October 18, 2017

Graham Findlay
Management Biologist
Midhurst District
Ministry of Natural Resources & Forestry
Government Complex
2284 Nursery Rd
Midhurst, ON L9X 1N8
Via email: graham.findlay@ontario.ca

Dear Mr. Findlay,

RE: SPECIES AT RISK BAT ASSESSMENT RESULTS – QUEENS COURT DEVELOPMENTS – TOWN OF PENETANGUISHENE

1.0 INTRODUCTION

Queen's Court Homes retained SLR Consulting (Canada) Ltd. to follow up on studies undertaken at Harbourview Heights (221 Fox Street), Penetanguishene, with the objective of furthering the residential development application. Your comments of 8 February 2017 indicate that you are not satisfied that the use of the subject property by bats, and particularly those listed under the Endangered Species Act, 2007 (ESA), has been adequately characterized by the previous reports (Azimuth Environmental Consulting).

The following technical memorandum follows up on our meeting of September 6, 2017. The purpose of this report is to assist Midhurst District Ministry of Natural Resources and Forestry (MNRF) in making an informed decision as to whether or not the activity is likely to kill, harass, or harm a listed bat species or destroy its habitat. We have described our methodology which incorporates MNRF recommendations which we have built upon to provide what we believe is greater rigor, given that we are dealing with a species committed to avoiding discovery when roosting. For that reason, we provide an overview section to communicate our understanding of the issues of bat recovery in Ontario. The results of the 2017 bat surveys conducted at the above noted property are provided, as well as a discussion of how these findings inform the development process, and conformity to the ESA.

2.0 OVERVIEW

Bats found in Ontario can be divided into two groups based on migratory behaviour. One group migrates to avoid the winter and returns to Ontario in the summer. Since they do not congregate in cold places, they are not susceptible to the effects of White-nose syndrome (WNS) that has been introduced to North America from Eurasia. WNS is a fungal disease (*Pseudogymnoascus destructans*) that affects hibernating bats by causing them to emerge from winter torpor (a state of low physical activity) more frequently than they otherwise would. The repeated awakening causes them to burn fat reserves as they leave the hibernation site in search of food causing dehydration, starvation and ultimately death.

The other group spends the winter in Ontario hibernating in mines or caves. This is the group of four species of bats that are designated as Endangered under the *Endangered Species Act*, 2007 (ESA): Little Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), Tri-

colored Bat (*Perimyotis subflavus)* and Eastern small-footed Myotis (*Myotis leibii*). The population declines in these four species are primarily due to the presence of WNS. Little Brown Bats are especially susceptible to this fungus.

Under the ESA, and to assist in the protection and recovery of the four hibernating ESA bat species populations, the Ministry of Natural Resources and Forestry (MNRF) requires proposed developments to have regard for habitats and features that may affect maternity, roosting, and hibernating sites. Studies show that bats have high fidelity to these critical habitats for hibernation, roosting and maternity sites. They are typically located in both anthropogenic structures (attics, mines, old buildings, bridges) and natural features (cavity trees, loose bark of trees and under rocks). Usage of these various features depends on the species.

Within the Queens Court property, summer roost habitat affinities were identified through previous work by others as well as by SLR in 2017. The following report documents the findings of acoustic analysis and emergence surveys conducted. The evaluation is also based on attributes of the of the site proposed for development (woodland) which includes trees with suitable cavities, tree structure, species, size, and/or loose bark that may provide possible roost habitat.

3.0 METHODOLOGY

General guidance for bat surveys related to development projects under the ESA lacks consistency. While draft guidance documents have been prepared by various MNRF Districts for internal use, none have been provided officially to individuals outside of the MNRF. The lack of knowledge of bats and bat behaviour has frequently been identified as a gap in our understanding (B.Fenton, 2017) making it difficult to assess, evaluate impacts and apply the mitigation hierarchy (avoid, redesign, mitigate and/or compensate).

Since bat species appeared on both Federal and Provincial SAR lists, SLR has been working internally with SLR's United Kingdom team of bat specialists. Attendance at meetings focused on bat ecology and management has made members of the scientific community in the US and Canada available for discussion. We have benefited from conversations with Dr. Brock Fenton, Professor Emeritus, University of Western Ontario and expert in bat behaviour and ecology;, Mr. Toby J. Thorne, Bat Researcher, Toronto Zoo; Dr. Cori Lausen, Bat Researcher and Consultant, Birchdale Ecological and experts at Bat Conservation Trust (UK) and Dr. Winifred Frick, Senior Director, Conservation Science, Bat Conservation International, as well as former MNRF bat biologist, Lesley Hale. The study of bat ecology is a rapidly evolving science, and adaptation to methods and our understanding of impacts, continues to change as new science becomes available.

Methods used in this evaluation follow in part those outlined by MNRF to the extent that the approach provides useful data (e.g. *A Technical Note: Species at Risk Bats, MNRF Regional Operations Division (2015))*. Our approach has been modified to reflect existing conditions at the subject site and benefits from previous application of MNRF methods. Given the specific development proposal, guidance of recent science and approaches suggested to SLR by leading bat experts has been used to answer questions regarding bat activity on the subject lands. Methods were reviewed with Midhurst MNRF who provided conceptual approval, but reserved judgement pending outcomes.

