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Stantec

WOODLOT



To: Pip Decker, Noble Environmental Power
Rick Tillotson, Tillotson Corporation

From: Adam Gravel
Stantec Consulting

PN: 106195

Date: January 2, 2008

Reference: Coordinated Survey Results for proposed Granite Reliable Power and North Country Wind Projects in Coos County, New Hampshire

Stantec Consulting (formerly Woodlot Alternatives, Inc.)¹ has conducted nighttime radar bird migration surveys and bat detector surveys at two locations in Coos County, New Hampshire. The sites include Granite Reliable Power's proposed Wind Park (Granite) and the North Country Wind Project (North Country). The two sites are located approximately four miles apart, with the North Country project located nearly due north of Granite Reliable Power's project.

Radar Surveys

Because the nearby vegetation and topography at any radar site can affect the radar's view of the surrounding airspace, the radars at both sites were positioned in a way to maximize the viewable airspace 360 degrees around it. The vegetation and topography at both sites provided a natural barrier to minimize detection of objects that cause ground clutter and can obstruct views of the airspace. Surveys were conducted in the fall of 2006 and spring 2007 at both sites. At the Granite site, the radar was located approximately 610 meters (2000')² in elevation during the fall 2006 survey and at the summit of Owlhead Mountain at an elevation of 853 m (2800') during the spring 2007 survey. Both the fall 2006 and spring 2007 radar surveys at the North Country Wind Project were conducted from the saddle between the summits of Sanguinary Mountain and Mud Pond Ridge at an elevation of approximately 853 meters (2800'). The similarity of the radar view at both sites allows for appropriate comparisons between sites. Despite some difference in levels of effort between the two projects, surveys were coordinated so as to ensure radar equipment was operating simultaneously at both sites on most nights.

Results of those surveys were generally very similar. For example, mean seasonal passage rates during the fall 2006 surveys were within approximately eight percent of

¹ Stantec Consulting, Inc. formally acquired Woodlot Alternatives, Inc. on October 1, 2007.

² Due to limited access to the ridgeline for the Granite Project during the fall 2006, the radar was located approximately 2.5 miles west of Mt. Kelsey and Owlhead Mountain at a lower elevation (2000').

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each other and mean seasonal flight directions were within seven percent of each other. Similarly, mean seasonal flight heights of targets were within 26 percent of each other, with one to eight percent of targets documented to be flying less than the maximum turbine height. Results of the spring 2007 surveys were also generally very similar with mean seasonal passage rates within 13 percent of each other and mean seasonal flight directions within 17 percent of each other. Additionally, the seasonal mean flight heights of targets were within 14 percent of each other with 12 to 14 percent of targets flying below the maximum turbine height. For more details of the similarities between the project sites refer to tables 1 through 6 attached to the end of this document.

Although survey effort varied slightly between sites for each season, consistent trends were observed on a nightly basis. On nights with the greatest passage rates at one site, the other site also received equal migration traffic, often with only a difference of 5 to 20 targets/km/hr. Similar trends were also observed for nightly mean flight heights and flight directions of targets moving through the project areas (Tables 1-6).

Because of the similarity of results, Stantec facilitated discussions with Granite and North Country about sharing of results from these radar surveys. The similarity of these results help demonstrate that nighttime bird migration characteristics are similar across the landscape, and that the likelihood for significant concentrations (i.e., local flight pathways) of night migrants over either site is low. The similarity in results between these two sites appears to indicate that nighttime bird migration in the region is generally broad front in nature, i.e., flight characteristics, including target magnitude, flight direction, and flight altitude, is consistent across the landscape. Stantec believes the results of these coordinated efforts will be helpful in terms of depicting seasonal migration activities on a regional and local basis.

Bat Detector Surveys

Bat detectors were deployed at both project sites during spring and fall seasons. At the Granite project, detectors were deployed continuously from late April thru the end of October 2007 at heights of 20 m (66') and 50 m (164') within the guy wire arrays of two meteorological towers in the project area. At the North Country project, detectors were deployed in fall 2006 from early September through mid October, and in spring 2007 from late April thru early June. During both seasons, detectors were deployed at heights of 40 m (131') and 15 m (49') within the guy wire arrays of a single meteorological tower in the North Country project area³.

The results of those surveys were generally very similar. During the spring season, detection rates (number of bat passes recorded per detector night) varied from 0.2 to 0.5 among the six detectors. During the fall season, detection rates varied from 0.1 to 0.7 (Table 7). Although survey effort at the Granite site included additional detector nights, primarily during the summer months, the overall detection rates between the two projects remained very similar.

