Elora Battery Energy Storage System, Elora, Ontario – Noise Feasibility Study

Final Report

July 8, 2024

Prepared for:
Elora BESS LP
100-8 King Street East
Toronto, ON M5C 1B5

Prepared by:
Stantec Consulting Ltd.

Project Number:
160901104

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Executive Summary

Elora BESS LP (Elora BESS) engaged Stantec Consulting Ltd. to assess the noise emissions from the proposed Elora Battery Energy Storage System (BESS) Project (the Project), located south of Fergus, Ontario. The Project site is located approximately 1 kilometre (km) south of the urban boundary of Fergus, at the northeast corner of Lot 11, Concession 3 in the Township of Centre Wellington, in Wellington County (the Site). The Project will consist of battery energy storage units, electrical inverters and transformers, internal access roads, electrical and communication cabling, a transmission substation, and other related electrical and infrastructure facilities. The Project will provide up to 211 Megawatt (MW) capacity of energy storage to increase capacity in Wellington County. The Project will utilize approximately 4.43 hectares of privately leased land.

This Noise Feasibility Study is prepared in support of the Project's design maturation and assesses the impact of the project stationary noise sources such as the battery energy storage units, inverters, and transformers on the surrounding noise sensitive land uses. This study is prepared in accordance with the Ministry of the Environment, Conservation and Parks (MECP) publication entitled, "Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning, Publication NPC-300" (NPC-300) (MECP 2013). This assessment is based on the site plan prepared for the Elora BESS, dated January 31, 2024.

Noise sources considered at the Project included battery energy storage units, electrical inverters and transformers. Six noise-sensitive receptors are considered, to the north, east, south and west of the Project.

The assessment of the Project stationary noise sources indicates that, with the proposed noise mitigation in place for the Inverters, the Project is expected to comply with the applicable noise limits, based on the proposed equipment and Stantec's understanding of the operational scenario.

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Acronyms / Abbreviations

BESS	Battery Energy Storage System
dB	Decibel
dBA	Decibel, A-weighted
ISO	International Organization for Standardization
L_{eq-1hr}	Energy equivalent sound level over a 1-hour time period
m	Metre(s)
MECP	Ontario Ministry of the Environment, Conservation and Parks
MVA	Megavolt Ampere
MW	Megawatt
NPC	Noise Pollution Control
OPOR	Outdoor Point of Reception
OPA	Official Plan Amendment
POR	Point of Reception

Glossary

Term	Definition
Background Sound Level	All-encompassing sound that is associated with a given environment, usually a composite of sounds from many sources near and far. Includes noise from all sources other than the sources of interest (i.e., sound other than those being measured or assessed), such as sound from other industrial sources, transportation sources, animals and nature.
Daytime	Defined as the hours from 07:00h to 23:00h for traffic noise impact assessment and 07:00h to 19:00h for stationary noise impact assessment.
Decibel	A logarithmic measure of any measured physical quantity and commonly used in the measurement of sound. The decibel (dB) provides the possibility of representing a large span of signal levels in a simple manner. The difference between the sound pressure for silenced versus a loud sound is a factor of 1:1,000,000 or more and the same in decibel is 0-130 dB, therefore it is less cumbersome to use a small range of equivalent values. A tenfold increase in sound power is equal to +10 dB; a tenfold increase in sound amplitude is equal to +20 dB.
Decibel, A-weighted	A-weighted decibels (dBA). Most common units for expressing sound levels since they approximate the response of the human ear.
Energy Equivalent Sound Level (L_{eq})	An energy-equivalent sound level (L_{eq}) over a specified period of time that would have the same sound energy as the actual (i.e. unsteady) time varying sound over the same period of time. It represents the average sound pressure encountered for the period. The period is often added as a suffix to the label (i.e. $L_{eq(24)}$ for the 24-hour equivalent sound level). A L_{eq} value expressed in dBA is a good, single-value descriptor to use as a measure of annoyance due to noise.
Evening	Defined as the hours from 19:00h to 23:00h for stationary noise impact assessment.

Term	Definition
Ground Absorption Coefficient	A parameter defined based on the noise reflection characteristics of the ground surface. It varies between 0.0 (fully reflective) to 1.0 (fully absorptive).
International Organization for Standardization	An international body that provides scientific standards and guidelines related to various technical subjects and disciplines.
Mitigation	Measures taken to reduce, eliminate, or control impacts on the environment.
Nighttime	Defined as the hours from 23:00h to 07:00h in Ontario
Noise	Any unwanted sound. “Noise” and “sound” are used interchangeably in this document.
Point of Reception	A representative point considered for the purpose of assessment within noise-sensitive receptor such as a residence, campground, daycare, school, church, or hospital.
Point Source	Source that radiates sound spherically (i.e. equally in all directions). Sound levels from a point source decrease at a theoretical rate of 6 dB per doubling of distance.
Predictable Worst-Case Operation	A planned and predictable mode of operation for stationary source(s), during the hour when the noise emissions from the stationary source(s) have the greatest impact at a point of reception, relative to the applicable limit.
Sound	A wave motion in air, water, or other media. It is the rapid oscillatory compression changes in a medium that propagate to distant points. It is characterized by changes in density, pressure, motion, and temperature as well as other physical properties. Not all rapid changes in the medium are due to sound (e.g. wind distortion on a microphone diaphragm).
Sound Level	Generally, sound level refers to the weighted sound pressure level obtained by frequency weighting, usually A- or C-weighted, and expressed in decibels

Term	Definition
Sound Power Level	The total sound energy radiated by a source per unit time (i.e. rate of acoustical energy radiation). The unit of measurement is the Watt. The acoustic power radiated from a given sound source as related to a reference power level (i.e. typically 1E-12 watts, or 1 picowatt) and expressed as decibels. A sound power level of 1 watt = 120 decibels relative to a reference level of 1 picowatt.
Sound Pressure Level	Logarithmic ratio of the root mean square sound pressure to the sound pressure at the threshold of human hearing (i.e., 20 micropascals).

1 Introduction

Elora BESS LP (Elora BESS) engaged Stantec Consulting Ltd. to assess the noise emissions from the proposed Elora Battery Energy Storage System (BESS) Project (the Project) located south of Fergus, Ontario. The Project site is located approximately 1 kilometre (km) south of the urban boundary of Fergus, at the northeast corner of Lot 11, Concession 3 in the Township of Centre Wellington, in Wellington County (the Site). The Site and surrounding area are shown in Figure 1 in Appendix A.

The Project consists of battery energy storage units, electrical inverters and transformers, internal access roads, electrical and communication cabling, a transmission substation, and other associated electrical and infrastructure facilities. The Project will provide up to 211 Megawatt (MW) capacity of energy storage to increase capacity in Wellington County. The Project will utilize approximately 4.43 hectares of privately leased land.

This Noise Feasibility Study was prepared in support of the Project's design maturation and assesses the impact of the project stationary noise sources on the surrounding noise-sensitive land uses.

This assessment was based on the site plan titled 'Prelim Site Exhibit', prepared for the Elora BESS and dated January 31, 2024 (Appendix B).

2 Site Location and Plan

The area surrounding the Site currently consists of agricultural lands to the north, south and west, and a landscaping supply store to the east. Highway 6 is located to the east beyond the landscaping supply store. The main access to the site is via 2nd Line at the north boundary of the site. A landscaped area is planned for the Site fronting along 2nd Line with a depth of approximately 260 metres (m), beyond which the Project equipment will be located. A transformer substation located at the south end of the Site. The south boundary of the Site is approximately 540 m south of 2nd Line. The Site and surrounding area features are shown in Figure 1 in Appendix A and the site plan is provided in Appendix B. Note that several DC-DC Converter units are shown in the site plan; however, at this stage in the design they are not expected to be included as part of the Project.

The Site and its surrounding area is predominantly flat. The Site is currently designated as agricultural under zoning code A.19.3. Agricultural lands to the north are zoned for Future Development (FD), while those to the south fall under Environmentally Protected (EP) zoning. A zoning map for the Site and its surrounding area is provided in Appendix C.

Single family dwellings are located in the north, east, south and west directions from the Site.

3 Guidelines and Criteria

This Noise Feasibility Study was completed in accordance with the MECP publication entitled "Environment Noise Guideline: Stationary and Transportation Sources – Approval and Planning Publication NPC-300", August 2013 (NPC-300).

The MECP NPC-300 environmental noise guideline establishes exclusion limits for noise levels from stationary sources for both outdoor receptors and plane of window receptors. Sound levels are expressed in terms of one-hour equivalent sound levels ($L_{eq\text{-}1hr}$) at the receptors. It establishes the applicable sound level limit(s) at the receptors, as the higher of the background sound level or MECP exclusionary limit. The background sound level is defined as the lowest hourly sound level established by monitoring performed over a minimum period of 48 hours. As background sound levels in the area were not measured at the time of this study, the exclusion limits will apply to the Project.

Based on the aerial image review of the Site and surrounding area, the existing acoustic environment of the proposed project site and the neighbouring noise-sensitive is representative of a Class 3 Area, which is described in the MECP guidelines as a rural area with an acoustical environment that is dominated by natural sounds having little or no road traffic. Noise limits for Class 3 Area receptors as summarized in Table 1 are used for this assessment.