Previous data collected for the site (tree snag density, Azimuth Environmental Consulting) and Ecological Land Classification (ELC) community classification data (Michalski Neilson and Associates) were also reviewed and assisted in the evaluation. Individual tree assessments

(detailed snag tree or density review) where every tree or sample plots are assessed according to a scale provided by the MNRF was not recommended or endorsed by experts for this property. The rationale is based on the existing woodland characteristics, biology and behaviour of relevant species of interest and inconsistencies of the snag attribute table suggested for use within MNRF internal documents. For example Silvis, Perry and Ford (2016) found that forest types and roost tree characteristics reported in the literature for species like Northern Myotis are often biased as the majority of studies have been conducted in certain landscapes (i.e. deciduous) not because of species preference or biology but rather surveyor bias (physical location, funding). Fundamentally, the majority of research conducted (W.Frick, *pers. comm.* 2017; Fenton 2015) notes that those bats likely do not select roosts based on a single roost tree characteristics, but rather on overall characteristics of woodlands, surrounding landscape and contributing factors (e.g. presence of wetlands, riparian areas, vernal pools) and is clearly tied to the local tree-species assemblage. Furthermore, snag tree evaluations themselves are also inherently biased from surveyor to surveyor, and often roost usage and or quality are misrepresented (Foster and Kurta 1999, in Bats in Forests Conservation and Management, 2007).

3.1 Survey Approach

Surveys for presence/absence as well as activity patterns were undertaken using both passive acoustic detectors as well as emergence surveys (T.Thorne, *pers. comm.* 2017, Thorne, and Fenton 2016).

Passive and active surveys were completed in June. In Ontario this is when young are born and adults are most active (MNRF, 2015; B.Fenton, 2015). Active surveys occurred on June 16 and July 6 2017, while the acoustic monitors were deployed for nearly 4 weeks, from June 16 to July 5, 2017.

3.1.1 Active Surveys (Emergence)

The intent of the survey was not to identity individual roost trees or visual confirmation of emergence of a bat(s) from a single tree. To do so would require highly invasive capture and recapture techniques and/or radio-tagging of individuals. Visual confirmation of emergence is not reliable in these types of environments where light (visibility), extensive overhead and understory canopy compromise a surveyors ability see views and a high number of candidate trees are present (B. Fenton, *pers. comm.* 2017, L. Hale *pers. comm.* 2015). The objective of the active survey was to assist in determining whether SAR bats are “emerging” generally from the woodland and to assist in determining activity (where possible) in the woodland. For example, is the woodland is being used as day roost(s)/maternity roost habitat, foraging habitat or both? Two surveys were recommended (T.Thorne *pers. comm.* 2017; C.Lausen, *pers. comm.* 2017) to meet project objectives and account for seasonal timing. If no emergence or bat(s) were detected additional surveys or review would be required.

Two groups consisting of four individuals (one experienced bat specialist and one assistant) traversed the woodland starting 1 hour before sunset (approximately 21:00) and ending at approximately 23:00 hrs in good weather. Surveyors traversed along both existing internal trails or relatively open understory areas (for safety) where woodland composition is predominately mature (maple, pine and beech) and working outwards north to south, east to west where habitat (evaluated earlier in the day, supplemented with previous snag tree work) was deemed to have the highest opportunities for roost habitat. Please refer to the attached map of the subject property.

Surveyors were equipped with heterodyne multiuse detectors: BatBox Duet, Peersonic RPA2, Echometer Touch and Sonabat Live with Pettersson recorder. Except for the BatBox Duet all were capable of recording bat pulses (calls). They were set to the same settings and all could be set to review frequencies 35-40 kKHz and above. Both the Sonabat Live and EcoMetre touch provided "real time" analysis of pulse signatures which were analysed in situ by the experienced specialist (T.Thorne). This assisted surveyors in determining exact times of emergence and identification of a specific species groups including activities such as "feeding buzzes" (foraging). For example *Myotis* species and Tri-coloured bats have a detection frequency equal to or greater than 40 kHz, where as other non SAR bats (e.g. Big Brown, Silver Haired, Hoary bat) call signatures are well below this threshold.

3.1.2 Passive Surveys (Acoustic Monitoring)

Species determination by acoustic detection is only as reliable as the deployment, positioning and appropriateness of the monitor used for the project. Accurate results maximizing the number of low clutter pulses requires deployment to consider the following:

- Location within low clutter environments (sparse or no understory);
- Deployment reflects the biology of species being targeted (forest vs edge);
- Targets areas of high probability of use (e.g. near water, high insect areas), and;
- Avoids dense understory areas and vertical placement[1].

The upland woodland on the subject property is generally homogeneous maple, pine and beech. Lowland ash swamp/forest with vernal pools is centrally located. Poplar occurs generally along the periphery. The 2017 habitat review included a review of previous work by others that confirmed that numerous suitable roost trees are dispersed throughout the woodland (not concentrated in only one area). The forest structure is an important consideration when establishing the locations and number of monitors required. While MNRF suggests methods for establishing number and locations of monitors required they do not take into account site variability, a targeted species biology, movement patterns, factors as addressed above or limitations of the detector itself. With recent advancements in technology, many acoustic monitors are now capable of detecting bats from over 30m (under typical conditions), to as far as 100m or greater (Tilley Scientific 2017, Wildlife Acoustic 2016). This can create cross over of pulses (multiple detections or pulses of a single individual on several monitors) if monitors are placed closed together. Importantly, if placed in high clutter environments (e.g. in a dense understory or targeting a specific tree(s)) the likelihood of the call signature being unreadable during the analysis is high, compromising accurate species identification (Tilley Scientific, *pers comm*. 2016; T.Thorne *pers comm.* 2017 and C.Lausen *pers comm.* 2015).

For the purposes of this survey, monitor locations targeted areas where the best call signatures would be achieved to accurately determine species while accounting for surveyor safety and potential for theft/tampering. Three monitoring stations (three stationary acoustic detectors) were chosen to capture the most representative and suitable roost areas of the woodland.

