Fall 2006 Radar Surveys of Nighttime Migration Activity at the Proposed Windpark in Coos County, New Hampshire by Granite Reliable Power, LLC

FINAL

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Executive Summary

During fall 2006, Woodlot Alternatives, Inc. conducted a radar survey of nocturnal migration at the proposed windpark in Coos County, New Hampshire. The surveys are part of permitting efforts by Granite Reliable Power, LLC (Granite) for the development of a wind power development at that site. The field investigation included a survey of nighttime activity in the vicinity of the project using radar and represents the first of a set of field investigations planned by Granite at this site.

The surveys were conducted from September 9 to October 12, 2006. The overall goal of the survey was to document nocturnal migration in the vicinity of the proposed wind farm, including the number of migrants, their flight direction, and their flight altitude. The results of these field surveys, especially when reviewed along with results of the spring 2007 surveys, will provide useful information about site-specific migration activity and patterns in the vicinity of the project.

The fall radar survey targeted 30 nights of radar surveys to collect and record video samples of the radar during horizontal operation, which documents the abundance, flight path, and speed of targets moving through the project area, and vertical operation, which documents the altitude of targets. Nightly passage rates varied from 22 ± 6 targets per kilometer per hour (t/km/hr) to 1,098 ± 177 t/km/hr, with an overall passage rate for the entire survey period of 469 ± 46 t/km/hr. The mean passage rate for this study is generally comparable to other studies conducted during previous years at different locations in the region. Mean flight direction through the project area was to the southwest, 223º ± 57º, which is typical of fall migration in the region. Flight direction varied between nights and was probably due to nightly variation in weather (particularly wind direction and speed).

The mean flight height of targets was 455 meters (m) ± 15 m (1,493’ ± 269’) above the radar site. The average nightly flight height ranged from 310 m ± 20 m (1,017’ ± 207’) to 638 m ± 25 m (2,094’ ± 280’). The percent of targets observed flying below 125 m (125’), the approximate maximum height of modern wind turbines, also varied by night, from 0 percent to 5 percent. The seasonal average percentage of targets flying below this height was 1 percent.

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WAI# 106195

1.0 Introduction

Granite Reliable Power, LLC (Granite) has proposed the construction of a wind development located in Coos County, New Hampshire (Figure 1). The project layout would include the erection of up to 67 wind turbines on or near the summits of Mt. Kelsey, Owlhead Mountain, the east side of Whitcomb Mountain, the east side of Long Mountain, and an un-named peak just west of Mt. Patience (herein referred to as Fish Brook Ridge) (the project). The project would include turbine pads, turbines, access roads to and along the ridgelines, and a power collection system. The proposed turbines would have a height of approximately 125 meters (410').

The topography within this region of New Hampshire is mountainous with elevations ranging from approximately 305 m (1,000') to 1,036 m (3,400'). These mountains occur within a landscape dominated by industrial forestry practices. High elevation spruce-fir forest exists at some of the summits, with the surrounding side slopes and valleys predominately yellow-birch (*Betula alleghaniensis)*, American beech (*Fagus grandifolia*), and sugar maple (*Acer saccharum*), species typically found in northern hardwood – conifer forests.

Woodlot Alternatives, Inc. (Woodlot), now Stantec Consulting[1], conducted a radar survey of nocturnal migration activity in the vicinity of the project during the fall 2006 migration period. This was the first of two seasons of radar surveys planned at this site. The overall goal of the survey was to document nocturnal migration in the vicinity of the project area, including the number of migrants, their flight direction, and their flight altitude.

2.0 Methods

2.1 Field Methods

The radar study was conducted near the northeastern end of the project area (Figure 1). The radar was located across the valley east of Mt. Kelsey and Owlhead Mountain, at an elevation of approximately 610 m (2,000')[2]. A marine surveillance radar similar to that described by Cooper *et al.* (1991) was used during field data collection. The radar has a peak power output of 12 kW and has the ability to track small animals, including birds, bats, and even insects, based on settings selected for the radar functions. It cannot, however, readily distinguish between different types of animals being detected. Consequently, all animals observed on the radar screen are called targets. The radar has an echo trail function that maintains past echoes of trails. During all operations, the radar's echo trail was set to 30 seconds.

