

**Appendix C**  
**Bat Study Report**

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# Invenergy Raleigh Wind Farm 2007 Bat Monitoring

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**NATURAL RESOURCE SOLUTIONS INC.**

Aquatic, Terrestrial and Wetland Biologists

# Invenergy Raleigh Wind Farm 2007 Bat Monitoring

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## **1.0 Introduction**

Natural Resource Solutions Inc. (NRSI) was retained by Dillon Consulting in August 2007 to conduct bat monitoring on the proposed Invenergy Raleigh Wind Farm, located in Chatham-Kent County, in former Raleigh Township along the northern shoreline of Lake Erie. This report gives a detailed summary of the bat monitoring completed by NRSI at the Invenergy Raleigh Wind Farm in August and September 2007. The bat survey work was completed for a proposed large scale utility wind farm.

The Invenergy Raleigh Wind Farm is composed primarily of active agricultural fields and is approximately less than 1km from the shoreline of Lake Erie. The study area is outlined in the map found attached to this report.

## 2.0 Background Review

Based on an assessment of habitat communities from aerial photographs and MNR mapping of the area, the study area is primarily agricultural lands with occasional pockets of deciduous forest, hedgerows, and isolated trees. Review of the National Topographic Database indicates that the lands are fairly flat with some woodlot habitat, and little wetland habitat that would provide roosting and feeding habitats for Ontario bat species.

### 2.1 Natural Areas

There are no designated natural areas located directly within the Invenergy Raleigh Wind Farm study area. Three designated natural areas are located approximately 5km northwest of the study area. Each of these three natural areas is described in more detail below. Due to their distance from the study area, these natural areas are not expected to influence local bat activity within the area.

#### **Jeanette's Creek Marsh**

This Provincially Significant Wetland (PSW) is about 43 ha in size and comprised of two different wetland types; swamp and marsh. The vegetation with the PSW consists mainly of cattail, and narrow leaved emergents.

#### **Jeanette's Creek Woods**

This Life Science ANSI is about 25 ha in size and is comprised of two small woodlots situated on clay plain. The vegetation located here is primarily lowland woods with several rare plant species such as shellbark hickory (*Carya laciniosa*).

#### **Jeanette's Creek Woodlots-Wetland**

This is a PSW complex is about 26.5 ha in size and is made up of two separate swamp communities . The dominant vegetation community is deciduous trees, some of which are S1 and S2 ranked species.

### 2.2 Site Sensitivity

The habitat found within the study area consists primarily of active agricultural fields, with a few small deciduous woodlots, hedgerows, and farm structures. Agricultural habitats typically provide suitable foraging habitat, and treed habitats and farm structures are expected to provide roosting locations for local bat populations. Based on the extent of treed habitat within the study area, limited roosting habitat for large bat populations is present within the study area. The study area is less than 1km from the shoreline of

Lake Erie, which is thought to concentrate bat activity, with the closest turbine located approximately 1.8km from shore, and the remaining situated more than 2 km away. There were no other habitats found within, or near, the study area that are likely to concentrate bat populations, including caves, mines, forested ridges, or known hibernacula. Site characteristics of the study area were compared to the May 2007 Draft Bat Guidance Document, and based on the distance to the shoreline of Lake Erie, the study area is a High sensitivity site.

### 3.0 Study Methodology

NRSI biologists conducted bat monitoring on 28 nights from early August through mid-September. Monitoring occurred on the following dates in August and September 2007.

- Nights of August 24/25, 25/26, 26/27, 27/28, 28/29, 29/30, 30/31, 31/September 1
- Nights of September 1/2, 2/3, 3/4, 4/5, 5/6, 6/7, 7/8, 8/9, 9/10, 10/11, 11/12, 12/13, 13/14, 14/15, 15/16

On some of the above dates, monitoring occurred at multiple stations on the same night contributing to the overall 28 nights of monitoring.

