ANNEX E. COLLISION RISK ASSESSMENTS

Delaunay Triangulation[1] from the proposed turbine locations was used to create a wind farm area[2] and from this the Collision Risk Analysis Area (CRAA) was created using a 500 m (metre) buffer (**Figure 6.3, EIAR Volume 2**). Using the larger 500 m area around the turbine's accounts for possible inaccuracies in the recording of flightlines and ensures the assessment is precautionary.

The ultimate aim is to have 100 % coverage of the turbines and associated CRAA by the viewsheds, however in practice this is often unachievable as a result of the topography of the Site, presence of mature forestry and limited to no access out with the Site. For the Proposed Development, although some small areas of the CRAA remain 'invisible' at 20 m above ground level (**Figure 6.3**, **Figure 6.4**, **Figure 6.5** and **Figure 6.6, EIAR Volume 2**), the habitat within these areas is of sufficient similarity such that the survey data collected and subsequently assessed are considered to be representative of the whole CRAA. In addition, there were no records made during any of the surveys which would suggest that this area was of any particular importance to target species. Furthermore, the flying time at risk height (secsHahr^{-1}) for each species is calculated as a single mean activity rate within the entirety of the CRAA.

Table E-1, **Table E-2** and **Table E-3** present the parameters which apply to each Collision Risk Model (CRM).

Table E-1 Wind farm parameters

Size of wind farm envelope	730.6	hectares (ha)
Number of turbines	12	turbines
Rotor diameter	162	metres (m)
Hub height	99	m
Max. rotor depth	1.11	m (at 15° pitch angle)
Max. chord	4.3	m
Pitch	15	degrees (°)
Rotation period	4.96	seconds (secs)
Turbine operation time	0.85	percent (%)
Risk height: highest	180	m
Risk height: lowest	18	m
Flight risk volume	1183578903	m^3

Table E-2 CRM parameters per species

Species	Length (m)	Wingspan (m)	Assumed flight speed, v (ms^{-1})	Avoidance rate	Probability of collision	Bird transit time (secs)
Barnacle goose	0.7	1.45	17	0.998	0.0606	0.1066
Curlew	0.6	1	13	0.98	0.0661	0.1318
Golden eagle	0.815	2.12	15	0.99	0.0715	0.1285
Golden plover	0.28	0.72	17.9	0.98	0.0440	0.0778
Hen harrier	0.48	1.1	12	0.99	0.0644	0.1327
Merlin	0.28	0.56	13	0.98	0.0510	0.1071
Peregrine falcon	0.48	1.1	12.1	0.98	0.0641	0.1316
Pink-footed goose	0.675	1.525	17.3	0.998	0.0595	0.1033
Red kite	0.66	1.95	12	0.99	0.0753	0.1477
Short-eared owl	0.38	1.02	13	0.98	0.0566	0.1148
White-tailed eagle	0.9	2.4	13.6	0.95	0.0803	0.1480

Table E-3 Visible area within the CRAA per vantage point

VP	Area (ha)
1	223.5
2	158.24
4	192.94
5	175.91
6	235.71
7	245.2
8	358.76
9	237.59
10	60.04
11	102.92

Birds are assumed to be active during all the daylight hours and this is estimated by calculating the number of hours per day between sunrise and sunset (adjusting for correct latitude) for the survey seasons as defined in **Table E-4** below.

Table E-4 Season definitions per species/species group

Species	Breeding season			Non-breeding season		
	Start date	End date	Hours presumed present	Start date	End date	Hours presumed present
Golden eagle	1st February	31st August	2,793	1st September	31st January	1,706
White-tailed eagle	1st February	31st August	2,793	1st September	31st January	1,706
Geese and swans	15th May	31st August	1,813	1st September	14th May	2,687
Raptors and owls	15th March	31st August	2,670	1st September	14th March	1,830
Waders	1st April	31st July	1,990	1st August	31st March	2,510

Outputs for the CRM for the following species are presented in the following order below:

- Barnacle goose;
- Curlew;
- Golden eagle;
- Golden plover;
- Hen harrier;
- Merlin;
- Peregrine falcon;
- Pink-footed goose;
- Red kite;
- Short-eared owl; and
- White-tailed eagle.

