FEHILY TIMONEY

DESIGNING AND DELIVERING
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Appendix 10.1

Ornithology Report

Ornithological Results Report for Survey Years 2019-2020, 2020-21, 2023-24

Shancloon Wind Farm, Co. Galway

Report prepared by APEM Group Woodrow

For RWE

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1 Overview

Woodrow APEM Group (hereafter referred to as Woodrow) was commissioned by RWE to undertake ornithological survey work for the proposed Shancloon Wind Farm (hereafter known as the proposed development site). The site is located in Co. Galway at National Grid Reference: M 31777 53794 and is adjacent to the Co. Mayo border. The Black River runs along the northern boundary of the proposed development site in a south-westerly direction into Lough Corrib. The proposal is for an 11-turbine wind farm.

Ornithological survey work, compliant with Scottish Natural Heritage (SNH, 2017), commenced at the proposed development site in April 2019 and was completed in September 2024. This report presented the methodologies and results of the following survey period at the proposed development site:

- Breeding 2019. Data from April 2019 to September 2019
- Non-Breeding 2019-2020. Data from October 2019 to March 2020
- Breeding 2020. Data from April 2020 to September 2020
- Non-breeding 2020-21. Data from October 2020 to March 2021
- Non-breeding 2023-24. Data from October 2023 to March 2023.
- Breeding 2024. Data from April 2024 to September 2024

Breeding season surveys undertaken included:

- Vantage point (VP) watches
- Breeding bird surveys:
    - Breeding waders (O'Brien and Smith, 1992),
    - Dusk surveys for crepuscular/nocturnal species (Gilbert *et al*., 1998),
    - Riverine survey along the Black River, including a survey of breeding kingfisher habitat suitability, and
    - Breeding raptor surveys within a 2 km site buffer.

Non-breeding season surveys undertaken included:

- VP watches,
- Winter walkover surveys,
- Wider area wintering waterbird surveys (IWeBS), and,
- Hen harrier roost watches.

For the ornithological surveys, the study area was defined as the area extending 500 m around the proposed turbine locations. This report documented the results from the desk study, field surveys and Collision Risk Modelling (CRM) for target species to provide the baseline ornithological information required to inform an ornithological impact assessment for the proposed Shancloon Wind Farm.

2 Desk-based study

An initial desk-based review of the proposed development site and wider area was compiled to determine the appropriate surveys required to inform any potential ornithological constraints. A preliminary assessment of avian habitat suitability and availability was undertaken using ortho-

imagery and 6-inch mapping, which was viewed using Bing Maps, Google Earth Pro, Google Maps, Ordnance Survey Ireland – GeoHive. This was further informed by scoping visits to the area undertaken in March 2019.

The National Parks and Wildlife Service (NPWS) Designations Viewer was used to identify the location of sites designated for nature conservation, specifically Special Protection Areas (SPAs), and the bird species (Qualifying Interests, QI) for which these sites have been designated. The Environmental Protection Area (EPA) mapping tool was used to investigate hydrological connectivity to sites designated for nature conservation. SPAs within the vicinity of the proposed development are listed in Table 1 and shown in Figure 1.

Bird records from the last 10 years for the 10 km national grid square encompassing the proposed development site [M35] were collated from the National Biodiversity Data Centre (NBDC) database using the report function on Biodiversity Maps. Most of these records are based on the Bird Atlas 2007-11 (Balmer *et al*., 2013). A full list of records returned from the NBDC data search is contained in **Appendix I**. These records were reviewed to investigate the target species potentially occurring within the 500 m turbine buffer and wider area to inform survey design and identify any potential ornithological constraints. Target species generally focus on red and amber-listed Birds of Conservation Concern (BoCCI) (Gilbert *et al*., 2021). Red-listed species are of the highest conservation concern where the population is rapidly declining in abundance or range, has experienced a historic rapid decline (without recovery) or are globally threatened. Amber-listed species are those with unfavourable European status, occur in internationally important numbers or are moderately declining in abundance or range. A species may also be amber-listed if a population occurs in very small numbers. These historical records and their conservation status (Gilbert *et al*., 2021) are listed in Table 2.

The NBDC maps were also used to examine other relevant data sets, including the Bird Watch Ireland bird sensitivity to wind energy layer as per Mc Guinness *et al.* (2015). Though no data was found for the west of the proposed development site, the east of the proposed development site was found to have a low sensitivity, with some areas of medium sensitivity to the north-east of the proposed development site. This was driven by proximity to areas identified for barn owl and whooper swan. As such, they can be used to inform wider area surveys. The results of the national whooper swan census (Burke *et al.,* 2021), the Birdwatch Ireland and Ulster Wildlife barn owl distribution map (Ulster Wildlife, 2021), and NBDC records were used to investigate the distribution and proximity of these species to the development.

Based on SNH (2017) guidelines, migratory populations of wintering geese and swans are notably sensitive to wind farm developments. As such, in addition to whooper swan, population censuses for greylag goose (Boland and Crowe, 2008; Lewis *et al.*, 2019a) and Greenland white-fronted goose (Fox *et al.*, 2021) were also reviewed.

2.1 Special Protection Areas (SPAs)

All SPAs within the vicinity of the proposed development site (or with a direct hydrological connection) were reviewed and are listed in Table 1 and shown in Figure 1. Lough Corrib SPA is the only European designated site within 15 km of the proposed development site, and there is a direct hydrological connection via the Black (Shrule) River (EPA code: 30B02), which runs in a westerly direction through the proposed development site. Lough Corrib SPA supports nationally important

wintering populations of mute swan, pochard, tufted duck, goldeneye, little grebe, coot and golden plover (Lewis *et al*., 2019b). In the breeding season, it supports substantial gull and tern colonies and approximately half the national population of breeding scoter (NPWS, 2014). It is also designated for the Annex I raptor species hen harrier, due to nationally important numbers utilising the site as a winter roost (NPWS, 2014).

SNH guidelines recommend that core foraging ranges of species should be examined to assess potential connectivity between the proposed development site and surrounding SPAs (SNH, 2016, 2017). As detailed Table 1, the closest SPA to the proposed development site is Lough Corrib SPA, which lies *c.* 11.20 km west. Lough Corrib SPA is designated for Greenland white-fronted goose, which have a reported winter core foraging range of 5-8 km (SNH, 2016). As such, the proposed development site is considered to lie outside of foraging ranges for this QI population. SNH (2016) does not report winter foraging ranges for hen harrier, but the maximum reported breeding foraging range is 10 km. The winter roost is located in the south of the SPA approximately 20 km south and the proposed development site is therefore also considered to lie outside of the core foraging range of these birds.

Table 1: Special Protection Areas (SPAs) within the vicinity of the proposed Shancloon Wind Farm

Special Protection Areas (SPAs)	**Distance to proposed development**	**Qualifying Interests**
Lough Corrib SPA (Site code: 004042)	11.20 km west	Gadwall (*Anas strepera*) [A051] Shoveler (*Anas clypeata*) [A056] Pochard (*Aythya ferina*) [A059] Tufted Duck *(Aythya fuligula)* [A061] Common Scoter *(Melanitta nigra)* [A065] Hen Harrier *(Circus cyaneus)* [A082] Coot (*Fulica atra*) [A125] Golden Plover (*Pluvialis apricaria*) [A140] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Common Gull *(Larus canus)* [A182] Common Tern *(Sterna hirundo)* [A193] Arctic Tern (*Sterna paradisaea*) [A194] Greenland White-fronted Goose *(Anser albifrons flavirostris)* [A395] Wetland and Waterbirds [A999]
Lough Carra SPA (Site code: 004051)	18.5 km north-west	Common Gull (*Larus canus*) [A182]
Lough Mask SPA (Site code: 004062)	20.3 km north-west	Tufted Duck (*Aythya fuligula*) [A061] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Common Gull (*Larus canus*) [A182] Lesser Black-backed Gull (*Larus fuscus*) [A183] Common Tern (*Sterna hirundo*) [A193] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] Wetland and Waterbirds [A999]

2.2 Wintering waterbirds

Due to the presence of several turloughs and small lakes in the wider area, an Irish Wetland Bird Survey (IWeBS) data request was carried out in September 2022 for all available data within 10 km of the proposed development site.

Watercourses within the proposed development site are small bog pools and the two tributaries of the Black River. These are not capable of supporting significant densities of waterbirds. The closest large waterbody is Hackett Lough approximately 3.2 km south of the proposed development site. This lough is subject to disturbance in the breeding season due to kayakers, swimmers and tourists. It is, however, likely more suitable for wintering waterbirds, with plenty of emergent vegetation for species such as little grebe and moorhen. There is currently no assigned counter for this IWeBS subsite, and it was therefore only covered during the field surveys.

The proposed development site is not documented as supporting nationally or internationally important numbers of wintering waterbirds or any sensitive wintering wetland species, especially swans or geese (Crowe, 2005; Boland and Crowe, 2012; Lewis *et al*., 2019b). The nearest habitats (within 5 km) containing nationally important populations are the North Central Galway lakes, which hold nationally important numbers of whooper swan, wigeon, shoveler and tufted duck. The North Central Galway Lakes encompass several small loughs and turloughs located in the wider area, such as, Rathbaun Turlough on the north side, Killower Turlogh, Turlough O'Gall, Belclare Turlough, Lough Hacket on the south side, and Shrule Turlough on the west side, which are all of them designated as pNHAs (Proposed Natural Heritage Areas) and are therefore accounted for in the wider area wintering waterbird surveys. IWeBS counts were also available for some of these pNHAs, see **Appendix II.**

Geese and swans are species which take regular commuting flights and are notably sensitive to wind farm developments. Rostaff and Killower, two townlands approximately 7 km from the proposed development site, are listed as having known Greenland white-fronted geese populations in the 2019/2020 International Census of Greenland white-fronted geese (Fox *et al*., 2021). The IWeBS data also showed small flocks occurring at Greaghans Turlough (7.5 km north-west), Belclare Turlough (4.2 km south-east) and Bindwell Turlough (4.3 km north). The proposed development site is, therefore considered to be within the maximum foraging range of these flocks (SNH, 2018).

No internationally important populations of whooper swan occur within the wider area, though there are smaller flocks of up to 250 birds reported in the area (Burke *et al*., 2021). The IWeBS data showed that flocks of whooper swan occur at Greaghans Turlough, Kilglassan Turlough, Belclare Turlough, Blindwell Turlough, Gardenfield Turlough and along the banks of the river Clare to the east of the proposed development site. These were generally small flocks of < 50 birds, though it should be noted that some subsites only have two years of count data and do not accurately represent flock sizes likely to occur in the area. Blindwell Turlough and Belclare Turlough lie within 5 km of the proposed development site, and therefore, the proposed development site falls within the core foraging range of birds associated with these waterbodies (5 km) (SNH, 2018).

Boland and Crowe (2008) report a population of greylag geese at Rostaff Lake *c.* 7.2 km south-west of the proposed development site, and IWeBS counts of this lake found that it supports a flock of 54 birds based on five-year mean peak counts (2016/17 – 2020/21). This population are part of the feral (resident) greylag goose population as opposed to the migratory Icelandic population that is of higher conservation concern (Boland and Crowe, 2008; Lewis *et al*., 2019b).

In terms of wintering waders, several species can often be found inland away from coastal hotspots, in particular snipe, golden plover and lapwing, as well as curlew, black-tailed godwit and ringed plover. The large areas of bog and wet grassland within the proposed development site are considered highly suitable for wintering snipe and golden plover. As well as this, the wetlands adjacent to the bog on the banks of the Black River are suitable for wintering lapwing. There are some small areas of forestry and scrub within the proposed development site with potential to support woodcock. Overall, the proposed development site is considered to provide a mosaic of suitable habitats for wintering waders.

2.3 Breeding waders

According to the latest Bird Atlas 2007-11, there are confirmed breeding records of snipe and probable breeding records of lapwing within the proposed development site (Balmer *et al*., 2013). The large areas of bog and wet grassland provide suitable habitat for breeding snipe, and areas of open farmland have the potential to host breeding lapwing.

There are recent records of wintering woodcock and curlew, although historical records of these species breeding within the national grid square M35 do exist (Sharrock, 1976). A recent reduction in Irish breeding range for woodcock means that the breeding population is red-listed, although the wintering population, which sees an influx of continental birds, remains green-listed (Gilbert *et al*., 2021). Breeding woodcock are now largely confined to the midlands and east of Ireland and are therefore unlikely to be present within the proposed development site, however, surveys were undertaken to confirm presence.

Despite a lack of recent breeding records within the proposed development site, there is a potential breeding habitat for curlew within areas of open bog. Areas of wet pasture may also contain tussocks or *Juncus* species, which could provide cover for nesting curlew.

2.4 Raptors

Habitat within a 2 km buffer of the proposed development site was considered potentially suitable for breeding buzzard, sparrowhawk and kestrel. There is also some limited potential for breeding hen harrier and merlin to occur. The area has the potential to support long-eared owls and barn owls.

2.4.1 Hen harrier

The last National Breeding Hen Harrier Survey conducted in 2015 did not include the 10 km national grid square [M35] encompassing the proposed development site (Ruddock *et al*., 2016). There are also no confirmed breeding records in any of the surrounding 10 km squares, though there are historic breeding records in this area (Gibbons *et al*., 1993).

Though traditionally, hen harriers prefer to nest within areas of mature heather, following the decline of this habitat in Ireland, pairs are increasingly being recorded utilising young conifer plantations (Wilson *et al*., 2006). At present, most of the forestry plantation within the 2 km buffer is closed thicket, however, it is important to note that, depending on ongoing forestry operations in the area, habitat suitability could change over the next 5-10 years leading to areas of clearfell/second rotation becoming suitable for breeding hen harrier before or during construction and operation of the proposed wind farm. Breeding hen harrier also generally tends to favour upland areas (>100 m above sea level) and are increasingly favouring more forested landscapes

(Ruddock *et al*., 2016; NPWS, 2015). Overall, there is considered to be a limited suitable breeding habitat for hen harrier within a 2 km buffer of the proposed development site has limited small pockets of forestry and is a lowland area. Breeding raptor surveys were undertaken to confirm the breeding status of hen harrier within the 2 km buffer of the proposed development site.

There are suitable foraging habitats for hen harrier in the non-breeding season, due to the large areas of open bog which support the open habitat species such as meadow pipit and skylark that hen harrier predominately preys upon. There is a recent record of a hen harrier in the west of the proposed development site in the NBDC records in January 2022 and a known winter hen harrier roost at Lough Corrib, though this roost site is a considerable distance from the proposed development site, *c.* 20 km south-west. As such, hen harrier roost watches were carried out in the winter to determine the presence of any hen harrier roosts within a 2 km buffer of the proposed development site.

2.4.2 Merlin

As with hen harrier, merlin typically breed in upland sites and, as such, the 2 km buffer of the proposed development site is considered unlikely to provide suitable habitat. Merlin is also traditionally a ground-nesting species, but in Ireland have taken to utilising old tree nests of other species, in particular those of corvids, due to the absence of suitable habitat (Lusby *et al*., 2017). The small blocks of forestry plantation adjacent to open bog in the north of the 2 km buffer of the proposed development site may, therefore, provide some suitable breeding habitat, but, as for hen harriers, merlin may be more likely to utilise the site for hunting in winter, when they are more widespread and move away from high ground. The large areas of open bog provide suitable hunting opportunities for this species, which favours small open habitat passerines such as meadow pipit and skylark.

2.4.3 Other raptors

Buzzard, sparrowhawk and kestrel are widespread resident species in Ireland and, based on habitat, are likely to breed within a 2 km buffer of the proposed development site. While buzzard and sparrowhawk are both green-listed, the conservation status for kestrel was upgraded throughout the proposed development surveys from amber to red-listed (Colhoun and Cummins, 2013; Gilbert *et al*., 2021). As reported in Lewis *et al*. (2019a), both breeding numbers and distribution of kestrels have declined significantly, which is thought to have been driven by changes in prey availability due to agricultural intensification (Wilson-Parr and O'Brien, 2019), as well as secondary rodenticide poisoning. Flight behaviour means kestrels are also a species emerging as notably susceptible to collision with turbines.

The 2 km buffer of the proposed development site is considered to hold no suitable peregrine breeding habitats, such as cliff faces, derelict buildings, or quarries (Moore *et al*., 1997). The NBDC records show the closest breeding pair to be at Kinlough Castle, *c.* 6.2 km south-west (2015), and most other records in the wider area were wintering records (Balmer *et al*., 2013).

2.4.4 Owls

The lower-lying, open agricultural areas with associated scrub and old growth woodland/treelines provide suitable nesting and foraging habitat for barn owl, and there are recent records of this red-

listed species in the wider area. As well as this, Mc Guinness *et al*. (2015) reported areas of, albeit low, sensitivity for barn owl in the western part of the proposed development site.

In Ireland, foraging distances from nest sites can extend up to 6 km and even as far as 9 km; however, the core breeding season home range is documented to be 4 to 5 km from the nest (Lusby and Cleary, 2014, TII 2021). This is further than the 1 km search area recommended by the SNH (2017) survey guidelines for breeding barn owls (owls other than short-eared owls). Likewise, the documented extent for breeding season home ranges for Irish barn owls exceeds the zone of sensitivity given for barn owls in relation to wind farm developments in Mc Guinness *et al*. (2015), which is 2 km.

Barn owls are reported as successfully breeding at a large wind farm in Scotland, with the number of pairs increasing after the provision of nest boxes, e.g., Crystal Rig Wind Farm[1]. It is generally considered that the low-level flight behaviour of barn owls (typically < 3-4 m) limits collision risk with larger turbines in the UK (and Ireland) where lattice towers are not commonly employed (Barn Owl Trust, 2015). As such, impacts are more likely to be associated with land use changes and loss of breeding territories due to the proposed development.

The forestry habitats adjacent to open fields within the 500 m buffer of the proposed turbine locations are suitable for long-eared owls and it is likely that this green-listed species breeds in the area. As for barn owls, impacts from wind farm developments are more likely to be associated with the removal of suitable habitats than potential collision risk.

Balmer *et al*. (2013) report wintering records of short-eared owl in the wider area associated with the south of Lough Corrib. There are also some NBDC winter records from Headford (*c.* 7.5 km south-west) and Ballagh (*c.* 15 km north-east). Though there is some potential for this sporadic winter visitor to occur, the lowland nature of the site makes it unlikely to be suitable breeding habitat. Short-eared owl is a rare and occasional breeder in Ireland (Hutchinson, 1989) and is more associated with upland areas in the breeding season, in particular with the Mullaghareirk Mountains, counties Limerick, Cork and Kerry, and the Antrim Hills. They are also highly nomadic, with recent GPS data recording one female breeding in both Scotland and Norway within the same year (Darvill, 2020). As such, it may be less vulnerable to land use changes than the barn owl, which remains in the same territory throughout its life, with traditional nest sites sometimes being occupied by successive generations (Lusby and O'Cleary, 2014).

2.5 Other species of conservation concern

2.5.1 Kingfisher

No recent records of kingfisher were found within the 10 km national grid square encompassing the proposed development site [M35] (Balmer *et al*., 2013). The river Clare *c.* 5 km east of the proposed development, part of the Lough Corrib SAC, holds ten probable kingfisher territories according to Cummins *et al*. (2010a). The closest reported territory to the proposed development site is *c.* 5.8 km east at Tuam. The Lough Corrib SAC is located 10.9 km west of the proposed development, at its closest point, although the reported kingfisher territories lie upstream of Lough Corrib and do not

[1] Available at: https://pes.eu.com/press-releases/ornithological-plan-leads-to-barn-owl-success/ [last accessed June 2023]

share a direct surface water hydrological connection with the proposed development. Due to the presence of two rivers within the proposed development and known kingfisher territories in the wider area, riverine surveys incorporating kingfisher habitat suitability surveys were employed.

2.5.2 Red grouse

Red grouse occur almost exclusively in open bog and heathland. No recent records of this species were found, and the results of the last national red grouse survey listed the species as absent in this area (Balmer *et al*., 2013; Cummins, *et al*. 2010b). Though most of the proposed development site is dominated by bog, it may not have the varying levels of heather cover required for this species. Red grouse populations occurring in the wider area are beyond the 500 m zone of sensitivity reported for this species in Mc Guinness *et al*. (2015) and, therefore, will not be affected by this proposal.

2.5.3 Swift

The conservation status of swifts was upgraded in 2021 from amber to red-listed (Colhoun and Cummins, 2013; Gilbert *et al*., 2021). There is potential for swifts to forage over the proposed development site during the summer months while nesting in suitable buildings of nearby towns and villages. The closest reported swift nest sites are at Shrule and Kilconly 3.3 km south-east and 1.5 km north of the proposed development site, respectively[2].

Depending on weather conditions swifts often forage at heights of 50 to 100 m, placing them within the collision risk zone of wind turbines. As swifts are habituated to manmade structures, it is considered unlikely that foraging birds will be displaced by operational turbines. Conversely, this species (along with swallows and other hirundines) may be actively drawn towards turbines to glean insects that are attracted to/more active around turbine towers and hardstands (Rydell *et al*., 2012). While the mechanism and potential effects are poorly understood at this stage, it is considered likely that this behaviour leads to heightened collision risk for this species. In Germany, 3% of 1,192 reported fatalities due to collisions with wind turbines between 1989 and 2010 were swifts, which when combined with swallow mortality was proportionally higher than would be expected for small, fast-flying and mobile species like swifts and hirundines (Dürr, 2010 in Rydell *et al*., 2012).

2.5.4 Nightjar

Areas of forestry plantation in upland habitats, specifically drier areas in young plantation and clearfell, as well as associated scrub and bracken have the potential to support another crepuscular/nocturnal breeding species, namely nightjars. This red-listed species is a very rare breeder in Ireland with plantations on the Galtees and Knockmealdowns in counties Tipperary and Waterford supporting the limited number of contemporary breeding records. It is considered very unlikely that nightjars occur in the vicinity of the proposed development site and there are no historical records of the species occurring in the vicinity of the proposed development.

2.5.5 Rare passerines

[2] Birdwatch Ireland online swift survey map. Available at: https://bwi.maps.arcgis.com/apps/MapJournal/index.html?appid=81ddc38cfcde40ffab699be638ee5b20 [last accessed June 2023]

As detailed in SNH (2017), it is considered that most passerines are at low risk of collision with wind turbines; as flight behaviour makes them less susceptible to collisions. This means that any fatalities due to collisions are unlikely to impact passerine communities at the population level. The exception may be rarer breeding passerines, which in an Irish context would include whinchat, ring ouzel, tree sparrow and yellowhammer. There are no documented populations of rare breeding passerines occurring in the vicinity of the proposed development (Balmer *et al*., 2013).

2.6 List of species of conservation concern

Table 2 presents the list of red and amber-listed BoCCI species recorded within national grid square M35. A full list of returned records including green-listed species, which are not considered threatened, is presented in **Appendix I.**

Table 2: NBDC bird records for red and amber-listed BoCCI for national grid square M35 from 2011-2021

Common Name	Scientific Name	BoCCI status[3]	Annex I[4]	Date of last record
Barn Owl	*Tyto alba*	Red Br.		31/12/2011
Snipe	*Gallinago gallinago*	Red Br. and Win.		31/12/2011
Dunlin	*Calidris alpina*	Red Br. and Win.	Y	31/12/2011
Curlew	*Numenius arquata*	Red Br. and Win.		31/12/2011
Golden Plover	*Pluvialis apricaria*	Red Br. and Win.	Y	31/12/2011
Grey Wagtail	*Motacilla cinerea*	Red Br.		31/12/2011
Kestrel	*Falco tinnunculus*	Red Br.		31/12/2011
Meadow Pipit	*Anthus pratensis*	Red Br.		31/12/2011
Redwing	*Turdus iliacus*	Red Win.		31/12/2011
Lapwing	*Vanellus vanellus*	Red Br. and Win.		31/12/2011
Shoveler	*Anas clypeata*	Red Br. and Win.		31/12/2011
Pochard	*Aythya ferina*	Red Br. and Win.		31/12/2011
Redshank	*Tringa totanus*	Red Br. and Win.		31/12/2011
Black-headed Gull	*Larus ridibundus*	Amber Br. and Win.		31/12/2011
Pintail	*Anas acuta*	Amber Win.		31/12/2011
Swallow	*Hirundo rustica*	Amber Br.		31/12/2011
Linnet	*Carduelis cannabina*	Amber Br.		31/12/2011
Starling	*Sturnus vulgaris*	Amber Br.		31/12/2011
Greenfinch	*Carduelis chloris*	Amber Br.		31/12/2011
Teal	*Anas crecca*	Amber Br. and Win.		31/12/2011
Wigeon	*Anas penelope*	Amber Br. and Win.		31/12/2011
Gadwall	*Anas strepera*	Amber Br. and Win.		31/12/2011
Cormorant	*Phalacrocorax carbo*	Amber Br. and Win.		30/03/2010
Goldcrest	*Regulus regulus*	Amber Br.		31/12/2011
Greenland White-fronted Goose	*Anser albifrons subsp. flavirostris*	Amber Win.	Y	31/12/2011

[3] BOCCI (Gilbert, *et al.* 2021) column refers to whether conservation concern status applies to wintering (Win), breeding (Br), or passage (Pas) populations.
[4] Indicates Annex I species of the EU Birds Directive.

Common Name	Scientific Name	BoCCI status[3]	Annex I[4]	Date of last record
Hen Harrier	*Circus cyaneus*	Amber [Br.]	Y	15/01/2022
House Martin	*Delichon urbicum*	Amber [Br.]		31/12/2011
House Sparrow	*Passer domesticus*	Amber [Br.]		31/12/2011
Mute Swan	*Cygnus olor*	Amber [Br. and Win.]		31/12/2011
Northern Wheatear	*Oenanthe oenanthe*	Amber [Br.]		31/12/2011
Sand Martin	*Riparia riparia*	Amber [Br.]		31/12/2011
Skylark	*Alauda arvensis*	Amber [Br.]		31/12/2011
Spotted Flycatcher	*Muscicapa striata*	Amber [Br.]		31/12/2011
Willow Warbler	*Phylloscopus trochilus*	Amber [Br.]		31/12/2011
Tufted Duck	*Aythya fuligula*	Amber [Br. and Win.]		31/12/2011
Whooper Swan	*Cygnus cygnus*	Amber [Br. and Win.]	Y	31/12/2011
Mallard	*Anas platyrhynchos*	Amber [Br. and Win.]		31/12/2011
Spotted Redshank	*Tringa erythropus*	Amber [Pas.]		31/12/2011

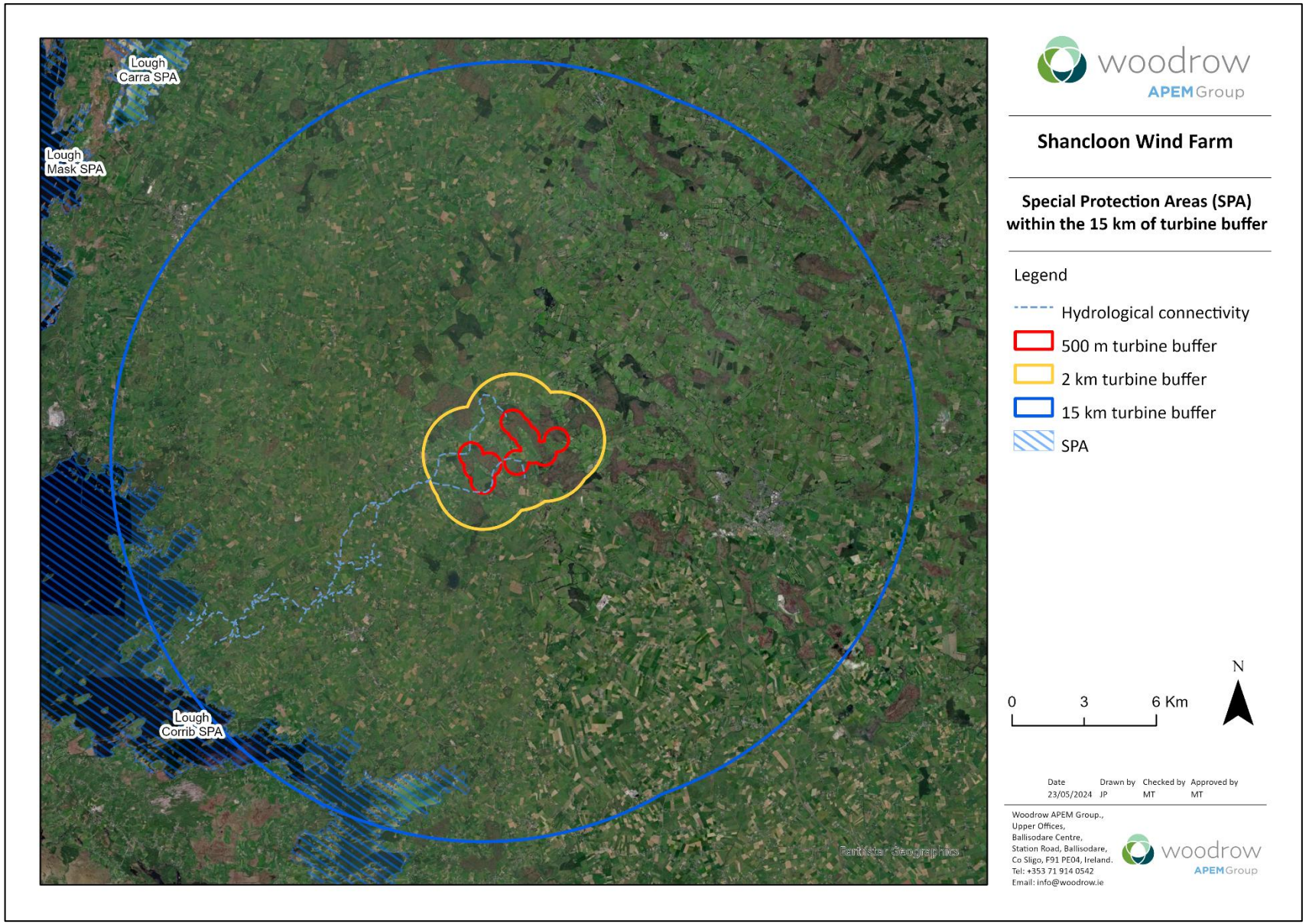

Figure 1: Special Protection Areas (SPAs) within the vicinity of the proposed development, showing hydrological connectivity to Lough Corrib SPA

3 Methodology

SNH (2017) guidelines provide recommended survey methodologies for the assessment of avian populations within and adjacent to onshore wind farms. Survey methodologies utilised for ornithological surveys are outlined in the following sections and adhere to the relevant SNH guidance.

Two years of ornithological surveys are recommended by the SNH guidelines, unless it can be demonstrated that a single year of data is sufficiently robust and appropriate for assessing the potential impacts of the proposal.

3.1 Vantage Point (VP) watches

VP watches record flight activity within the 500 m turbine buffer to provide data on selected target species for assessing avian collision risk. Five VPs were used to cover the 500 m turbine buffer of the proposed development site, the locations of which are shown in Figure 2. Viewshed analysis undertaken using GIS using a surface offset of 25 m (the lowest rotor swept height of all turbine models) and confirmed to be accurate during ground-truthing) indicated that the five VPs provide complete coverage (99.94%) of the 500 m turbine buffer and the potential turbine locations for the proposed development site – see **Appendix III** for the viewshed map.

Based on viewsheds extending 2 km, some of the viewsheds of the VPs overlap (see **Appendix III**). Therefore, it is acknowledged that as a function of coverage (survey effort), the flight seconds reported cumulatively for all the VP watches will provide an overestimate for flight times. The conducting of VP watches simultaneously by two or more surveyors was avoided to avoid any duplicate records. To limit observer fatigue, surveyors did not typically undertake VP watches of more than 3-hours in duration without a break, unless inclement periods of weather meant watches were paused for short durations until conditions improved.

Target species were determined and included those identified as being at risk from displacement effects caused by wind farm developments or from collision with turbines. Target species for which flightline data was captured were as follows:

- Waders and wildfowl (ducks, geese and swans);
- Other waterbirds (including grebes, herons, rails, crakes and gulls);
- Raptors and owls;
- Any species listed on Annex I of the Birds Directive; and
- Any non-passerine species listed as red on the Birds of Conservation Concern in Ireland 2020-26 (BoCCI) (Gilbert *et al*., 2021)

VP watches involved the surveyor observing birds from a stationary position using binoculars and a telescope. In accordance with SNH (2017) guidance, the viewshed of the VP was scanned every 5 minutes. When a target species was seen, the surveyor estimated the height of the bird and its usage of the area by drawing its flight path on a map and noting its behaviour. Flight heights were estimated visually. Other data collected included the number of birds, time of detection and duration of flight, as well as sex and age class if relevant. A list of all non-target species encountered within the proposed development site was also compiled during watches, though priority was given to recording target species in the case of busier survey days.

The aim for each survey season, i.e. the breeding season (April to September) and non-breeding season (October to March), was to conduct a minimum of 36 hours of watches per VP per season, ensuring that watches were spread relatively evenly over the survey season. Surveys undertaken for the proposed development site were compliant with SNH guidelines (2017). An additional 2 hours were completed at VP 4 during the 2019 breeding season, and an additional 2 and 2.5 hours, respectively, were completed at VP1 and VP2 during the 2019-20 non-breeding season. Survey hours completed at each VP location per date of each season are provided in Table 3, Table 4, Table 5, Table 6, Table 7 and Table 8. Further details on survey timings, surveyor and weather conditions are provided in **Appendix IV**.

Table 3: VP watch survey hours completed during the 2019 breeding season

Breeding season 2019	VP1	VP2	VP3	VP4	VP5
30/03/2019					1
17/04/2019	2.75	2.25	2.67	1.5	1
18/04/2019	4	4		3	3
19/04/2019			3		3
24/04/2019	3	3	3	3	
25/04/2019					3.5
30/04/2019	2.5	2.75		3.75	3.5
01/05/2019			3	3.5	
08/05/2019		3		3	
23/05/2019	3				3
24/05/2019				3	
28/05/2019		3			
30/05/2019	2.75		3.33		
07/06/2019	3		3		
11/06/2019		3		3	3
17/06/2019	3			2.25	
27/06/2019		3			3
28/06/2019			3		
01/07/2019	3			3	
11/07/2019		3			3
12/07/2019			3	3	
19/07/2019	3				
25/07/2019			3		
30/07/2019		3	3		3
09/08/2019	3			3	
17/08/2019		2	2		2
22/08/2019	3		2	3	
23/08/2019		2			2
05/09/2019			2		
06/09/2019		2			2
Total of hours	36	36	36	38	36

Table 4: VP watch survey hours completed during the 2019-20 non-breeding season

Non-breeding season 2019-20	VP1	VP2	VP3	VP4	VP5
24/09/2019	1				

25/09/2019	2		3	3	
26/09/2019		3			3
04/10/2019	3		3		
07/10/2019				3	
08/10/2019	3		3		
09/10/2019		3			2
10/10/2019					1
11/10/2019		3			3
06/11/2019		2.5		3	2
12/11/2019	1.5			3	
18/11/2019			3		3
21/11/2019	2	2		2	
27/11/2019	2.5		3	3	
02/12/2019				3	
04/12/2019	2.5	2	3		
05/12/2019					1
07/12/2019	3		3		2
08/12/2019		3		3	1
12/12/2019		3			1.5
06/01/2020		1.5		2	
07/01/2020			1		1.5
09/01/2020	3				
10/01/2020		3	3		
15/01/2020	3		2		1
16/01/2020	0.5	1.5		2	2
27/01/2020	3			3	
28/01/2020		3	3		
30/01/2020					3
03/02/2020	3				
04/02/2020		1			
06/02/2020					3
08/02/2020		2	3		
09/02/2020					3
13/02/2020	3			3	
24/02/2020		3			
27/02/2020		2	3		3
28/02/2020	1				
Total of hours	37	38.5	36	33	36

Table 5: VP watch survey hours completed during the 2020 breeding season

Breeding season 2020	VP1	VP2	VP3	VP4	VP5
21/04/2020			2	2	2
22/04/2020			2	2	2
24/04/2020	3	6			
25/04/2020	3				

Breeding season 2020	VP1	VP2	VP3	VP4	VP5
28/04/2020			2	2	2
29/04/2020			5	2	2
30/04/2020	3	3			3
12/05/2020			3		3
14/05/2020				6	
15/05/2020	3	3			
27/05/2020			3		3
28/05/2020	3	3			
29/05/2020			3		3
07/06/2020	3	3			
12/06/2020			3	3	3
18/06/2020					3
25/06/2020	3	3			
30/06/2020			3	3	
20/07/2020		6			
21/07/2020					6
22/07/2020				6	
23/07/2020	6				
24/07/2020			6		
11/08/2020			4		
12/08/2020				6	
13/08/2020					4
14/08/2020	3			4	
25/08/2020	3	3			
26/08/2020	3	3			
28/08/2020		3			
Total of hours	36	36	36	36	36

Table 6: VP watch survey hours completed during the 2020-21 non-breeding season

Non-breeding 2020-21	VP1	VP2	VP3	VP4	VP5
05/09/2020-			3		
06/09/2020	3				3
28/09/2020			3		3
29/09/2020	3			3	
30/09/2020		6			
14/10/2020		6			
15/10/2020				6	
16/10/2020			6		
20/10/2020	6				
21/10/2020					6
06/11/2020				3	3
15/11/2020			6		
16/11/2020	6				
17/11/2020		6			
20/11/2020				3	3
02/12/2020			3		3

Non-breeding 2020-21	VP1	VP2	VP3	VP4	VP5
03/12/2020				3	
04/12/2020	3	3			
08/12/2020			3		3
14/12/2020	3				3
15/12/2020			3	3	
16/12/2020		3			3
21/01/2021	2.5			3	
22/01/2021		3	3		
25/01/2021				3	3
26/01/2021	3			3	
27/01/2021			3		
29/01/2021					3
22/02/2021		3		3	
24/02/2021	3				
09/03/2021		3		3	
10/03/2021	3.5	3	3		
Total of hours	36	36	36	36	36

Table 7: VP watch survey hours completed during the 2023-24 non-breeding season

Non-breeding 2023-24	VP1	VP2	VP3	VP4	VP5
27/10/2023			3		3
28/10/2023	3	3			
29/10/2023	3			3	
07/11/2023	3			3	
08/11/2023		3	3		
09/11/2023	3				
10/11/2023				3	6
21/11/2023	3	6			
23/11/2023				3	1.5
24/11/2023			6		1.5
30/11/2023		3		3	
01/12/2023			6		2
02/12/2023					3
03/12/2023		3		3	2
04/12/2023	6				
24/01/2024	9				
25/01/2024		7.5			
26/01/2024		1.5	6.25		
27/01/2024			2.75	5	
28/01/2024				4	4
29/01/2024					5
21/02/2024		9			
22/02/2024				9	
23/02/2024	6				
25/02/2024			6		
26/02/2024					3.75
27/02/2024					6.25

Non-breeding 2023-24	VP1	VP2	VP3	VP4	VP5
26/03/2024			6		
Total of hours	36	36	39	36	38

Table 8: VP watch survey hours completed during the 2024 breeding season

Breeding 2024	VP1	VP2	VP3	VP4	VP5
26/03/2024			6	3	
27/03/2024	3	3			
28/03/2024					6
03/04/2024		3			
18/04/2024				6	
22/04/2024		6			
23/04/2024			6		6
24/04/2024	6				
21/05/2024					6
22/05/2024	6	6			
23/05/2024				6	
24/05/2024			6		
10/06/2024					3
20/06/2024			6		
21/06/2024	6				
24/06/2024				6	
25/06/2024		6			
02/07/2024					3
16/07/2024					6
26/07/2024				6	
29/07/2024	6				
30/07/2024			6		
31/07/2024		6			
09/08/2024					3
14/08/2024				6	
15/08/2024	6				
16/08/2024			6		
19/08/2024		6			
24/08/2024					3
11/09/2024	3			3	
Total of hours	36	36	36	36	36

3.2 Collision Risk Modelling

VP watches were conducted to collect flightline data which could then be used to model collision risk. For target species generating sufficient levels of flight time within the zone of collision risk, data sets were run through a Collision Risk Model (CRM), as detailed in SNH (2024), Band (2024) and Band *et al*. (2007), using avoidance rates as given in SNH (2018). These results provided estimates of the number of collisions per annum and decade, and for the lifetime of the proposed wind turbines (30 years). A detailed methodology, along with results, is provided in **Appendix XIII.**

3.3 Breeding bird surveys

The purpose of breeding bird surveys, according to SNH guidelines was to provide information on the distribution of breeding birds occurring within study area, highlighting the locations of potentially sensitive species to be recognised as ecological constraints, e.g., breeding waders or raptors. Various methods were employed depending on the habitat type and the expected species highlighted in the desk-based study. As such, the survey methodology employed a range of survey techniques determined by desk-based study such as proximity to designated sites, habitat availability and associated avian assemblages. The study area for breeding bird walkovers included the 500 m buffer of the proposed turbine locations (Figure 2). Breeding bird survey coverage is shown on Figure 3.

Based on topography and habitat availability, the desk-based study determined that the 500 m turbine buffer had the potential to support a range of target species, including lowland breeding waders (e.g., snipe, curlew and lapwing) and crepuscular/nocturnal woodland species (e.g., woodcock and long-eared owls). According to SNH (2017), breeding wader surveys should follow an adapted Brown and Sheperd (1993) methodology with four visits undertaken at least seven days apart, covering the whole breeding season between mid-April and early July. An 800 m search radius from the proposed turbine locations is recommended for breeding curlew (Pearce-Higgins *et al*. 2009). During these surveys, all other bird species encountered were also noted, along with an indication of their behaviour and breeding status.

In addition to the above methodology for breeding waders, suitable wet areas within the 500 m turbine buffer of the proposed development site were surveyed for breeding snipe. Surveys running from dawn to three hours after or late afternoon to dusk (O'Brien and Smith, 1992) were undertaken to increase the chances of detecting breeding behaviour, including chipping, or drumming snipe. Three visits at dawn/dusk were made during the 2019 breeding season, two visits during the 2020 breeding season and five visits during the 2024 breeding season.

Dusk surveys were carried out in woodland areas to identify roding woodcock (territorial males), as detailed in Gilbert *et al*. (1998). These surveys were carried out roughly 15 minutes before sunset and 60 minutes after sunset between May and June, as recommended by the UCC Irish Woodcock Project (UCC Ornithology Group, 2021). During dusk surveys, surveyors also listened for other crepuscular and nocturnal species, including owls. Following the 2019 dusk surveys for woodcock, along with the results of the desk study, it was determined that there was no potential for breeding woodcock to occur within the 500 m turbine buffer and targeted woodcock surveys were not deemed necessary during the 2020 and 2024 breeding season surveys.

Due to the presence of two rivers within the 500 m turbine buffer, Black (Shrule) River and Togher River, and known kingfisher territories in the wider area, riverine surveys for kingfisher habitat suitability were incorporated into the breeding bird surveys. Kingfisher habitat suitability surveys were carried out to determine whether there were tall, vertical banks within which kingfisher could dig their nests and whether the water was slow flowing, with suitable perching locations for fishing (Cummins *et al*., 2010a). Survey coverage for riverine surveys included stretches of the Black (Shrule) River and Togher River that occur within the 500 m turbine buffer.

The small forestry blocks adjacent to bog habitat in the 2 km turbine buffer of the proposed development site were judged to be suitable for tree-nesting merlin and, during the walkover surveys, surveyors also recorded any merlin signs, such as plucking posts. This was in addition to wider area raptor surveys, which employed ‘mini-VPs’ to target suitable merlin habitats.

Survey dates for breeding bird walkover surveys for each season, detailed above, are provided in Table 9, Table 10 and Table 11. Further details on survey timings, surveyor and weather conditions are provided in **Appendix V**.

Table 9: Breeding bird surveys carried out during the 2019 breeding season

Date	Visit	Survey type	Start time	Surveyor
25/04/2019	1	Dawn survey	06:00	HD, HPD, KW
25/04/2019	1	Walkover and Riverine	08:00	HD, HPD, KW
01/05/2019	2	Walkover and Riverine	11:35	HPD
08/05/2019	2	Walkover and Riverine	10:00	HPD
11/06/2019	3	Dusk survey	19:45	HD, KW
11/06/2019	3	Walkover	19:45	HD, KW
17/06/2019	4	Dusk survey	20:30	KW
17/06/2019	4	Walkover	20:30	KW

Table 10: Breeding bird surveys carried out during the 2020 breeding season

Date	Visit	Survey type	Start time	Surveyor
11/05/2020	1	Walkover and Riverine	12:00	KW
13/05/2020	1	Dusk survey	19:30	KW
13/05/2020	1	Walkover	19:30	KW
15/05/2020	1	Walkover	10:00	KW
16/06/2020	2	Walkover	11:30	KW
18/06/2020	2	Dusk survey	17:30	KW
18/06/2020	2	Walkover and Riverine	17:30	KW
19/06/2020	2	Walkover and Riverine	10:00	KW

Table 11: Breeding bird surveys carried out during the 2024 breeding season

Date	Visit	Survey type	Start time	Surveyor
09/04/2024	1	Walkover	09:00	AP
18/04/2024	2	Walkover	09:00	AP
24/04/2024	2	Dusk survey	20:00	AP
02/05/2024	3	Walkover	09:00	AP
09/05/2024	3	Walkover	09:00	AP
15/05/2024	4	Walkover	05:00	AP
27/05/2024	5	Dusk survey	20:46	AP
01/06/2024	5	Walkover	09:00	AP
26/06/2024	6	Walkover	16:00	AP
27/06/2024	6	Dusk survey	21:00	AP
30/06/2024	6	Dusk survey	21:00	AP
13/07/2024	7	Dusk survey	20:50	AP
08/08/2024	8	Dusk survey	21:15	BF

3.4 Breeding raptor surveys

SNH (2017) recommended surveying up to 2 km from the proposed development site for most breeding raptor species, including hen harriers and merlin. This could be extended if the proposed development site lied within the potential zone of influence SPAs (SNH, 2016). In this instance, the proposed development site was not near any SPAs designated for raptors (the closest being *c.* 10.9 km west) and the 2 km turbine buffer was considered appropriate, as shown Figure 4. Breeding raptor survey coverage is shown on Figure 5.

A combination of 'mini-VPs', as well as driven and walked transects were used to search potential nesting habitats within the hinterland over the breeding seasons of 2020, 2021 and 2024. Survey methods for breeding raptors follow those outlined in Hardey *et al*. (2013). Some suitable breeding habitats for hen harrier and merlin were identified within the 2 km turbine buffer where open bog habitat with scrubby fringes was present, adjacent to the conifer plantation. A total of four visits were carried out during the 2019 breeding season, three visits during the 2020 breeding season and seven visits during the 2024 breeding season. These survey dates and surveyors are detailed in Table 12Table 12, Table 13 and Table 14. Further details on survey timings, surveyor and weather conditions are provided in **Appendix VI**.

Following the collation of the breeding raptor survey results, a breeding territory analysis of raptor species was undertaken. Depending on the observations made by the surveyors, the time of the year and the frequency of observations these territories were categorized into: Probable breeding territory, which means it is likely to find a nesting territory within this area, more than 70% of probability, or Confirmed breeding territory, which means that a nest or chicks were seeing on the surveys or a resident territory pair, consequently this area is an established territory.

Table 12: Wider area breeding raptor survey effort undertaken during the 2019 breeding season

Date	Visit	Survey Type	Start time	Surveyor
01/05/2019	1	Raptor survey	08:30	HD
08/05/2019	1	Raptor survey	13:00	HD
07/06/2019	2	Raptor survey	08:30	RW
11/06/2019	2	Raptor survey	15:30	HD
28/06/2019	3	Raptor survey	08:30	KW
05/07/2019	4	Raptor survey	08:00	KW
19/07/2019	4	Raptor survey	07:45	KW

Table 13: Wider area breeding raptor survey effort undertaken during the 2020 breeding season

Date	Visit	Survey Type	Start time	Surveyor
20/05/2020	1	Raptor survey	16:15	JK
20/05/2020	1	Raptor survey	07:30	KW
18/06/2020	2	Raptor survey	10:30	JK
23/06/2020	2	Raptor survey	09:30	JK
27/07/2020	3	Raptor survey	12:00	KW
28/07/2020	3	Raptor survey	08:30	KW

Table 14: Wider area breeding raptor survey effort undertaken during the 2024 breeding season

Date	Visit	Survey Type	Start time	Surveyor
03/04/2024	1	Raptor survey	09:45	AP
24/04/2024	2	Raptor survey	13:45	AP
05/05/2024	3	Raptor survey	11:30	AP
29/05/2024	4	Raptor survey	09:45	AP
10/06/2024	5	Raptor survey	13:30	BF
02/07/2024	6	Raptor survey	11:00	BF
23/07/2024	7	Raptor survey	09:45	AP

3.5 Winter walkover surveys

Winter walkovers provided useful information on the distribution of winter bird species occurring within the proposed development site and how they were utilising each habitat type. Walkover surveys were also a more suitable survey method for species which were difficult to detect during VP watches, such wintering woodcock, and rarer passerine species.

Winter walkovers within the 500 m turbine buffer of the proposed development site were undertaken during the 2019-20, 2020-21 and 2023-24 non-breeding seasons (Figure 2). Surveyors walked the 500 m turbine buffer of the proposed development site recording all species encountered, ensuring to cover a sample of all habitats present. Winter walkover survey coverage is shown on Figure 6. The dates of the winter walkovers carried out each non-breeding season can be found in Table 15, Table 16 and Table 17. Further details on survey timings, surveyor and weather conditions are provided in **Appendix VII**.

Table 15: Walkover survey effort undertaken during the 2019-20 non-breeding season

Date	Visit	Survey type	Start time	End time	Surveyor
14/11/2019	1	Walkover	10:00	17:00	MH
16/11/2019	1	Walkover	08:00	12:00	MH
08/01/2020	2	Walkover	09:00	15:30	MH
15/01/2020	2	Walkover	10:30	15:30	MH
04/02/2020	3	Walkover	09:00	16:30	MH
06/02/2020	3	Walkover	09:00	13:00	MH

Table 16: Walkover survey effort undertaken during the 2020-21 non-breeding season

Date	Visit	Survey type	Start time	End time	Surveyor
21/10/2020	1	Walkover	10:00	18:00	KW
23/10/2020	1	Walkover	16:30	18:30	KW
24/10/2020	1	Walkover	09:00	10:00	KW
10/12/2020	2	Walkover	09:30	16:00	KW
18/12/2020	2	Walkover	12:30	14:30	KW
21/02/2021	3	Walkover	11:00	16:00	KW
12/03/2021	4	Walkover	07:15	08:45	KW

Table 17: Walkover survey effort undertaken during the 2023-24 non-breeding season

Date	Visit	Survey type	Start time	End time	Surveyor
22/11/2023	1	Walkover	09:00	16:00	AP
02/01/2024	2	Walkover	09:00	12:00	AP
02/02/2024	3	Walkover	09:00	15:30	AP
02/03/2024	4	Walkover	09:00	15:30	AP
20/03/2024	5	Walkover	09:00	15:30	AP
29/03/2024	6	Walkover	09:00	12:00	AP

3.6 Wintering waterbird surveys

In assessing the impact of the proposed wind farm, it was important to provide contextual data on the numbers of waterbirds in the wider area relative to the usage of the proposed development site by these species. SNH guidelines required monitoring of swan and geese foraging and roosting locations when occurring in the environs of the proposed development site, and specifically where SPAs are designated for these species. Study areas of up to 500 m from the proposed development for foraging locations and up to 1 km from the proposed development for roost locations are

recommended, although this may be extended where high levels of activity are anticipated (SNH, 2017).

In Ireland, swan and goose distribution is not well documented beyond designated sites. In addition, many wintering waterbirds occur outside of SPAs. As such, the number of survey visits undertaken was subject to the level of waterbird activity recorded within the proposed development and wider area. The surveys were based on the approach employed by IWeBS (Irish Wetland Bird Surveys) and the study area was extended up to 6 km from the proposed development to cover turloughs and loughs in the wider area which were considered suitable for foraging and roosting wintering waterbirds (Figure 4). Wintering waterbird survey coverage is shown on Figure 7.

Four wider area wintering waterbird survey visits were conducted for 2019-20 winter, seven visits were carried out for 2020-21 winter and four visits for the 2023-24 winter. While surveys focussed on waterbirds, other target species, notably raptors, present during the surveys were also recorded. The dates of these surveys are shown in Table 18, Table 19 and Table 20. Further details on survey timings, surveyor and weather conditions are provided in **Appendix VIII**.

Table 18: Wider area wintering waterbird surveys undertaken during the 2019-20 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
09/10/2019	1	Waterbird surveys	11:30	MH
05/12/2019	2	Waterbird surveys	08:30	MH
07/01/2020	3	Waterbird surveys	11:00	MH
05/02/2020	4	Waterbird surveys	09:15	MH

Table 19: Wider area wintering waterbird surveys undertaken during the 2020-21 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
19/10/2020	1	Waterbird surveys	12:00	KW
18/11/2020	2	Waterbird surveys	09:00	AR
03/12/2020	3	Waterbird surveys	10:00	KW
18/12/2020	4	Waterbird surveys	09:00	KW
25/01/2021	5	Waterbird surveys	09:45	KW
26/02/2021	6	Waterbird surveys	09:00	KW
12/03/2021	7	Waterbird surveys	07:00	KW

Table 20: Wider area wintering waterbird surveys undertaken during the 2023-24 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
23/11/2023	1	Waterbird surveys	08:00	ED
02/12/2023	3	Waterbird surveys	08:30	ED
05/02/2024	2	Waterbird surveys	08:00	ED
26/02/2024	4	Waterbird surveys	08:30	ED
04/03/2024	5	Waterbird surveys	08:00	BF
13/03/2024	6	Waterbird surveys	15:30	BF

3.7 Hen harrier roost searches

During the initial desk review, it was noted that the combination of open bog, scrub and forestry plantation could provide cover for roosts and therefore it was recommended to carry out hen harrier roost searches. SNH (2017) guidance stipulated concerning surveying for communal raptor

roosts, including those of hen harriers, that roost sites within 2 km of a proposed development site should be identified.

For the proposed development, the approach to surveying for hen harrier roosts was determined by two factors:

- Availability of potentially suitable roosting habitat in the vicinity of the proposed development, as described by Clarke and Watson (1990) and in the Irish national hen harrier winter roost survey guidelines (O'Donoghue, 2019); and
- Hen harrier activity was observed during VP watches, site walkovers and wider area surveys.

SNH (2017) defers to Hardey *et al*. (2013) for specific roost survey methodology requiring surveyors to employ professional judgement in identifying and targeting potential roosts based on observed flight activity within or adjacent to the proposed development. Hardey *et al*. (2013) recommend locating birds in the late afternoon and then attempting to track them back to roosts. O'Donoghue (2019) notes that the best time to conduct a roost watch is at least 40 minutes before sunset until dark or 30 minutes before sunrise until at least 30 minutes after sunrise. The dates of the hen harrier roost watches are detailed in Table 21, Table 22 and Table 23.

Table 21: Hen harrier roost surveys undertaken during the 2019-20 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
12/12/2019	1	Hen Harrier survey	15:55	MH
09/01/2020	2	Hen Harrier survey	16:00	KW
10/01/2020	3	Hen Harrier survey	16:00	KW
15/01/2020	4	Hen Harrier survey	16:00	MH
16/01/2020	5	Hen Harrier survey	16:00	MH
27/01/2020	6	Hen Harrier survey	16:15	KW
05/02/2020	7	Hen Harrier survey	16:25	MH
06/02/2020	8	Hen Harrier survey	16:30	MH
07/02/2020	9	Hen Harrier survey	16:30	MH

Table 22: Hen harrier roost surveys undertaken during the 2020-21 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
23/10/2020	1	Hen Harrier survey	17:00	DP
17/11/2020	2	Hen Harrier survey	14:50	AR
18/11/2020	3	Hen Harrier survey	14:50	AR
16/12/2020	4	Hen Harrier survey	15:30	KW
18/12/2020	5	Hen Harrier survey	15:15	KW
22/02/2021	6	Hen Harrier survey	15:00	KW
24/02/2021	7	Hen Harrier survey	17:00	KW
10/03/2021	8	Hen Harrier survey	17:30	KW

Table 23: Hen harrier roost surveys undertaken during the 2023-24 non-breeding season

Date	Visit	Survey type	Start time	Surveyor
22/11/2023	1	Hen Harrier survey	16:00	EM
23/11/2023	2	Hen Harrier survey	16:00	EM
30/11/2023	3	Hen Harrier survey	15:45	EM
02/12/2023	4	Hen Harrier survey	16:00	EM
30/01/2024	5	Hen Harrier survey	08:10	SM
30/01/2024	6	Hen Harrier survey	09:30	SM

Date	Visit	Survey type	Start time	Surveyor
23/02/2024	7	Hen Harrier survey	16:52	SM
23/02/2024	8	Hen Harrier survey	18:00	SM

3.8 Survey limitations

Survey limitations included:

- Breeding bird walkover surveys were undertaken on two occasions during the 2020 breeding season. For breeding waders, three visits are recommended by SNH (2017) guidance. While this is a limitation, dusk and dawn surveys specifically for breeding snipe were undertaken which is additional to the SNH (2017) recommendations.
- Breeding bird and winter walkover surveys were limited to areas within the study area where permission had been granted.
- Hen harrier roost searches did not cover all winter months, as recommended by Hardey *et al*. (2013), however, nine visits were carried out in winter 2019-20 and eight visits in winter 2020-21 in winter 2023-24 with even coverage of the non-breeding season.

Despite these limitations, it is considered that sufficient data was collected over the three-year survey period to establish a robust ornithological baseline, inform an impact assessment and identify any ornithological constraints that may arise from the proposed development.

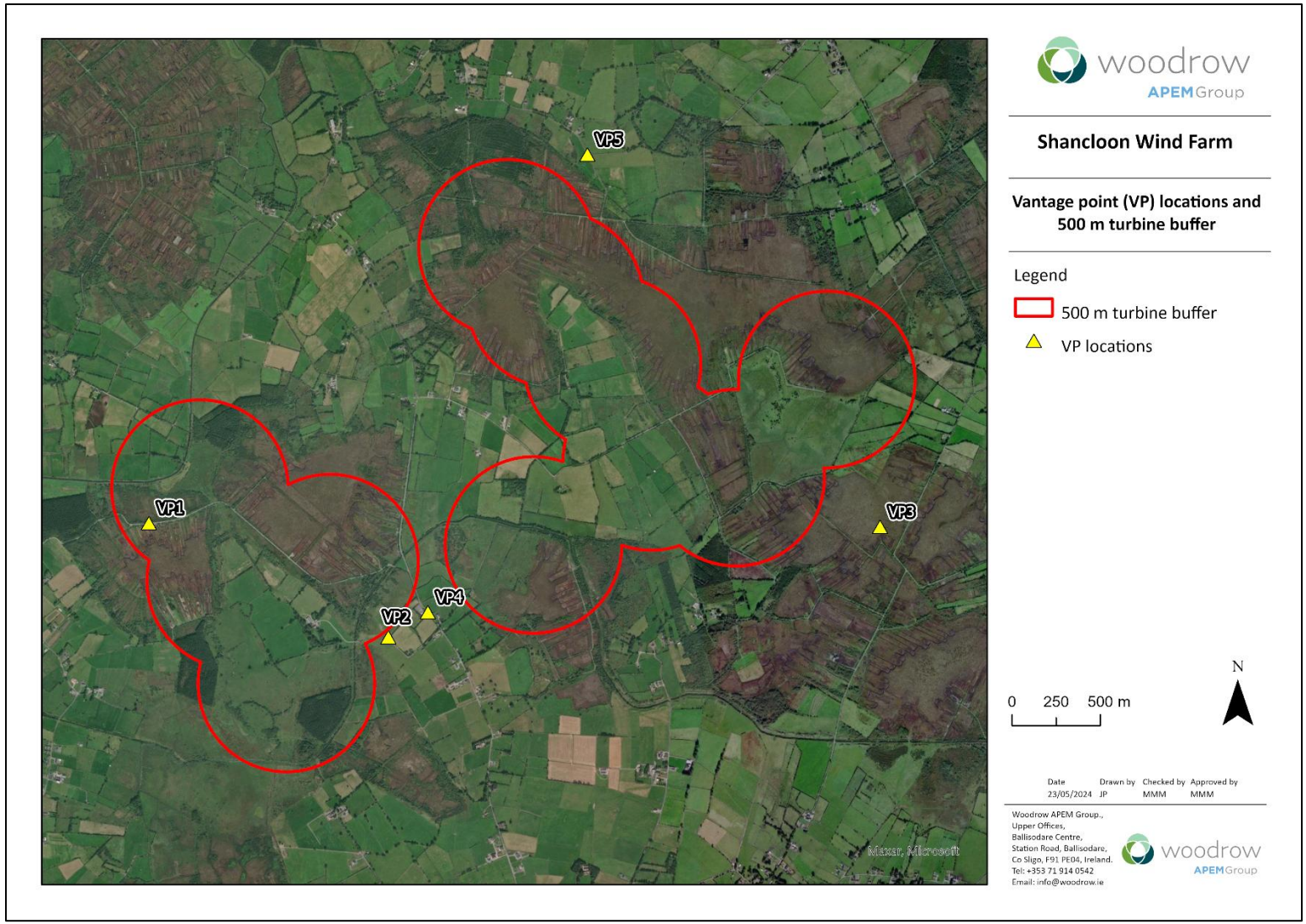

Figure 2: 500 m turbine buffer for VP watches, breeding bird surveys and winter walkover surveys

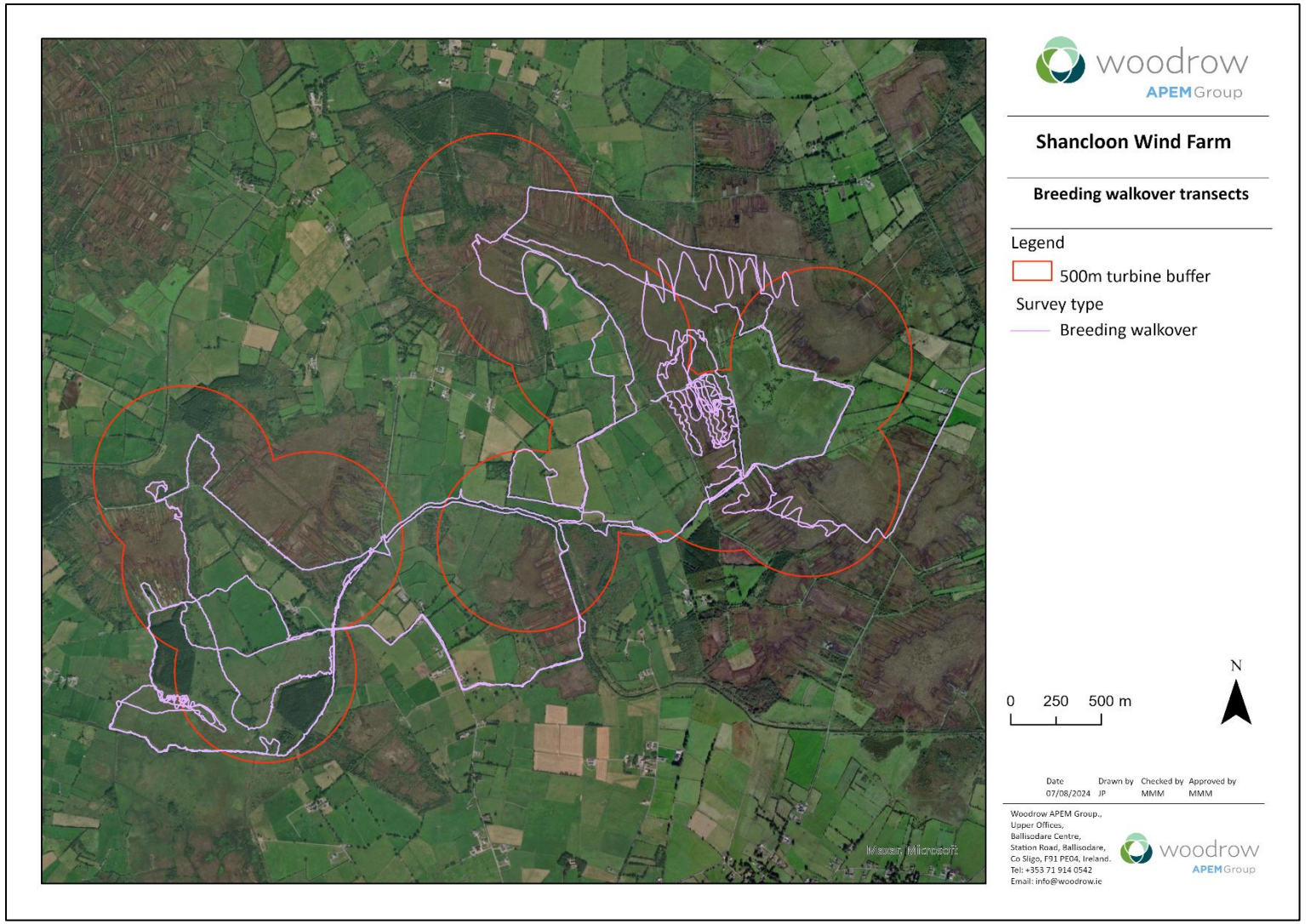

Figure 3: Breeding bird survey coverage within the 500 m turbine buffer

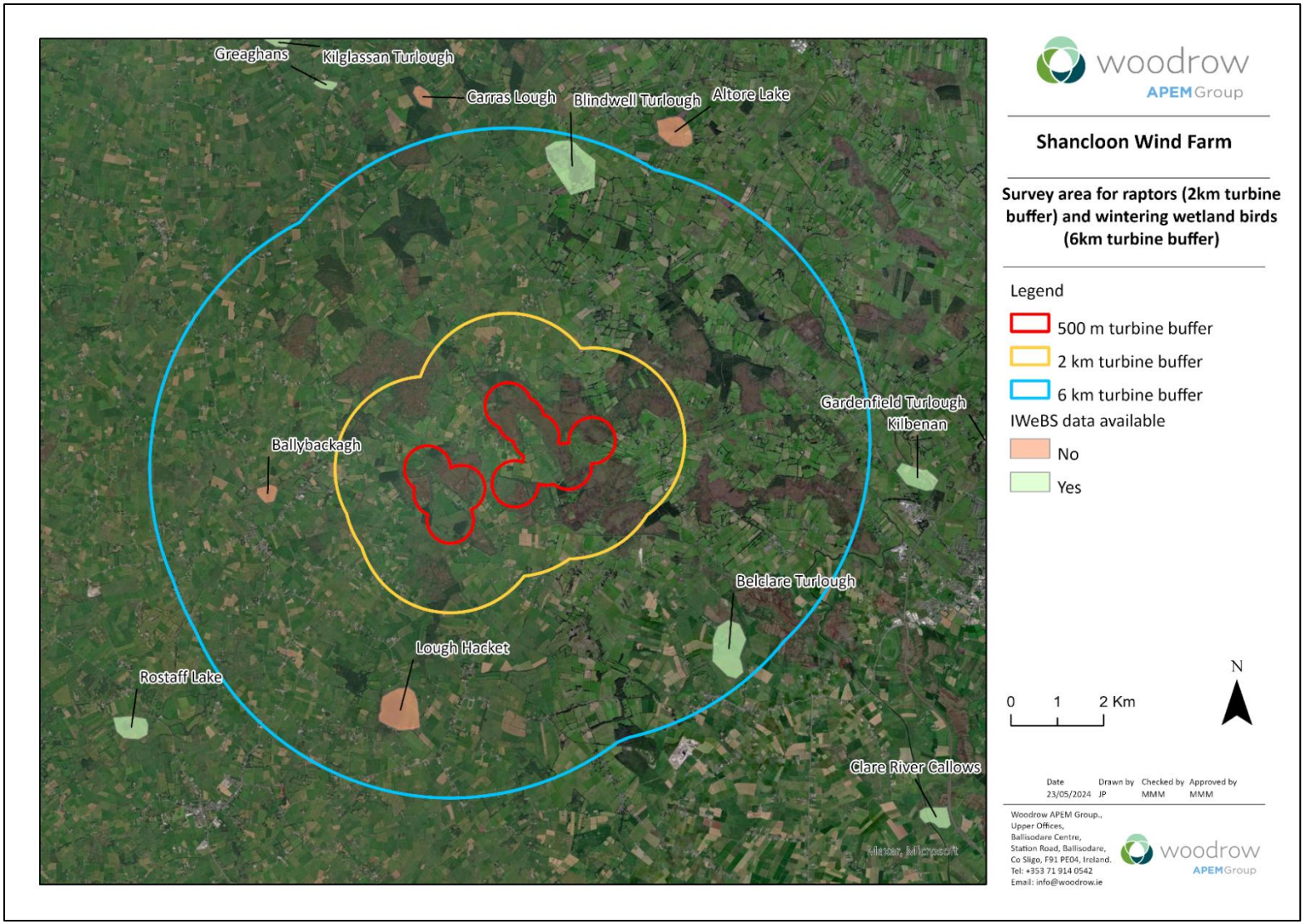

Figure 4: 2 km turbine buffer for breeding raptor and hen harrier roost watches, and 6 km turbine buffer for wintering waterbird surveys

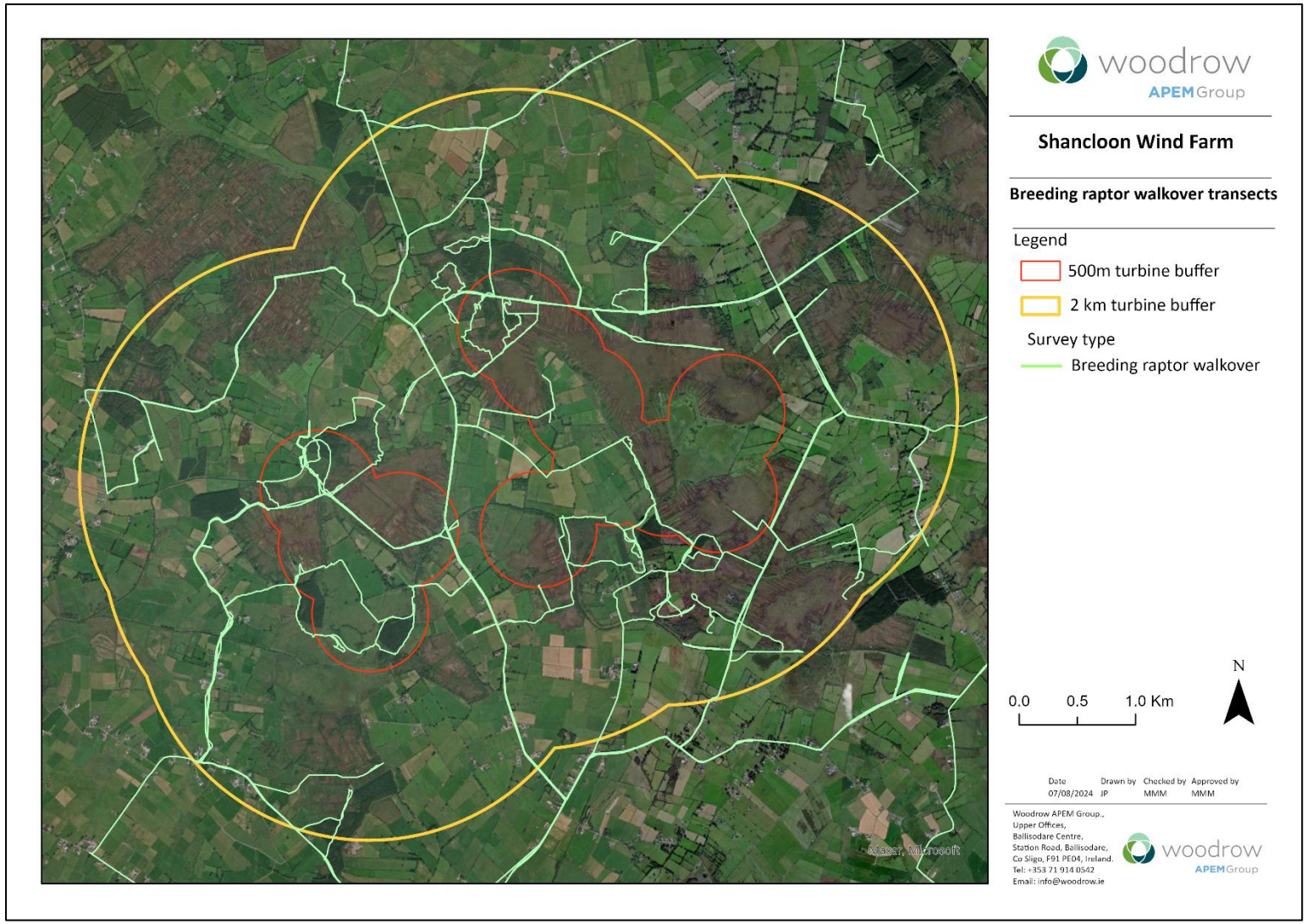

Figure 5: Breeding raptor survey coverage within the 2 km turbine buffer

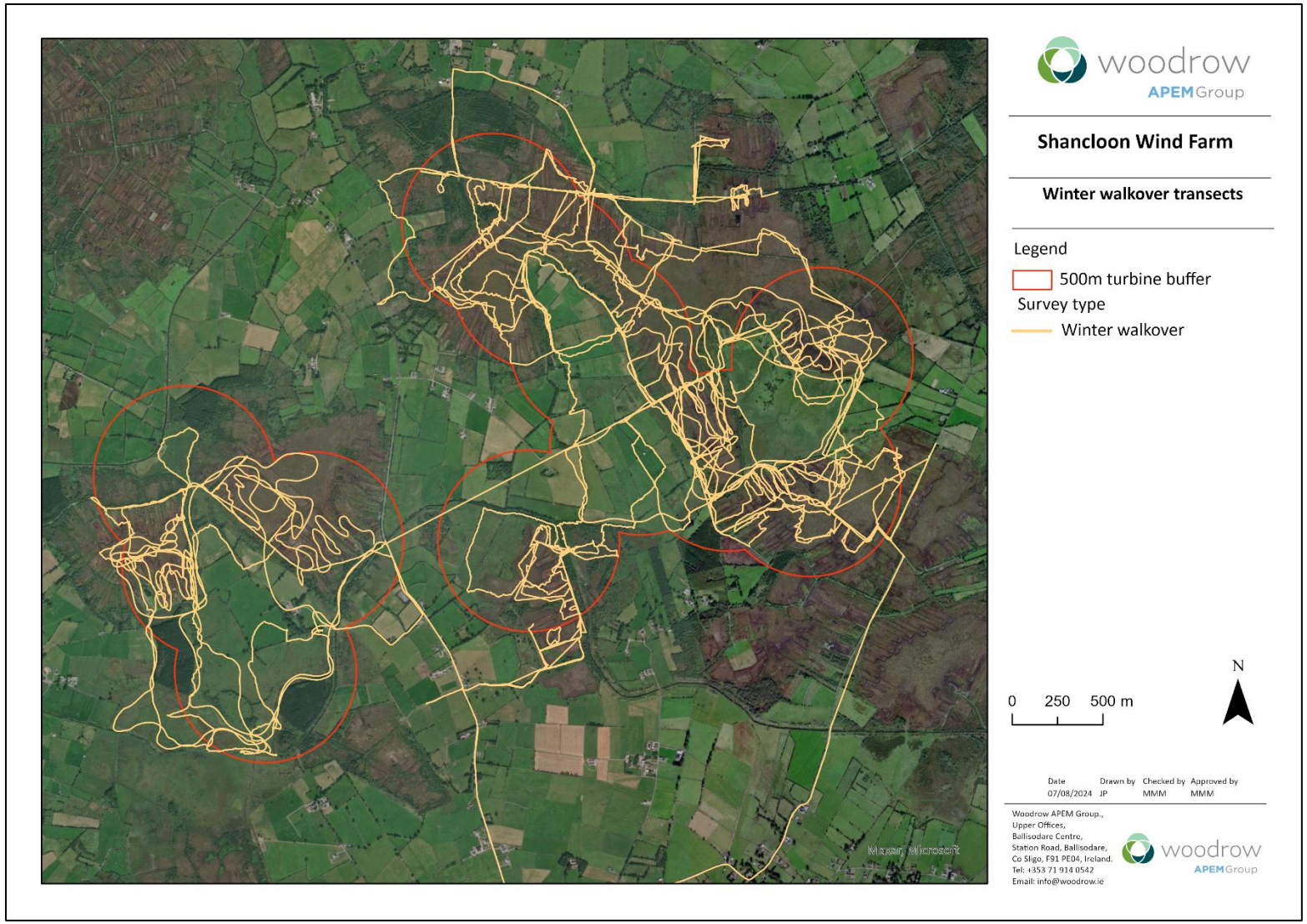

Figure 6: Winter walkover survey coverage within the 500 m turbine buffer

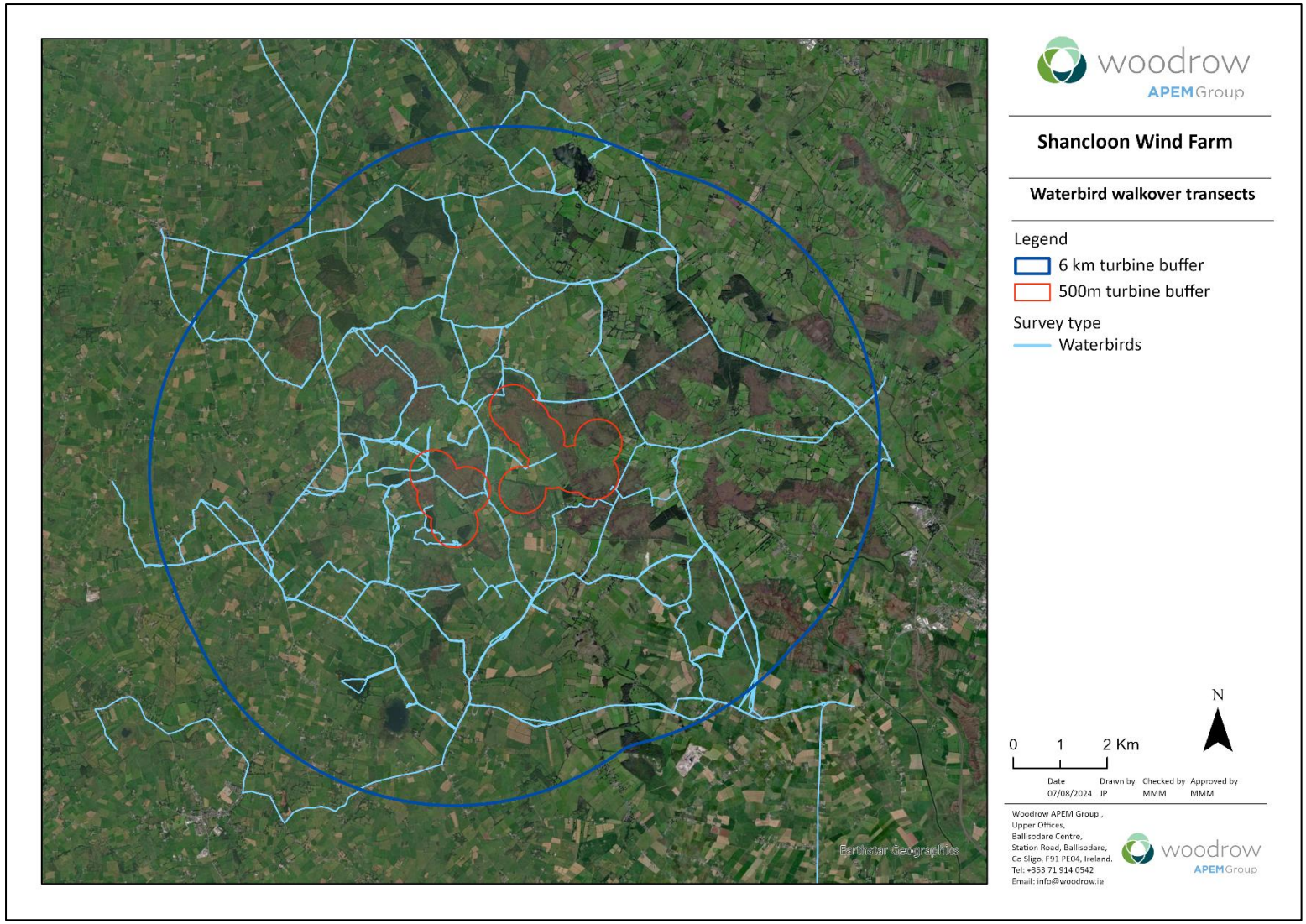

Figure 7: Wintering waterbird survey coverage within the 6 km turbine buffer

4 Survey results

4.1 Vantage Point (VP) watches

A total of 33 target species were recorded during VP watches over three years of surveys. Flight times for target species recorded within the 500 m turbine buffer over three years of surveys (Year 1: from April 2019 to March 2020, Year 2: from April 2020 to March 2021, and Year 3: from October 2023 to September 2024) are provided in Table 24. Flightline maps are provided in **Appendix X**, where individual flightlines shown on the maps can be cross-referenced via identification numbers to additional data on flight behaviour within attribute tables. To examine seasonal or annual variation in the occurrence of target species, flight time data was divided into the six seasons covered during the study period and is provided Table 25, Table 26, Table 27, Table 28, Table 29 and Table 30.

