

Technical Note: Construction Noise – Automation Contractor Works

Project	ALDI National Distribution Centre, Bardon		
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1 Introduction

- 1.1 BWB has previously undertaken a noise assessment in support of the submission of the Construction Environmental Management Plan (CEMP) for the ALDI National Distribution Centre at Bardon.
- 1.2 It is understood that the Automation Contractor wishes to undertake construction work outside of approved working hours for the Site. The proposed out of hours working could include Monday to Friday 18:00 – 07:30 hours and therefore includes the evening and night-time period. This technical note summarises additional assessment work focusing on these periods.
- 1.3 The note defines the appropriate noise limits for construction activities and predicts the likelihood of temporary disturbance from noise at the nearest noise-sensitive receptors (NSRs). No changes or additional noise controls are proposed during the daytime hours; therefore, this note focuses on the assessment of evening and night-time works only.
- 1.4 For the purposes of the assessment work, information has been provided to BWB by the contractor team regarding the proposed phasing and operating equipment for the Site activities. The assessment is therefore based on candidate equipment and techniques.

Nearest Sensitive Receptors

- 1.5 Details of each receptor considered within the assessment are detailed below in **Table 1.1** and shown in **Figure 1.1**.

Table 1.1: Noise Sensitive Receptors

NSR No.	Address	Type of receptor	Grid Coordinates		Distance from site boundary
			Easting	Northing	
1	224 Battram Road, Ibstock, LE67 1GB	Residential	442591	309361	389m to the north west

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NSR No.	Address	Type of receptor	Grid Coordinates		Distance from site boundary
			Easting	Northing	
2	53 Battram Road, Ibstock, LE67 1GA	Residential	443146	309450	518m to the north east
3	1 Wood Road, Nailstone, LE67 1GE	Residential	443317	308926	218m to the east
4	Lodge Farm, Nailstone, CV13 0QP	Residential	442824	308057	248m to the south east
5	Dwelling, Grange Road, Nailstone, CV13 0QW	Residential	442265	308346	204m to the south west
6	Wiggs Farm, Grange Road, Nailstone, CV13 0QW	Residential	442366	308749	145m to the west

- 1.6 An impact may be experienced at other receptors, but this is likely to be equal to or less than those stated above.

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Figure 1.1: Nearest Sensitive Receptor Locations



Proposed works

- 1.7 **Appendix A** presents the programme of works and required plant per month, along with the number of each plant item required.
- 1.8 From a review of this programme, it was determined that the worst-case phase for noise generation would be during the mezzanine installation, with main plant equipment in operation during this phase. Therefore, the assessment has been based on the mezzanine installation activity.

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2 Standards & Guidance

BS5228-1:2009+A1:2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise

- 2.1 This standard sets out techniques to predict the likely noise effects from construction works, based on detailed information on the type and number of plants being used, their location and the length of time they are in operation.
- 2.2 The noise prediction methods can be used to establish likely noise levels in terms of the $L_{Aeq,T}$ over the core working day. This standard also documents a database of information, including previously measured sound pressure level data for a variety of different construction plant undertaking various common activities.
- 2.3 Three example methods are presented for determining the significance of construction noise impacts. In summary, these methods adopt either a series of fixed noise level limits, are concerned with ambient noise level changes as a result of the construction operations or a combination of the two.
- 2.4 With respect to absolute fixed noise limits, those detailed within Advisory Leaflet 72: 1976: Noise control on building sites are presented. These limits are presented according to the nature of the surrounding environment, but only cover a 12-hour working day of 07:00 – 19:00, are therefore not relevant to the Automation Contractor evening and night works.
- 2.5 The standard goes on to provide methods for determining the significance of construction noise levels by considering the change in the ambient noise level that would arise as a result of the construction operations. Two example assessment methods are presented. These are the 'ABC method' as summarised within **Table 2.1** and the '5 dB(A) change' method as described below.

Table 2.1: Example Threshold of Potential Significant Effect at Dwellings (Construction Noise) – ABC Method

Assessment category and threshold value period	Threshold value in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends ^{D)}	55	60	65
NOTE 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.			

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Assessment category and threshold value period	Threshold value in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
NOTE 2: If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.			
NOTE 3: Applied to residential receptors only.			
A) Category A: threshold values to use when ambient levels (when rounded to the nearest 5 dB) are less than these values.			
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.			
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.			
D) 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays.			

