MARSHALL DAY Acoustics

AYRBURN SCREEN HUB
ASSESSMENT OF NOISE EFFECTS

Rp 001 20250265 | 7 August 2025

84 Symonds Street
PO Box 5811
Victoria Street West
Auckland 1142 New Zealand
T: +64 9 379 7822 F: +64 9 309 3540
www.marshallday.com

Project: **AYRBURN SCREEN HUB**

Prepared for: **Waterfall Park Developments Ltd**
10 Viaduct Harbour
Auckland 1010

Attention: **George Watts**

Report No.: **Rp 001 20250265**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft		For team review	15/04/25	Micky Yang	Damian Ellerton
Approved	01		21/05/25	Micky Yang	Rob Hay
Approved	02	Minor updates	27/05/25	Micky Yang	-
Approved	03	Minor updates	1/07/25	Micky Yang	-
Approved	04	Minor updates	24/07/25	Micky Yang	-
Approved	05	Minor updates	07/08/25	Micky Yang	-

Cover Photo: ©fedorovekb - stock.adobe.com

TABLE OF CONTENTS

1.0 EXPERIENCE OF THE AUTHORS

The contributing authors, in their capacity as authors of this report, have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. Where this report relies on information provided by other experts, this is outlined within the report.

My name is Micky Suen Wen Yang, and I am the lead author of this report. I am a senior acoustic engineering consultant with 9 years' experience at Marshall Day Acoustics. I hold a Bachelor of Engineering and Commerce Conjoint degree from the University of Auckland. I have worked on a wide range of environmental noise project from large infrastructure to small event projects across the country. I am a Member of the Acoustical Society of New Zealand.

Damian Paul Ellerton is a reviewer and is an Associate at Marshall Day Acoustics. He holds a Science degree from Waikato University majoring in Earth Sciences (Soils), and a Master of Science Degree in Environmental Acoustics from South Bank University, London, England. He has worked in the field of acoustics for more than 20 years. He was employed by the New Plymouth District Council between 1994 and 1998 and his duties included assessment of noise compliance as well as assisting with policy development. Since 1998 he has worked as an acoustic consultant in England (3.5 years) and since then in New Zealand (3.5 years in Christchurch and 1.5 years in Wellington). He established the New Plymouth office for Marshall Day Acoustics in 2007.

Rob Lachlan Hay is the other reviewer and is an Associate and Director at Marshall Day Acoustics. He holds a Bachelor of Science and Masters of Science degree from the University of Canterbury, majoring in Chemistry. He has worked in the field of acoustics for over 21 years. He joined Marshall Day in 2006, and has been involved in many significant large scale environmental noise assessment projects throughout New Zealand including manufacturing, transportation and retailing and subdivision activities. Rob has assessed the noise effects of the Silverlight Studios film hub near Wanaka which was very similar in scope and nature to the proposed Ayrburn Screen Hub. He has also assessed the noise related effects of mixed-use subdivisions incorporating residential, hospitality and retail activities, which have significant areas of commonality to the proposal. The proposed Silverlight Studios development near Wanaka included provision for purpose built indoor studios, supporting workshops and offices, backlots, and both staff and visitor accommodation. While no single element of these assessments is acoustically unusual, the combination and scale specifically for filming related purposes in New Zealand is not common, with the closest more common comparison being large-scale mixed-use developments. Rob is familiar with the Ayrburn site and its surrounds, having visited the site numerous times since 2021 to undertake a variety of noise measurements, observe construction activities and for personal recreation.

2.0 SUMMARY

Marshall Day Acoustics has been engaged by Waterfall Park Developments Ltd (WPDL) to carry out an assessment of noise effects for the proposed Ayrburn Screen Hub development. We understand this is to be carried out as a Fast Track project.

This report presents:

- A description of the Screen Hub and potential noise sources
- The applicable noise performance standards for construction and proposed site activities
- The existing ambient noise environment
- The likely construction methodology and equipment needed
- Predicted construction noise and vibration levels
- Predicted site activity noise levels and an assessment of any noise effects

We find that:

- An Operational Noise Management Plan (ONMP) is considered necessary to assist management of site activity noise – a draft is appended to this report
- Operational noise from traffic, set construction (i.e. workshop noise) and amenity facilities can comply
- Backlot production can comply if carried out according to the mitigation measures in the ONMP
- All other related activities can comply.
- Construction noise can comply at all potential noise sensitive receivers
- Construction vibration can comply at all potential sensitive receivers
- The Environmental Management Plan contains appropriate construction noise and vibration management measures

In summary, noise and vibration from the construction and operation of the Screen Hub can be controlled to an appropriate and permitted level and accordingly there will be no unacceptable adverse noise effects.

Appendix A presents a glossary of terminology used in this report and Appendix B presents a site plan.

3.0 PROJECT DESCRIPTION

3.1 Overview

The Ayrburn Screen Hub project seeks to fill a gap in film production facilities in Otago. It is intended to be a one stop shop for productions of various sizes. The Screen Hub is comprised of:

- Studio buildings
- Workshops / workrooms for departments such as - wardrobe, rigging, stunts, specials, camera, steel, props fabrication, special effects, art and construction etc.
- Offices for departments such as - production, locations, art, wardrobe, construction, data, camera, postproduction / editing and special effects etc)
- Dressing rooms and rehearsal spaces for actors.
- Back lot space (flexible lot space for anything from shooting outdoor sets to parking spaces including tech and catering etc).
- Accommodation units for crew, together with associated amenity facilities

In addition, the application also proposes to relocate and reduce the size of the back of house functions of the existing Ayrburn hospitality precinct into one building called the 'Depot'. We understand the Depot will be used for storage and staffroom/offices.

When the Screen Hub is not in use ('hotel mode'), we understand the area is proposed to be used as hotel accommodation and office space.

Appendix C provides a description of the activity areas too.

3.2 Noise sources

The Screen Hub will be used for a variety of activities. We provide a brief commentary on the following potential key noise sources below – refer Section 5.2 for model inputs.

1. Traffic noise
2. Mechanical ventilation noise from the pool/amenity building, offices, and accommodation buildings
3. Production noise
    i. Workshop noise
    ii. Backlot noise
    iii. Sound stage noise
4. Office and accommodation use

3.2.1 Traffic noise

Traffic noise from vehicles using the Screen Hub or the associated facilities will form a major part of the noise profile from the Screen Hub. Vehicles will largely consist of passenger vehicles with some trucks from time to time.

Carriageway Consulting has carried out a transportation assessment[1] which we have relied on to assess traffic noise (see Section 5.3.2).

[1] Carriageway Consulting report 'Proposed Screen Hub Ayrburn' dated 4 February 2025

3.2.2 Mechanical ventilation noise

Any mechanical plant on the site around the Screen Hub will be designed to not cause intrusive noise into the sound stages, production offices, outdoor filming areas, or offices and accommodation units. We consider that mechanical plant noise received off site will be negligible, because noise levels would be controlled within site to typical residential/commercial noise levels.

We have excluded a mechanical noise assessment at this stage because the design of buildings and plant selection are not sufficiently advanced to make this an accurate exercise. This is typical of building developments during the resource consent process.

Nevertheless, careful consideration will need to be given to this at detailed design stage. Typically, this is guaranteed through a condition of consent that requires confirmation of design with respect to noise prior to uplifting the Building Consent. The following design choices would need to be considered to enable compliance:

- Mechanical unit selections
- Mechanical unit locations
- Noise barriers or noise enclosures design
- Attenuator or other engineering control design

In our experience, with careful design, mechanical noise can be reduced to an appropriate and compliant level. It is typical for a suitably qualified acoustic engineer to be involved during the HVAC design stage to assess and confirm this.

3.2.3 Production noise

The Ayrburn Design Report[2] provides commentary about how the production spaces will be used. We have used this to inform our model inputs which is provided in greater detail in Section 5.3.3 to Section 5.3.5.

We understand that the scale of productions will vary. This means the requirements for production area and space, time of day, and duration will also vary. The facilities have been designed so that two smaller productions can use the facility at the same time.

We understand that the Screen Hub will be operated generally as follows:

- Normal hours for preparation and shooting – 0800 – 1845 Monday to Friday
- Only occasional work needed after hours or on weekends
- Almost all filming will be done during the daytime.
- Night-time or twilight shoots may be required, but these are usually done on locations rather than at the Screen Hub.
- Night-time sequences that need to be shot at the Screen Hub will be done inside of a sound stage during the daytime because the sound stage environment can be controlled

[2] Ayrburn – Studio and Visitor Accommodation Design Report dated 3 June 2025

Workshop noise

The workshop space will cater for:

- The art department
- Wardrobes
- Rigging
- Stunts
- Special effects production
- Camera storage
- Props and set design and construction

We understand that smaller sets are also sometimes filmed in these areas. Section 5.4.2 provides our predicted noise levels.

Sound stage noise

Filming within indoor sound stages may generate significant noise from time to time. However, as the sound stages are noise sensitive receivers themselves, and are therefore designed to control ingress of external noise sources that may contaminate the filming environment, this will not result in elevated noise levels at potentially noise sensitive receivers (Section 5.0). Examples of such noise sources near to the Screen Hub include commercial and private flights overhead, and general activity noise on site including surrounding sound stages, and workshops. The high sound insulation design of the sound stages means they not only keep external noise out, but they keep their own noise in.

Based on our experience at similar facilities, we consider that filming within the sound stages will have negligible impact on surrounding neighbours. We have predicted filming inside of the sound stages to confirm this – see Section 5.4.3.

We understand the sound stages can also be used for set construction and storage of sets when they are not used for filming. We have used the workshop noise construction scenario for set construction, refer Section 5.4.2.

Backlot noise

We understand the backlot area is a flexible use area incorporating a hardstand near the studio buildings. It would be used for:

- Deliveries
- Catering/craft services
- Construction and filming of outdoor sets
- Parking of crew and cast vehicles including tech trucks, mobile dressing rooms, and bathrooms.

The only noise sources of note are set construction and outdoor filming. We have not predicted construction noise specifically for the Backlot because we have carried out a representative set construction noise scenario already (see Section 5.4.2).

To understand how a worst-case night-time outdoor film studio scenario might look in this location, a V8 wind and rain making equipment, along with a large crew and directors PA were modelled – refer Section 5.3.5.

3.2.4 Office, accommodation, and amenities use

We have not assessed office, accommodation, and private amenities use (such as yoga room, small private gym room, spa rooms, private treatment rooms). These activities can readily comply at the neighbouring sites because these activities occur indoors at typical of internal residential/office noise levels.

4.0 EXISTING AMBIENT NOISE ENVIRONMENT

We carried out unattended noise measurements for one week to quantify the typical existing ambient noise environment.

The measurements were carried out between 29 March 2025 and 5 April 2025.

Table 1 below provides a summary of results.

Refer Figure 1 overleaf to see the long-term logger position. The logger recorded noise levels continuously throughout that time period. Figure 2 overleaf shows a plot which includes the average levels and the range.

Note, we have excluded weather events where:

- rain was above 0 mm/hr
- wind was above 5m/s

Table 1: Summary of long-term measurement results

	Measured 5min L_{eq} (dBA)			Measured 5min L_{90} (dBA)		
	Average	**Min**	**Max**	**Average**	**Min**	**Max**
Day (0800 – 2000)	47	31	63	40	26	59
Night (2000 – 0800	42	21	66	33	21	56

Based on these ambient measurement results and additional analysis, we conclude that:

- the ambient environment is considered moderately quiet during both the daytime and night-time
- there is no significant difference between the daytime and night-time (5 dB difference in average L_{eq} and 7 dB difference in average L_{90}) compared to typical suburban/urban environments. This is expected given Ayrburn is in a rural lifestyle area rather than a remote rural or very large lot lifestyle area
- during the middle of the night from 2200 – 0500 hrs, night-time noise levels are low at approximately 20 – 30 dB L_{Aeq}.
- noise levels during the day are generally below 50 dB L_{Aeq}.
- the existing ambient noise environment suggests the noise limits for the zone are appropriate (see Section 5.1.1).