[1] Delaunay triangulation is a form of mathematical/computational geometry where a given set of points (in this case the turbine locations) are all joined to create discrete triangles. Further information is available here: https://uk.mathworks.com/help/matlab/math/delaunay-triangulation.html

[2] This was adjusted where appropriate depending on the spatial location of the turbines in relation to other turbines.

E.1 Barnacle goose

Non-Breeding Season 2021/2022

Table E-5 Barnacle goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	1070.95	11314.24	0.00001

Table E-6 Barnacle goose mortality estimates

Mean activity in wind farm at rotor height	0.0073	hr^{-1}
Total Combined rotor swept volume	448415	m^3
Bird occupancy	19.6375	hrs/season
Bird occupancy of rotor swept volume	26.78380288	bird-sec
No. of transits through rotors	251.1551383	per season
Estimated collisions	15.2147	per season
Estimated collisions after correction for operation	12.9325	per season
Estimated collisions after avoidance factor	0.0259	per season
Equivalent to 1 bird every	38.7	seasons

E.2 Curlew

Non-Breeding Season 2021/2022

Table E-7 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	31.78	7212.18	0.0000003

Table E-8 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0002	hr^{-1}
Total Combined rotor swept volume	423681	m^3
Bird occupancy	0.5636	hrs/season
Bird occupancy of rotor swept volume	0.7263	bird-sec
No. of transits through rotors	5.5124	per season
Estimated collisions	0.3642	per season
Estimated collisions after correction for operation	0.3096	per season
Estimated collisions after avoidance factor	0.0062	per season
Equivalent to 1 bird every	162	seasons

Breeding Season 2022

Table E-9 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	103.79	7071.4	0.000002

Table E-10 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0012	hr^{-1}
Total Combined rotor swept volume	423681	m^3
Bird occupancy	2.4156	hrs/season
Bird occupancy of rotor swept volume	3.1130	bird-sec
No. of transits through rotors	23.6256	per season
Estimated collisions	1.5610	per season
Estimated collisions after correction for operation	1.3268	per season
Estimated collisions after avoidance factor	0.0265	per season
Equivalent to 1 bird every	37.7	seasons

Breeding Season 2023

Table E-11 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
7	267.32	7355.92	0.000003
8	1.9	9507.16	0.00000002
11	9	2436.10	0.0000001

Table E-12 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0021	hr^{-1}
Total Combined rotor swept volume	423681	m^3
Bird occupancy	4.1656	hrs/season
Bird occupancy of rotor swept volume	5.3681	bird-sec
No. of transits through rotors	40.7406	per season
Estimated collisions	2.6918	per season
Estimated collisions after correction for operation	2.2880	per season
Estimated collisions after avoidance factor	0.0458	per season
Equivalent to 1 bird every	21.9	seasons

E.3 Golden eagle

Breeding Season 2021

Table E-13 Golden eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	168.27	8884.05	0.000002
2	194.58	5775.81	0.000003
4	918.63	6945.80	0.00001

Table E-14 Golden eagle mortality estimates

Mean activity in wind farm at rotor height	0.0120	hr^{-1}
Total Combined rotor swept volume	476860	m^3
Bird occupancy	33.6246	hrs/season
Bird occupancy of rotor swept volume	48.7701	bird-sec
No. of transits through rotors	379.4508	per season
Estimated collisions	27.1277	per season
Estimated collisions after correction for operation	23.0585	per season
Estimated collisions after avoidance factor	0.2306	per season
Equivalent to 1 bird every	4.3	seasons

Non-Breeding Season 2021/2022

Table E-15 Golden eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	152.97	5016.41	0.000002
5	127.75	5277.20	0.000002
6	399.33	7307.11	0.00001

