Avian Studies for the Consumer's Energy Proposed Wind Energy Site: Summary of 2010 Field Seasons - Annual Report

Prepared By:
Joelle Gehring, Ph.D.
Senior Conservation Scientist-Zoology Leader
Michigan State University, Michigan Natural Features Inventory
P.O. Box 30444 Lansing, MI 48909-7944

Prepared For:
Consumer's Energy
1 Energy Plaza Dr.
Jackson, MI 49201-2357

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Executive summary

The majority of the areas with high potential for wind energy generation are near the shorelines of the Great Lake's. These shorelines have also been documented to provide important habitat for wildlife, including migratory songbirds and raptors. Avian collisions with wind turbines have been documented, but the frequency of those collisions is site and situation specific. Informed siting of wind turbines can minimize impacts to birds. In addition to collision risks, some grassland or open-land nesting bird species are not adapted to nesting near any tall structure, including a wind turbine, and can be displaced. Due to the potential for avian collisions with wind turbines or turbine related avian displacement from nesting areas, we conducted surveys of both large birds and songbirds to better understand the densities of birds in the project areas, as well as the species composition, habitat use and flight behaviors. These data will help wind energy developers and resource managers to make appropriate decisions regarding the potential impacts to birds and the methods by which they might reduce those impacts.

We established two raptor and other large bird viewing station in the Project Area. We conducted 6-hour surveys at the stations in late April and May 2010 and again in September through November 2010. During surveys, each raptor, large bird, and sensitive status species was recorded in addition to the bird's flight path, flight direction, approximate flight altitude, and the distance to each bird from the observer. Technicians also recorded the behavior and habitat use of each bird, and weather characteristics. Examination of the spring and fall 2010 large bird survey data suggests that most species' flight behavior does not put them at frequent risk of collision. While Bald Eagles were detected, their flight height was almost entirely at a higher altitude than the likely rotor-swept area (RSA) of turbines. The high numbers of Canada Geese and the overlap between this species' average flight height and the estimated RSA height suggests that the risk of collisions for these species may be higher than for many of the other species observed in the areas. The consideration of external, ongoing research may be useful in determining the potential risk that wind turbine construction would provide for this species.

In an effort to quantify the songbird use of the project areas, we collected point count data to estimate breeding bird densities in June and early July 2010. Several of the grassland / openland species observed in the project areas are thought to be sensitive to

the presence of tall structures in their breeding habitats, potentially forcing their displacement. Row crop agricultural fields would tend to have fewer area sensitive species than pastures, and hayfields.

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Introduction

The U.S. Department of Energy has a goal of 10 GW of wind energy deployment in Michigan by the year 2030, and Michigan currently has only about 150 MW deployed - a 99% gap between potential and capacity. The interconnection queue for the Midwest Independent (Transmission) System Operator (MISO) presently includes requests for the interconnection in Michigan of approximately 3,000 MW of wind turbines. The majority of the areas with high potential for wind energy generation are near the shorelines of the Great Lake's. These shorelines have also been documented to provide important habitat for wildlife, including migratory songbirds and raptors. Shoreline areas have been suggested to be important as stopover sites for Neotropical migratory birds (Ewert 2006, Diehl et al. 2003) and as concentration or funneling areas for migrating raptors which avoid crossing large areas of water (Kerlinger 1989). Waterfowl (e.g., Common Loon) and waterbirds (e.g., gulls, herons, cranes) also use shoreline areas especially during the breeding and migration seasons. Research across North America has demonstrated a relationship between the densities of birds in an area and the numbers of avian collisions.

Avian collisions with wind turbines have been documented but the frequency of

those collisions is site and situation specific. Songbird collisions with turbines, as well as with other tall structures, are related to the lighting systems of the structure (Gehring et al. 2009). Songbirds can become attracted to non-blinking lights, especially during nocturnal migration; thereby, increasing their risk of collision with any structure illuminated with these types of lights. Most turbines are lit with Federal Aviation Administration recommended blinking lights which decreases the likelihood of songbirds becoming attracted into the site. Birds that use the airspace within the rotor swept area of a turbine are at risk of a collision and therefore the frequency of avian collisions at turbine sites can be directly correlated to the density of birds in the local area.

In addition to collision risks, some grassland or open-land nesting bird species are not adapted to nesting near any tall structure, including a wind turbine (Strickland 2004). These species can be displaced from traditional nesting areas upon construction of a nearby wind turbine (Leddy et al. 1999).

Due to the potential for avian collisions with wind turbines or turbine related avian displacement from nesting areas we conducted surveys of both large birds and songbirds to better understand the densities of birds in the area as well as the species composition, habitat use and flight behaviors. These data will help wind energy developers and resource managers to make appropriate decisions regarding the potential impacts to birds and the methods in which they might reduce those impacts.

Study Site and Methods

Study site and description

Research was conducted in a Project Area in Mason County, located in western Michigan, USA (Fig.1). The land use / land cover of the Project Area is a mixture of agricultural fields (e.g, corn, soybeans, pumpkins), orchards (e.g., apple, cherry), pastures, forested areas, and some inland lakes and wetlands. The natural vegetation in this area is generally described as dry northern forests and open wetlands. The forest overstory typically includes components of jack pine (*Pinus banksiana*), white pine (*Pinus strobes*), aspen (*Populus* spp.), maple (*Acer* spp.), and oak (*Quercus* spp.) species with an understory of bracken fern (*Dennstaedtiaceae* spp.) and blueberry (*Vaccinium*

spp.). The topography is predominantly flat sand lake plain (Albert 1995) and ranges approximately 1.5 – 7 miles from the Lake Michigan shoreline.

