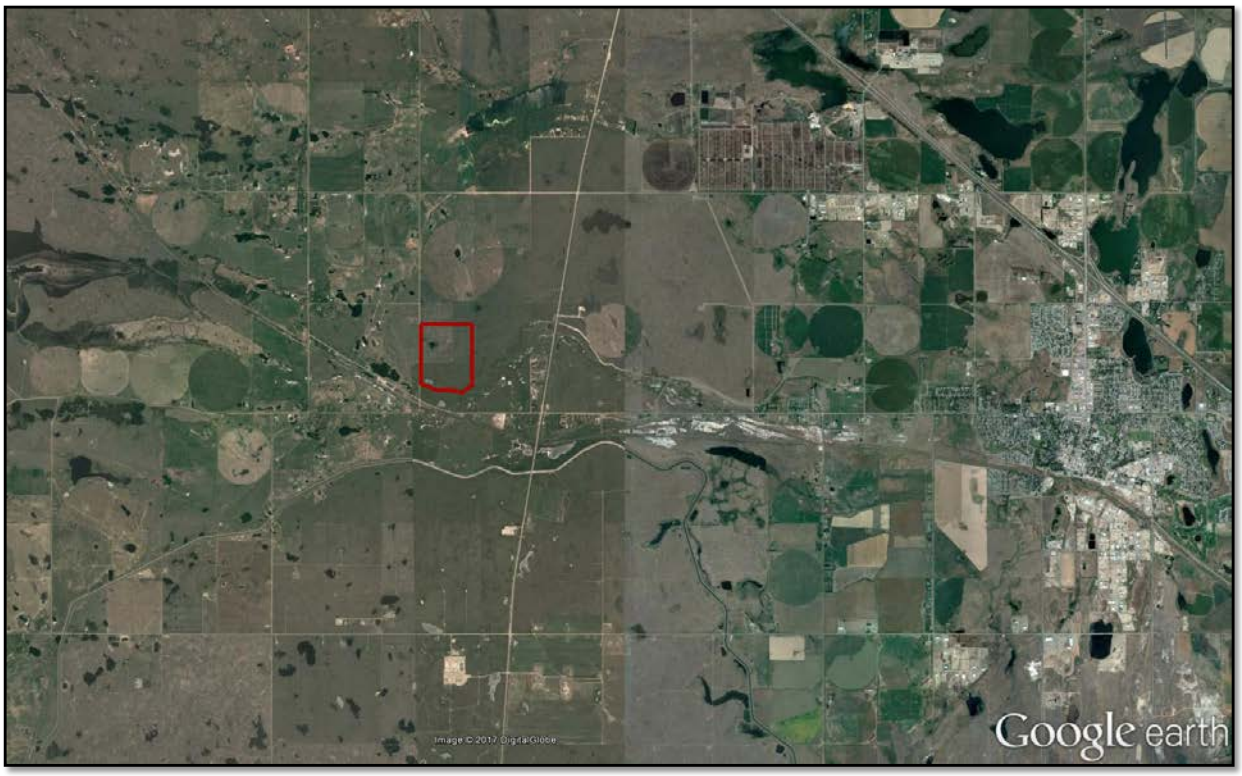
Noise Impact Assessment

Innogy Renewables Canada Inc.

Solar Krafte Cassils Solar Project
W½ 04-019-15 W4M



Prepared For:

Innogy Renewables Canada Inc.

Prepared By:

Mr. Peter Davis, C.E.T.
Mr. James Farquharson, C.E.T.

Issued: February 28, 2018
Project Number: 260602

Sound Advice • Sound Delivery

Suite 250, 600 Crowfoot Crescent NW Calgary, Alberta T3G0B4 Phone 403.547.9511 Fax 403.547.9502 www.fdiacoustics.com

Executive Summary

Innogy Renewables Canada Inc. (Innogy) wanted to determine the environmental noise impact of equipment associated with the Solar Krafte Cassils Solar Plant proposed for the W½ of Section 04, Township 019, Range 15, West of the 4th Meridian (W½ 04-019-15 W4M). Innogy retained the services of FDI Acoustics to complete a Noise Impact Assessment for the facility to determine if the predicted cumulative sound levels comply with the Permissible Sound Levels (PSLs) of the Alberta Utilities Commission (AUC) Rule 012, Noise Control[1] (Rule 012), and as applicable, the Alberta Energy Regulator (AER) Directive 038, Noise Control[2] (Directive 038). The assessment also provides the foundation to develop noise control measures for any regulated facility's equipment should the predicted cumulative sound levels exceed the PSLs for facilities regulated by the AUC and the AER.

Sound pressure levels related to the significant noise sources associated with the proposed solar project equipment were developed from a combination of manufacturer's data, FDI Acoustics' sound pressure level library and calculated following schemes as presented in texts on the subject.

Following accepted acoustic evaluation practices, the sound pressure level data was used to calculate octave band sound power level values for the significant noise sources associated with the proposed solar plant equipment. These sound power levels were incorporated into the Brüel & Kjær Predictor™ Type 7810 noise propagation software. The noise propagation model calculates the sound level contribution of the solar plant and substation for the nearest or most impacted residence. The predicted facility sound level contributions (daytime and nighttime) are added to the ambient sound levels as prescribed in Rule 012 and Directive 038. The overall results, the cumulative sound levels, are then compared with the PSLs to determine compliance.

The results of the modelling along with the PSLs for the receiver location assessed are presented in the following table.