Table E-16 Golden eagle mortality estimates

Mean activity in wind farm at rotor height	0.0078	hr^{-1}
Total Combined rotor swept volume	476860	m^3
Bird occupancy	13.3812	hrs/season
Bird occupancy of rotor swept volume	19.4084	bird-sec
No. of transits through rotors	151.0051	per season
Estimated collisions	10.7956	per season
Estimated collisions after correction for operation	9.1763	per season
Estimated collisions after avoidance factor	0.0918	per season
Equivalent to 1 bird every	10.9	seasons

Breeding Season 2022

Table E-17 Golden eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	229.20	8006.96	0.000003
5	217.42	7212.18	0.000002
6	764.56	9664.24	0.00001

Table E-18 Golden eagle mortality estimates

Mean activity in wind farm at rotor height	0.0099	hr^{-1}
Total Combined rotor swept volume	476860	m^3
Bird occupancy	27.5940	hrs/season
Bird occupancy of rotor swept volume	40.0230	bird-sec
No. of transits through rotors	311.3952249	per season
Estimated collisions	22.2622	per season
Estimated collisions after correction for operation	18.92290341	per season
Estimated collisions after avoidance factor	0.1892	per season
Equivalent to 1 bird every	5.3	seasons

Non-Breeding Season 2022/2023

Table E-19 Golden eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	175.68	3472.90	0.00001
5	40.55	2638.60	0.000001
6	55.86	3535.70	0.000002

Table E-20 Golden eagle mortality estimates

Mean activity in wind farm at rotor height	0.0057	hr^{-1}
Total Combined rotor swept volume	476860	m^3
Bird occupancy	9.7677	hrs/season
Bird occupancy of rotor swept volume	14.1673	bird-sec
No. of transits through rotors	110.2274296	per season
Estimated collisions	7.8804	per season
Estimated collisions after correction for operation	6.6983	per season
Estimated collisions after avoidance factor	0.0670	per season
Equivalent to 1 bird every	14.9	seasons

Breeding Season 2023

Table E-21 Golden eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	233.66	4949.98	0.000001
7	219.72	8827.10	0.000001
8	317.34	12915.38	0.000002
9	187.81	8553.13	0.000001
10	113.12	2161.35	0.000001
11	68.44	3740.09	0.0000004

Table E-22 Golden eagle mortality estimates

Mean activity in wind farm at rotor height	0.0048	hr^{-1}
Total Combined rotor swept volume	476860	m^3
Bird occupancy	13.3779	hrs/season
Bird occupancy of rotor swept volume	19.40359979	bird-sec
No. of transits through rotors	150.9677325	per season
Estimated collisions	10.7930	per season
Estimated collisions after correction for operation	9.1740	per season
Estimated collisions after avoidance factor	0.0917	per season
Equivalent to 1 bird every	10.9	seasons

E.4 Golden plover

Non-Breeding Season 2021/2022

Table E-23 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	6.97	7212.18	0.0000001

Table E-24 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.00005	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	0.1237	hrs/season
Bird occupancy of rotor swept volume	0.1296	bird-sec
No. of transits through rotors	1.6657	per season
Estimated collisions	0.0734	per season
Estimated collisions after correction for operation	0.0624	per season
Estimated collisions after avoidance factor	0.0012	per season
Equivalent to 1 bird every	802	seasons

Breeding Season 2022

Table E-25 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	3.67	4397.67	0.0000001
6	45.2	7071.40	0.000001

Table E-26 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.0006	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	1.1374	hrs/season
Bird occupancy of rotor swept volume	1.1920	bird-sec
No. of transits through rotors	15.3174	per season
Estimated collisions	0.6746	per season
Estimated collisions after correction for operation	0.5735	per season
Estimated collisions after avoidance factor	0.0115	per season
Equivalent to 1 bird every	87.2	seasons

Non-Breeding Season 2022/2023

Table E-27 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	128.52	7212.18	0.000001

Table E-28 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.0011	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	2.7354	hrs/season
Bird occupancy of rotor swept volume	2.8665	bird-sec
No. of transits through rotors	36.8369	per season
Estimated collisions	1.6225	per season
Estimated collisions after correction for operation	1.3791	per season
Estimated collisions after avoidance factor	0.0276	per season
Equivalent to 1 bird every	36.3	seasons

