Slane Road Phase 2

Acoustic Design Statement

D230602RP2 R5

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Document Information

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1	20 December 2023	Minor Updates	Miguel Cartuyvels	Emmet English
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Glossary

A-weighting	A spectrum adaption that is applied to measured noise levels to represent human hearing. A-weighted levels are used as human hearing does not respond equally at all frequencies.
dB	Decibel—a unit of measurement used to express sound level. It is based on a logarithmic scale which means a sound that is 3 dB higher has twice as much energy. We typically perceive a 10 dB increase in sound as a doubling of loudness.
dB(A)	Units of the A-weighted sound level.
Frequency (Hz)	The number of times a vibrating object oscillates (moves back and forth) in one second. Fast movements produce high frequency sound (high pitch/tone), but slow movements mean the frequency (pitch/tone) is low. 1 Hz is equal to 1 cycle per second.
L_{eq}	Equivalent Noise Level—Energy averaged noise level over the measurement time.
R_W	Weighted Sound Reduction Index—A laboratory measured value of the acoustic separation provided by a single building element (such as a partition). The higher the R_W the better the noise isolation provided by a building element.
L_{den}	(day-evening-night noise level) is the A-weighted, Leq (equivalent noise level) over a whole day, but with a penalty of +10 dB(A) for night-time noise (22:00-07:00) and +5 dB(A) for evening noise (19:00-23:00).
L_{day}	(day noise level), is the A-weighted, Leq (equivalent noise level) over the 16-hour day period of 07:00-23:00 hours, also known as the day noise indicator
L_{night}	(night noise level), is the A-weighted, Leq (equivalent noise level) over the 8-hour night period of 23:00-07:00 hours, also known as the night noise indicator.

Executive Summary

Amplitude Acoustics was engaged by Lagan Homes to conduct an acoustic modelling and traffic noise intrusion assessment for a proposed residential development on a greenfield site at Old Slane Road, Mell/Tullyallen, Drogheda, Co. Louth. The site has existing planning permission for a strategic housing development 237 no. residential units (86 no. houses, 151 no. apartments), creche and associated site works (ABP 311578-21).

The development was divided in two phases for which Lagan Homes are seeking planning permission. Amplitude has previously provided an acoustic design statement for the phase 1 works. This report is an acoustic design statement assessing the noise levels for the proposed works on a section of the site that will form the second phase of the development consisting of 207 no. residential houses. Buildings on site will be 2 and 3 storeys detached, semi-detached and terraced dwellings.

The criteria for the project have been developed having regard to the requirements of:

- Louth County Council Noise Action Plan (2018 – 2023);
- ProPG: *Planning & Noise - Professional Practice Guidance on Planning & Noise*, May 2017; and,
- British Standard BS8233:2014 *Guidance on sound insulation and noise reduction for buildings*.

A ProPG Noise Risk Assessment and traffic noise intrusion assessment with outdoor amenity have been carried out for a proposed residential development on a greenfield site adjacent to the M1 and the R168 on the outskirts of Drogheda, Co. Louth.

The assessment includes for the forecast increase in traffic volume and associated increase in noise levels outlined in the TII document Project Appraisal Guidelines Unit 5.3 'Travel Demand Projections'. Façade specifications for the glazing and façade elements have been developed to meet the internal noise criteria based on the predicted noise levels and measured noise levels.

To improve outdoor amenity area noise levels, a combination of 2m wall, 3m, 4m wall and a berm have been considered to reduce the traffic noise impact on the site, in addition to the screening provided by the development buildings. Details of the construction of these walls have been included in Table 10 and include concrete block walls, concrete panel walls in concrete posts with no gaps. Timber panels have limited acoustic performance and have not been relied upon to sound attenuation.

Provided that the construction details in Section 6.1 are implemented in full, the internal noise levels in the residential properties are predicted to meet the internal noise criteria. The acoustic screening due to the introduction of the development buildings, boundary noise walls and berms significantly reduces the noise on-site to below the 50-55dB threshold for all amenity spaces. Consequently, the external amenity noise levels are considered acceptable with regard to ProPG guidance.