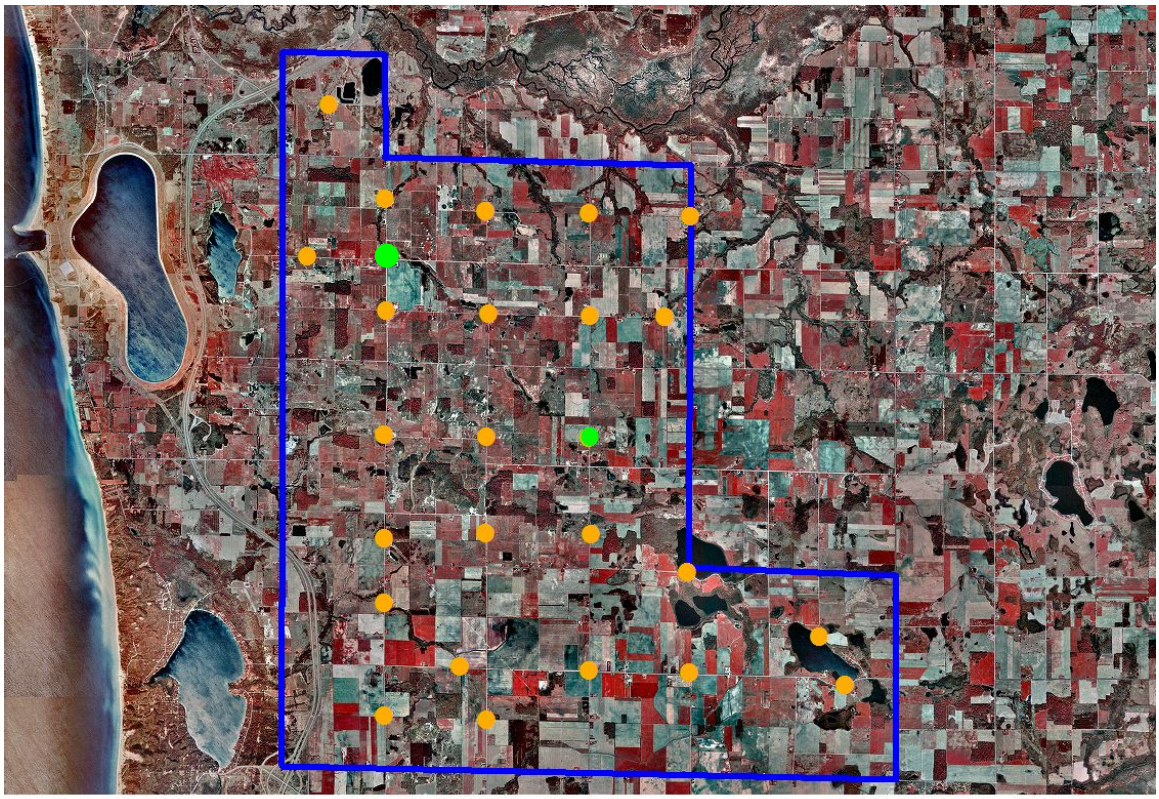

Figure 1. Point count sites (orange dots) and a large bird viewing stations (green dots) were established Mason County, MI in and around the Project Area proposed for wind energy development. Point count sites were surveyed in June and early July 2010 for bird use. Large bird surveys were conducted at the viewing stations in the spring and fall of 2010. The Project Area is predominantly agricultural lands with some interspersed forested areas.

Large bird surveys

We established raptor and other large bird viewing stations in both the Project Area. These stations provided the best possible viewsheds of the proposed project sites (Fig. 1). Following methods similar to those used by Hawkwatch International, we conducted 6-hour surveys at the stations in late April and May 2010 and again in September – mid November 2010. When conducting outdoor research, some flexibility in scheduling is needed and some surveys were missed due to dangerous conditions.

During surveys each raptor, large bird, and sensitive status species was recorded in addition to the bird's flight path, flight direction, approximate flight altitude (lowest and highest flight altitude), whether it flew within the proposed project area, and the distance to each bird from the observer. Technicians used landmarks as reference when measuring distance to birds and flight altitude (Fig. 2). Technicians also recorded the behavior and habitat use of each bird. Behavior categories were as follows: perched (PE), soaring (SO), flapping (FL), flushed (FH), circle soaring (CS), hunting (HU), gliding (GL), and other (OT, noted in comments). Any comments or unusual observations were also noted. Weather data were collected in concert with large bird surveys; specifically, temperature, wind speed, wind direction, and cloud cover. The date, start, and end time of observation period, species or best possible identification, number of individuals, sex and age class, distance from plot center when first observed, closest distance, height above ground, activity, and habitat(s) were recorded.

Figure 2. In the spring and fall of 2010 observers surveyed the viewshed for large birds from the viewing stations in the Mason County, MI Project Area.

Breeding songbird surveys

In an effort to quantify the songbird use of the project areas, we collected data using methods similar to those used in studies estimating breeding bird densities (Reynolds 1995, Johnson et al. 2000). Twenty five point count locations were established within Project Area (Figs. 1 and 3). Surveys were conducted in June and early July 2010 to focus on quantifying the breeding birds in the project areas, as the migrant birds were not as likely to be present as other times of the year.

Surveys at point count sites were 10 min. long (after 2 minutes of silence) and conducted between 15 minutes before sunrise and 1030 AM. Technicians recorded the following data: date, survey start time, temperature, wind speed, wind direction, cloud cover. Each individual bird observed during a survey was recorded by species, as well as the azimuth to the bird, gender (if known), distance from the observer, estimated flight height (if applicable), and other comments.

Figure 3. In June and early July 2010 observers conducted point counts in the Project Area, Mason County, MI.

