Fall 2005 Daytime Avian Migration Survey Report for the Kibby Wind Power Project

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1.0 INTRODUCTION

1.1 Project Context

TransCanada Energy Ltd. (TransCanada) is proposing to develop, own and operate a 100–200 megawatt (MW) wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Wind Power Project. The project is in a location for which a similar project proposal by U.S. Windpower was previously approved by the Land Use Regulation Commission (LURC). TransCanada intends to utilize existing information from that licensing effort and conduct additional baseline studies to appropriately determine the level of potential impact associated with the project.

The project will be located in an unincorporated area of Franklin County, Maine. Turbine locations are anticipated to be established along four ridgelines within the project area, as shown in Figure 1. The property is owned by Plum Creek and the surrounding areas are currently actively managed for forest products. The Kibby Wind Power Project can take advantage of existing logging roads and cleared areas to access the ridgelines, and forestry activities can continue with the project in place. The project will utilize the superior wind resource found in this vicinity to create clean, renewable power generation. TransCanada is committed to siting and designing the facilities to minimize environmental and community impacts to the extent possible.

The specific purpose of daytime avian migration surveys is to observe the approximate numbers, species, and patterns of use by spring and fall daytime migrating birds in the vicinity of the proposed Kibby Wind Power Project.

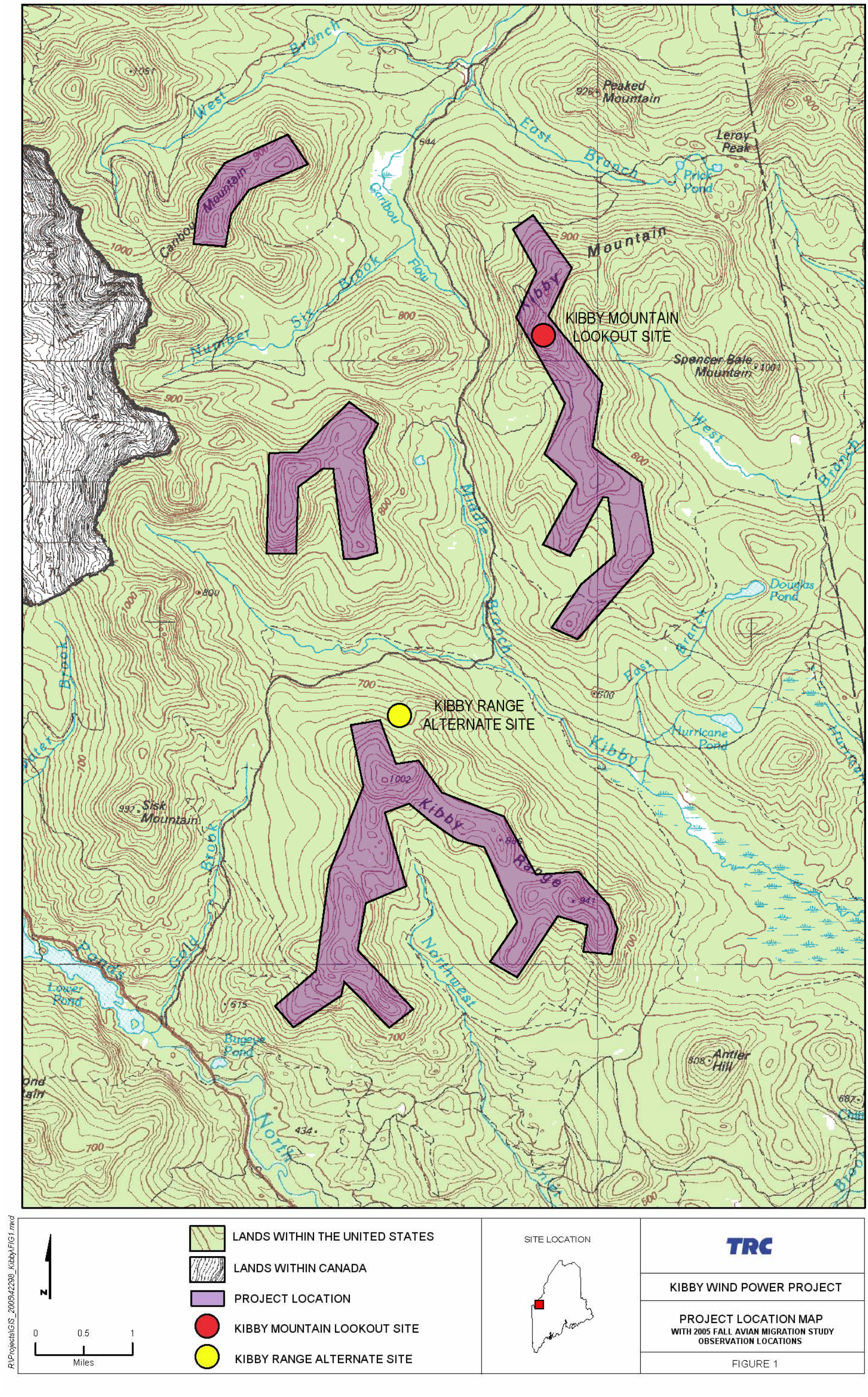
The purpose of this report is to document the findings of daytime avian migration surveys performed in the fall of 2005. These findings will be used in concert with previous studies conducted in the area as well as future findings (from anticipated 2006 spring and fall migration studies) to evaluate use, and to assess potential risk of avian collisions with the proposed turbines during periods of migration.

1.2 Project Area Description

The project area is located in the Boundary Mountains of western Maine, in Franklin County. It is within the Western Mountains Biophysical Region of Maine, which borders northern New Hampshire and Quebec, Canada.

The Western Mountains Biophysical Region is best characterized by its rugged topography, cool climate, low annual precipitation, and high snowfall. The average maximum temperature in July is approximately 24ºC (75ºF), which is lower than any other part of the state except the Eastern Coastal Region. The average minimum temperature in January is -18ºC (-1ºF), comparable to that of northern Maine. The average annual precipitation in this region is low, at approximately 15 centimeters (cm) (6 inches [in]) although this varies with elevation and aspect. Due to the rain shadow effect that mountains and mountain ranges produce, windward slopes may receive up to

Figure 1: Project Location



20 cm (8 in) of annual precipitation while leeward slopes may receive less than 14 cm (5.5 in) (McMahon 1990).

The predominant peaks in the project vicinity include Smart, Caribou, Kibby, Tumbledown, Spencer Bale and Sisk mountains, all of which are over 975 meters (m) (3,199 feet [ft]) high. Caribou and Kibby mountains are the tallest of these mountains, at 1,051 m (3,448 ft) and 1,115 m (3,658 ft), respectively, and are both included as potential wind turbine development areas of the project. Kibby Range is the largest of the mountain ranges in the project area, in terms of area and number of peaks included within ridgelines, and has several peaks that are approximately 915 m to 1,000 m (3,002 ft to 3,281 ft) high. The valley bottoms in the study area average between 650 m and 750 m (2,133 ft and 2,461 ft) in elevation. Gold Brook drains the southwestern portion of the project area southward, to the North Branch of the Dead River. Kibby Stream and Spencer Stream drain the central and eastern parts of the project area eastward, to the Dead River. The headwaters of the Moose River drain the northern parts of the project area.

Soils within the project area are generally cool, shallow, and well drained at elevations above 762 m (2,500 ft). The ridge tops are made up of shallow Saddleback soils while deeper Enchanted soils occur on upper slopes. Both of these soils are cryic and are characterized by a mean annual soil temperature between 0ºC and 8ºC (32ºF and 47ºF). Balsam fir (*Abies balsamea*) and red spruce (*Picea rubens*) are the dominant tree species along ridge tops above 762 m (2,500 ft). Sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) are the dominant tree species in the valleys. Within the maple/birch/beech forests of the lower elevations within the project area, hobblebush (*Viburnum lantanoides*) is the most common woody shrub species. The project area is located within a working forest. Consequently, the dominant forest types are present in a variety of different ages and species composition. The road system in the area is well developed and forest harvesting activities within the last 12 years are fairly evenly distributed throughout the townships. Harvesting is generally limited to areas below 823 m (2,700 ft).

1.3 Definitions

Kibby Vicinity: For the purpose of this report, the term “Kibby vicinity” refers to the entire general area depicted on Figure 1. It includes both project and non-project areas. During this study, migratory movements (to the extent visible from respective observation vantages) were recorded for birds traveling within the entire Kibby vicinity.

Project Area: For the purpose of this report, “project area” refers specifically (and collectively) to those areas depicted on Figure 1 as “project location.”

Avian Migrant: Efforts were made to record only migrating birds. This was judged primarily based on each individual’s behavior, and the expectancy for a given species to migrate. All raptors observed were recorded as migrants, due to their expectance to migrate. However, it is possible that some individuals were resident birds. Non-raptors were recorded only if they traveled continuously through the Kibby vicinity (typical of Canada geese and blue jays

observed), or if they rose from trees and headed in a consistent trajectory until out of sight (typical of most passerines observed).

1.4 Objectives

The main objectives of fall 2005 daytime avian migration surveys were to:

- Obtain a quantitative assessment of species composition, relative abundance, distribution, spatial patterns of use, and flight characteristics utilized by birds migrating during daytime hours in the Kibby vicinity and in the project area; and
- Identify route(s) used by daytime migrating birds passing through the Kibby vicinity and the project area.

1.5 Prior Studies

In 1992 and 1993, U.S. Windpower monitored fall raptor migration in the Kibby vicinity (NEWES 1993; U.S. Windpower 1994). Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors crossing the project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the project area. Where appropriate, the results from these surveys are compared to the results from the fall 2005 surveys.