Notably, the proposed development can be considered as an improvement on the existing planning permission for the site as it:

- Predicts the noise levels across the site based on forecast traffic growth rather than preexisting levels only
- The layout plan reduces the noise levels across the site more than the parent scheme due to more effective use of layout to screen the noise from the M1.

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1 Introduction

Amplitude Acoustics was engaged by Lagan Homes to conduct an acoustic modelling and traffic noise intrusion assessment for a proposed residential development on a greenfield site at Old Slane Road, Mell/Tullyallen, Drogheda, Co. Louth. The site has existing planning permission for a strategic housing development 237 no. residential units (86 no. houses, 151 no. apartments), creche and associated site works (ABP 311578-21).

The development was divided in two phases for which Lagan Homes are seeking planning permission. Amplitude has previously provided an acoustic design statement for the phase 1 works. This report is an acoustic design statement assessing the noise levels for the proposed works on a section of the site that will form the second phase of the development consisting of 207 no. residential houses. Buildings on site will be 2 and 3 storeys detached, semi-detached and terraced dwellings.

The purpose of the assessment is to:

1. Provide a risk assessment for the subject site based on baseline monitoring and acoustic modelling of the application site with regard to ProPG 2017 Noise Risk Classification.
2. Predict façade noise levels across the site during daytime and night-time periods and, using the predicted levels, provide façade specifications to bring internal traffic noise levels within limits specified by BS8233 and ProPG 2017.
3. Predict exposure to noise in external amenity spaces and specify suitable mitigation measures.

This is Revision 2 of the report which has been updated to account for LRD opinion dated 21st February 2024 pertaining to noise, as outlined below.

> The acoustic design statement prepared by Amplitude Acoustics has concluded that acoustic screening will significantly reduce the external noise level on-site to largely below the 50-55dB threshold for amenity spaces, thought the statement does identify that there will be a limited area between 55-60dB $L_{Aeq\ 16\ hours}$. The acoustic design statement also reports that future noise levels are expected to rise by between 1-2dB over the next 10 years. The prospective applicant is recommended to investigate additional noise reduction measures on site to take account of those areas where the external noise level exceeds the 55dB $L_{Aeq\ 16\ hours}$ threshold. The prospective applicant is also recommended to investigate additional noise reduction measures factoring in expected future noise level increases of 1-2dB over the next 10 years.

In response to the above, the predicted noise levels across the site have been amended to include the increase in noise levels expected due to future traffic growth as outlined in Table 4 on this report. The internal and external noise levels across the been assessed with regard to this future scenario (2034). Mitigation measures have been developed to ensure these are achieved under both the current (2024) and forecast (2034) traffic volumes. Notably, achieving the 55dB $L_{Aeq,\ 16hr}$ in all external gardens is predicted to be achieved by implementing the guidance outlined in Section 6 on this report.

2 Site Description

The permitted SHD is located on a greenfield site adjacent to the M1 and the R168 on the outskirts of Drogheda, Co. Louth. The site is bounded by:

- The R168 and agricultural land beyond to the North.
- The M1 with dwellings and agricultural land beyond to the West.
- Residences, agricultural land and Slane Road to the South.
- Residences, agricultural land and the M1 Retail Park to the East.

Figure 1 below shows an aerial view of the site in relation to the surrounding area, the M1 and the R168. The location of the traffic noise logger and positions used for attended model calibration measurements are also shown.

