (2006), although the key area closest to the Proposed Development was covered from the two main VPs (VP1 and VP3) throughout the year. This later start is deemed unlikely to have resulted in any significant limitations to the findings of the surveys. As elsewhere in Orkney, the dales of south Hoy hold a high density of hen harriers, such that early visits may record much activity, but with little indication of actual territory locations or even of the numbers of females that will stop to settle in an area (since there can be much moving around by birds early in the season).

For short-eared owl, research in Scotland to better define a specific survey methodology (Calladine et al, 2010) found that the detection probability in March was very low and the best period in which to undertake watches was between mid-April and July. However, it is known that in Orkney short-eared owls may be easily seen in some years in March, apparently coinciding with years when they are at high density (Williams, 2013). Since owls are rarely, or never, at high density on Hoy (there are no voles on the island) it is not expected that territories were missed due to some of the raptor watches commencing in late April.

As is standard for the Orkney Raptor Study Group (ORSG), young birds were followed to the point of ringing i.e. not necessarily through to actual fledging, but to 'near-fledged'. This means that the results are comparable to the historic ORSG data.

3.4.3 Breeding raptors findings

Full details of the timing and conditions during each raptor survey visit and the specific areas surveyed are provided in Table C.5 and Table C.6 for 2018 and 2019 respectively.

All surveys were carried out in suitable weather conditions (wind speed generally less than Beaufort F4, avoiding heavy rain and fog) and in conditions of good visibility.

The breeding locations of protected species are environmentally sensitive information (SNH, 2016). All records of protected species considered likely to have bred in the survey area are therefore presented in a separate confidential annex (see Appendix 7.2 Ornithology Confidential Annex). The scarce raptor species recorded breeding were hen harrier, merlin and short-eared owl. The breeding locations recorded in 2018 and 2019 are shown in Figure 2.51 and Figure 2.52, respectively, in Appendix 7.2 Ornithology Confidential Annex.

Table 3.4 below summarises the results each year by visit date and incorporates the observations from the main VPs and MBS walkover surveys. The final counts for the scarcer species each year were:

Year 1 (2018):

- Hen harrier – nine confirmed or probably occupied sites (eight within 2 km); five sites successful, with 13 young near to fledging (all within 2 km); four failed. One additional 'possibly occupied' site.
- Merlin – three occupied sites (two within 2 km); one site successful, with three young near to fledging (within 2 km); one outcome unknown; one failed.
- Short-eared owl – one 'probably occupied' site and one 'possibly occupied' site (both within 2 km); no breeding success noted.

Year 2 (2019):

- Hen harrier – seven confirmed or 'probably occupied' sites (six within 2 km); two sites successful, with seven young near to fledging (both within 2 km); five failed. Two additional 'possibly occupied' sites.
- Merlin – one occupied site (within 2 km); successful, with at least one young fledged.
- Short-eared owl – one occupied site (within 2 km); successful, with three young near to fledging. Two additional 'possibly occupied' sites (both within 2 km).

The late merlin territory in 2018 had not been detected on the first three visits and was not followed up further (it was more than 2.5 km from the Proposed Development), but the activity seen indicated that it too may have succeeded.

Table 3.4 Raptor visits 2018 and 2019: recommended dates, achieved dates and summary findings including observations from other fieldwork (HH = hen harrier, ML = merlin, SE = short-eared owl)

	Visit 1	Visit 2	Visit 3	Visit 4
Purpose of visit	check for occupancy	locate active nests	check for young	check for fledged young
Hen harrier, recommended dates	March – mid-April	mid-April – mid-May	late May – late June	late June – August
Merlin, recommended dates	late March - April	early May to early June	mid-late June	July – early August
Short-eared owl, recommended dates	early March – mid-April	mid-April – May	June	July
Achieved raptor watch dates, 2018	18th – 27th April	8th – 15th May	5th – 12th June	27th June – 4th July

	Visit 1	Visit 2	Visit 3	Visit 4
Numbers of raptors, 2018	HH: 10 females ML: 1 pair SE: 1 male	HH: 7 females ML: 2 pairs	HH: 6 ongoing ML: 2 ongoing	HH: 5 successful ML: 1 successful & 1 late found
Achieved raptor watch dates, 2019	17th – 24th April	9th – 10th May	17th June	3rd – 4th July
Numbers of raptors, 2019	HH: 7 females ML: 1 pair SE: 1 male	HH: 6 – 7 females ML: 1 pair SE: 1 – 2 males	HH: 4 ongoing ML: 1 ongoing SE: 1 – 2 ongoing	HH: 2 successful ML: 1 successful SE: 1 successful

In addition, three nationally common raptor species were found. One pair of buzzards nested each year along the middle of the Burn of Ore about 300 m from the Proposed Development and successfully fledged a chick in 2018. Up to three sparrowhawks were seen from VP watches in both years near the plantations on the lower ground at the east side of the survey area, but no nesting attempts were found in either year. A kestrel was seen hunting over Wee Fea occasionally from MBS walkovers and VP watches in 2019, and a probable juvenile was seen from VP watches in early August, but no nesting attempt was suspected within the survey area.

3.4.4 Breeding divers survey area and method

A separate breeding survey for red-throated divers was not undertaken however, all lochans within the 2 km raptor survey area were checked for signs of breeding red-throated divers, with additional coverage out to the west for Sands Water and Lochs of Geniefea (see Figure 2.50 in Appendix 7.2 Ornithology Confidential Annex). Observations of the breeding waters were made whilst undertaking the raptor and skua work, as well as from the focal diver watches (see Section 4).

The breeding status of all pairs seen away from Lochs of Geniefea was assessed as:

- Successful;
- Laying eggs but not successful;
- Making a scrape but not laying eggs; and
- Present regularly on a lochan but not making a scrape.

There were fewer checks at Lochs of Geniefea and this area is known to attract failed breeders and non-breeders from elsewhere, so only the number of successful and failed breeding pairs was recorded there.

3.4.5 Breeding divers findings

The locations of breeding red-throated divers recorded during the 2018 and 2019 surveys are shown in Figure 2.53 in Appendix 7.2 Ornithology Confidential Annex. The numbers in each breeding class are summarised in Table 3.5 below.

Most successful pairs rear one chick, but two pairs in 2018 were likely to have fledged two chicks and at least one pair in 2019.

Table 3.5 Breeding red-throated divers - numbers of pairs recorded during the 2018 and 2019 surveys

	2018	2019
Successful pairs	7	12
Pairs laying eggs but failing to rear a chick	4	4
Pairs making a scrape but not laying eggs	1	2
Pairs regularly present but not making a scrape	3	0
Total pairs present	15	18

4 FOCAL DIVER WATCHES

4.1 METHOD

The key aim of the focal diver watches was to map as many red-throated diver flights as possible incoming to or outgoing from any of the breeding lochans within the diver survey area (see Section 3.4.4). Therefore, precise VP locations were less important than gaining the best view of the targeted lochans and the wider area to allow flight paths to be followed for as far as possible. VPs were selected to cover several lochans, rather than looking solely at one at a time. Clusters of lochans or closely adjacent lochans were grouped together for this analysis (see Appendix 7.2 Ornithology Confidential Annex).

In line with the current SNH survey guidelines (SNH, 2017) the aim was to gather at least 20 flights to or from each breeding water. In addition to the observations from focal diver watches there were a number of flights from the main VP watches and from ad hoc records that could be attributed to a specific breeding water or area. However, even with these extra records the 20-flight target was not achieved for most of the smaller single lochans, particularly where a pair may have been present in one year only.

Since the rationale behind the 20-flight target is to identify which waters may be affected by the development (in terms of flight routes) then it can be said confidently at the outset that all of the lochans within the diver survey area may be affected. It is known from previous surveys (for other proposals) that birds from any of these waters can fly over or near the Proposed Development (i.e. along the Burn of Ore and along the Sky Fea – Wee Fea ridge) as well as to the north of it along the Mill Burn, or to the west of it along the Burn of Heldale.

Some flights were of birds alighting at nearby vacant lochans to loaf and where these were grouped together, no 'in/out' flight has been counted. Other flights headed down to Heldale Water where loafing birds (which could include breeders from elsewhere, and non-breeders) were seen to number up to 14 in the evening of 29th May 2019. Although there was no breeding at Heldale Water in 2018 or 2019, it has been included as a flight destination and departure point.

There are many more breeding waters scattered across Hoy well to the north of the Proposed Development and beyond the diver survey area. Contrary to expectations, birds from here may fly widely in all directions and not just along the shortest east-west routes to Scapa Flow feeding grounds. Flights traversing the survey area, arriving from or departing to the north, were also mapped. It is likely that a proportion of these may have been non-breeders although birds carrying fish were also included.

4.2 SURVEY EFFORT AND FINDINGS

The focal diver observation effort undertaken in 2018 and 2019 are summarised in Table 4.1 and Table 4.2 respectively, along with the total number of flights attributed to each breeding lochan or group of lochans.

Table 4.1 Focal diver watch summary 2018

VP location	Dates watched	Total time watched (hh:mm)	Number of flights attributed to breeding lochans/groups
South slope Withigill	9th Aug and 21st Aug	9:15	17
Sky Fea	3rd July; 19th July; 7th Aug; 9th Aug; 22nd Aug and 23rd Aug	33:37	24
Bakingstone Hill	23rd Aug	3:00	3
Wee Fea	30th May; 31st May; 4th July and 17th July	18:00	11
Binga Fea	31st May and 8th Aug	9:50	4
Cairn Hill	7th Aug	9:00	9
	TOTALS	**82:42**	**68**

Table 4.2 Focal diver watch summary 2019

VP location	Dates watched	Total time watched (hh:mm)	Number of flights attributed to breeding waters/areas
Sky Fea	9th May and 30th May, 11th June; 3rd July; 23rd July; 4th Aug; 5th Aug; 20th Aug and 21st Aug	31:30	61
Bakingstone Hill	22nd July; 20th Aug and 21st Aug	10:20	28
Wee Fea	23rd July	3:00	5
	TOTALS	**44:50**	**94**

The dates, times and weather conditions of each focal diver watch are shown in Table D.1 and Table D.2 in Appendix D.

A summary of all red-throated diver flight activity that could be attributed to particular breeding lochans or groups of lochans from all surveys are shown in Table 4.3. The total numbers of flights for the focal diver watches each year in Table 4.3 may differ slightly from the totals in Table 4.1 and Table 4.2, since occasional flights (counted as one attributed flight) flew from one water to another and generated both an OUT and an IN flight.

All flight lines attributed to breeding lochans recorded during the focal diver watches in 2018 and 2019 are shown in Appendix 7.2 Ornithology Confidential Annex. Full details of each of these flight lines are included in Annex 1 Red-throated Diver Data.

Table 4.3 Number of red-throated diver flights attributed to particular breeding lochans or groups of lochans

Breeding water	No. flights from focal diver watches - 2018	No. flights from focal diver watches - 2019	No. flights from main VP watches - 2018	No. flights from main VP watches - 2019	No. flights from ad hoc observations	Total no. flights in or out
Site A	1	7	1	8	1	18
Site B	6	7	0	4	0	17
Site C	1	2	0	7	0	10
Site D	0	17	0	3	0	20
Site E	0	2	0	6	1	9
Site F	0	4	0	1	0	5
Site G	37	27	8	22	1	95
Site H	10	24	4	9	3	49
Site I	4	6	5	15	2	32
Site J	4	3	0	0	0	7

5 HEN HARRIER ROOST WATCHES

5.1 SURVEY AREA AND METHOD

The scope of work agreed with SNH in Year 1 did not include specific hen harrier roost watches, although some roosting birds were seen from the main VP watches.

In Year 2 hen harrier roost surveys were undertaken. A total of six VPs (including at, or close to, the main VPs) were selected to cover four known roost sites and two other areas of potentially suitable roosting habitat within about 2 km of the Proposed Development (see Figure 2.54 in Appendix 7.2 Ornithology Confidential Annex). On Hoy, hen harriers prefer to roost in rush patches, more rarely in bracken (in the autumn before it breaks down) or willows. The four additional roost VPs covered two large rushy areas (one inside the Proposed Development footprint and one at the south-east edge of the 2 km buffer) and two burnsides with a scattering of small rushy patches (one close to the north of the Proposed Development and one at the northern edge of a 2 km buffer).

The main VPs (VP1 and VP3) already covered two known roosting areas and one watch each month from the main VPs was timed to start at dawn or finish in the dusk. Later in the season specific roost VPs (H1 and H3) located forward of the main VPs, and therefore closer to the roost areas were used for these areas). Such evening watches from the main VPs extended beyond the three-hour cut-off of the main watch, with the observer staying until no longer able to see bird activity against the ground. The dedicated roost watches were mostly a minimum of two hours long, starting well before sunrise or ending in the dusk when it was no longer possible to see bird activity against the ground.

One watch was carried out at each of the four additional roost VPs in November 2019. Subsequently, following consultation with SNH, it was judged most important to concentrate on the area closest to the Proposed Development and the two most distant roost VPs (H4 and H6 each covering ground at about 2 km) were discontinued. This enabled the limited time budget to be targeted at the remaining two roost VPs and allowed for five watches at each of them across the winter. Again, following consultation with SNH, the last three roost watches from VP3 and the last one from VP1 were carried out separately from the main VP watches, from forward positions closer to the roosting areas.