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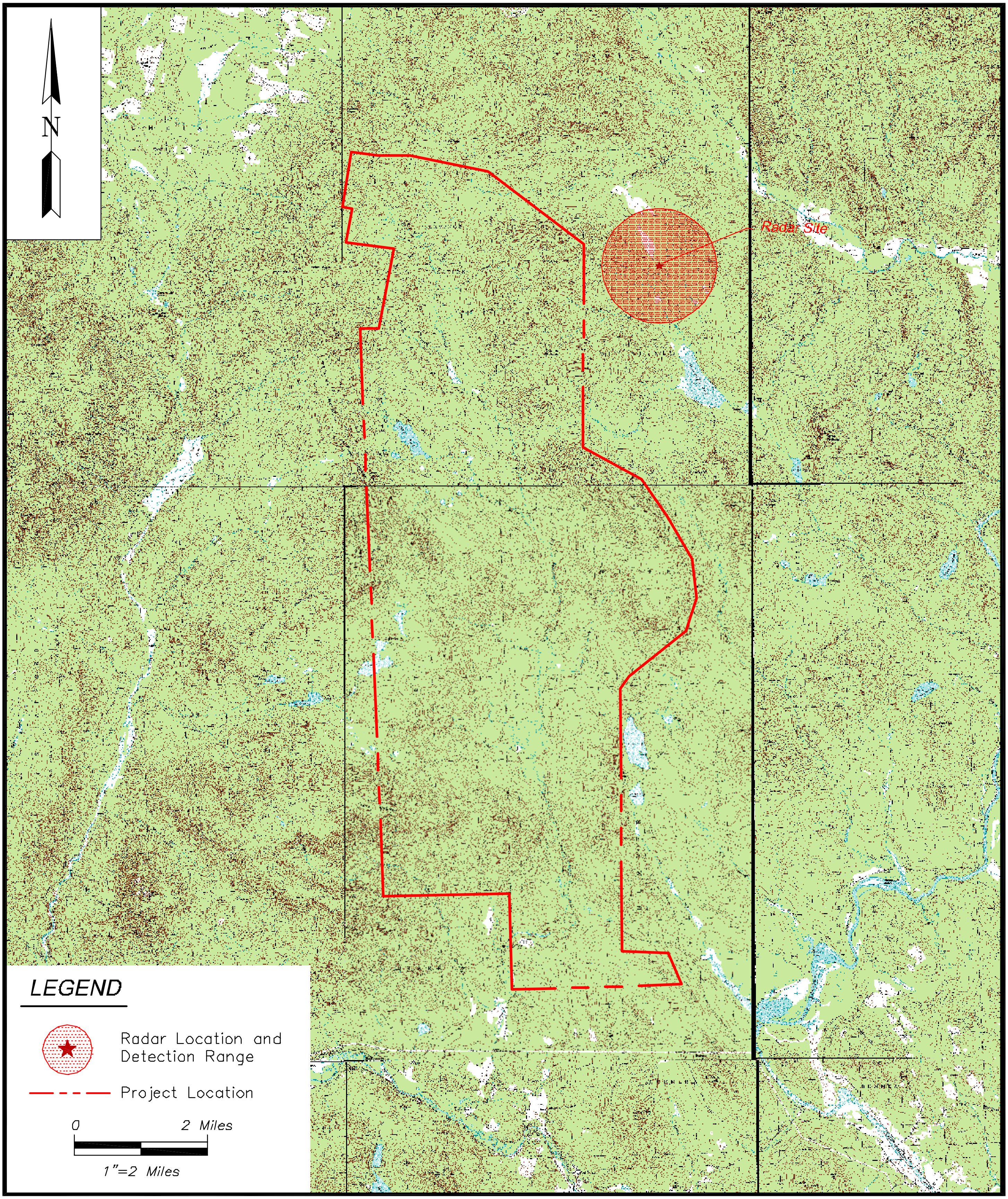
[1] On October 1, 2007 Woodlot Alternatives, Inc. was formally acquired by Stantec Consulting, Inc.
[2] Efforts were made to locate the radar survey station along one of the ridgelines proposed for development. However, inadequate access and logistical constraints precluded this. Consequently, a lower elevation site near the ridgelines proposed for development was selected.



PREPARED BY:

WOODLOT ALTERNATIVES, INC.
ENVIRONMENTAL CONSULTANTS

106195-FD00-Radar.dwg

SHEET TITLE:

Radar Location Map

PROJECT:

Noble Windpark
Errol, New Hampshire

DATE: November 2006
SCALE: 1"=2 Miles
PROJ. NO.: 106195
FIGURE:
1

The radar was equipped with a 2-m (6.5') waveguide antenna. The antenna has a vertical beam height of 20º (10º above and below horizontal) and the front end of the antenna was inclined approximately 5º to increase the proportion of the beam directed into the sky.

Objects on the ground detected by the radar cause returns on the radar screen (echoes) that appear as blotches called ground clutter. Large amounts of ground clutter reduce the ability of the radar to track birds and bats flying over those areas. However, vegetation and hilltops near the radar can be used to reduce or eliminate ground clutter by 'hiding' clutter-causing objects from the radar. These nearby features also cause ground clutter, but their proximity to the radar antenna can limit the ground clutter to the center of the radar screen (Figure 2). The presence of ground clutter and other objects that could reduce clutter were important factors considered during the site selection process.

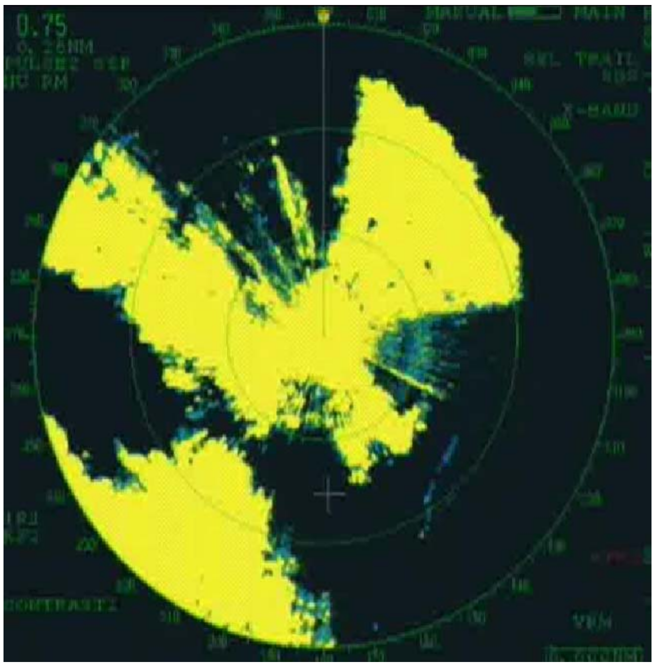


Figure 2. Ground clutter in project area

Nightly radar surveys were conducted from sunset to sunrise. Thirty nights of surveys were targeted for sampling beginning the night of September 9 and ending the night of October 12, 2006. Because the anti-rain function of the radar must be turned down to detect small songbirds and bats, surveys could not be conducted during periods of inclement weather. Therefore, surveys were targeted largely for nights without rain. However, to characterize nighttime movement patterns during nights without optimal migration conditions, nights with weather forecasts including occasional showers were sampled.

The radar was operated in two modes during each hour of each night surveyed. In the first mode, surveillance, the antenna spins horizontally to survey the airspace around the radar and detects targets moving through the area. By analyzing the echo trail, the flight direction of targets can be determined. In the second mode of operation, vertical, the antenna is rotated 90º to vertically survey the airspace above the radar (Harmata *et al.* 1999). In vertical mode, target echoes do not provide directional data but do provide information on the altitude of targets passing through the vertical, 20º radar beam.