Based on a site sensitivity of High for the study area, a monitoring period of late July through September is recommended by the May 2007 Draft Bat Guidance Document. As NRSI was not retained to conduct bat monitoring on the Invenergy Raleigh Wind Farm project until the later part of August, no bat monitoring was conducted in July, and therefore some summer swarming and migration bat activity may have been missed.

However, NRSI has conducted bat monitoring in similar habitats for two nearby wind power projects, located <5km and 10km from the Invenergy Raleigh Wind Farm (NRSI 2007a,b). Bat monitoring for these projects was conducted from early August through to September 2007. The data collected during the overlapping monitoring period at the Swanton Wind Farm site (NRSI 2007b) is similar to the results from the Invenergy Raleigh Wind Farm. This similarity indicates that early August data collected at the Swanton site is equivalent to data that would have been collected at the Invenergy Raleigh Wind Farm study area. Further details, along with results from both nearby sites, are provided in Section 4.4.

The monitoring period of August and September corresponds to anticipated periods of high activity and is expected to overlap with the migration period of Ontario's migratory bat species.

On each monitoring night, acoustic bat monitoring equipment was set up prior to sunset and data was collected through the night until sunrise the following morning. The

monitoring equipment consisted of a Pettersson D240x broadband ultrasonic detector; a microphone enabled system that is set in real-time record mode. The total monitoring effort of 28 nights was shared between three monitoring stations.

The monitoring stations were selected in habitats that are representative of the very uniform habitats found within the study area. Monitoring station locations can be seen on the map attached to this report (see Appendix I), and are described briefly below.

- Monitoring station BAT-001 was located on the southern end of the study area on the north side of 16<sup>th</sup> Concession, between Four Rod Rd. and Dillon Rd. This station was located in a small clump of deciduous trees adjacent to a soybean field.
- Monitoring station BAT-002 was located along the north side of 11<sup>th</sup> Concession, between Dillon Rd. and Bloomfield Rd. This station is located along a creek lined with shrubby vegetation and adjacent to an active corn field.
- Monitoring station Bat-003 was located on the north side of 13<sup>th</sup> Concession, between Merlin Rd. and Drake Rd. This station was placed on the east side of a deciduous hedgerow lining a small creek and is adjacent to an active soybean field.

Abundance data was collected and analyzed for the presence of bat passes, and total passes through-the-night. Passage rates (passes/hr) were calculated based on total number of passes recorded and length of monitoring period for the study area and for the individual monitoring stations. These were averaged and analyzed by time of night and date to determine whether any spatial or temporal concentrations occur.

Abundance monitoring was the primary form of data collection and was used to gather information on usage rates of bats in different areas and habitats within the study area.

Species data was recorded directly into a laptop computer using Pettersson D240x ultrasonic monitoring devices, through SonoBat software. The calls were recorded using a time expansion of 10x, and were analyzed with SonoBat software, and compared with

recorded calls of known species. Call sonograms were compared on the basis of peak frequency, call length, call shape, harmonics, and other acoustic attributes.

## 4.0 Results

A total of 370 bat passes were recorded in 209 hours of acoustic monitoring, resulting in an overall passage rate of 1.8 passes/hr. Table 1 provides the overall results at each monitoring station. Overall monitoring effort in September was slightly higher than in August.

**Table 1. Passage Rate Results per Monitoring Station**

	<b>BAT-001</b>	<b>BAT-002</b>	<b>BAT-003</b>
Bat Passes	229	48	93
Hours of Acoustic Monitoring	74	90	45
<i>Overall Passage Rate (passes/hr)</i>	<i>3.1</i>	<i>0.5</i>	<i>2.1</i>

The higher passage rate observed at station BAT-001 is expected to be a result of the proximity of this station to both the shoreline of Lake Erie and a nearby woodlot, which is expected to provide suitable roosting habitat for local bat populations. Stations BAT-002 and BAT-003 are both located along creek habitats with limited tree cover.