2.6 The 5 dB method states the following:

"Noise levels generated by construction activities are deemed to be significant if the total noise (pre-construction ambient plus construction noise) exceeds the pre-construction ambient noise by 5 dB or more, subject to lower cut-off values of 65 dB, 55 dB and 45 dB $L_{Aeq,T}$ from construction noise alone, for the daytime, evening and night-time periods, respectively; and a duration of one month or more, unless works of a shorter duration are likely to result in significant impact."

Consultation with Hinckley and Bosworth Borough Council

- 2.7 At the outset of the project, consultation was undertaken with Giles Rawdon at Hinckley and Bosworth Borough Council via email on 18 July 2023 setting out the proposed methodology for the extended construction hours. A response was received via email on 26 July 2023 stating that the proposed methodology was satisfactory.

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3 Baseline Noise Climate

- 3.1 A baseline noise survey was undertaken in 2014 in support of the planning stage noise assessment works and is fully documented in the noise assessment, which accompanied the planning submission (BWB Noise Impact Assessment MCP2278 rev 3 dated 24/11/2020). The noise monitoring locations and results are presented in **Figure 3.1** and **Table 3.1**.

Figure 3.1: Noise Measurement Locations



Table 3.1: Noise Measurement Locations

Location	Sound Pressure Levels, dB LAeq,1h	
	Evening (19:00 – 23:00)	Night-time (23:00 – 07:00)
MP1	39 - 42	31 - 46

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Location	Sound Pressure Levels, dB $L_{Aeq,1h}$	
	Evening (19:00 – 23:00)	Night-time (23:00 – 07:00)
MP2	37 - 46	27 - 49
MP3	37 - 49	31 - 53
MP4	48 - 57	38 - 60

3.2 Given these results, irrespective of whether the ABC approach or the 5 dB method was adopted, the follow limits would be established:

- Evenings and weekends – **55 dB $L_{Aeq,T}$**
- Night-time (23:00 – 07:00) – **45 dB $L_{Aeq,T}$**

4 Noise Assessment

Noise Model

4.1 In order to predict the noise levels from the proposed works at the NSRs, a detailed acoustic model of the site has been generated in order to calculate the noise propagation across the site. This noise model was generated applying the following methodology:

- The model was generated using the PC based CadnaA® noise modelling package;
- The noise model was set to apply the noise prediction methodology set out in ISO 9613-2: Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation;
- To reflect the local ground cover, ground absorption was set to $G = 0.5$ (50% acoustically reflective ground);
- Second order reflections were enabled;
- Topography was incorporated into the model directly from publicly available LiDAR dataset information;
- Base mapping for the surrounding area was imported from Google Maps;
- Receptor heights were set to 4m above local ground height; and
- Due to works potentially occurring higher than the installed acoustic barrier on the perimeter of the site, it has been excluded from the model to show a worst-case scenario.

4.2 For the mezzanine installation phase, the noise generative equipment/activities are summarised in **Table 4.1**.

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Table 4.1: Noise Model Input Data

Equipment Activity	Source Reference	LWA (dB)	Quantity	% On time
Mezzanine Installation				
30T Mobile Crane	C.4.43	98	1	75
Fork Lift Truck (GAS Powered)	D.7.69	106*	4	75
Scissor Lift (Electric)	C.4.59	106	10	75
Impact Gun (Knut Runner)	C.4.95	101	10	75
SDS Hammer Drill	C.4.69	113	2	75
* Denotes L _{WA} derived directly from L _{AFmax} rather than L _{Aeq,T}				

- 4.3 Broadband noise data was used based on BS5228-1 data for similar plant. Where specific data was not available, L_{WA} data has been used from BS5228-1 to provide a reasonable assumption regarding noise output. This is presented in **Appendix B**.
- 4.4 It has been agreed that all works outside of the previously agreed construction hours will be undertaken inside the building with all doors closed. All deliveries to site will continue to be undertaken inside the agreed construction hours, and all materials required for the evening and night-time will be inside the building in advance of that period so that work can be fully undertaken internally.
- 4.5 As such, the effective noise breakout from the building during these periods has been calculated.

