

APPENDIX K
ELECTROMAGNETIC INTERFERENCE STUDY
CORRESPONDENCE



May 3, 2013

Mr. Danny Splettstosser
Truro-Millbrook Wind Limited Partnership
4845 Pearl East Circle, Suite 200
Boulder, CO 80301

Dear Mr. Splettstosser,

RE: Summary Report – Electromagnetic Interference Study (EMI)
Proposed Millbrook/Truro Heights Community Wind Project

INTRODUCTION

Strum Consulting have been mandated by JUWI to verify the impact of the deployment of a 5 turbine proposed windfarm on the telecommunication systems operating within the region. This report presents the preliminary results of the impact study, identifying telecommunication systems in the proposed windfarm area that might be affected by interference due to the operation of the wind turbine generators. The study aims to identify radar and navigation systems, broadcast systems and point to point communications susceptible to be affected by windfarm interference. Consultation zones related to broadcast TV, Radio and TV Reception points have been provided on Figure 2 (attached).

The methodologies used in this study are in accordance with the RABC/CanWEA published guidelines.

This assessment has been completed using the coordinates listed in Table A, below, as placement and elevation of the wind turbines.

Turbine ID	X	Y	Ground Elevation (meters)	Nacelle Height (meters)	Rotor Diameter (meters)	Total Height (meters)
WTG1	473179	5018760	154.94	100	122	316
WTG2	473139	5019140	150.58	100	122	312
WTG3	473153	5019590	141.19	100	122	303
WTG4	473382	5018400	148.73	100	122	310
WTG5	473454	5018060	144.52	100	122	306

Coordinates – UTM Zone 20 North

Engineering • Surveying • Environmental

Head Office
Railside, 1355 Bedford Hwy.
Bedford, NS B4A 1C5
t. 902.835.5560 (24/7)
f. 902.835.5574

Antigonish Office
3-A Vincent's Way
Antigonish, NS B2G 2X3
t. 902.863.1465
f. 902.863.1389

Deer Lake Office
101 Nicholasville Road
Deer Lake, NL A8A 1V5
t. 855.770.5560
f. 902.835.5574

TELEVISION BROADCAST SYSTEMS

Of the telecommunication systems susceptible to interference from the wind turbine operation, analog television reception is most likely to be affected. Analog television interference from wind turbine generally occurs as video distortion taking the form of a movement of the picture synchronized with the blades passage frequency. It should also be noted that analog signal transmission has been predominantly replaced the majority of TV broadcast operators have converted their analog NTSC TV stations to the ATSC North American digital standard. As required by a decision of the CRTC (Public Notice CRTC 2007-53),

In the case of the Truro-Millbrook site, three analog television broadcast stations were found to be located within the 2 kilometer consultation zone.

Based on the equation $R=0.051*B*\sqrt{T}$, where B is equal to the length of one of wind turbines blades in meters, and T is equal to the number of proposed turbines it has been calculated that receivers of analogue over the air broadcasts within a 14 kilometer radius from the geographical centre of the proposed wind turbine farm would in all likelihood experience some level of static and ghosting on local analog over the air reception; however, most broadcasting and receivers now employ the new digital signal standard as required by a decision of the CRTC (Public Notice CRTC 2007-53) So any negative overall impact to the area should be limited at best.

CBC Radio-Canada

CBC Radio-Canada has introduced specific criteria for assessing the interference of wind turbine generators in relation to its broadcast infrastructure. (*Document: CBC Radio-Canada Involvement and Requirements Concerning Wind Energy*). This document mandates that an inventory of all CBC/Radio-Canada's existing television broadcasting transmitters within 89 kilometres of the project be looked at for potential inference concerns.

CBC Radio-Canada has one television transmitter located within the specially requested 89 kilometre consultation zone.

FM BROADCAST STATIONS

Previous studies and simulations in laboratories have shown that FM broadcast reception is generally not affected by the wind turbine operation, as long as a minimum distance of a few hundred meters from the wind turbine is maintained. Perception of FM reception degradation would take the shape of a background "hissing noise" synchronised with the blades rotation.

In the case of the Truro-Millbrook site, no privately owned FM broadcast stations were found to be located within the 2 kilometer consultation zone.

CBC Radio-Canada

CBC Radio-Canada has introduced specific criteria for assessing the interference of wind turbine generators in relation to its broadcast infrastructure. (*Document: CBC Radio-Canada Involvement and Requirements Concerning Wind Energy*). This document mandates that an inventory of all

CBC/Radio-Canada's existing FM broadcasting transmitters within 5 kilometres of the project be looked at for potential interference concerns.

There are no CBC Radio-Canada FM radio transmitters identified within 5 kilometers of the proposed site.

AM BROADCAST STATION

Just like television signals, AM broadcast signals are amplitude modulated and as such could experience interference from wind turbine operation. However, the AM broadcast systems operate at very low frequency (0.535 – 1.705 MHz) with wavelength much longer than TV signals and thus are not reflected by wind turbine components. The reception of AM broadcast signals will not be affected, unless the receiver is very close to the wind turbine itself (less than a few meters). One should note that the construction of any metallic vertical structure near an AM antenna system (within a few wavelengths) would modify the radiation pattern of the antenna system, as the new structure will react as a secondary radiator. Considering the lightning protection cables within the wind turbine blades, the placement of a wind turbine within proximity of an AM station array might cause serious service disruption. A 5 km consultation zone is required for AM-Omnidirectional antenna where as a 15 km consultation zone is required for AM-Directional antenna.

In the case of the Truro-Millbrook site, there are no AM broadcast stations within the proposed windfarm area.

CBC Radio-Canada

CBC Radio-Canada has introduced specific criteria for assessing the interference of wind turbine generators in relation to its broadcast infrastructure. (*Document: CBC Radio-Canada Involvement and Requirements Concerning Wind Energy*). This document mandates that an inventory of all CBC/Radio-Canada's existing AM broadcasting transmitters within 5 kilometres of the project be looked at for potential interference concerns.

There are no CBC Radio-Canada AM radio transmitters identified within 5 kilometers of the proposed Truro-Millbrook site.