During the monitoring time frame, all eight species of Ontario bats are known to be active, and have range maps that overlap with the proposed study area. The monitoring period also corresponds to the anticipated period of peak migration of Ontario's bat species.

### 4.1 Bat Species

Based on the 2007 monitoring NRSI biologists confirmed the presence of hoary bat, red bat, little brown bat, eastern pipistrelle and big brown bat/silver-haired bat within the project area. Big brown and silver-haired bats are often difficult to discriminate based on recordings, as they are known to have very similar call characteristics (OMNR 2006). These two species are often lumped together when analyzing bat sonograms, as has been done here.

Calls of big brown bat/silver-haired bats and little brown bats were common within the study area. These species are all common species with secure populations in Ontario. Very few calls of the eastern pipistrelle were recorded during the monitoring period, suggesting that large populations of this species are not present within the study area.

None of Ontario's bat species are considered nationally or provincially rare. Brief natural history information for all eight bat species known to occur within Ontario is provided below, based on information from Banfield (1974), Gerson (1984), and Dobbyn (1994).

### **Little Brown Bat**

This species is Ontario's most common bat species, and can be found throughout most of the province, with records as far North as James Bay. Little brown bats (*Myotis lucifugus*) will use a variety of different habitats, usually preferring forests with nearby rivers, creeks, or meadows. This species has also adapted to urban settings and will regularly roost in buildings.

Little brown bats will begin hibernating in September, congregating in caves and mines throughout Ontario. Females will move from hibernation sites to nurseries in April, while males will remain in hibernation until mid-May. This species is very common with secure populations in Ontario (OMNR 2005).

### **Big Brown Bat**

Big brown bats (*Eptesicus fuscus*) are the most urbanized of any Ontario bat species, and are frequently found near cities and towns, foraging along streetlamps. One of the most common Ontario bat species, the big brown bat is found throughout southern Ontario and as far north as Red Lake, and is a provincially secure species (S5) (OMNR 2005).

Big brown bats often forage above meadows, ponds, rivers, and along streetlights in towns and cities. Roosting of this species regularly occurs in barns and other buildings. Occasionally they will roost under bark or within small rock crevices. Big brown bats are very cold tolerant, and will often not begin hibernation until late in the fall, sometimes as late as early December. Hibernation of this species occurs within Ontario, often in close proximity to summer roosting sites. Big brown bats are usually the first bat to emerge from hibernation in early April.

### **Red Bat**

Red bats (*Lasiurus borealis*) are a very distinctive, medium-sized, Ontario bat species. An apparently secure Ontario bat species (S4) (OMNR 2005), red bats are found throughout southwestern Ontario with some isolated sightings further east, and as far north as James Bay. Red bats are known to be strong fliers and many records of this species have been found well outside of its distribution range.

Red bats are one of Ontario's three migrating species, and will usually migrate to Ontario in late May, staying until early September. Foraging of this species often occurs at or above tree height, sometimes as high as 200m above the ground. Preferred foraging habitats include hilly forest, streams, ponds, and can sometimes be found foraging in towns near streetlights. Roosting of this species will usually occur solitarily in trees.

### **Hoary Bat**

Hoary bats (*Lasiurus cinereus*) are Ontario's largest species of bats, and one of the most distinctive. They are a solitary species, often roosting high in the trees.

Hoary bats will emerge from their daytime roosts late in the evening to forage among forested habitats, often near open meadows or lakes within a forested community. Hoary bats are secure within Ontario (S5) (OMNR 2005), and occupy an extensive range within Ontario as far north as James Bay but with regular populations throughout southern Ontario.

One of Ontario's three migratory species, Hoary bats do not usually arrive in Ontario until late May. This species can usually be found within Ontario as last as October before migrating to the southern United States.