The distant VPs that were dropped included an area where no previous roost watches had been undertaken and which proved to have limited likely habitat – there was no sign of any birds there during the one evening watch on 28th November 2019. The other area included a fairly extensive rush patch where roosting birds had been seen in the past (including a male in the breeding season) and a single hen harrier was seen flying up from there during the one morning watch on 29th November 2019. This location was partly obscured from main VP3, although birds flying towards it from the north would have been visible crossing the VP viewing arc (one was seen roosting there in the 2018/19 winter from VP3, but none in 2019/20).

5.2 DIFFERENCES FROM PUBLISHED METHODS AND SURVEY LIMITATIONS

The fieldwork was not designed to follow any particular published method, but merely to give a reasonable sample of watches at the closest known or potential roost sites across the non-breeding season.

Coverage did not extend fully out to the 2 km recommended in the SNH survey guidelines (SNH, 2017) because, within the limited time budget available, it was considered more important to achieve good coverage of the areas closer to the Proposed Development. This approach was adopted in consultation with SNH. Two roost VPs covering ground towards the edge of the 2 km buffer were therefore used only once and then dropped; one appeared to be of limited suitability for roosting and the other was a known roosting area for occasional single birds. The lack of subsequent sightings at

this latter area from VP3, which partially covered it, indicates that there was no change in its status as merely an occasional roost.

The SNH guidance (SNH, 2017) refers to 'communal' roosts, but in Orkney, hen harriers often roost singly and are not necessarily faithful to any particular roost site. Dedicated roost surveys on Mainland Orkney, and past wind farm survey work across the county, have shown that some small roost sites, used by up to three or four birds, may be used more regularly. However, both single roosting birds and the more regular small roosts have been found to generate very little flight at risk height, with birds usually approaching and departing low to the ground, and with limited interaction around the roost site. The low and very localised risk associated with small hen harrier roosts was a prime factor behind the decision to drop the two more distant roost VPs and to concentrate closer around the Proposed Development.

5.3 FINDINGS

Table 5.1 summarises the hen harrier roost watches undertaken (including those as part of a main VP watch) and indicates the numbers of hen harriers recorded at known or potential roost sites. Figure 2.54 in Appendix 7.2 Ornithology Confidential Annex shows all of the locations where hen harriers were seen to roost during the 2019/20 surveys and also sightings from the VP surveys at dawn and dusk undertaken in 2018/19.

Table 5.1 Summary of hen harrier roost watches and activity observed

VP identifier	Dates of watches	Number of hen harriers pausing at dusk	Number of hen harriers seen roosting
H1/main VP1	29th Nov; 9th Jan; 22nd Jan; 13th Feb and 4th Mar	none	none
H2	29th Nov; 3rd Dec; 21st Jan; 18th Feb and 3rd Mar	one on 3rd Dec; one on 18th Feb, towards R1	none
H3/main VP3	29th Nov; 4th Dec; 10th Jan; 12th Feb and 4th Mar	one additional bird on 10th Jan	one – two birds each watch
H4	29th Nov	n/a (morning watch)	one
H5	28th Nov; 4th Dec; 10th Jan; 14th Feb and 3rd Mar	none	single bird on three occasions
H6	28th Nov	none	none

Hen harriers were seen to roost in three locations, all of them known previously. The main known roosting area was covered from VP3 (and later H3); birds had also been seen there from VP3 in the 2018/19 winter. Single birds were seen erratically from roost watch point H5 and once from H4 (at which only one watch was carried out).

At a fourth location, not watched before, single birds twice flew around the area in the evening and then perched on nearby posts but were not seen moving on. It is common for birds to seem as if they are about to roost e.g. by pausing on a post near suitable vegetation, but then to fly on elsewhere (Andrew Upton, pers. comm.) so these birds did not necessarily stay to roost; there were no other indications of roosting birds in this area during the other three roost watches. At one site previously known for occasional single roosting birds, there was no activity this year.

The main known roosting area was covered from VP3 (and later H3); birds had also been seen there from VP3 in the 2018/19 winter. Single birds were seen erratically from roost watch point H5 and once from H4 (at which only one watch was carried out).

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7 APPENDICES

APPENDIX A FIGURES

Figure A.1 Year 1 (April 2018 to March 2019) survey area with VP locations and six great skua recording zones

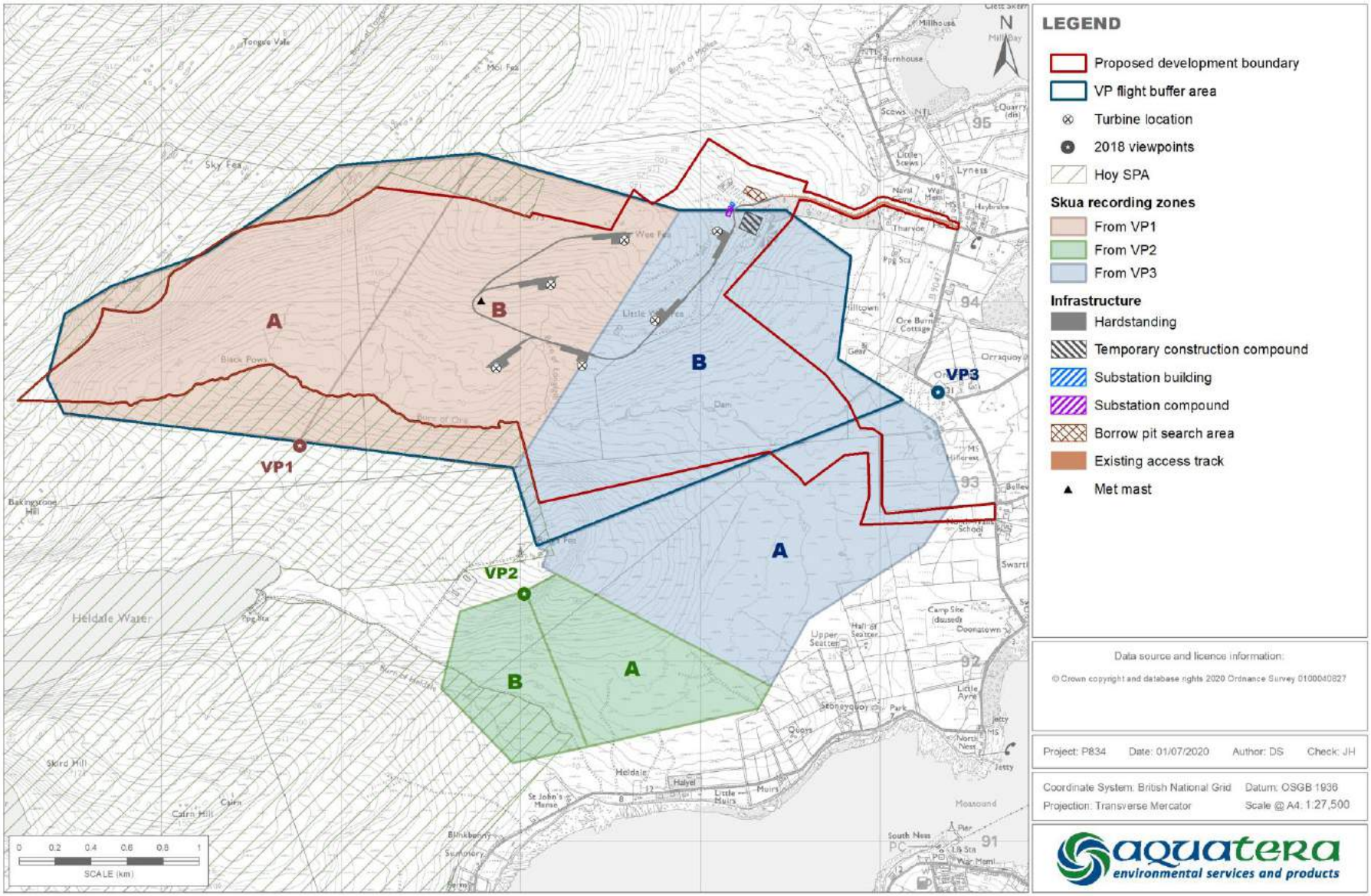

Figure A.2 Year 2 (April 2019 to March 2020) survey area with VP locations and ten great skua recording zones