Figure 1: Logger position

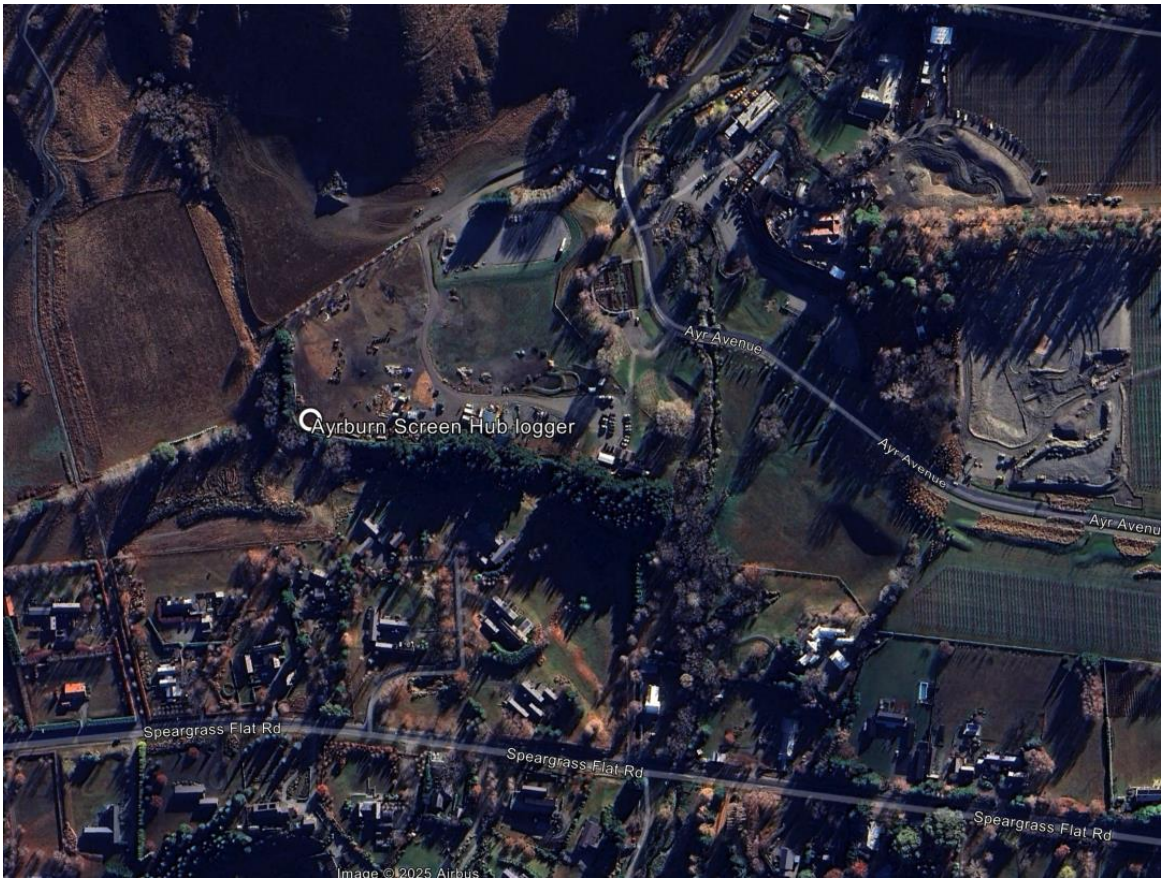
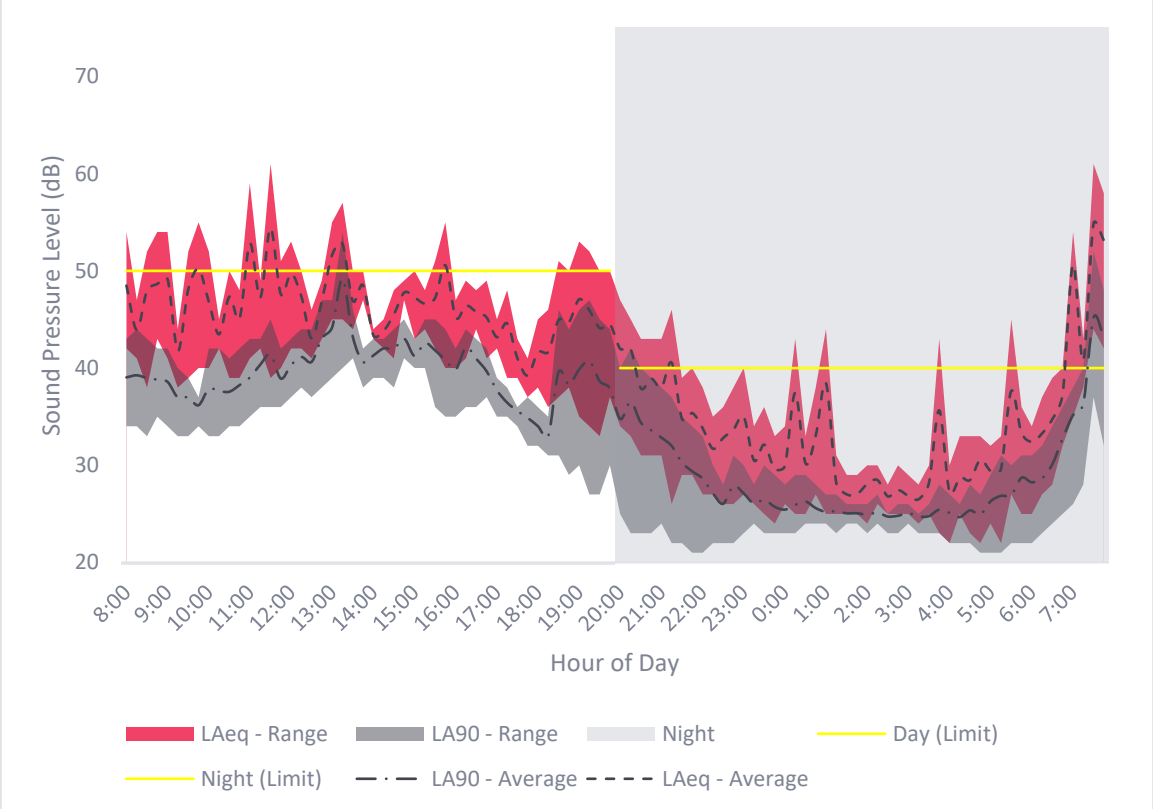


Figure 2: Long-term measurement results – range of noise levels at different times of day



5.0 OPERATIONAL NOISE ASSESSMENT

5.1 Noise Performance Standards

5.1.1 District Plan

The Screen Hub is located within the wider Ayrburn Structural Plan site (see Figure 3 below and refer Appendix 1 of the application package).

Figure 3: Screen Hub relative to the overall Ayrburn site

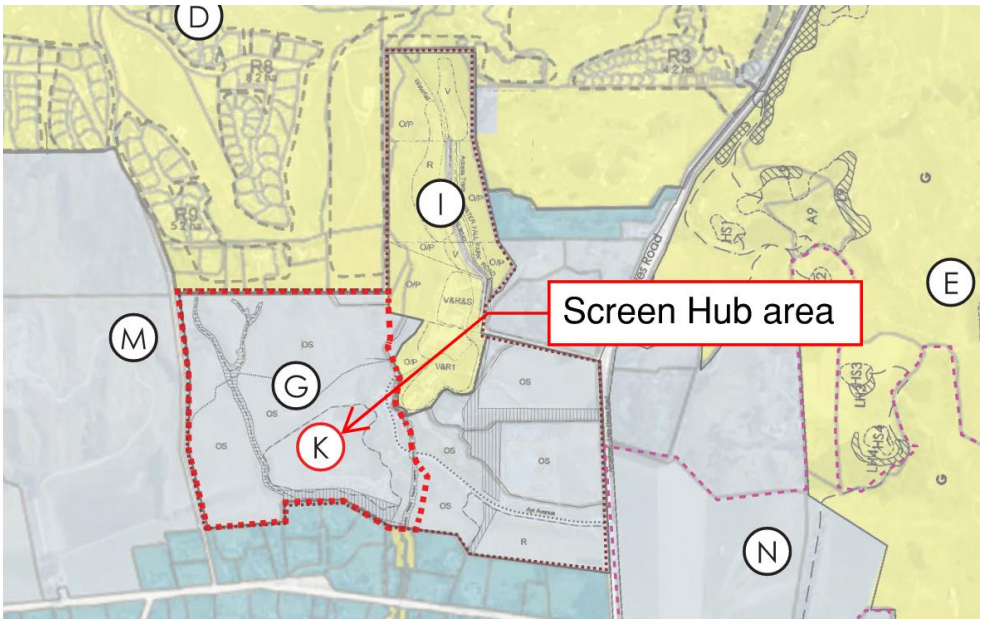
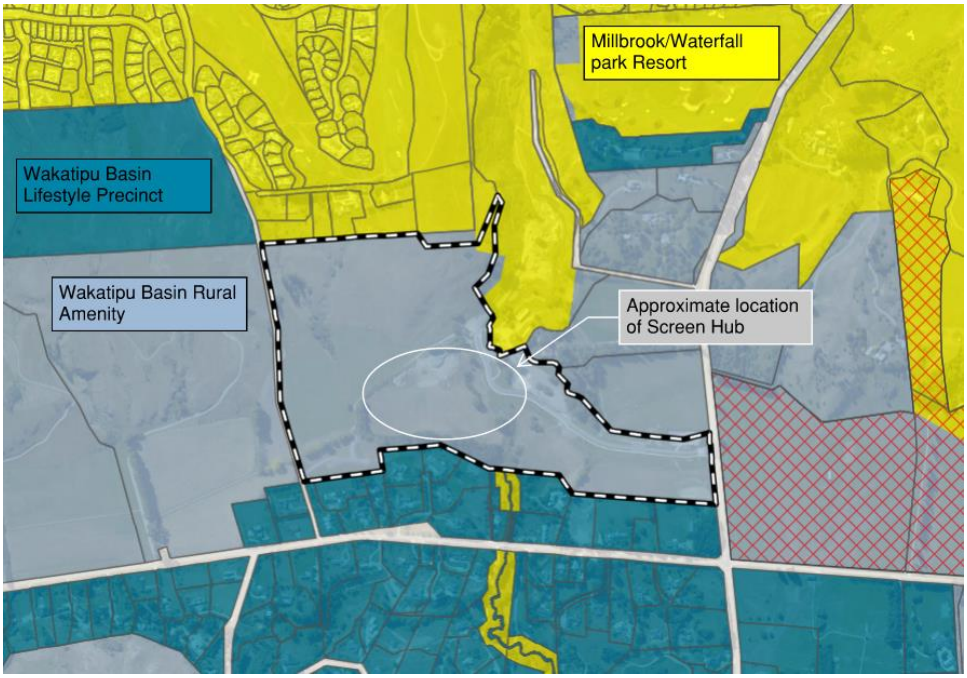


Figure 4 shows the site zoning in the PDP over aerial imagery. The overall Ayrburn site is covered by two zones – *Waterfall Park Zone* and *Wakatipu Basin Rural Amenity Zone*. The portion that is relevant to this assessment is zoned *Wakatipu Basin Rural Amenity Zone*. To the north, there is the *Resort Zone* for Millbrook and Waterfall park. Receivers to the west and east are zoned *Wakatipu Basin Rural Amenity Zone*. Immediately to the south are rural residential receivers zoned *Wakatipu Basin Lifestyle Precinct*.

