

Attachment A12

Noise and Vibration Impact Assessment



118-130 Epsom Road & 905 South Dowling Street, Zetland

Noise and Vibration Impact Assessment

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E-LAB Consulting

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1 INTRODUCTION

This Noise and Vibration Impact Assessment has been prepared in support of a Development Application (DA) made to City of Sydney Council for the proposed development at 118-130 Epsom Road & 905 South Dowling Street, Zetland. The application seeks to construct residential apartments of up to 23 storeys high where Suttons City currently exists.

In summary, this assessment will address the following key acoustic considerations:

- Noise impact to the development's habitable areas (i.e. living rooms and bedrooms of apartments) from traffic movement along surrounding roads
- Noise emissions from mechanical plant associated with the project building to surrounding noise-sensitive receivers

The acoustic, noise and vibration legislation, standards and guidelines applicable to the proposed development include:

- Sydney Development Control Plan (DCP) 2012
- SEPP (Infrastructure) 2007
- Development Near Rail Corridors and Busy Roads – Interim Guideline
- NSW EPA Noise Policy for Industry (NPI) 2017
- Bureau of Meteorology, Daily rainfall report
- NSW EPA Interim Construction Noise Guideline (ICNG) 2009
- Assessing vibration: A technical guideline 2006
- British Standard BS5228 – Part 1:1997 “Noise and Vibration Control on Construction and Open Sites”
- British Standard BS7358:1993 “Evaluation and Measurement for Vibration in Buildings” – Part 2: “Guide to Damage Levels from Groundborne Vibration”
- German Standard DIN4150 – Part 3: “Structural vibration in buildings – Effects on structures”



2 PROJECT OVERVIEW

2.1 SITE DESCRIPTION

The location of the proposed development, noise monitoring and measurement locations, and surrounding noise-sensitive receivers are presented in Figure 1. Noise-sensitive receivers have been delineated into receiver catchments (RCs) as indicated in Figure 1, where the permissible land-uses within each of the receiver catchments are outlined below:

- RC1 – Active recreation receivers (Gunyama Park), Mixed Use zone
- RC2 – Commercial receivers, Mixed Use zone
- RC3 – Residential receivers, Mixed Use zone
- RC4 – Residential receivers, Mixed Use zone
- RC5 – Residential receivers, Mixed Use zone
- RC6 – Commercial receivers, Mixed Use zone
- RC7 – Residential receivers, Mixed Use zone

Figure 1: Acoustic site plan identifying the surrounding noise-sensitive receivers and noise monitoring locations



LEGEND

- Active Recreation Receiver Catchment
- Commercial Receiver Catchment
- Residential Receiver Catchment
- LT# Long-Term Noise Monitoring
- ST# Short-Term Noise Monitoring



2.2 SITE ACOUSTIC CONSIDERATIONS

Upon reviewing the design documentation prepared for the Development Application, the acoustic elements considered for the proposed development are:

- Noise impact to the development's habitable areas (i.e. living rooms and bedrooms of apartments) from traffic movement along surrounding roads
- Noise emissions from mechanical plant associated with the project building to surrounding noise-sensitive receivers

3 NOISE SURVEYS

3.1 INSTRUMENTATION

The equipment used for the noise survey was the following:

- Hand-held sound spectrum analyser Rion-NL52, S/N 186647
- ARL Type 1 Environmental Noise Loggers, S/N 16-306-037, 16-707-006 and 16-707-037

All equipment was calibrated before and after the measurements and no significant drift was found. All equipment carries current traceable calibration certificates that can be provided upon request.

3.2 SHORT-TERM NOISE MONITORING

Short-term noise measurements were conducted on 04/05/2022 in the vicinity of surrounding noise-sensitive receivers to characterize the background and ambient noise associated with these receivers. The results of the short-term noise measurements conducted at locations ST1, ST2 and ST3 (see Figure 1 for location) are summarised in Table 1.

Table 1: Short-term noise measurements summary

MEASUREMENT LOCATION	MEASUREMENT TIME	L _{Aeq} dB(A)	L _{A90} dB(A)	L _{A10} dB(A)	COMMENTS
ST1	9:01am to 9:15am	70	66	73	Predominantly continuous traffic noise from the Eastern Distributor
ST2	8:43am to 8:56am	65	59	67	Predominantly continuous traffic noise from Link Rd and distant traffic noise from the Eastern Distributor
ST3	8:30am to 8:40am	74	67	77	Predominantly continuous traffic noise from Epsom Rd and distant traffic noise the Eastern Distributor

3.3 LONG-TERM NOISE MONITORING – TRAFFIC NOISE

Long-term noise monitoring was conducted between 04/05/2022 to 18/08/2022 at locations LT1, LT2 and LT3 (indicated in Figure 1) to establish the traffic noise levels for the site and have been summarised in Table 2 below.

Table 2: Unattended traffic noise monitoring results

LOCATION	MEASURED TRAFFIC NOISE LEVELS dB(A)			
	Day (7am - 10pm) L _{Aeq,15hour}	Day (7am - 10pm) L _{Aeq,1hour}	Night (10pm – 7am) L _{Aeq,9hour}	Night (10pm – 7am) L _{Aeq,1hour}
LT2	74	75	69	72
LT3	69	71	63	66

Please refer to Appendix C for the noise monitoring data.



3.4 LONG-TERM NOISE MONITORING – BACKGROUND NOISE

Background noise levels and subsequent Rating Background Noise Level (RBL) have been established in accordance with the Noise Policy for Industry 2017 using the results of the noise monitoring at location LT1.

The description of time of day is outlined within the Noise Policy for Industry and described as follows:

- Day – the period from 7:00am to 6:00pm Monday to Saturday or 8am to 6pm on Sundays and public holidays
- Evening – the period from 6:00pm to 10:00pm
- Night – the period from 10:00pm – 7:00am

Table 3: Unattended noise monitoring results – LT1

LOCATION	MEASURED RATING BACKGROUND NOISE LEVELS L _{A90} dB(A)		
	DAY	EVENING	NIGHT
LT1	51	50	42
LT2	71	68	53
LT3	57	56	52

The local ambient noise environment is typical of an urban residential environment (as classified by the NPI).

Please refer to Appendix C for the noise monitoring data.



4 PROJECT NOISE AND VIBRATION CRITERIA

This section presents the regulatory requirements, and acoustic design criteria for the proposed development.

4.1 INTERNAL NOISE LEVELS

4.1.1 Sydney Development Control Plan 2012

Section 4.2.3.11 of the Sydney DCP 2012 establishes the following acoustic criteria for residential and mixed use developments:

“The repeatable maximum $L_{Aeq(1\text{ hour})}$ for residential buildings and serviced apartments must not exceed the following levels:

(a) for closed windows and doors:

(i) 35dB for bedrooms (10pm-7am); and

(ii) 45dB for main living areas (24 hours).

(b) for open windows and doors:

(i) 45dB for bedrooms (10pm-7am); and

(ii) 55dB for main living areas (24 hours).

Where natural ventilation of a room cannot be achieved, the repeatable maximum $L_{Aeq(1\text{ hour})}$ level in a dwelling when doors and windows are shut and air conditioning is operating must not exceed:

(a) 38dB for bedrooms (10pm-7am); and

(b) 48dB for main living areas (24 hours).

These levels are to include the combined measured level of noise from both external sources and the ventilation system operating normally.”

4.1.2 Development Near Rail Corridors and Busy Roads – Interim Guideline

The Department of Planning (DoP) Interim Guideline details the application of Clause 102 of the Infrastructure State Environmental Planning Policy (SEPP) which is required to be used when a residential development is adjacent to a freeway, a tollway, or transitway or a road with an annual average daily traffic volume (AADTV) of more than 20,000 vehicles. Based on the Transport for NSW Traffic Volume Viewer, Botany Road carries over 20,000 vehicles, therefore the DoP Interim Guideline is applicable.

The guideline states:

“If the development is for the purposes of residential accommodation, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following L_{Aeq} levels are not exceeded:

In any bedroom in the residential accommodation – 35 dB(A) at any time between 10.00 pm and 7.00 am,

Anywhere else in the residential accommodation (other than a garage, kitchen, bathroom or hallway) – 40 dB(A) at any time.”

The DoP’s Development near Rail Corridors and Busy Roads – Interim Guideline also states the following regarding an open windows assessment:

“If internal noise levels with windows or doors open exceed the criteria by more than 10dBA, the design of the ventilation for these rooms should be such that occupants can leave windows closed, if they so desire, and also to meet the ventilation requirements of the Building Code of Australia.”



4.2 EXTERNAL NOISE EMISSIONS

4.2.1 NSW EPA Noise Policy for Industry (NPI) 2017 – Industrial Noise (Plant and Equipment)

The NSW EPA’s Noise Policy for Industry (NPI) 2017 has been implemented to assess the noise impacts of mechanical plant and equipment, as well as other industrial noise sources on the surrounding receiver catchments.

The NPI sets out a framework for the derivation of project noise trigger levels that are used to assess the potential impacts of noise from industry (and industrial noise sources) and indicate the noise level at which feasible and reasonable noise management measures should be considered.

This policy applies to noise sources from activities listed in Schedule 1 of the POEO Act and those regulated by the EPA. This includes noise sources from mechanical plant and equipment within the proposed development, for which this policy will be applied.

The project noise trigger level provides a benchmark for assessing a proposal, where if exceeded, indicates a potential noise impact on the community and so triggers a management response such as additional mitigation measures. The project noise trigger level is the lower (the more stringent) value of the project intrusiveness noise level and project amenity noise level determined in Sections 2.3 and 2.4 of the NPI, respectively.

Project Intrusiveness Noise Level

The intrusiveness of an industrial noise source may generally be considered acceptable if the level of noise from the source (in terms of L_{Aeq}) measured over a 15-minute period does not exceed the background noise level by more than 5 dB when beyond a minimum threshold. The project intrusiveness noise level is only applicable to surrounding residential receivers.

To account for the temporal variation of background noise levels, the method outlined in Fact Sheet A of the NPI establishes a method in determining the Rating Background Noise Level (RBL) to be used in the assessment.

The intrusiveness noise level is determined as follows:

$$L_{Aeq,15min} \text{ (Intrusiveness Criteria)} = \text{Rating Background Noise Level (RBL)} + 5 \text{ dB(A)}$$

Where the RBLs established in accordance with Fact Sheet A are lower than the values presented in Table 4 for each assessment period, the values presented in Table 4 shall be used for that particular assessment period. These result in the minimum intrusiveness noise levels provided in Table 4.

Table 4: Minimum assumed RBLs and project intrusiveness noise levels

TIME OF DAY	MINIMUM ASSUMED RBL - dB(A)	MINIMUM PROJECT INTRUSIVENESS NOISE LEVELS - $L_{Aeq,15min}$ dB(A)
Day	35	40
Evening	30	35
Night	30	35

Table 5 provides the project intrusiveness noise levels applicable to each of the surrounding residential noise-sensitive receivers.