Flight time was split into time in different altitudinal levels in order to better understand the extent to which target species fly within the Collision Risk Zone (CRZ). The flight height range of the CRZ was defined as 25 to 180 m, which was a precautionary range based on the lowest minimum rotor swept height and highest tip height for the turbine specifications proposed. Proposed turbines included Vestas V150, Nordex 149 and Siemens Gamesa 155. There were 26 target species recorded within the CRZ. A further seven target species were recorded flying within the 500 m turbine buffer although were detected flying below the CRZ in height band A (0 to 25 m) (Table 24).

Based on professional judgement, CRM is run for target species with a total aggregate flight time (i.e., number of individuals x flight time) of > 400 seconds occurring within the potential CRZ over the three years (i.e. at collision risk height and within the turbine envelope = 500 m turbine buffer), and more than three observations over the study period. Target species with an aggregate flight time of < 400 seconds were excluded from this analysis as collision risk for them would be negligible. The species highlighted in Table 24 are those identified as having flight times greater than 400 seconds within the CRZ. See Section 4.7 for more details on the CRM.

Table 24: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer over three years of surveys

Target species	**Max No. birds**	**No. flights**	**Flight time (seconds) in height bands**			
			A 0-25m	**B 25-180m**	**C >180m**	**Total**
Black-headed gull	6	5	32	29	-	61
Brent goose	1	1	4	-	-	4
Buzzard	**4**	**115**	**1,151**	**9,998**	**845**	**11,993**
Canada goose	1	1	17	-	-	17
Common gull	14	3	76	397	-	473
Common sandpiper	1	1	8	-	-	8
Cormorant	**4**	**38**	**475**	**1,363**	-	**1,838**
Crane	1	1	11	-	-	11
Curlew	**75**	**6**	**59**	**112**	-	**171**
Golden eagle	1	2	8	-	-	8
Golden plover	**180**	**48**	**495**	**5,481**	**204**	**6,180**
Great black-backed gull	**3**	**7**	**-**	**528**	-	**528**
Greenshank	1	1	72	-	-	72

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Grey heron	2	39	1,180	115	-	1,295
Greylag goose	14	1	-	2	-	2
Gyrfalcon	1	1	49	-	-	49
Hen harrier	1	16	539	98	-	637
Herring gull	**15**	**22**	**46**	**1,535**		**1,582**
Kestrel	**3**	**256**	**7,846**	**17,263**	**260**	**25,370**
Lapwing	**105**	**6**	**78**	**343**	-	**421**
Lesser black-backed gull	**30**	**152**	**2,121**	**6,524**	**577**	**9,222**
Little egret	1	5	127	71	-	198
Mallard	**6**	**102**	**1,984**	**1,043**	-	**3,027**
Merlin	1	17	456	76	-	532
Mute swan	4	7	104	174	-	277
Peregrine	1	9	247	89	-	336
Snipe	**7**	**58**	**289**	**3,731**	-	**4,020**
Sparrowhawk	**2**	**58**	**458**	**2,226**	-	**2,683**
Teal	8	3	40	115	-	155
Whimbrel	**16**	**5**	-	**133**	-	**133**
White-tailed eagle	1	1	68	-	-	68
Whooper swan	**14**	**23**	**366**	**585**	-	**951**
Woodcock	1	2	12	-	-	12

Table 25: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2019 breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Buzzard	1	26	178	3,666	357	4,202
Common gull	1	2	76	217	-	293
Crane	1	1	11	-	-	11
Curlew	1	2	29	17	-	46
Greenshank	1	1	72	-	-	72
Grey heron	2	4	90	-	-	90
Hen harrier	1	1	21	-	-	21
Herring gull	1	2	-	88	-	88
Kestrel	1	54	1710	5,313	-	7,024
Lesser black-backed gull	6	56	981	2,779	53	3,813
Mallard	3	23	344	239	-	583
Merlin	1	1	-	11	-	11
Snipe	1	9	-	1,137	-	1,137
Sparrowhawk	1	14	45	849	-	894
Whimbrel	16	3	-	101	-	101

Table 26: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2019-20 non-breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-80m	C >180m	Total
Black-headed gull	3	2	-	25	-	25
Buzzard	2	11	436	91	-	528
Cormorant	2	15	159	441	-	600
Curlew	75	4	30	95	-	125
Golden plover	120	26	495	3,215	-	3,710
Great black-backed gull	1	4	-	274	-	274
Grey heron	2	9	282	105	-	387
Hen harrier	1	2	72	-	-	72
Jack snipe	1	1	3	-	-	3
Kestrel	1	13	246	515	-	761
Lapwing	105	4	78	248	-	326
Lesser black-backed gull	2	2	185	-	-	185
Little egret	1	2	67	71	-	138
Mallard	6	14	204	260	-	464
Merlin	1	5	224	31	-	255
Mute swan	4	3	59	-	-	59
Peregrine	1	6	48	89	-	137
Snipe	7	16	31	515	-	546
Sparrowhawk	1	5	40	-	-	40
Teal	8	3	40	115	-	155
Whooper swan	3	1	56	-	-	56
Woodcock	1	2	12	-	-	12

Table 27: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2020 breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Buzzard	2	15	189	2213	-	2,402
Common sandpiper	1	1	8	-	-	8
Grey heron	1	6	107	-	-	107
Herring gull	7	11	27	607	-	634
Kestrel	2	53	1,787	4,409	260	6,456
Lesser black-backed gull	30	22	166	1,379	459	2,004
Mallard	4	13	274	159	-	434
Mute swan	2	2	45	-	-	45
Peregrine	1	2	163	-	-	163
Snipe	2	6	63	1,803	-	1,866
Sparrowhawk	2	5	32	32	-	65
Whimbrel	6	1	-	10	-	10

Table 28: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2020-21 non-breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Buzzard	1	11	47	337	488	871
Cormorant	1	10	157	625	-	782
Golden plover	120	5	-	125	-	125
Grey heron	1	5	237	-	-	237
Greylag goose	14	1	-	2	-	2
Gyrfalcon	1	1	49	-	-	49
Hen harrier	1	6	202	98	-	300
Herring gull	1	1	19	-	-	19
Kestrel	2	65	1,171	4,870	-	6,040
Lapwing	10	1	-	34	-	34
Lesser black-backed gull	2	8	79	642	65	786
Little egret	1	2	40	-	-	40
Mallard	4	8	221	49	-	270
Merlin	1	3	55	-	-	55
Mute swan	2	1	-	132	-	132
Peregrine	1	1	36	-	-	36
Snipe	3	13	113	134	-	247
Sparrowhawk	2	14	149	907	-	1,057
Whooper swan	6	5	87	210	-	297

Table 29: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2023-24 non-breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Buzzard	1	16	219	268	-	487
Canada goose	1	1	17	-	-	17
Cormorant	4	10	159	128	-	287
Golden eagle	1	2	8	-	-	8
Golden plover	180	16	-	2,064	204	2,268
Great black-backed gull	1	1	-	20	-	20
Grey heron	1	3	53	-	-	53
Hen harrier	1	7	243	-	-	243
Herring gull	15	7	-	841	-	841
Kestrel	1	32	350	871	-	1,222
Lapwing	2	1	-	61	-	61
Lesser black-backed gull	13	2	3	13	-	16
Little egret	1	1	20	-	-	20
Mallard	4	2	28	142	-	170
Merlin	1	7	148	34	-	183
Snipe	2	5	21	76	-	97
Sparrowhawk	1	7	41	147	-	188
White-tailed eagle	1	1	68	-	-	68
Whooper swan	14	15	219	323	-	542

Table 30: Target species flight time, number of flights and the maximum number of individuals recorded in a single flight within the 500 m turbine buffer during the 2024 breeding season

Target species	Max No. birds	No. flights	Flight time (seconds) in height bands			
			A 0-25m	B 25-180m	C >180m	Total
Black-headed gull	6	2	32	3	-	35
Brent goose	1	1	4	-	-	4
Buzzard	4	35	81	3,422	-	3,503
Common gull	14	1	-	180	-	180
Cormorant	2	3	-	169	-	169
Golden plover	76	1	-	78	-	78
Great black-backed gull	3	2	-	234	-	234
Grey heron	2	12	411	10	-	421
Herring gull	2	1	-	-	-	-
Kestrel	3	39	2,582	1,285	-	3,866
Lesser black-backed gull	13	62	708	1,711	-	2,418
Mallard	6	42	912	194	-	1,106
Merlin	1	1	29	-	-	29
Mute swan	2	1	-	42	-	42
Snipe	5	9	61	67	-	128
Sparrowhawk	2	13	151	290	-	441
Whimbrel	1	1	-	23	-	23
Whooper swan	7	2	4	52	-	55

4.2 Breeding bird surveys

4.2.1 2019 Breeding Season

A total of 39 species were recorded during the 2019 breeding season surveys. Table 31 lists red and amber-listed species recorded, the number of individuals recorded on each visit and their breeding status within the 500 m turbine buffer of the proposed development site. Figure 8 and Figure 9 show the locations of red and amber-listed birds recorded during the 2019 breeding season, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XI**.

Table 31: Summary of breeding bird walkover and dusk surveys carried out during the 2019 breeding season

Species	BTO code	No. individuals				BoCCI 2020-2026	Breeding status
		Visit 1	Visit 2	Visit 3	Visit 4		
Curlew	CU	4	-	-	-	Red	Four observations were recorded on the 25 of April 2019 in the north-east, centre and south-east of the 500 m turbine buffer. No further observations were recorded, and these birds were as considered to be a passage migrant rather than prospecting or breeding.
Kestrel	K.	2	-	1	-	Red	No confirmed breeding territory was identified for kestrel within the 500 m turbine buffer. Likely breeding in the wider area.

Species	BTO code	No. individuals				BoCCI 2020-2026	Breeding status
		Visit 1	Visit 2	Visit 3	Visit 4		
Meadow pipit	MP	68	1	11	-	Red	Breeding in suitable habitat within the 500 m turbine buffer.
Snipe	SN	19	-	4	2	Red	Breeding snipe were identified in suitable habitat in the south-east, east and north-east of the 500 m turbine buffer. Occupied breeding territories were considered to be present in these areas and represent locations of chipping and drumming snipe. An influx of individuals in April recorded in the centre and west of the 500 m turbine buffer are passage birds that were not recorded during later survey visits.
Goldcrest	GC	1	-	-	-	Amber	Breeding in suitable forestry habitat within the 500m turbine buffer.
Kingfisher	KF	-	3	-	-	Amber	Suitable nesting habitat for kingfisher was identified along the Black (Shrule) River and Togher River. Considered to be holding territory along the Black (Shrule) River outside the 500 m turbine buffer.
Lesser black-backed gull	LB	-	-	5	-	Amber	Not breeding within the 500 m turbine buffer.
Linnet	LI	14	-	-	-	Amber	Likely breeding in suitable scrub habitat within the 500 m turbine buffer.
Mallard	MA	25	-	4	-	Amber	Likely breeding in suitable habitat within the 500m turbine buffer and wider area.
Sand martin	SM	48	8	-	-	Amber	Breeding in peat banks to the north and south of the 500 m turbine buffer. Nesting colonies were not observed and therefore may be located outside of the 500 m turbine buffer.
Skylark	S.	28	2	4	-	Amber	Breeding in suitable habitat within the 500 m turbine buffer.
Swallow	SL	-	1	1	-	Amber	Likely breeding in suitable structures within the 500 m turbine buffer and wider area.
Willow warbler	WW	28	6	-	-	Amber	Breeding in suitable woodland and scrub habitat within the 500 m turbine buffer and wider area.

4.2.2 Breeding season 2020

A total of 49 different bird species were recorded during the 2020 breeding bird surveys. Table 32 lists the species, the number of individuals recorded on each visit and the BoCCI conservation status

following Gilbert *et al.*, 2021. The breeding status of each species within the 500 m turbine buffer is also provided in this table. Figure 10 and Figure 11 show the locations of red and amber-listed birds recorded during the 2020 breeding bird surveys, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XI**.

Table 32: Summary of breeding bird walkover and dusk surveys carried out during the 2020 breeding season

Species	BTO code	No. individuals		BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2		
Kestrel	K.	1	1	Red	No confirmed breeding territory was identified for kestrel within the 500 m turbine buffer. Likely breeding in the wider area.
Meadow pipit	MP	40	16	Red	Breeding in suitable habitat within the 500 m turbine buffer.
Snipe	SN	11	15	Red	Snipe were recorded chipping and drumming from wet grassland habitats along the margins of the Black (Shrule) River, and its tributaries, to the north and south-west of the 500 m turbine buffer. In bog habitats in the south-east of the 500 m turbine buffer breeding snipe were also recorded, which is consistent with breeding territory locations recorded during the 2019 breeding season. Snipe are considered to hold breeding territories in these areas.
Goldcrest	GC	-	3	Amber	Breeding in suitable forestry habitat within the 500m turbine buffer.
Greenfinch	GR	-	3	Amber	Likely breeding in suitable habitat within the 500m turbine buffer and wider area.
House sparrow	HS	-	5	Amber	Likely breeding in suitable structures and habitat within the 500m turbine buffer and wider area.
Kingfisher	KF	1	-	Amber	Suitable nesting habitat for kingfisher was identified along the Black (Shrule) River and Togher River. One individual recorded in the west of the 500 m turbine buffer along the Togher River, a tributary of the Black (Shrule) River. Likely breeding in this location where suitable habitat is present, although no nesting site located. Considered to be a separate territory to that recorded during the 2019 breeding season.
Lesser black-backed gull	LB	-	1	Amber	Not breeding within the 500 m turbine buffer.
Linnet	LI	3	7	Amber	Likely breeding in suitable scrub habitat within the 500 m turbine buffer.
Mallard	MA	8	4	Amber	Likely breeding in suitable habitat within the 500m turbine buffer and wider area.
Mute swan	MS	1	16	Amber	A pair of mute swans were recorded incubating a nest along the Black (Shrule) River in the centre of the 500 m turbine buffer.
Sand martin	SM	15	-	Amber	Breeding in peat banks to the north and west of the 500 m turbine buffer. Nesting colonies were not observed and therefore may be located outside of the 500 m turbine buffer.
Skylark	S.	14	15	Amber	Breeding in suitable habitat within the 500 m turbine buffer.
Spotted flycatcher	SF	-	1	Amber	Likely breeding in suitable woodland and scrub habitat within the 500m turbine buffer.
Swallow	SL	-	6	Amber	Likely breeding in suitable structures within the 500 m turbine buffer and wider area.
Willow warbler	WW	41	36	Amber	Breeding in suitable woodland and scrub habitat within the 500 m turbine buffer and wider area.

4.2.3 Breeding season 2024

A total of 51 different bird species were recorded during the 2024 breeding bird surveys. Table 33 lists the species, the number of individuals recorded on each visit and the BoCCI conservation status following Gilbert *et al.*, 2021. The breeding status of each species within the 500 m turbine buffer is also provided in this table. Figure 12 and Figure 13 show the locations of red and amber-listed birds recorded during the 2024 breeding bird surveys, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XI**.

Table 33: Summary of breeding bird walkover and dusk surveys carried out during the 2024 breeding season

Species	BTO code	No. individuals						BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
Grey wagtail	GL	-	-	-	-	1	-	Red	The observation pertains to one single individual that was recorded in the south-west of the 500 m turbine buffer. No further observations were recorded.
Kestrel	K.	1	1	-	5	1	-	Red	A pair was recorded displaying in May to the south-west of the 500 m turbine buffer. No confirmed breeding territory was identified for kestrel within the 500 m turbine buffer. Likely breeding in the wider area.
Meadow pipit	MP	24	12	30	30	8	19	Red	Breeding in suitable habitat within the 500 m turbine buffer.
Snipe	SN	7	2		1	10	2	Red	Snipe were recorded in wet grassland habitats along the margins of the Black (Shrule) River, and its tributaries, to the north and south-west of the 500 m turbine buffer, which is consistent with breeding territory locations recorded during the previous breeding seasons. In bog habitats in the south-west of the 500 m turbine buffer breeding snipe were also recorded.
Swift	SI	-	-	-	-	-	2	Red	A pair of swifts were recorded in the south-

Species	BTO code	No. individuals						BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
									east of the 500 m turbine buffer. No further observations were recorded, and this species did not breed within the proposed development site.
Common gull	CM	-	-	-	-	-	1	Amber	Not breeding within the 500 m turbine buffer.
Goldcrest	GC	6	14	1	8	6	6	Amber	Breeding in suitable forestry habitat within the 500 m turbine buffer.
Lesser black-backed gull	LB	-	2	-		3	3	Amber	Not breeding within the 500 m turbine buffer.
Linnet	LI	9	18	-	16	6	4	Amber	Likely breeding in suitable scrub habitat within the 500 m turbine buffer.
Mallard	MA	6	-	-	5	-	-	Amber	Likely breeding in suitable habitat within the 500 m turbine buffer and wider area.
Sand martin	SM	7	10	-	54	15	2	Amber	Breeding in peat banks to the north and west of the 500 m turbine buffer. Nesting colonies were not observed and therefore may be located outside of the 500 m turbine buffer.
Skylark	S.	10	8	-	18	2	8	Amber	Breeding in suitable habitat within the 500 m turbine buffer.
Starling	SG	3	-	-	1	9	18	Amber	Breeding in suitable habitat within the 500 m turbine buffer.
Swallow	SL	3	3	-	10	3	11	Amber	Likely breeding in suitable structures within the 500 m turbine buffer and wider area.
Willow warbler	WW	28	23	-	40	12	9	Amber	Breeding in suitable woodland and scrub habitat within the 500 m turbine buffer and wider area.

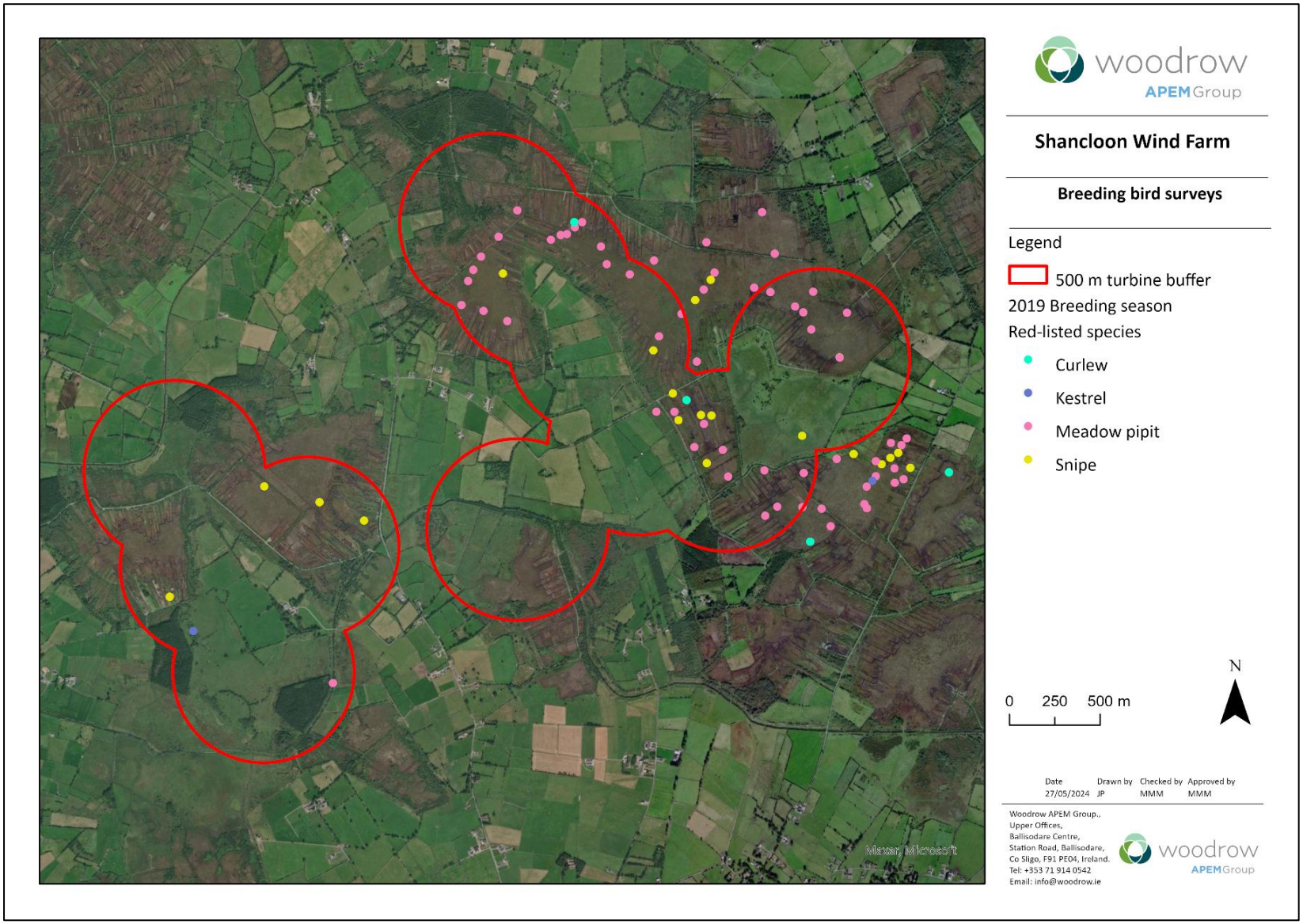

Figure 8: Red-listed species recorded during the 2019 breeding bird surveys within 500 m turbine buffer

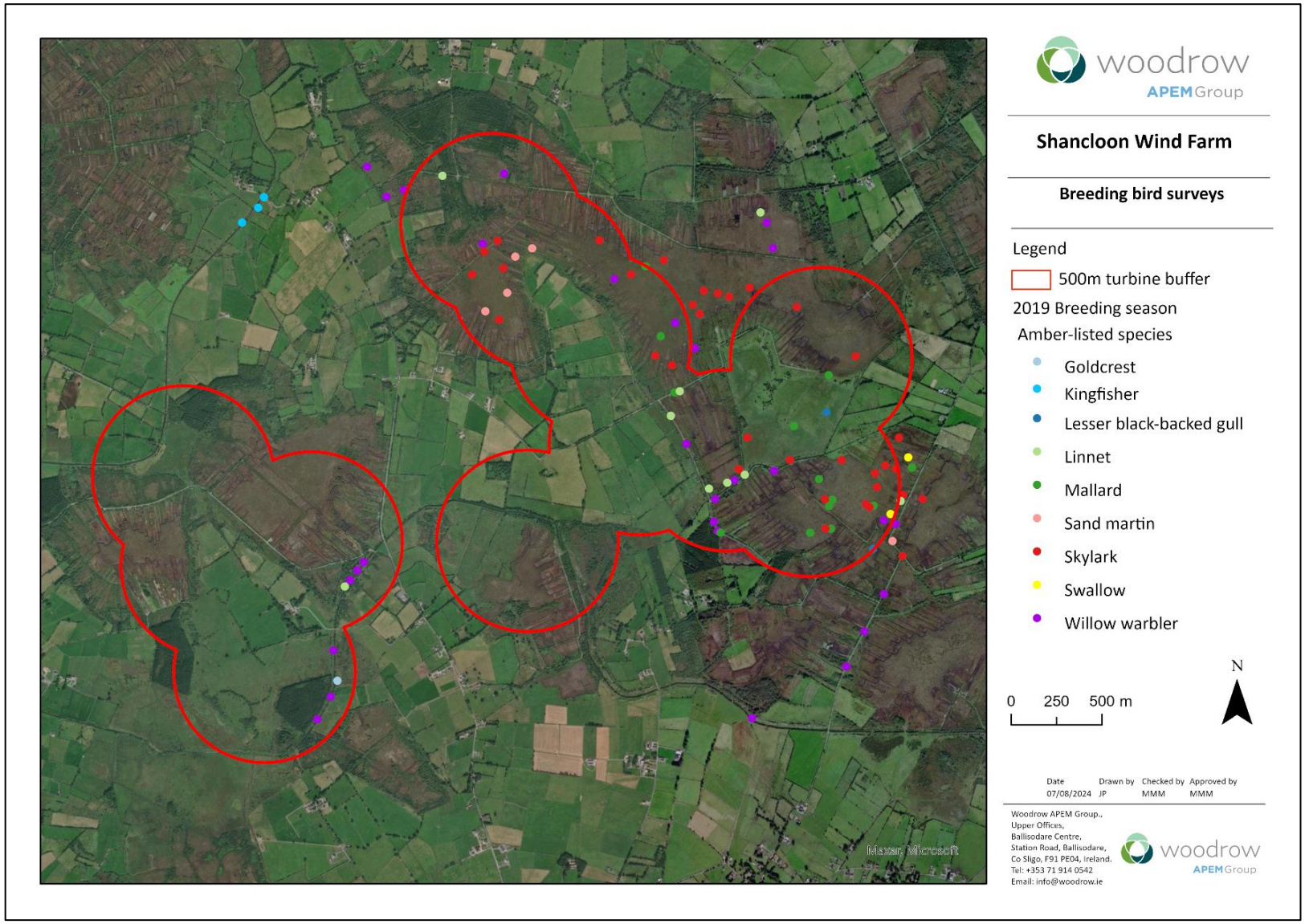

Figure 9: Amber-listed recorded during the 2019 breeding bird surveys within 500 m turbine buffer

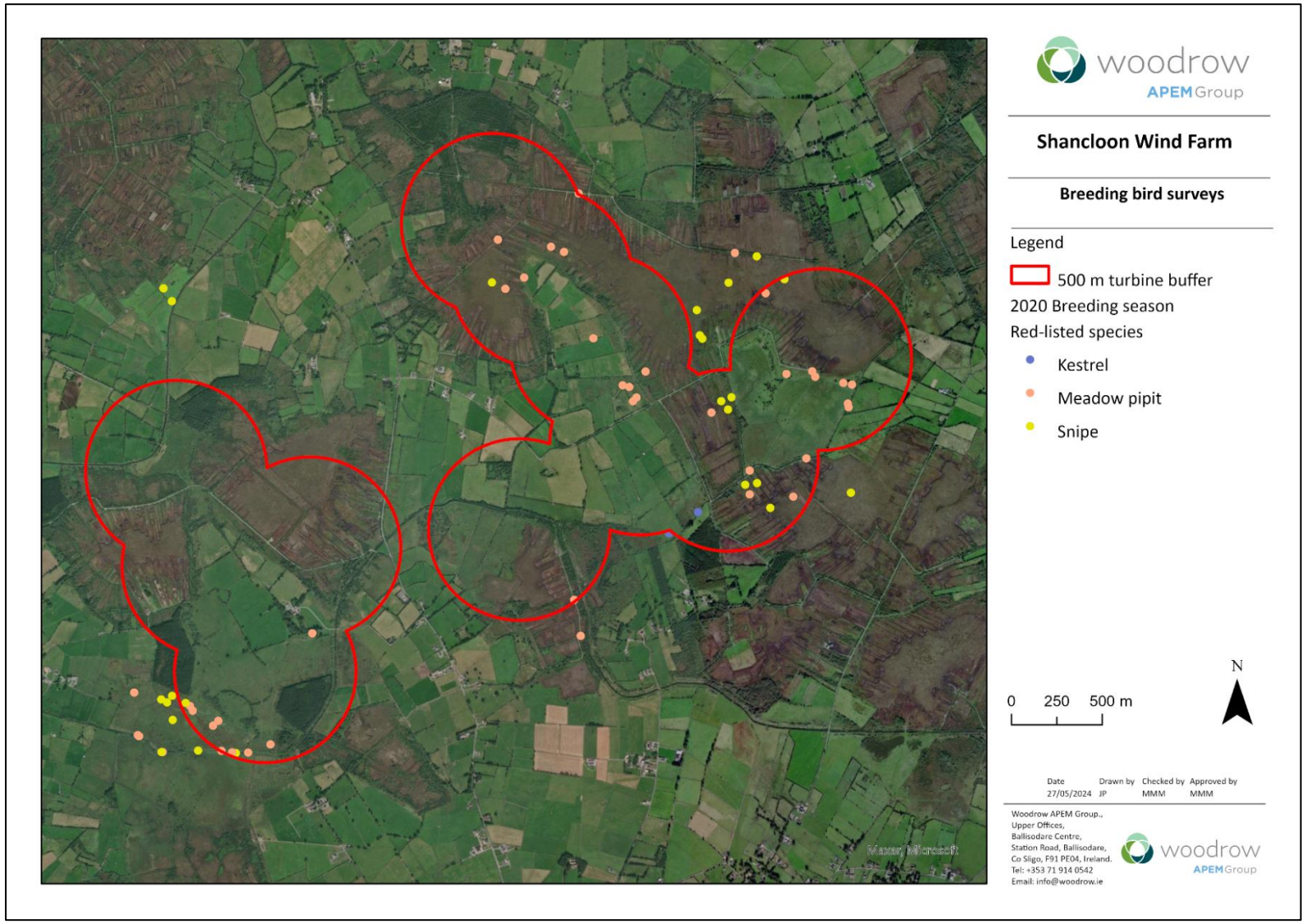

Figure 10: Red-listed species recorded during the breeding bird surveys 2020 within 500 m turbine buffer

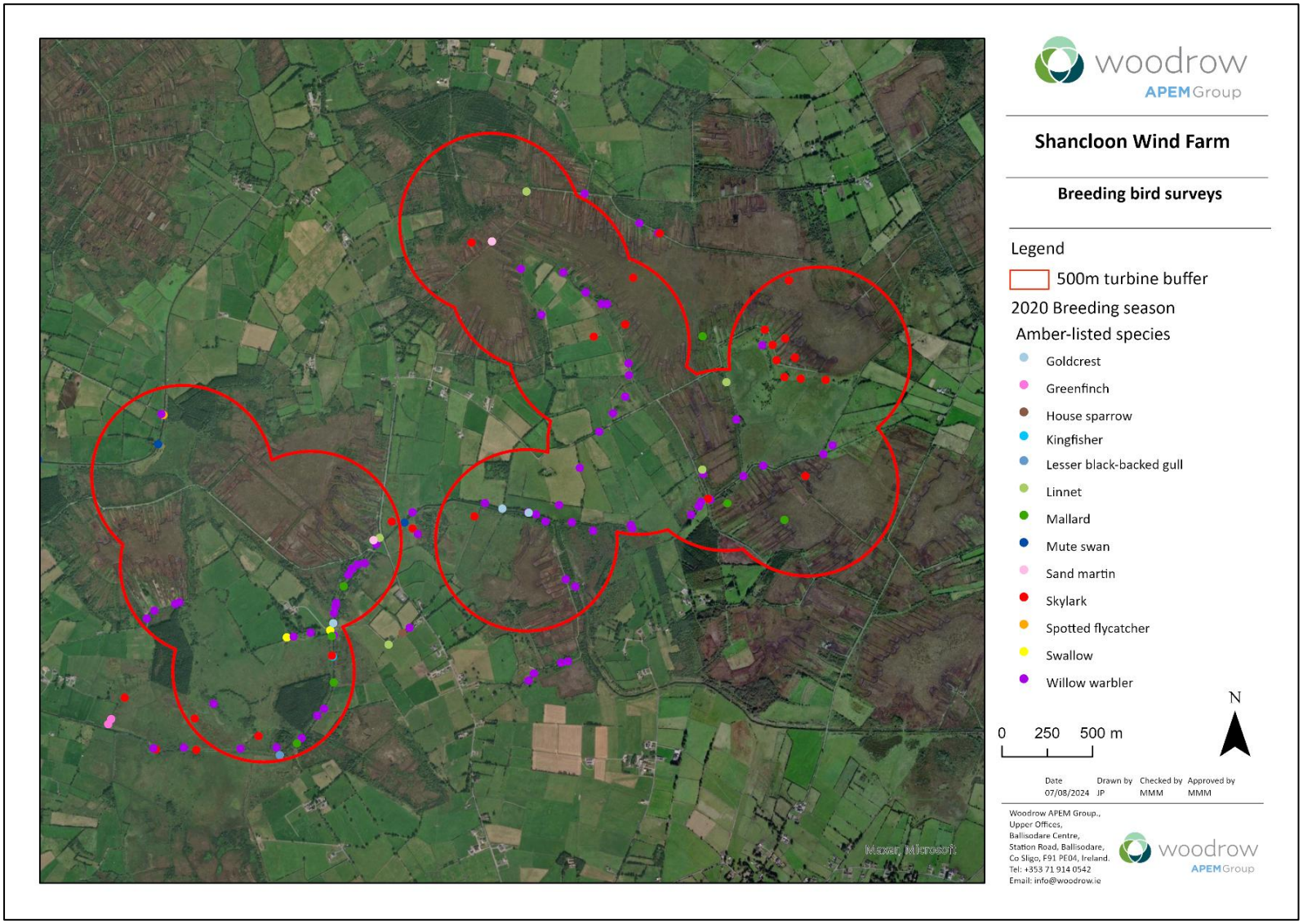

Figure 11: Amber-listed species recorded during the breeding bird surveys 2020 within 500 m turbine buffer

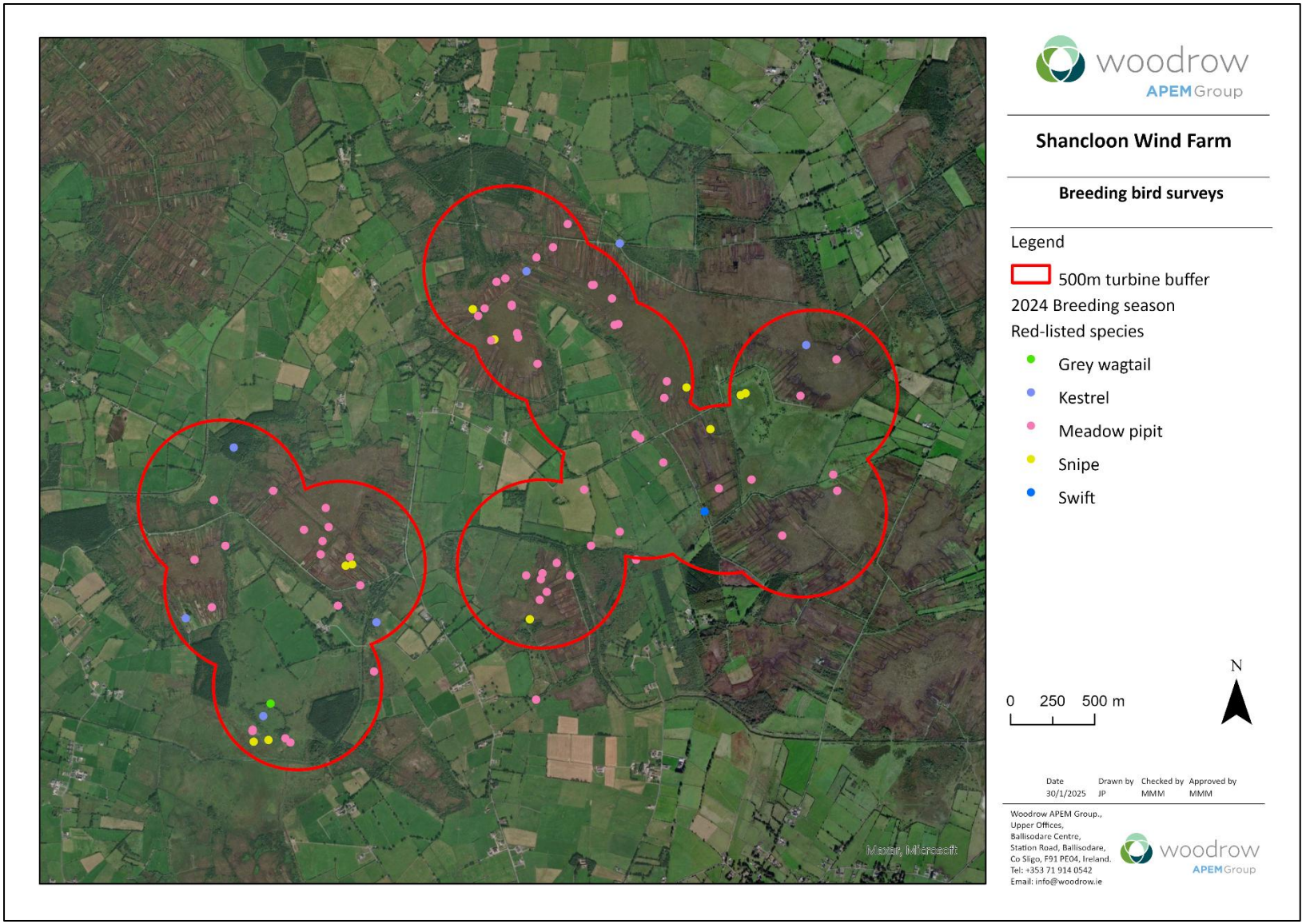

Figure 12: Red-listed species recorded during the breeding bird surveys 2024 within 500 m turbine buffer

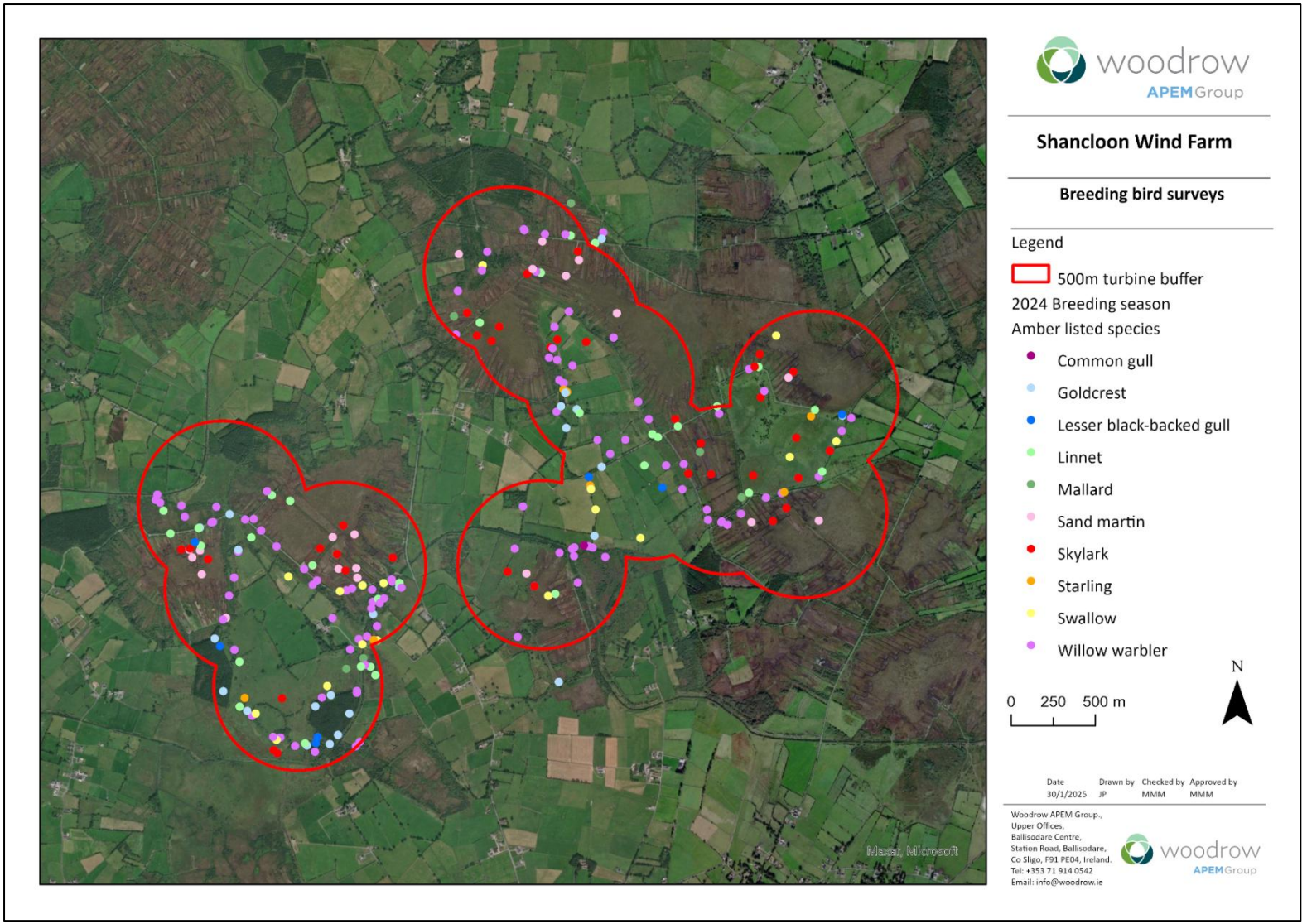

Figure 13: Amber-listed species recorded during the breeding bird surveys 2024 within 500 m turbine buffer

4.3 Breeding raptor surveys

Table 34**,** Table 35 and Table 36 show the number of raptor observations recorded during each breeding raptor survey date in the wider area for the 2019, 2020 and 2024 breeding seasons, respectively. The breeding status of each species of raptors within the 2 km turbine buffer are also provided in these tables.

Figure 14, Figure 15 and Figure 16 show the locations of raptor species recorded during the 2019, 2020 and 2024 breeding raptor surveys, respectively.

No hen harrier, peregrine or merlin were recorded during the breeding raptor surveys within the 2 km turbine buffer.

Table 34: Summary of breeding raptor survey results for the 2019 breeding season

Species	BTO code	No. individuals			BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3		
Kestrel	K.	2	-	-	Red	Kestrel observations were recorded during Visit 1 of the breeding raptor surveys to the south-west of the breeding raptor survey area however, no breeding behaviour was observed during these surveys.
Buzzard	BZ	2	-	-	Green	Buzzard observations were recorded during Visit 1 of the breeding raptor surveys to the north and north-east of the breeding raptor survey area however, no breeding behaviour was observed during these surveys.

Table 35: Summary of breeding raptor survey results for the 2020 breeding season

Species	BTO code	No. individuals			BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3		
Kestrel	K.	1	1	1	Red	Kestrel were observed during each visit within the 2km turbine buffer. All records were made in the west of the 500 m turbine buffer. Observations included single birds flying or hunting. A juvenile kestrel was observed flying in the west of the 500 m turbine buffer in July. While a nest site was not located, records indicate that kestrel held a breeding territory within the west of the breeding raptor survey area
Buzzard	BZ	3	4	4	Green	Breeding was confirmed in the north of the breeding raptor survey area in July when three fledging buzzards were observed on an oak tree. Further buzzard records were observed to the west within the breeding raptor survey area
Sparrowhawk	SH	2	-	3	Green	Sparrowhawk observations were recorded in the north and north-east of the 500 m turbine buffer.

Table 36: Summary of breeding raptor survey results for the 2024 breeding season

Species	BTO code	No. individuals							BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7		
Kestrel	K.	1	2	5	-	2	-	5	Red	Kestrel were observed during most survey visits.

Species	BTO code	No. individuals							BoCCI 2020-2026	Breeding status within 500m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	Visit 7		
										Observations were made in the west, east and north of the 500 m turbine buffer and included single birds flying or hunting. A male and juvenile were observed hunting over bog habitats in the west of the 500 m turbine buffer in July. While a nest site was not located, records indicate that kestrel held a breeding territory within the west of the breeding raptor survey area
Short-eared owl	SE	-	2	-	-	-	-	-	Amber	Two individuals were observed to the south-west adjacent to the 500 m turbine buffer in July. No evidence of breeding behaviour.
Buzzard	BZ	9	10	12	2	1	2	4	Green	Breeding was confirmed in the eastern part of the 500 m turbine buffer in July when one fledging was observed on a spruce. Further buzzard records were observed to the west, east and north of the breeding raptor survey area
Sparrowhawk	SH	3	3	-	1	1	-	-	Green	Sparrowhawk observations were recorded in the north and north-east of the 500 m turbine buffer and in the west, east and south of the breeding raptor survey area. No breeding territory was identified.

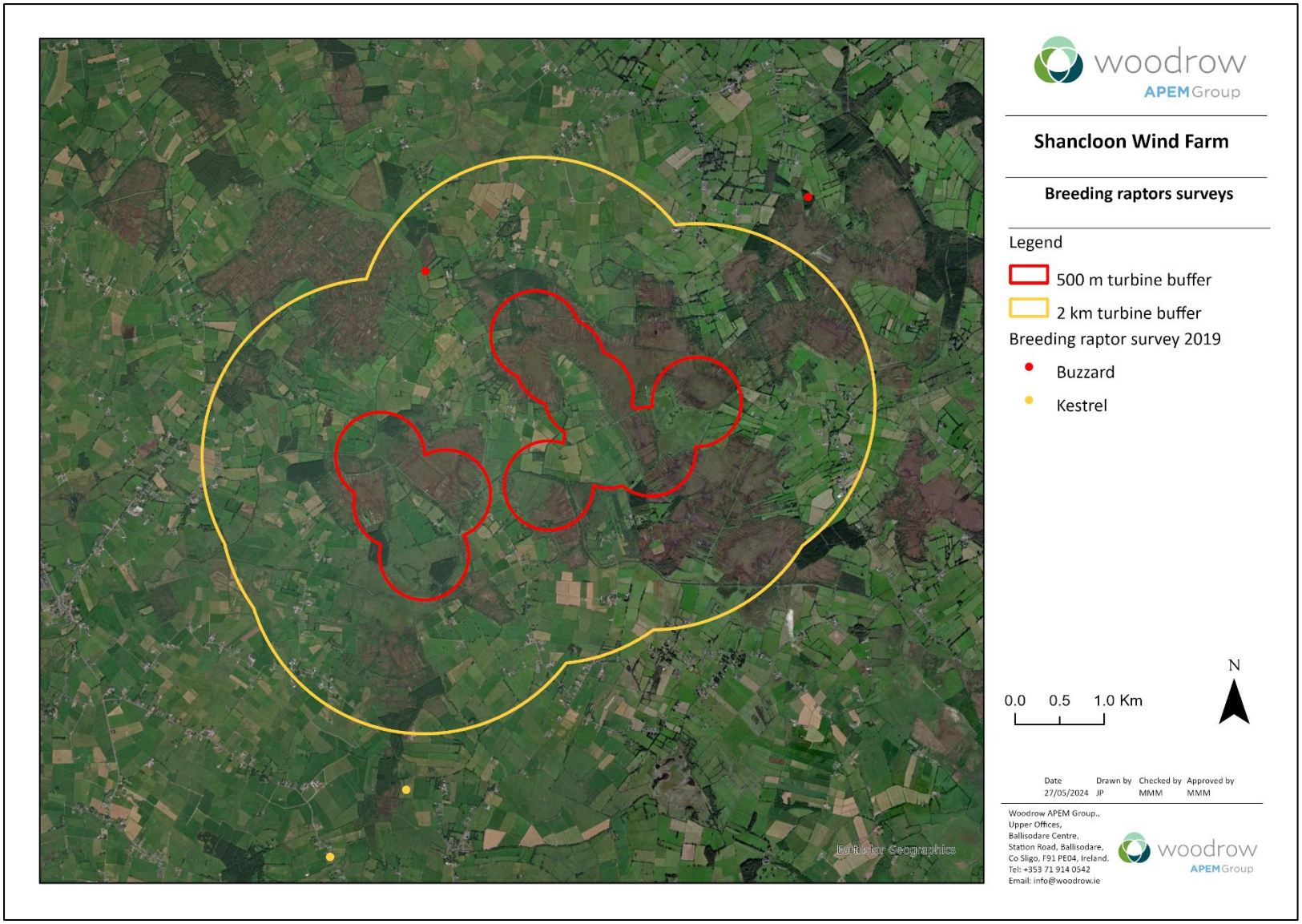

Figure 14: Raptor species recorded during the 2019 breeding season within the breeding raptor survey area

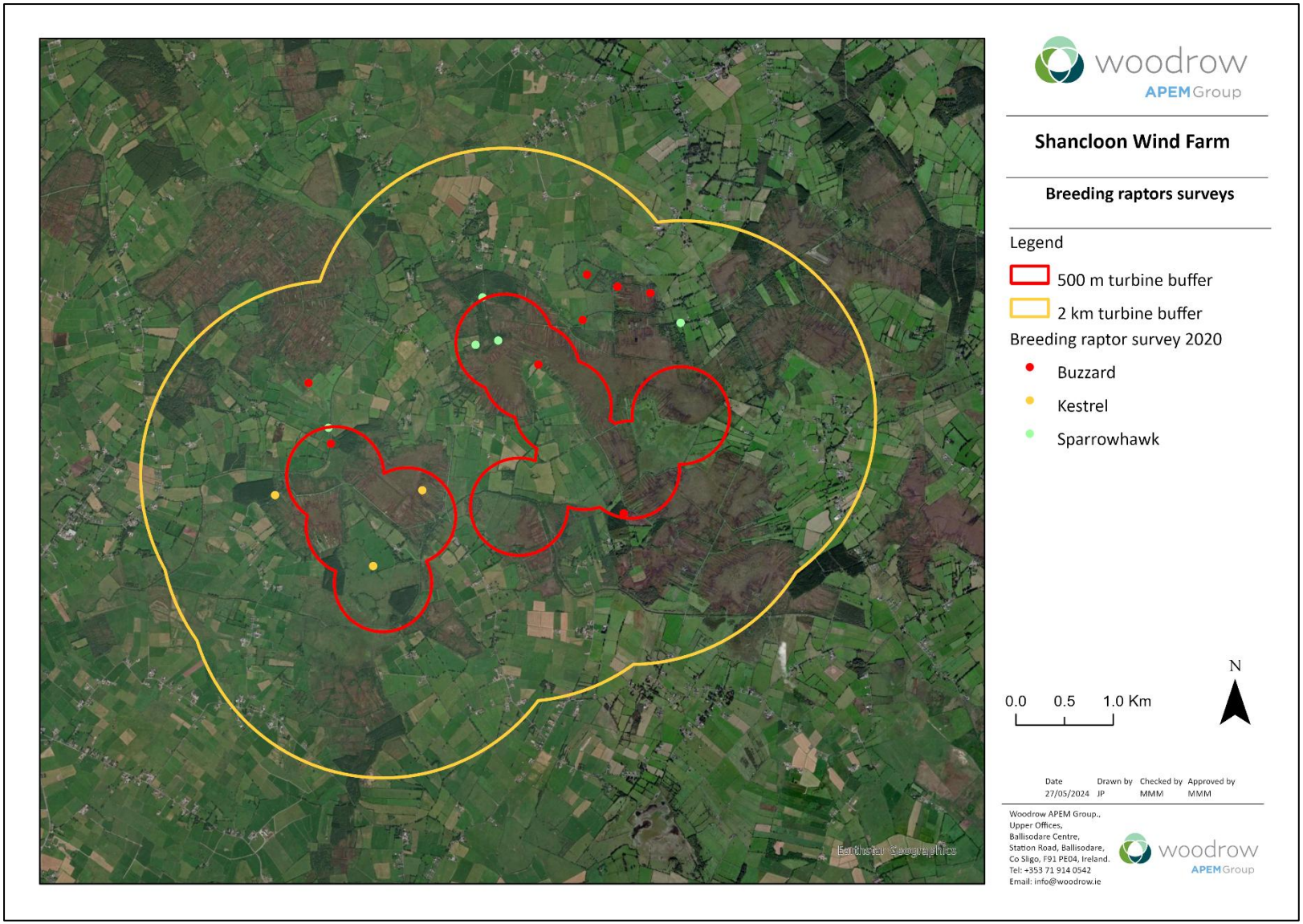

Figure 15: Raptor species recorded during the 2020 breeding season within the breeding raptor survey area

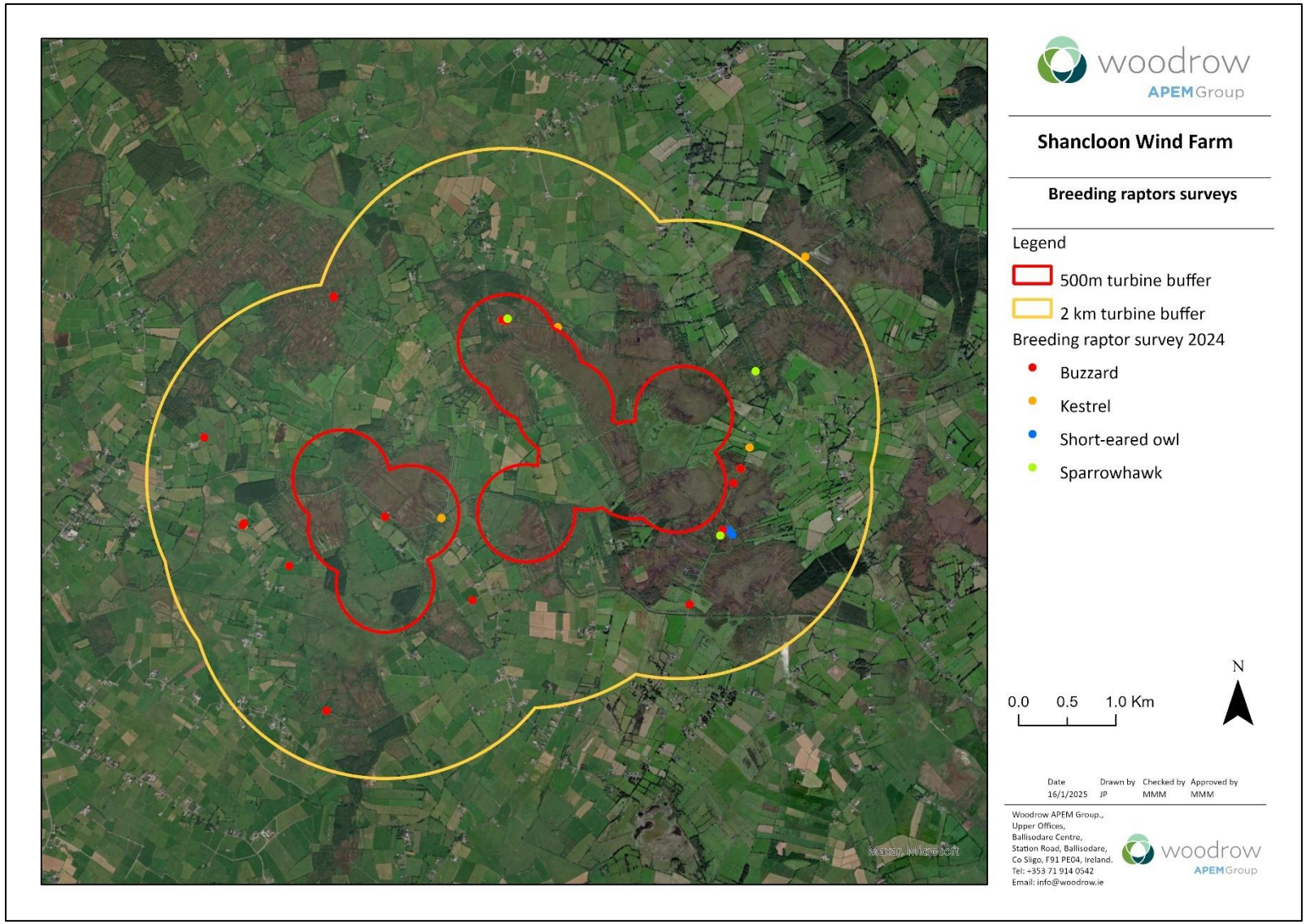

Figure 16: Raptor species recorded during the 2024 breeding season within the breeding raptor survey area

4.4 Winter walkover surveys

4.4.1 Non-breeding season 2019-20

Winter walkover surveys covering the 500 m turbine buffer of the proposed development site was undertaken on three visits during the 2019-20 non-breeding season. A total of 15 different bird species were recorded during the walkover surveys. Table 37 lists the red and amber-listed species, the number of individuals recorded on each visit and their location within the 500 m turbine buffer. Figure 17 and Figure 18 show the locations of red and amber-listed birds recorded during the 2019-20 non-breeding season, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XII**.

Table 37: Summary of winter walkover surveys non-breeding season 2019-20

Species	BTO code	No. individuals			BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3		
Curlew	CU	20	5	-	Red	Curlew observations were recorded in the south-west of the 500 m turbine buffer in wet grassland habitat. These birds are over-wintering individuals passing through the site.
Golden plover	GP	17	59	13	Red	Golden plover were recorded on each visit and were observed using mainly bog habitats in the north, north-east and west of the 500 m turbine buffer.
Lapwing	L.	13	23	-	Red	All observations of lapwing were made in the south-west of the 500 m turbine buffer in wet grassland habitat.
Snipe	SN	108	107	126	Red	Snipe was the most frequently recorded species with a peak flock size of 27 flushing birds. Observations were mainly distributed across bog habitats within the 500 m buffer, and in wet grassland habitat in the south-west of the 500 m buffer.
Woodcock	WK	2	1	2	Red	Small numbers of woodcock were recorded in the south and eastern section of the 500 m buffer.
Cormorant	CA	2	1	-	Amber	Observations were largely restricted to watercourses, Black (Shrule) River and its tributaries present within the 500 m buffer.
Mallard	MA	54	9	7	Amber	
Mute swan	MS	2	4	-	Amber	
Teal	T.	54	30	80	Amber	
Wigeon	WN	-	-	10	Amber	

4.4.2 Non-breeding season 2020-21

Winter walkover surveys covering the 500 m turbine buffer of the proposed development site were undertaken on four visits during the 2020-21 non-breeding season. A total of 22 different bird species were recorded during the walkover surveys. Table 38 lists the red and amber-listed species, the number of individuals recorded on each visit and their location within the 500 m turbine buffer.

Figure 19 and Figure 20 show the locations of red and amber-listed birds recorded during the 2020-21 non-breeding season, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XII**

Table 38: Summary of winter walkover surveys non-breeding season 2020-21

Species	BTO code	No. individuals				BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4		
Golden plover	GP	78	33	-	-	Red	Golden plover were recorded on two visits and were observed flying over bog habitats mainly in the east of the 500 m turbine buffer with a maximum flock size of 30 birds. A maximum flock size of 32 birds were flushed from bog habitats in the west of the 500 m turbine buffer. Records suggest period use of the site during the winter period.
Kestrel	K.	1	-	-	-	Red	An observation of a male kestrel flushed from the ground was made in the west of the 500 m turbine buffer.
Pochard	PO	-	-	10	-	Red	One flock of ten birds was observed in the south-west of the 500 m turbine buffer along a tributary of the Black (Shrule) River.
Shoveler	SV	-	-	8	-	Red	One flock of eight birds was observed in the south-west of the 500 m turbine buffer along a tributary of the Black (Shrule) River.
Snipe	SN	90	88	35	10	Red	Snipe was the most frequently recorded species. Observations were mainly distributed across bog habitats within the 500 m turbine buffer, and in wet grassland habitat in the south-west of the 500 m buffer.
Woodcock	WK	-	1	-	-	Red	One individual was recorded in the north of the 500 m turbine buffer.
Cormorant	CA	1	1	-	-	Amber	Two individuals were recorded flying over the 500 m turbine buffer.
Hen harrier	HH	-	2	-	-	Amber	Two observations of a hunting male hen harrier were on recorded the same visit in December 2020 over the northern proportion of the 500 m turbine buffer.

Species	BTO code	No. individuals				BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4		
Kingfisher	KF	1	-	-	-	Amber	One kingfisher observation was made along the Togher River, a tributary of the Black (Shrule) River, in the south-west of the 500 m turbine buffer.
Lesser black-backed gull	LB	-	-	1	-	Amber	One individual recorded on flying over the easter section of the 500 m turbine buffer.
Mallard	MA	25	8	30	-	Amber	The majority of observations were made in the south-west of the 500 m buffer along the Togher River. Two separate observations were made in bog habitats in the north of the 500 m turbine buffer.
Merlin	ML	3	2	-	-	Amber	Five merlin observations were made during the walkover surveys. Three observations of a female merlin hunting and flying within eastern portion of the 500 m buffer were made in October 2020. A following two observations were made of a female flushed from bog in the west of the 500 m turbine buffer in December 2020.
Mute swan	MS	-	-		2	Amber	An observation of mute swan was recorded in the south-west of the 500 m buffer along a tributary of the Black (Shrule) River.
Short-eared owl	SE	1	-	-	-	Amber	One individual was flushed from bog habitat in the north-eastern section of the 500 m buffer. No other observations were made.
Teal	T	-	73	138	-	Amber	Teal observations were made in the south-west of the 500 m buffer along the Togher River, a tributary of the Black (Shrule) River.
Whooper swan	WS	7	-	-	-	Amber	In October 2020 a flock of seven birds were recorded flying south over the west of the 500 m turbine buffer and likely dropping down close to the Togher River. During the March 2021 visit, incidental observations of up to 29 whooper swans were recorded foraging in fields c.

Species	BTO code	No. individuals				BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4		
							4km south-east of the 500 m buffer.
Wigeon	WN	4	-	4	-	Amber	Wigeon observations were made in the south-west of the 500 m buffer along the Togher River, a tributary of the Black (Shrule) River.

4.4.3 Non-breeding season 2023-24

Winter walkover surveys covering the 500 m turbine buffer were undertaken on six visits during the 2023-24 non-breeding season. A total of 57 bird species were recorded during the walkover surveys. Table 38Table 39 lists the red and amber-listed species, the number of individuals recorded on each visit and their location within the 500 m turbine buffer.
Figure 21 and Figure 20Figure 22 show the locations of red and amber-listed birds recorded during the 2023-24 non-breeding season, respectively. A list of all species recorded, including green-listed species, is provided in **Appendix XII.**

Table 39: Summary of winter walkover surveys non-breeding season 2023-24

Species	BTO code	No. individuals						BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
Golden plover	GP	23	-	-	1	-	-	Red	Golden plover were recorded on two visits flying over bog habitats in the north and south-east of the 500 m turbine buffer. A maximum flock size of 21 birds were flushed from bog habitats in the north-west of the 500 m turbine buffer. Records suggest periodic use of the site during the winter period.
Kestrel	K.	2	-	-	1	4	1	Red	Kestrel observations were made mainly in the southern section of the 500 m buffer.
Lapwing	L.	37	-	-	-	-	-	Red	A maximum flock size of 37 lapwings were observed flying over wet

Species	BTO code	No. individuals						BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
									grasslands in the north-west of the 500 m turbine buffer.
Meadow pipit	MP	8	-	2	99	32	10	Red	Meadow pipits were recorded in almost every visit and was the most frequently recorded species with a peak flock size of 40 flushing birds. Observations were mainly distributed across bog habitats and wet grasslands within the 500 m buffer.
Redwing	RE	12	-	61	2	-	-	Red	Redwing were observed in three visits with a peak flock size of 40 flushing birds from the south-west of the 500 m turbine buffer. Observations were mainly distributed in the southern section of the 500 m buffer.
Snipe	SN	12	3	53	14	11	-	Red	Snipe was the second most frequently recorded species with a peak flock size of 49 birds. Observations were mainly distributed across bog habitats within the 500 m buffer, and in wet grassland habitat in the south-west of the 500 m buffer.
Woodcock	WK		-	1	2	-	-	Red	Small numbers of woodcock were recorded in the

Species	BTO code	No. individuals						BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
									south-east of the 500 m buffer.
Cormorant	CA	1	-	-	-	-	-	Amber	One individual cormorant was recorded flying over the north-west of the 500 m turbine buffer.
Goldcrest	GC	2	-	9	17	2	5	Amber	Goldcrest were recorded in almost every visit. Observations were widespread within the 500 m buffer.
Hen harrier	HH	-	-	-	-	1	-	Amber	One observation of an adult hen harrier was recorded in March 2024 over the northern portion of the 500 m turbine buffer.
Kingfisher	KF	-	-	-	1	-	-	Amber	One kingfisher observation was made along the Togher River, a tributary of the Black (Shrule) River, in the north-west of the 500 m turbine buffer.
Lesser black-backed gull	LB	-	-	-	-	-	16	Amber	During the last visit, there were seven observations of birds flying over the western section of the 500 m turbine buffer with a maximum flock size of four birds.
Linnet	LI	-	-	-	-	3	-	Amber	Three individuals were recorded flying over the north-east of 500 m turbine buffer.
Mallard	MA	-	-	4	4	8	5	Amber	The majority of observations

Species	BTO code	No. individuals						BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
									were made in the western section of the 500 m buffer along the Togher River.
Sand martin	SM	-	-	-	-	3	5	Amber	Sand martin observations were made in the south-west of the 500 m buffer along the Togher River, a tributary of the Black (Shrule) River.
Skylark	S.	-	-	1	-	4	6	Amber	Skylark observations were mainly distributed across bog habitats within the 500 m buffer.
Starling	SG	86	-	20	20	-	10	Amber	Most observations were made in the west and south-west of the 500 m turbine buffer
Teal	T.	-	-	72	19	5	-	Amber	Teal observations were made in the south of the 500 m buffer along the Togher River, a tributary of the Black (Shrule) River. A maximum flock size of 72 birds were recorded within bog habitats in the south-west of the 500 m turbine buffer.
Whooper swan	WS	-	-	-	2	-	20	Amber	In March 2023 a flock of 20 birds were recorded flying over the south-west of the 500 m turbine buffer and another flock of two birds were seen flying in

Species	BTO code	No. individuals						BoCCI 2020-2026	Location within 500 m turbine buffer
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6		
									north-east of the 500 m buffer.
Wigeon	WN	-	-	3	-	-	-	Amber	One wigeon observation of three birds was made in the south-west of the 500 m buffer along the Togher River, a tributary of the Black (Shrule) River.
Willow warbler	WW	-	-	-	-	-	9	Amber	Willow warbler were recorded singing mainly in the western section of the 500 m turbine buffer.