Results and Summary

Large bird surveys – Spring 2010

During the 24 large bird surveys, observers detected 1,200 large birds of 18 species. There was a mean of 50.0 birds detected per survey (0.4 birds / hour; Table 1). The raptors (e.g., hawks, eagles, vultures) were the most common species group detected with 17.4 birds / survey, 2.9 birds / hour (Table 2, Fig. 4). The waterbird group (e.g, gulls, herons, cranes) was the second most frequently detected species group with 16.5 birds / survey, 2.8 birds / hour (Table 2, Fig. 5). The corvid group (i.e., American Crow; 11.3 birds / survey, 1.9 birds / hour, Table 2, Fig. 6) was the third most frequently detected species and waterfowl (e.g., Canada Goose, ducks; 4.7 birds / survey, 0.8 birds / hour); Table 2, Fig. 7) were the least frequently detected species group. Turkey Vultures were the most common species detected (308 birds, Table 3).

Assuming the wind turbine rotor-swept area (RSA) would be 45 – 145 m above the ground, 36% of all bird observations were below the RSA, 29% within the RSA, and 35% flew above the RSA. The mean flight altitude of the most common species, the Turkey Vulture, was 226 m with 4% flying below the RSA, 41% within the RSA, and 56% above the RSA. The lack of significant topographic features in the project area resulted in more diffuse flight patterns of migrating raptors. No funneling of raptors or corvids through specific areas was observed. However, waterbirds and waterfowl used the agricultural fields for foraging and loafing.

Table 1. Large bird abundance and richness in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2010 at two large bird survey sites.

	Large Bird Survey
No. Species	24
Mean No. Species / Survey	0.8
Mean No. Species / Hour	0.1
Mean No. Birds / Survey	50.0
Mean No. Birds / Hour	0.4

Table 2. Mean bird abundance in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2010 at two large bird survey sites.

Group	Mean Abundance [a]
Corvids	11.3
Raptors	17.4
Waterbirds	16.5
Waterfowl	4.7

[a] Mean Abundance = mean number of individuals observed per survey

Table 3. Avian abundance and richness in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the spring of 2010 at 2 large bird survey sites.

Species	No. Bird
American Crow	271
American Kestrel	5
Bald Eagle	7
Broad-winged Hawk	1
Canada Goose	62
Cooper's Hawk	3
Double-crested Cormorant	17
Great Blue Heron	1
Green Heron	1
Herring Gull	29
Mallard	28
Northern Harrier	2
Ring-billed Gull	82
Red-shouldered Hawk	1
Red-tailed Hawk	75
Sandhill Crane	31
Turkey Vulture	308
Unknown large raptor	16
Unknown Waterfowl	22
Unknown Gull	234
Unknown Corvid	1
Wild Turkey	1

Large bird surveys – Fall 2010

During the 16 large bird surveys observers detected 6,008 large birds of 10 species. There was a mean of 375.5 birds detected per survey (62.6 birds / hour) (Table 4). The waterfowl group (e.g., Canada Goose, ducks) was the most abundant of the bird groups per survey (369.0 birds / survey, 61.5 birds / hour; Table 5, Fig. 7), followed by the raptors (e.g., hawks, eagles, vultures; 5.3 birds / survey, 0.9 birds / hour; Table 5, Fig. 4). The corvid group (e.g., American Crow; 1.0 birds / survey, 0.2 birds / hour, Table 5, Fig. 5), and waterbirds (e.g, gulls, herons, cranes; 0.3 birds / survey, 0.04 birds / hour; Table 5, Fig. 6). Canada Goose was the most common waterfowl species detected during the surveys (5,848 birds total, 365.0 birds / survey, 60.9 birds / hour Table 6) and was observed throughout the survey period (Fig. 7).

Assuming the potential wind turbine rotor-swept area (RSA) would be 45 – 145 m above the ground, 0% of all birds flew below the RSA, 65% within the RSA, and 35% flew above the RSA. The mean flight altitude of the most common species, Canada Goose, was 136.9 m with 0% flying below the RSA, 65% within the RSA, and 35% above the RSA. As previously mentioned, waterfowl are currently not believed to collide with wind turbines as frequently as some other avian groups, such as raptors. Some waterfowl species have been documented to actually avoid turbines via their flight behavior (Desholm and Kahlert 2006). Similar to other areas and seasons, migrating raptor flight patterns did not follow a specific path through the viewshed, which is likely due to the consistent and contiguous topographic features.

Table 4. Large bird abundance and richness in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the fall of 2010 at a large bird survey site.

	Large Bird Survey
No. Species	10
Mean No. Species / Survey	0.6
Mean No. Species / Hour	0.1
Mean No. Birds / Survey	375.5
Mean No. Birds / Hour	62.6

Table 5. Mean bird abundance in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected

in the fall of 2010 at a large bird survey site.

Group	Mean Abundance [a]
Waterfowl	369.0
Corvids	1.0
Raptors	5.3
Waterbirds	0.3

[a] Mean Abundance = mean number of individuals observed per survey

Table 6. Avian abundance and richness in Mason County, MI in and around the Project Area proposed for the development of wind energy by Consumer's Energy. Data were collected in the fall of 2010 at a large bird survey site.

Species	No. Bird
American Crow	10
Bald Eagle	10
Canada Goose	5848
Cooper's Hawk	10
Mallard	30
Ring-billed Gull	4
Red-tailed Hawk	21
Rough-legged Hawk	8
Sharp-shinned Hawk	8
Turkey Vulture	23
Unknown large raptor	8
Wood Duck	30

Summary of large bird flight behavior in the Project Area

The data collection period utilized by our study design captured the migration period of the focal species, as intended. This is evident by the fluctuating numbers of migrant birds observed throughout the survey weeks (Figs. 4-7).

Upon examination of the spring and fall 2010 large bird survey data, it appears that the flight behavior of many species did not put them at frequent risk of collisions (Figs. 8 and 9). The overlap of flight altitudes and the estimated RSA in the spring data suggests that American Crows, American Kestrels, Turkey Vultures, and Canada Geese were at the highest risk for collision. In the fall, Cooper's Hawks and Rough-legged Hawks, and Canada Geese had the highest risk of collisions, given their flight heights. Bald Eagle flight was almost entirely at higher altitudes than the RSA of turbines; thereby, decreasing their risk of collision. There were high numbers of Canada Geese in the Project Area, especially in the fall. While 65% flew at the height with the RSA waterfowl have generally demonstrated the ability to avoid wind farms and related collisions (Desholm and Kahlert 2006).