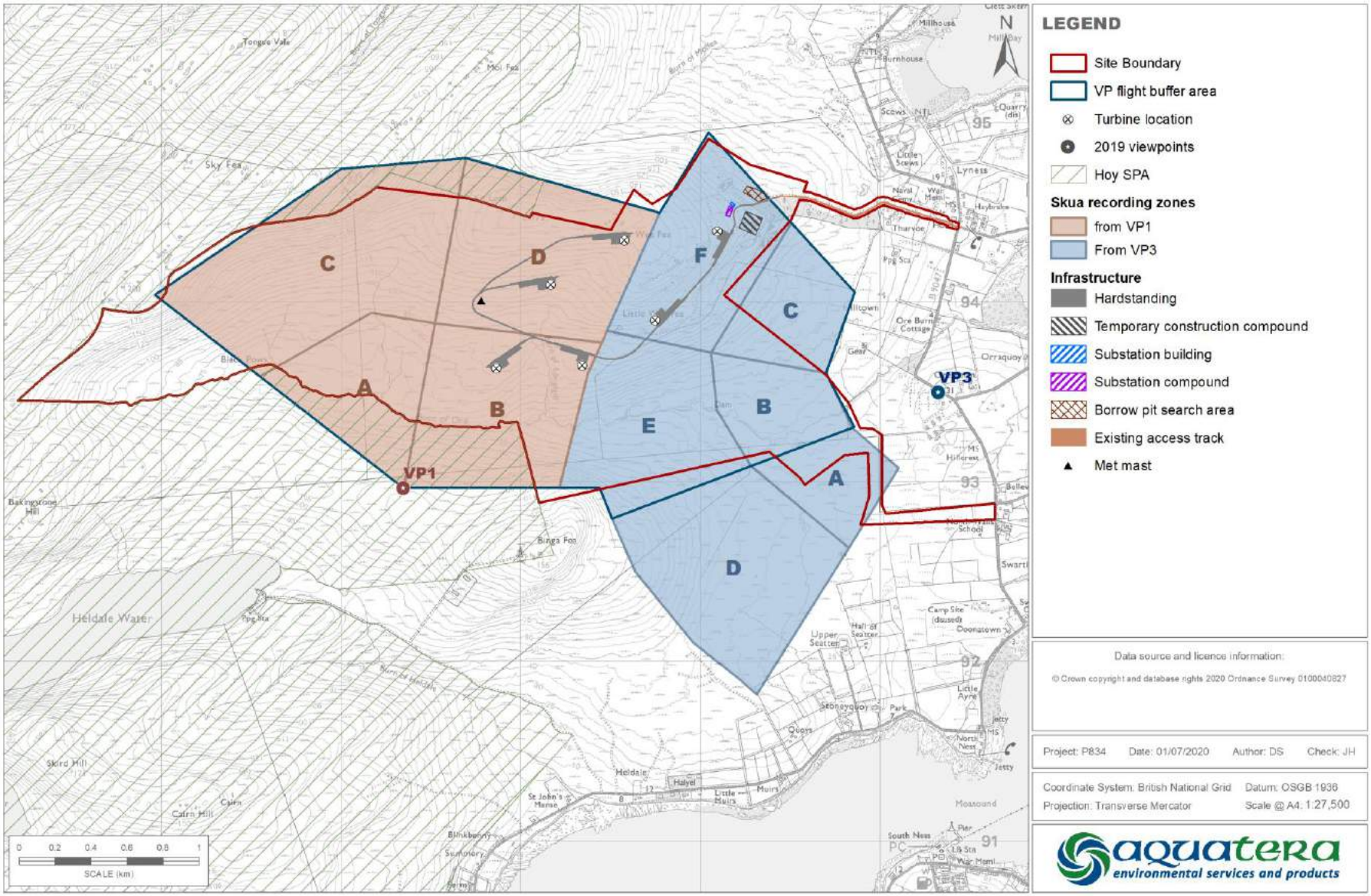

Figure A.3 VP locations and visibility from VP used in Year 1 (2018/19) surveys

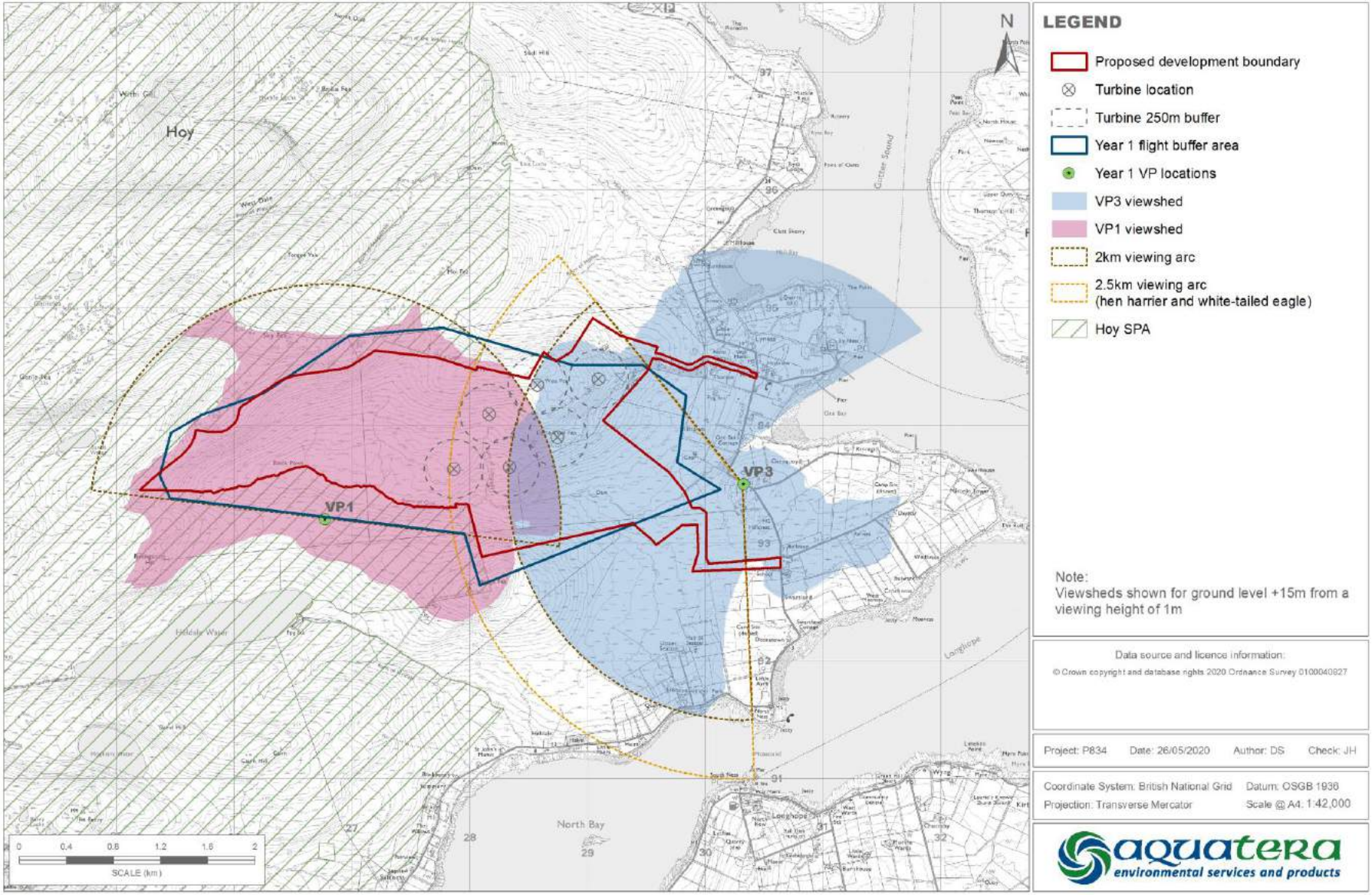

Figure A.4 VP locations and visibility from VP used in Year 2 (2019/20) surveys

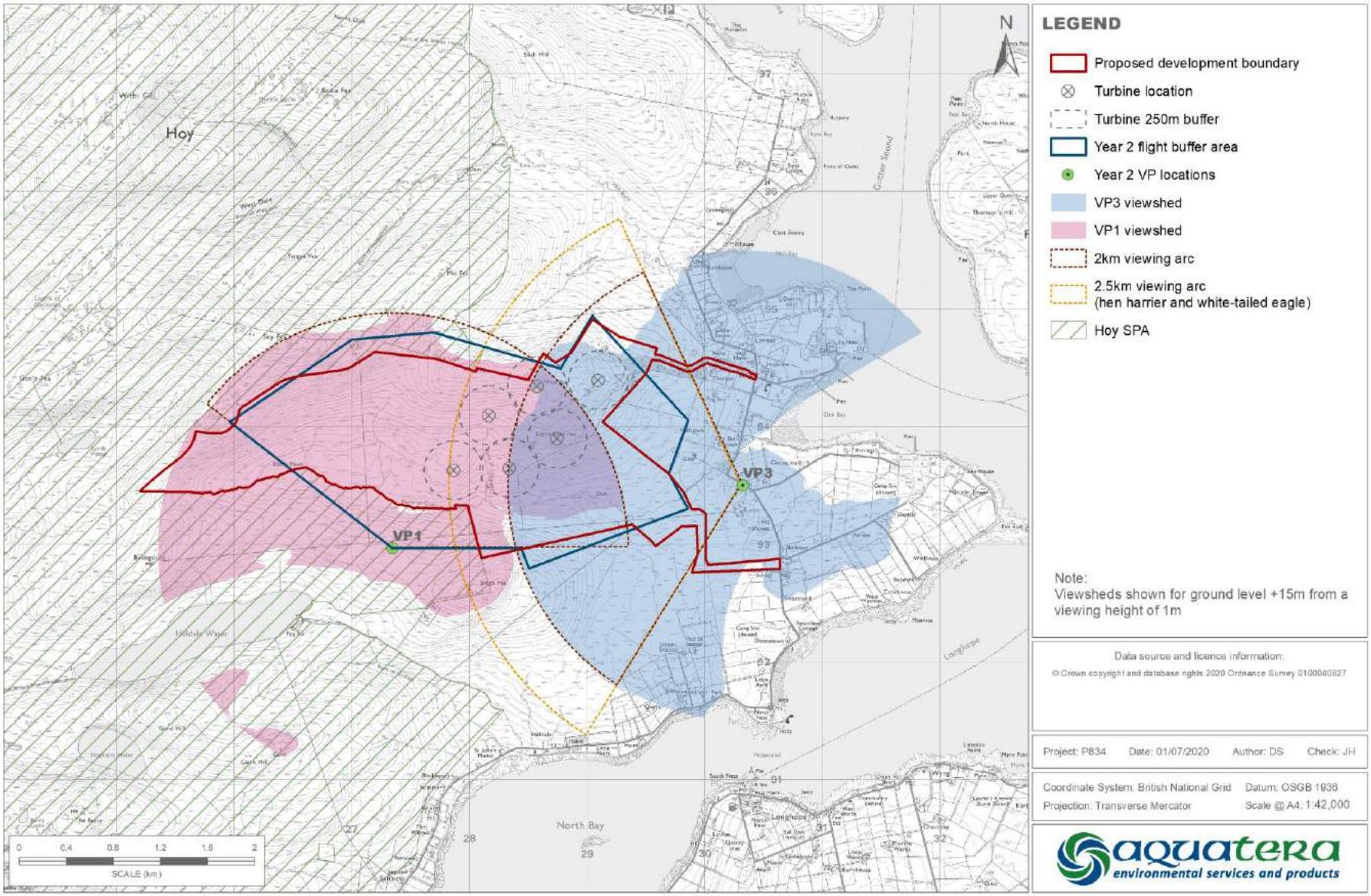

Figure A.5 All peregrine flight lines recorded in Year 1 (April 2018 to March 2019)

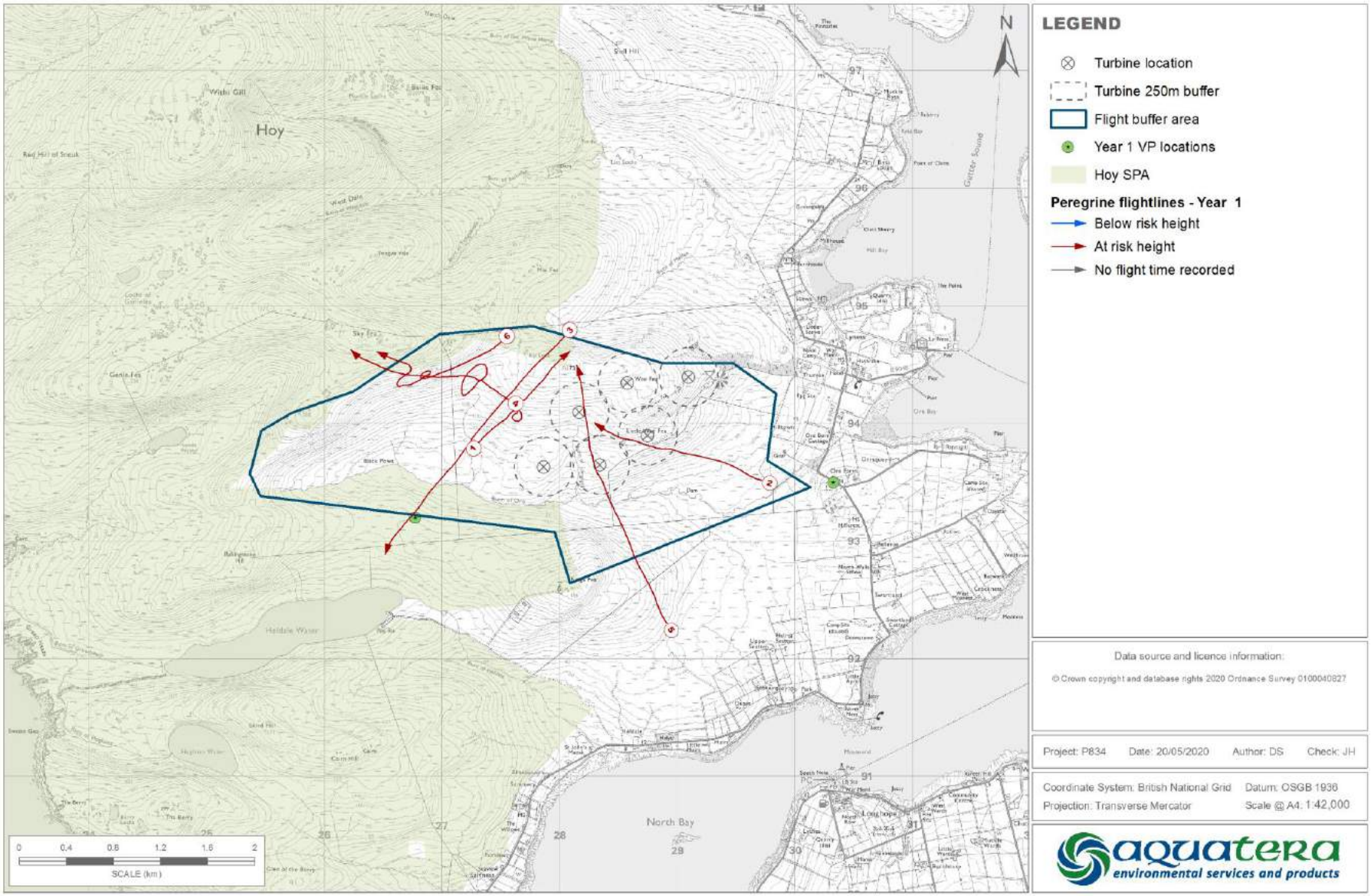

Figure A.6 All peregrine flight lines recorded in Year 2 (April 2019 to March 2020)

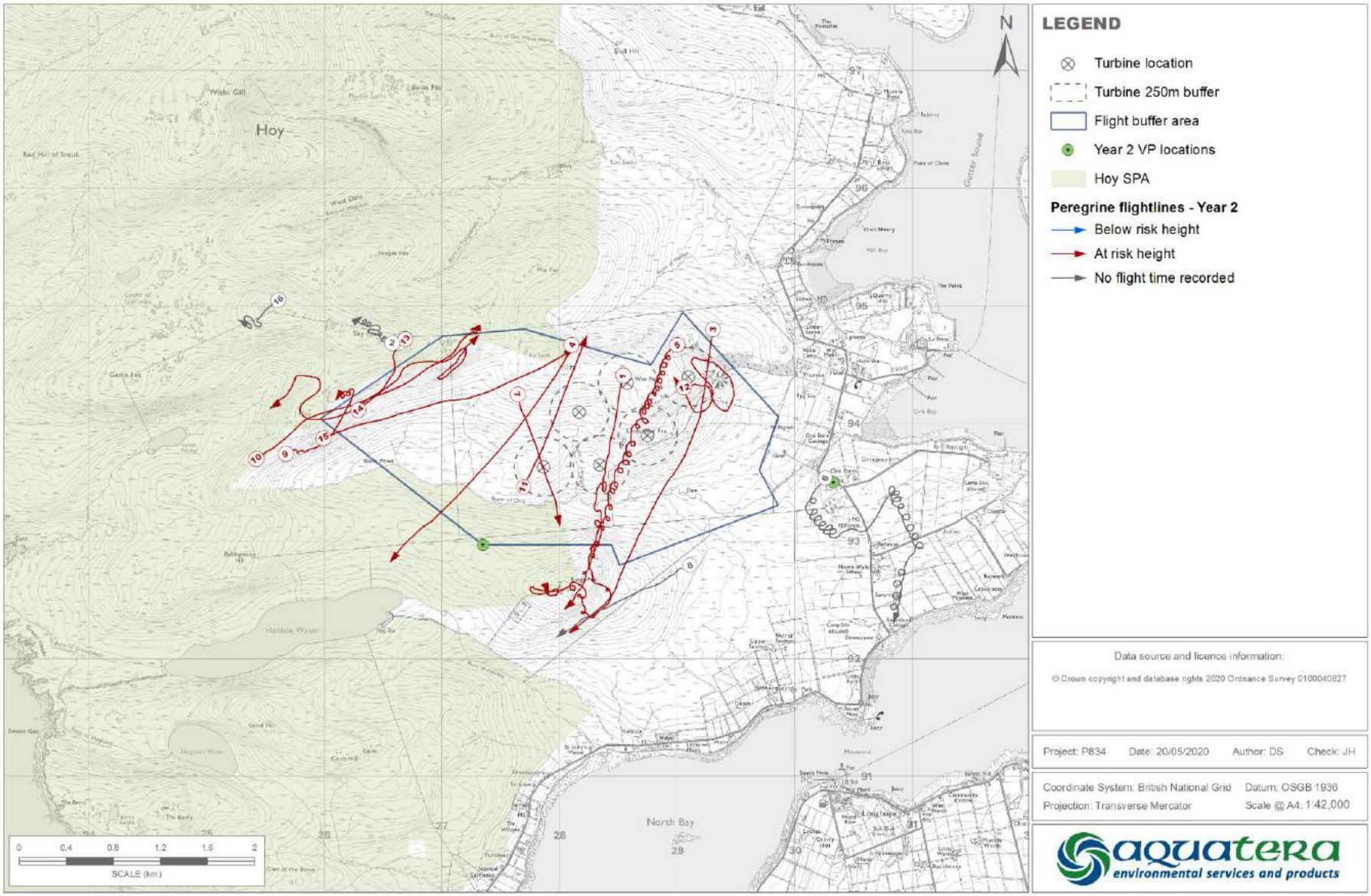

Figure A.7 All merlin flight lines recorded in Year 1 (April 2018 to March 2019)