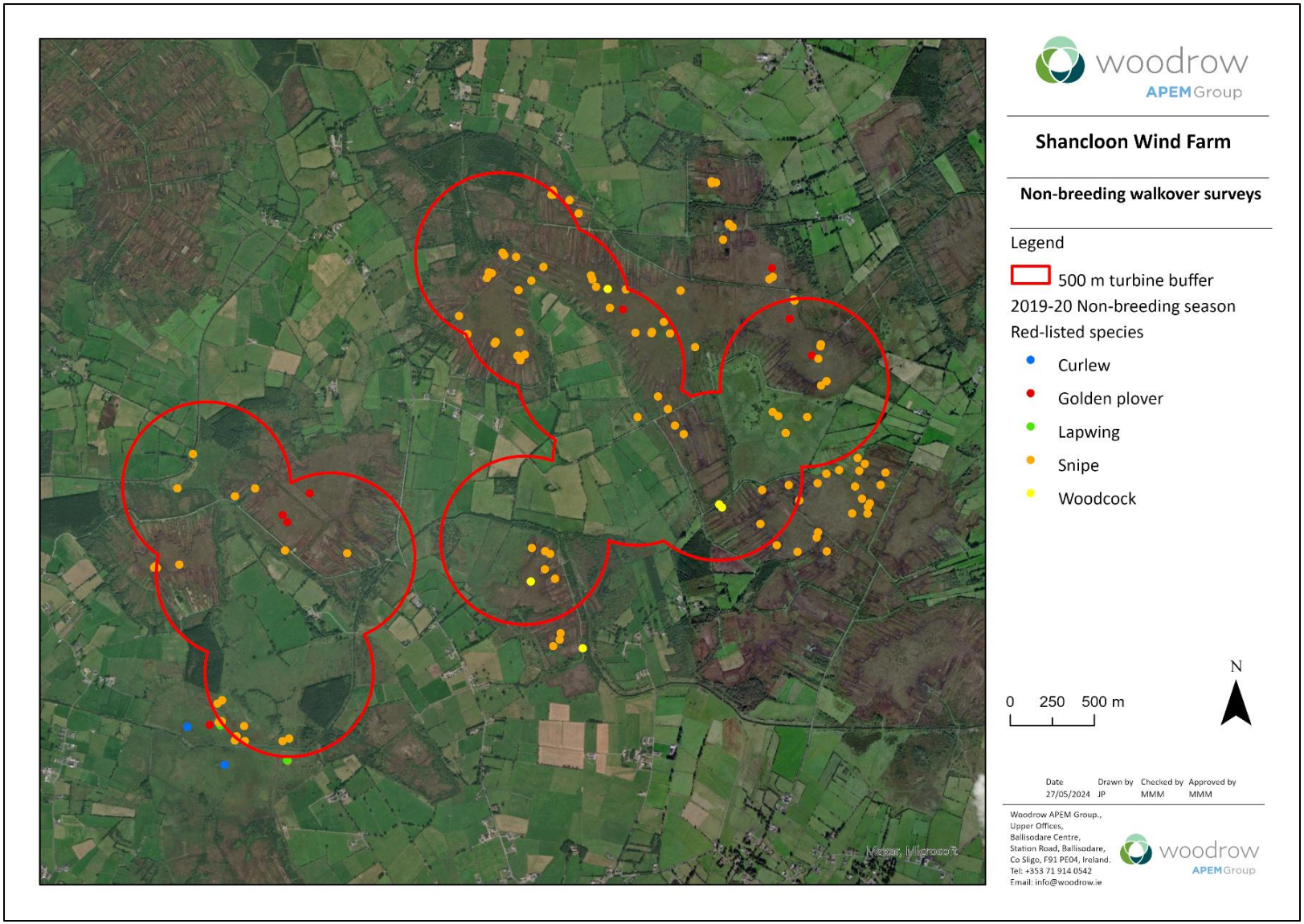

Figure 17. Red-listed species recorded during non-breeding walkover surveys 2019-20 within 500 m turbine buffer

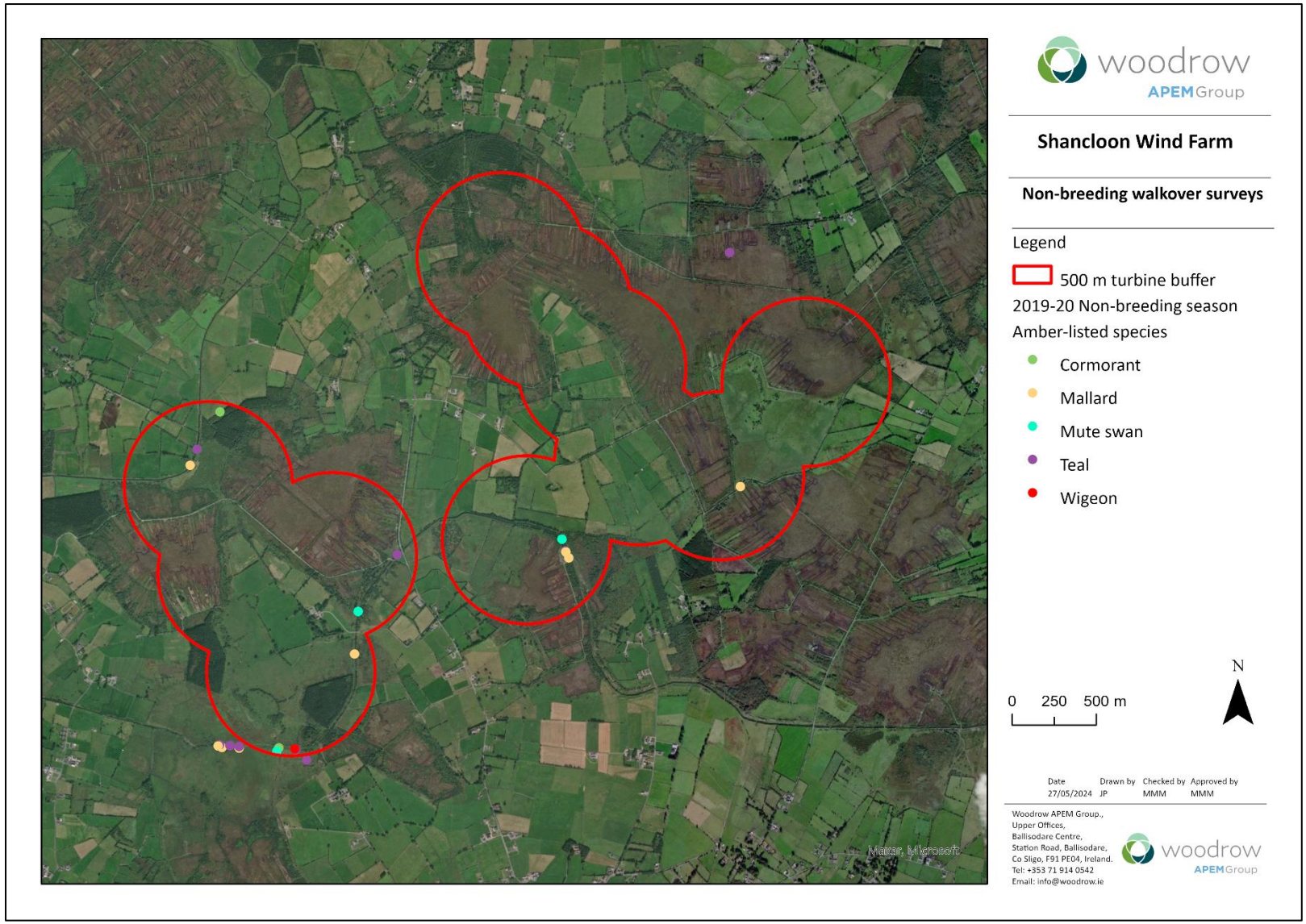

Figure 18: Amber-listed species recorded during non-breeding walkover surveys 2019-20 within 500 m turbine buffer

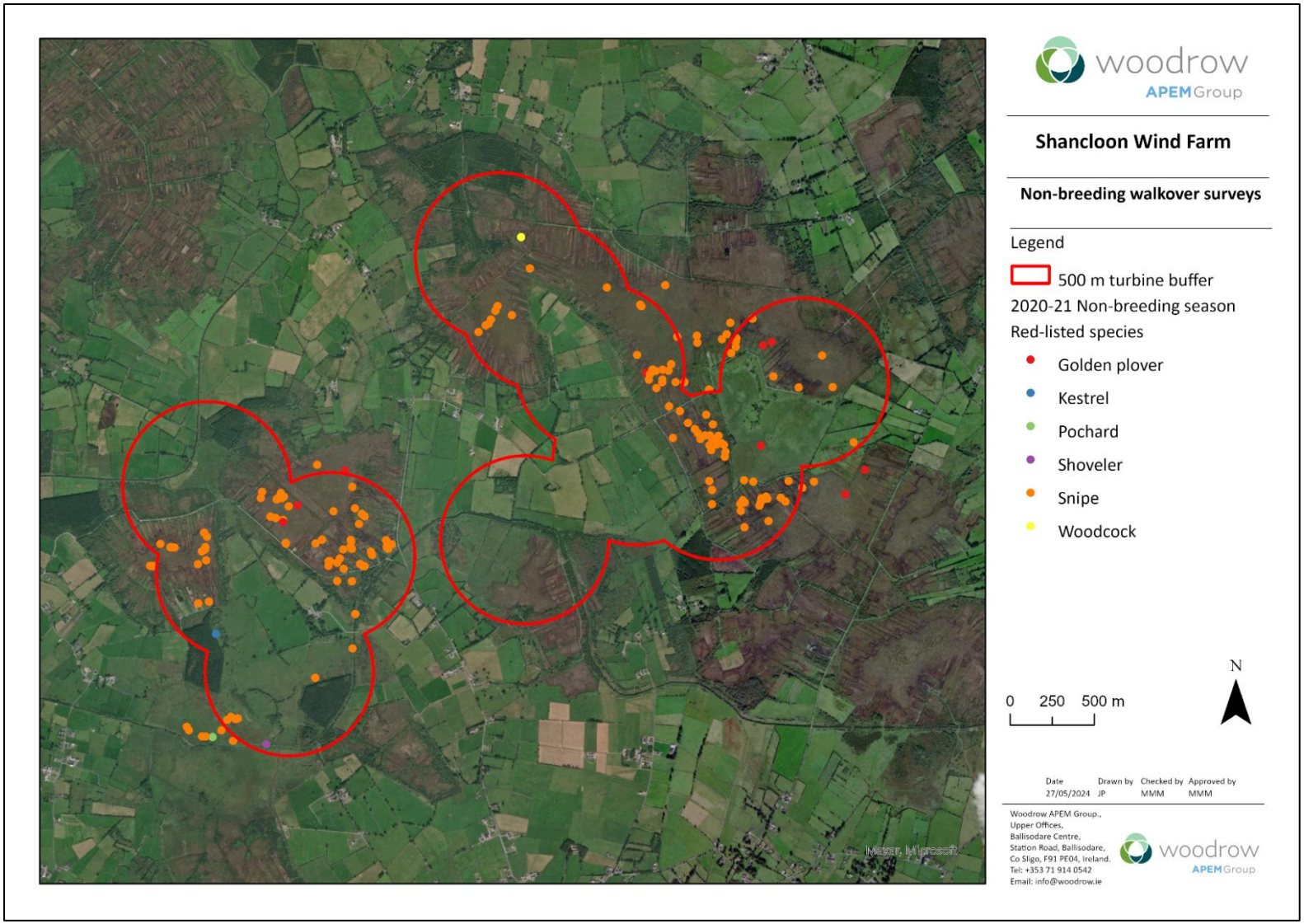

Figure 19. Red-listed species recorded during non-breeding walkover surveys 2020-21 within 500 m turbine buffer

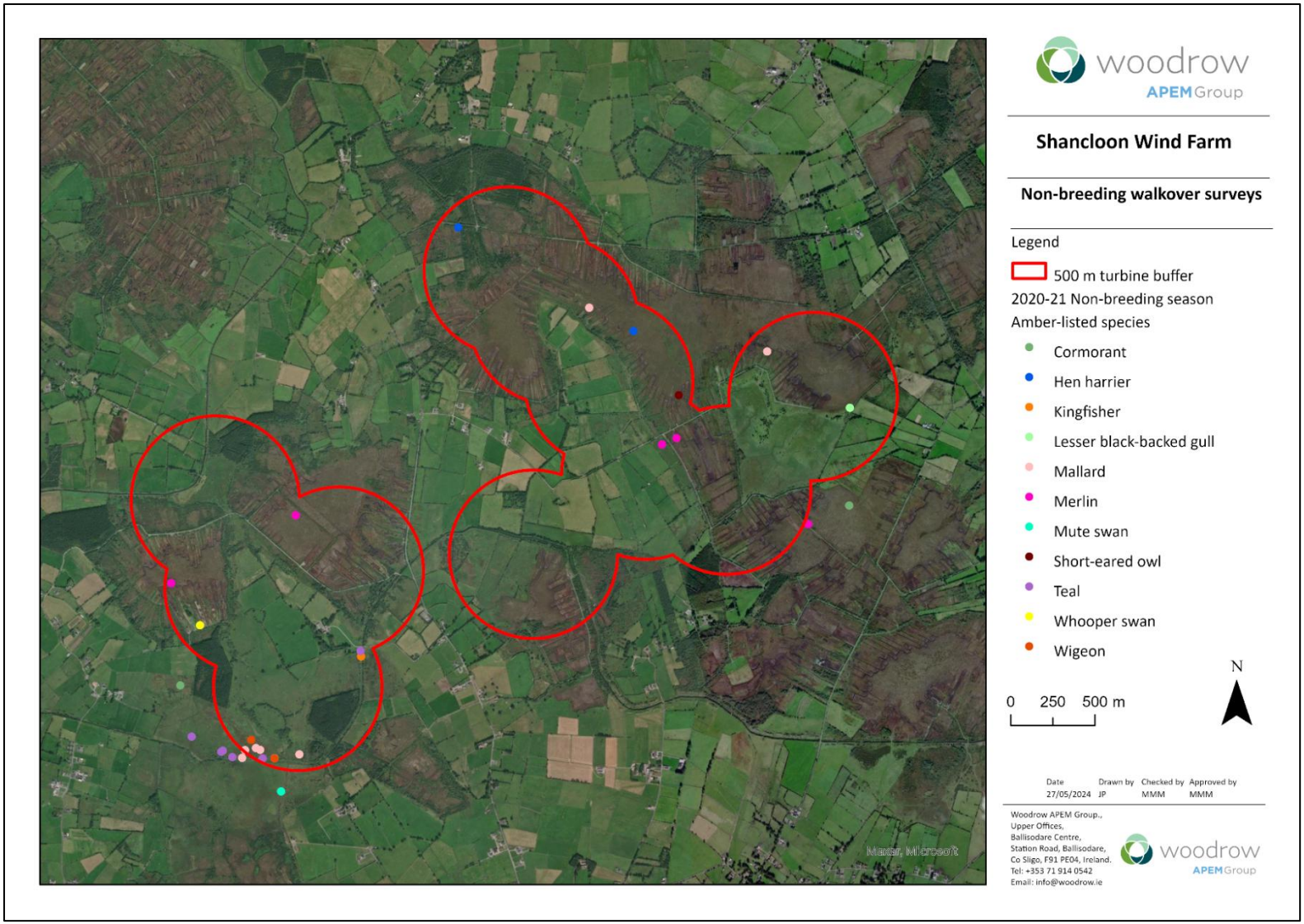

Figure 20. Amber-listed species recorded during non-breeding walkover surveys 2020-21 within 500 m turbine buffer

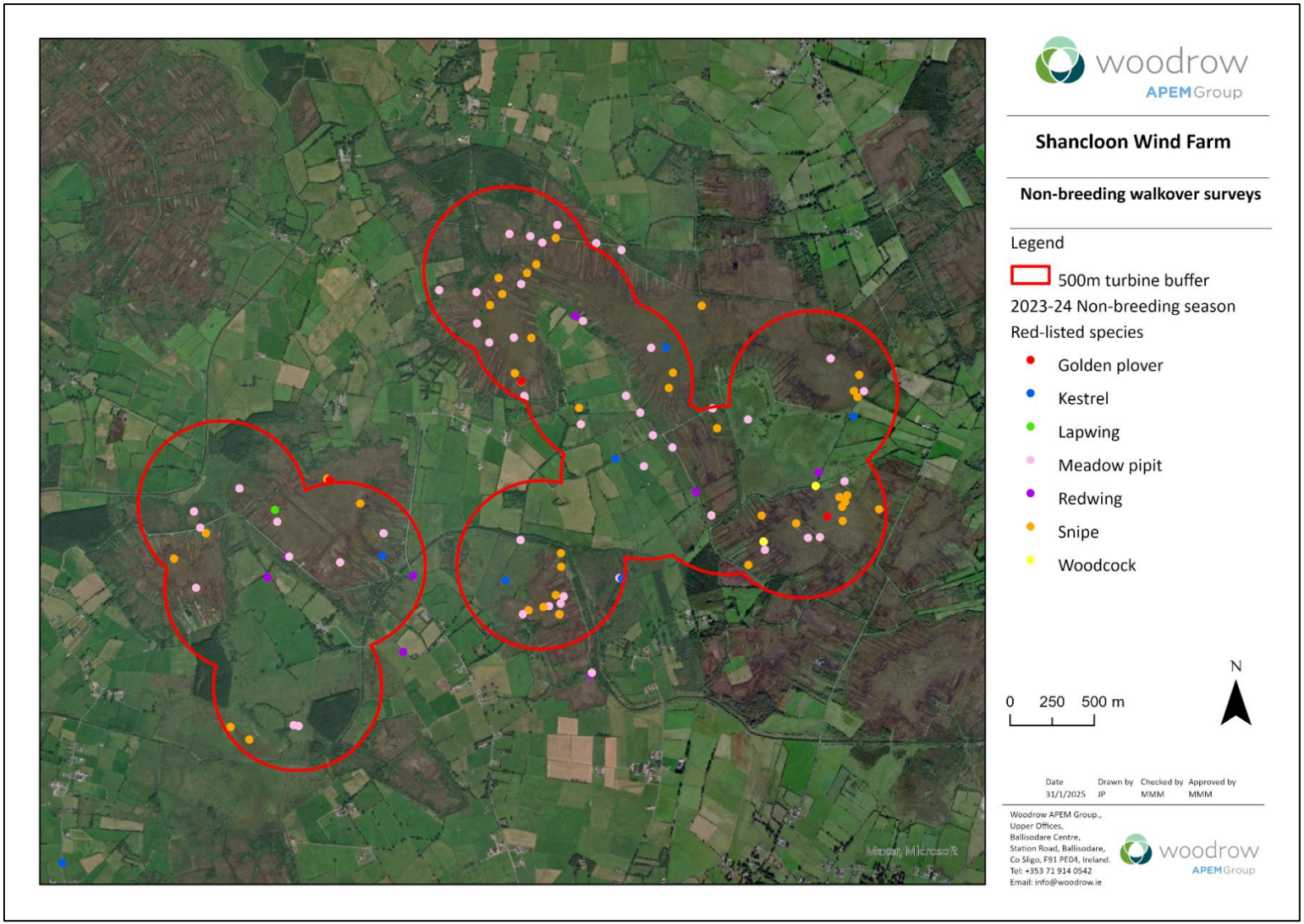

Figure 21. Red-listed species recorded during non-breeding walkover surveys 2023-24 within 500 m turbine buffer

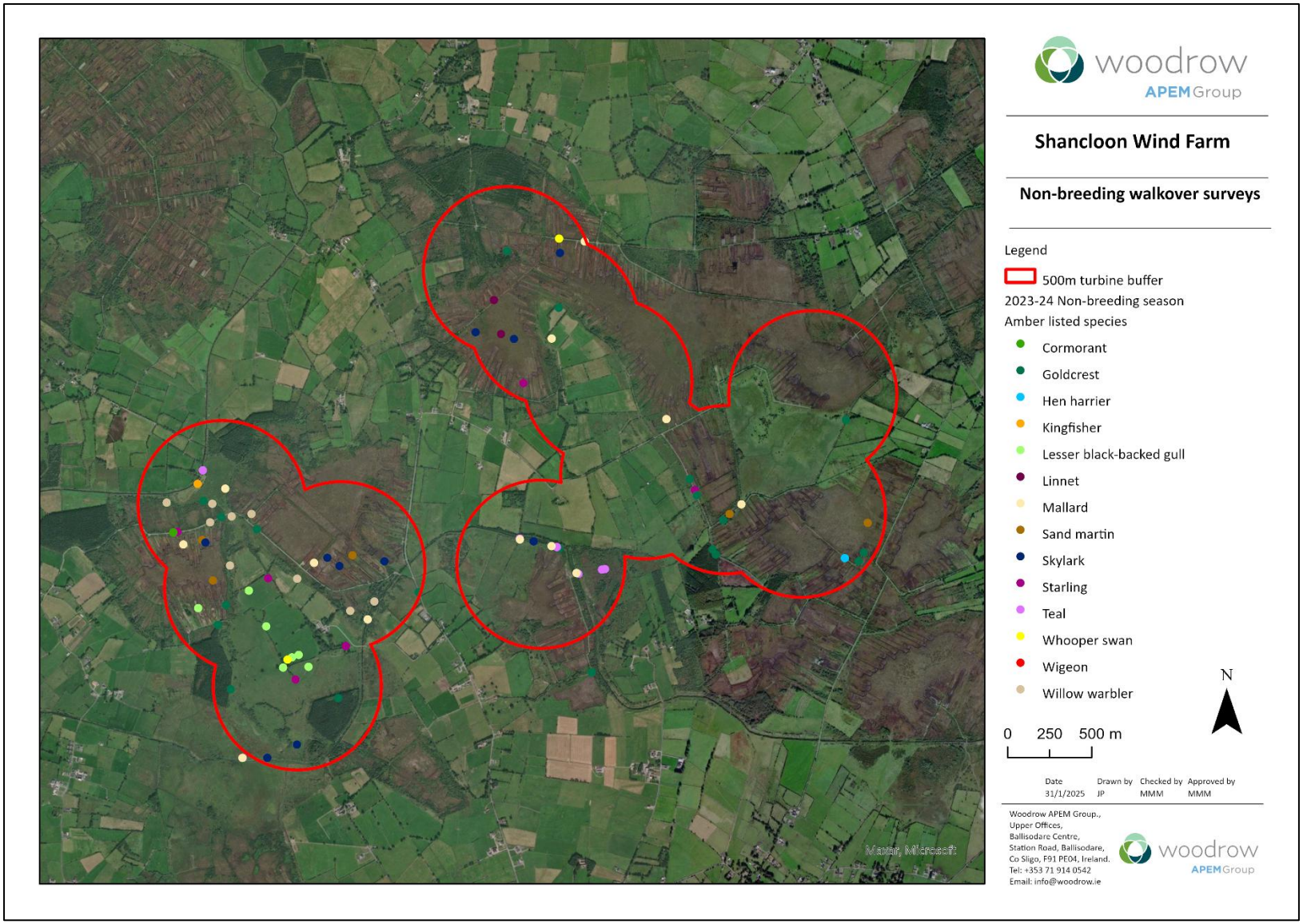

Figure 22. Amber-listed species recorded during non-breeding walkover surveys 2023-24 within 500 m turbine buffer

4.5 Wintering waterbird surveys

4.5.1 Non-breeding season 2019-20

Table 40 lists the species and the number of waterbirds recorded on each visit to the waterbird survey area during the 2019-20 non-breeding season. From the survey results, a total of 36 waterbird species were recorded (Table 40). Figure 23 show the locations of red-listed waterbirds and Figure 24 amber-listed waterbirds recorded during the 2019-20 non-breeding season.

Table 40: Summary of wider area wintering waterbirds recorded during the 2019-20 non-breeding season

Species	BTO code	No. individuals				BoCCI 2020-2026
		Visit1	Visit2	Visit3	Visit4	
Black-tailed godwit	BW	1	-	-	-	Red
Curlew	CU	56	33	19	102	Red
Dunlin	DN	-	38	22	36	Red
Golden plover	GP	201	1,335	675	-	Red
Goldeneye	GN	-	-	1	-	Red
Lapwing	L.	82	285	317	288	Red
Pochard	PO	4	55	51	71	Red
Redshank	RK	-	-	-	3	Red
Shoveler	SV	46	15	19	117	Red
Snipe	SN	2	7	-	-	Red
Woodcock	WK	-	2	-	-	Red
Black-headed gull	BH	-	169	41	62	Amber
Common gull	CM	-	26	-	-	Amber
Coot	CO	-	1	4	3	Amber
Cormorant	CA	4	12	10	13	Amber
Gadwall	GA	-	-	-	26	Amber
Great crested grebe	GG	1	-	1	-	Amber
Greylag goose	GJ	-	44	-	270	Amber
Herring gull	HG	17	-	6	17	Amber
Lesser black-backed gull	LB	7	-	-	-	Amber
Mallard	MA	187	125	101	130	Amber
Mute swan	MS	22	43	25	24	Amber
Pintail	PT	-	3	-	-	Amber
Ruff	RU	4	1	-	-	Amber
Teal	T.	89	319	365	856	Amber
Tufted duck	TU	68	159	117	238	Amber
Whooper swan	WS	-	165	56	83	Amber
Wigeon	WN	8	600	611	733	Amber
Great black-backed gull	GB	-	1	21	16	Green
Green sandpiper	GE	-	1	-	-	Green
Grey heron	H.	4	2	-	2	Green
Little egret	ET	1	-	-	1	Green
Little grebe	LG	-	-	-	1	Green
Moorhen	MH	4	2	-	1	Green
Pink-footed goose	PG	-	-	-	1	Green

Species	BTO code	No. individuals				BoCCI 2020-2026
		Visit1	Visit2	Visit3	Visit4	
Whimbrel	WM	-	114	64	64	Green

4.5.2 Non-breeding season 2020-21

Table 41 shows the species and the number of individuals recorded on each visit in the waterbird survey area during the 2020-21 non-breeding season. From these surveys, a total of 25 waterbird species recorded (Table 41). Figure 25 and Figure 26 show the locations of red and amber-listed waterbirds recorded during the 2020-21 non-breeding season, respectively.

Table 41: Summary of wider area wintering waterbirds recorded during the 2020-21 non-breeding season

Species	BTO code	No. individuals							BoCCI 2020-2026
		Visit1	Visit2	Visit3	Visit4	Visit5	Visit6	Visit7	
Curlew	CU	4	107	56	-	-	-	-	Red
Golden plover	GP	-	-	44	-	50	-	-	Red
Lapwing	L.	-	211	150	50	-	2	-	Red
Pochard	PO	-	-	-	-	-	10	-	Red
Snipe	SN	30	-	-	-	-	-	-	Red
Greenland white-fronted goose	WG	-	-	50	-	-	-	16	Amber
Black-headed gull	BH	-	54	60	-	-	1	10	Amber
Common gull	CM	-	-	-	-	-	50	-	Amber
Cormorant	CA	-	2	1	-	-	9	-	Amber
Greylag goose	GJ	-	3	45	44	-	-	-	Amber
Herring gull	HG	-	-	-	-	-	2	-	Amber
Lesser black-backed gull	LB	-	-	-	-	-	-	1	Amber
Mallard	MA	40	14	-	-	-	17	14	Amber
Mute swan	MS	6	2	-	-	-	2	4	Amber
Teal	T.	4	50	28	-	-	76	91	Amber
Tufted duck	TU	-	24	-	-	-	52	8	Amber
Whooper swan	WS	-	114	214	227	32	17	92	Amber
Wigeon	WN	-	162	-	-	150	40	100	Amber
Canada goose	CG	-	-	-	-	-	35	-	Green
Great black-backed gull	GB	-	3	-	-	-	-	-	Green
Grey heron	H.	3	-	-	-	-	-	-	Green
Little egret	ET	-	-	24	-	-	-	-	Green
Little grebe	LG			1					Green
Pink-footed goose	PG	-	53	-	-	-	-	-	Green
Whimbrel	WM	-	-	-	-	48	30	3	Green

4.5.3 Non-breeding season 2023-24

Table 42 shows the species and the number of individuals recorded on each visit in the waterbird survey area during the 2023-24 non-breeding season. From these surveys, a total of 33 waterbird

species recorded (Table 42Table 41).

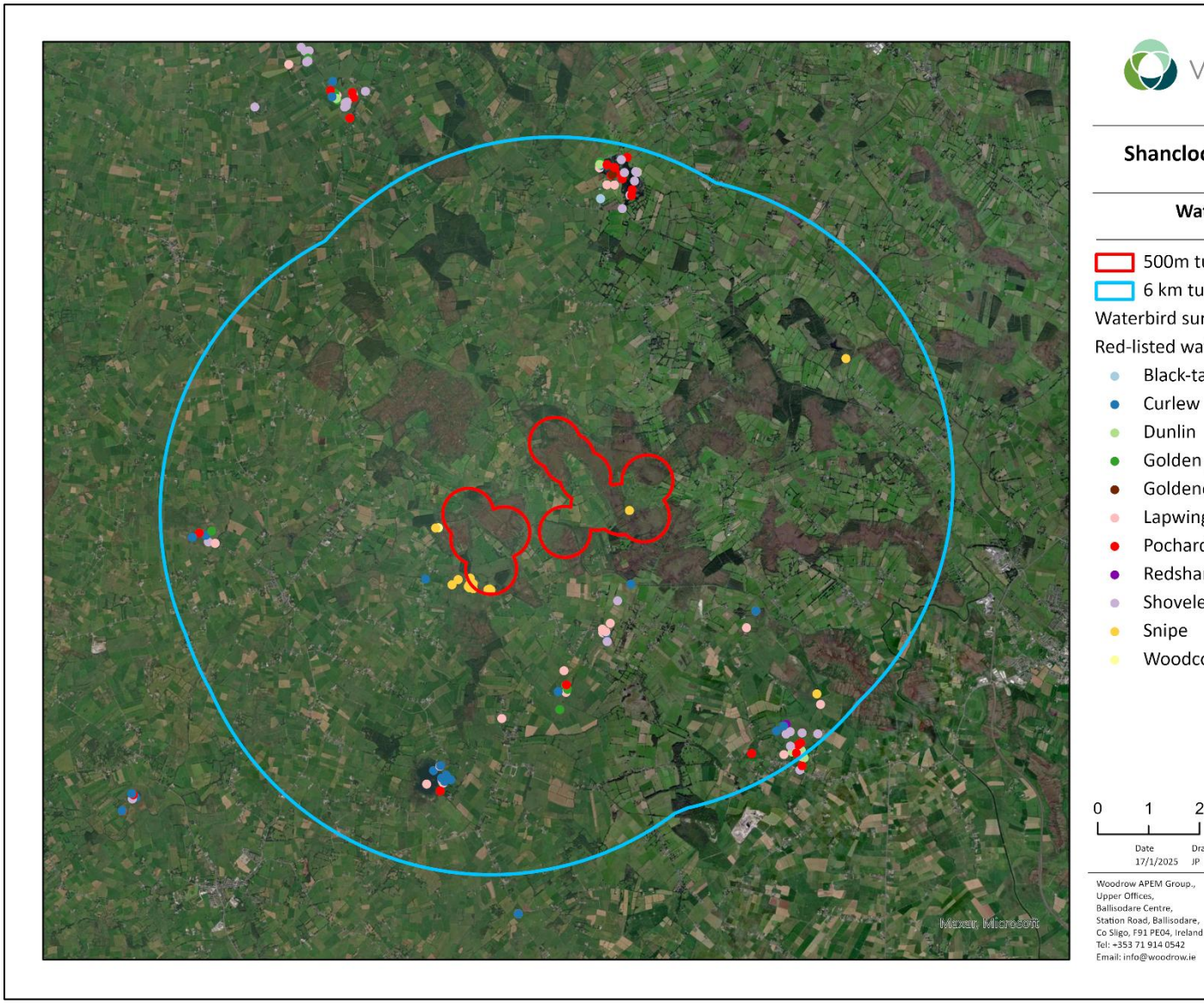

Figure 27 and

Figure 28 show the locations of red and amber-listed waterbirds recorded during the 2023-24 non-breeding season, respectively.

Table 42: Summary of wider area wintering waterbirds recorded during the 2023-24 non-breeding season

Species	BTO code	No. individuals						BoCCI 2020-2026
		Visit1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	
Curlew	CU	25	5	266	125	-	18	Red
Dunlin	DN		19	-	-	-	-	Red
Golden plover	GP	-	-	74	50	-	-	Red
Lapwing	L.	3	21	116		20		Red
Pochard	PO	10	94	196	100	6	6	Red
Shoveler	SV	8	30	326	189	-	16	Red
Snipe	SN	1	1	-	1	-	1	Red
(Greater) white-fronted goose	WG	31	46	-	42	-		Amber

Black-headed gull	BH	32	12	177	80	26	40	Amber
Common gull	CM	-	2	500	32	-	56	Amber
Coot	CO	-	-	-	6	1	6	Amber
Cormorant	CA	15	8	30	25	-	6	Amber
Gadwall	GA	-	-	11	87	38	14	Amber
Great crested grebe	GG	-	-	-	6	-	-	Amber
Greylag goose	GJ	133	57	373	208	8	-	Amber
Herring gull	HG	-	-	17		10	6	Amber
Lesser black-backed gull	LB	-	-	2	18	2	-	Amber
Mallard	MA	75	107	100	123	6	13	Amber
Mute swan	MS	4	4	10	20	5	10	Amber
Pintail	PT	-	-	-	-	4		Amber
Teal	T.	173	50	1,166	592	60	43	Amber
Tufted duck	TU	110	126	446	592	83	95	Amber
Whooper swan	WS	74	18	112	57	9	-	Amber
Wigeon	WN	366	315	1,244	1,933	22	146	Amber
Barnacle goose	BY	-	-	2	2	-	-	Amber
Red-breasted merganser	RM	-	-	-	-	2	-	Amber
Great black-backed gull	GB	-	-	3	-	-	-	Green
Grey heron	H	1	-	6	1	4	-	Green
Little egret	ET	-	-		1	-	-	Green
Little grebe	LG	-	-	2	5	2	2	Green
Moorhen	MH	-	-	7	10	2	3	Green
Pink-footed goose	PG	-	-	-	1	-	-	Green
Ring-necked duck	NG	-	-	-	1	-	-	Green

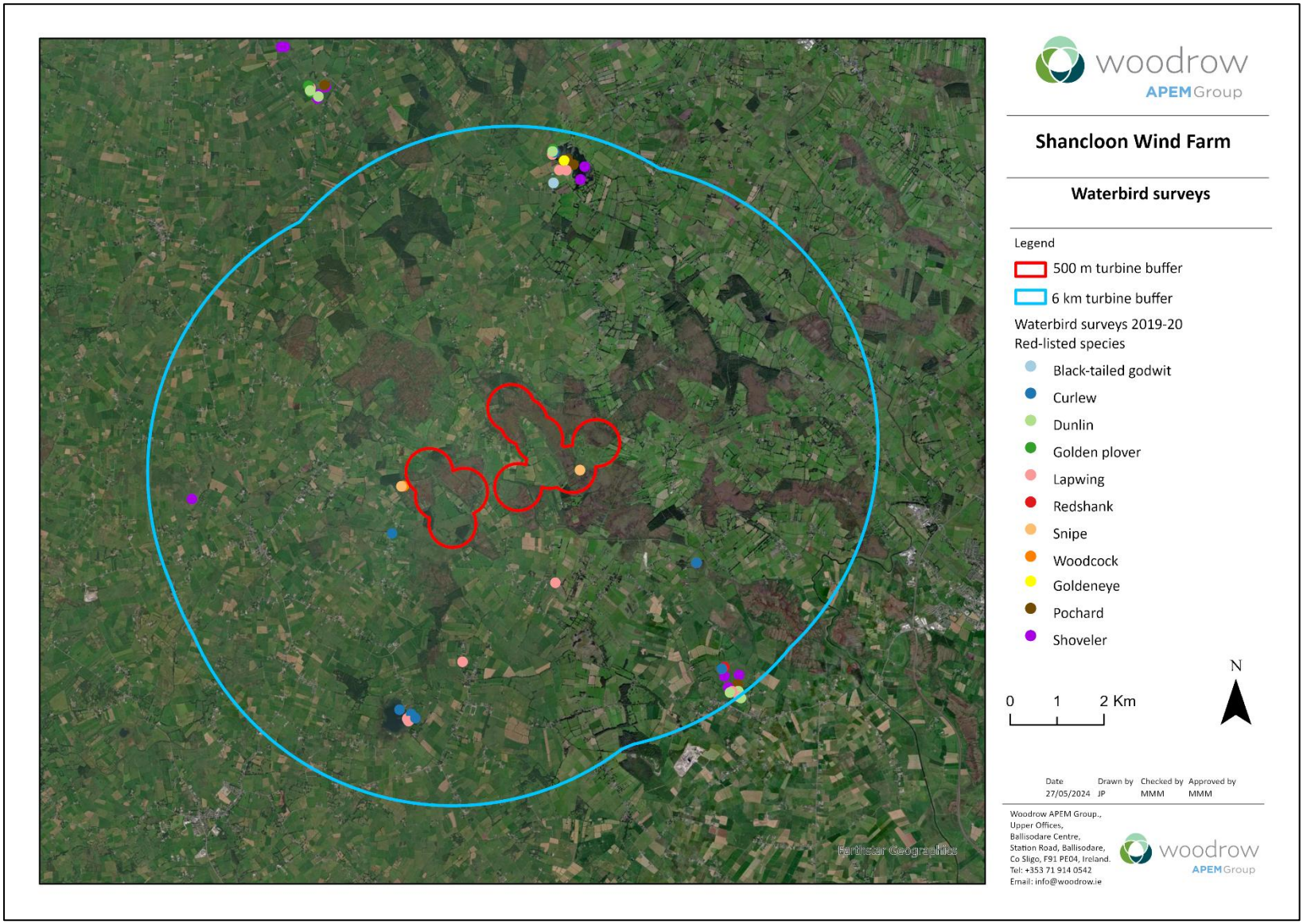

Figure 23: Red-listed waterbird species identified during waterbird surveys in the 2019-20 non-breeding season

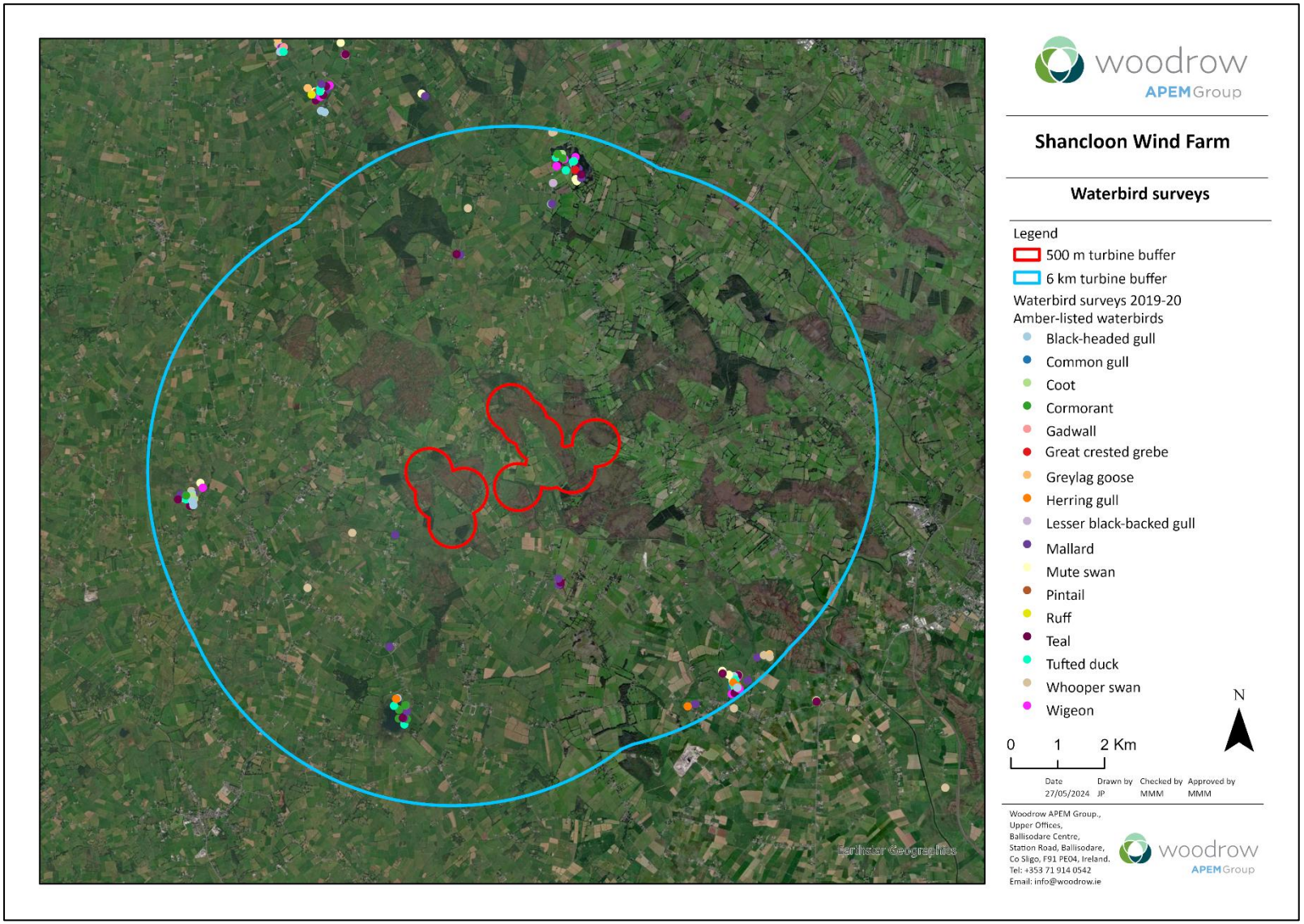

Figure 24: Amber-listed waterbird species identified during waterbird surveys in the 2019-20 non-breeding season

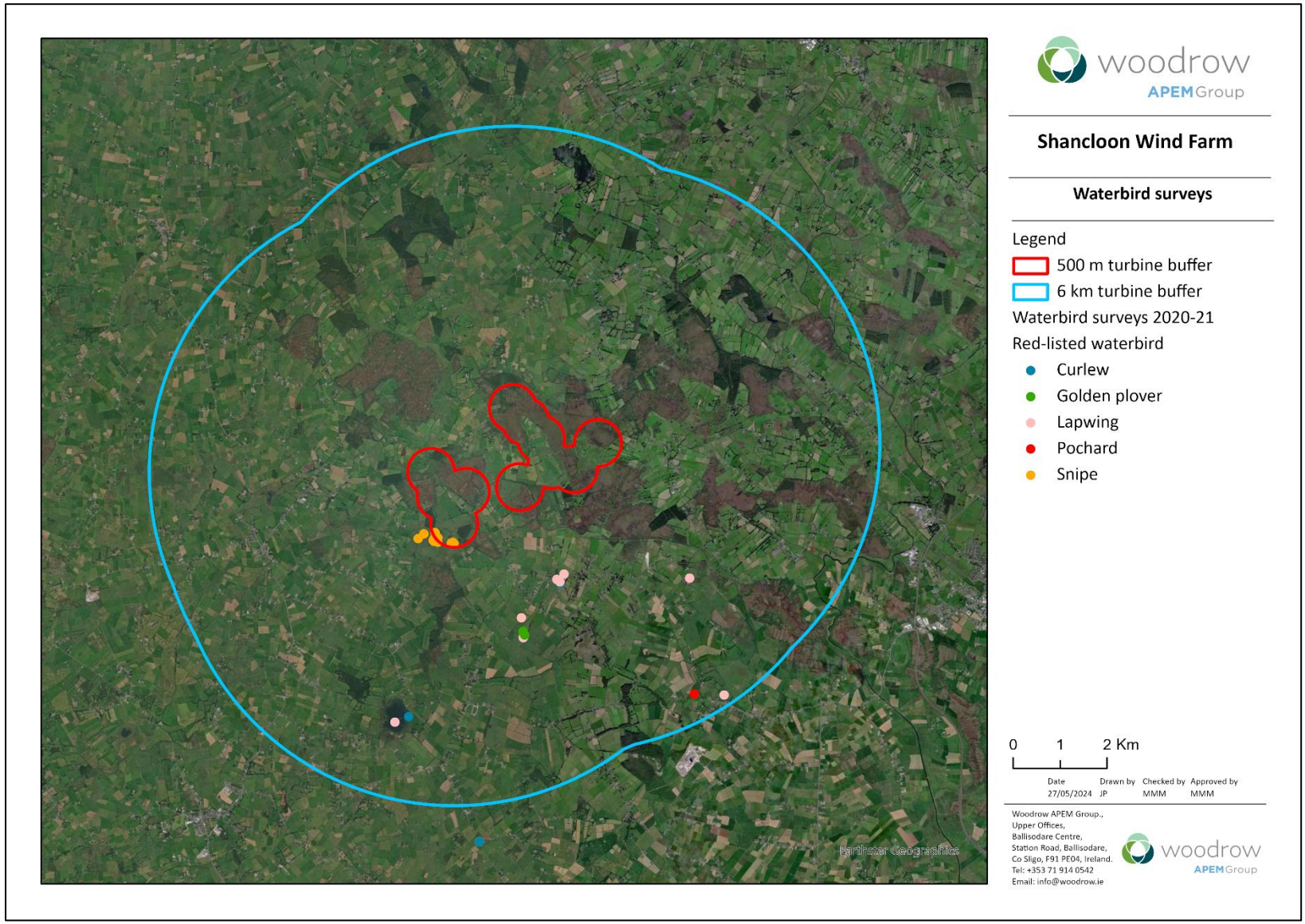

Figure 25: Red-listed waterbird species identified during waterbird surveys in the 2020-21 non-breeding season

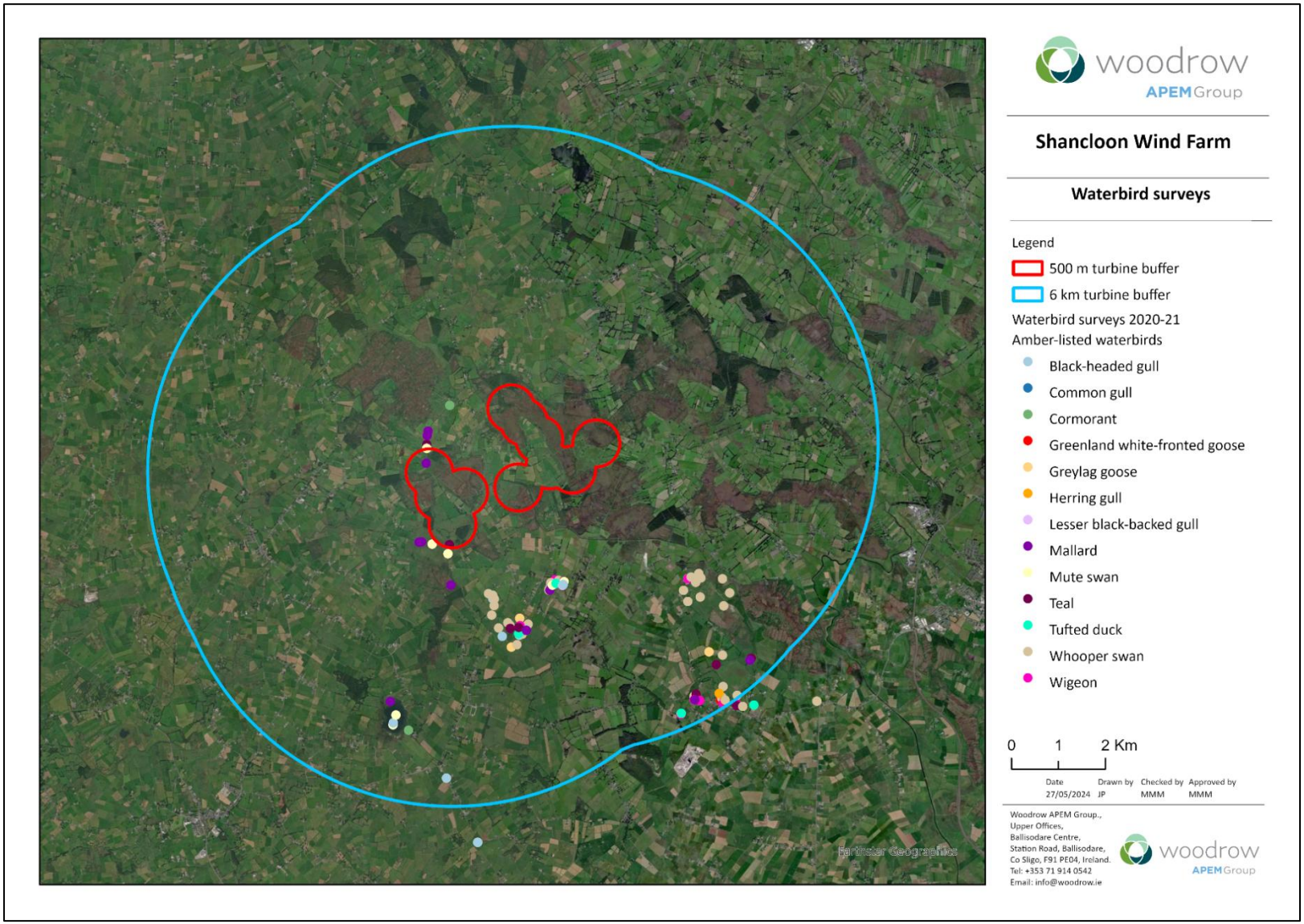

Figure 26: Amber-listed waterbird species identified during waterbird surveys in the 2020-21 non-breeding season

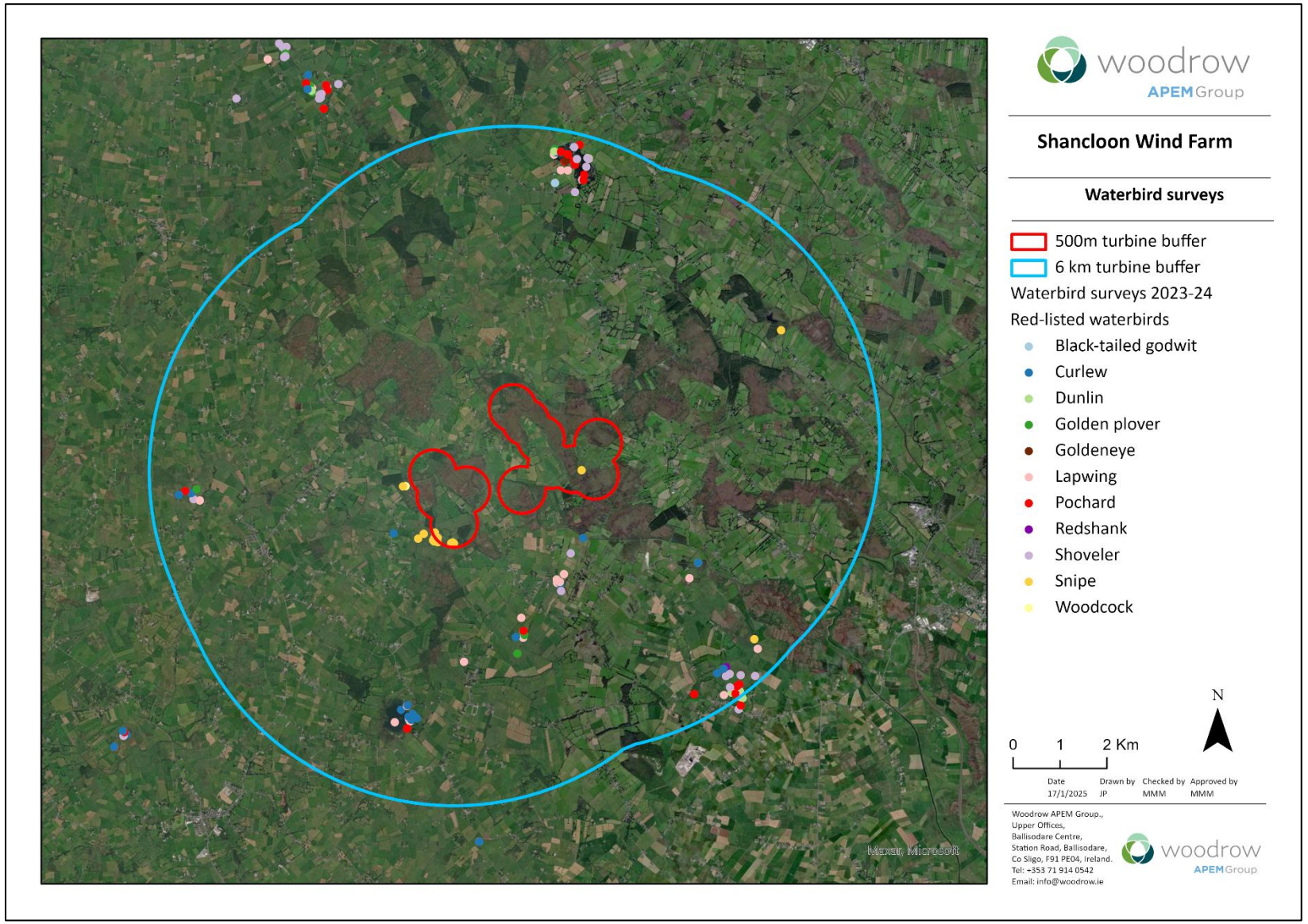

Figure 27: Red-listed waterbird species identified during waterbird surveys in the 2023-24 non-breeding season

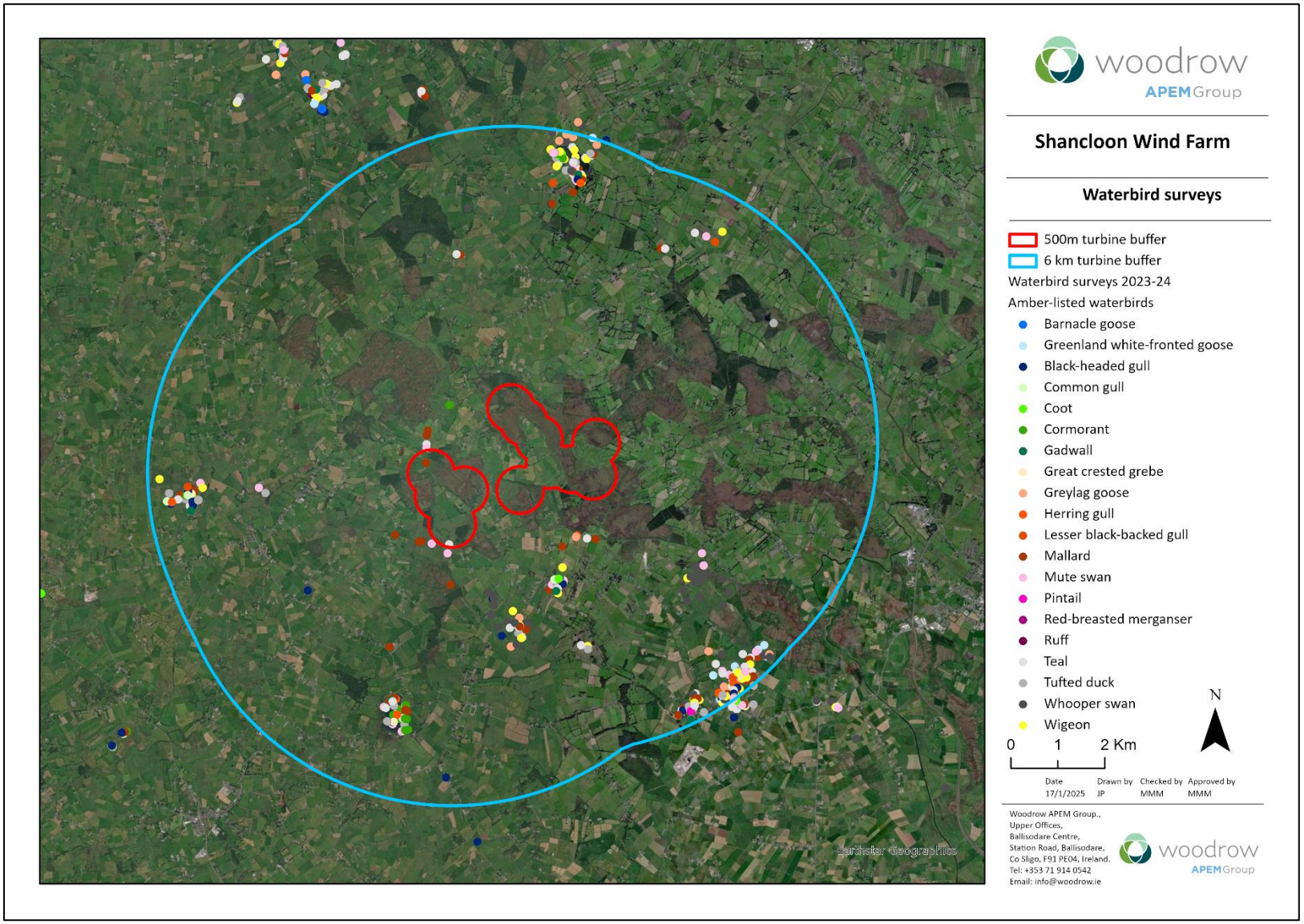

Figure 28: Amber-listed waterbird species identified during waterbird surveys in the 2023-24 non-breeding season

4.6 Hen harrier roost searches

Although some suitable roost habitat exists within the 2 km turbine buffer and hen harriers were recorded during surveys, there was no evidence of roosting hen harrier recorded during targeted hen harrier roost searches that were undertaken over the three winter seasons. Details of observations during roost surveys are detailed below.

During the 2020-21 winter roost searches, hen harriers were recorded on five occasions (Table 43, Figure 29). Two ringtail hen harriers were observed on 18 December 2020 hunting in the south-western extend of the 500 m turbine buffer along the Black (Shrule) River and briefly interacting in a display flight (flight no. 1 and flight no. 2, Figure 29). On the same survey, a male hen harrier was observed in a similar area before dusk (flight no. 3, Figure 29). On 22 February 2021 a ringtail hen harrier was observed hunting in the south-east of the 500 m turbine buffer (flight no. 4, Figure 29) with a second observation in a similar area (flight no. 5, Figure 29).

Table 43. Hen harrier observation during roost watches in the 2020-21 non-breeding season.

Flight ID	Date	Time	No. of birds	Gender
1	18/12/2020	15:42	2	Ringtail
2	18/12/2020	15:44	2	Ringtail
3	18/12/2020	15:47	1	Male
4	22/02/2021	17:45	1	Ringtail
5	22/02/2021	17:51	1	Ringtail

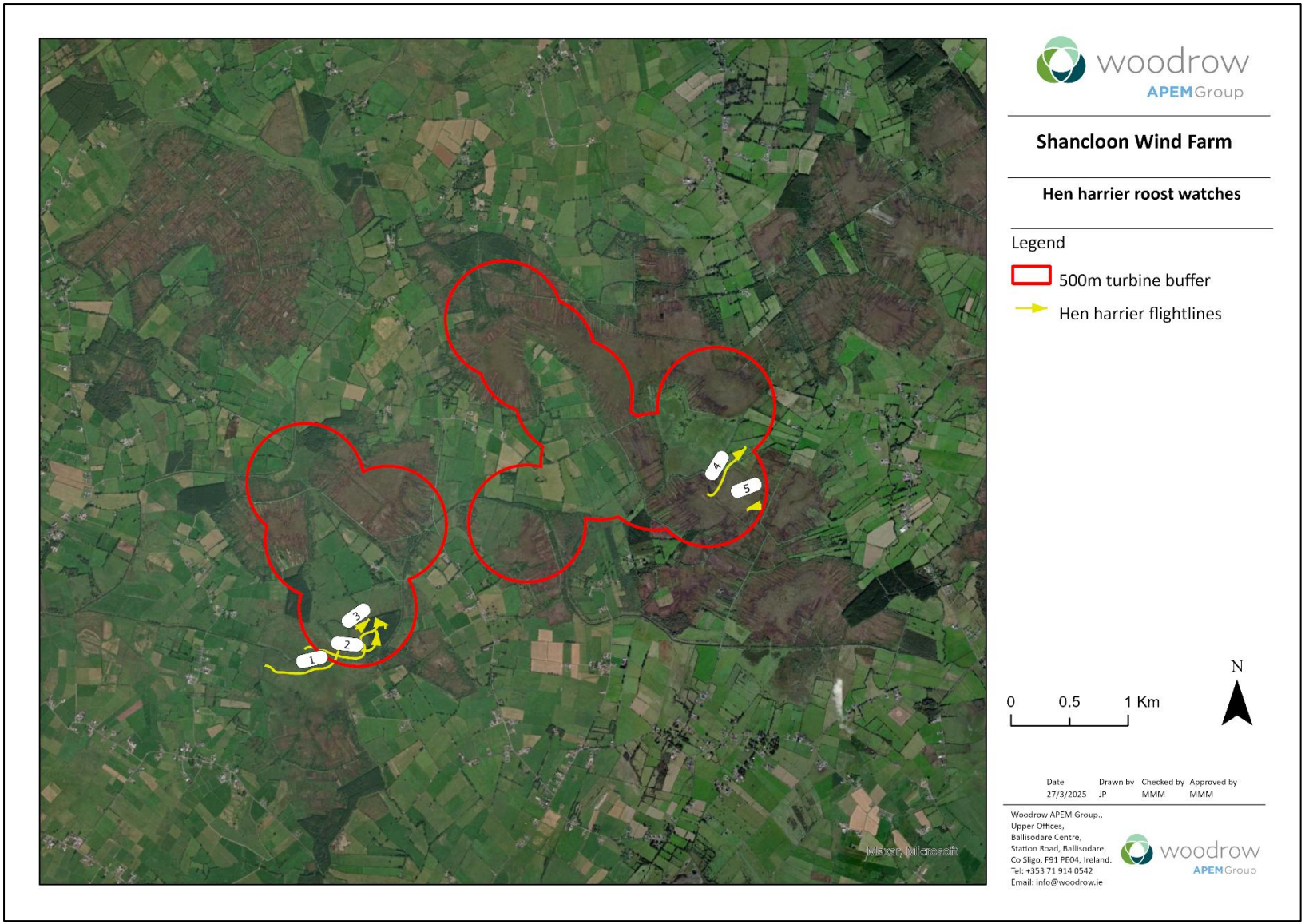

Figure 29: Hen harrier flightlines recorded during the 2020-21 non-breeding season roost watches

4.7 Summary results for Collision Risk Model

Appendix XIII provides the detailed methodology and results for the CRMs that were run for selected target species. The report uses bird usage data derived from VP watches conducted by appropriately experienced ornithological surveyors. Furthermore, the new guidance published by SNH (2024) was used, which aims to promote a standardised approach to collision risk assessment for onshore wind farms, to increase the transparency of calculations and to promote greater confidence in the results. A detailed report is available explaining the derivation of the model (Band 2024).

Three turbine models were specified for use in the proposed development: the Vestas V150 (V150), Nordex 149 (N149), and Siemens Gamesa 155 (SG155). CRM was run for each turbine model. The CRZ, defined as the height between the minimum and maximum swept height of the turbine rotor within a 500 m buffer of turbines, was 25-180 m for the SG155, 30 – 179 for the N149, and 30-180 for the V150 model. Full turbine specification used in the CRMs are provided in **Appendix XIII**.

Based on professional judgement, CRM was run for target species with a total aggregate flight time (i.e., number of individuals x flight time) of > 400 seconds occurring within the CRZ over the three years (i.e. at collision risk height and within the turbine envelope = 500 m turbine buffer), and more than three observations over the study period. Target species with an aggregate flight time of < 400 seconds were excluded from CRM analysis as this flight time would generate an imperceptible predicted collision risk over the lifetime of the proposed wind farm. Based on the criteria outlined above, CRMs were run for the following 14 target species:

- Buzzard
- Cormorant
- Curlew
- Golden plover
- Great black-backed gull
- Herring gull
- Kestrel
- Lapwing
- Lesser black-backed gull
- Mallard
- Snipe
- Sparrowhawk
- Whimbrel
- Whooper swan

NatureScot (2018) provides guidance on the use of avoidance rates in collision risk assessments. Collision risks have been calculated for avoidance rates of 95%, 98%, 99%, and 99.5% for each season (breeding and non-breeding) and for year. The avoidance rate suggested by SNH (2018) and Furness (2019) are used to provide estimates of the number of collisions per annum, per decade and for the operational lifespan of the proposed wind farm development (30 years) (Table 44). It is important to mention that the collision rate calculated for golden plover in the non-breeding season included all winter months and April, since this species is a winter and passage visitor. In the case of whimbrel, the

collision rate calculated in the breeding season included only May and April, since this species is a spring passage migrant.

The CRMs found that the V150 generated the lowest predicted collision risk in comparison with the SG15 and N149. This result may be driven by the higher average operational speeds of the SG155 (average rotational period: 6.42 sec) and the N149 (average rotational period: 5.58 sec). Despite the V150 having a larger risk volume than the N149, the average operational speeds are lower (average rotational period: 6.85 sec). Moreover, the rotor diameter of the SG155 is 5 meters larger than the rotor diameter of the Vestas V150, creating a bigger area where the bird might collide.

Table 44 provides the collision probability of the selected target species passing through the rotors, taking into account different avoidance rates estimate for the non-breeding and breeding seasons and year. The turbine models and specifications with the highest and lowest predicted collision risk are indicated in red and green, respectively. Species in bold denote a rate of more than 1 collision per decade.

Taking into account the turbine model with the lowest predicted collision rate (turbine model V150), the CRMs generated low levels of theoretical collision risk (i.e. less than 1 collision per decade, with NatureScot CRM suggested avoidance rate) over the 30-year life span of the proposed development for seven species; cormorant, great black-backed gull, herring gull, mallard, sparrowhawk, whimbrel and whooper swan. This level of predicted collisions would be considered negligible and would not affect these species at the population level, i.e., collision mediated mortality would not add significantly (>1%) to background levels of mortality.

Higher levels of flight time in the CRZ (i.e. more than 1 collision per decade, with NatureScot CRM suggested avoidance rate) over the 30-year life span of the proposed development were predicted for seven species; buzzard, curlew, golden plover, kestrel, lapwing, lesser black-backed gull and snipe for turbine model V150 (Table 44), and depending on turbine specification the collision per year, using the avoidance rate suggested by SNH (2018) and Furness (2019) were estimated at:

- 0.22 – 0.29 collisions per year for buzzard (98.0% avoidance rate)
- 0.22 – 0.24 collisions per year for curlew (98.0% avoidance rate)
- 8.28 – 8.95 collisions per year for golden plover (98% avoidance rate)
- 0.99 - 1.30 collisions per year for kestrel (95.0% avoidance rate)
- 1.77 – 1.94 collisions per year for lapwing (98.0% avoidance rate)
- 0.15 – 0.18 collisions per year for lesser black-backed gull (99.5% avoidance rate)
- 0.16 – 0.23 collisions per year for snipe (98.0% avoidance rate)

These levels of predicted collision risk warrant further investigation in terms of effects on these birds at a population level.

Table 44. Collision rate estimated by the non-breeding (NB) and the breeding seasons (B) and year-round, applying different avoidance rate

Turbine	Target species	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Per decade*	Per 30 years*
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
SG155	**Buzzard**	0.09	0.64	0.73	0.04	0.26	0.29	0.02	0.13	0.15	0.01	0.06	0.07	2.92	8.76
	Cormorant	0.19	0.10	0.29	0.08	0.04	0.12	0.04	0.02	0.06	0.02	0.01	0.03	1.19	3.56
	Curlew	0.60	0.01	0.61	0.24	0.01	0.25	0.12	0.002	0.12	0.06	0.001	0.06	2.45	7.34
	Golden plover	22.36	-	22.36	8.95	-	8.95	4.47	-	4.47	2.24	0.001	2.24	89.45	268.36
	Great black-backed gull	0.04	0.82	0.86	0.02	0.33	0.35	0.01	0.16	0.17	0.004	0.08	0.08	0.87	2.60
	Herring gull	0.75	0.18	0.93	0.30	0.07	0.37	0.15	0.04	0.19	0.08	0.02	0.10	0.94	2.81
	Kestrel	0.28	1.02	1.30	0.11	0.41	0.52	0.06	0.20	0.26	0.03	0.10	0.13	13.03	39.10
	Lapwing	4.86	-	4.86	1.94	-	1.94	0.97	-	0.97	0.49	-	0.49	19.44	58.33
	Lesser black-backed gull	0.19	1.64	1.83	0.08	0.66	0.74	0.04	0.33	0.37	0.02	0.16	0.18	1.84	5.51
	Mallard	0.11	0.18	0.28	0.04	0.07	0.11	0.02	0.04	0.06	0.01	0.02	0.03	1.14	3.42
	Snipe	0.18	0.41	0.59	0.07	0.16	0.23	0.04	0.08	0.12	0.02	0.04	0.06	2.33	6.99
	Sparrowhawk	0.03	0.06	0.09	0.01	0.02	0.04	0.01	0.01	0.02	0.003	0.01	0.01	0.36	1.08
	Whimbrel	-	0.14	0.14	-	0.06	0.06	-	0.03	0.03	-	0.01	0.01	0.58	1.74
	Whooper swan	0.75	-	0.75	0.30	-	0.30	0.15	-	0.15	0.08	-	0.08	0.75	2.26
N149	**Buzzard**	0.08	0.53	0.60	0.03	0.21	0.24	0.02	0.11	0.12	0.01	0.05	0.06	2.41	7.24
	Cormorant	0.16	0.09	0.25	0.07	0.04	0.11	0.03	0.02	0.05	0.02	0.01	0.03	1.01	3.03
	Curlew	0.56	0.01	0.57	0.23	0.0001	0.23	0.11	0.0001	0.12	0.06	0.001	0.06	2.30	6.90
	Golden plover	21.09	-	21.09	8.43	-	8.43	4.22	-	4.22	2.11	-	2.11	84.35	253.04
	Great black-backed gull	0.04	0.82	0.86	0.02	0.33	0.35	0.01	0.16	0.17	0.004	0.08	0.09	0.87	2.60
	Herring gull	0.75	0.18	0.93	0.30	0.07	0.37	0.15	0.04	0.19	0.08	0.02	0.09	0.94	2.81
	Kestrel	0.23	0.86	1.09	0.09	0.34	0.43	0.05	0.17	0.22	0.02	0.09	0.11	10.88	32.64
	Lapwing	4.70	-	4.70	1.88	-	1.88	0.94	-	0.94	0.47	-	0.47	18.81	56.44
	Lesser black-backed gull	0.17	1.42	1.59	0.07	0.57	0.64	0.03	0.28	0.32	0.02	0.14	0.16	1.58	4.75
	Mallard	0.09	0.15	0.24	0.04	0.06	0.10	0.02	0.03	0.05	0.01	0.02	0.02	0.98	2.95
	Snipe	0.13	0.29	0.42	0.05	0.12	0.17	0.03	0.06	0.08	0.01	0.03	0.04	1.68	5.03
	Sparrowhawk	0.03	0.06	0.09	0.01	0.02	0.03	0.01	0.01	0.02	0.003	0.01	0.01	0.35	1.04
	Whimbrel	-	0.14	0.14	-	0.06	0.06	-	0.03	0.03	-	0.01	0.01	0.56	1.69
	Whooper swan	0.68	-	0.68	0.27	-	0.27	0.14	-	0.14	0.07	-	0.07	0.68	2.05
V150	**Buzzard**	0.07	0.48	0.55	0.03	0.19	0.22	0.01	0.10	0.11	0.007	0.05	0.06	2.20	6.61
	Cormorant	0.15	0.08	0.23	0.06	0.03	0.09	0.03	0.02	0.05	0.015	0.01	0.02	0.93	2.80
	Curlew	0.53	0.01	0.54	0.21	0.01	0.22	0.11	0.003	0.11	0.053	0.001	0.05	2.18	6.53

Turbine	Target species	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Per decade*	Per 30 years*
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
	Golden plover	20.70	-	20.70	8.28	-	8.28	4.14	-	4.14	2.070	-	2.07	82.80	248.41
	Great black-backed gull	0.04	0.76	0.81	0.02	0.31	0.33	0.01	0.15	0.16	0.004	0.08	0.08	0.81	2.42
	Herring gull	0.69	0.17	0.86	0.28	0.07	0.35	0.14	0.03	0.17	0.069	0.02	0.09	0.86	2.59
	Kestrel	0.21	0.78	0.99	0.08	0.31	0.39	0.04	0.16	0.20	0.021	0.08	0.10	9.87	29.61
	Lapwing	4.43	-	4.43	1.77	-	1.77	0.89	-	0.89	0.443	-	0.44	17.73	53.18
	Lesser black-backed gull	0.16	1.32	1.48	0.06	0.53	0.59	0.03	0.26	0.30	0.016	0.13	0.15	1.48	4.43
	Mallard	0.09	0.15	0.24	0.04	0.06	0.10	0.02	0.03	0.05	0.009	0.02	0.02	0.94	2.82
	Snipe	0.12	0.28	0.40	0.05	0.11	0.16	0.02	0.06	0.08	0.012	0.03	0.04	1.63	4.89
	Sparrowhawk	0.03	0.05	0.08	0.01	0.02	0.03	0.01	0.01	0.02	0.003	0.01	0.01	0.32	0.95
	Whimbrel	-	0.14	0.14	-	0.05	0.05	-	0.03	0.03	-	0.01	0.01	0.54	1.62
	Whooper swan	0.62	-	0.62	0.25	-	0.25	0.12	-	0.12	0.062	-	0.06	0.62	1.87

*Suggested avoidance rate suggested by SNH (2018) and Furness (2019) (Table A13.3) was used to estimate the number of collisions per decade and for the operational lifespan of the proposed wind farm development (30 years)

5 Discussion

5.1 Waterbirds

5.1.1 Swans, geese and ducks

During VP surveys, whooper swan generated more than 400 aggregated flight seconds within the CRZ. A total of 23 whooper swan observations were recorded generating a total of 951 flight seconds over the three winter surveys, with 62% of the flight time occurring within the CRZ. Flock sizes recorded were between three and 14 birds, and the occurrence of flights was periodic with no pattern emerging that was suggestive of birds regularly travelling between roost sites and foraging areas. Furthermore, two whooper swan flights a single bird and a flock of seven individuals were recorded on the 26 and 27 of March, equating to a total of 48 flight seconds within the CRZ.

Over three survey years, seven mute swan flights of flock sizes ranging between a single bird up to four birds, were recorded equating to a total of 277 flight seconds, with 63% of the flight seconds within the CRZ.

Of geese species recorded during VP surveys, a single greylag goose flock (14 birds) was recorded flying through the 500 m turbine buffer during the 2020-21 non-breeding season, generating a total of 2 flight seconds. One Canada goose was recorded flying through the 500 m turbine buffer during the 2023-24 non-breeding season, equating to a total of 17 flight seconds. A single brent goose was recorded commuting within the 500 m turbine buffer during the 2024 breeding season, for a total of four seconds.

Of duck species recorded during VP surveys, three teal flights were recorded within the 500 m turbine buffer equating to a total of 155 flight seconds, with 74% of the flight time occurring within the CRZ. Mallards were frequently recorded within the 500 m turbine buffer, with a total of 102 observations equating to 3,027 flight seconds, with 34% of the flight time occurring within the CRZ. Flights were generally of one to six individuals. The CRM output for mallard predicted that there would be 0.11 collisions per year and 3.42 collisions over the 30-year lifetime of the proposed project (see **Appendix XIII** for full details). For this species, applying an annual adult survival rate of 0.627 (BTO BirdFacts), the additional annual mortality on the local population (estimated as 18,810 birds) due predicted collision risk is estimated to be 0.001%. Based on Percival, (2003) this is classed as a negligible effect, with a <1% effect considered negligible.

Overall, given the wetland features and use of the wider area by waterbirds, movements of swan, geese and ducks appear to largely avoid traversing across the proposed development site, represented in this report by the 500 m turbine buffer. In addition, while numbers of whooper swan were regularly recorded in the wider area, flocks were not recorded feeding or roosting with the proposed development site. As such, lands immediately within the proposed development site do not appear to represent an important resource for swans, geese and ducks.

5.1.2 Waders

Eight wader species were recorded during VP watches over the three-year survey period, with the aggregated flight times for five wader species, including curlew, golden plover, lapwing, snipe, and whimbrel, equating to more than 400 seconds within the CRZ. During these surveys, one observation of common sandpiper and greenshank, and two observations of woodcock were recorded.

A total of 48 golden plover observations were recorded generating a total of 6,180 flight seconds, with 89% of the flights occurring within the CRZ. Flock size ranged from one to 180 birds with an average flock size of 27 birds. Flight activity was recorded during the non-breeding seasons with higher activity noted over winter 2023-24 compared to winter 2020-21 and winter 2020-19. Activity and spread of activity across the non-breeding seasons is representative of golden plover over-wintering in the area rather than passing through during the spring or autumn passage seasons.

The CRM output for golden plover predicted that there would be 8.95 collisions per year and 268 collisions over the 30-year lifetime of the project, taking into consideration the worst-case scenario (see **Appendix XIII** for full details). Applying an annual adult survival rate of 0.73 (Sandercock, 2003; as cited by Robinson, 2005 in BTO BirdFacts), the additional annual mortality on the local population (calculated as 4,000 birds) due to the predicted collision risk is estimated to be 1.21%. Therefore, to have a >1% population effect turbine mediated mortality would need to be in the region of 10-11 collision per annum. Based on Percival, (2003) this is classed as a low effect. This level of predicted collision risk, although relatively low, warrants further investigation to determine potential for significant population level effects and this is considered further in the ornithological impact assessment. It should be noted that a species-specific avoidance rate is not provided for golden plover and therefore the SNH (2018) guidelines suggest applying the default 98% rate. It is considered that while the default rate may be appropriate for breeding populations, it may not accurately capture avoidance rates of wintering birds due to differences in behaviour and ecology. Post-construction monitoring studies from wind farms in the UK (e.g. Goole Wind Farm - see Percival *et al*., 2018) indicate that higher avoidance rates should be applied for non-breeding golden plovers and avoidance of 99.8% is likely to generate more realistic modelled outputs, and this would be in line with avoidance rates applied for wintering geese (SNH, 2018, 2024).Collision risk for wader species, including golden plovers are generally considered to be low due to manoeuvrability in flight (Mc Guinness *et al.*, 2015). Considering an avoidance rate of 99.5% for golden plover, the collision risk for the proposed development would be lower than predicted using the default avoidance rate applied in the CRM (e.g. 2.24 collision per year predicted for SG155).

A total of six lapwing observations were recorded generating a total of 421 flight seconds, with 81 % of the flights occurring within the CRZ. Flock size ranged from eight to 105 birds with an average flock size of 35 birds. One flight recorded in February 2020 accounted for 62% of the flight time recorded. All flights were associated with birds commuting through the area during the winter months, likely moving between agricultural fields and wetland features in the wider area. The CRM output for lapwing predicted that there would be 1.94 collision per year and 58 collisions over the 30-year lifetime of the project using the default 98% avoidance rate (see **Appendix XIII** for full details). Applying an annual adult survival rate of 0.705 (Sandercock, 2003; as cited by Robinson, 2005 in BTO BirdFacts), the additional annual mortality on the local population (calculated as 5,000 birds) due to the predicted collision risk is estimated to be 0.11%. Therefore, to have a >1% population effect, turbine mediated mortality would need to be in the region of 14.75 collision per annum. Based on Percival, (2003) this is classed as a negligible effect, with a <1% effect considered negligible. For context, at a national lapwing population level, 1% of the national population is 850 birds (Lewis *et al*. 2019b). As for golden plover above, a species-specific avoidance rate is not provided for lapwing and therefore the default 98% rate was applied, as per SNH (2018) guidelines. However, collision risk for wader species is generally considered to be low due to manoeuvrability in flight, and as such the collision risk for lapwing predicted by the CRM is likely to be lower.

A total of 58 snipe observations were recorded during VP watches totalling 4,020 flight seconds, with 93% occurring within CRZ. Snipe were recorded during both the non-breeding and breeding seasons, with display flights (drumming) regularly recorded around VP3 and numbers of birds using the site to over-winter. The CRM output for snipe predicted that there would be 0.23 collisions per year and 7 collisions over the 30-year lifetime of the proposed project (see **Appendix XIII** for full details). For snipe, applying an annual adult survival rate of 0.535 (Sandercock, 2003; as cited by Robinson, 2005 in BTO BirdFacts), the additional annual mortality on the local population (estimated as 100 birds) due predicted collision risk is estimated to be 0.26%. Therefore, to have a >1% population effect turbine mediate mortality would need to be in the region of 0.47 collisions per annum. Based on Percival, (2003) this is classed as a negligible effect, with a <1% effect considered negligible. As flight activity for this species is largely crepuscular (active at dawn and dusk) and VP surveys are carried out during daylight hours, VP surveys are not always an effective method of estimating snipe flight activity. As such, flight time within the 500 m turbine buffer is likely underestimated. However, the NatureScot CRM spreadsheet considered the levels of nocturnal activity by each specific target species. In the case of snipe, the level of nocturnal activity was set with a score of five whereby nocturnal activity is equal to diurnal activity (SNH, 2024). Due to the absence of a species-specific avoidance rate for snipe, and understanding of wader manoeuvrability in flight, the avoidance rate for snipe is likely to be higher than the default of 98%, as per SNH (2018) guidelines, and therefore the predicted collision risk lower than the CRM output.

A total of six curlew observations were recorded during VP watches totalling 171 flight seconds, with 65% occurring within the CRZ. There were two breeding season records, neither of which were associated with a breeding attempt within or adjacent to the 500 m turbine buffer. The April record was thought to be two birds on spring passage and individual recorded in July could be attributable to a failed breeding attempt. No curlew was recorded during the second and the third year of surveys within the 500 m turbine buffer. The CRM output for curlew predicted that there would be 0.24 collision every year and 7.34 collisions over the 30-year lifetime of the proposed project (see **Appendix XIII** for full details). For curlew, applying an annual adult survival rate of 0.899 (BTO BirdFacts), the additional annual mortality on the local population (estimated as 276 birds) due predicted collision risk is estimated to be 2.69%. Therefore, to have a >1% population effect turbine mediate mortality would need to be in the region of 0.28 collisions per annum. This level of predicted collision risk, although relatively low, warrants further investigation to determine potential for significant population level effects and this is considered further in the ornithological impact assessment

A total of five whimbrel observations were recorded during VP watches totalling 1,590 aggregated flight seconds, all occurring within the CRZ. Whimbrel are spring passage migrants in Ireland and all observations were limited to late April/early May, with numbers recorded ranging between 1 and 16 birds. The predicted collision risk for whimbrel based on CRM output was considered insignificant in terms of effects at the population level.