[1] Derived from Bat Acoustics Training, Mattawa, 2015 led by Dr. Cori Lausen supplemented by communications with Dr. Fenton, other leading experts and literature research (e.g. Kunz and Parsons 2009),

- Station 1. SM3 (full spectrum, Wildlife Acoustics)
- Station 2. SM4 (full spectrum, Wildlife Acoustics)
- Station 3. SM4 (full spectrum, Wildlife Acoustics)

All units were set to the same settings (gain 12 db, / 16 kHz high filter off/ sample rate 256 kHz / min duration 1-5 ms / max – none / minimum trigger frequency 16 kHz / trigger level 12 db / window 3 sec/ max lens 20 sec) and have very similar omnidirectional microphones. The SM3 is a less compact unit than the SM4, but is more durable. It was deployed at Station 1, given the chance for tampering and theft.

Table 1. Survey Conditions

Date	***Weather***	***Survey Time***
June 16, 2017	Clear, no rain, Beaufort scale 01-1 temp 23 ^{0}C	20:00 – 23:00 (sunset 21:00)
July 6, 2017	Clear, no rain, Beaufort scale 01-1 temp 22 0C	20:00 – 23:00 (sunset 21:04)
Acoustic deployment June 16 14:00 to July 6 23:00. Minimum of 10 nights. Average weather during deployment was clear, with little rain.		

Survey methods and acoustic deployment (setting, frequency) were determined in consultation with Toby Thorne and SLR's UK bat research team using current science and techniques.

3.2 Qualifications of Researcher

SLR Ecologist Kim Laframboise (with expertise in conducting bat exit surveys, and use of acoustic equipment) and consulting bat specialist Toby J. Thorne (Toronto Zoo) facilitated the surveys and conducted the emergence review with two other SLR staff. Mr. Thorne conducted the call data analysis. Mr. Thorne specializes in bat acoustic call analysis and surveys and studied under Dr. Brock Fenton (University of Western Ontario), Bat Ecologist.

3.3 Echolocation Pulse Analytical Approach

SLR's analysis used a three-step verification process. This included the main analysis using Sonabat where all files were filtered to remove noise (Sonobat Batch Scrubber 5.4, set to highest quality and to discard calls <20 kHz). Files were then were reviewed manually by Mr. Thorne using Sonobat Viewer (Sonobat 4.0.5 Base). Mr. Thorne has extensive experience in manual call analysis. A representative subset of calls were sent to SLR U.K. expert Dr. Ben Garnett who also has extensive experience analysing Ontario bat calls in addition to the U.K. Sequences were classified to species where possible, to species group or as unidentified bat. Based on Mr. Thorne's and SLR expertise and communication with several bat experts, auto identification programs should not be used exclusively to identify bats due to the potential for error. Automated call analysis programs such as Kaleidoscope Pro (used by the EcoMetre Touch), have an accuracy rating between 75-80%. Manual call analysis and use of more than one software tool greatly improves the reliability of interpretation.

3.4 Adjacent Habitat Review

Northern Myotis and Little Brown bats have been documented using anthropogenic features as maternity and day roost sites. In Ontario, Northern Myotis are almost always found in natural environments and rarely recorded using structures. Little Myotis is almost exclusively in structures (B.Fenton, *pers. comm*. 2016, T.Thorne, *pers. comm.* 2017)[2]. The subject property (woodland) is near a large waterbody (Penetang Bay), in an older urban environment (older houses surround the subject property which increase potential structure use) and in a landscape that is somewhat fragmented. During the pre-field review a need to understand whether suitable structures (houses, sheds, churches or mature urban trees) adjacent to the woodland could also be used as roosting sites was identified. This was deemed important based on the species biology and roosting preferences, particularly if Little Myotis were identified through the acoustic analysis. Presence of this SAR species within the woodland may indicate foraging (general habitat use) rather than roosting especially if suitable anthropogenic features were identified (T.Thorne, *pers. comm.* 2017; B.Garnett, *pers. comm.* 2017).

All houses along the edge of the woodland were reviewed visually (10 x 42 resolution binoculars) from the road or sidewalk. One old church within 500m of the woodland was also reviewed. Structures were ranked as high, medium or low potential based on known attributes typically preferred by Little Myotis (and bats generally). The criterion for likelihood of use was adapted from *Bat Surveys: Good Practice Guidelines*, Bat Conservation Trust by Hundt, L. (2016).

Table 2. Building or Built Structure Ranking

Likelihood of use	Typical Attributes
High	- Pre 20th century or early 20th century construction. - Shingled roof, poorly maintained fabric providing ready access points for bats into roofs. Roof warmed by the sun, in particular south facing roofs- louvres, structure on roofs, loose tiles, window gaps. - Noticeable entry points - Mature trees (greater than 40 cm) with noticeable loose bark, cavities or defects (indicating possible cavities)
Medium	- Older homes with shingled roofs, other structures in close proximity (e.g. sheds), - Possible attics, spaces or voids - Shingled roofs, somewhat maintained
Low	- Modern, well-maintained buildings or built structures that provide few opportunities for access by bats. - Buildings and built structures comprised primarily of prefabricated steel and sheet materials. - High level of regular disturbance. - Highly urbanized location with few or no mature trees, parkland, woodland or wetland. - High levels of external lighting.

[2] Personal observations and knowledge of ongoing (unpublished) research being conducted throughout Ontario.

SLR acknowledges this is a cursory review with limited access to structures and is not intended to be a definitive analysis of roost usage. Information collected contributed to the analysis of bat behaviour with respect to the woodland.