Noise Breakout

- 4.6 Internal to external noise breakout calculations have been used to assess the noise construction noise levels produced from within the unit to the external facades. Within the calculation, the noise sources for plant items have been located at a distance of 10m from the wall element, as worst-case.
- 4.7 The direct sound pressure levels (Direct SPL) within the unit as a result of internal processes have been calculated based on the following formula:

$$\text{Direct SPL} = L_w + (10 \times \log (1 / ((4 \times 3.14) \times D^2)))$$

Where:

L_w is the sound power level of the source; and

D is the distance of the source from the façade.

- 4.8 The reverberant sound pressure level (Reverb SPL) has been calculated as follows:

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$$\text{Reverb SPL} = L_w + (10 \times \log(4 / RC))$$

Where:

L_w is the sound power level of the source; and

RC is the room constant.

- 4.9 These have again been logarithmically added together to provide the Reverb SPL for each façade for all sources. The Reverb SPL has then been logarithmically added to the Direct SPL for each wall element.
- 4.10 **Table 4.2** details the calculated internal noise level at the room boundary, assuming that all construction activity takes place at 10m from the wall element, as a worst-case.

Table 4.2: Calculated internal noise levels

	North wall	East wall	South wall	West wall
Internal noise level (dB)	88	88	88	88

- 4.11 It is understood that the façade comprises Kingspan KS 1100CS QuadCore Coldstore Panel. This is understood to offer a single figure weighted sound reduction of 24dB R_w and is detailed in **Table 4.3**.

Table 4.3: Octave band specification of cladding

Type	Octave band reduction (dB)					
	63 Hz	125 Hz	250 Hz	500 Hz	1kHz	2kHz
Kingspan KS 1100CS QuadCore Coldstore Panel	20	15	17	23	18	25

- 4.12 The calculated internal noise levels have been included in the model as vertical area sources, on the aspects of the unit closest to each NSR, based on an internal noise level as per **Table 4.2**, and the wall panel specified in **Table 4.3**.
- 4.13 For each NSR, the internal noise level has been applied to the closest area sources to represent a worst-case scenario whereby all plant is located at 10m from the wall element during the mezzanine installation phase. For each scenario, noise contour maps due to construction noise breakout are shown in **Appendix C**.
- 4.14 Receptor points were established in the noise model to provide single figure resultant noise levels at 4m above local ground height (*i.e., first floor level*) at each receptor and at the associated closest Site boundary. The results are presented in **Table 4.4**.

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Table 4.4: Overview of resultant worst case noise levels

Worst case scenario for given receptors	Sound Pressure Level, dB LAeq,T	
	At Receptor	At Site Boundary
NSR1	32	52
NSR2	30	51
NSR3	32	51
NSR4	35	43
NSR5	39	40
NSR6	44	51

BS 5228-1 Assessment

- 4.15 The results of the noise modelling indicate that, at all receptors the evening limit of 55 dB and the night-time limit of 45 dB would be achieved in the worst-case scenario. NSRs 1 to 3 are predicted to experience levels considerably lower than the evening and night-time limits. NSR6 is predicted to experience the highest noise levels at 44 dB, however even during the mezzanine installation phase with plant at the closest point of their work area to the receptor, the limit is predicted to be met. The corresponding worst-case noise level at the boundary would be 52 dB. It is considered that, for the vast majority of the time, noise levels at receptors would be lower than predicted.
- 4.16 Based on this, it is considered that long term noise monitoring could assist in confirming adherence to the noise limit for selected periods in the programme, however at this stage no specific noise interventions are required. Further consideration to monitoring is provided in **Section 5**.

5 Monitoring

- 5.1 In **Section 4**, it was identified that, whilst construction noise limits are predicted to be met at all times allowing for a worst-case scenario, given the margin between the limit for predicted levels at NSR6, it is recommended that continuous noise monitoring is undertaken during the initial works to verify the prediction work.
- 5.2 It is recommended that the most appropriate approach would be to install one noise monitoring station close to NSR6 for the first 8 weeks of the programme. This should be supplemented by a series of short-term sample measurements of the individual items of plant on site to verify source noise data and, where noise levels are higher than predicted, appropriate mitigation measures are employed.

We trust the content of this Technical Note to be clear and of assistance at this stage. Should you wish to discuss any aspect in further detail, please do not hesitate to contact us and we will be happy to help.