### **Silver-haired Bat**

One of Ontario's three migrating species of bat, silver-haired bats (*Lasionycteris noctivagans*) will usually remain in Ontario until August and September before migrating south to the United States. After hibernation, silver-haired bats will usually return to Ontario in late May or June. The range of this species stretches as far north as Thunder Bay and James Bay, with the majority of the known populations occurring in southern Ontario. Populations of this species are apparently secure (S4) within Ontario (OMNR 2005).

Silver-haired bats can often be found foraging near forested habitats, above lakes and streams, and prefer aquatic insects. Summer roosting will usually occur in hollow trees, loose bark, or large, abandoned bird nests.

### **Small-footed Bat**

Small-footed bats (*Myotis leibii*) are the least common species in Ontario and are classified as having vulnerable to impaired populations within Ontario (OMNR 2005). The range of this species includes most of Southern Ontario with some isolated summer sightings as far north as Sault Ste. Marie.

Hibernation of this species does not generally begin until late November, often emerging from hibernation by mid-April. Hibernation sites are often smaller caves with higher rates of air movement than other bat species. Populations of this species appear to show a preference to hilly coniferous forested habitats for foraging. Little is known about roosting site habitat preference.

### **Northern Long-eared Bat**

Northern long-eared bats (*Myotis septentrionalis*) can be found foraging in forested areas with nearby meadows and rivers. Roosting habitats of this species can include under tree bark, rock crevices, and sometimes behind shutters or under shingles.

This species can be found within much of Southern Ontario, with individual records reaching Thunder Bay and Moosonee. This species is anticipated to be a vulnerable Ontario species indicated by a provincial SRank of S3? (OMNR 2005). Northern long-eared bats will often use the same hibernation sites as little brown bats and begin hibernation in late October, emerging again in early May.

### **Eastern Pipistrelle**

Eastern pipistrelles (*Pipistrellus subflavus*) can often be found foraging along slow moving rivers, forest edge, or above open meadows. These bats begin feeding around sunset, often flying high in the canopy hunting flying insects. Eastern pipistrelles are rarely found in heavily wooded areas or open areas

unless large trees are present. This species hibernates in Ontario in caves and abandoned mines, usually from mid-October through May.

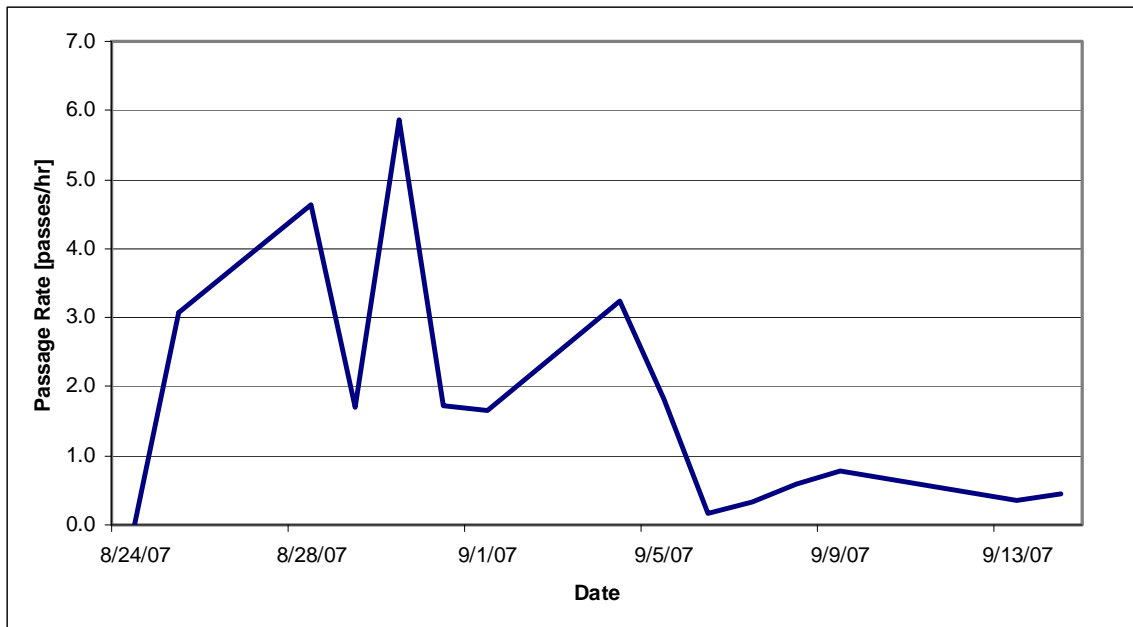
Range of this species covers much of southern Ontario. Populations are considered vulnerable within Ontario (S3?) (OMNR 2005), and are usually found as single individuals or small groups.