4.0 RESULTS AND DISCUSSION

Calls of four species were detected with certainty to be using the woodland as habitat: Big Brown Bat, Hoary Bat, **Little Brown Myotis** and **Northern Myotis species**. No Tri-coloured bats or Eastern Small-footed bats were recorded either during the emergence review or the month long acoustic deployment survey. Results of bat surveys are discussed below.

4.1 Emergence Review

These results are based on evidence provided by hand held detection equipment collected on transects through the woodland. This method enables the investigator to incorporate spatial observations of approaches relative to fine level habitat characteristics, in addition to the temporal patterns that indicate foraging vs roosting behaviour.

4.1.1 Northern Myotis

Northern Myotis were confirmed with certainty to be using the woodland during emergence surveys. Emergence was interpreted as bat pulses occurring at dusk as the bats left their roosting locations. Timing was predictable and occurred generally at the same time during both surveys (21: 29 – 21:45 June 16 and 21:30 - 21:50 July 6) confirming Northern Myotis are using trees within the woodland for roosting[3]. The review of adjacent residences, parklands and urban trees around the woodland indicated potential for trees or features which may also be used, and it cannot be discounted that these features could also be used as roost sites and species may move from external roosts into the woodland (general habitat). However, the timing of pulses and activity noted on the heterodynes during the traveling transects indicated emergence is occurring within woodland as well as indicating that roosts are also located within the woodland.

Unless studies are undertaken to handle the bats (radio-tagging; capture/recapture) a maternity roost cannot be identified through snag studies or acoustic surveys. Based on our knowledge of Northern Myotis, and using a conservative approach, we interpret our results as evidence of roosting that includes maternity roosts. In general these are solitary females and small groups although the literature is not conclusive. Roosts habits can change frequently. Studies have shown for example preferences for roost trees and types changed with pregnant females whereby they would use staging roosts early in the spring prior to giving birth, and switch roost once young are able to fly (Foster and Kurta 1999 in Bats in Forests Conservation and Management, 2007), Furthermore Wilhere (2003) found that multiple roosts types may be used and varied both seasonally and yearly to increase thermoregulation benefits, additional food resources (when food is scarce) and or in response to emergency (unpredictable factors). Recurrent roost switching is also common for many species of bats whereby an array of different tree attributes could be used. Importantly, attributes which may not be considered " as preferred" are used where " one bat is using the tree one day, several bats the next , and zero bats a few days later" not exclusively for day or individual roots but in some cases maternity as

[3] Proximity is relative as heterodynes can pick up call pulses 10 - 20 m away but this remains evidence of roosting.

well (Erickson and West. 2003). Foster and Kurta (1999) through their research have shown that the Northern Myotis is known to switch roots frequently (about every two days) over the course of the summer, and suggests that trees in addition to those which may be known roost sites are very important (e.g. when pups are flightless). Therefore, requiring a large number of trees, and forest habitats containing a multi-species matrix (i.e. open areas and linear corridors) to carry out life processes.

It is important to remember that the number of pulses recorded is not representative of the number of bats present. The type of roost, either a day roost by a single male or maternity roost (female with young) is also inclusive. However, the timing (June), frequency of pulses and surveyor expertise allow inferences to be made. The results of the emergence review in SLR's opinion strongly indicate maternity use by Northern Myotis. Several "feeding buzzes" were also documented during the emergence review especially near the central areas of woodland. This is not surprising as the understory within these areas is more open, moist with lots of insects present making the woodland in the lower areas preferred areas for this species as well as for other bats recorded. The walking transects indicated that the areas dominated by poplar and successional peripheral areas (located to the north and east slopes), had the least activity recorded (as evidenced by pulse recording and observation). This is also not surprising as these areas are more densely covered with buckthorn, shrub trees, and smaller trees.

4.1.2 Little Brown Myotis

Little Brown Myotis was also recorded within the woodland with pulses recorded later in the survey after emergence (dusk). Typically recorded at 22:30 to 23:00 well after typical emergence times recorded for this species and similar to other bats (Kunz and Anthony 1996) indicating that Little Brown Bats are likely roosting off site and moving into the woodland to feed and use the woodland as general habitat. This is consistent with SLR's understanding of this species preferred use of structures instead of natural roosts. This species has the ability to travel up to 2 km or more to forage in a single night and have been tracked up to 11 km from their roost sites (Towanda and Falxa 2007).

In SLR's opinion which is based on the 2017 results review, the woodland is of low likelihood to be used as maternity roost site by Little Brown Bats. The woodland is used as general habitat. Several "feeding buzzes" were documented during the active survey review especially near the central areas of woodland over vernal pools where insects could be expected to occur. This is also consistent with Little Brown Myotis biology as this species characteristically forages in open areas or understory.

4.2 Acoustic Analysis

These results are based on the analysis of recordings obtained from stationary detectors deployed over almost four weeks within the woodland at suitable locations. The purpose of acoustic analysis is to assist in determining species presence and absence. The analysis can only provide an index of activity rather than absolute numbers of bats.

Differentiating the four ESA species of bats in Ontario (e.g. *Myotis*) from other non-regulated bats is relatively easy, due to distinct frequency characteristics, shape and often the presence of a downward 'tail' at the end of the calls present in the *Myotis* genus and frequencies over 40 kHz. Distinguishing between the *Myotis* species is considerably more difficult as their calls have convergently evolved to enable detection of similar small prey insects.

Data from the three acoustic detectors were downloaded and analysed to identify bat echolocation pulses to species level where possible (Table 4).