The radar was operated at a range of 1.4 kilometers (km) (0.75 nautical miles). At this range, the echoes of small birds can be easily detected, observed, and tracked. At greater ranges, larger birds can be detected, but the echoes of small birds are reduced in size and restricted to a smaller portion of the radar screen, reducing the ability to observe the movement pattern of individual targets.

2.2 Data Collection

The radar display was connected to video recording software of a computer. Based on a random sequence for each night, approximately 25 minutes of video samples were recorded during each hour of operation. These included 15 one-minute horizontal samples and 10 one-minute vertical samples. The pattern of randomly recorded horizontal and vertical samples was repeated each hour of the night after sunset and throughout each night surveyed.

During each hour, additional information was also recorded, including weather conditions and ceilometer observations. Ceilometer observations involved directing a one-million candlepower spotlight vertically into the sky in a manner similar to that described by Gauthreaux (1969). The ceilometer beam was observed by eye for 5 minutes to document and characterize low-flying (below 125 m [410']) targets. The ceilometer was held in-hand so that any birds, bats, or insects passing through it could be tracked for several seconds, if needed. Observations from each ceilometer observation period were recorded, including the number of birds, bats, and insects observed. This information was used during data analysis to help characterize activity of insects, birds, and bats.

2.3 Data Analysis

Video samples were analyzed using a digital analysis software tool developed by Woodlot. For horizontal samples, targets were identified as birds and bats rather than insects based on their speed. The speed of targets was corrected for wind speed and direction; targets traveling faster than approximately 6 m per second were identified as a bird or bat target (Larkin 1991, Bruderer and Boldt 2001). The software tool recorded the time, location, and flight vector for each target traveling fast enough to be a bird or bat. The results for each sample were output to a spreadsheet. For vertical samples, the software tool recorded the entry point of targets passing through the vertical radar beam, the time, and flight altitude above the radar location. The results for each sample were output to a spreadsheet. These datasets were then used to calculate passage rate (reported as targets per km of migratory front per hour [t/km/hr]), flight direction, and flight altitude of targets.

Mean target flight directions (± 1 circular standard deviation) were summarized using software designed specifically to analyze directional data (Oriana2© Kovach Computing Services). The statistics used for this are based on Batschelet (1965), which take into account the circular nature of the data. Nightly wind direction was also summarized using similar methods using data collected from the Berlin regional airport.

Flight altitude data were summarized using linear statistics. Mean flight altitudes (± 1 standard error) were calculated by hour, night, and overall season. The percent of targets flying below

125 m (410') (the approximate maximum height of the proposed wind turbines) was also calculated hourly, for each night, and for the entire survey period.

3.0 Results

Radar surveys were conducted during 328 hours on 30 nights between September 9 and October 12, 2006 (Appendix A Table 1). Some nights with periods of rain resulted in fewer hours of data recorded on those nights. Although the radar was not located at the summit of the ridgeline proposed for development, the radar site still provided generally good visibility of the surrounding airspace and targets were observed flying into and out of the ground clutter (Figure 2). Ground clutter was common on the radar screen. However, observations of targets entering and exiting the areas of ground clutter indicated that, in general, the visibility around the radar site and the radar's ability to detect and track nighttime migration was good.

3.1 Passage Rates

Nightly passage rates varied from 22 ± 6 t/km/hr (October 11) to 1,098 ± 177 t/km/hr (September 22), and the overall passage rate for the entire survey period was 469 ± 46 t/km/hr (Figure 3; Appendix A Table 2). Five percent of all radar targets were identified as insects, and were not included in the passage rates.

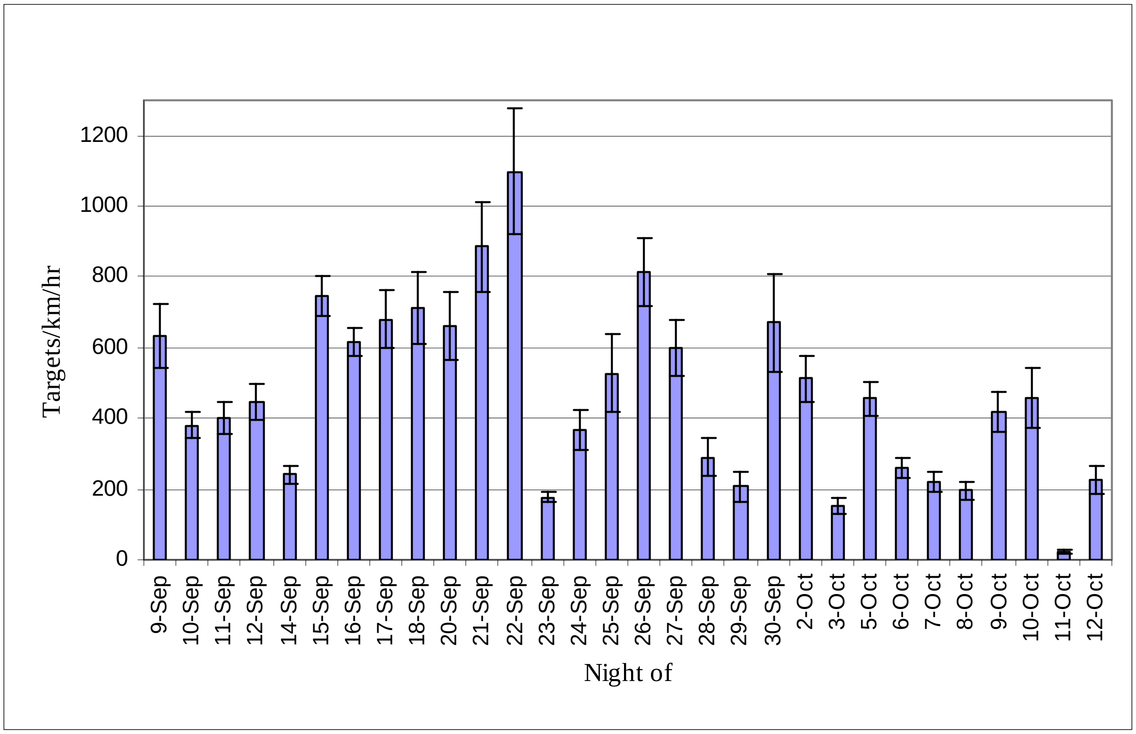


Figure 3. Nightly passage rates (error bars = +1 standard error) observed

Hourly passage rates varied greatly throughout each night and for the season overall. For the entire season, passage rate peaked four to seven hours after sunset and was followed by a gradual decrease through the remainder of the night, with a significant decrease in the two hours prior to sunrise (Figure 4).