Table 5: Project intrusiveness noise level criteria for each residential receiver catchment

RECEIVER CATCHMENT	TIME OF DAY	MEASURED RBL - dB(A) ¹	PROJECT INTRUSIVENESS NOISE LEVELS - $L_{Aeq,15min}$ dB(A)
RC3, RC4, RC5 and RC7	Day	51	56
	Evening	50	55
	Night	42	47

Note 1: As a conservative approach, the lowest measured RBLs have been adopted to establish the project intrusiveness noise levels for surrounding residential receivers

Project Amenity Noise Level

The recommended amenity noise levels represent the objective for total industrial noise at a receiver location, whereas the project amenity noise level represents the objective for noise from a single industrial development at a receiver location.

To ensure that industrial noise levels (existing plus new) remain within the recommended amenity noise levels for an area, a project amenity noise level applies for each new source of industrial noise as follows:

$$\text{Project Amenity Noise Level} = \text{Recommended Amenity Noise Level (see Table 6)} - 5 \text{ dB(A)}$$

The following exceptions to the above method to derive the project amenity noise level apply:

- In areas with high traffic noise levels. Where the level of transport noise, road traffic noise in particular is high enough to make noise from an industrial source inaudible, the project amenity noise level shall be set at 15 dB(A) below the measured $L_{Aeq,period(traffic)}$ for the particular assessment period;
- In proposed developments in major industrial clusters;
- Where the resultant project amenity noise level is 10 dB(A) or more lower than the existing industrial noise level. In this case the project amenity noise levels can be set at 10 dB(A) below existing industrial noise levels if it can be demonstrated that existing industrial noise levels are unlikely to reduce over time; and
- Where cumulative industrial noise is not a necessary consideration because no other industries are present in the area, or likely to be introduced into the area in the future. In such cases the relevant amenity noise level is assigned as the project amenity noise level for the development.

The recommended amenity noise level, project amenity noise level, and converted project amenity noise level for comparison with the intrusiveness criteria (from time of day period to 15-minute) is provided for each surrounding receiver catchment in Table 6.



Table 6: Project amenity noise level criteria for each receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	RECOMMENDED AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,period}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)
RC3, RC4, RC5 and RC7	Residential (Urban)	Day	60	55	58
		Evening	50	45	48
		Night	45	40	43
RC2 and RC6	Commercial	When in use	65	60	63
RC1	Active Recreation	When in use	55	50	53

Note 1: Urban residential as classified in Table 2.3 of the Noise Policy for Industry (NPI) 2017

Sleep Disturbance and Maximum Noise Level Assessment

Where the proposed development night-time noise levels generated at a residential location exceed either:

- $L_{Aeq,15min}$ 40 dB(A) or the prevailing RBL plus 5 dB(A), whichever is greater, and/or
- L_{AFmax} 52 dB(A) or the prevailing RBL plus 15 dB(A), whichever is greater.

a detailed maximum noise level event assessment should be undertaken.

Corrections for Annoying Noise Characteristics – Noise Policy for Industry Fact Sheet C

Fact Sheet C contained within the Noise Policy for Industry outlines the correction factors to be applied to the source noise level at the receiver before comparison with the project noise trigger levels established within this report, to account for the additional annoyance caused by these modifying factors.

The modifying factor corrections should be applied having regard to:

- The contribution noise level from the premises when assessed/measured at a receiver location, and
- The nature of the noise source and its characteristics (as set out in Fact Sheet C).

Table C1 within Fact Sheet C sets out the corrections to be applied for any assessment in-line with the NPI. The corrections specified for tonal, intermittent and low-frequency noise are to be added to the measured or predicted levels at the receiver before comparison with the project noise trigger levels. The adjustments for duration are to be applied to the criterion.

Project Noise Trigger Levels

Table 7 presents the project intrusiveness and project amenity noise levels for each period, and each receiver catchment, as well as the resultant project noise trigger levels (PNTLs) that shall be applied for any assessment of impacts of mechanical plant and equipment noise on the surrounding receiver catchments.

Table 7: Project noise trigger levels (PNTL) to be applied to each surrounding receiver catchment

RECEIVER CATCHMENT	RECEIVER TYPE	TIME OF DAY	PROJECT INTRUSIVENESS NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	PROJECT AMENITY NOISE LEVEL - $L_{Aeq,15min}$ dB(A)	SLEEP DISTURBANCE NOISE LEVEL - dB(A)	PROJECT NOISE TRIGGER LEVEL - $L_{Aeq,15min}$ dB(A)
RC3, RC4, RC5 and RC7	Residential	Day	56	58	N/A	56
		Evening	55	48	N/A	48
		Night	47	43	47 $L_{Aeq,15min}$ 57 L_{AFmax}	43
RC2 and RC6	Commercial	When in use	N/A	63	N/A	63
RC1	Active Recreation	When in use	N/A	53	N/A	53

4.3 CONSTRUCTION NOISE CRITERIA

The noise criteria outlined within the Interim Construction Noise Guideline (ICNG) 2009 has been adopted for the assessment of noise emissions from the construction of the proposed development.

4.3.1 Airborne Noise – Residential Receiver Catchments

The airborne noise criteria for residential receivers inside surrounding receiver catchments have been extracted from Table 2 in the ICNG and is presented in Table 8 below.

Table 8: NSW ICNG construction noise criteria for surrounding residential receivers

TIME OF DAY	MANAGEMENT LEVEL $L_{Aeq,15min}^1$	HOW TO APPLY
Recommended Standard Hours: Monday – Friday 7am – 6pm	Noise Affected RBL + 10dB	<p>The noise-affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> ▪ Where the predicted or measured $L_{Aeq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residences of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
Saturday 8am – 1pm No work on Sundays or public holidays	Highly Noise Affected 75 dB(A)	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur in, taking into account: <ul style="list-style-type: none"> – Times identified by the community when they are less sensitive to noise (such as before and after school, for works near schools, or mid-morning or mid-afternoon for works near residences) – If the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Outside Recommended Standard Hours	Noise Affected RBL + 5dB	<ul style="list-style-type: none"> ▪ The proponent should apply all feasible and reasonable work practices to meet the noise affected level. ▪ Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. ▪ For guidance on negotiating agreements see section 7.2.2.

Note 1: Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30m of the residence. Noise levels may be higher at upper floors of the noise affected residence.



4.3.2 Airborne Noise – Commercial Receiver Catchments

Per Section 4.1.3 of the ICNG, the airborne noise criterion for offices and retail outlets is $L_{Aeq, (15 \text{ min})}$ 70 dB(A) externally. This has been adopted for commercial receivers inside surrounding receiver catchments.

4.3.3 Airborne Noise – Active Recreation Receiver Catchments

Per Section 4.1.2 of the ICNG, the airborne noise criterion for active recreation areas is $L_{Aeq, (15 \text{ min})}$ 65 dB(A) externally. This has been adopted for active recreation receivers inside surrounding receiver catchments.

4.3.4 Ground-borne Noise – Residential Receiver Catchments

Ground-borne noise is noise generated by vibration transmitted through the ground into a structure, such as an excavator with a hydraulic hammer attachment, or impact/bore piling. The following ground-borne noise levels for residences have been extracted from Section 4.2 of the ICNG and indicate when management actions should be implemented.

- Evening (6pm to 10pm) – Internal Noise Level: $L_{Aeq, 15min}$ 40 dB(A); and
- Night-time (10pm to 7am) – Internal Noise Level: $L_{Aeq, 15min}$ 35 dB(A).

An assessment of ground-borne noise to these levels is only required when the ground-borne noise levels are higher than airborne noise levels, and for surrounding residential receiver catchments. The ground-borne noise levels are for evening and night-time periods only. The levels shall be assessed at the centre of the most affected habitable room.

4.4 CONSTRUCTION VIBRATION CRITERIA

4.4.1 Human Comfort – Continuous and Impulsive Vibration Criteria

Where occupants can detect vibration in buildings, this may potentially impact on their quality of life or working efficiency. The level of vibration that affects the amenity of occupants within a building is lower than that associated with building damage. The NSW DEC have prepared a guideline, “*Assessing vibration: a technical guideline*”, which presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques.

Acceptable values of human exposure to continuous and impulsive vibration are dependent on the time of day and the activity taking place in the occupied space. Guidance on preferred values for continuous and impulsive vibration acceleration is provided in Table 9.

Table 9: Preferred and maximum weighted RMS values for continuous and impulsive vibration acceleration (m/s^2) 1-80 Hz

LOCATION	ASSESSMENT PERIOD ¹	PREFERRED VALUES		MAXIMUM VALUES	
		z-axis	x- and y-axes	z-axis	x- and y-axes
Continuous vibration					
Residences	Daytime	0.010	0.0071	0.020	0.014
	Night time	0.007	0.005	0.014	0.010
Offices, schools, educational institutions and places of worship	Day- or night time	0.020	0.014	0.040	0.028
Impulsive vibration					
Residences	Daytime	0.30	0.21	0.60	0.42
	Night time	0.10	0.071	0.20	0.14
Offices, schools, educational institutions and places of worship	Day- or night time	0.64	0.46	1.28	0.92

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

4.4.2 Human Comfort – Intermittent Vibration Criteria

Intermittent vibration is vibration which is perceived in separately identifiable repeated bursts. Its onset can be sudden, or there might be a gradual onset and termination bounding a more sustained event. The vibration dose value (VDV) defines a relationship that yields a consistent assessment of intermittent vibration and correlates well with subjective human response.

Acceptable values of vibration dose have been extracted from Table 2.4 of the guideline and are presented in Table 10.

Table 10: Acceptable vibration dose values for intermittent vibration ($m/s^{1.75}$)

LOCATION	DAYTIME ¹		NIGHT-TIME ¹	
	PREFERRED VALUE	MAXIMUM VALUE	PREFERRED VALUE	MAXIMUM VALUE
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80

Note 1: Daytime is 7:00am to 10:00pm and night time is 10:00pm to 7:00am

4.4.3 Cosmetic Damage

Structural vibration thresholds are set to minimize the risk of cosmetic surface cracks and lie below the levels that have the potential to cause damage to the main structure. Table 11 presents guide values for building vibration, based on the vibration thresholds above which cosmetic damage has been demonstrated outlined within BS7385-Part 2:1993. These values are evaluated to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as 95% probability of no effect.

Table 11: Transient vibration guide values for cosmetic damage – BS 7385-2:1993

TYPE OF BUILDING	PEAK PARTICLE VELOCITY IN FREQUENCY RANGE OF PREDOMINANT PULSE (PPV)	
	4 Hz TO 15 Hz	15 Hz AND ABOVE
Reinforced or framed structures Industrial or light commercial type buildings	50mm/s	N/A
Unreinforced or light framed structures Residential or light commercial type buildings	15mm/s	20mm/s (50mm/s at 40Hz and above)

4.4.4 Structural Damage

Structural damage criteria are established within DIN4150-Part 3 “Structural vibration in buildings – Effects on structures”. Table 12 indicates the vibration limits presented in DIN4150-Part 3, where upon exceeding these thresholds lies the risk in inducing structural damage.