The use of automated ID software (Sonabat) coupled with manual call analysis capable of determining calls, feeding buzzes, clusters, and detection of overlapping data was employed to determine whether ESA regulated bats occurred on site or the general vicinity (Figures 1 and 2).

Table 3. Acoustic Recording Summary

Microphone / Location	Big Brown	Hoary	Northern Myotis	Little Brown	Unidentified bat
Stn 1.	Y	Y	37 Highest # of pulses	65 Highest # of pulses	*Calls were evaluated but excluded as the scope was to identify SAR . Unidentified are typically noise clutters.*
Stn 2.		Y	30 Highest # of pulses	107 Highest # of pulses	
Stn 3.	Y	Y	5	5	

**** Note that species totals are estimates and confidence of pulses. They likely are over-estimate of actual calls because there is a high probability that individual bats were recorded by multiple microphones simultaneously and or a single reoccurring bat pass within the area (can be detected up to 30-100 m). Presented for activity comparison between station NOT as number of bats.***

The analysis of the call data confirmed **Little Brown Myotis**, and **Northern Myotis** were detected at all three stations with Northern Myotis pulses registering at the emergence time (approximately 21:20). Little Brown Myotis pulses registered later after typical emergence. Small Footed Bats or Tri-colored Bats were not detected. This is further confirmed by the emergence surveys which also did not detect bat pulses for either of these species. Activity that would suggest feeding swarms was also identified.

Figure 1. Example of the majority of pulse signatures – representing Little Brown Bat (MYLU) (peak energy extending above 40 kHz)

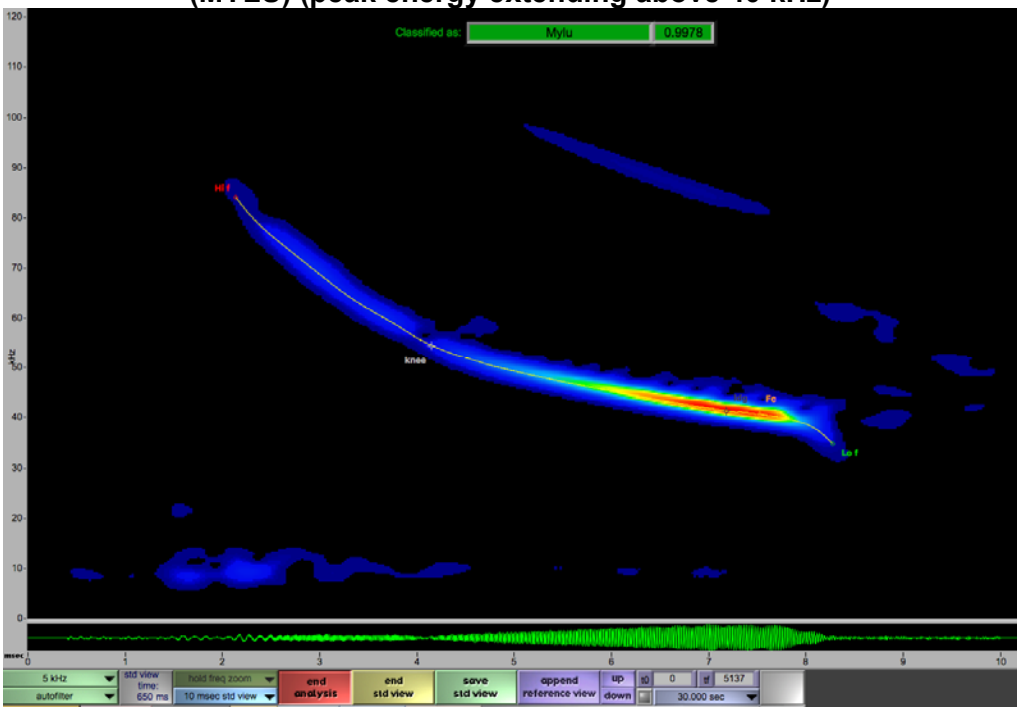
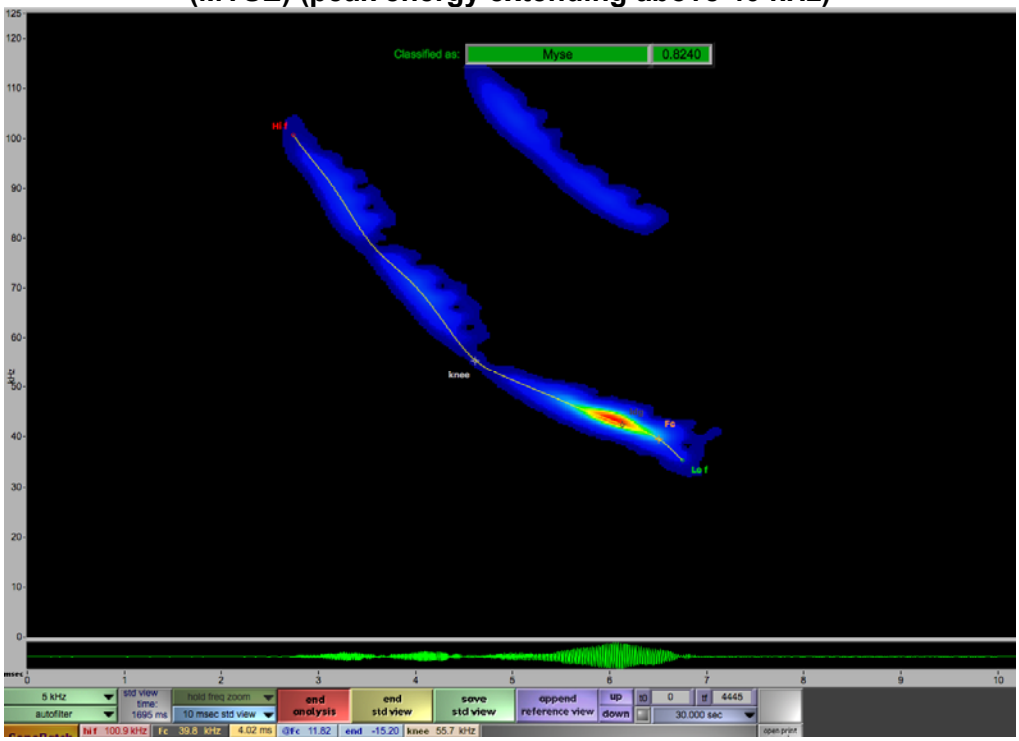


