
South Branch Wind Farm Acoustic Audit - Immission

Summary for Public Distribution

■ Introduction

The South Branch Wind Farm (project) operates 10 Siemens SWT-3.0-113 wind turbines located within the Township of South Dundas in the United Counties of Stormont, Dundas and Glengarry. As part of the Renewable Energy Approval (REA) application process, a pre-construction acoustic computer model was created in order to satisfy the requirements of the Ministry of Environment and Climate Change (MOECC) sound level limits.

In order to confirm the acoustic model and ensure that the wind project is operating as per MOECC regulations, the project's REA requires that an Acoustic Audit . Immission+is done once the project is in operation.

The Acoustic Audit . Immission+is a process that measures sources of noise emissions due to the operation of the project at designated measurement locations called receptors. The results of the acoustic audit are assessed to determine compliance with the Noise Performance Limits established by the MOECC and set out in the REA. The acoustic audits were completed in the spring and fall of 2015 and were documented in two separate acoustic audit reports that have been submitted to the MOECC (reports dated May 8, 2015 and March 3, 2016). The project was found to be in compliance with the Noise Performance Limits as set out in the REA. The following provides a summary of the results of the acoustic audit reports.

■ How does a wind project create noise?

The main sources of noise associated with the operation of a wind project are the wind turbines and the transformer substation. Noise from wind turbines can be divided into two areas:

- Aerodynamic noise - considered the dominant source of noise and is generated by the turbine blades passing through the air.
- Mechanical noise - is generated by different components in the hub such as the direct drive generator.

At short distances from the turbine, the aerodynamic noise from the rotating blades can be noticeable. As the distance from the turbine increases, the aerodynamic noise and mechanical noise are less pronounced and ambient sound levels can sometimes mask the audibility of the turbine noise. This is why sound measurements during the acoustic audit were conducted during the night time hours when ambient noise would be reduced.

The noise produced by a transformer substation exhibits a hum, associated with the fundamental electrical frequency and its harmonics. The transformer noise is assessed separately in the Acoustic Audit . transformer substation+.

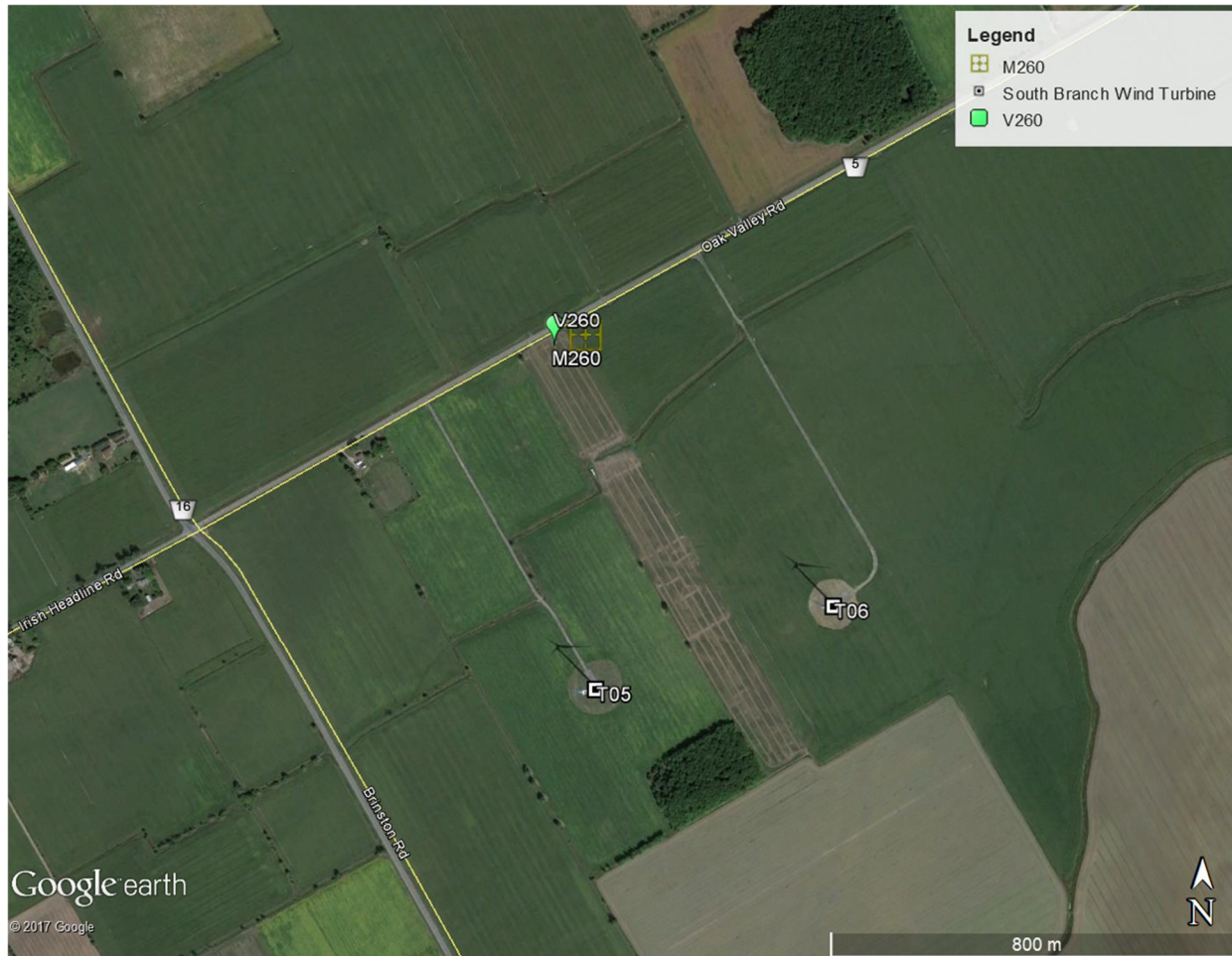
The noise produced by wind turbines, as well as ambient noise, increases with wind speed.