Figure 4: Zone map and aerial



PDP Chapter 36 provides the noise limits applicable to Screen Hub. The noise limits are:

- Rule 36.5.1 for noise received in the *Wakatipu Basin Rural Amenity Zone* – assessed at any point within the notional boundary of a residential unit

  50dB $L_{Aeq\ (15\ min)}$ 0800 – 2000 hrs
  40dB $L_{Aeq\ (15\ min)}$ 2000 – 0800 hrs
  75dB L_{AFmax}

- Rule 36.5.2 for noise received in the *Wakatipu Basin Lifestyle Precinct*, *Waterfall Park Resort* and *Millbrook Resort Zone*[3] - assessed at any point within any site

  50dB $L_{Aeq(15\ min)}$ 0800 – 2000 hrs
  40dB $L_{Aeq(15\ min)}$ 2000 – 0800 hrs
  No L_{AFmax} noise limit in PDP

5.1.2 NZS 6802:2008

The PDP refers to, and requires assessment in accordance with, NZS 6802:2008.

NZS 6802:2008 is commonly used in New Zealand to inform assessments of environmental noise. Section 8.6 of the standard provides guidance on desirable upper limits of sound exposure at or within the boundary (or notional boundary) of any dwelling. The guideline noise limits are useful especially when there are no applicable noise limits specified by local authorities. The guideline noise limits are:

- Daytime – 55 dB $L_{Aeq\ (15\ min)}$
- Night-time – 45 dB $L_{Aeq\ (15\ min)}$ and 75 dB L_{AFmax}

The noise levels provided in Section 8.6 are intended to provide territorial authorities with appropriate guidance for the development of local noise criteria. These are widely accepted as pragmatic noise limits for a residential setting. Typically, the night-time period is defined as 2200 to 0700 hours. However, in the PDP night-time is defined being from 2000 to 0800 hours.

Overall, we consider the PDP is more conservative than NZS 6802 both because of the noise limit and the extended duration of the night-time period; and that complying with the PDP noise limits would result in negligible noise effects.

5.2 Prediction software

We used the 3D sound modelling software SoundPLAN® version 9.1 to undertake the noise modelling. This is an internationally recognised tool that utilises the algorithms detailed in ISO9613-2: 1996- *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613). ISO 9613 considers a range of frequency dependent attenuation factors, including spherical divergence, atmospheric absorption, ground effect, acoustic screening, and directivity effects. It assumes meteorological conditions favourable to propagation from sources (downwind at wind speeds 1 -5 m/s in all directions) and is therefore conservative.

The following sections provide more detail about model inputs. Appendix D provides a summary table of sound power levels.

[3] Residential Activity Areas only

5.3 Model assumptions and inputs

5.3.1 General model

The following general assumptions and inputs have been included in the model:

- Site terrain provided by the project team since there will be some ground contouring work
- Elevation data from LINZ for the area around the site
- Generally mixed ground conditions (g = 0.8) except for the back lot which is fully hard (g = 0)

5.3.2 Traffic noise model

Our predictions were based on the following inputs:

- Passenger vehicles sound power level of 87 dB L_{WA}
- Trucks / heavies sound power level of 109 dB L_{WA}
- Carriageway Consulting transportation assessment[4]. They assessed peak hour movement numbers for both typical Screen Hub use and off-season use. We understand the predicted movement numbers are:

Table 2: Carriageway's predicted traffic movement numbers

	Peak hour vehicle movements (two-way)	
	Typical Screen Hub use	**Hotel use***
Studio	31	0
Accommodation	0	157
Spa	42	42

* Their assessment didn't split into morning or evening peak. So, we have assumed it applies to both

- No percentage of heavy vehicles were provided in Carriageway's report, so we assumed 10% during the typical use only. This means we assumed no heavy vehicles when the Screen Hub is in 'hotel mode'. We also assume all traffic speed is <20 km/h.
- The PDP noise limits are referenced to 15 minutes. However, traffic volume predictions often are presented as hourly or daily (from our experience). Therefore, to assess to the PDP noise limits, we have assumed equal split of vehicle movements on a per hour basis.

5.3.3 Workshop / set construction noise model

We used the following for workshop and set constructions:

- Sound power level of 107 dB L_{WA} during set construction.

  We obtained this level from the British Standard BS 5228-1:2009 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* database of sound power levels for construction. We have used the entry for hammering (Table no. D7.80) as we consider this would likely characterise the noise during set construction.
- Hammering occurs for 50% of the assessment time. Other times are quieter activities like drilling or fetching material etc.
- Set construction inside the buildings have the large roller doors open

[4] Carriageway Consulting report 'Proposed Screen Hub Ayrburn,' dated 4 February 2025

- Workshop building has an absorptive ceiling tile and heavy velour drape on all walls
- Large internal doors dividing the Flexi, Workshop, and Construction areas are open
- Two external work areas
- Assumed no shielding provided by large trucks or other vehicles in the vicinity

5.3.4 Sound stage noise model

We used the following model inputs in our prediction:

- Internal noise level of 95 dB L_{Prev}.
- Sound Stage building envelope (example only for the purposes of this application)

Table 3: Indicative/Example Building Envelope Constructions

Building Element	Construction
Roof	• 100mm warm roof system • Suspended light steel grid forming min. 1m cavity • Heavy weight acoustic ceiling tile (i.e. plasterboard backed) Or similar double layer ceiling construction
Masonry Wall	• 150mm precast concrete or similar heavy weight construction
Glazing (DGU)	• None

- Sound Stage building has heavy velour drape on all walls
- Large internal doors are closed
- External roller doors are open (unrealistic as these would be closed for production)
- Assumed no shielding provided by large trucks or other vehicles in the vicinity

5.3.5 Backlot noise model

We have used the following to assess a worst-case backlot film studio scenario:

- Wind / rain machine sound power level of 120 dB L_{WA}. We understand that wind and rain machines are often powered by un-treated V8 petrol engines hence the high sound power level.
- 1 no. wind / rain machine located centrally within the backlot
- Wind machine used for 100% of the time
- Director's PA sound power level of 125 dB L_{WA}. This results in sound 10dB louder at 1kHz for speech intelligibility compared to the wind / rain machine
- Director's PA system used for 30% of the time
- One scenario on the hardstand area east of the workshop spaces
- One scenario on the hardstand area west of the workshop spaces

5.4 Noise Prediction results

5.4.1 Traffic noise

Appendix E provides our predicted noise contours and Appendix F provides the prediction results at the closest receivers surrounding the site. We predict the following scenarios:

- Typical usage:
  - Complies at all receivers during the daytime by 14 dB or more
  - Complies at all receivers during the night-time by 4 dB or more
- Hotel usage:
  - Complies at all receivers during the daytime by 11 dB or more
  - Complies at all receivers during the night-time by 1 dB or more

5.4.2 Workshop / set construction noise

We have predicted workshop noise related to set construction inside and outside of the workshop space and sound stages occurring concurrently using the assumptions in Section 3.2.3. Note, set construction only occurs during the daytime.

We predict set construction noise can comfortably comply with the PDP daytime noise limit of 50 dB $L_{Aeq\ (15min)}$ at all receivers. Appendix E shows our predicted noise contours and Appendix F provides the prediction results at the closest receivers surrounding the site.

533 Speargrass Flat Road is the most potentially affected receiver because they may have line of sight into the construction area on the hardstand area. We predict noise levels of 49 dB L_{Aeq} at this receiver. At all other receivers, noise levels are less than 45 dB L_{Aeq}.

If set construction was carried out inside the buildings only (even with doors open), then compliance with the daytime noise limit can be readily achieved i.e. <45dB L_{Aeq} at 533 Speargrass Flat Road and <35dB L_{Aeq} everywhere else.

The ONMP contains management measures to ensure compliance can be achieved at all times.

5.4.3 Sound stage noise

We predict sound stage noise can readily comply with the daytime noise limit of 50 dB L_{Aeq} at all receivers, even with the roller doors open (which is unrealistic as these would be closed for production). Appendix E shows our predicted noise contours and Appendix F provides the prediction results at the closest receivers surrounding the site.

We recommend the proposed building envelope is reviewed by a suitably qualified acoustic consultant prior to lodging building consent.

5.4.4 Backlot noise

As noted in Section 3.2.3, we predict backlot noise assuming a worst-case production scenario using a wind / rain machine.

We predict non-compliance of the PDP noise limits during both daytime and night-time at the majority of receivers, if the backlot is operated using the worst-case scenario. We predict noise levels from 1 dB to 12 dB above the permitted noise limit if carried out during the daytime and 2 to 22 dBA if carried out during the night-time. Appendix E shows our predicted noise contours.

Therefore, we recommend the following mitigation measures:

- No internal combustion engine powered wind and rain machines used at any time
- Wind and rain machines must be battery powered or electric when used during the daytime. It must be used no more than 50% of the daytime period
- No battery powered or electric wind and rain machine to be used during the night-time
- If a director's PA is used, it must be limited to 100 dB L_{WA} (77 dB L_{Aeq} at 10m). This enables compliance for production within any area of the Backlot. There is no time restriction.
- Minimise night-time production as far as practicable
- No pyrotechnics or explosion during night-time

We have predicted this too with figures in Appendix E. Appendix F provides the prediction results at the closest receivers surrounding the site.

The above measures are included in the ONMP.

5.5 Noise Effects

We assess noise effects from the proposed worst-case activities on site with reference to:

- Noise performance standards from the District Plan (Section 5.1)
- The existing ambient noise environment (Section 4.0)
- Predicted noise levels arising from different types of activity on site (Section 5.4)
- The character of the noise that may be received at neighbouring residential properties.

We summarise our noise effects assessment below.

5.5.1 Traffic noise

We consider that there would be acceptable traffic noise effects because:

- We predict traffic noise will comply with the PDP noise limits at all receivers at all times
- We predict that daytime traffic noise would likely be imperceptible because our predicted noise level of 36 dB L_{Aeq} or less is at least 11 dB below the measured average 5min L_{eq} of 47 dBA
- We predict night-time traffic noise may be perceptible at times because our predicted noise level of 39 dB L_{Aeq} or less is 3dB below the measured average 5min L_{eq} of 42 dBA. During the quietest part of the night, a vehicle pass may be more perceptible, because the lowest measured 5 min L_{eq} was 21 dBA. But this would likely occur very infrequent because Carriageway predicts no accommodation traffic movements during Screen Hub use, the Screen Hub is used during the day generally, and during hotel use, guests would often arrive during the daytime
- We consider the noise character would likely not be new to the environment as traffic noise already exists as a result of the surrounding road network and the Ayrburn internal road network servicing the hospitality and event centre hub

5.5.2 Workshop / set construction noise

We consider that workshop noise effects are acceptable because:

- Set construction and workshop noise is a daytime activity only
- We predict compliance with the PDP daytime noise limits at all receivers

- We predict workshop noise levels (typically less than 40 dB L_{Aeq} but up to 49 dB L_{Aeq} at 533 Speargrass Road) would be similar in level to the existing noise environment (measured average 5min L_{eq} of 47 dBA) but would likely be perceptible due to its character
- The character of the noise would not be typical of a rural environment but would be similar to general household construction noise commonly present in the area from time to time, so would likely not be novel for the environment
- Set construction does not occur frequently and would generally be for shorter periods of time

5.5.3 Sound Stage

We consider that there would be negligible noise effects because:

- We predict Sound Stage noise will readily comply with the daytime noise limit at all receivers
- We predict that Sound Stage noise would be imperceptible because it is approximately 9 dBA or more below the existing daytime noise levels (measured average 5min L_{eq} of 47 dBA)

5.5.4 Backlot noise

We consider that backlot production noise would be unacceptable if the worst case scenario occurs without implementing mitigation measures described in the ONMP. In Appendix F we present the unmitigated backlot noise levels alongside the mitigated levels for completeness.