Predicted Sound Levels
Solar Krafte Cassils Solar Plant

Receiver Location & Sound Level Description	Daytime Sound Level (dBA L_{eq})	Nighttime Sound Level (dBA L_{eq})
Residence 1 - SE¼ 05-019-15 W4M		
Predicted Cumulative Sound Level	45.4	38.1
Permissible Sound Level	50.0	40.0

FDI Acoustics Project 260602

The results of the environmental noise propagation model indicate the cumulative sound levels of the proposed Solar Krafte Cassils Solar Plant, in combination with the existing AltaLink Brooks 28S Substation are predicted to comply with the daytime and nighttime PSLs of AUC Rule 012 and AER Directive 038 at the nearest or most impacted residence.

Table of Contents

Figures & Tables

List of Figures

List of Tables

Scope of Work

Innogy Renewables Canada Inc. (Innogy) wanted to determine the environmental noise impact of equipment associated with the Solar Krafte Cassils Solar Plant proposed for the W½ of Section 04, Township 019, Range 15, West of the 4th Meridian (W½ 04-019-15 W4M). Innogy retained the services of FDI Acoustics to complete a Noise Impact Assessment for the facility to determine if the predicted cumulative sound levels comply with the Permissible Sound Levels (PSLs) of the Alberta Utilities Commission (AUC) Rule 012, Noise Control[1] (Rule 012), and as applicable, the Alberta Energy Regulator (AER) Directive 038, Noise Control[2] (Directive 038). The assessment also provides the foundation to develop noise control measures for any regulated facility's equipment should the predicted cumulative sound levels exceed the PSLs for facilities regulated by the AUC and the AER.

Method

Octave band sound power levels related to the significant noise sources associated with the proposed solar plant equipment and existing substation were calculated from a combination of manufacturer's data, FDI Acoustics' sound pressure level library following schemes as presented in texts on the subject.

FDI personnel completed an inventory of all facilities regulated under AUC/AER licensure and compiled a list of all residences within 3 km of the proposed facility boundary during a visit to the area on July 13, 2017. Information regarding the topography and vegetation of the area surrounding the facility site was noted at the time of the study area visit and supplemented with information obtained from commercial sources. Sound pressure measurements of any regulated energy industry facilities were undertaken, where applicable, during the study area visit. This information formed the input for an environmental noise propagation computer model that calculates the sound level contribution at the nearest residence, or in lieu of a residence, at 1500 metres. This approach is consistent with the requirements of Rule 012 and Directive 038. The results of the model are presented as the overall solar plant sound level contribution and the predicted cumulative sound levels for the residential receiver location under assessment. A noise contour is then generated to depict where the proposed facility is predicted to comply with the PSLs of the regulations. The results are reviewed with the predicted cumulative sound levels compared with the applicable PSLs to determine compliance.

Noise Regulation Criteria

Rule 012, Noise Control, is the regulation governing environmental noise emissions for facilities under the jurisdiction and licensure of the AUC, Directive 038 is the environmental noise regulation imposed by the AER for facilities under their licensure. Although Rule 012 and Directive 038 are regulations imposed by two separate licensing bodies, the technical aspects, methods for assessment and the reporting criteria of the two are very similar. Each regulation requires the inclusion of noise sources under the jurisdiction of the other approval body when assessing the environmental noise impact of a facility.

The facility licensing requirements of the AUC and the AER require the disclosure of the environmental noise impact through the completion of a Noise Impact Assessment for any new or modified permanent facility licensed after October 17, 1988 where there is a reasonable expectation of an intermittent or continuous noise source. The AER requires the reporting of the nighttime cumulative sound level and the nighttime PSL in Schedule 2.4 of Directive 056. The AER also requires that the applicant keep the Noise Impact Assessment on file for audit purposes. The AUC requests that applicants include a copy of the Noise Impact Assessment with the submission.

Both documents regulate noise by defining criteria for the determination of the permissible sound level (PSL) at the nearest residence (dwelling unit) to a facility. If there is no residence within 1500 metres of the fence line of a facility, a level of 40 dBA L_{eq} must not be exceeded at this distance during the nighttime. Multiple facility environments require the inclusion of all facilities that may contribute to the noise environment at a residence or 1500 metre receiver location. The definition of dwelling unit includes permanent occupied residences, seasonally occupied residences and campgrounds. Actual compliance with the PSLs is only determined by comparing the comprehensive sound levels from a valid comprehensive sound survey with the daytime and nighttime PSLs. Although it is not mandatory to complete a comprehensive sound survey after the commissioning of a new or modified facility, the regulatory bodies expect that the comprehensive sound levels of the facility comply with the applicable PSLs.

Noise Impact Assessments present the calculated comprehensive sound levels (cumulative sound levels) that are derived by adding the predicted contribution of the facility to the ambient sound level for the daytime and nighttime periods. The ambient sound levels include sounds from both far and near the point of measurement except for energy-related industrial sounds. Energy related sounds include specified activities and facilities regulated by the AUC and the AER. The licensee can elect to measure the ambient sound levels at a receiver location when it is believed that the value derived from the basic sound level matrix does not represent the sound environment of the area. Application of the results of an Ambient Sound Survey requires the approval of the AUC and/or the AER. Rule 012 and Directive 038 define the nighttime ambient sound level as being 5 dB lower than the applicable basic sound level for the dwelling unit[3].