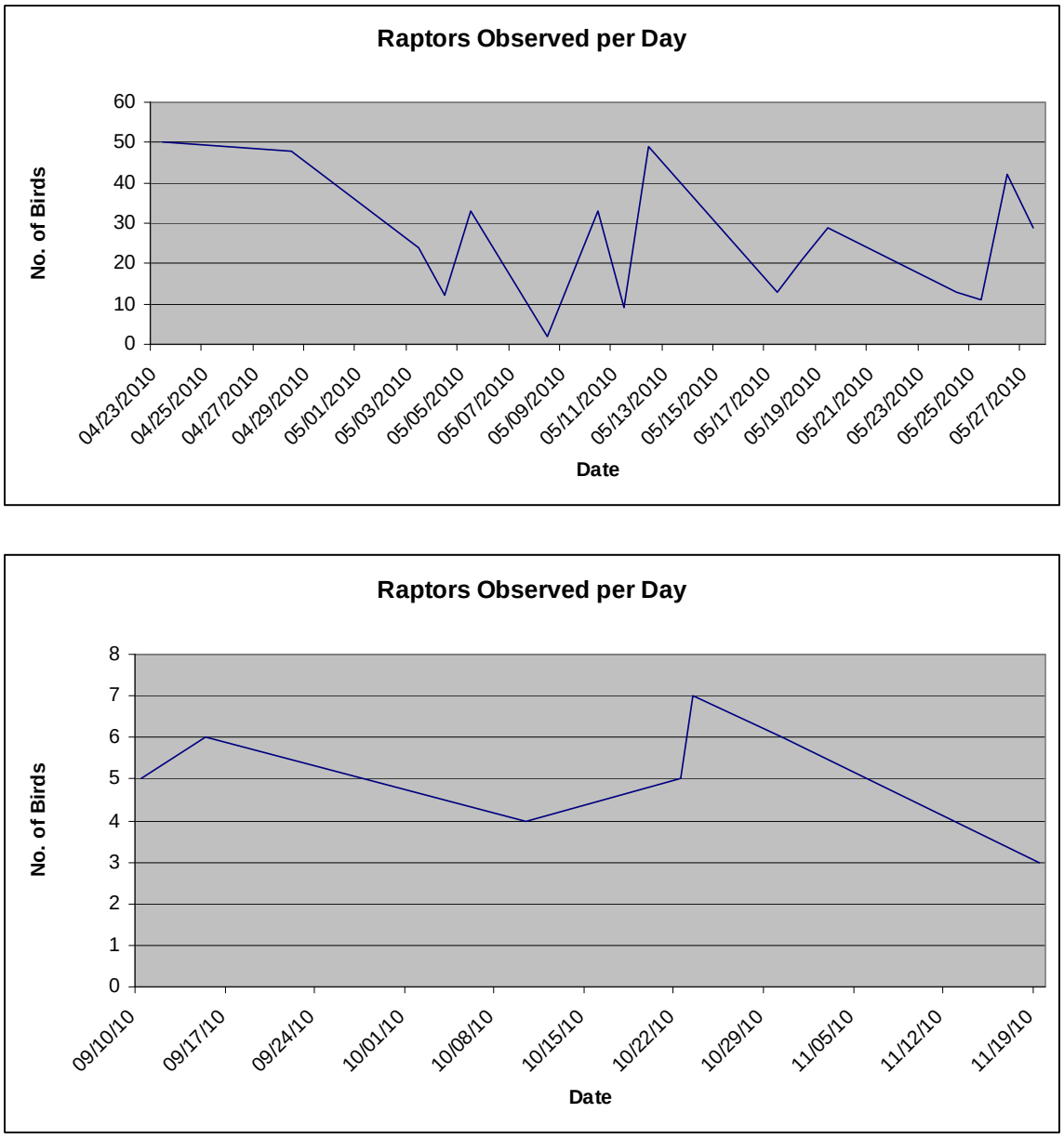

Figure 4. In the spring and fall of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The numbers of raptors detected were quantified by survey day.

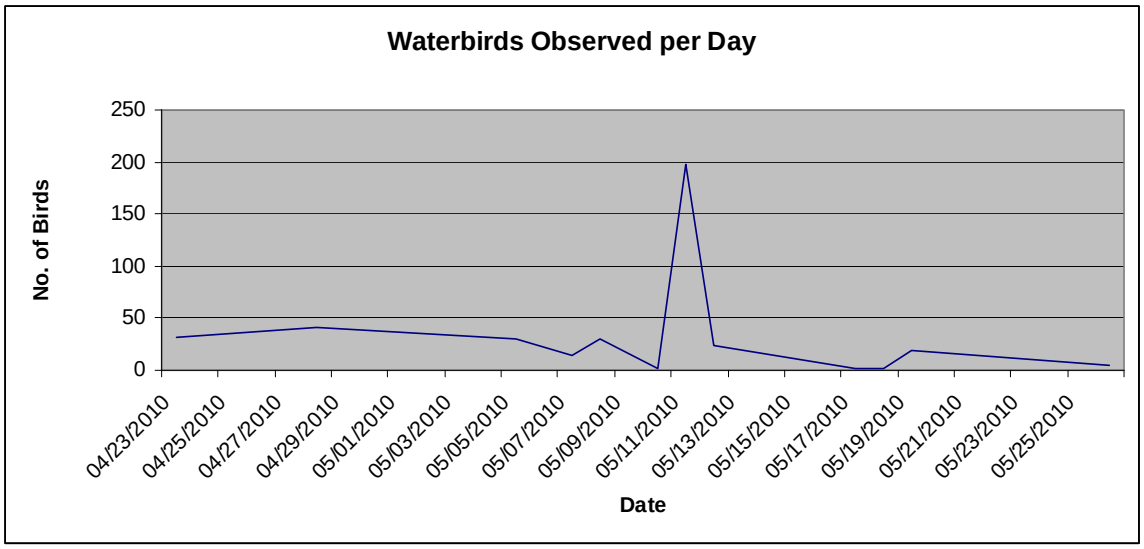

Figure 5. In the spring and fall of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The numbers of waterbirds detected were quantified by survey day. Waterbird densities were low and not graphed for the fall field season.