³ During fall 2006, detectors were initially deployed during August in the met tower opening, prior to the installation of the tower. When the tower was erected, the detectors were deployed in the guy wires. For the purposes of comparison, only results from detectors deployed in the met tower are included.

Reference: Coordinated Survey Results for proposed Granite Reliable Power and North Country Wind Projects in Coos County, New Hampshire

For all detectors, bat calls were identified to the lowest possible taxonomic level. These were then grouped into four guilds based either on similarity in call characteristics between some species or the uncertainty in the ability of frequency division detectors to adequately provide information for this differentiation. During both spring and fall surveys, the species composition at both sites was very consistent, with the majority of calls at all detectors at both sites identified either as unknown or within the big brown/silver-haired/hoary bat guild (Table 8).

Attachment: Tables 1-8

cc: Martha Staskus, Vermont Environmental Research Associates

Reference: **Coordinated Survey Results for proposed Granite Reliable Power and North Country Wind Projects in Coos County, New Hampshire**

Table 1. Nightly Mean Flight Directions - Fall 2006				
Night of	Granite Reliable Power		North Country	
	Mean Flight Direction	Circular Stdev	Mean Flight Direction	Circular Stdev
5-Sep	--	--	188	69
6-Sep	--	--	210	93
7-Sep	--	--	249	115
8-Sep	--	--	327	102
9-Sep	188	45	181	61
10-Sep	214	57	212	62
11-Sep	244	78	261	75
12-Sep	223	75	--	--
14-Sep	268	68	355	92
15-Sep	216	46	192	38
16-Sep	183	100	194	36
17-Sep	259	61	357	57
18-Sep	272	58	--	--
20-Sep	199	38	179	66
21-Sep	208	33	174	36
22-Sep	236	41	283	73
23-Sep	24	91	--	--
24-Sep	186	57	164	43
25-Sep	224	54	197	74
26-Sep	216	41	190	52
27-Sep	263	44	303	36
28-Sep	267	42	262	41
29-Sep	130	43	99	31
30-Sep	233	42	253	60
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°	208°	87°

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Table 2. Nightly Mean Flight Heights - Fall 2006								
Night of	Granite Reliable Power				North Country			
	Mean	Stdev	SE	% of targets below 125 meters	Mean	Stdev	SE	% of targets below 120 meters
5-Sep	--	--	--	--	225	111	64	17%
6-Sep	--	--	--	--	330	115	47	11%
7-Sep	--	--	--	--	351	92	28	3%
8-Sep	--	--	--	--	275	45	13	20%
9-Sep	625	145	42	0%	451	77	23	3%
10-Sep	494	80	24	0%	348	66	22	4%
11-Sep	492	58	17	0%	495	89	27	1%
12-Sep	481	45	13	0%				--
14-Sep	378	66	25	2%	309	26	9	11%
15-Sep	638	85	25	0%	467	134	39	3%
16-Sep	499	88	25	1%	396	69	21	7%
17-Sep	389	16	5	1%	336	33	15	8%
18-Sep	418	29	8	1%	--	--	--	--
20-Sep	417	71	32	1%	400	115	57	9%
21-Sep	423	48	14	0%	365	63	18	5%
22-Sep	459	54	16	1%	309	50	15	17%
23-Sep	451	98	30	2%	389	46	14	2%
24-Sep	450	36	11	1%	334	40	13	12%
25-Sep	419	89	28	1%	381	49	14	2%
26-Sep	431	29	9	1%	412	83	24	4%
27-Sep	354	31	9	4%	270	52	17	5%
28-Sep	360	24	8	2%	349	122	35	5%
29-Sep	415	67	28	1%	391	144	59	10%
30-Sep	411	80	25	1%	--	--	--	--
2-Oct	564	157	45	1%	--	--	--	--
3-Oct	548	157	47	3%	--	--	--	--
5-Oct	514	52	16	0%	--	--	--	--
6-Oct	616	135	39	1%	--	--	--	--
7-Oct	501	136	38	2%	--	--	--	--
8-Oct	409	66	19	2%	--	--	--	--
9-Oct	414	51	15	1%	--	--	--	--
10-Oct	348	34	9	2%	--	--	--	--
11-Oct	424	107	48	3%	--	--	--	--
12-Oct	310	63	20	5%	--	--	--	--
Entire Season	455	82	15	1%	361	66	14	8%