Breeding bird surveys confirmed the presence of breeding snipe within the 500 m turbine buffer during the 2019, 2020 and 2024 breeding seasons. Snipe were recorded chipping and drumming from wet grassland habitats along the margins of the Black (Shrule) River, and its tributaries, to the north and south-west of the 500 m turbine buffer. Snipe were also considered to hold breeding territories in bog habitat in the south-east of the 500 m turbine buffer. No other wader species was identified as breeding within the 500 m turbine buffer during surveys.

In the wider area, Blindwell Turlough held the greatest diversity of waders with numbers of golden plover, lapwing, curlew, black-tailed godwit and dunlin recorded. Belclare Lough held numbers of dunlin, lapwing, curlew and dunlin, while Lough Hacket held numbers of lapwing and curlew. No waders were recorded using the wetland at Lough Ballbackagh during the wider area wintering waterbird surveys. The presence of these wetland habitats in the wider area supports the usage of the proposed development site by waders during the winter months.

5.1.3 Gulls

Five species of gull were recorded during VP watches, including common gull, herring gull, lesser black-backed gull, black-headed gull and great black-backed gull. Only three of these species, great black-backed gull, herring gull and lesser black-backed gull, generated aggregated flight time of more than 400 seconds within the CRZ during a three-year period.

Lesser black-backed gull was the most frequently recorded gull species with 152 observations generating a total of 9,222 flight seconds, with 71% of the seconds occurring at CRZ. Flock size ranged from one to 30 birds, with typically observed flights involving one bird. Flight activity was considerably higher during the breeding seasons compared to the non-breeding seasons. Lesser black-backed gulls breed in Ireland, while most of the individuals migrate south during the winter. The high frequency of flights recorded in summer, mainly located in the west and south-west of the 500 m turbine buffer, suggests that there is likely breeding in the wider area. The CRM output for lesser black-backed gull predicted that there would be 0.18 collisions every year and 5.51 collisions over the 30-year lifetime of the proposed project. For this species, applying an annual adult survival rate of 0.913 (BTO BirdFacts), the additional annual mortality on the local population (estimated as 14,224 birds) due predicted collision risk is estimated to be 0.01%. Therefore, in order to have a >1% population effect turbine mediate mortality would need to be in the region of 12.37 collisions per annum. Based on Percival, (2003) this is classed as a negligible effect, with a <1% effect considered negligible. The predicted collision risk for this species based on the flight times recorded and other parameters that are included in the CRM were considered insignificant in terms of effects at the population level.

The second most recorded gull species was herring gull with a total of 22 flights recorded equating to 1,582 of flight seconds, with 97% of the seconds occurring within the CRZ. More than 90% of the flights were recorded during the 2020 breeding season. The predicted collision risk for herring gull based on CRM output was considered insignificant in terms of effects at the population level (see **Appendix XIII** for full details).

Seven great black-backed gull observations were recorded during VP watches over the three-year study period, totalling 528 flight seconds, all occurring within the CRZ. Four of these records were observed during the 2019-20 non-breeding season, including three birds in January 2020 flying within the east of the 500 m turbine buffer, and a single bird commuting in the south-west of the 500 m turbine buffer in December 2019. Two records were recorded during the 2024 breeding season. The predicted collision risk for great black-backed gull based on CRM output was considered insignificant in terms of effects at the population level (see **Appendix XIII** for full details).

Surveys indicate that gulls commute across the site, with a suggestion that lesser black-backed gull breed in the wider area, however the presence of breeding colonies in the wider area was not confirmed.

5.1.4 Other waterbirds

A total of 38 cormorant observations were recorded generating 1,838 flight seconds, with 74% of the flight seconds recorded within the CRZ. All the records, except two observations of two birds and one observation of four birds, were of single birds during the non-breeding seasons, with most flights associated with birds commuting along watercourses which traverse the 500 m turbine buffer. Three observations were recorded during the 2024 breeding season. The CRM output for cormorant predicted that there would be 0.24 collisions every year and 7.34 collisions over the 30-year lifetime of the proposed project. The predicted collision risk for cormorant based on CRM output was considered insignificant in terms of effects at the population level.

During wider area wintering waterbird surveys, cormorant observations were associated with the Black (Shrule) River and Togher River systems.

Overall, a total of 39 grey heron observations were recorded equating to 1,295 of flight seconds, with 9% of the seconds occurring within the CRZ. As for cormorant, grey heron activity was largely associated with the Black (Shrule) River and Togher River systems that occur within the 500 m turbine buffer and wider area. In addition, a total of five little egret observations were recorded during VP watches, totalling 198 flight seconds, with 40% of the flight seconds occurring within the CRZ. Also, one crane observation was recorded during the 2019 breeding season, in the western area of the 500 m turbine buffer.

5.2 Raptors

Nine species of raptor were recorded during the VP surveys within the 500 m turbine buffer including eight native species such as buzzard, golden eagle, hen harrier, kestrel, merlin, peregrine, sparrowhawk and white-tailed eagle, and one non-native species, gyrfalcon. However, only three raptor species, including buzzard, kestrel and sparrowhawk, displayed a total aggregate flight time of more than 400 seconds within the CRZ over the three-year survey period.

Kestrel was the most active raptor species within the 500 m turbine buffer with 256 flights recorded which generated 23,370 flight seconds recorded, 68% occurring within the CRZ. From all flights, 57% were recorded during the breeding seasons and the remaining 43% during the non-breeding seasons. For kestrel, the CRM output predicted that 1.30 collisions per year and 39 collisions would occur over the 30-year lifetime of the project (see **Appendix XIII** for full details). While kestrel are red-listed and despite declining numbers, this species remains a common and widespread raptor in Ireland with the national population somewhere between 9,918-17,393 pairs (Lewis *et al*. 2019a). At a national population level this magnitude of effect would be considered negligible, i.e. <1% population effect, as per Percival (2003). If considering the magnitude of the effect on the local kestrel populations (estimated as 50 birds within 10 km^2) then the magnitude of effect would be assessed as significant, with a 7% increase in annual background mortality rate due to collisions based on an annual survival rate of 0.69 (as published on BTO BirdFacts based on Village, 1990). Breeding raptor surveys identified one breeding territory within the 2 km turbine buffer, which based on the CRM would be lost to the local population because of predicted collisions. This level of predicted collision risk warrants further investigation to determine potential for significant population level effects and this is considered further in the ornithological impact assessment

A total of 115 buzzard sightings were recorded during VP watches over the three-year study period. Buzzard observations generated 11, 993 flight seconds, with 83% occurring within the CRZ. Typically, single buzzards were recorded foraging, displaying, or commuting through the 500 m turbine buffer,

with occasionally up to two birds observed simultaneously. For buzzard, based on observed flight activity within the 500 m turbine buffer, the collision risk was predicted to be 0.29 collisions per year and 9 collisions over 30 years (see **Appendix XIII** for full details). Breeding raptor surveys identified one confirmed breeding territory within the northern section of the 2 km turbine buffer where three fledging buzzards were observed on an oak tree.

A total of 58 sparrowhawk observations were recorded during VP watches conducted over the three-year study period, generating 2,683 flight seconds, with 83% occurring within the CRZ. This species tends to fly relatively low (below rotor swept height), especially when hunting. However, display flights and when commuting longer distances results in flight time within the CRZ. Almost the same number of flights were during the breeding and the non-breeding seasons. The CRM generated low levels of theoretical collision risk for sparrowhawk at 0.04 collisions per year and 1 collision over 30 years (see **Appendix XIII** for full details). It is acknowledged that the application of CRMs to smaller, evasive species like sparrowhawk may not provide an accurate estimate of collision risk, as these species can be difficult to detect over the full extent of the viewsheds for VPs, due diminutive size, cryptic nature and/or flight behaviour. While fatalities have been reported from Irish wind farm sites (Cullen and Williams, 2010), sparrowhawk is a common and widespread raptor in Ireland (8,746 – 14,252 pairs (Lewis *et al*. 2019a)). Therefore, this level of predicted collisions would be considered negligible and would not affect these species at any population level, i.e., collision mediated mortality would not add significantly (>1%) to background levels of mortality. During VP watches, a confirmed breeding territory including a sparrowhawk family of two adults and three juveniles in a nest was recorded in the south of the 500 m turbine buffer of the proposed development site. Separately, a second possible territory was recorded, where a female was observed carrying prey along a hedgerow heading to the east of the 500 m turbine buffer, likely towards the nest. A third possible territory was observed where one female was observed soaring in the north of the 500 m turbine buffer.

A total of 16 hen harrier observations were recorded equating to 637 flight seconds, with 15% of the seconds occurring within the CRZ. Only one flight was recorded during the 2019 breeding season. From the 15 remaining flights recorded during winter periods, two of these observations were made during the 2019-20 non-breeding season, six during the 2020-21 non-breeding season and seven during the 2023-24 non-breeding season. Almost half of the flights recorded during the 2020-21 winter season were recorded during a single three-hour VP watch in October 2020, which shows that usage of the site was limited and flights through the area were periodic. These results, along with results of other wider area surveys including hen harrier roost watches, suggest that flights are not associated with breeding or winter roosting sites within the 2 km buffer.

A total of nine peregrine observations were recorded generating 245 flight seconds, with 36% of the flight time occurring within the CRZ. Eight of these observations were recorded during the non-breeding season and four of which were attributable to juvenile birds. Typically, single birds were recorded hunting or travelling through the 500 m buffer. Considering this and the infrequency of flights over two years of surveys, the proposed development site does not represent a particularly important site for peregrine.

A total of 17 merlin flights were observed during VP surveys, 15 of them during the non-breeding seasons and only two flights during the breeding seasons. Separately merlin was also recorded on five occasions during winter walkover surveys. Typically, merlin occupy lower ground during the winter

months where prey is more abundant, and breed in remote upland locations. While observations are infrequent, merlin appear to be using the lands within the proposed development site to over-winter.

While there is a diverse range of raptor species that utilise the proposed development site, no breeding territories or winter roosts were confirmed within the proposed development site, represented in this report as the 500 m turbine buffer. In saying that, the lands within the site provide an important prey resource for the local raptor populations namely kestrel, and wintering populations of hen harrier and merlin.

5.3 Other species of conservation concern

5.3.1 Kingfisher

No recent records of kingfisher were found within the 10 km national grid square encompassing the proposed development site [M35] (Balmer *et al*., 2013). Although it has been reported that the River Clare *c.* 5 km east of the proposed development site, part of the Lough Corrib SAC, holds at least ten probable kingfisher territories (Cummins *et al*., 2010a) and the closest registered territory to the proposed development site is *c.* 5.8 km east at Tuam.

Suitable nesting habitat for kingfisher was identified along the Black (Shrule) River and Togher River. During breeding bird surveys across the three-year survey period, two breeding kingfisher territories were identified. One territory was located to the north of the proposed development site outside the 500 m turbine buffer along the Black (Shrule) River, and the second was within the south of 500 m turbine buffer along the Togher River. Given kingfisher is an elusive species and are territorial birds, sightings of kingfisher during the breeding season were holding breeding territory. As such any river crossings should be carefully considered during the design phase of the proposed development.

5.3.2 Red and amber-listed passerines

Meadow pipit was the one red-listed passerine of conservation concern recorded during the three-year survey period. Meadow pipit was the most abundant and widespread passerine recorded during the breeding seasons and bred within suitable open bog and grassland habitat within the 500 m turbine buffer. Nine amber-listed passerines of conservation concern were recorded during the three-year survey period and included goldcrest, greenfinch, house sparrow, linnet, skylark, willow warbler, spotted flycatcher, sand martin and swallow. These species are considered to breed within the 500 m turbine buffer in suitable habitat such as scrub, woodland, forestry, grassland, bog habitats and peat banks. Populations of red and amber-listed passerines recorded within the proposed development site are not at risk of collision with turbines but are sensitive to vegetation removal and disturbance in comparison to raptors, waders and wildfowl.

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Appendix I – National Biodiversity Data Centre (NBDC) records for national grid square M35 from 2011-2021

Common Name	Scientific Name	BoCCI status[5]	Annex I[6]	Date of last record
Barn Owl	*Tyto alba*	Red Br.		31/12/2011
Snipe	*Gallinago gallinago*	Red Br. & Win.		31/12/2011
Dunlin	*Calidris alpina*	Red Br. & Win.	Y	31/12/2011
Curlew	*Numenius arquata*	Red Br. & Win.		31/12/2011
Golden Plover	*Pluvialis apricaria*	Red Br. & Win.	Y	31/12/2011
Grey Wagtail	*Motacilla cinerea*	Red Br.		31/12/2011
Kestrel	*Falco tinnunculus*	Red Br.		31/12/2011
Meadow Pipit	*Anthus pratensis*	Red Br.		31/12/2011
Redwing	*Turdus iliacus*	Red Win.		31/12/2011
Lapwing	*Vanellus vanellus*	Red Br. & Win.		31/12/2011
Shoveler	*Anas clypeata*	Red Br. & Win.		31/12/2011
Pochard	*Aythya ferina*	Red Br. & Win.		31/12/2011
Redshank	*Tringa totanus*	Red Br. & Win.		31/12/2011
Black-headed Gull	*Larus ridibundus*	Amber Br. & Win.		31/12/2011
Pintail	*Anas acuta*	Amber Win.		31/12/2011
Swallow	*Hirundo rustica*	Amber Br.		31/12/2011
Linnet	*Carduelis cannabina*	Amber Br.		31/12/2011
Starling	*Sturnus vulgaris*	Amber Br.		31/12/2011
Greenfinch	*Carduelis chloris*	Amber Br.		31/12/2011
Teal	*Anas crecca*	Amber Br. & Win.		31/12/2011
Wigeon	*Anas penelope*	Amber Br. & Win.		31/12/2011
Gadwall	*Anas strepera*	Amber Br. & Win.		31/12/2011
Cormorant	*Phalacrocorax carbo*	Amber Br. & Win.		30/03/2010
Goldcrest	*Regulus regulus*	Amber Br.		31/12/2011
Greenland White-fronted Goose	*Anser albifrons flavirostris*	Amber Win.	Y	31/12/2011
Hen Harrier	*Circus cyaneus*	Amber Br.	Y	15/01/2022
House Martin	*Delichon urbicum*	Amber Br.		31/12/2011
House Sparrow	*Passer domesticus*	Amber Br.		31/12/2011
Mute Swan	*Cygnus olor*	Amber Br. & Win.		31/12/2011
Northern Wheatear	*Oenanthe oenanthe*	Amber Br.		31/12/2011
Sand Martin	*Riparia riparia*	Amber Br.		31/12/2011
Skylark	*Alauda arvensis*	Amber Br.		31/12/2011
Spotted Flycatcher	*Muscicapa striata*	Amber Br.		31/12/2011
Willow Warbler	*Phylloscopus trochilus*	Amber Br.		31/12/2011
Tufted Duck	*Aythya fuligula*	Amber Br. & Win.		31/12/2011
Whooper Swan	*Cygnus cygnus*	Amber Br. & Win.	Y	31/12/2011

[5] BOCCI (Gilbert, *et al.* 2021) column refers to whether conservation concern status applies to wintering (Win), breeding (Br), or passage (Pas) populations

[6] Annex I of the EU Birds Directive

Common Name	Scientific Name	BoCCI status[5]	Annex I[6]	Date of last record
Mallard	*Anas platyrhynchos*	Amber Br. & Win.		31/12/2011
Spotted Redshank	*Tringa erythropus*	Amber Pas.		31/12/2011
Magpie	*Pica pica*	Green		31/12/2011
Blackcap	*Sylvia atricapilla*	Green		05/06/2019
Blue Tit	*Cyanistes caeruleus*	Green		31/12/2011
Chaffinch	*Fringilla coelebs*	Green		31/12/2011
Coal Tit	*Periparus ater*	Green		31/12/2011
Blackbird	*Turdus merula*	Green		31/12/2011
Bullfinch	*Pyrrhula pyrrhula*	Green		31/12/2011
Buzzard	*Buteo buteo*	Green		22/12/2018
Chiffchaff	*Phylloscopus collybita*	Green		31/12/2011
Cuckoo	*Cuculus canorus*	Green		09/06/2015
Moorhen	*Gallinula chloropus*	Green		31/12/2011
Pheasant	*Phasianus colchicus*	Green		31/12/2011
Raven	*Corvus corax*	Green		31/12/2011
Whitethroat	*Sylvia communis*	Green		31/12/2011
Wood Pigeon	*Columba palumbus*	Green		31/12/2011
Collared Dove	*Streptopelia decaocto*	Green		31/12/2011
Jackdaw	*Corvus monedula*	Green		31/12/2011
Jay	*Garrulus glandarius*	Green		31/12/2011
Sparrowhawk	*Accipiter nisus*	Green		31/12/2011
Goldfinch	*Carduelis carduelis*	Green		31/12/2011
Robin	*Erithacus rubecula*	Green		31/12/2011
Fieldfare	*Turdus pilaris*	Green		31/12/2011
Great Tit	*Parus major*	Green		31/12/2011
Green-winged Teal	*Anas carolinensis*	Green		31/12/2011
Grey Heron	*Ardea cinerea*	Green		31/12/2011
Dunnock	*Prunella modularis*	Green		31/12/2011
Hooded Crow	*Corvus cornix*	Green		31/12/2011
Lesser Redpoll	*Carduelis cabaret*	Green		31/12/2011
Long-tailed Tit	*Aegithalos caudatus*	Green		31/12/2011
Mistle Thrush	*Turdus viscivorus*	Green		31/12/2011
Peregrine Falcon	*Falco peregrinus*	Green	Y	31/12/2011
Reed Bunting	*Emberiza schoeniclus*	Green		31/12/2011
Rook	*Corvus frugilegus*	Green		31/12/2011
Sedge Warbler	*Acrocephalus schoenobaenus*	Green		31/12/2011
Song Thrush	*Turdus philomelos*	Green		31/12/2011
Pied Wagtail	*Motacilla alba*	Green		31/12/2011
Wren	*Troglodytes troglodytes*	Green		31/12/2011

Appendix II – IWeBS data request for winter seasons 2016-17 to 2021-22

Year	Common name	Latin name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Subsite: Belclare Turlough- 0G393										
2016/17	Greenland White-fronted Goose	*Anser albifrons flavirostris*			27	45	45			117
2016/17	Whooper Swan	*Cygnus cygnus*					14		60	74
2016/17	Shoveler	*Anas clypeata*					2			2
2016/17	Wigeon	*Anas penelope*			95		350	8	7	460
2016/17	Mallard	*Anas platyrhynchos*			30		81	8	1	120
2016/17	Teal	*Anas crecca*			8		111	6		125
2016/17	Tufted Duck	*Aythya fuligula*						2	14	16
2016/17	Lapwing	*Vanellus vanellus*			35	250	66	12		363
2016/17	Curlew	*Numenius arquata*					80			80
2016/17	Black-headed Gull	*Larus ridibundus*					28		14	42
2019/20	Greylag Goose	*Anser anser*						15		15
2019/20	Mute Swan	*Cygnus olor*			2					2
2019/20	Whooper Swan	*Cygnus cygnus*			4				4	8
2019/20	Wigeon	*Anas penelope*	60		92		117	110	69	448
2019/20	Mallard	*Anas platyrhynchos*	261		63		74	132	24	554
2019/20	Teal	*Anas crecca*			4		20	80	8	112
2019/20	Tufted Duck	*Aythya fuligula*	5		60				32	97
2019/20	Lapwing	*Vanellus vanellus*			150		11	200		361
2019/20	Golden Plover	*Pluvialis apricaria*			10					10
2019/20	Curlew	*Numenius arquata*						50		50
2019/20	Black-headed Gull	*Larus ridibundus*	3							3
2019/20	Great Black-backed Gull	*Larus marinus*							2	2
2019/20	Lesser Black-backed Gull	*White-headed Gulls*	1		1		7	3	1	13
2019/20	Grey Heron	*Ardea cinerea*	1							1
Subsite: Blindwell Turlough (Rathbaun)- 0G394										
2016/17	Whooper Swan	*Cygnus cygnus*			50		65	12	48	175
2016/17	Shoveler	*Anas clypeata*				50	70		16	136
2016/17	Wigeon	*Anas penelope*			375	180	300		35	890
2016/17	Mallard	*Anas platyrhynchos*			300	70	60		10	440
2016/17	Teal	*Anas crecca*				15	100			115
2016/17	Tufted Duck	*Aythya fuligula*				15	50		30	95
2019/20	Mute Swan	*Cygnus olor*			1		3			4
2019/20	Whooper Swan	*Cygnus cygnus*			2			5	38	45
2019/20	Wigeon	*Anas penelope*			15		15	111	80	221
2019/20	Mallard	*Anas platyrhynchos*	5		10			3	50	68
2019/20	Tufted Duck	*Aythya fuligula*	34				8	81	55	178
2019/20	Black-headed Gull	*Larus ridibundus*						14	14	28
Subsite: Clare River Callows (Cloonkeen)- 0G396										
2017/18	Whooper Swan	*Cygnus cygnus*				10				10
2017/18	Golden Plover	*Pluvialis apricaria*				120				120
2018/19	Whooper Swan	*Cygnus cygnus*							7	7
2018/19	Mallard	*Anas platyrhynchos*							2	2
2018/19	Lapwing	*Vanellus vanellus*							2	2
2018/19	Black-headed Gull	*Larus ridibundus*					10			10
2018/19	Common Gull	*Larus canus*							4	4

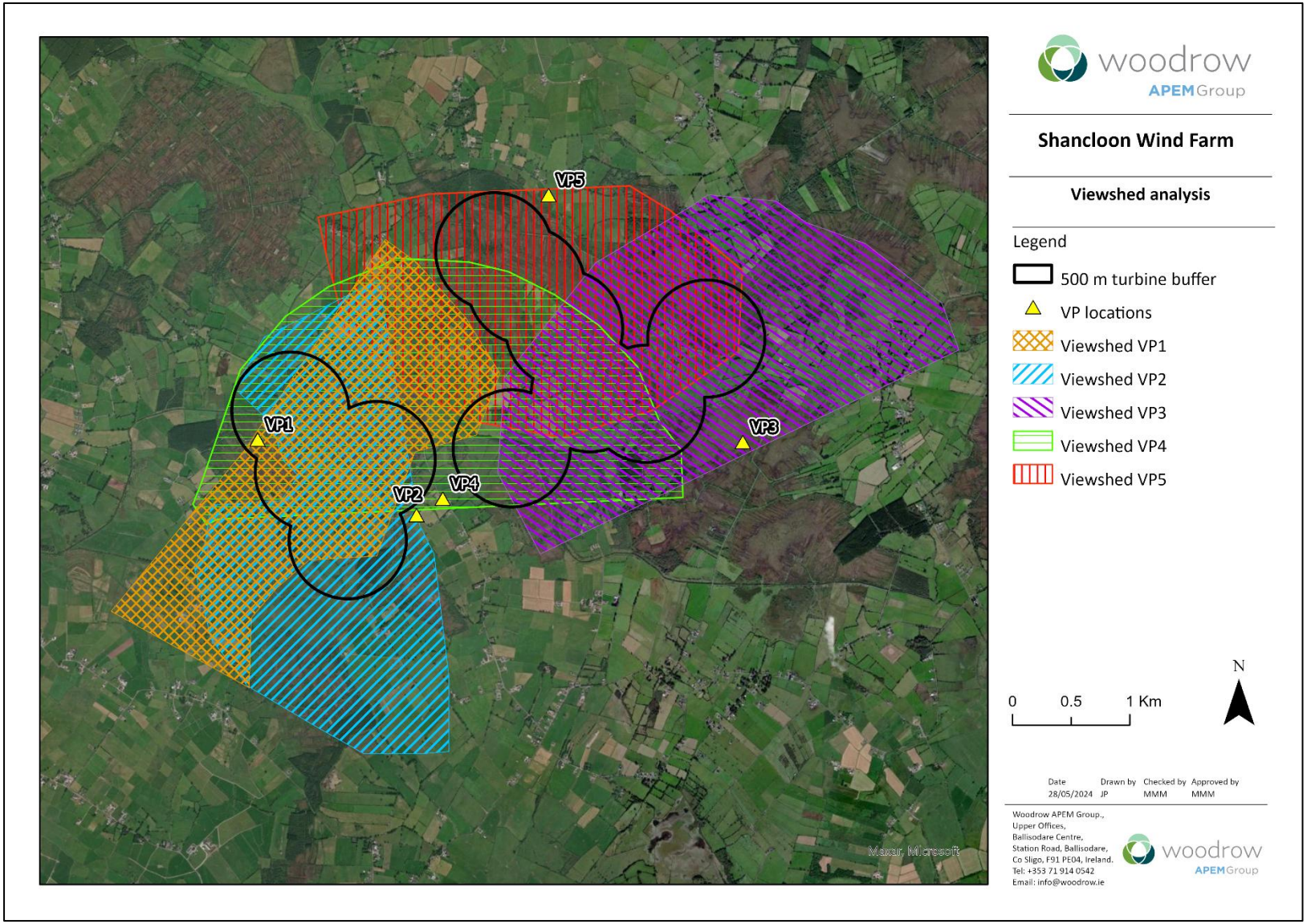
Year	Common name	Latin name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2018/19	Lesser Black-backed Gull	*White-headed Gulls*							18	18
2018/19	Little Egret	*Egretta garzetta*							1	1
2019/20	Whooper Swan	*Cygnus cygnus*			8					8
2019/20	Lapwing	*Vanellus vanellus*		44			22		3	69
2019/20	Great Black-backed Gull	*Larus marinus*			1		6			7
2019/20	Grey Heron	*Ardea cinerea*							1	1
2020/21	Mute Swan	*Cygnus olor*			2					2
2020/21	Whooper Swan	*Cygnus cygnus*			4					4
2020/21	Mallard	*Anas platyrhynchos*			2					2
2020/21	Lapwing	*Vanellus vanellus*			200					200
2020/21	Black-headed Gull	*Larus ridibundus*	1							1
2020/21	Cormorant	*Phalacrocorax carbo*				2	4			6
Subsite: Corafin - 0GS40										
2017/18	Golden Plover	*Pluvialis apricaria*						50		50
2018/19	Black-headed Gull	*Larus ridibundus*				6	4			10
2018/19	Herring Gull	*Larus argentatus*						2		2
2019/20	Whooper Swan	*Cygnus cygnus*							20	20
2019/20	Black-headed Gull	*Larus ridibundus*						5		5
2019/20	Great Black-backed Gull	*Larus marinus*				1			2	3
2020/21	Whooper Swan	*Cygnus cygnus*				2	1			3
2020/21	Lapwing	*Vanellus vanellus*				80		30		110
Subsite: Gardenfield Turlough - 0G392										
2016/17	Mute Swan	*Cygnus olor*							1	1
2016/17	Whooper Swan	*Cygnus cygnus*			5	8	2	2		17
2016/17	Wigeon	*Anas penelope*				12				12
2016/17	Little Egret	*Egretta garzetta*				2				2
2019/20	Greylag Goose	*Anser anser*						350		350
2019/20	Mute Swan	*Cygnus olor*	3				2			5
2019/20	Whooper Swan	*Cygnus cygnus*			3		4		10	17
2019/20	Mallard	*Anas platyrhynchos*							2	2
2019/20	Lapwing	*Vanellus vanellus*			200					200
2019/20	Golden Plover	*Pluvialis apricaria*					400	400		800
2019/20	Black-headed Gull	*Larus ridibundus*	20						3	23
2019/20	Lesser Black-backed Gull	*White-headed Gulls*							2	2
Subsite: Greaghans- 0DS11										
2016/17	Greylag Goose	*Anser anser*					3	110	2	115
2016/17	Greenland White-fronted Goose	*Anser albifrons flavirostris*						55		55
2016/17	Mute Swan	*Cygnus olor*						2		2
2016/17	Whooper Swan	*Cygnus cygnus*					12		34	46
2016/17	Shoveler	*Anas clypeata*			3	50	8	50	25	136
2016/17	Wigeon	*Anas penelope*			97	200	55	180	30	562
2016/17	Mallard	*Anas platyrhynchos*			10	30	4	45		89
2016/17	Teal	*Anas crecca*			20	20				40
2016/17	Tufted Duck	*Aythya fuligula*					9	30	32	71

Year	Common name	Latin name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2016/17	Red-breasted Merganser	*Mergus serrator*							1	1
2016/17	Lapwing	*Vanellus vanellus*			70	160	42	300		572
2016/17	Curlew	*Numenius arquata*					6			6
2016/17	Black-headed Gull	*Larus ridibundus*					25	15	120	160
2016/17	Lesser Black-backed Gull	*White-headed Gulls*							2	2
2016/17	Grey Heron	*Ardea cinerea*			1					1
2019/20	Light-bellied Brent Goose	*Branta bernicla hrota*							12	12
2019/20	Greylag Goose	*Anser anser*						26		26
2019/20	Mute Swan	*Cygnus olor*			11			2	1	14
2019/20	Whooper Swan	*Cygnus cygnus*			3				3	6
2019/20	Shoveler	*Anas clypeata*			50			4	34	88
2019/20	Wigeon	*Anas penelope*	40		80		110	20	40	290
2019/20	Mallard	*Anas platyrhynchos*	20		55		6	12	30	123
2019/20	Teal	*Anas crecca*					20			20
2019/20	Tufted Duck	*Aythya fuligula*			20		25	12	20	77
2019/20	Lapwing	*Vanellus vanellus*							10	10
2019/20	Golden Plover	*Pluvialis apricaria*					30			30
2019/20	Curlew	*Numenius arquata*	15					30		45
2019/20	Black-headed Gull	*Larus ridibundus*							100	100
2019/20	Lesser Black-backed Gull	*White-headed Gulls*	2							2
Subsite: Kilbenan- 0G370										
2018/19	Black-headed Gull	*Larus ridibundus*							10	10
2018/19	Common Gull	*Larus canus*			5					5
2019/20	Whooper Swan	*Cygnus cygnus*					1			1
2019/20	Common Gull	*Larus canus*							4	4
2019/20	Great Black-backed Gull	*Larus marinus*							2	2
2020/21	Black-headed Gull	*Larus ridibundus*			7					7
Subsite: Kilglassan Turlough- 0D314										
2016/17	Greylag Goose	*Anser anser*			19					19
2016/17	Mute Swan	*Cygnus olor*			1	1	3			5
2016/17	Whooper Swan	*Cygnus cygnus*			4		39	46	45	134
2016/17	Shoveler	*Anas clypeata*				20	18	37	11	86
2016/17	Wigeon	*Anas penelope*			200	363	107	170	96	936
2016/17	Mallard	*Anas platyrhynchos*				12	62	37	14	125
2016/17	Teal	*Anas crecca*				5	30	50	39	124
2016/17	Tufted Duck	*Aythya fuligula*					9		18	27
2016/17	Lapwing	*Vanellus vanellus*				170	42	50	50	312
2016/17	Golden Plover	*Pluvialis apricaria*				500				500
2016/17	Curlew	*Numenius arquata*			1	130	6			137
2016/17	Black-headed Gull	*Larus ridibundus*					25			25
2016/17	Lesser Black-backed Gull	*White-headed Gulls*							5	5
2016/17	Grey Heron	*Ardea cinerea*				1				1
2019/20	Mute Swan	*Cygnus olor*	36		3		13	4	12	68
2019/20	Whooper Swan	*Cygnus cygnus*			26		18	18	36	98
2019/20	Shoveler	*Anas clypeata*	2		0			10	16	28

Year	Common name	Latin name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2019/20	Wigeon	*Anas penelope*	49		265		100	327	124	865
2019/20	Mallard	*Anas platyrhynchos*	25		80		25	52	35	217
2019/20	Teal	*Anas crecca*			107			11	12	130
2019/20	Tufted Duck	*Aythya fuligula*	34		65		2	57	130	288
2019/20	Lapwing	*Vanellus vanellus*	20		60		60	20		160
2019/20	Curlew	*Numenius arquata*			35		22	91		148
2019/20	Redshank	*Tringa totanus*							2	2
2019/20	Black-headed Gull	*Larus ridibundus*						2	84	86
2019/20	Grey Heron	*Ardea cinerea*			1			2	1	4
Subsite: Rostaff Lake- 0D305										
2016/17	Greylag Goose	*Anser anser*	5	45			3	1		54
2016/17	Whooper Swan	*Cygnus cygnus*		8		8	10			26
2016/17	Shoveler	*Anas clypeata*		10	5				6	21
2016/17	Wigeon	*Anas penelope*	4	60	150	40	330		100	684
2016/17	Mallard	*Anas platyrhynchos*	15	90	1				10	116
2016/17	Teal	*Anas crecca*			30					30
2016/17	Pochard	*Aythya ferina*			9	4		3		16
2016/17	Tufted Duck	*Aythya fuligula*			10	2	30	3	4	49
2016/17	Lapwing	*Vanellus vanellus*		70				29	6	105
2016/17	Curlew	*Numenius arquata*	30	34		30	70	40		204
2016/17	Black-headed Gull	*Larus ridibundus*				60	50	120		230
2016/17	Common Gull	*Larus canus*						200	400	600
2016/17	Cormorant	*Phalacrocorax carbo*			6	4	3	5	1	19
2016/17	Grey Heron	*Ardea cinerea*	1						1	2
2017/18	Greylag Goose	*Anser anser*		2						2
2017/18	Mute Swan	*Cygnus olor*	1	1					2	4
2017/18	Whooper Swan	*Cygnus cygnus*		9	6	7		14	8	44
2017/18	Shoveler	*Anas clypeata*		18	60	6	21	15	20	140
2017/18	Wigeon	*Anas penelope*		142	68	100	280	366	30	986
2017/18	Mallard	*Anas platyrhynchos*			12	20	6	1	9	48
2017/18	Teal	*Anas crecca*		30		10	80	40	15	175
2017/18	Pochard	*Aythya ferina*			16	10				26
2017/18	Tufted Duck	*Aythya fuligula*		4	34	25	43	21	21	148
2017/18	Moorhen	*Gallinula chloropus*				1				1
2017/18	Lapwing	*Vanellus vanellus*		15			40	33	5	93
2017/18	Curlew	*Numenius arquata*		70	2	10	140	40	10	272
2017/18	Black-headed Gull	*Larus ridibundus*		26				47		73
2017/18	Common Gull	*Larus canus*						35	140	175
2017/18	Ring-billed Gull	*Ring-billed Gull*					6			6
2017/18	Great Black-backed Gull	*Larus marinus*			2			1		3
2017/18	Cormorant	*Phalacrocorax carbo*		2	4		1	2	1	10
2018/19	Greylag Goose	*Anser anser*		3	170					173
2018/19	Mute Swan	*Cygnus olor*		3						3
2018/19	Whooper Swan	*Cygnus cygnus*					2			2
2018/19	Shoveler	*Anas clypeata*			11		20	10	43	84
2018/19	Wigeon	*Anas penelope*		30	225		131	450	344	1180
2018/19	Mallard	*Anas platyrhynchos*	2				14			16
2018/19	Teal	*Anas crecca*			8			7		15
2018/19	Pochard	*Aythya ferina*			7			1		8

Year	Common name	Latin name	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
2018/19	Tufted Duck	*Aythya fuligula*	4	2	68		17	4	4	99
2018/19	Lapwing	*Vanellus vanellus*		80	190				3	273
2018/19	Curlew	*Numenius arquata*	30	15	11		59	80		195
2018/19	Black-headed Gull	*Larus ridibundus*		54	33			50		137
2018/19	Common Gull	*Larus canus*						350		350
2018/19	Glaucous Gull	*Larus hyperboreus*						1		1
2018/19	Cormorant	*Phalacrocorax carbo*	2	2	4		2			10
2018/19	Grey Heron	*Ardea cinerea*		1						1
2018/19	Little Egret	*Egretta garzetta*							1	1
2019/20	Unidentified duck	*#N/A*			200					200
2019/20	Greylag Goose	*Anser anser*		5						5
2019/20	Mute Swan	*Cygnus olor*	2							2
2019/20	Whooper Swan	*Cygnus cygnus*						16		16
2019/20	Shoveler	*Anas clypeata*	6	10	60	50	56	17	20	219
2019/20	Gadwall	*Anas strepera*					25			25
2019/20	Wigeon	*Anas penelope*		38	130	30	200	285	300	983
2019/20	Mallard	*Anas platyrhynchos*	33	6			3	2		44
2019/20	Teal	*Anas crecca*		15			6	8		29
2019/20	Pochard	*Aythya ferina*			7	2	2			11
2019/20	Tufted Duck	*Aythya fuligula*	6	30		30	50	7	3	126
2019/20	Scaup	*Anas marila*					3			3
2019/20	Great Crested Grebe	*Podiceps cristatus*					1			1
2019/20	Lapwing	*Vanellus vanellus*		20		450	70	5	3	548
2019/20	Golden Plover	*Pluvialis apricaria*				300				300
2019/20	Curlew	*Numenius arquata*	60	64	1		1	11		137
2019/20	Black-headed Gull	*Larus ridibundus*			163	30			96	289
2019/20	Common Gull	*Larus canus*						400	190	590
2019/20	Herring Gull	*Larus argentatus*					4			4
2019/20	Cormorant	*Phalacrocorax carbo*		2	2		2	1	1	8
2019/20	Grey Heron	*Ardea cinerea*	1				1			2
2020/21	Greylag Goose	*Anser anser*				50				50
2020/21	Whooper Swan	*Cygnus cygnus*		9						9
2020/21	Shoveler	*Anas clypeata*		42		50				92
2020/21	Wigeon	*Anas penelope*	32	88		80				200
2020/21	Mallard	*Anas platyrhynchos*	36	24						60
2020/21	Teal	*Anas crecca*		15						15
2020/21	Pochard	*Aythya ferina*		1						1
2020/21	Tufted Duck	*Aythya fuligula*	7	5						12
2020/21	Coot	*Fulica atra*	1							1
2020/21	Great Crested Grebe	*Podiceps cristatus*	1	1						2
2020/21	Lapwing	*Vanellus vanellus*	10	23						33
2020/21	Curlew	*Numenius arquata*	1	6		20				27
2020/21	Cormorant	*Phalacrocorax carbo*		3		2				5
2020/21	Grey Heron	*Ardea cinerea*	1	2						3
2020/21	Little Egret	*Egretta garzetta*				1				1

Appendix III – Vantage Point (VP) viewshed analysis



Appendix IV – Vantage point watches effort table

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2019	30/03/2019	5	1.00	10:33	RW	4	SW	Moderate	8	14	Drizzle
Breeding 2019	17/04/2019	1	2.75	10:30	RW	3	SE	Good	8	10	None
Breeding 2019	17/04/2019	2	2.25	13:45	RW	3	SE	Good	7	14	None
Breeding 2019	17/04/2019	3	1.67	13:56	MT	3	SE	Good	5-7	12-14	Dry
Breeding 2019	17/04/2019	3	1.00	16:45	MT	2-3	SE	Good	5	14	Dry
Breeding 2019	17/04/2019	4	1.50	16:24	RW	2-3	SE	Good	3-5	14	
Breeding 2019	17/04/2019	5	1.00	11:47	MT	2-3	SE	Good	8	11-12	Dry
Breeding 2019	18/04/2019	1	4.00	10:30	KW	2-4	SE	Good	2-8	13-16	None
Breeding 2019	18/04/2019	2	4.00	15:30	KW	1-3	SE	Good	1-4	13-17	None
Breeding 2019	18/04/2019	4	3.00	14:07	RW	3	SE	Good	2	14-15	None
Breeding 2019	18/04/2019	5	3.00	10:51	RW	4	SE	Good	2	14-15	None
Breeding 2019	19/04/2019	3	3.00	07:15	KW	1	SE	Good	2-7	15-18	None
Breeding 2019	19/04/2019	5	3.00	10:43	KW	3	SE	Good	7-8	18-20	None
Breeding 2019	24/04/2019	1	3.00	09:00	KW	2-3	E	Good	8	10-11	Showers
Breeding 2019	24/04/2019	2	3.00	12:00	HD	2-3	E	Good	8	15	None
Breeding 2019	24/04/2019	3	3.00	12:20	KW	3-4	E/SE	Good	8	12-13	Light shower
Breeding 2019	24/04/2019	4	3.00	09:00	HD	2	E	Good-Moderate	8	14	Light drizzle
Breeding 2019	25/04/2019	5	2.50	10:30	KW	2	SE	Good	3-5	20-21	None
Breeding 2019	25/04/2019	5	1.00	13:00	HD	2	SE	Good	6	14	None
Breeding 2019	30/04/2019	1	2.50	16:10	HD	3-4	SW	Good	2-4	12-10	None
Breeding 2019	30/04/2019	2	2.75	12:15	HD	3-4	W	Good	4-5	12	None
Breeding 2019	30/04/2019	4	3.75	15:30	HD	3	W	Good	3-5	12	None
Breeding 2019	30/04/2019	5	3.50	12:15	HD	3-4	SW	Good	5	13-12	None
Breeding 2019	01/05/2019	3	3.00	08:30	HD	2-3	W	Good	5-8	12	Light shower
Breeding 2019	01/05/2019	4	3.50	12:30	HD	4-5	W	Good-Moderate	7-8	12	Showers
Breeding 2019	08/05/2019	2	3.00	13:15	HD	3-4	NE	Good	6-8	11	Mostly dry
Breeding 2019	08/05/2019	4	3.00	16:30	HD	4	NE	Good	6-8	10	None
Breeding 2019	23/05/2019	1	3.00	13:30	RW	2-3	W	Good	4-5	10-12	None
Breeding 2019	24/05/2019	4	3.00	11:02	RW	4	SW	Good	4	10-11	None
Breeding 2019	28/05/2019	2	3.00	13:30	KW	1-3	W/NW	Good	4-6	15	None
Breeding 2019	30/05/2019	1	2.75	11:40	RW	4	SW	Moderate	8	14	Persistent
Breeding 2019	30/05/2019	3	3.33	14:42	RW	3	SW	Moderate	8	14	Persistent
Breeding 2019	07/06/2019	1	3.00	08:57	RW	1	SW	Good	7	11	None
Breeding 2019	07/06/2019	3	3.00	12:14	RW	2	WNW	Good	7	11	Dry

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2019	11/06/2019	2	3.00	12:00	KW	3-4	N	Good	6-8	12-14	None
Breeding 2019	11/06/2019	4	3.00	15:10	KW	4	N	Good	4-8	15	None
Breeding 2019	11/06/2019	5	3.00	12:20	HD	3-4	N	Good	7	16	None
Breeding 2019	17/06/2019	1	3.00	14:00	KW	3-4	SW	Good	7-8	16	Shower
Breeding 2019	17/06/2019	4	2.25	17:10	KW	3-4	SW	Good	7-8	15	None
Breeding 2019	27/06/2019	2	3.00	16:30	KW	2-3	E	Good	0-2	25-26	None
Breeding 2019	27/06/2019	5	3.00	13:00	KW	3-5	E	Good	1-4	23-25	None
Breeding 2019	28/06/2019	3	3.00	12:00	KW	3-4	SE	Good	8	20	None
Breeding 2019	01/07/2019	1	3.00	13:30	KW	2-3	NW	Good	5-8	19-21	None
Breeding 2019	01/07/2019	4	3.00	16:45	KW	2	NW	Good	1-6	18-19	None
Breeding 2019	11/07/2019	2	3.00	13:00	KW	3	W	Good	6-8	19	None
Breeding 2019	11/07/2019	5	3.00	16:15	KW	2-3	W	Good	4-8	22-24	Showers
Breeding 2019	12/07/2019	3	3.00	06:45	KW	0-3	NW	Good-Moderate	6-8	12-15	Mist
Breeding 2019	12/07/2019	4	3.00	10:15	KW	2	NW	Good	6-8	17-18	None
Breeding 2019	19/07/2019	1	3.00	11:00	KW	1-3	E	Good-Moderate	8	19-20	Heavy showers
Breeding 2019	25/07/2019	3	3.00	08:42	RW	0-3	NW	Good	6-8	14	Light drizzle
Breeding 2019	30/07/2019	2	3.00	12:30	KW	3	NW	Good	4-7	17-18	Llight showers
Breeding 2019	30/07/2019	3	3.00	07:30	KW	2	N/NW	Good	7	12-14	None
Breeding 2019	30/07/2019	5	3.00	12:15	HD	4	NW	Good	5-7	18	None
Breeding 2019	09/08/2019	1	3.00	07:00	KW	2	SE	Good	3-8	12-16	Shower
Breeding 2019	09/08/2019	4	3.00	10:30	KW	2-4	SSE	Good	6-8	19-22	Showers, one heavy
Breeding 2019	17/08/2019	2	2.00	09:00	KW	3-5	SW	Good	2-5	15-16	None
Breeding 2019	17/08/2019	3	2.00	06:45	KW	1-2	SW	Good	1-3	13-15	None
Breeding 2019	17/08/2019	5	2.00	11:15	KW	4-5	SW	Good	3-8	16-17	Showers
Breeding 2019	22/08/2019	1	3.00	10:00	KW	3-4	SW	Good-Moderate	8	19-20	Showers
Breeding 2019	22/08/2019	3	2.00	18:15	KW	3-4	SW	Good	6-8	17-19	None
Breeding 2019	22/08/2019	4	3.00	14:00	KW	4-5	SW	Good	8	20-21	None
Breeding 2019	23/08/2019	2	2.00	07:45	KW	3	S	Good	6-8	14-16	None
Breeding 2019	23/08/2019	5	2.00	10:15	KW	2-3	S	Good	5-7	18-19	None
Breeding 2019	05/09/2019	3	2.00	18:00	KW	3-4	SW	Good	2-6	14-15	None
Breeding 2019	06/09/2019	2	2.00	08:15	KW	1-3	W	Good	5-7	14	None
Breeding 2019	06/09/2019	5	2.00	10:30	KW	3-4	W	Good	4-7	15-16	None
Non-breeding 2019-20	24/09/2019	1	1.00	16:05	MH	3	SSE	Good	7-8	15	None
Non-breeding 2019-20	25/09/2019	1	2.00	07:35	MH	2-3	SW-SSW	Good	7-8	12-15	None
Non-breeding 2019-20	25/09/2019	3	3.00	13:00	MH	2-4	SSW	Good	8	15	Drizzly showers
Non-breeding 2019-20	25/09/2019	4	3.00	09:45	MH	3-4	SW	Good	7-8	15	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2019-20	26/09/2019	2	3.00	11:15	MH	4-5	SW	Good	7-8	15	Showers
Non-breeding 2019-20	26/09/2019	5	3.00	08:05	MH	4	SW	Good	6-8	13	Showers
Non-breeding 2019-20	04/10/2019	1	3.00	11:15	KW	3-4	WNW	Good	4-8	16	None
Non-breeding 2019-20	04/10/2019	3	3.00	07:45	KW	4-6	WNW	Good-Moderate	7-8	14	Shower
Non-breeding 2019-20	07/10/2019	4	3.00	15:00	MH	5	SW	Good	3-7	13-15	Light rain 1706-1715
Non-breeding 2019-20	08/10/2019	1	3.00	13:15	MH	5	WSW	Good	6	12	Heavy showers
Non-breeding 2019-20	08/10/2019	3	3.00	08:25	MH	5	SW	Good	4-6	11-12	Occasional showers
Non-breeding 2019-20	09/10/2019	2	3.00	07:20	MH	1-3	WSW-SW	Good	4-7	8-9	Isolated shower
Non-breeding 2019-20	09/10/2019	5	2.00	17:10	MH	4	W	Good	6-8	11	Heavy showers
Non-breeding 2019-20	10/10/2019	5	1.00	16:15	MH	6	SW	Good	8	13	Shower
Non-breeding 2019-20	11/10/2019	2	3.00	07:30	KW	1	SW	Good	3-5	7-9	Light shower
Non-breeding 2019-20	11/10/2019	5	3.00	11:00	KW	1-4	SW	Good-Moderate	4-7	12	Showers
Non-breeding 2019-20	06/11/2019	2	2.50	14:55	MH	2	S-SSW	Good	8	6	Showers
Non-breeding 2019-20	06/11/2019	4	3.00	07:20	MH	0-1	SSE	Good	7-8	4	Some rain after 0907
Non-breeding 2019-20	06/11/2019	5	2.00	10:35	MH	2	SSE	Good	8	5	After 1208
Non-breeding 2019-20	12/11/2019	1	1.50	09:00	MH	2	NW	Good	2-8	5	None
Non-breeding 2019-20	12/11/2019	4	3.00	07:55	MH	2	W	Good	5	6	None
Non-breeding 2019-20	18/11/2019	3	3.00	10:15	KW	1	SW	Good	6-8	1-4	None
Non-breeding 2019-20	18/11/2019	5	3.00	13:45	KW	1-2	SW	Good	4-8	5-6	None
Non-breeding 2019-20	21/11/2019	1	2.00	09:15	KW	2	E	Good-Moderate	8	6-7	Persistent rain
Non-breeding 2019-20	21/11/2019	2	2.00	11:30	KW	2	E	Good-Moderate	8	6-8	Persistent to intermittent
Non-breeding 2019-20	21/11/2019	4	2.00	14:00	KW	2	E	Good-Moderate	8	7	Persistent light rain
Non-breeding 2019-20	27/11/2019	1	2.50	07:45	KW	1	N	Good	5-8	6-9	None
Non-breeding 2019-20	27/11/2019	3	3.00	10:45	KW	1-2	N	Good	6-8	7-8	Light mist (5 mins)
Non-breeding 2019-20	27/11/2019	4	3.00	14:00	KW	1-2	N	Good	5-8	5-7	None
Non-breeding 2019-20	02/12/2019	4	3.00	13:50	MH	2	SW	Good	7	7	None
Non-breeding 2019-20	04/12/2019	1	2.50	10:50	MH	2	WSW	Good	1-2	9	None
Non-breeding 2019-20	04/12/2019	2	2.00	07:05	MH	1	WSW	Good	2-8	7	Brief light rain
Non-breeding 2019-20	04/12/2019	3	3.00	13:55	MH	2	WSW	Good	1-4	8	Light rain
Non-breeding 2019-20	05/12/2019	5	1.00	10:20	MH	5	SSW	Good	8	10	None
Non-breeding 2019-20	07/12/2019	1	3.00	13:55	MH	5	SW	Good	4-8	11	Light rain after 1540
Non-breeding 2019-20	07/12/2019	3	3.00	08:00	MH	4	SW	Good	8	10	Drizzly showers
Non-breeding 2019-20	07/12/2019	5	2.00	11:40	MH	5	SSW	Good	7-8	10	None
Non-breeding 2019-20	08/12/2019	2	3.00	13:45	MH	5-6	WSW	Good	6-8	7	Showers
Non-breeding 2019-20	08/12/2019	4	3.00	10:20	MH	5	WSW	Good	5	7	Showers

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2019-20	08/12/2019	5	1.00	08:05	MH	5	SW	Good	5-8	5	None
Non-breeding 2019-20	12/12/2019	2	3.00	11:00	MH	3	WSW	Good	5	9	Light showers
Non-breeding 2019-20	12/12/2019	5	1.50	14:15	MH	2	WSW	Good	8	7	Showers
Non-breeding 2019-20	06/01/2020	2	1.50	13:20	MH	4	WSW	Good	2-4	10 - 9	Passing light shower
Non-breeding 2019-20	06/01/2020	4	2.00	15:05	MH	3	WSW	Good	1-4	8 -7	None
Non-breeding 2019-20	07/01/2020	3	1.00	16:05	MH	5	SW	Good	7-8	12 - 11	Passing light shower
Non-breeding 2019-20	07/01/2020	5	1.50	08:15	MH	5	SSW	Good	8	11	Periods of rain
Non-breeding 2019-20	09/01/2020	1	3.00	09:30	KW	0-1	E	Good-Moderate	6-8	-1-2	None
Non-breeding 2019-20	10/01/2020	2	3.00	12:15	KW	4-5	S	Good	6-8	8-9	None-persistent
Non-breeding 2019-20	10/01/2020	3	3.00	08:45	KW	3-4	S	Good	3-6	3-8	None
Non-breeding 2019-20	15/01/2020	1	3.00	13:45	KW	4-5	SW	Good	4-5	7-8	Light shower
Non-breeding 2019-20	15/01/2020	3	2.00	08:10	MH	4-5	SW	Good	3-6	5	Passing showers before 0844
Non-breeding 2019-20	15/01/2020	5	1.00	14:50	MH	5	SW	Good	5-8	7	Passing shower
Non-breeding 2019-20	16/01/2020	1	0.50	15:02	MH	5	SW	Good	3-4	8	None
Non-breeding 2019-20	16/01/2020	2	1.50	10:20	MH	5-6	SSE	Good	8	9	Light passing showers
Non-breeding 2019-20	16/01/2020	4	2.00	08:10	MH	4-5	SE-SSE	Good	8	9	Showers
Non-breeding 2019-20	16/01/2020	5	2.00	13:00	MH	4-5	SW	Good	4-8	8	Brief passing shower
Non-breeding 2019-20	27/01/2020	1	3.00	13:45	KW	1-4	SW	Good-Poor	6-8	4-0	Snow showers
Non-breeding 2019-20	27/01/2020	4	3.00	10:15	KW	1-3	SW	Good-Moderate	7-8	4	Showers and hail
Non-breeding 2019-20	28/01/2020	2	3.00	10:15	KW	2-4	W	Good	4-8	2-5	Showers
Non-breeding 2019-20	28/01/2020	3	3.00	13:45	KW	2-4	W	Good-Moderate	5-8	4-5	Showers
Non-breeding 2019-20	30/01/2020	5	3.00	08:45	KW	3-5	SW	Good-Moderate	7-8	8-11	Mist
Non-breeding 2019-20	03/02/2020	1	3.00	14:25	KW	4	W	Good	4	6	None
Non-breeding 2019-20	04/02/2020	2	1.00	16:45	KW	3	W	Good	2	9	None
Non-breeding 2019-20	06/02/2020	5	3.00	13:15	MH	4	SE	Good	6	8	None
Non-breeding 2019-20	08/02/2020	2	2.00	08:05	KW	5	SSW	Good	6	5	Showers
Non-breeding 2019-20	08/02/2020	3	3.00	14:25	MH	5	SSW	Good	7	7	Showers
Non-breeding 2019-20	09/02/2020	5	3.00	13:00	KW	1	SW	Good	8	2-3	None
Non-breeding 2019-20	13/02/2020	1	3.00	13:00	KW	2-3	N	Good	2-8	6-7	None
Non-breeding 2019-20	13/02/2020	4	3.00	09:30	KW	2-3	NW/N	Good-Moderate	3-8	2-4	Light mist
Non-breeding 2019-20	24/02/2020	2	3.00	16:15	KW	0-1	N-NE	Good	3-5	2	None
Non-breeding 2019-20	27/02/2020	2	2.00	09:00	KW	1-2	NW-WNW	Good	2-4	0-4	None
Non-breeding 2019-20	27/02/2020	3	3.00	11:15	KW	2-5	WNW-W	Good	2-5	5-7	None
Non-breeding 2019-20	27/02/2020	5	3.00	14:45	KW	2-3	W	Good	3-7	7-9	None
Non-breeding 2019-20	28/02/2020	1	1.00	09:00	KW	0-2	W	Good	5-7	1	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2020	21/04/2020	3	2.00	12:10	JK	4	E	Good	5	12	None
Breeding 2020	21/04/2020	4	2.00	09:30	JK	5	E	Good	5	9	None
Breeding 2020	21/04/2020	5	2.00	14:50	JK	4	SE	Good	5	18	None
Breeding 2020	22/04/2020	3	2.00	11:00	JK	4	E-SE	Good	5	10	None
Breeding 2020	22/04/2020	4	2.00	13:30	JK	4	E-SE	Good	5	14	None
Breeding 2020	22/04/2020	5	2.00	16:00	JK	4	E	Good	5	17	None
Breeding 2020	24/04/2020	1	3.00	12:15	KW	2	NE	Good	4-7	12-2	None
Breeding 2020	24/04/2020	2	3.00	08:45	KW	1	NE	Good	6-7	5-9	None
Breeding 2020	24/04/2020	2	3.00	16:15	KW	0-1	N-NE	Good	3-5	20	None
Breeding 2020	25/04/2020	1	3.00	08:00	KW	1	N	Good	0-1	9-22	None
Breeding 2020	28/04/2020	3	2.00	10:10	JK	4	SE	Good	5	10	None
Breeding 2020	28/04/2020	4	2.00	12:40	JK	4	SW	Good	5	13	None
Breeding 2020	28/04/2020	5	2.00	15:15	JK	4	S-SW	Good	5	15	None
Breeding 2020	29/04/2020	3	2.00	10:30	JK	4	SE	Good	6-7	8	None
Breeding 2020	29/04/2020	3	3.00	19:30	KW	1	NE	Good-Moderate	7	7-10	Shower
Breeding 2020	29/04/2020	4	2.00	13:00	JK	4	S-SE	Good	6-7	11	None
Breeding 2020	29/04/2020	5	2.00	15:20	JK	4	W-SW	Good	5-6	12	None
Breeding 2020	30/04/2020	1	3.00	13:20	JK	4	NW	Good	6-7	11	None
Breeding 2020	30/04/2020	2	3.00	09:50	JK	4	W-NW	Good	5-6	9	None
Breeding 2020	30/04/2020	5	3.00	19:30	KW	1-2	NW	Good	1-6	5-9	None
Breeding 2020	12/05/2020	3	3.00	10:45	JK	5	NW	Good	5-6	9	None
Breeding 2020	12/05/2020	5	3.00	14:15	JK	5	NW	Good	5-6	12	None
Breeding 2020	14/05/2020	4	3.00	10:30	JK	5	NW	Good	3	11-15	None
Breeding 2020	14/05/2020	4	3.00	14:00	JK	5	NW	Good	3	15	None
Breeding 2020	15/05/2020	1	3.00	10:45	JK	5	NW	Good	5-6	11	None
Breeding 2020	15/05/2020	2	3.00	14:30	JK	5	NW	Good	5-6	14	None
Breeding 2020	27/05/2020	3	3.00	10:15	JK	5	SE	Good	4	22	None
Breeding 2020	27/05/2020	5	3.00	13:45	JK	5	S-SE	Good	4	24	None
Breeding 2020	28/05/2020	1	3.00	19:00	KW	4	SE	Good	3-5	25	None
Breeding 2020	28/05/2020	2	3.00	10:00	KW	2	SE	Good	2-3	20-24	None
Breeding 2020	29/05/2020	3	3.00	13:45	JK	6	S-SE	Good	4	25	None
Breeding 2020	29/05/2020	5	3.00	10:20	JK	6	S-SE	Good	4	20	None
Breeding 2020	07/06/2020	1	3.00	11:00	TK	2-3	NNW-NW	Good	8	13-15	None
Breeding 2020	07/06/2020	2	3.00	14:30	TK	3	N	Good	8	13-15	None
Breeding 2020	12/06/2020	3	3.00	11:00	TK	4	NE	Good	8	14-15	None
Breeding 2020	12/06/2020	4	3.00	14:45	TK	4	NE	Good	8	15-16	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2020	12/06/2020	5	3.00	12:15	JK	7-8	NE	Good	5-6	16	None
Breeding 2020	18/06/2020	5	3.00	07:15	JK	7-8	NW	Good	7-8	11	None
Breeding 2020	25/06/2020	1	3.00	11:30	TK	1	n-ne	Good	7-8	22-23	None
Breeding 2020	25/06/2020	2	3.00	16:00	TK	1	NNE-NE	Good	8	22-23	None
Breeding 2020	30/06/2020	3	3.00	10:00	TK	3-4	W-WSW	Good	6-7	12-13	None
Breeding 2020	30/06/2020	4	3.00	13:45	TK	3-4	SW	Good	6	15-16	None
Breeding 2020	20/07/2020	2	3.00	07:45	DP	1-3	SW	Good	2-5	12-14	None
Breeding 2020	20/07/2020	2	3.00	11:15	DP	2-4	SW-W	Good	6	16-20	None
Breeding 2020	21/07/2020	5	3.00	06:30	DP	1-2	S-SW	Good	6-7	10-12	None
Breeding 2020	21/07/2020	5	3.00	10:00	DP	3-4	SW	Good	6	14-16	None
Breeding 2020	22/07/2020	4	3.00	07:15	DP	3-4	S	Good-Moderate	8	10-12	Light drizzle
Breeding 2020	22/07/2020	4	3.00	10:45	DP	4	SW	Good	8	14-16	Light drizzle
Breeding 2020	23/07/2020	1	3.00	07:15	DP	2	W	Good	8	9-12	None
Breeding 2020	23/07/2020	1	3.00	10:45	DP	2-3	W	Good	7	14-16	None
Breeding 2020	24/07/2020	3	3.00	08:00	DP	2-4	SW	Good-Moderate	8	12-14	Light drizzle
Breeding 2020	24/07/2020	3	3.00	11:30	DP	3-4	SW	Good-Moderate	8	14-16	Light rain
Breeding 2020	11/08/2020	3	2.00	07:45	DP	1	NW	Good-Moderate	8	14-16	None
Breeding 2020	11/08/2020	3	2.00	10:15	DP	1-2	NW	Good	8	19-21	None
Breeding 2020	12/08/2020	4	3.00	06:45	DP	3-4	N	Good-Poor	7-8	14-15	None
Breeding 2020	12/08/2020	4	3.00	09:45	DP	2-4	N	Good	7	18-21	None
Breeding 2020	13/08/2020	5	2.00	10:30	DP	2-3	NE	Good	8	17-19	None
Breeding 2020	13/08/2020	5	2.00	13:00	DP	3-4	NE	Good	8	19-22	None
Breeding 2020	14/08/2020	1	3.00	08:00	KW	2	ENE	Moderate	8	15-19	None
Breeding 2020	14/08/2020	4	2.00	07:45	DP	3-4	E	Moderate	8	14-15	None
Breeding 2020	14/08/2020	4	2.00	10:15	DP	3-4	E	Good	8	16-18	None
Breeding 2020	25/08/2020	1	3.00	16:30	KW	2-4	NW	Good	7-8	14-15	Light showers
Breeding 2020	25/08/2020	2	3.00	12:30	KW	4-5	WNW	Good-Moderate	8	14-15	Showers
Breeding 2020	26/08/2020	1	3.00	13:30	KW	3	W	Good	3-7	17-19	None
Breeding 2020	26/08/2020	2	3.00	09:45	KW	2-3	W	Good	4-7	14-16	None
Breeding 2020	28/08/2020	2	3.00	09:00	KW	3	N/NNE	Good	4-7	13-15	None
Non-breeding 2020-21	05/09/2020	3	3.00	10:30	DP	3-4	NW	Good	6-8	14-15	None
Non-breeding 2020-21	06/09/2020	1	3.00	07:00	DP	2-3	NW	Good	6	11-13	None
Non-breeding 2020-21	06/09/2020	5	3.00	10:30	DP	2-3	NW	Good	6-8	15-16	None
Non-breeding 2020-21	28/09/2020	3	3.00	07:45	DP	2-4	NW	Good	5-8	11-13	None
Non-breeding 2020-21	28/09/2020	5	3.00	11:15	DP	4	NW	Good	6	14-15	None
Non-breeding 2020-21	29/09/2020	1	3.00	07:30	DP	4	NW	Good	6-7	8-9	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2020-21	29/09/2020	4	3.00	11:00	DP	3-4	NW	Good	6-8	12-14	None
Non-breeding 2020-21	30/09/2020	2	3.00	07:45	DP	3-4	NW	Good	7-8	10-11	Passing showers
Non-breeding 2020-21	30/09/2020	2	3.00	11:15	DP	3-4	NW	Good	8	11-12	None
Non-breeding 2020-21	14/10/2020	2	3.00	07:30	DP	2	NE	Good	6-7	7-8	None
Non-breeding 2020-21	14/10/2020	2	3.00	11:00	DP	3-4	NE	Good	7-8	9-10	None
Non-breeding 2020-21	15/10/2020	4	3.00	07:45	DP	2	NE	Poor	8	8-9	None
Non-breeding 2020-21	15/10/2020	4	3.00	11:15	DP	2-4	NE-E	Good-Moderate	6-7	9-11	None
Non-breeding 2020-21	16/10/2020	3	3.00	07:30	DP	2-4	SE	Good	3-5	6-7	None
Non-breeding 2020-21	16/10/2020	3	3.00	11:00	DP	3-4	SE	Good	6-7	8-9	None
Non-breeding 2020-21	20/10/2020	1	3.00	07:30	DP	3-4	SE	Good-Moderate	7-8	8-9	Light showers
Non-breeding 2020-21	20/10/2020	1	3.00	11:00	DP	4	SE	Good-Moderate	8	10-11	Light rain
Non-breeding 2020-21	21/10/2020	5	3.00	07:30	DP	3-5	N-NW	Good-Poor	8	8-9	Light drizzle passing
Non-breeding 2020-21	21/10/2020	5	3.00	11:00	DP	4-5	NW	Good	8	10-11	None
Non-breeding 2020-21	06/11/2020	4	3.00	12:00	KW	2	E	Good	0-1	7-9	None
Non-breeding 2020-21	06/11/2020	5	3.00	08:30	KW	1-2	SE/E	Good	1	8-10	None
Non-breeding 2020-21	15/11/2020	3	3.00	09:00	AR	1-2	WSW-WNW	Good	5-8	8-10	None
Non-breeding 2020-21	15/11/2020	3	3.00	12:30	AR	2-4	WNW-W	Good	6-8	10-11	None
Non-breeding 2020-21	16/11/2020	1	3.00	07:45	AR	3	SW	Good	8	9-11	Light rain
Non-breeding 2020-21	16/11/2020	1	3.00	11:15	AR	3	SW	Good	8	10-9	Light rain
Non-breeding 2020-21	17/11/2020	2	3.00	08:00	AR	3-4	SSW	Good	8	13	None
Non-breeding 2020-21	17/11/2020	2	3.00	11:30	AR	3	SSW	Good	8	13-14	None
Non-breeding 2020-21	20/11/2020	4	3.00	09:45	KW	4-5	SW	Moderate	8	11-12	None
Non-breeding 2020-21	20/11/2020	5	3.00	13:30	KW	4-5	SW	Moderate-Poor	8	12	Mist
Non-breeding 2020-21	02/12/2020	3	3.00	09:30	KW	2-3	W	Good	3-7	5-7	Showers
Non-breeding 2020-21	02/12/2020	5	3.00	13:00	KW	3	W	Good	4-7	7-8	Showers
Non-breeding 2020-21	03/12/2020	4	3.00	12:30	KW	2	NW	Good	1-3	2-4	None
Non-breeding 2020-21	04/12/2020	1	3.00	12:00	KW	2-3	NW	Good-Moderate	3-8	4-6	Showers
Non-breeding 2020-21	04/12/2020	2	3.00	08:30	KW	1-2	NW	Good-Moderate	3-8	3	Shower
Non-breeding 2020-21	08/12/2020	3	3.00	09:30	KW	2	NW	Good	3-4	2-3	None
Non-breeding 2020-21	08/12/2020	5	3.00	13:00	KW	2	NW	Good-Moderate	1-3		None
Non-breeding 2020-21	14/12/2020	1	3.00	12:45	KW	3-4	SW	Good-Moderate	4-8	8-9	Showers
Non-breeding 2020-21	14/12/2020	5	3.00	09:15	KW	3	SW	Good-Moderate	5	6-8	Showers
Non-breeding 2020-21	15/12/2020	3	3.00	08:45	KW	3	S/SSW	Good	3-4	5-9	None
Non-breeding 2020-21	15/12/2020	4	3.00	12:15	KW	3	SW	Good	2	6-7	None
Non-breeding 2020-21	16/12/2020	2	3.00	08:30	KW	2-3	W/NSW	Good	7-8	5-8	Showers
Non-breeding 2020-21	16/12/2020	5	3.00	12:15	KW	2-3	WSW	Good	6-8	7-9	Showers

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2020-21	21/01/2021	1	2.50	13:30	KW	1	NW	Good	2-5	5	None
Non-breeding 2020-21	21/01/2021	4	3.00	10:00	KW	1	NW	Good	4-8	4-5	Light rain
Non-breeding 2020-21	22/01/2021	2	3.00	08:45	KW	1	W	Good	2-5	1-4	None
Non-breeding 2020-21	22/01/2021	3	3.00	12:15	KW	2	W/N	Good	2-8	4-5	Sleet shower
Non-breeding 2020-21	25/01/2021	4	3.00	14:30	KW	1	SW	Good	3-6	5-2-5	None
Non-breeding 2020-21	25/01/2021	5	3.00	11:00	KW	1	SW	Good	3-6	-1-5	Light shower
Non-breeding 2020-21	26/01/2021	1	3.00	12:00	KW	2	SW	Good	8	8-11	None
Non-breeding 2020-21	26/01/2021	4	3.00	08:30	KW	1	S/SSW	Good-Poor	8	5-8	None
Non-breeding 2020-21	27/01/2021	3	3.00	12:30	KW	1	S	Moderate-Poor	8		Light rain
Non-breeding 2020-21	29/01/2021	5	3.00	08:15	KW	2-4	W	Good	1-8	7-8	Shower
Non-breeding 2020-21	22/02/2021	2	3.00	09:30	KW	2-3	S	Good	1	2-5	None
Non-breeding 2020-21	22/02/2021	4	3.00	13:15	KW	3-4	S	Good	2-7	10-12	None
Non-breeding 2020-21	24/02/2021	1	3.00	08:00	KW	3-4	SW	Good-Moderate	7-8	7-10	Shower
Non-breeding 2020-21	09/03/2021	2	3.00	10:15	KW	3	S	Good	8	8-9	Persistent light rain
Non-breeding 2020-21	09/03/2021	4	3.00	13:45	KW	3-4	S	Good-Moderate	8	9-10	Persistent
Non-breeding 2020-21	10/03/2021	1	3.50	07:30	KW	1-2	S	Good-Moderate	8	5-6	Persistent light - heavy
Non-breeding 2020-21	10/03/2021	2	3.00	11:00	KW	3-5	S	Good-Poor	8	8-12	Persistent
Non-breeding 2020-21	10/03/2021	3	3.00	14:30	KW	5-6	SW	Good-Moderate	5-8	11-12	Showers
Breeding 2024	27/03/2024	1	3.00	10:30	PC	3-4	NE	Good	8	6	0.4mm
Breeding 2024	24/04/2024	1	3.00	06:00	PC	1	NW	Good	8	4	None
Breeding 2024	24/04/2024	1	3.00	09:30	PC	1	NW	Good	8	4	None
Breeding 2024	22/05/2024	1	3.00	06:30	PC	1-2	SW	Good	8	9	0.3mm
Breeding 2024	22/05/2024	1	3.00	10:00	PC	1-2	SW	Good	8	9	0.3mm
Breeding 2024	21/06/2024	1	3.00	05:45	PC	4-6	SSW	Good	8	12	0.1mm
Breeding 2024	21/06/2024	1	3.00	09:30	PC	4-6	SSW	Good	8	12	0.1mm
Breeding 2024	29/07/2024	1	3.00	07:00	PC	1-2	SW	Good	8	11	None
Breeding 2024	29/07/2024	1	3.00	10:30	PC	1-2	SW	Good	8	11	None
Breeding 2024	15/08/2024	1	3.00	06:00	PC	1-2	SW	Good	8	16	0.8mm
Breeding 2024	15/08/2024	1	3.00	09:30	PC	1-2	SW	Good	8	16	0.8mm
Breeding 2024	11/09/2024	1	3.00	12:15	BF	3	NW	Good	5	10	Light
Breeding 2024	27/03/2024	2	3.00	07:00	PC	2-4	NE	Good	8	5	1mm
Breeding 2024	03/4/2024	2	3.00	13:00	BF	1	W	Good	5	12	Showers
Breeding 2024	22/04/2024	2	3.00	07:00	PC	1	N	Good	8	6	none
Breeding 2024	22/04/2024	2	3.00	10:30	PC	1	N	Good	8	6	none
Breeding 2024	22/05/2024	2	3.00	06:15	PC	1-2	NW	Good	8	10	none

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2024	22/05/2024	2	3.00	09:45	PC	1-2	NW	Good	8	10	none
Breeding 2024	25/06/2024	2	3.00	06:15	PC	1	NE	Good	0	13	none
Breeding 2024	25/06/2024	2	3.00	09:45	PC	1	NE	Good	0	13	none
Breeding 2024	31/07/2024	2	3.00	07:00	PC	1	SE	Good	8	12	none
Breeding 2024	31/07/2024	2	3.00	10:30	PC	1	SE	Good	8	12	none
Breeding 2024	19/08/2024	2	3.00	07:00	PC	2	SE	Good	8	13	Rain and mist
Breeding 2024	19/08/2024	2	3.00	10:30	PC	2	SE	Good	8	13	Rain and mist
Breeding 2024	26/03/2024	3	3.00	07:00	PC	2-3	N	Good	8	6	0.3mm
Breeding 2024	26/03/2024	3	3.00	10:30	PC	2-3	N	Good	8	6	0.3mm
Breeding 2024	23/04/2024	3	3.00	06:45	PC	1-2	N	Good	8	10	none
Breeding 2024	23/04/2024	3	3.00	10:15	PC	1-2	N	Good	8	10	none
Breeding 2024	24/05/2024	3	3.00	06:00	PC	1-2	NW	Good	7	5	none
Breeding 2024	24/05/2024	3	3.00	09:30	PC	1-2	NW	Good	7	5	none
Breeding 2024	20/06/2024	3	3.00	06:00	PC	1-2	SW	Good	8	11	none
Breeding 2024	20/06/2024	3	3.00	09:30	PC	1-2	SW	Good	8	11	none
Breeding 2024	30/07/2024	3	3.00	07:00	PC	1	NW	Good	3	10	None
Breeding 2024	30/07/2024	3	3.00	10:30	PC	1	NW	Good	3	10	None
Breeding 2024	16/08/2024	3	3.00	06:00	PC	1-2	SW	Good	8	9	0.1mm
Breeding 2024	16/08/2024	3	3.00	09:30	PC	1-2	SW	Good	8	9	0.1mm
Breeding 2024	26/03/2024	4	3.00	10:30	PC	1-3	NE	Moderate	8	7	0.7mm
Breeding 2024	18/04/2024	4	3.00	06:40	PC	1	SW	Good	8	5	None
Breeding 2024	18/04/2024	4	3.00	10:10	PC	1	SW	Good	8	5	None
Breeding 2024	23/05/2024	4	3.00	06:05	PC	1-3	NW	Good	9	9	None
Breeding 2024	23/05/2024	4	3.00	09:35	PC	1-3	NW	Good	9	9	None
Breeding 2024	24/06/2024	4	3.00	06:30	PC	1	NE	Good	8	12	None
Breeding 2024	24/06/2024	4	3.00	10:00	PC	1	NE	Good	8	12	None
Breeding 2024	26/07/2024	4	3.00	06:00	PC	1-2	SW	Good	8	12	0.4mm
Breeding 2024	26/07/2024	4	3.00	09:30	PC	1-2	SW	Good	8	12	0.4mm
Breeding 2024	14/08/2024	4	3.00	06:00	PC	1	SW	Good	7	11	0.1mm
Breeding 2024	14/08/2024	4	3.00	09:30	PC	1	SW	Good	7	11	0.1mm
Breeding 2024	11/09/2024	4	3.00	09:00	PC	3	W	Good	3	10	None
Breeding 2024	28/03/2024	5	3.00	08:45	AP	2-3	N-NE	Good	2-7	5-16	None
Breeding 2024	28/03/2024	5	3.00	11:45	AP	2-3	N-NE	Good	2-7	5-16	None
Breeding 2024	23/04/2024	5	3.00	09:30	AP	2-4	N	Good	3-8	10-18	Light drizzle
Breeding 2024	23/04/2024	5	3.00	11:30	AP	2-4	N	Good	3-8	10-18	Light drizzle
Breeding 2024	21/05/2024	5	3.00	06:35	AP	1-2	N	Good	5-8	14-21	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Breeding 2024	21/05/2024	5	3.00	09:35	AP	1-2	N	Good	5-8	14-21	None
Breeding 2024	10/06/2024	5	3.00	10:15	BF	3	N	Good	4	15	None
Breeding 2024	02/07/2024	5	3.00	07:45	BF	1	W	Good	5	12	None
Breeding 2024	16/07/2024	5	3.00	09:50	AP	2-3	NW-W	Good	2-8	15-19	None
Breeding 2024	16/07/2024	5	3.00	12:50	AP	2-3	NW-W	Good	2-8	15-19	None
Breeding 2024	09/08/2024	5	3.00	05:45	BF	3	W	Good	2	13	None
Breeding 2024	24/08/2024	5	3.00	17:00	BF	3	W	Good	2	14	None
Non-breeding 2023-24	28/10/2023	1	3.00	09:00	BF	3	SE	Good	1	7	None
Non-breeding 2023-24	29/10/2023	1	3.00	13:00	BF	2	NE	Good	5-7	8	Shower
Non-breeding 2023-24	07/11/2023	1	3.00	13:15	EM	2-3	SW-S	Good	3-6	9	Showers
Non-breeding 2023-24	09/11/2023	1	3.00	12:30	EM	3-4	W	Good	4-7	10	Shower
Non-breeding 2023-24	21/11/2023	1	3.00	14:00	EM	2	SW/W	Good	6	9	None
Non-breeding 2023-24	04/12/2023	1	3.00	08:00	EM	2-3	NW	Good	1-5	0-2	None
Non-breeding 2023-24	04/12/2023	1	3.00	11:00	EM	3	NW	Good	1-5	2-4	None
Non-breeding 2023-24	28/10/2023	2	3.00	12:15	BF	3	SE	Good	2-5	10	Shower
Non-breeding 2023-24	08/11/2023	2	3.00	08:45	EM	3-4	SW	Good	1-7	9	Showers
Non-breeding 2023-24	21/11/2023	2	3.00	07:45	EM	1	W	Good	6	4	None
Non-breeding 2023-24	21/11/2023	2	3.00	10:45	EM	1	W	Good	6	10	None
Non-breeding 2023-24	30/11/2023	2	3.00	1245	EM	3	S	Good	1	4	None
Non-breeding 2023-24	03/12/2023	2	3.00	16:30	EM	3	NE	Good	8	1-2	None
Non-breeding 2023-24	27/10/2023	3	3.00	14:30	EM	3	E	Good	2-5	9	None
Non-breeding 2023-24	29/10/2023	4	3.00	09:00	BF	2	E	Good	1-6	7	None
Non-breeding 2023-24	08/11/2023	3	3.00	13:45	EM	2-3	SW	Good	4-7	8	Showers
Non-breeding 2023-24	24/11/2023	3	3.00	08:00	EM	1	N	Good	4-5	3	None
Non-breeding 2023-24	24/11/2023	3	3.00	11:00	EM	1-2	N	Good	3-7	9	None
Non-breeding 2023-24	01/12/2023	3	3.00	08:15	EM	1	SE	Good	6-7	0	None
Non-breeding 2023-24	01/12/2023	3	3.00	11:15	EM	1-2	S/SE	Good	6-7	3	None
Non-breeding 2023-24	07/11/2023	4	3.00	09:00	EM	3	W	Good	2-3	10	None
Non-breeding 2023-24	10/11/2023	4	3.00	10:45	EM	3-4	W	Good	4-5	11	Shower
Non-breeding 2023-24	23/11/2023	4	3.00	11:15	EM	4	W	Good	6-7	12	None
Non-breeding 2023-24	30/11/2023	4	3.00	09:30	EM	3	S	Good	1	3	None
Non-breeding 2023-24	03/12/2023	4	3.00	10:15	EM	3	N	Moderate - Good	8	1-2	None
Non-breeding 2023-24	27/10/2023	5	3.00	11:00	BF	3	E	Good	5-6	8	None
Non-breeding 2023-24	10/11/2023	5	3.00	07:30	EM	2-3	W	Good	2-5	7	None
Non-breeding 2023-24	10/11/2023	5	3.00	14:00	EM	4	W	Good	4-6	10	Showers