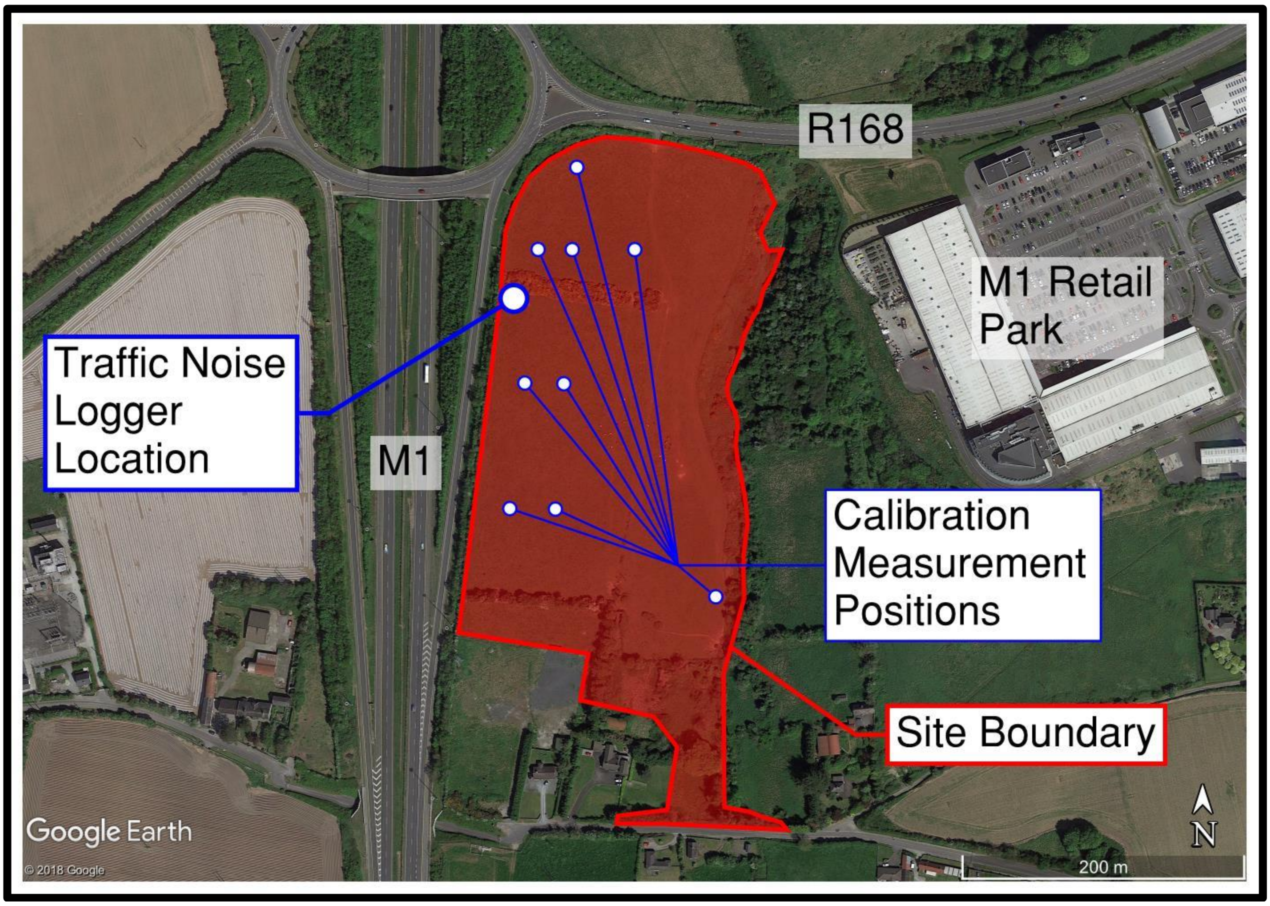


Figure 1: Aerial photograph showing the development site in relation to the surrounding area, the M1 and the R168.

A layout plan for the proposed phase 2 of the development is included in Appendix A.

3 Acoustic Criteria

The criteria for the project have been developed with regard to the requirements of ProPG 2017, BS 8233:2014, and the Louth County Council Noise Action Plan.

3.1 Internal Noise Levels

The relevant internal noise criteria for the development have been based on the requirements of ProPG 2017 and BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. Table 1 below provides internal L_{Aeq} target levels for overall noise in the design of a building as defined in BS 8233.

Table 1: BS 8233:2014 internal noise criteria – Commercial and Residential Buildings.

Activity	Location	07:00 to 23:00 Hrs	23:00 to 07:00 Hrs
Resting	Living Room	35 dB $L_{Aeq, 16 hour}$	-
Dining	Dining Room/Area	35 dB $L_{Aeq, 16 hour}$	-
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq, 16 hour}$	30 dB $L_{Aeq, 8 Hours}$

Note 1: Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values. In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night.

