ESTIMATES OF BIRD MORTALITY ASSOCIATED WITH TRANSMISSION LINES

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ABBREVIATIONS

FERC	Federal Energy Regulatory Commission
kV	Kilovolts
MW	Megawatt
NYPA	New York Power Authority
NMPC	Niagara Mohawk Power Corporation
NIS	Niagara Information System
NYSEG	New York State Electric & Gas USACE United States Army Corps of Engineers
NYSDOS	New York State Department of State
NYSDOT	New York State Department of Transportation
NYSM	New York State Museum
NYSOPRHP	New York State Office of Parks, Recreation, and Historic Preservation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USFWS	United States Fish and Wildlife Service

EXECUTIVE SUMMARY

Sixty-three hours of daylight observations of birds crossing five power line spans within the Niagara Power Project relicensing area were conducted during the Spring migration period in late April and early May 2004. An interaction between a bird and a transmission line was defined as an event where a bird entered an area bound by the structures supporting a transmission line span, the apparent edges of the right of way parallel to the transmission line, and a vertical area bound by the ground and an estimated altitude twice the height of the structures. Two field biologists observed birds within this area for 3 hours per span over a 10-day period. The team also searched for evidence of dead birds within each span, and estimated various sources of bias associated with searching for dead birds.

A total of 4,960 "interactions" between birds and power lines were observed. Forty-two bird species were identified during the study. A total of seven dead birds or feather spots were found. No collisions between birds and electric utility conductors or structures were observed. When all search biases were accounted for, an estimated total of 13 dead birds was calculated. Two collision rate estimates (CRE), one using the total number of flights observed and one using an estimated number of flights per day (calculated from our data) were developed. These were 0.27% and 0.72% respectively. These collision rate estimates indicate that between 0.27% and 0.72% of the flights that enter the study area would result in bird mortality. Depending upon the method used, the calculated collision rates for the study area are well below or slightly below the mean and median values reported from other studies in the US. We conclude that based on data acquired during the Spring migration, electric transmission lines in the study area do not appear to be substantial sources of mortality.

1.0 INTRODUCTION

The New York Power Authority (NYPA) is engaged in the relicensing of the Niagara Power Project (Project) in the Towns of Lewiston and Niagara and the City of Niagara Falls, Niagara County, New York. The present operating license of the plant expires in August 2007. In preparation for the relicensing of the Project, NYPA is developing information related to the ecological, engineering, recreational, cultural, and socioeconomic aspects of the Project. The objectives of this issue are to: 1) describe the ownership of and maintenance responsibilities for transmission facilities within the FERC project boundary; and 2) analyze the relationship between electrical transmission facilities and bird collisions and determine whether bird collisions are occurring along transmission facilities within the Project Boundary.

The scope and design of this investigation was prepared by relicensing staff from NYPA; URS Corporation (URS); and E/PRO Engineering and Environmental Consulting, LLC (E/PRO).

1.1 Background

The 1,880-MW (firm capacity) Niagara Power Project is one of the largest non-federal hydroelectric facilities in North America. The Project was licensed to the Power Authority of the State of New York (alternatively, the New York Power Authority) in 1957. Construction of the Project began in 1958, and electricity was first produced in 1961.

The Project has several components. Components of the Project are thoroughly described in other reports prepared for this Project. In summary, water is withdrawn from the Niagara River near the Town of Lewiston, and pumped to a 1.8 billion gallon forebay on the east side of the Niagara River, downstream of Niagara Falls (Figure 1.1-1). From the forebay water is pumped either through the 13 turbines of the Robert Moses Niagara Power Plant, or into the 22 billion gallon Lewiston Reservoir. A large switchyard located south of the forebay is the interface between the electric generation portion of the project and the various transmission lines that carry electricity to the Project's service area.

1.2 Investigation Area

Approximately 3,707 acres of lands are owned by or fall under the jurisdiction of NYPA in the Towns of Lewiston, and Niagara, City of Niagara Falls, and the Village of Lewiston. The upland area owned or managed by NYPA in this area (minus the water area of the reservoir and forebay) is approximately 1,571 acres. 128 acres of land within the Project Boundary are owned by the City of Niagara Falls with NYPA holding an easement for operation and maintenance of water transmission conduits for almost all of this acreage. Another approximately 40 acres of land within the Project Boundary are not owned by NYPA. These 1,739 acres comprise the "investigation area" for this report (Figure 1.1-1). Specific areas investigated in this study are shown in Figures 1.1-2 through 1.1-6.

Some of these lands occur within the Project Boundary and are hereafter referred to as "Project lands". All of the areas included in this study lie within the Project Boundary. NYPA manages the majority of these lands, with the remainder managed by the City of Niagara Falls, NYSOPRHP, NYSDOT, NMPC, NYSEG, local governments, and other entities. The NYPA-owned lands that are managed by NYPA are primarily those associated with the generation and transmission of electricity at the Niagara Power Project. Lands owned and managed by NYPA (though not associated with project operations) also include lands used for construction purposes, a portion of the gorge, a 30-acre parcel of land that contains a NYPA warehouse, and several areas adjacent to the Robert Moses Parkway.

Estimates of area to be studied were made using GIS. Transmission lines and switchyards within the FERC Project Boundary are owned or managed by the New York Power Authority (NYPA), Niagara Mohawk (NIMO) and the New York State Electric and Gas Corporation (NYSEG). Approximate ROW miles owned or managed by each within the Project boundary are:

NYPA: 1.2 miles

NIMO: 4.1 miles

NYSEG: < 0.1 miles

Total ROW: 5.3 miles (not including a - small NYSEG portion)

Given the small length of NYSEG transmission ROW, this study was limited to NYPA and NIMO transmission lines. NIMO lines were sampled only where they occupy NYPA-owned ROW.