E.5 Hen harrier

Breeding Season 2021

Table E-29 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	4.38	8884.05	0.0000001

Table E-30 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.00004	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	0.1098	hrs/season
Bird occupancy of rotor swept volume	0.1316	bird-sec
No. of transits through rotors	0.9912	per season
Estimated collisions	0.0639	per season
Estimated collisions after correction for operation	0.0543	per season
Estimated collisions after avoidance factor	0.0005	per season
Equivalent to 1 bird every	1842	seasons

Non-Breeding Season 2021/2022

Table E-31 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	50.42	6684.46	0.000001
6	11.76	8485.68	0.0000002

Table E-32 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.0006	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	1.0917	hrs/season
Bird occupancy of rotor swept volume	1.3083	bird-sec
No. of transits through rotors	9.8557	per season
Estimated collisions	0.6352	per season
Estimated collisions after correction for operation	0.5399	per season
Estimated collisions after avoidance factor	0.0054	per season
Equivalent to 1 bird every	185	seasons

Non-Breeding Season 2022/2023

Table E-33 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	4.13	8485.68	0.0000001

Table E-34 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.00004	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	0.0741	hrs/season
Bird occupancy of rotor swept volume	0.0888	bird-sec
No. of transits through rotors	0.6688	per season
Estimated collisions	0.0431	per season
Estimated collisions after correction for operation	0.0366	per season
Estimated collisions after avoidance factor	0.0004	per season
Equivalent to 1 bird every	2730	seasons

Breeding Season 2023

Table E-35 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
7	313.55	8827.10	0.000002
8	14.9	12915.38	0.0000001
11	13.87	3740.09	0.0000001

Table E-36 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.0019	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	4.9789	hrs/season
Bird occupancy of rotor swept volume	5.9667	bird-sec
No. of transits through rotors	44.9493	per season
Estimated collisions	2.8968	per season
Estimated collisions after correction for operation	2.4622	per season
Estimated collisions after avoidance factor	0.0246	per season
Equivalent to 1 bird every	40.6	seasons

E.6 Merlin

Breeding Season 2021

Table E-37 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
2	2.77	5775.81	0.00000004

Table E-38 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.00003	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	0.0695	hrs/season
Bird occupancy of rotor swept volume	0.0728	bird-sec
No. of transits through rotors	0.6794	per season
Estimated collisions	0.0347	per season
Estimated collisions after correction for operation	0.0295	per season
Estimated collisions after avoidance factor	0.0006	per season
Equivalent to 1 bird every	1697	seasons

Non-Breeding Season 2021/2022

Table E-39 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	0.20	5981.10	0.000000003
5	0.98	6684.46	0.00000001

Table E-40 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.00001	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	0.0207	hrs/season
Bird occupancy of rotor swept volume	0.0217	bird-sec
No. of transits through rotors	0.202399706	per season
Estimated collisions	0.0103	per season
Estimated collisions after correction for operation	0.0088	per season
Estimated collisions after avoidance factor	0.0002	per season
Equivalent to 1 bird every	5695	seasons

Non-Breeding Season 2022/2023

Table E-41 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	1.56	6945.80	0.00000002

Table E-42 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.00002	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	0.0280	hrs/season
Bird occupancy of rotor swept volume	0.0294	bird-sec
No. of transits through rotors	0.2740	per season
Estimated collisions	0.0140	per season
Estimated collisions after correction for operation	0.0119	per season
Estimated collisions after avoidance factor	0.0002	per season
Equivalent to 1 bird every	4207	seasons

Breeding Season 2023

Table E-43 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
8	19.4	12915.38167	0.0000001
9	42.18	8553.13	0.0000003

Table E-44 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.0003	hr^{-1}
Total Combined rotor swept volume	344531	m^3
Bird occupancy	0.8957	hrs/season
Bird occupancy of rotor swept volume	0.9386	bird-sec
No. of transits through rotors	8.7597	per season
Estimated collisions	0.4470	per season
Estimated collisions after correction for operation	0.3800	per season
Estimated collisions after avoidance factor	0.007599602	per season
Equivalent to 1 bird every	132	Seasons