Table 1 MECP Noise Exclusion Limits – Class 3 Area

Receiver Category	Time Period (hh:mm)	$L_{eq\text{-}1hr}$ (dBA)[1]
Outdoor Receptor	Daytime 07:00–19:00	45
	Evening 19:00–23:00	40
	Nighttime 23:00–07:00	-[2]
Plane of Window Receptor	Daytime 07:00–23:00	45
	Evening 19:00–23:00	40
	Nighttime 23:00–07:00	40

Note:

1. Higher of the minimum existing hourly background (ambient) sound level or the exclusion limits. As no background sound levels have been measured, the exclusion limits will apply.
2. Outdoor Receptors are not assessed for the nighttime period.

4 Points of Reception

In accordance with MECP NPC-300, Project noise impacts are evaluated at points of reception (PORs) located on noise sensitive land uses.

The following noise sensitive land uses are considered as per the guideline:

- Permanent, seasonal, or rental residences;
- Hotels, motels and campgrounds;
- Schools, universities, libraries and daycare centres;
- Hospitals and clinics, nursing/retirement homes; and
- Churches and places of worship.

Six (6) representative PORs are considered for this assessment. For the existing dwellings, both plane of window and outdoor PORs are considered. Per NPC-300, the PORs located at the exterior plane of window at the highest floor of the receptor were considered. The receptor heights are defined as 1.5 m for the first floor, and an additional 3 m for each subsequent floor. For the Outdoor POR (OPOR), the receptor was modelled at a height of 1.5 m above ground level, within 30 m of the façade of the dwelling and within the property line of the receptor, in the direction of the Project. The PORs considered in this assessment are listed in Table 2 and are shown in relation to the Site in Figure 1.

Based on a review of the surrounding area zoning and lots, no vacant lots were identified that were closer to the Project than the PORs identified herein, and thus noise impacts at vacant lots were not assessed. Provided that the sound level limits due to the Project are met at all identified PORs, it is expected that sound level limits will be met at all noise-sensitive receptors further from the Project.

Table 2 Points of Reception Summary

POR ID	POR Description	Receptor Height
POR01 / OPOR01	6227 Highway 6, 1 storey dwelling	1.5 m / 1.5 m
POR02 / OPOR02	6224 Highway 6, 3 storey dwelling	7.5 m / 1.5 m
POR03 / OPOR03	6235 Guelph Road, 2 storey dwelling	4.5 m / 1.5 m
POR04 / OPOR04	7714 2nd Line, 1 storey dwelling	1.5 m / 1.5 m
POR05 / OPOR05	936 Guelph Road, 1 storey dwelling	1.5 m / 1.5 m
POR06 / OPOR06	7856 2nd Line, 2 storey dwelling	4.5 m / 1.5 m

5 Stationary Noise Sources

The noise sources associated with the Project were identified from discussions with Elora BESS and review of the Project site plan titled ‘Prelim Site Exhibit’, dated January 31, 2024 (Appendix B).

The following significant noise sources were identified for the Project:

- One hundred and ninety-six (196) Solbank 3.0 Battery Energy Storage System Units
- Twelve (12) Augmentation Batteries – Solbank 3.0 Battery Energy Storage System Units
- Sixty-six (66) Power Electronics FP4200M Inverters (with 60% Fan Speed and attenuation kit)
- Two (2) 110 MVA Transformers

A summary of the Project noise sources, including details on the types of sources, modelled sound power levels, locations, sound characteristics, and any proposed noise control measures is provided in Table 3. The equipment layout is shown in Figure 2 and manufacturer's noise specifications/test data for the equipment are included in Appendix D.

The proposed Power Electronics model FP4200M Inverters are expected to operate under 60% load/fan speed during the worst-case predictable operations and include an attenuation kit. The octave band levels sound power levels for the transformers were based on similar transformers from Stantec's database, normalized to sound levels provided by Elora BESS. Each of the BESS units, Augmentation BESS units, Inverters and Transformers were modelled as point sources.

Truck traffic to the Project is expected to be occasional for maintenance and thus not included as part of this assessment. No other insignificant noise sources are expected at the Project.

Table 3 Stationary Noise Source Summary

Source ID (Qty)	Source Description	Source Type [1]	Sound Power Level (dBA)	Source Location (I/O) [2]	Sound Characteristics [3]	Noise Control Measures [4]
BESS (196 units)	Solbank 3.0 Battery Energy Storage System unit	P	82	O	S	U
AugBESS (12 units)	Augmentation Battery – Solbank 3.0 Battery Energy Storage System unit	P	82	O	S	U
Inverter (66 units)	Power Electronics FP4200M 60% Fan Speed, with attenuation kit	P	88	O	S	A
Transformer (2 units)	110 MVA Transformer	P	86 [5]	O	S, T	U

Notes:
1. Source Type: P = Point Source, A = Area Source, L = Line Source, VA = Vertical Area Source
2. Source Location: O = Outside of building, I = Inside of building
3. Sound Character: T = Tonal, S = Steady, B = Buzzing, C = Cyclical, Q = Quasi-Steady Impulsive, I = Impulsive
4. Noise Control Measures: S = Silencer/Muffler, A = Acoustic Lining or plenum, U = Uncontrolled, E = Acoustic Enclosure, L = Lagging, B = Barrier.
5. Sound power level for 110 MVA Transformer provided by Elora BESS

The MECP NPC-104 *Sound Level Adjustments* (MECP 1978) guidelines prescribe adjustments for sources with special qualities or characters of sound. They are punitive adjustments which apply to noise sources with subjectively annoying characteristics, including tonal sounds, quasi-impulsive sounds, and beating sounds (i.e. sounds with cyclically varying amplitudes). Based on manufacturer test results, all noise sources associated with the Project are expected to be steady with no special qualities except for the transformer, which is expected to be a tonal noise source. A 5 dB tonal penalty has been applied to the transformer sound power level.

6 Assessment Methodology

The battery energy storage units, inverters, and transformers, and they were conservatively modelled as operating continuously during daytime, evening and nighttime periods, although they may cycle on and off at various times under actual use.

Noise modelling was completed using the commercially available software package CADNA/A, published by Datakustik GmbH, which is configured to implement the ISO 9613-2 *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General method of calculation, December 1996*, (ISO 1996) environmental sound propagation algorithms. The acoustic model account for the following:

- Geometrical divergence (noise attenuation due to distance)
- Barrier effects (noise shielding) of the intervening structures/buildings
- Atmospheric absorption
- Ground absorption
- Local topography

The model also considers a downwind condition, in which for the purpose of analysis the wind direction is always oriented from each source location towards each POR.

Topography of the site was not included in the model due to the relatively flat geography of the Site and surrounding area. Local barrier effects were included, such as screening and reflection effects from the on-site equipment but screening due to any off-site buildings (e.g. for agricultural use) was not included.

Within the study and surrounding area, the ground surfaces are predominantly agricultural fields, with some roads. The site and surrounding area was modelled using a ground absorption coefficient of (G=0.7), which is expected to be representative of both the on-site ground conditions (gravel base), and off-site conditions including the agricultural fields and roads. Any bodies of water (such as the on-site pond and the pond near POR02) were modelled as fully reflective (G=0).

Typical Ontario meteorological parameters were included in the model: a temperature of 10 degrees Celsius and a relative humidity of 70%.

NPC-300 requires that the established sound level limit is compared against the Predictable worst-case operation of the Project. This means the basis of the noise assessment should be the hour when the noise emissions from the stationary source(s) have the greatest impact at a point of reception, relative to the lowest hourly sound level at any hour (applicable limit). The predictable worst-case operation of the Project is considered as the simultaneous operation of all on-site sources during day, evening, and nighttime periods, and is expected to be conservative.

7 Noise Assessment

The predicted noise impact from the project equipment on the representative PORs in the vicinity of the project site was modelled for daytime, evening and nighttime operations, with all equipment in operation as listed in Table 3. Predicted sound levels for normal operations are summarized in Table 4. A noise contour for the facility operations are presented in Figure 3.

Sound levels at all PORs due to the Project are expected to meet the NPC-300 sound level limits during the daytime, evening and nighttime periods.

Table 4 Predicted Sound Levels at the PORs

POR ID	POR Description	POR Height	Time of Day	Predicted Sound Level at POR (L_{eq-1hr}, dBA)	Sound Level Limit (dBA)	Meets Limits? (Y/N)
POR01	6227 Highway 6	1.5 m	Daytime (07:00-19:00)	39	45	Y
			Evening (19:00-23:00)	39	40	Y
			Nighttime (23:00-07:00)	39	40	Y
OPOR01		1.5 m	Daytime (07:00-19:00)	39	45	Y
			Evening (19:00-23:00)	39	40	Y
POR02	6224 Highway 6	7.5 m	Daytime (07:00-19:00)	39	45	Y
			Evening (19:00-23:00)	39	40	Y
			Nighttime (23:00-07:00)	39	40	Y
OPOR02		1.5 m	Daytime (07:00-19:00)	37	45	Y
			Evening (19:00-23:00)	37	40	Y
POR03	6235 Guelph Road	4.5 m	Daytime (07:00-19:00)	39	45	Y
			Evening (19:00-23:00)	39	40	Y
			Nighttime (23:00-07:00)	39	40	Y
OPOR03		1.5 m	Daytime (07:00-19:00)	38	45	Y
			Evening (19:00-23:00)	38	40	Y
POR04	7714 2nd Line	1.5 m	Daytime (07:00-19:00)	34	45	Y
			Evening (19:00-23:00)	34	40	Y
			Nighttime (23:00-07:00)	34	40	Y
OPOR04		1.5 m	Daytime (07:00-19:00)	34	45	Y
			Evening (19:00-23:00)	34	40	Y
POR05	936 Guelph Road	1.5 m	Daytime (07:00-19:00)	31	45	Y
			Evening (19:00-23:00)	31	40	Y
			Nighttime (23:00-07:00)	31	40	Y
OPOR05		1.5 m	Daytime (07:00-19:00)	30	45	Y