With mitigation measures implemented, we consider the effects are acceptable because:

- We predict compliance with the PDP daytime and night-time noise limits
- We predict daytime Backlot noise (typically around 40 – 50 dB L_{Aeq}) would be similar in level compared to the existing daytime noise levels (measured average 5min L_{eq} of 47 dBA)
- The character will depend on what is being filmed but at the worst-case using a wind machine and Director's PA, it will sound similar to a distant fan and person's voice. This would likely not be typically expected in this zone. But this type of noise would not occur frequently – not all films will require a wind machine and a Director's PA would not be used all the time
- We predict that mitigated night-time Backlot noise (typically 30 to 40 dB L_{Aeq}) would be perceptible to a receiver outside because the existing night-time ambient noise environment is between 20 – 30 dB L_{Aeq}. However, we predict there would be no risk of sleep disturbance because we predict internal noise levels would be 25 dB L_{Aeq} or less with a partially opened window
- Night-time Backlot use will also be very infrequent because night-time shoots are typically done on location or inside of a sound stage

6.0 CONSTRUCTION NOISE AND VIBRATION ASSESSMENT

6.1 Construction Activities

We understand that construction will have the following key components:

- Construction duration of 36 months
- Construction timeframe of Monday to Saturday 0730 – 1800 hrs
- Construction methodology consisting of:
  - General earthworks and compaction
  - Shallow foundations with no foundation piling
  - Retaining wall to the northern extent may require concrete encased universal columns. This would be bored rather than driven
  - Rock excavation is likely required in the north-east section of site (refer Figure 2b of GeoSolve's report[5]). However, the exact volume and method of excavation is not known at this stage, and it is noted in the GeoSolve report that it is soft to medium rock. For the purposes of our assessment, we assume rock breaking which represents the worst-case scenario although in practice the rock may be removed by ripping.

6.2 Construction Noise

6.2.1 Performance standards

Queenstown Lakes District Council Proposed District Plan (PDP) Rule 36.5.13 provides the construction noise limits. It says that:

"Construction sound must be measured and assessed in accordance with NZS 6803:1999 Acoustics - Construction Noise. Construction sound must comply with the recommended upper limits in Tables 2 and 3 of NZS 6803. Construction sound must be managed in accordance with NZS 6803."

Table 4 provides the applicable 'long-term' duration noise limits from NZS 6803. They apply at 1m from an occupied building.

Table 4: Construction noise limits from NZS 6803 received in residential zones and dwellings in rural areas

Day of week	Time period	Noise limit (dBA)	
		L_{eq}	L_{max}
Weekdays	0630 – 0730	55	75
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	45	75
Saturdays	0630 – 0730	45	75
	0730 – 1800	70	85
	1800 – 2000	45	75
	2000 – 0630	45	75
Sundays and public holidays	0630 – 0730	45	75
	0730 – 1800	55	85
	1800 – 2000	45	75
	2000 – 0630	45	75

[5] Geosolve's Geotechnical Report for Resource Consent (Ref 150098.11) dated 21 January 2025

6.2.2 Typical equipment noise levels

Table 5 overleaf presents the typical operating sound power levels of equipment required for this Project. The table presents noise levels at 1m from a façade at various distances from the works. The predicted noise levels are conservative and does not include mitigation, shielding provided by natural terrain, or consideration for duration of activities.

The indicative sound power levels have been sourced from our database of measured noise sources or BS 5228-1:2009 "*Code of practice for noise and vibration control on construction and open sites Part 1: Noise*". This list is not exhaustive.

Table 5: Indicative construction noise levels at 1m from the facade without effective noise barriers

Equipment	Sound Power	Façade Noise Level (dB L_{Aeq})			Limit Setback (m)
	(dB L_{WA})	60m	70m	80m	70 dB L_{Aeq}
Rock breaker (20-30T)	121	79	77	75	132
Grader	111	69	67	65	52
Excavator (44T)	110	68	66	64	48
Excavator (20T)	103	61	59	57	25
Dozer	108	66	64	62	40
Concrete truck and pump	103	61	59	57	25
Vibratory roller	103	61	59	57	25

6.2.3 Construction noise assessment

Receivers along Speargrass Flat Road are approximately 55m or more from the closest work area (the proposed Mill Creek Sediment Trap). They are approximately 260m from a potential rock excavation area.

Receivers to the north are at least 250m away from any construction activity.

Given the above and our predicted noise levels and setback distances in Table 5, we predict compliance with the NZS 6803 noise limits (Table 4) can be achieved at all receivers. As such, we consider all construction noise related to building the Screen Hub is permitted with respect to noise under the PDP.

Note, we consider that any construction activities related to set production in the Screen Hub falls under operational noise (see Section 5.4.2).

6.3 Construction Vibration

6.3.1 Performance standards

The PDP does not provide specific construction vibration performance standards. However, Rule 36.5.10 refers to DIN 4150-3:1999. The rule says:

"Vibration from any activity shall not exceed the guideline values given in DIN 4150-3:1999 Effects of vibration on structures at any buildings on any other site."

The most applicable vibration limit is 5mm/s PPV received at the foundation of residential receivers.

The criteria relate to the avoidance of cosmetic building damage, such as cracking in paint or plasterwork. Cosmetic building damage effects are deemed '*minor damage'* in the DIN 4150 and can generally be easily repaired. The cosmetic building damage thresholds are much lower than those that would result in structural damage. DIN 4150 states:

"*Experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur*."

6.3.2 Potential vibration effects

The main vibration concern of building owners and occupants is usually building damage, but they will feel vibration at levels much lower than those that would cause damage.

British Standard BS 5228-2:2009 "*Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*" provides the following guidance on the amenity effects of vibration. The descriptions are reproduced below, and are supplemented with our own descriptions for 2mm/s and 5mm/s:

- 0.3 mm/s PPV Just perceptible in normal residential environments
- 1 mm/s PPV Typically acceptable with prior notification
- 5mm/s PPV Highly unsettling in dwellings and workplaces. If prolonged, some occupants may want to leave the building. Computer screens will shake, and items could fall off shelves if they are not level.

6.3.3 Typical vibration setback distances

Table 6 provides indicative construction vibration levels for proposed activities that have the potential to result in vibration in building structures. They are based on our measurement database.

The amenity vibration levels are the typical vibration levels expected for each activity, while the cosmetic building damage limits conservatively includes a 100% safety factor to manage risk.

We predict all construction vibration can comply with 5mm/s PPV. As such, we consider construction vibration to be acceptable.

Furthermore, we predict all receivers would receive vibration level below 1mm/s PPV. Prior notification would be sufficient to manage any potential effects.

Table 6: Indicative distances to comply with vibration limits at building foundations

Equipment/activity	Amenity Setback 1mm/s PPV (m)	Cosmetic Building Damage Setback – 5mm/s PPV (m)
Rock breaking	19	10
Vibratory rolling	38	14

6.4 Construction noise and vibration management

We have reviewed Enviroscope's Environmental Management Plan (EMP) dated May 2025[6]. Section 7 of the EMP provides the construction noise and vibration management criteria and management measures. We find that the EMP is generally acceptable, particularly given the relative low risk we predict for the project.

[6] Report number 25028

7.0 RECOMMENDED CONDITIONS OF CONSENT

We recommend the following conditions of consent are included if consent is granted for this project:

Construction Noise and Vibration

1. Construction noise is to be measured and assessed in accordance with New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise.* The long-term noise limits in that standard applies.
2. The construction hours where earthmoving / rock excavation equipment are used are limited to Monday to Saturday 0730 – 1800 hrs. This time restriction applies only to works related to make the Screen Hub operational. Subsequent construction work related to set production activities have no time restraints so long as they comply with the zone noise limits (Condition 5)

   Advice note: Quiet construction works outside of these hours can still occur so long as they comply with the noise limits in Condition 1. Such works include painting, planting, interior plastering, electrical work, site meetings, toolbox meetings, etc.
3. Construction vibration is to be measured and assessed in accordance with German Standard DIN 4150-3:1999 *Structural Vibration - Effects of Vibration on Structures*.

Operational Noise

4. Noise from operation of the Screen Hub (all activities associated with it) shall comply with:

Receiving Zone	Noise limit	Time	Compliance point
Wakatipu Basin Rural Amenity Zone	50dB $L_{Aeq\ (15min)}$ 40dB $L_{Aeq\ (15min)}$ 75dB L_{AFmax}	0800 – 2000 hrs 2000 – 0800 hrs	Assessed at any point within the notional boundary of a residential unit existing, or has consent to be constructed, before 1 January 2025.
Wakatipu Basin Lifestyle Precinct, *Waterfall Park Resort* and *Millbrook Resort Zone*	50dB $L_{Aeq(15\ min)}$ 40dB $L_{Aeq(15\ min)}$	0800 – 2000 hrs 2000 – 0800 hrs	Assessed at any point within any site.

5. An Operation Noise Management Plan (ONMP) is to be certified by Council at least 10 days prior to the Screen Hub being operational. The ONMP shall be based on the draft Ayrburn Screen Hub Operational Noise Management Plan (Rp 003 20250265) dated 7 August 2025.
6. Prior to granting building consent for any phase of the development, a report shall be prepared by a suitably qualified person that confirms noise from mechanical plant will not give rise to cumulative noise levels from the site activities in excess of the noise limits in condition [XX].
7. Prior to granting building consent for any phase of the development, a report shall be prepared by a suitably qualified person that identifies:
   i. The appropriate level of sound insulation for the Sound Stage building to ensure that cumulative noise from the site due to all typical operational noise sources will comply with Condition [XX]; and
   ii. How the specified level of sound insulation will be achieved.

APPENDIX A GLOSSARY OF TERMINOLOGY

A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
Ambient	The ambient noise level is the noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A- weighted) so as to more closely approximate the frequency bias of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
$L_{A90\ (t)}$	The A-weighted noise level equaled or exceeded for 90% of the measurement period. This is commonly referred to as the background noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.
Noise	A sound that is unwanted by, or distracting to, the receiver.
Notional boundary	A line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling. This definition is from NZS 6802:2008.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

APPENDIX B SITE PLAN

A **Filming studios**
14m external height clear span building for set construction and filming.

B **Workshop and workroom spaces**
Flexible spaces for construction, fabrication, wardrobe, paint and tech departments such as Grip, Lighting, Rigging and Camera etc.

C **'Backlot'**
Flexible hardstand area for tech trucks, catering, outdoor sets, storage and carparking as required.

D **Controlled entries**
Two entries so that the facility can be used for two smaller productions working at the same time.

E **Offices and private actor spaces and dressing rooms**
To be used as production and department offices. When not in use for a production, these will be able to convert to double and single visitor accommodation suites for the open market.

F **Crew or visitor accommodation**
to be used for accommodating crew. When not in use for a production these will be used for visitor accommodation.

G **Christine's Hill**
Retained as open pasture browntop grass and grazed by sheep and kept free of invasive weeds. Riparian planting areas to be fenced.

H **Existing Countryside Trail**
Public trail largely via easement over the applicant's land on Christines Hill and in road reserve on the flat land.