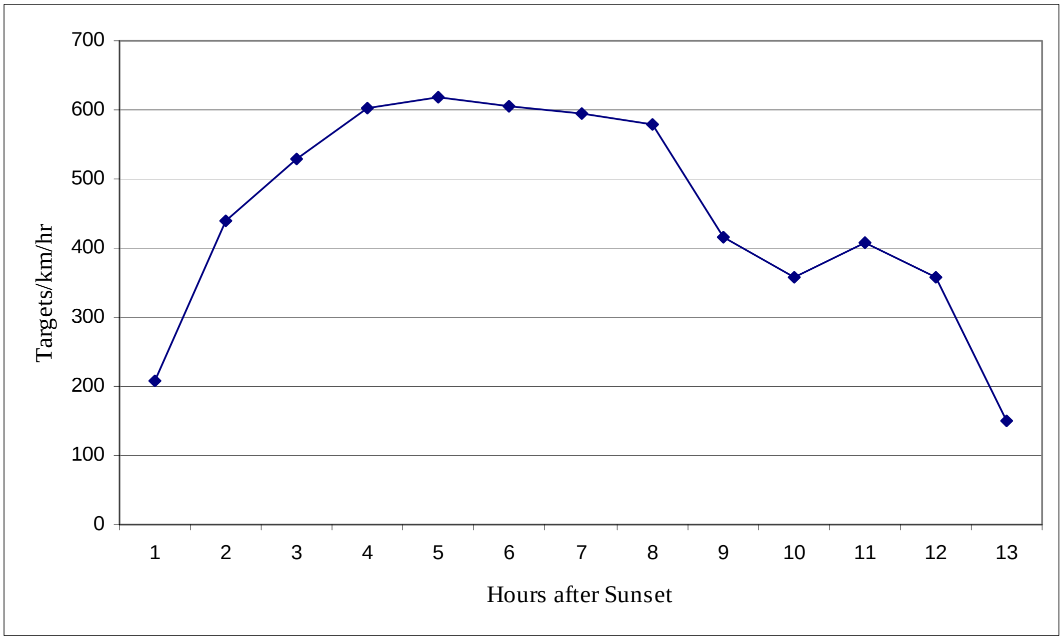


Figure 4. Hourly passage rates for entire season

3.2 Flight Direction

The mean flight direction through the project area was 223º ± 57º (Figure 5). There was considerable night-to-night variation in mean flight direction, although most nights included flight directions generally to the south and southwest (Appendix A Table 3).

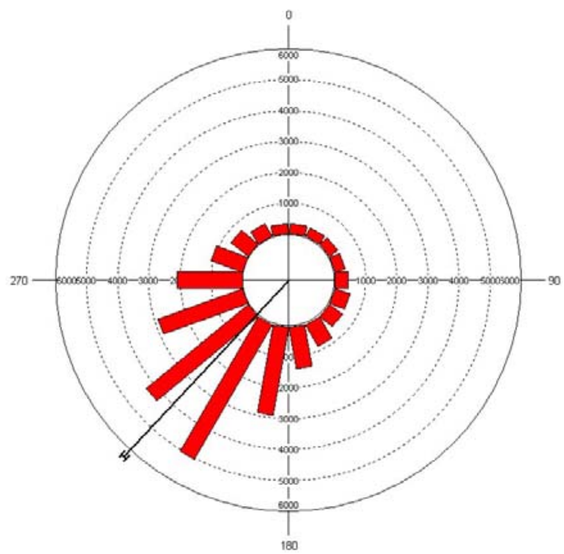


Figure 5. Mean flight direction through the project area (the bracket along the margin of the histogram is the 95% confidence interval).

3.3 Flight Altitude

The seasonal mean flight height of targets over the radar site was 455 m ± 15 m (1,493' ± 269'). The mean nightly flight height ranged from 310 m ± 20 m (1,017' ± 207') to 638 m ± 25 m (2,094' ± 280') (Figure 6; Appendix A Table 4). The percent of targets observed flying below 125 m (410') also varied by night, from 0 percent to 5 percent (Figure 7) and the seasonal average percentage of targets flying below this height was 1 percent. Hourly flight height remained consistent throughout the night with no large differences in flight height from hour to hour (Figure 8).