Noise Regulation Criteria (continued)

Rule 012 and Directive 038 also recognize that low frequency noise[4] (LFN) emanating from a facility can create concern from nearby residents in some situations where the overall dBA value is below the PSL. In response to this issue the regulations recommend that a Noise Impact Assessment report both the overall predicted "A" weighted sound level (dBA), the overall predicted "C" weighted sound level (dBC), and the dBC - dBA value as a preliminary investigation of the low frequency sound component. A low frequency noise situation is defined as a 20 dB or greater difference in the overall predicted dBC - dBA value along with a clear tonal component below 250 hertz as measured during a valid comprehensive sound survey. A comprehensive sound survey investigation is required to determine if an actual low frequency condition exists. This is a specialized investigation and is required only in response to a LFN complaint in accordance with Rule 012 and Directive 038.

Action with respect to the mitigation of LFN at the Noise Impact Assessment stage is recommended when the following conditions exist;

- a predicted facility sound level contribution that exceeds 35 dBA at a residence and,
- a predicted dBC - dBA value that equals or exceeds 20 dB and,
- source sound power levels that indicate the presence of a LFN tone and,
- modelling results that indicate the potential of a LFN tone satisfying the definition of Rule 012 and Directive 038,
- or for existing facilities with a history of LFN complaints.

Permissible Sound Levels

In accordance with Rule 012 and Directive 038, the PSLs are dwelling unit specific and derived from information regarding the area dwelling unit density; proximity of the dwelling unit to heavily travelled transportation routes including motor vehicle routes, rail lines, aircraft flyways and other specified adjustments. The PSL during the daytime is adjusted to a level 10 dB above the nighttime level to reflect that daytime ambient sound levels are generally higher than nighttime sound levels.

The residence assessed (Residence 1) is located within an area with a dwelling unit density of eight or less units per quarter section of land and at a distance greater than 500 metres from a heavily travelled transportation route. Following the categorization requirements of the Basic Sound Level matrix, the PSLs for Residence 1 were determined as 50 dBA L_{eq} for the daytime, and 40 dBA L_{eq} for the nighttime.

Table 1 presents the PSLs for the residence assessed with the detailed development presented in Appendix A.

Table 1
Permissible Sound Levels
Solar Krafte Cassils Solar Plant

Receiver Location	Daytime Permissible Sound Level (dBA L_{eq})	Nighttime Permissible Sound Level (dBA L_{eq})
Residence 1 - SE¼ 05-019-15 W4M	50.0	40.0