Table 12: Guideline value of vibration velocity, v_i , for evaluating the effects of short-term vibration – DIN4150-3

LINE	TYPE OF STRUCTURE	VIBRATION VELOCITY, v_i , IN MM/S				PLANE OF FLOOR OF UPPERMOST FULL STOREY
		FOUNDATION			ALL FREQUENCIES	
		AT A FREQUENCY OF				
		LESS THAN 10HZ	10 TO 50HZ	50 TO 100HZ*		
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	
2	Dwellings and buildings of similar design and/or use	5	5 to 15	15 to 20	15	
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (e.g. buildings that are under a preservation order)	3	3 to 8	8 to 10	8	

*For frequencies above 100Hz, at least the values specified in this column shall be applied

5 NOISE IMPACT ASSESSMENT

5.1 MECHANICAL PLANT AND EQUIPMENT NOISE EMISSION

At this stage of the proposed development, mechanical plant and equipment selections have not been made. During the design development stage of the project, the mitigation measures outlined in Section 6.1 should be considered when preparing the mechanical services to design to ensure compliance with the external noise emissions criteria established in Section 4.2.

It should be noted that any significant external noise emissions from mechanical plant and equipment are not expected to occur from the development that would require screening or the like.

5.2 EXTERNAL NOISE INTRUSION

5.2.1 Noise Modelling and Assumptions

In order to provide acoustic amenity to occupants of the proposed development and comply with the project specific internal noise limits, the noise impact of surrounding noise sources (Epsom Rd, Link Rd and Eastern Distributor) was assessed at the façade of the proposed development within the proposed development.

3D acoustic modelling for noise emissions from the surrounding roads was conducted using the software SoundPlan (Version 8.2). Noise emissions and impacts from vehicle movements on the surrounding roads were modelled in accordance with the CoRTN prediction techniques and calibrated to the measurements conducted for this assessment.

This model is recognised by regulatory authorities around Australia and is endorsed by the NSW DP&E for use in projects of this scale. The acoustic modelling was undertaken considering specific meteorological characteristics such as wind speeds, prevailing wind directions and temperature in accordance with the hourly weather data for a full calendar year described in the Test Reference Year for Mascot 1987 (94767 Mascot (Syd AMO) 1978-87 1987).

Attenuation due to distances, building shielding and environmental absorption, together with additional noise incident on the façade due to façade reflections are taken into account within the 3D model.

5.2.2 “Windows Closed” Assessment

The results of the 3D modelling are provided in Appendix A (in the form of façade noise contours), showing the incident noise levels on the façade (daytime and night-time) as a result of noise emissions from the external noise sources mentioned above. The incident noise levels are presented in the following noise metrics (being the more onerous requirement between Sydney DCP 2012 and DoP Interim Guideline for day/night):

- $L_{Aeq,1h}$ statistical form for the purpose of demonstrating compliance with the Sydney DCP 2012 during night-time period
- $L_{Aeq,15h}$ statistical form for the purpose of demonstrating compliance with the DoP Interim Guideline during the daytime period

5.2.3 “Windows Open” Assessment

A preliminary “windows open” assessment has been conducted to assess whether the habitable spaces can meet the project internal noise limits established in Section 4.1.1 with windows open for natural ventilation (open in accordance with the natural ventilation requirements of the National Construction Code 2019 and Apartment Design Guide), and to assist the next stages of design development in understanding the façade designs suitable to facilitate acoustic comfort.

Appendix B provides preliminary zones where openings in the façade may result in noise exceedances in the “windows open” acoustic criteria (for bedrooms and living areas). The legend for the zones is further explained in Section 6.2 It should be noted that these zones are preliminary, and may change as the design develops due to a change in the building form, form of the façade, internal finishes within each of the habitable spaces, additional measurements to be undertaken once the COVID-19 lockdown is uplifted, and location of openings.



6 NOISE MITIGATION MEASURES

6.1 MECHANICAL PLANT AND EQUIPMENT NOISE MITIGATION

Mitigation measures for the mechanical plant should be considered during the design development stage to ensure compliance with the outlined criteria at the nearest sensitive receiver catchments. These mitigation measures could include but not limited to the following:

- Positioning mechanical plant away from nearby receivers
- Acoustic attenuators fitted to duct work
- Screening around mechanical plant
- Acoustic insulation within duct work

It should be noted that the noise reduction requirements will likely be refined and reduced once the mechanical plant and equipment selections and designs have been progressed further during the detailed design of the proposed development. The mitigation measures proposed at this stage of the development are conservative in nature.

6.2 EXTERNAL NOISE INTRUSION MITIGATION

6.2.1 “Windows Closed” Mitigation

The acoustic design requirements for the façade to achieve the “windows closed” acoustic criteria established within Section 4.1.1 should be considered in later design stages when the apartment layouts, façade types and further details are developed.

6.2.2 “Windows Open” Mitigation

Where this is an exceedance in the “windows open” acoustic criteria, Table 13 provides façade design guidance that could be implemented as part of further design development. Table 13 shall be read in conjunction with Appendix B to understand the location of each exceedance zone. Ventilation openings to serve habitable spaces should be located in the “no exceedance” zones as far as practicable.

Table 13: Design guidance for natural ventilation designs to meet "Windows Open" acoustic criteria

"WINDOWS OPEN" EXCEEDANCE ZONE	DESIGN GUIDANCE
No Exceedance – 0 dB(A)	Openings can be made in this location without any special design requirements or shielding. These locations should be sought out for locating openings to naturally ventilate habitable spaces.
0 – 7dB(A) Exceedance	<p>Openings made in these locations for the purposes of facilitating natural ventilation to any habitable spaces will need to consider one or more of the following façade design elements:</p> <ul style="list-style-type: none"> ▪ Solid upstands/balustrades partnered with low level awning/casement windows. The distance between the window opening and the solid balustrade will affect the attenuation possible. ▪ Acoustically lined soffits with high level awning/casement windows that are top-opening and not bottom-opening (insulation to comply with requirements of BCA) ▪ Wintergardens ▪ The design of the building form could shield any windows or doors, casting a shadow over the window/door from the perspective of Epsom Rd, Link Rd and Eastern Distributor. The larger the shadow zone, the larger the exceedance.
>7dB(A) Exceedance	<p>In this zone, the following acoustic treatment should be investigated:</p> <ul style="list-style-type: none"> ▪ Increasing the shadow zone of the building from over and windows and doors (perspective from Epsom Rd, Link Rd and Eastern Distributor), to further reduce noise intrusion beyond 7dB(A) ▪ Acoustic ventilators/plenums/devices that incorporate the following design/functionality elements: <ul style="list-style-type: none"> – Sufficient acoustic attenuation to meet internal noise requirements – A method of opening and closing the device – Insect mesh – Prevention of water ingress – Accessibility for cleaning and maintenance

It should be noted that these zones are preliminary and may change as the design develops due to a change in the building form, form of the façade, internal finishes within each of the habitable spaces and location of openings.



7 CONCLUSION

This Noise and Vibration Impact Assessment has been prepared in support of a Development Application (DA) made to City of Sydney Council for the proposed development at 118-130 Epsom Road & 905 South Dowling Street, Zetland.

The assessment has considered the following key acoustic elements:

- Noise impact to the development's habitable areas (i.e. living rooms and bedrooms of apartments) from traffic movement along surrounding roads
- Noise emissions from mechanical plant associated with the project building to surrounding noise-sensitive receivers

To assess each of the acoustic considerations for the proposed development, noise and vibration criteria has been established in Section 4 in accordance with the following documents:

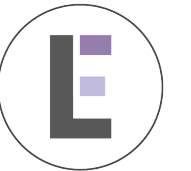
- Sydney Development Control Plan (DCP) 2012
- SEPP (Infrastructure) 2007
- Development Near Rail Corridors and Busy Roads – Interim Guideline
- NSW EPA Noise Policy for Industry (NPI) 2017
- Bureau of Meteorology, Daily rainfall report
- NSW EPA Interim Construction Noise Guideline (ICNG) 2009
- Assessing vibration: A technical guideline 2006
- British Standard BS5228 – Part 1:1997 “Noise and Vibration Control on Construction and Open Sites”
- British Standard BS7358:1993 “Evaluation and Measurement for Vibration in Buildings” – Part 2: “Guide to Damage Levels from Groundborne Vibration”
- German Standard DIN4150 – Part 3: “Structural vibration in buildings – Effects on structures”

Having given regard to the analysis conducted within this report, it is the finding of this noise and vibration impact assessment that the proposed development is compliant with the relevant noise and vibration criteria controls for this type of development, and it is expected to comply with the applicable regulations with regards to noise and vibration, particularly those listed above.

It is recommended the Development Application for the proposed development is not rejected on the basis of noise and vibration, under the implementation of the mitigation measures outlined within the report.

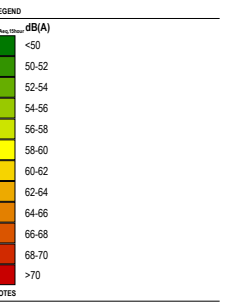
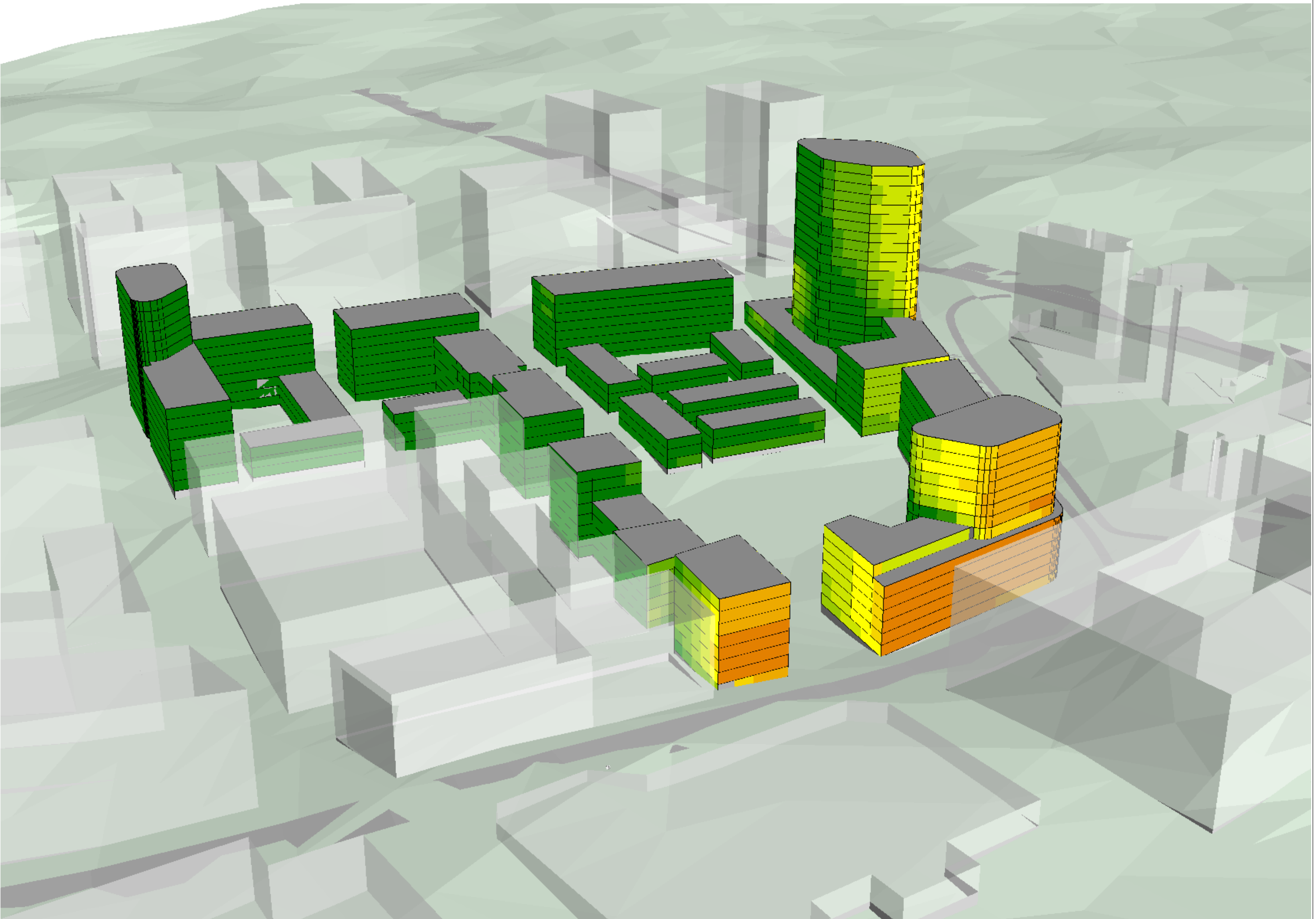
Appendix A **“Windows Closed” Façade Noise Levels**