RADAR SYSTEMS

Radar systems generally operate in the microwave frequencies from 1 GHz to 10 GHz or more, and use the radio wave reflection to locate and identify any eventual target. Military and civil usage of radar systems is mainly related to air traffic control and meteorology to name a few applications. Any fixed structure in the radar station line of sight will reflect a part of the signal transmitted by the radar back to the radar receiver which will process it. The echo from the structure will be similar to the echo from an aircraft, but will show different particularities designated as its radar signature and processing can differentiate between a structure signature and an aircraft signature, even between two different types of aircraft.

When the structure is fixed, filtration and processing can generally eliminate the structure signature from the radar display, reducing the impact for the radar operator. The navigational radar, especially the long range radar, typically have a slight positive antenna elevation angle, such that structures far enough from the radar station are not visible from the radar station position and generally do not cause any significant radar response. Moving structures like wind turbine cause important disturbance to radar operation, since the signature is continuously changing according to rotor speed and wind direction. Especially when many wind turbines are clustered in relatively large wind farms, the filtration and processing of these radar echoes become virtually impossible.

The meteorological radars operate in the same way and attempt to measure the cloud density and precipitation as close as possible to the earth surface. In order to achieve a larger coverage area, they are usually installed on higher platforms and their antenna elevation angles are generally close to the horizon and sometime negative, depending on local topography. The presence of fix structures can be dealt with in the same way as for the navigational radar, however since the radar beam is grazing the earth surface, echo from structure even over the horizon are often seen. Attempts to develop filtration and complex processing to cancel the responses from moving structures like wind turbine have been made with disappointing results.

Based on the RABC/CANWEA guidelines, a consultation zone of 80 km radius is required around the Air Traffic Control (ATC) radar stations (PSR), 10 km (SSR) and a 60 km around Canadian Coast Guard (CCG) radar station, while an 80 km radius consultation zone is required around the meteorological radar stations. Similarly, the Department of National Defence (DND) requires a 100 km consultation zone around the defence radar stations.

DND AIR DEFENCE AND AIR CONTROL RADAR SYSTEMS

The role of the Canadian Air Defence System is to provide aerospace surveillance, thereby contributing to the defence of North America, through radar systems located throughout Canada's arctic, coastal and inland regions. The Department of National Defence was contacted to evaluate if potential interference with their installations would be caused by the proposed windfarm.

DND has no objections to the proposed windfarm (see attached).

DND Radio Communications

DND was also contacted to inquire about potential interference to their radio communications network. A response was received on from Mario Lavoie, Spectrum Engineering Technician stated:

"I have reviewed your proposal in respect to DND's radio communication systems, and I have no objections or concerns."

Canadian Coast Guard

The Canadian Coast Guard was contacted to evaluate the project for potential interference in regard to their vessel traffic system radars. A response was received from DFO which indicated no objections to the windfarm as proposed (see attached).

Royal Canadian Mounted Police (RCMP)

A request has been forwarded to the RCMP in regard to potential interference with their communication systems.

To date no response has been received.

VOR AND PRIMARY AIR TRAFFIC CONTROL (ATC) SURVEILLANCE RADAR

The VOR (VHF Omnidirectional Range) use frequencies in the 108-118 MHz band and a combination of amplitude and frequency modulation to facilitate aircraft short-range navigation. The VOR ground stations are generally located within the boundaries of airports but are sometimes located along main navigation corridors for en-route navigation. A clear area of approximately five hundred meters around ground stations should be maintained for proper operation and precision of the airborne receiver. Tall buildings or structures should be avoided at larger distance from the station to avoid distortion of the variable azimuth signal. Previous investigation has shown that wind turbine structures can be considered as static structures regard to VOR operation and the Transport Canada Aeronautical Obstruction Clearance should be obtained as for any other tall structure.

A request has been submitted to NavCanada to assess the potential impact of the proposed wind farm on the Halifax (YHZ) airport VOR and primary surveillance radar.

NAVCanada has no objections to the project as proposed (see attached).

ENVIRONMENT CANADA

A request has been made to Environment Canada (EC) to assess for potential interference with their weather radar installations. A response was received from Environment Canada which indicated no objections to the windfarm as proposed (see attached).

NATURAL RESOURCES CANADA

Natural Resources Canada operates a network of seismic monitoring stations throughout Canada. A request has been send to Natural Resources to determine if any potential interference from the proposed windfarm exists.

To date no response has been received.

Point to Point Systems

The CanWEA/RABC Guidelines recommend a consultation zone within a 1 km radius around the transmit and receive sites for point to point type radio systems, and a cylinder around the transmission path, with a diameter determined as a function of the Fresnel zone.

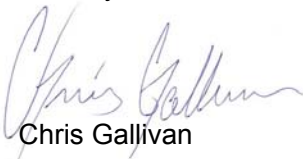
A total of 348 search results were identified as point to point radio systems. These results were paired using the call sign field, where call signs were not available pairing was completed based on Owner and TX/RX frequency pairing. One tower was identified to be within the 1 km consultation zone. This tower has a call sign of VFW529 and is owned by the local Fire Department. Figure 1 (attached) provides the locations of all towers identified within a 10 km radius of the proposed site centre.

CLOSURE

Should additional information become available, Strum requests that this information be brought to our attention immediately so that we can re-assess the conclusions presented in this report. This report was prepared by Chris Gallivan, Environmental Specialist and reviewed by Shawn Duncan, Vice President.

If you have any questions, please do not hesitate to contact us.