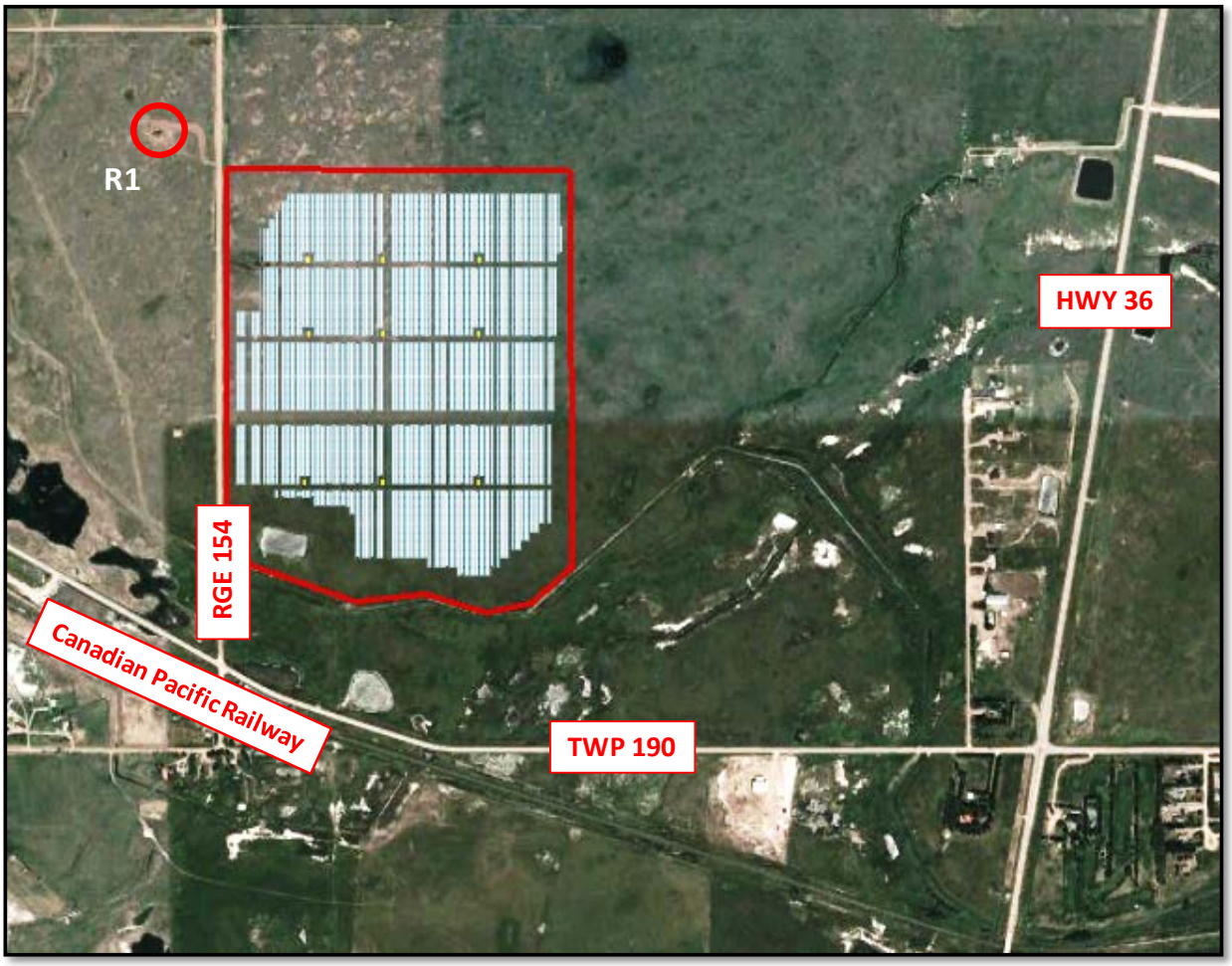
FDI Acoustics Project 260602

Study Area

The Solar Krafte Cassils Solar Plant is proposed for the W½ 04-019-15 W4M approximately 7 kilometres west of Brooks, Alberta. The residence assessed (R1) is in the SE¼ 05-019-15 W4M approximately 150 metres northwest of the Solar Krafte Cassils facility boundary. The AltaLink Brooks 28S Substation (see figure 2) is located within NW¼ 28-019-15 W4M approximately 2050 metres southeast of the solar plant boundary. The AltaLink Cassils 324S Substation (see figure 2) is located within NE¼ 29-019-15 W4M approximately 2180 metres south of the solar plant boundary. The surrounding landscape is described as agricultural land with a generally flat topography.

Figure 1 presents an aerial photograph of the development site indicating the location of the proposed solar plant, the nearest most impacted residence as well as other area features.

Figure 1
Local Study Area Map
Solar Krafte Cassils Solar Plant

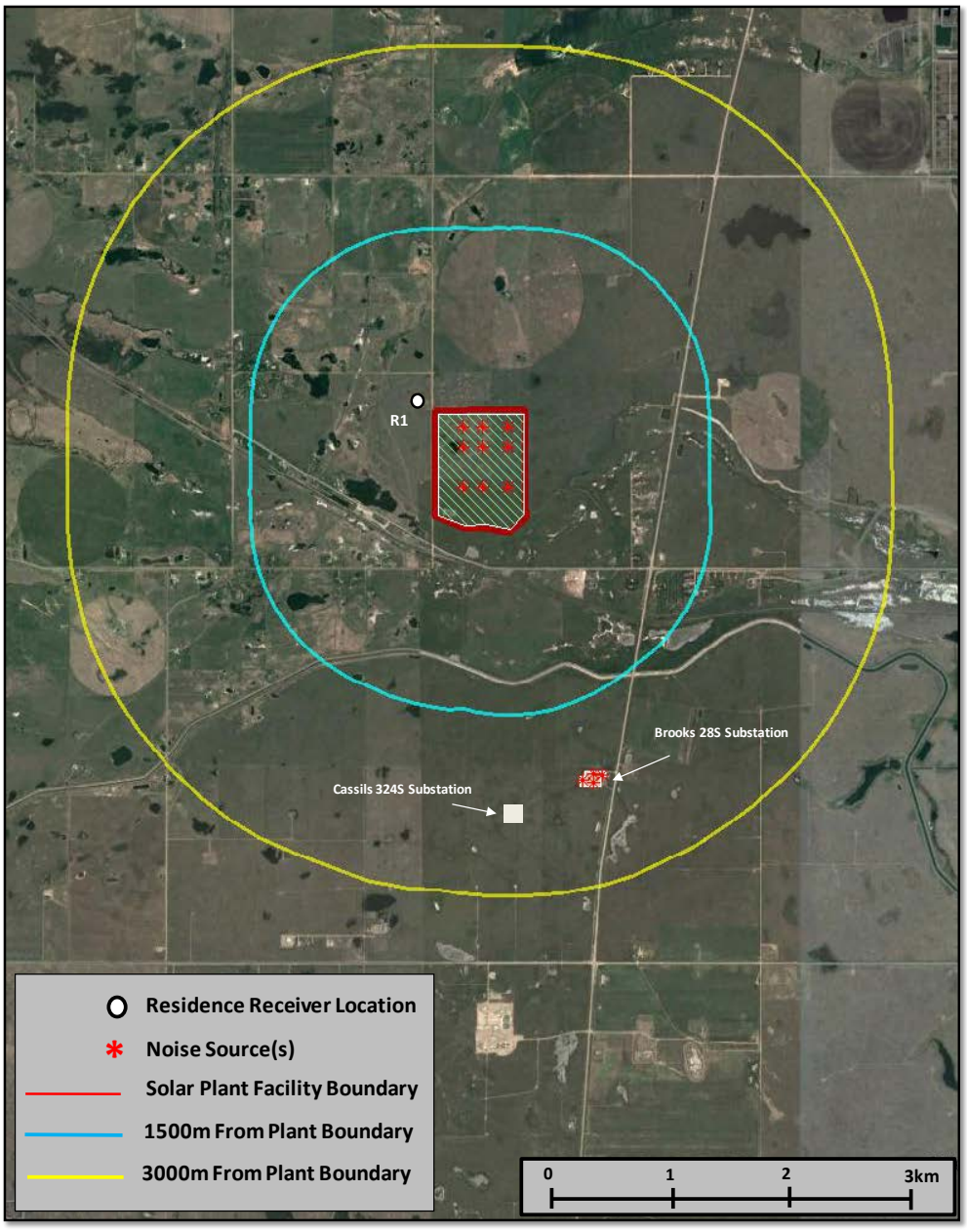


FDI Acoustics Project 260602

Study Area (continued)

Figure 2 presents a map of the overall study area indicating the location of the proposed solar plant site, AltaLink Brooks and Cassils substations, the nearest residence, the 1500 metre AUC/AER boundary and the 3.0 kilometre study area boundary and other features.