POR ID	POR Description	POR Height	Time of Day	Predicted Sound Level at POR (L_{eq-1hr}, dBA)	Sound Level Limit (dBA)	Meets Limits? (Y/N)
			Evening (19:00-23:00)	30	40	Y
POR06	7856 2nd Line	4.5 m	Daytime (07:00-19:00)	37	45	Y
			Evening (19:00-23:00)	37	40	Y
			Nighttime (23:00-07:00)	37	40	Y
OPOR06		1.5 m	Daytime (07:00-19:00)	36	45	Y
			Evening (19:00-23:00)	36	40	Y

8 Conclusions

Elora BESS LP engaged Stantec Consulting Ltd. to conduct a Noise Feasibility Study for the proposed Elora Battery Energy Storage System located approximately 1 km south of the urban boundary of Fergus, Ontario. This Feasibility Study evaluated the impact of the project stationary noise sources at the nearby noise-sensitive receptors. The assessment indicates that, with the proposed mitigation in place for the Inverters (60% operating load with attenuation kit installed), the Project is expected to comply with the noise limit criteria in NPC-300 at the assessed PORs. No additional noise mitigation is expected to be required for the Project. However, it is recommended to update this noise study as the design progresses and for future approvals, to determine any additional noise mitigation requirements for the Project.

9 References

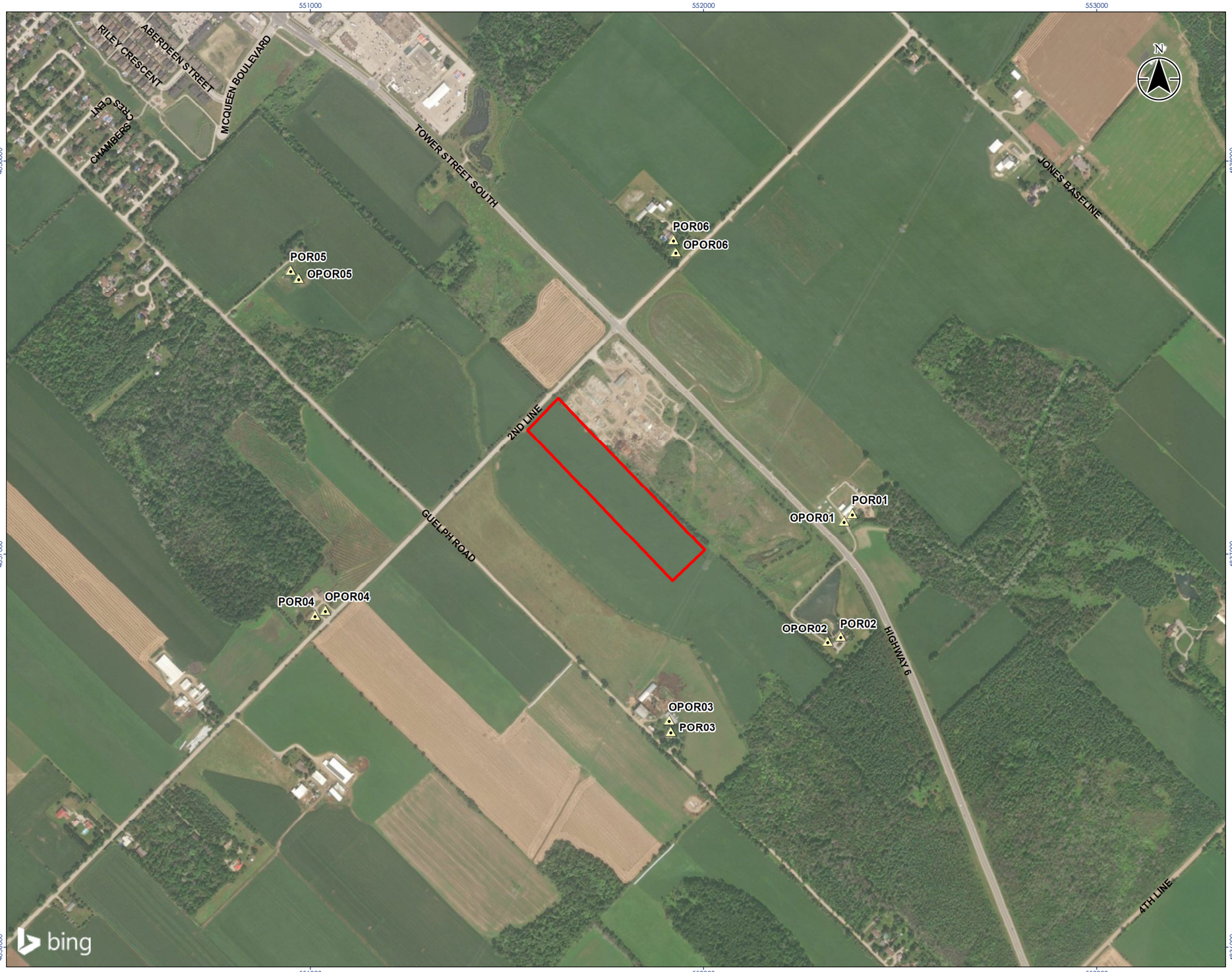
ISO. 1996. "Acoustics - Attenuation of sound during propagation outdoors." nternational Standards Organization.

MECP. 2013. "Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning." *NPC-300.* August.

MECP. 1978. *NPC-104 Sound Level Adjustments.* Ontario Ministry of the Environment, Conservation and Parks.

Appendices

Appendix A Figures



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Legend

- Point of Reception
- Project Boundary

0 250 500 m

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Notes

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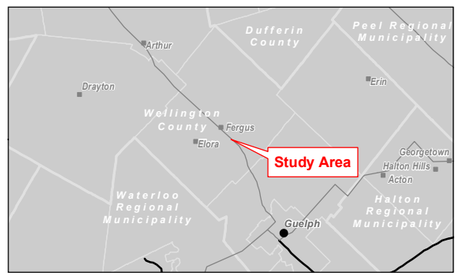

Project Location
Township of Centre Wellington

160901104 REV2
Prepared by BF on 2024-07-03
Technical Review by AW on 2024-06-04

Client/Project
AYPA POWER CANADA LP
NOISE IMPACT STUDY:
PROPOSED ELORA BATTERY ENERGY STORAGE SYSTEM

Figure No.
1

Title
Project Boundary and Points of Reception

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Legend

- BESS Unit
- Inverter
- T Transformer
- Building
- Pond
- Project Boundary

0 25 50 m

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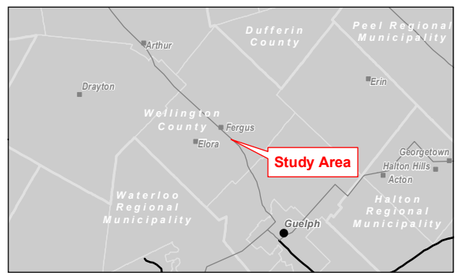


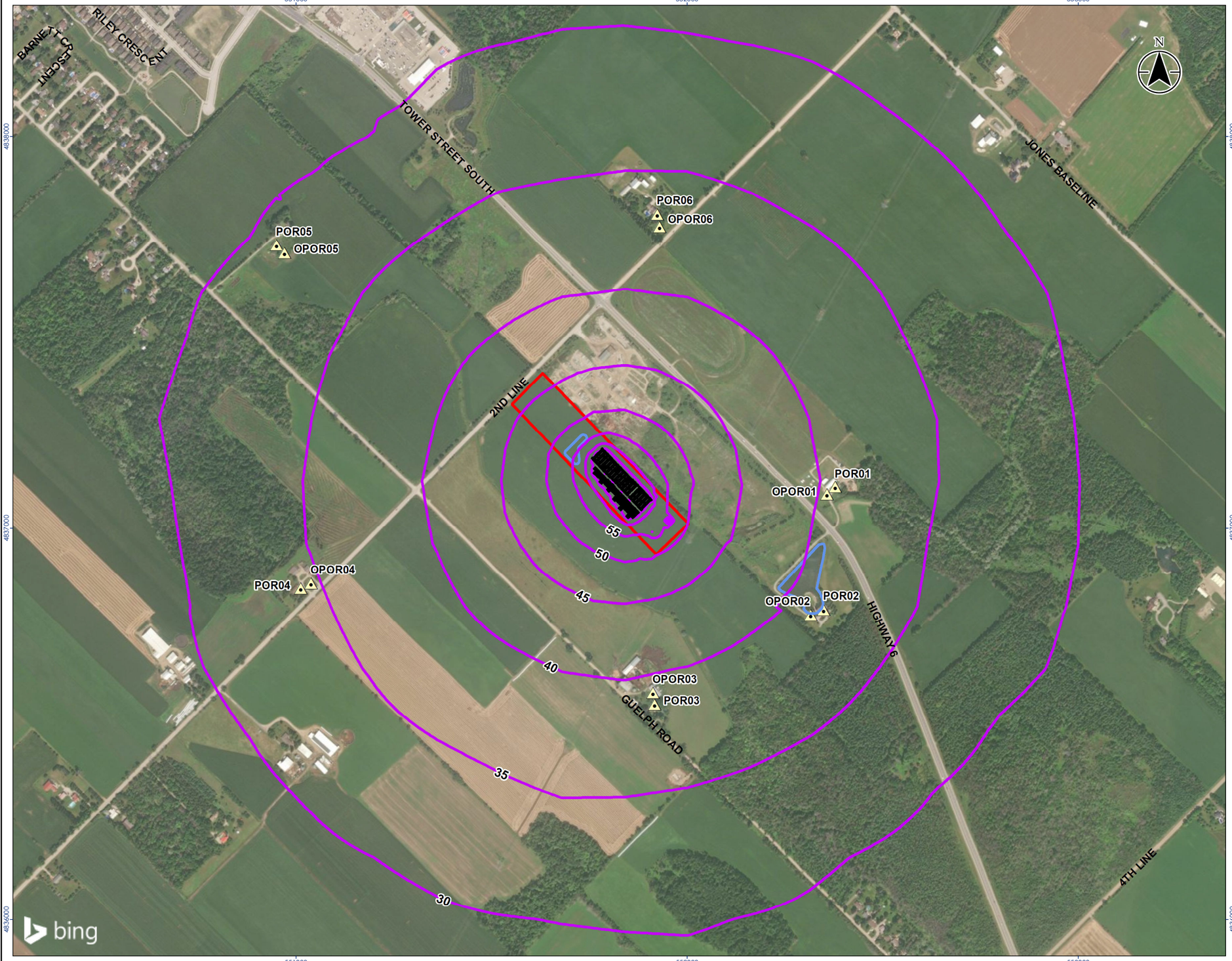
Project Location
Township of Centre Wellington