For the purposes of this assessment, we have determined glazing requirements on the basis of achieving internal noise criteria as shown in Table 1 the living, sleeping and working areas of the proposed development.

3.2 Louth CoCo Noise Action Plan 2018 – 2023

The *Louth County Council Noise Action Plan 2018 – 2023* [1] recommends the following threshold levels for onset of assessment of noise mitigation measures:

> *"For assessment of noise mitigation measures*
> - *70 dB L_{den}*
> - *57 dB L_{night}"*

For areas with traffic noise levels in excess of the above "onset of assessment" levels, a rigorous planning process with consideration of a variety of noise mitigation measures is recommended.

3.3 External Amenity Areas

Guidance on noise levels for external amenity areas is provided by BS 8233:2014 and ProPG 2017. ProPG 2017 refers to the BS8233:2014 guidance which states that: "*the acoustic environment of external amenity areas that are an intrinsic part of the overall design should always be assessed and noise levels should ideally not be above the range 50 – 55 dB LAeq,16hr". The standard continues… "These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces but should not be prohibited."*

It should be noted that both BS8233:2014 and ProPG 2017 do not advise that development should be restricted in areas with undesirable noise levels, however it does recommend that appropriate mitigation measures are put in place and planning should not be restricted on this basis. Where required, design guidance has been provided to ensure lowest practicable external noise levels are achieved in line with ProPG 2017.

[1] Louth County Council Noise Action Plan 2018 – 2023 available at: https://www.louthcoco.ie/en/services/environment/noise-action-plan/noise-action-plan-2018-louth-co-co-final.pdf

3.4 ProPG: Professional Practice Guidance on Planning & Noise

In order to assess the noise risk to the proposed development and as a result appropriate mitigation the methodology provided in ProPG has been followed.

ProPG was published on 22 June 2017 and the scope is restricted to new residential development exposed predominantly to airborne noise from transport sources. The guidance encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise. The guidance was prepared by the Institute of Acoustics, the Association of Noise Consultants and the Chartered Institute of Environmental Health. It encourages a holistic design process where acoustics is integral to the living environment. This covers careful site layout and better orientation of rooms within dwellings. *ProPG acknowledges and reflects the Noise Policy Statement for England, the National Planning Policy Framework and Planning Policy Guidance – Noise.*

The recommended approach for new residential development is in two stages; Stage 1 is an initial noise risk assessment of the proposed development site for an early indication of the initial suitability of the site for new residential development.

3.4.1 Stage 1 Assessment

For reference, the indicative noise levels for the initial site noise risk assessment as presented in ProPG are illustrated below.