2.0 STUDY METHODOLOGY

2.1 Survey Protocol

The methods for the daytime migrant survey protocol are largely based on methods used during daytime migrant monitoring performed for U.S. Windpower for this site and standards set forth by the Hawk Migration Association of North America (HMANA), and by HawkWatch International (Hoffman and Smith 2003). An interagency meeting with Maine Department of Inland Fisheries and Wildlife (MDIFW), United States Fish and Wildlife Service (USFWS), LURC, Maine Department of Environmental Protection (MDEP), and United States Army Corps of Engineers (USACE) was held August 18, 2005, to discuss proposed migration studies for the Fall 2005. During this discussion, Mr. Thomas Hodgman, MDIFW Bird Group, noted that the daytime migration studies performed for U.S. Windpower were a good model to follow. Written comments were also submitted by Mr. Hodgman, August 30, 2005, which stated that the proposed protocol (see Appendix A) was adequate.

2.1.1 Survey Site Locations

The Kibby Mountain lookout tower, a 15-foot tall fire tower, was selected as the observation point for daytime migration surveys due to its northern location in relation to the project area and its 360-degree viewshed. This location is identified on Figure 1, and referred to in this report as "Kibby Mountain Lookout." An alternate site was located in a clear-cut on the northern slope of Kibby Range ("Kibby Range Alternative Site" on Figure 1). This site was used when the cloud ceiling was low enough to limit visibility from the Kibby Mountain Lookout, but still allowed clear viewing up the Kibby Stream (Middle Branch) valley from another location.

2.1.2 Number and Timing of Surveys

Surveys were performed during periods of favorable weather for migration, i.e., timed to start the morning after the passage of a cold front and then conducted for three consecutive days. Surveys were not conducted during precipitation, in fog, on days that were overcast with low cloud cover, or during any other circumstances that hampered visibility. Some survey events were abbreviated if unfavorable weather conditions developed over the course of the survey effort. A total of 13 survey days were completed during September 2005. Average survey duration was approximately 6 hours per event.

2.1.3 Surveyor Preparedness

For the daytime migrant surveys, surveyors were familiarized with the topography of the area (including the elevation of the survey site, surrounding ridge elevations and distances from the sampling site, and tree height) prior to starting surveys. Each surveyor was trained in the methodology, and was expected to become familiar with the survey area prior to commencing surveys. Only persons experienced in bird identification performed these surveys.

2.1.4 Data Collection

Detailed weather and migratory bird observation data were collected during each survey. Data were entered on data sheets developed specifically for this project based on those used by HMANA (2005). Data were entered using codes and guidelines as suggested by HMANA (see Appendix B), with the exception that flight heights were characterized by relative height and location in relation to typical wind turbine heights instead of their position in relation to eye level (see Sections 2.1.4.2 and 3.3.1).

2.1.4.1 Weather Observations

Weather conditions were noted at the beginning of each survey and hourly thereafter if changes occurred. Data were collected based on codes and protocol used by HMANA, and were recorded directly onto weather observation data sheets. Parameters recorded included wind speed (estimated using Beaufort scale), wind direction (compass direction from which the wind is coming, or "variable"), temperature (degrees Celsius), relative humidity (as recorded daily for Berlin, New Hampshire), barometric pressure (as recorded daily for Berlin, New Hampshire), percent cloud cover (visually estimated by observer), visibility (distance estimated by observer based on landmarks and topography of known distances from observation point), and precipitation (general descriptions, such as light mist, drizzle, etc.).

2.1.4.2 Individual Bird Observations

When collecting data for daytime migrant surveys, surveyors performed continuous scanning with the naked eye and with binoculars. Typically, several hours of consecutive data were collected during each survey event. Each bird was watched for as long as the surveyor was able to see it with binoculars. In a few instances several birds passed at once; in this case, efforts were made to keep track of all individuals. Rarely, observation of an individual bird may have been truncated in order to observe an incoming individual. In most instances, surveyors were able to watch each individual continuously from the time it was detected until it was out of sight. The following data were recorded for each bird observed:

- Species (if possible)
- Sex (if possible)
- Age class (if possible)
- Flight height at first observation, and any changes during observation. Flight height was documented in three categories relative to typical wind turbine rotor swept area (RSA) height for passage within the project area. A fourth category was used for flight outside of the project area. Categories were recorded as:
  - (0) below typical RSA height (less than 100 feet above the ground);
  - (1) within typical RSA height (between 100 and 300 feet above the ground); and
  - (2) above typical RSA height (greater than 300 feet above the ground); and
  - (3) outside of project area.
- General location at first detection, and general course of flight over duration of observation

- Activity, including soaring (wings and tail fully spread, wings not flapping, usually riding air currents upward), flapping (continuous wing-beats during flight), gliding (downward coasting flight with wing tips pulled back, tails typically closed), perching, hunting, and other
- General compass bearing flight direction (S, SSW, NE, etc.)

It should be noted that flight heights were estimated using relative known elevations of various geographic features. For example, the known difference in elevation of a saddle and its adjacent peak/s was used to as a reference to estimate the flight height of a bird passing through that area. Approximate tree heights at various locations were also considered when estimating flight height.

Also, birds traveling in groups were recorded as flocks (see Section 2.1.4.3, below) if they shared common data parameters. Individuals within a group were recorded separately if data parameters (such as species, flight height, etc.) varied within the group.

2.1.4.3 Flock Observations

Flock observations were treated in the same way as individual bird observations, with counts or estimates of the number of birds comprising the flock. Groups were treated as flocks only if all data parameters were common to all individuals within the group for the entire duration of observation.

2.1.4.4 Field Quality Assurance and Quality Control

Data sheets were reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Any problems noted were rectified at that time, and any changes to the data sheets were initialed by the person making the change (if other than the original observer).

2.2 Data Analysis

Data were entered into and stored in a numerical database or spreadsheet format.

The following summaries and statistics were generated, as applicable, to address the objectives and goals of this study.

- Species lists and indices of bird relative abundance;
- Flight paths and heights, by species;
- Number of observations, by species, within the project area;
- Number and proportion of observations, by species, within typical wind turbine RSA height; and
- Frequency of activities observed.

3.0 RESULTS AND DISCUSSION

3.1 Species Identified and Relative Abundance

The passage of both raptor and non-raptor migratory species was documented during daytime migration surveys. Raptor and non-raptor groups are discussed respectively in Sections 3.1.1 and 3.1.2, below.

3.1.1 Raptor Species

A total of 13 daytime migration surveys were performed in September 2005. These surveys occurred on September 6, 7, 9, 10, 11, 14, 21, 22, 23, 24, 27, 28 and 29. The study consisted of a total of 75.5 observation hours.

A total of 252 individual raptors were recorded, representing at least 13 different species from 8 genera (Table 1). Only 25 of these raptors could not be identified to the species level: 15 were identified as buteos, 9 were identified as small accipiters, and 1 was identified as an unknown raptor.

Table 1. Raptor Species Observed During Fall 2005 Daytime Migration Surveys, and their Relative Abundance

Species	Latin Name	Number Observed	Relative Abundance
Buteo			
Red-tailed hawk	*Buteo jamaicensis*	81	32.1%
Broad-winged hawk	*Buteo platypterus*	50	19.8%
Unknown buteo	(Buteo sp.)	15	6.0%
Subtotal		*146*	*57.9%*
Accipiter			
Sharp-shinned hawk	*Accipiter striatus*	34	13.5%
Cooper's hawk	*Accipiter cooperii*	7	2.8%
Northern goshawk	*Accipiter gentilis*	3	1.2%
Unknown small accipiter	(Accipiter sp.)	9	3.6%
Subtotal		*53*	*21.0%*
Pandion			
Osprey	*Pandion haliaetus*	34	13.5%
Subtotal		*34*	*13.5%*
Falco			
American kestrel	*Falco sparverius*	5	2.0%
Merlin	*Falco columbarius*	1	0.4%
Peregrine falcon	*Falco peregrinus*	3	1.2%
Subtotal		*9*	*3.6%*

(Continued on next page)

Haliaeetus			
Bald eagle	*Haliaeetus leucocephalus*	3	1.2%
Subtotal		*3*	*1.2%*
Aquila			
Golden eagle	*Aquila chrysaetos*	2	0.8%
Subtotal		*2*	*0.8%*
Circus			
Northern harrier	*Circus cyaneus*	3	1.2%
Subtotal		*3*	*1.2%*
Cathartes			
Turkey vulture	*Cathartes aura*	1	0.4%
Subtotal		*1*	*0.4%*
Unknown Raptors			
Raptor sp. (sm)	*N/A*	1	0.4%
Subtotal		*1*	*0.4%*
TOTALS		**252**	**100.0%**

Buteos were most abundant, comprising 57.9 percent of all individuals recorded. Accipiters comprised 21.1 percent of all individuals recorded. The four most abundant species were red-tailed hawks (32.1 percent of all records), broad-winged hawks (19.8 percent of all records), osprey (13.5 percent of all records), and sharp-shinned hawks (13.5 percent of all records). All other genera/species combined comprised only 7.6 percent of all observations.

In 2005, the number of raptors observed per hour of effort was highest during the middle of September, with lower frequency of observations early and late in the month (see Table 2). This generally agrees with the results of the 1992 and 1993 studies performed in the project area (U.S. Windpower 1994). The average rate of observations for the fall 2005 season was 3.34 raptors per hour of effort.

Table 2. Number of Raptors Observed Per Hour of Effort, by Date

Date	Hours of Observation	Number of Raptors	RAPTORS PER HOUR
9/6/2005	6.5	18	***2.77***
9/7/2005	9	6	***0.67***
9/9/2005	1.5	5	***3.33***
9/10/2005	7	29	***4.14***
9/11/2005	6	34	***5.67***
9/14/2005	5.75	17	***2.96***
9/21/2005	8.75	51	***5.83***
9/22/2005	7	22	***3.14***
9/23/2005	4.25	18	***4.24***
9/24/2005	5	27	***5.40***
9/27/2005	4.25	14	***3.29***

(Continued on next page)

9/28/2005	7	10	***1.43***
9/29/2005	3.5	1	***0.29***
TOTALS:	**75.5**	**252**	**AVERAGE: 3.34**

Three state- and/or federal-listed raptor species were recorded during fall 2005 surveys. Three bald eagles (*Haliaeetus leucocephalus* – State Threatened, Federal Threatened), two golden eagles (*Aquila chrysaetos* – State Endangered) and three peregrine falcons (*Falco peregrinus* – State Endangered) were observed, for a total of eight individual listed birds. Collectively, these eight individuals represent 3 percent of all raptors recorded during the 2005 season.