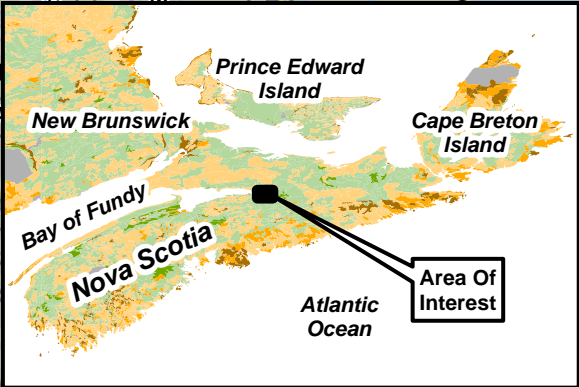
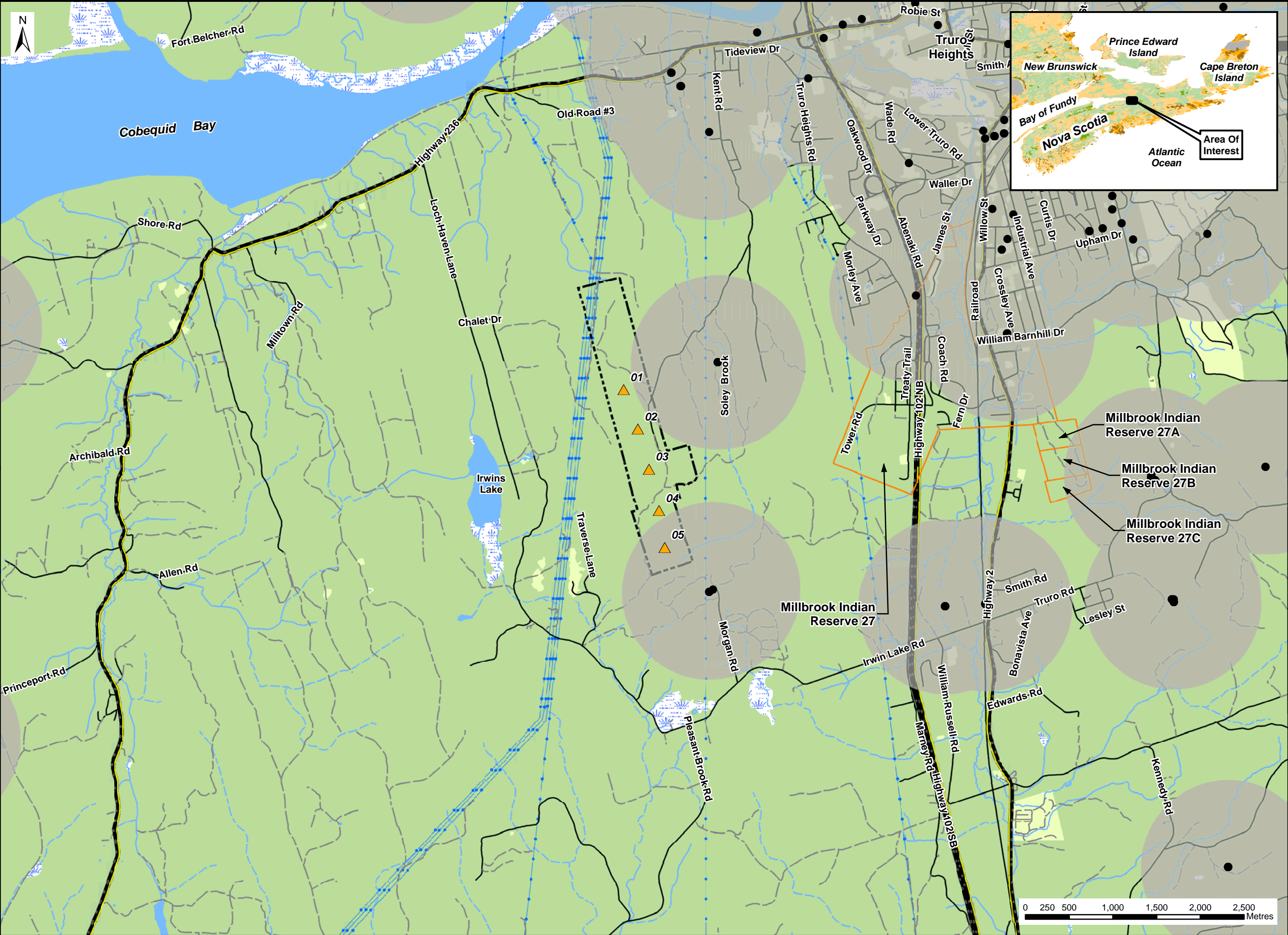
Thank you,



Chris Gallivan
Environmental Specialist
cgallivan@strum.com



Shawn Duncan
Vice President
sduncan@strum.com



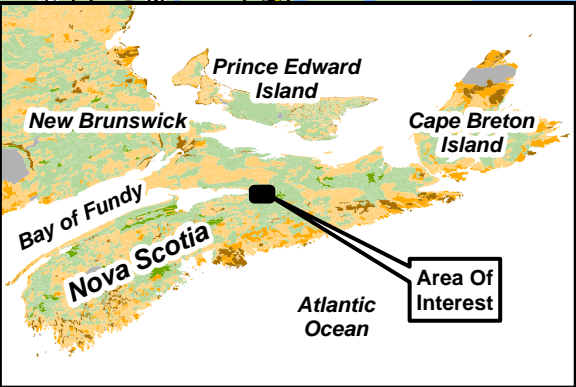
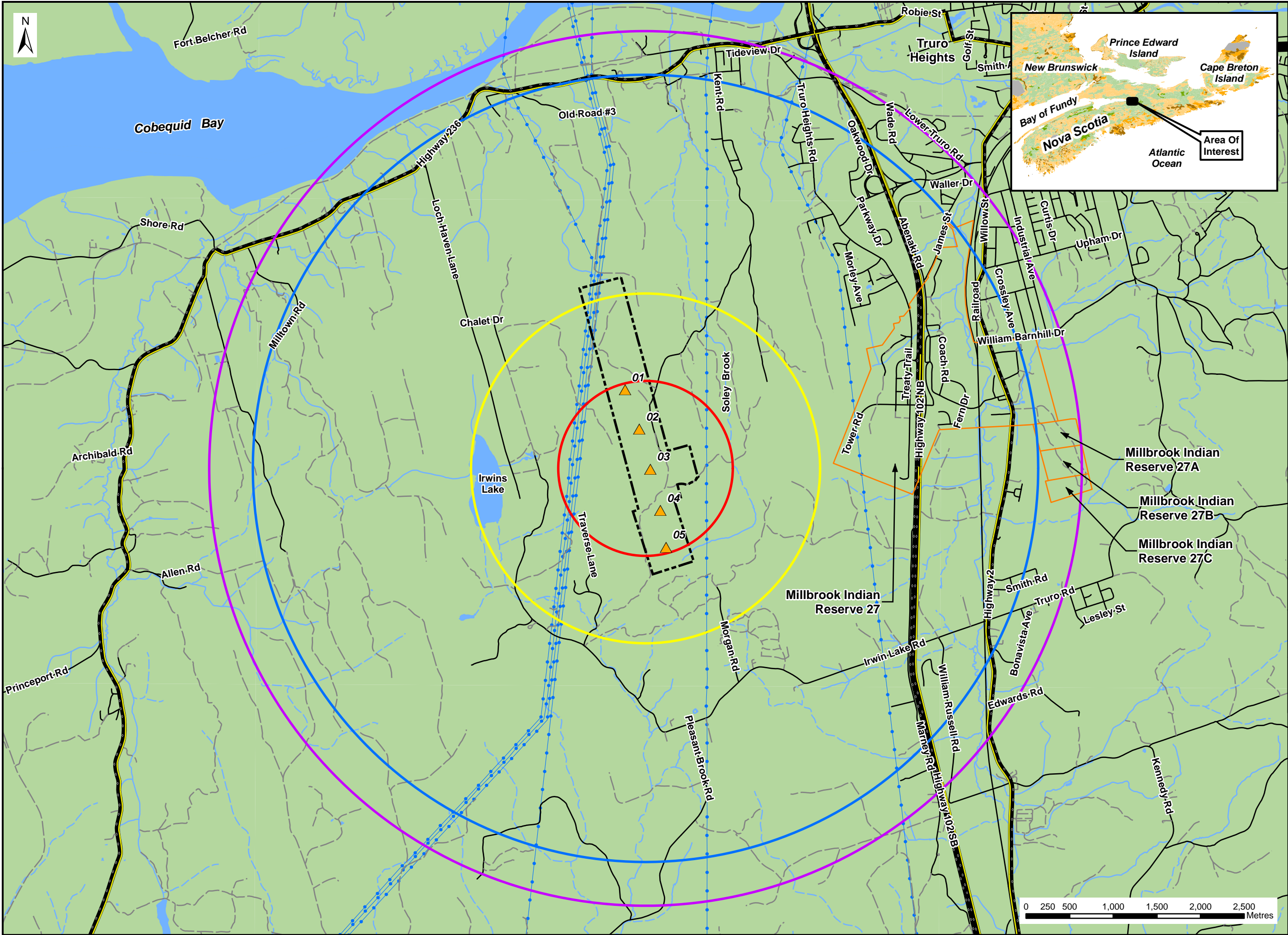
- Notes:**
- Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Radio Tower Locations Obtained Through Industry Canada Website (<http://sd.ic.gc.ca/>).
 - Projection: NAD83(CSRS), UTM Zone 20 North.