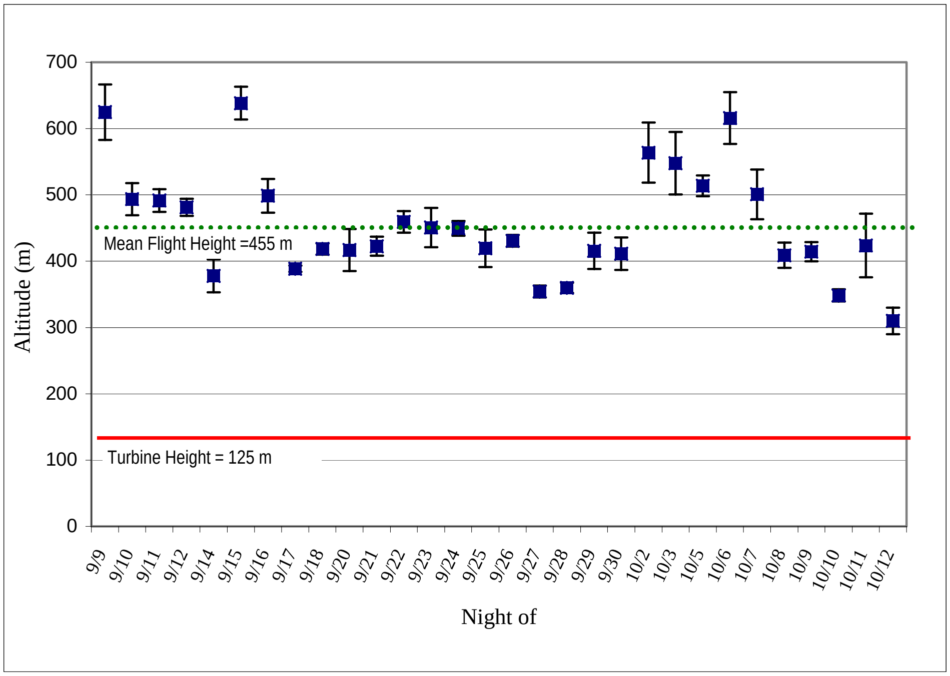


Figure 6. Mean nightly flight height of targets (error bars = +1 standard error) at Coos County, Fall 2006

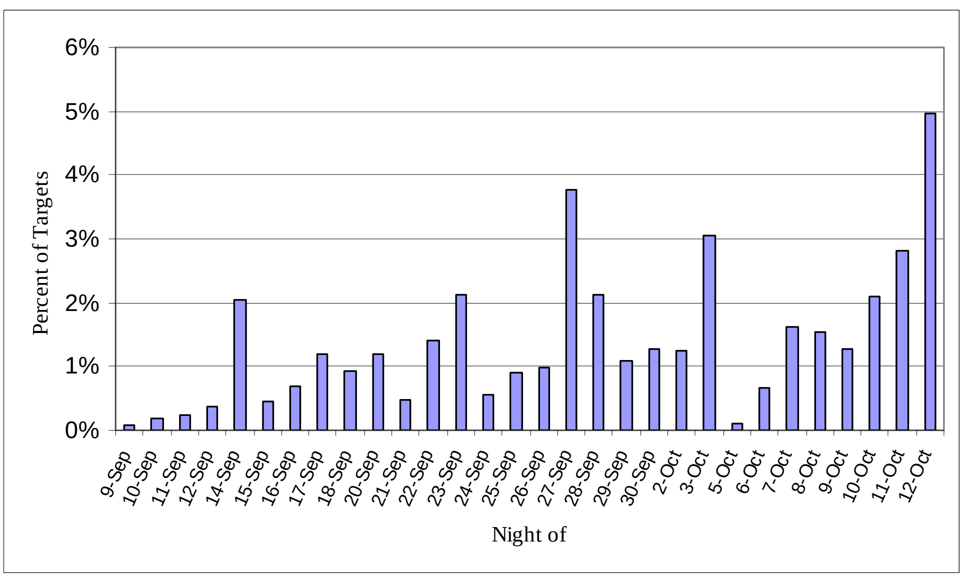


Figure 7. Percent of targets observed flying below a height of 125 m (410') at Coos County, Fall 2006

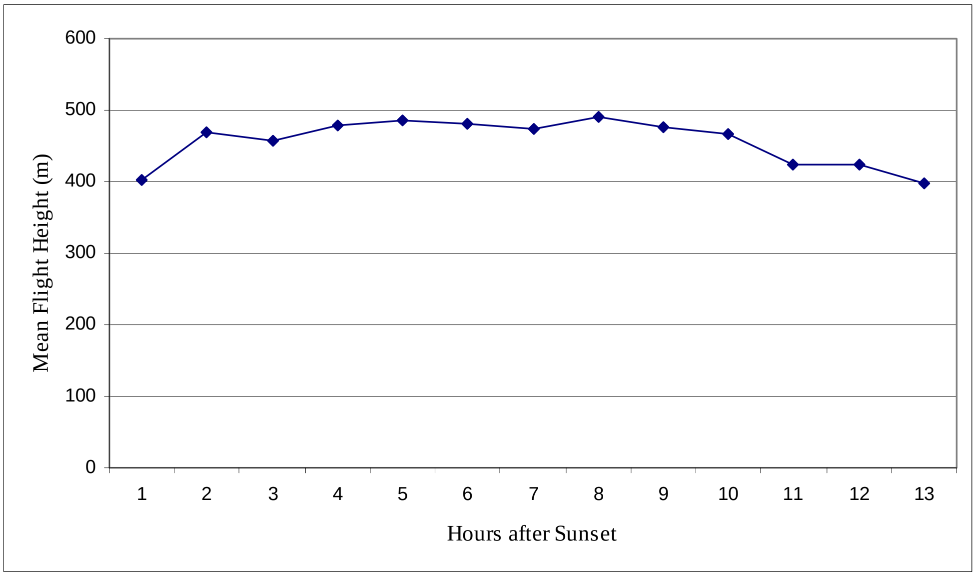


Figure 8. Hourly target flight height distribution at Coos County, Fall 2006

3.4 Ceilometer and Moonwatching Observations

Ceilometer data collected during the radar survey yielded a total of 242 5-minute observations. Those observations, however, resulted in only three bird and two bat sightings in the ceilometer beam (Appendix A Table 5). On nights that bats were observed in the ceilometer, several suspected bats were identified during radar data analysis. However, some nights with suspected bat activity on the radar screen, no bats were seen during the ceilometer survey.

4.0 Discussion

Fall 2006 radar surveys documented migration activity and patterns in the vicinity of the proposed project. In general, migration activity and flight patterns varied between and within nights, which is very typical of nocturnal migration. Nightly variation in the magnitude and flight characteristics of nocturnally migrating songbirds is not uncommon and is often attributed to weather patterns, such as cold fronts and winds aloft (Hassler *et al.* 1963, Gauthreaux and Able 1970, Richardson 1972, Able 1973, Bingman *et al.* 1982, Gauthreaux 1991). This was evident at the project area. Nights with winds from a northerly direction (winds optimal for fall migration), target flight direction was to the southwest. Additionally, on nights with winds from a northerly direction, passage rates were highest.