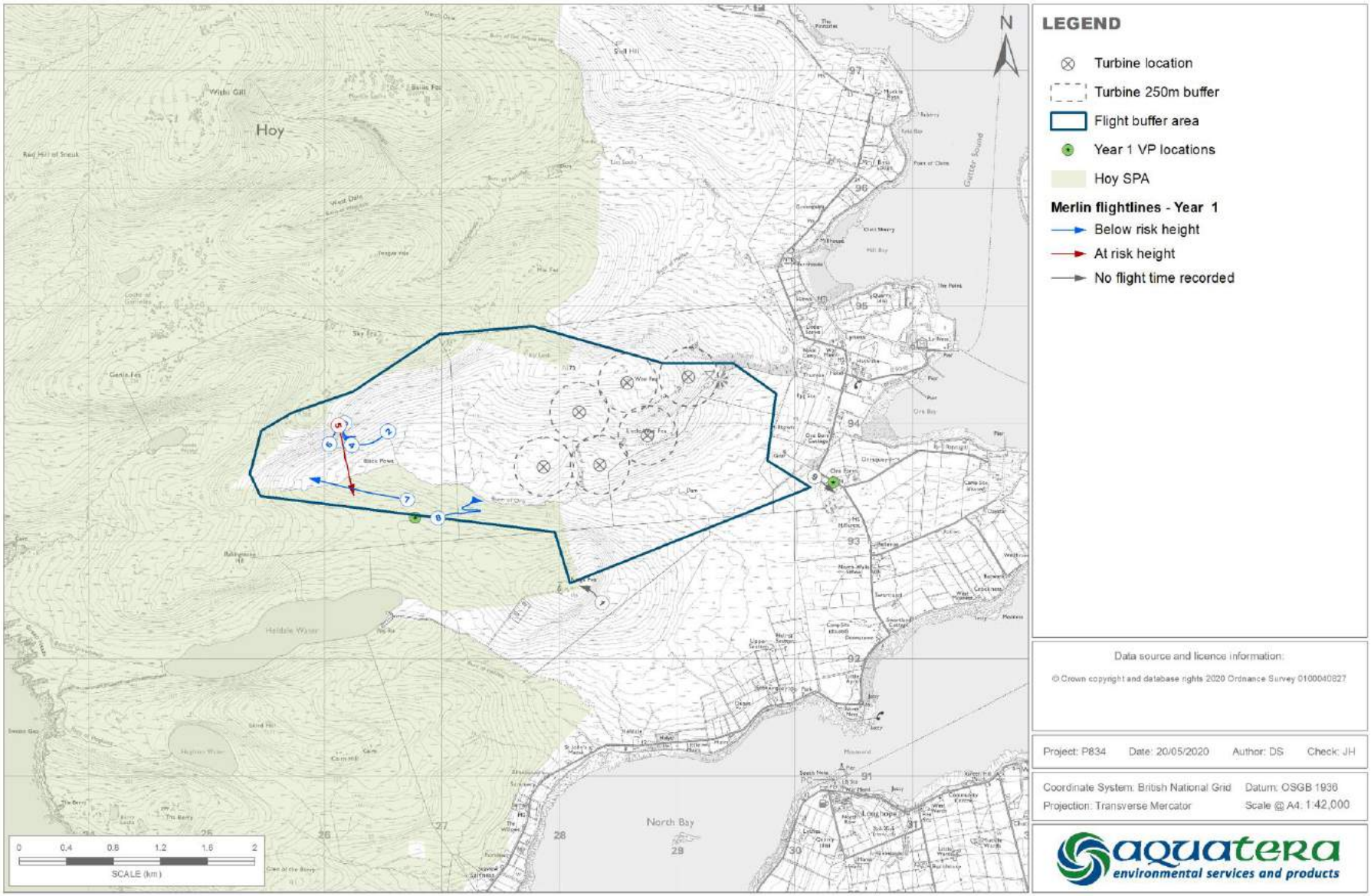

Figure A.8 All merlin flight lines recorded in Year 2 (April 2019 to March 2020)

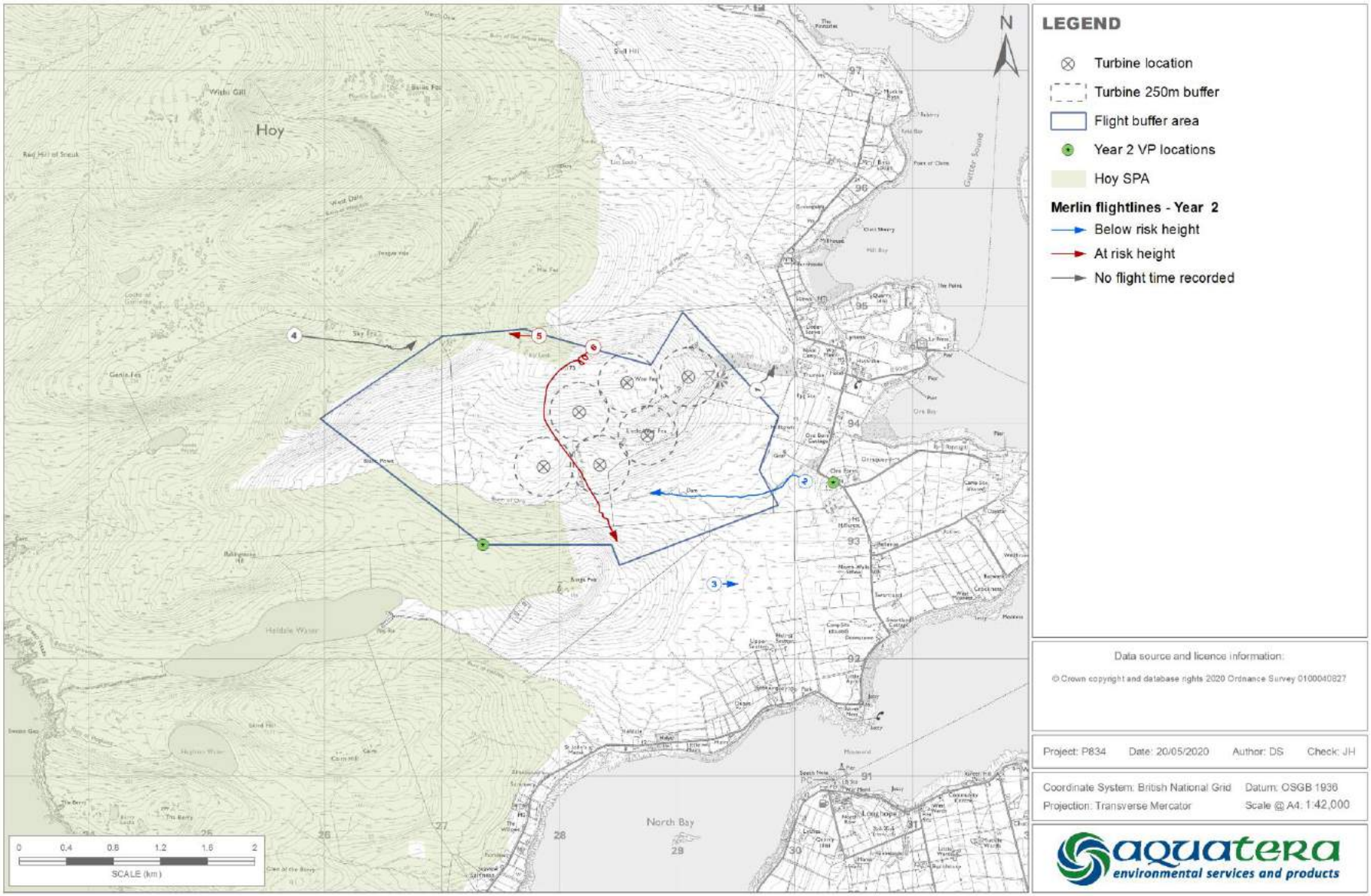

Figure A.9 All white-tailed eagle flight lines recorded in Year 1 (April 2018 to March 2019)

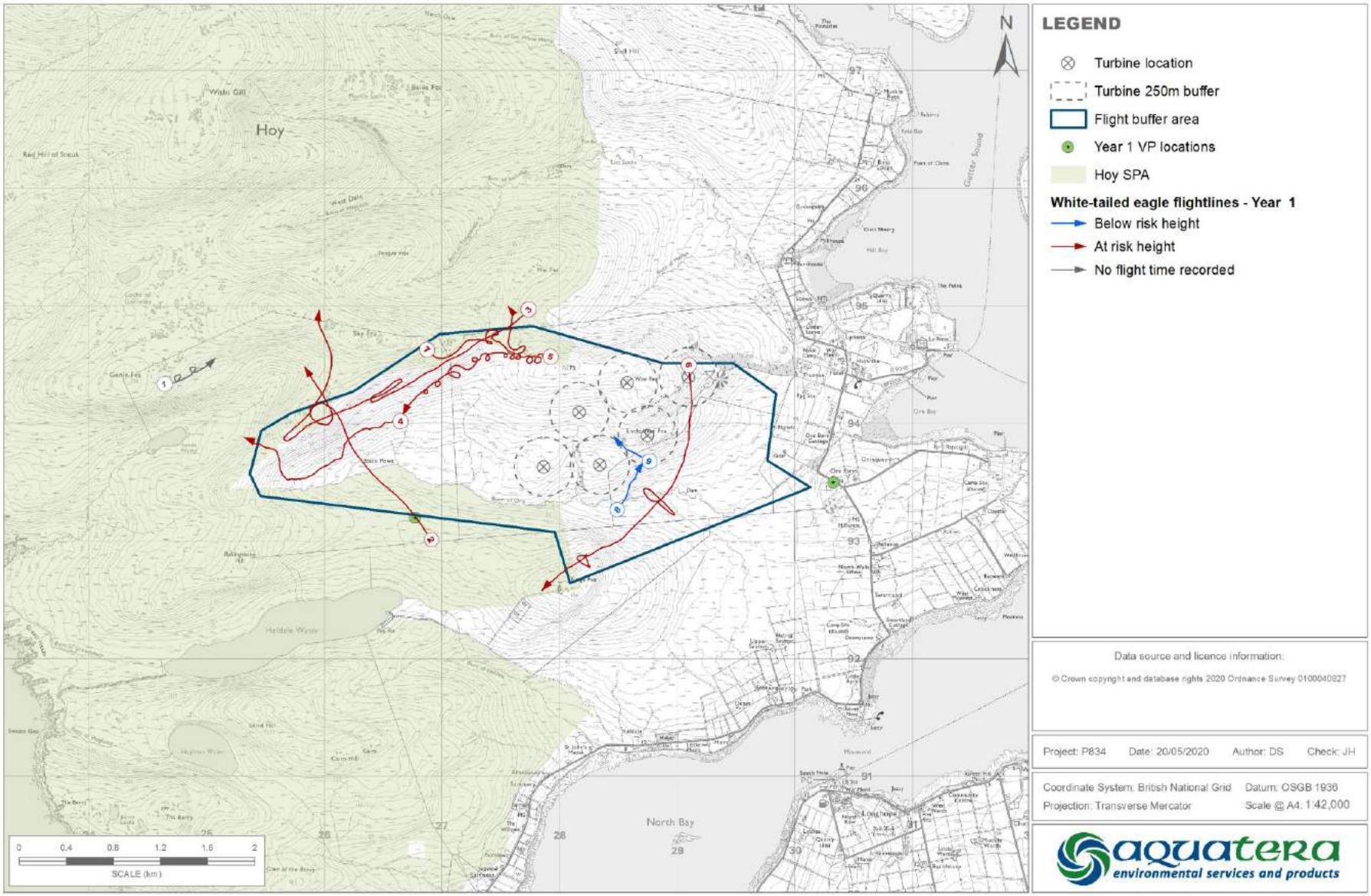

Figure A.10 All white-tailed eagle flight lines recorded in Year 2 (April 2019 to March 2020) (map 1 of 2)