E-LAB CONSULTING

ISSUE	DATE	STATUS
1	10/06/2022	For Information



PROJECT
115-130 EPSOM RD & 955 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

ARCHITECT
MAKO ARCHITECTURE



CLIENT
MERITON

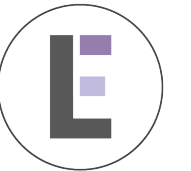
SCALE
NTS

STATUS
FOR INFORMATION

DRAWING
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NOISE LEVELS FOR LIVING ROOMS - VIEW 1

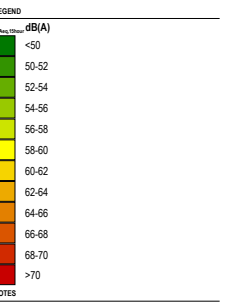
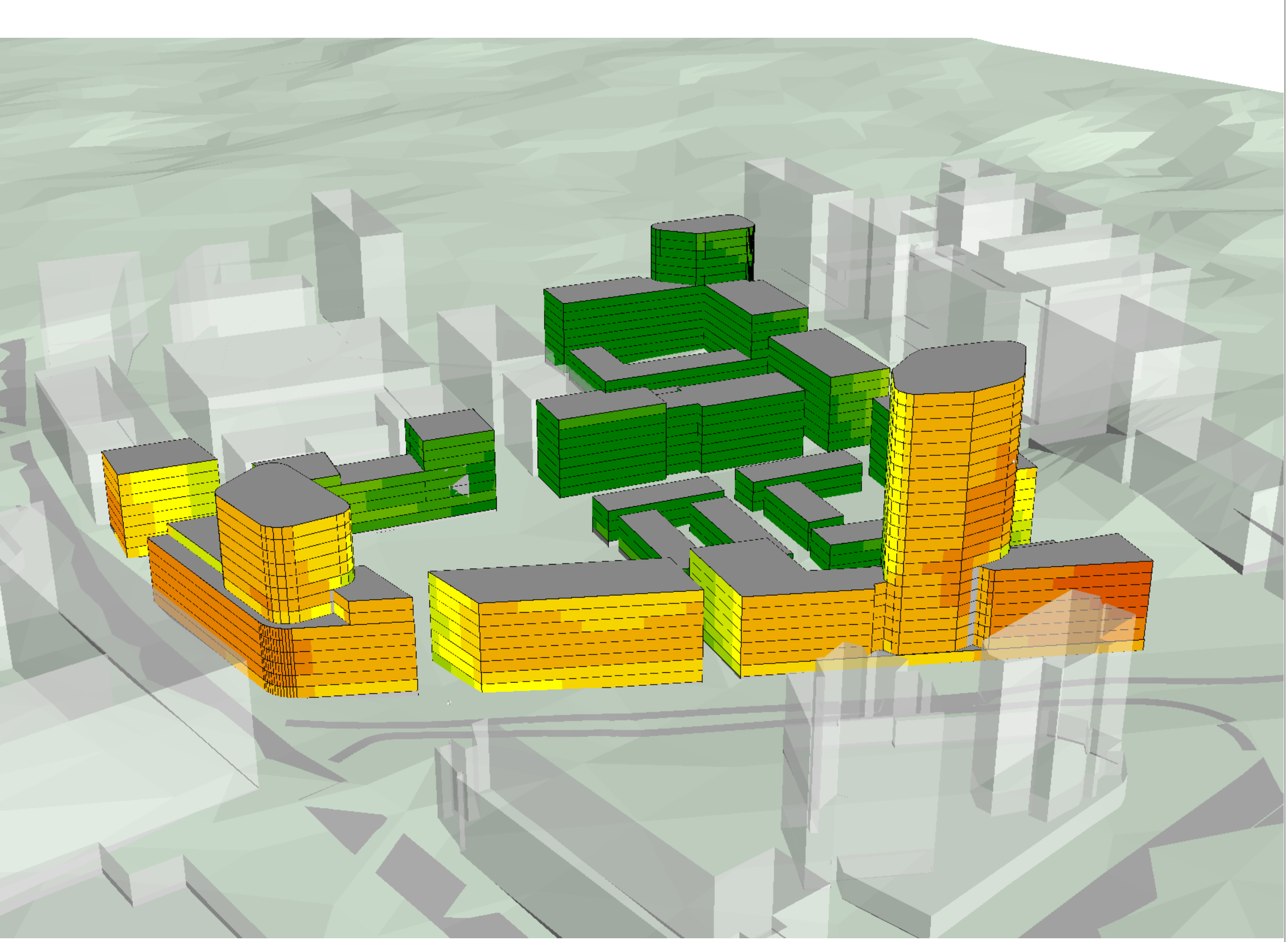
DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-200-01-01	001



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	10/05/2022	For Information



PROJECT
115-130 EPSOM RD & 955 SOUTH DOWLING ST, ZETLAND

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MERITON

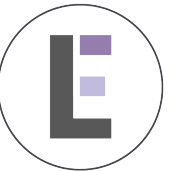
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STATUS
FOR INFORMATION

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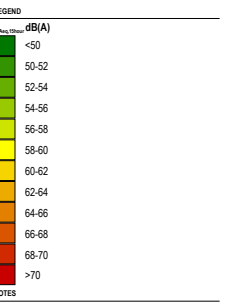
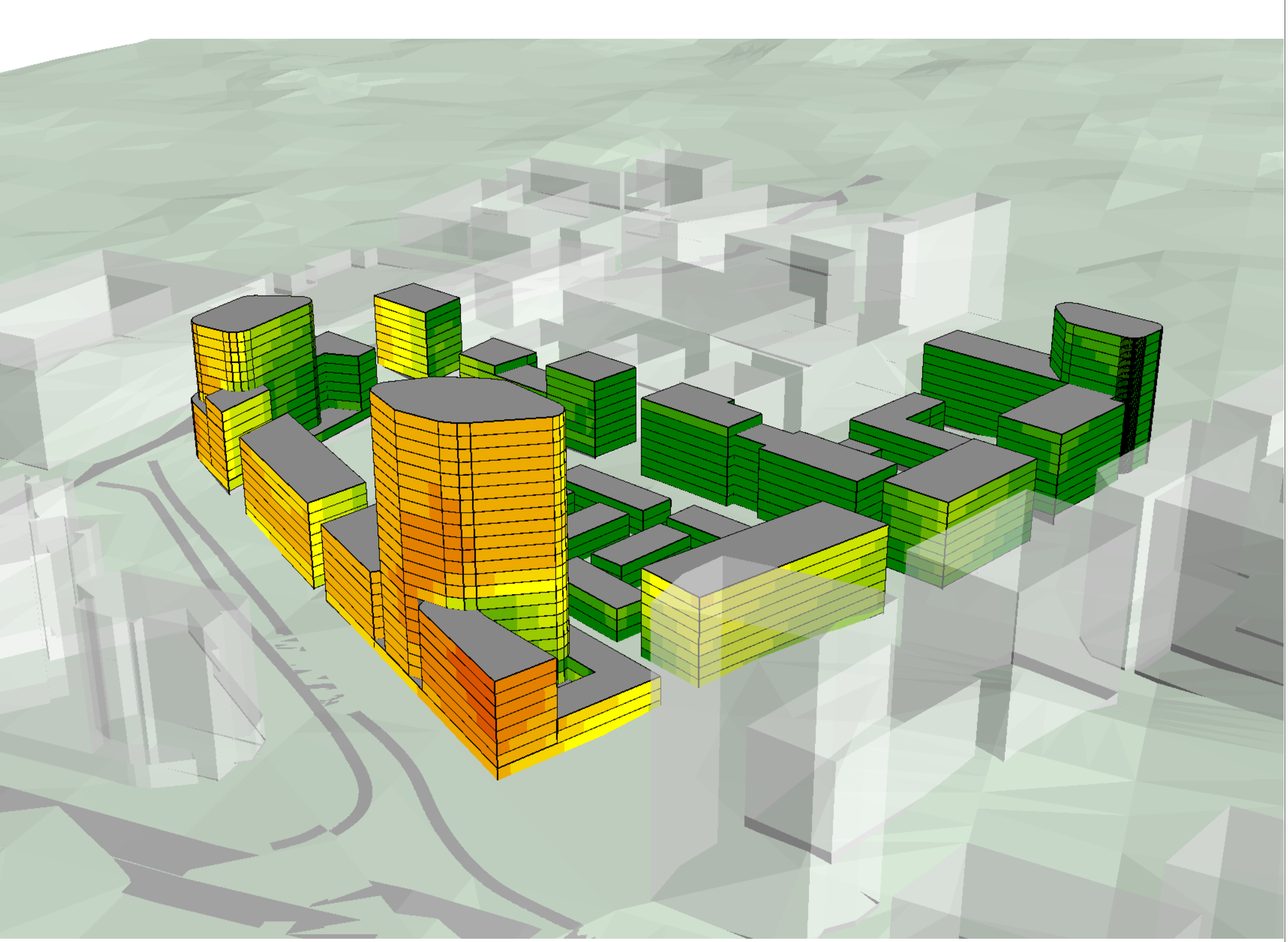
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ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-200-02-01	001



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ISSUE	DATE	STATUS
1	10/05/2022	For Information



PROJECT
115-135 EPSOM RD & 955 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

ARCHITECT
MAKO ARCHITECTURE



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MERITON

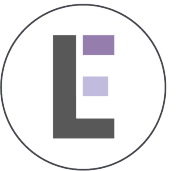
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STATUS
FOR INFORMATION