- Legend:**
- Proposed Turbine
 - Point-To-Point Radio Tower
 - 1 km Consultation Zone
 - Project Site Boundary
 - Major Roads and Highways
 - Roads
 - Access Roads / Trails
 - Existing Transmission Lines
 - Mapped Stream
 - Indefinite Stream
 - Water Bodies
 - Mapped Wet Area
 - Cleared Area

**Point-To-Point
Transmission
Locations**



Date:	April 2013	Project #:	12-4328
Scale:	1:40,000	Drawing #:	1
Drawn By:	H. Serhan		
Checked By:	C. Gallivan		



- Notes:**
- Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
 - Projection: NAD83(CSRS), UTM Zone 20 North.

- Legend:**
- Proposed Turbine
 - Consultation Zones**
 - Private TV (1km)
 - FM Radio (2km)
 - Analog TV (4.5km)
 - AM & FM Radio - CBC Radio (5km)
 - Project Site Boundary
 - Major Roads and Highways
 - Roads
 - Access Roads / Trails
 - Existing Transmission Lines
 - Mapped Stream
 - Indefinite Stream
 - Water Bodies

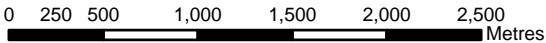
Consultation Zones



Community Wind Farms Inc.



Date: April 2013	Project #: 12-4328
Scale: 1:40,000	Drawing #: 2
Drawn By: H. Serhan	
Checked By: M. Smith	



From: XNCR, Windfarm Coordinator <Windfarm.Coordinator@DFO-MPO.GC.CA>
Sent: October-23-12 12:10 PM
To: Chris Gallivan
Subject: RE: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia

Hello,

There is no CCG communication or radar site in the vicinity of the proposed wind farm (Millbrook). Therefore, we do not anticipate any interference problems.

Regards,

Martin Grégoire, P. Eng
Canadian Coast Guard

From: Chris Gallivan [<mailto:CGallivan@strum.com>]
Sent: October 23, 2012 8:28 AM
To: XNCR, Windfarm Coordinator
Subject: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia

I am conducting an initial investigation into the placement of a potential 5 wind turbine farm in near Millbrook – Truro Heights Nova Scotia. We are looking only to see if there would be potential inference with your operations and the proposed wind turbine installation.

The turbine specifications are as follows:

1. 100 meter high tower with a 3 blade rotor (diameter of 122 metres)

I have included the requested excel file which include the proposed turbine locations, with coordinates and elevations. A map showing the turbines proposed locations has also been included.

If you have any questions or require additional information please do hesitate to contact me directly.

Chris Gallivan
Environmental Specialist



Bedford • Antigonish • Deer Lake

Head Office:
Railside, 1355 Bedford Highway
Bedford, NS B4A 1C5

Tel: 902.835.5560 (24/7)

From: MARIO.LAVOIE2@forces.gc.ca
Sent: October-23-12 9:47 AM
To: Chris Gallivan
Cc: +WindTurbines@forces.gc.ca
Subject: FW: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia
Attachments: Drawing 1 - Millbrook Topo Mapping - 4328.pdf.pdf.pdf; WEB2010-BP8A04-01 12-4328 Millbrook - Truro Heights, Nova Scotia.xls.xls

I have reviewed your proposal in respect to DND's radio communication systems, and I have no objections or concerns.
Thank you for coordinating with DND.
Have a good Day.

Mr. Mario Lavoie
Spectrum Engineering Technician
National Defence | Défense nationale
Ottawa, Canada K1A 0K2
mario.lavoie2@forces.gc.ca
Telephone | Téléphone 613-992-3479
Facsimile | Télécopieur 613-991-3961
Government of Canada | Gouvernement du Canada

From: Chris Gallivan [<mailto:CGallivan@strum.com>]
Sent: Tuesday, 23, October, 2012 08:24 AM
To: Lavoie MJ@ADM(IM) J6 Coord@Ottawa-Hull
Subject: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia

I am conducting an initial investigation into the placement of a potential 5 wind turbine farm in near Millbrook – Truro Heights Nova Scotia. We are looking only to see if there would be potential inference with your operations and the proposed wind turbine installation.