160901104 REV1
Prepared by BF on 2024-07-03
Technical Review by AW on 2024-06-04

Client/Project
AYPA POWER CANADA LP
NOISE IMPACT STUDY:
PROPOSED ELORA BATTERY ENERGY STORAGE SYSTEM

Figure No.
2

Title
Project Stationary Noise Sources



Stantec

Legend

- Equivalent Sound Level Contours at 4.5m Height (dBA, Daytime, Evening, Nighttime)
- Building
- Pond
- Project Boundary

0 200 400 m

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Notes

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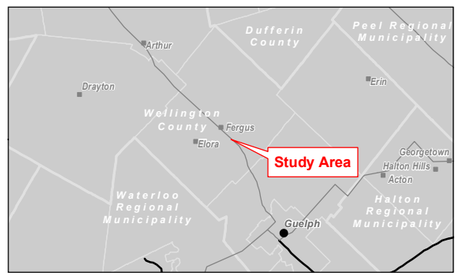

Project Location
Township of Centre Wellington

160901104 REV1
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Client/Project
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NOISE IMPACT STUDY:
PROPOSED ELORA BATTERY ENERGY STORAGE SYSTEM

Figure No.
3

Title
Project Equivalent Sound Level Contours – Worst-Case Predictable Operating Scenario (Daytime, Evening, Nighttime)

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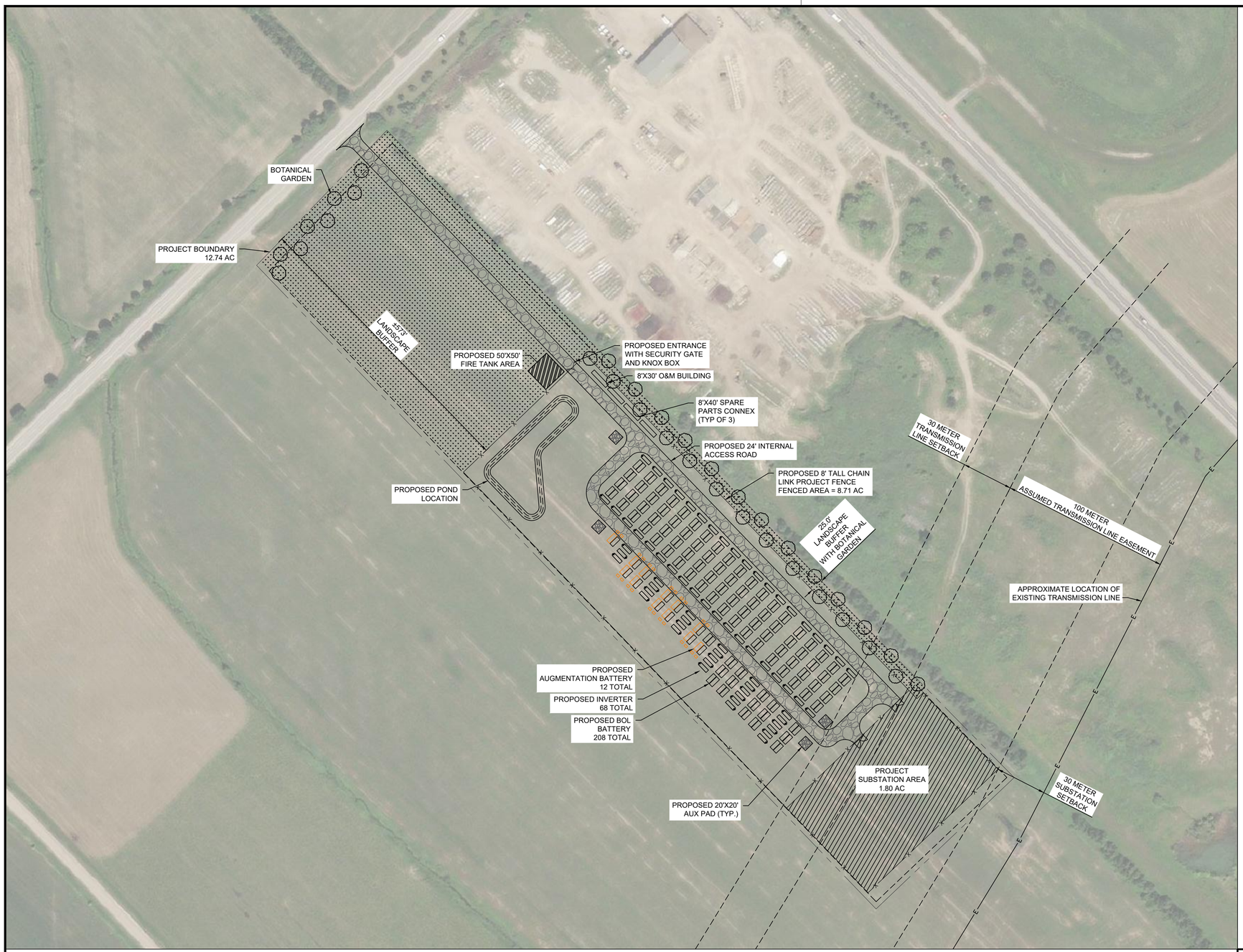
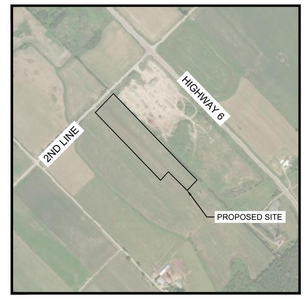
Appendix B Site Plan





VICINITY MAP
1"=1000'

LEGEND:

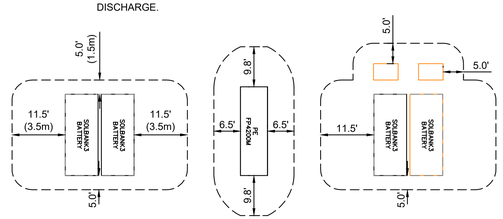
- PARCEL BOUNDARY
- PROJECT BOUNDARY
- 24' INTERNAL ROAD
- PROPOSED FENCE
- ASSUMED SETBACK
- SUBSTATION LOCATION

QUANTITIES:

PROJECT BOUNDARY	12.74 AC
ROAD	61,115 SF
PROPOSED FENCE	3,305 LF
24' WIDE ACCESS GATES	3 EA

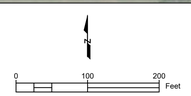
NOTES:

1. EQUIPMENT QUANTITIES, LOCATIONS AND LAYOUTS SHOWN ARE INDICATIVE AND SUBJECT TO CHANGE DURING DETAILED DESIGN.
2. SIZE OF CAPACITOR BANK ESTIMATED ASSUMING REQUIRED PF OF 0.95 AT POI.
3. SITE SPECIFIC FEATURES SUCH AS RETENTION PONDS AND DRAINAGE SHOWN FOR SCHEMATIC PURPOSES AND IS SUBJECT TO CHANGE DURING DETAILED DESIGN.
4. SPACE FOR AUGMENTATION CONTAINERS CAN BE USED FOR LAYDOWN DURING INITIAL CONSTRUCTION.
5. SYSTEM SIZED FOR SELF FEEDING AUX POWER DURING DISCHARGE.