#### 4.2 Results by Date

Analysis by date for all stations within the study area reveals an average August passage rate of 2.8 passes/hr, while passage rates in September declined to an average of 1.0 passes/hr. The lower passage rate observed in September is consistent with other bat monitoring projects undertaken by NRSI in southern Ontario. The observed August passage rate suggests low bat activity within the area, and does not indicate the presence of concentrated activity within the study area. The relatively higher August rates are expected to coincide with summer swarming periods and the migration period of Ontario's bat species.

The highest through-the-night passage rate of any single night of monitoring within the Invenergy Raleigh Wind Farm study area was 5.9 passes/hr, recorded at station BAT-001 on the night of August 30/31, 2007 (see Figure 1).

The abundance trends observed at the study area also show consistently higher bat activity throughout the month of August, compared with a rapid decline in activity into September.



**Figure 1. Bat Passage Rate (passes/hour) by Date for all Monitoring Stations**

#### **BAT-001**

An average passage rate of 3.3 passes/hr was observed at station BAT-001 in August, before declining to a lower passage rate of 2.5 passes/hr in September. The peak in activity at this monitoring station was observed on the night of August 28/29, when an average passage rate of 6.1 passes/hr was recorded.

#### **BAT-002**

At this station, passes were recorded only once in August (the night of August 31/September 1) with a passage rate of 1.4 passes/hr, the highest observed at this station. In September, an average of 0.5 passes/hr was recorded.