Figure 2
Overall Study Area Map
Solar Krafte Cassils Solar Plant



FDI Acoustics Project 260602

Description of Equipment

The 27.050400 MW DC rated Solar Krafte Cassils Solar Plant includes the following equipment:

- Solar Krafte Cassils Solar Plant: (9) SunGrow SG3000HV Inverter/Transformers, Photovoltaic panels on FS TO horizontal axis trackers.

The electrical power produced at the Solar Krafte Cassils Solar Plant is tied into the FortisAlberta distribution feeder out of the AltaLink Brooks 28S Substation located approximately 2050 metres southeast of the plant boundary.

- T1 Transformer – 245/144/22 kV, 240/320/400 MVA.
- T2 Transformer – 245/144/22 kV, 240/320/400 MVA.
- T3 Transformer – 138/25 kV, 15/20/25 MVA.
- R1 Shunt Reactor – 240 kV, 50 Mvar.

The modelled octave band sound power levels for the AltaLink Brooks 28S Substation were calculated from overall sound power values provided by AltaLink for each noise generating item at the substation. The associated AltaLink 324S Substation has no sources of noise. Specific information regarding the substation operation should be directed to AltaLink. There was no noise generating equipment associated with any AER regulated wellsites located within the study area.

Source Sound Power Levels

FDI Acoustics completed calculations to determine sound power levels for the significant noise sources associated with the facility equipment using a combination of manufacturer's data, FDI Acoustics' sound pressure level library and following schemes as presented in texts on the subject. The sound power values modelled are presented in Table 2 below.

Table 2
Source Sound Power Levels
Solar Krafte Cassils Solar Plant

Sound Source Description	Sound Power Level (dBA re: 10^{-12} W)									
	Octave Band Frequency (Hertz)									Sum
	31.5	63	125	250	500	1000	2000	4000	8000	
SunGrow SG3000HV Inverter/Transformer Skid										
SG3000HV Unit	80.5	86.5	88.5	83.5	83.5	77.5	72.5	67.5	60.5	92.5
AltaLink Brooks 28S Substation										
T1 Transformer	65.7	84.9	97.0	99.5	104.9	102.1	98.3	93.2	84.0	108.5
T2 Transformer	65.7	84.9	97.0	99.5	104.9	102.1	98.3	93.2	84.0	108.5
T3 Transformer	52.7	71.9	84.0	86.5	91.9	89.1	85.3	80.2	71.0	95.5
R1 Shunt Reactor	51.5	70.7	82.8	85.3	90.7	87.9	84.1	79.0	69.8	94.3

FDI Acoustics Project 260602

Noise Propagation Model

The Predictor™ 7810 v8.12 environmental noise assessment software package from Brüel & Kjær Sound & Vibration Measurement A/S was employed to determine the environmental noise impact of the proposed solar plant equipment. The noise prediction program completes complex sound propagation calculations that include the effects of the environment, terrain, and topography. The algorithms used by the model are consistent with international standards, including International Organization for Standardization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation (ISO 1996)[5, 6, 7].

The model has the capability to simulate a series of point, line, area emission sources along with emitting roof and emitting façade. Each source type can be characterized by sound power levels in octave bands. Other parameters such as building dimensions and equipment enclosure noise attenuation ratings, if applicable, are also used to define sound power levels. The Predictor™ model also accounts for noise attenuation related to meteorological conditions (such as temperature and humidity), ground cover and physical barriers, either natural (terrain based) or anthropogenic.

The calculated individual source sound power level complete with information regarding the facility location, equipment layout and the reception location were entered in the model. The meteorological conditions selected favoured the transmission of sound from the facility site to the point of reception.

Table 3 lists the modelled environmental parameters.

Table 3
Noise Model Environmental Parameters
Solar Krafte Cassils Solar Plant

Environmental Parameter	Model Input Value
Ground Attenuation Factor	0.5
C_o – Local Meteorological Correction	0 (No Meteorological Correction)
Receiver Height Above Ground	1.5m
Relative Humidity	70%
Temperature	+15°C
Wind Velocity	1.0m/sec – 5.0m/sec (ISO 9613 default w/mild inversion)
Topography (8 metre Contour Interval)	w/ Terrain
Wind Direction	From the Cassils Solar Plant to Residence 1

FDI Acoustics Project 260602

Results

Table 4 presents the overall predicted facility sound pressure level and the source sound pressure level contributions as dBA and dBC values for the assessed residential receiver location. The source sound level contribution values are order ranked by the "A" weighted contribution level.