Figure 2 Example of the majority of pulse signatures – representing Northern Long Eared (MYSE) (peak energy extending above 40 kHz)



4.3 Survey Limitations

- While this methodology is robust and defensible, in an effort to accurately detect species emergence and evidence of bat activity, the absence of bats from a survey is not assurance that it may not occur in the future. The bats' high mobility means it is virtually impossible to rule out bats using any type of structure for roosting or habitat for foraging or on a flight path.

- Observations (visually) can be difficult to confirm. This can be attributed to a bats' fundamental biological nature making them difficult to detect even under ideal circumstances and or by experienced surveyors.

- Species identifications should always be interpreted with an understanding of the difficulties of acoustic identification.

- Species at Risk Information is accurate and up to date as of this report (October 2017). Species designation's under Ontario Regulation 230/08 (Species at Risk in Ontario List) occurs periodically. It is the owner's responsibility to ensure that species and habitats regulated under Endangered Species Act (2007) or those protected under other policies (i.e. the Migratory Bird Convention Act, Fish and Wildlife Conservation Act) are protected.

5.0 REASONABLE CONSIDERATION OF ALTERNATIVES

The development proposal is in the final stages of draft plan approval. The next phase is to present the draft plan to the public for review and comment. The proposal seeks to develop the central portion of the woodland. The alignment of Beck Boulevard has been accepted by the municipality by the Town of Penetanguishene. Connecting infrastructure for the road is already in place.

Through the approach taken to determine bat activity in the woodlot, we conclude that the woodland provides general habitat for Little Brown Myotis and Northern Myotis. The results and surveyor expertise strongly suggest evidence that the woodland provides maternal roosting habitat for Northern Myotis.

Determining the location and function of snag tree clusters or "eco-elements" to distinguish higher quality habitat (i.e. maternity roost trees) as outlined in the Sections above will not provide answers under the ESA to mitigate risk. Tree preferences (use) over the course of a year changes, reproductive females often use different summer habitats from males and non-reproductive females and varies based on sex and reproductive status. Thus, would not provide any more information with respect to the potential for "higher" quality bat habitat given the woodland features applicable to the subject property (W.Frick, *pers.comm*. 2017, Thorne, *pers.comm* 2017, Lausen *pers.comm* 2015). As outlined in Section 2.0 there are numerous variables that cannot be anticipated when dealing with SAR bats. Several hundred potential roost trees are distributed throughout the woodland community. The work completed previously and the 2017 surveys confirmed that for this woodland, definition of a specific area (or eco-element) that would be of higher quality than any other feature preferred by Northern Myotis is not possible. This is because the entire woodland is contributing to habitat necessary for females, their young and males to carry out their important life cycle requirements.

The woodland as a whole in this case is acting as the “eco-element”. This is fundamentally based on both Little Brown and Northern Myotis species biology, behaviour and observations of the bat specialists completing the 2017 review and those consulted for this project. Relocation of a road, or reducing lot size, will not change the potential impacts that may occur. Opening the canopy under any development scenario, changing grades or altering the moisture regime will likely create compounding effects such as a reduction in the insect population, loss of characteristics of foraging habitat (Northern Myotis prefer to forage insects from lower canopy), increases in light (natural and artificial) affecting roosting habits or preference for specific trees which may be used by for Northern Myotis.

Knowledge gaps are considerable concerning impacts created by developments such as that proposed on the subject lands. The effects of the scale or intensity of the impacts created within habitat for species such as Northern Myotis is poorly understood and difficult to quantify (Silvis, Perry and Ford 2016). Especially when the reason for listing both the Little Brown Bat and Northern Myotis is due to WNS (in North America). Other significant negative impacts include collisions with wind turbines and removal of hibernation habitat which have been the leading causes of bat population declines (O'Shea, Cryan, et. Al. 2016).

6.0 CONCLUSIONS

It appears that the development will remove general habitat for At-Risk Myotis, however the response by the population to partial removal of the woodland cannot be anticipated at this time given that there are surrounding features (street trees, open water) also likely used, and that the Little Browns at a minimum may be travelling some distance to forage in the woodland and other areas. Given our current knowledge, we cannot predict whether the remaining woodland will continue to provide habitat for these species. On the basis of our evidence, it appears that the highest areas of activity occur within the interior of the woodland that cannot be avoided by the residential development.

Given the results of the acoustic analysis and emergence survey ESA regulated bats Northern Myotis and Little Brown Bat are documented within the subject property (woodland). In SLR’s expert opinion the woodland is the eco-element. Redesign of the proposed subdivision (e.g. road relocation, reduction in lot size, maintenance of groups of roost trees at the expense of others (and possibly creating a hazard condition for the emerging community) will not reduce the contributing function the woodland provides for Northern Myotis and Little Brown Bat life cycle requirements. We trust previous meetings and extensive discussions between SLR and MNRF coupled with this report provides confidence for MNRF to make informed decisions as whether or not a 17 C permit under the ESA is required.