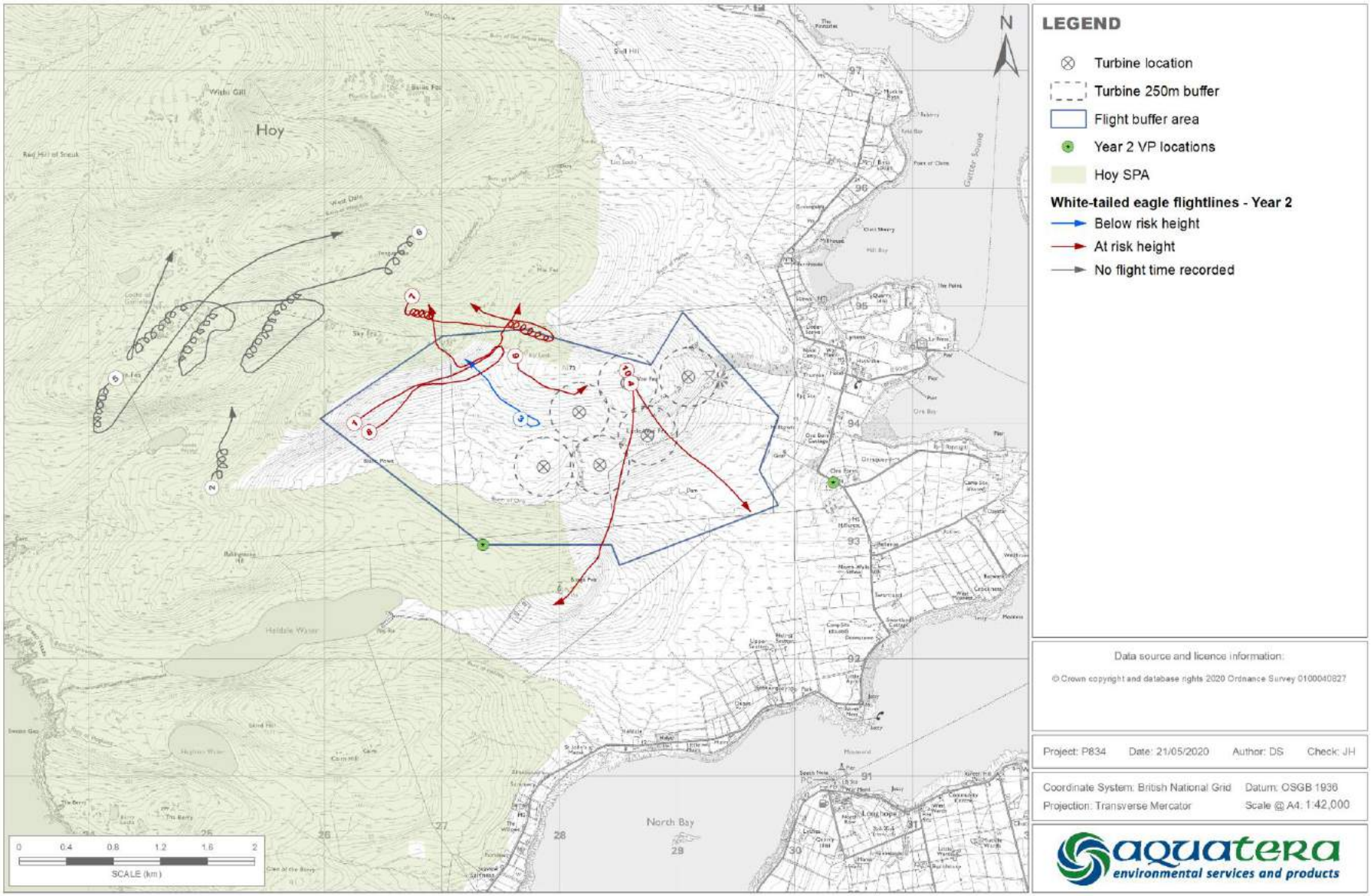

Figure A.11 All white-tailed eagle flight lines recorded in Year 2 (April 2019 to March 2020) (map 2 of 2)

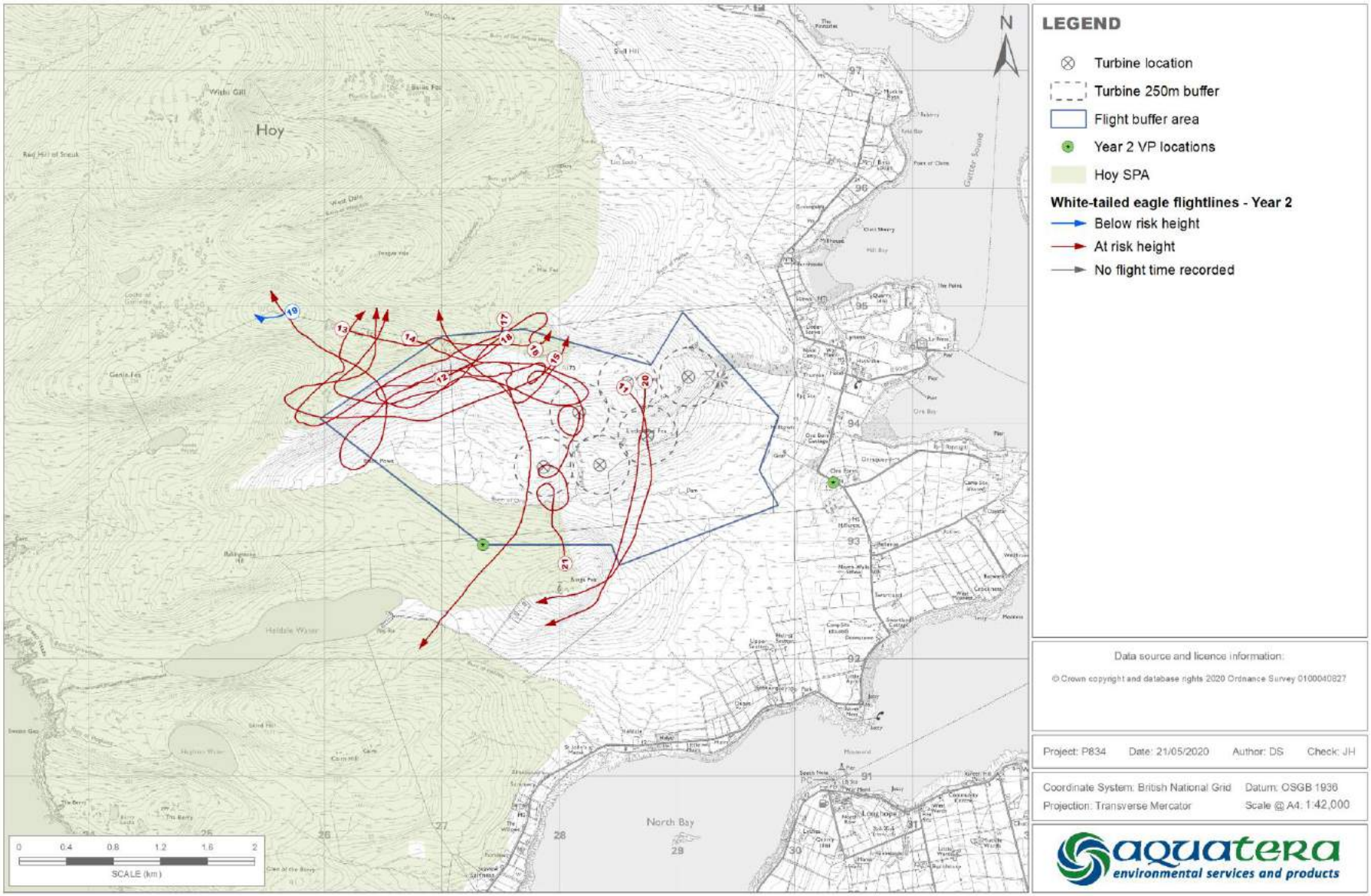

Figure A.12 All golden eagle flight lines recorded in Year 2 (April 2019 to March 2020) (map 1 of 2)

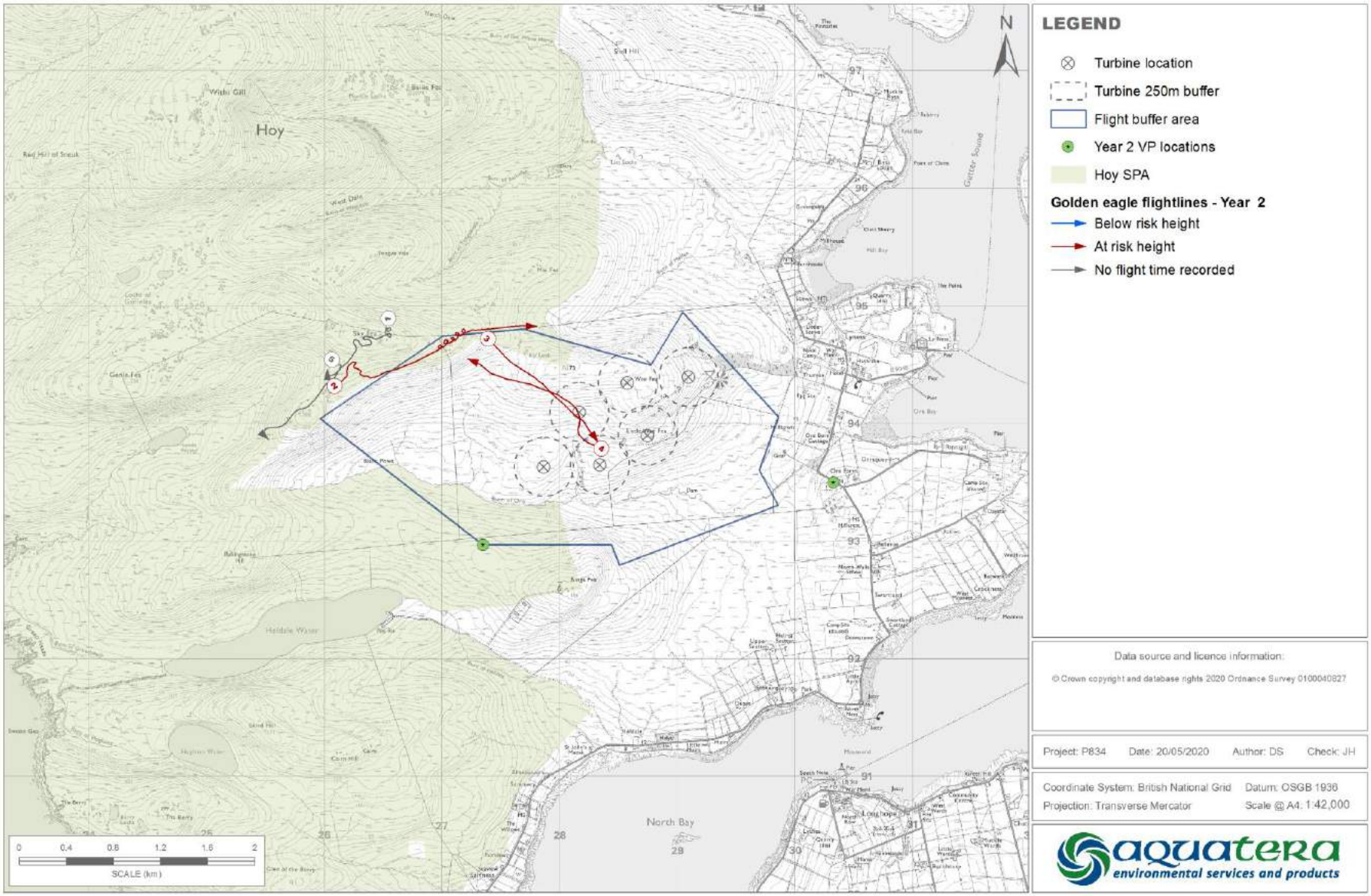

Figure A.13 All golden eagle flight lines recorded in Year 2 (April 2019 to March 2020) (map 2 of 2)