1.3 Purpose

The objectives of this issue are to: 1) describe the ownership of and maintenance responsibilities for transmission facilities within the FERC project boundary; and 2) analyze the relationship between electrical transmission facilities and bird collisions and determine whether bird collisions are occurring along transmission facilities within the Project Boundary.

The first objective was met through studies associated with E/PRO 2005. The E/PRO report describes the ownership and maintenance of property within the project area.

The second objective was met through quantitative analysis for this study.

1.4 Background of the Issue

Birds and flying mammals may become injured or killed through collisions with tall man-made structures located inside their flight paths. Buildings, communication towers, transmission and distribution lines, wind-powered electric generating stations and other tall structures have been implicated in causing bird mortality (USFWS 2002).

Electric transmission and distribution lines may directly cause mortality through electrocutions and collisions. Due to the differences in distribution and transmission line structure and conductor configurations, electrocutions of even very large birds on transmission lines are rare events. Distribution lines (generally defined as lines carrying less than 69 kV) often have conductors mounted close to and above cross-members -. Poles on distribution lines often have switches, transformers and other structures where birds could contact wires or metal pieces and be electrocuted. Modern transmission lines, with their greater insulator lengths and distances between metal structures and conductors, generally are not responsible for electrocutions, even in large birds (Bradley undated manuscript).

Collisions between birds and overhead wires have been described as early as the late 1800's for telegraph wires (Aldrich 1877, Coues 1876), and early 1900's for telephone lines (Emerson 1904). With the advent of the National Environmental Policy Act (NEPA), public concern over potential bird mortality caused by transmission lines has increased, and, therefore, the amount of research on the issue has increased as well. NUS Corporation (1979) compiled a summary list of studies. Among the conclusions drawn by the study were that species with larger appendages (legs and necks) or high wing loadings (e.g. swans) collided more often with power lines. The frequency of collisions was also influenced by poor visibility due to weather or time of day, the location and diameter of the lines, and the ages of the birds involved (NUS 1979).

Potential impacts of transmission lines on bird mortality have been studied rather extensively along the west coast (TES 1989, 1990; Willdan Associates 1982; Bradley undated; Arend 1970; Meyer 1978; Williams and Colson 1988), in the upper prairie states in central US (McKenna and Allard 1976; Cassel et al 1979; Faanes 1987, Stahldecker 1975), the eastern Midwest (LaBerge 1976; Rusz et al 1986; Anderson 1978), and the east coast (Small and Hunter 1989). Several conclusions can be drawn from these studies. Bird mortality was influenced by the location of the transmission line, in that lines located near bird concentration areas or along migration routes saw greater mortality. Decreased visibility tends to result in more collisions. Birds with greater wing loading rates tend to collide more often with transmission lines than more agile fliers with lower loading rates.

Crowder and Rhoads (2001) list several examples of rather large bird kills associated with electric power lines, including 75 *Chen caerulescens* (snow geese) in Manitoba (Blokpoel and Hatch 1976), "several hundred" *Grus canadensis* (sandhill cranes) in Nebraska (Wheeler 1966). In summary Crowder and Rhoads (2001) stated their literature review suggested that bird strikes on power lines were "isolated, but relatively common events". The U.S. Fish and Wildlife Service (USFWS) produced a two-page summary titled Migratory Bird Mortality (USFWS 2002) that discussed the magnitude of various sources of mortality. Table 1.4-1 shows the magnitude of the estimated deaths. Building strikes appear to be one of the largest sources of bird deaths, accounting for over 90 million deaths annually. Cars and poisoning also appear to cause millions of deaths each year. USFWS mentions but does not cite an often cited study of bird mortality in Wisconsin, that estimated 39 million birds are killed annually by domestic rural cats in that state alone (Coleman et al 1997).

USFWS reports a conservative estimate of "tens of thousands" of bird deaths caused annually by collisions with high-tension electric transmission lines. They note that when distribution lines are added, electric lines in general could be responsible for 176 million deaths annually. In general, it seems that bird strikes on electric transmission lines (not including the more numerous and lower voltage distribution lines) may be responsible for many fewer deaths than buildings, cars, poisoning and other causes.

TABLE 1.4-1

ESTIMATED DEATHS BY HAZARD TYPE

Hazard	Estimated Annual Deaths*
Building window strikes	97 to 976 million (possibly closer to 40 to 50 million)
Transmission line strikes	Tens of thousands**
Cars	60 million
Wind turbines	33,000
Poisoning	72 million

* Source USFWS 2002.

** Note that this is a conservative estimate in the sense that USFWS indicates that when all bulk transmission and distribution lines are accounted for, and extrapolating from European studies, collisions with all electric lines could be responsible for 174 million deaths annually. Note however that this study focuses on potential mortality associated with Transmission lines only.

Non-Internet Public (NIP) information has been removed from the following page(s).

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Volume 2
Section: Estimates of Bird Mortality Associated with Transmission Lines

FIGURE 1.1-1

SITE LOCATION MAP

[NIP – General Location Maps]

FIGURE 1.1-2

NORTH LEWISTON SITE

[NIP – General Location Maps]

FIGURE 1.1-3

WITMER ROAD SITE

[NIP – General Location Maps]

FIGURE 1.1-4

SOUTH LEWISTON SITE

[NIP – General Location Maps]

FIGURE 1.1-5

INTAKES SITE

[NIP – General Location Maps]

FIGURE 1.1-6

FISHING ACCESS SITE

[NIP – General Location Maps]

2.0 METHODS

The Scope of Services for Issue 14 and 15 indicated that the methods outlined in de la Zerda and Rosselli (1997) or other acceptable methods should be used to estimate the potential for bird interactions with transmission facilities. The methods that De La Zerda and Rosselli used in 1997 were published in Spanish in a final report to an electric utility in Colombia, but these same methods were also used in a study published in English in 2002 (de la Zerda and Rosselli 2002).