SOLBANK 3 BATTERY | PE INVERTER | AUGMENTATION CONFIGURATION

STANDARD EQUIPMENT SPACING



PRELIMINARY - NOT FOR CONSTRUCTION

aypa A BLACKSTONE PORTFOLIO COMPANY

DESIGNED | DETAILED

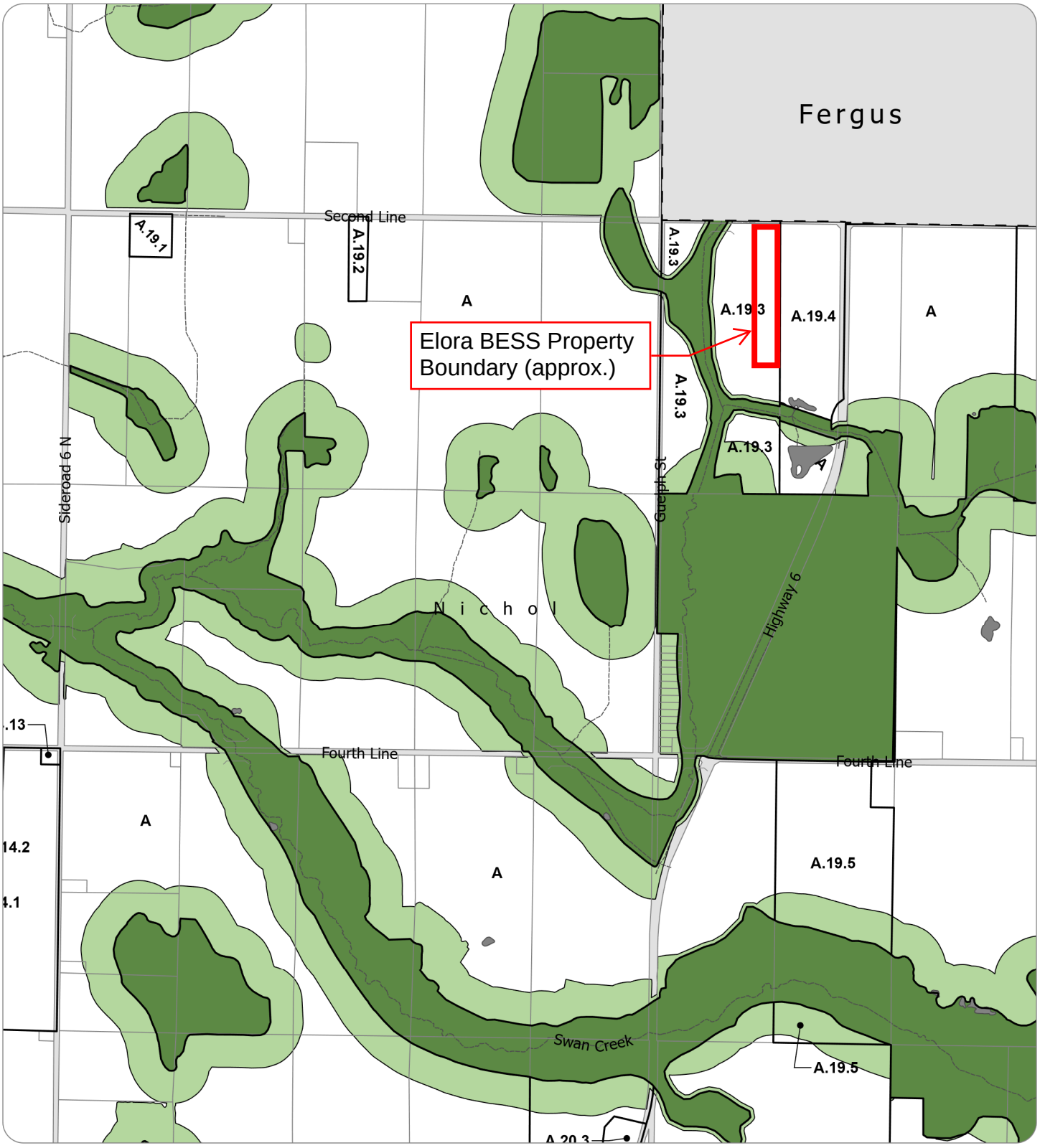
ELORA BESS

PRELIM SITE EXHIBIT

CANADA MTM ZONE 10, INTERNATIONAL FEET

MW	200	—	MWhr	800
DWG	EXHIBIT	—	REV	0
DATE	1/31/2024			

Appendix C Zoning Map



Zone Boundary
Environmental Protection
Environmental Protection Overlay
Urban Area
Parcel Fabric
Floodplain
Flood Fringe
Waterbody
Watercourse
Road

				21	27	33	39	
1	6	11	16	22	28	34	40	
2	7	12	17	23	29	35	41	
3	8	13	18	24	30	36	42	
4	9	14	19	25	31	37	43	
5	10	15	20	26	32	38	44	

Township of Centre Wellington
Zoning By-Law
Schedule "A"

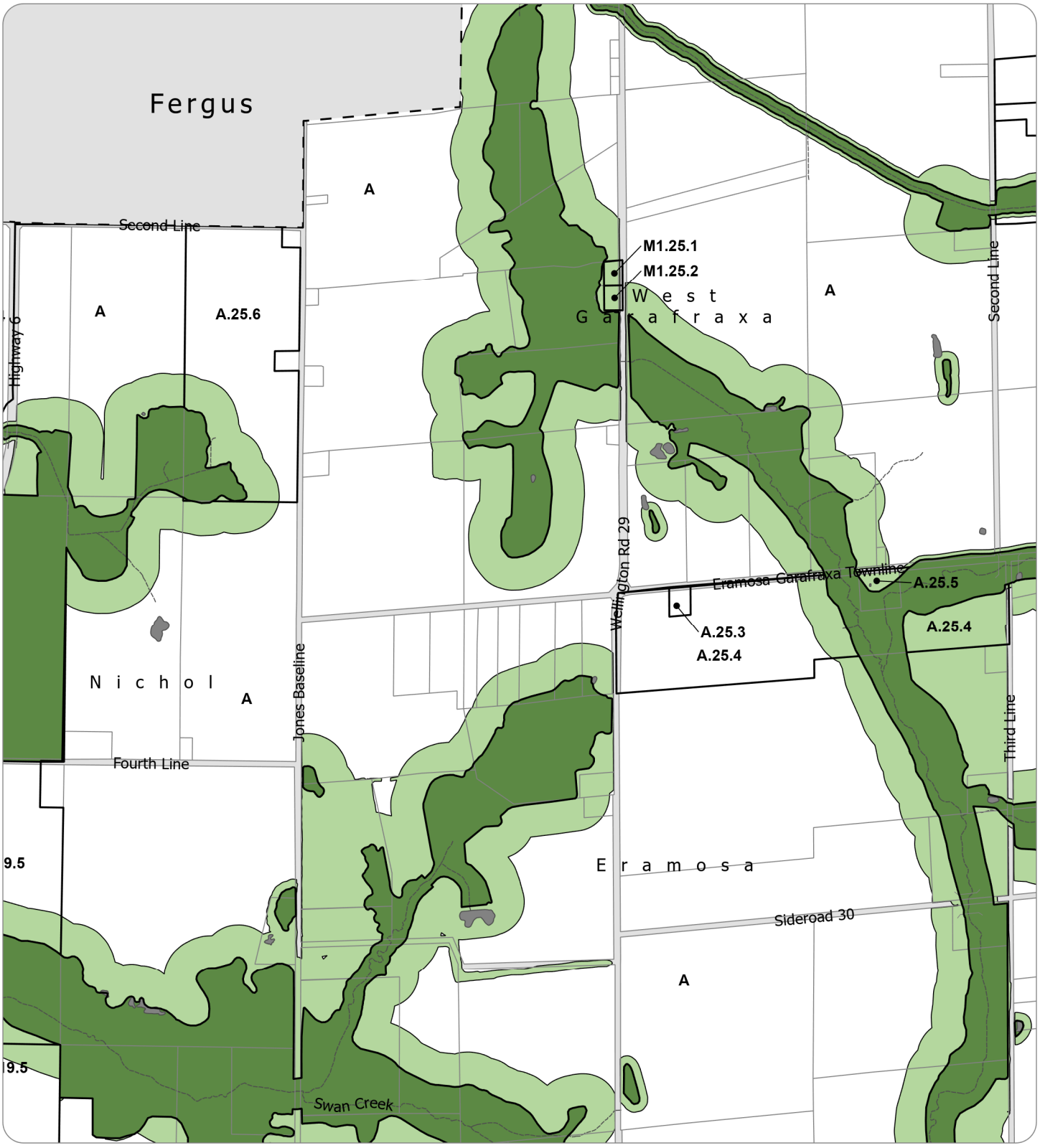
Map 19

Nichol

Path: O:\DATA_ENTERPRISE\ZONING\ARPX\Zoning_ByLaw_Maps\Zoning_ByLaw_Maps.aprx

1:20,000
0 100 200 400 m

Author: GWolowich
Date Saved: 2023-09



Zone Boundary
Environmental Protection
Environmental Protection Overlay
Urban Area
Parcel Fabric
Floodplain
Flood Fringe
Waterbody
Watercourse
Road

				21	27	33	39	
1	6	11	16	22	28	34	40	
2	7	12	17	23	29	35	41	
3	8	13	18	24	30	36	42	
4	9	14	19	25	31	37	43	
5	10	15	20	26	32	38	44	

Township of Centre Wellington
Zoning By-Law
Schedule "A"