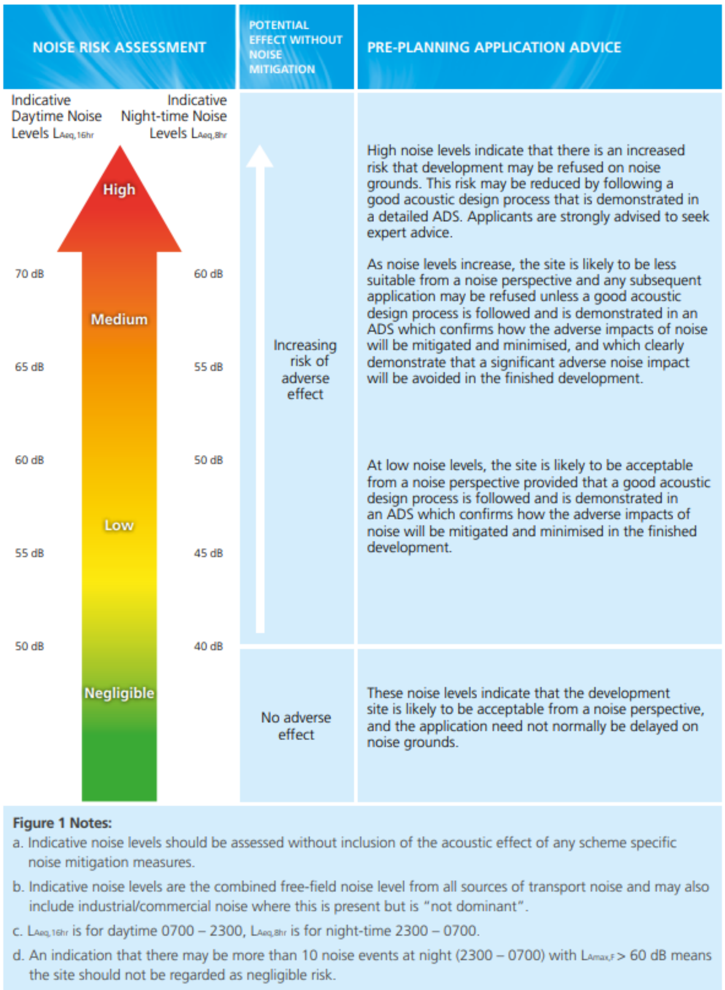


Figure 2: Stage 1 – Initial Site Noise Risk Assessment

3.4.2 Stage 2 Assessment

Stage 2 is a systematic consideration of four key elements:

- Demonstrating a “Good Acoustic Design Process”.
- Observing internal “Noise Level Guidelines”.
- Undertaking an “External Amenity Area Noise Assessment”.
- Consideration of “Other Relevant Issues”.

Good Acoustic Design Process

General principles (in order of preference):

- Maximising spatial separation of noise sources and receptors.
- Reducing existing noise levels or relocating noise sources, if possible.
- Using existing topography and existing structures.
- Incorporating noise barriers as part of the scheme.
- Using layout to reduce noise propagation across the site.
- Using orientation to reduce noise exposure of sensitive rooms.
- Using building envelope to mitigate noise.

Internal Noise Level Guidelines

ProPG guidance is based on BS 8233:2014 and World Health Organisation recommendations. Internal ambient noise levels (IANL) are provided in Table 1.

External Amenity Areas

External amenity areas which are an intrinsic part of the overall design should ideally not be above 50 - 55 dB $L_{Aeq,16hr}$; or designed to achieve the lowest practicable noise levels (BS 8233:2014).

If significant adverse noise impacts remain on any private external amenity space, then this is partially off-set if residents are provided with access to a “relatively quiet” alternative external amenity space.

Consideration of Other Relevant Issues

- Compliance with relevant national/local policy.
- Magnitude and extent of compliance with ProPG.
- Likely occupants of the development.
- Acoustic design versus unintended adverse consequences.
- Acoustic design versus planning objectives.

4 Noise Measurements

Attended noise surveys were conducted on the 8th of November 2019 and 15th November 2019. An unattended noise logger was deployed to continuously record traffic noise levels at the traffic noise monitoring position indicated in Figure 1 from 20th November 2019 to 26th November 2019. An assessment of the TII traffic count data indicates that that there has been less than a 1% change in the Average Daily Traffic along the adjacent M1 between 2019 and 2024. This corresponds to approximately 0dB change in the traffic noise levels on the site. Therefore, the daytime and nighttime traffic noise levels are assumed unchanged since the 2019 survey.

4.1 Instrumentation

A class 1 sound level meter in accordance with IEC 61672-1:2013 was used for all measurements. Table 2 below summarises the measurement equipment used.

Table 2: Measurement Equipment

Description	Manufacturer	Model	Serial Number
Sound Analyser	Norsonic	Nor140	1402707
Sound Level Meter	Sinus	Tango Plus	0001813
Calibrator	Norsonic	Nor-1251	35275

All equipment has calibration certificates traceable back to the relevant Standard. A calibration check of the sound analyser was conducted prior to and following the assessment using an external acoustic calibrator, with no significant drift in calibration measured.

4.2 Procedure

Noise measurements of the various sources were undertaken in accordance with the following:

- The microphone of the sound level meter was at a height of approximately 1.3 metres at a known distance and orientation to the source whilst it was operating.
- A wind shield was used during all measurements, and the measurements were undertaken during calm, still weather (for which the wind velocity did not exceed 5 m/s).
- Care was taken to avoid any effect on the measurement of extraneous noise, acoustic vibration or electrical interference.