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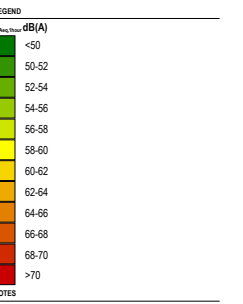
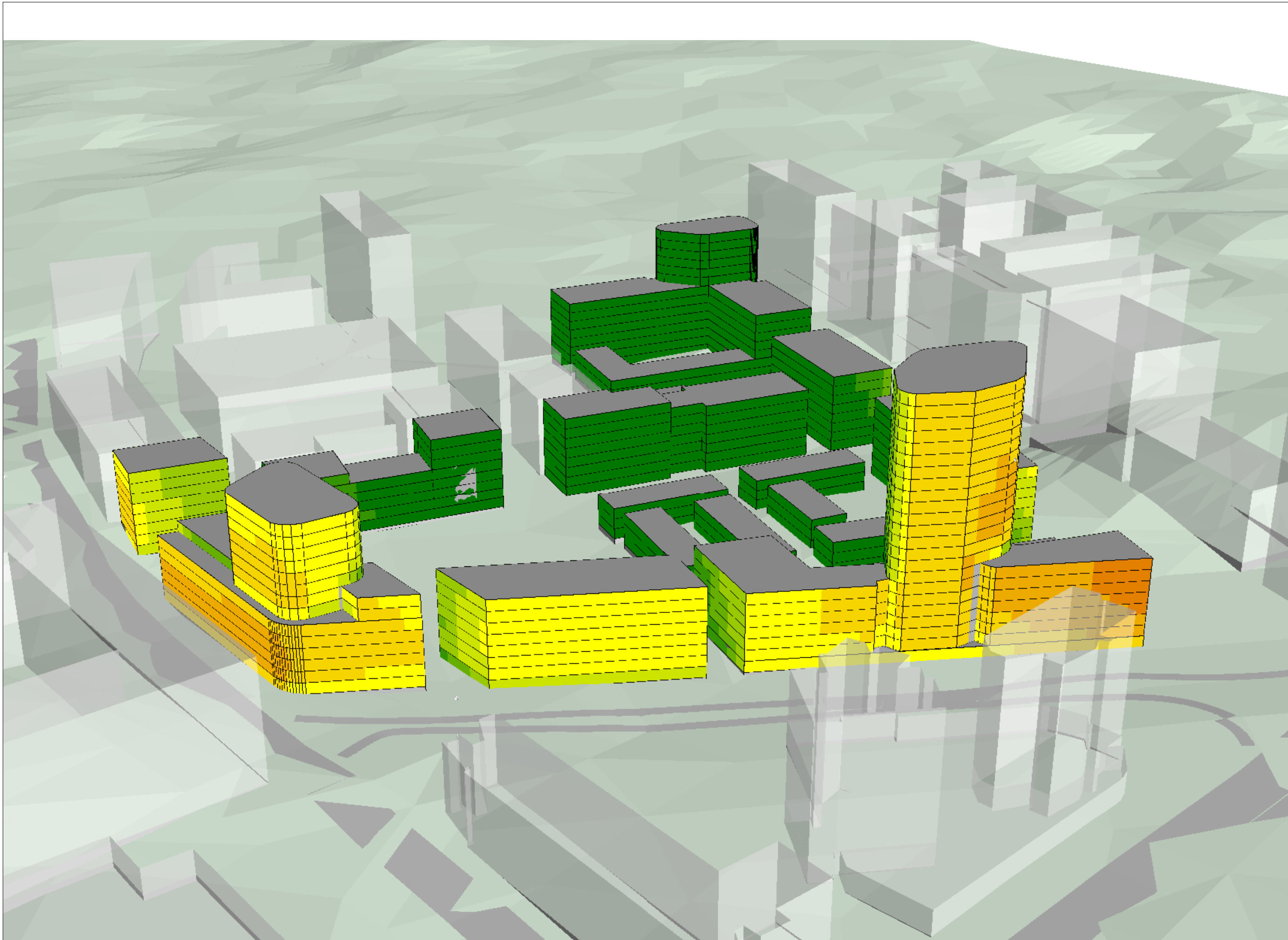
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DRAWING NUMBER	REVISION
AC-DWG-200-03-01	001



E-LAB CONSULTING

ISSUE	DATE	STATUS
1	10/05/2022	For Information



PROJECT
115-130 EPSOM RD & 905 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

ARCHITECT
MAKO ARCHITECTURE



CLIENT
MERITON

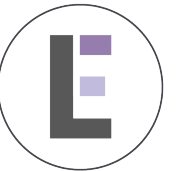
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STATUS
FOR INFORMATION

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NOISE LEVELS FOR BEDROOMS - VIEW 2

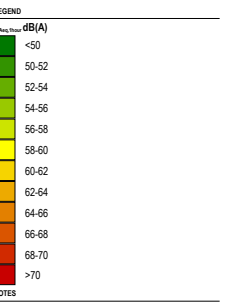
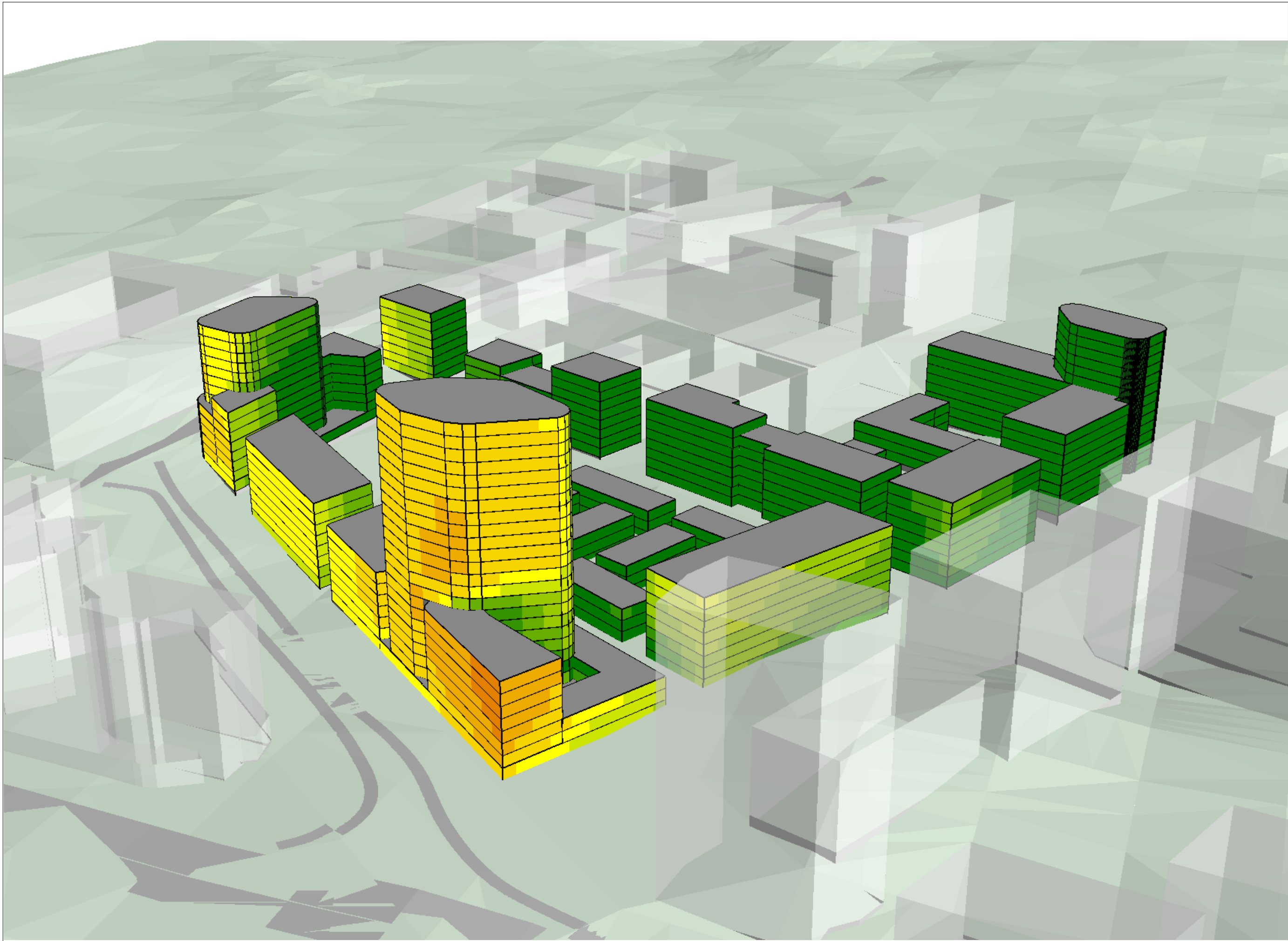
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ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-200-05-01	001



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ISSUE	DATE	STATUS
1	10/06/2022	For Information



PROJECT
115-135 EPSOM RD & 955 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

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SCALE
N.T.S.

STATUS
FOR INFORMATION

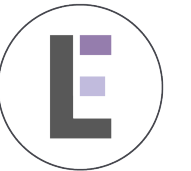
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NOISE LEVELS FOR BEDROOMS - VIEW 3

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-200-06-01	001

Appendix B “Windows Open” Assessment Zones





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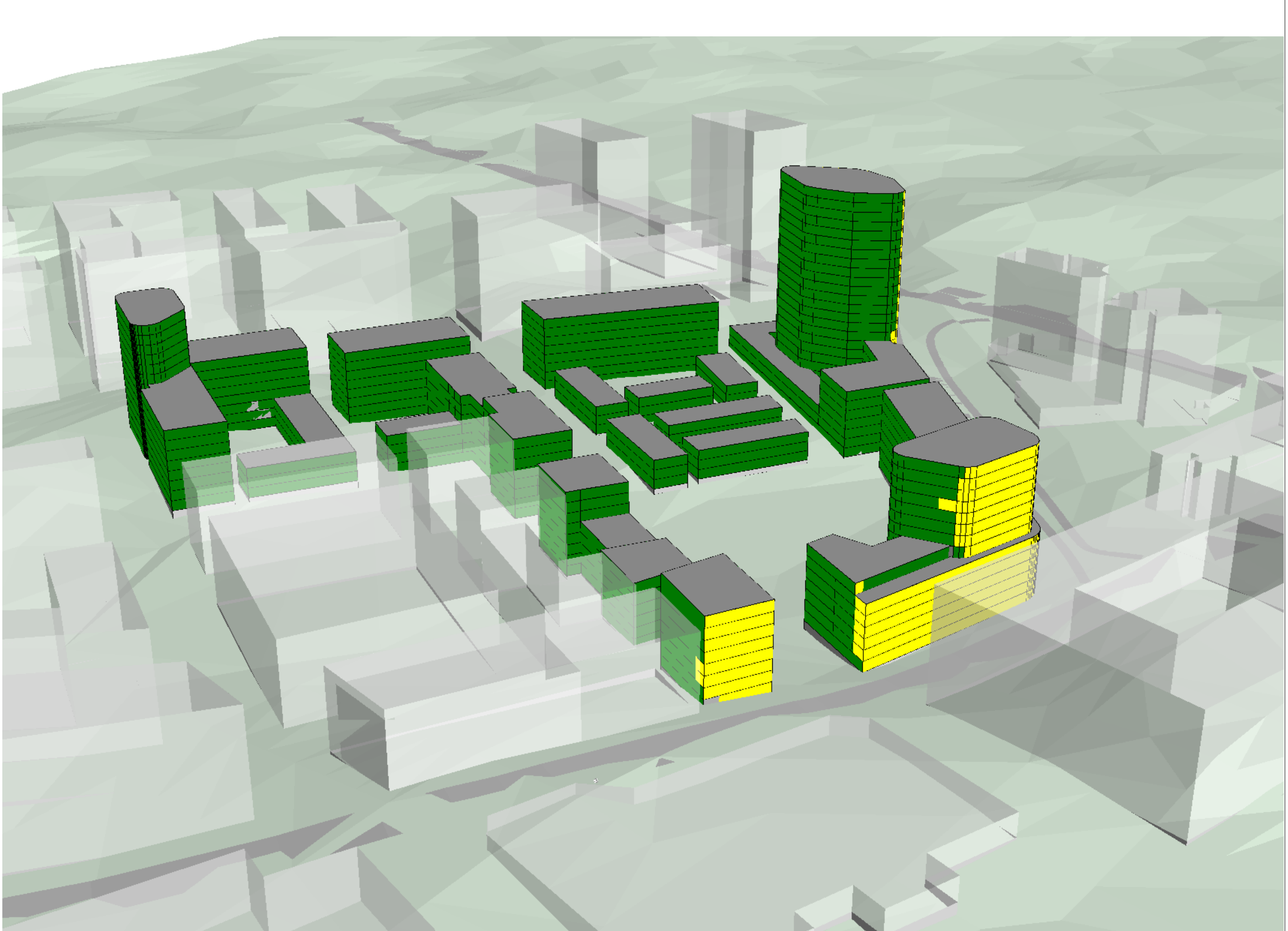
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1	12/05/2022	For Information
2	10/06/2022	For Information