The de la Zerda and Rosselli (2002) study used "spans", or the distance between two transmission line support towers as the sampling unit. We estimated 11-paired towers within the approximately 1.2 mile NATL section within the Project Boundary. Thus there are approximately nine towers/mile within this section, or eight spans/mile. If span length is similar among the companies (no tower locations were available for the NIMO lines) then the 5.4 miles of ROW proposed for this study would include an estimated 49 spans. The study sampled five spans, or roughly 10% of the ROW.

Sample units, defined as spans were randomly selected through a stratified random selection. We sampled one span along the NIMO ROW north of the Lewiston Reservoir (Figure 1.1-2); one span along the NATL and NIMO ROW that runs north and south of the Niagara switchyard (Figure 1.1-3); one span along the ROW south of the Lewiston Reservoir (Figure 1.1-4); one span along the ROW running east-west north of the Robert Moses Parkway (Figure 1.1-5); and the span that crosses the Niagara Gorge between the NYPA Niagara project and the Sir Adam Beck project in Canada (Figure 1.1-6). The assumption was that the Lewiston Reservoir, the tailrace at the Robert Moses power plant, and the Niagara River were likely to function as strong attractors for birds (Rusz et al. 1986) and would be areas of concentration. Transmission lines near these areas were therefore seen as potential areas for bird strikes.

Flights of birds across the lines were recorded by two observers in each span. Each span was observed for 3 hours. Since the likelihood of actually observing a bird strike is low (de la Zerda and Rosselli 2002, Anderson 1978, Rusz et al 1986), one team member searched within the span for fresh dead bird carcasses or feather spots at the beginning of each sampling period. The species of each carcass or feather spot was recorded. Carcass searches were not possible at the Niagara Gorge Crossing span.

The search area for tabulating bird crossings was defined as an area bound by the distal (outside) ends of the transmission structures, the approximate width of the right-of-way, the ground, and an area above the transmission line estimated as twice the height of the structure and transmission lines. These approximate boundaries formed a volume within which bird/transmission line interactions were tallied. An interaction was defined as a bird moving within that volume. Each time a bird entered and left the sample volume an interaction was recorded. Birds that flew above the transmission lines higher than twice the structure and transmission line height were noted but not analyzed, since we believed that birds flying beyond this height could not truly be thought of as "interacting" with the transmission lines. When a bird entered the sample volume and landed on the ground or perched within the volume, this action was counted as one interaction. When the bird moved again from the ground or perch, another interaction was recorded.

Sampling at the Niagara Gorge crossing was complicated by the inability to make observations from below the lines. The team used the public fishing access site that NYPA provides at the base of the Robert Moses Power plant. In this difficult-to-sample area, it was necessary to identify physical features that would allow the team to identify a sampling volume. The volume sampled was defined as an area bound by the walls of the Beck and Moses structures, the outside (upstream and downstream) transmission lines that cross the Niagara Gorge, an upper limit defined by the height of the large moving crane over the turbines on the Robert Moses structure, and a lower limit defined as the distance between the conductors and the top of the moving crane, extended below the conductor. The lower limit was selected because of the extensive distance between the Niagara River water surface and the conductors. The team believed that birds flying below the lower limit defined above could not be thought of as interacting with the transmission lines.

Each team member was equipped with binoculars, and a spotting scope was available for long-distance identifications. Team member's movements were kept miminal during the three-hour observation periods in order to not flush birds and cause an artificial increase in bird/transmission line interactions. Birds were identified to species, and tallies of the number of interactions per species were recorded for each three-hour observation period. Observations typically began at approximately 0700, and ended at approximately 1900.

2.1 Estimation of Sampling Bias in the Carcass Surveys

The carcass search can be biased by several factors. De la Zerda and Rosselli (2002) list these factors as ***search bias***, ***removal bias***, ***habitat bias*** and ***crippling bias***. ***Search bias*** is a measure of a field observer's ability to find dead birds. This was assessed by having a staff member not involved in the live bird counts place 15 dead, farm raised *Cotrunix cotrunix* (migratory quail) within two and one-half spans of the right of way beginning south of Witmer Road (Figure 1.1-1). *Cotrunix* were selected because their size was equivalent to large *Turdus migratorius* (robin), or roughly a middle-size bird, and because their rather cryptic striping and coloration would make finding the birds challenging. Birds were purchased already dead from a farmer in Ohio, and were frozen and transported to the study site. Dead frozen birds were thawed before being placed on the right-of-way. Each surveyor moved through the area and looked for the dead birds. ***Search bias*** was calculated as the percentage of the 15 birds found, following Equation 2.1.1.

Equation 2.1.1: ***Search Bias***: SB = (TFDB / PQF) - TFDB

Where: SB = Search Bias

TFDB = Total Fresh Dead Birds and Feather Spots Found

PQF = Proportion of Quail Found

Removal bias is an estimate of the probability that dead birds would be removed from the sampling area within 24 hours by predators, scavengers, etc., before being seen by surveyors. It was estimated by placing an additional 15 dead quail within the study area. The locations of all thirty carcasses were recorded. ***Removal bias*** was calculated using the following Equation 2.1.2.