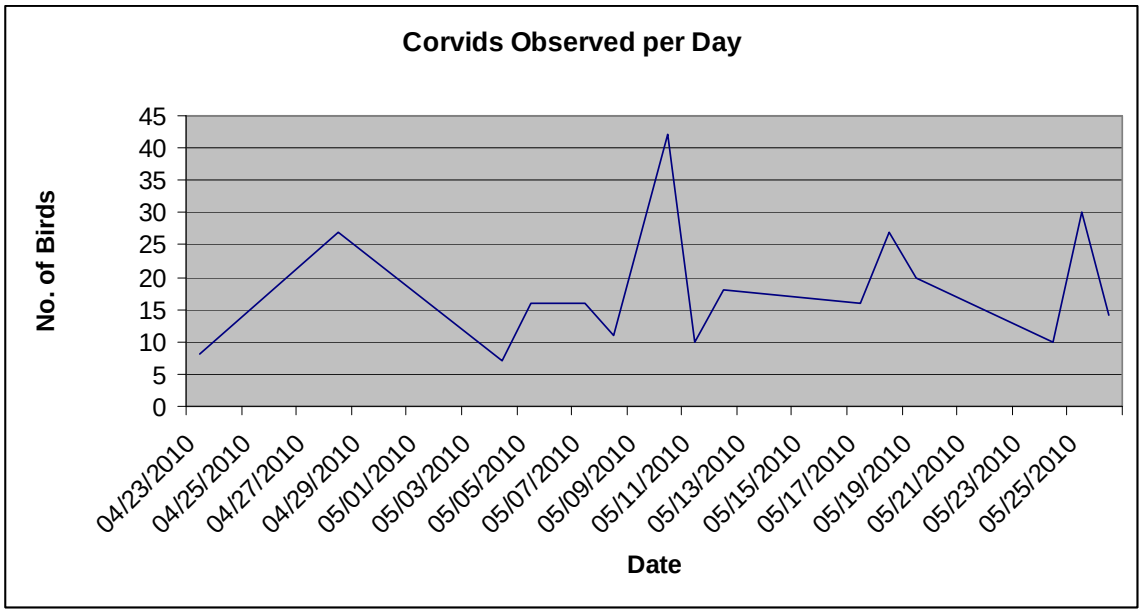

Figure 6. In the spring and fall of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The numbers of corvids detected were quantified by survey day. Corvid densities were low and not graphed for the fall field season.