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Chris Gallivan
Environmental Specialist

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Head Office:

From: Weather Radars Contact,National Radar Program [Ontario] <weatherradars@ec.gc.ca>
Sent: October-26-12 10:54 AM
To: Chris Gallivan; Weather Radars Contact,National Radar Program [Ontario]
Subject: RE: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia

Dear Mr. Chris Gallivan,

Thank you for contacting the Meteorological Service of Canada, a branch of Environment Canada, regarding your wind energy intentions.

Our preliminary assessment of the information provided to us via e-mail on October 23, 2012 indicates that any potential interference that may be created by the Millbrook Wind Farm near Truro, Nova Scotia will not be severe. Although we would prefer our radar view to be interference free, this is not always reasonable. As a consequence, we do not have strong objections to the current proposal.

If your plans are modified in any manner (e.g. number of turbines, height, placement or materials) this analysis would no longer be valid. An updated analysis must be conducted.

Please contact us at: weatherradars@ec.gc.ca.

Thank you for your ongoing cooperation and we wish you success.

Best Regards,

Carolyn Rennie
National Radar Program
Meteorological Service of Canada
Environment Canada
4905 Dufferin Street
Toronto, Ontario M3H 5T4
Office : 3N-WS12
Carolyn.Rennie@ec.gc.ca
Phone : 416-739-4931

Carolyn Rennie
Le Programme Nationale de Radar
Service météorologique du Canada
Environnement Canada
4905, rue Dufferin
Toronto, Ontario M3H 5T4
Bureau : 3N-WS12
Carolyn.Rennie@ec.gc.ca
Téléphone : 416-739-4931

From: Chris Gallivan [<mailto:CGallivan@strum.com>]
Sent: Tuesday, October 23, 2012 8:16 AM
To: Weather Radars Contact,National Radar Program [Ontario]
Subject: [12-4328] Review of Proposed 5 Wind Turbine Farm Installation - Millbrook - Truro Heights, Nova Scotia

I am conducting an initial investigation into the placement of a potential 5 wind turbine farm in near Millbrook – Truro Heights Nova Scotia. We are looking only to see if there would be potential inference with your operations and the proposed wind turbine installation.

The turbine specifications are as follows:

1. 100 meter high tower with a 3 blade rotor (diameter of 122 metres)

I have included the requested excel file which include the proposed turbine locations, with coordinates and elevations. A map showing the turbines proposed locations has also been included.

If you have any questions or require additional information please do hesitate to contact me directly.

Chris Gallivan
Environmental Specialist



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From: ADIN.SWITZER@forces.gc.ca
Sent: October-30-12 9:34 AM
To: Chris Gallivan
Cc: JOCELYN.BELAND@forces.gc.ca
Subject: Detailed Analysis - No Interference - Millbrook Wind Turbine Farm, Millbrook-Trouro Heights, NS - WTA-2123
Attachments: WEB2010-BP8A04-01 12-4328 Millbrook - Truro Heights, Nova Scotia.xls

Chris,

We have completed the detailed analysis of your proposed site, Millbrook Wind Turbine Farm, located near Millbrook-Trouro Heights, NS (WTA-2123). The results of our detailed analysis have shown that there is likely to be no interference with DND radar and flight operations.

Therefore, as a result of these findings we have no objections with your project as submitted (attached).

If however, the layout were to change/move, please re-submit that proposal for another assessment using the assigned WTA number listed above. The concurrence for this site is valid for 24 months from date of this email. If the project should be cancelled or delayed during this timeframe please advise this office accordingly.

It should be noted that our office looks at each submission on a case by case basis and as such, concurrence on this submission in no way constitutes a concurrence for similar projects in the same area, nor does it indicate that similar concurrence might be offered in another region.

Finally, the concurrence offered in this email extends only to the subject projects and current proponent. Should the project or any part of it be altered, or be sold to another developer, this office must be notified and we reserve the right to reassess the project.

Thank you for your patience on this matter and for considering DND radar and airport facilities in your project development process.

If you have any questions feel free to contact me.

Thank you.

<<WEB2010-BP8A04-01 12-4328 Millbrook - Truro Heights, Nova Scotia.xls>> Adin Switzer Capt AEC Liaison Officer
CCISF/ESICC ATESS/ESTTMA Défense nationale | National Defence

8 Wing Trenton, Astra, ON K0K 3W0

TEL: 613 392-2811 Ext4834 (CSN: 827-4834)

FAX: 613 965-3200

Gouvernement du Canada | Government of Canada ü Please consider the environment before printing this email | S'il vous plaît pensez à l'environnement a



Wind turbine submission form

12-4328 Millbrook - Truro Heights Turbine information

Turbine Number	LAT dd mm ss.ss	LONG -ddd mm ss.ss	Ground Elevation (meters)	Nacelle Height (meters)	Rotor Diameter (meters)	Total Height (meters)
WTG1	45 19 18.6024	-63 20 32.003	154.97	100	122	316
WTG2	45 19 30.9108	-63 20 33.914	150.58	100	122	312
WTG3	45 19 45.4944	-63 20 33.36	141.19	100	122	303
WTG4	45 19 6.9636	-63 20 22.61	148.73	100	122	310
WTG5	45 18 55.9548	-63 20 19.237	144.52	100	122	306



January 22, 2013

Your file
Project #12-4328
Our file
12-4663

Mr. Chris Gallivan
Strum Environmental
Raiside, 1355 Bedford Highway
Bedford, NS
B4A 1C5

RE: Wind Farm: 5 Wind Turbines - Truro, NS
(See attached spreadsheet)

Mr. Gallivan,

We have evaluated the captioned proposal and NAV CANADA has no objection to the project as submitted.

The nature and magnitude of electronic interference to NAV CANADA ground-based navigation aids, including RADAR, due to wind turbines depends on the location, configuration, number, and size of turbines; all turbines must be considered together for analysis. The interference of wind turbines to certain navigation aids is cumulative and while initial turbines may be approved, continued development may not always be possible.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications and issue NOTAM as required. To assist us in that end, we ask that you notify us at least 10 business days prior to the erection of the turbines. This notification requirement can be satisfactorily met by returning a completed, signed copy of the attached form by e-mail at landuse@navcanada.ca or fax at 613-248-4094. In the event that you should decide not to proceed with this project or if the structure is dismantled, please advise us accordingly so that we may formally close the file.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca.