Map 25

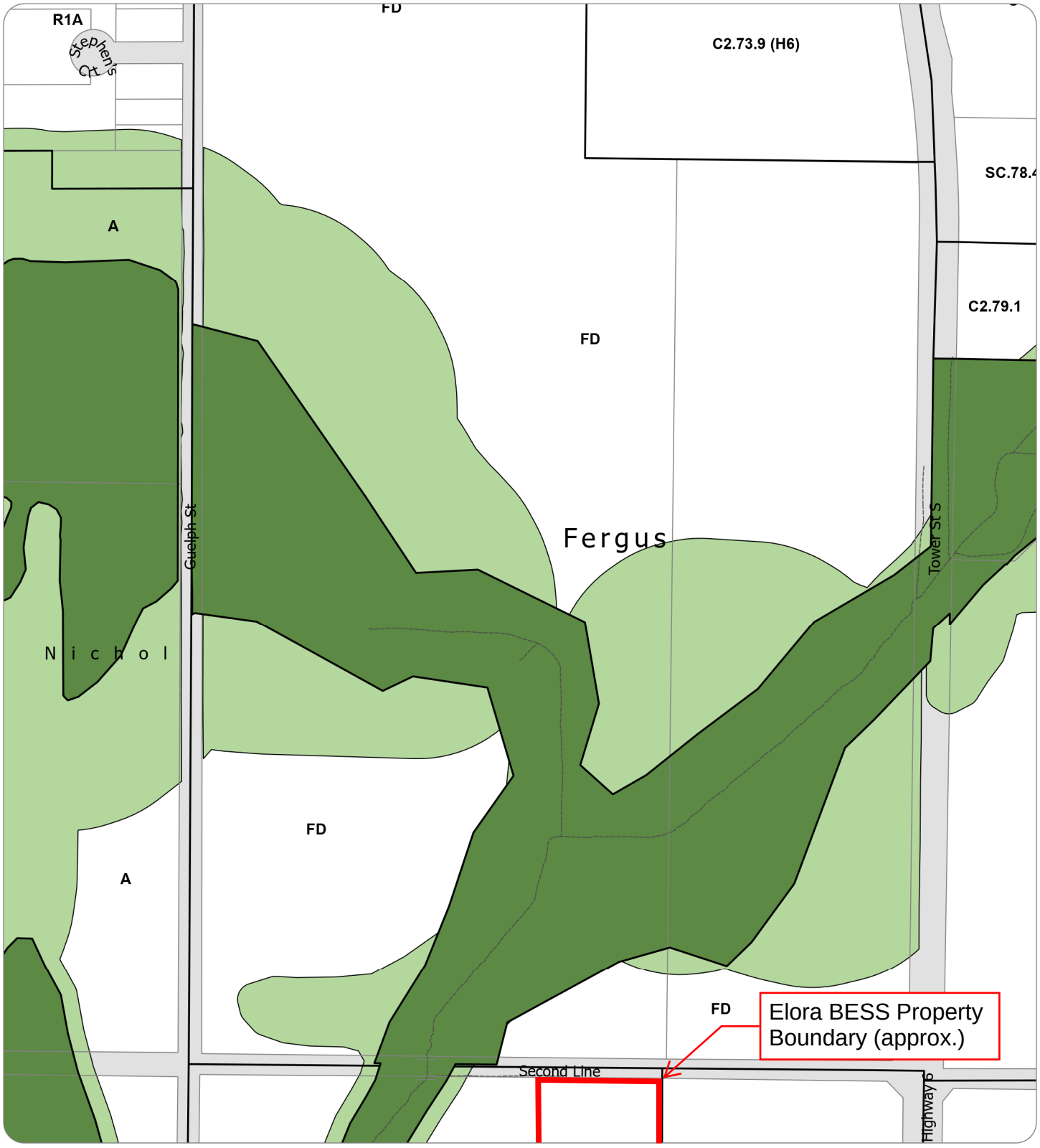
Nichol-WG-Eramosa

Path: O:\DATA_ENTERPRISE\ZONING\ARPX\Zoning_ByLaw_Maps\Zoning_ByLaw_Maps.aprx

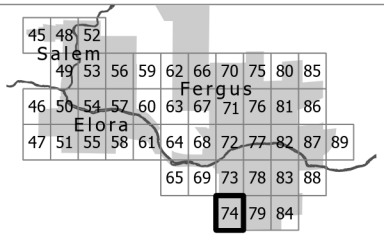
1:20,000

0 100 200 400 m

Author: GWolowich
Date Saved: 2023-09



Zone Boundary
Environmental Protection
Environmental Protection Overlay
Heritage Area Overlay
Parcel Fabric
Floodplain
Flood Fringe
Waterbody
Watercourse
Road



Township of Centre Wellington
Zoning By-Law
Schedule "A"

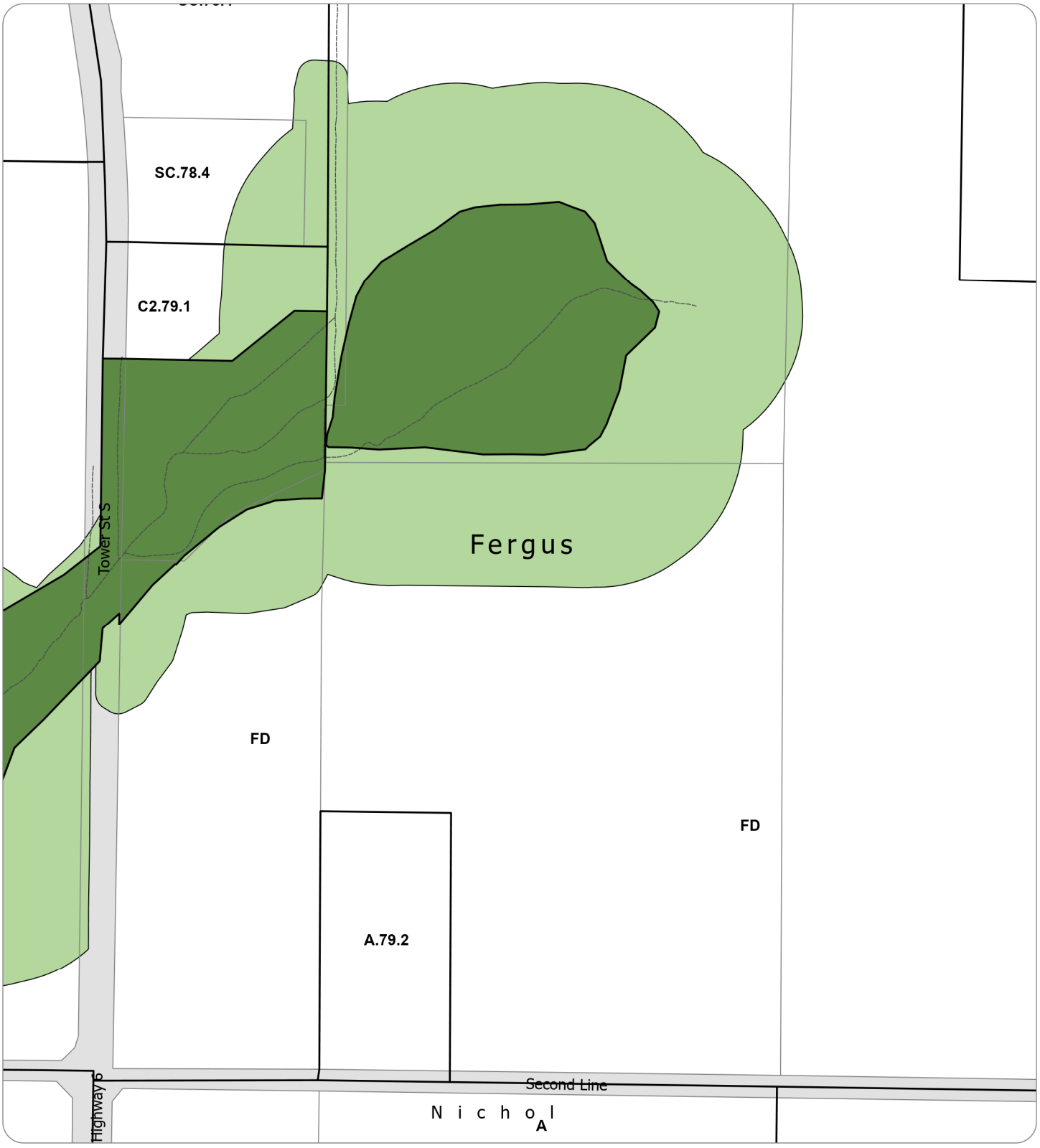
Map 74

Fergus

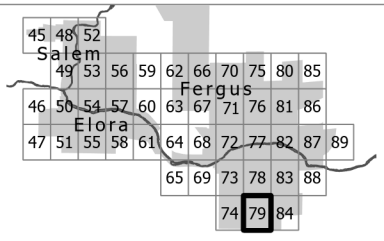
Path: O:\DATA_ENTERPRISE\ZONING\ARPX\Zoning_ByLaw_Maps\Zoning_ByLaw_Maps.aprx

1:5,000
0 50 100 m

Author: GWolowich
Date Saved: 2023-09



Zone Boundary
Environmental Protection
Environmental Protection Overlay
Heritage Area Overlay
Parcel Fabric
Floodplain
Flood Fringe
Waterbody
Watercourse
Road



Township of Centre Wellington
Zoning By-Law
Schedule "A"