APPENDIX A: Plant Deployment

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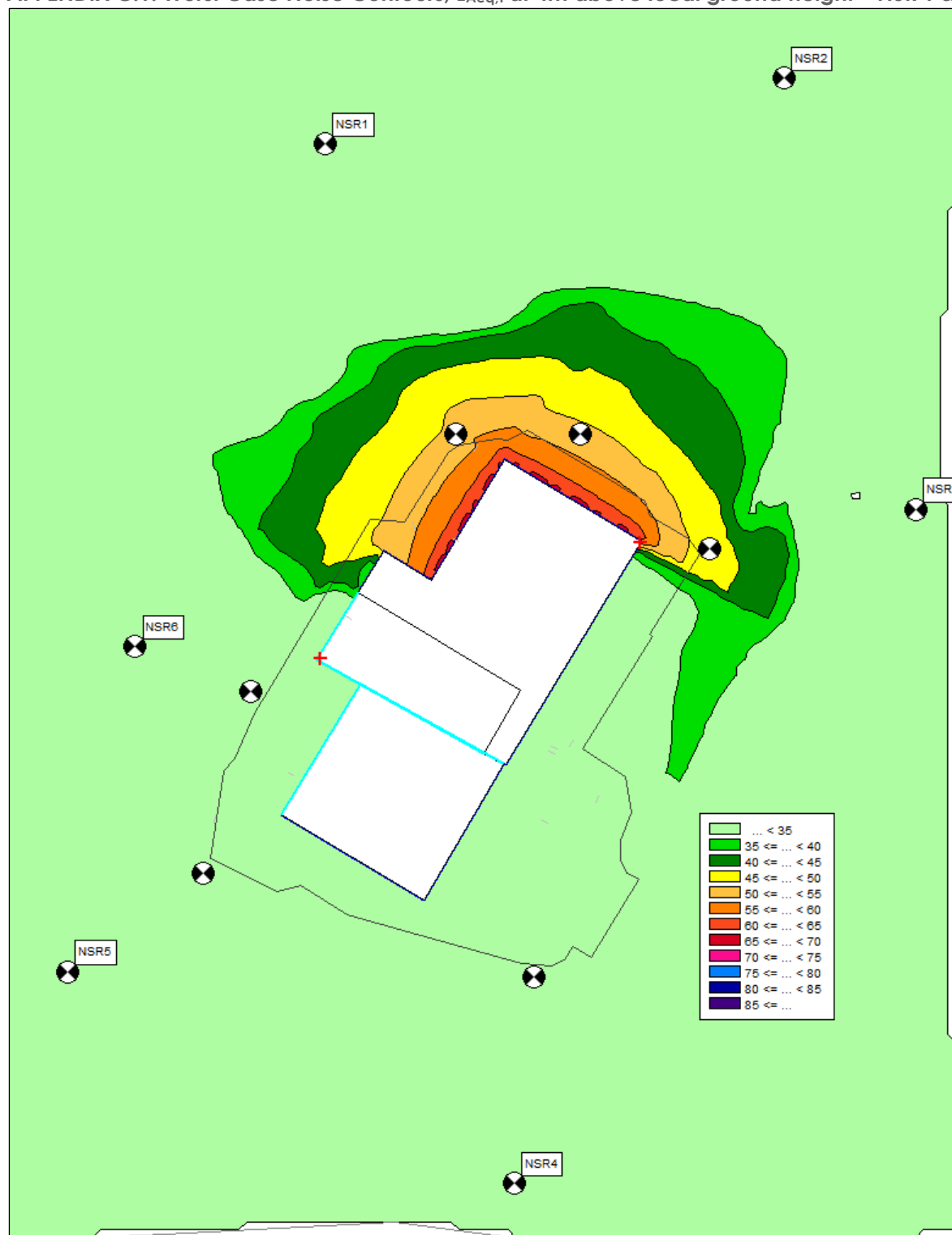
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APPENDIX B: Octave Band Noise Data Used in Noise Model