NAV CANADA's land use evaluation is valid for a period of 12 months. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Industry Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA engineering as deemed necessary.

Yours truly,

A handwritten signature in black ink, appearing to read "A. English", written over a light blue horizontal line.

Scott English
for
David Legault
Manager, Data Collection
Aeronautical Information Services

cc ATLR - Atlantic Region, Transport Canada

APPENDIX L
SOUND MONITORING AND MODELING RESULTS



April 26, 2013

Mr. Judd Rogers

juwi Wind, LLC

4845 Pearl East Circle, Suite 200

Boulder, CO 80301

USA

Dear Mr. Rogers,

Re: Existing Sound Levels

Millbrook/Truro Heights Community Wind Projects, Truro Heights, NS

Strum Consulting was retained by juwi Wind to document existing sound levels in the area of two proposed projects; Millbrook Community Wind Project and Truro-Heights Community Wind Project, near Truro, NS. The two Projects are expected to share common infrastructure (e.g. shared access from Tower Road and shared utility right of way) and will be constructed on similar timelines. Therefore, for the purposes of the sound assessment, the two Projects are presented together as one Project site, incorporating turbines 1 to 3 on PID 20215711 (Millbrook Community Wind), turbines 4 and 5 situated on PID 20206330 (Truro Heights Community Wind), and all associated access roads within those boundaries.

Results indicate that the average sound levels over the sampling period were 50.2 and 49.3 dBA at the monitoring locations.

This report provides a brief understanding of the scope, methodology and findings of the assessment.

BACKGROUND

The Project consists of a combined 10 MW wind power development approximately 5 km southwest of the town of Truro, Nova Scotia. This sound assessment was completed to establish pre-construction sound levels at two locations near the Project site boundaries.

MONITORING LOCATIONS

Monitoring locations were selected near the Project site boundaries, in areas that are close to receptors (Drawing 1, attached). Efforts were also made to locate the monitoring equipment in open locations where sound attenuation from vegetation and topography would be minimal. Table 1 provides basic information for each monitoring location.

Engineering • Surveying • Environmental

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Antigonish Office
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Antigonish, NS B2G 2X3
t. 902.863.1465
f. 902.863.1389

Deer Lake Office
101 Nicholasville Road
Deer Lake, NL A8A 1V5
t. 855.770.5560
f. 902.835.5574

Table 1. Monitoring Locations

Monitoring Location ID	Location Near Project Site	Location Relative to Nearest Receptor	GPS Location	
			UTM Easting	UTM Northing
Millbrook/Truro Heights Northeast	Near the northeastern Project site boundary.	2.1 km west of the nearest receptor	473340 m	5020046 m
Millbrook/Truro Heights Southwest	On the southwestern Project site boundary.	0.5 km Northeast of the nearest receptor	473127 m	5017812 m

METHODOLOGY

The assessment was completed using Casella CEL-490 real time noise monitor with data logging capability. At each location, the monitor was kept in a locked weatherproof case, with the microphone supported by tripods at a height of 1.5 m above the ground. The microphone was mounted inside an acoustically transparent weather resistant cage, designed to minimize the effects of environmental noise interferences such as wind and rain.

Each noise monitor was deployed for five days in November or December, 2012. The two monitors were initially deployed together in their respective locations November 13th, 2012, and collected November 17th. However, the monitor deployed at the Millbrook/Truro Heights Southwest location only recorded approximately twelve hours of data. This location was successfully re-assessed over a six day period from December 5th to 11th. The data from the initial November run for the Millbrook/Truro Heights Southwest monitoring location was not used in this assessment. Care was taken to locate the equipment in areas where sources of noise contamination (i.e. near a stream or power lines) would be minimized.

Each data logger was configured to collect:

- A-Weighting Frequencies (frequency range);
- Slow (S) Time Weighting (response); and
- A sample frequency of 1 minute (sample frequency).

The frequency range for the data runs was 0-140 dB and each logger was calibrated at 114.0 dB at 1 kHz. Each measurement represents the attenuated sound pressure levels collected over 1 minute. These readings were logged every minute over the sampling period at each monitoring location. The data was analyzed to determine a number of parameters, including daytime, evening, and night sound levels. Descriptions of all parameters are attached.

The data are representative of the acoustical environment at the monitoring locations during the monitoring period including all natural and anthropogenic sources of sound, such as wind, wildlife, and traffic.

RESULTS AND DISCUSSION

Results of the assessment are summarized in Table 2.

Table 2. Sound Level Assessment Results

Receptor ID / Parameter (Measured in dBA)	Millbrook/Truro Heights Northeast	Millbrook/Truro Heights Southwest
LAS _{eq}	50.2	49.3
LAS _D	51.6	44.6
LAS _E	36.7	54.0
LAS _N	50.7	47.8
LAS _{mx}	82.4	81.2
LAS _{mn}	22.4	20.6
LAS ₉₅	27.0	23.0

Average Sound Levels (LAS_{eq})

The average sound levels (LAS_{eq}) at both monitoring locations (50.2 dBA and 49.3 dBA) were higher than expected for a rural/sub-urban area. This is likely attributed to the proximity to Highway 102, located approximately 3 km east of these receptors.

Daytime vs. Evening vs. Night-time Sound Levels

For the Millbrook/Truro Heights Northeast location, the average daytime sound levels (LAS_D) were higher than both the average evening and night-time sound levels (LAS_E and LAS_N), which is to be expected for a rural / sub-urban area. However, the average night time sound levels (LAS_N) for this location (50.7dBA) were un-expectedly high, and nearly as high as the LAS_D for this location (51.6dBA). This is most likely the result of a weather event that blew through the region beginning the night of November 13th, 2012, and lasting until the following afternoon. This event drove the sound levels up for the duration of the wind storm, causing the average night-time sound levels calculated for the entire run to be skewed atypically high. While the monitor deployed at the Millbrook/Truro Heights Southwest location only recorded 12 hours of data during its first deployment on November 13th, 2012, it did record the increased sound levels that were associated with this isolated wind storm before it shut down. This supports the theory that the increased sound levels were caused by an isolated weather event that affected the general area of the Project site.