I **Extension of existing spur**
To mitigate landscape effects from the trail up Christines Hill and screen larger studio buildings from view.

J **Existing conifer shelter belt**
To be retained as required by the Ayrburn Structure Plan.

K **Existing mature vegetation.**
To be retained.

L **Native riparian planting**
To the ephemeral watercourse.

M **Grapevines**
To bookend the site and provide an open space buffer as per that between Arrowtown - Lake Hayes Road and the site.

N **Ayrburn Depot**
Deliveries and ancillary function to the Ayrburn hospitality precinct. This will replace / formalise all the temporary storage containers, portacom staff rooms and offices scattered around the site.

O **Engineered Wetlands / detention ponds**
To ensure water entering Mill Creek is sufficiently treated.

P **Ayrburn Hospitality Precinct (existing)**
5 Restaurants, 7 bars, butcher, retail, bakery, music events area ice creamery, children's playgrounds, wedding venue and botanic garden including a flower farm.

Q **Northbrook Retirement and Hotel**
170 retirement units including 23 hospital grade care suites, clubhouse, gym pool and spa. An 18 room boutique Hotel with a 120 pax event space.

R **Reception & Breakfast area**
For crew/ visitor accommodation

S **Gym / wellness / Screening & VIP lounge**
For crew / visitor accommodation

U **Productive Garden (existing)**

V **Mill Creek**

W **Proposed Mill Creek Sediment Trap**
50x12m serviceable in line sediment trap.

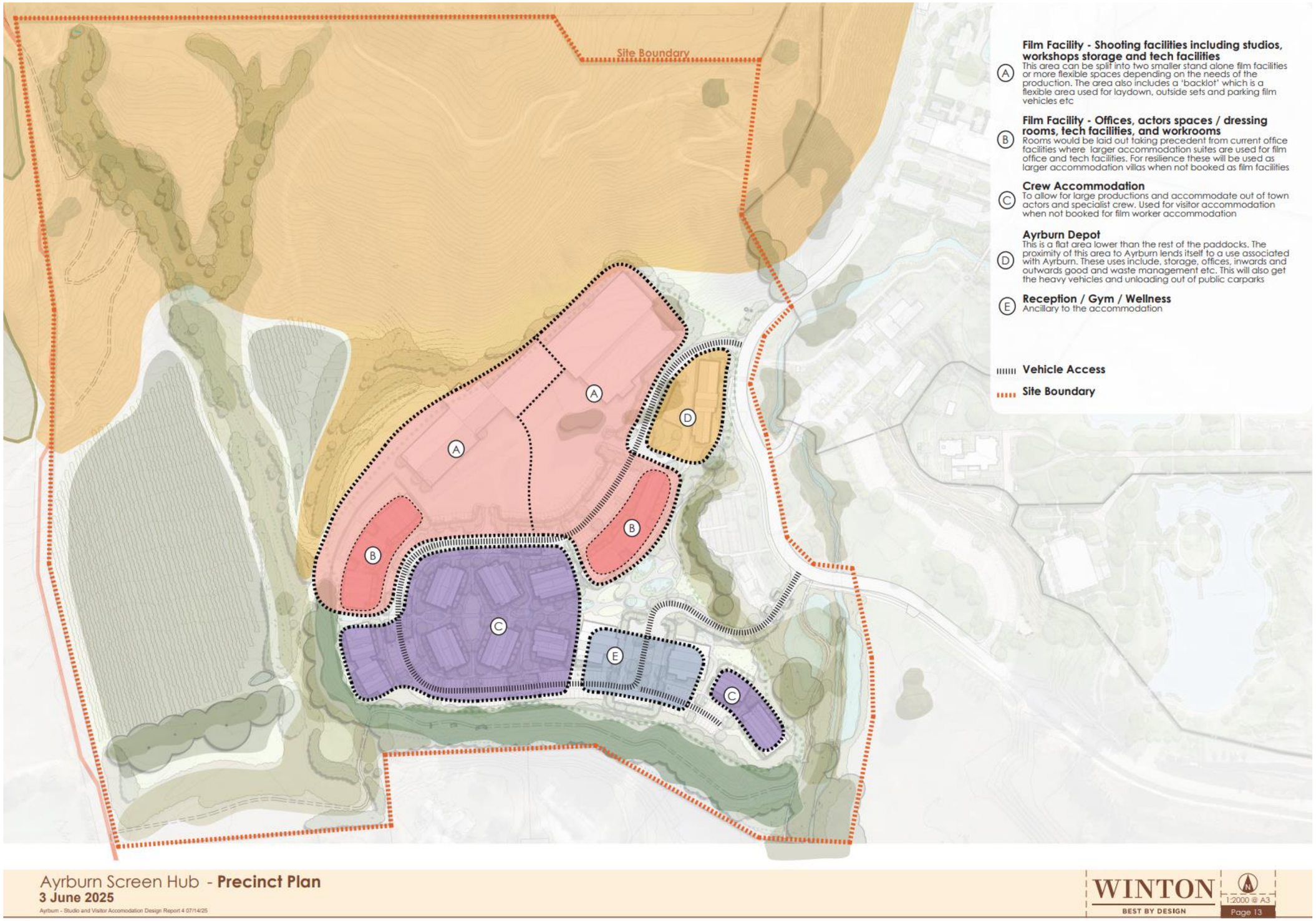
X **2.5m high Hedge**
and solid timber fence

Y **Proposed public trails**
Refer public trails plan

Ayrburn Screen Hub - **Masterplan**
3 June 2025
Ayrburn - Studio and Visitor Accomodation Design Report 4 07/14/25