LEGEND

"Windows Open" Exceedance Zone

■	No Exceedance
■	0-7 dB(A) Exceedance
■	> 7dB(A) Exceedance

NOTES



PROJECT
115-130 EPSOM RD & 905 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

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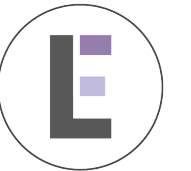
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STATUS
FOR INFORMATION

DRAWING
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FOR LIVING ROOMS - VIEW 1

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-100-01-02	002



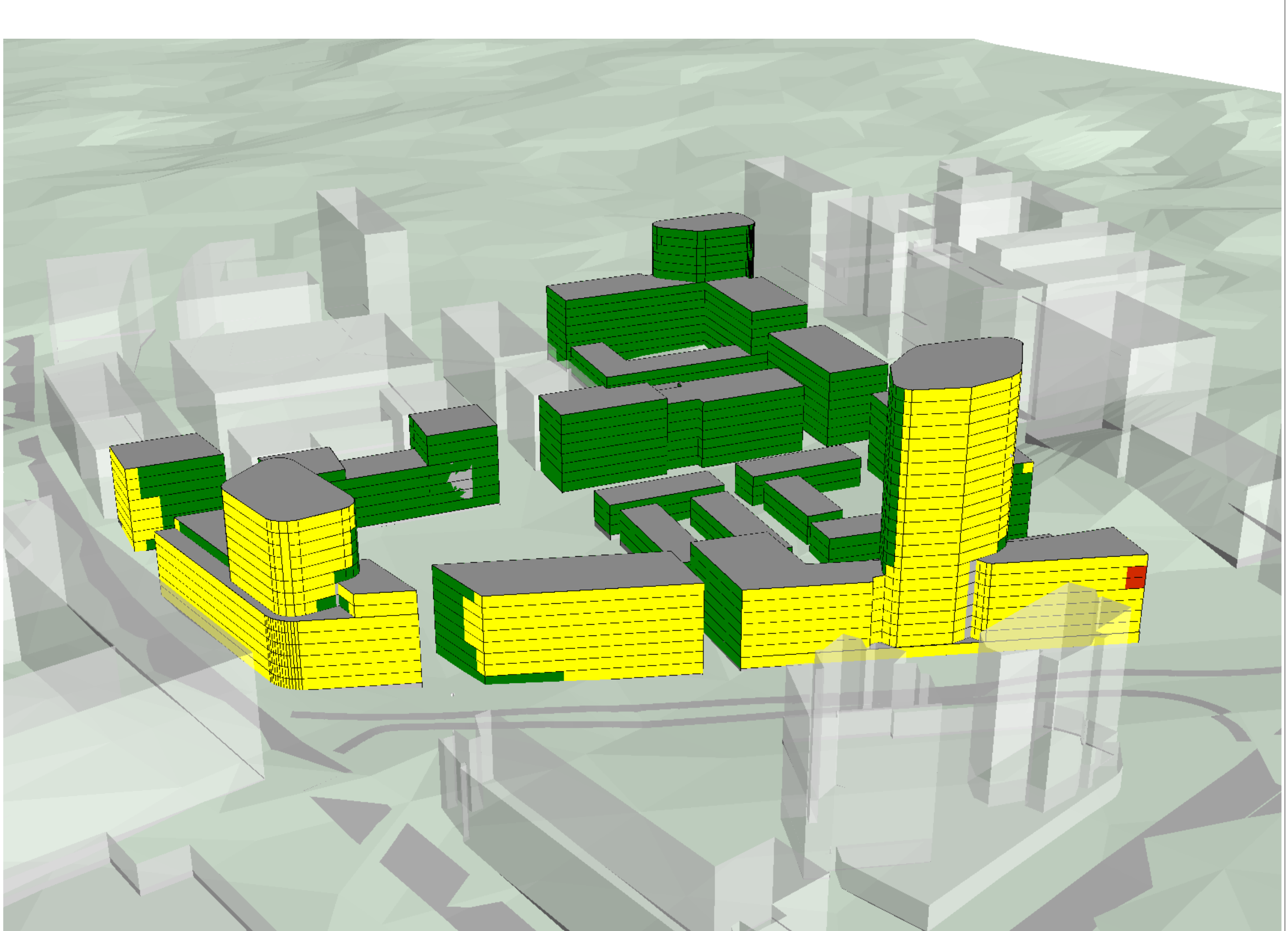
E-LAB CONSULTING

ISSUE	DATE	STATUS
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2	10/06/2022	For Information

LEGEND

"Windows Open" Exceedance Zone	
	No Exceedance
	0-7 dB(A) Exceedance
	> 7dB(A) Exceedance

NOTES



PROJECT
115-130 EPSOM RD & 905 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

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MAKO ARCHITECTURE



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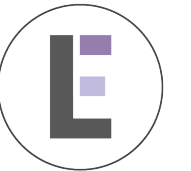
SCALE
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STATUS
FOR INFORMATION

DRAWING
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FOR LIVING ROOMS - VIEW 2

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-100-02-02	002



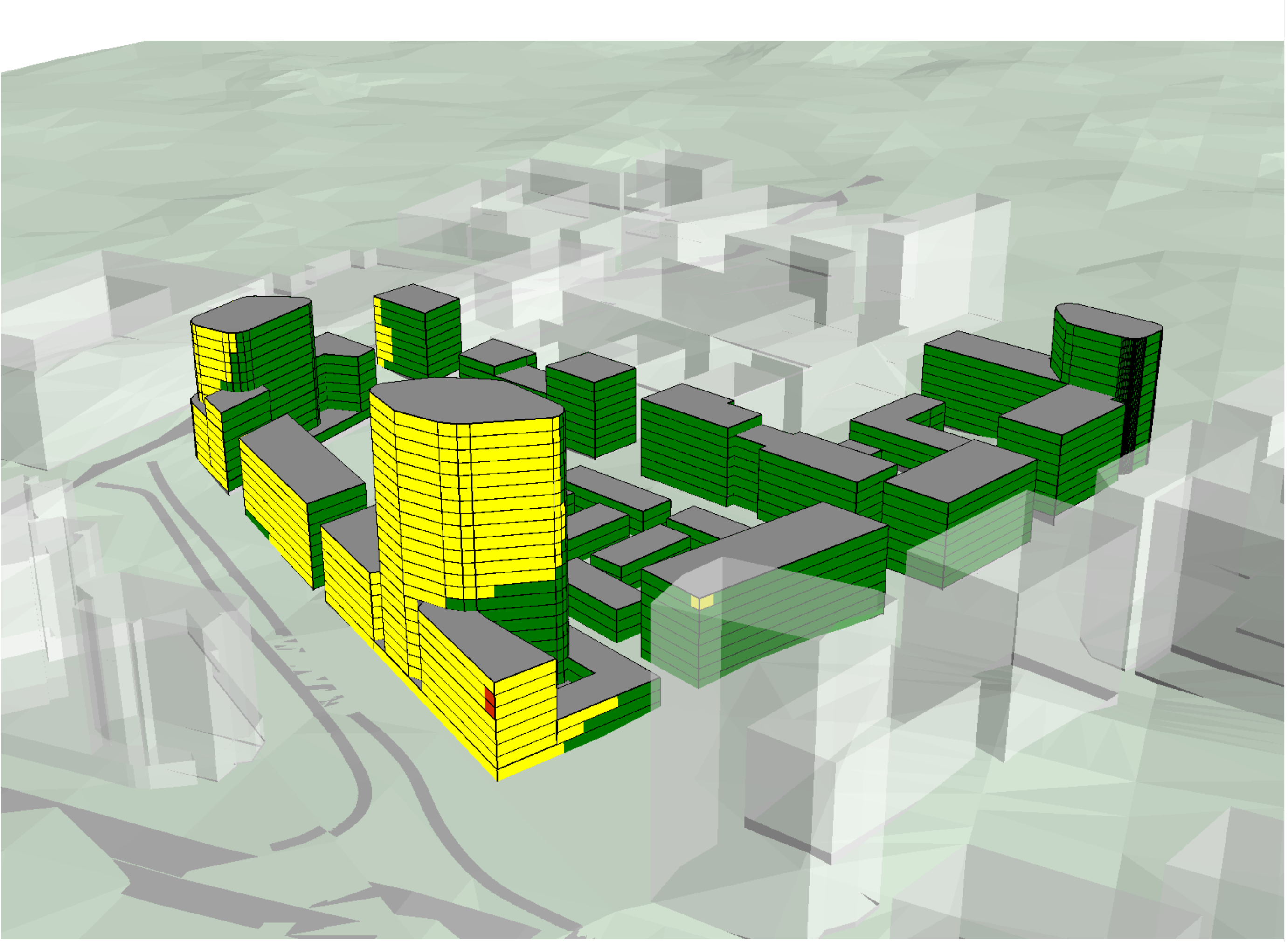
E-LAB CONSULTING

ISSUE	DATE	STATUS
1	12/05/2022	For Information
2	10/06/2022	For Information

LEGEND

"Windows Open" Exceedance Zone	
■	No Exceedance
■	0-7 dB(A) Exceedance
■	> 7dB(A) Exceedance

NOTES



PROJECT
115-130 EPSOM RD & 905 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P0226

ARCHITECT
MAKO ARCHITECTURE



CLIENT
MERITON

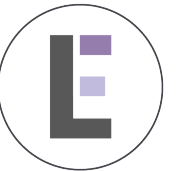
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FOR LIVING ROOMS - VIEW 3

DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-100-03-02	002



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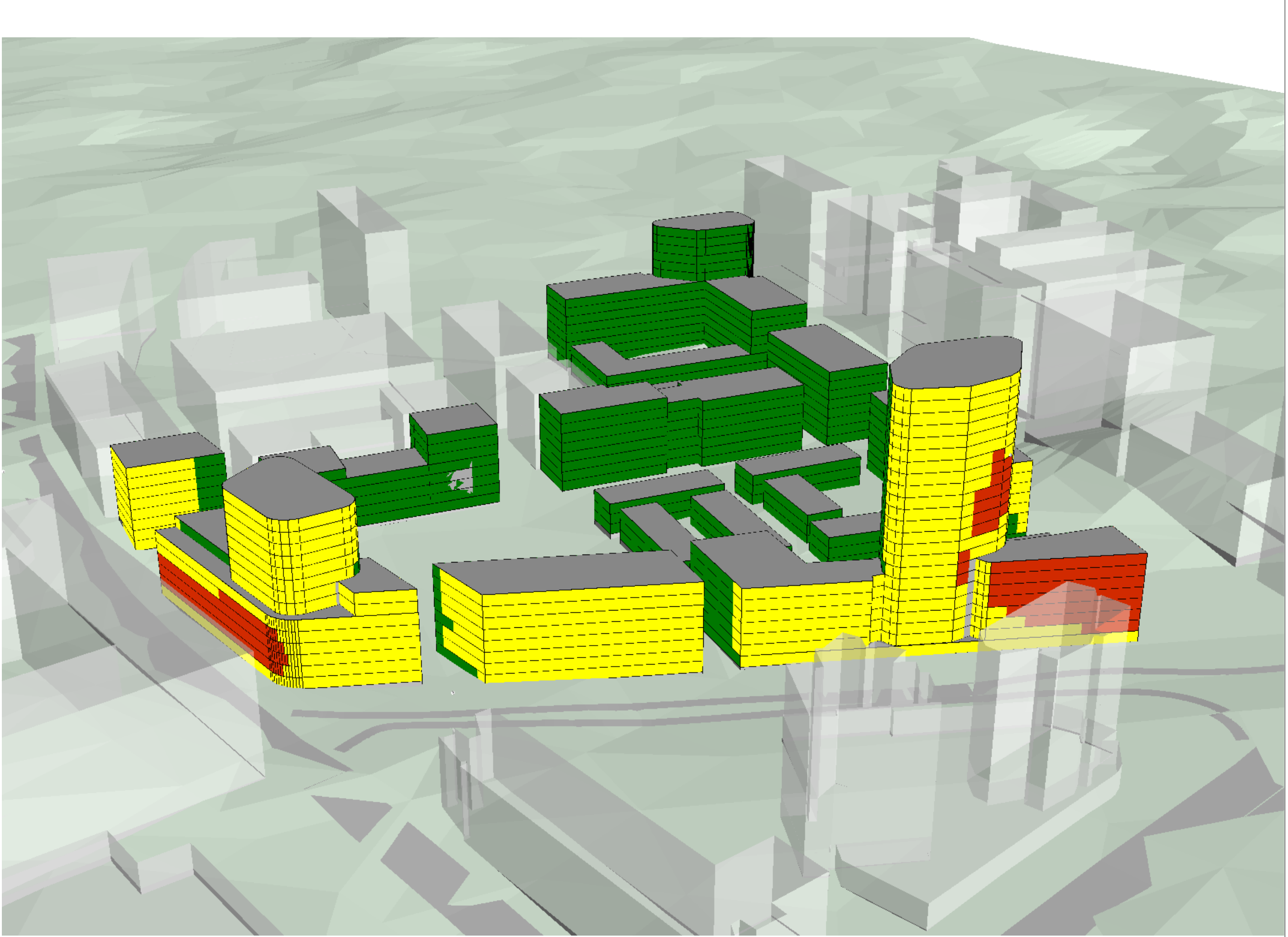
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2	16/06/2022	For Information

LEGEND

"Windows Open" Exceedance Zone

■	No Exceedance
■	0-7 dB(A) Exceedance
■	> 7dB(A) Exceedance

NOTES



PROJECT
115-135 EPSOM RD & 955 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

ARCHITECT
MAKO ARCHITECTURE



CLIENT
MERITON

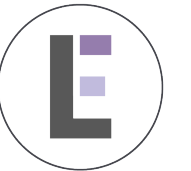
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STATUS
FOR INFORMATION

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DISCIPLINE
ACOUSTICS AND VIBRATION

DRAWING NUMBER	REVISION
AC-DWG-100-05-02	002



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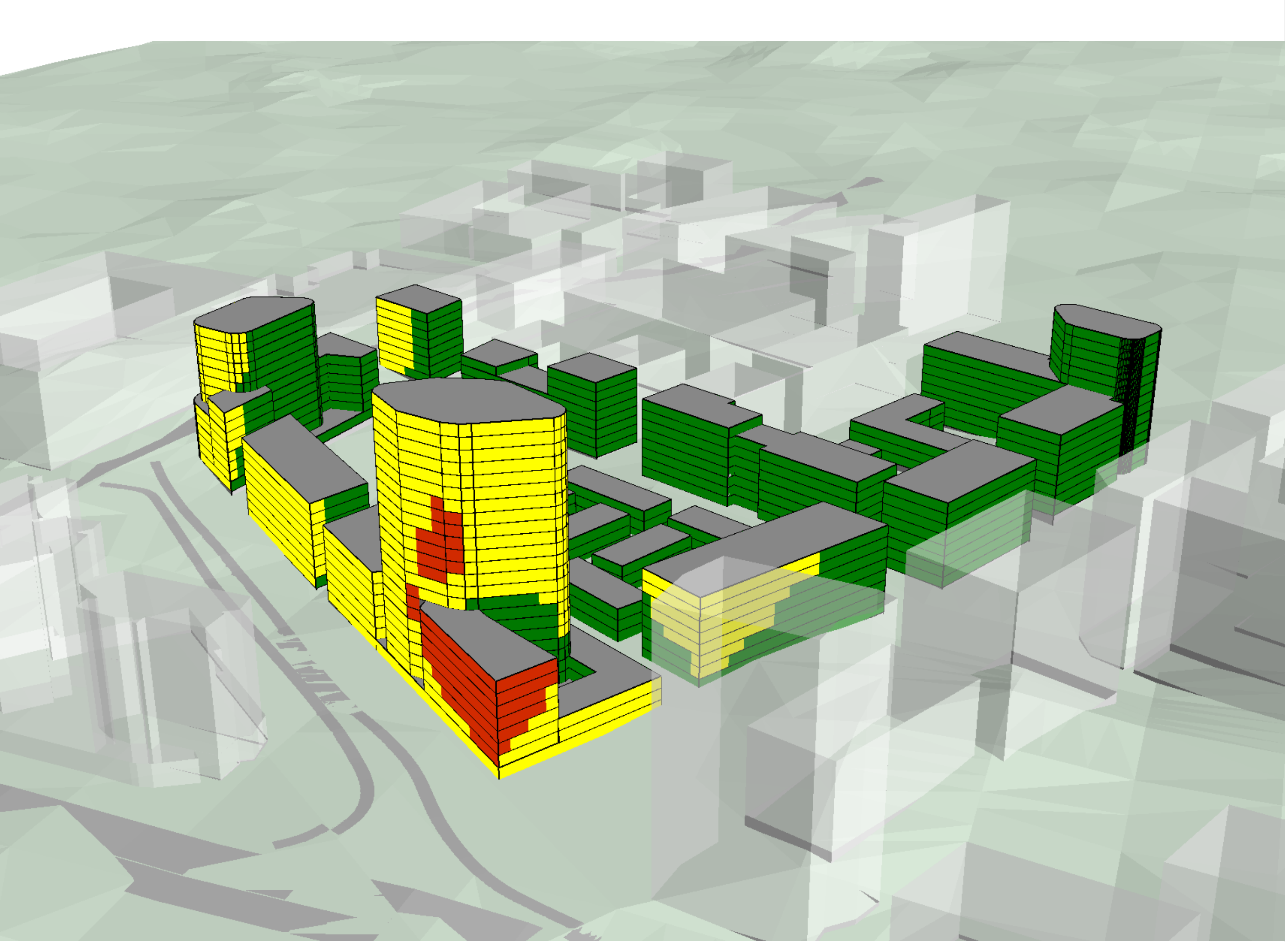
ISSUE	DATE	STATUS
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2	10/06/2022	For Information

LEGEND

"Windows Open" Exceedance Zone

- No Exceedance
- 0-7 dB(A) Exceedance
- > 7dB(A) Exceedance

NOTES



PROJECT
115-130 EPSOM RD & 905 SOUTH DOWLING ST, ZETLAND

PROJECT NO.
P00226

ARCHITECT
MAKO ARCHITECTURE



CLIENT
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SCALE
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STATUS
FOR INFORMATION

DRAWING
"WINDOWS OPEN" EXCEEDANCE ZONES FOR BEDROOMS - VIEW 3

DISCIPLINE
ACOUSTICS AND VIBRATION

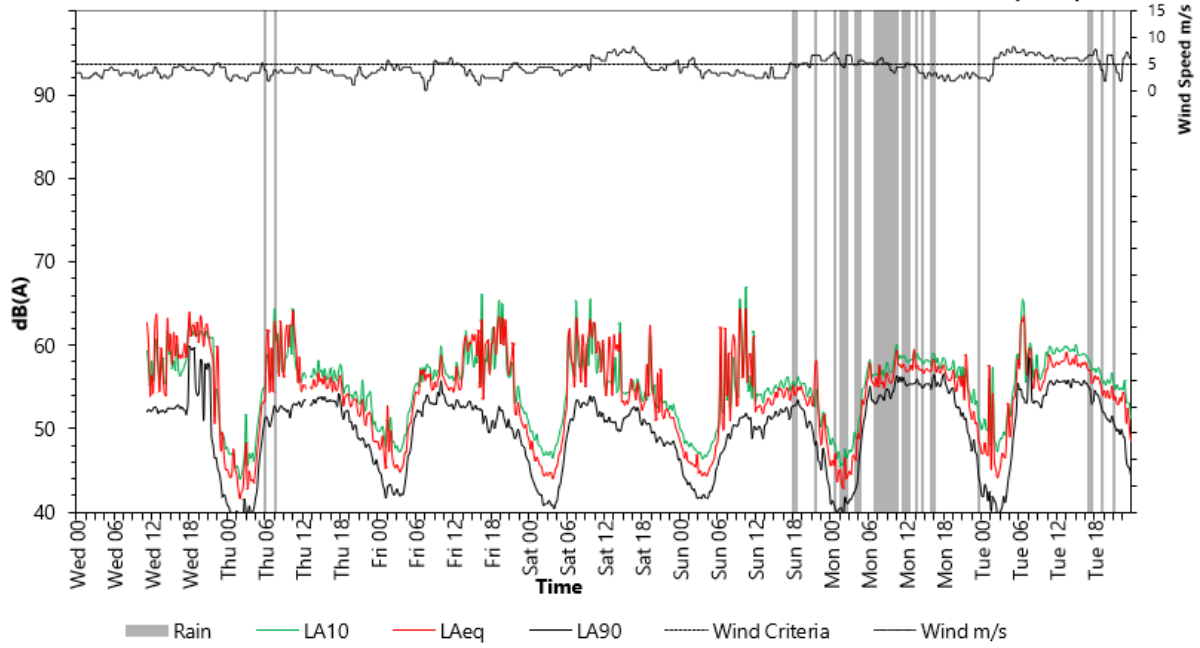
DRAWING NUMBER	REVISION
AC-DWG-100-06-02	002