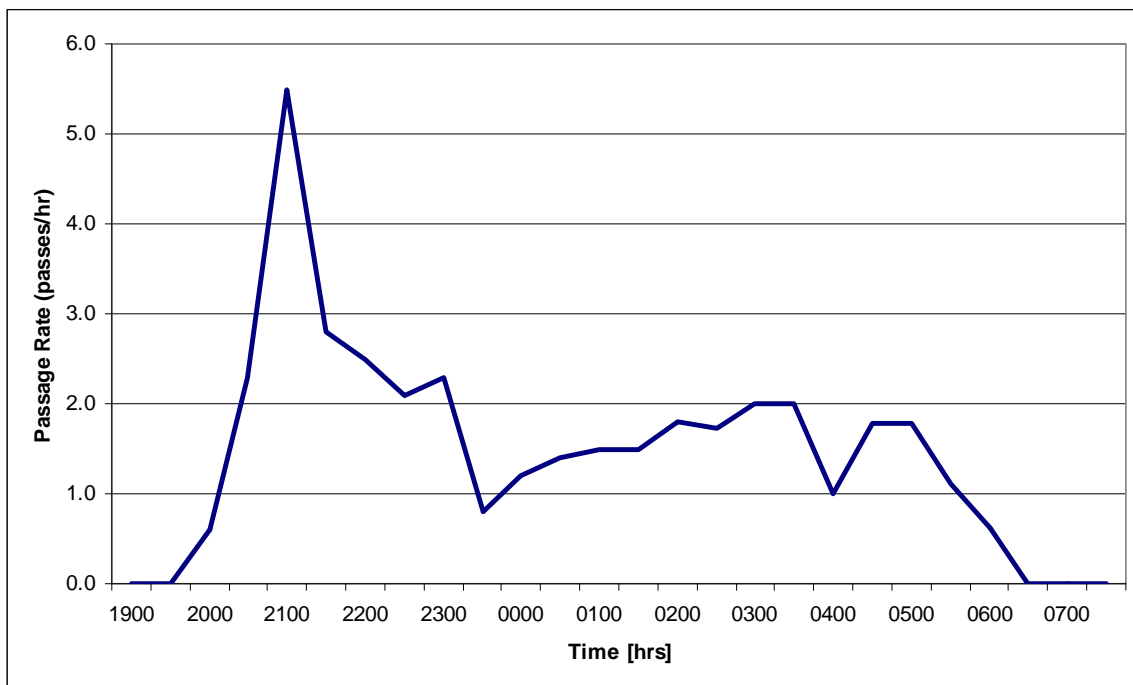
#### **BAT-003**

An average passage rate of 2.3 passes/hr was recorded at this station in August, which declined to 1.5 passes/hr in September. The highest passage rate recorded at this station was 3.2 passes/hr, recorded during the night of August 28/29.

### 4.3 Results by Time

A strong peak in bat activity was documented within the study area between 2100-2200hrs (see Figure 2). This corresponds to a time when local bat populations are

known to leave their daytime roosts to begin foraging. All three stations peak in activity during similar time periods, at approximately 2100hrs. A short decrease in activity near midnight was observed, before slightly higher rates were observed for the remainder of the night. Bat activity ended at approximately 0630hrs. This plateau in early morning activity is not as dramatic as those observed by NRSI at other bat monitoring projects, but is consistent with an early morning foraging period known to occur with local bat populations. These through-the-night passage rates and general trends are comparable to other bat monitoring projects in Ontario, which show similar peaks in activity prior to midnight, with secondary peaks in the early morning prior to sunrise (at approximately 0300hrs).



**Figure 2. Passage Rate (passes/hour) by Time of Night (hrs) for all Monitoring Stations**

### **BAT-001**

Through-the-night passage rates for BAT-001 had an activity peak of 8.3 passes/hr observed between 2100-2130hrs. This passage rate is higher than the peak through-the-night average for all monitoring stations (see Figure 2), but occurs at a similar time. Passage rates through-the-night at this station display a similar trend to the one shown in Figure 2.

### **BAT-002**

An activity peak of 2.0 passes/hr was observed between 2030-2100hrs at BAT-002. Though the passage rate is lower than that found in Figure 2, the peak occurs at a similar time of night. A second peak of 1.8 passes/hr occurs at this station between 2300-2330hrs.

### **BAT-003**

Activity peaked at 8.8 passes/hr between 2100-2130hrs at station BAT-003. This passage rate is higher than the peak through-the-night average for all monitoring stations (see Figure 2), but occurs at a similar time. Passage rates through-the-night at this station display a similar trend to the one shown in Figure 2, with a noticeable increase in activity (4.0 passes/hr) occurring between 0500-0530hrs.

#### **4.4 Other Bat Monitoring in Vicinity**

NRSI conducted bat monitoring at two nearby locations between August and September 2007. The monitoring at these nearby sites includes data gathered during early August, which represents the time period prior to commencing bat monitoring at the Invenergy Raleigh Wind Farm study area. As these sites are in close proximity and can provide data that NRSI was unable to collect for the Invenergy Raleigh Wind Farm study area, bat monitoring results for the two nearby locations are presented below.

#### **Swanton Wind Farm (NRSI, 2007b)**

Located within 5km west of the Invenergy Raleigh Wind Farm study area, bat monitoring at the Swanton study area occurred at one monitoring station over 15 nights between August 3 and September 11, 2007. During the overlapping monitoring period for the Swanton and Invenergy Raleigh Wind Farm study areas, passage rates were very similar at both sites. This similarity indicates that had NRSI conducted early August bat monitoring at the Invenergy Raleigh Wind Farm study area, results would have been equivalent to those obtained at the Swanton site.