WINTON BEST BY DESIGN 1:2000 @ A3 Page 15

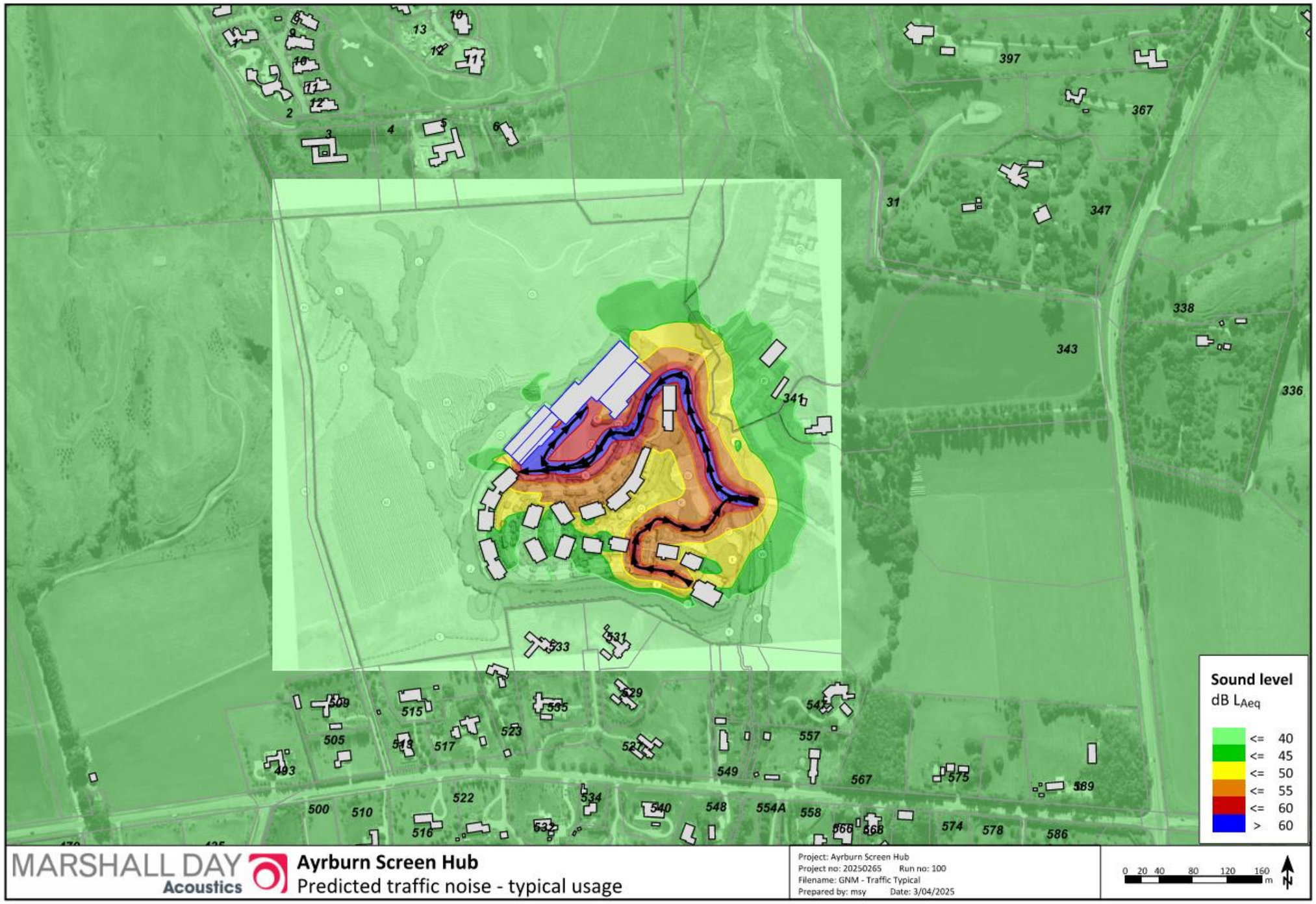
APPENDIX C AYRBURN SCREEN HUB – SCREEN ACTIVITY AREAS

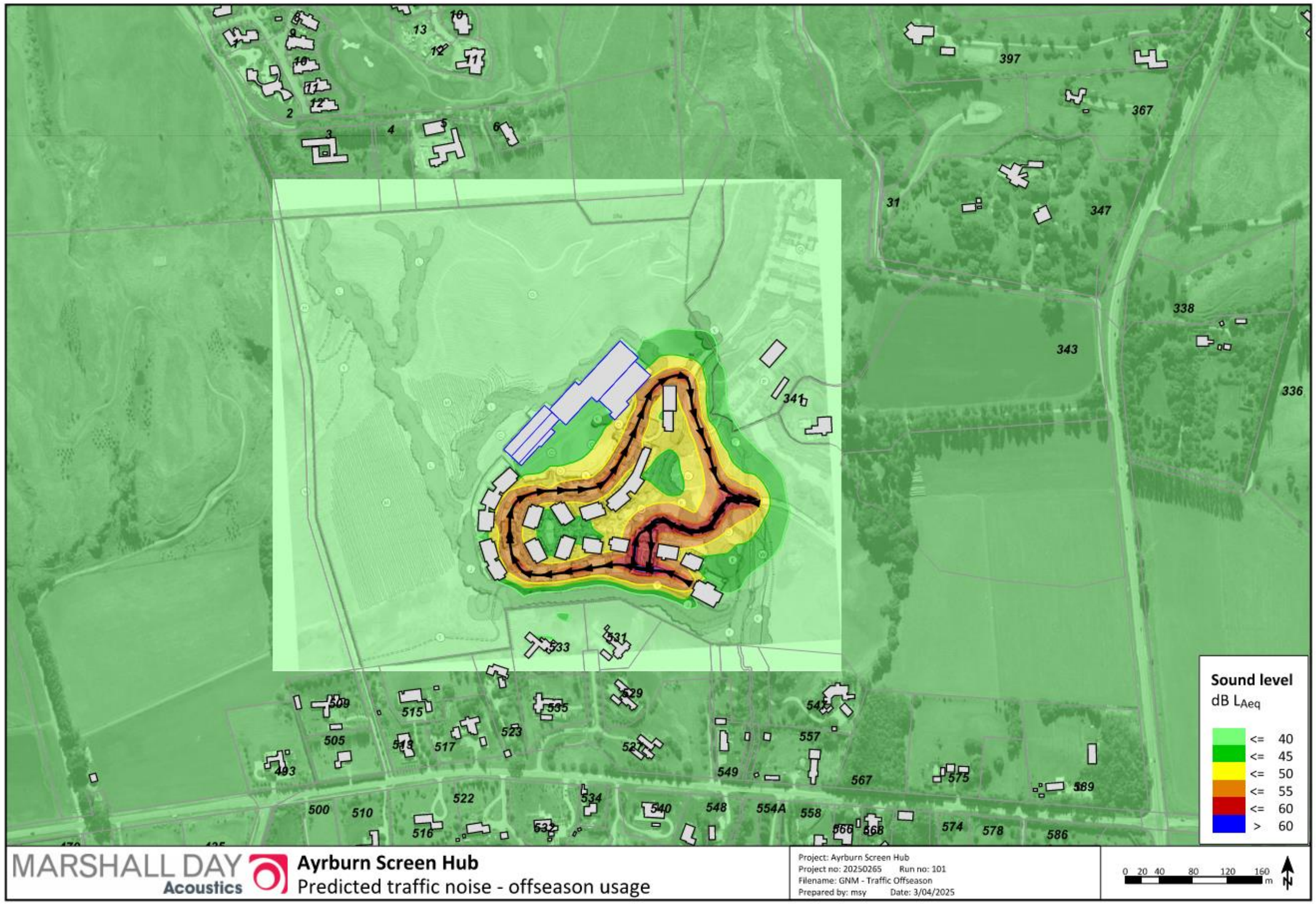


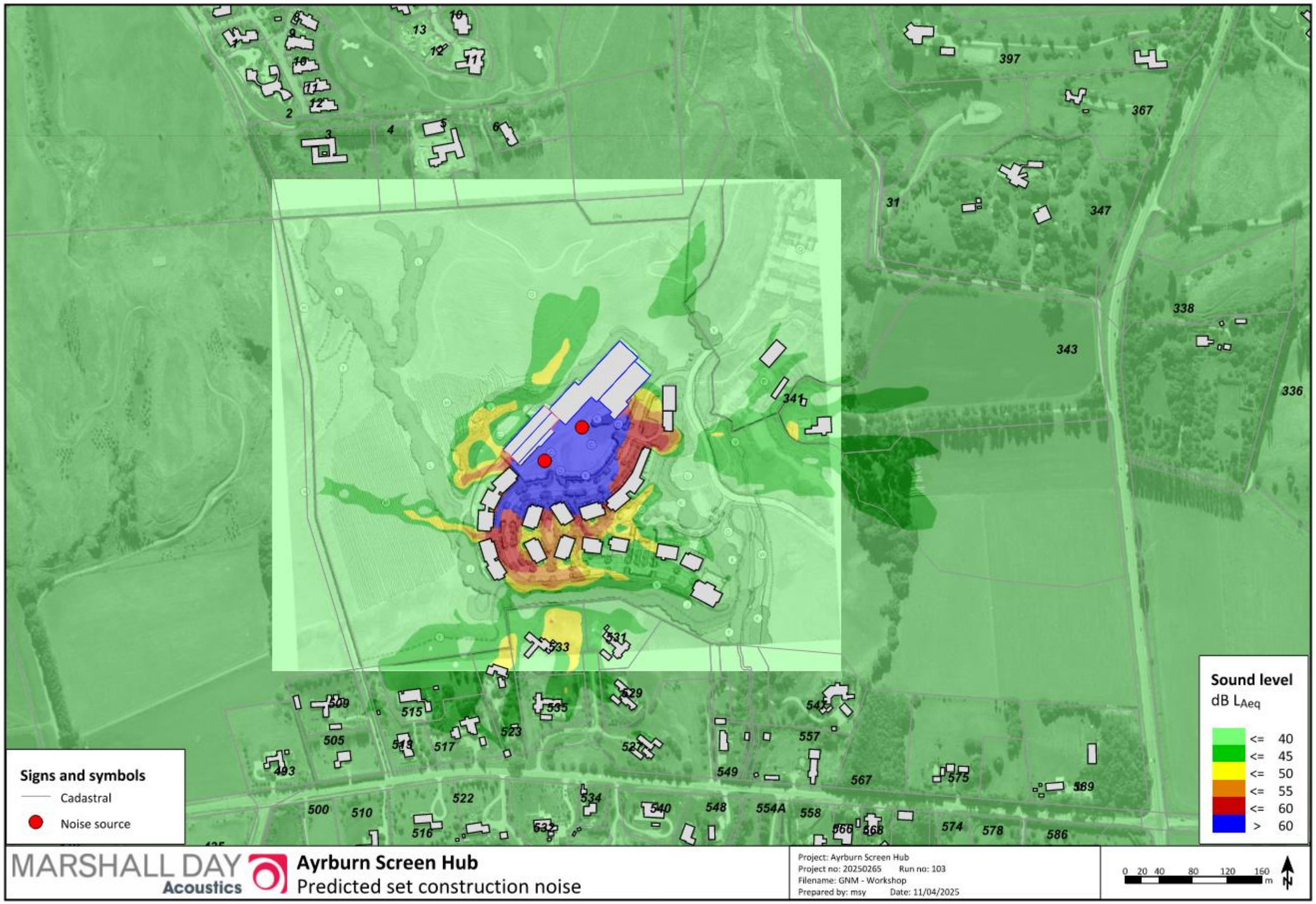
APPENDIX D NOISE SOURCE SOUND POWER LEVELS

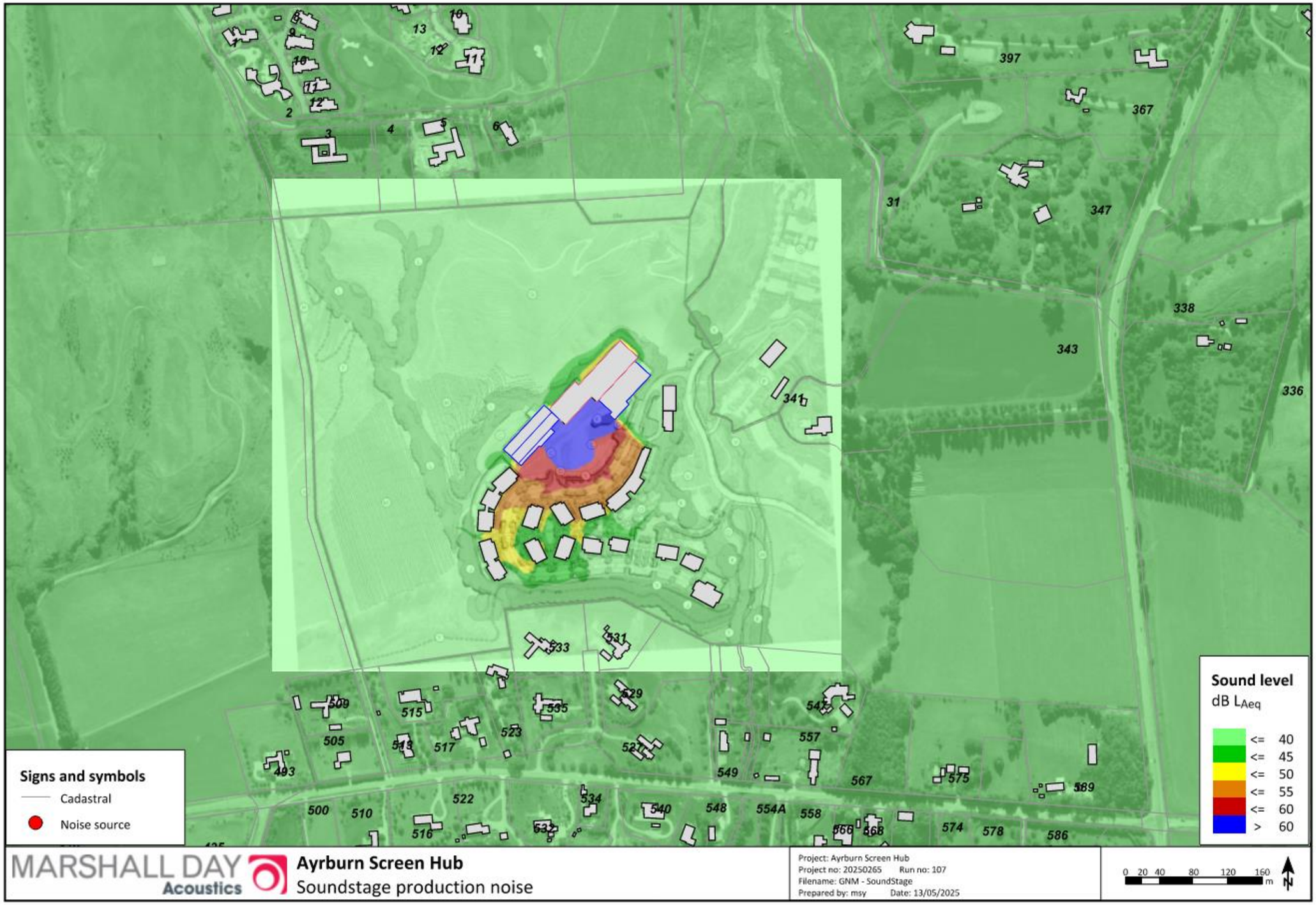
Noise Source	Source level
Passenger vehicles	87 dB L_{WA}
Trucks / heavies	109 dB L_{WA}
Set construction noise	107 dB L_{WA}
Internal combustion engine wind/rain machine	120 dB L_{WA}
Electric wind/rain machine	112 dB L_{WA} – aerodynamic noise from fan
Director's PA	125 dB L_{WA}
Director's PA (mitigated)	100 dB L_{WA} @ night-time 105 dB L_{WA} @ daytime
Sound Stage internal noise level	95 dB L_{Prev}