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2023-24	23/11/2023	5	1.50	14:30	EM	3	W	Good	7	12	None
Non-breeding 2023-24	24/11/2023	5	1.50	14:15	EM	2	N	Good	7	10	None
Non-breeding 2023-24	01/12/2023	5	2.00	14:30	EM	2	S	Good	4-6	3	None
Non-breeding 2023-24	02/12/2023	5	3.00	13:45	EM	2	SE	Good	1-2	3	None
Non-breeding 2023-24	03/12/2023	5	2.00	08:00	EM	2	N	Moderate	8	1	None
Non-breeding 2023-24	24/01/2024	1	3.00	08:20	SM	3-4	SW	Good	6-8	10	None
Non-breeding 2023-24	24/01/2024	1	3.00	11:20	SM	3-4	SW	Good	2-8	10	None
Non-breeding 2023-24	24/01/2024	1	3.00	14:20	SM	3-4	SW	Good	2-3	10	None
Non-breeding 2023-24	25/01/2024	2	3.00	09:20	SM	2-3	S	Good	8	9	Heavy Showers
Non-breeding 2023-24	25/01/2024	2	3.00	12:20	SM	3-4	S-SW	Good	8	9	None
Non-breeding 2023-24	25/01/2024	2	1.50	15:20	SM	3-4	SW-SSW	Good	6-8	9	None
Non-breeding 2023-24	26/01/2024	2	1.50	08:50	SM	3	SW	Good	2	10	None
Non-breeding 2023-24	26/01/2024	3	3.00	10:45	SM	3-4	SW	Good	2-4	10	Light Showers
Non-breeding 2023-24	26/01/2024	3	3.00	13:45	SM	4	SW	Good	3-8	10	Light Showers
Non-breeding 2023-24	26/01/2024	3	0.25	16:45	SM	4	SSW	Good	8	10	Light Showers
Non-breeding 2023-24	27/01/2024	3	2.75	09:02	SM	4	SSE	Good	8	11	None
Non-breeding 2023-24	27/01/2024	4	3.00	12:10	SM	3-5	SSE-S	Good	8	10	None
Non-breeding 2023-24	27/01/2024	4	2.00	15:10	SM	4-5	S	Good	8	10	None
Non-breeding 2023-24	28/01/2024	4	3.00	08:55	SM	5	SSE	Good	6-8	10	Shower
Non-breeding 2023-24	28/01/2024	4	1.00	11:55	SM	5	SSE	Good	8	10	Shower
Non-breeding 2023-24	28/01/2024	5	3.00	13:30	SM	4	W	Good - Moderate	8	9	Light Rain
Non-breeding 2023-24	28/01/2024	5	1.00	16:30	SM	4	W	Good - Moderate	8	9	Light Rain
Non-breeding 2023-24	29/01/2024	5	3.00	09:50	SM	3	NW	Good	2-6	6	None
Non-breeding 2023-24	29/01/2024	5	2.00	12:50	SM	3	NW	Good	1-2	6	None
Non-breeding 2023-24	21/02/2024	2	3.00	09:00	SM	5	WSW-SW	Good	7-8	7	Showers
Non-breeding 2023-24	21/02/2024	2	3.00	12:00	SM	5-4	SW	Good	6	7	Showers
Non-breeding 2023-24	21/02/2024	2	3.00	15:00	SM	4	SW-SSW	Good	4-6	7	None
Non-breeding 2023-24	22/02/2024	4	3.00	08:55	SM	4	WSW	Good	2-6	7	Shower
Non-breeding 2023-24	22/02/2024	4	3.00	11:55	SM	4	WSW	Good	2-6	7	Shower
Non-breeding 2023-24	22/02/2024	4	3.00	14:55	SM	4	WSW	Good	2-6	7	Shower
Non-breeding 2023-24	23/02/2024	1	3.00	10:30	SM	5-6	NNW	Good	6-8	10	Showers
Non-breeding 2023-24	25/02/2024	3	3.00	09:30	SM	3	NE	Good	8	3	None
Non-breeding 2023-24	25/02/2024	3	3.00	12:30	SM	3	NE-N	Good	7-8	3	None
Non-breeding 2023-24	26/02/2024	5	3.00	08:05	SM	3	WNW	Good	5-8	7	None

Season	Date	VP	Duration(hr)	Start Time	Surveyor	Wind force	Wind Dir.	Visibility	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2023-24	26/02/2024	5	0.75	11:05	SM	3	WNW	Good	5	6	None
Non-breeding 2023-24	27/02/2024	5	3.00	07:25	SM	4	SW	Good	5-8	7	None
Non-breeding 2023-24	27/02/2024	5	3.00	10:25	SM	4-5	SW	Good	5-6	6	None
Non-breeding 2023-24	27/02/2024	5	0.25	13:25	SM	4	SW	Good	6	5	None
Non-breeding 2023-24	23/02/2024	1	3.00	13:30	SM	4-6	NNW-W	Good	2-6	10	None
Non-breeding 2023-24	26/03/2024	3	3.00	07:00	PC	2-3	NE	Good	8	6	None
Non-breeding 2023-24	26/03/2024	3	3.00	10:30	PC	2-3	NE	Good	8	6	None

Appendix V – Breeding dusk and walkover effort table

Season	Date	Survey type	Start time	End time	Surveyor	Wind Force	Wind Direction	Cloud (oktas)	Temp. (C)	Rain
Breeding 2019	25/04/2019	Dawn survey	06:00	08:00	HD + HPD + KW	2	E	5	14-15	None
Breeding 2019	25/04/2019	Walkover	08:00	12:15	HD + HPD + KW	2	E	5	14-15	None
Breeding 2019	01/05/2019	Walkover	11:30	14:45	HPD	3	W	6	11-13	None
Breeding 2019	08/05/2019	Walkover	10:00	13:00	HPD	3	W	6	11-13	None
Breeding 2019	11/06/2019	Dusk survey	19:45	21:45	HD + KW	3	N	6	12-13	None
Breeding 2019	11/06/2019	Walkover	19:45	21:45	HD + KW	3	N	6	12-13	None
Breeding 2019	17/06/2019	Dusk survey	20:30	22:30	KW	3-4	SW	7-8	16	None
Breeding 2019	17/06/2019	Walkover	20:30	22:30	KW	3-4	SW	7-8	16	None
Breeding 2020	11/05/2020	Walkover	12:00	16:30	KW	5	NW	5-6	9	None
Breeding 2020	13/05/2020	Dusk survey	19:30	21:30	KW	5	NW	3	15	None
Breeding 2020	13/05/2020	Walkover	19:30	21:30	KW	5	NW	3	15	None
Breeding 2020	15/05/2020	Walkover	10:00	14:00	KW	5	NW	5-6	14	None
Breeding 2020	16/06/2020	Walkover	11:30	18:30	KW	2	NW	6	14	None
Breeding 2020	18/06/2020	Dusk survey	20:30	22:30	KW	7-8	NW	7-8	11	None
Breeding 2020	18/06/2020	Walkover	17:30	21:00	KW	7-8	NW	7-8	11	None
Breeding 2020	19/06/2020	Walkover	10:00	11:15	KW	3	SSW	6	14-18	None
Breeding 2024	09/04/2024	Walkover	09:00	12:00	AP	4	NW	10	8	Showers
Breeding 2024	18/04/2024	Walkover	11:30	13:00	AP	2	NW	5	8	None
Breeding 2024	24/04/2024	Dusk survey	20:00	21:30	AP	1	N	1	6-10	None
Breeding 2024	02/05/2024	Walkover	09:00	12:00	AP	5	S	2	17	None
Breeding 2024	09/05/2024	Walkover	09:00	12:00	AP	1	S	2	18	None
Breeding 2024	15/05/2024	Walkover	9:00	11:00	AP	2	NE	3	15	None
Breeding 2024	27/05/2024	Dusk survey	20:46	22:36	AP	1	S	6	12	None
Breeding 2024	01/06/2024	Walkover	09:00	12:00	AP	7	W	6	11	None
Breeding 2024	26/06/2024	Walkover	16:00	18:00	AP	10	W	6	10	None
Breeding 2024	27/06/2024	Dusk survey	21:00	23:00	AP	3-4	W	8	12	None
Breeding 2024	30/06/2024	Dusk survey	21:00	23:00	AP	3	W	8	15	None
Breeding 2024	13/07/2024	Dusk survey	20:50	23:00	AP	1	N	2-6	12-17	None
Breeding 2024	08/08/2024	Dusk survey	21:15	23:15	BF	3	W	5	16	None

Appendix VI – Breeding raptor survey effort table

Season	Date	Start time	End time	Surveyor	Wind Force	Wind Direction	Cloud (oktas)	Temp. (C)	Rain
Breeding 2019	01/05/2019	08:30	16:00	HD	1	SW	6	10-12	Dry until 1245 now light rain
Breeding 2019	08/05/2019	13:00	21:00	HD	3	NE	8	8-11	Light drizzle at start
Breeding 2019	07/06/2019	08:30	12:00	RW	3	N	8	13-15	None
Breeding 2019	11/06/2019	15:30	18:30	HD	4	NE	8	15-16	None
Breeding 2019	28/06/2019	08:30	12:00	KW	1-2	SW	8	18	None
Breeding 2019	05/07/2019	08:00	12:00	KW	1-2	W	8	19	None
Breeding 2019	19/07/2019	07:45	10:45	KW	2	E	8	16	Mist
Breeding 2020	20/05/2020	07:30	15:00	KW	2	SSE	7-8	18	None
Breeding 2020	20/05/2020	16:15	17:15	TK	2	SSE	7-8	18	None
Breeding 2020	18/06/2020	10:30	12:30	JK	2	NW	6	14	None
Breeding 2020	23/06/2020	09:30	16:30	JK	3	SSW	6	14-18	Showers
Breeding 2020	27/07/2020	12:00	19:00	KW	3-4	SW	7	14	None
Breeding 2020	28/07/2020	08:30	15:30	KW	2-4	SW	8	12-14	Light Drizzle at times
Breeding 2024	03/04/2024	09:45	15:40	AP	2-7	NW	2-7	11	None
Breeding 2024	24/04/2024	13:45	19:45	AP	1-2	N	3-4	14	None
Breeding 2024	05/05/2024	11:30	17:30	AP	1-2	N	3-8	12-16	None
Breeding 2024	29/05/2024	09:45	15:45	AP	3-4	NW	5	13-17	None
Breeding 2024	10/06/2024	13:30	19:30	BF	3	N	3	18	None
Breeding 2024	02/07/2024	11:00	17:00	BF	2	W	4	18	None
Breeding 2024	23/07/2024	09:45	15:45	AP	1-2	W	8	16-18	None

Appendix VIII – Winter walkover surveys effort table

Season	Date	Survey type	Start time	End time	Surveyor	Wind Force	Wind direction	Cloud (oktas)	Temp. (C)	Rain
Non-Breeding 2019-20	14/11/2019	Walkover	10:00	17:00	MH	2-4	SW	1	4	None
Non-Breeding 2019-20	16/11/2019	Walkover	08:00	12:00	MH	1	S	8	2-5	None
Non-Breeding 2019-20	08/01/2020	Walkover	09:00	15:30	MH	2	SW	5	5-9	None
Non-Breeding 2019-20	15/01/2020	Walkover	10:30	15:30	MH	5	SW	2	6	Occasional showers
Non-Breeding 2019-20	04/02/2020	Walkover	09:00	16:30	MH	3	W	3	7-10	None
Non-Breeding 2019-20	06/02/2020	Walkover	09:00	13:00	MH	3	SE	7	2-7	None
Non-Breeding 2020-21	21/10/2020	Walkover	10:00	18:00	KW	3	NW	4	10	Showers
Non-Breeding 2020-21	23/10/2020	Walkover	16:30	18:30	KW	2	W	8	10	Light Showers
Non-Breeding 2020-21	24/10/2020	Walkover	09:00	10:00	KW	2	SW	3	7	None
Non-Breeding 2020-21	10/12/2020	Walkover	09:30	16:00	KW	3	SW	8	8	Persistent Rain in afternoon
Non-Breeding 2020-21	18/12/2020	Walkover	12:30	14:30	KW	3	S	5	10	Showers
Non-Breeding 2020-21	21/02/2021	Walkover	11:00	16:00	KW	3	SW	5	12	None
Non-Breeding 2020-21	12/03/2021	Walkover	07:15	08:45	KW	5	SW	4	5	None
Non-Breeding 2023-24	22/11/2023	Walkover	09:00	16:00	AP	4	W	7	12	Occasionally very light showers
Non-Breeding 2023-24	02/01/2024	Walkover	09:00	12:00	AP	8	SW	4	9	None
Non-Breeding 2023-24	02/02/2024	Walkover	09:00	15:30	AP	14	S	5	12	None
Non-Breeding 2023-24	02/03/2024	Walkover	09:00	15:30	AP	7	W	5	9	None
Non-Breeding 2023-24	20/03/2024	Walkover	09:00	15:30	AP	5	S	6	11	None
Non-Breeding 2023-24	29/03/2024	Walkover	09:00	12:00	AP	2	S	4	7	None

Appendix VIII – Winter waterbird surveys effort table

Season	Date	Start time	End time	Surveyor	Wind Force	Wind Dir.	Cloud (oktas)	Temp. (C)	Rain
Non-breeding 2019-20	09/10/2019	11:30	17:00	MH	3	SW	3	6-11	None
Non-breeding 2019-20	05/12/2019	08:30	16:00	MH	5-6	W	1	8-11	Periods of drizzled/light rain
Non-breeding 2019-20	07/01/2020	11:00	15:30	MH	5-7	SW	8	11-12	Periods of rain/drizzle
Non-breeding 2019-20	05/02/2020	09:15	15:15	MH	2	S	4	2-7	None
Non-breeding 2020-21	19/10/2020	12:00	18:00	KW	3	SE	8	10-12	Frequent heavy showers
Non-breeding 2020-21	18/11/2020	09:00	14:00	AR	2	WSW	2-6	8-10	None
Non-breeding 2020-21	03/12/2020	10:00	12:00	KW	2	NW	4	2-3	Showers
Non-breeding 2020-21	18/12/2020	09:00	11:00	KW	2	SW	5	7-10	Showers
Non-breeding 2020-21	25/01/2021	09:45	10:45	KW	1	W	1	0	None
Non-breeding 2020-21	26/02/2021	09:00	11:30	KW	4	SW	1	6-11	None
Non-breeding 2020-21	12/03/2021	07:00	09:00	KW	4	SW	4	3-6	None
Non-breeding 2023-24	23/11/2023	08:00	11:00	ED	4	W	7	12	None
Non-breeding 2023-24	02/12/2023	08:30	12:00	ED	2	S	3	2	Two very light showers
Non-breeding 2023-24	05/2/2024	08:00	12:00	ED	2	W	4	8	None
Non-breeding 2023-24	26/2/2024	08:30	12:30	ED	4	W	6	6	None
Non-breeding 2023-24	04/03/2024	08:00	11:30	BF	1	W	3	13	None
Non-breeding 2023-24	13/03/2024	15:30	18:15	BF	3	SW	4	8	None

Appendix IX – Hen Harrier roost watches effort table

Season	Date	Observer	Time	Duration (minutes)	Latitude.	Longitude.	Wind Force	Temp.	Rain
Non-Breeding 2019-2020	12/12/2019	MH	16:00	60	53.55240	-9.03586	0-3	Cool	Dry
Non-Breeding 2019-2020	09/01/2020	KW	16:00	90	53.55240	-9.03586	1-3	Cool	Dry
Non-Breeding 2019-2020	10/01/2020	KW	16:00	90	53.55240	-9.03586	0-3	Cool	Dry
Non-Breeding 2019-2020	15/01/2020	MH	16:00	90	53.55240	-9.03586	4-6	Cool	Intermittent
Non-Breeding 2019-2020	16/01/2020	MH	16:00	90	53.55240	-9.03586	3-5	Cool	Dry
Non-Breeding 2019-2020	27/01/2020	KW	16:00	90	53.55240	-9.03586	0-3	Cool	Dry
Non-Breeding 2019-2020	05/02/2020	MH	16:35	100	53.55240	-9.03586	0-3	Cool	Dry
Non-Breeding 2019-2020	06/02/2020	MH	16:30	90	53.51651	-8.96780	0-3	Cool	Dry
Non-Breeding 2019-2020	07/02/2020	MH	16:30	95	53.54243	-8.94552	4-6	Mild	Intermittent
Non-Breeding 2020-2021	23/10/2020	DP	17:00	120	53.53491	-9.03202	4-6	Cool	Dry
Non-Breeding 2020-2021	17/11/2020	AR	14:50	125	53.53511	-9.03258	0-3	Cool	Intermittent
Non-Breeding 2020-2021	18/11/2020	AR	14:50	125	53.55192	-9.04024	4-6	Cool	Intermittent
Non-Breeding 2020-2021	16/12/2020	KW	15:25	95	53.52071	-9.02134	0-3	Cool	Dry
Non-Breeding 2020-2021	18/12/2020	KW	15:15	120	53.52071	-9.02134	0-3	Mild	Dry
Non-Breeding 2020-2021	22/02/2021	KW	15:00	90	53.51675	-8.96694	4-6	Mild	Dry
Non-Breeding 2020-2021	24/02/2021	KW	17:00	90	53.52025	-8.97467	0-3	Cool	Dry
Non-Breeding 2020-2021	10/03/2021	KW	17:35	85	53.52821	-8.97800	7-9	Mild	Intermittent
Non-Breeding 2023-2024	22/11/2023	EM	16:00	90	53.53741	-8.99196	4-6	Cold	Dry
Non-Breeding 2023-2024	23/11/2023	EM	16:00	90	53.54998	-9.00099	0-3	Cold	Dry
Non-Breeding 2023-2024	30/11/2023	EM	15:45	90	53.52751	-9.01689	0-3	Very Cold	Dry
Non-Breeding 2023-2024	2/12/2023	EM	16:00	90	53.53658	-8.97293	0-3	Very Cold	Dry
Non-Breeding 2023-2024	30/1/2024	SM	08:10	60	53.50581	-8.92983	0-3	Cold	Dry
Non-Breeding 2023-2024	30/1/2024	SM	09:30	60	53.52512	-8.96891	0-3	Cold	Dry
Non-Breeding 2023-2024	23/2/2024	SM	16:52	60	53.54979	-9.00287	4	Cold	Dry
Non-Breeding 2023-2024	23/2/2024	SM	18:00	60	53.51634	-8.93687	4	Cold	Dry

Appendix X – VP data including flightline tables and maps for target species

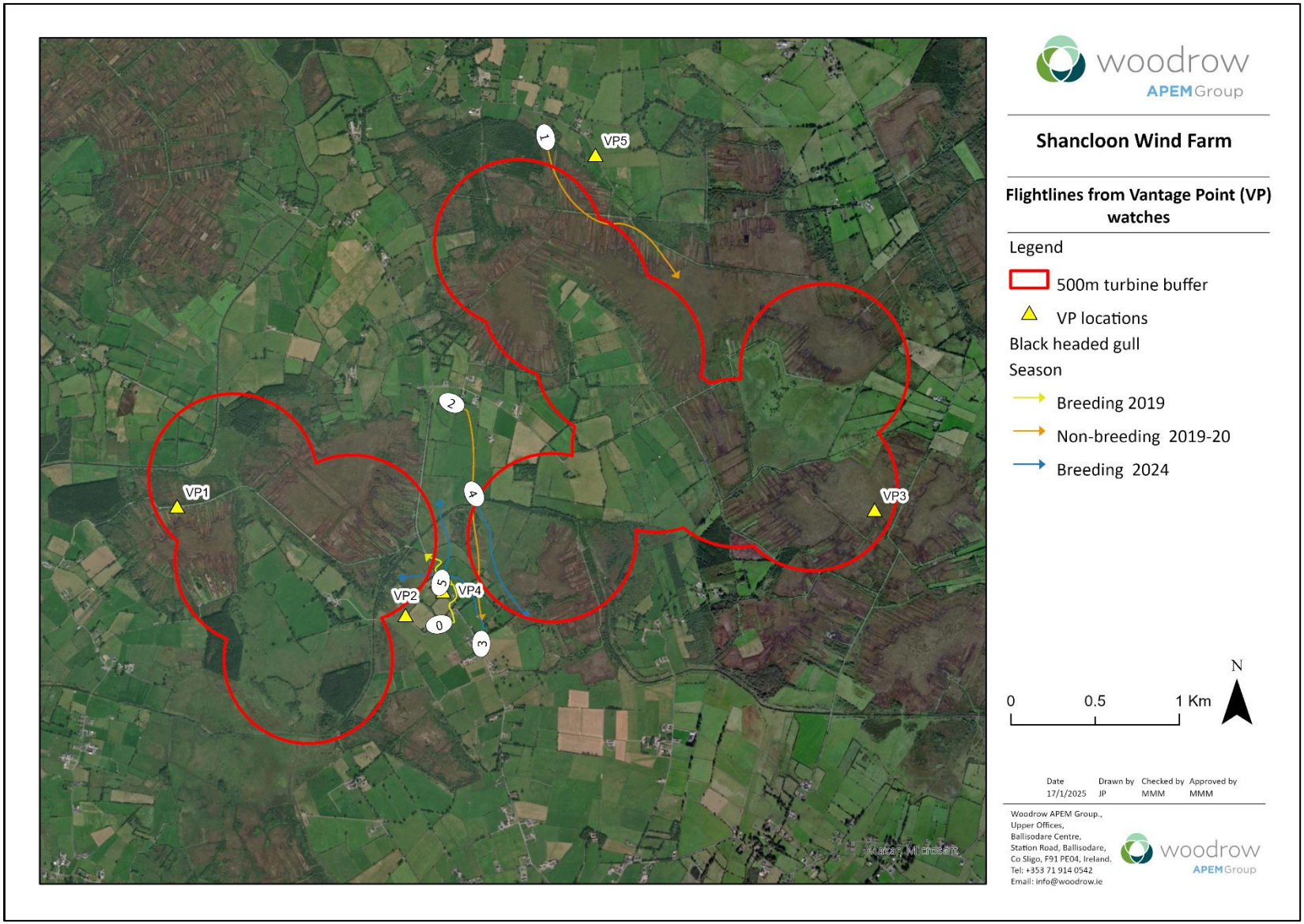


Figure X.1. Black-headed gull flightlines from VP Watches

Table IX.1: VP watch data for black-headed gull

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	4	Black-headed gull	2	01/07/2019	19:13	3	25	20	B			Flying	Yes
1	5	Black-headed gull	3	07/12/2019	12:51	40	50	30	B			Commuting	Yes
2	4	Black-headed gull	2	12/11/2019	09:11	23	47	80	B			Commuting	Yes
3	4	Black-headed gull	6	18/4/2024	11:32	14	20	0	-		A	Flying	Yes
4	4	Black-headed gull	1	24/6/2024	09:01	32	0	0	-		A	Flying	Yes
5	4	Black-headed gull	1	24/6/2024	10:09	0	20	0	-		A	Flying	No

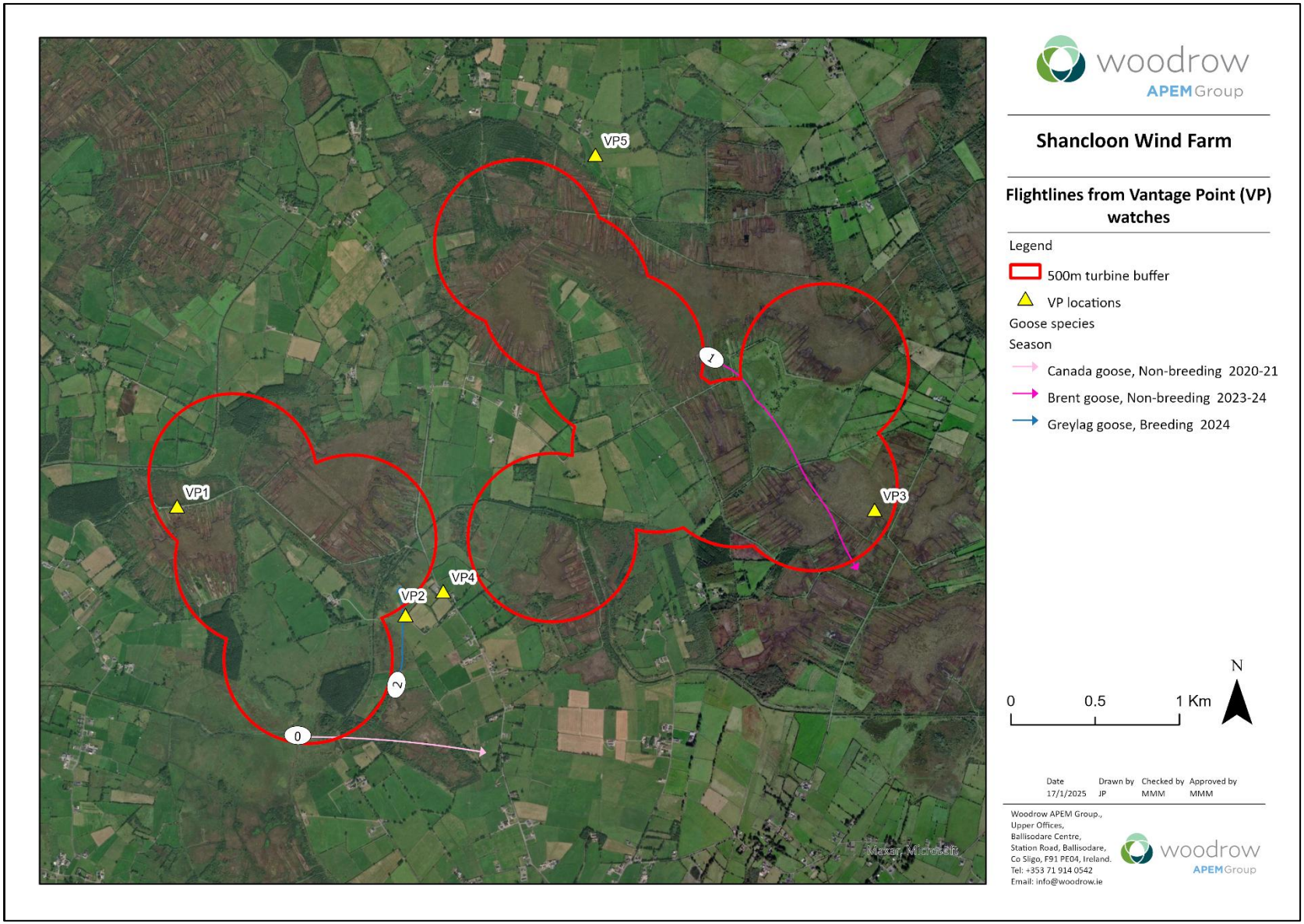


Figure X.2. Goose species flightlines from VP Watches

Table IX.2: VP watch data for goose species

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Greylag goose	14	16/12/2020	08:34	10	52	25	B		A	Flying	Yes
1	3	Canada goose	1	26/1/2024	10:52	20	10	20	B		A	Flying	Yes
2	2	Brent goose	1	03/4/2024	15:08	15	0	10	A			Flying	Yes

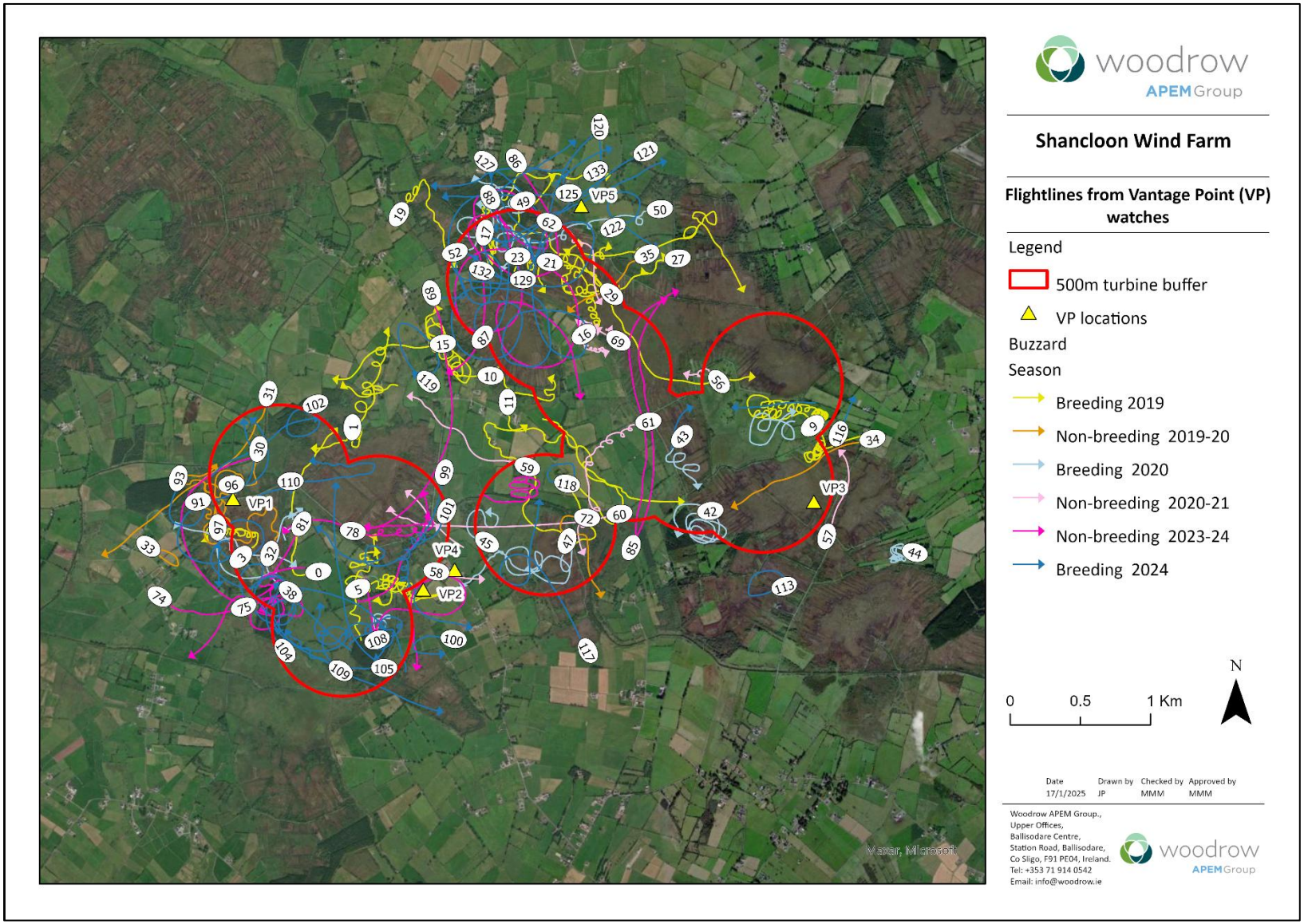


Figure X.3. Buzzard flightlines from VP Watches

Table IX.3: VP watch data for buzzard

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Buzzard	1	17/04/2019	10:34	97	3	30	B			Flying	Yes
1	1	Buzzard	1	17/04/2019	11:03	0	270	70	B			Soaring	No
2	1	Buzzard	1	17/06/2019	16:52	50	22	15	A			Flying	Yes
3	1	Buzzard	1	09/08/2019	08:31	42	34	25	B		J	Flying	Yes
4	2	Buzzard	1	18/04/2019	17:09	27	0	10	A			Flying	Yes
5	2	Buzzard	1	28/05/2019	14:42	155	113	120	B			Soaring	Yes
6	2	Buzzard	1	28/05/2019	14:42	189	77	120	B			Soaring	Yes
7	2	Buzzard	1	27/06/2019	18:42	88	0	20	B			Soaring	Yes
8	2	Buzzard	1	17/08/2019	10:17	28	0	10	A		J	Flying	Yes
9	3	Buzzard	1	07/06/2019	13:38	424	49	60	B		A	Soaring	Yes
10	4	Buzzard	2	18/04/2019	14:24	0	346	100	B			Soaring	No
11	4	Buzzard	1	30/04/2019	16:00	1461	645	150	B			Hunting	Yes
12	4	Buzzard	1	30/04/2019	18:58	0	236	150	B			Hunting	No
13	4	Buzzard	1	01/05/2019	13:36	374	17	200	C			Flying	Yes
14	4	Buzzard	1	01/05/2019	14:23	55	51	100	B			Flying	Yes
15	4	Buzzard	1	08/05/2019	19:14	0	32	75	B			Hunting	No
16	5	Buzzard	1	17/04/2019	12:42	302	0	100	B			Flying	Yes
17	5	Buzzard	1	18/04/2019	11:22	93	7	25	B		A	Flying	Yes
18	5	Buzzard	1	18/04/2019	12:58	0	258	60	B		A	Soaring	No
19	5	Buzzard	1	19/04/2019	11:14	13	196	20	B			Soaring	Yes
20	5	Buzzard	1	25/04/2019	12:28	1	236	30	B			Hunting	Yes
21	5	Buzzard	1	25/04/2019	12:33	814	58	120	B			Hunting	Yes
22	5	Buzzard	1	25/04/2019	13:29	45	0	30	B		A	Flying	Yes
23	5	Buzzard	1	25/04/2019	13:29	50	0	50	B		A	Soaring	Yes
24	5	Buzzard	1	25/04/2019	13:29	11	7	120	B		A	Soaring	Yes
25	5	Buzzard	1	25/04/2019	13:29	19	131	100	B			Hunting	Yes
26	5	Buzzard	1	30/04/2019	14:01	0	5	40	B			Hunting	No
27	5	Buzzard	1	30/04/2019	14:01	0	10	60	B			Hunting	No
28	5	Buzzard	1	30/04/2019	14:01	0	15	90	B			Hunting	Yes
29	5	Buzzard	2	11/06/2019	12:38	0	55	60	B		A	Flying	Yes
30	1	Buzzard	1	08/10/2019	15:13	34	1	10	A			Commuting	Yes
31	1	Buzzard	1	12/11/2019	09:49	0	45	20	B			Commuting	Yes
32	1	Buzzard	1	04/12/2019	11:20	45	0	25	B			Mobbed	Yes
33	1	Buzzard	1	03/02/2020	14:54	175	0	40	B			Hunting	No

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
34	3	Buzzard	1	27/02/2020	11:23	98	30	15	A			Flying	Yes
35	5	Buzzard	1	06/02/2020	15:23	16	9	20	B			Flying	Yes
36	1	Buzzard	1	24/04/2020	15:14	8	0	6	A			Flying	Yes
37	1	Buzzard	1	07/06/2020	13:16	320	172	50	B		A	Hunting	Yes
38	1	Buzzard	1	25/08/2020	18:42	37	0	20	B		A	Flying	Yes
39	1	Buzzard	1	26/08/2020	14:21	0	94	20	B		A	Flying	No
40	2	Buzzard	1	28/05/2020	11:37	99	0	40	B			Hunting	Yes
41	3	Buzzard	1	21/04/2020	13:48	245	0	100	B		A	Soaring	Yes
42	3	Buzzard	2	29/05/2020	14:55	292	155	150	B		A	Soaring	Yes
43	3	Buzzard	1	29/05/2020	15:38	244	0	150	B		A	Soaring	Yes
44	3	Buzzard	2	11/08/2020	10:56	0	840	120	B			Soaring	No
45	4	Buzzard	1	14/05/2020	11:50	624	0	100	B		A	Soaring	Yes
46	4	Buzzard	1	14/05/2020	14:38	164	111	150	B	M	A	Soaring	Yes
47	4	Buzzard	1	12/06/2020	16:06	70	0	35	B			Flying	Yes
48	4	Buzzard	1	12/08/2020	11:07	202	81	10	A		A	Commuting	Yes
49	5	Buzzard	2	21/04/2020	15:22	263	25	100	B	M,F	A	Soaring	Yes
50	5	Buzzard	1	22/04/2020	16:09	142	305	80	B	M	A	Soaring	Yes
51	5	Buzzard	1	27/05/2020	15:48	10	114	150	B		A	Soaring	Yes
52	5	Buzzard	1	12/06/2020	13:55	256	186	100	B		A	Soaring	Yes
53	1	Buzzard	1	16/11/2020	08:21	20	0	7	A		A	Perched	Yes
54	2	Buzzard	1	17/11/2020	09:38	2	3	25	B			Flying	Yes
55	2	Buzzard	1	17/11/2020	09:38	10	0	10	A			Flying	Yes
56	3	Buzzard	1	05/09/2020	13:19	12	46	45	B			Commuting	Yes
57	3	Buzzard	1	16/10/2020	11:57	0	52	50	B			Commuting	No
58	4	Buzzard	1	15/10/2020	11:27	0	31	35	B			Commuting	No
59	4	Buzzard	1	15/12/2020	12:18	1	42	15	A			Flying	Yes
60	4	Buzzard	1	25/01/2021	16:04	218	29	150	B		A	Flying	Yes
61	4	Buzzard	1	22/02/2021	13:49	466	0	200	C			Flying	Yes
62	5	Buzzard	1	06/09/2020	11:37	45	50	300	C			Commuting	Yes
63	5	Buzzard	1	28/09/2020	13:16	141	0	120	B			Commuting	Yes
64	5	Buzzard	1	21/10/2020	09:51	0	0	10	A			Perched	Yes
65	5	Buzzard	1	21/10/2020	09:53	0	0	10	A			Perched	Yes
66	5	Buzzard	1	21/10/2020	09:54	5	0	10	A			Flying	Yes
67	5	Buzzard	1	21/10/2020	09:57	0	0	10	A			Perched	Yes
68	5	Buzzard	1	21/10/2020	11:43	0	0	10	A			Perched	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
69	5	Buzzard	1	21/10/2020	11:59	0	0	10	A			Perched	Yes
70	5	Buzzard	1	21/10/2020	12:17	12	0	10	A			Flying	Yes
71	5	Buzzard	1	21/10/2020	12:17	0	0	10	A			Perched	Yes
72	4	Buzzard	1	02/12/2019	14:47	64	16	30	B			Commuting	Yes
73	1	Buzzard	1	04/12/2023	11:40	63	0	20	B		A	Mobbed	Yes
74	1	Buzzard	1	24/01/2024	13:44	30	260	30	B			Present	Yes
75	1	Buzzard	1	24/01/2024	13:45	20	240	35	B			Present	Yes
76	1	Buzzard	1	24/01/2024	13:45	25	0	40	B			Mobbing	Yes
77	2	Buzzard	1	28/10/2023	13:56	40	0	5	A			Flying	Yes
78	2	Buzzard	1	28/10/2023	14:49	30	0	10	A			Flying	Yes
79	2	Buzzard	1	28/10/2023	15:05	5	0	10	A			Flying	Yes
80	2	Buzzard	1	21/11/2023	08:59	42	0	18	A		A	Flying	Yes
81	2	Buzzard	1	03/12/2023	15:57	4	0	0	A		A	Commuting	Yes
82	2	Buzzard	1	21/02/2024	10:21	35	0	20	B			Flying	Yes
83	2	Buzzard	1	21/02/2024	14:22	20	15	40	B			Circling	Yes
84	4	Buzzard	1	22/02/2024	11:22	25	5	25	B			Present	Yes
85	4	Buzzard	1	22/02/2024	11:22	25	5	25	B			Present	Yes
86	5	Buzzard	1	29/01/2024	10:45	60	20	30	B			Present	Yes
87	5	Buzzard	1	29/01/2024	13:59	30	5	35	B			Present	No
88	5	Buzzard	1	27/02/2024	09:52	128	0	25	B			Present	Yes
89	5	Buzzard	1	28/01/2024	14:40	40	45	40	B			Present	Yes
90	1	Buzzard	1	27/03/2024	11:25	10	0	0	-			Flying	Yes
91	1	Buzzard	1	27/03/2024	11:55	181	0	0	-		A	Hunting	Yes
92	1	Buzzard	1	15/08/2024	12:28	27	0	0	-			Hunting	Yes
93	1	Buzzard	4	11/09/2024	12:41	20	70	100	B			Flying	Yes
94	1	Buzzard	1	24/04/2024	10:14	0	0	0	-		A	Soaring	Yes
95	1	Buzzard	1	24/04/2024	10:36	59	0	0	-		A	Hunting	Yes
96	1	Buzzard	1	24/04/2024	11:27	152	0	0	-		A	Soaring	Yes
97	1	Buzzard	1	21/06/2024	10:12	0	11	0	-		A	Hunting	No
98	1	Buzzard	1	29/07/2024	12:06	430	0	0	-		A	Hunting	Yes
99	2	Buzzard	1	27/03/2024	09:04	126	0	0	-		A	Flying	Yes
100	2	Buzzard	1	31/07/2024	08:31	0	22	0	-		A	Hunting	No
101	2	Buzzard	1	31/07/2024	10:41	450	28	0	-		A	Soaring	Yes
102	2	Buzzard	2	31/07/2024	11:00	514	0	0	-			Soaring	Yes
103	2	Buzzard	2	31/07/2024	11:27	258	0	0	-		A	Hunting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
104	2	Buzzard	1	31/07/2024	12:26	187	0	0	-		A	Soaring	Yes
105	2	Buzzard	4	31/07/2024	12:30	0	0	0	-			Flying	Yes
106	2	Buzzard	1	22/05/2024	08:20	10	0	6	A		A	Hunting	Yes
107	2	Buzzard	1	22/05/2024	09:05	20	0	25	B		A	Flying	Yes
108	2	Buzzard	1	22/05/2024	10:02	0	0	0	-		A	Hunting	Yes
109	2	Buzzard	1	22/05/2024	10:18	0	0	20	B		A	Hunting	Yes
110	2	Buzzard	1	22/05/2024	10:24	152	0	0	-		A	Hunting	Yes
111	2	Buzzard	2	22/05/2024	11:20	0	0	0	-		A	Flying	Yes
112	2	Buzzard	1	25/06/2024	12:31	101	0	0	-		A	Hunting	Yes
113	3	Buzzard	1	30/07/2024	11:21	0	197	0	-		A	Soaring	No
114	3	Buzzard	1	30/07/2024	13:16	24	0	20	B		A	Hunting	Yes
115	3	Buzzard	1	23/04/2024	12:16	10	0	0	-		A	Hunting	Yes
116	3	Buzzard	1	20/06/2024	11:09	0	4	6	A		A	Hunting	No
117	4	Buzzard	1	11/09/2024	11:41	0	30	30	-			Mobbed	Yes
118	4	Buzzard	1	24/06/2024	12:17	45	0	0	-		A	Hunting	Yes
119	5	Buzzard	1	28/03/2024	09:35	0	180	30	-			Commuting	No
120	5	Buzzard	1	28/03/2024	10:20	0	270	50	-			Commuting	No
121	5	Buzzard	2	28/03/2024	11:21	40	240	40	-			Commuting	Yes
122	5	Buzzard	3	28/03/2024	13:36	0	240	80	-	1M,2F		Commuting	No
123	5	Buzzard	1	23/04/2024	11:03	20	0	25	-			Mobbed	Yes
124	5	Buzzard	1	23/04/2024	11:17	120	10	100	-			Soaring	Yes
125	5	Buzzard	1	23/04/2024	11:44	0	50	30	-			Commuting	No
126	5	Buzzard	1	23/04/2024	12:18	150	0	40	-			Soaring	Yes
127	5	Buzzard	1	23/04/2024	12:37	40	180	50	-			Hunting	Yes
128	5	Buzzard	1	23/04/2024	13:13	0	80	30	-			Commuting	Yes
129	5	Buzzard	2	23/04/2024	13:31	100	20	40	-			Soaring	Yes
130	5	Buzzard	1	23/04/2024	14:16	0	20	70	-			Mobbed	No
131	5	Buzzard	1	23/04/2024	14:57	20	0	25	-			Hunting	Yes
132	5	Buzzard	1	10/06/2024	12:24	210	20	100	-			Hunting	Yes
133	5	Buzzard	2	16/07/2024	12:58	0	5	5	-			Hunting	No
134	5	Buzzard	1	16/07/2024	14:07	500	100	50	-			Soaring	Yes

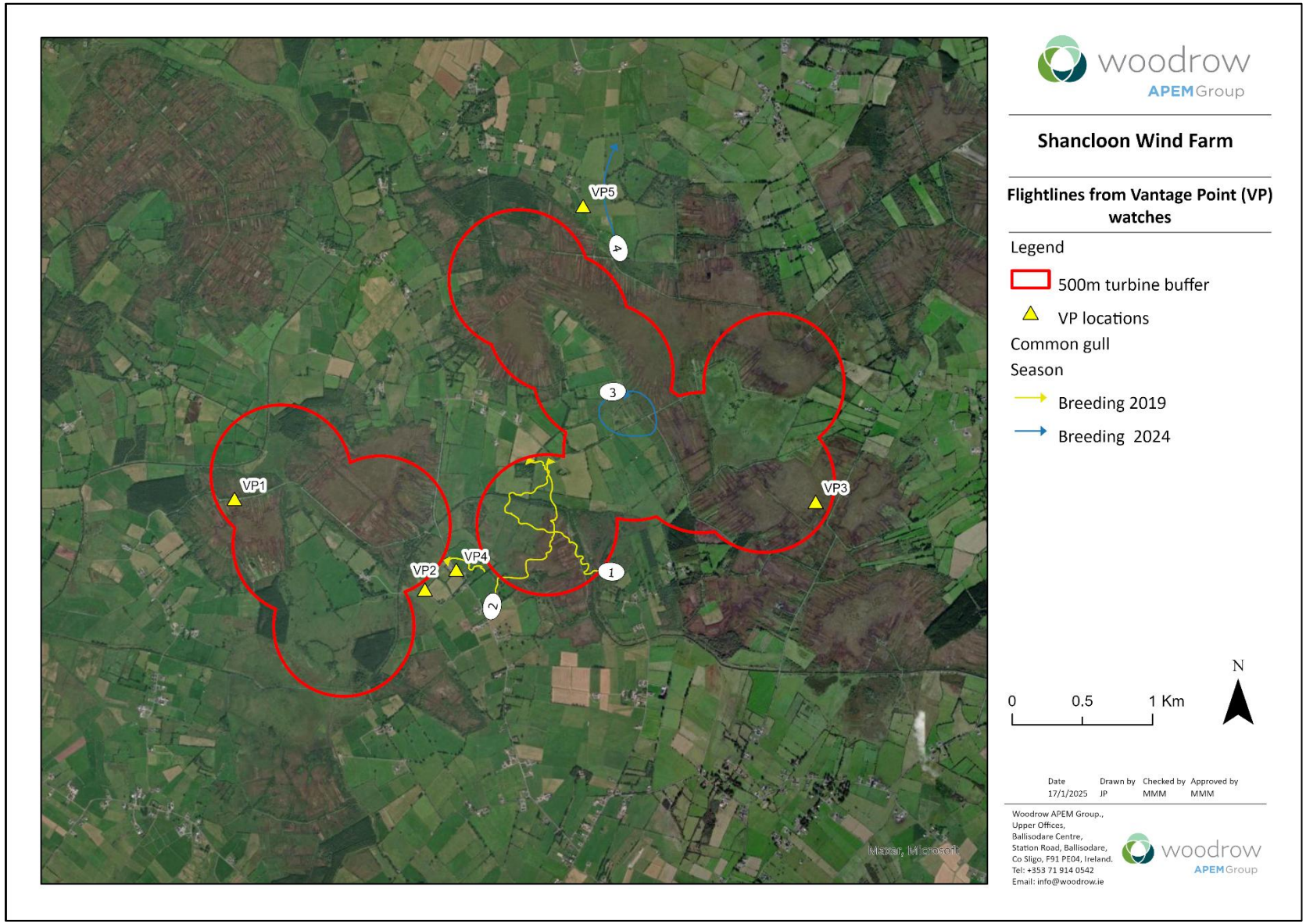


Figure X.4. Common gull flightlines from VP Watches

Table IX.4: VP watch data for common gull

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	4	Common gull	1	01/07/2019	18:27	0	22	15	A			Flying	No
1	4	Common gull	1	12/07/2019	10:53	217	0	40	B			Flying	Yes
2	4	Common gull	1	12/07/2019	12:35	84	8	20	B			Flying	Yes
3	5	Common gull	14	28/03/2024	10:56	180	0	30	-			Commuting	Yes
4	5	Common gull	2	16/07/2024	10:11	0	40	25	-		J	Commuting	No

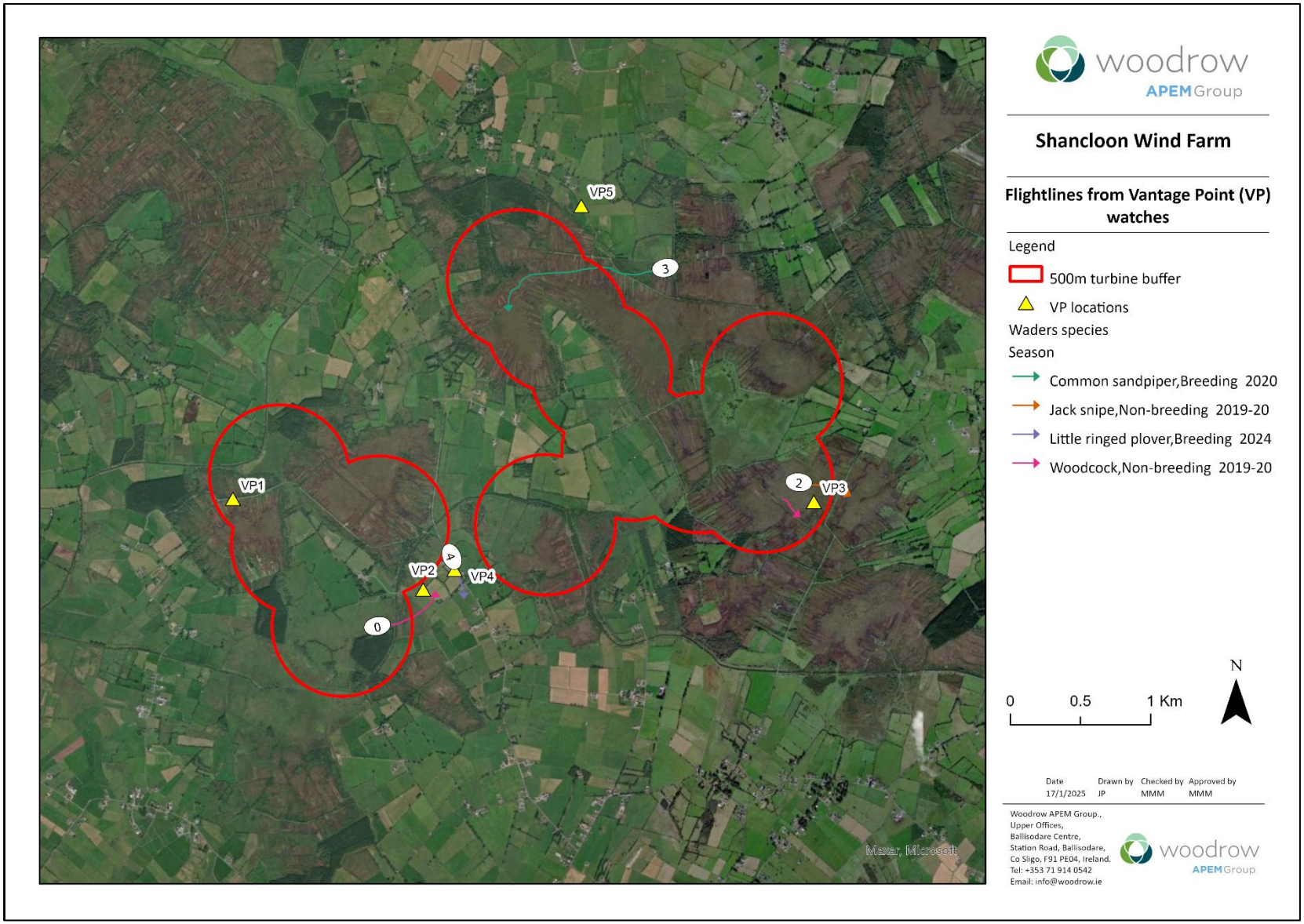


Figure X.5. Other wader species flightlines from VP Watches

Table IX.5: VP watch data for other wader species

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Woodcock	1	06/11/2019	17:17	13	22	15	A			Commuting	Yes
1	3	Woodcock	1	10/01/2020	11:45	7	0	1	A			Flying	Yes
2	3	Jack snipe	1	28/01/2020	13:45	5	5	2	A			Flying	Yes
3	5	Common sandpiper	1	30/04/2020	22:01	11	5	5	A			Flying	Yes
4	4	Little ringed plover	1	14/08/2024	08:47	52	0	0	-		A	Flying	No

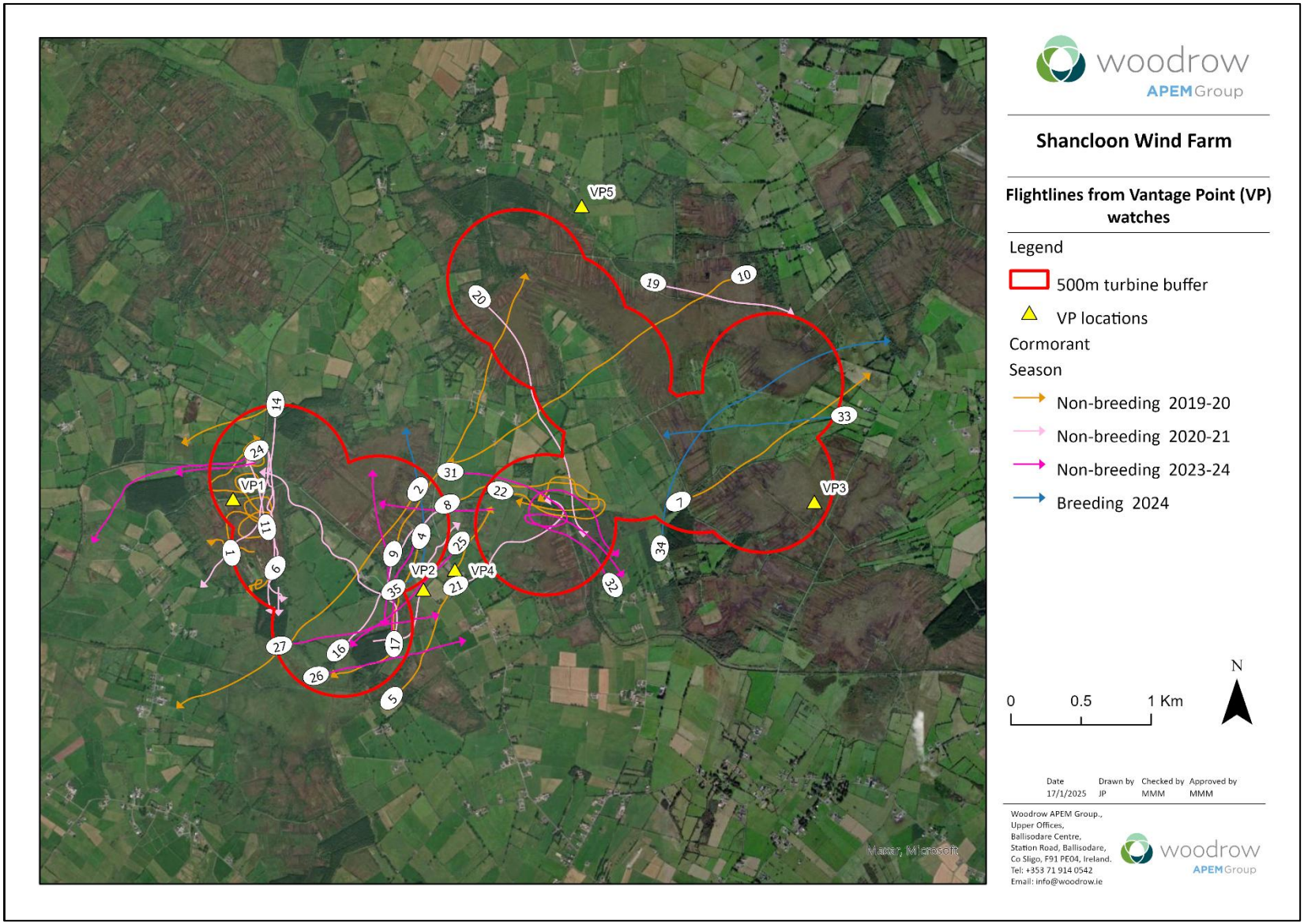


Figure X.6. Cormorant flightlines from VP Watches

Table IX.6: VP watch data for cormorant

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Cormorant	1	08/10/2019	15:30	44	66	10	A			Commuting	Yes
1	1	Cormorant	1	28/02/2020	09:00	46	20	15	A			Flying	Yes
2	2	Cormorant	1	04/12/2019	09:08	79	46	60	B			Commuting	Yes
3	2	Cormorant	1	04/12/2019	09:06	23	32	70	B			Commuting	Yes
4	2	Cormorant	1	16/01/2020	11:03	70	0	25	B			Present	Yes
5	2	Cormorant	1	08/02/2020	09:36	13	72	45	B			Flying	Yes
6	1	Cormorant	1	13/02/2020	14:21	47	0	15	A			Flying	Yes
7	3	Cormorant	1	08/02/2020	10:29	83	17	80	B			Flying	Yes
8	4	Cormorant	1	27/01/2020	12:46	31	4	10	A			Flying	Yes
9	4	Cormorant	1	05/02/2020	09:01	130	10	40	B			Commuting	Yes
10	5	Cormorant	1	06/02/2020	13:58	41	59	60	B			Flying	Yes
11	1	Cormorant	1	16/11/2020	08:07	15	0	15	A		A	Flying	Yes
12	1	Cormorant	1	14/12/2020	15:34	83	4	30	B		A	Flying	Yes
13	1	Cormorant	1	21/01/2021	14:50	18	0	25	B		A	Flying	Yes
14	1	Cormorant	1	21/01/2021	15:15	106	38	40	B		A	Flying	Yes
15	1	Cormorant	1	24/02/2021	09:45	105	0	20	B		A	Flying	Yes
16	2	Cormorant	1	04/12/2020	08:41	132	0	30	B		A	Flying	Yes
17	2	Cormorant	1	16/12/2020	10:34	104	0	25	B		A	Flying	Yes
18	2	Cormorant	1	22/01/2021	10:24	63	43	20	B		A	Flying	Yes
19	3	Cormorant	1	02/12/2020	12:01	0	131	50	B			Flying	No
20	4	Cormorant	1	21/01/2021	11:27	103	42	40	B		A	Flying	Yes
21	4	Cormorant	1	25/01/2021	14:50	170	35	40	B		A	Flying	Yes
22	4	Cormorant	1	02/12/2019	16:10	125	0	60	B			Commuting	Yes
23	1	Cormorant	1	28/10/2023	10:34	20	0	30	B			Flying	Yes
24	1	Cormorant	1	29/10/2023	14:12	5	40	30	B			Present	Yes
25	2	Cormorant	1	08/11/2023	09:58	25	52	30	B		A	Commuting	Yes
26	2	Cormorant	4	21/11/2023	08:36	30	26	20	B		A	Commuting	Yes
27	2	Cormorant	1	21/11/2023	09:03	39	12	40	B		A	Commuting	Yes
28	2	Cormorant	2	21/11/2023	09:13	67	0	15	A		A	Commuting	Yes
29	2	Cormorant	1	21/11/2023	12:51	38	0	8	A		A	Present	Yes
30	4	Cormorant	1	10/11/2023	11:07	50	5	20	B		A	Commuting	Yes
31	4	Cormorant	1	27/01/2024	12:16	30	5	35	B			Present	Yes
32	4	Cormorant	1	27/01/2024	12:41	50	0	25	B			Present	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
33	3	Cormorant	1	16/08/2024	11:27	0	52	0	-		A	Flying	Yes
34	3	Cormorant	1	23/04/2024	11:05	181	10	0	-		A	Flying	Yes
35	4	Cormorant	2	14/08/2024	07:02	34	8	0	-	J	A	Flying	Yes

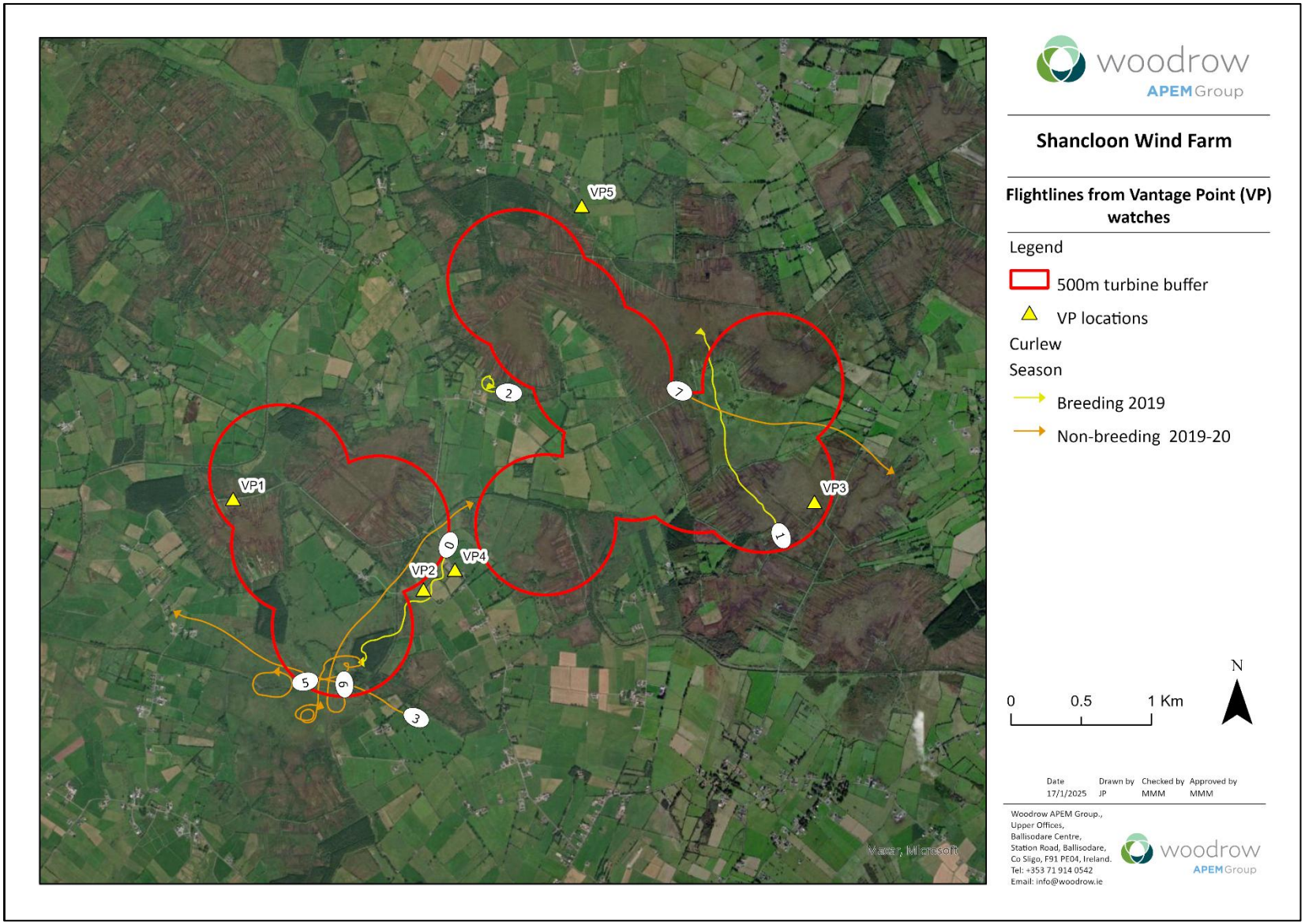


Figure X.7. Curlew flightlines from VP Watches

Table IX.7: VP watch data for curlew

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Curlew	1	06/09/2019	09:05	50	36	20	B			Flying	Yes
1	3	Curlew	1	12/07/2019	07:04	20	3	35	B			Flying	Yes
2	4	Curlew	2	30/04/2019	18:49	0	25	40	B			Flying	No
3	2	Curlew	1	09/10/2019	08:27	14	26	25	B			Commuting	Yes
4	2	Curlew	7	12/12/2019	11:22	0	45	30	B			Calling	No
5	2	Curlew	11	12/12/2019	13:21	86	79	60	B			Flushed	Yes
6	2	Curlew	11	12/12/2019	13:38	60	20	60	B			Flushed	Yes
7	3	Curlew	75	08/10/2019	10:33	48	27	20	B			Commuting	Yes

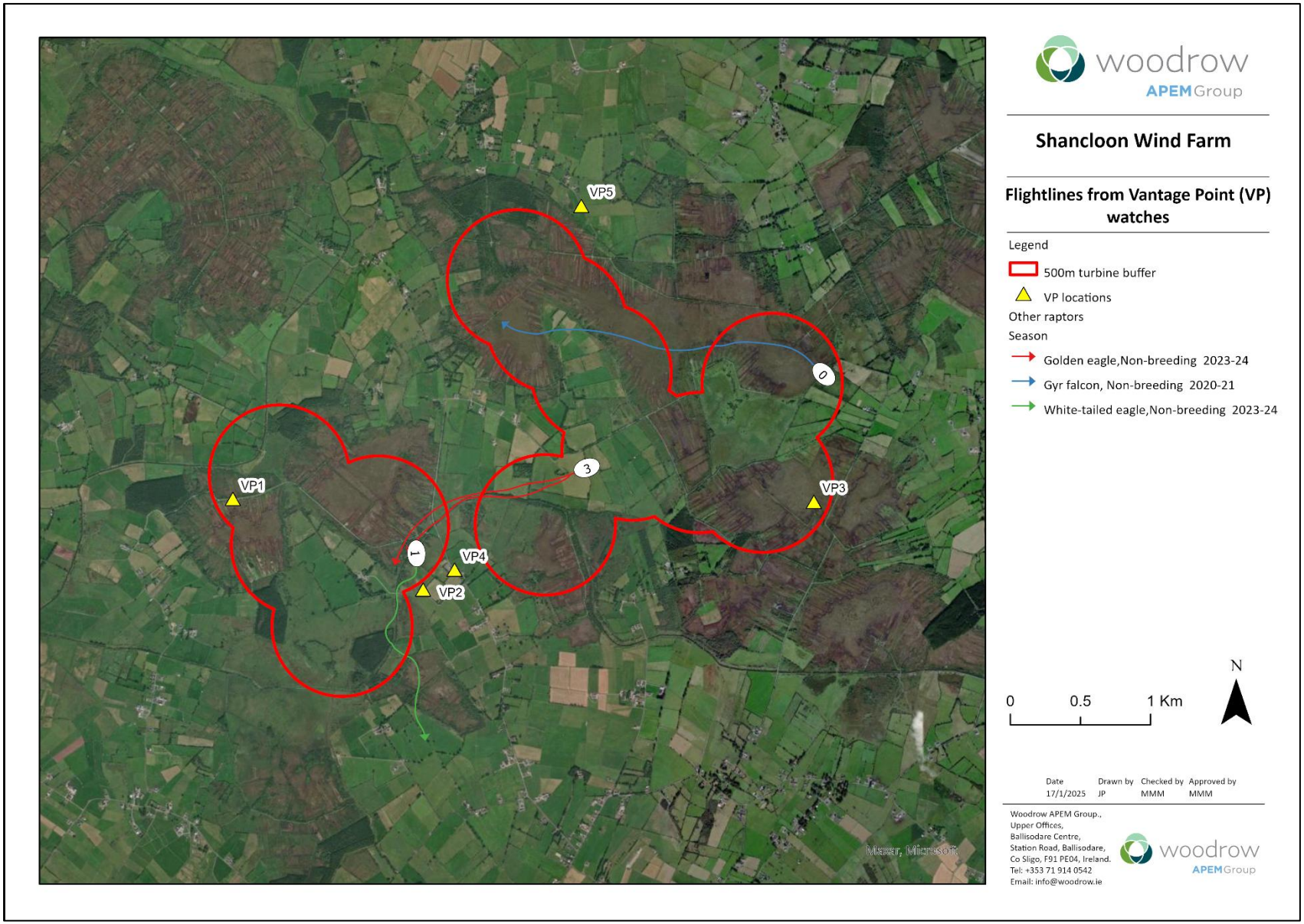


Figure X.8. Other raptors flightlines from VP Watches

Table IX.8: VP watch data for other raptors species

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	3	Gyr falcon	1	08/12/2020	12:06	57	9	20	B		A	Hunting	Yes
1	2	White-tailed eagle	1	08/11/2023	10:21	125	130	20	B		J	Flying	Yes
2	4	Golden eagle	1	22/02/2024	10:22	5	15	10	A			Present	Yes
3	4	Golden eagle	1	22/02/2024	10:22	5	15	10	A			Present	Yes

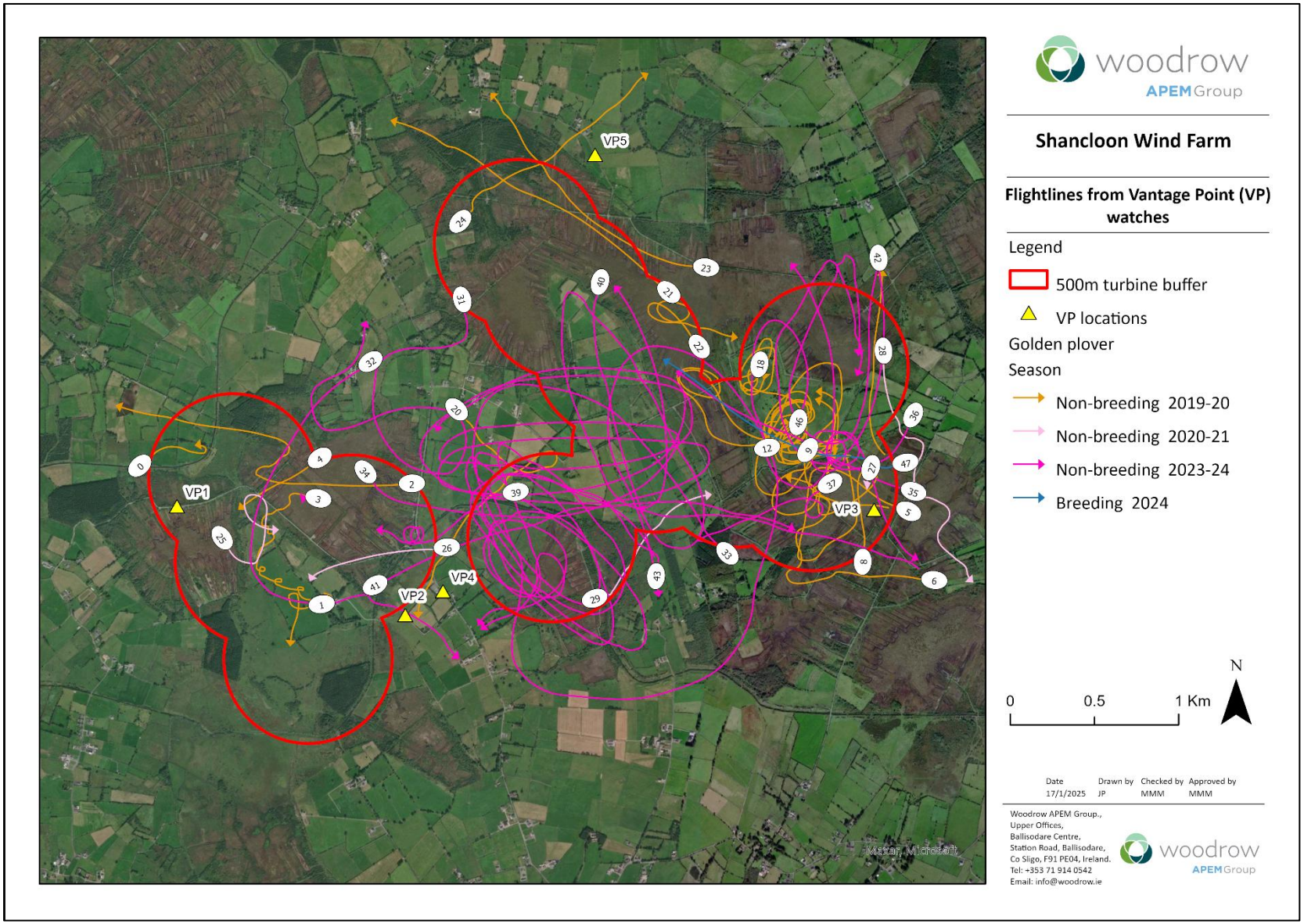


Figure X.9. Golden plover flightlines from VP Watches

Table IX.9: VP watch data for golden plover

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Golden plover	4	12/11/2019	09:17	90	0	150	B			Commuting	Yes
1	1	Golden plover	14	07/12/2019	14:32	58	87	20	B			Commuting	Yes
2	2	Golden plover	28	04/12/2019	08:58	63	12	60	B			Commuting	Yes
3	1	Golden plover	2	13/02/2020	14:21	299	16	80	B			Flying	Yes
4	1	Golden plover	1	13/02/2020	14:21	63	0	30	B			Flying	Yes
5	3	Golden plover	23	04/10/2019	08:56	109	0	20	B			Flying	Yes
6	3	Golden plover	1	04/10/2019	09:23	115	112	20	B			Flying	Yes
7	3	Golden plover	17	08/10/2019	08:36	270	0	40	B			Circling	Yes
8	3	Golden plover	7	08/10/2019	09:16	320	0	50	B			Circling	Yes
9	3	Golden plover	46	08/10/2019	09:19	90	0	50	B			Circling	Yes
10	3	Golden plover	53	08/10/2019	09:21	420	0	40	B			Circling	Yes
11	3	Golden plover	53	08/10/2019	09:37	360	0	45	B			Circling	Yes
12	3	Golden plover	27	08/10/2019	09:43	135	0	50	B			Commuting	Yes
13	3	Golden plover	18	08/10/2019	09:58	165	0	25	B			Circling	Yes
14	3	Golden plover	20	08/10/2019	10:17	270	0	35	B			Circling	Yes
15	3	Golden plover	12	08/10/2019	10:37	49	11	60	B	M,F		Commuting	Yes
16	3	Golden plover	11	08/10/2019	10:53	268	27	50	B			Circling	Yes
17	3	Golden plover	2	08/10/2019	11:04	105	0	20	B	M,F		Commuting	Yes
18	3	Golden plover	39	08/10/2019	11:10	170	5	20	B			Circling	Yes
19	3	Golden plover	120	08/10/2019	11:22	120	0	30	B			Circling	Yes
20	4	Golden plover	18	06/11/2019	10:07	63	82	80	B			Commuting	Yes
21	5	Golden plover	6	09/10/2019	18:53	61	34	40	B			Commuting	Yes
22	5	Golden plover	18	10/10/2019	16:28	146	29	40	B			Circling	Yes
23	5	Golden plover	35	06/11/2019	10:42	42	48	70	B			Commuting	Yes
24	5	Golden plover	6	08/12/2019	08:31	30	45	75	B			Commuting	Yes
25	1	Golden plover	32	16/11/2020	09:22	90	0	50	B			Flying	Yes
26	2	Golden plover	1	17/11/2020	11:31	15	0	40	B			Flying	Yes
27	3	Golden plover	1	15/11/2020	12:47	0	0	0	A			Calling	Yes
28	3	Golden plover	60	15/12/2020	09:54	17	73	120	B			Flying	Yes
29	4	Golden plover	120	03/12/2020	14:04	22	7	120	B			Flying	Yes
30	1	Golden plover	23	07/11/2023	14:17	0	0	0	-			Perched	Yes
31	1	Golden plover	80	24/01/2024	11:43	0	65	150	B			Present	No