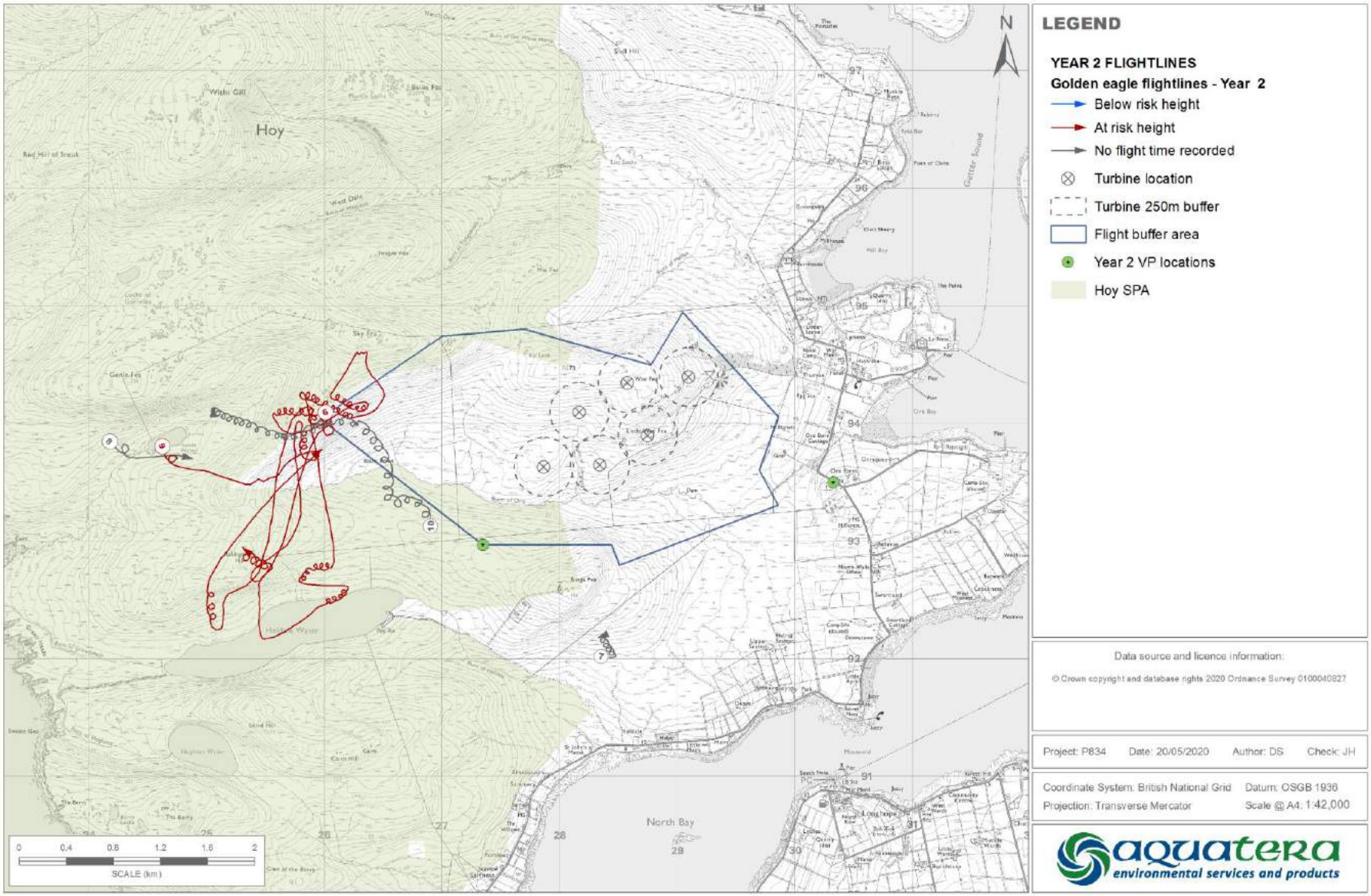

Figure A.14 All short-eared owl flight lines recorded in Year 1 (April 2018 to March 2019)

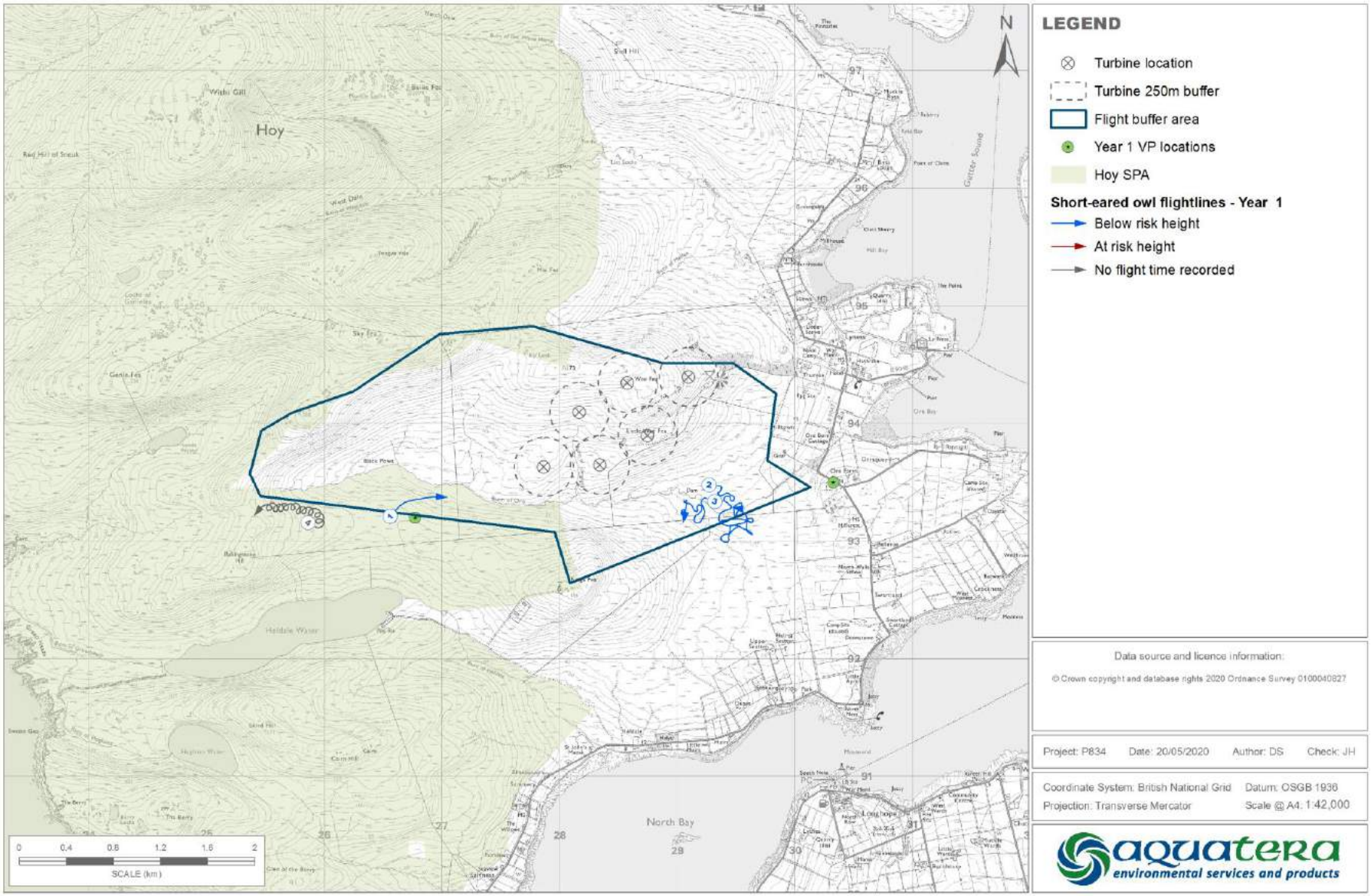

Figure A.15 All short-eared owl flight lines recorded in Year 2 (April 2019 to March 2020) (map 1 of 2)

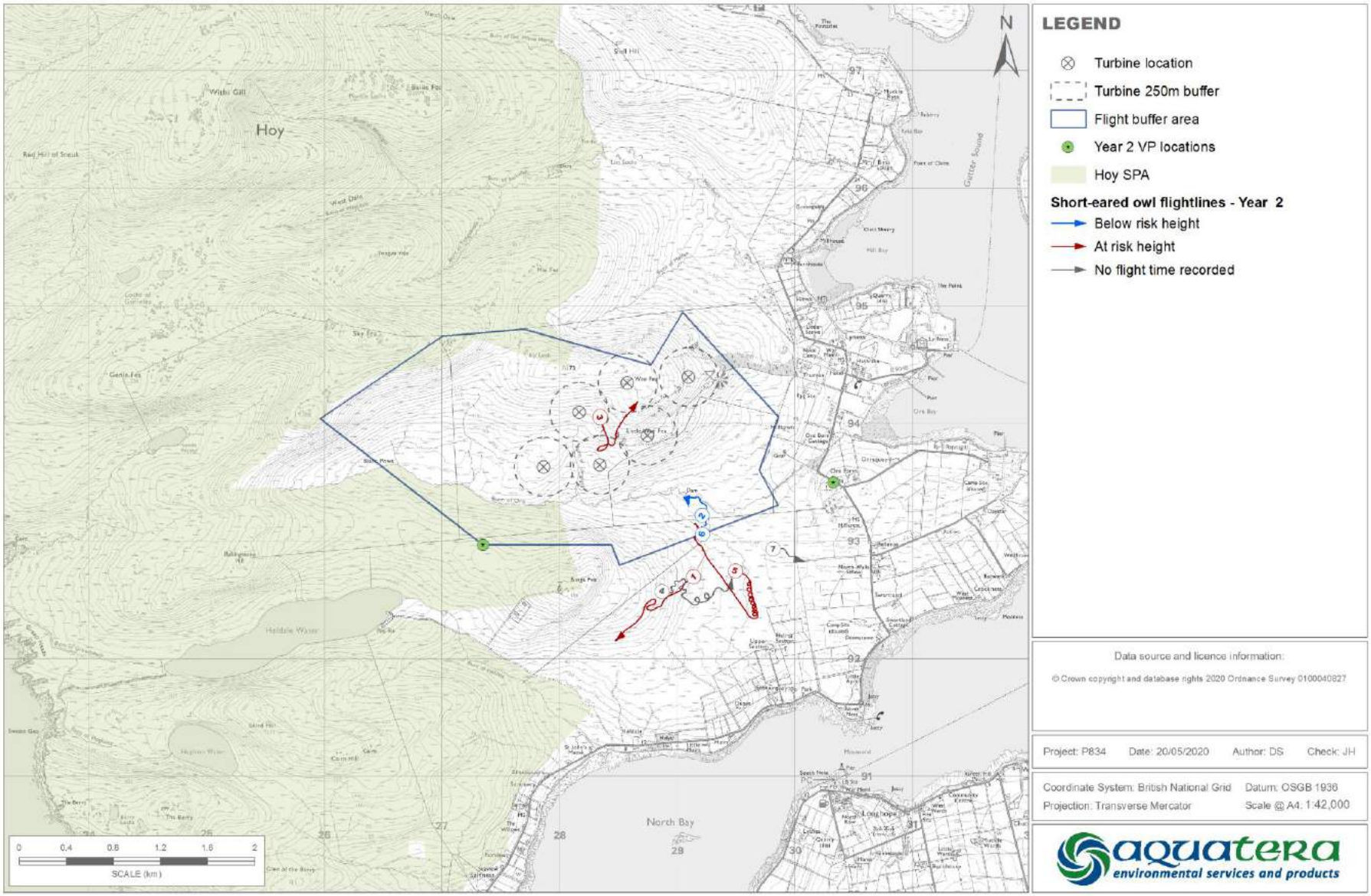

Figure A.16 All short-eared owl flight lines recorded in Year 2 (April 2019 to March 2020) (map 2 of 2)