Table 4
Order Ranked Sound Pressure Levels
Residence 1 - SE¼ 05-019-15 W4M
Solar Krafte Cassils Solar Plant

Source Description	Source Sound Level Contribution (dBC)	Source Sound Level Contribution (dBA)
1A Solar Krafte Cassils: Inverter/Transformer	59.4	30.7
2A Solar Krafte Cassils: Inverter/Transformer	57.9	29.0
3A Solar Krafte Cassils: Inverter/Transformer	54.7	25.4
3B Solar Krafte Cassils: Inverter/Transformer	53.8	24.4
3C Solar Krafte Cassils: Inverter/Transformer	52.5	23.0
1B Solar Krafte Cassils: Inverter/Transformer	47.1	20.9
2B Solar Krafte Cassils: Inverter/Transformer	46.0	19.9
AltaLink Brooks 28S Substation: T1	36.0	19.4
AltaLink Brooks 28S Substation: T2	35.8	19.1
1C Solar Krafte Cassils: Inverter/Transformer	44.5	18.2
2C Solar Krafte Cassils: Inverter/Transformer	43.9	17.6
AltaLink Brooks 28S Substation: T3	23.0	6.3
AltaLink Brooks 28S Substation: R1	21.7	5.0
Combined Facilities Contribution Sum	**63.7**	**35.2**

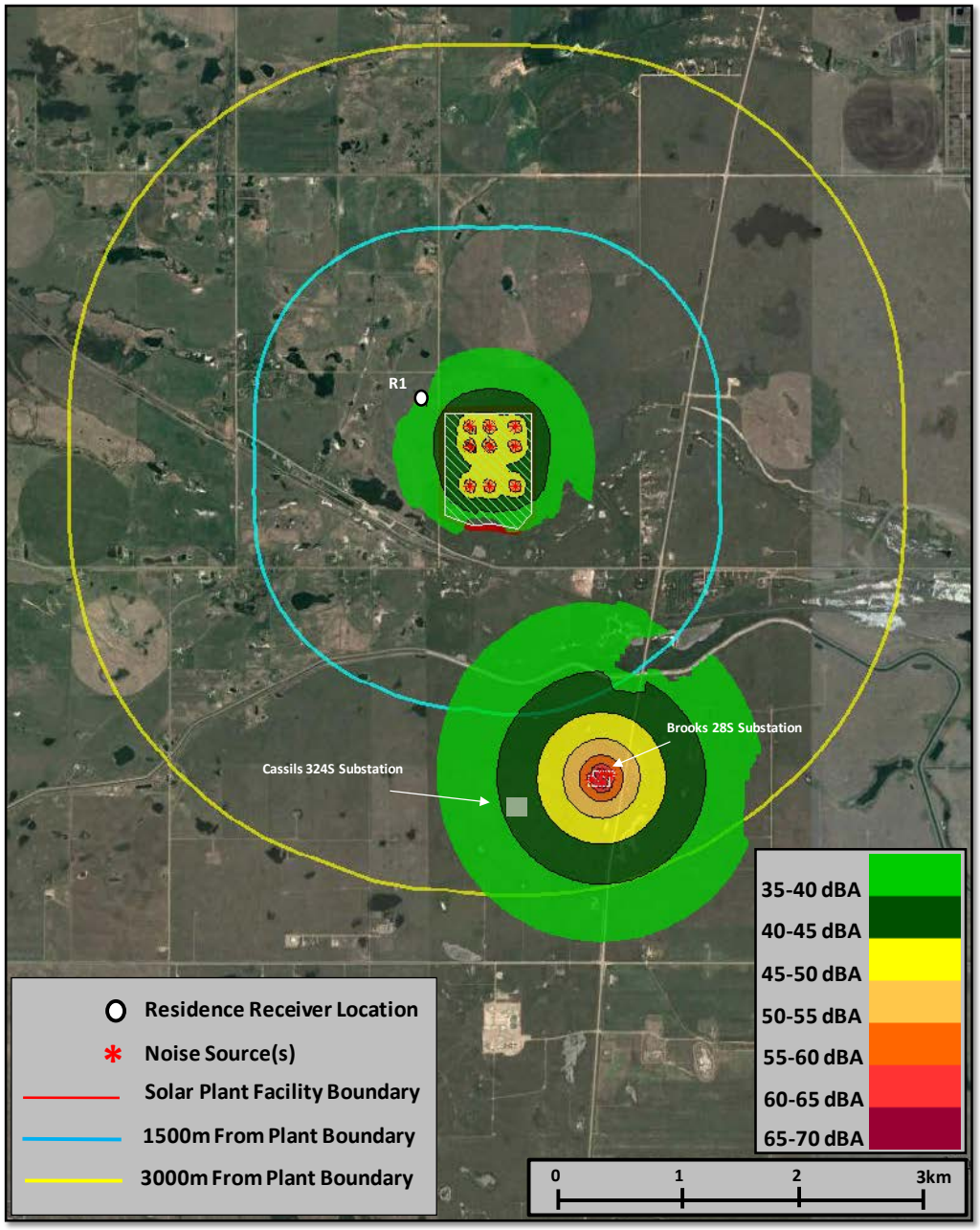
FDI Acoustics Project 260602

Order ranked sound pressure levels (Table 4) at a distant point of reception may differ from the facility order ranked sound power levels (Table 2). This can occur for several reasons including the frequency composition of each noise source, the physical height of the noise source above the ground, acoustical shielding at the site or the topography between the site and the receiver.

Results (continued)

Figure 3 presents a noise contour graphic of the overall predicted sound pressure level contribution for the modelled area facilities.

Figure 3
Facility Contribution Noise Contour
Solar Krafte Cassils Solar Plant



FDI Acoustics Project 260602

Discussion of Results

Table 5 presents the overall predicted facility sound level contribution along with the ambient sound levels of Rule 012 and Directive 038 for the residence assessed. The cumulative sound levels, which are the sum of the predicted facility sound level contribution plus the ambient sound levels (daytime and nighttime) are used in determining compliance with the PSLs. Table 5 also presents the PSLs.