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
32	2	Golden plover	77	25/01/2024	11:44	120	10	170	C			Present	Yes
33	2	Golden plover	86	25/01/2024	13:28	360	40	200	C			Present	Yes
34	2	Golden plover	180	25/01/2024	15:33	###	620	100	B			Present	Yes
35	3	Golden plover	76	26/03/2024	09:12	78	0	0	-			Flying	Yes
36	3	Golden plover	6	08/11/2023	16:31	190	10	40	B		A	Commuting	Yes
37	3	Golden plover	11	24/11/2023	10:31	180	5	100	B		A	Flushed	Yes
38	3	Golden plover	20	26/01/2024	11:04	40	5	30	B			Flying	Yes
39	3	Golden plover	65	26/01/2024	14:03	70	0	35	B			Flying	Yes
40	3	Golden plover	0	26/01/2024	16:10	0	0	150	B			Present	Yes
41	3	Golden plover	0	26/01/2024	16:22	0	0	150	B			Present	Yes
42	3	Golden plover	5	26/01/2024	16:42	30	15	120	B			Flying	Yes
43	4	Golden plover	28	28/01/2024	12:11	360	0	40	B			Flying	Yes
44	4	Golden plover	28	28/01/2024	12:11	360	0	40	B			Present	Yes
45	3	Golden plover	120	27/01/2024	10:26	180	45	40	B			Present	Yes
46	3	Golden plover	140	27/01/2024	11:01	95	30	35	B			Present	Yes
47	3	Golden plover	76	26/03/2024	09:12	78	0	0	-			Flying	Yes

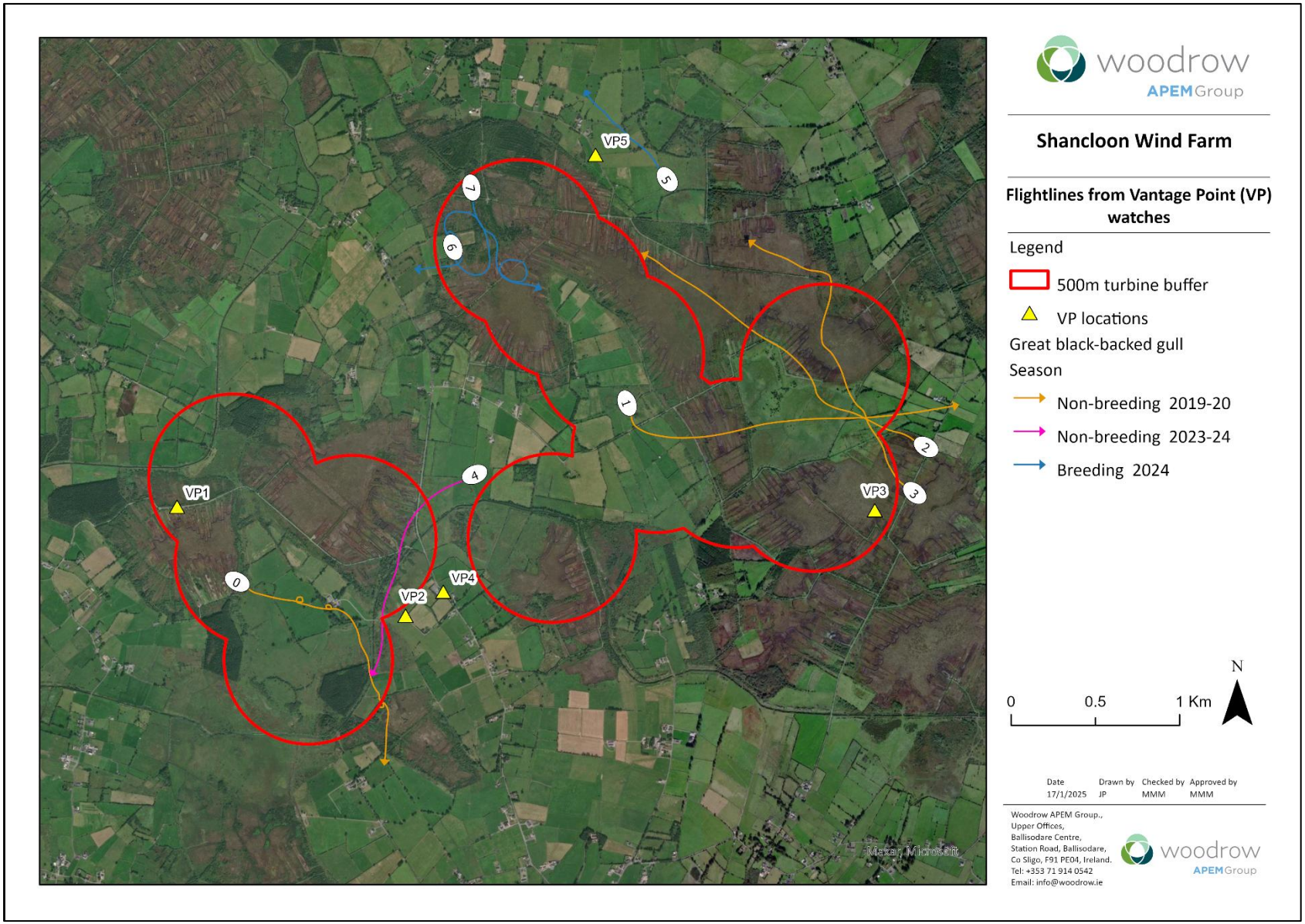


Figure X.10. Great black-backed gull flightlines from VP Watches

Table IX.10: VP watch data for great black-backed gull

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Great black-backed gull	1	08/12/2019	15:31	75	25	60	B			Commuting	Yes
1	3	Great black-backed gull	1	15/01/2020	09:03	125	30	30	B		A	Commuting	Yes
2	3	Great black-backed gull	1	15/01/2020	09:12	71	69	40	B			Commuting	Yes
3	3	Great black-backed gull	1	15/01/2020	09:59	120	60	35	B		A	Commuting	Yes
4	2	Great black-backed gull	1	25/01/2024	11:47	25	15	25	B		A	Present	Yes
5	5	Great black-backed gull	2	23/04/2024	09:49	0	50	30	-			Commuting	No
6	5	Great black-backed gull	3	23/04/2024	11:17	180	0	100	-		3A	Soaring	Yes
7	5	Great black-backed gull	1	21/05/2024	11:56	70	0	30	-			Soaring	Yes

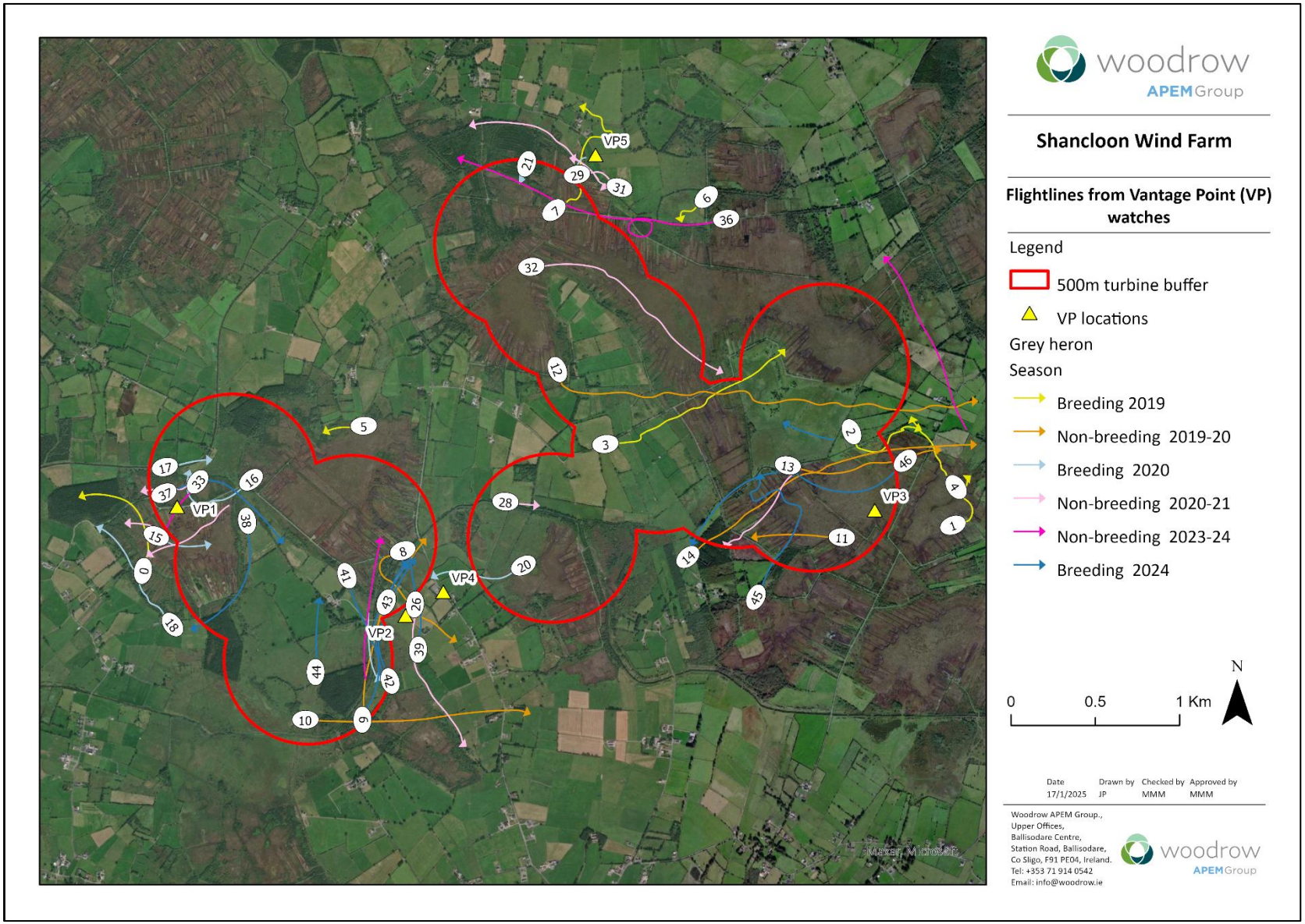


Figure X.11. Grey heron flightlines from VP Watches

Table IX.11: VP watch data for grey heron

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Grey heron	1	30/04/2019	18:29	0	44	20	B			Flying	No
1	3	Grey heron	1	17/04/2019	15:04	0	8	20	B			Flying	No
2	3	Grey heron	1	17/04/2019	16:47	7	10	20	B			Flying	Yes
3	3	Grey heron	2	30/07/2019	08:57	31	0	2	A			Flying	Yes
4	3	Grey heron	2	05/09/2019	18:18	0	40	15	A			Flying	No
5	4	Grey heron	1	01/05/2019	14:34	0	14	15	A			Flying	No
6	5	Grey heron	1	30/04/2019	14:01	0	2	15	A			Flying	No
7	5	Grey heron	1	27/06/2019	13:29	35	11	15	A			Flying	Yes
8	2	Grey heron	1	04/12/2019	09:22	35	35	30	B			Commuting	Yes
9	2	Grey heron	1	06/01/2020	14:36	95	0	20	B			Commuting	Yes
10	2	Grey heron	2	04/02/2020	17:10	26	94	50	B			Flying	Yes
11	3	Grey heron	1	25/09/2019	14:38	35	0	10	A			Commuting	Yes
12	3	Grey heron	1	18/11/2019	11:26	123	29	10	A			Flying	Yes
13	3	Grey heron	1	27/11/2019	12:59	48	25	10	A	F		Flying	Yes
14	3	Grey heron	1	07/12/2019	08:42	92	43	35	B			Commuting	Yes
15	1	Grey heron	1	25/06/2020	12:57	24	6	20	B		A	Flying	Yes
16	1	Grey heron	1	23/07/2020	11:36	23	0	10	A		A	Commuting	Yes
17	1	Grey heron	1	14/08/2020	09:49	12	0	3	A		A	Flying	Yes
18	1	Grey heron	1	14/08/2020	10:17	0	66	25	B		A	Flying	No
19	2	Grey heron	1	28/08/2020	09:01	45	0	3	A		A	Flying	Yes
20	4	Grey heron	1	22/07/2020	10:49	18	23	20	B		A	Commuting	Yes
21	5	Grey heron	1	21/07/2020	06:48	0	0	20	B		A	Calling	Yes
22	5	Grey heron	1	21/07/2020	07:57	0	146	40	B		A	Commuting	No
23	1	Grey heron	1	29/09/2020	10:19	25	5	15	A			Commuting	Yes
24	1	Grey heron	1	20/10/2020	13:14	29	15	15	A			Commuting	Yes
25	1	Grey heron	1	26/01/2021	13:48	0	18	5	A		A	Flying	No
26	2	Grey heron	1	30/09/2020	12:41	0	69	35	B			Commuting	No
27	3	Grey heron	1	16/10/2020	10:11	141	2	10	A			Commuting	Yes
28	4	Grey heron	1	26/01/2021	09:45	18	0	20	B		A	Flying	Yes
29	5	Grey heron	1	08/12/2020	14:16	0	19	5	A		A	Flying	No
30	5	Grey heron	1	08/12/2020	15:49	0	31	5	A			Flying	No
31	5	Grey heron	1	16/12/2020	13:43	0	32	10	A		A	Flying	No
32	5	Grey heron	1	29/01/2021	10:03	45	5	10	A		A	Flying	Yes
33	1	Grey heron	1	28/10/2023	09:29	20	0	5	A			Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
34	2	Grey heron	1	21/11/2023	09:15	24	0	12	A		A	Flying	Yes
35	3	Grey heron	1	08/11/2023	16:20	0	85	15	A		A	Commuting	No
36	5	Grey heron	1	02/12/2023	15:27	38	13	12	A		A	Commuting	Yes
37	1	Grey heron	1	15/08/2024	12:29	27	0	0	-		A	Flying SE	Yes
38	1	Grey heron	1	21/06/2024	11:08	31	0	0	-		A	Flying	Yes
39	2	Grey heron	1	31/07/2024	07:01	18	17	0	-		A	Flying	Yes
40	2	Grey heron	1	19/08/2024	11:50	54	0	0	-		J	Flying	Yes
41	2	Grey heron	1	03/04/2024	13:45	20	0	5	A			Flying	Yes
42	2	Grey heron	1	22/04/2024	08:53	110	5	0	-		A	Flying	Yes
43	2	Grey heron	1	22/04/2024	12:21	10	0	0	-		A	Flying	Yes
44	2	Grey heron	2	25/06/2024	10:13	21	0	0	-		A	Flying	Yes
45	3	Grey heron	1	30/07/2024	07:42	61	0	0	-		A	Flying	Yes
46	3	Grey heron	1	30/07/2024	08:09	46	0	0	-		A	Flying	Yes
47	3	Grey heron	1	30/07/2024	08:28	48	0	0	-		A	Flying	Yes
48	3	Grey heron	1	30/07/2024	09:24	5	0	0	-		A	Flying	Yes

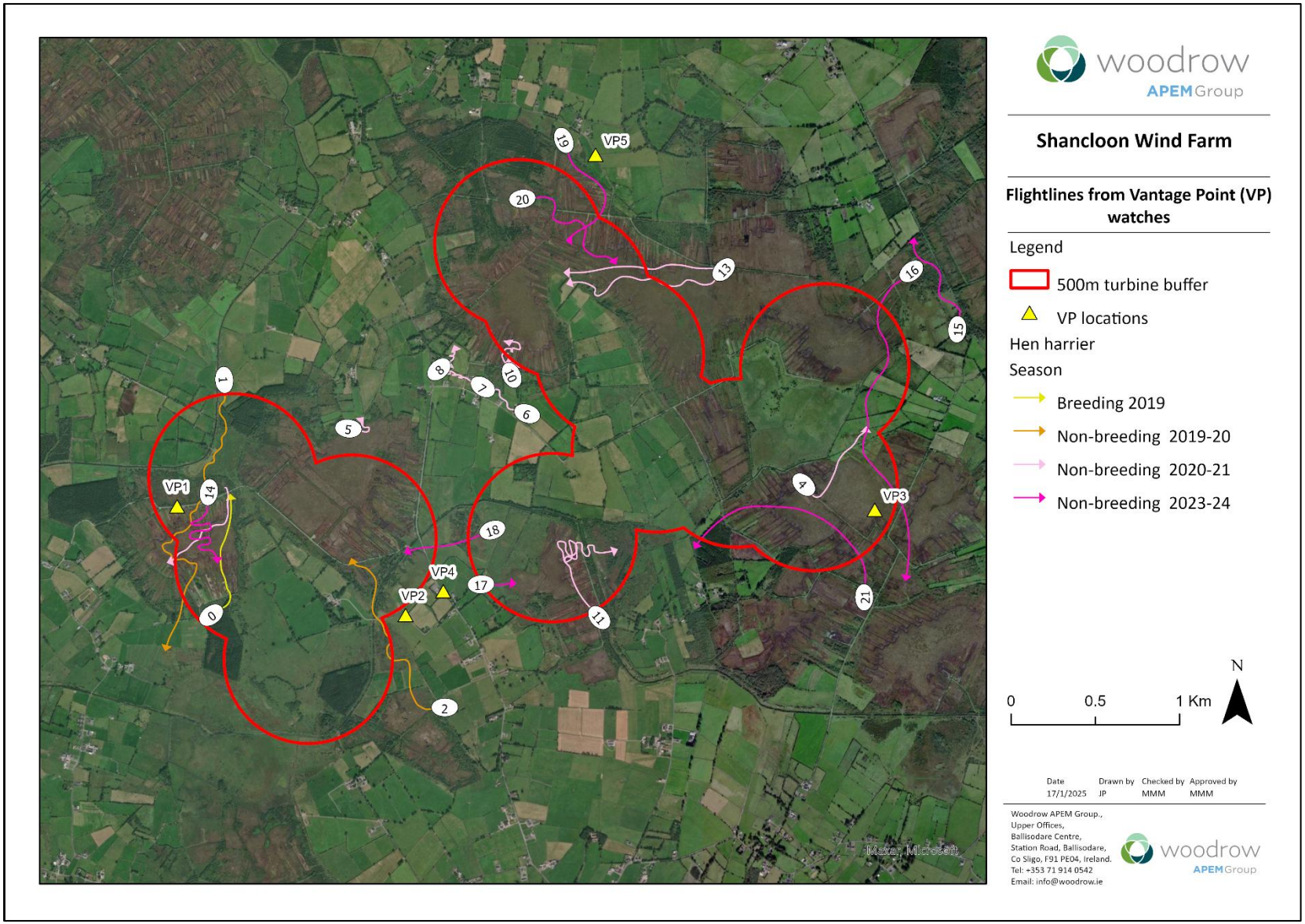


Figure X.12. Hen harrier flightlines from VP Watches

Table IX.12: VP watch data for hen harrier

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Hen harrier	1	18/04/2019	14:27	21	0	10	A	F		Hunting	Yes
1	1	Hen harrier	1	27/11/2019	09:48	82	64	5	A	M		Hunting	Yes
2	2	Hen harrier	1	21/11/2019	13:29	23	15	5	A			Flying	Yes
3	1	Hen harrier	1	26/01/2021	13:47	63	6	1	A	M	A	Hunting	Yes
4	3	Hen harrier	1	28/09/2020	09:05	82	0	15	A	F	A	Hunting	Yes
5	4	Hen harrier	1	15/10/2020	13:41	0	36	10	A	F	A	Hunting	No
6	4	Hen harrier	1	15/10/2020	13:53	0	57	30	B	F	A	Circling	No
7	4	Hen harrier	1	15/10/2020	13:53	0	112	30	B	F	A	Circling	No
8	4	Hen harrier	1	15/10/2020	13:53	0	118	120	B	F	A	Circling	No
9	4	Hen harrier	1	15/10/2020	13:54	0	47	20	B	F	A	Circling	No
10	4	Hen harrier	1	15/10/2020	13:54	17	5	30	B	F	A	Circling	Yes
11	4	Hen harrier	1	22/02/2021	14:17	71	0	40	B	M	A	Flying	Yes
12	5	Hen harrier	1	20/11/2020	14:21	26	24	38	B	F	A	Hunting	Yes
13	5	Hen harrier	1	20/11/2020	15:24	94	47	20	B	F	A	Hunting	Yes
14	1	Hen harrier	1	28/10/2023	11:29	40	0	1	A	F	A	Flying	Yes
15	3	Hen harrier	1	08/11/2023	14:57	0	5	10	A	F	A	Hunting	No
16	3	Hen harrier	1	08/11/2023	15:15	120	70	3	A	F	A	Hunting	Yes
17	4	Hen harrier	1	29/10/2023	10:36	5	0	2	A	F	A	Flying	Yes
18	4	Hen harrier	1	10/11/2023	11:04	7	10	15	A	F	A	Commuting	Yes
19	5	Hen harrier	1	10/11/2023	08:14	45	39	2	A	F	A	Hunting	Yes
20	5	Hen harrier	1	23/11/2023	14:55	74	0	3	A	F	A	Hunting	Yes
21	3	Hen harrier	1	27/01/2024	11:03	35	0	15	A	M	J	Present	Yes

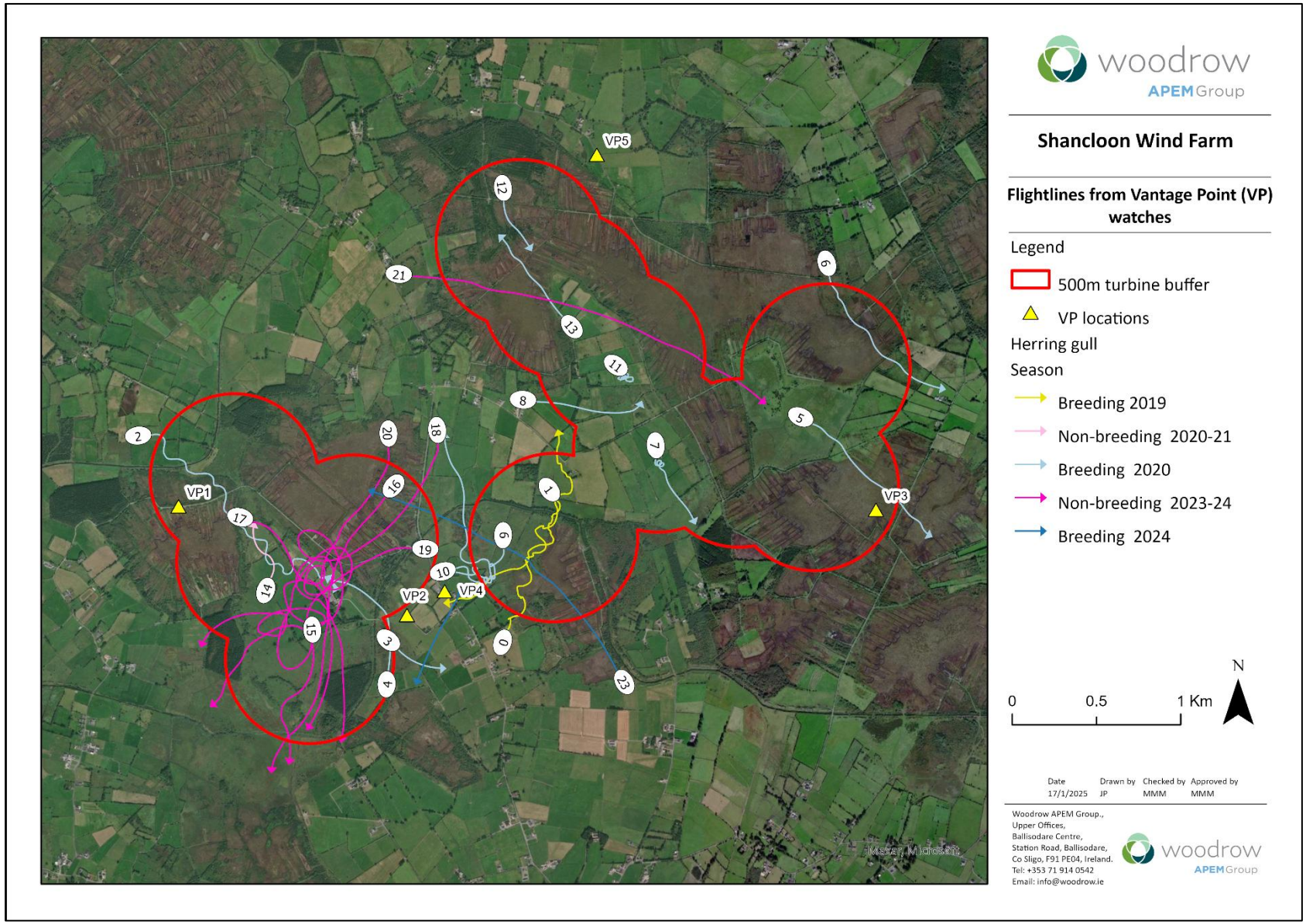


Figure X.13 Herring gull flightlines from VP Watches

Table IX.13: VP watch data for herring gull

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	4	Herring gull	1	12/07/2019	11:54	77	17	35	B			Flying	Yes
1	4	Herring gull	1	12/07/2019	12:26	37	20	30	B			Flying	Yes
2	1	Herring gull	1	14/08/2020	09:28	239	8	35	B		J	Flying	Yes
3	2	Herring gull	1	20/07/2020	08:06	0	71	25	B		A	Commuting	No
4	2	Herring gull	1	20/07/2020	10:02	87	13	120	B		A	Commuting	Yes
5	3	Herring gull	1	24/07/2020	08:12	43	19	100	B		A	Commuting	Yes
6	3	Herring gull	4	24/07/2020	08:42	43	16	100	B		A	Commuting	Yes
7	3	Herring gull	4	24/07/2020	09:39	57	0	50	B		A	Commuting	Yes
8	4	Herring gull	3	22/07/2020	07:52	40	6	100	B		A	Commuting	Yes
9	4	Herring gull	1	22/07/2020	09:12	33	22	10	A		A	Commuting	Yes
10	4	Herring gull	1	22/07/2020	09:34	31	97	15	A		A	Commuting	Yes
11	4	Herring gull	7	22/07/2020	09:52	57	0	140	B		A	Circling	Yes
12	5	Herring gull	1	21/07/2020	08:29	33	0	50	B		A	Commuting	Yes
13	5	Herring gull	1	21/07/2020	08:47	57	0	50	B		A	Commuting	Yes
14	1	Herring gull	1	04/12/2020	13:39	19	0	10	A		J	Flying	Yes
15	1	Herring gull	15	24/01/2024	11:40	10	3	30	B			Present	Yes
16	2	Herring gull	1	25/01/2024	10:03	35	0	35	G		1st Winter	Present	Yes
17	2	Herring gull	4	25/01/2024	14:16	650	10	50	B		3 A, 1 J	Present	Yes
18	2	Herring gull	9	25/01/2024	15:56	70	20	40	B			Present	Yes
19	2	Herring gull	2	25/01/2024	16:32	45	10	30	B		A	Present	Yes
20	2	Herring gull	3	21/02/2024	17:55	45	0	40	B			Drifted SW	Yes
21	5	Herring gull	1	29/01/2024	14:11	15	5	30	B		A	Present	Yes
22	2	Herring gull	6	03/04/2024	14:22	20	0	10	A			Flying	No
23	4	Herring gull	2	11/09/2024	09:31	0	80	40	-			Commuting	Yes

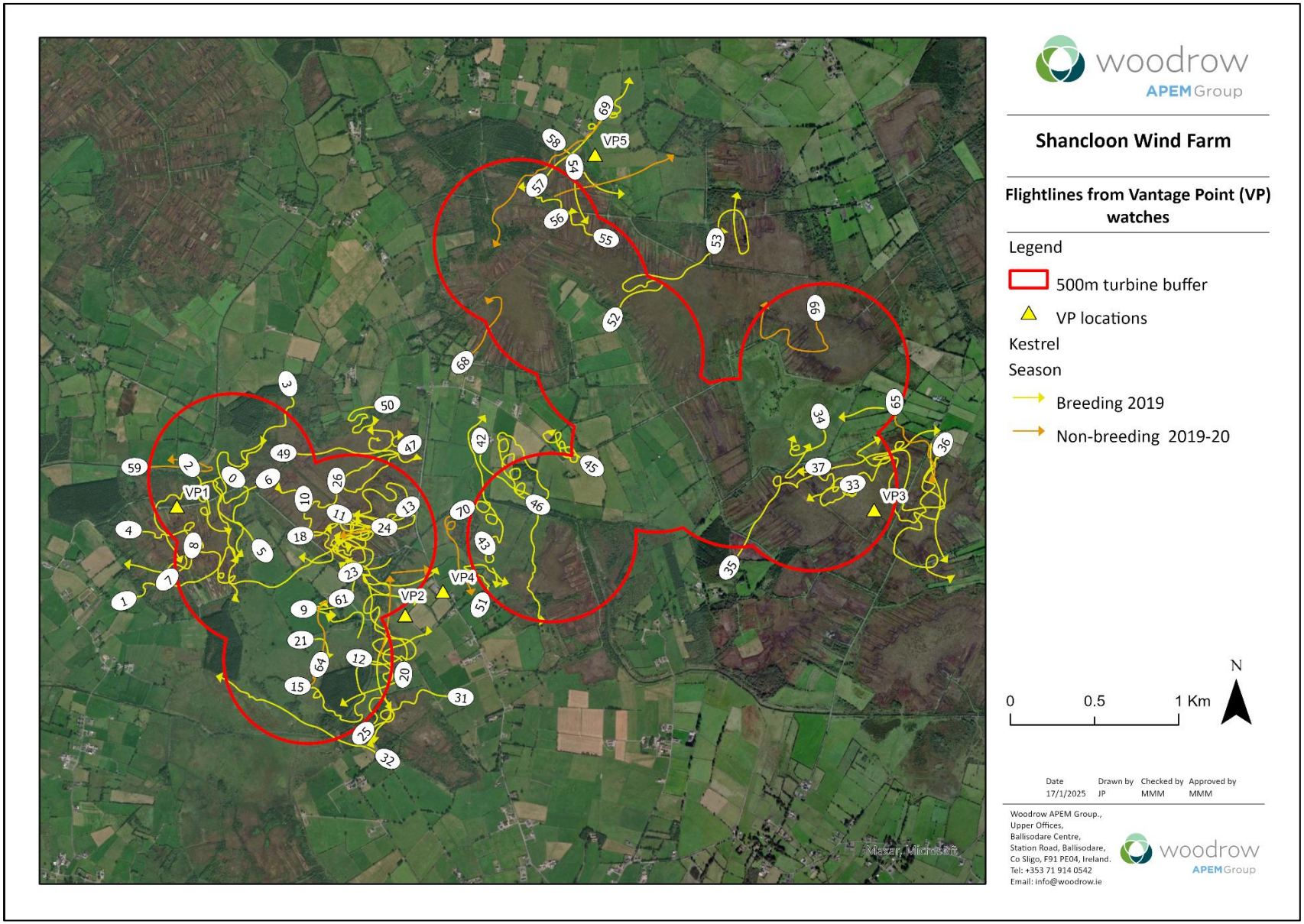


Figure X.15. Kestrel flightlines from VP Watches (Year 1)

Table IX.15: VP watch data for Kestrel (Year 1)

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Kestrel	1	17/04/2019	11:38	125	0	25	B			Hunting	Yes
1	1	Kestrel	1	18/04/2019	11:54	232	155	15	A			Foraging	Yes
2	1	Kestrel	1	30/04/2019	16:11	89	0	20	B	M		Hunting	Yes
3	1	Kestrel	1	17/06/2019	15:57	196	14	20	B			Hunting	Yes
4	1	Kestrel	1	01/07/2019	15:37	192	21	50	B			Foraging	Yes
5	1	Kestrel	1	19/07/2019	12:06	251	0	25	B			Foraging	Yes
6	1	Kestrel	1	22/08/2019	10:24	225	63	20	B			Hunting	Yes
7	1	Kestrel	1	22/08/2019	11:09	9	0	7	A	F		Hunting	Yes
8	1	Kestrel	1	22/08/2019	11:16	26	58	20	B			Hunting	Yes
9	2	Kestrel	1	17/04/2019	15:35	97	11	20	B			Hunting	Yes
10	2	Kestrel	1	17/04/2019	14:47	69	0	20	B			Hunting	Yes
11	2	Kestrel	1	17/04/2019	15:04	241	0	40	B			Hunting	Yes
12	2	Kestrel	1	17/04/2019	15:21	34	74	40	B			Hunting	Yes
13	2	Kestrel	1	24/04/2019	12:44	156	0	50	B			Hunting	Yes
14	2	Kestrel	1	24/04/2019	13:11	149	0	80	B	M		Hunting	Yes
15	2	Kestrel	1	24/04/2019	13:29	439	165	100	B	M		Hunting	Yes
16	2	Kestrel	1	24/04/2019	13:59	54	0	100	B			Hunting	Yes
17	2	Kestrel	1	24/04/2019	14:01	449	0	120	B			Hunting	Yes
18	2	Kestrel	1	24/04/2019	14:23	255	0	120	B			Hunting	Yes
19	2	Kestrel	1	24/04/2019	14:54	45	8	50	B	M		Flying	Yes
20	2	Kestrel	1	30/04/2019	12:21	61	29	100	B	M		Hunting	Yes
21	2	Kestrel	1	30/04/2019	13:26	82	0	80	B			Hunting	Yes
22	2	Kestrel	1	30/04/2019	14:20	50	0	120	B			Hunting	Yes
23	2	Kestrel	1	08/05/2019	14:54	224	0	100	B	M		Hunting	Yes
24	2	Kestrel	1	08/05/2019	16:04	309	99	150	B	M		Hunting	Yes
25	2	Kestrel	1	27/06/2019	16:46	11	8	15	A			Flying	Yes
26	2	Kestrel	1	11/07/2019	15:14	536	0	25	B			Foraging	Yes
27	2	Kestrel	1	30/07/2019	12:33	19	0	10	A			Flying	Yes
28	2	Kestrel	1	30/07/2019	12:47	4	0	5	A			Foraging	Yes
29	2	Kestrel	1	30/07/2019	12:51	4	0	5	A			Foraging	Yes
30	2	Kestrel	1	30/07/2019	14:13	5	0	10	A			Foraging	Yes
31	2	Kestrel	1	23/08/2019	09:40	0	177	15	A			Hunting	No
32	2	Kestrel	1	06/09/2019	09:47	44	19	15	A			Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
33	3	Kestrel	1	24/04/2019	12:51	478	0	20	B			Hunting	Yes
34	3	Kestrel	1	28/06/2019	12:58	556	0	30	B			Foraging	Yes
35	3	Kestrel	1	30/07/2019	09:11	175	74	30	B			Foraging	Yes
36	3	Kestrel	1	22/08/2019	19:28	402	273	20	B			Hunting	Yes
37	3	Kestrel	1	22/08/2019	19:36	21	0	10	A			Flying	Yes
38	3	Kestrel	1	22/08/2019	19:56	163	230	15	A			Hunting	Yes
39	3	Kestrel	1	05/09/2019	18:44	0	28	20	B			Hunting	No
40	3	Kestrel	1	05/09/2019	18:44	0	21	10	A			Hunting	No
41	3	Kestrel	1	05/09/2019	18:51	48	0	15	A			Hunting	Yes
42	4	Kestrel	1	17/04/2019	16:44	26	12	40	B	F		Hunting	Yes
43	4	Kestrel	1	17/04/2019	17:04	10	4	15	A			Hunting	Yes
44	4	Kestrel	1	17/04/2019	17:10	280	0	60	B			Hunting	Yes
45	4	Kestrel	1	18/04/2019	15:00	19	43	30	B			Flying	Yes
46	4	Kestrel	1	18/04/2019	15:56	189	90	60	B	F		Hunting	Yes
47	4	Kestrel	1	30/04/2019	17:10	35	27	50	B			Hunting	Yes
48	4	Kestrel	1	30/04/2019	18:09	0	72	75	B			Hunting	No
49	4	Kestrel	1	01/05/2019	15:46	23	171	100	B			Hunting	Yes
50	4	Kestrel	1	08/05/2019	19:25	0	147	100	B			Hunting	No
51	4	Kestrel	1	12/07/2019	10:34	82	30	30	B			Foraging	Yes
52	5	Kestrel	1	25/04/2019	11:11	146	125	50	B		A	Flying	Yes
53	5	Kestrel	1	25/04/2019	11:17	0	167	40	B			Foraging	No
54	5	Kestrel	1	30/04/2019	13:58	21	1	15	A			Hunting	Yes
55	5	Kestrel	1	30/04/2019	13:58	30	0	30	B			Hunting	Yes
56	5	Kestrel	1	30/04/2019	13:58	253	0	40	B			Hunting	Yes
57	5	Kestrel	1	27/06/2019	14:38	208	76	30	B			Foraging	Yes
58	5	Kestrel	1	30/07/2019	14:05	16	0	60	B			Hunting	No
59	1	Kestrel	1	28/02/2020	09:10	7	5	10	A	F		Flying	Yes
60	2	Kestrel	1	10/01/2020	13:43	104	0	20	B			Hunting	Yes
61	2	Kestrel	1	10/01/2020	14:24	51	0	20	B			Hunting	Yes
62	2	Kestrel	1	04/02/2020	16:53	20	5	15	A	M	A	Flying	Yes
63	2	Kestrel	1	04/02/2020	17:10	15	0	10	A	M	A	Flying	Yes
64	2	Kestrel	1	08/02/2020	10:03	35	0	30	B	M	A	Hunting	Yes
65	3	Kestrel	1	04/10/2019	08:39	0	87	15	A	M		Hunting	No
66	3	Kestrel	1	27/02/2020	14:03	313	16	40	B			Hunting	Yes
67	5	Kestrel	1	09/10/2019	18:02	9	31	15	A			Commuting	Yes
68	5	Kestrel	1	11/10/2019	13:55	69	40	20	B			Hunting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
69	5	Kestrel	1	18/11/2019	15:47	12	8	10	A			Flying	Yes
70	4	Kestrel	1	12/11/2019	09:45	0	105	50	B			Commuting	No

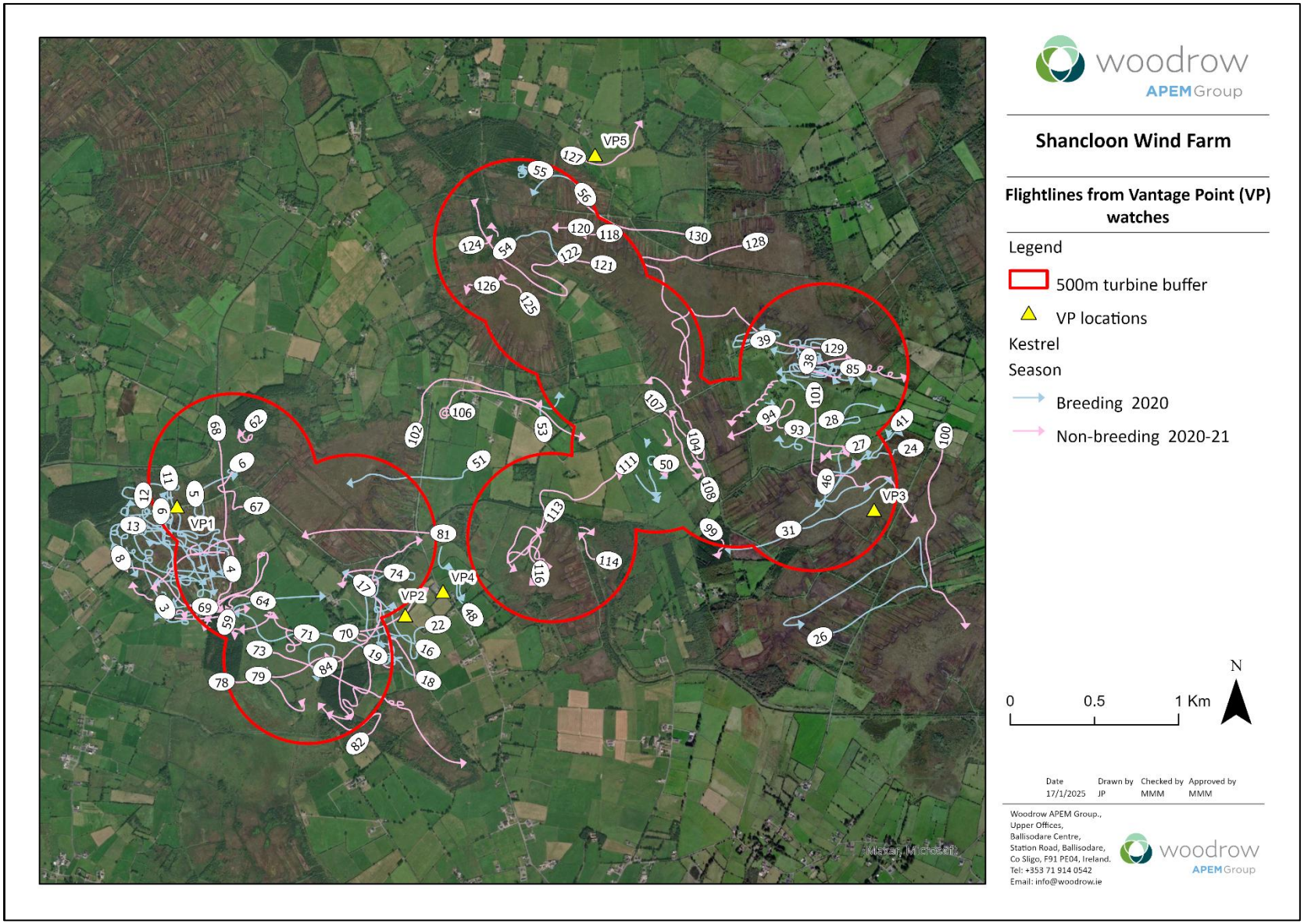


Figure X.16. Kestrel flightlines from VP Watches (Year 2)

Table IX.16: VP watch data for Kestrel (Year 2)

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Kestrel	1	24/04/2020	13:27	116	65	40	B	M		Hunting	Yes
1	1	Kestrel	1	28/05/2020	20:19	17	156	30	B	M		Hunting	Yes
2	1	Kestrel	1	28/05/2020	20:25	0	7	5	A	M		Flying	No
3	1	Kestrel	1	28/05/2020	20:37	106	246	50	B	M		Hunting	Yes
4	1	Kestrel	1	28/05/2020	21:01	436	357	50	B			Hunting	Yes
5	1	Kestrel	1	07/06/2020	13:38	260	0	260	C	M	A	Hunting	Yes
6	1	Kestrel	1	23/07/2020	08:28	0	0	15	A			Perched	Yes
7	1	Kestrel	1	23/07/2020	11:48	139	248	20	B	F	A	Hunting	Yes
8	1	Kestrel	1	23/07/2020	12:29	0	3	25	B	M	A	Flushed	No
9	1	Kestrel	2	26/08/2020	13:41	16	148	15	A	M	A, J	Hunting	Yes
10	1	Kestrel	1	26/08/2020	13:52	219	43	15	A		J	Hunting	Yes
11	1	Kestrel	1	26/08/2020	14:01	71	64	15	A		J	Hunting	Yes
12	1	Kestrel	1	26/08/2020	14:24	150	94	30	B		J	Mobbed	Yes
13	1	Kestrel	1	26/08/2020	15:00	774	119	30	B		J	Hunting	Yes
14	1	Kestrel	1	26/08/2020	15:26	58	107	20	B		J	Hunting	Yes
15	1	Kestrel	1	26/08/2020	15:30	249	102	30	B		J	Flying	Yes
16	2	Kestrel	1	15/05/2020	15:11	8	29	30	B	M	A	Hunting	Yes
17	2	Kestrel	1	15/05/2020	16:02	23	0	30	B	M	A	Flying	Yes
18	2	Kestrel	1	28/05/2020	12:02	627	235	100	B	M		Hunting	Yes
19	2	Kestrel	1	25/06/2020	16:51	35	0	20	B	M	A	Flying	Yes
20	2	Kestrel	1	25/06/2020	16:54	15	0	15	A	M	A	Flying	Yes
21	2	Kestrel	1	20/07/2020	09:28	12	0	15	A	F	A	Hunting	Yes
22	2	Kestrel	1	25/08/2020	13:16	82	75	20	B	F	A	Hunting	Yes
23	2	Kestrel	1	26/08/2020	10:33	84	0	20	B			Hunting	Yes
24	3	Kestrel	1	22/04/2020	11:20	43	10	30	B	M	A	Hunting	Yes
25	3	Kestrel	1	22/04/2020	11:48	48	0	30	B	M	A	Flying	Yes
26	3	Kestrel	1	29/04/2020	20:51	0	357	60	B	M		Hunting	No
27	3	Kestrel	1	27/05/2020	11:58	135	0	30	B	M	A	Soaring	Yes
28	3	Kestrel	1	27/05/2020	12:23	87	0	30	B	M	A	Soaring	Yes
29	3	Kestrel	1	12/06/2020	13:18	93	82	25	B	M	A	Flying	Yes
30	3	Kestrel	1	30/06/2020	11:24	94	0	40	B	M	A	Hunting	Yes
31	3	Kestrel	1	30/06/2020	12:09	175	0	30	B	M	A	Hunting	Yes
32	3	Kestrel	1	24/07/2020	08:36	10	0	10	A	M	A	Hunting	Yes
33	3	Kestrel	1	24/07/2020	09:01	436	0	25	B			Hunting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
34	3	Kestrel	1	24/07/2020	09:50	63	0	40	B			Hunting	Yes
35	3	Kestrel	1	24/07/2020	10:03	720	0	15	A			Hunting	Yes
36	3	Kestrel	1	24/07/2020	10:14	158	0	15	A			Hunting	Yes
37	3	Kestrel	2	24/07/2020	10:34	191	0	20	B			Hunting	Yes
38	3	Kestrel	1	24/07/2020	12:19	258	0	30	B			Hunting	Yes
39	3	Kestrel	1	24/07/2020	12:27	180	112	40	B			Hunting	Yes
40	3	Kestrel	1	24/07/2020	12:37	136	0	30	B			Hunting	Yes
41	3	Kestrel	1	24/07/2020	14:05	0	0	15	A			Perched	No
42	3	Kestrel	1	24/07/2020	14:07	96	0	25	B			Hunting	Yes
43	3	Kestrel	1	24/07/2020	14:27	201	0	40	B			Hunting	Yes
44	3	Kestrel	1	24/07/2020	14:28	36	0	30	B			Flying	Yes
45	3	Kestrel	1	11/08/2020	10:29	5	0	5	A	M	J	Commuting	Yes
46	3	Kestrel	1	11/08/2020	11:08	39	13	5	A	M	J	Hunting	Yes
47	4	Kestrel	1	21/04/2020	11:16	0	78	30	B	M	A	Hunting	No
48	4	Kestrel	1	28/04/2020	13:22	0	48	30	B	M	A	Hunting	No
49	4	Kestrel	1	22/07/2020	10:02	4	0	30	B	F	A	Hunting	Yes
50	4	Kestrel	1	22/07/2020	11:12	188	0	30	B	F	A	Hunting	Yes
51	4	Kestrel	1	22/07/2020	11:32	232	231	30	B	F	A	Carrying food	Yes
52	4	Kestrel	1	22/07/2020	11:52	18	0	60	B	F	A	Hunting	Yes
53	4	Kestrel	1	22/07/2020	13:10	22	26	50	B		A	Hunting	Yes
54	5	Kestrel	1	21/07/2020	09:04	144	0	30	B	F	A	Hunting	Yes
55	5	Kestrel	1	21/07/2020	10:38	49	0	30	B	F	A	Hunting	Yes
56	5	Kestrel	1	21/07/2020	12:52	192	0	20	B	F	A	Hunting	Yes
57	5	Kestrel	1	13/08/2020	14:23	22	0	25	B	F	A	Commuting	Yes
58	1	Kestrel	1	29/09/2020	08:28	5	0	5	A	F	A	Hunting	Yes
59	1	Kestrel	1	29/09/2020	08:36	224	0	15	A	F	A	Commuting	Yes
60	1	Kestrel	1	20/10/2020	13:27	0	0	20	B	M	A	Perched	No
61	1	Kestrel	1	20/10/2020	13:29	0	18	20	B			Commuting	No
62	1	Kestrel	1	20/10/2020	13:35	37	0	35	B			Hunting	Yes
63	1	Kestrel	1	16/11/2020	08:40	60	0	20	B			Hunting	Yes
64	1	Kestrel	1	16/11/2020	10:25	28	2	15	A	F	A	Hunting	Yes
65	1	Kestrel	1	16/11/2020	11:49	14	6	20	B	F	A	Flying	Yes
66	1	Kestrel	1	16/11/2020	12:32	18	12	15	A	F	A	Hunting	Yes
67	1	Kestrel	1	04/12/2020	13:12	352	0	30	B	F	A	Hunting	Yes
68	1	Kestrel	1	21/01/2021	14:47	197	0	50	B	F	A	Hunting	Yes
69	1	Kestrel	1	26/01/2021	14:43	2	41	15	A	F	A	Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
70	2	Kestrel	1	30/09/2020	12:39	11	24	25	B	F	A	Commuting	Yes
71	2	Kestrel	1	30/09/2020	12:45	20	0	25	B			Hunting	Yes
72	2	Kestrel	1	30/09/2020	13:12	79	0	30	B			Hunting	Yes
73	2	Kestrel	1	14/10/2020	08:06	53	64	45	B	F	A	Hunting	Yes
74	2	Kestrel	1	14/10/2020	11:36	71	0	35	B	F	A	Hunting	Yes
75	2	Kestrel	1	14/10/2020	12:51	81	0	10	A	F	A	Hunting	Yes
76	2	Kestrel	1	14/10/2020	12:51	319	0	40	B	F	A	Hunting	Yes
77	2	Kestrel	1	14/10/2020	12:51	27	0	20	B	F	A	Hunting	Yes
78	2	Kestrel	1	14/10/2020	13:00	69	0	35	B	F	A	Hunting	Yes
79	2	Kestrel	1	14/10/2020	13:00	274	0	25	B	F	A	Hunting	Yes
80	2	Kestrel	1	14/10/2020	13:00	249	0	35	B	F	A	Hunting	Yes
81	2	Kestrel	1	17/11/2020	14:12	30	0	30	B			Flying	Yes
82	2	Kestrel	1	04/12/2020	11:11	292	331	40	B			Hunting	Yes
83	2	Kestrel	1	22/02/2021	11:54	190	67	30	B	F	A	Hunting	Yes
84	2	Kestrel	1	22/02/2021	12:09	249	0	25	B	F	A	Hunting	Yes
85	3	Kestrel	1	05/09/2020	10:56	37	0	35	B			Commuting	Yes
86	3	Kestrel	1	05/09/2020	11:04	183	0	25	B			Hunting	Yes
87	3	Kestrel	1	28/09/2020	10:28	27	0	15	A	F	J	Hunting	Yes
88	3	Kestrel	1	28/09/2020	10:28	17	0	15	A	F	J	Hunting	Yes
89	3	Kestrel	1	28/09/2020	10:31	0	0	5	A	M	A	Hunting	Yes
90	3	Kestrel	1	16/10/2020	08:07	146	0	20	B			Hunting	Yes
91	3	Kestrel	1	16/10/2020	08:39	0	0	10	A	F	A	Perched	Yes
92	3	Kestrel	1	16/10/2020	08:50	111	0	5	A	M	A	Commuting	Yes
93	3	Kestrel	1	16/10/2020	08:50	26	0	30	B	M	A	Commuting	Yes
94	3	Kestrel	1	16/10/2020	08:50	19	0	30	B	M	A	Commuting	Yes
95	3	Kestrel	1	16/10/2020	08:51	21	0	35	B			Commuting	Yes
96	3	Kestrel	1	16/10/2020	09:15	0	0	10	A	F	J	Perched	Yes
97	3	Kestrel	2	16/10/2020	09:37	20	0	5	A	M,F	A	Flying	Yes
98	3	Kestrel	1	16/10/2020	13:48	84	0	25	B	M	A	Hunting	Yes
99	3	Kestrel	1	15/11/2020	14:20	14	26	25	B			Hunting	Yes
100	3	Kestrel	1	15/12/2020	09:27	0	263	30	B			Flying	No
101	3	Kestrel	1	15/12/2020	10:07	253	59	20	B	M	A	Hunting	Yes
102	4	Kestrel	1	29/09/2020	11:21	0	68	40	B	F	A	Commuting	No
103	4	Kestrel	1	29/09/2020	11:47	71	0	25	B			Hunting	Yes
104	4	Kestrel	1	29/09/2020	11:50	149	0	30	B			Hunting	Yes
105	4	Kestrel	1	29/09/2020	11:51	12	0	30	B			Commuting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
106	4	Kestrel	1	29/09/2020	12:19	11	176	40	B	F	J	Hunting	Yes
107	4	Kestrel	1	29/09/2020	13:42	287	0	35	B			Hunting	Yes
108	4	Kestrel	1	29/09/2020	13:47	172	0	35	B			Hunting	Yes
109	4	Kestrel	1	15/10/2020	11:54	0	0	35	B	M	A	Perched	Yes
110	4	Kestrel	1	15/10/2020	13:03	0	0	25	B	M	A	Perched	Yes
111	4	Kestrel	1	15/10/2020	13:03	133	0	30	B	M	A	Hunting	Yes
112	4	Kestrel	1	15/10/2020	13:03	57	0	25	B	M	A	Commuting	Yes
113	4	Kestrel	1	03/12/2020	13:54	551	0	30	B			Hunting	Yes
114	4	Kestrel	1	21/01/2021	12:09	11	0	20	B	F	A	Gliding	Yes
115	4	Kestrel	1	21/01/2021	12:17	4	0	20	B	F	A	Flying	Yes
116	4	Kestrel	1	22/02/2021	13:34	38	0	20	B	F	A	Flying	Yes
117	5	Kestrel	1	06/09/2020	10:56	6	0	20	B	F	A	Commuting	Yes
118	5	Kestrel	1	28/09/2020	12:05	51	0	25	B	F	A	Hunting	Yes
119	5	Kestrel	1	28/09/2020	12:05	117	0	30	B	F	A	Hunting	Yes
120	5	Kestrel	1	28/09/2020	12:05	20	0	25	B	F	A	Hunting	Yes
121	5	Kestrel	1	28/09/2020	13:06	25	0	20	B	F	A	Hunting	Yes
122	5	Kestrel	1	28/09/2020	13:06	321	0	30	B	F	A	Hunting	Yes
123	5	Kestrel	1	28/09/2020	13:42	42	0	35	B			Hunting	Yes
124	5	Kestrel	1	28/09/2020	13:42	10	0	35	B			Hunting	Yes
125	5	Kestrel	1	21/10/2020	08:39	117	0	10	A	F	A	Hunting	Yes
126	5	Kestrel	1	21/10/2020	09:35	5	0	25	B			Hunting	Yes
127	5	Kestrel	1	20/11/2020	14:13	0	30	20	B	M	A	Hunting	No
128	5	Kestrel	1	20/11/2020	15:18	175	183	40	B			Hunting	Yes
129	5	Kestrel	1	14/12/2020	09:21	213	96	50	B			Hunting	Yes
130	5	Kestrel	1	16/12/2020	13:17	61	205	30	B		A	Hunting	Yes

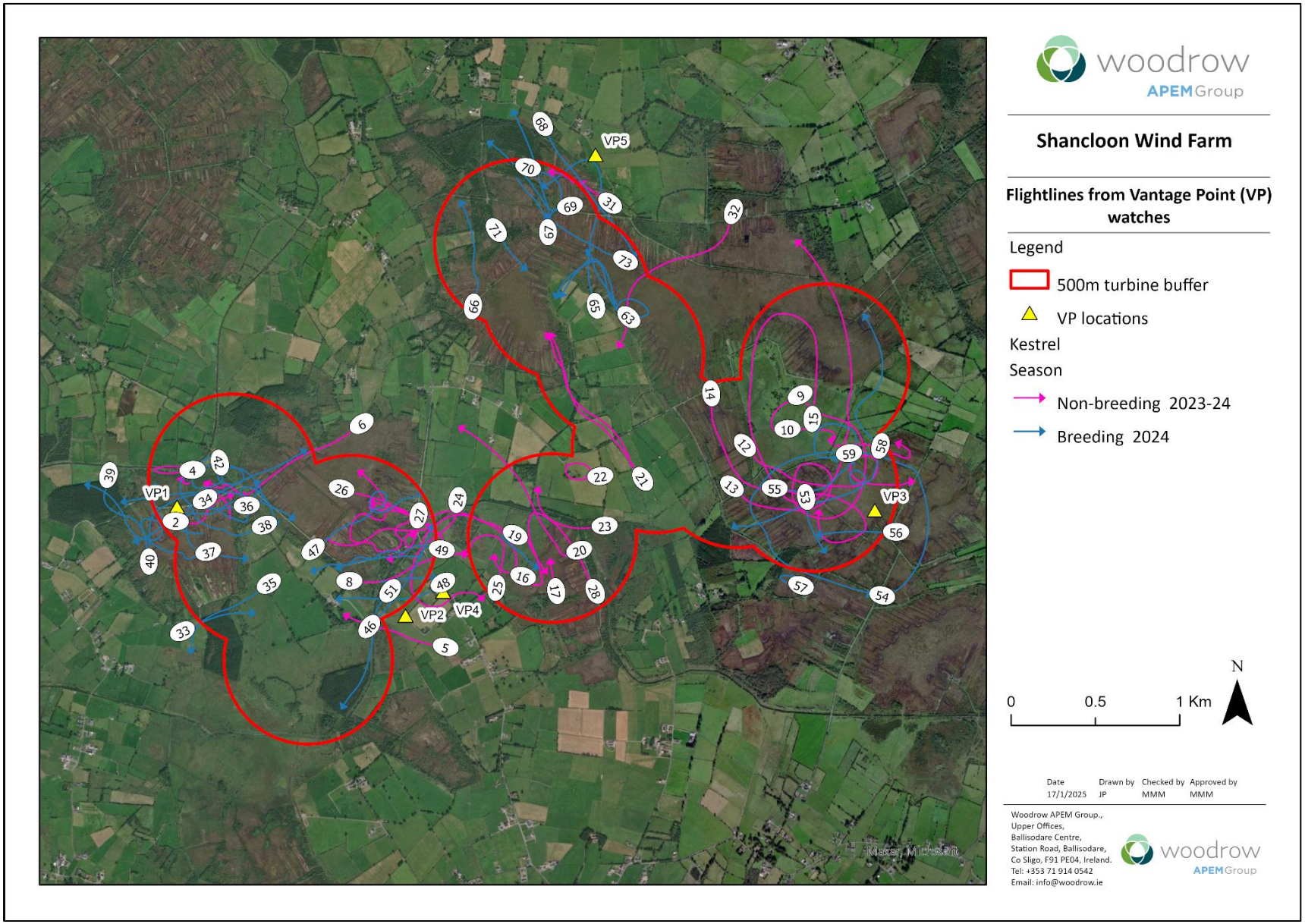


Figure X.17. Kestrel flightlines from VP Watches (Year 3)

Table IX.17: VP watch data for Kestrel (Year 3)

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Kestrel	1	28/10/2023	11:14	30	0	0	-			Flying	Yes
1	1	Kestrel	1	29/10/2023	14:31	30	0	6	A			Present	Yes
2	1	Kestrel	1	29/10/2023	15:24	30	0	0	-	M	A	Present	Yes
3	1	Kestrel	1	29/10/2023	15:35	20	0	5	A			Present	Yes
4	1	Kestrel	1	09/11/2023	12:32	120	0	0	-			Hunting	Yes
5	2	Kestrel	1	21/11/2023	13:11	14	15	10	A	F	A	Present	Yes
6	2	Kestrel	1	30/11/2023	15:40	135	60	30	B	F	A	Hunting	Yes
7	2	Kestrel	1	03/12/2023	15:03	53	0	0	A	M	A	Hunting	Yes
8	2	Kestrel	1	21/02/2024	15:03	10	5	10	A			Present	Yes
9	3	Kestrel	1	27/10/2023	16:09	30	0	20	B			Hovering	Yes
10	3	Kestrel	1	27/10/2023	16:14	30	0	15	A			Hovering	Yes
11	3	Kestrel	1	27/10/2023	16:18	30	0	15	A			Hovering	Yes
12	3	Kestrel	1	25/02/2024	14:20	139	10	25	B	F	J	Hovering	Yes
13	3	Kestrel	1	26/01/2024	11:39	30	0	40	B	F	A	Mobbing	Yes
14	3	Kestrel	1	26/01/2024	13:29	65	0	40	B			Flying	Yes
15	3	Kestrel	1	26/01/2024	16:40	40	0	30	B	F		Flying	Yes
16	4	Kestrel	1	29/10/2023	09:12	5	0	5	A			Flying	Yes
17	4	Kestrel	1	29/10/2023	09:53	10	0	5	A			Flying	Yes
18	4	Kestrel	1	29/10/2023	10:18	10	0	0	-			Flying	Yes
19	4	Kestrel	1	28/01/2024	10:21	40	20	20	B	M	A	Present	Yes
20	4	Kestrel	1	22/02/2024	16:47	0	30	30	B			Present	Yes
21	4	Kestrel	1	22/02/2024	16:47	45	0	30	B			Present	Yes
22	4	Kestrel	1	10/11/2023	13:38	130	0	35	B	F	A	Hunting	Yes
23	4	Kestrel	1	23/11/2023	13:01	26	0	25	B	F	A	Hunting	Yes
24	4	Kestrel	1	03/12/2024	12:23	45	120	20	B	M	A	Hunting	Yes
25	4	Kestrel	1	27/01/2024	16:31	20	15	15	A	M		Present	Yes
26	4	Kestrel	1	27/01/2024	16:33	135	0	25	B	F		Present	Yes
27	4	Kestrel	1	27/01/2024	16:57	8	0	10	A	M		Present	Yes
28	4	Kestrel	1	28/01/2024	10:21	40	20	20	B	M	A	Flying	Yes
29	4	Kestrel	1	22/02/2024	16:47	0	30	30	B			Present	Yes
30	5	Kestrel	1	27/10/2023	11:17	20	0	15	A			Flying	Yes
31	5	Kestrel	1	27/10/2023	13:09	20	0	20	B			Flying	No

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
32	5	Kestrel	1	27/02/2024	13:20	25	55	30	B	M		Present	Yes
33	1	Kestrel	1	27/03/2024	12:18	26	0	0	-	F	A	Hunting	Yes
34	1	Kestrel	1	27/03/2024	12:31	18	0	0	-	F	A	Flying	Yes
35	1	Kestrel	1	15/08/2024	12:02	81	10	0	-			Hunting	Yes
36	1	Kestrel	1	11/09/2024	13:11	100	80	20	B			Hunting	Yes
37	1	Kestrel	1	11/09/2024	13:32	0	70	40	B			Hunting	Yes
38	1	Kestrel	1	11/09/2024	13:58	5	60	8	A			Hunting	Yes
39	1	Kestrel	1	11/09/2024	14:33	0	35	10	A			Hunting	No
40	1	Kestrel	1	11/09/2024	14:48	50	120	20	B			Hunting	Yes
41	1	Kestrel	1	24/04/2024	10:27	172	0	0	-	M	A	Flying	Yes
42	1	Kestrel	1	24/04/2024	11:27	163	0	0	-	F	A	Soaring	Yes
43	1	Kestrel	1	24/04/2024	12:08	10	0	0	-	M	A	Hunting	Yes
44	1	Kestrel	1	21/06/2024	10:36	396	0	0	-	M	A	Hunting	Yes
45	1	Kestrel	1	29/07/2024	10:41	253	17	0	-			Hunting	Yes
46	2	Kestrel	1	27/03/2024	09:29	60	0	15	A	F	A	Flying	Yes
47	2	Kestrel	1	31/07/2024	13:00	199	0	0	-	M	A	Hunting	Yes
48	2	Kestrel	1	22/04/2024	12:14	110	0	0	-			Soaring	Yes
49	2	Kestrel	1	22/05/2024	10:54	124	0	0	-	F	A	Hunting	Yes
50	2	Kestrel	1	22/05/2024	11:40	20	0	20	B	M	A	Hunting	Yes
51	2	Kestrel	1	22/05/2024	12:45	44	0	20	B	M	A	Hunting	Yes
52	2	Kestrel	1	25/06/2024	12:17	192	0	0	-	M	A	Hunting	Yes
53	3	Kestrel	1	30/07/2024	10:33	21	0	7	A	M	A	Hunting	Yes
54	3	Kestrel	3	30/07/2024	10:33	0	0	0	-	M		Hunting	Yes
55	3	Kestrel	1	16/08/2024	06:35	461	0	0	-		J	Hunting	Yes
56	3	Kestrel	2	16/08/2024	08:11	32	0	0	-		J	Hunting	Yes
57	3	Kestrel	1	16/08/2024	10:27	50	512	0	-			Hunting	No
58	3	Kestrel	1	16/08/2024	11:00	412	0	0	-	M	A	Hunting	Yes
59	3	Kestrel	1	20/06/2024	08:37	0	0	0	-	F	A	Hunting	Yes
60	3	Kestrel	1	20/06/2024	11:37	171	0	0	-			Hunting	Yes
61	4	Kestrel	1	24/06/2024	07:07	24	0	0	A	M	A	Hovering	Yes
62	5	Kestrel	1	28/03/2024	09:39	100	0	10	-	M		Hunting	Yes
63	5	Kestrel	1	28/03/2024	09:54	120	0	20	-			Hunting	Yes
64	5	Kestrel	1	28/03/2024	12:32	80	0	15	-	F		Hunting	Yes
65	5	Kestrel	1	28/03/2024	14:17	0	30	20	-	F		Fly-land	Yes
66	5	Kestrel	1	23/04/2024	13:42	140	0	20	-			Hunting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
67	5	Kestrel	1	21/05/2024	08:03	30	20	15	-	M	A	Commuting	Yes
68	5	Kestrel	1	21/05/2024	08:22	10	90	45	-	M	A	Hunting	Yes
69	5	Kestrel	1	21/05/2024	08:31	40	10	30	-	M	A	Commuting	Yes
70	5	Kestrel	1	21/05/2024	10:59	300	0	40	-			Hunting	Yes
71	5	Kestrel	1	02/07/2024	10:34	20	0	10	-			Hunting	Yes
72	5	Kestrel	1	16/07/2024	13:06	10	0	20	-			Commuting	Yes
73	5	Kestrel	1	16/07/2024	15:23	50	0	15	-			Hunting	Yes

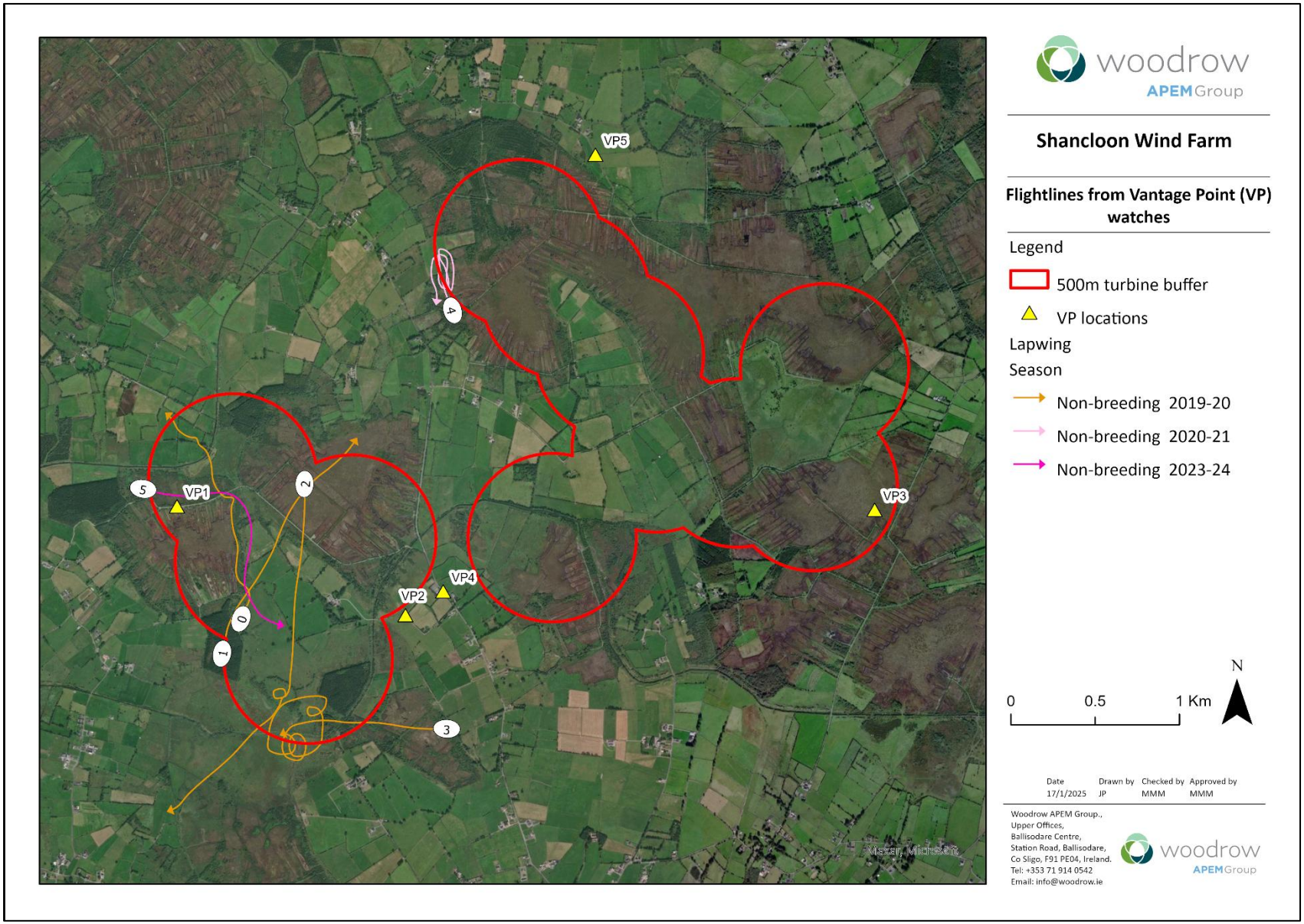


Figure X.18. Lapwing flightlines from VP Watches

Table IX.18: VP watch data for lapwing

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Lapwing	14	04/10/2019	13:46	81	3	15	A			Flying	Yes
1	2	Lapwing	8	06/11/2019	15:53	99	11	50	B			Commuting	Yes
2	2	Lapwing	39	04/12/2019	09:18	131	59	70	B			Commuting	Yes
3	2	Lapwing	105	08/02/2020	08:53	120	90	75	B			Flying	Yes
4	5	Lapwing	10	21/10/2020	09:33	54	33	50	B			Commuting	Yes
5	1	Lapwing	2	04/12/2023	11:32	61	0	25	B		A	Commuting	Yes