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Table 3. Nightly Mean Passage Rates - Fall 2006						
Night of	Granite Reliable Power			North Country		
	Mean	Stdev	SE	Mean	Stdev	SE
5-Sep	--	--	--	514	457	228
6-Sep	--	--	--	664	579	219
7-Sep	--	--	--	200	110	33
8-Sep	--	--	--	723	272	82
9-Sep	633	309	93	636	343	99
10-Sep	381	120	35	493	282	81
11-Sep	402	154	47	184	90	26
12-Sep	448	167	50	--	--	--
14-Sep	242	68	26	459	298	106
15-Sep	745	181	55	153	185	53
16-Sep	618	129	39	268	268	85
17-Sep	679	280	81	397	239	107
18-Sep	713	336	101			
20-Sep	661	214	96	843	665	332
21-Sep	885	437	126	747	284	82
22-Sep	1098	587	177	429	137	41
23-Sep	176	45	14			
24-Sep	367	195	56	429	206	59
25-Sep	527	347	110	840	455	144
26-Sep	813	318	96	653	279	81
27-Sep	599	279	80	696	322	93
28-Sep	291	161	51	153	139	46
29-Sep	206	131	44	208	172	52
30-Sep	672	479	138	906	499	166
2-Oct	512	222	64	--	--	--
3-Oct	153	74	21	--	--	--
5-Oct	455	164	46	--	--	--
6-Oct	259	107	30	--	--	--
7-Oct	222	99	29	--	--	--
8-Oct	196	85	25	--	--	--
9-Oct	418	212	59	--	--	--
10-Oct	459	303	84	--	--	--
11-Oct	22	15	6	--	--	--
12-Oct	227	129	41	--	--	--
Entire Season	469	250	46	505	246	54

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Table 4. Nightly Mean Flight Directions - Spring 2007				
Night of	Granite Reliable Power		North Country	
	Mean Flight Direction	Circular Stdev	Mean Flight Direction	Circular Stdev
26-Apr	3	51	43	60
27-Apr	26	63	107	65
28-Apr	--	--	215	127
29-Apr	79	58	--	--
30-Apr	147	67	--	--
1-May	75	62	78	68
2-May	112	69	--	--
3-May	116	53	133	44
7-May	60	23	--	--
8-May	75	34	96	47
9-May	120	92	125	116
10-May	28	51	78	69
11-May	173	112	--	--
12-May	126	68	129	77
13-May	86	38	102	52
14-May	50	44	78	50
15-May	15	45	--	--
18-May	104	87	115	63
19-May	110	81	69	76
20-May	360	44	--	--
21-May	87	28	104	44
22-May	38	65	69	71
23-May	63	47	75	53
24-May	97	37	119	55
25-May	98	44	101	62
26-May	106	78	96	81
28-May	93	45	113	56
29-May	84	37	--	--
30-May	255	137	--	--
31-May	87	31	--	--
1-Jun	84	43	--	--
Entire Season	76°	53°	92°	66°

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Table 5. Nightly Mean Flight Heights - Spring 2007								
Night of	Granite Reliable Power				North Country			
	Mean	STDV	SE	% of targets below 125 meters	Mean	STDV	SE	% of targets below 120 meters
26-Apr	583	70	29	6%	333	105	32	8%
27-Apr	310	178	73	30%	335	167	83	28%
28-Apr	--	--	--	--	145	114	47	55%
29-Apr	372	141	58	11%	--	--	--	--
30-Apr	81	35	20	68%	--	--	--	--
1-May	421	120	49	15%	237	56	28	28%
2-May	209	46	19	26%	--	--	--	--
3-May	289	194	87	34%	161	49	16	41%
7-May	375	102	34	13%	--	--	--	--
8-May	376	85	32	11%	350	76	24	7%
9-May	552	111	39	6%	416	81	26	8%
10-May	423	111	45	11%	394	69	23	5%
11-May	369	215	81	21%	--	--	--	--
12-May	341	319	121	35%	262	192	61	24%
13-May	217	50	19	40%	196	60	20	28%
14-May	346	51	19	9%	362	59	21	9%
15-May	444	154	89	19%	--	--	--	--
18-May	233	61	23	25%	238	131	44	28%
19-May	305	125	51	23%	338	130	43	10%
20-May	223	122	70	61%	--	--	--	--
21-May	194	58	24	32%	190	42	14	26%
22-May	469	177	79	8%	515	116	39	5%
23-May	304	45	16	13%	316	43	14	7%
24-May	280	38	17	18%	265	19	6	9%
25-May	328	65	27	15%	284	43	14	12%
26-May	257	17	7	21%	217	54	18	19%
28-May	196	49	22	31%	174	61	20	19%
29-May	247	28	11	21%	--	--	--	--
30-May	392	129	53	15%	--	--	--	--
31-May	442	199	81	6%	--	--	--	--
1-Jun	377	86	35	17%	--	--	--	--
Entire Season	332	110	20	14%	290	128	22	12%