The LAS_D for the Millbrook/Truro Heights Southwest receptor (44.6 dBA), as they were recorded during the monitor's second deployment at this location from December 5th to 11th, was lower than both the LAS_E and LAS_N (54.0 dBA and 47.8 dBA respectively). This is unusual for a location that receives noise input from anthropogenic sources, which are usually much lower during evening and night-time hours. Again, the best explanation for this anomaly is an increase in noise levels due to wind storms that blew through the area during evening and night-time hours. However, Environment Canada's Debert weather station did not register high wind speeds (e.g. hourly averages over 20 km/h for over four consecutive hours) during evening or night-time hours (Environment Canada 2012). It is possible that since it is located on a plateau at the top of a hill, the Project site was exposed to more wind input than the location of the Debert weather station.

Minimum and Maximum Sound Levels (LAS_{mn} and LAS_{mx})

The lowest recorded sound level (LAS_{mn}) occurred early in the morning (between 3:30 am and 6:30 am) at both monitoring locations. At this time, wind levels (Environment Canada 2012) and, presumably, traffic levels were low.

The highest recorded sound level (LAS_{mx}) at both monitoring locations, occurred at times when the sound levels had been at a sustained high for several hours (e.g. over 50 dBA for three hours or more). Again, the most likely explanation for these peaks is that they occurred during wind storms, most likely as a result of a particularly strong gust in the area of the receptor.

Background Sound Levels (LAS_{95})

The LAS_{95} represents the sound level threshold that is exceeded 95% of the time. This measurement is an objective indicator of background sound levels of an area that are always present. The LAS_{95} calculated at both monitoring locations were 27.0 dBA at Millbrook/Truro Heights Northeast, and 23.0 dBA at Millbrook/Truro Heights Southwest. These background sound levels are normal for a sub-urban/rural environment.

Predicted Sound Level Exposure vs. Existing Sound Levels

Predictive sound modeling was completed for the Project as part of the Environmental Assessment (EA). Average existing sound levels (LAS_{eq}) recorded at the two monitoring locations exceed the predicted Project sound levels at nearby receptors. These results indicate that the sound of the turbines will be largely masked by the existing sound levels in the area

SUMMARY

Sound monitoring was completed at two locations to establish pre-construction sound levels near the perimeter of the Project site. Average sound levels were recorded at 50.2 and 49.3 dBA, which are higher than is typical for rural/sub-urban areas, likely because of the Project site's proximity to major transportation roadways. The results indicate that the major influence on sound levels is from the wind and weather conditions in the area, and to a lesser extent, from anthropogenic sources of noise (e.g. noise pollution from Highway 102).

Furthermore, the average sound levels recorded exceed the predicted sound levels at nearby receptors, indicating that the sound of the turbines will be largely masked by the existing sound levels present in the area.

If you have any questions, please contact us.

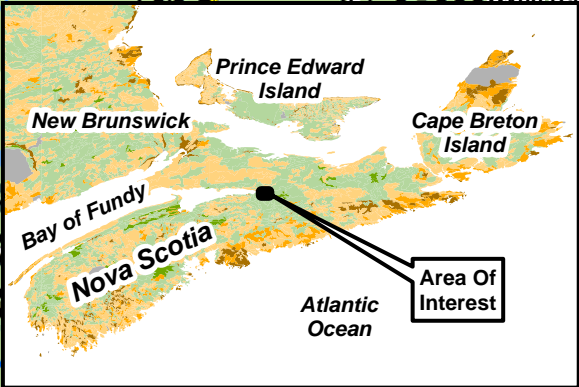
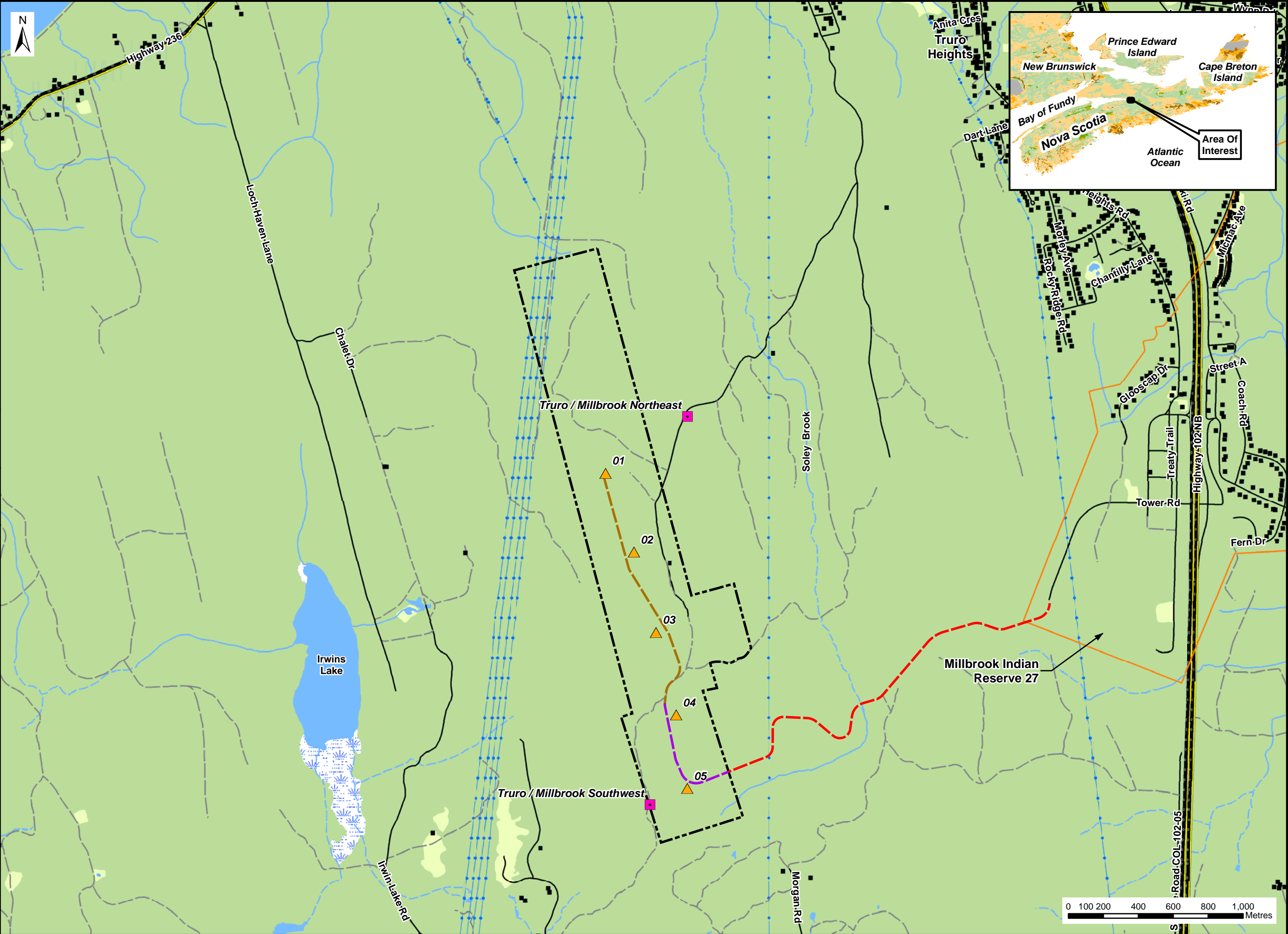
Thank you,