4.3 Results

A summary of the relevant day and night measured levels is presented in Table 3 below. It should be noted that the noise levels displayed represent the noise at the monitoring location which is approximately 70 metres from the centre of the dual carriageway. Positions within the site vary from approximately 45 metres to approximately 230 metres from the M1.

Table 3: Average traffic noise measurements for 20th - 26h November 2019 at traffic noise monitoring location.

Time period	Assessment period	Noise Levels
Day	07:00 to 23:00 Hrs	63 dB(A) $L_{Aeq, 16 hour}$
Night	23:00 to 07:00 Hrs	58 dB(A) $L_{Aeq, 8 hour}$

5 Assessment

Noise emissions on the proposed site have been modelled using SoundPLAN 9 which implements the 'Calculation of road traffic noise (CORTN) algorithm'. The model accounts for the following factors:

- Traffic Flow in terms of Average Daily Traffic (AADT).
- Percentage Heavy Vehicles.
- Traffic Speed and road gradient.
- Distance attenuation, including source and receptor heights.
- Barrier effects due to facility structures and other buildings.
- Ground effects and absorption.
- Atmospheric attenuation.

The proposed development was modelled using information sourced from the TII Traffic Count Data available here https://trafficdata.tii.ie/sitedashboard.asp?sgid=XZOA8M4LR27P0HAO3_SRSB&spid=669C221137E8 . The development layout was provided by JFOC Architects.

The 10-year forecast has been established using the forecast traffic flows using the *TII Project Appraisal Guidelines Unit 5.3 'Travel Demand Projections'* adopting 'Central Growth Rates' as per the TII document. Table 4 below indicates the traffic growth rate according to the TII document.

Table 4. Traffic growth rate per year and vehicle

Vehicle Type	Growth up to 2030	Growth between 2030 - 2040
Light Vehicle	1.0148	1.0070
Heavy Vehicle	1.0363	1.0174

These rated growth levels have been calculated and included as road AADT for the proposed scenario. The calculated rise of noise levels across the development is approximately 1 dB over the next 10 years.
Inputs into the model for the M1 motorway are summarised in Table 5 below and in Table 6 for the R168. The tables include the existing traffic profile (2024) and 10-year forecast (2034). The proposed scenario with the development in place considers the predicted road traffic count in 2034 as a worst-case scenario.

Table 5: Parameters used to model Traffic Noise for the M1.

Parameter	Existing (2024)	Forecast (2034)
Annual Average Daily Traffic (AADT)(1)	41434 Vehicles	51909 Vehicles
Percentage Heavy Vehicles(1)	11.7%	14.8%
Traffic Speed(2)	120 km/hr	120 km/hr
Terrain(3)	TII Lidar	TII Lidar

1. Model input data for existing traffic volumes have been derived from: https://trafficdata.tii.ie/sitedashboard.asp?sgid=XZOA8M4LR27P0HAO3_SRSB&spid=669C221137E8
2. Local Signage
3. TII Lidar digital terrain model data sourced from https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b7c4b0e763964070ad69bf8c1572c9f5

Table 6: Parameters used to model Traffic Noise for the R168.

Parameter	Existing (2024)	Forecast (2034)
Annual Average Daily Traffic (AADT)(1)	6320 Vehicles	7872 Vehicles
Percentage Heavy Vehicles(1)	9.8%	12.4%
Traffic Speed Existing Roads(2)	80 km/hr	80 km/hr

Parameter	Existing (2024)	Forecast (2034)
Slip Road Annual Average Daily Traffic (AADT)(1)	3160 Vehicles	3936 Vehicles
Terrain(3)	TII Lidar	TII Lidar

1. Estimated based on similar roads and traffic volumes on adjoining roads.
2. Local Signage.
3. TII Lidar digital terrain model data sourced from https://dcenr.maps.arcgis.com/apps/webappviewer/index.html?id=b7c4b0e763964070ad69bf8c1572c9f5

The model has been calibrated and validated using the results of both the unattended monitoring, and the spatially distributed attended calibration measurements, the positions of which are shown in Figure 1, with good agreement between measured and predicted existing noise levels shown.