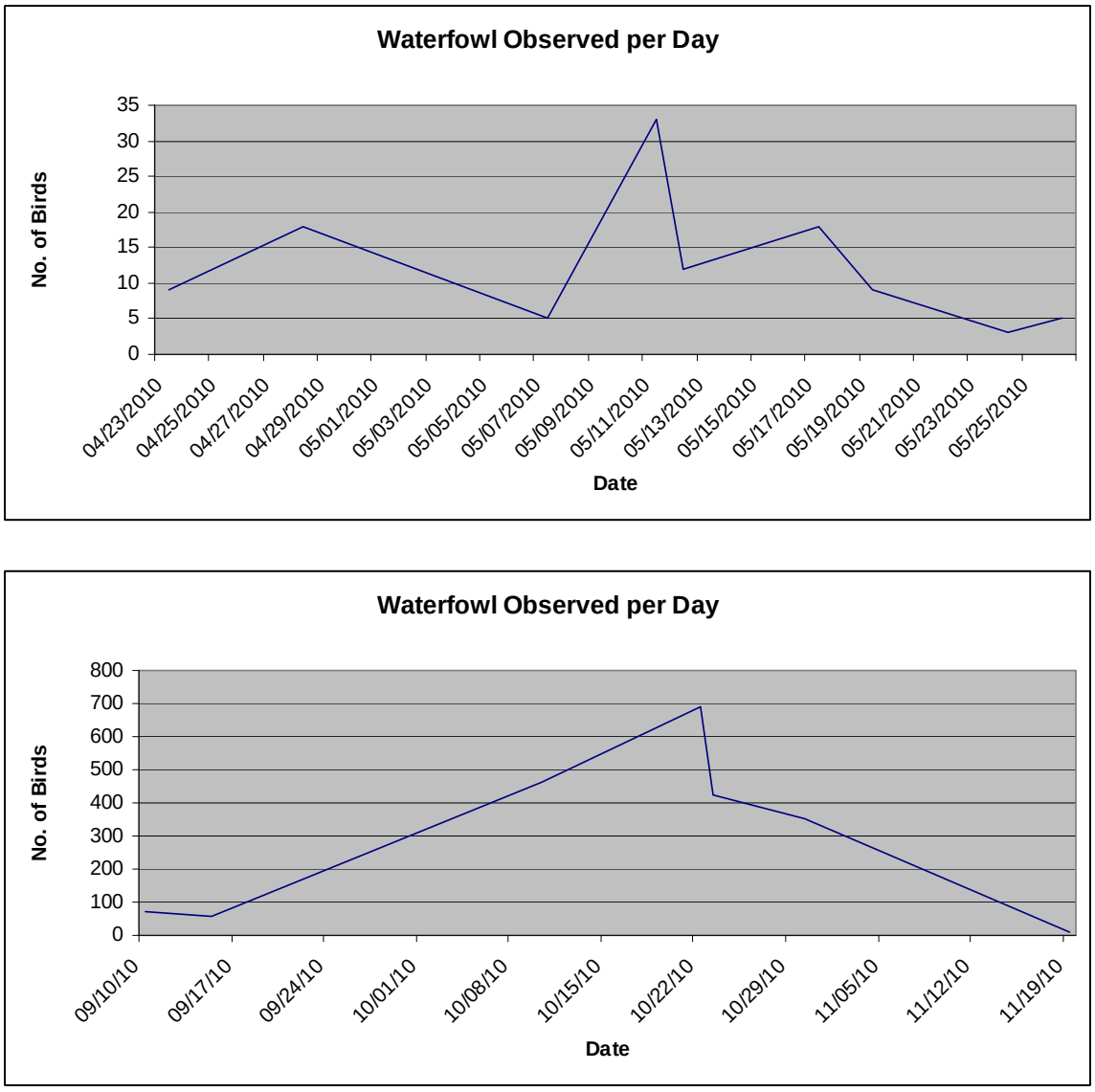

Figure 7. In the spring and fall of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The numbers of waterfowl detected were quantified by survey day.

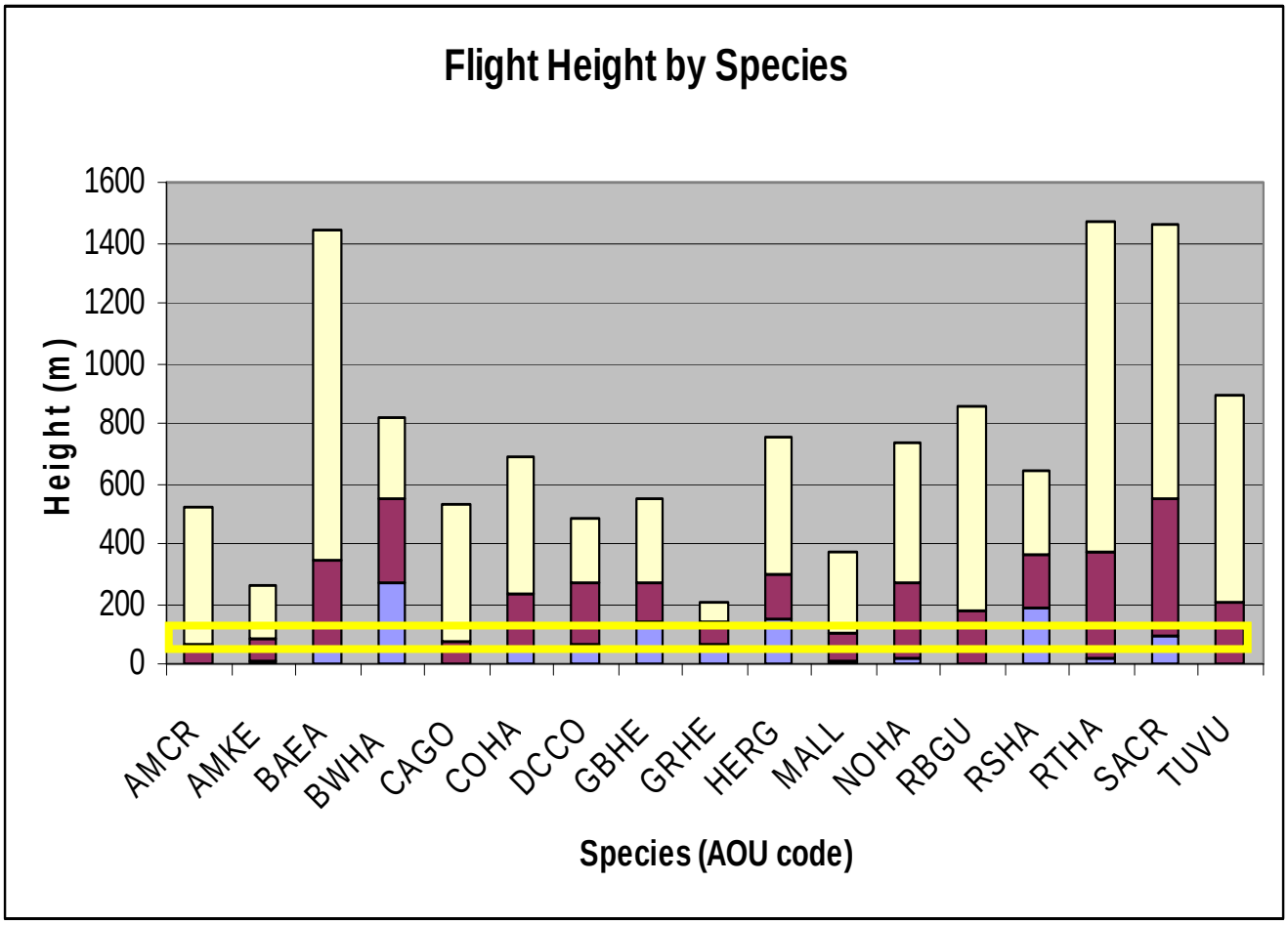

Figure 8. In the spring of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The AOU species codes are detailed in Appendix A, the top of the blue bars represent the minimum height of flight, the top of the dark red bar represents the mean height of flight, and the top of the cream bar represents the maximum flight height of each species. The horizontal gold bar is approximately the rotor swept area of a wind turbine.