Similar studies, performed by U.S. Windpower in 1992 and 1993, reported somewhat variant findings (see Table 3). In 1992 and 1993, broad-winged hawks were the most abundant species, recorded at 55 percent and 60 percent, respectively. In 2005, they were among the most abundant species, but were observed less frequently (19.8 percent) than in previous studies. Instead, red-tailed hawks (which represented 14.7 percent of all observations in 1992, and made up only 3.3 percent of the observations in 1993) were the most abundant species observed in 2005. Ospreys have been recorded fairly consistently in each study year (i.e., about 13.5 percent of the observations). Other species have been recorded at varying degrees of relative abundance in each of the study years.

Table 3. Comparison of Species Relative Abundance, 1992, 1993 and 2005

Parameter	1992	1993	2005
Total records from Kibby Mountain Lookout	100	60	252 [a]
No. of Species	8	11	13
No. of Genre	4	6	8
Top Species (% Relative Abundance) [b]			
#1	Broad-winged (55%)	Broad-winged (60%)	Red-tailed (32.1%)
#2	Red-tailed (14.7%)	Osprey (5.1%)	Broad-winged (19.8%)
#3	Osprey (7.3%)	Merlin (4.7%)	Osprey (13.5%)
#4	American kestrel (5.5%)	5 species (3.3% each)	Sharp-shinned (13.5%)
RTE Species [c]			
Bald eagle (S/F: Threatened)	0	1	3
Golden eagle (S: Endangered)	0	0	2
Peregrine falcon (S: Endangered)	1	3	3

[a] Includes 18 individuals observed from Kibby Range Alternate vantage

[b] 1992 and 1993 data (NEWES 1993, U.S.Windpower 1994) calculated based on total numbers observed from all sites (not limited to Kibby Mountain Lookout); 2005 data based on 252 total individuals observed, including 18 individuals from Kibby Range Alternate.

[c] RTE = Rare, Threatened and Endangered species; S = State-listed; F = Federal-listed

Listed species were also recorded during the previous U.S. Windpower studies. One peregrine falcon was seen in 1992, and three peregrines and one bald eagle were seen in 1993. Golden eagles were not observed during the previous formal surveys; however, two were observed flying together near Kibby Range on September 10, 1993.

3.1.2 Non-Raptor Species

A total of 207 individual non-raptor migrants were recorded during daytime migration surveys (Table 4). The majority of these (an estimated 109 individuals, or 52.7 percent of all non-raptor daytime migrants) were Canada geese, which were observed in 3 separate flocks.

Table 4. Non-Raptor Species Observed During Fall 2005 Daytime Migration Surveys, and their Relative Abundance.

Species	Latin Name	# Observed	Relative Abundance
Canada goose	*Branta canadensis*	109	52.7%
Blue jay	*Cyanocitta cristata*	50	24.2%
Yellow-rumped warbler	*Dendroica coronata*	24	11.6%
(Warbler sp.)	(Warbler sp.)	10	4.8%
Dark-eyed junco	*Junco hyemalis*	6	2.9%
Magnolia warbler	*Dendroica magnolia*	3	1.4%
Cedar waxwing	*Bombycilla cedrorum*	2	1.0%
Black-throated blue warbler	*Dendroica caerulescens*	1	0.5%
Chestnut-sided warbler	*Dendroica pensylvanica*	1	0.5%
(Dendroica sp.)	(Dendroica sp.)	1	0.5%
TOTALS:		207	100.0%

It should be noted that passerine observations were limited to a small area (a few hundred feet) around the observer. Passerines within several hundred feet of the surveyors' vantage point were more likely to be observed than those further away. In comparison, larger species such as raptors and Canada geese could be seen thousands of feet away.

It should also be noted that the only species that were documented to be moving in flocks were Canada geese and blue jays. Three large flocks of Canada geese passed through the Kibby Mountain vicinity during observation. These flocks were observed between 9:00 AM and 3:00 PM, and they moved through the vicinity at high altitudes. Several small flocks (less than 12 birds per flock) of blue jays were observed. All blue jays were observed between 7:00 AM and noon, and they typically moved through the project area at low altitudes.

Aside from blue jays, the passerines that were documented were typically noted moving singularly or in pairs. These species typically migrate nocturnally, and in flocks. They were noted during daytime migration studies only if they were observed in continuous flight along a consistent trajectory. Most of these species were documented prior to 9:00 AM, and many of them were observed to come up out of the trees and head off in continuous flight. It is possible

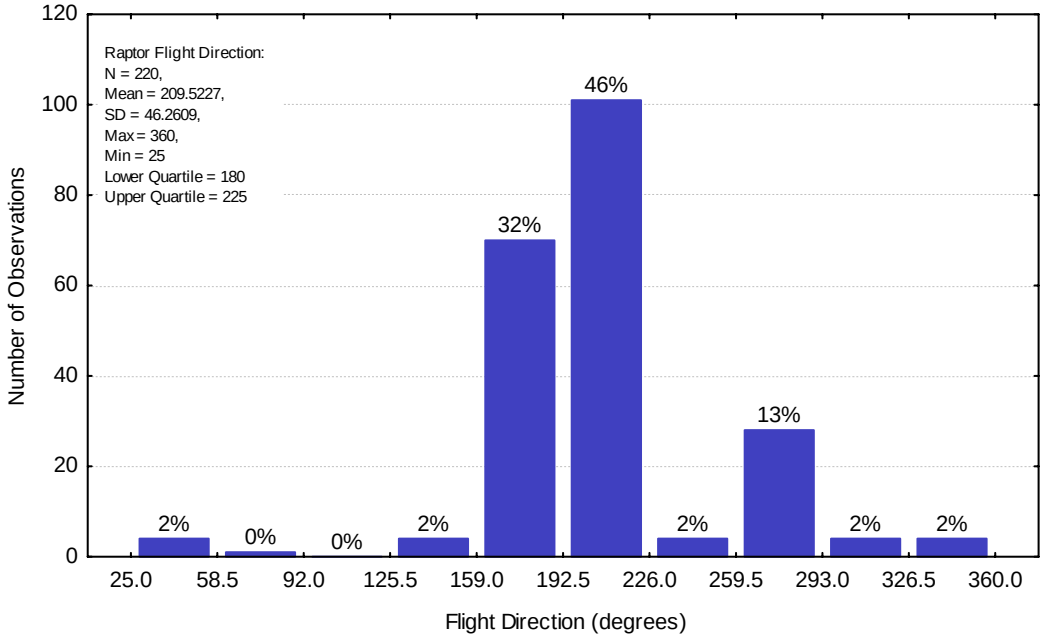
that these movements were associated with morning dispersal of nocturnal migrants for the purpose of foraging, however, they were recorded as migrants for the purposes of this study.

3.2 General Flight Paths Observed in the Kibby Vicinity

3.2.1 Raptor Species

As illustrated in Figure 2, the overwhelming percentage of raptor observations (78 percent) trend in a southeast-to-southwest direction, with considerably fewer observations (combined total = 22 percent) trending to the north/northeast, east/southeast, southwest/west, and west/northwest.

Figure 2: Direction of Raptor Flights

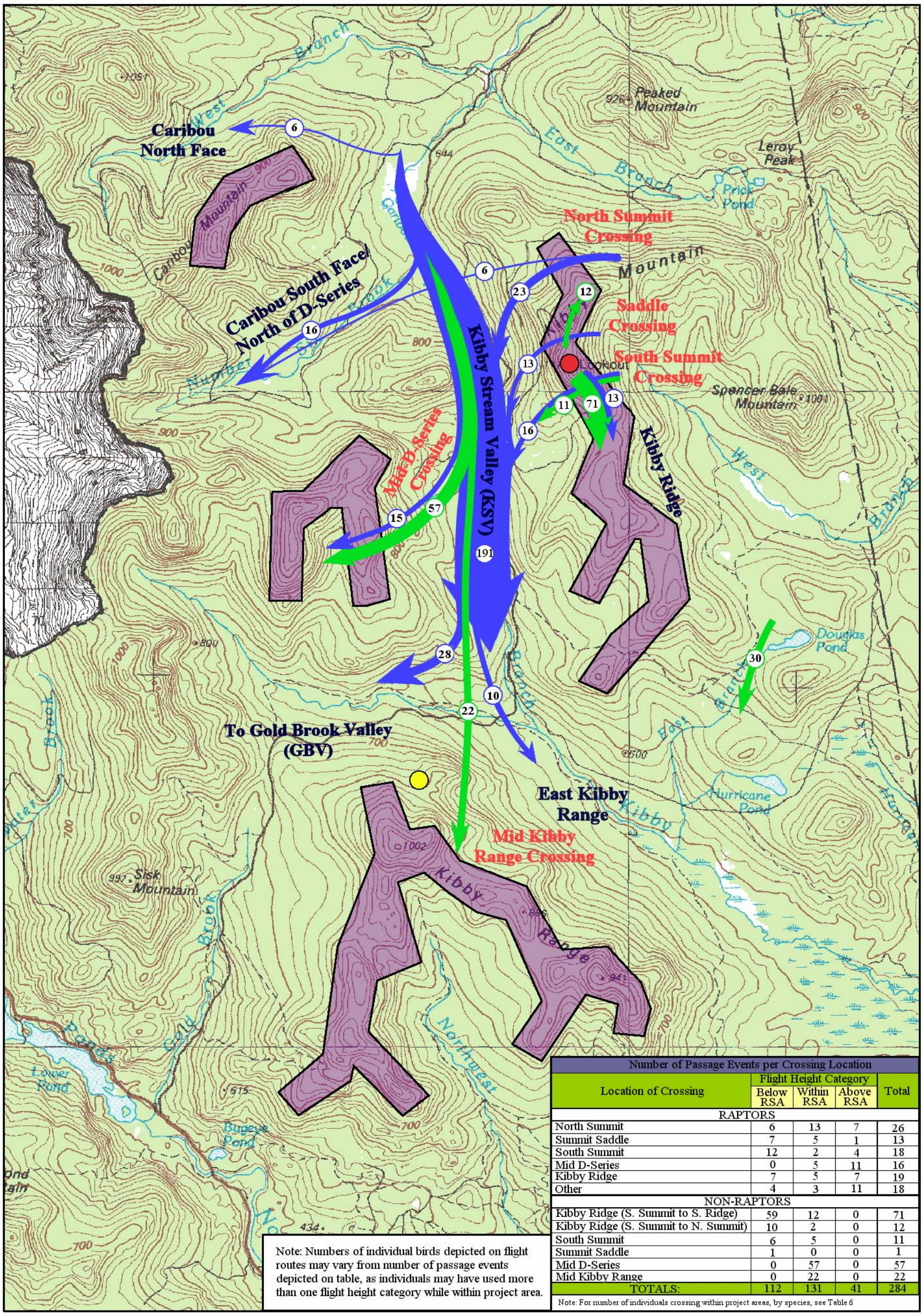


(N=360°; E = 90°; S=180°; and W=270°)