Equipment	BS 5228 Reference	Octave band sound pressure levels at 10 m, Hz								A weighted sound pressure level $L_{Aeq,1h}$, dB at 10m
		63	125	250	500	1k	2k	4k	8k	
Wheeled mobile crane	C.4.43	80	76	71	63	64	63	56	50	70
Site fork lift trucks	D.7.69	-	-	-	-	-	-	-	-	88
Diesel scissor lift	C.4.59	80	77	74	74	74	71	65	63	78
Handheld Cordless Nail Gun	C4.95	63	65	65	66	65	69	64	61	73
Core drill (electric)	C.4.69	75	74	75	72	74	75	80	80	85

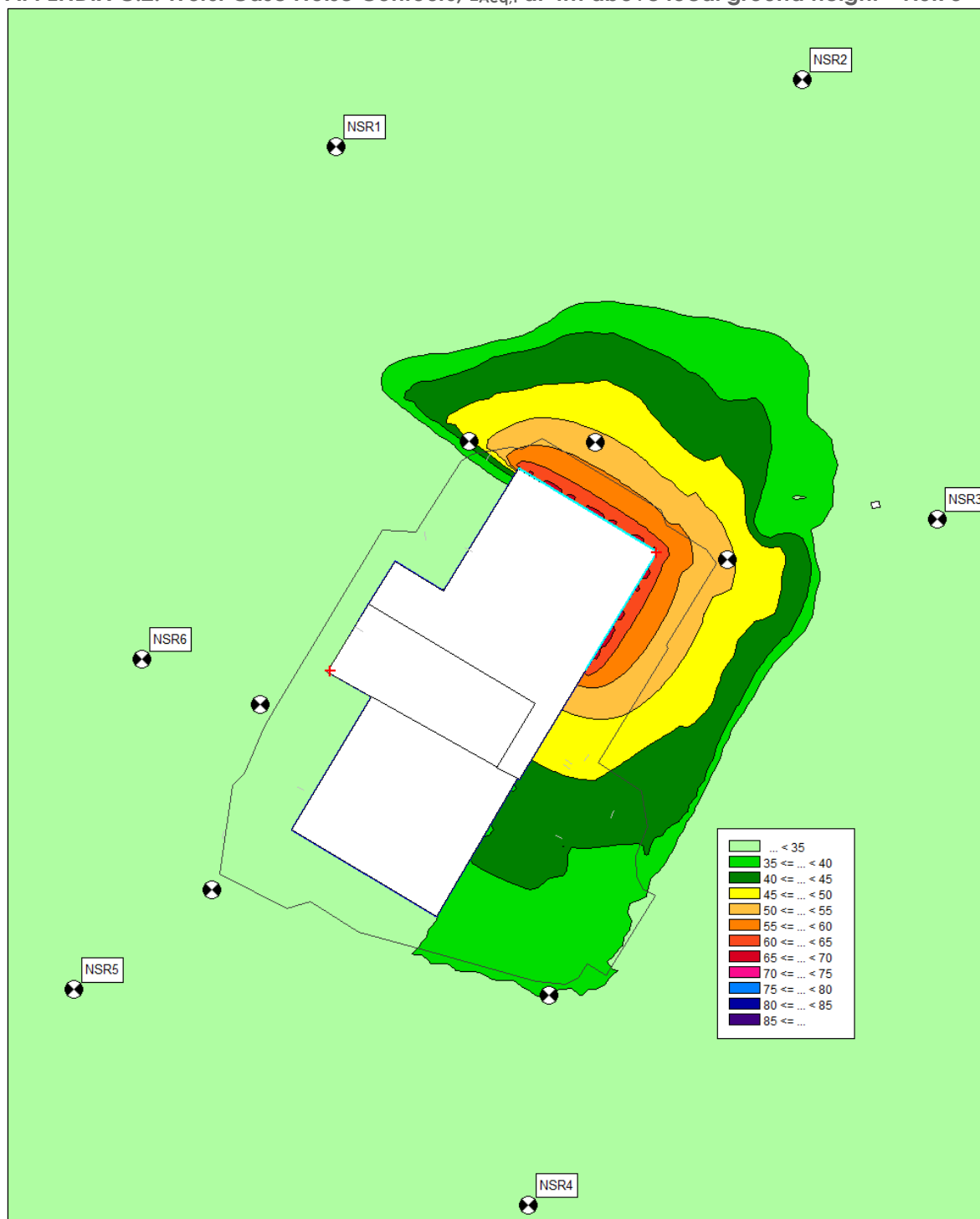
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APPENDIX C.1: Worst Case Noise Contours, $L_{Aeq,T}$ at 4m above local ground height – NSR 1 & 2