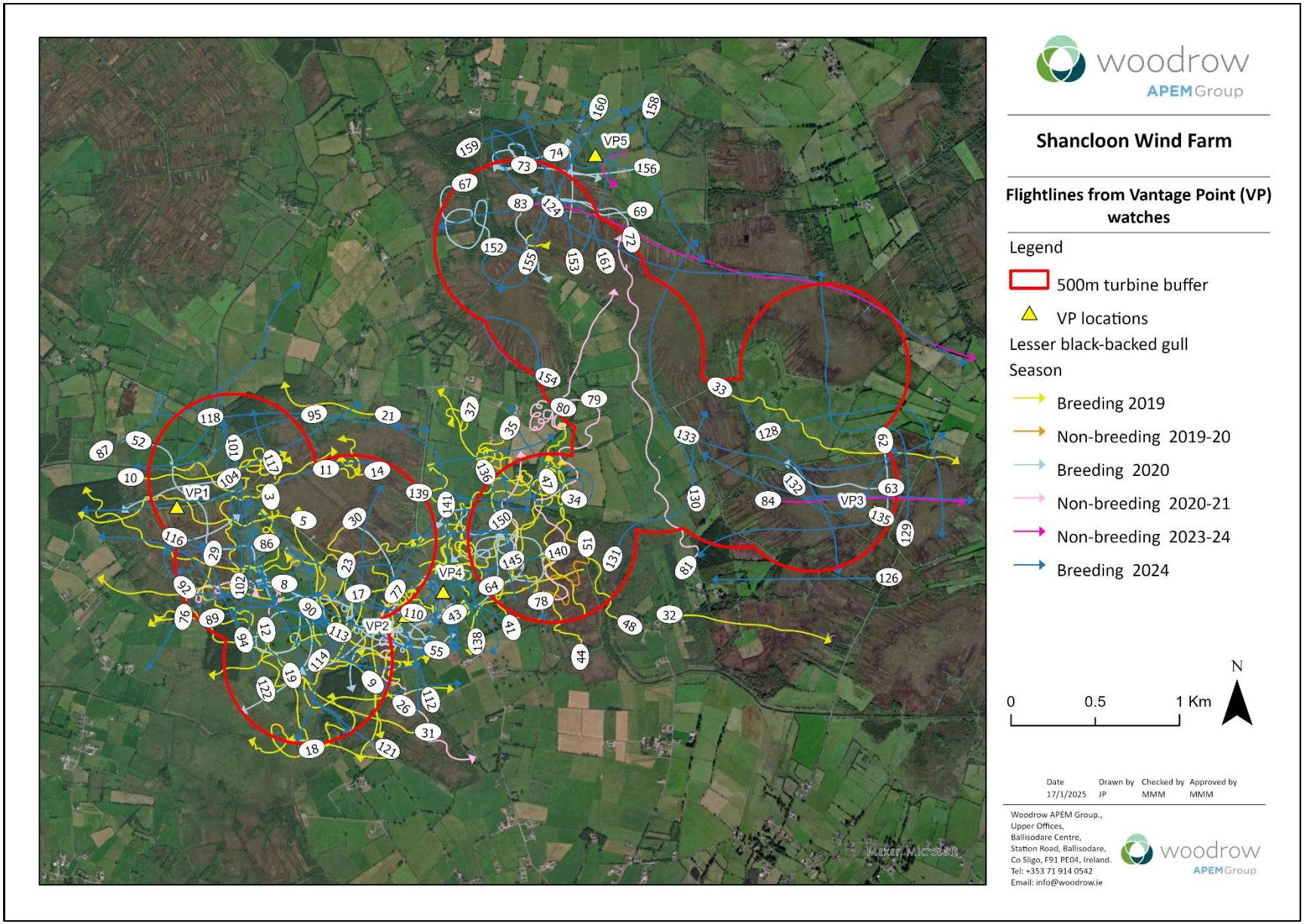


Figure X.19. Lesser black-backed gull flightlines from VP Watches

Table IX.19: VP watch data for lesser black-backed gull

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Lesser black-backed gull	2	17/04/2019	13:02	327	0	60	B		A	Flying	Yes
1	1	Lesser black-backed gull	1	17/04/2019	13:04	66	0	100	B		A	Flying	Yes
2	1	Lesser black-backed gull	1	30/04/2019	17:50	2	0	10	A		A	Flying	Yes
3	1	Lesser black-backed gull	1	30/04/2019	17:51	131	93	20	B		A	Flying	Yes
4	1	Lesser black-backed gull	1	30/04/2019	17:52	3	0	10	A			Flying	Yes
5	1	Lesser black-backed gull	1	30/05/2019	14:12	66	35	15	A		A	Flying	Yes
6	1	Lesser black-backed gull	1	30/05/2019	14:12	35	30	30	B		A	Flying	Yes
7	1	Lesser black-backed gull	1	17/06/2019	14:03	41	27	25	B			Flying	Yes
8	1	Lesser black-backed gull	1	17/06/2019	14:54	133	11	25	B			Flying	Yes
9	1	Lesser black-backed gull	5	01/07/2019	15:44	218	0	50	B			Flying	Yes
10	1	Lesser black-backed gull	1	19/07/2019	13:17	123	4	20	B			Flying	Yes
11	2	Lesser black-backed gull	1	17/04/2019	14:41	11	8	15	A			Flying	Yes
12	2	Lesser black-backed gull	2	17/04/2019	15:49	144	65	80	B			Flying	Yes
13	2	Lesser black-backed gull	1	18/04/2019	15:39	39	0	15	A			Flying	Yes
14	2	Lesser black-backed gull	1	18/04/2019	16:40	326	3	70	B			Present	Yes
15	2	Lesser black-backed gull	1	18/04/2019	17:08	150	0	150	B			Soaring	Yes
16	2	Lesser black-backed gull	1	18/04/2019	17:08	151	0	60	B			Soaring	Yes
17	2	Lesser black-backed gull	1	24/04/2019	12:09	22	0	40	B		A	Flying	Yes
18	2	Lesser black-backed gull	2	24/04/2019	13:38	42	3	40	B			Flying	Yes
19	2	Lesser black-backed gull	6	30/04/2019	14:56	110	120	200	C			Flying	Yes
20	2	Lesser black-backed gull	1	08/05/2019	13:33	39	13	30	B			Flying	Yes
21	2	Lesser black-backed gull	2	08/05/2019	15:23	0	48	50	B		A	Flying	No
22	2	Lesser black-backed gull	1	08/05/2019	15:41	10	24	40	B		A	Flying	Yes
23	2	Lesser black-backed gull	1	08/05/2019	15:50	183	11	150	B		A	Flying	Yes
24	2	Lesser black-backed gull	1	08/05/2019	15:54	5	20	20	B		A	Flying	Yes
25	2	Lesser black-backed gull	1	08/05/2019	16:04	49	0	50	B		A	Flying	Yes
26	2	Lesser black-backed gull	1	11/06/2019	13:39	51	26	20	B			Flying	Yes
27	2	Lesser black-backed gull	1	27/06/2019	16:53	31	14	10	A			Gliding	Yes
28	2	Lesser black-backed gull	1	27/06/2019	17:50	121	0	15	A			Flying	Yes
29	2	Lesser black-backed gull	1	27/06/2019	17:56	130	16	15	A			Flying	Yes
30	2	Lesser black-backed gull	1	11/07/2019	13:38	79	20	10	A			Flying	Yes
31	2	Lesser black-backed gull	1	23/08/2019	08:36	45	29	25	B			Flying	Yes
32	3	Lesser black-backed gull	1	17/04/2019	14:44	0	55	60	B			Flying	No
33	3	Lesser black-backed gull	1	24/04/2019	13:48	95	36	5	A			Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
34	4	Lesser black-backed gull	1	17/04/2019	16:27	76	110	70	B			Flying	Yes
35	4	Lesser black-backed gull	2	24/04/2019	11:26	0	34	20	B			Foraging	No
36	4	Lesser black-backed gull	1	01/05/2019	12:53	45	31	30	B		A	Flying	Yes
37	4	Lesser black-backed gull	2	08/05/2019	18:45	0	40	20	B		A	Foraging	No
38	4	Lesser black-backed gull	1	11/06/2019	17:58	0	23	40	B			Flying	No
39	4	Lesser black-backed gull	1	17/06/2019	18:53	30	87	25	B			Flying	Yes
40	4	Lesser black-backed gull	1	01/07/2019	16:45	263	10	80	B			Soaring	Yes
41	4	Lesser black-backed gull	1	01/07/2019	17:57	42	82	20	B			Flying	Yes
42	4	Lesser black-backed gull	1	01/07/2019	18:51	70	1	20	B			Flying	Yes
43	4	Lesser black-backed gull	4	12/07/2019	11:43	0	237	50	B			Soaring	No
44	4	Lesser black-backed gull	1	12/07/2019	11:55	74	32	40	B			Flying	Yes
45	4	Lesser black-backed gull	1	12/07/2019	12:06	31	79	20	B			Flying	Yes
46	4	Lesser black-backed gull	1	12/07/2019	12:20	72	0	30	B			Flying	Yes
47	4	Lesser black-backed gull	1	12/07/2019	12:26	37	11	30	B			Flying	Yes
48	4	Lesser black-backed gull	1	12/07/2019	12:34	102	15	25	B			Flying	Yes
49	4	Lesser black-backed gull	1	12/07/2019	12:57	106	0	20	B			Flying	Yes
50	5	Lesser black-backed gull	1	11/07/2019	16:15	5	23	25	B			Flying	Yes
51	4	Lesser black-backed gull	1	27/01/2020	11:51	71	6	20	B			Flying	Yes
52	1	Lesser black-backed gull	1	28/05/2020	20:51	161	2	30	B			Flying	Yes
53	1	Lesser black-backed gull	1	07/06/2020	12:49	37	3	20	B		A	Flying	Yes
54	1	Lesser black-backed gull	1	07/06/2020	12:02	31	14	25	B		A	Flying	Yes
55	2	Lesser black-backed gull	1	28/05/2020	11:09	239	77	80	B			Flying	Yes
56	2	Lesser black-backed gull	1	28/05/2020	12:41	8	193	50	B			Soaring	Yes
57	2	Lesser black-backed gull	1	07/06/2020	14:58	33	27	30	B		A	Flying	Yes
58	2	Lesser black-backed gull	1	07/06/2020	15:46	87	5	30	B		A	Flying	Yes
59	2	Lesser black-backed gull	1	25/06/2020	16:25	40	0	20	B		A	Flying	Yes
60	2	Lesser black-backed gull	4	25/06/2020	18:30	224	1	40	B		A	Flying	Yes
61	2	Lesser black-backed gull	1	26/08/2020	12:00	51	52	20	B		A	Flying	Yes
62	3	Lesser black-backed gull	1	29/04/2020	11:08	27	0	30	B	M	A	Flying	Yes
63	3	Lesser black-backed gull	1	12/06/2020	11:52	45	0	20	B		A	Flying	Yes
64	4	Lesser black-backed gull	30	29/04/2020	14:28	339	23	150	B		A	Circling	Yes
65	4	Lesser black-backed gull	18	14/05/2020	14:22	723	416	200	C		A	Circling	Yes
66	4	Lesser black-backed gull	1	12/06/2020	14:55	27	8	20	B			Flying	Yes
67	5	Lesser black-backed gull	7	27/05/2020	14:17	239	31	150	B		A	Circling	Yes
68	5	Lesser black-backed gull	3	27/05/2020	14:50	84	0	150	B		A	Flying	Yes
69	5	Lesser black-backed gull	4	29/05/2020	10:48	25	13	50	B		A	Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
70	5	Lesser black-backed gull	1	12/06/2020	12:51	0	28	30	B		A	Flying	No
71	5	Lesser black-backed gull	1	12/06/2020	13:28	18	18	30	B		A	Flying	Yes
72	5	Lesser black-backed gull	1	18/06/2020	09:20	25	23	50	B		A	Flying	Yes
73	5	Lesser black-backed gull	1	18/06/2020	09:48	12	23	50	B		A	Flying	Yes
74	5	Lesser black-backed gull	1	18/06/2020	10:05	32	56	50	B		A	Circling	Yes
75	1	Lesser black-backed gull	1	24/02/2021	10:28	79	0	20	B		A	Flying	Yes
76	1	Lesser black-backed gull	2	10/03/2021	09:22	94	0	40	B		A	Flying	Yes
77	2	Lesser black-backed gull	2	10/03/2021	11:16	59	91	40	B		A	Gliding	Yes
78	4	Lesser black-backed gull	1	06/11/2020	13:44	131	7	50	B		A	Flying	Yes
79	4	Lesser black-backed gull	1	06/11/2020	13:46	37	43	200	C		A	Soaring	Yes
80	4	Lesser black-backed gull	1	06/11/2020	13:47	96	98	200	C		A	Circling	Yes
81	4	Lesser black-backed gull	2	21/01/2021	10:47	328	43	80	B		A	Flying	Yes
82	4	Lesser black-backed gull	2	26/01/2021	09:39	119	8	40	B		A	Flying	Yes
83	3	Lesser black-backed gull	13	26/03/2024	07:42	10	50	0	-		A	Flying	Yes
84	3	Lesser black-backed gull	1	26/03/2024	09:08	20	11	0	-		A	Flying	Yes
85	5	Lesser black-backed gull	1	27/10/2023	11:50	30	0	30	B			Flying	No
86	1	Lesser black-backed gull	1	27/03/2024	10:52	20	7	0	-		A	Flying	Yes
87	1	Lesser black-backed gull	1	27/03/2024	11:20	0	168	0	-		A	Flying	Yes
88	1	Lesser black-backed gull	1	15/08/2024	07:16	37	0	0	-		A	Flying	Yes
89	1	Lesser black-backed gull	3	15/08/2024	07:42	42	0	0	-		A	Flying	Yes
90	1	Lesser black-backed gull	4	24/04/2024	06:48	100	0	0	-		A	Flying	Yes
91	1	Lesser black-backed gull	1	24/04/2024	08:30	30	22	0	-		A	Flying	Yes
92	1	Lesser black-backed gull	1	24/04/2024	10:19	30	12	0	-		A	Flying	Yes
93	1	Lesser black-backed gull	2	24/04/2024	10:36	29	1	0	-		A	Flying	Yes
94	1	Lesser black-backed gull	1	22/05/2024	06:32	50	0	0	-		A	Flying	Yes
95	1	Lesser black-backed gull	1	22/05/2024	12:05	116	20	0	-		A	Flying	Yes
96	1	Lesser black-backed gull	1	21/06/2024	08:45	17	18	0	-		A	Flying	Yes
97	1	Lesser black-backed gull	1	21/06/2024	10:04	52	0	0	-		A	Flying	Yes
98	1	Lesser black-backed gull	1	21/06/2024	12:16	20	0	0	-		A	Flying	Yes
99	1	Lesser black-backed gull	1	29/07/2024	07:14	14	0	0	-		A	Flying	Yes
100	1	Lesser black-backed gull	1	29/07/2024	10:58	32	11	0	-		A	Flying	Yes
101	1	Lesser black-backed gull	1	29/07/2024	11:46	71	0	0	-		A	Flying	Yes
102	1	Lesser black-backed gull	1	29/07/2024	13:20	36	0	0	-		J	Flying	Yes
103	2	Lesser black-backed gull	4	27/03/2024	08:13	102	0	0	-		A	Flying	Yes
104	2	Lesser black-backed gull	3	27/03/2024	08:24	31	0	0	-		A	Flying	Yes
105	2	Lesser black-backed gull	1	27/03/2024	08:50	30	18	0	-		A	Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
106	2	Lesser black-backed gull	3	31/07/2024	08:36	33	0	0	-		A	Flying	Yes
107	2	Lesser black-backed gull	1	31/07/2024	13:22	51	0	0	-		A	Flying	Yes
108	2	Lesser black-backed gull	2	03/04/2024	13:05	300	0	0	A			Feeding	No
109	2	Lesser black-backed gull	1	22/04/2024	07:51	41	0	0	-		A	Flying	Yes
110	2	Lesser black-backed gull	2	22/04/2024	08:05	28	0	0	-		A	Flying	Yes
111	2	Lesser black-backed gull	2	22/04/2024	09:11	50	5	0	-		A	Flying	Yes
112	2	Lesser black-backed gull	1	22/04/2024	13:07	0	8	0	-		A	Flying	No
113	2	Lesser black-backed gull	1	22/05/2024	07:42	39	0	50	B		A	Flying	Yes
114	2	Lesser black-backed gull	1	22/05/2024	08:27	64	0	50	B		A	Flying	Yes
115	2	Lesser black-backed gull	1	22/05/2024	08:39	23	0	10	A		J	Flying	Yes
116	2	Lesser black-backed gull	5	22/05/2024	09:05	161	0	15	A		A	Flying	Yes
117	2	Lesser black-backed gull	1	22/05/2024	11:07	6	0	0	-		A	Flying	Yes
118	2	Lesser black-backed gull	2	25/06/2024	07:05	20	40	0	-		A	Flying	Yes
119	2	Lesser black-backed gull	1	25/06/2024	07:22	20	5	0	-		A	Flying	Yes
120	2	Lesser black-backed gull	1	25/06/2024	08:44	16	16	0	-		A	Flying	Yes
121	2	Lesser black-backed gull	1	25/06/2024	09:59	60	8	0	-		A	Flying	Yes
122	2	Lesser black-backed gull	1	25/06/2024	10:29	32	0	0	-		A	Flying	Yes
123	2	Lesser black-backed gull	1	25/06/2024	12:31	0	12	0	-		A	Flying	No
124	3	Lesser black-backed gull	13	26/03/2024	07:42	10	50	0	-		A	Flying	Yes
125	3	Lesser black-backed gull	1	26/03/2024	09:08	20	11	0	-		A	Flying	Yes
126	3	Lesser black-backed gull	2	30/07/2024	11:22	0	46	60	B		A	Flying	No
127	3	Lesser black-backed gull	2	16/08/2024	11:43	0	43	0	-		A	Flying	Yes
128	3	Lesser black-backed gull	2	23/04/2024	07:22	25	25	0	-		A	Flying	Yes
129	3	Lesser black-backed gull	1	23/04/2024	08:31	80	40	0	-		A	Flying	Yes
130	3	Lesser black-backed gull	2	23/04/2024	09:26	16	0	0	-		A	flying	Yes
131	3	Lesser black-backed gull	1	24/05/2024	08:32	102	25	0	-		A	Flying	Yes
132	3	Lesser black-backed gull	1	20/06/2024	06:51	67	0	0	-		A	Flying	Yes
133	3	Lesser black-backed gull	2	20/06/2024	08:06	92	15	0	-		A	Flying	Yes
134	3	Lesser black-backed gull	1	20/06/2024	0846	87	5	0	-		A	Flying	Yes
135	3	Lesser black-backed gull	1	20/06/2024	10:18	119	0	30	B		A	Flying	Yes
136	4	Lesser black-backed gull	1	14/08/2024	12:12	39	0	0	-		A	Flying	Yes
137	4	Lesser black-backed gull	1	18/04/2024	08:31	0	29	0	-		A	Flying	No
138	4	Lesser black-backed gull	1	18/04/2024	10:10	0	33	0	-		A	Flying	No
139	4	Lesser black-backed gull	1	18/04/2024	10:18	40	33	0	-		A	Flying	Yes
140	4	Lesser black-backed gull	1	18/04/2024	12:08	40	7	0	-		A	Flying	Yes
141	4	Lesser black-backed gull	1	23/05/2024	06:21	0	40	20	B		A	Flying	No

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
142	4	Lesser black-backed gull	1	23/05/2024	09:03	0	31	0	-		A	Flying	No
143	4	Lesser black-backed gull	1	23/05/2024	09:42	24	0	1	A		A	Flying	Yes
144	4	Lesser black-backed gull	1	23/05/2024	12:28	39	0	20	B		A	Flying	Yes
145	4	Lesser black-backed gull	1	24/06/2024	09:27	10	42	0	-		A	Flying	Yes
146	4	Lesser black-backed gull	1	24/06/2024	10:51	0	48	0	-		A	Flying	No
147	4	Lesser black-backed gull	1	24/06/2024	11:24	0	38	0	-		A	Flying	No
148	4	Lesser black-backed gull	1	24/06/2024	12:10	20	10	0	-		A	Flying	Yes
149	4	Lesser black-backed gull	1	26/07/2024	07:12	15	4	0	-		A	Flying	Yes
150	4	Lesser black-backed gull	1	26/07/2024	09:56	44	6	0	-		A	Flying	Yes
151	4	Lesser black-backed gull	1	26/07/2024	11:51	0	98	0	-		A	Flying	No
152	5	Lesser black-backed gull	2	28/03/2024	10:11	150	0	40	-		2A	Commuting	Yes
153	5	Lesser black-backed gull	1	23/04/2024	10:00	120	60	50	-			Commuting	Yes
154	5	Lesser black-backed gull	1	23/04/2024	10:21	30	10	20	-			Fly-land	Yes
155	5	Lesser black-backed gull	1	23/04/2024	10:58	10	10	25	-		A	Commuting	Yes
156	5	Lesser black-backed gull	2	23/04/2024	12:34	0	100	30	-		2A	Hunting	No
157	5	Lesser black-backed gull	3	21/05/2024	07:29	10	20	30	-		A	Commuting	Yes
158	5	Lesser black-backed gull	4	21/05/2024	07:40	0	40	50	-		A	Commuting	No
159	5	Lesser black-backed gull	4	21/05/2024	08:08	0	80	40	-		A	Commuting	No
160	5	Lesser black-backed gull	1	21/05/2024	08:17	50	15	40	-		A	Commuting	Yes
161	5	Lesser black-backed gull	1	21/05/2024	08:34	100	0	60	-		A	Commuting	Yes

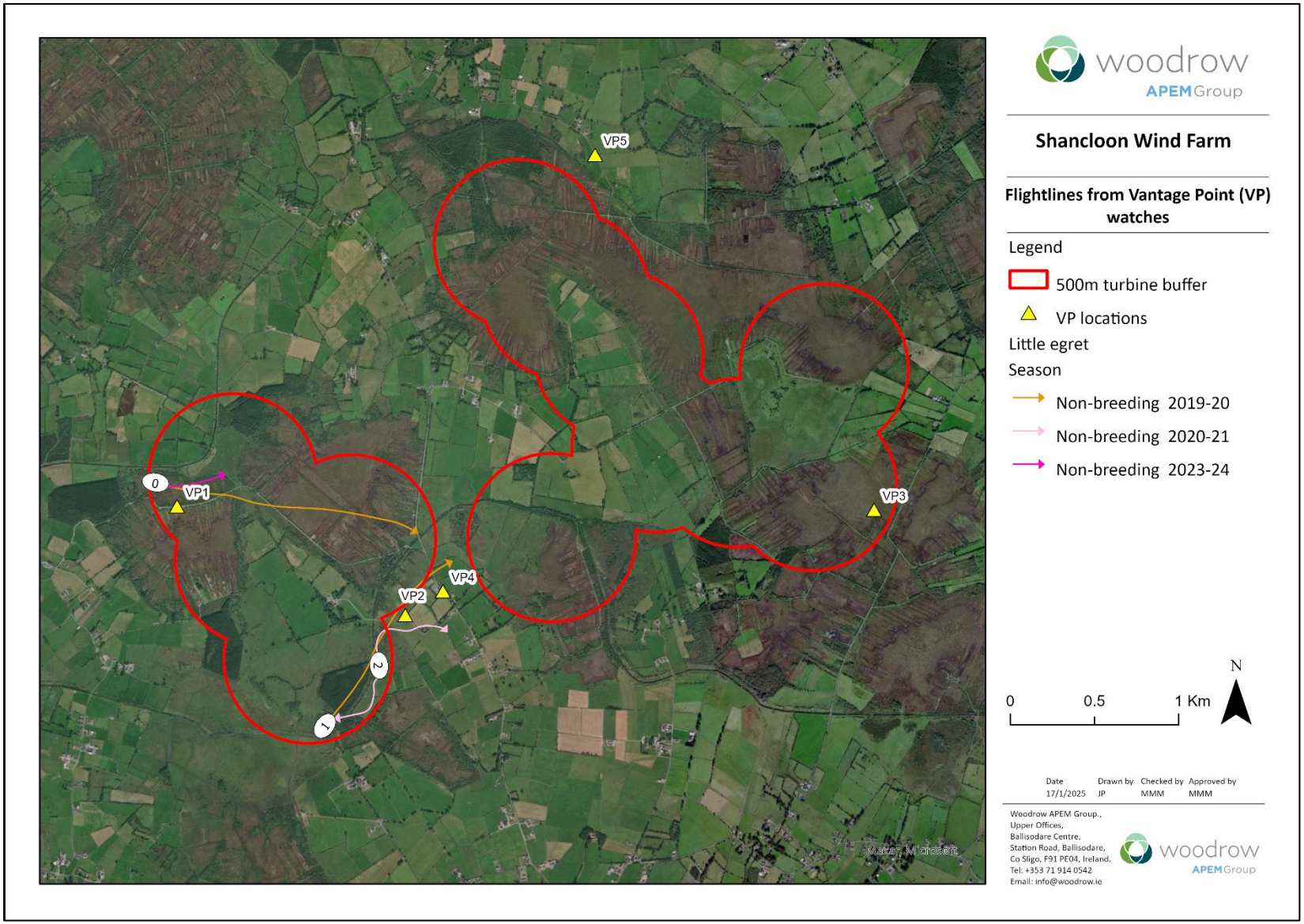


Figure X.20. Little egret flightlines from VP Watches

Table IX.20. VP watch data for little egret

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Little egret	1	21/11/2019	10:48	67	27	20	B	M		Flying	Yes
1	2	Little egret	1	12/12/2019	13:39	98	37	50	B			Flushed	Yes
2	2	Little egret	1	22/01/2021	08:46	19	44	20	B		A	Flying	Yes
3	2	Little egret	1	22/01/2021	11:22	34	0	10	A		A	Flying	Yes
4	1	Little egret	1	04/12/2023	10:02	20	0	8	A		A	Commuting	Yes

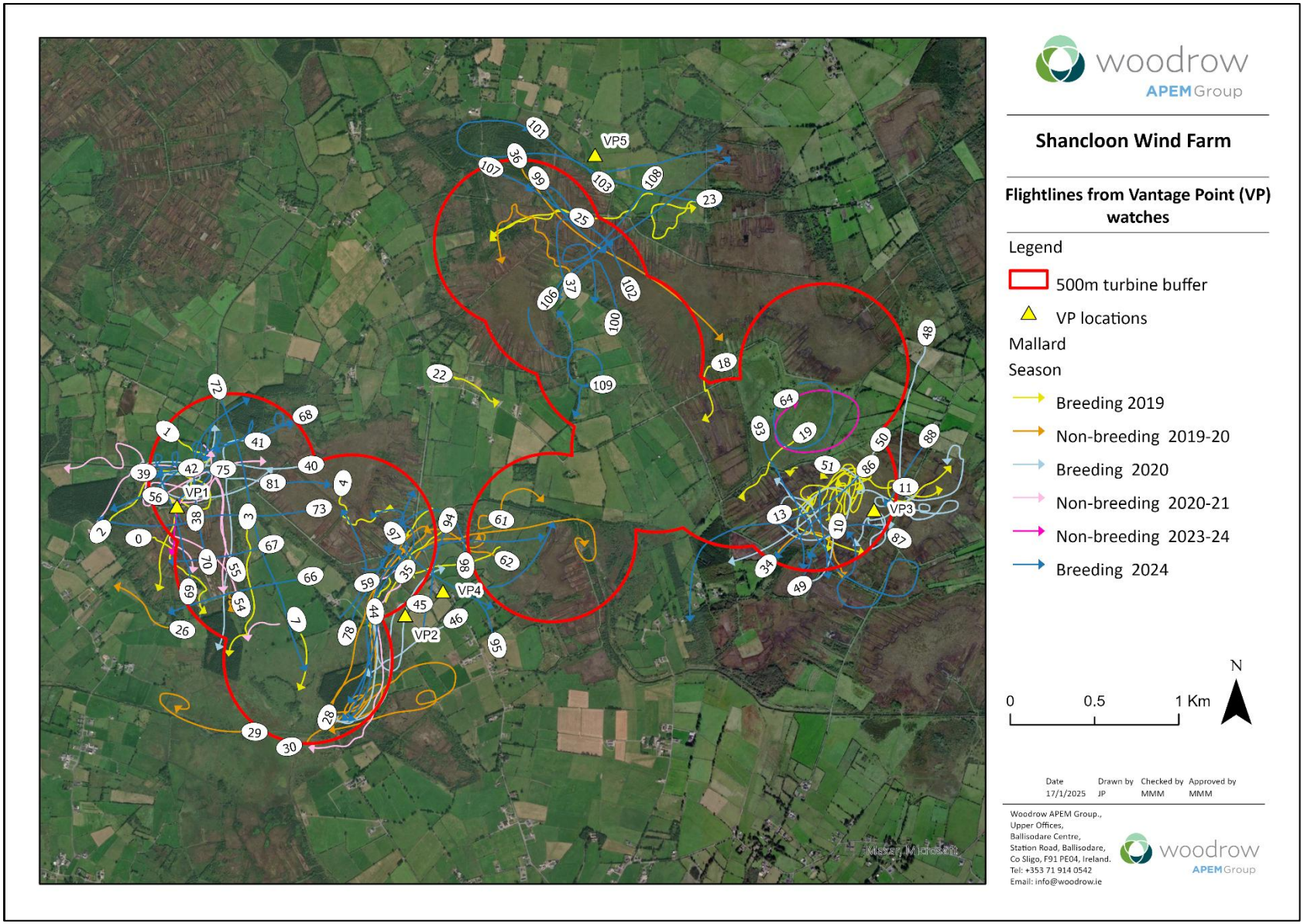


Figure X.21. Mallard flightlines from VP Watches

Table IX.21. VP watch data for mallard

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Mallard	2	17/04/2019	12:29	30	18	30	B			Flying	Yes
1	1	Mallard	2	18/04/2019	12:14	62	28	15	A	M,F		Flying	Yes
2	1	Mallard	3	24/04/2019	09:08	26	12	10	A			Flying	Yes
3	1	Mallard	1	01/07/2019	16:07	46	0	20	B			Flying	Yes
4	2	Mallard	3	17/04/2019	14:56	36	0	30	B			Flying	Yes
5	2	Mallard	1	30/04/2019	12:22	12	0	40	B			Foraging	Yes
6	2	Mallard	1	30/04/2019	14:42	20	8	20	B	M		Flying	Yes
7	2	Mallard	1	08/05/2019	15:32	12	0	100	B		A	Flying	Yes
8	3	Mallard	1	19/04/2019	07:15	0	14	10	A	M		Flying	No
9	3	Mallard	1	19/04/2019	07:16	8	14	10	A	F		Flying	Yes
10	3	Mallard	1	19/04/2019	07:26	43	0	5	A	M		Flying	Yes
11	3	Mallard	3	19/04/2019	09:31	47	0	10	A	2M,F		Flying	Yes
12	3	Mallard	1	19/04/2019	07:55	20	0	5	A			Flying	Yes
13	3	Mallard	3	24/04/2019	15:09	33	0	10	A			Flying	Yes
14	3	Mallard	1	01/05/2019	09:37	49	0	30	B	M		Flying	Yes
15	3	Mallard	1	01/05/2019	10:05	17	0	10	A	M		Flying	Yes
16	3	Mallard	1	01/05/2019	10:41	21	0	10	A	M		Flying	Yes
17	3	Mallard	1	28/06/2019	13:26	8	0	20	B			Flying	Yes
18	3	Mallard	3	12/07/2019	07:17	7	2	20	B			Flying	Yes
19	3	Mallard	2	22/08/2019	18:16	11	0	10	A			Flying	Yes
20	4	Mallard	1	30/04/2019	16:30	14	1	25	B			Flying	Yes
21	4	Mallard	2	01/05/2019	13:20	9	7	20	B			Flying	Yes
22	4	Mallard	1	08/05/2019	18:33	0	13	40	B			Flying	No
23	5	Mallard	3	30/04/2019	13:54	0	44	20	B	2M,F		Flying	No
24	5	Mallard	2	30/04/2019	15:22	15	8	20	B	2M		Flying	Yes
25	5	Mallard	2	30/04/2019	15:22	98	0	40	B			Flying	Yes
26	1	Mallard	2	21/11/2019	10:54	0	53	15	A			Flying	No
27	2	Mallard	1	09/10/2019	09:05	86	0	20	B			Commuting	Yes
28	2	Mallard	5	08/12/2019	13:47	50	0	40	B			Commuting	Yes
29	2	Mallard	27	12/12/2019	13:21	0	110	50	B			Flushed	No
30	2	Mallard	4	12/12/2019	13:23	27	48	50	B			Flushed	Yes
31	2	Mallard	1	24/02/2020	17:15	26	0	5	A	M		Flying	Yes
32	2	Mallard	3	27/02/2020	09:47	38	0	25	B	M,2F		Flying	Yes
33	1	Mallard	3	13/02/2020	14:21	31	0	10	A	M,2F		Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
34	3	Mallard	2	08/02/2020	10:51	31	4	30	B			Flying	Yes
35	4	Mallard	1	16/01/2020	09:29	44	6	40	B	F		Flying	Yes
36	5	Mallard	3	26/09/2019	09:44	64	16	40	B			Flying	Yes
37	5	Mallard	1	27/02/2020	16:43	28	0	20	B			Flying	Yes
38	1	Mallard	1	24/04/2020	12:22	26	0	10	A	M		Flying	Yes
39	1	Mallard	1	25/04/2020	08:34	28	0	15	A			Flying	Yes
40	1	Mallard	1	25/04/2020	08:35	38	3	20	B			Flying	Yes
41	1	Mallard	1	25/04/2020	09:17	51	3	20	B	M		Flying	Yes
42	1	Mallard	2	07/06/2020	11:31	60	0	40	B	M,F	A	Flying	Yes
43	2	Mallard	1	24/04/2020	17:15	26	0	5	A	M		Flying	Yes
44	2	Mallard	3	25/08/2020	13:59	18	20	15	A		J	Flying	Yes
45	2	Mallard	3	25/08/2020	14:02	20	11	10	A		J	Flying	Yes
46	2	Mallard	4	26/08/2020	10:22	25	46	20	B		J	Flying	Yes
47	3	Mallard	2	22/04/2020	12:22	14	0	30	B	M,F	A	Flying	Yes
48	3	Mallard	3	29/04/2020	19:30	0	51	22	B	M		Flying	No
49	3	Mallard	1	29/04/2020	19:38	75	4	20	B	M		Flying	Yes
50	3	Mallard	2	29/04/2020	21:28	11	2	5	A			Flying	Yes
51	3	Mallard	1	29/04/2020	21:37	163	149	60	B			Circling	Yes
52	1	Mallard	1	26/01/2021	14:31	10	38	25	B		A	Flying	Yes
53	1	Mallard	2	24/02/2021	10:49	28	0	20	B		A	Flying	Yes
54	1	Mallard	3	10/03/2021	08:07	29	4	10	A	M,F	A	Flying	Yes
55	1	Mallard	2	10/03/2021	08:23	25	0	10	A	M,F	A	Flying	Yes
56	1	Mallard	4	10/03/2021	08:32	94	97	40	B	M,F	A	Flying	Yes
57	1	Mallard	1	10/03/2021	08:42	39	0	10	A	M	A	Flying	Yes
58	1	Mallard	2	10/03/2021	09:35	49	0	5	A	M,F	A	Flying	Yes
59	2	Mallard	1	09/03/2021	11:02	80	38	20	B	F	A	Flying	Yes
60	4	Mallard	2	12/11/2019	08:11	25	0	15	A			Commuting	Yes
61	4	Mallard	1	02/12/2019	15:48	45	0	30	B	M		Commuting	Yes
62	4	Mallard	6	02/12/2019	16:26	15	15	20	B			Commuting	Yes
63	1	Mallard	2	28/10/2023	10:55	40	0	20	B			Flying	Yes
64	3	Mallard	4	26/03/2024	09:22	142	0	0	-			Displaying	Yes
65	1	Mallard	1	27/03/2024	11:50	10	0	0	-	M	A	Flying	Yes
66	1	Mallard	1	27/03/2024	12:49	32	2	0	-	M	A	Flying	Yes
67	1	Mallard	2	27/03/2024	13:16	25	0	0	-	M	A	Flying	Yes
68	1	Mallard	2	15/08/2024	10:11	12	0	0	-	M,F	A	Flying	Yes
69	1	Mallard	1	15/08/2024	10:58	19	0	0	-	F	A	Flying	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
70	1	Mallard	2	15/08/2024	11:22	24	0	0	-			Flying	Yes
71	1	Mallard	3	24/04/2024	06:17	17	0	0	-	M,F	A	Flying	Yes
72	1	Mallard	1	24/04/2024	06:40	76	0	0	-	M	A	Flying	Yes
73	1	Mallard	1	24/04/2024	08:00	50	34	0	-	M	A	Flying	Yes
74	1	Mallard	1	24/04/2024	09:58	20	10	0	-	M	A	Flying	Yes
75	1	Mallard	2	21/06/2024	07:26	6	0	0	-	M,F	A	Flying	Yes
76	1	Mallard	2	29/07/2024	12:14	7	0	0	-			Flying	Yes
77	2	Mallard	3	27/03/2024	07:19	97	0	0	-	M,F	A	Flying	Yes
78	2	Mallard	2	27/03/2024	08:05	40	0	0	-	M,F	A	Flying	Yes
79	2	Mallard	1	27/03/2024	08:15	34	0	0	-	M	A	Flying	Yes
80	2	Mallard	1	27/03/2024	08:35	30	0	0	-	M	A	Flying	Yes
81	2	Mallard	1	27/03/2024	09:02	10	0	0	-	M	A	Flying	Yes
82	2	Mallard	6	19/08/2024	08:24	60	0	0	-			Flying	Yes
83	2	Mallard	3	22/04/2024	07:16	18	0	0	-		A	Flying	Yes
84	2	Mallard	2	22/04/2024	09:53	28	0	0	-	M,F	A	Flying	Yes
85	3	Mallard	4	26/03/2024	09:22	142	0	0	-			Displaying	Yes
86	3	Mallard	2	30/07/2024	07:48	49	18	0	-	M,F	A	Flying	Yes
87	3	Mallard	1	23/04/2024	09:03	12	0	0	-	M	A	Flying	Yes
88	3	Mallard	2	23/04/2024	09:20	10	5	0	-	M,F	A	Flying	Yes
89	3	Mallard	2	23/04/2024	09:29	30	0	0	-	M,F	A	Flying	Yes
90	3	Mallard	1	23/04/2024	13:06	12	0	0	-	M	A	Flying	Yes
91	3	Mallard	2	24/05/2024	06:00	39	0	5	A	M,F	A	Flying	Yes
92	3	Mallard	2	24/05/2024	07:47	46	0	0	-	M,F	A	Flying	Yes
93	3	Mallard	1	24/05/2024	08:16	51	20	0	-	M	A	Flying	Yes
94	4	Mallard	1	26/03/2024	12:01	0	20	0	-	M	A	Flying	No
95	4	Mallard	2	26/03/2024	13:05	26	9	0	-	M	A	Flying	Yes
96	4	Mallard	2	18/04/2024	10:30	19	7	0	-	M,F	A	Flying	Yes
97	4	Mallard	2	18/04/2024	12:42	5	15	0	-		A	Flying	Yes
98	4	Mallard	1	23/05/2024	12:05	19	10	0	-	M	A	Flying	Yes
99	5	Mallard	5	28/03/2024	09:28	30	0	15	-	5M		Fly-land	Yes
100	5	Mallard	2	28/03/2024	09:46	15	20	15	-	2M		Commuting	Yes
101	5	Mallard	1	28/03/2024	10:28	0	20	10	-	M		Commuting	No
102	5	Mallard	1	28/03/2024	12:18	20	0	10	-	M		Commuting	Yes
103	5	Mallard	1	28/03/2024	13:31	0	30	15	-	M		Fly-land	No
104	5	Mallard	1	23/04/2024	10:38	0	20	15	-	M		Commuting	No
105	5	Mallard	1	23/04/2024	11:08	10	0	5	-	M		Fly-land	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
106	5	Mallard	2	23/04/2024	14:14	20	15	30	-			Commuting	Yes
107	5	Mallard	2	21/05/2024	06:50	25	0	20	-	M,F		Commuting	Yes
108	5	Mallard	2	21/05/2024	10:06	20	0	10	-	M,F	A	Commuting	Yes
109	5	Mallard	1	21/05/2024	10:29	15	0	10	-	M	A	Commuting	Yes
110	5	Mallard	2	21/05/2024	10:54	20	0	10	-	M,F	A	Fly-land	Yes

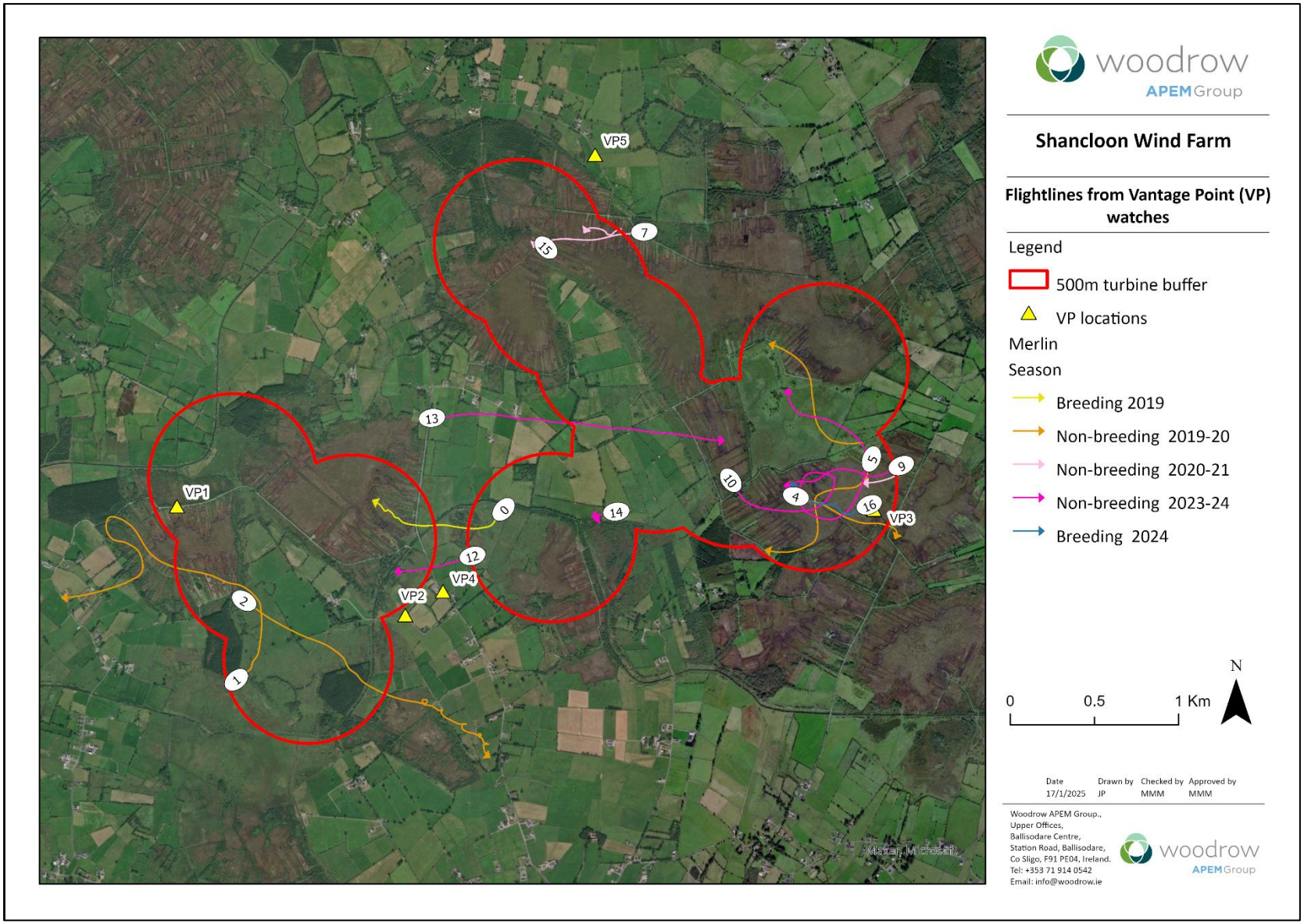


Figure X.22. Merlin flightlines from VP Watches

Table IX.22. VP watch data for merlin

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	4	Merlin	1	08/05/2019	18:53	14	4	50	B			Flying	Yes
1	1	Merlin	1	09/01/2020	10:49	36	13	25	B	F	J	Hunting	Yes
2	2	Merlin	1	06/01/2020	14:27	35	40	35	B	F		Commuting	Yes
3	3	Merlin	1	25/09/2019	15:09	50	0	8	A	F		Hunting	Yes
4	3	Merlin	1	27/11/2019	11:32	21	5	1	A			Hunting	Yes
5	3	Merlin	1	10/01/2020	11:45	157	0	2	A			Flying	Yes
6	3	Merlin	1	22/01/2021	14:37	14	1	1	A	M	A	Flying	Yes
7	5	Merlin	1	08/12/2020	14:49	28	2	5	A		J	Hunting	Yes
8	5	Merlin	1	08/12/2020	14:59	17	1	20	B			Mobbing	Yes
9	3	Merlin	1	24/11/2023	10:33	60	0	5	A	F	A	Hunting	Yes
10	3	Merlin	1	26/01/2024	11:39	30	0	40	B			Mobbing	Yes
11	4	Merlin	1	22/02/2024	11:04	40	5	5	A	M	A	Flying	Yes
12	4	Merlin	1	07/11/2023	11:25	8	7	25	B	M	A	Commuting	Yes
13	4	Merlin	1	27/01/2024	13:38	15	5	20	B			Present	Yes
14	4	Merlin	1	22/02/2024	11:04	40	5	5	A	M	A	Flying	Yes
15	5	Merlin	1	23/11/2023	10:00	0	0	0	A	F		Perched	Yes
16	3	Merlin	1	30/07/2024	09:02	29	0	0	-			Hunting	Yes

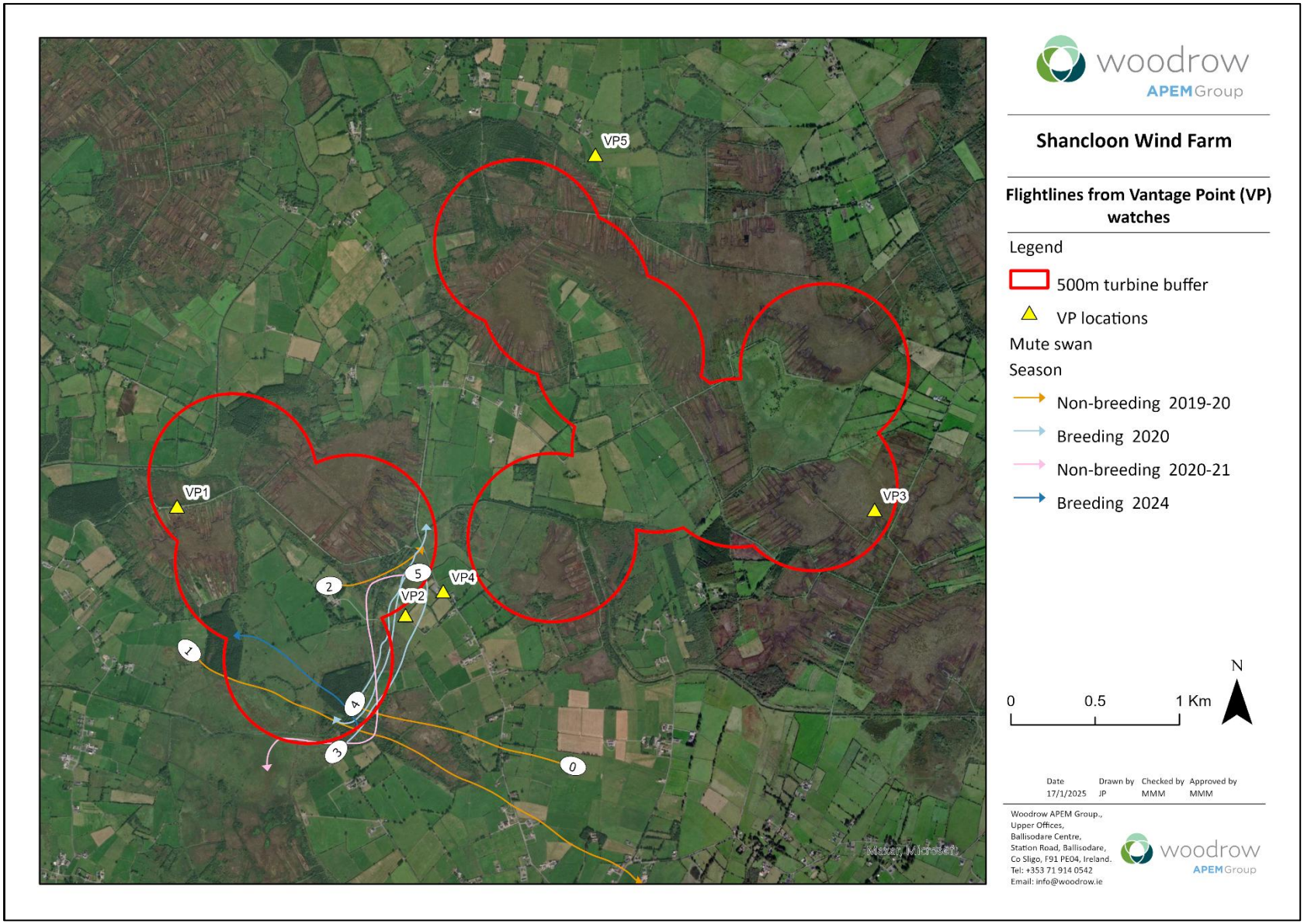


Figure X.23. Mute swan flightlines from VP Watches

Table IX.23. VP watch data for mute swan

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Mute swan	1	11/10/2019	08:26	22	191	20	B			Flying	Yes
1	2	Mute swan	2	11/10/2019	09:39	33	84	10	A			Flying	Yes
2	2	Mute swan	4	10/01/2020	11:57	47	0	15	A		2 A, 2 J	Flying	Yes
3	2	Mute swan	2	24/04/2020	09:05	46	41	5	A			Flying	Yes
4	2	Mute swan	2	24/04/2020	11:44	23	2	5	A			Flying	Yes
5	2	Mute swan	2	22/02/2021	10:24	212	129	40	B		J	Flying	Yes
6	2	Mute swan	2	22/05/2024	06:30	42	0	40	B		A	Flying	Yes

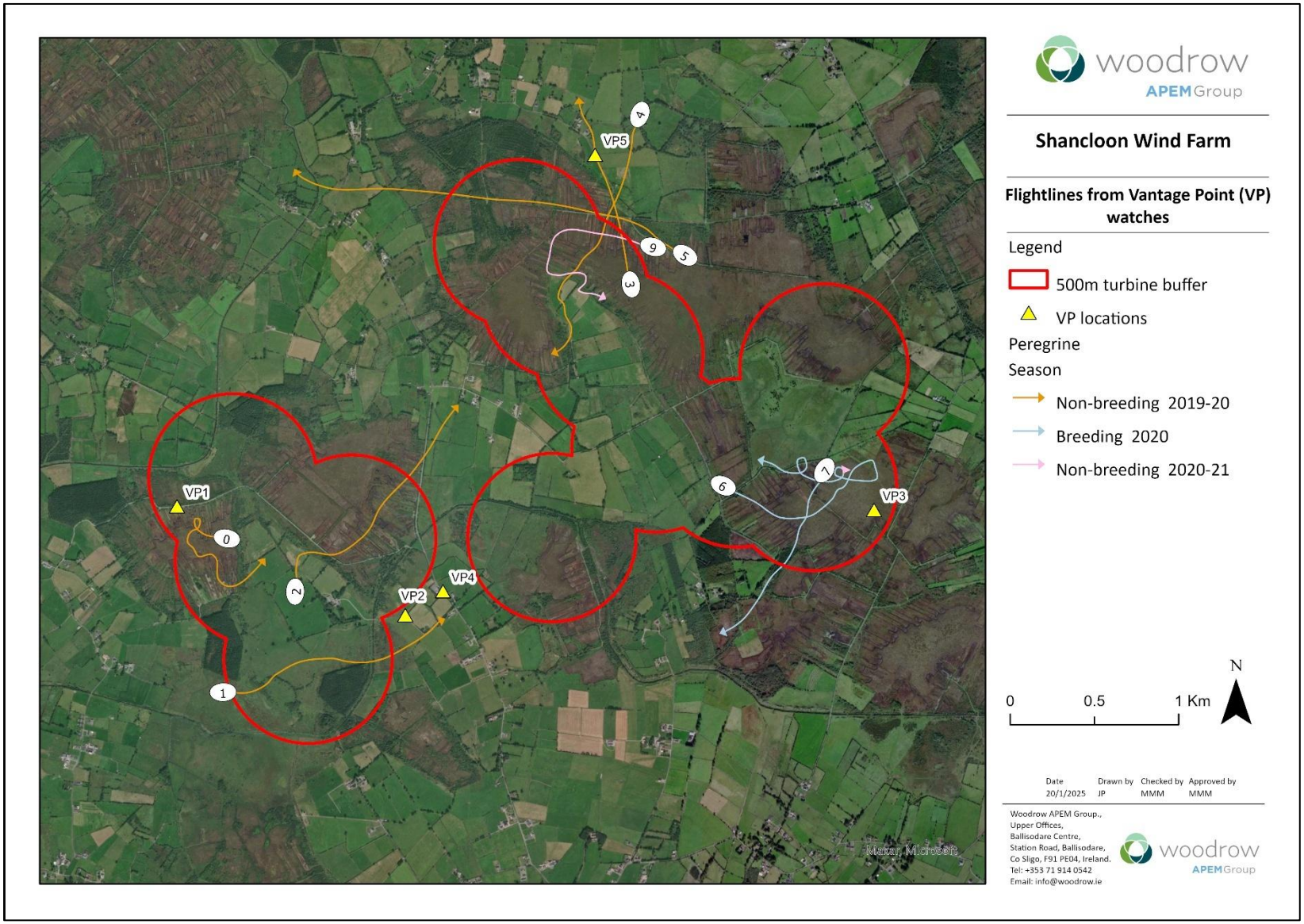


Figure X.24. Peregrine flightlines from VP Watches

Table IX.24. VP watch data for peregrine

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Peregrine	1	28/02/2020	09:34	28	15	20	B			Hunting	Yes
1	2	Peregrine	1	28/01/2020	10:15	35	13	25	B			Hunting	Yes
2	2	Peregrine	1	04/02/2020	17:06	72	38	60	B	F	J	Flying	Yes
3	5	Peregrine	1	11/10/2019	11:00	4	16	10	A			Hunting	Yes
4	5	Peregrine	1	16/01/2020	14:36	31	19	20	B	M	A	Flying	Yes
5	5	Peregrine	1	27/02/2020	17:35	44	75	30	B		J	Hunting	Yes
6	3	Peregrine	1	21/04/2020	13:07	146	0	20	B	M	A	Soaring	Yes
7	3	Peregrine	1	11/08/2020	11:10	34	35	5	A		J	Commuting	Yes
8	3	Peregrine	1	28/09/2020	08:42	0	0	0	A		J	Perched	Yes
9	5	Peregrine	1	08/12/2020	14:59	38	2	10	A			Hunting	Yes

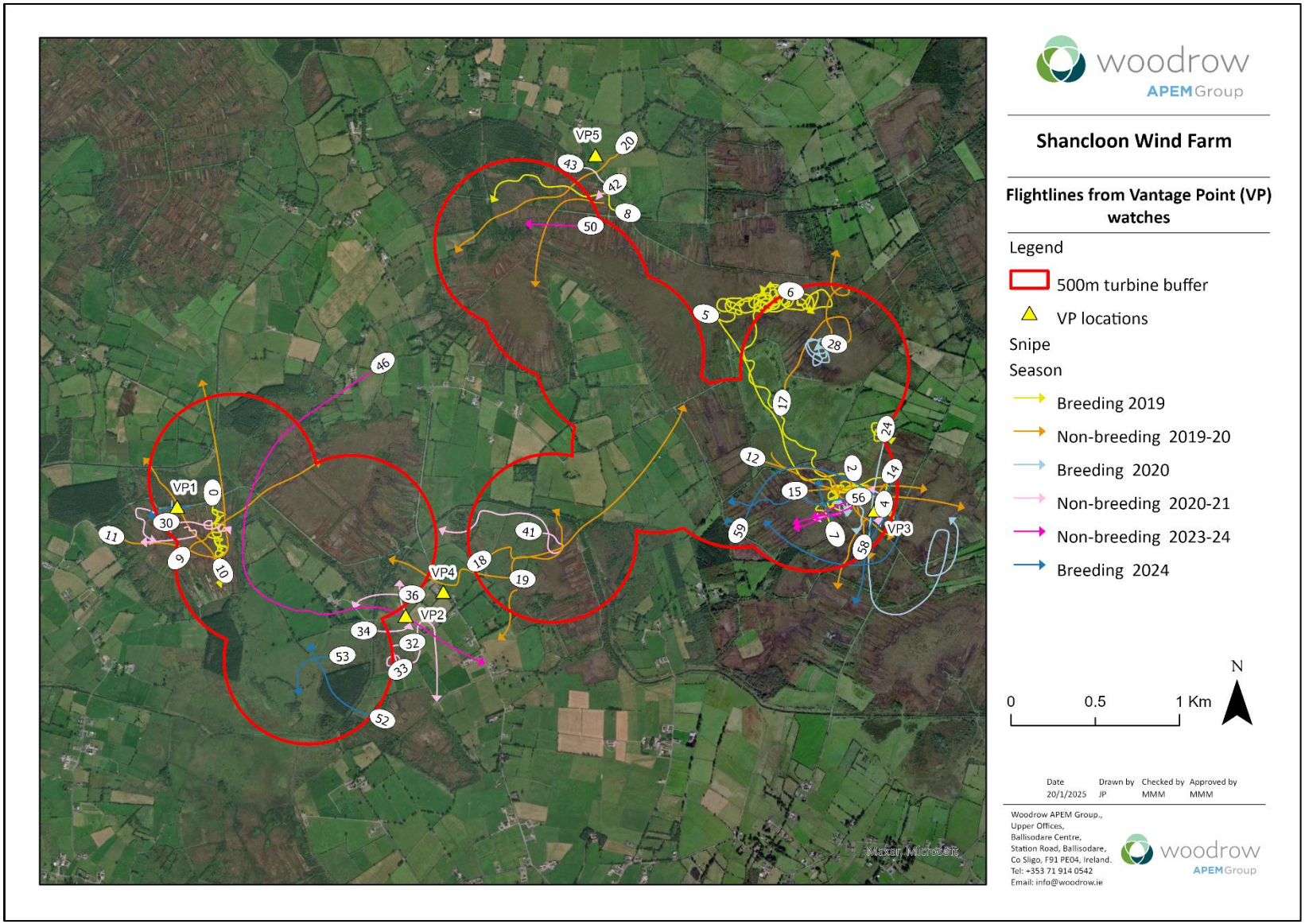


Figure X.25. Snipe flightlines from VP Watches

Table IX.25. VP watch data for snipe

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Snipe	1	19/07/2019	12:35	383	0	35	B			Drumming	Yes
1	3	Snipe	1	17/04/2019	17:08	0	0	0	A			Chipping	Yes
2	3	Snipe	1	28/06/2019	12:42	271	0	40	B			Drumming	Yes
3	3	Snipe	1	28/06/2019	14:10	103	69	25	B			Drumming	Yes
4	3	Snipe	1	12/07/2019	08:05	68	11	40	B			Flying	Yes
5	3	Snipe	1	12/07/2019	08:44	78	580	40	B			Drumming	Yes
6	3	Snipe	1	12/07/2019	08:47	427	227	45	B			Drumming	Yes
7	3	Snipe	1	30/07/2019	07:50	34	8	40	B			Flying	Yes
8	5	Snipe	1	11/06/2019	12:34	46	0	50	B			Flushed	Yes
9	1	Snipe	2	25/09/2019	08:07	39	1	30	B			Commuting	Yes
10	1	Snipe	1	25/09/2019	09:32	32	3	35	B			Commuting	Yes
11	1	Snipe	1	15/01/2020	13:45	3	14	15	A			Flying	Yes
12	3	Snipe	2	25/09/2019	14:14	53	27	25	B			Commuting	Yes
13	3	Snipe	5	25/09/2019	13:25	32	3	15	A			Commuting	Yes
14	3	Snipe	1	25/09/2019	15:06	24	6	25	B			Commuting	Yes
15	3	Snipe	1	08/10/2019	08:39	34	11	35	B			Commuting	Yes
16	3	Snipe	3	08/10/2019	08:47	61	4	50	B			Commuting	Yes
17	3	Snipe	2	08/10/2019	09:43	39	6	25	B			Commuting	Yes
18	4	Snipe	1	06/11/2019	07:33	80	0	50	B			Commuting	Yes
19	4	Snipe	1	16/01/2020	08:19	19	16	50	B			Flying	Yes
20	5	Snipe	7	26/09/2019	08:07	48	17	25	B			Commuting	Yes
21	5	Snipe	1	06/11/2019	11:39	45	5	40	B			Commuting	Yes
22	1	Snipe	1	25/06/2020	12:41	15	0	10	A		A	Flying	Yes
23	3	Snipe	2	21/04/2020	12:38	18	0	3	A	M,F	A	Roosting	Yes
24	3	Snipe	1	29/04/2020	21:43	11	33	2	A			Chipping	Yes
25	3	Snipe	1	12/05/2020	11:25	12	0	10	A		A	Flying	Yes
26	3	Snipe	1	12/05/2020	12:53	15	0	10	A		A	Flying	Yes
27	3	Snipe	1	24/07/2020	14:12	0	0	0	A			Calling	Yes
28	5	Snipe	1	30/04/2020	21:56	1803	0	30	B			Drumming	Yes
29	1	Snipe	2	29/09/2020	09:22	37	32	5	A			Commuting	Yes
30	1	Snipe	1	20/10/2020	13:22	9	0	5	A	M	A	Commuting	Yes
31	1	Snipe	1	26/01/2021	13:47	14	29	30	B		A	Flying	Yes
32	2	Snipe	3	30/09/2020	08:43	10	29	5	A			Commuting	Yes
33	2	Snipe	6	30/09/2020	08:44	0	23	40	B			Commuting	Yes
34	2	Snipe	1	14/10/2020	09:42	5	11	0	A			Commuting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
35	2	Snipe	1	14/10/2020	09:42	22	14	30	B			Commuting	Yes
36	2	Snipe	1	17/11/2020	11:47	5	0	3	A			Present	Yes
37	3	Snipe	1	28/09/2020	08:24	42	0	0	A			Flushed	Yes
38	3	Snipe	1	28/09/2020	08:24	42	0	30	B			Flushed	Yes
39	3	Snipe	1	28/09/2020	09:34	5	0	0	A			Flushed	Yes
40	3	Snipe	2	16/10/2020	09:30	12	0	0	A			Commuting	Yes
41	4	Snipe	1	25/01/2021	14:50	85	16	20	B		A	Flying	Yes
42	5	Snipe	1	21/10/2020	07:39	0	0	0	A			Calling	No
43	5	Snipe	1	25/01/2021	12:43	0	4	5	A		A	Foraging	No
44	4	Snipe	1	12/11/2019	08:19	45	0	60	B			Commuting	Yes
45	4	Snipe	1	02/12/2019	13:59	13	17	35	B			Flushed	Yes
46	2	Snipe	1	25/01/2024	14:38	120	30	120	B			Flying	Yes
47	3	Snipe	1	08/11/2023	15:08	6	0	1	A		A	Flushed	Yes
48	3	Snipe	1	24/11/2023	10:50	6	0	1	A		A	Flushed	Yes
49	3	Snipe	1	01/12/2023	09:40	5	0	1	A	F	A	Flushed	Yes
50	5	Snipe	2	10/11/2023	08:15	4	0	2	A		A	Flushed	Yes
51	1	Snipe	1	27/03/2024	11:26	17	0	0	-			Flying	Yes
52	2	Snipe	1	22/05/2024	07:46	42	0	45	B			Flying	Yes
53	2	Snipe	1	22/05/2024	11:25	25	0	0	-	M	A	Displaying	Yes
54	3	Snipe	2	30/07/2024	11:46	10	25	20	B			Flying	Yes
55	3	Snipe	1	16/08/2024	06:07	12	0	0	-			Flying	Yes
56	3	Snipe	1	24/05/2024	07:08	31	0	0	-			Flying	Yes
57	3	Snipe	1	20/06/2024	06:08	0	0	0	-	M	A	Chipping	Yes
58	3	Snipe	2	20/06/2024	06:15	0	0	0	-				Yes
59	3	Snipe	5	20/06/2024	06:30	0	0	0	-		A	Displaying	Yes

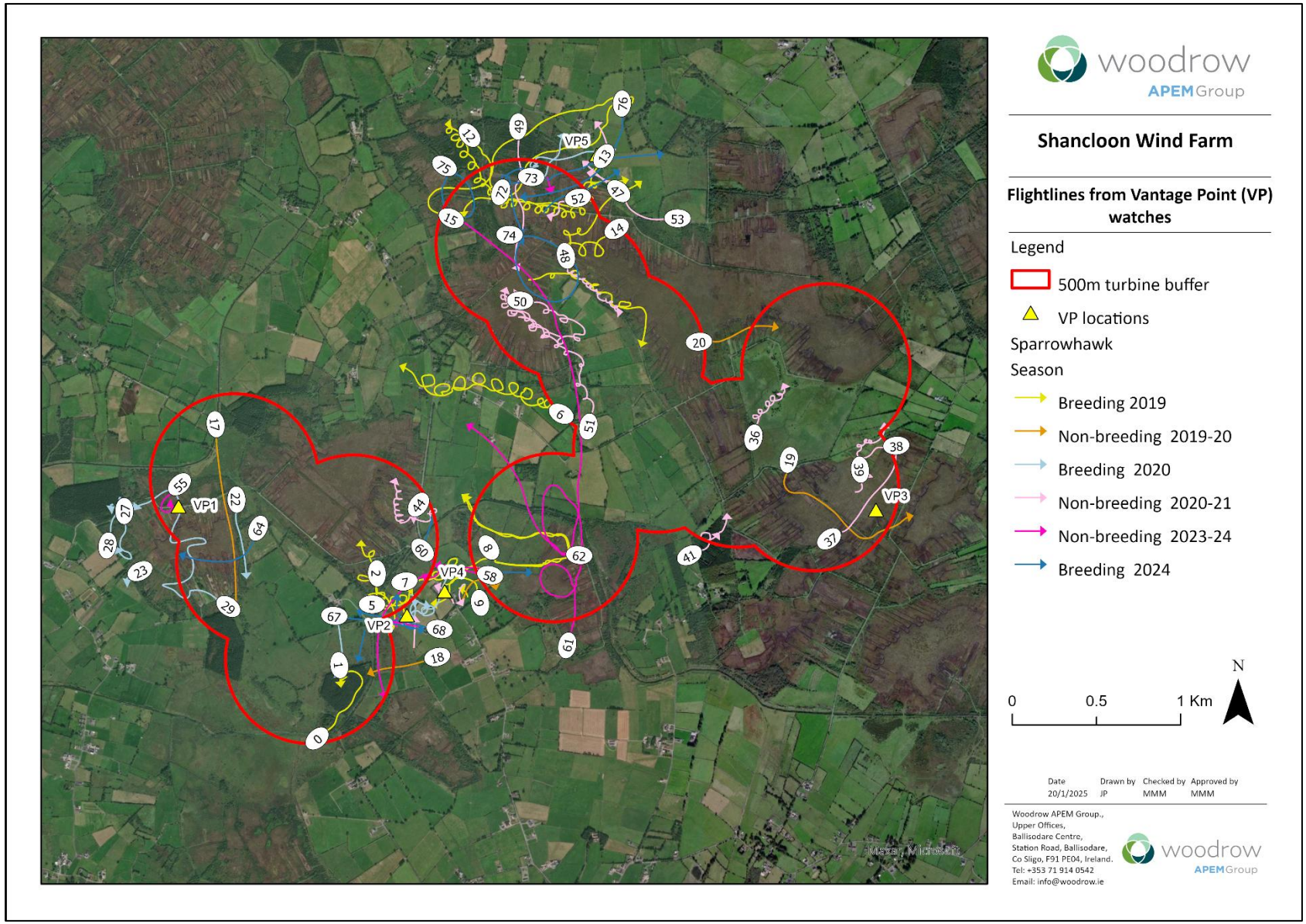


Figure X.26. Sparrowhawk flightlines from VP Watches

Table IX.26. VP watch data for sparrowhawk

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	1	Sparrowhawk	1	30/04/2019	18:13	111	0	140	B			Soaring	Yes
1	1	Sparrowhawk	1	30/04/2019	18:13	3	0	120	B			Flying	Yes
2	2	Sparrowhawk	1	18/04/2019	16:23	7	0	15	A			Foraging	Yes
3	2	Sparrowhawk	1	18/04/2019	16:25	0	2	1	A			Foraging	Yes
4	2	Sparrowhawk	1	18/04/2019	16:26	150	20	80	B			Foraging	Yes
5	2	Sparrowhawk	1	18/04/2019	16:50	158	0	80	B			Hunting	Yes
6	4	Sparrowhawk	1	18/04/2019	15:05	1	121	90	B	F		Soaring	Yes
7	4	Sparrowhawk	1	30/04/2019	17:06	49	26	80	B	F		Soaring	Yes
8	4	Sparrowhawk	1	30/04/2019	17:06	148	17	150	B	F		Soaring	Yes
9	4	Sparrowhawk	1	11/06/2019	16:25	0	112	25	B			Hunting	No
10	4	Sparrowhawk	1	17/06/2019	18:12	2	11	25	B			Hunting	Yes
11	4	Sparrowhawk	1	12/07/2019	11:57	0	8	5	A			Foraging	No
12	5	Sparrowhawk	1	19/04/2019	11:55	58	31	1	A	F		Hunting	Yes
13	5	Sparrowhawk	1	19/04/2019	12:09	234	129	70	B			Soaring	Yes
14	5	Sparrowhawk	1	25/04/2019	12:34	331	89	120	B			Hunting	Yes
15	5	Sparrowhawk	1	11/07/2019	17:17	7	147	30	B	M		Foraging	Yes
16	5	Sparrowhawk	1	11/07/2019	17:27	0	5	4	A	M		Foraging	Yes
17	1	Sparrowhawk	1	28/02/2020	09:15	12	47	20	B	F		Hunting	Yes
18	2	Sparrowhawk	1	27/02/2020	09:07	8	10	10	A			Hunting	Yes
19	3	Sparrowhawk	1	04/10/2019	09:47	23	5	3	A	F		Hunting	Yes
20	3	Sparrowhawk	1	10/01/2020	11:03	9	14	20	B	F		Hunting	Yes
21	4	Sparrowhawk	1	27/11/2019	15:15	4	6	20	B	F		Hunting	Yes
22	1	Sparrowhawk	1	25/04/2020	09:29	4	0	5	A			Hunting	Yes
23	1	Sparrowhawk	1	23/07/2020	07:43	0	0	15	A		J	Calling	No
24	1	Sparrowhawk	2	23/07/2020	08:13	0	0	15	A		J	Calling	No
25	1	Sparrowhawk	1	23/07/2020	08:39	0	0	25	B		J	Calling	No
26	1	Sparrowhawk	1	23/07/2020	11:01	0	0	15	A		J	Calling	No
27	1	Sparrowhawk	1	23/07/2020	12:28	0	19	25	B		J	Flying	No
28	1	Sparrowhawk	2	23/07/2020	12:33	0	24	25	B	F	A, J	Young	No
29	1	Sparrowhawk	1	26/08/2020	15:07	20	8	3	A			Flying	Yes
30	2	Sparrowhawk	1	20/07/2020	08:09	5	20	15	A	F	A	Carrying food	Yes
31	2	Sparrowhawk	1	20/07/2020	12:58	0	12	5	A	F	A	Hunting	No

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
32	2	Sparrowhawk	1	26/08/2020	11:03	0	228	60	B	M	A	Hunting	No
33	2	Sparrowhawk	1	28/08/2020	10:13	13	0	3	A	M	A	Hunting	Yes
34	5	Sparrowhawk	2	21/07/2020	09:24	79	115	50	B	M,F	A	Circling	Yes
35	2	Sparrowhawk	1	22/01/2021	09:31	0	12	1	A	F	A	Hunting	No
36	3	Sparrowhawk	1	05/09/2020	11:39	41	0	100	B			Commuting	Yes
37	3	Sparrowhawk	1	28/09/2020	09:49	39	8	35	B	M	A	Hunting	Yes
38	3	Sparrowhawk	1	28/09/2020	09:49	22	0	10	A	M	A	Hunting	Yes
39	3	Sparrowhawk	1	28/09/2020	09:49	116	13	30	B	M		Hunting	Yes
40	3	Sparrowhawk	1	16/10/2020	11:02	41	0	2	A	M	A	Hunting	Yes
41	3	Sparrowhawk	1	15/11/2020	09:55	42	18	40	B	F	A	Mobbed	Yes
42	3	Sparrowhawk	1	15/11/2020	09:55	60	0	20	B	F	A	Present	Yes
43	4	Sparrowhawk	1	15/10/2020	12:51	14	3	20	B	F	A	Circling	Yes
44	4	Sparrowhawk	1	15/10/2020	12:51	62	0	30	B	F	A	Circling	Yes
45	4	Sparrowhawk	1	20/11/2020	10:36	0	17	1	A	F	A	Hunting	No
46	4	Sparrowhawk	1	20/11/2020	11:15	0	4	2	A	F	A	Hunting	No
47	5	Sparrowhawk	1	06/09/2020	12:23	0	34	2	A	F	A	Hunting	No
48	5	Sparrowhawk	1	28/09/2020	11:43	144	0	100	B			Commuting	Yes
49	5	Sparrowhawk	2	06/11/2020	08:51	69	12	30	B	M,F	A	Flying	Yes
50	5	Sparrowhawk	1	06/11/2020	10:47	244	0	100	B			Hunting	Yes
51	5	Sparrowhawk	1	06/11/2020	10:48	191	0	100	B			Hunting	Yes
52	5	Sparrowhawk	1	21/10/2020	08:54	15	0	20	B	F		Hunting	Yes
53	5	Sparrowhawk	1	20/11/2020	16:43	0	22	1	A	M	A	Hunting	No
54	5	Sparrowhawk	1	25/01/2021	13:40	0	34	2	A	F	A	Hunting	No
55	1	Sparrowhawk	1	28/10/2023	09:51	20	0	20	B			Flying	Yes
56	2	Sparrowhawk	1	08/11/2023	09:08	0	6	1	A	M	A	Hunting	No
57	2	Sparrowhawk	1	21/02/2024	15:06	8	0	5	A	M	A	Present	Yes
58	4	Sparrowhawk	1	29/10/2023	10:14	0	5	1	A			Flying	No
59	4	Sparrowhawk	1	07/11/2023	10:08	3	28	6	A	F	A	Hunting	Yes
60	4	Sparrowhawk	1	23/11/2023	13:22	1	2	3	A	F	A	Hunting	Yes
61	4	Sparrowhawk	1	27/01/2024	13:12	150	0	40	B			Present	Yes
62	4	Sparrowhawk	1	22/02/2024	12:00	10	3	3	A	F		Present	Yes
63	5	Sparrowhawk	1	10/11/2023	10:28	5	0	2	A	F	A	Hunting	Yes
64	1	Sparrowhawk	1	24/04/2024	08:07	20	0	0	-	F	A	Hunting	Yes
65	2	Sparrowhawk	1	31/07/2024	07:26	7	0	0	-	M	A	Hunting	Yes
66	2	Sparrowhawk	1	31/07/2024	08:44	7	0	0	-	M	A	Hunting	Yes

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
67	2	Sparrowhawk	1	22/04/2024	11:48	20	6	1	A	F	A	Flying	Yes
68	2	Sparrowhawk	1	25/06/2024	06:19	13	7	0	-	M	A	Hunting	Yes
69	4	Sparrowhawk	1	14/08/2024	06:16	10	0	0	-			Hovering	Yes
70	4	Sparrowhawk	1	14/08/2024	10:44	6	0	0	-	J		Hovering	Yes
71	5	Sparrowhawk	2	28/03/2024	11:04	60	90	30	-	M,F		Commuting	Yes
72	5	Sparrowhawk	2	28/03/2024	11:11	60	0	20	-	M,F		Courtship	Yes
73	5	Sparrowhawk	1	16/07/2024	12:34	5	20	10	-	F		Hunting	Yes
74	5	Sparrowhawk	1	16/07/2024	13:24	240	0	120	-			Soaring	Yes
75	5	Sparrowhawk	1	16/07/2024	14:13	30	90	30	-			Mobbing	Yes
76	5	Sparrowhawk	1	16/07/2024	15:44	70	30	15	-	F		Hunting	Yes

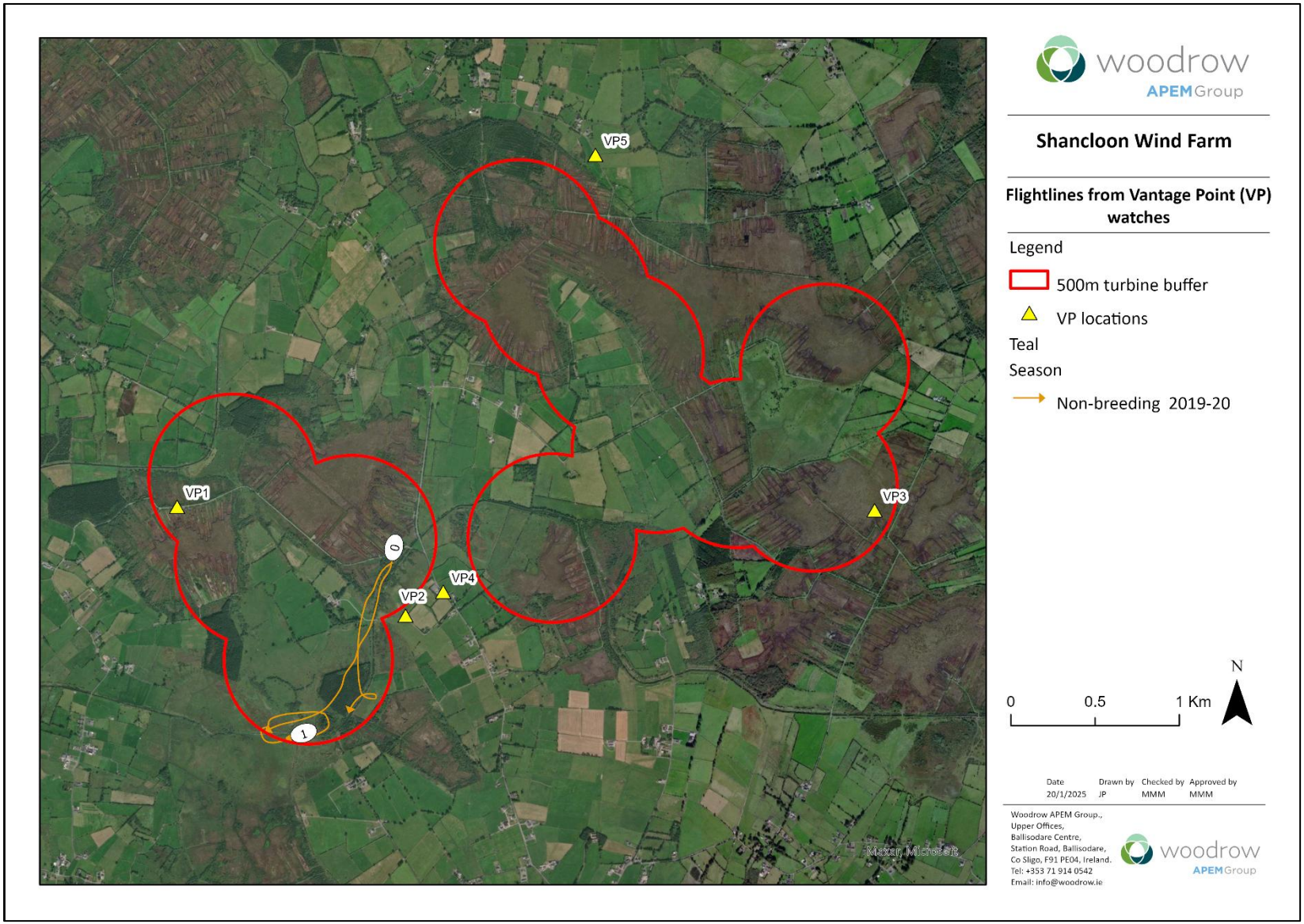


Figure X.27. Teal flightlines from VP Watches

Table IX.27. VP watch data for teal

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Teal	1	26/09/2019	11:32	60	0	25	B			Commuting	Yes
1	2	Teal	8	12/12/2019	13:21	49	11	20	B			Flushed	Yes
2	2	Teal	3	08/02/2020	08:23	55	0	25	B			Flying	Yes