On six nights between August 3 and August 11, the Swanton study area's average nightly passage rate was 2.5 passes/hr, with a peak of 5.4 passes/hr during the night of August 9/10. Monitoring resumed again on September 2, by which time NRSI had commenced bat monitoring at the Invenergy Raleigh Wind Farm study area.

Results of the monitoring by time at the Swanton study area include data collected between August 3 and September 11. An elevated passage rate of 7.5 passes/hr was observed just prior to sunset, between 1900-1930hrs. This time period is consistent with a time period when bats are known to leave their daytime roosts to forage in nearby fields. Passage rates declined after this initial activity peak to lower values, remaining relatively consistent for the remainder of the night. Smaller secondary peaks were observed between 2130-2200hrs (3.5 passes/hr) and again between 0130-0200hrs (3.0 passes/hr).

The report concluded that concentrated bat populations are not found within the Swanton study area.

### **Bisnett Wind Farm (NRSI 2007a)**

Located approximately 10km east of the Invenergy Raleigh Wind Farm study area, bat monitoring at the Bisnett Wind Farm occurred at two monitoring stations over 24 nights between August 5 and September 19, 2007. At the Bisnett study area, station BAT-002 was elevated 30m off the ground, while station BAT-001 was placed near ground level. During the overlapping monitoring period for the Bisnett and Invenergy Raleigh Wind Farm study areas, passage rates at the Bisnett study area were considerably higher than those observed at the Invenergy Raleigh Wind Farm study area; 5.9 passes/hr and 1.8 passes/hr, respectively.

## 5.0 Summary of Results

The monitoring period of August and September corresponds to a period when all eight species known within Ontario are expected to be present and active within southern Ontario. This period also overlaps with the anticipated period of migration for Ontario's migratory bat species.

An overall passage rate of 1.8 passes/hr for all stations was recorded within the study area, peaking in the month of August. The overall passage rate is low, despite some moderate activity observed at monitoring station BAT-001, with nightly passage rates reaching higher than 5.0 passes/hr on two monitoring dates. The higher passage rate observed at station BAT-001 is expected to be a result of the proximity of this station to both the shoreline of Lake Erie and a nearby woodlot, which is expected to provide suitable roosting habitat for local bat populations. In contrast stations BAT-002 and BAT-003, both of which are located along creek habitats with limited tree cover, had low activity, with average passage rates of 0.5 and 2.1 passes/hr respectively. These passage rates are low, and do not suggest the presence of concentrated bat activity within the proposed study area. Consistent with other bat monitoring projects, an overnight activity peak was observed prior to midnight, declining to low but consistent activity before slight increases in activity were observed again early in the morning, prior to sunrise.

Species analysis revealed the presence of hoary bat, red bat, little brown bat, eastern pipistrelle and big brown bat/silver-haired bat within the original study area. The latter two species have very similar call characteristics and are often lumped together during call analysis, as was done during this study. In addition, calls of an unidentified *Myotis* species were recorded at this study area. This call is likely a little brown bat, but also shared call characteristics with other species, and identification of this call could not be confirmed.

There is little known about bat passage rates and migration routes within Ontario, making comparison of passage rates with known areas of concentrated bat activity difficult. However, based on bat monitoring conducted by NRSI at similar projects, an average passage rate of 1.8 passes/hr represents a low passage rate. This passage rate does not suggest the presence of concentrated bat activity or heavy bat migration

through the study area. Data trends and species identified within the study areas are generally consistent with data found by NRSI at other monitoring sites within Ontario.

Based on background review of natural areas and habitat features near the study area, along with results from the 2007 bat monitoring, it is anticipated that passage rates within the study areas will remain low during most of the year, with small peaks in activity during the migration and summer swarming periods in Ontario.

## 6.0 References

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**Appendix I**

Invenergy Raleigh Wind Farm Study Area and Bat Monitoring Stations



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