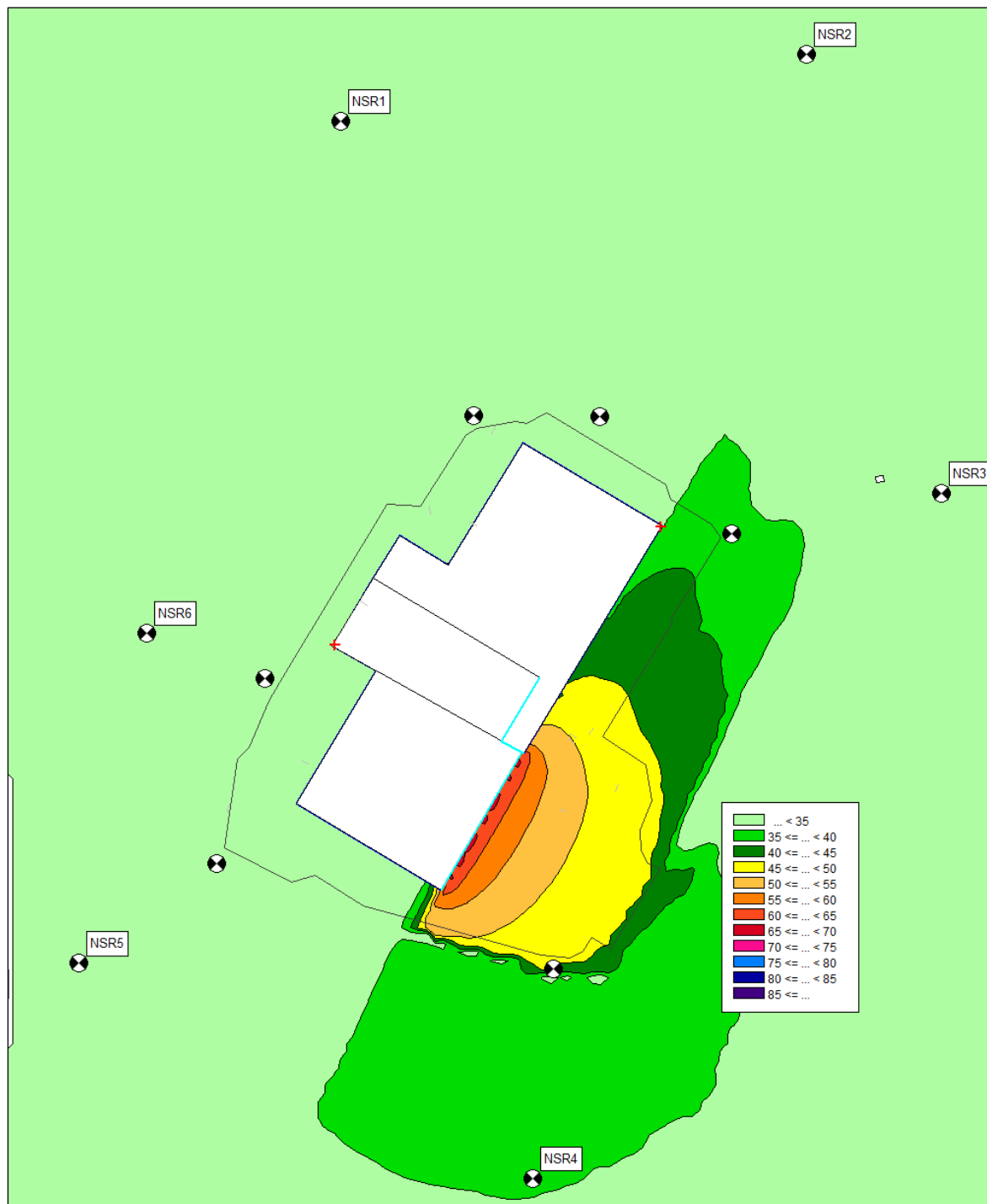
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APPENDIX C.2: Worst Case Noise Contours, $L_{Aeq,T}$ at 4m above local ground height – NSR 3