Equation 2.1.2: ***Removal Bias***: RB = ((TFDB + SB)/PNR) – (TFDB +SB)

Where: RB = Removal Bias

PNR = Proportion of planted Quail Not Removed after 24 hours

Habitat bias is an estimate of the proportion of the study area that was inaccessible, and therefore could not be searched during the carcass surveys. The area beneath the Sir Adam Beck – Robert Moses connector was inaccessible. Equation 2.1.3 was used to calculate ***Habitat Bias.***

Equation 2.1.3: ***Habitat Bias:*** HB = ((TFDB + SB+ RB)/PS) – (TFDB + SB + RB)

Where: HB = Habitat Bias

PS = Proportion of the area that was searchable

Crippling bias is an estimate of the number of birds that may strike the transmission line or towers but not fall within the study area. It is calculated by direct observation of the phenomenon, and is therefore an unlikely event. Equation 2.1.4 was used to calculate ***Crippling Bias***.

Equation 2.1.4: ***Crippling Bias:*** CB = ((TFDB + SB+ RB + HB)/PBC) – (TFDB + SB + RB + HB)

Where: CB = Crippling Bias

PBC = Proportion of observed collisions falling within the study area.

The various bias calculations were used to adjust the actual counts of fresh dead birds and feather spots to estimate the total number of collisions between birds and transmission lines. The ***Estimate of Total Collisions*** (ETC) was calculated as the sum of the total of fresh dead birds and feather spots found, and the various bias factors, using Equation 2.1.5.

Equation 2.1.5: **Estimate of Total Collisions*:*** ETC = TFDB + SB + RB + HB + CB

Finally, a ***Collision Rate Estimate*** (CRE) was calculated that expressed the estimate of total collisions as a proportion of the total bird flights observed, using Equation 2.1.6.

Equation 2.1.6: **Collision Rate Estimate*:*** CRE = (ETC/TF) x 100

Where TF = the total flights observed. CRE was calculated for the spring and fall migration periods.

3.0 RESULTS

3.1 Bird Count Results

The five sampled spans, dates and times at which they were sampled are shown in Table 3.1-1. Sites were sampled from early morning through early evening on the dates shown. Site sampling was arranged so that each site was sampled during a morning, afternoon, and evening period. Night sampling was not completed for this study. The Buffalo Ornithological Society (2002) reported attempting to complete a night survey from the Rainbow Bridge, and indicated that reliably identifying and counting birds, even with night vision equipment, proved quite difficult. The team attempted to identify and count birds on the evening of 29 April, and found the attempt futile.

A total of 4,960 bird/power line interactions were observed during the Spring surveys (Table 3.1-2). Forty-two species were identified interacting within the five power lines sampled. Only one bird, a small sparrow, could not be reliably identified to species. The bird was observed at a distance in shrubs at the North Lewiston site, during overcast and rainy conditions. Ring-billed gulls (*Larus delawarensis*) accounted for 2,651 observed interactions, or just over 53% of the total interactions observed. A sizable population of *Larus delawarensis* was found circling beneath and above the conductors between the Robert Moses and Beck projects, and was responsible for most of the counts for this species. Red wing blackbirds (*Agelaius phoeniceus*) were the next most commonly observed birds, with 1,082 interactions observed. A number of different types of birds were observed crossing the lines, including water birds, raptors, scavengers and a variety of passerines (small perching birds).

The greatest number of species observed occurred at the Witmer Road site, where 27 bird species were noted during the study. The team found 25 species at the North Lewiston Reservoir; 19 at the Intakes; and 17 at the South Lewiston and Fishing Access sites. Note that these are not thorough species lists, inasmuch as the purpose of the project was not to document the presence of all species within the study area, but rather to assess the number of bird/transmission line interactions. For example, the team heard a sora rail calling in a wetland at the Witmer Road site. However, the bird does not appear in the data set because it was never observed flying.

The hourly observation records shown in Table 3.1-3 to Table 3.1-7 show the typical pattern of greater bird activity during earlier morning and earlier evening hours, with relatively lower activities, as expressed in terms of bird/transmission line interactions, during mid-day. The greatest number of observations was made at the Fishing Access site, where 1,184 bird/transmission line interactions were recorded. The team recorded 1,176 interactions at the Intakes site and 1,172 at Witmer Road. The lowest numbers of interactions were recorded at the North and South Lewiston Reservoir Sites, with 793 interactions at South Lewiston and 635 at North Lewiston. At all of the sites, *Larus delawarensis* made up over 25% of the observations. *L. delawarensis* accounted for 90% of the observations at the Fishing Access site; 66% at South Lewiston; 45% at the Intakes; 29% at North Lewiston and 28% at the Witmer Road site.

The outfalls at the Robert Moses and Beck Plants are sites where gulls, in particular large groups of *L. delawarensis* and *L. philadelphia* are attracted to the area to feed. The large number of interactions recorded at this site was largely the result of a large number of gulls continually circling and diving, catching fish in the area (Table 3.1-6). The South Lewiston (Table 3.1-5) and Intakes (Table 3.1-7) sites appear to lie along paths that gulls use during their daily trips between the Niagara River, the Reservoir and other areas.

Red wing blackbirds (*Agelaius phoeniceus*) accounted for many of the interactions at the North and South Lewiston (Table 3.1-5), Intakes (Table 3.1-7), and Witmer Road Sites (Table 3.1-4). Starlings (*Sturnus vulgaris*) were commonly recorded at the Intakes Site, and goldfinches (*Carduelis tristis*) and robins (*Turdus migratorius*) were common at the North (Table 3.1-3) and South Lewiston (Table 3.1-5) sites. Raptors were relatively uncommon. More raptors were observed than are recorded in Tables 3.1-3 through 3.1-7, but these unrecorded raptors were flying so high above the transmission lines that their passage did not constitute an interaction.