Surveys using similar methods and equipment conducted within the last several years are rapidly becoming available. These other studies provide an opportunity to compare the results from this study with other areas of the Northeast and the central Appalachian states. There are limitations in comparing data from previous years with data from 2006, as year-to-year variation in continental bird populations may effect how many birds migrate through an area. Additionally, differences in site characteristics, such as the landscape and vegetation surrounding a radar survey location, can play a large role in a radar's ability to see targets in all directions around it, so direct comparisons of sites should be made with caution.

Table 1. Summary of Available Radar Fall Survey Results.

Project Site	Landscape	Average Passage Rate (t/km/hr)	Range in Nightly Passage Rates	Average Flight Direction	Average Flight Height (m)	Percent Targets Below Turbine Height	Citation
Fall 1998							
Harrisburg, NY	Great Lakes plain / ADK foothills	122	N/A	181	N/A	N/A	Cooper and Mabee 1999
Wethersfield, NY	Agricultural plateau	168	N/A	179	N/A	N/A	Cooper and Mabee 1999
Fall 2003							
Chautauqua, NY	Great Lakes shore	238	10-905	199	532	(125 m) 4 %	Cooper *et al.* 2004a
Mt. Storm, WV	Forested ridge	241	8-852	184	410	N/A	Cooper *et al.* 2004b
Fall 2004							
Franklin, WV	Forested ridge	229	18-643	175	583	(125 m) 8%	Woodlot 2004a
Prattsburgh, NY	Agricultural plateau	193	12-474	188	516	(125 m) 3%	Woodlot 2004b
Prattsburgh, NY	Agricultural plateau	200	18-863	177	365	(125 m) 9%	Mabee *et al.* 2005
Deerfield, VT (Existing Facility)	Forested ridge	175	7-519	194	438	(100 m) <1%	Woodlot 2004c
Deerfield, VT (Western Expansion)	Forested ridge	193	8-1121	223	624	(100 m) 5%	Woodlot 2004c
Deerfield, VT (Valley Site)	Forested ridge	150	58-404	214	503	(100 m) <1%	Woodlot 2004c
Deerfield, VT (3 sites combined)	Forested ridge	178	7-1121	212	611	(100 m) 3%	Woodlot 2004c
Sheffield, VT	Forested ridge	114	19-320	200	566	(125 m) 1%	Woodlot 2006
Fall 2005							
Churubusco, NY	Great Lakes plain / ADK foothills	152	9-429	193	438	(120 m) 5%	Woodlot 2005a
Clinton County, NY	Great Lakes plain / ADK foothills	197	n/a	162	333	(n/a) 12%	Young 2006
Dairy Hills, NY	Agricultural plateau	94	n/a	180	466	(n/a) 10%	Young 2006
Fairfield, NY	Agricultural plateau / ADK foothills	691	116-1351	198	516	(125 m) 4%	Woodlot 2005b
Jordanville, NY	Agricultural plateau	380	26-1019	208	440	(125 m) 6%	Woodlot 2005c
Mars Hill, ME	Forested ridge	512	60-1092	228	424	(120 m) 8%	Woodlot 2005d
Sheldon, NY	Agricultural plateau	197	43-529	213	422	(120 m) 3%	Woodlot 2005e
Fall 2006							
Errol, NH	Forested ridge	469	22-1098	223	455	(125 m) 1%	this report

Some research suggests that bird migration may be affected by landscape features, such as coastlines, large river valleys, and mountain ranges. This has been documented for diurnally migrating birds, such as raptors, but is not as well established for nocturnally migrating birds (Sielman *et al*. 1981; Bingman *et al*. 1982; Bruderer and Jenni 1990; Richardson 1998; Fortin *et al*. 1999; Williams *et al.* 2001; Diehl *et al*. 2003; Woodlot, unpublished data).

The landscape in the project area is of mountainous terrain. The overall elevation differential across the site is approximately 305 m (1,000') to 1,036 m (3,400'). This differential is fairly considerable when comparing to other sites in the northeast that are at lower elevation. The mean flight height of 455 ± 15 suggests some migrants might fly below ridgelines while others might be flying well above the ridgelines in the area.

The emerging body of studies characterizing nighttime bird movements shows a relatively consistent trend in regards to the altitude at which night migrants fly (Table 1). In general, nighttime migration typically occurs several hundred meters or more above the ground. The range in mean flight heights is approximately 300 to 600 m (1,000' to 2,000') above the ground. The percentage of targets documented at heights below that of modern wind turbines is variable, but is typically 3 to 15 percent. Some studies, however, have documented even smaller percentages of targets below turbine height. The average flight height documented in Coos County (455 m, or 1,493') is well within the range of other studies in the region and the percent flying below maximum turbine height is much lower than at other studies.

5.0 Conclusions

Radar surveys during the fall 2006 migration period have provided information on nocturnal bird migration patterns in the vicinity of the project area. The results of the surveys indicate that bird migration patterns are generally similar to patterns observed at other sites in the region.

Migration activity varied throughout the season, which is largely attributable to weather patterns. The mean passage rate was comparable to passage rates documented at other recent studies in the region, indicating that migration activity over the project is not particularly unique. Additionally, the flight height data indicate that the majority of migration during the fall survey period took place well above the height of the proposed turbines over the radar station.