■ The measurement locations

The acoustic audit measurements for the Project were performed at three (3) different Points of Reception that were selected using the following criteria set out in the REA:

- The Points of Reception represent the location of the greatest predicted noise impact i.e., the highest predicted Sound Level; **and**
- The Points of Reception were located in the direction of prevailing winds from the facility.

Location 1



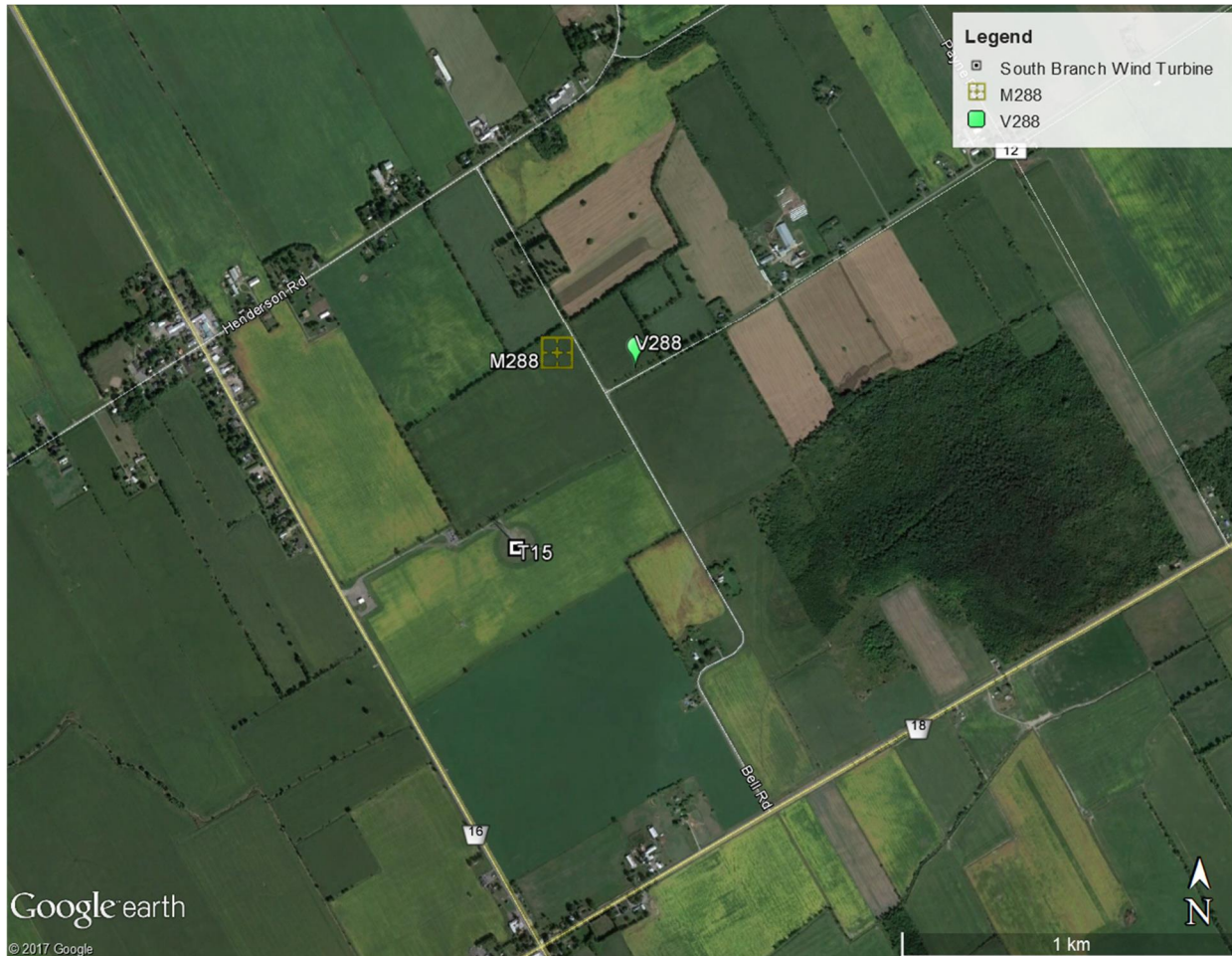
Measurement equipment at Location 1 was placed just South of Oak Valley Road near vacant lot receptor V260 identified in the Acoustic Assessment Report, facing the nearest turbine T05 (680m from the turbine). Location 1 is also close to turbine T06.