3.2 Dead Bird Survey Results

Table 3.2-1 shows the results of the daily surveys for evidence of dead birds, arranged by site and date. An NS entry indicates the site was not surveyed on that date. Zeros indicate that no evidence of dead birds was found during the visual survey. The Fishing Access site was not surveyed for dead birds, since the area beneath the lines was largely inaccessible, and carcasses would not be found anyway due to the extremely swift current.

Evidence of dead birds was found at the North Lewsiton, Witmer Road, and South Lewiston sites. A total of 7 occurrences were noted. One dead starling was found at the North Lewsiton site on 29 April. The greatest number of carcasses was found on 26 April at the Witmer Road site, where one grackle, one starling and one woodcock were found. The starling was reduced to a feather spot by 27 April. On six May, one grackle feather spot and one partial starling carcass were found at Witmer Road. One dead starling was noted at the South Lewiston site on four May. No dead birds were found at the Intakes site.

There are several possible reasons why more dead birds were found at Witmer Road than the other sites. The Witmer Road area appeared to be regularly mowed; during our survey the vegetation was mostly grasses and forbs with very few shrubs. The mowed aspect made this area rather easy to survey. In addition, an active crow's nest on the southernmost structure was observed in this study area (structure NR1 1/8). An adult crow was observed moving to and from this nest during our survey; it is possible that some of the birds observed were killed by the crow but not transported to the nest.

3.3 Bias Estimation Results

The effect of various potential sources of bias in finding dead birds was assessed. These biases included search bias, removal bias, habitat bias, and crippling bias. Search bias is a measure of the ability of the field staff to find dead birds. **Of the 15 birds placed, the field team found 10. Search bias for this study, as calculated using Equation 2.1.1, was 3.5**.

Removal bias is an estimate of the bias introduced by removal of bird carcasses by scavengers or predators before the carcasses could be found by the field, team. **Removal bias was calculated using Equation 2.1.2, and was 0.319 for this study.**

Habitat bias is an estimate of the bias introduced because portions of the study area could not be searched by the field team. Approximately 20% of the total surveyed area, that is the area beneath the

Beck-Moses connector at the Fishing Access site, could not be surveyed for dead birds. **Habitat bias, as calculated using Equation 2.1.3, was estimated as 2.71 for this study.**

Crippling bias is an estimate of the number of birds that are crippled by striking a transmission line, but which landed outside the study areas. **No bird strikes on the lines were directly observed, so the value of this bias estimate was 0.**

An estimate of total collisions was calculated using Equation 2.1.5. This estimate combines the total observed dead bird evidence with estimates from the various bias factors. **Total estimated collisions for this study was 13.21.** That is, given the various biases inherent in the sampling method, it is possible that roughly 13 dead birds could have been found during the sampling period.

Finally, a collision rate estimate (CRE) was calculated using Equation 2.1.6. CRE is essentially an estimate of the proportion of flights that could result in a collision between birds and transmission lines. In this study, data indicate that approximately 0.27% of the bird flights in the spring would result in a collision.

Other researchers have used slightly different methods for calculating a collision rate estimate. Several studies completed for the Bonneville Power Authority used the average number of flights over 24 hours as an estimate of total flights. The team observed 4,960 bird/transmission line interactions over 63 hours of observations, yielding an estimate of 78.73 birds/hour for all lines studied. Extrapolated over 24 hours this yields an estimate of 1,889.52 birds/day. CRE calculated using this figure is 0.72%.

Table 3.3-1 shows the collision rate estimates derived from studies completed for the Bonneville Power Authority. The studies from which data were extracted were summarized by Beaulaurier, et al (1982), and Table 3.3-1 is taken from this paper. Flights per day in these studies completed in the Northwest US ranged from 12 to over 3,000. Collision rate estimates calculated from these studies ranged from 0.12 to 1.61. The collision rate of 0.01 from the Willdan Associates (1981) data was based on observed collisions only, and not on an estimate of total collisions that took into account the various sources of bias used in this and other studies.

We calculated mean and median collision rate estimates using the data in Table 3.3-1. The mean and median were calculated without the Bybee Lake, no ground wire study, since ground wires were intact on all of the spans used in our study, and without the Willdan Associates (1981) Columbia River data, since the collision rate estimate for this study was based on observed collisions only. We found a mean of 0.61, and a median value of 0.54, based on the studies in Table 3.3-1. Depending upon the method used, the CRE calculated for this study was well below or slightly above these mean and median values. By any method, the CRE is for this study is below 1%.

TABLE 3.1-1

SITES, DATES AND TIMES SAMPLED

Site	Dates & Times Sampled	Total Spring Hours Sampled
North Lewiston	27 Apr, 0815-1115 29 Apr, 1140-1440 3 May, 1430-1730 5 May, 1035-1313	12
Witmer Road	27 Apr, 1220-1520 28 Apr, 1535-1835 30 Apr, 0745-1045 5 May, 0710-1010 6 May, 1425-1725	15
South Lewiston	27 Apr, 1545-1845 29 Apr, 0800-1100 4 May, 1045-1345 5 May, 1410-1710	12
Intakes	28 Apr, 0745-1145 3 May, 1040-1340 4 May, 1430-1730 6 May, 0715-1015	12
Fishing Access	28 Apr, 1145-1445 29 Apr, 1510-1810 4 May, 0715-1015 6 May, 1050-1350	12

TABLE 3.1-2

SPECIES AND NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED DURING SPRING SURVEYS