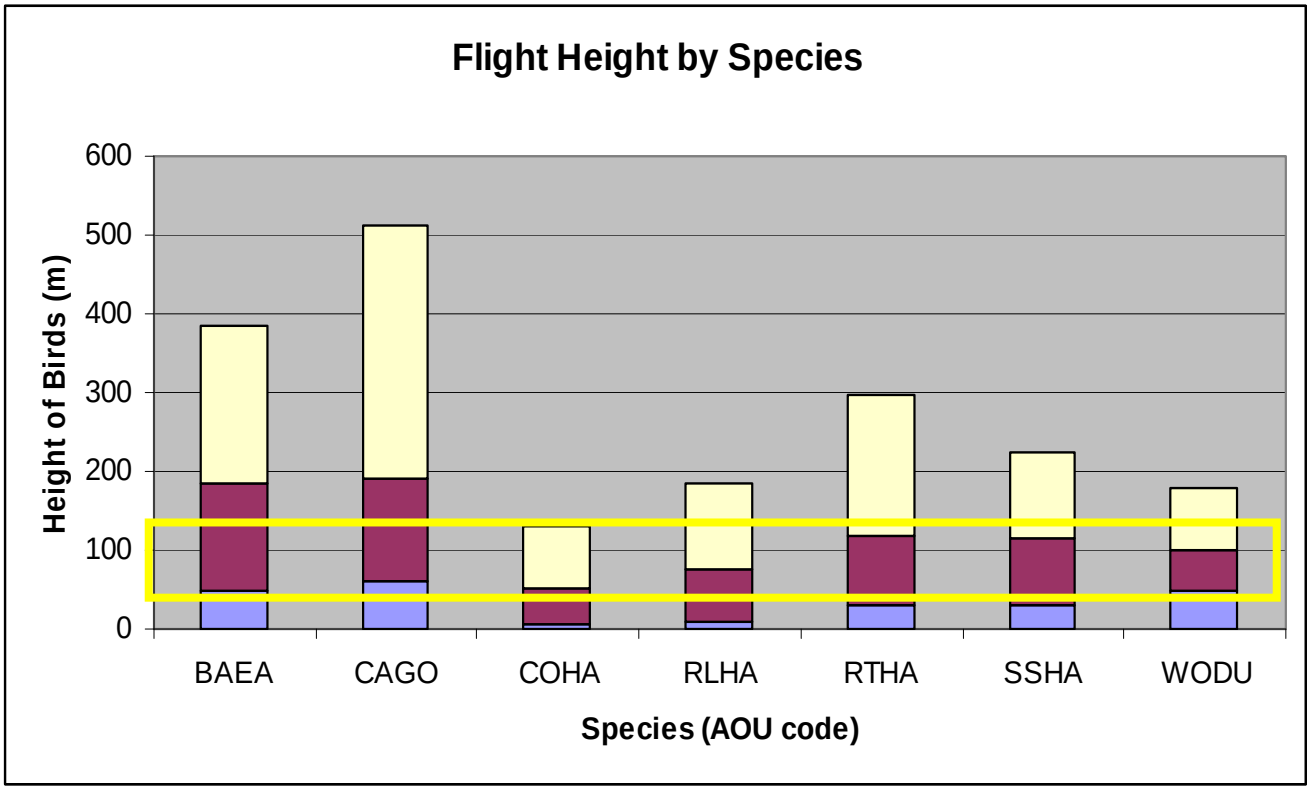

Figure 9. In the fall of 2010 large bird surveys were conducted in Mason County, Michigan, in and around the Project Area proposed for the development of wind energy by Consumer's Energy. The AOU species codes are detailed in Appendix A, the top of the blue bars represent the minimum height of flight, the top of the dark red bar represents the mean height of flight, and the top of the cream bar represents the maximum flight height of each species. The horizontal gold bar is approximately the rotor swept area of a wind turbine.

Breeding Songbird Surveys

We completed 25 point counts between June 10th and July 15, 2010. Surveys of point count stations detected 599 birds of 55 species in the Project Area (Table 7, Appendix A). We detected a mean of 24.0 birds per point count visit (mean of 2.2 species / survey; Table 7).

The 2 most abundant bird groups per survey were the non-native invasive species (4.2 birds / survey), followed by swallows and swifts (2.7 birds / survey; Table 8). These species groups were consistent with the disturbed, agricultural, open / grassland / shrubland habitats found in the Project Area.

Several of the grassland / openland species observed in the project areas are thought to be sensitive to the presence of tall structures in their breeding habitats, forcing

their displacement. Those species in the project areas that could be potentially sensitive to the construction of tall structures include: Red-winged Blackbird, Eastern Meadowlark, Field Sparrow, Song Sparrow, Savannah Sparrow, Clay-colored Sparrow, and Bobolink. The point counts where we detected 3 or more of those species are highlighted in Figure 10. The Project Area includes a high proportion of these point counts. Row crop agricultural fields would tend to have fewer of these sensitive species than pastures, and hayfields. Turbine setbacks from open grassland areas are recommended to minimize the potential displacement of grassland birds. Another option for mitigation of potential nest loss may include agreements with local owners of hay fields to forego hay mowing until songbirds have fledged their young in the middle of June.

Table 7. Avian abundance and richness in Mason County, MI in and around the Project Area proposed for the development of wind energy. Data were collected in June 2010.

	Point Counts
No. Species	55
Mean No. Individuals / Survey	24.0
Mean No. Species/Survey	2.2

Table 8. Mean bird abundance in Mason County, MI in and around the Project Area proposed for the development of wind energy. Data were collected in June and July 2010 at point count sites.