Location 2



Measurement equipment at Location 2 was placed across the street opposite to the property of Receptor R76 identified in the Acoustic Assessment Report, facing the nearest turbine T07 (708m from the turbine). Location 2 is also close to turbine T08.

Location 3



Measurement equipment at Location 3 was placed on the adjacent field to vacant lot receptor V288, facing the nearest turbine T15 (596m from the turbine). Location 3 was chosen to represent V288 due to setup limitations.

■ How was the study done?

The acoustic audit measurements required in the REA were performed by Aeroustics, an Independent Acoustical Consultant, on two (2) separate occasions; Spring 2015 and Fall 2015. The Spring 2015 acoustic audit and Fall 2015 acoustic audit were both performed over many days spanning from January 28, 2015 to April 1, 2015 and September 17, 2015 to January 3, 2016 respectively.

The acoustic audit was completed as per the methodology outlined in Part D of the MOECC Compliance Protocol for Wind Turbine Noise . Guideline for Acoustic Assessment and Measurement±

A microphone was placed at a measurement height of 4.5m above grade, at least 5m away from any large reflecting surfaces, and in direct line of sight to the nearest turbine. The figure below shows a photo of the equipment at Location 1 at the project and lists the main components in the sound measurement equipment set-up.



The Measurement System

- 10-metre-tall mast
- Sound level meter (at base)
- Primary and secondary windscreen (4.5m high)
- Microphone (4.5m high)
- Anemometer (10m high)
- Solar panel (at base)

For the duration of the measurement time, acoustic and weather data was logged simultaneously in one-minute intervals. Measurements were conducted when the turbines were operational (Turbine ON) as well as when the project was parked (Turbine OFF) in order to quantify the ambient sound level.

A one-minute measurement interval was considered valid if:

- The interval occurred between 10pm . 5am: measurements were conducted during the night time in order to minimize noise contamination from ambient sources such as road traffic, farming activity etc.
- No precipitation was detected within an hour before or after the interval: measurements excluded periods of rain which would contaminate the data with rain noise as well as increased road traffic noise from wet roads.
- The maximum measured wind speed at 10m was no more than 2 metres/second (m/s) higher than the recorded average for that interval: Periods with gusty wind conditions were excluded to avoid wind induced noise which would contaminate the data set.
- The temperature was above -10°C: Below this temperature the measurement equipment (e.g. microphone) may not operate to specifications.
- Either all nearby required turbines were operating for Turbine ON measurements, or all nearby required turbines were parked for ambient measurements (Turbine OFF).
- Transient activities such as cars driving by or airplane flyover were excluded from the analysis.

Turbine Only sound is determined by correcting valid Turbine ON data points by logarithmically subtracting Turbine OFF valid data points. The Turbine Only results are then compared to the Sound Level Limits.

▪ What are the REA Sound Level Limits?

The purpose of the sound measurements was to confirm whether the sound emitted by the project is in compliance with the MOECC sound level limits. The REA identifies the sound level limits, as per the table below.

Wind Speed (m/s) at 10m height	4	5	6	7	8	9	10
Sound Level Limits, dBA (decibels, hourly A-weighted)	40.0	40.0	40.0	43.0	45.0	49.0	51.0

▪ What were the results?

Both the Spring and Fall Immission audit results demonstrate that the Project is operating in full compliance with the MOECC Sound Level Limits at each of the (3) three measurement locations. The audit results also were generally in alignment with the predicted levels of the pre-construction acoustic model. The Spring and Fall Acoustic Audit reports have been submitted to the MOECC to satisfy the requirements of Acoustic Audit Immission Section E1 and E2 of the project's REA and are currently under the review process. Results of the audit for receptors R76 and V260 are presented in Table 1 and Table 2.

Table 1: South Branch Immission Audit Results - Phase 1

Phase 1 Immission Audit*	4	5	6	7
Turbine sound level - R76	34	36	38	40
Turbine sound level - V260	32	36	38	39
MOECC Sound Level Limit	40	40	40	43

Table 2: South Branch Immission Audit Results - Phase 2

Phase 2 Immission Audit*	4	5	6	7
Turbine sound level - R76	35	39	40	43**
Turbine sound level - V260	37	39	40	40
MOECC Sound Level Limit	40	40	40	43

* South Branch received feedback from the MOECC on July 11, 2017 regarding the completeness of the measurement dataset at V288, and are currently working toward a resolution. Results from V288 are not presented at this time.

** At this wind speed, the Background sound levels at this receptor were higher than the sound level from the wind turbines. The reported turbine-only sound level is based on a conservative assessment; the actual turbine-only sound level is likely to be noticeably lower.

Questions or further clarification on this audit can be directed to the Project team at southbranch@edpr.com or phone 1-416-502-9463.