Appendix C **Noise Monitoring Data**



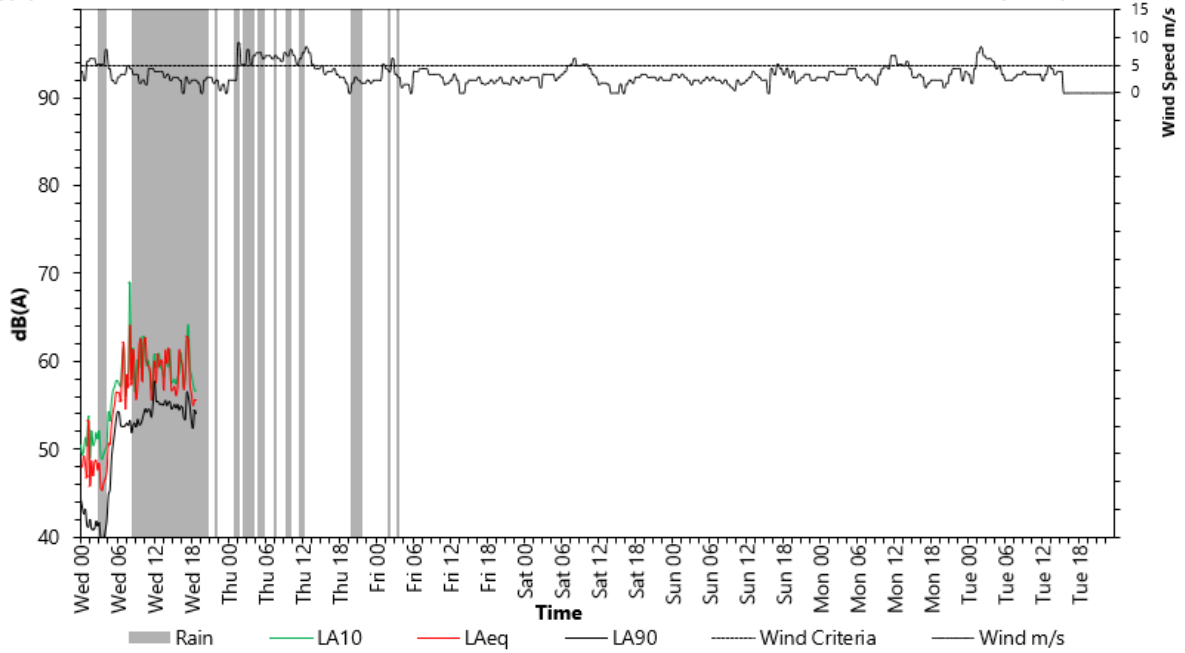
118-130 Epsom Rd & 905 South Dowling St, Zetland LT1

Wednesday 04 May 2022
to
Tuesday 10 May 2022



118-130 Epsom Rd & 905 South Dowling St, Zetland LT1

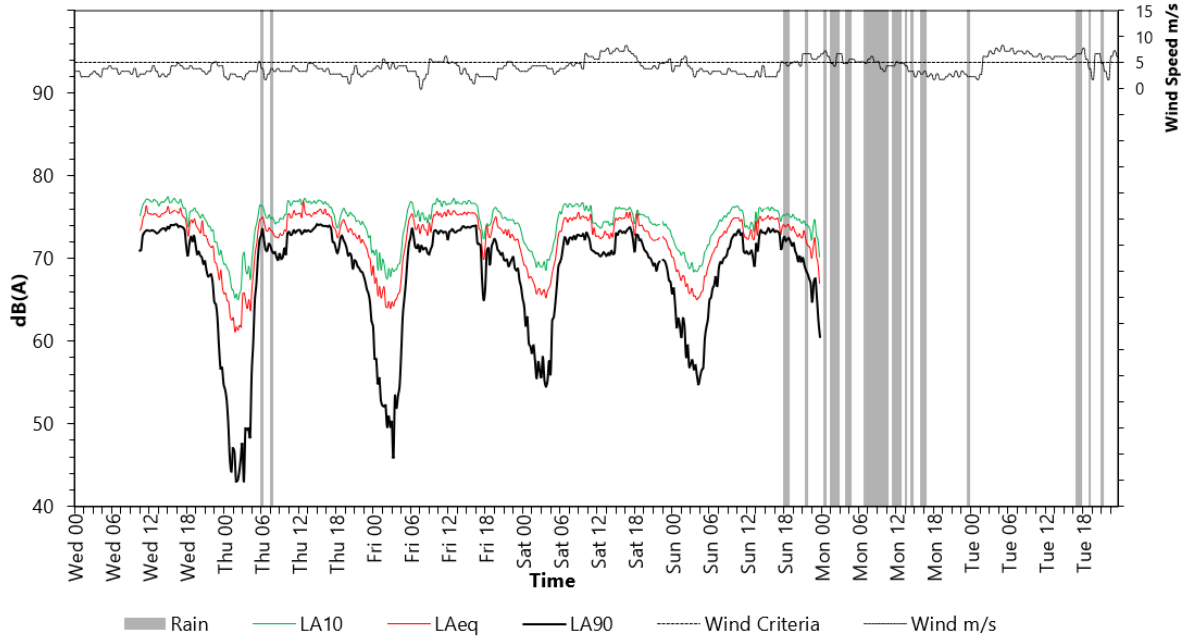
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to
Tuesday 17 May 2022



118-130 Epsom Rd & 905 South Dowling St, Zetland

Wednesday 04 May 2022
to
Tuesday 10 May 2022

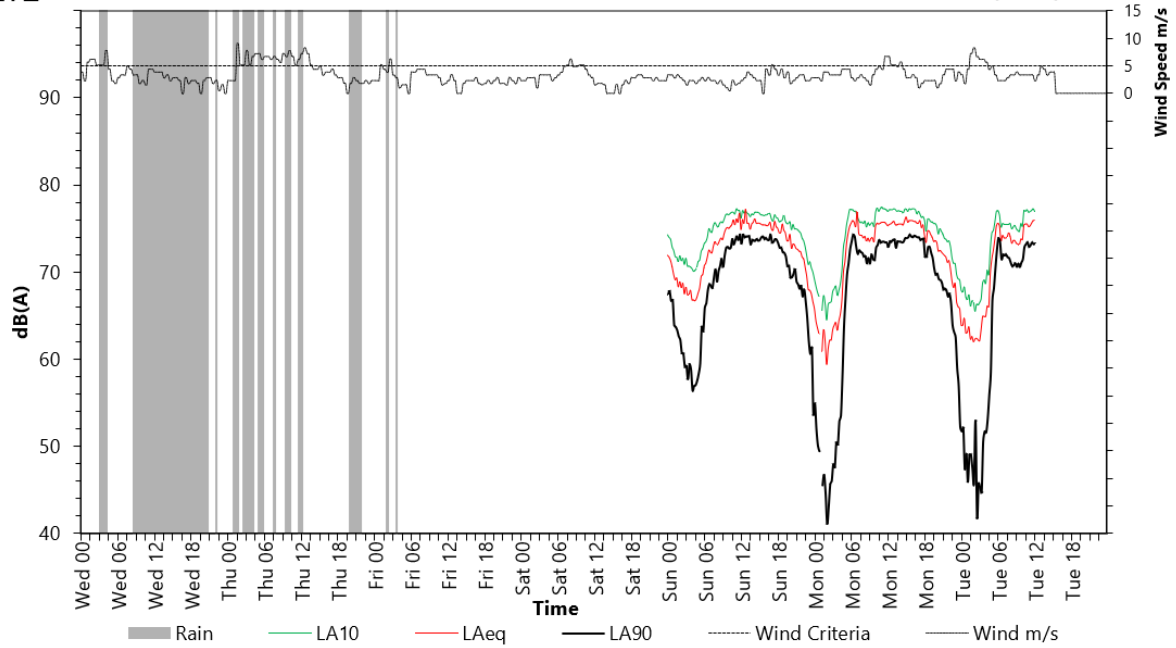
LT2



118-130 Epsom Rd & 905 South Dowling St, Zetland

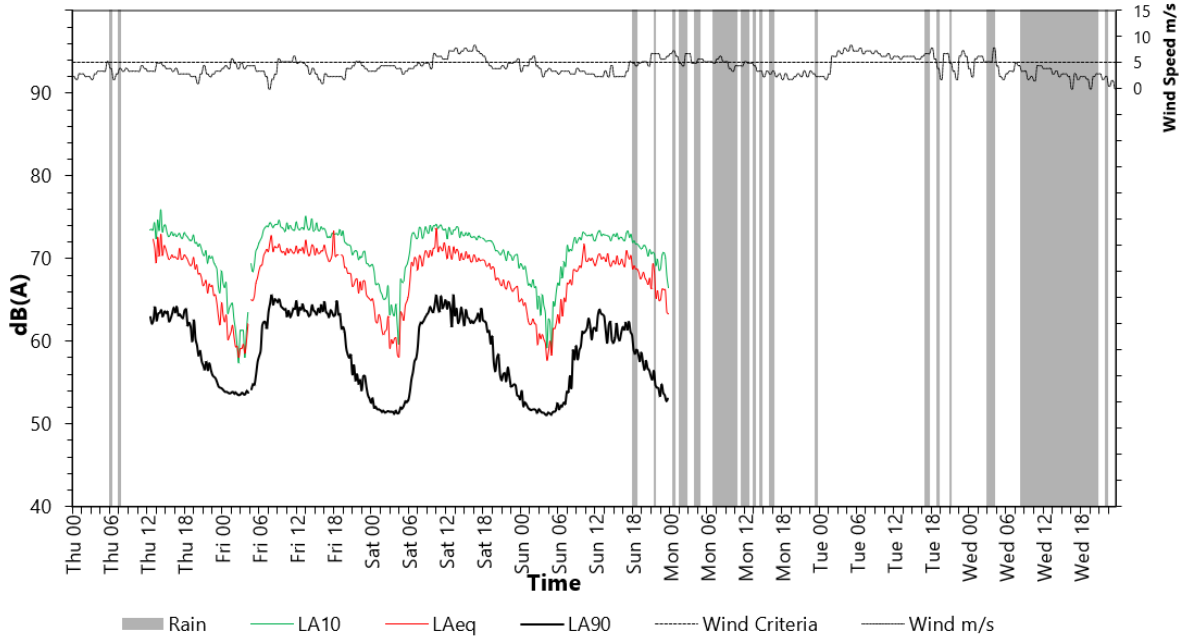
Wednesday 11 May 2022
to
Tuesday 17 May 2022

LT2



118-130 Epsom Rd & 905 South Dowling St, Zetland LT3

Thursday 05 May 2022
to
Wednesday 11 May 2022



118-130 Epsom Rd & 905 South Dowling St, Zetland LT3

Thursday 12 May 2022
to
Wednesday 18 May 2022