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Appendix A

Radar Survey Summary Data Tables

Appendix A Table 1. Survey dates, results, level of effort, and weather - Proposed Windpark in Coos County, NH – Fall 2006

Date	Passage rate	Flight Direction	Flight Height (m)	Hours of Survey	Temperature (F)	Wind Speed (mph)	Wind Direction (from)
9-Sep	633	188	625	11	52	4	NW
10-Sep	381	214	494	12	37	0	N/A
11-Sep	402	244	492	11	36	0	N/A
12-Sep	448	223	481	11	38	0	N/A
14-Sep	242	268	378	7	58	0	SSE
15-Sep	745	216	638	11	57	0	0
16-Sep	618	183	499	11	51	0	0
17-Sep	679	259	389	12	49	0	0
18-Sep	713	272	418	11	50	0	0
20-Sep	661	199	417	5	49	3	NW
21-Sep	885	208	423	12	45	1	NW
22-Sep	1098	236	459	11	45	0	N
23-Sep	176	24	451	11	54	0	W
24-Sep	367	186	450	12	53	6	NW
25-Sep	527	224	419	10	41	1	NW
26-Sep	813	216	431	11	33	0	SW
27-Sep	599	263	354	12	38	0	SE
28-Sep	291	267	360	10	55	10	SE
29-Sep	206	130	415	9	42	3	West
30-Sep	672	233	411	12	46	3	ESE
2-Oct	512	219	564	12	40	0	NNW
3-Oct	153	144	548	12	58	1	W
5-Oct	455	198	514	13	32	0	N
6-Oct	259	235	616	13	29	0	0
7-Oct	222	225	501	12	29	0	0
8-Oct	196	235	409	12	33	0	0
9-Oct	418	202	414	13	40	0	SW
10-Oct	459	246	348	13	N/A	N/A	N/A
11-Oct	22	295	424	6	51	4	W
12-Oct	227	181	310	10	41	2	W

Appendix A Table 2. Summary of passage rates by hour, night, and for entire season - Proposed Windpark in Coos County, NH
Fall 2006

Night of	Passage Rate (targets/km/hr) by hour after sunset													Entire Night		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**Mean**	**Stdev**	**SE**
9-Sep	686	175	380	964	600	1007	1114	820	446	343	429	--	--	633	309	93
10-Sep	339	557	484	541	471	407	450	309	279	250	295	193	--	381	120	35
11-Sep	67	379	600	616	561	418	370	377	375	300	354	--	--	402	154	47
12-Sep	146	327	536	729	611	589	529	416	400	300	350	--	--	448	167	50
14-Sep	99	260	240	313	236	279	268	--	--	--	--	--	--	242	68	26
15-Sep	621	999	1007	810	947	857	571	650	568	589	579	--	--	745	181	55
16-Sep	--	616	579	529	771	768	707	639	523	450	786	429	--	618	129	39
17-Sep	139	521	771	745	900	868	879	921	879	729	679	121	--	679	280	81
18-Sep	163	693	943	1125	814	820	836	811	--	711	932	0	--	713	336	101
20-Sep	413	977	536	639	741	--	--	--	--	--	--	--	--	661	214	96
21-Sep	289	868	1259	1307	1363	1157	1307	1264	557	343	343	557	--	885	437	126
22-Sep	286	1082	1564	1921	1811	1468	1251	1214	739	450	287	--	--	1098	587	177
23-Sep	139	193	121	150	180	193	223	164	107	209	257	--	--	176	45	14
24-Sep	471	316	163	54	43	364	424	429	466	476	707	493	--	367	195	56
25-Sep	210	1007	--	879	921	716	681	--	343	168	139	207	--	527	347	110
26-Sep	311	579	656	900	1157	1050	1050	1257	--	996	536	450	--	813	318	96
27-Sep	294	743	759	825	836	975	843	721	418	171	305	300	--	599	279	80
28-Sep	225	164	243	429	557	493	332	257	175	36	--	--	--	291	161	51
29-Sep	--	356	478	150	146	158	133	237	145	55	--	--	--	206	131	44
30-Sep	184	500	1023	1350	1554	1055	807	568	307	214	136	364	--	672	479	138
2-Oct	32	214	500	429	561	696	579	786	718	550	369	707	--	512	222	64
3-Oct	11	129	161	86	150	114	171	186	134	171	202	321	--	153	74	21
5-Oct	421	686	605	586	568	552	561	407	407	332	390	348	54	455	164	46
6-Oct	75	171	219	253	240	332	361	279	307	279	379	407	64	259	107	30
7-Oct	64	96	--	327	246	293	284	193	274	295	286	268	43	222	99	29
8-Oct	37	86	279	193	264	243	286	229	186	129	129	296	--	196	85	25
9-Oct	0	321	236	214	321	570	638	550	457	504	654	718	257	418	212	59
10-Oct	43	89	300	621	670	836	814	821	771	246	331	300	123	459	303	84
11-Oct	52	16	11	18	24	13	--	--	--	--	--	--	--	22	15	6
12-Oct	18	29	129	343	296	279	182	--	--	--	332	307	355	227	129	41
Entire Season	**208**	**438**	**528**	**601**	**619**	**606**	**595**	**580**	**416**	**357**	**407**	**357**	**149**	**469**	**250**	**46**

-- indicates no data for that hour

Appendix A Table 3. Mean Nightly Flight Direction - Proposed Windpark in Coos County, NH – Fall 2006

Night of	Mean Flight Direction	Circular Stdev
9-Sep	188	45
10-Sep	214	57
11-Sep	244	78
12-Sep	223	75
14-Sep	268	68
15-Sep	216	46
16-Sep	183	100
17-Sep	259	61
18-Sep	272	58
20-Sep	199	38
21-Sep	208	33
22-Sep	236	41
23-Sep	24	91
24-Sep	186	57
25-Sep	224	54
26-Sep	216	41
27-Sep	263	44
28-Sep	267	42
29-Sep	130	43
30-Sep	233	42
2-Oct	219	39
3-Oct	144	94
5-Oct	198	37
6-Oct	235	63
7-Oct	225	54
8-Oct	235	59
9-Oct	202	42
10-Oct	246	34
11-Oct	295	34
12-Oct	181	74
Entire Season	**223°**	**57°**

Appendix B Table 4. Summary of mean flight heights by hour, night, and for entire season - Proposed Windpark in Coos County, NH Fall 2006