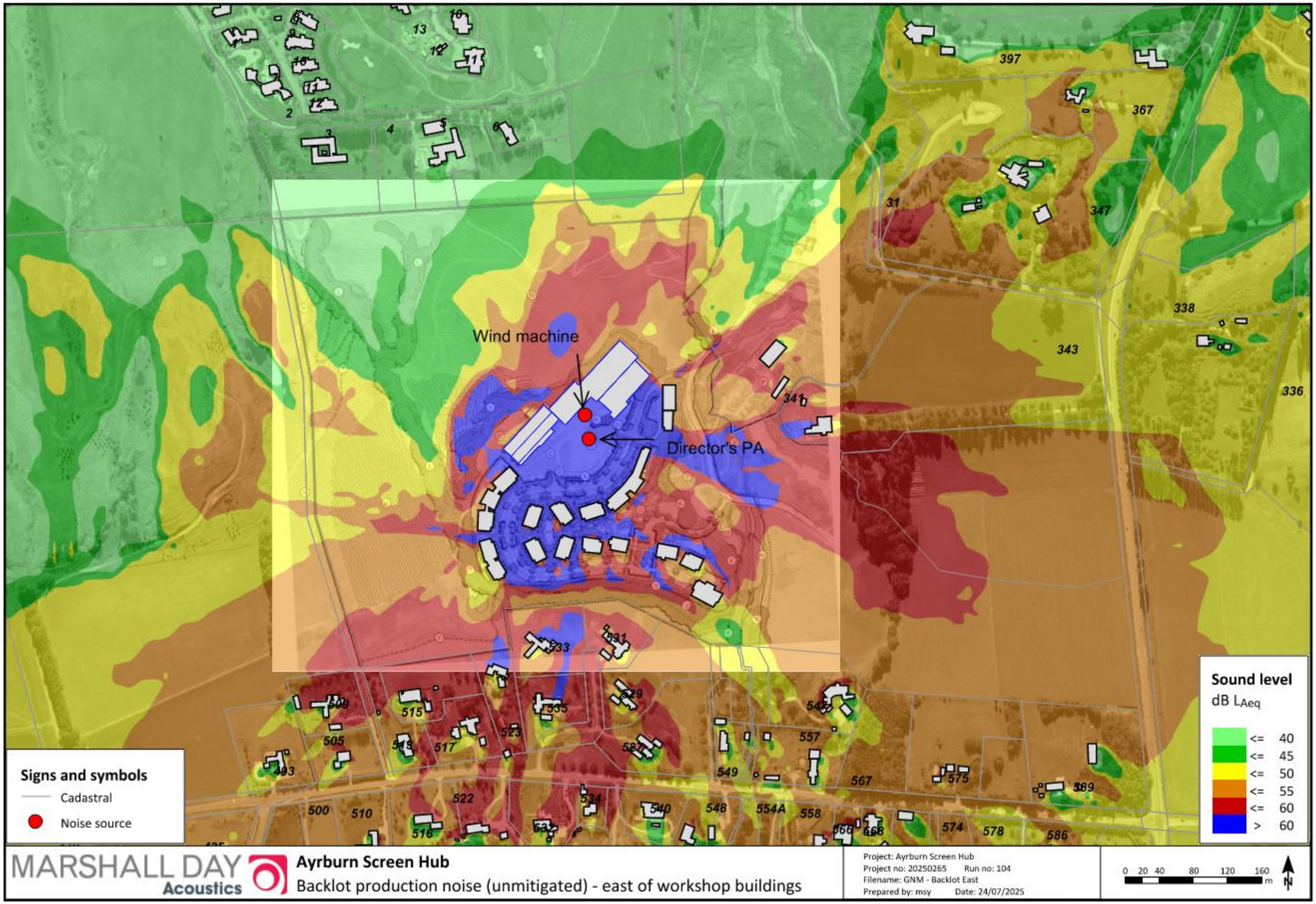
APPENDIX E PREDICTED NOISE CONTOURS

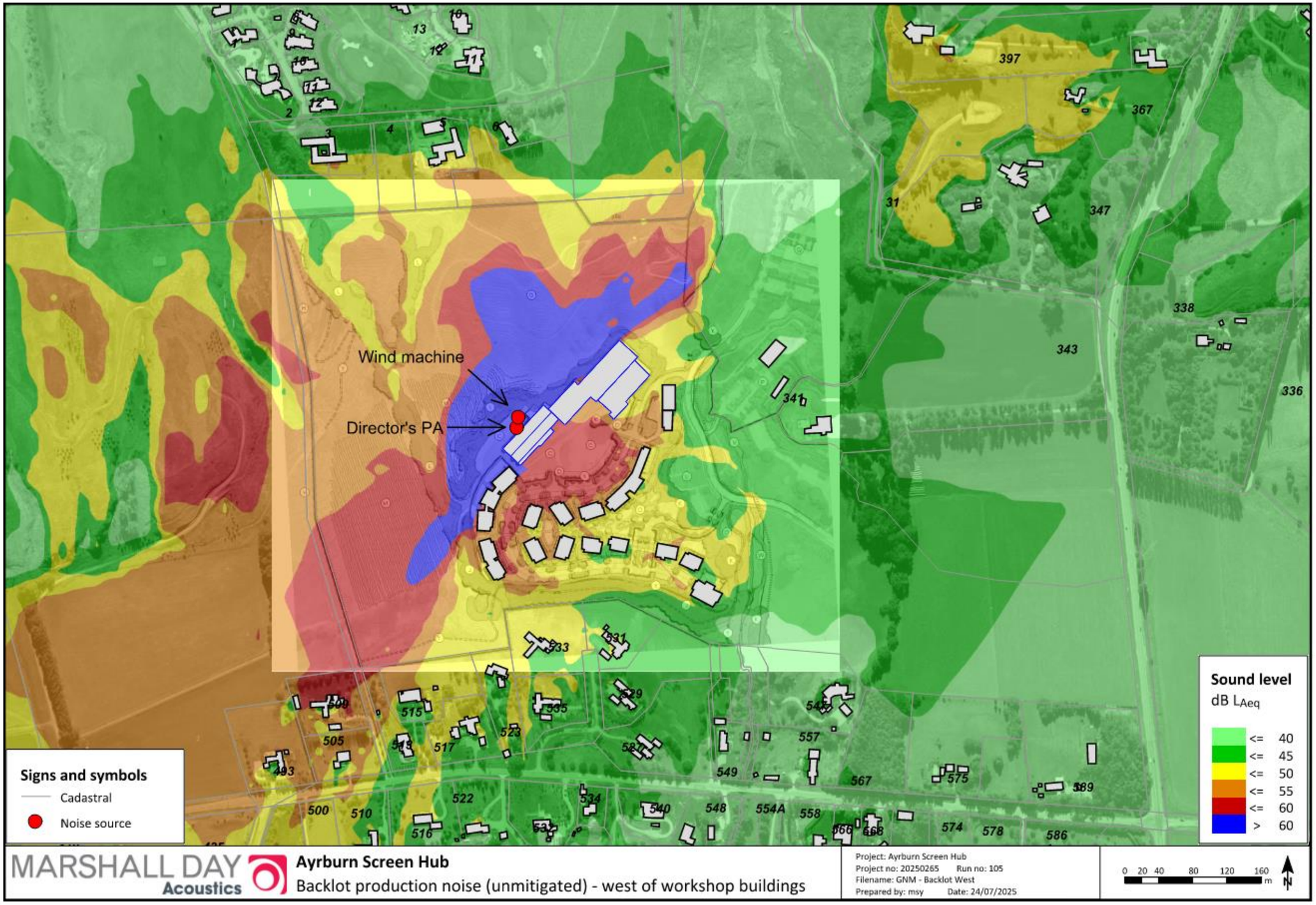


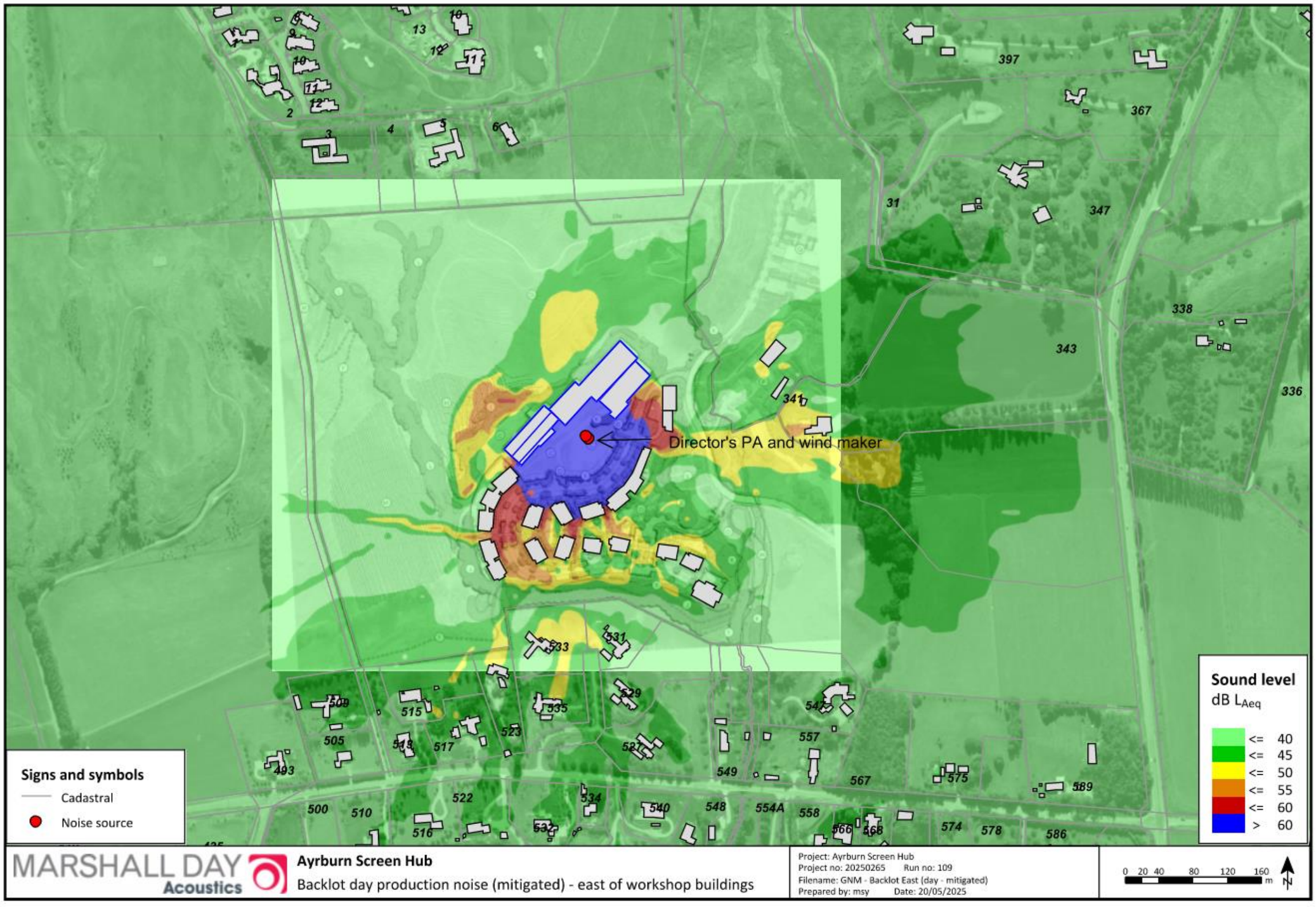


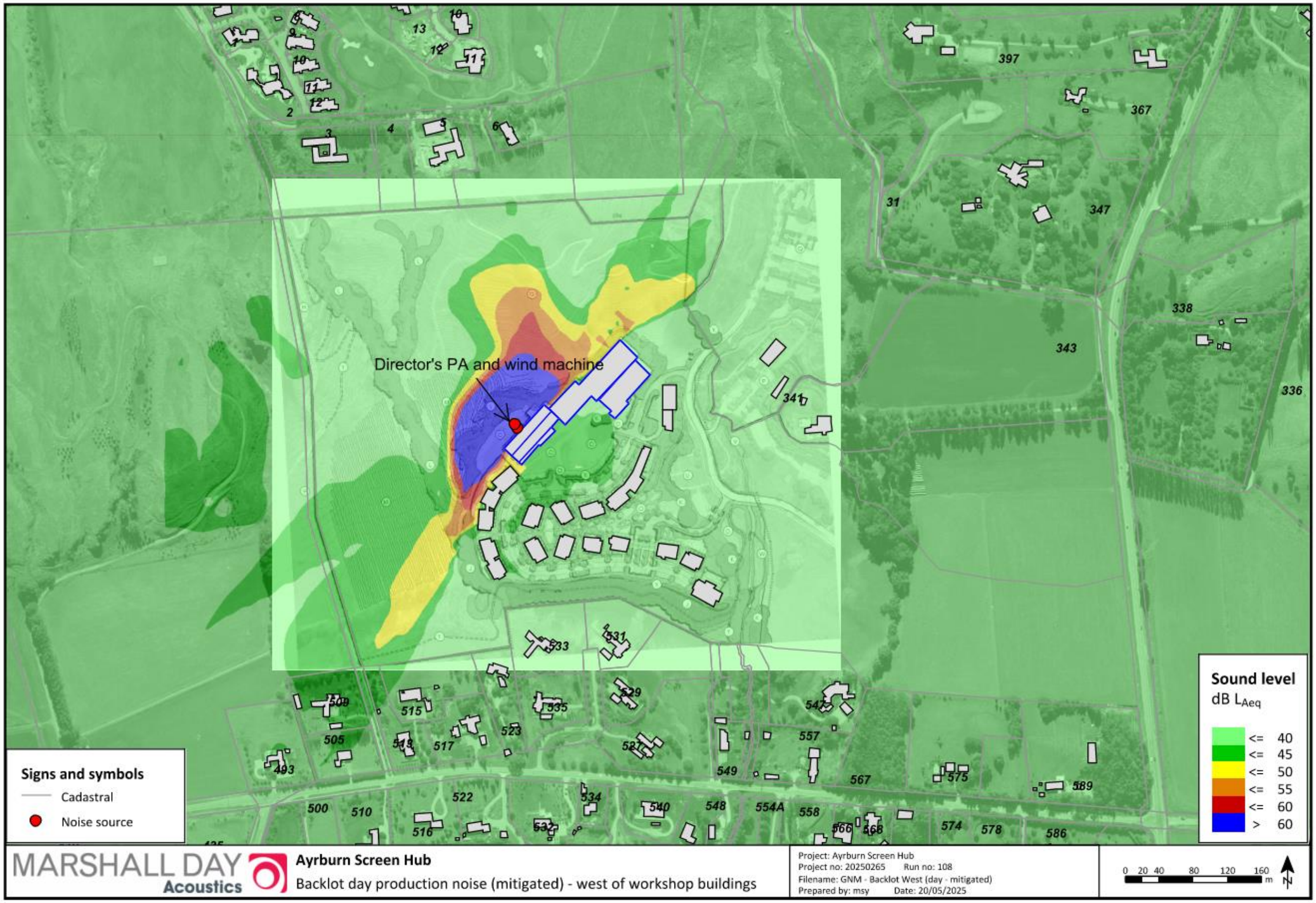


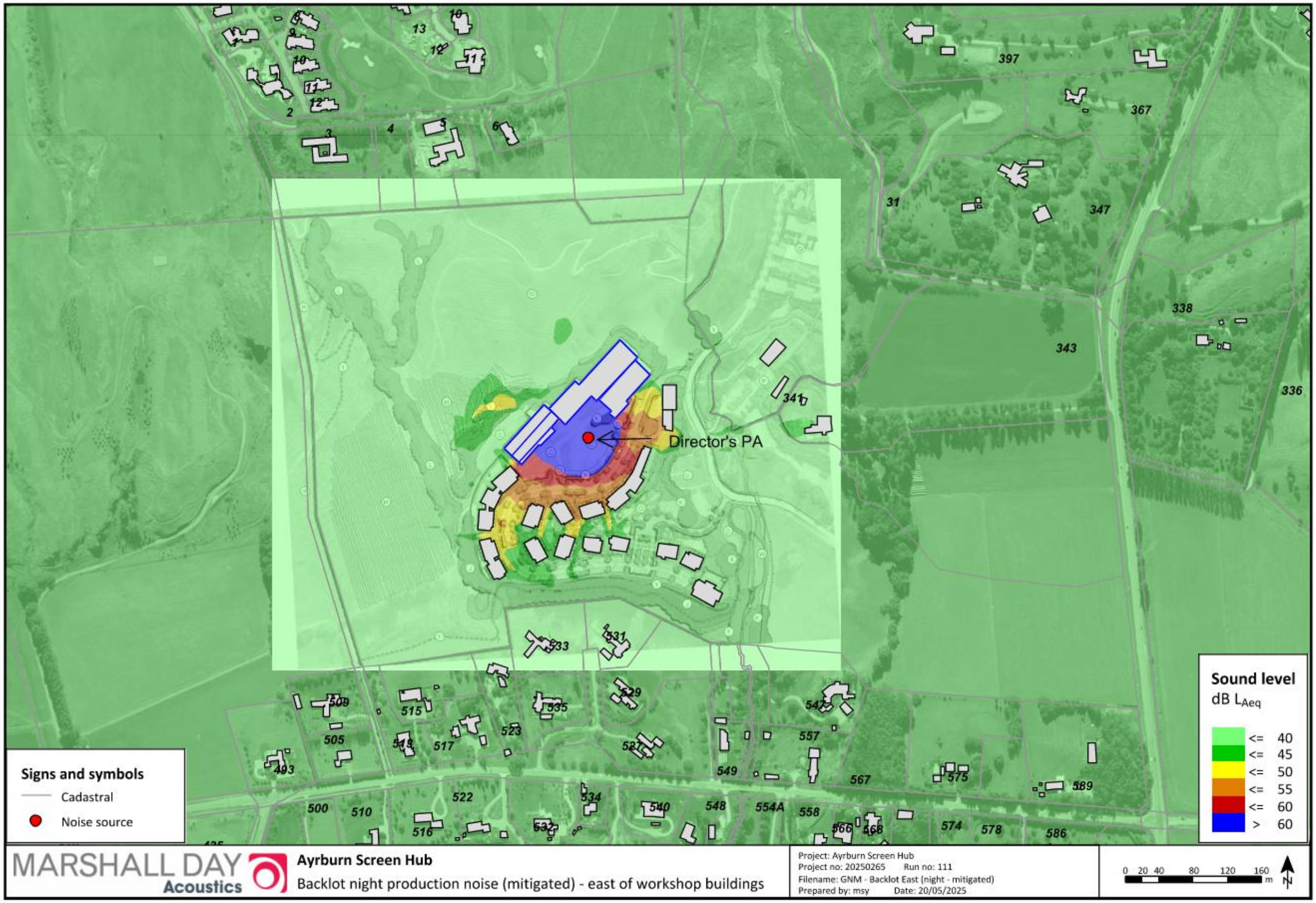


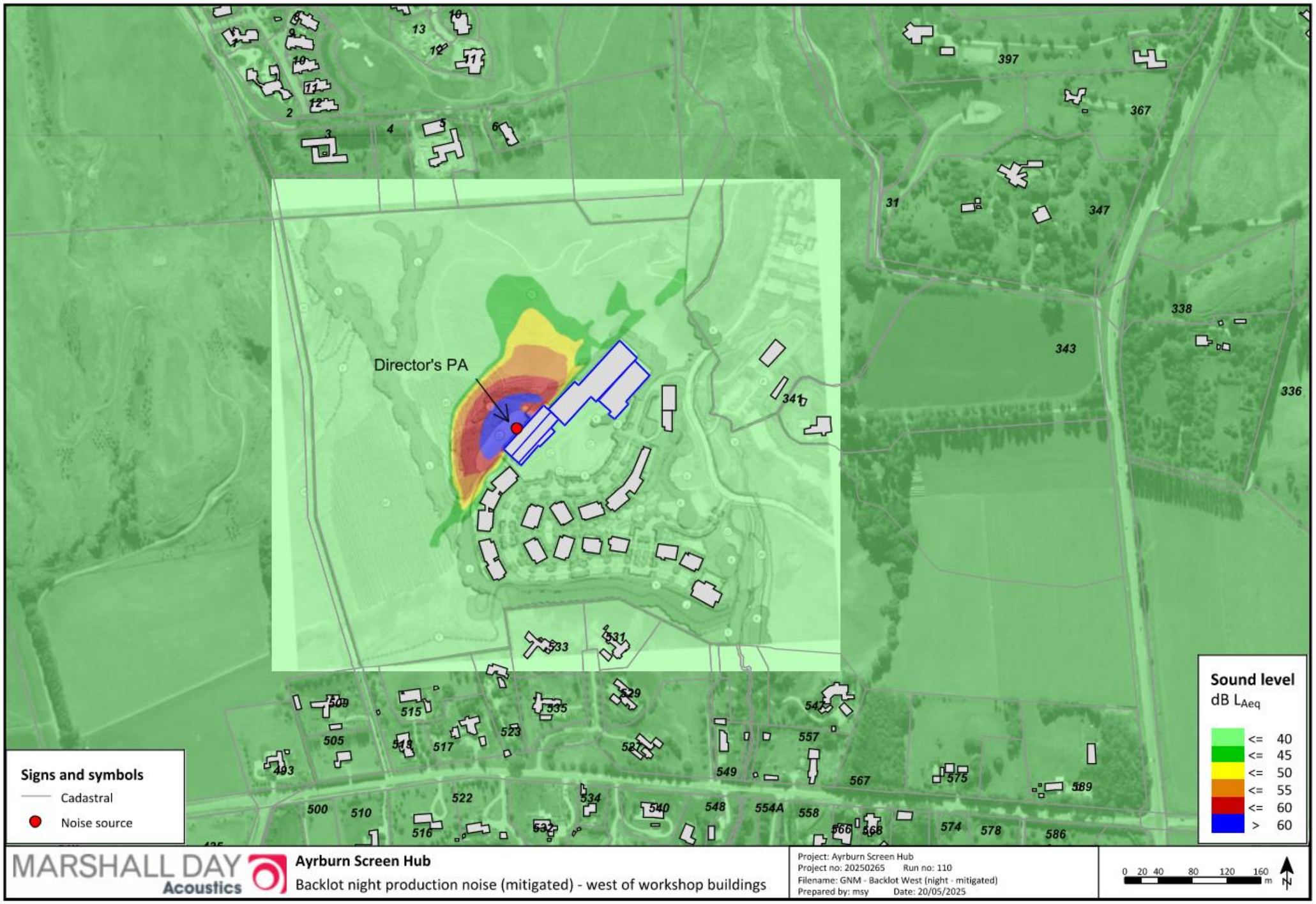












APPENDIX F PREDICTED NOISE LEVEL TABLE

Receiver	Daytime only activities (0800 - 2000 hrs)					Activities that can occur at night-time (2000 - 0800 hrs)			
	Noise limit	Set construction – outdoors and indoors	Set construction – indoors only	Sound Stage Production	Backlot production (with mitigation - day)	Noise limit	Traffic - Typical	Traffic - 'hotel mode'	Backlot production (with mitigation - night)
Arrowtown-Lake Hayes Road 037	50	<40	<40	<38	37	40	<30	<30	<30
Arrowtown-Lake Hayes Road 338	50	<40	<40	<38	38	40	<30	<30	<30
Arrowtown-Lake Hayes Road 347	50	<40	<40	<38	42	40	31	<30	34
Arrowtown-Lake Hayes Road 347	50	<40	<40	<38	35	40	30	<30	<30
Malaghans Road (empty lot)	50	<40	<40	<38	35	40	<30	<30	<30
Millvista Lane 003	50	<40	<40	<38	31	40	<30	<30	<30
Millvista Lane 005	50	<40	<40	<38	33	40	<30	<30	<30
Millvista Lane 006	50	<40	<40	<38	30	40	<30	<30	<30
Speargrass Flat Road 471	50	<40	<40	<38	40	40	<30	<30	31
Speargrass Flat Road 509	50	<40	<40	<38	44	40	<30	<30	36
Speargrass Flat Road 515	50	40	<40	<38	44	40	30	30	35
Speargrass Flat Road 523	50	44	41	<38	47	40	33	35	40
Speargrass Flat Road 529	50	<40	<40	<38	36	40	30	32	<30
Speargrass Flat Road 531	50	40	<40	<38	40	40	36	37	31
Speargrass Flat Road 533	50	49	41	<38	50	40	35	39	40
Speargrass Flat Road 547	50	<40	<40	<38	35	40	32	30	<30