Table 5
Predicted Sound Levels
Solar Krafte Cassils Solar Plant

Location & Sound Level Descriptor	Daytime Sound Level (dBA L_{eq})	Nighttime Sound Level (dBA L_{eq})
Residence 1 - SE¼ 05-019-15 W4M		
Ambient Sound Level (BSL – 5 dB)	45.0	35.0
Predicted Facility Sound Level Contribution	35.2	35.2
Predicted Cumulative Sound Level	**45.4**	**38.1**
Permissible Sound Level	50.0	40.0

FDI Acoustics Project 260602

A comparison of the predicted cumulative sound levels with the PSLs indicates the proposed Solar Krafte Cassils Solar Plant is predicted to comply with the daytime and nighttime PSL of Rule 012 and Directive 038 at Residence 1.

Discussion of Results (continued)

Table 6 presents the predicted facility contribution as dBC and dBA values along with the difference in these two values. A difference of 20 dB or greater in these two values is an initial requirement in determining if a low frequency component could exist at a reception point.

Table 6
dBC – dBA Low Frequency Evaluation
Solar Krafte Cassils Solar Plant

Receiver Location	Predicted Sound Levels		
	dBC	dBA	dBC - dBA
Residence 1 - SE¼ 05-019-15 W4M	63.7	35.2	28.5

FDI Acoustics Project 260602

Table 6 indicates the dBC - dBA value for Residence 1 is above the 20 dB threshold as outlined in the regulations for low frequency noise situations. In instances where the dBC - dBA value exceeds the 20 dB limit, the low frequency provisions of the regulations require a complaint originating from a residence and the presence of a tone as measured during a comprehensive sound survey. The regulators review the low frequency noise component of a facility at the second stage of the complaint investigation process. This assessment reports the dBC - dBA value as an initial investigation of the potential of the facility to exceed the low frequency criterion for information purposes.

Conclusion

The results of the environmental noise propagation model indicate the cumulative sound levels of the proposed Solar Krafte Cassils Solar Plant, in combination with the AltaLink Brooks 28S Substation, are predicted to comply with the daytime and nighttime PSL of AUC Rule 012 and AER Directive 038 at the assessed nearest or most impacted residence.

Glossary

Ambient Sound Level	All noises that exist in an area and are not related to a facility covered by Directive 038 and Rule 012. Ambient noise includes sound from other industrial noise not subject to either regulation for example; transportation sources, animals and nature.
A-weighted sound level	The sound level as measured on a sound level meter using a setting that emphasizes the middle frequency components similar to the frequency response of the human ear.
Basic Nighttime Sound Level (BSL)	The A weighted L_{eq} sound level commonly observed to occur in the designated land-use categories with industrial presence (AUC Directive Glossary). The BSL in the initial building block from which the PSL is determined.
C-weighted sound level	The C-weighting approximates the sensitivity of human hearing at industrial noise levels (above about 85 dBA). The C-weightings sound level (i.e., measured with the C-weightings) is more sensitive to sounds at low frequencies than the A-weighted sound level and is sometimes used to assess the low frequency content of complex sound environments.
Calibration	A procedure used for the adjustment of a sound level meter using a reference source of a known sound pressure level and frequency. Calibration must take place before and after the sound level measurements.
Comprehensive Sound Level (CSL)	The measured sound level that is a composite of different airborne sounds from many sources both far away and near the point of measurement as measured during a valid comprehensive sound survey. The CSL does include industrial components and must be measured with them, but it should exclude abnormal noise events. The CSL is used to determine whether a facility is compliant with Directive 038 or Rule 012.
Cumulative Sound Level	All AER and AUC regulated facility sound as predicted in the environmental noise model plus the ambient sound level. The cumulative sound level is used for determination of compliance with the allowable PSLs in the preparation of a Noise Impact Assessment.
Daytime	Defined as the hours from 07:00 to 22:00.
Daytime adjustment	An adjustment that allows a 10 dBA increase above the basic sound level for nighttime, as daytime sound levels are generally about 10 dBA higher than nighttime values.

dB (decibel) or dBZ	The decibel (dB) is a logarithmic unit of measurement that expresses the magnitude of a physical quantity (usually power or intensity) relative to a specified or implied reference level. Since it expresses a ratio of two quantities with the same unit, it is a dimensionless unit. A decibel is one tenth of a bel (B). A reference pressure of 20 microPascals (µPa) is used because sounds in air at a frequency of 1000 Hz and with a pressure of 20 microPascals (µPa) can just barely be heard by most people.
dBA	The decibel (dB) sound pressure level filtered through the A filtering network to approximate human hearing response. See dB and A-weighted sound level.
dBC	The decibel (dB) sound pressure level is adjusted to include the low frequency end of the spectrum. Although less consistent with human hearing than dBA, dBC can be used to discern the impact of low frequency sound emissions from industrial operations.
Energy equivalent sound level (L_{eq})	The L_{eq} is a single-number average, A-weighted sound level that represents cumulative acoustical energy as measured over a specified time interval. This interval should be specified in brackets following the L_{eq} (e.g.: L_{eq} (9) is a nine-hour L_{eq}).
ENM	Environmental noise prediction software created by RTA Technology Pty. Ltd.
Facility	Any operation used in exploration, processing, development and transportation of energy resources.
Infringement	Locating a residence within the existing noise footprint (boundary) of a facility, such that the facility could be seen as not complying with Directive 038 or Rule 012.
L_{eq}	See Energy equivalent sound level.
Nighttime	Defined as the hours from 22:00 to 07:00.
Noise	Generally understood as unwanted sound.
Noise Impact Assessment (NIA)	Identifies the expected sound level emanating from a facility as measured 15 m from the nearest or most impacted permanently or seasonally occupied dwelling or other reception point as defined by Directive 038 or Rule 012. It also identifies what the permissible sound level is and how it was calculated.