7.0 RECOMMENDATIONS

Further consultation with MNRF will help refine mitigation measures which may help reduce (but not eliminate) impacts as part of the development proposal[4]. This may include but is not limited to the following:

- Vegetation and tree removals after September 1st, but before April 1st (MNRF consultation may refine this timing window) when bats are migrating and unlikely to occupy a site for a prolonged period of time and young have flight ability.

[4] Recommendations are not intended to replace mitigation requirements or Overall Net Benefit options should a 17 C permit be required.

- To assist in bridging knowledge gaps an experienced biologist (qualifications to the satisfaction of MNRF), could be present during tree removals to review cut trees for bats. For example once a tree is on the ground cavities, bark and areas surrounding the tree could be searched. This is not intended for every tree (tree selection at the discretion of the experienced biologist) but an opportunity to collection further information (evidence of occupation) and further our understanding of timing windows. Protocols should be developed in consultation with leading bat experts (i.e. Ontario Bat working group, Toronto Zoo, Bat Conservation International, Brock Fenton).
- Incorporate into the development design lighting and features similar to bird friendly design guidelines that reduce ambient light around remnant woodland edges.
- Incorporate into any environmental protection areas, parklands, SWM Ponds landscape natural areas (as identified through the development application process) bat rocket boxes (colony boxes) using the most current science and designs available. This will provide education tools to further educate the public and promote wildlife education and habitat creation. These should be monitored and data forwarded to organizations such as the Toronto Zoo, MNRF, and/or Bat Conservation International to inform existing knowledge gaps.

If there are questions or concerns with this assessment please do not hesitate to contact the undersigned

Yours sincerely,

SLR Consulting (Canada) Ltd.

Kim Laframboise Dipl.F.T., E.M.T
Terrestrial Ecologist

Bibliography

Alexander Silvis, Roger W. Perry, and W. Mark Ford. 2016 Relationships of Three Species of Bats Impacted by White-Nose Syndrome to Forest Condition and Management. Unpublished on-line.

Brooks, R.T. 2008. Habitat-associated and temporal patterns of bat activity in a diverse forest landscape of southern New England, USA. Biodiversity Conservation. 18: 529–545. doi:10.1007/s10531-008- 9518-x.

COSEWIC. 2013. COSEWIC assessment and status report on the Little Brown Myotis Myotis lucifugus, Northern Myotis Myotis septentrionalis and Tri-colored Bat Perimyotis subflavus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxiv + 93 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Erickson, J.L and S.D West. 2003 Associations of bats with Local structure and landscape featuresof forested stands in Western Oregon and Washington. Biological and Conservation 109:95-102

Bat Conservation Trust (2016) Bat surveys for professional Ecologist (Good Practice Guidelines) Unpublished on-line.

Foster, R. W., A. Kurta. 1999. Roosting ecology of the northern bat (*Myotis Septentrionalis*) and comparisons with the endangered Indiana bat (Myotis sodalist). Journal of Mammalogy 80:659-672

Garnett. B, 2017. Email and telephone communication. Senior Consultant, Ecological Services at SLR Consulting UK.

Harvey J Michael, Altenbach, J. Scott and Best , L Troy. 2011. Bats of the United States and Canada

Henry, M.L., D.W. Thomas, R. Vaudry and M. Carrier. 2002. Foraging distances and home range of pregnant and lactating little brown bats (*Myotis lucifugus*). Journal of Mammalogy, 83(3):767–774

Humphrey, C. 2017. Recovery Strategy for the Eastern Small-footed Myotis (Myotis leibii) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vii + 76 pp.

Kunz, T. H and Anthony E. L.P. 1996. Variation in the timing of Nightly Emergence Behavior in the Little Brown Bat, Myotis lucifugus (Chiroptera: Vespertiliondae) in Contributions in Mammalogy: A memorial Volume Honoring Dr. J. Knox Jones Museum of Texas Tec University, il +315 pp.

Kunz, T. H. and Parsons, S. (eds) 2009. Ecological and behavioral methods for the study of bats. Journal of Mammalogy 92: 475–478.

Kunz and Parsons. 2009. Ecological and Behavioral Methods for the Study of Bats (2nd edition). John Hopkins University press.

Kunz, Thomas H and Fenton, Brook. 2003. Bat Ecology. University of Chicago Press. Paperback edition 2005.

Lacki, Hayes and Kurta. 2007. Bats in Forests Conservation and Management. John Hopkins University press.

Lausen, C. 2015. Bat Acoustic & Analysis Training Material, Wildlife Conservation Society of Canada Mattawa, Ontario

Mitchell-Jones, A.J. 2004. Bat mitigation guidelines. English Nature.

Ontario Ministry of Natural Resources . 2011. Bats and Bat Habitats: Guidelines for Wind Power Projects. Second Edition. July 2011.

Ministry of Natural Resources and Forestry Regional Operations Division. 2015. Technical Note: Species at Risk (SAR) Bats. Internal Use Only. June 2015.

Ministry of Natural Resources and Forestry (Guelph District). 2014. Use of Buildings and Isolated Trees by Species at Risk Bats: Survey Methodology. October 2014.
Thorne, J. Toby. 2017. Bats of Ontario. Field Identification Series.