A diagrammatic representation of the flight paths used by migrating raptors through the project area during the fall 2005 migration season is depicted on Figure 3. The line weights of flight paths depicted on Figure 3 are roughly relative to the number of birds documented to use that route; the actual numbers of birds using each flight path are also depicted. It should be stressed that the flight paths depicted are approximate, and based on the visual observations from the Kibby Mountain Lookout.

With respect to the effects of landscape features, as depicted on Figure 3, the majority (191 individuals) of raptors first appeared in the valley just west of the Kibby Mountain summit. Several others (71 individuals) approached from the northeast, crossing the north ridge of Kibby Mountain (i.e., north of the Kibby Mountain Lookout) in various locations. Most birds then traveled down Kibby Stream (Middle Branch) valley between Kibby Mountain and D-Series ridge, then toward the east shoulder of Kibby Range before going out of sight. This path

Figure 3: Daytime Migrant Migration Routes



appeared to have a divergence near the north summit of Kibby Range, where some birds (28 individuals) headed southwest to cross between the toe of D-Series ridge and the north end of Kibby Range; this route would lead to the Gold Brook valley on the west side of Kibby Range. Alternatively, some birds (10 individuals) continued southward along the east side of the Kibby Range. In most cases, birds were out of sight before their course at this divergence could be determined.

It should be noted that surveyors monitored the area 360° around their vantage, and no raptors were observed to fly down the valley on the east side of Kibby Mountain. Rarely, individuals appeared on the east side of Kibby Ridge, but then crossed the mountain or traveled along the ridge to the Kibby Stream valley.

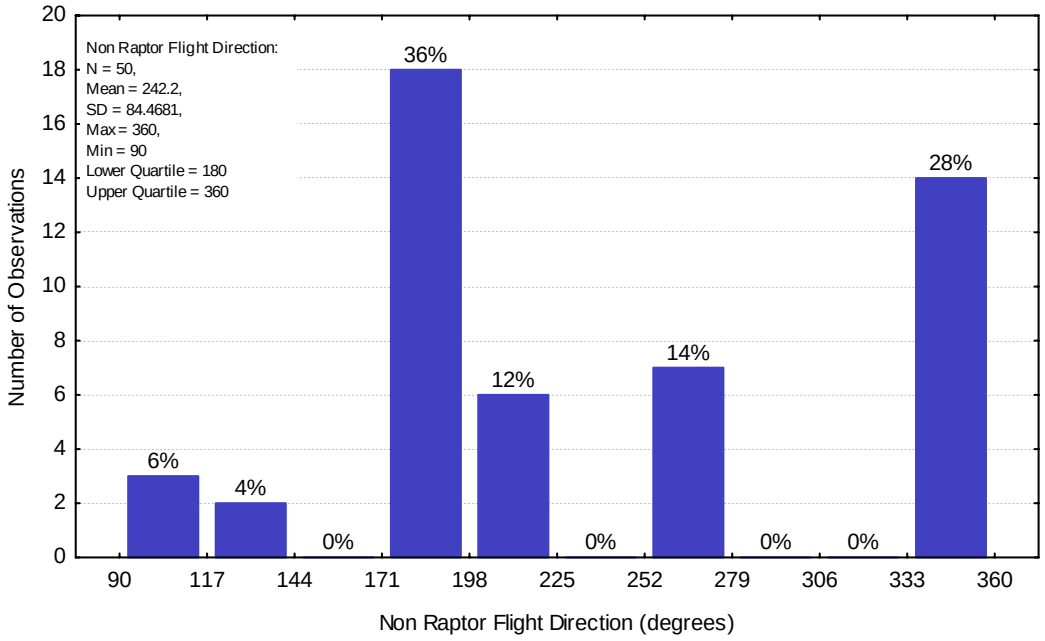
The flight paths described herein for fall 2005 are similar to those described for this area during the 1992 and 1993 U.S. Windpower surveys (U.S. Windpower 1994).

The only migration routes that seemed to be dominated by a specific species were a west-southwesterly traverse through the valley between the south face of Caribou Mountain and the north summit of the D-Series ridge, and a westerly traverse along the north face of Caribou Mountain. These routes were frequented by red-tailed hawks, with most traffic occurring on one survey date. It is unclear if this trend was related to species preference or to ambient wind conditions on that day.

3.2.2 Non-Raptor Species

The majority of non-raptor species were Canada geese and blue jays, which were observed in a few discrete flocks. Other species were observed relatively infrequently. For this reason, data for analysis of flight direction are limited. However, based upon the limited data available, the flight paths of non-raptor species trend in either a north/northeast direction (28 percent) or a southeast/south direction (36 percent), with lesser contributions towards the west/southwest (14 percent), southwest (12 percent), southeast (4 percent), and east/southeast (6 percent) (see Figure 4).

Figure 4: Direction of Non-Raptor Flights



(N=360°; E = 90°; S=180°; and W=270°)

In large part however, the movements of passerines recorded during daytime migration surveys were inconsistent, as shown on Figure 4. Individuals were typically observed in continuous flight in a given trajectory, however, trajectories varied widely per individual. Many of the species that were recorded during daytime migrant surveys are typically considered to be night-time migrants. It is possible that their observed movements were for the purposes of distributing to other, more desirable foraging habitats.

All blue jays recorded (except one) traveled at tree-top level along the higher elevations of Kibby Mountain's ridge, and then turned down the Kibby Stream valley. One blue jay flew down the valley without first traversing the ridgetop.

Three flocks of Canada geese passed through the project area during the fall 2005 survey period. One flock of 30 individuals traveled down the valley to the east of Kibby Mountain. One flock of 22 traveled down the Kibby Stream valley, then crossed over Kibby Range approximately mid-way down its eastern ridge. One flock of 57 traveled down the Kibby Stream valley, then crossed D-Series ridge approximately mid-way down its eastern ridge.

A diagrammatic representation of the approximate flight paths of non-raptor species is depicted on Figure 3.

3.3 Project Area Flight Paths and Flight Heights

3.3.1 Raptor Species

Most species moved through the Kibby vicinity at highly variable flight heights. For this reason, heights were only differentiated when birds passed within the project area. Flight height within the RSA of typical wind turbines was documented as (0) below, (1) within, or (2) above typical RSA height. Flight outside of the project area was recorded as a separate category (3). Each bird observed may have been recorded in one or more of these four categories while in the Kibby vicinity. Likewise, individuals may have been recorded in multiple flight height categories while in the project area.

Of 252 raptors recorded, 87 individuals (35 percent) were observed within the project area at some point in their flight path. The remaining 165 individuals (65 percent) never passed within the project area (see Table 5). Among the 87 raptors that were recorded to pass within the project area, 33 passed within typical RSA height at some point during their flight (Table 5). Thirty-one raptors passed below typical RSA height at some point during their flight, and 39 raptors passed above typical RSA height at some point during their flight.

Table 5. Raptor Flight Heights, Passages Within Areas of Proposed Arrays, and Crossing Locations by Genre and Species

Species	Flight Height Category				Location relative to Project Area		Number of Individuals Observed					
	Below RSA	Within RSA	Above RSA	Outside Project area	IN	OUT	North Summit	Summit Saddle	South Summit	D-Series	Kibby Ridge	Other
Buteo												
Red-tailed hawk	3	14	10	81	23	58	6	4	1	8	1	3
Broad-winged hawk	8	8	9	43	21	29	9	3	1	3	3	5
Buteo sp.	1	0	1	14	2	13	1	0	0	0	0	1
Subtotal	*12*	*22*	*20*	*138*	*46*	*100*	*16*	*7*	*2*	*11*	*4*	*9*
Accipiter												
Sharp-shinned hawk	11	2	5	32	16	18	3	1	7	0	5	1
Cooper's hawk	3	0	1	6	4	3	0	3	3	0	0	1
Northern goshawk	0	0	0	3	0	3	0	0	0	0	0	0
Accipiter sp. (sm)	1	1	1	9	1	8	0	0	0	0	1	0
Subtotal	*15*	*3*	*7*	*50*	*21*	*32*	*3*	*4*	*10*	*0*	*6*	*2*
Pandion												
Osprey	0	2	6	32	7	27	1	0	1	3	0	2
Subtotal	*0*	*2*	*6*	*32*	*7*	*27*	*1*	*0*	*1*	*3*	*0*	*2*
Falco												
American kestrel	3	1	1	4	4	1	0	1	2	0	0	1
Merlin	0	1	0	1	1	0	0	1	0	0	0	0
Peregrine falcon	0	2	1	3	2	1	1	0	0	0	1	0
Subtotal	*3*	*4*	*2*	*8*	*7*	*2*	*1*	*2*	*2*	*0*	*1*	*1*
Haliaeetus												
Bald eagle	0	0	1	2	1	2	0	0	1	0	0	0
Subtotal	*0*	*0*	*1*	*2*	*1*	*2*	*0*	*0*	*1*	*0*	*0*	*0*
Aquila												
Golden eagle	0	1	1	2	2	0	1	0	0	1	0	0
Subtotal	*0*	*1*	*1*	*2*	*2*	*0*	*1*	*0*	*0*	*1*	*0*	*0*
Circus												
Northern harrier	1	0	1	2	2	1	1	0	0	0	1	0
Subtotal	*1*	*0*	*1*	*2*	*2*	*1*	*1*	*0*	*0*	*0*	*1*	*0*