Map 79

Fergus

Path: O:\DATA_ENTERPRISE\ZONING\ARPX\Zoning_ByLaw_Maps\Zoning_ByLaw_Maps.aprx

1:5,000
0 50 100 m

Author: GWolowich
Date Saved: 2023-09

Appendix D Manufacturer Equipment Data Sheets

BESS and AugBESS
Sound Level Data

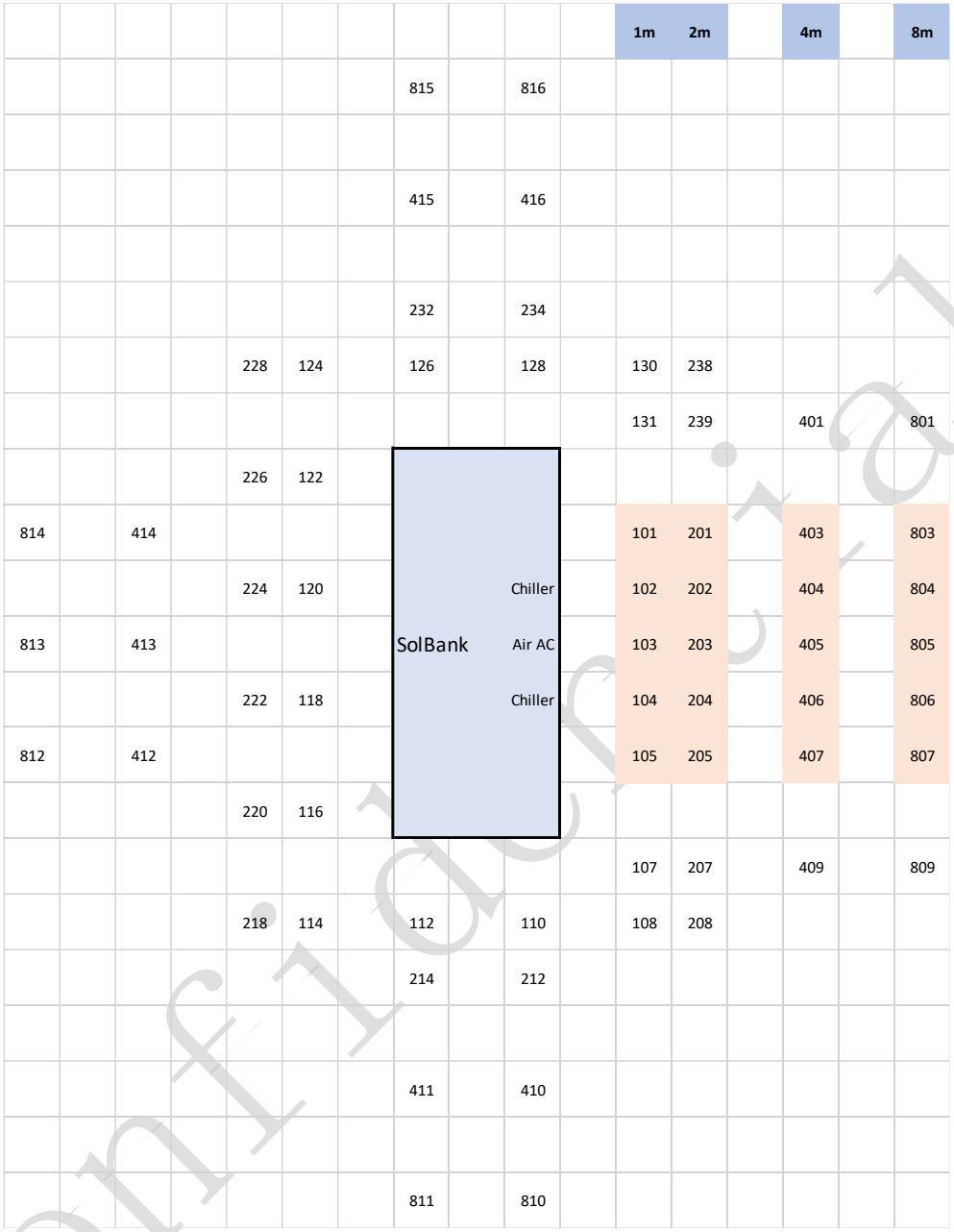
0.25P_SolBank Noise Level

Testing Report

Applicable Product Models:

CSI-SolBank-S-2967-4h-E-E/E-0
CSI-SolBank-S-2967-4h-H-A/E-0

Revision	Date	Prepared By	Notes
A	2023.01.11	Zhangcheng Cao	Initial draft
B	2023.02.09	Zhangcheng Cao	Notes added for 0.25P testing
C	2023.08.16	Zhangcheng Cao	Modify the applicable product model



3.2 Parameter setting

1) Analysis bandwidth: (0-25600) Hz
2) Sampling frequency: ≥ 2.56 times of analysis bandwidth
3) Frequency resolution: 2Hz
4) Recording method: A
5) Time characteristic: S

3.3 Notes

For noise level test of the 0.25P SolBank model, a

4. Test photos

1m	位置				
频率（Hz）	101	102	103	104	105
50	31.5	32.4	31.3	31.0	32.2
63	35.5	36.5	38.2	38.6	36.6
80	34.6	33.1	36.1	35.3	36.8
100	41.1	39.2	37.7	36.9	40.3
125	40.3	39.4	46.7	42.5	42.6
160	44.1	42.3	44.6	40.7	42.4
200	44.3	43.6	44.7	43.6	44.6
250	45.6	48.4	47.5	49.3	45.7
315	47.3	48.8	46.7	47.9	48.9
400	50.8	48.7	49.9	47.7	50.5
500	50.1	48.0	49.1	50.1	51.4
630	48.6	48.1	48.6	47.2	48.5
800	48.7	49.3	49.8	49.4	50.6
1000	50.1	49.2	50.7	50.4	50.4
1250	51.1	49.9	52.2	51.3	50.2
1600	49.6	48.9	50.1	50.3	50.6
2000	47.8	47.8	48.1	49.1	49.4
2500	48.9	48.7	47.5	49.6	50.3
3150	48.6	47.1	47.6	49.9	51.3
4000	48.5	45.3	44.5	46.4	47.9
5000	45.1	43.3	41.9	44.3	50.1
6300	51.5	48.6	43.0	45.8	51.8
8000	38.3	34.4	33.6	36.2	43.2
10000	38.4	33.5	29.0	32.4	40.2
12500	57.8	49.9	38.6	38.2	54.0
16000	28.9	21.5	18.1	22.8	29.9
20000	31.8	23.3	17.7	19.8	31.8

Inverter - Power Electronics
Sound Level Data

TECHNICAL REPORT

ACOUSTIC CHARACTERISATION
POWER ELECTRONICS INVERTER
HEM-PCSM Gen3

+Technical
C/ Luis Bolinches 18 esc 2, 1º A
46023 - VALENCIA
Telephone: 96.320.21.11
correo@tecnival.com
www.tecnival.com

Code: C230802

5. PROCEDURE

The machine will be inspected at the POWER ELECTRONICS facilities in Liria on 3 August 2023.

Once the condition of the markings corresponding to the measurement surface has been checked, both on the inverter and on the floor and interior/exterior roads, the measurements are started at 20:00 hours. In this way, the aim is to speed up the measurement by reducing the interference with the operations of the installations, as well as to obtain a more stable background noise measurement.

As indicated in the background, the inverter has several acoustic attenuation elements coupled to the ventilation air intake and exhaust inlets.

Illustration 2. PCSM Gen3 Inverter with acoustic attenuation kit

Microphone Position MP	Sound Pressure Level Background Noise L'pi(ST)		Sound Pressure Level Source L'pi(ST)		Apparent Directivity Dlj*
	dB (A)	*Ref.*	dB (A)	*Ref.*	dB
1	54,6	*003*	61	*001*	-4,75
2	54,1	*005*	63,8	*006*	-1,95
3	53,5	*010*	64,3	*009*	-1,45
4	51,7	*011*	63,4	*012*	-2,35
5	54,8	*016*	65,2	*015*	-0,55
6	53,1	*017*	64,7	*018*	-1,05
7	53,7	*022*	64,7	*021*	-1,05
8	53,8	*023*	64,2	*024*	-1,55
9	53,5	*028*	61,5	*027*	-4,25
10	53,3	*029*	59,5	*030*	-6,25
11	50,5	*040*	61,7	*039*	-4,05
12	54,5	*034*	64	*033*	-1,75
13	53,4	*047*	63,5	*045*	-2,25
14	52,5	*053*	62,3	*052*	-3,45
15	54	*035*	62,3	*036*	-3,45
16	51,6	*054*	59,8	*055*	-5,95
17	52,1	*041*	62,1	*042*	-3,65
18	54,7	*048*	63,8	*049*	-1,95
19	48,6	*059*	63,9	*058*	-1,85
20	48,2	*060*	67,5	*061*	1,75
21	50	*065*	65,3	*064*	-0,45
22	52,5	*066*	66,5	*067*	0,75
23	50,7	*071*	65,8	*070*	0,05
24	51,3	*072*	66,8	*073*	1,05
25	50,6	*077*	67,3	*076*	1,55
26	51,8	*078*	63,2	*079*	-2,55
27	50,2	*083*	61,5	*082*	-4,25
28	48,9	*084*	61	*085*	-4,75
29	49,8	*089*	64,8	*088*	-0,95
30	47,5	*090*	69,1	*091*	3,35
31	52,6	*095*	68,3	*094*	2,55
32	50,8	*096*	65,6	*097*	-0,15
33	50,6	*004*	67,1	*003*	1,35
34	50,3	*005*	66,4	*006*	0,65
35	50,3	*010*	68,4	*009*	2,65
36	50,4	*011*	69	*013*	3,25
37	49,5	*017*	62,9	*016*	-2,85
38	48,3	*018*	60,2	*019*	-5,55
39	47	*048*	68,3	*047*	2,55
40	46,9	*043*	69,4	*044*	3,65
41	48	*042*	70,2	*041*	4,45
42	49,3	*036*	67,5	*037*	1,75
43	49,8	*035*	66,3	*034*	0,55
44	49	*030*	70,1	*031*	4,35
45	50,2	*029*	70,5	*028*	4,75
46	50,5	*024*	67	*025*	1,25
47	50,6	*023*	63,4	*022*	-2,35
48	49,2	*049*	63,3	*050*	-2,45