E.7 Peregrine falcon

Breeding Season 2021

Table E-45 Peregrine falcon flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	2.43	8884.05	0.00000003
2	168.90	5775.81	0.000002
4	237.96	6945.80	0.000003

Table E-46 Peregrine falcon mortality estimates

Mean activity in wind farm at rotor height	0.0038	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	10.2645	hrs/season
Bird occupancy of rotor swept volume	12.3009	bird-sec
No. of transits through rotors	93.4391	per season
Estimated collisions	5.9874	per season
Estimated collisions after correction for operation	5.0893	per season
Estimated collisions after avoidance factor	0.1018	per season
Equivalent to 1 bird every	9.8	seasons

Non-Breeding Season 2021/2022

Table E-47 Peregrine falcon flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	0.10	6684.46	0.000000001

Table E-48 Peregrine falcon mortality estimates

Mean activity in wind farm at rotor height	0.000001	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	0.0017	hrs/season
Bird occupancy of rotor swept volume	0.0020	bird-sec
No. of transits through rotors	0.0153	per season
Estimated collisions	0.0010	per season
Estimated collisions after correction for operation	0.0008	per season
Estimated collisions after avoidance factor	0.00002	per season
Equivalent to 1 bird every	59919	seasons

Breeding Season 2022

Table E-49 Peregrine falcon flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
5	35.79	5804.92	0.0000005

Table E-50 Peregrine falcon mortality estimates

Mean activity in wind farm at rotor height	0.0003	hr^{-1}
Total Combined rotor swept volume	393999	m^3
Bird occupancy	0.9089	hrs/season
Bird occupancy of rotor swept volume	1.0892	bird-sec
No. of transits through rotors	8.2740	per season
Estimated collisions	0.5302	per season
Estimated collisions after correction for operation	0.4507	per season
Estimated collisions after avoidance factor	0.0090	per season
Equivalent to 1 bird every	111	seasons

E.8 Pink-footed goose

Non-Breeding Season 2021/2022

Table E-51 Pink-footed goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	1103.70	11314.24	0.00001

Table E-52 Pink-footed goose mortality estimates

Mean activity in wind farm at rotor height	0.0075	hr^{-1}
Total Combined rotor swept volume	442232	m^3
Bird occupancy	20.2380	hrs/season
Bird occupancy of rotor swept volume	27.2221	bird-sec
No. of transits through rotors	263.4025	per season
Estimated collisions	15.6810	per season
Estimated collisions after correction for operation	13.3288	per season
Estimated collisions after avoidance factor	0.0267	per season
Equivalent to 1 bird every	37.5	seasons

E.9 Red kite

Breeding Season 2021

Table E-53 Red kite flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	2468.98	8884.05	0.00003
2	1169.49	5775.81	0.00002
4	795.45	6945.80	0.00001

Table E-54 Red kite mortality estimates

Mean activity in wind farm at rotor height	0.0416	hr^{-1}
Total Combined rotor swept volume	438521	m^3
Bird occupancy	111.1960354	hrs/season
Bird occupancy of rotor swept volume	148.3150929	bird-sec
No. of transits through rotors	1003.86888	per season
Estimated collisions	75.55049564	per season
Estimated collisions after correction for operation	64.2179	per season
Estimated collisions after avoidance factor	0.6422	per season
Equivalent to 1 bird every	1.6	seasons

Non-Breeding Season 2021/2022

Table E-55 Red kite flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	415.68	5981.10	0.00001
5	587.21	6684.46	0.00001
6	837.60	8485.68	0.00001