Common Name	Scientific Name	Total Interactions Observed
double crested cormorant	*Phalacrocorax auritus*	50
Canada goose	*Branta canadensis*	17
mallard	*Anas platyrhynchos*	8
herring gull	*Larus argentatus*	34
ring-billed gull	*Larus delawarensis*	2651
Bonaparte's gull	*Larus philadelphia*	24
common tern	*Sterna hirundo*	6
great blue heron	*Ardea herodias*	3
black crowned night heron	*Nycticorax nycticorax*	3
killdeer	*Charadrius vociferus*	20
American woodcock	*Philohela minor*	1
lesser yellowlegs	*Tringa flavipes*	6
sharp-shinned hawk	*Accipiter striatus*	2
northern harrier	*Circus cyanus*	1
red tailed hawk	*Buteo jamaicensis*	5
turkey vulture	*Cathartes aura*	21
American kestrel	*Falco sparverius*	2
peregrine falcon	*Falco peregrinus*	1
mourning dove	*Zenaida macroura*	78
pigeon	*Columba livia*	90
yellow-shafted flicker	*Colaptes auratus*	2
barn swallow	*Hirundo rustica*	48
tree swallow	*Iridioprocne bicolor*	27
rough wing swallow	*Stelgidopteryx ruficollis*	18
chimney swift	*Chaetura pelagica*	7
crow	*Corvus brachyrhynchos*	32
blue jay	*Cyanocitta cristata*	7
catbird	*Dumetella carolinensis*	2
mocking bird	*Mimus polyglottos*	1
robin	*Turdus migratorius*	151
yellow warbler	*Dendroica petechia*	10
red wing blackbird	*Agelaius phoeniceus*	1082
brown-headed cowbird	*Molothrus ater*	12
common grackle	*Quiscalus quiscula*	74
meadow lark	*Sturnella magna*	10

TABLE 3.1-2 (CONT.)

SPECIES AND NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED DURING SPRING SURVEYS

Common Name	Scientific Name	Total Interactions Observed
starling	*Sturnus vulgaris*	206
house sparrow	*Passer domesticus*	3
cardinal	*Cardinalis cardinalis*	7
goldfinch	*Carduelis tristis*	167
song sparrow	*Melospiza melodia*	40
savannah sparrow	*Passerculus sandwichensis*	30
unknown sparrow	*NA*	1
Total Interactions Observed		**4960**

TABLE 3.1-3

NORTH LEWISTON RESERVOIR, NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED BY DATE, TIME AND SPECIES DURING SPRING SURVEYS

Common name	Scientific name	27 April 2004				29 April 2004				3 May 2004				5 May 2004			
		0815	0915	1015	total	1140	1240	1340	total	1430	1530	1630	total	1035	1135	1235	total
Mallard	*Anas platyrhynchos*				0				0		2		2				0
herring gull	*Larus argentatus*	5			5				0				0	1			1
ring bill gull	*Larus delawarensis*	25	15	20	60	9	15	24	48	13	8	28	49	17		11	28
common tern	*Sterna hirundo*				0				0				0	6			6
killdeer	*Charadrius vociferus*		1	2	3			1	1		1		1				0
northern harrier	*Circus cyanus*	1			1				0				0				0
turkey vulture	*Cathartes aura*			3	3	1			1				0			1	1
mourning dove	*Zenaida macroura*				0				0			1	1				0
pigeon	*Columba livia*	4		1	5			9	9	6			6				0
yellow-shafted flicker	*Colaptes auratus*		1		1				0				0				0
barn swallow	*Hirundo rustica*	2			2				0				0				0
tree swallow	*Iridioprocne bicolor*				0				0				0	1		3	4
crow	*Corvus brachyrhynchos*			1	1				0				0				0
robin	*Turdus migratorius*	8	8	16	32				0	16	5	2	23	8	9	3	20
yellow warbler	*Dendroica petechia*				0				0	1	4	2	7	1	2		3
red wing blackbird	*Agelaius phoeniceus*	22	18	24	64	2	3	2	7	23	5	5	33	26	10	3	39
brown-headed cowbird	*Molothrus ater*				0	2			2			1	1	7	1		8
common grackle	*Quiscalus quiscula*	1			1				0				0				0
meadow lark	*Sturnella magna*				0				0				0				0
starling	*Sturnus vulgaris*	5			5	1			1				0				0
cardinal	*Cardinalis cardinalis*		4	1	5				0				0				0
goldfinch	*Carduelis tristis*	2	10	10	22		2		2	7	5		12	38	26	18	82
song sparrow	*Melospiza melodia*		8	2	10	2			2	2	1	2	5	2	3		5
savannah sparrow	*Passerculus sandwichensis*				0				0				0	1	1		2
unknown sparrow			1		1				0				0				0
Total interactions		**75**	**66**	**80**	**221**	**17**	**20**	**36**	**73**	**68**	**31**	**41**	**140**	**109**	**53**	**39**	**201**