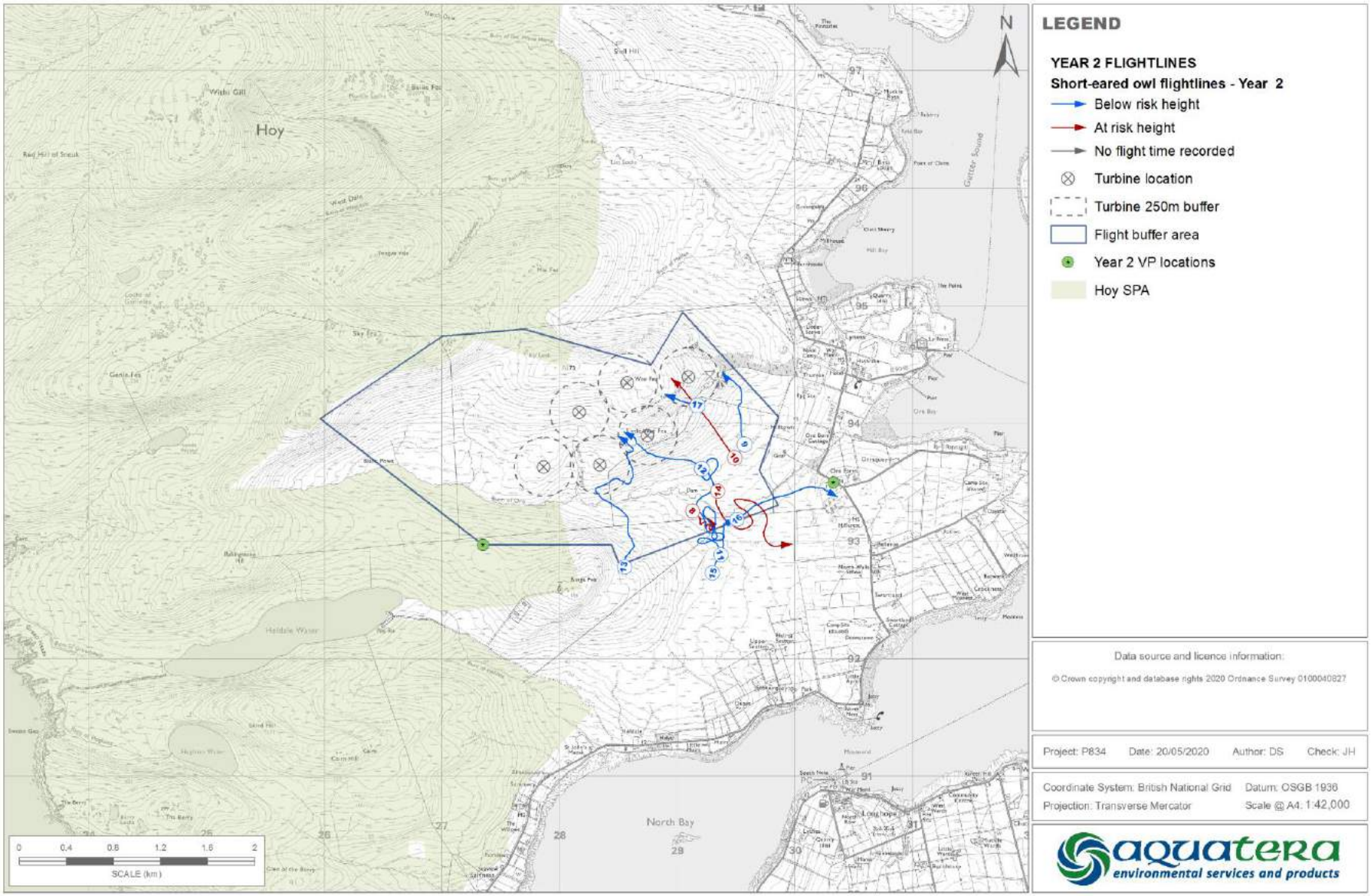

Figure A.17 All Arctic skua flight lines recorded in Year 1 (April 2018 to March 2019)

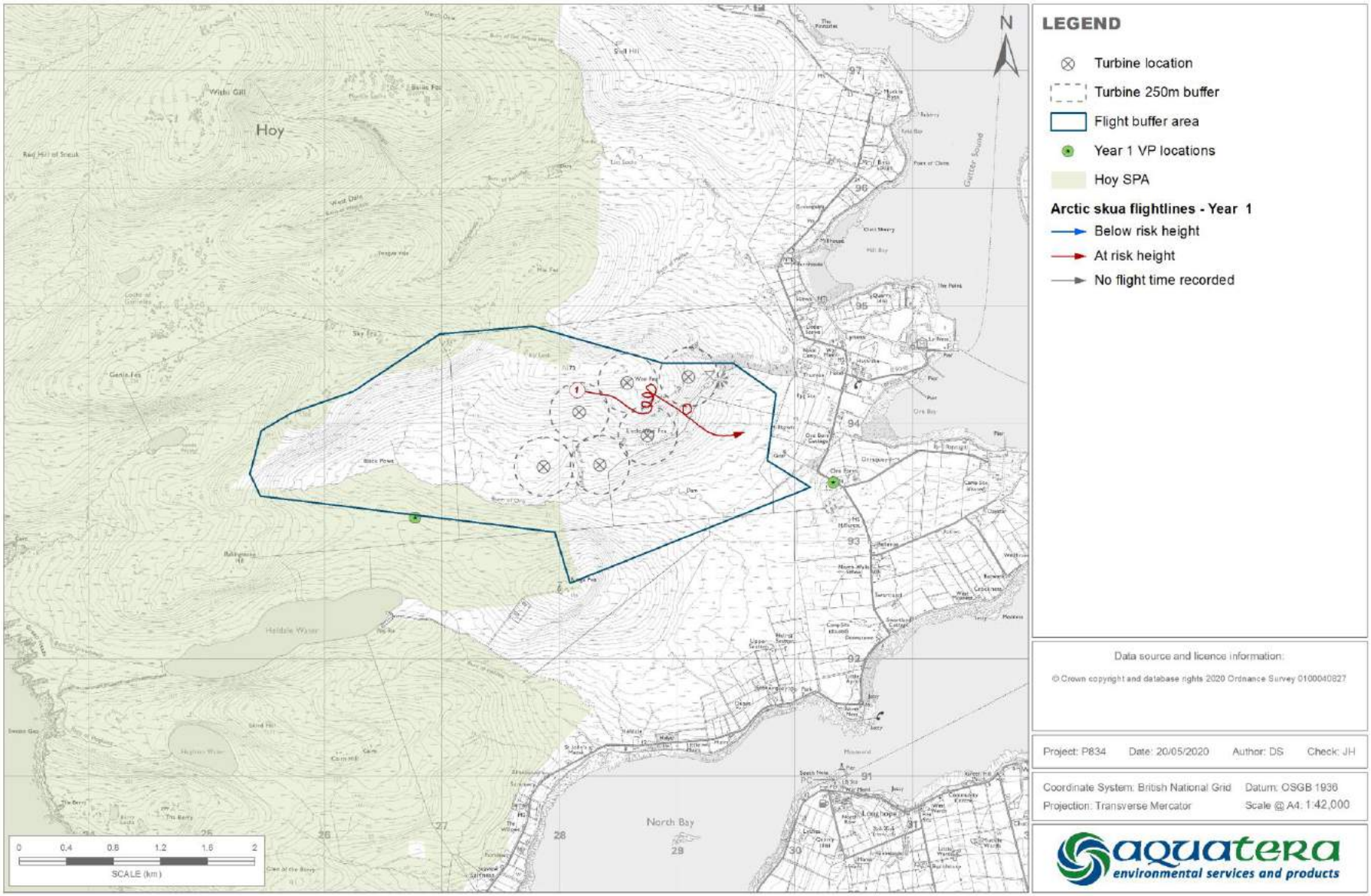

Figure A.18 All Arctic skua flight lines recorded in Year 2 (April 2019 to March 2020)

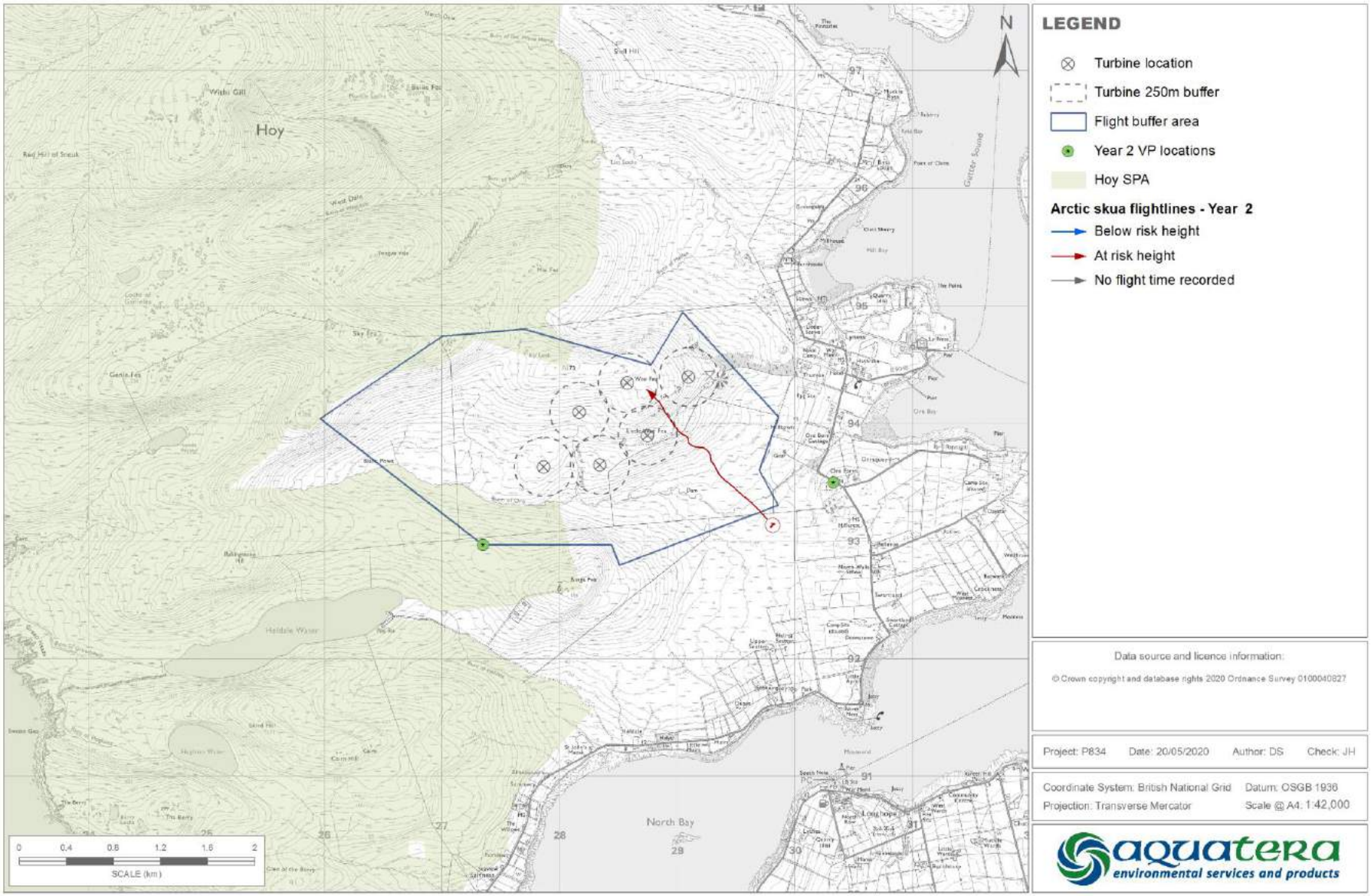

Figure A.19 All whooper swan flight lines recorded in Year 1 (April 2018 to March 2019)

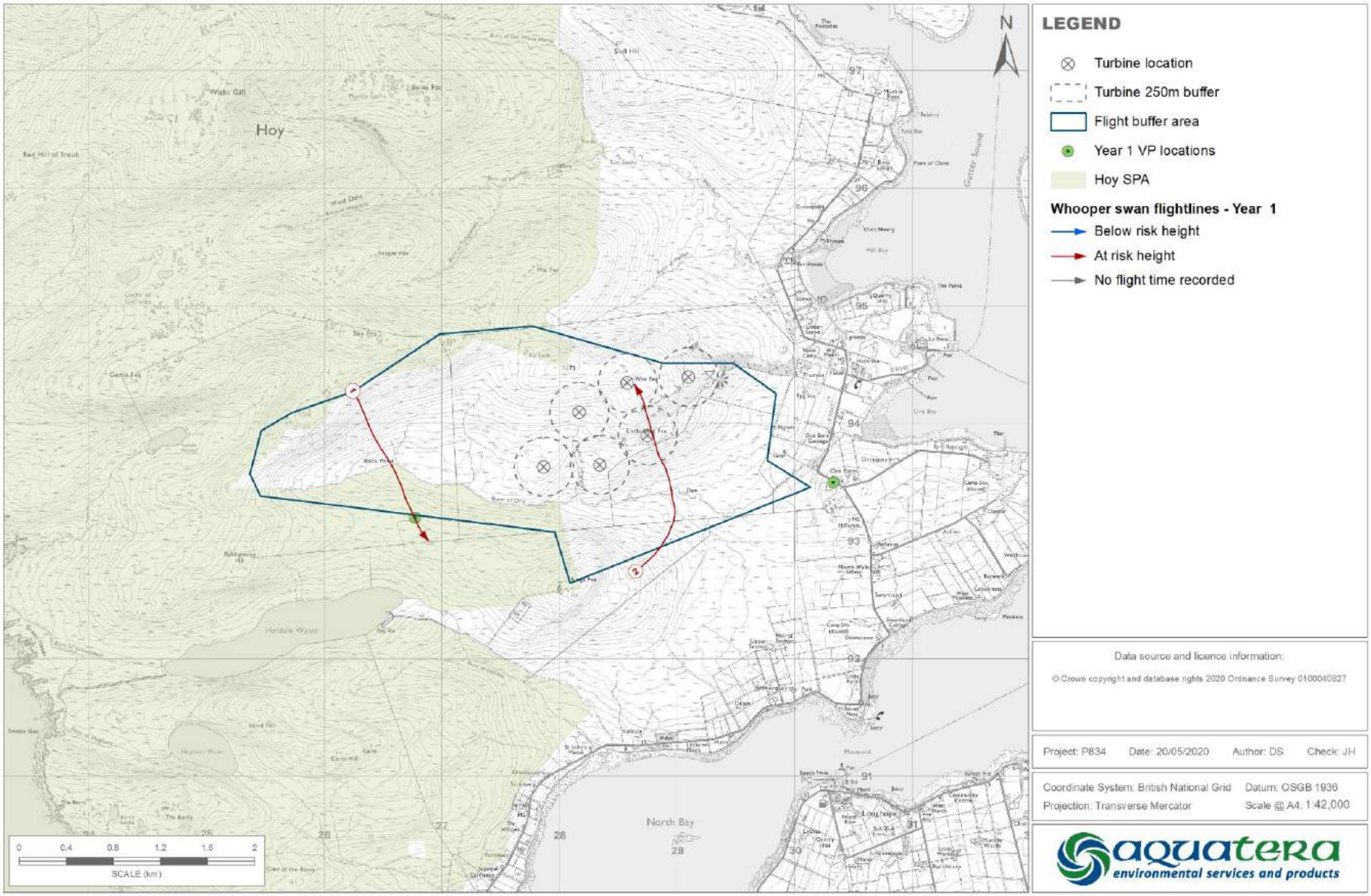

Figure A.20 All whooper swan flight lines recorded in Year 2 (April 2019 to March 2020)