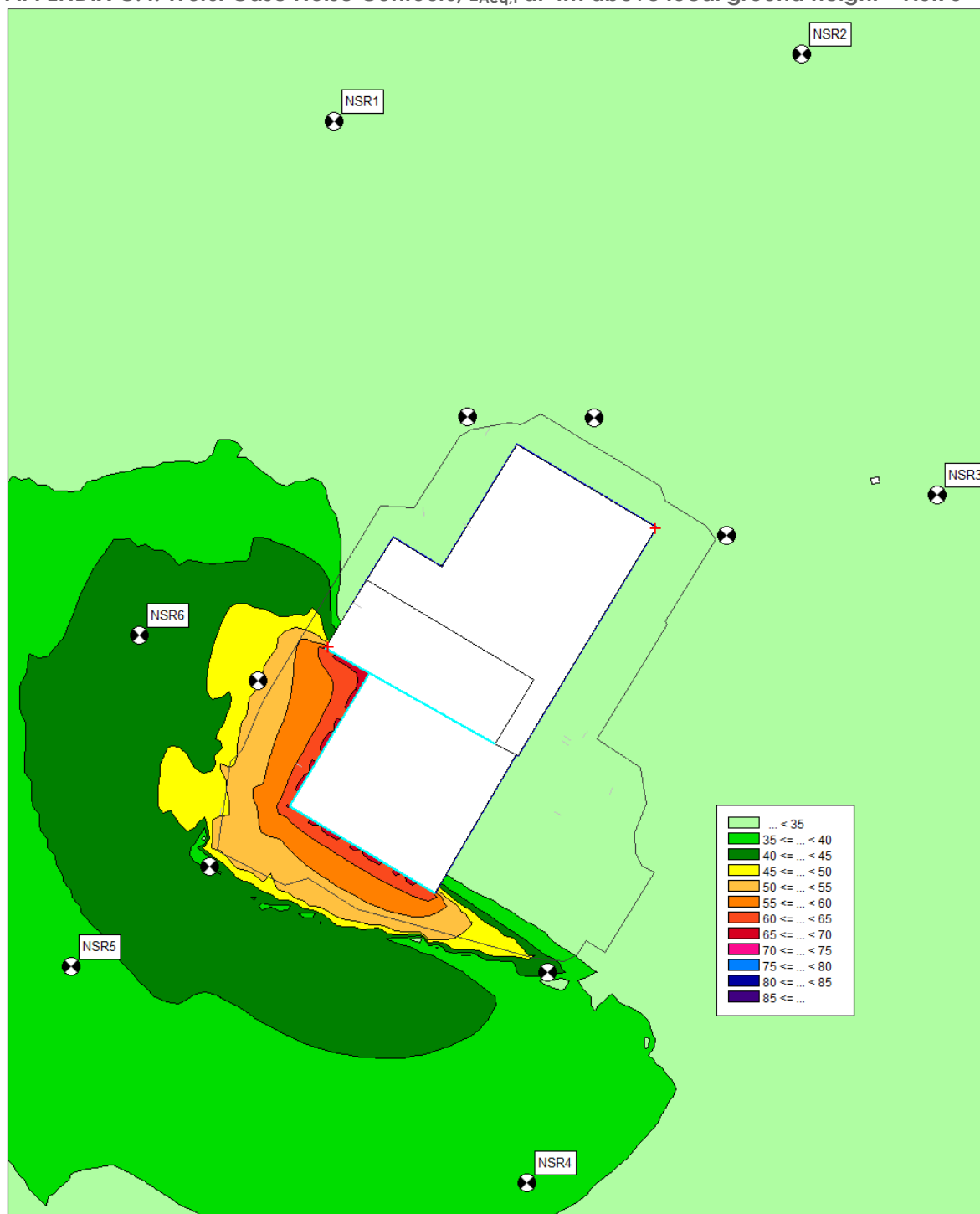
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APPENDIX C.3: Worst Case Noise Contours, $L_{Aeq,T}$ at 4m above local ground height – NSR 4



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APPENDIX C.4: Worst Case Noise Contours, $L_{Aeq,T}$ at 4m above local ground height – NSR 5



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APPENDIX C.5: Worst Case Noise Contours, $L_{Aeq,T}$ at 4m above local ground height – NSR 6