25 species observed

TABLE 3.1-4

WITMER ROAD, NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED BY DATE, TIME AND SPECIES DURING SPRING SURVEYS

Common name	Scientific Name	27 April 2004				28 April 2004				30 April 04				5 May 2004				6 May 2004			
		1220	1320	1420	total	1535	1635	1735	total	0745	0845	0945	total	0710	0810	0910	total	1425	1525	1625	total
double crested cormorant	*Phalacrocorax auritus*	1			1		1		1	10	10	1	21				0			1	1
Canada goose	*Branta canadensis*				0				0	2			2	4	1		5	4	2		6
mallard	*Anas platyrhynchos*				0		2	1	3				0	2			2				0
herring gull	*Larus argentatus*	1			1				0				0				0				0
ring bill gull	*Larus delawarensis*	16	14	5	35	26	61	17	104	30	27		57	7	6	33	46	28	5	64	97
killdeer	*Charadrius vociferus*		1	1	2				0	3		2	5	1			1		3		3
American woodcock	*Philohela minor*				0			1	1				0				0				0
lesser yellowlegs	*Tringa flavipes*				0				0				0	6			6				0
red tailed hawk	*Buteo jamaicensis*				0				0				0				0			2	2
American kestrel	*Falco sparverius*				0			1	1				0				0				0
mourning dove	*Zenaida macroura*	1	1	3	5	12	5	2	19	2	5		7	2	2	8	12	2	2	4	8
pigeon	*Columba livia*	14	1		15	4	4		8	6	2	2	10	7			7	13	2	7	22
barn swallow	*Hirundo rustica*				0				0				0				0	1		4	5
tree swallow	*Iridioprocne bicolor*				0	1			1	1			1		1		1	1			1
rough wing swallow	*Stelgidopteryx ruficollis*				0				0			1	1				0				0
chimney swift	*Chaetura pelagica*				0				0				0				0	2			2
crow	*Corvus brachyrhynchos*	3			3	2	5	1	8	4	5	1	10	1	1	4	6				0
blue jay	*Cyanocitta cristata*		1		1				0		1		1		2		2				0
mocking bird	*Mimus polyglottos*				0				0				0		1		1				0
robin	*Turdus migratorius*	1			1		1		1	2		2	4	6	2		8	5	3	1	9
red wing blackbird	*Agelaius phoeniceus*	23	6	3	32	14	18	20	52	62	74	41	177	50	75	56	181	19	14	20	53
common grackle	*Quiscalus quiscula*				0	2			2	14	7	2	23	4		5	9			3	3
meadow lark	*Sturnella magna*				0				0	6			6		1		1	3			3
starling	*Sturnus vulgaris*	1			1	1			1	2	1		3				0				0
goldfinch	*Carduelis tristis*		1		1				0			3	3	1	2	1	4				0
song sparrow	*Melospiza melodia*	1			1				0	2	1		3				0		2		2
savannah sparrow	*Passerculus sandwichensis*			1	1				0	1		4	5	5	8	6	19	1	2		3
Total interactions		**62**	**25**	**13**	**100**	**62**	**97**	**43**	**202**	**147**	**133**	**59**	**339**	**96**	**102**	**113**	**311**	**79**	**35**	**106**	**220**

27 species observed

TABLE 3.1-5

SOUTH LEWISTON RESERVOIR, NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED BY DATE, TIME AND SPECIES DURING SPRING SURVEYS

Common name	Scientific Name	27 April 2004				29 April 2004				4 May 2004				5 May 2004			
		1545	1645	1745	total	0800	0900	1000	total	1045	1145	1245	total	1410	1510	1610	total
herring gull	*Larus argentatus*			1	1	1			1	3			3				0
ring bill gull	*Larus delawarensis*	73	77	57	207	7	18	13	38	19	42	31	92	49	81	62	192
great blue heron	*Ardea herodias*				0				0			1	1				0
sharp-shinned hawk	*Accipiter striatus*				0		1		1	1			1				0
red tailed hawk	*Buteo jamaicensis*				0			1	1		1		1				0
mourning dove	*Zenaida macroura*				0				0	1			1				0
barn swallow	*Hirundo rustica*				0		1		1		2	2	4	1	2	2	5
blue jay	*Cyanocitta cristata*				0				0				0		1		1
robin	*Turdus migratorius*	4	1		5	3	5	3	11	1	3	1	5	1		1	2
red wing blackbird	*Agelaius phoeniceus*	3		2	5	28	39	3	70	20	24	14	58	5	8	4	17
brown-headed cowbird	*Molothrus ater*				0				0	1			1				0
common grackle	*Quiscalus quiscula*		2		2				0				0				0
starling	*Sturnus vulgaris*				0	1	4		5	5	1		6				0
house sparrow	*Passer domesticus*				0				0				0			3	3
cardinal	*Cardinalis cardinalis*				0		2		2				0				0
goldfinch	*Carduelis tristis*				0	11	4	2	17	4	8	2	14	2	4	4	10
song sparrow	*Melospiza melodia*				0	1			1	2	3		5	3			3
Total interactions		**80**	**80**	**60**	**220**	**52**	**74**	**22**	**148**	**57**	**84**	**51**	**192**	**61**	**96**	**76**	**233**

17 species observed

TABLE 3.1-6

INTAKES, NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED BY DATE, TIME AND SPECIES DURING SPRING SURVEYS

Common name	Scientific Name	28 April 2004				3 May 2004				4 May 2004				6 May 2004			
		0745	0845	0945	Totals	1040	1140	1240	Totals	1430	1530	1630	totals	0715	0815	0915	totals
double crested cormorant	*Phalacrocorax auritus*		20		20		2		2		1		1				0
Canada goose	*Branta canadensis*				0				0				0	2			2
herring gull	*Larus argentatus*	1		1	2				0		1	3	4		1		1
ring bill gull	*Larus delawarensis*	35	70	48	153	24	41	29	94	47	53	68	168	40	39	36	115
great blue heron	*Ardea herodias*				0				0	1			1				0
killdeer	*Charadrius vociferus*			1	1		1	1	2	1			1				0
American kestrel	*Falco sparverius*			1	1				0				0				0
mourning dove	*Zenaida macroura*	5	3		8	3		1	4	2	1	5	8	2		3	5
pigeon	*Columba livia*			2	2		4		4				0				0
common yellow-shafted flicker	*Colaptes auratus*				0				0				0		1		1
barn swallow	*Hirundo rustica*				0	2	2		4	3	4		7			1	1
tree swallow	*Iridioprocne bicolor*	4		2	6			1	1				0		5	2	7
rough wing swallow	*Stelgidopteryx ruficollis*				0				0		3		3				0
blue jay	*Cyanocitta cristata*				0				0				0	2			2
robin	*Turdus migratorius*	5	3	2	10		4	2	6		3	3	6	5		3	8
red wing blackbird	*Agelaius phoeniceus*	36	25	12	73	7	11	3	21	1	8	2	11	62	77	50	189
common grackle	*Quiscalus quiscula*		11		11	2	1	8	11		2	1	3		5	4	9
starling	*Sturnus vulgaris*	13	33	31	77	6	17	5	28	9	12	8	29	20	15	15	50
song sparrow	*Melospiza melodia*				0	1			1			1	1	1			1
Total interactions		**99**	**165**	**100**	**364**	**45**	**83**	**50**	**178**	**64**	**88**	**91**	**243**	**134**	**143**	**114**	**391**