(Continued on next page)

Species	Flight Height Category				Location relative to Project Area		Number of Individuals Observed					
	Below RSA	Within RSA	Above RSA	Outside Project area	IN	OUT	North Summit	Summit Saddle	South Summit	D-Series	Kibby Ridge	Other
Cathartes												
Turkey vulture	0	1	1	1	1	0	0	0	0	0	1	0
Subtotal	*0*	*1*	*1*	*1*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*
Unknown Raptors												
Raptor sp. (sm)	0	0	0	1	0	1	0	0	0	0	0	0
Subtotal	*0*	*0*	*0*	*1*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*0*
TOTALS	**31**	**33**	**39**	**235**	**87**	**165**	**23**	**13**	**16**	**15**	**13**	**14**

Most instances of passage into the project area consisted of brief traverses (or crossings) in five general areas. These areas include:

- across the north side of the north summit of Kibby Mountain,
- across the saddle between the north and south summits of Kibby Mountain,
- across the south side of the south summit of Kibby Mountain,
- along the ridge of Kibby Mountain, and
- across the eastern ridge of D-Series.

The areas listed above are depicted on Figure 2, along with a table which lists the number of occurrences of passage below, within or above typical RSA height at each location. Note that the arrows depicted on Figure 3 for these crossings show an average route; actual travel occurred within the general area indicated by these symbols. The number of individuals, by species, which used these respective areas are listed on Table 5. The numbers of occurrences of passage below, within and above typical RSA height, by location and by species, are presented in Table 6. In a few instances, individuals passed into or through the project area in random locations. These events are listed as "other" on Figure 3 and in Tables 5 and 6. Table 6 also delineates the number of individuals, by species, which crossed the project area in multiple locations.

Table 6. Number of Occurrences of Raptor Species Below, Within and Above Typical RSA Height, by Crossing

Crossing *Species (#)*	Flight Height Category			TOTAL
	Below RSA	Within RSA	Above RSA	
North Summit	**6**	**13**	**5**	**24**
Buteo sp. (1)			*1*	*1*
Broad-winged hawk (7)	*5*	*5*		*10*
Golden eagle (1)		*1*		*1*
Northern harrier (1)			*1*	*1*
Osprey (1)			*1*	*1*
Peregrine falcon (1)		*1*		*1*
Red-tailed hawk (6)		*5*	*1*	*6*
Sharp-shinned hawk (3)	*1*	*1*	*1*	*3*
Summit Saddle	**2**	**5**	**1**	**8**
Broad-winged hawk (2)	*1*	*1*		*2*
American kestrel (1)		*1*		*1*
Red-tailed hawk (4)	*1*	*3*	*1*	*5*
South Summit	**6**	**2**	**4**	**12**
Bald eagle (1)			*1*	*1*
American kestrel (1)	*1*			*1*
Merlin (1)		*1*		*1*
Osprey (1)		*1*	*1*	*2*
Red-tailed hawk (1)			*1*	*1*
Sharp-shinned hawk (6)	*5*		*1*	*6*

(Continued on next page)

Crossing *Species (#)*	Flight Height Category			TOTAL
	Below RSA	Within RSA	Above RSA	
D-Series	**0**	**5**	**10**	**15**
Broad-winged hawk (2)			*2*	*2*
Golden eagle (1)			*1*	*1*
Osprey (3)		*1*	*2*	*3*
Red-tailed hawk (8)		*4*	*5*	*9*
Kibby Ridge	**7**	**5**	**6**	**18**
Accipiter sp. (1)	*1*	*1*	*1*	*3*
Broad-winged hawk (2)		*1*	*1*	*2*
Northern harrier (1)	*1*			*1*
Peregrine falcon (1)		*1*	*1*	*2*
Red-tailed hawk (1)	*1*			*1*
Sharp-shinned hawk (5)	*4*	*1*	*2*	*7*
Turkey vulture (1)		*1*	*1*	*2*
Multiple crossings	**6**	**0**	**3**	**9**
Broad-winged hawk (3)	*1* [a/b]		*2* [c/d, c/e]	*3*
Cooper's hawk (3)	*3* [a/b]			*3*
American kestrel (1)	*1* [a]		*1* [f]	*2*
Sharp-shinned hawk (1)	*1* [a/b]			*1*
Other	**4**	**3**	**10**	**17**
Buteo sp. (1)	*1*			*1*
Broad-winged hawk (5)	*1*	*1*	*4*	*6*
Cooper's hawk (1)			*1*	*1*
Kestrel (1)	*1*			*1*
Osprey (2)			*2*	*2*
Red-tailed hawk (3)	*1*	*2*	*2*	*5*
Sharp-shinned hawk (1)			*1*	*1*
TOTALS:	**31**	**33**	**39**	

[a] *South Summit* [c] *North Summit* [e] *Mid D-Series*
[b] *Summit Saddle* [d] *Kibby Ridge* [f] *North Kibby Range*

The north summit was the most frequently traversed crossing, with 23 individuals documented; 16 of these were buteos. Passage within typical RSA height at this location occurred 13 times. Passage below typical RSA height occurred 6 times, and passage above typical RSA height occurred 7 times. Passage within typical RSA height occurred more times at this location than any other location. This occurred when raptors approached from the northeast, then traveled westward along the north face of Kibby Mountain's northern (west-to-east running) ridge. The birds would then cross the north shoulder of Kibby Mountain, just north of the north summit and drop into the Kibby Stream valley on the west side of the mountain.

The south summit was the next most popular crossing, with 16 birds documented; 10 of these were accipiters. Birds passed within typical RSA height near the south summit only two times. A total of 12 passage events occurred below typical RSA height at this location, and four occurred above typical RSA height.

A total of 15 individuals were documented crossing the east ridge of D-Series; 11 of these were buteos. Five passage events were within typical RSA height at this location, and 11 occurred above typical RSA height. No passage events were observed below typical RSA height.

Thirteen individuals were documented crossing the saddle between the north and south summits of Kibby Mountain. Seven of these were buteos, four were accipiters and two were small falcons. Passage within typical RSA height occurred five times, while passage below typical RSA height occurred seven times, and passage above typical RSA height occurred once.

Thirteen individuals were observed flying along portions of the Kibby Mountain's ridge (Kibby Ridge). Six of these were accipiters, and four were buteos; the remaining three were a peregrine falcon, a northern harrier and a turkey vulture. The distance traversed along the ridge was highly variable per individual, but generally consisted of a traverse along a portion of the ridge before moving off its west slope into the Kibby Stream valley. During such traverses, flight within typical RSA height was documented five times, while flight below and above typical RSA height was documented seven times each.

Finally, 14 individuals passed within the project area in various locations other than these apparent "hot spots." Passage within typical RSA height at these collective locations occurred three times, while passage below typical RSA height occurred four times, and passage above typical RSA height occurred 11 times.

3.3.1.1 Rare Threatened and Endangered Species Within the Project Area

Five state- or federal-listed species were documented within the project area (Table 5). One bald eagle crossed the project area near the south summit of Kibby Mountain, at an elevation above typical RSA height. Two peregrine falcons were documented within the project area at Kibby Mountain. One peregrine falcon crossed the north summit within typical RSA height, then traveled down Kibby Stream valley, outside of the project area. The other peregrine falcon appeared near the north summit and traversed along Kibby Ridge. It flew within typical RSA height near the summits, and then above typical RSA height toward the south end of the ridge. Two golden eagles passed within the project area: one crossed the north summit of Kibby Mountain within typical SA height, and the other crossed the D-Series ridge well above typical RSA height.

3.3.2 Non-Raptor Species

Three flocks of Canada geese passed through the Kibby vicinity during fall 2005 surveys. Two of these flocks passed within the project area. One flock of 22 individuals traveled down the Kibby Stream valley, then crossed over Kibby Range approximately mid-way down its eastern ridge. This crossing occurred within typical RSA height. One flock of 57 individuals traveled down the Kibby Stream valley, then crossed the D-Series ridge approximately mid-way down its eastern ridge. This crossing occurred at an elevation well above typical RSA height.

Several small flocks of blue jays, comprising 50 total individuals, were documented traveling along Kibby Ridge. These flocks traveled along the ridge for variable distances before moving

off the west side of the ridge into the Kibby Stream valley. Most of the blue jays traveled at tree-top level, below typical RSA height; however, 11 individuals ascended to within typical RSA height at some point during their observed flight.

The flight heights of non-raptor species observed during fall 2005 daytime migrant surveys are listed in Table 7, in order of descending species abundance. Occurrences of passage below, within and above typical RSA height, by location and by species, are presented in Table 8. See Figure 3 for a diagrammatic representation of where non-raptor flight paths intersect the project area.