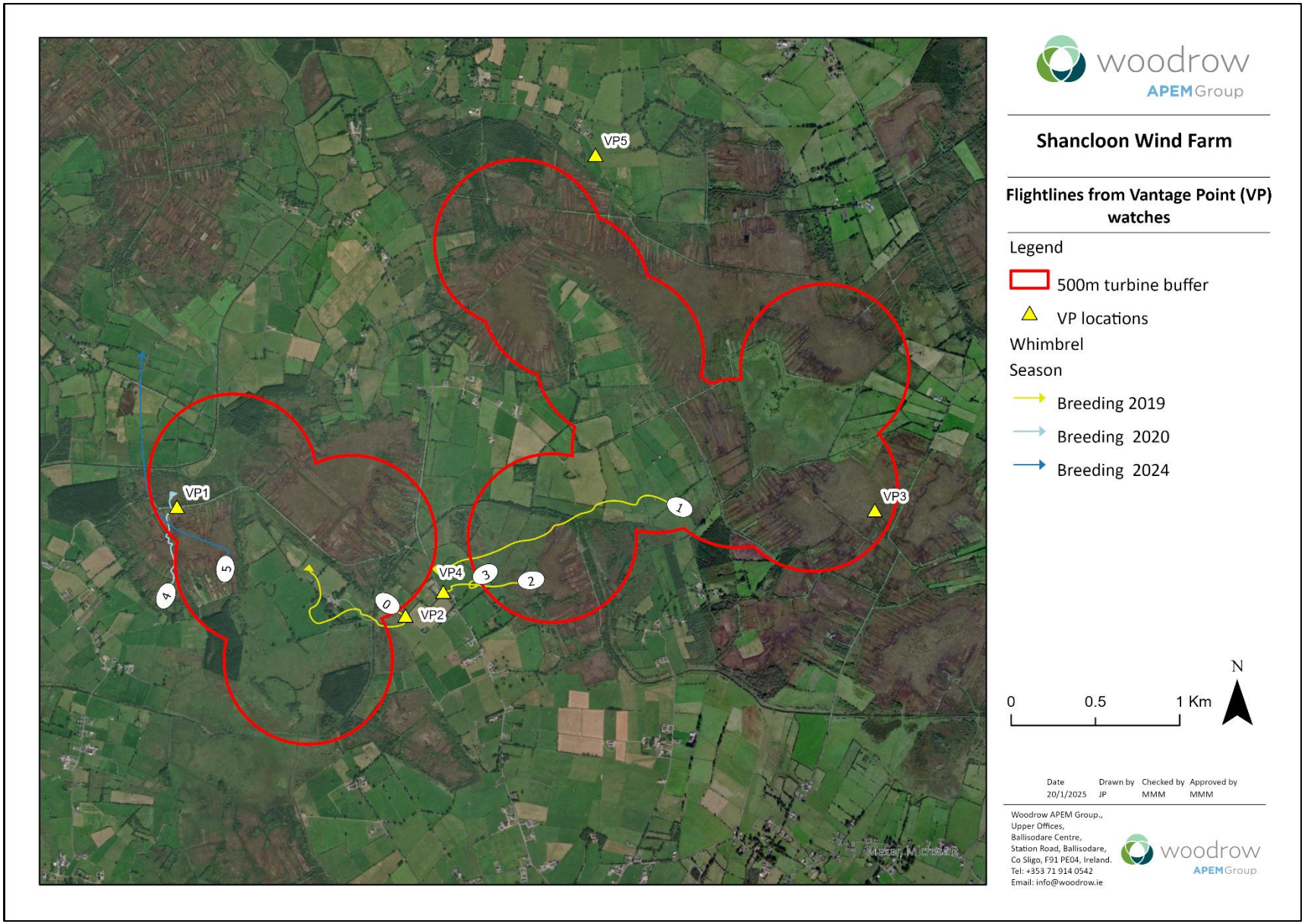


Figure X.28. Whimbrel flightlines from VP Watches

Table IX.28. VP watch data for whimbrel

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Whimbrel	14	30/04/2019	13:54	28	6	150	B			Flushed	Yes
1	4	Whimbrel	16	30/04/2019	18:36	89	16	50	B			Flying	Yes
2	4	Whimbrel	1	30/04/2019	18:59	8	12	30	B			Flying	Yes
3	4	Whimbrel	2	01/05/2019	13:08	0	0	0	A			Foraging	No
4	1	Whimbrel	6	30/04/2020	15:03	22	30	100	B		A	Flying	Yes
5	1	Whimbrel	1	24/04/2024	07:40	60	22	0	-		A	Flying	Yes

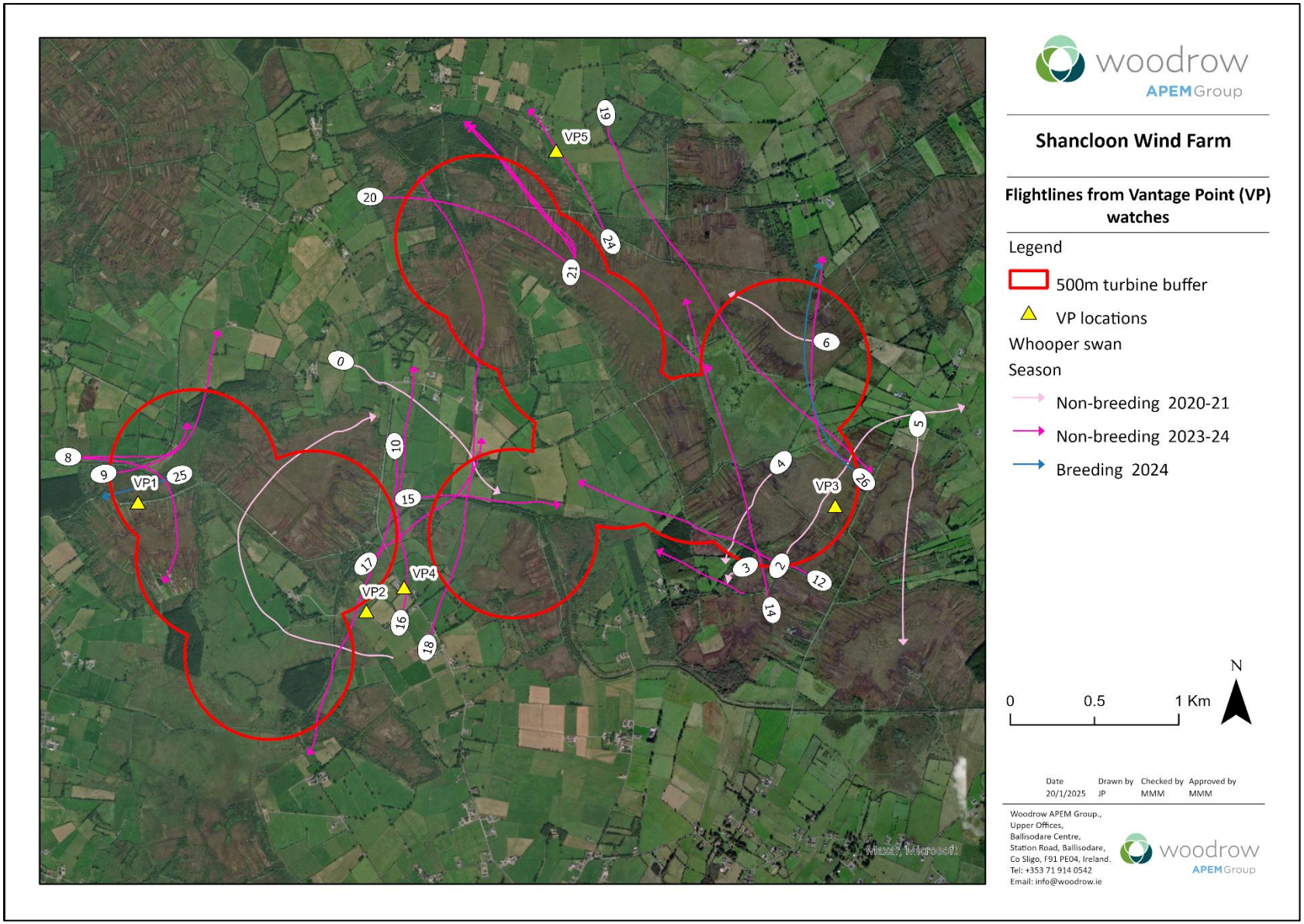


Figure X.29. Whooper swan flightlines from VP Watches

Table IX.29. VP watch data for whooper swan

Flight ID	VP no.	Species	No. birds	Date	Time	Flight time in buffer	Flight time outside buffer	Height (m)	Height band	Sex	Age	Behaviour	Within buffer?
0	2	Whooper swan	4	14/10/2020	09:52	27	95	100	B			Commuting	Yes
1	2	Whooper swan	5	14/10/2020	10:12	135	57	120	B			Commuting	Yes
2	3	Whooper swan	3	16/10/2020	08:17	62	65	35	B			Commuting	Yes
3	3	Whooper swan	0	15/11/2020	10:18	0	0	0	A			Calling	No
4	3	Whooper swan	3	15/11/2020	10:22	89	11	25	B		A	Flying	Yes
5	3	Whooper swan	4	15/12/2020	09:27	0	47	20	B		A	Flying	No
6	3	Whooper swan	6	22/01/2021	14:46	94	7	20	B			Flying	Yes
7	1	Whooper swan	1	28/10/2023	09:17	40	0	40	B			Flying	Yes
8	1	Whooper swan	3	28/10/2023	10:07	60	0	40	B			Flying	Yes
9	1	Whooper swan	6	29/10/2023	13:07	30	0	30	B			Present	Yes
10	2	Whooper swan	10	21/11/2023	08:55	150	20	30	B		A	Commuting	Yes
11	3	Whooper swan	5	26/03/2024	07:51	4	44	0	-		A	Flying	Yes
12	3	Whooper swan	4	24/11/2023	08:43	55	1	20	B		A	Commuting	Yes
13	3	Whooper swan	3	24/11/2023	09:22	20	0	20	B		A	Commuting	No
14	3	Whooper swan	2	01/12/2023	09:17	56	4	35	B	F	A	Commuting	Yes
15	4	Whooper swan	5	29/10/2023	09:36	30	0	20	B			Flying	Yes
16	4	Whooper swan	6	07/11/2023	10:33	0	90	20	B		A	Commuting	No
17	4	Whooper swan	3	23/11/2023	13:23	3	40	25	B		A	Commuting	Yes
18	4	Whooper swan	6	27/01/2024	12:35	60	20	35	B			Present	Yes
19	5	Whooper swan	2	29/01/2024	09:57	40	80	50	B			Present	Yes
20	5	Whooper swan	2	27/02/2024	07:50	32	5	40	B			Present	Yes
21	5	Whooper swan	14	10/11/2023	07:54	65	10	12	A		A	Commuting	Yes
22	5	Whooper swan	3	10/11/2023	08:08	62	10	15	A		A	Commuting	Yes
23	5	Whooper swan	3	10/11/2023	08:14	64	8	12	A		A	Commuting	Yes
24	5	Whooper swan	7	10/11/2023	09:07	0	78	15	A		A	Commuting	No
25	1	Whooper swan	7	27/03/2024	13:00	62	0	0	-		A	Flying	Yes
26	3	Whooper swan	5	26/03/2024	07:51	4	44	0	-		A	Flying	Yes

Appendix XI– Breeding bird survey results

Table XI.1. Summary of breeding bird survey records from the 2019 breeding season.

Species	BTO code	No. individuals				BoCCI 2020-2026
		Visit 1 25/4/19	Visit 2 1&8/5/19	Visit 3 11/6/19	Visit 4 17/6/19	
Curlew	CU	4	-	-	-	Red
Kestrel	K	2	-	1	-	Red
Meadow pipit	MP	68	1	11	-	Red
Snipe	SN	19	-	4	2	Red
Goldcrest	GC	1	-	-	-	Amber
Kingfisher	KF	-	3	-	-	Amber
Lesser black-backed gull	LB	-	-	5	-	Amber
Linnet	LI	14	-	-	-	Amber
Mallard	MA	25	-	4	-	Amber
Sand martin	SM	48	8	-	-	Amber
Skylark	S	28	2	4	-	Amber
Swallow	SL	-	1	1	-	Amber
Willow warbler	WW	28	6	-	-	Amber
Blackbird	B	7	1	-	-	Green
Blackcap	BC	2	-	-	-	Green
Bullfinch	BF	1	1	-	-	Green
Chaffinch	CH	2	-	-	-	Green
Chiffchaff	CC	4	-	-	-	Green
Coal tit	CT	2	1	-	-	Green
Cuckoo	CK	2	-	1	-	Green
Dunnock	D	3	1	-	-	Green
Grasshopper warbler	GH	5	-	-	-	Green
Great tit	GT	2	-	-	-	Green
Grey heron	H	-	-	1	-	Green
Hooded crow	HC	6	-	-	-	Green
Jackdaw	JD	1	-	-	-	Green
Lesser redpoll	LR	9	2	-	-	Green
Pheasant	PH	3	-	-	-	Green
Reed bunting	RB	11	-	1	-	Green
Robin	R	9	1	-	-	Green
Rook	RO	2	-	-	-	Green
Sedge warbler	SW	2	1	-	-	Green
Song thrush	ST	7	-	1	-	Green
Sparrowhawk	SH	1	-	-	-	Green
Stonechat	SC	4	-	-	-	Green
Whimbrel	WM	-	2	-	-	Green
Whitethroat	WH	7	2	-	-	Green
Woodpigeon	WP	1	1	-	-	Green
Wren	WR	33	3	1	-	Green

Table XI.2. Summary of breeding bird survey records from the 2020 breeding season.

Species	BTO code	No. individuals		BoCCI 2020-2026
		Visit 1	Visit 2	
Kestrel	K	1	1	Red
Meadow pipit	MP	40	16	Red
Snipe	SN	11	15	Red
Goldcrest	GC	-	3	Amber
Greenfinch	GR	-	3	Amber
House sparrow	HS	-	5	Amber
Kingfisher	KF	1	1	Amber
Lesser black-backed gull	LB	-	1	Amber
Linnet	LI	3	7	Amber
Mallard	MA	8	4	Amber
Mute swan	MS	1	16	Amber
Sand martin	SM	15	-	Amber
Skylark	S	14	15	Amber
Spotted flycatcher	SF	-	1	Amber
Swallow	SL	-	6	Amber
Willow warbler	WW	41	36	Amber
Blackbird	B	29	15	Green
Blackcap	BC	10	6	Green
Blue tit	BT	11	9	Green
Bullfinch	BF	1	14	Green
Buzzard	BZ	-	3	Green
Chaffinch	CH	15	15	Green
Chiffchaff	CC	3	-	Green
Coal tit	CT	2	5	Green
Cuckoo	CK	7	1	Green
Dunnock	D	7	7	Green
Goldfinch	GO	8	11	Green
Grasshopper warbler	GH	3	2	Green
Great tit	GT	1	8	Green
Grey heron	H	-	2	Green
Hooded crow	HC	1	4	Green
Lesser redpoll	LR	11	4	Green
Long-tailed tit	LT	-	9	Green
Magpie	MG	2	4	Green
Mistle thrush	M	4	16	Green
Pied wagtail	PW	0	1	Green
Raven	RN	0	2	Green
Reed bunting	RB	1	9	Green
Reed warbler	RW	2	0	Green
Robin	R	25	11	Green
Rook	RO	0	3	Green
Sedge warbler	SW	6	7	Green
Siskin	SK	0	1	Green
Song thrush	ST	9	10	Green

Species	BTO code	No. individuals		BoCCI 2020-2026
		Visit 1	Visit 2	
Sparrowhawk	SH	0	1	Green
Stonechat	SC	1	2	Green
Treecreeper	TC	0	1	Green
Whitethroat	WH	12	12	Green
Woodpigeon	WP	6	10	Green

Table XI.2. Summary of breeding bird survey records from the 2020 breeding season.

Species	BTO code	No. individuals					BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	
Grey wagtail	GL	-	-	-	1	-	Red
Kestrel	K	2	3	2	1	-	Red
Meadow pipit	MP	36	38	22	8	19	Red
Snipe	SN	9	1	-	3	2	Red
Swift	SI	-	-	-	-	2	Red
Common gull	CM	-	-	-	-	1	Amber
Goldcrest	GC	20	4	5	6	6	Amber
Lesser black-backed gull	LB	2	-	-	3	3	Amber
Linnet	LI	27	3	13	6	4	Amber
Mallard	MA	6	5	-	-	-	Amber
Sand martin	SM	17	38	16	15	2	Amber
Skylark	S	18	3	15	2	8	Amber
Starling	SG	3		1	9	18	Amber
Swallow	SL	6	9	1	3	11	Amber
Willow warbler	WW	51	17	23	12	9	Amber
Blackbird	B	21	6	8	11	6	Green
Blackcap	BC	6	6	5	3	4	Green
Blue tit	BT	8	-	2	-	6	Green
Bullfinch	BF	5	1	2	2	1	Green
Buzzard	BZ	9	9	1	-	-	Green
Chaffinch	CH	17	5	11	6	7	Green
Chiffchaff	CC	6	3	-	4	-	Green
Coal tit	CT	5	2	1	5	-	Green
Cuckoo	CK	1	1	11	1	1	Green
Dunnock	D	1	2	4	3	2	Green
Goldfinch	GO	-	-	6	-	9	Green
Great black-backed gull	GB	3	-	-	-	-	Green
Great tit	GT	2	3	4	5	2	Green
Hooded (grey) crow	HC	14	4	9	14	8	Green
Jackdaw	JD	2	3	4	-	2	Green
Jay	J	-	1	-	2	-	Green
Lesser redpoll	LR	-	7	15	12	16	Green
Little egret	ET	3	-	-	-	-	Green
Long-tailed tit	LT	6	2	-	1	-	Green
Magpie	MG	7	7	4	5	-	Green
Mistle thrush	M	8	-	12	3	2	Green
Pheasant	PH	2	1	3	2	-	Green

Species	BTO code	No. individuals					BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	
Pied wagtail	PW	1	1	1	-	-	Green
Raven	RN	11	1	1	-	1	Green
Reed bunting	RB	7	-	9	3	11	Green
Robin	R	9	3	6	6	2	Green
Rook	RO	7	1	1	-	2	Green
Sedge warbler	SW	-	1	4	-	-	Green
Siskin	SK	1	-	2	2	-	Green
Song thrush	ST	8	4	10	4	3	Green
Sparrowhawk	SH	-	1	-	-	1	Green
Stonechat	SC	-	-	4	-	-	Green
Treecreeper	TC	-	-	3	-	-	Green
Whitethroat	WH	-	8	12	9	5	Green
Woodpigeon	WP	25	36	13	4	-	Green
Wren	WR	22	10	19	16	6	Green

Table XI.3. Summary of breeding bird survey records from the 2024 breeding season.

Species	BTO code	No. individuals							BoCCI 2020-2026
		Visit 1 9/4/24	Visit 2 18&24/4/24	Visit 3 2&9/5/24	Visit 4 15/5/24	Visit 5 27/5 & 1/6/24	Visit 6 26&27/6/24	Visit 7 13/7/24	
Grey wagtail	GL	-	-	-	-	-	-	-	Red
Kestrel	K	1	1	-	5	1	-	-	Red
Meadow pipit	MP	24	12	30	30	8	19	-	Red
Snipe	SN	7	2		1	10	2	-	Red
Swift	SI	-	-	-	-	-	2	-	Red
Common gull	CM	-	-	-	-	-	1	-	Amber
Goldcrest	GC	6	14	1	8	6	6	-	Amber
Lesser black-backed gull	LB	-	2	-		3	3	-	Amber
Linnet	LI	9	18	-	16	6	4	-	Amber
Mallard	MA	6	-	-	5	-	-	-	Amber
Sand martin	SM	7	10	-	54	15	2	-	Amber
Skylark	S	10	8	-	18	2	8	-	Amber
Starling	SG	3	-	-	1	9	18	-	Amber
Swallow	SL	3	3	-	10	3	11	-	Amber
Willow warbler	WW	28	23	-	40	12	9	-	Amber
Blackbird	B	6	15	-	14	11	6	-	Green
Blackcap	BC	2	4	-	11	3	4	-	Green
Blue tit	BT	4	4	-	2	-	6	-	Green
Bullfinch	BF	4	1	-	3	2	1	-	Green
Buzzard	BZ	7	2	-	10	1		-	Green
Chaffinch	CH	8	9	-	16	6	7	-	Green
Chiffchaff	CC	2	4	-	3	4	-	-	Green
Coal tit	CT	1	4	-	3	5	-	-	Green
Cuckoo	CK	-	1	-	12	1	1	-	Green
Dunnock	D	-	1	-	6	3	2	-	Green

Species	BTO code	No. individuals							BoCCI 2020-2026
		Visit 1 9/4/24	Visit 2 18&24/4/24	Visit 3 2&9/5/24	Visit 4 15/5/24	Visit 5 27/5 & 1/6/24	Visit 6 26&27/6/24	Visit 7 13/7/24	
Goldfinch	GO	-	-	-	6	-	9	-	Green
Great black-backed gull	GB	-	3	-	-	-	-	-	Green
Great tit	GT	1	1	-	7	5	2	-	Green
Hooded (grey) crow	HC	10	4	-	13	14	8	-	Green
Jackdaw	JD		2	-	7		2	-	Green
Jay	J	-	-	-	1	2		-	Green
Lesser redpoll	LR	-	-	-	22	12	16	-	Green
Little egret	ET	3	-	-	-	-	-	-	Green
Long-tailed tit	LT	2	4	-	2	1	-	-	Green
Magpie	MG	4	3	-	11	5	-	-	Green
Mistle thrush	M	3	5	-	12	3	2	-	Green
Pheasant	PH	1	1	-	4	2	-	-	Green
Pied wagtail	PW	1		-	2	-	-	-	Green
Raven	RN	1	10	-	2	-	1	-	Green
Reed bunting	RB	2	5	-	9	3	11	-	Green
Robin	R	3	6	-	9	6	2	-	Green
Rook	RO	-	7	-	2		2	-	Green
Sedge warbler	SW	-	-	-	5	-	-	-	Green
Siskin	SK	-	1	-	2	2	-	-	Green
Song thrush	ST	4	4	-	14	4	3	-	Green
Sparrowhawk	SH	-	-	-	1		1	1	Green
Stonechat	SC	-	-	-	4	-	-	-	Green
Treecreeper	TC	-	-	-	3	-	-	-	Green
Whitethroat	WH	-	-	-	20	9	5	-	Green
Woodpigeon	WP	11	14	-	49	4		-	Green
Wren	WR	12	10	-	29	16	6	-	Green

Appendix XII – Winter walkover survey results

Table XII.1. Summary of winter walkover survey records from the 2019-20 non-breeding season.

Species	BTO code	No. individuals			BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	
Curlew	CU	20	5	-	Red
Golden plover	GP	17	59	13	Red
Lapwing	L	13	23	-	Red
Snipe	SN	108	107	126	Red
Woodcock	WK	2	1	2	Red
Cormorant	CA	2	1	-	Amber
Mallard	MA	54	9	7	Amber
Mute swan	MS	2	4	-	Amber
Teal	T	54	30	80	Amber
Wigeon	WN	-	-	10	Amber
Grey heron	H	1	-	1	Green
Jack snipe	JS	2	1	-	Green
Little egret	ET	2	1	1	Green
Moorhen	MH	-	2	1	Green
Peregrine	PE	-	-	2	Green

Table XII.2. Summary of winter walkover survey records from the 2020-21 non-breeding season.

Species	BTO code	No. individuals			BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	
Golden plover	GP	78	33	-	Red
Kestrel	K	1	-	-	Red
Pochard	PO	-	-	10	Red
Shoveler	SV	-	-	8	Red
Snipe	SN	90	88	35	Red
Woodcock	WK	-	1	-	Red
Cormorant	CA	1	1	-	Amber
Hen harrier	HH	-	2	-	Amber
Kingfisher	KF	1	-	-	Amber
Lesser black-backed gull	LB	-	-	1	Amber
Mallard	MA	25	8	30	Amber
Merlin	ML	3	2	-	Amber
Mute swan	MS	-	-	2	Amber
Teal	T	-	73	138	Amber
Whooper swan	WS	7	-	0	Amber
Wigeon	WN	4	-	4	Amber
Buzzard	BZ	4	-	4	Green
Grey heron	H	4	-	1	Green
Jack snipe	JS	2	3	-	Green
Little egret	ET	-	3	1	Green
Sparrowhawk	SH	-	1	-	Green
Whimbrel	WM	-	-	3	Green

Table XII.3. Summary of winter walkover survey records from the 2023-24 non-breeding season.

Species	BTO code	No. individuals						BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	
Golden plover	GP	23	-	-	1	-	-	Red
Kestrel	K	2	-	-	1	4	1	Red
Lapwing	L	37	-	-	-	-	-	Red
Meadow pipit	MP	8	-	2	99	32	10	Red
Redwing	RE	12	-	61	2	-	-	Red
Snipe	SN	12	3	53	14	11	-	Red
Woodcock	WK		-	1	2	-	-	Red
Cormorant	CA	1	-		-	-	-	Amber
Goldcrest	GC	2	-	9	17	2	5	Amber
Hen harrier	HH	-	-	-		1	-	Amber
Kingfisher	KF	-	-	-	1	-	-	Amber
Lesser black-backed gull	LB	-	-	-	-	-	16	Amber
Linnet	LI	-	-	-		3		Amber
Mallard	MA	-	-	4	4	8	5	Amber
Sand martin	SM	-	-		-	3	5	Amber
Skylark	S	-	-	1	-	4	6	Amber
Starling	SG	86		20	20	-	10	Amber
Teal	T	-	-	72	19	5	-	Amber
Whooper swan	WS	-	-	-	2	-	20	Amber
Wigeon	WN	-	-	3	-	-	-	Amber
Willow warbler	WW	-	-	-	-	-	9	Amber
Blackbird	B	7	1	4	6	13	8	Green
Blue tit	BT	2	-	-	4	2	1	Green
Bullfinch	BF	1	-	-	4	3	2	Green
Buzzard	BZ	-	-	4		7	8	Green
Chaffinch	CH	8	1	11	11	12	10	Green
Chiffchaff	CC	-	-	-	-	-	5	Green
Coal tit	CT	-	-	2	2	2	2	Green
Common crossbill	CR	-	4	3	-	-	-	Green
Dunnock	D	1	1	4	1	3	2	Green
Fieldfare	FF	79	-	93	3	5	5	Green
Goldfinch	GO	47	-	-	6	3	-	Green
Great black-backed gull	GB	-	-	-	-	-	1	Green
Great tit	GT	1	-	-	1	10	5	Green
Grey heron	H	2	-	-	-	-	-	Green
Hooded (grey) crow	HC	9	-	-	-	15	6	Green
Jack snipe	JS	2	-	1	-	-	1	Green
Jackdaw	JD	-	-	-	-	-	8	Green
Jay	J	-	-	-	-	1	1	Green
Lesser redpoll	LR	-	6	2	10	2	21	Green
Little egret	ET	1	-	-	-	-	-	Green
Long-tailed tit	LT	4	-	-	3	2	4	Green

Species	BTO code	No. individuals						BoCCI 2020-2026
		Visit 1	Visit 2	Visit 3	Visit 4	Visit 5	Visit 6	
Magpie	MG	5	-	-	-	9	2	Green
Mistle thrush	M	-	-	-	-	2	-	Green
Peregrine	PE	1	-	-	-	-	-	Green
Pheasant	PH	-	-	-		4	1	Green
Pied wagtail	PW	1	-	1	2	1	-	Green
Raven	RN	7	-	-	-	2	5	Green
Reed bunting	RB	1	3	8	14	12	2	Green
Robin	R	5	-	11	26	11	10	Green
Rook	RO	-	-	20	-	-	2	Green
Siskin	SK	3	2	3	30	6	4	Green
Song thrush	ST	-	-	3	10	3	2	Green
Sparrowhawk	SH	-	-	-	-	-	1	Green
Stonechat	SC	-	-		1	3	1	Green
Woodpigeon	WP	4	-	1	-	19	9	Green
Wren	WR	10	1	2	9	19	13	Green

Appendix XIII – Collision Risk Modelling report

Overview

Apem Group Woodrow was commissioned by RWE to undertake ornithological survey work for the proposed Shancloon Wind Farm (hereafter referred to as the proposed development site). The site is located in Co. Galway at National Grid Reference: M 31777 53794 and is adjacent to the Co. Mayo border. The Black River runs along the northern boundary of the site in a south-westerly direction into Lough Corrib. The proposal is for a 11-turbine wind farm.

The intention of this report is to display modelled data, based on observed bird usage of the area, to provide an indication of the likely collision risk imposed by the proposed wind farm on potentially sensitive avian populations. The report uses bird usage data derived from vantage point (VP) watches conducted by appropriately experienced ornithological surveyors. Furthermore, the new guidance published by Scottish Natural Heritage (SNH) (2024) was used, which aims to promote a standardised approach to collision risk assessment for onshore wind farms, to increase the transparency of calculations and to promote greater confidence in the results. A detailed report is available explaining the derivation of the model (Band 2024).

Flightline data for selected target species were collected from five VPs between April 2019 and September 2024. The survey covered three breeding bird seasons and three non-breeding seasons of VP watches. This amounted to 1,085 hours of VP watch data (545 hours during the non-breeding seasons and 540 hours during breeding seasons). Further information on VP locations and survey effort can be found in the main ornithological report and supporting appendices (See **Appendix III** and **Appendix IV**), which provide details of timings for VP watches and demonstrate that the minimum requirement of 36 hours per VP per season was achieved over the three-year survey period.

Three turbine models have been specified for use in the proposed development: the Vestas V150 5.6 MW (V150), Nordex 149 5.7 MW (N149), and Siemens Gamesa 155 (SG155). The model has been run for each turbine model. The collision risk zone (CRZ, defined as the height between the minimum and maximum swept height of the turbine rotor within a 500 m buffer of turbines) is 25-180 m for the SG155, 30 – 179 for the N149, and 30-180 for the V150 model, as detailed in Table 13. 2.

Based on professional judgement, Collision Risk Modelling (CRM) was run for target species with a total aggregate flight time (i.e., number of individuals x flight time) of > 400 seconds occurring within the potential CRZ over the three years (i.e. at collision risk height and within the turbine envelope = 500 m turbine buffer), and with more than 3 observations over the study period. Target species with an aggregate flight time of < 400 seconds were excluded from this analysis as collision risk for them would be negligible. Based on the criteria outlined above, CRMs were run for the following 14 target species (Table 13. 1).

Table 13. 1. Target species total aggregated flight time within the 500 m turbine buffer over three years of surveys

Species	Total flight time (seconds) recorded across all height bands
Buzzard	13,519
Cormorant	2,080
Curlew	3,300
Golden plover	313,849
Great black-backed gull	855
Herring gull	4,937

Species	Total flight time (seconds) recorded across all height bands
Kestrel	25,614
Lapwing	12,985
Lesser black-backed gull	32,601
Mallard	6,452
Snipe	4,708
Sparrowhawk	2,869
Whimbrel	1,590
Whooper swan	4,875

Further information on the species recorded within the study area along with the number of observations per species can be found in Section 4.1 Vantage Point (VP) watches.

Methodology

The collision risk analysis was undertaken using the NatureScot CRM model (SNH, 2024) and guidelines (Band 2000, 2024, Band *et al*. 2007). The NatureScot CRM model uses two approaches for different situations (SNH, 2024). The first approach is for birds that take regular flights through a wind farm area and the second is for birds that may occupy an area, including a wind farm, as a regular territory. The model approach used in this case is the second, relating to birds occupying a given area.

The model estimates the number of collisions through a process of five stages:

- Stage A utilises bird survey data that has been collected through the VP surveys (detailed in Appendix X), to establish the density of flying birds within 500m of turbines, and the proportion of birds that are flying at a potential risk height between the lowest and highest points of the rotors.
- Stage B estimates the potential number of bird passages through rotors in the relevant time period, based on both the bird density, and the proportion of birds flying at risk height.
- Stage C determines the collision probability during a single bird rotor transit.
- Stage D estimates the rate of potential collision for a given bird species based on current levels of bird usage of the site, whilst taking into consideration the proportional of time in which the turbines are not in operation.
- Stage E takes into consideration the likely proportion of birds avoiding either the wind farm or its turbines. This may either be due to displacement from the site, birds undertaking evasive action or birds being attracted to the wind farm, for example, as a response to habitat changes.
- Stage F considers potential uncertainties and an estimate of error in the number of predicted collisions.

Stage A- Flight activity

Stage A estimated the number of flights that may potentially be at risk of turbine collision in the absence of the displacement of birds, birds taking other avoidance actions, or birds being attracted towards the wind farm.

In the case of non-directional flights, there are two key parameters derived from survey observations that are needed in order describe the magnitude of flight activity:

- Areal bird density (DA); and
- Proportion of birds flying at risk height (Q_{2R})

The definition of **areal bird density (DA)** is the number of birds that are in flight at any height at a particular time, per unit area (generally per square kilometre, km^2). Bird occupancy was converted to areal bird density (per m^2) by dividing by the area watched from each VP (the VP viewshed, shown in Appendix III). Flight activity from VP watches was recorded in bird seconds, which is particularly appropriate for situations where bird numbers are low. DA was calculated as shown in Equation 1.

$$D_A = b / (t \times A) \; birds \; m^{-2} \qquad \text{(Equation 1)}$$

where:

(b) is the number of target species flight seconds recorded from a VP;
(t) is the duration (in seconds) of all VP watches during either a month, season or year;
(A) is the area of the VP viewshed (km^2) as shown in Figure X.

D_A was calculated for each VP separately, with the figure subsequently averaged. However, where there exists a considerable difference in the time and/or area that is covered by relevant VP surveys the average figure should be weighted appropriately. Thus, the weighting factor used acknowledges that the quantity of data collected in a watch is proportional both to the size of the area observed and the duration of the VP watch.

The mean density DA is calculated using Equation 2:

$$Mean \; density \; DA \; = \; \Sigma \; bi \; \sqrt{(ti \; x \; Ai)} \; / \; (ti \; x \; Ai) \; / \; \Sigma \; \sqrt{(ti \; x \; Ai)} \qquad \text{(Equation 2)}$$

In the case of conditions where a VP viewshed results in a significant difference in mean density DA (for example, as due to a difference in underlying habitat), the bird density should then either be calculated separately for each individual VP site and then applied in order to determine the likely collision risk within that area. Alternatively, a turbine-weighted average bird density should be employed instead, i.e. the bird density for each VP should be weighted by the number of turbines present within that viewshed.

In this case, the average areal bird density ($D_{average}$) was estimated using Equation 3.

The formula for this is:

$$Daverage \; = \; \Sigma \; (Ni \; x \; Di) \; / \; \Sigma \; Ni \qquad \text{(Equation 3)}$$

where:

D_i is the areal bird density within the VP viewshed (i);
N_i is the number of turbines to be sited in that VP viewshed; and
$D_{average}$ is the average areal bird density.

The definition of **proportion of birds flying at risk height (Q_{2R})** is the proportion of birds present between the lowest and highest points of a rotor, measured relative to the rotor base. In cases where flights are only recorded in the rotor swept height band, Q_{2R} will be 100%.

Daylight hours and nocturnal activity

Bird surveys are generally undertaken diurnally, with recorded levels of flight activity assumed to be representative of flight activity across all daylight hours. Daylight hours are dependent the latitude of the wind farm site as well as the time of year. Daylight and night hours per month are provided within the NatureScot CRM spreadsheet when the latitude of a particular site is inputted. The latitude of the

wind farm site is expressed as degrees and minutes in degrees with decimal places. This data is subsequently utilised to calculate the daylight hours for each given month. The latitude of the wind farm site in question is 53° 31' north (entered in decimals as 53.53°).

Calculations used in the collision model account for collision risk associated with diurnal and nocturnal flights. Diurnal activity is based on the flight activity recorded for each target species during field surveys. As nocturnal surveys were not possible, nocturnal flight activity is based on the diurnal flight activity, and professional judgement regarding the likely levels of nocturnal activity for each target species.

Levels of nocturnal activity by all target species were estimated, using a one to five scale to approximate nocturnal flight (with a score of one equal to 0% nocturnal activity, two equal to 25% of diurnal activity, three equal to 50% of diurnal activity, four equal to 75% of diurnal activity and five whereby nocturnal activity is equal to diurnal activity). It should be noted that for truly nocturnal species, this will underestimate nocturnal flight activity, which will be >100% of diurnal activity.

Stage B- Estimating number of bird flights through rotors

The total **amount of bird transit flights anticipated through rotors** is proportional to the number of turbines, as well as the cross-sectional area of the turbine rotors, and the density of birds in the airspace flying at risk height (calculated at Stage A). The total number of bird transits through rotors was calculated separately for each month. Therefore, a key output within the collision risk assessment is a statement of the potential number of bird transits per month and season or year through the wind farm turbines, assuming that birds exhibit no avoidance behaviour. As such, the risk of collision is considered to be directly proportional to the potential number of bird transit flights.

Stage B considers the available figures for bird density (D_A), the proportion of risk height flights (Q_{2R}), the nocturnal activity factor (f_{night}), and the figures for monthly daylight and night hours calculated at Stage A. In order to estimate the number of birds flying through rotors, the model takes into account the number of turbines, the turbine rotor radius and the flight speed of target species. For flight speed, a typical mean flight speed is selected based on standard key literature, acknowledging that flight speed (and thus collision risk) will vary depending on bird behaviour (commuting, migration, foraging etc).

The number of bird transits expected through rotors was calculated using equation 4.

$$Number\ of\ transits = v * (D_{average}\ Q_{2R} / 2R) * (T\ \pi R2) * (tday + fnight\ tnight) \qquad (Equation\ 4)$$

where:

v is bird speed, relative to the ground (m sec^{-1});
$D_{average}$ is the average areal bird density (Birds m^{-2});

Q_{2r} is the proportion of birds flying at risk height (%);

R is the length of the rotor blades, from axis to tip (m);

T is the number of turbines;

f_{night} is the nocturnal activity factor; and

t_{day} and t_{night} the wind farm latitude is used to calculate daylight and night-time hours for each month, and the total for a year;

Stage C- Probability of collision for a single rotor transit

Stage C utilises information on turbine size and speed (Table 13. 2), as well as physical details on bird size and speed in order to accurately calculate the collision risk for birds flying through an active turbine rotor (Table 13. 3).

It is presumed that birds have the ability to avoid stationary infrastructure. This model, therefore estimates the likely probability of collisions occurring if a bird passes at random at any point through the rotor disk on a flight path perpendicular to the rotor plane. The collision probability for birds approaching at oblique angle is the same as the probability for those approaching at a perpendicular angle; there is no additional effect of turbulence in the wake of a rotor blade; and also, no slipstream effect, i.e. air rushing over a blade may carry a bird clear of it.

Due to the geometry of the blades relative to the direction of flight, upwind flights carry a higher collision risk than downwind flights. This remains the case even when the flight speed of the bird relative to the ground is taken to be the same. In situations where there is an equal likelihood of both upwind and downwind flights, it is considered suitable to take an average of both collision probabilities. As such, the relative proportion of both upwind and downwind flights was utilised in this case to weigh the respective probabilities of collision. The default proportion was set to a probability of 50:50 upwind:downwind.

The NatureScot CRM spreadsheet provide a collision risk calculator for a single passage through the rotor. This calculator assesses the collision risk probability for a bird taking a single passage flight through a rotor at each radius (r) and angle (ϕ), in increments from r/R=0.05 out to r/R=1, and at 10-degree intervals of ϕ. The probability of collision was then averaged out over the entire area of the rotor disc to generate the average collision risk for a passage at any given point across the rotor.

By design, wind turbines operate at a range of various speeds. Typically, wind turbines do not operate below a cut-in speed, which is generally between three and four m/sec. The turbines then increase in speed in line with wind speed, up to a maximum operating wind speed of around 12 m/sec.

The model assessed the probability of collision risk using the **turbine rotational speed** for three turbine models. In such cases where wind turbines operate at range of different rotational speeds, the calculation should be carried using a mean operational turbine speed. Preferably, the mean speed utilised in the calculation should be measured over time using an analysis of available wind data to determine the likely frequency distribution of turbine speeds. However, in cases where this is not available, the speed used should be based on the most likely value as anticipated by the wind farm developer. At Stage D of the model, an allowance is made to account for the proportion of time in which a wind turbine is not in operation. This may be due either because of low wind speeds or maintenance being carried out on the turbine. In this case, the mean turbine speed used in the calculation takes only the operational time of the turbine into account and excludes times when the turbine was idle or stationary.

Table 13. 2. Turbine data

Symbol	Description	Units	Turbine model		
			SG155	N149	V150
b	Number of blades		3	3	3
	Hub height	m	102.5	104.7	105
	Rotor diameter	m	155	149.1	150
	Minimum swept height	m	25	30.15	30
	Maximum swept height	m	180	179.25	180
C	Maximum blade width	m	4.5	4.2	4.2

Symbol	Description	Units	Turbine model		
			SG155	N149	V150
γ	Average blade pitch*	°	13	13	13
	Dynamic operating range Speed	(m/s)	3-27 m/s	3-22 m/s	3-25 m/s
Ω	Average operating range	rpm	9.35	10.75	8.76
	Average rotational period	s	6.42	5.58	6.85

*Note: Pitch angle varies along the length of the blade, from a high angle close to the hub, to a low pitch angle towards the blade tips, i.e. the blade is twisted. Pitch angle also varies as the pitch is controlled to alter the rotation speed of the turbine. In the model, an average angle is used, representing an average pitch along the blade length. 15-30 degrees is reasonable for a typical large turbine.

Table 13. 3. Bird data and avoidance rates for target species

Target species	Bird length (m)	Wingspan (m)	Bird speed (m/s)	% of flight upwind/downwind	Nocturnal activity (From 1 to 5)	Avoidance rate*
Buzzard	0.54	1.21	11.6	50/50	1	0.980
Cormorant	0.9	1.45	15.2	50/50	2	0.980
Curlew	0.55	0.9	16.3	50/50	2	0.980
Golden plover	0.28	0.72	17.9	50/50	2	0.980
Great black-backed gull	0.69	1.60	13.7	50/50	2	0.995
Herring gull	0.62	1.48	12.8	50/50	2	0.995
Kestrel	0.34	0.76	10.1	50/50	1	0.950
Lapwing	0.3	0.84	12.8	50/50	2	0.980
Lesser black-backed gull	0.58	1.43	13.4	50/50	2	0.995
Mallard	0.58	0.9	18.5	50/50	2	0.980
Snipe	0.26	0.46	17.1	50/50	5	0.980
Sparrowhawk	0.33	0.62	11.3	50/50	1	0.980
Whimbrel	0.41	0.82	16.3	50/50	1	0.980
Whooper swan	1.53	2.31	17.3	50/50	2	0.995
*Source SNH 2018, 2024 and Furness 2019						

Stage D- Multiplying to yield expected collisions per year

Single transit risk

Stage D multiplies the number of flights through rotors across the wind farm (Stage B) and the risk of collision for each single bird transit through a rotor (Stage C) to yield an estimate of total potential collision risk using equation 5.

*Single transit risk = (No. of bird transits through rotors * Weighted probability of collision single)/100* *(Equation 5)*

Non-operational time

The factor Q_{op} accounts for the time in which the turbine is not in operation, by representing the proportion of time in which the turbine is operational. Wind turbines are not in constant operation. Generally, a wind turbine is either idle or at rest for a certain proportion of time due either to wind speeds being too weak to generate power or, in exceptional cases, due to the turbines being intentionally closed down in order to avoid damage in the event of exceptionally high winds. Additionally, there is a requirement that wind turbines are occasionally shut down to allow for maintenance to be carried out.

Finally, the Single transit risk is multiplied by the factor Q_{op} to allow for the proportion of time that the wind turbines are operational. This is before considering avoidance behaviour, which is stage E.

Stage E- Applying the avoidance rate

Avoidance

The preceding stages of the model operate on the assumption that birds will not undertake any avoidance action in response to the presence of wind turbines. However, birds do generally undertake avoidance action in order to prevent wind turbine collisions. Data derived from collision monitoring based on frequent searches of the wind farm site for bird corpses and observations of habitat use in the vicinity indicatives avoidance rates of 98% and over for many bird species. This data therefore indicates the collision risk to be less than 2% of that calculated from Stages A-D alone.

Following NatureScot guidelines (2024), the potential collision mortality, for each month and for a year, after avoidance was calculated using a range of assumed avoidance rates of 95%, 98%, 99% and 99.5%.

Large turbine array correction factor

The large turbine array correction factor should be included only for large wind farm developments (more than 50 turbines). Therefore, this is not a requirement for the proposed development site, and there is no need for further discussion.

Stage F- Expressing uncertainty

In the estimate of collision risk following the method detailed above, there exists numerous sources of variability or uncertainty in the output. Band (2024) sets out an accurate description of potential sources of uncertainty, as well as a procedure of evaluating and presenting these sources.

The aim of this stage is to reflect the range of uncertainty in the collision estimate that could impact target species populations and/or growth rates. Information to include should reflect:

- uncertainty or variability in flight activity data, such as imprecise flight height estimates and lack of knowledge about night-time behaviour;
- uncertainty surrounding the limitations of the collision model, such as the variability of bird dimensions and flight speed, the simplification in the shape of a bird and turbine blades; and
- uncertainty arising from turbine options such as the number, size and speed.

Results

Viewshed spatial coverage

The VP locations used were the same during all survey periods. Viewshed analysis was undertaken to determine spatial coverage from each VP. This was calculated using ArcGIS Pro, and the accuracy of viewsheds was confirmed in the field by surveyors. The viewshed analysis was calculated using a surface offset of 25 m (the lowest rotor swept height of both turbine models) which mapped visible airspace available to surveyors (of an assumed height of 1.75 m) at 25m. This illustrates the visible area at collision risk height.

Spatial coverage the viewsheds within the 2 km viewshed arc and the coverage as a proportion of the 500 m turbine buffer, is given in Table 13. 4. The locations of the VPs and their viewsheds are mapped in **Appendix III**.

Table 13. 4. Viewshed coverage of 500 m buffer of turbines and VP survey effort

VP	Area of CRZ visible within 500 m turbine buffer (Km²)	% Coverage of the 500 m turbine buffer	VP survey effort (hrs)		
			Non-breeding season (Oct - March)	Breeding season (April- Sep)	Total
VP1	1.761	27.41	108	108	216
VP2	1.987	30.93	108	108	216
VP3	2.632	40.97	111	108	219
VP4	3.974	61.85	108	108	216
VP5	2.891	45.00	110	108	218
Total	**13.245**	**99.16***	**545**	**540**	**1,085**
*This is the total area within the 500 m turbine buffer that is covered by at least one viewshed					

Stage A: Flight activity

Bird density

VP watches have been undertaken over three years (three breeding seasons and three non-breeding seasons), covering the entire site plus a buffer area of 500 m around the proposed turbine location (99.16% coverage, see **Appendix III**). The proposed development site was covered from five VP locations. Overlapping viewsheds are discussed in Table 13. 4.

VP watches were undertaken for a minimum of 72 hours per year; 36 hours during the breeding season (April – September) and 36 hours during the non-breeding season (October – March) in each of three years in line with NatureScot guidance (SNH, 2017, 2018). The watches were divided into sessions of less than three hours in duration with breaks between sessions to limit observer fatigue, and the sessions spread to include a representative sample of daylight hours. All flights of target species were recorded during each watch period, yielding total flying time in bird-seconds over the duration of the watch. Flying time was divided by the period of the watch (in seconds) and the area watched to give the average density of birds in flight per square kilometre.

Survey results are presented in Table 13. 5. The number of VP watches is detailed in **Appendix IV** and VP data, including flightlines tables and maps, are detailed in **Appendix X**. Flight times within the study area (500 m turbine buffer) and the analysis period are provided in Table 13. 5 for the 14 target species included in the model.

It should also be noted that, in Ireland, whimbrel is a passage migrant. Studies have shown that whimbrel tend to make stopovers in Ireland during their spring migration and not their autumn migration (Carneiro et al., 2019; Alves et al., 2016). Therefore, it was consequently determined that the period in which whimbrel are likely to be recorded within the proposed development site is from April to May. Golden plover is a winter visitor in Ireland, which also remain during the passage season (i.e., April) and this was account for this target species in the model. There are also localised breeding populations of golden plover in Ireland, however no breeding birds were recorded during baseline surveys.

The mean density (DA) is given in Table 13. 5 for each target species and was calculated for each period (breeding and non-breeding). Except for golden plover that DA was estimated using flight time recorded during the non-breeding season and April; and for whimbrel which was estimated only for the passage season (April and May). In addition, lapwing was only recorded during non-breeding season within the proposed development site.

Table 13. 5. Flight seconds and mean bird density for all target species during three-years of survey

Target species	Analysis Period	Time in flight (bird-secs)					DA (birds/km²)	
		VP1	VP2	VP3	VP4	VP5	Non-breeding season (Oct - Mar)	Breeding season (Apr- Sep)
Buzzard	Year-round	1,964	3,342	1,362	3,144	3,707	0.0005	0.0023
Cormorant	Year-round	637	689	212	526	17	0.0006	0.0003
Curlew	Year-round	-	1,023	2,277	-	-	0.0052	0.0001
Golden plover	Non-breeding (+ April)	6,855	145,396	140,357	18,064	3,177	0.0866*	-
Great black-backed gull	Year-round	-	76	218	-	561	0.0001	0.0015
Herring gull	Year-round	374	3,459	383	618	102	0.0035	0.0006
Kestrel	Year-round	5,366	6,603	7,483	3,091	3,070	0.0017	0.0040
Lapwing	Non-breeding season	1,202	11,447	-	-	336	0.0166	-
Lesser black-backed gull	Year-round	3,746	4,989	842	20,056	2,967	0.0008	0.0054
Mallard	Year-round	1,511	1,755	2,148	278	760	0.0009	0.0011
Snipe	Year-round	692	170	1,490	213	2,143	0.0004	0.0011
Sparrowhawk	Year-round	184	215	353	411	1,706	0.0003	0.0004
Whimbrel	Passage (April-May)	81	313	-	1,196	-	-	0.0010**
Whooper swan	Non-breeding season	666	1,484	1,163	550	1,012	0.0020	-

*Birds recorded in April were included in the density estimation for the non-breeding period, as these were birds recorded on passage, rather than breeding birds.

**Whimbrel were recorded only during April and May passage.

Proportion flying at risk height

The assessment considers two turbine options of which have rotor swept heights of 25-180 m (SG155), 30-179 m (N149), and 30-180 m (V150) respectively (see Table 13. 2). The surveys recorded the flight heights of birds, estimated visually. The proportion of observed birds at rotor risk height (or within the CRZ), was calculated for each turbine model (*Table 13. 6*).

Table 13. 6. Proportion of observed birds flying at rotor risk height at rotor risk height (%Q2R) during all VP watches.

Target species	Number of birds observed	%Q2R for SG155	%Q2R for N149	%Q2R for V150
Buzzard	129	69.77	57.36	57.36
Cormorant	44	59.09	50.00	50.00
Curlew	100	24.00	23.00	23.00
Golden plover	1750	90.51	89.49	89.49
Great black-backed gull	9	100.00	100.00	100.00
Herring gull	65	95.38	95.38	95.38
Kestrel	262	54.58	45.42	45.42
Lapwing	178	92.13	91.01	91.01
Lesser black-backed gull	286	59.79	51.75	51.75
Mallard	199	26.13	23.12	23.12
Snipe	87	59.77	44.83	44.83
Sparrowhawk	62	45.16	43.55	43.55
Whimbrel	38	100.00	100.00	100.00
Whooper swan	105	54.29	48.57	48.57

Stage B: Estimating number of flights through rotors

The output from Stage B is the potential number of bird transits through rotors, per month and per annum (*Table 13. 7*). The total number of bird transits expected through rotors is proportional to the number and cross-sectional area of the rotors, and to the density of birds in the airspace at risk height or in the CRZ.

Table 13. 7. Potential number of bird transits through rotors per month and year

Model	Target species	Projected number of rotor transits												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
SG155	Buzzard	5	5	7	38	45	46	46	42	35	7	5	5	286
	Cormorant	4	4	5	2	3	3	3	3	2	5	4	4	43
	Curlew	153	153	189	3	4	4	4	3	3	177	154	148	994
	Golden plover	1906	1900	2347	-	-	-	-	-	-	2206	1912	1845	12116
	Great black-backed gull	2	2	3	49	55	56	56	53	46	3	2	2	330
	Herring gull	23	25	34	6	7	7	8	7	6	30	24	22	198
	Kestrel	18	20	26	73	86	88	89	80	67	24	19	17	606
	Lapwing	353	351	434	-	-	-	-	-	-	408	354	341	2241
	Lesser black-backed gull	12	12	14	103	116	117	119	111	98	13	12	11	737
	Mallard	7	7	9	13	14	15	15	14	12	9	7	7	130
	Snipe	16	14	16	37	38	37	38	38	37	16	15	16	320
	Sparrowhawk	2	2	3	4	5	5	5	5	4	3	2	2	41
	Whimbrel	-	-	-	32	38	-	-	-	-	-	-	-	70
	Whooper swan	33	33	41	-	-	-	-	-	-	38	33	32	210
N149	Buzzard	4	4	6	30	35	36	37	33	27	5	4	4	225
	Cormorant	8	8	10	5	5	5	6	5	5	10	9	8	85
	Curlew	37	37	46	1	1	1	1	1	1	43	37	36	242
	Golden plover	1688	1682	2078	0	0	0	0	0	0	1954	1693	1633	10728
	Great black-backed gull	2	2	3	47	53	53	54	50	44	3	2	2	316
	Herring gull	38	42	56	10	12	12	13	11	9	50	40	36	331
	Kestrel	13	14	19	54	63	65	65	59	49	17	14	12	445
	Lapwing	333	332	410	0	0	0	0	0	0	385	334	322	2117
	Lesser black-backed gull	10	10	12	85	96	97	98	92	81	11	10	9	610
	Mallard	6	6	8	11	12	12	13	12	10	7	6	6	110
	Snipe	11	10	11	27	28	27	28	28	27	11	11	11	229
	Sparrowhawk	2	2	3	4	5	5	5	4	4	2	2	2	38
	Whimbrel	0	0	0	31	36	0	0	0	0	0	0	0	67
	Whooper swan	28	28	35	0	0	0	0	0	0	33	28	27	180
V150	Buzzard	4	4	6	30	36	37	37	33	28	5	4	4	228
	Cormorant	4	4	5	2	3	3	3	2	2	5	4	4	40
	Curlew	147	146	180	3	3	3	3	3	3	170	147	142	951
	Golden plover	1845	1839	2271	-	-	-	-	-	-	2135	1850	1785	11726
	Great black-backed gull	2	2	3	47	53	54	55	51	45	3	2	2	320
	Herring gull	19	20	27	5	6	6	6	5	5	24	19	17	159
	Kestrel	15	16	22	60	70	72	73	65	54	19	15	14	496
	Lapwing	337	336	415	-	-	-	-	-	-	390	338	326	2142
	Lesser black-backed gull	10	10	12	86	97	98	100	93	82	11	10	9	617
	Mallard	6	6	8	11	12	13	13	12	10	7	6	6	111
	Snipe	12	10	12	27	28	27	28	28	27	12	11	12	232

Model	Target species	Projected number of rotor transits												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Sparrowhawk	2	2	3	4	5	5	5	4	4	2	2	2	39
	Whimbrel	-	-	-	31	37	-	-	-	-	-	-	-	68
	Whooper swan	29	29	35	-	-	-	-	-	-	33	29	28	182

Stage C: Probability of collision for single rotor transit

Data relating to the likelihood of a bird being hit when flying through the rotor is derived from the NatureScot CRM spreadsheet. The outputs are provided for each target species in Table 13. 8.

Table 13. 8. Probability of collision for a single rotor transit for target species

Target species	Weighted single transit		
	V150	N149	SG155
Buzzard	5.66%	6.28%	5.97%
Cormorant	6.16%	6.76%	6.40%
Curlew	4.96%	5.30%	5.15%
Golden plover	4.24%	4.37%	4.37%
Great black-backed gull	5.91%	6.44%	6.16%
Herring gull	5.81%	6.37%	6.08%
Kestrel	5.10%	5.69%	5.42%
Lapwing	4.60%	4.94%	4.81%
Lesser black-backed gull	5.60%	6.08%	5.83%
Mallard	4.87%	5.16%	5.05%
Snipe	4.06%	4.23%	4.21%
Sparrowhawk	4.77%	5.26%	5.05%
Whimbrel	4.61%	4.86%	4.78%
Whooper swan	7.62%	8.43%	7.94%

Stage D: Multiplying to yield expected collisions per year

Following the above steps, the number of bird transits per year through the rotors can be combined with the probability of a bird being hit when flying through the rotor to give a likely collision rate per month and per year (assuming no avoidance). An avoidance figure is then applied to get a predicted likely collision rate, and thus a likely mortality rate. This stage considers the proportion of time that turbines are likely to be operational (Table 13. 9). The collision rate before this avoidance figure is applied is illustrated in Table 13. 10.

Table 13. 9. Monthly and year operational time for each turbine model

Period	Operational time (%)		
Month	SGG-155	N149	V150
1	91.4%	90.9%	91.2%
2	91.3%	90.9%	91.1%
3	87.6%	87.4%	87.5%
4	86.4%	86.3%	86.3%
5	86.5%	86.5%	86.5%
6	82.9%	82.9%	82.9%
7	81.8%	81.8%	81.8%
8	86.2%	86.2%	86.2%
9	86.5%	86.5%	86.5%
10	89.7%	89.7%	89.1%
11	90.2%	90.1%	89.8%
12	92.0%	91.4%	91.5%
Year	**87.7%**	**87.6%**	**87.6%**

Table 13. 10. Collision rate before avoidance for target species

Model	Target species	Collision rate before avoidance												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
SG155	Buzzard	0.3	0.3	0.4	2.0	2.3	2.3	2.3	2.1	1.8	0.4	0.3	0.3	14.6
	Cormorant	0.2	0.2	0.3	0.1	0.2	0.1	0.1	0.1	0.1	0.3	0.2	0.2	2.4
	Curlew	7.2	7.2	8.5	0.1	0.2	0.2	0.2	0.1	0.1	8.2	7.1	7.0	46.1
	Golden plover	76.0	75.7	89.7	-	-	-	-	-	-	86.5	75.4	74.2	477.5
	Great black-backed gull	0.1	0.1	0.2	2.6	2.9	2.8	2.8	2.8	2.5	0.2	0.1	0.1	17.3
	Herring gull	1.3	1.4	1.8	0.3	0.4	0.4	0.4	0.4	0.3	1.6	1.3	1.2	10.7
	Kestrel	0.9	1.0	1.3	3.4	4.0	4.0	3.9	3.7	3.1	1.2	0.9	0.8	28.2
	Lapwing	15.5	15.4	18.3	-	-	-	-	-	-	17.6	15.4	15.1	97.2
	Lesser black-backed gull	0.6	0.6	0.7	5.2	5.8	5.7	5.7	5.6	4.9	0.7	0.6	0.6	36.7
	Mallard	0.3	0.3	0.4	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.3	0.3	5.7
	Snipe	0.6	0.6	0.6	1.3	1.4	1.3	1.3	1.4	1.4	0.6	0.6	0.6	11.7
	Sparrowhawk	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	1.8
	Whimbrel	-	-	-	1.3	1.6	-	-	-	-	-	-	-	2.9
	Whooper swan	2.4	2.4	2.8	-	-	-	-	-	-	2.7	2.4	2.3	15.1
N149	Buzzard	0.2	0.2	0.3	1.6	1.9	1.9	1.9	1.8	1.5	0.3	0.2	0.2	12.1
	Cormorant	0.5	0.5	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.5	0.5	5.1
	Curlew	1.8	1.8	2.1	0.03	0.04	0.04	0.04	0.04	0.03	2.0	1.8	1.7	11.5
	Golden plover	67.1	66.8	79.4	-	-	-	-	-	-	76.6	66.7	65.2	421.7
	Great black-backed gull	0.1	0.1	0.2	2.6	2.9	2.8	2.8	2.8	2.5	0.2	0.1	0.1	17.3
	Herring gull	2.2	2.4	3.1	0.6	0.7	0.7	0.7	0.6	0.5	2.9	2.3	2.1	18.7
	Kestrel	0.7	0.7	1.0	2.6	3.1	3.1	3.0	2.9	2.4	0.9	0.7	0.6	21.8
	Lapwing	15.0	14.9	17.7	-	-	-	-	-	-	17.1	14.9	14.5	94.1
	Lesser black-backed gull	0.5	0.5	0.6	4.5	5.0	4.9	4.9	4.8	4.2	0.6	0.5	0.5	31.7
	Mallard	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.3	0.3	4.9
	Snipe	0.4	0.4	0.4	1.0	1.0	0.9	1.0	1.0	1.0	0.4	0.4	0.4	8.4
	Sparrowhawk	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	1.7
	Whimbrel	-	-	-	1.3	1.5	-	-	-	-	-	-	-	2.8
	Whooper swan	2.2	2.2	2.6	-	-	-	-	-	-	2.5	2.2	2.1	13.7
V150	Buzzard	0.2	0.2	0.3	1.5	1.7	1.7	1.7	1.6	1.4	0.3	0.2	0.2	11.0
	Cormorant	0.2	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.2	0.2	2.1
	Curlew	6.6	6.6	7.8	0.1	0.1	0.1	0.1	0.1	0.1	7.5	6.6	6.4	42.4
	Golden plover	71.4	71.1	84.2	-	-	-	-	-	-	80.7	70.5	69.3	447.1

Model	Target species	Collision rate before avoidance												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
	Great black-backed gull	0.1	0.1	0.2	2.4	2.7	2.6	2.6	2.6	2.3	0.1	0.1	0.1	16.1
	Herring gull	1.0	1.1	1.4	0.2	0.3	0.3	0.3	0.3	0.2	1.3	1.0	0.9	8.2
	Kestrel	0.7	0.7	1.0	2.6	3.1	3.1	3.0	2.9	2.4	0.9	0.7	0.6	21.7
	Lapwing	14.1	14.1	16.7	-	-	-	-	-	-	16.0	14.0	13.7	88.6
	Lesser black-backed gull	0.5	0.5	0.6	4.2	4.7	4.6	4.6	4.5	4.0	0.6	0.5	0.5	29.5
	Mallard	0.3	0.3	0.3	0.5	0.5	0.5	0.5	0.5	0.4	0.3	0.3	0.3	4.7
	Snipe	0.4	0.4	0.4	0.9	1.0	0.9	0.9	1.0	0.9	0.4	0.4	0.4	8.2
	Sparrowhawk	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	1.6
	Whimbrel	-	-	-	1.2	1.5	-	-	-	-	-	-	-	2.7
	Whooper swan	2.0	2.0	2.4	-	-	-	-	-	-	2.3	2.0	1.9	12.5

Stage E: Applying the avoidance rate

NatureScot (2018) provides guidance on the use of avoidance rates in collision risk assessments. Collision risks have been calculated for avoidance rates of 95%, 98%, 99%, and 99.5% for each season (breeding and non-breeding) and for year. The avoidance rate suggested by NatureScot CRM (2018) and Furness (2019) (Table 13. 11) was used to provide estimates of the number of collisions per decade and for the operational lifespan of the proposed wind farm development (30 years) (Table 13. 11). It is important to mention that the collision rate calculated for golden plover in the non-breeding season included all winter months and April, since, as it was mentioned before, this species is a winter and passage visitor. In the case of whimbrel, the collision rate calculated in the breeding season included only May and April, since this species is a spring passage migrant.

Table 13. 11 provides the collision probability of the selected target species passing through the rotors, taking into account different avoidance rates estimate for the non-breeding and breeding seasons and year. Species in bold denote a rate of more than 1 collision per decade.

The CRMs found that the V150 generated the lowest predicted collision risk in comparison with the SG15 and N149. This result may be driven by the higher average operational speeds of the SG155 (average rotational period: 6.42 sec) and the N149 (average rotational period: 5.58 sec). Despite the V150 having a larger risk volume than the N149, the average operational speeds are lower (average rotational period: 6.85 sec). Moreover, the rotor diameter of the SG155 is 5 meters larger than the rotor diameter of the Vestas V150, creating a bigger area where the bird might collide.

Taking into account the turbine model with the lowest predicted collision rate (turbine model V150), the CRMs generated low levels of theoretical collision risk (i.e. less than 1 collision per decade, with NatureScot CRM suggested avoidance rate) over the 30-year life span of the proposed development for seven species; cormorant, great black-backed gull, herring gull, mallard, sparrowhawk, whimbrel and whooper swan. This level of predicted collisions would be considered negligible and would not affect these species at the population level, i.e., collision mediated mortality would not add significantly (>1%) to background levels of mortality. Higher levels of flight time in the CRZ (i.e. more than 1 collision per decade, with NatureScot CRM suggested avoidance rate) over the 30-year life span of the proposed development were predicted for seven species; buzzard, curlew, golden plover, kestrel, lapwing, lesser black-backed gull and snipe for turbine model V150.

These levels of predicted collision risk warrant further investigation in terms of potential effects on these species populations. The population-level consequences of predicted collision risks can be assessed by considering the additional mortality that would be caused (assuming that the collision risk is non-additive) relative to background mortality rates in the population, with a threshold level of a 1% increase in annual mortality used to determine whether the impact will be significant (Percival, 2003). Estimates of the potential increase in annual mortality rates for target species are delineated within the discussion section on the main ornithology result report, for the relevant species.

Table 13. 11. Collision rate estimated by the non-breeding (NB) and the breeding seasons (B) and year-round, applying different avoidance rates.

Turbine	Target species	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Collisions Per decade using suggested avoidance rates*	Collisions Per 30 years using suggested avoidance rates*
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
SG155	**Buzzard**	0.09	0.64	0.73	0.04	0.26	0.29	0.02	0.13	0.15	0.009	0.064	0.07	2.92	8.76
	Cormorant	0.19	0.10	0.30	0.08	0.04	0.12	0.04	0.02	0.06	0.019	0.010	0.03	1.19	3.56
	Curlew	0.60	0.01	0.61	0.24	0.005	0.24	0.12	0.002	0.12	0.060	0.001	0.06	2.45	7.34
	Golden plover	22.36	-	22.36	8.95	-	8.95	4.47	-	4.47	2.236	0.0001	2.24	89.45	268.36
	Great black-backed gull	0.04	0.82	0.87	0.02	0.33	0.35	0.01	0.16	0.17	0.004	0.082	0.09	0.87	2.60
	Herring gull	0.75	0.18	0.94	0.30	0.07	0.37	0.15	0.04	0.19	0.075	0.018	0.09	0.94	2.81
	Kestrel	0.28	1.02	1.30	0.11	0.41	0.52	0.06	0.20	0.26	0.028	0.102	0.13	13.03	39.10
	Lapwing	4.86	-	4.86	1.94	-	1.94	0.97	-	0.97	0.486	-	0.49	19.44	58.33
	Lesser black-backed gull	0.19	1.64	1.84	0.08	0.66	0.73	0.04	0.33	0.37	0.019	0.164	0.18	1.84	5.51
	Mallard	0.11	0.18	0.28	0.04	0.07	0.11	0.02	0.04	0.06	0.011	0.018	0.03	1.14	3.42
	Snipe	0.18	0.41	0.58	0.07	0.16	0.23	0.04	0.08	0.12	0.018	0.041	0.06	2.33	6.99
	Sparrowhawk	0.03	0.06	0.09	0.01	0.02	0.04	0.01	0.01	0.02	0.003	0.006	0.01	0.36	1.08
	Whimbrel	-	0.14	0.14	-	0.06	0.06	-	0.03	0.03	-	0.014	0.01	0.58	1.74
	Whooper swan	0.75	-	0.75	0.30	-	0.30	0.15	-	0.15	0.075	-	0.08	0.75	2.26
N149	**Buzzard**	0.08	0.53	0.60	0.03	0.21	0.24	0.02	0.11	0.12	0.008	0.053	0.06	2.41	7.24
	Cormorant	0.16	0.09	0.25	0.07	0.04	0.10	0.03	0.02	0.05	0.02	0.009	0.03	1.01	3.03
	Curlew	0.56	0.01	0.58	0.23	0.00	0.23	0.11	0.00	0.12	0.06	0.001	0.06	2.30	6.90
	Golden plover	21.09	-	21.09	8.43	-	8.43	4.22	-	4.22	2.11	-	2.11	84.35	253.04
	Great black-backed gull	0.04	0.82	0.87	0.02	0.33	0.35	0.01	0.16	0.17	0.004	0.082	0.09	0.87	2.60
	Herring gull	0.75	0.18	0.94	0.30	0.07	0.37	0.15	0.04	0.19	0.08	0.018	0.09	0.94	2.81
	Kestrel	0.23	0.86	1.09	0.09	0.34	0.44	0.05	0.17	0.22	0.02	0.086	0.11	10.88	32.64
	Lapwing	4.70	-	4.77	1.88	-	1.91	0.94	-	0.94	0.47	-	0.47	18.81	56.44
	Lesser black-backed gull	0.17	1.42	1.58	0.07	0.57	0.63	0.03	0.28	0.32	0.02	0.142	0.16	1.58	4.75
	Mallard	0.09	0.15	0.25	0.04	0.06	0.10	0.02	0.03	0.05	0.01	0.015	0.02	0.98	2.95
	Snipe	0.13	0.29	0.42	0.05	0.12	0.17	0.03	0.06	0.08	0.01	0.029	0.04	1.68	5.03
	Sparrowhawk	0.03	0.06	0.09	0.01	0.02	0.03	0.01	0.01	0.02	0.003	0.006	0.01	0.35	1.04
	Whimbrel	-	0.14	0.14	-	0.06	0.06	-	0.03	0.03	-	0.014	0.01	0.56	1.69
	Whooper swan	0.68	-	0.68	0.27	-	0.27	0.14	-	0.14	0.07	-	0.07	0.68	2.05
V150	**Buzzard**	0.07	0.48	0.55	0.03	0.19	0.22	0.01	0.10	0.11	0.007	0.048	0.06	2.20	6.61
	Cormorant	0.15	0.08	0.23	0.06	0.03	0.09	0.03	0.02	0.05	0.015	0.008	0.02	0.93	2.80

Turbine	Target species	Collision rate after 0.95 avoidance			Collision rate after 0.98 avoidance			Collision rate after 0.99 avoidance			Collision rate after 0.995 avoidance			Collisions Per decade using suggested avoidance rates*	Collisions Per 30 years using suggested avoidance rates*
		NB	B	Year	NB	B	Year	NB	B	Year	NB	B	Year		
	Curlew	0.53	0.01	0.54	0.21	0.005	0.22	0.11	0.003	0.11	0.053	0.001	0.05	2.18	6.53
	Golden plover	20.70	-	20.70	8.28	-	8.28	4.14	-	4.14	2.070	-	2.07	82.80	248.41
	Great black-backed gull	0.04	0.76	0.81	0.02	0.31	0.32	0.01	0.15	0.16	0.004	0.076	0.08	0.81	2.42
	Herring gull	0.69	0.17	0.86	0.28	0.07	0.35	0.14	0.03	0.17	0.069	0.017	0.09	0.86	2.59
	Kestrel	0.21	0.78	0.99	0.08	0.31	0.39	0.04	0.16	0.20	0.021	0.078	0.10	9.87	29.61
	Lapwing	4.43	-	4.43	1.77	-	1.77	0.89	-	0.89	0.443	-	0.44	17.73	53.18
	Lesser black-backed gull	0.16	1.32	1.48	0.06	0.53	0.59	0.03	0.26	0.30	0.016	0.132	0.15	1.48	4.43
	Mallard	0.09	0.15	0.23	0.04	0.06	0.09	0.02	0.03	0.05	0.009	0.015	0.02	0.94	2.82
	Snipe	0.12	0.28	0.41	0.05	0.11	0.16	0.02	0.06	0.08	0.012	0.028	0.04	1.63	4.89
	Sparrowhawk	0.03	0.05	0.08	0.01	0.02	0.03	0.01	0.01	0.02	0.003	0.005	0.01	0.32	0.95
	Whimbrel	-	0.14	0.14	-	0.05	0.05	-	0.03	0.03	-	0.014	0.01	0.54	1.62
	Whooper swan	0.62	-	0.62	0.25	-	0.25	0.12	-	0.12	0.062	-	0.06	0.62	1.87

*Avoidance rates as per suggested by SNH (2018) and Furness (2019) (Table 13.3) was used to estimate the number of collisions per decade and for the operational lifespan of the proposed wind farm development (30 years)

Stage F: Expressing uncertainty

As outlined in NatureScot guidance (2024), potential uncertainties when interpreting predicted collisions should be quantified as much as possible. As it was mentioned in the methods section there are three sources of uncertainty throughout the CRM process, such as uncertainty in the survey data collected; uncertainty arising from limitations which are inbuilt into the CRM due to the requirement for simplification; and uncertainty arising from turbine specifications.

Uncertainty can arise during data collection, for example imprecisions when mapping the location of flights or categorising flight heights. This has been limited as much as possible by using experienced surveyors, the same survey team throughout the survey programme and data was collected over multiple years to increase robustness. The inability to collect nocturnal survey data means that there is uncertainty in predicted nocturnal flight activity throughout the operational phase, however significant nocturnal activity is only predicted for snipe, which has been accounted for them in the model. Therefore, uncertainty introduced into the model from the data collection has been estimated at ±20%.

The NatureScot CRM model contains simplifications, for example assuming uniform bird dimensions and flight speeds, and simplifications of turbine blade dimensions. This is inaccurate due to inherent natural variability within species populations, different flight speeds associated with different activities (commuting, hunting, display etc) and weather conditions, however it is necessary to ensure that the model is not overly complex. It is considered that simplifications in the model introduce uncertainty of ±20%.

Three different turbine model dimensions used in the CRM have been provided by the client and are based on specifications for the proposed turbine model that will be used when the proposed development is constructed. An allowance for turbine micro-siting means that there is uncertainty over the precise turbine layout. However, the micro-siting variation is expected to be null or very low and consequently it would not affect the flight activity recorded in the proposed development site. Therefore, it is considered that data collection uncertainty should be considered negligible.

Overall uncertainty can be quantified by combining the three sources of uncertainty using the following equation.

√(〖0.2〗^2+〖0.2〗^2)

This gives an overall uncertainty of ±28%.

While this estimated level of uncertainly appears high, the model has followed NatureScot CRM guidelines (2024) and survey methods are in accordance with surveys undertaken for onshore wind farms (SNH, 2017). As such, this level of uncertainty is not considered to undermine the integrity or output of the model.

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