19 species observed

TABLE 3.1-7

FISHING ACCESS, NUMBER OF BIRD/POWER LINE INTERACTIONS OBSERVED BY DATE, TIME AND SPECIES DURING SPRING SURVEYS

		28 April 2004				29 April 2004				4 May 2004				6 May 2004			
Common name	**Scientific Name**	**1145**	**1245**	**1345**	**total**	**1510**	**1610**	**1710**	**total**	**0715**	**0815**	**0915**	**total**	**1050**	**1150**	**1250**	**total**
double crested cormorant	*Phalacrocorax auritus*				0				0	2			2	1			1
Canada goose	*Branta canadensis*	2			2				0				0				0
mallard	*Anas platyrhynchos*				0				0	1			1				0
herring gull	*Larus argentatus*				0				0	7			7	5	3		8
ring bill gull	*Larus delawarensis*	109	75	49	233	57	115	97	269	203	177	89	469	50	23	24	97
Bonaparte's gull	*Larus philadelphia*		2	11	13		2	2	4		2	2	4	1	1	1	3
great blue heron	*Ardea herodias*				0				0	1			1				0
black crowned night heron	*Nycticorax nycticorax*				0				0		2	1	3				0
red tailed hawk	*Buteo jamaicensis*	1			1				0				0				0
turkey vulture	*Cathartes aura*	4		6	10		3		3				0		1	2	3
peregrine falcon	*Falco peregrinus*			1	1				0				0				0
pigeon	*Columba livia*			1	1				0	1			1				0
barn swallow	*Hirundo rustica*			1	1				0				0	13	5		18
tree swallow	*Iridioprocne bicolor*				0				0				0	5			5
rough wing swallow	*Stelgidopteryx ruficollis*	2	1	3	6				0				0	1	6	1	8
chimney swift	*Chaetura pelagica*				0				0				0		4	1	5
crow	*Corvus brachyrhynchos*				0		3		3				0		1		1
Total interactions		**118**	**78**	**72**	**268**	**57**	**123**	**99**	**279**	**215**	**181**	**92**	**488**	**76**	**44**	**29**	**149**

17 species observed

TABLE 3.2-1

RESULTS OF DAILY SURVEYS FOR EVIDENCE OF DEAD BIRDS

	26 April 2004	27 April 2004	28 April 2004	29 April 2004	30 April 2004	3 May 2004	4 May 2004	5 May 2004	6 May 2004
N. Lewiston	NS	0	NS	1 starling	NS	0		0	NS
Witmer Road	1 grackle	1 feather spot starling	0	NS	0	NS		0	1 feather spot grackle
	1 starling								1 starling
	1 woodcock								
S. Lewiston	NS	0	NS	0	NS	NS	1 starling	0	NS
Intakes	NS	NS	0	NS	NS	0	0	NS	0
Fishing access	NS	NS	NS	NS	NS	NS	NS	NS	NS

TABLE 3.3-1

COMPARISON OF COLLISION RATES FROM OTHER STUDIES.

Site	Number of flights/day	CRE
Lower Crab Creek[1]	248	0.34
Bybee Lake[1]	54	1.61
Lower Crab Creek[2]	150	0.65
Bybee Lake[2]	190	0.68
Saddle Mountain Lake[2]	250	0.51
Lower Crab Creek[3]	67	0.28
Bybee Lake no ground wire[3]	64	0.58
Bybee Lake ground wire intact[3]	12	1.03
Crowe Butte Slough[4]	2070	0.12
Columbia River[4]	3730	0.57
Crowe Butte Slough[5]	102	0.31
Columbia River[5]	368	0.01

Table Source: Beaulaurier, et al (1982)

Data sources: 1: Meyer (1978); 2: James and Haak (1979); 3: Beaulaurier (1981); 4: James (1980); 5: Willdan Associates (1981)

4.0 CONCLUSIONS

Many human structures and activities, including electric transmission lines, are known to cause mortality among birds. The overall estimated mortality rate due strictly to high voltage electric transmission lines may be lower than that associated with other structures and activities (see Table 1.4-1). In this study, the field team observed a total of 4,960 bird/transmission line interactions. Forty-two species of birds were identified during the study.

No direct collisions between birds and transmission lines were observed. This is not unusual for this type of study. Evidence of seven dead birds, in the form of whole or partial carcasses or feather spots, was found among the five sample areas during the Spring study. Using techniques commonly employed in such studies to estimate a total number of dead birds accounting for various sources of bias, we estimated as many as 13.21 birds may have been killed during the study. Collision rate estimates of 0.27% and 0.72% were calculated. Differences in the collision rate estimates were due to differences in how the total number of flights was calculated.

By either calculation method, this study estimates that between 0.72% and 0.27% of bird flights near transmission lines would result in bird mortality. Both figures are low compared to other published studies. High voltage transmission lines within the Niagara Power Project relicensing study area do not seem to be substantial sources of bird mortality during the spring.

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