Table 7. Non-Raptor Flight Heights and Passage Within Project Area

Species	Flight Height				Individual Passage Location Relative to Project Area	
	Below RSA	Within RSA	Above RSA	Outside Project Area	IN	OUT
Canada goose	0	79	0	109	79	30
Blue jay	50	11	0	50	50	0
Yellow-rumped warbler	14	4	0	14	16	8
(Warbler sp.)	4	3	0	4	7	3
Dark-eyed junco	3	1	0	5	3	3
Magnolia warbler	1	0	0	3	1	2
Cedar waxwing	1	0	0	1	1	1
Black-throated blue warbler	1	0	0	0	1	0
Chestnut-sided warbler	1	0	0	1	1	0
(Dendroica sp.)	1	0	0	1	1	0
TOTALS:	**76**	**98**	**0**	**188**	**160**	**47**

Table 8. Number of Occurrences of Non-Raptor Species Below, Within and Above Typical RSA Height, by Crossing

Crossing	Flight Height Category			TOTAL
Species (#)	Below RSA	Within RSA	Above RSA	
Kibby Ridge (from S. summit along south ridge)	**59**	**12**	**0**	**71**
Black-throated blue warbler (1)	*1*			*1*
Blue jay (50)	*50*	*11*		*61*
Magnolia warbler(1)	*1*			*1*
Warbler sp. (1)	*1*			*1*
Yellow-rumped warbler (6)	*6*	*1*		*7*

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Kibby Ridge (from S. summit to N. summit)	**10**	**2**	**0**	**12**
Chestnut-sided warbler (1)	1			1
Dark-eyed junco(1)	*1*	*1*		*2*
Warbler sp. (2)	*2*			*2*
Yellow-rumped warbler (6)	*6*	*1*		*7*
South Summit	**6**	**5**	**0**	**11**
Cedar waxwing (1)	*1*			*1*
Dark-eyed junco(2)	*2*			*2*
Warbler sp. (4)	*1*	*3*		*4*
Yellow-rumped warbler (4)	*2*	*2*		*4*
Summit Saddle	**1**	**0**	**0**	**1**
Dendroica sp. (1)	*1*			*1*
Mid D-Series	**0**	**57**	**0**	**57**
Canada goose (57)		*57*		*57*
Mid Kibby Range	**0**	**22**	**0**	**22**
Canada goose (22)		*22*		*22*
TOTALS:	76	98	0	**174**

3.4 Frequency of Activities Observed

3.4.1 Raptor Species

Of several potential activities, only five general categories were observed among migrating raptors during the fall of 2005: these behaviors were flapping, soaring, gliding, perching and hunting. Many birds performed more than one of these activities while being observed.

Gliding was the most frequent activity observed, with 238 birds of 252 raptors observed (94 percent) gliding at some point during their observed flight (Table 9). A total of 126 of all raptors observed (50 percent) performed *only* this activity. The next most frequent was soaring, with 38 percent (96 birds) of all raptors recorded performing this at some point during their observed flight. Flapping was much less frequent, with only 10 percent of individuals performing this activity. Perching and hunting were observed infrequently. Migrating raptors typically employ primarily soaring and gliding as an energy saving strategy, so these observations are not surprising (Burton 1985). These results are consistent with the assumption that raptors were actively moving through the area as part of their migratory journey.

Hunting activity was recorded for four individual raptors: a broad-winged hawk, a Cooper's hawk, and a sharp-shinned hawk were each recorded as "hunting" in wooded areas along the ridge of Kibby Mountain. One red-tailed hawk was observed hunting over clear-cuts along the Kibby Stream valley. It is possible that these individuals were residents of the area, however, it is also possible that these were migrants stopping over to feed, therefore they were counted as migrants.

Table 9. Raptor Activities Observed During Fall 2005 Surveys

Species	Activity				
	Glide	Soar	Flap	Perch	Hunt
Buteo					
Red-tailed hawk	79	40	4	1	1
Broad-winged hawk	48	17	0	4	1
Buteo sp.	14	7	0	0	0
Subtotal	*141*	*64*	*4*	*5*	*2*
Accipiter					
Sharp-shinned hawk	31	11	10	2	1
Cooper's hawk	6	1	1	1	1
Northern goshawk	3	1	0	0	0
Accipiter sp. (sm)	9	1	6	0	0
Subtotal	*49*	*14*	*17*	*3*	*2*
Pandion					
Osprey	33	13	0	0	0
Subtotal	*33*	*13*	*0*	*0*	*0*
Falco					
American kestrel	3	1	2	1	0
Merlin	1	0	0	0	0
Peregrine falcon	3	0	1	0	0
Subtotal	*7*	*1*	*3*	*1*	*0*
Haliaeetus					
Bald eagle	2	1	0	0	0
Subtotal	*2*	*1*	*0*	*0*	*0*
Aquila					
Golden eagle	2	2	0	0	0
Subtotal	*2*	*2*	*0*	*0*	*0*
Circus					
Northern Harrier	2	1	1	0	0
Subtotal	*2*	*1*	*1*	*0*	*0*
Cathartes					
Turkey vulture	1	0	0	0	0
Subtotal	*1*	*0*	*0*	*0*	*0*
Unknown Raptors					
Raptor sp. (sm)	1	0	0	0	0
Subtotal	*1*	*0*	*0*	*0*	*0*
TOTALS	**238**	**96**	**25**	**9**	**4**

3.4.2 Non-Raptor Species

The only activities observed for non-raptor species were flapping and perching. All of the 207 non-raptorial migrating birds that were recorded were flapping. One individual bird (a chestnut-sided warbler) momentarily perched near the lookout tower on Kibby Mountain before moving on; this was the only instance where a behavior other than flapping was recorded. These results are not surprising as, by way of definition, only birds that were clearly moving through the area on an apparent migratory path were recorded onto daytime migrant data sheets.

4.0 SUMMARY OF FINDINGS

In total, 252 individual raptors were recorded. The four most abundant raptor species were red-tailed hawks (32.1 percent of all records), broad-winged hawks (19.8 percent of all records), osprey (13.5 percent of all records), and sharp-shinned hawks (13.5 percent of all records). State- and/or federal-listed species (three bald eagles, two golden eagles and three peregrine falcons) represented 3 percent of all records. All other species combined comprised the remaining 4.6 percent of all records.

In addition, 207 individual non-raptorial migrants were recorded. The majority of these (an estimated 109 individuals, or 52.7 percent of all non-raptors) were Canada geese, which were observed in three separate flocks. Blue jays were the next most common non-raptor species observed, with 50 individuals (24 percent of all non-raptors) documented.

Raptor migratory use in the Kibby vicinity appeared to be concentrated in the Kibby Stream valley, with various routes feeding into or departing from the valley (see Figure 3). Canada geese were also observed using the Kibby Stream valley, as well as the valley to the east of Kibby Mountain, with periods of traverse across the project area. Assessment of migratory use by passerines was limited due to their small size and reduced visibility. Most passerines were observed flying along Kibby Ridge (below typical RSA height), and out of the project area.

Passage within the project area was observed to occur in a few distinct locations, which are detailed in Section 3.3. A total of 247 birds (87 raptors and 160 non-raptors) passed within the project area at some point during their flight. Of these, 131 birds flew within typical RSA height at some point during their flight, while 112 flew below the presumed RSA and 41 flew above it.

The portion of the project area most frequented by migrating raptors was the north summit area, where 24 individuals (mostly buteos) crossed Kibby Mountain just north of the north summit. Of these individuals, 13 passed within typical RSA height at some point during their flight.

Two large flocks (totaling 79 individuals) of Canada geese were observed using the Kibby Stream valley, however, they each passed within the project area and within typical RSA height. This constitutes the greatest number of occurrences for a single species within typical RSA height among all species (raptor and non-raptors) observed.

5.0 REFERENCES

Burton, R. 1985. Bird Behavior. Roxbury Natural History Limited, London. Alfred A. Knopf, Inc. 224 p.

HMANA. 2005. Hawk Migration Association of North America Daily Report Form and data collection instructions. Information available online at: **www.hmana.org**

Hoffman, S.W., & J.P. Smith. 2003. Population trends of migratory raptors in western North America, 1977-2001. Condor, 105:397-419. Available online at: **www.hawkwatch.org/publications/Manuscripts/Hoffman%20and%Smith%20Condor%20105.pdf**

New England Wind Energy Station (NEWES). 1993. Supplimental Report on September 1993 Comparative New England Raptor Migration Data. Unpublished study report.

U.S. Windpower. 1994. New England Wind Energy Station: September 1993 Raptor Migration Survey Summary Report. Unpublished study report.