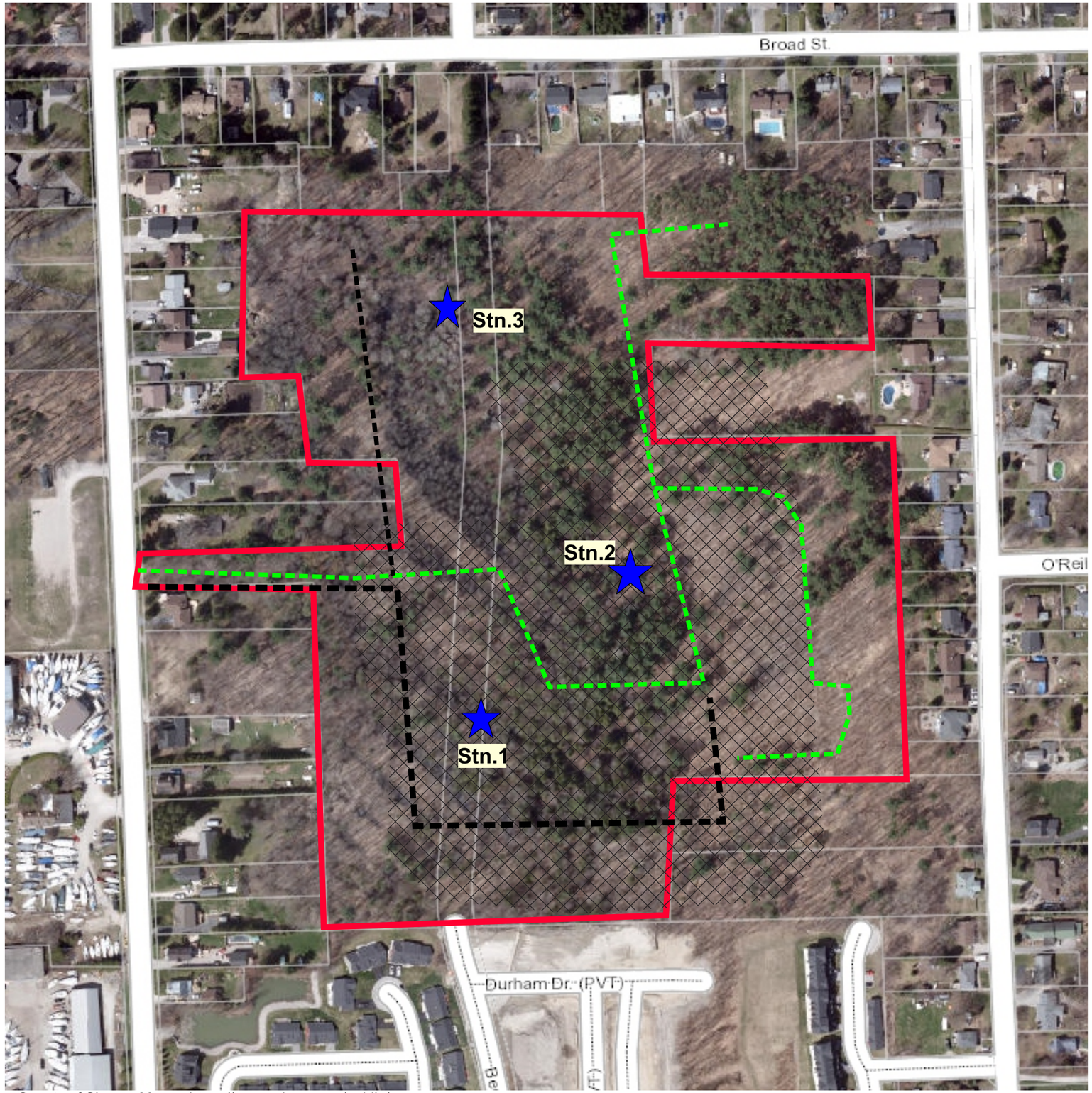
Thorne, Toby, Lausen, Cori, Brock Fenton, Mylea Bayless. 2017. Personal Communication (on going) Bat roosting and habitat affinities in Ontario surveys methods and bat biology . Toby is a M.Sc Bat Biologist and Researcher at the Toronto Zoo. Dr, Cori Lausen is a Research Biologist, Bat Specialist with Wildlife Conservation Society Canada, Mylea Bayless is research scientist with Bat Conservation International. Dr. Brock Fenton is Researcher and Ontario leading bat expert.

Thomas, Moss and Vater. 2004. Echolocation in Bats and Dolphins. University of Chicago Press.

Thomas J. O'Shea, Paul M. Cryan, et. Al. 2016. Multiple mortality events in bats: a global review. Mammal Review, 2016; DOI:

Towanda, T. & G. Falxa (2007) Emergence and foraging patterns of Myotis spp. bats in the southern Puget Sound region. The Society of Northwestern Vertebrate Biology Joint Annual Meeting in conjunction with Northwest Scientific Association and Northwest Lichenologists. Victoria, British Columbia, February 2007. Poster

Wilhere, G.F. 203. Simulations of Snag dynamics in an industrial Douglas-fir forest. Forest Ecology and Management 174:521-539.



Map Base - County of Simcoe Maps - https://maps.simcoe.ca/public/

DRAFT

- Property Boundary
- Highest Activity - Bat pulses
  Northern Myotis , Little Brown Bat
- Transect 1
- Transect 2
- Acoustic Monitoring Locations (approximate)

To be read in conjunction with SLR Technical Memorandum October 11, 2017

ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

Harbourview Heights

Penetanguishene, Ontario

2017 Bat Survey Results

Date: October 11, 2017

Project No. 209.40492.00000

Drawing No. F1

SLR global environmental solutions