Table E-56 Red kite mortality estimates

Mean activity in wind farm at rotor height	0.0177	hr^{-1}
Total Combined rotor swept volume	438521	m^3
Bird occupancy	32.3176	hrs/season
Bird occupancy of rotor swept volume	43.1058	bird-sec
No. of transits through rotors	291.7609328	per season
Estimated collisions	21.9577	per season
Estimated collisions after correction for operation	18.6641	per season
Estimated collisions after avoidance factor	0.1866	per season
Equivalent to 1 bird every	5.4	seasons

Breeding Season 2022

Table E-57 Red kite flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	1769.03	7042.27	0.00002
5	329.49	5804.92	0.000004
6	1001.57	8485.68	0.00001

Table E-58 Red kite mortality estimates

Mean activity in wind farm at rotor height	0.0295	hr^{-1}
Total Combined rotor swept volume	438521	m^3
Bird occupancy	78.7398	hrs/season
Bird occupancy of rotor swept volume	105.0245	bird-sec
No. of transits through rotors	710.8567068	per season
Estimated collisions	53.4985969	per season
Estimated collisions after correction for operation	45.4738	per season
Estimated collisions after avoidance factor	0.4547	per season
Equivalent to 1 bird every	2.2	seasons

Non-Breeding Season 2022/2023

Table E-59 Red kite flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
4	492.23	6945.80	0.00001
5	969.26	5277.20	0.00001
6	1210.731	8485.68	0.00002

Table E-60 Red kite mortality estimates

Mean activity in wind farm at rotor height	0.0262	hr^{-1}
Total Combined rotor swept volume	438521	m^3
Bird occupancy	47.9248	hrs/season
Bird occupancy of rotor swept volume	63.9229	bird-sec
No. of transits through rotors	432.6612584	per season
Estimated collisions	32.5618	per season
Estimated collisions after correction for operation	27.6775	per season
Estimated collisions after avoidance factor	0.2768	per season
Equivalent to 1 bird every	3.6	seasons

Breeding Season 2023

Table E-61 Red kite flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
7	1227.62	8827.10	0.00001
8	456.68	12915.38167	0.000003
9	2084.02	8553.13	0.00002
10	629.4799539	2161.35	0.000005
11	512.61	3740.09	0.000004

Table E-62 Red kite mortality estimates

Mean activity in wind farm at rotor height	0.0268	hr^{-1}
Total Combined rotor swept volume	438521	m^3
Bird occupancy	71.4218	hrs/season
Bird occupancy of rotor swept volume	95.2635	bird-sec
No. of transits through rotors	644.7898667	per season
Estimated collisions	48.5265	per season
Estimated collisions after correction for operation	41.2475	per season
Estimated collisions after avoidance factor	0.4125	per season
Equivalent to 1 bird every	2.4	seasons

E.10 Short-eared owl

Non-Breeding Season 2022/2023

Table E-63 Short-eared owl flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
6	3.72	8485.68	0.00000005

Table E-64 Short-eared owl mortality estimates

Mean activity in wind farm at rotor height	0.00004	hr^{-1}
Total Combined rotor swept volume	369265	m^3
Bird occupancy	0.0667	hrs/season
Bird occupancy of rotor swept volume	0.0749	bird-sec
No. of transits through rotors	0.6521	per season
Estimated collisions	0.0369	per season
Estimated collisions after correction for operation	0.0314	per season
Estimated collisions after avoidance factor	0.0006	per season
Equivalent to 1 bird every	1593	seasons

E.11 White-tailed eagle

Breeding Season 2023

Table E-65 White-tailed eagle flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
7	193.58	8827.10	0.000001
8	316.57	12915.38167	0.000002
11	230.54	3740.09	0.000001

Table E-66 White-tailed eagle mortality estimates

Mean activity in wind farm at rotor height	0.0031	hr^{-1}
Total Combined rotor swept volume	497884	m^3
Bird occupancy	8.6912	hrs/season
Bird occupancy of rotor swept volume	13.1617	bird-sec
No. of transits through rotors	88.9250	per season
Estimated collisions	7.141299655	per season
Estimated collisions after correction for operation	6.0701	per season
Estimated collisions after avoidance factor	0.3035	per season
Equivalent to 1 bird every	3.3	seasons