Night of	Mean Flight Height (m) by hour after sunset													Entire Night			% of targets below 125 meters
	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	STDV	SE	
9-Sep	410	479	577	716	861	735	711	659	556	495	486	813	--	625	145	42	0%
10-Sep	575	661	552	505	493	501	465	440	430	444	366	--	--	494	80	24	0%
11-Sep	453	611	511	545	506	497	496	488	482	415	403	--	--	492	58	17	0%
12-Sep	514	548	479	540	508	480	453	409	414	511	450	468	--	481	45	13	0%
14-Sep	388	396	250	399	392	467	351	--	--	--	--	--	--	378	66	25	2%
15-Sep	486	740	731	648	640	718	711	589	644	621	485	648	--	638	85	25	0%
16-Sep	574	602	531	509	514	507	532	535	549	477	370	284	--	499	88	25	1%
17-Sep	371	389	422	393	404	379	387	402	385	372	371	--	--	389	16	5	1%
18-Sep	469	436	415	410	434	444	428	417	360	382	427	398	--	418	29	8	1%
20-Sep	371	425	322	484	482	--	--	--	--	--	--	--	--	417	71	32	1%
21-Sep	439	482	490	472	421	430	413	398	370	331	403	--	--	423	48	14	0%
22-Sep	479	584	515	464	463	446	445	387	401	435	433	--	--	459	54	16	1%
23-Sep	305	327	379	435	438	473	630	562	438	427	545	--	--	451	98	30	2%
24-Sep	406	456	411	--	458	512	503	459	472	430	419	418	--	450	36	11	1%
25-Sep	415	615	457	392	469	438	401	--	--	370	367	268	--	419	89	28	1%
26-Sep	463	418	433	450	426	418	--	436	436	479	407	372	--	431	29	9	1%
27-Sep	378	427	368	367	343	338	351	345	328	352	356	297	--	354	31	9	4%
28-Sep	365	385	386	389	351	322	346	359	336	--	--	--	--	360	24	8	2%
29-Sep	--	301	404	388	449	485	467	--	--	--	--	--	--	415	67	28	1%
30-Sep	519	531	512	423	352	294	337	351	425	395	387	--	--	411	80	25	1%
2-Oct	361	436	528	596	559	620	684	837	797	576	369	402	--	564	157	45	1%
3-Oct	373	--	--	403	601	490	511	649	839	795	454	409	501	548	157	47	3%
5-Oct	417	567	575	584	544	508	482	492	513	--	515	452	--	514	52	16	0%
6-Oct	235	524	618	684	673	645	649	740	--	719	681	551	673	616	135	39	1%
7-Oct	350	342	532	651	713	624	595	547	579	486	439	388	265	501	136	38	2%
8-Oct	--	393	371	492	456	524	467	412	373	421	335	362	300	409	66	19	2%
9-Oct	319	325	407	449	439	414	428	--	454	475	468	413	383	414	51	15	1%
10-Oct	253	377	361	363	377	355	365	369	372	336	324	334	343	348	34	9	2%
11-Oct	324	--	374	397	416	606	--	--	--	--	--	--	--	424	107	48	3%
12-Oct	258	389	329	311	363	303	161	--	--	--	329	339	318	310	63	20	5%
Entire Season	**403**	**470**	**456**	**478**	**485**	**482**	**473**	**491**	**476**	**467**	**424**	**423**	**398**	**455**	**82**	**15**	**1%**

Appendix A Table 5. Survey dates, results, level of effort, and weather - Proposed Windpark in Coos County, NH Fall 2006

Night of	Radar Results			Ceilometer Results			Weather Conditions		
	Birds	Bats	Insects	Birds	Bats	Insects	Temp	Wind Speed (mph)	Wind Direction (from)
9-Sep	96%	3%	1%	--	--	--	59	1	S
10-Sep	100%	0%	0%	--	--	--	59	1	W
11-Sep	100%	0%	0%	--	--	--	49	7	SE
12-Sep	100%	0%	0%	--	--	--	57	6	SE
14-Sep	84%	0%	16%	--	--	--	61	4	SSE
15-Sep	100%	0%	0%	0	1	26	61	3	ESE
16-Sep	100%	0%	0%	2	0	19	58	5	SE
17-Sep	98%	0%	2%	0	0	27	64	9	ESE
18-Sep	99%	0%	1%	0	0	19	51	7	W
20-Sep	100%	0%	0%	0	0	0	44	7	SE
21-Sep	100%	0%	0%	0	0	5	55	6	SE
22-Sep	100%	0%	0%	0	0	3	57	5	NW
23-Sep	100%	0%	0%	0	0	32	53	5	S
24-Sep	100%	0%	0%	0	0	3	46	7	SE
25-Sep	100%	0%	0%	0	0	2	57	10	SE
26-Sep	95%	5%	0%	0	1	5	60	14	SE
27-Sep	96%	4%	0%	0	0	6	41	5	SE
28-Sep	94%	2%	4%	0	0	2	54	10	SE
29-Sep	100%	0%	0%	0	0	0	52	2	S
30-Sep	89%	5%	6%	0	0	8	46	7	SE
2-Oct	76%	0%	24%	0	0	12	58	3	SE
3-Oct	76%	0%	24%	0	0	27	53	10	NW
5-Oct	100%	0%	0%	0	0	0	37	4	SE
6-Oct	98%	0%	2%	0	0	0	39	6	SE
7-Oct	92%	0%	8%	0	0	2	40	8	SE
8-Oct	70%	0%	30%	1	0	7	45	8	SE
9-Oct	84%	0%	16%	0	0	18	51	5	SE
10-Oct	98%	0%	2%	0	0	12	55	15	SE
11-Oct	84%	0%	16%	0	0	0	44	6	NW
12-Oct	63%	0%	37%	0	0	14	37	7	SE
Total	**95%**	**1%**	**5%**	**0**	**2**	**249**			