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Table 6. Nightly Mean Passage Rates - Spring 2007						
Night of	Granite Reliable Power			North Country		
	Mean	Stdev	SE	Mean	Stdev	SE
26-Apr	478	179	63	207	135	43
27-Apr	11	11	4	27	28	9
28-Apr	--	--	--	24	33	10
29-Apr	324	221	78	--	--	--
30-Apr	48	23	10	--	--	--
1-May	427	203	72	262	158	50
2-May	194	130	43	--	--	--
3-May	97	39	15	124	65	21
7-May	855	63	24	--	--	--
8-May	641	301	100	177	59	19
9-May	339	140	53	206	55	18
10-May	386	255	104	157	64	23
11-May	138	100	33	--	--	--
12-May	99	74	26	98	62	20
13-May	218	132	54	133	82	26
14-May	291	131	66	320	95	34
15-May	8	10	4	--	--	--
18-May	142	84	32	127	97	31
19-May	373	290	102	254	154	49
20-May	2	3	1	--	--	--
21-May	870	362	128	387	192	64
22-May	619	224	79	285	116	39
23-May	703	212	80	310	123	41
24-May	705	241	85	238	84	28
25-May	545	237	97	210	72	24
26-May	398	213	75	113	57	19
28-May	342	89	40	71	45	15
29-May	378	213	95	--	--	--
30-May	93	70	25	--	--	--
31-May	82	39	16	--	--	--
1-Jun	457	156	59	--	--	--
Entire Season	342	97	18	187	99	22

Table 7. Summary of bat detector field survey effort and results											
Granite Reliable Wind Park						North Country Wind Project					
Location	Dates	# Detector-Nights*	# Recorded sequences	Detection Rate **	Maximum # calls recorded ***	Location	Dates	# Detector-Nights*	# Recorded sequences	Detection Rate **	Maximum # calls recorded ***
Spring 2007						Spring 2007					
Owl Head High	4/26-6/1	37	8	0.2	5	Met Tower High	4/26-6/11	47	25	0.5	18
Owl Head Low	4/30-6/1	19	5	0.3	2	Met Tower Low	4/13-6/11	60	25	0.4	11
Trio Pond's High	4/28-6/1	35	8	0.2	3						
Trio Pond's Low	4/28-6/1	35	12	0.3	2						
Overall Spring Results		126	33	0.3	--	Overall Spring Results		107	50	0.5	--
Summer/Fall 2007						Fall 2006					
Owl Head High	6/1-8/24, 8/28-9/26, 10/5-10/8, 10/18-10/22	124	50	0.4	10	Met Tower High	9/2 - 10/16	43	14	0.3	3
Owl Head Low	6/1-8/8, 8/29-9/11, 9/24-9/27, 10/4, 10/18-10/30	93	63	0.7	13	Met Tower Low	9/26- 10/8	13	1	0.1	1
Trio Pond's High	6/1-8/2, 8/16, 8/29-9/26, 10/8-10/30	116	80	0.7	7						
Trio Pond's Low	6/1-8/28, 9/5-9/26, 10/8-10/30	134	98	0.7	9						
Overall Summer/Fall Results		467	291	0.6	--	Overall Summer/Fall		56	15	0.3	--
Overall Year Results		593	324	0.5		Overall Year Results		163	65	0.4	

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Table 8. Summary of the composition of recorded bat call sequences					
Granite Reliable Wind Park			North Country Wind Project		
Spring 2007			Spring 2007		
Detector	Guild				Total
	Big brown guild	Red bat/E. pipistrelle	Myotis	Unknown	
Owl's Head High	1	1	--	6	8
Owl's Head Low	3	--	2	--	5
Trio Pond's High	2	--	1	5	8
Trio Pond's Low	3	--	3	6	12
Total Spring	9	1	6	17	33
	27%	3%	18%	52%	100%
Fall 2007			Fall 2006		
Detector	Guild				Total
	Big brown guild	Red bat/E. pipistrelle	Myotis	Unknown	
Owl Head High	19	--	--	31	50
Owl Head Low	35	--	3	25	63
Trio Pond's High	9	2	8	61	80
Trio Pond's Low	24	--	15	59	98
Total Fall	87	2	26	176	291
	30%	1%	9%	60%	100%
Overall Year Results	96	3	32	193	324
	30%	1%	10%	60%	100%
Detector	Guild				Total
	Big brown guild	Red bat/ E. pipistrelle	Myotis	Unknown	
Met Tower High	14	--	--	11	25
Met Tower Low	10	--	4	11	25
Total Spring	24	0	4	22	50
	48%	0%	8%	44%	100%
Total Fall	7	1	1	6	15
	47%	7%	7%	40%	100%
Overall Year Results	31	1	5	28	65
	48%	2%	8%	43%	100%