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REFERENCES

Environment Canada. (2012). National Climate Data Information Archive. Accessed January 2013
from: http://www.climate.weatheroffice.gc.ca/climateData/canada_e.html



- Notes:**
- Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
 - Projection: NAD83(CSRS), UTM Zone 20 North.

- Legend:**
- Proposed Turbine
 - Sound Monitor
 - Millbrook Proposed Road
 - Truro Heights Proposed Road
 - Tower Road Extension
 - Project Site Boundary
 - Building
 - Major Roads and Highways
 - Roads
 - Access Roads / Trails
 - Existing Transmission Lines
 - Mapped Stream
 - Indefinite Stream
 - Water Bodies
 - Mapped Wet Area
 - Cleared Area

Sound Monitoring Locations



Date:	April 2013	Project #:	12-4328
Scale:	1:20,000	Drawing #:	1
Drawn By:	H. Serhan		
Checked By:	M. Smith		

- **The LAS_{eq}** – This is the average noise level that contains the same amount of sound energy as the actual fluctuating sound level during the sample period. This represents the average sound level over the duration of the sampling period.
- **The LAS_D** – This is the LA_{eq} of the daytime sound levels between the hours of 07:00 and 19:00. This represents the average sound level during the day over the sampling period.
- **The LAS_E** - This is the LA_{eq} of the evening sound levels between the hours of 19:00 and 23:00. This represents the average sound level during the evening over the sampling period.
- **The LAS_N** - This is the LA_{eq} of the nighttime sound levels between the hours of 23:00 and 07:00. This represents the average sound level during the night over the sampling period.
- **The LAS_{mx}** – This represents the highest ‘slow’ time weighted sound pressure level expressed in decibels. This represents the highest sound level attenuated over 1 second recorded during the sampling period.
- **The LAS_{mn}** - This represents the lowest ‘slow’ time weighted sound pressure level expressed in decibels. This represents the lowest sound level attenuated over 1 second recorded during the sampling period.
- **The LTM_5** – This is a time average value calculated every 5 seconds that takes the highest level occurring during the preceding five seconds and assumes that it was present for the whole of the 5 second interval. Comparing the LTM_5 with the LA_{eq} gives an objective measure of how erratic the sound level was throughout the sampling period.
- **The LAS_{95}** – This is the sound level in decibels that is exceeded 95% of the time. This parameter is an objective measurement of the average background sound level measured throughout the sampling period.

Table L1: Sound Modeling Results, Millbrook/Truro Heights Community Wind Projects

Project # 12-4328/12-4544

<u>Receptor ID</u>	<u>Easting (m)</u>	<u>Northing (m)</u>	<u>Predicted Sound Levels (dBA)</u>
R1	473775	5016000	27.3
R2	471604	5019761	32.6
R3	472499	5017583	36
R4	474225	5016471	28.8
R5	472428	5016997	32
R6	472543	5017353	34.9
R7	474045	5017415	35.4
R8	474352	5016574	29
R9	471614	5019760	32.7
R10	474363	5016638	29.3
R11	474359	5016620	29.2
R12	472929	5016882	33
R13	474314	5016568	29.1
R14	473838	5016099	27.7
R15	473830	5020409	33.3
R16	474685	5016573	27.8
R17	472551	5017331	34.8
R18	472411	5016993	31.9
R19	474180	5016427	28.7
R20	474727	5016551	27.6
R21	473762	5016018	27.4
R22	474618	5016575	28.1
R23	474134	5016628	30
R24	472471	5016611	30
R25	473960	5016937	32.5
R26	472207	5016928	30.8
R27	472411	5017283	33.6
R28	474398	5016593	28.9
R29	473955	5016912	32.4
R30	472970	5016893	33.2
R31	474748	5016539	27.5
R32	474448	5016606	28.8
R33	473888	5017451	37
R34	473865	5016138	27.9
R35	474015	5016870	31.8
R37	472480	5016886	31.6
R38	472391	5017299	33.6
R40	473443	5015971	27.4
R41	474170	5016589	29.6
R42	474100	5016704	30.5
R43	473683	5015969	27.2
R44	471881	5017668	32.3
R45	474251	5016491	28.9
R46	474298	5016537	29
R47	472365	5016888	31.2
R48	474175	5016448	28.9
R49	473631	5015959	27.2
R50	473475	5015980	27.4
R51	473696	5015989	27.3
R52	473993	5016908	32.2

<u>Receptor ID</u>	<u>Easting (m)</u>	<u>Northing (m)</u>	<u>Predicted Sound Levels (dBA)</u>
R53	474681	5016617	28
R54	474120	5016709	30.5
R55	474357	5016656	29.4
R56	473404	5015962	27.3
R57	474156	5016646	30
R58	472485	5017083	32.8
R59	472571	5017438	35.6
R60	472575	5017447	35.7
R61	472692	5017609	37.8
R62	471777	5017978	32.5
R63	471776	5017966	32.5
R64	471767	5017960	32.4
R65	471748	5017979	32.4
R66	471736	5017969	32.3
R67	471966	5018988	35.7
R68	471476	5018827	32.1
R69	471485	5018758	32.1
R70	471511	5018546	32
R71	474646	5017031	29.9
R72	474607	5017073	30.3

*R36 removed from model after field truthing confirmed that there was no structure at this location

*R39 removed from model as it is considered a participating receptor