Group	Mean Abundance [a]
Blackbirds	2.3
Chickadees/Nuthatches	0.8
Corvids	2.2
Doves	0.8
Finches/Buntings	2.6
Flycatchers	0.7
Invasives	5.0
Other Passerines	0.4
Raptors	0.2
Shorebirds	0.4
Sparrows	2.6
Swallows/Swifts	3.2
Thrushes	1.4
Vireos	0.1
Warblers	0.3
Waterbirds	0.4
Waxwings	0.5
Woodpeckers	0.3
Wrens	0.3

[a] Mean Abundance = mean number of individuals observed per survey

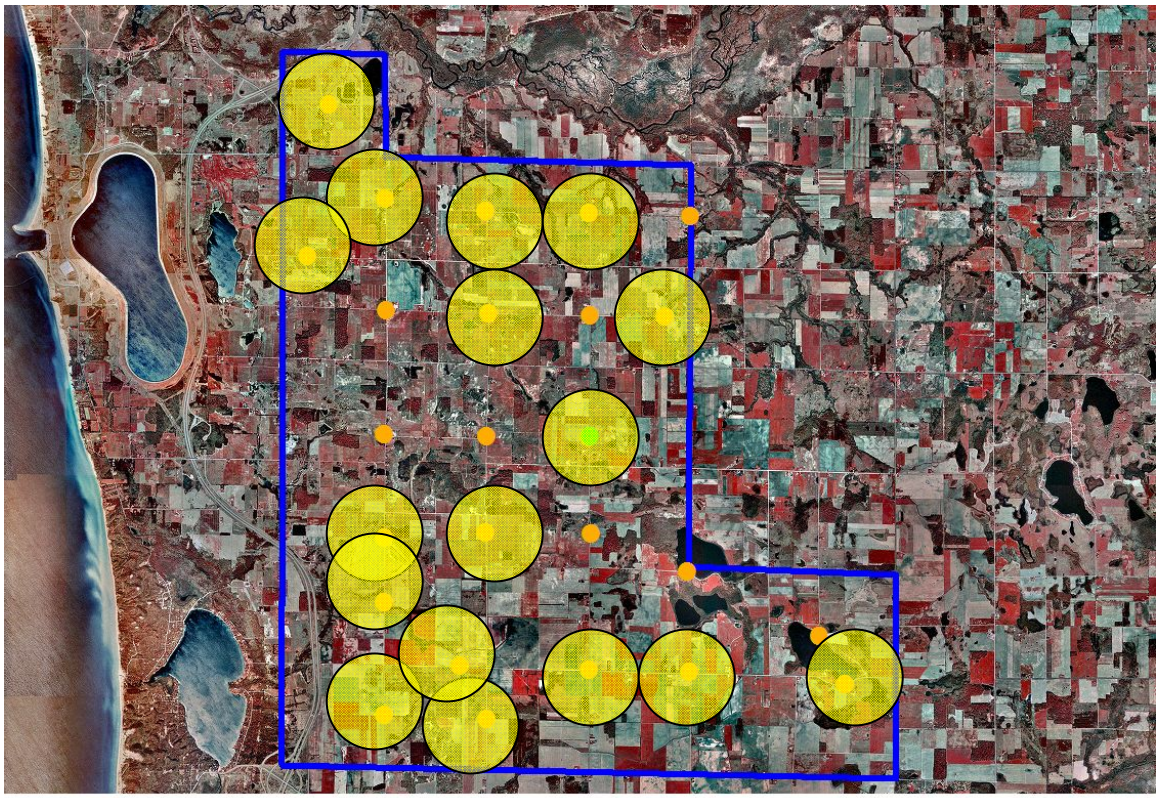

Figure 10. Point count sites (orange dots) were established in Mason County, MI for a Project Area proposed for wind energy development. Point count sites were surveyed for bird use in June and early July 2010. Those points highlighted with yellow circles included 3 or more detections of open area species potentially sensitive to the construction of tall structures.

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Appendix A. List of bird species observed during bird surveys conducted in Mason County, Michigan, in and around the Project Area proposed for wind energy development. These sites were surveyed in 2010 for bird use.

Species[a]	AOU code
Double-crested Cormorant	DCCO
Canada Goose	CAGO
Mallard	MALL
Wood Duck	WODO
Great Blue Heron	GBHE
Green Heron	GRHE
Wild Turkey	WITU
Turkey Vulture	TUVU
Sharp-shinned Hawk	SSHA
Cooper's Hawk	COHA
Red-tailed Hawk	RTHA
Red-shouldered Hawk	RSHA
Broad-winged Hawk	BWHA
Rough-legged Hawk	RLHA
Northern Harrier	NOHA
Bald Eagle	BAEA
American Kestrel	MAKE
Sandhill Crane	SACR
Killdeer	KILL
Herring Gull	HEGU
Ring-billed Gull	RBGU
Mourning Dove	MODO
Rock Pigeon	ROPI
Chimney Swift	CHSW
Northern Flicker	NOFI
Downy Woodpecker	DOWO
Eastern Kingbird	EAKI
Eastern Phoebe	EAPH
Eastern Wood Pewee	EAWP
Great-crested Flycatcher	GCFL
Tree Swallow	TRES
Barn Swallow	BARS
Chimney Swift	CHSW
Blue Jay	BLJA
American Crow	AMCR
Black-capped Chickadee	BCCH
Tufted Titmouse	TUTI
White-breasted Nuthatch	WBNU
House Wren	HOWR
Brown Thrasher	BRTH
Gray Catbird	GRCA
Black-billed Cuckoo	BBCU

Appendix A (continued).

Species[a]	
American Robin	AMRO
Eastern Bluebird	EABL
Cedar Waxwing	CEDW
European Starling	EUST
Red-eyed Vireo	REVI
Warbling Vireo	WAVI
Common Yellowthroat	COYE
Yellow Warbler	YEWA
Ovenbird	OVEN
Bobolink	BOBO
Red-winged Blackbird	RWBL
Eastern Meadowlark	EAME
Baltimore Oriole	BAOR
Common Grackle	COGR
Brown-headed Cowbird	BHCO
European Starling	EUST
Scarlet Tanager	SCTA
Rose-breasted Grosbeak	RBGR
Northern Cardinal	NOCA
Indigo Bunting	INBU
House Finch	HOFI
American Goldfinch	AMGO
House Sparrow	HOSP
Chipping Sparrow	CHSP
Field Sparrow	FISP
Song Sparrow	SOSP
Savannah Sparrow	SASP
Clay-colored Sparrow	CCSP

[a] names of birds follow the AOU Check-list of North American Birds