Octave	A series of electronic filters separate sound into discrete frequency bands, making it possible to know how sound energy is distributed as a function of frequency. The octave band has a centre frequency that is double the centre frequency of the octave band preceding it.
1/3 Octave	The 1/3 octave band analysis provides a finer breakdown of sound distribution as a function of frequency.
Permissible Sound Level (PSL)	The maximum sound level that a facility should not exceed at a point 15m from the nearest or most impacted dwelling unit.
Representative conditions	Those conditions typical for an area and/or the nature of a complaint. Sound levels must be taken only when representative conditions exist; this may necessitate a survey of extensive duration (two or more consecutive nights).
Sound monitoring survey	The measurement and recording of sound levels and pertinent related information over a given time period.
Sound level meter	An instrument designed and calibrated to respond to sound and to give objective, reproducible measurements of sound pressure levels. It normally has several features that enable its frequency response and averaging times to be changed.
Sound pressure level	A measurement of the local pressure deviation from the ambient (average, or equilibrium) pressure caused by a sound wave.
Sound power level	Expressed in decibels (dB), it is equal to 10 times the logarithm to the base 10 of the ratio of the sound power of the source to a reference sound power level, typically 10^{-12} watts.
Spectrum	A wide range or sequence of frequencies.
Tonal components **(low frequency noise)**	A test for the presence of tonal components consists of two parts. The first must demonstrate that the sound pressure level of and one of the linear, (Z-weighted), 1/3 octave bands between 20 and 250 Hz is 10 dBZ or more than the sound pressure level of at least one of the adjacent bands within two 1/3 octave bands widths. In addition, there must be a minimum of a 5 dBZ drop from the band containing the tone within two bandwidths on the opposite side. The second part is that the tonal component must be a pronounced peak clearly obvious within the spectrum.
Windscreen	A specialized piece of porous sponge that fits over the microphone to reduce the noise generated by the wind blowing across the microphone.

Appendix A – Permissible Sound Level Calculation

Residence 1 - SE¼ 05-019-15 W4M

Permissible Sound Level (PSL) Determination
Solar Krafte Cassils Solar Plant
AUC Rule 012 / AER Directive 038

Basic Nighttime Sound Level

Proximity to Transportation*	Dwelling Unit Density per ¼ Section of Land**			Nighttime (22:00-07:00) (dBA L_{eq})	Daytime (07:00-22:00) (dBA L_{eq})
	1-8 Dwellings (dBA)	9-160 Dwellings (dBA)	>160 Dwellings (dBA)		
Category 1	40	43	46	**40**	**40**
Category 2	45	48	51		
Category 3	50	53	56		
			Daytime Sound Level Adjustment	N/A	**+10**
			Basic Sound Level	**40**	**50**

Class A Adjustments

Class	Reason for Adjustment	Value (dB)		
A1	Seasonal Adjustment (Wintertime)	0 to +5	0	0
A2	Ambient Monitoring Adjustment	-10 to +10	N/A	N/A
Class A Adjustment = Sum of A1 and A2 (as applicable), but not to exceed a maximum of 10 dB				
		Total Class A Adjustments	**0**	**0**

Class B Adjustments

Class	Duration of Activity	Value (dB)		
B1	1 Day	+15		
B2	7 Days	+10		
B3	< or = to 60 Days	+5		
B4	>60 Days	0	0	0
Class B Adjustment = one only of B1, B2, B3 or B4 allowed				
		Total Class B Adjustments	**0**	**0**
		Permissible Sound Levels (dBA)	**40**	**50**

The average rural ambient noise level is 5 dBA less than the Basic Sound Level.

*Proximity to Transportation Category Definitions:
Category 1: Dwelling units more than 500m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 2: Dwelling units more than 30m but less than 500m from heavily travelled roads and/or rail lines and not subject to frequent aircraft flyovers.
Category 3: Dwelling units less than 30m from heavily travelled roads and/or rail lines and subject to frequent aircraft flyovers.

**Density per quarter section refers to a quarter section with the affected dwelling at the centre (a 451 metre radius). For quarter sections with various land uses or with mixed densities, the density chosen is then averaged for the area under consideration.

Appendix B – References

1. Alberta Utilities Commission (AUC) Rule 012, Noise Control Effective July 04, 2017.
2. Alberta Energy Regulator (AER) Directive 038, Noise Control Approved February 16, 2007. Calgary, Alberta.
3. Environment Council of Alberta, Public Hearings on Noise in Alberta: Report and Recommendations, 1982.
4. Journal of the Canadian Acoustical Association Vol. 29 No. 3 p. 74-77. Quantifying Receptor Annoyance from Low Frequency Industrial Noise in the Environment DeGagne D.C., Remmer, W. 2001.
5. International Organization for Standardization (ISO 9613-1), Attenuation of sound during propagation outdoors - Part 1: Calculation of the absorption of sound by the atmosphere, Approved 1993.
6. International Organization for Standardization (ISO 9613-2), Attenuation of sound during propagation outdoors - Part 2: General method of calculation, Approved 1996.
7. International Organization for Standardization (ISO 1996-2:2007), Description, measurement, and assessment of environmental noise - Part 2: Determination of environmental noise levels, Approved 2007 (Revises ISO 1996-2:1987 Acoustics – Description and measurement of environmental noise – Part 2: Acquisition of data pertinent to land use).