APPENDIX A

Daytime Avian Migration Survey Protocol For the Kibby Wind Power Project

Daytime Avian Migration Survey Protocol for the Kibby Wind Power Project

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FIGURE

Figure 1: Project Location Map 1-2

APPENDIX

Appendix A HMANA Data Form and Instructions

1.0 PROJECT DESCRIPTION

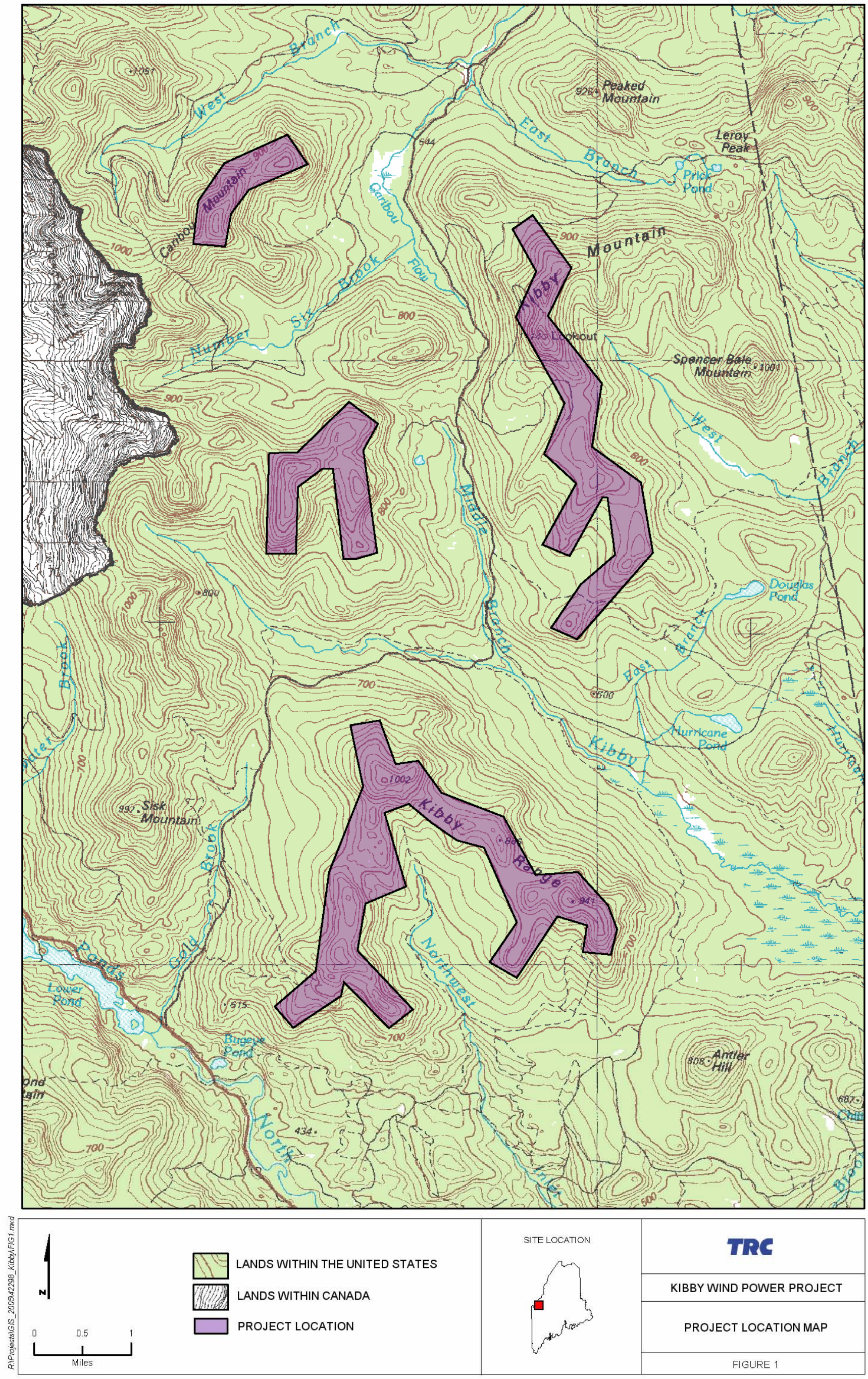
TransCanada Energy Ltd. (TransCanada) is proposing to develop, own and operate a 100–200 megawatt (MW) wind power generating facility in the Boundary Mountains of Western Maine known as the Kibby Wind Power Project. The project is in a location for which a similar project proposal by U.S. Windpower was previously approved by the Land Use Regulation Commission (LURC). TransCanada intends to conduct additional baseline studies and utilize existing information from the previous licensing effort to determine appropriately the level of potential impact associated with the project.

The project will be located in an unincorporated area of Franklin County, Maine. Turbine locations are anticipated to be established along four ridgelines within the project area, as shown in Figure 1. The property is owned by Plum Creek (formerly owned by SD Warren), and the surrounding areas are currently actively managed for forest products. The Kibby Wind Power Project can take advantage of existing logging roads and cleared areas to access the ridgelines, and forestry activities can continue in a complementary fashion with the project in place. The project will utilize the superior wind resource found in this vicinity to create clean, renewable power generation.

As currently proposed, the Kibby Wind Power Project will be developed in two phases. The first 100-MW phase will involve the installation of approximately 67 GE 1.5 MW turbines (which have a hub height of 65 meters and a rotor diameter of 70.5 meters). The turbines will require access, as well as a gathering system for consolidating their electrical output at a common substation. From that proposed substation, a 115 kilovolt (kV) transmission line will be installed. Depending upon system requirements, the electrical interconnection will be installed to the existing substation at either Stratton or Bigelow, a distance of approximately 20 to 28 miles. It is anticipated that the electrical interconnection work will occur in part within the town of Eustis, likely requiring a local and Maine Department of Environmental Protection (MDEP) permitting process in addition to LURC approval.

A second project phase is being considered, which would involve installation of an additional 100-MW array of GE 1.5 MW turbines. Due to electricity transmission capacity constraints, this second phase would include a 115 kV interconnection to the Hydro Quebec bulk transmission system in the Lac Megantic region of Quebec (approximately 25 miles away). From that point, electricity would be available for sale into both Canada and the United States (U.S.). This portion of the project would require, in addition to the full array of environmental permits, review under a Presidential Permit by the U.S. Department of Energy.

Figure 1: Project Location Map



It is estimated that, for both project phases, approximately 30 miles of new roads could be required for access to turbine locations. TransCanada will endeavor to minimize impacts to wetlands and erosive soils and to utilize existing roadways to the extent possible. Although clearing will be required for construction and operation of the wind turbines, and to allow for electrical infrastructure, clearing will be minimized to the extent possible. The location of the project is relatively remote from public view. Visual change in the landscape will be assessed and presented, however, views of the project are anticipated to be distant and from limited locations. Construction jobs will result from the project, as well as approximately 15 to 20 permanent jobs for the region.

TransCanada Energy Ltd. is a subsidiary of TransCanada Corporation, an established Canadian company, with a proven track record in developing large infrastructure projects, including numerous wind projects currently ongoing in Canada. An important hallmark of its development process is to establish and maintain strong, open and responsible relationships with the communities within which they will operate facilities and with the regulatory agencies tasked with project oversight. In order to provide adequate information as a basis for agency decision-making, TransCanada intends to supplement existing available information from the U.S. Windpower project with comprehensive environmental studies. This draft protocol is intended to outline a scope of work to address one element of those environmental evaluations so an opportunity is afforded for agency input prior to implementation.

A LURC application is currently being prepared that will request installation of up to eight meteorological towers (met towers) for the purposes of collecting site-specific wind data in support of more detailed design and layout information. The met towers are also intended for use during environmental studies (for example, bat surveys, where installation of monitoring devices at an elevated location provides the best possible data). Environmental studies are anticipated to commence in late July 2005, with the met tower LURC application anticipated to be submitted in August. Given TransCanada's desire to include environmental data from both the fall and spring seasons, the LURC rezoning petition and preliminary development plan (and necessary MDEP application material) is anticipated to be filed in the summer of 2006. TransCanada hopes to obtain permits by spring 2007 so construction can commence at that time, taking advantage of the summer and fall construction season. Commercial operation is anticipated by approximately December 2008. Timely review and comment on study protocols will be encouraged to ensure that all applicable input is applied in even the earliest stages of project work.

2.0 PROTOCOL INTRODUCTION

As part of pre-construction analyses for the Kibby Wind Power Project, several studies will be performed that will assist in determining which avian species use the project area, and how they use it. The specific purpose of daytime avian migration surveys is to observe the approximate numbers, species, and patterns of use by spring and fall daytime migrants in the project vicinity, and develop a qualitative assessment of general patterns of use by migrating birds in the vicinity of the proposed Kibby Wind Power Project. Two different surveys will be done for daytime migrants: an early morning foraging migrant survey and a daytime migrant survey. Data collected at these sites will also be compared with data collected in prior studies of the project area. In addition, available data collected by others in the study vicinity will be utilized to supplement the project surveys.

2.1 Objectives

The main objectives of daytime avian migration surveys are to:

- Obtain a quantitative assessment of species composition, relative abundance, distribution, and spatial patterns of use by birds migrating during daytime hours in and around the project area;
- Identify migrant species foraging in the project area;
- Identify route(s) used by daytime migrating birds passing through/near project area; and
- Evaluate potential for collisions at proposed turbine sites.

2.2 Prior Studies

From 1992 to 1994, U.S. Windpower monitored fall raptor migration in the vicinity of the project. Their work consisted of day-long surveillance during peak migration and identified numbers and species of raptors crossing the project area. The goals were to identify raptor species' relative abundance, composition, and flight characteristics (flight height, direction, and consistency of use) in the project area. U.S. Windpower also performed studies to characterize morning migration and foraging behavior of migrating songbirds. These studies demonstrated a pattern of use of the area as a minor migratory route for raptors with minimal use as a foraging stopover.

3.0 STUDY METHODOLOGY

3.1 Survey Site Selection

Various locations will be surveyed by transect for the foraging migrant bird survey. Their locations will be scattered throughout the project area. These transects will be sited to represent different habitats of the area (valley, clearcut, mature forest, slopes, ridge top, etc.). The Kibby Mountain fire tower has been selected as the observation point for the daytime migration survey due to its northern location in relation to the project area and its 360-degree visibility.

3.2 Survey Protocol

Foraging migrant bird surveys will be similar to those performed during the fall of 1994 for U.S. Windpower for this site. The survey will be performed by one observer walking slowly along a transect early in the morning. All birds observed will be identified to species, and distance from the transect will be recorded. The behavior of each bird when first observed and foraging birds' locations (including where they are foraging, i.e., substrate: ground, shrubs, trees, etc.) will also be noted.

The methods for the daytime migrant survey protocol are largely based on methods used during daytime migrant monitoring performed for U.S. Windpower for this site and standards set forth by the Hawk Migration Association of North America (HMANA), and by HawkWatch International (Hoffman and Smith 2003).

3.2.1 Number and Timing of Surveys

Surveys will be performed in fall 2005 and spring 2006. Fall 2005 surveys will occur between September 1 and October 15, and the spring 2006 surveys will occur between March 1 and May 31. Seasonal surveys will consist of multiple survey days at each of the survey plots.

Foraging migrant surveys will be performed early in the morning, between dawn and 9 a.m. each day. Each daytime migrant survey day will be divided into two periods, morning (between dawn and noon) and afternoon (between noon and sunset). Observations will be scheduled so as to cover these daylight hours equally.

The purpose of dividing survey events into morning and evening periods is to capture movements of predominantly nocturnal migrants that may be traveling diurnally due to concurrent environmental circumstances (for example, night time rain, low-cloud ceiling, etc.). Such movements are most likely during early morning hours. Raptors and other diurnal migrants are expected to be observed throughout the daytime hours.