L'p(ST) =	65,9 dB (A)	
Range L'p(ST) =	11,0 dB (A)	No additional positions required per paragraph 8.1.2 (a)
Lp(B) =	51,6 dB (A)	
Range Lp(B) =	7,9 dB (A)	No additional positions required per paragraph 8.1.2 (a)
ΔLp	14,3 dB (A)	
K1 =	0,2 dB (A)	Applies correction for background noise
Are there Dli* < 5	Sí/Yes	No additional positions required per paragraph 8.1.2 (b)
MP =	48	

Table 3. Range and apparent directivities. 60 operating instructions, with modified attenuation kit.

MEAN TIME-AVERAGED SOUND PRESSURE LEVEL FROM THE ARRAY OF MICROPHONE POSITIONS OVER THE MEASUREMENT SURFACE
(ISO 3744, sections 8.2.2.2, 8.2.3 & 8.2.4)

Mid-band frequencies of octave bands (Hz)	$\overline{L'_p(ST)}$	$\overline{L_p(B)}$	ΔL_p	K_1
12.5	59,9	51,9	8,0	0,7537
16	61,5	50,9	10,6	0,3977
20	63,2	50,9	12,3	0,2609
25	66,3	50,6	15,7	
31.5	69,9	50,5	19,4	
40	70,9	51,8	19,2	
50	70,4	51,2	19,2	
63	66,1	51,1	15,0	0,1405
80	68,9	50,8	18,1	
100	71,7	49,4	22,2	
125	69,8	48,1	21,7	
160	68,4	48,8	19,6	
200	68,3	43,7	24,6	
250	65,6	42,5	23,2	
315	60,8	46,1	14,7	0,1494
400	56,8	42,1	14,7	0,1501
500	56,3	43,2	13,1	0,2182
630	55,4	45,8	9,7	0,4966
800	54,7	44,6	10,1	0,4455
1k	53,9	43,3	10,6	0,3970
1.25k	53,6	40,9	12,7	0,2411
1.6k	52,1	38,6	13,5	0,1981
2k	49,6	36,6	12,9	0,2260
2.5k	47,0	35,9	11,1	0,3478
3.15k	44,9	33,8	11,1	0,3497
4k	44,0	31,4	12,6	0,2459
5k	41,0	32,5	8,5	0,6632
6.3k	39,3	27,0	12,3	0,2629
8k	37,6	22,0	15,6	
10k	39,4	17,6	21,8	
12.5k	30,5	18,0	12,4	0,2545
16k	27,1	15,0	12,2	0,2720

	$\overline{L'_p(ST)}$	$\overline{L_p(B)}$	ΔL_p	K_1
A-weighted	65,9	51,6	14,3	0,1648

A-WEIGHTED SOUND POWER LEVEL FROM MID-BAND FREQUENCIES OF ONE-THIRD OCTAVE BANDS
(ISO 3744, Annex E)

Coef. C_k	$\overline{L_{pk}}$	L_{Wk}	Aux: $10^{0,1(Lwk+Ck)}$
-30,2	70,4288	92,9006	1.862.364
-26,2	65,9775	88,4494	1.678.573
-22,5	68,9068	91,3787	7.724.526
-19,1	71,6518	94,1237	31.795.693
-16,1	69,8361	92,3079	41.763.086
-13,4	68,3514	90,8233	55.249.528
-10,9	68,3306	90,8025	97.779.628
-8,6	65,6329	88,1048	89.223.586
-6,6	60,6986	83,1705	45.398.998
-4,8	56,6849	79,1568	27.269.388
-3,2	56,0962	78,5681	34.419.584
-1,9	54,9472	77,4190	35.637.311
0,8	54,2805	76,7524	56.916.275
	53,5044	75,9762	39.593.385
0,6	53,3827	75,8545	44.203.136
1	51,8978	74,3697	34.432.530
1,2	49,3573	71,8292	20.087.053
1,3	46,6968	69,1687	11.139.649
1,2	44,5246	66,9964	6.601.526
1	43,7625	66,2344	5.289.765
0,5	40,2899	62,7617	2.119.202
-0,1	39,0780	61,5498	1.396.315
-1,1	37,5877	60,0596	786.977
-2,5	39,4011	61,8730	865.562

SOUND POWER LEVEL FROM THE SOUND PRESSURE LEVEL, IN dB(A)
(ISO 3744, section 8.2.5)

$$\overline{L_p} = \overline{L'_p}(ST) - K_1 \qquad L_W = \overline{L_p} + 10lg\frac{S}{S_0}$$

Area of measurement surface [S] = 176,68 m^2 $S_0 = 1\ m^2$

L_W = 88,2 dB(A)

$$\overline{L_{pk}} = \overline{L'_{pk}}(ST) - K_1$$

$$L_{Wk} = \overline{L_{pk}} + 10lg\frac{S}{S_0}$$

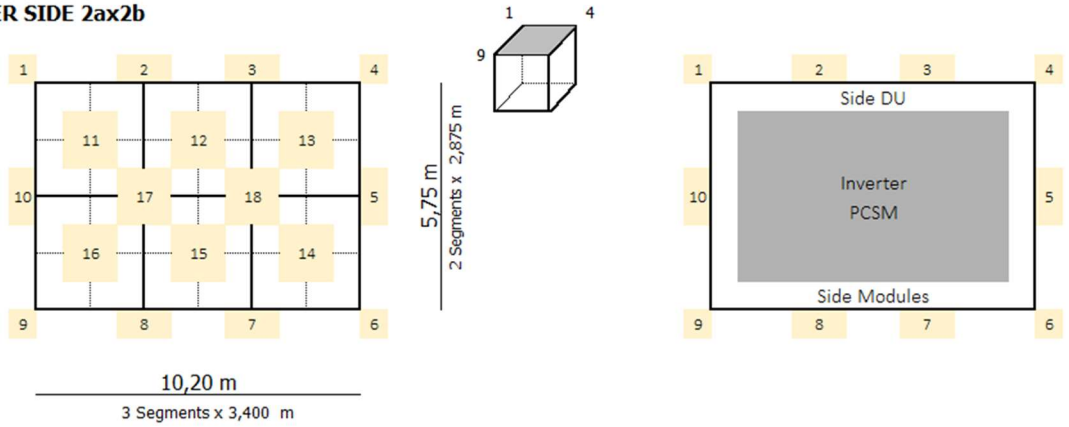
$$L_{WA} = 10lg \sum_{k=k_{min}}^{k_{max}} 10^{0,1(L_{Wk}+C_k)}$$

L_{WA} = 88,4 dB(A)

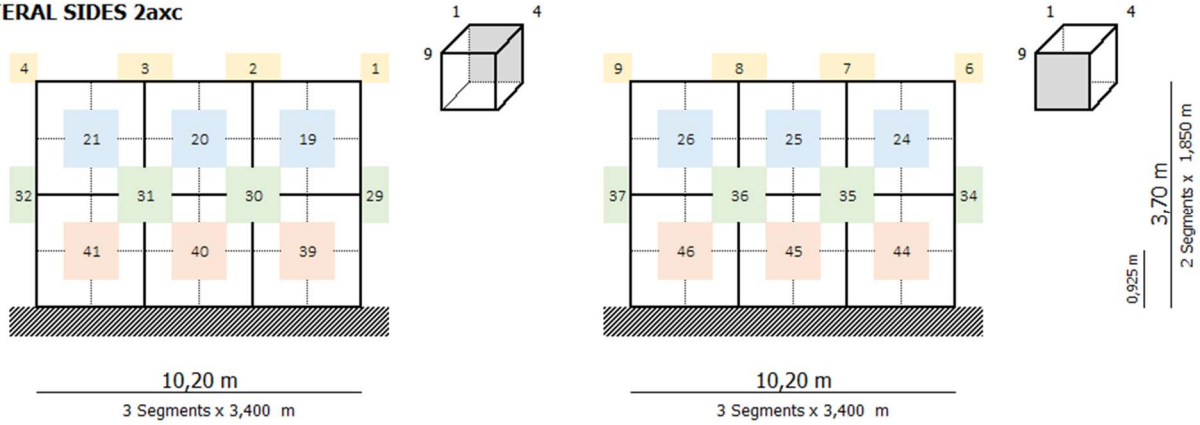
Table 5. Sound pressure level and sound power. 60% operating instructions, with modified attenuation kit

ANEXO I. Diagram of the microphone positions and dimensions of the measuring surface for the inverter with attenuation kit

UPER SIDE 2ax2b



LATERAL SIDES 2axc



LATERAL SIDES 2bxc