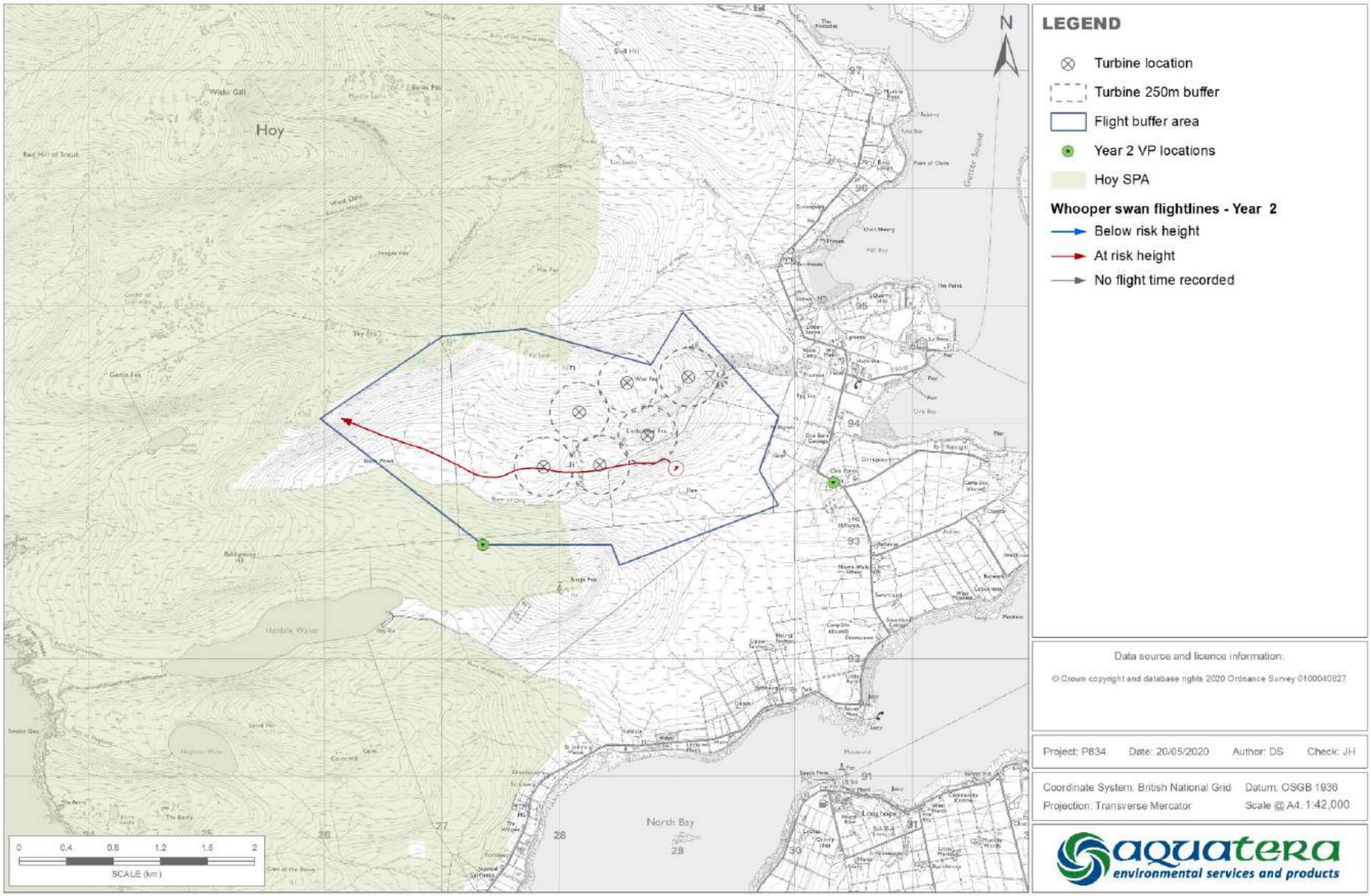

Figure A.21 Moorland Breeding Birds – 2018 Wader territories (Curlew, Dunlin and Redshank)

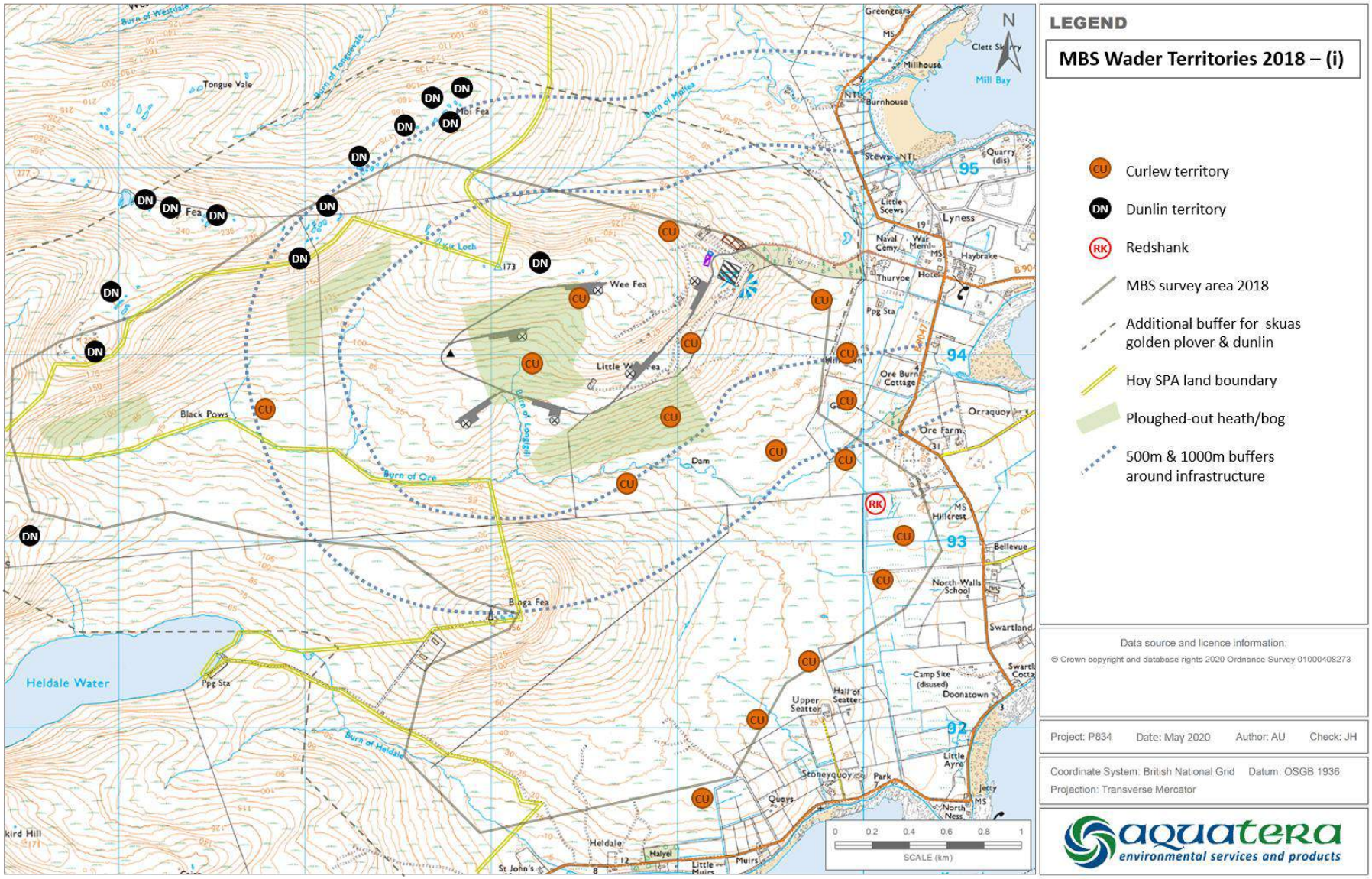

Figure A.22 Moorland Breeding Birds – 2019 Wader territories (Curlew, Dunlin and Redshank)

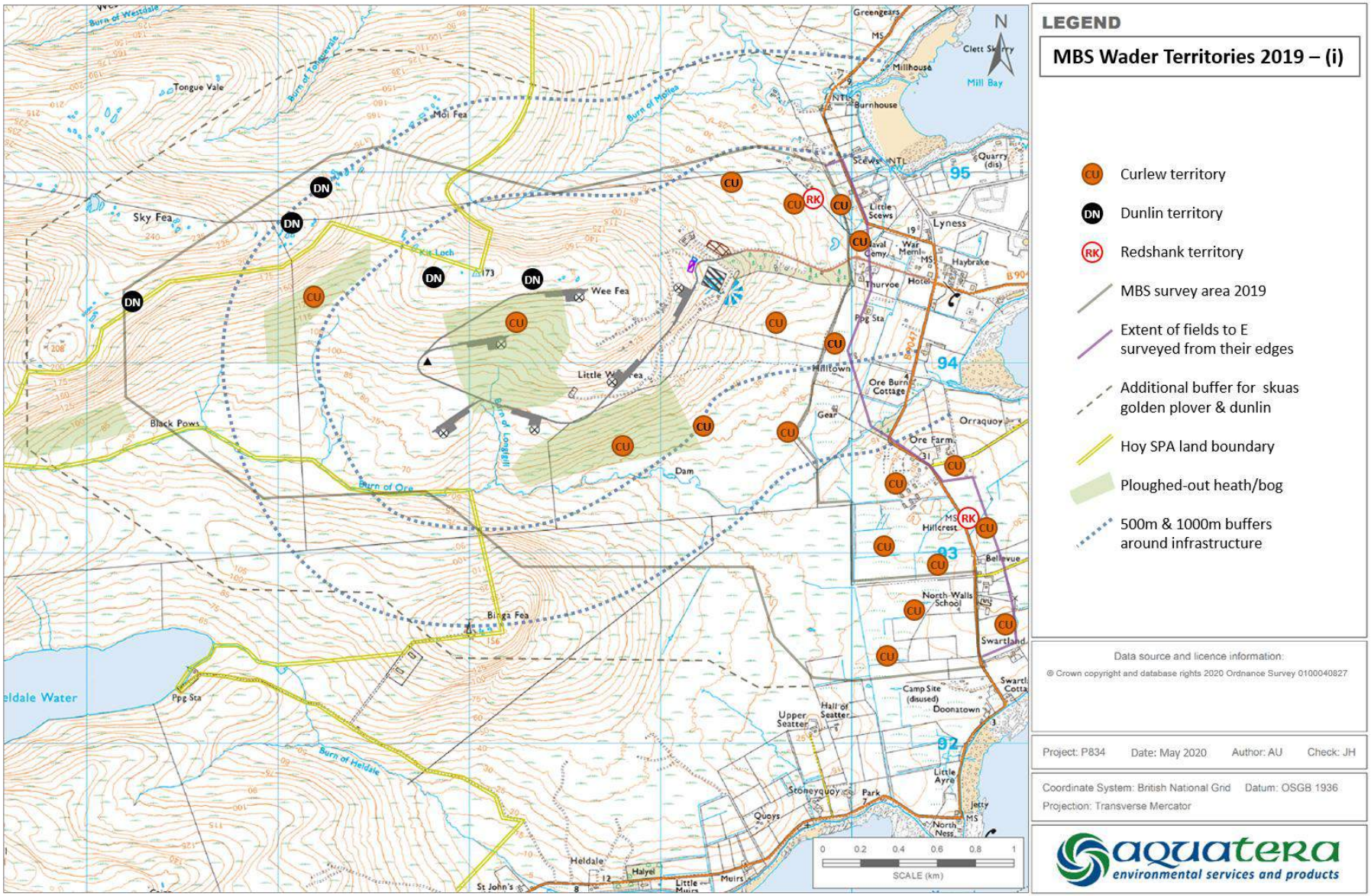

Figure A.23 Moorland Breeding Birds – 2018 Wader territories (Snipe, Golden Plover, Lapwing and Oystercatcher)