Sampling will be performed based upon favorable weather for migration, timed to start the morning after the passage of a cold front. Surveys will be done for three consecutive days following this weather event. Surveys will not be conducted during precipitation, in fog, on days that are overcast with low cloud cover, or during any other circumstances that hamper visibility.

3.2.2 Surveyor Preparedness

For foraging migrant behavior surveys, surveyors will be familiar with the protocol, bird behavior, the transect locations, and will be experienced in bird identification.

For the daytime migrant surveys, surveyors will be familiarized with the topography of the area, including the elevation of the survey site, surrounding ridge elevations and distances from the sampling site, and tree height, prior to starting surveys. Knowledge of these parameters will be useful in estimating flight height. Each surveyor will be trained in the methodology, and will calibrate themselves to the survey site prior to commencing survey activity. Surveyors will also be experienced in bird identification.

3.2.3 Data Collection

Detailed weather and migratory bird observation data will be collected during each survey. All data will be entered onto data sheets. For migrating raptors, data will be collected on forms consistent with those utilized by HMANA, using their suggested codes and guidelines (see Appendix A). Similar but separate data forms will be used to note all other species.

3.2.3.1 Weather Observations

Weather conditions will be noted at the beginning of each survey and hourly thereafter. Data will be collected based on codes and protocol by HMANA, and will be recorded directly onto observation data sheets. Parameters that will be recorded are:

- Wind speed (recorded based on HMANA codes and descriptions)
- Wind direction (compass direction from which the wind is coming, or "variable")
- Temperature (degrees Celsius)
- Humidity (percent relative)
- Barometric pressure
- Percent cloud cover
- Visibility (approximate distance)
- Precipitation

3.2.3.2 Individual Bird Observations

Migratory bird observations will be recorded continuously throughout each survey period. Foraging migrant surveyors will record time of start and end of observations, each for each individual bird observed they will record behavior (flying, foraging, calling, other), and substrate (ground, shrub (deciduous or conifer), tree (deciduous or conifer)).

When collecting data on migrating birds, surveyors will perform continuous scanning with the naked eye and with binoculars. Spotting scopes will be used as necessary to aid in identification.

Observations will be segmented into one-hour periods, but several hours of consecutive data will be collected at each plot. The following data will be recorded for each bird observed:

- Species (if possible)
- Sex (if possible)
- Age class (if possible)
- Altitude at first observation, with noted variations over duration of presence within the survey area (using codes denoting below, within, or above rotor swept area)
- Distance from observation point at first observation, and variations over duration of presence within the survey radius
- Behavior (such as soaring, flapping, circling, gliding, perching, hunting, or other)
- General compass bearing flight direction (S, SSW, NE, etc.)

In the event a bird cannot be identified to the species level, it will be described to the greatest extent possible. For example, unknown raptors will be further described as large or small.

3.2.3.3 Flock Observations

Flock observations will be treated in the same way as individual bird observations, with counts or estimates of the number of birds comprising the flock.

3.2.3.4 Field Quality Assurance and Quality Control

Data sheets will be reviewed for completeness, accuracy, and legibility prior to leaving the survey site. Incidental observation data sheets will be inspected at the end of each survey day. Any problems noted will be rectified at that time; changes to the data sheets will be initialed by the person making the change.

Data will be analyzed concurrently with on-going field work to determine if project objectives are being met or will be met with the types of data and method of data being collected. Since similar protocols have been successfully utilized in other areas, only minor, if any, modifications should be needed during the course of the study, but since every project area is biologically and physically different, data will be frequently evaluated relative to the objectives. Any proposed changes to the protocols will be discussed with Maine Department of Inland Fisheries and Wildlife (MDIFW) prior to implementation.

3.2.4 Data Entry and Analysis

3.2.4.1 Data Entry

Data as recorded onto data sheets in the field will be entered into and stored in a numerical database or spreadsheet format. All entered data will be checked against original field notes and

any errors detected will be corrected using the field data sheets and/or by consulting with the observer.

3.2.4.2 Data Analysis

The following summaries and statistics will be generated to address the objectives and goals of this study.

- Species lists by season and survey location;
- Indices of bird relative abundance;
- Avian migration patterns by species, season, and habitat type;
- Flight paths and heights, by species and season;
- Frequency of behaviors observed;
- Number of observations of foraging by habitat/substrate;
- Relative use among observation points by species and season;
- Number and proportion of observations, by species and season, within the rotor-swept area of the proposed turbines; and
- Number of observations, by species and season, within the proposed development area.

Standard statistical parameters (e.g., means, standard deviations) will be computed, where appropriate. Multivariate techniques such as multiple logistic regression (to estimate the resource selection functions) and multiple regression (to relate relative use in different areas to habitat or topographic features) may also be used, as appropriate, to analyze data.

4.0 REFERENCES

HMANA. 2005. Hawk Migration Association of North America Daily Report Form and data collection instructions. Information available online at: www.hmana.org

Hoffman, S.W., & J.P. Smith. 2003. Population trends of migratory raptors in western North America, 1977-2001. Condor, 105:397-419. Available online at: www.hawkwatch.org/publications/Manuscripts/Hoffman%20and%Smith%20Condor%20105.pdf

APPENDIX A

HMANA DATA FORM AND INSTRUCTIONS

HAWK MIGRATION ASSOCIATION OF NORTH AMERICA

HMANA DAILY REPORT FORM

LOCATION _____ | | | |

OBSERVER(S) _____ MO____DAY____YR_____

ADDRESS _____

TIME (STD)	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7		
Wind Speed																
Wind Dir. (From)																
Temp. (Deg. C)																
Humidity																
Bar. Pressure																
Cloud Cover																
Visibility																
Precipitation																
Flight Direction																
Height of Flight																
No. of Observers															Total	
Dur. of Obs. (min)																

Black Vulture															BV	
Turkey Vulture															TV	
Osprey															OS	
Swallow-tailed Kite															SK	
White-tailed Kite															WK	
Mississippi Kite															MK	
Hook-billed Kite															HK	
Bald Eagle															BE	
Northern Harrier															NH	
Sharp-shinned															SS	
Cooper's Hawk															CH	
Northern Goshawk															NG	
Red-shouldered															RS	
Broad-winged															BW	
Short-tailed Hawk															ST	
Swainson's Hawk															SW	
Red-tailed Hawk															RT	
Ferruginous Hawk															FH	
White-tailed Hawk															WT	
Zone-tailed Hawk															ZT	
Harris' Hawk															HH	
Rough-legged															RL	
Golden Eagle															GE	
American Kestrel															AK	
Merlin															ML	
Peregrine Falcon															PG	
Gyrfalcon															GY	
Prairie Falcon															PR	
Crested Caracara															CC	
Unid. Vulture															UV	
Unid. Accipiter															UA	
Unid. Buteo															UB	
Unid. Eagle															UE	
Unid. Falcon															UF	
Unid. Raptor															UU	
Other (From Back)															OO	
TOTAL															TH	

Comments

Comments: Use back of form. Rarities: List species, hour number and description on back of form.

Rev: 03/98 LEK

APPENDIX B

Data Form and Instructions

Daytime Migrant Survey Data Sheet

Observers:	Date:	Time Start:	Time End:

Weather (see reverse for instructions)		Location:
wind speed:	bar. press:	
wind direction:	cloud cover:	
temp (C):	visibility:	
humidity:	precipitation:	

ID	Species	#	Age (J,A,U)	Gender (M,F,U)	Time of first Observation	Behavior (So,Fl,Ci,Gl,Pe,Hu)	Flight Direction	Flight Height (0-4)	Time of last Observation	Notes
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

GENERAL INSTRUCTIONS:

For weather, enter for the first hour of observation, for following hours only if data changes, if there are no changes, draw a line from the recorded data through the hours in which no change occurred; do not use ditto marks or dashes. For hawks, enter only the number seen (no zeros). Write notes, comments, etc. below. Send completed form to appropriate **Regional Editor** - or to - **HMANA, P.O. Box 822, Boonton,NJ 07005-0822**.

Weather and Observation Codes

Wind Speed: Enter code: 0-less than 1 km/h, (calm, smoke rises vertically); 1 - 1-5 km/h, (smoke drift shows wind direction); 2 - 6-11 km/h, (leaves rustle, wind felt on face); 3 - 12-19 km/h, (leaves, small twigs in constant motion; light flag extended); 4 - 20-28 km/h (raises dust, leaves, loose paper; small branches in motion); 5 - 29-38 km/h (small trees in leaf sway); 6 - 39-49 km/h (larger branches in motion; whistling heard in wires); 7 - 50-61 km/h (whole trees in motion; resistance felt walking against the wind); 8 - 62-74 km/h (twigs small branches broken off trees; walking generally impeded); 9 - Greater than 75 km/h.
Wind Direction: Enter compass direction from which the wind is coming, i.e., N, NNE, SE, etc. If variable, enter VAR.
Temperature: Record temperature in degrees Celsius.
Humidity: Record the percent relative humidity.
Barometric Pressure: Record barometric pressure in inches.
Cloud Cover: Record percent of sky with background cloud cover.
Visibility: Judge from your longest view and enter distance in kilometers. To convert miles to kilometers multiply by 1.61.
Precipitation: Enter code: 0 for none, 1 for Haze or Fog, 2 for Drizzle, 3 for Rain, 4 for Thunderstorm, 5 for Snow, 6 for wind driven dust, sand or snow.
Flight Direction: Enter compass direction migrants are heading, i.e., S, SSW, etc.
Height of Flight: Height of Flight. Enter code: 0 - Below rotor sweep; 1 -within rotor sweep; 2 - above rotor sweep; 3 - outside of turbine array area 4 - No predominant height

Observers: Number of observers **CONTRIBUTING** to the count for the hour noted.
Duration of Observation: Specify time in minutes.

COMMENTS