Elevations of buildings and noise barriers have been set as follows:

- Base elevations of buildings have been set to the median existing topographic elevation of the building footprint.
- Noise barrier base elevations are set to the existing topographic elevation, therefore the final built elevation of the upper edge of the barriers should be at the specified height above the existing topography of the site.
- Walls and Fences have been defined in the site layout plan for proposed development. Based on our experience the following walls and fences have been identified as sufficient to act as noise barriers:
    - 2m High Concrete Post and Concrete Panel Fence. Panel fencing is to be reviewed to ensure no visible gaps in the fencing exist. Where gaps exist, these are to be sealed with mortar or approved grout.
    - 2m High Acoustic Fencing on 2m High Planted Berm
    - 2m High Acoustic Fencing
    - 4m High Acoustic Fencing
    - 2m High Rendered Finished Block Wall with Brick Cladded Piers.

All Acoustic Fencing, Panels Fencing and Concrete walls should achieve an Rw 30 or above. Standard block walls or concrete panels typically achieve this value. Timber panel fencing outlined in the landscape plan has limited acoustic performance and has not been relied upon to reduce the noise levels across the site. Further details on noise barriers in provided in Section 6.

5.1 Predicted Traffic Noise Contour Bands

The predicted L_{den}, L_{day} and L_{night} traffic noise contour bands across the site for existing and proposed conditions are shown within the next pages.

5.2 ProPG Risk Assessment

The predicted existing noise contour bands, validated by real site measurements, across the proposed development site enable a ProPG Noise Risk Assessment to be conducted for the site (see Figure 3 and Figure 4). The range of predicted noise levels within the site boundary are as follows:

- L_{day}: 55 – 70dB $L_{Aeq,\ 16\ hour}$
- L_{night}: 45 – 65dB $L_{Aeq,\ 8\ hour}$

It can be seen from the images that traffic noise levels for the development site are classified as Medium risk during the daytime, and Medium to High risk during the night-time. This indicates that traffic noise is a key issue for the site and that measures are required to ensure that internal and external noise levels comply with the guidance of ProPG 2017, BS8233 and WHO Guidelines.

5.3 ProPG Stage 2 – Noise Assessment

5.3.1 Good Acoustic Design

ProPG states that *'Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises.'*

Having regard to the constraints of the site and the requirement for the designers to adhere to relevant Development Plan Policy and established Building Regulations, the proposed scheme has adopted the following Good Acoustic Design Measures:

- The development layout has been reviewed multiple times based on acoustic requirements;
- All bedrooms have been oriented facing the interior side of the development;
- All external amenity areas have been located on the sheltered side of the proposed buildings;
- The Western boundary of the site has been treated with acoustic barrier; and,
- Incorporation of acoustic glazing and ventilation to the façades of exposed dwellings.

5.4 County Louth Noise Action Plan

Figure 3 and Figure 4 on the following pages present the predicted traffic noise contours across the site in terms of L_{den} and L_{night} respectively. Each of the figures compares the predicted noise contours across the site without and with the introduction of buildings and acoustic barriers of the proposed development considering the future traffic noise in 2034. It can be seen from Figure 3 and Figure 4 that there are portions of the site which, under existing conditions, exceed the threshold levels (70dB L_{den} and 57dB L_{night}) outlined in the Louth Noise Action Plan for onset of assessment of noise mitigation measures.

In compliance with the Louth Noise Action Plan a rigorous planning process has been conducted involving the introduction of mitigation including buildings self-screening and the use of acoustic barriers. it can also be seen from the noise contours for the proposed development that noise levels across the site are substationally below both the L_{DEN} and L_{night} thresholds, due to the attenuation the introduction of buildings self-screening and the use of berms and acoustic barriers. Consequently the noise levels incident on buildings across the site are predicted to be substantially below the L_{DEN} and L_{night} thresholds outlined in the NAP.

Compliance with the intent of the Noise Action Plan is considered achieved by implementing the construction details required to achieve the external and internal noise levels within the project criteria are outlined in Section 6 of this report.

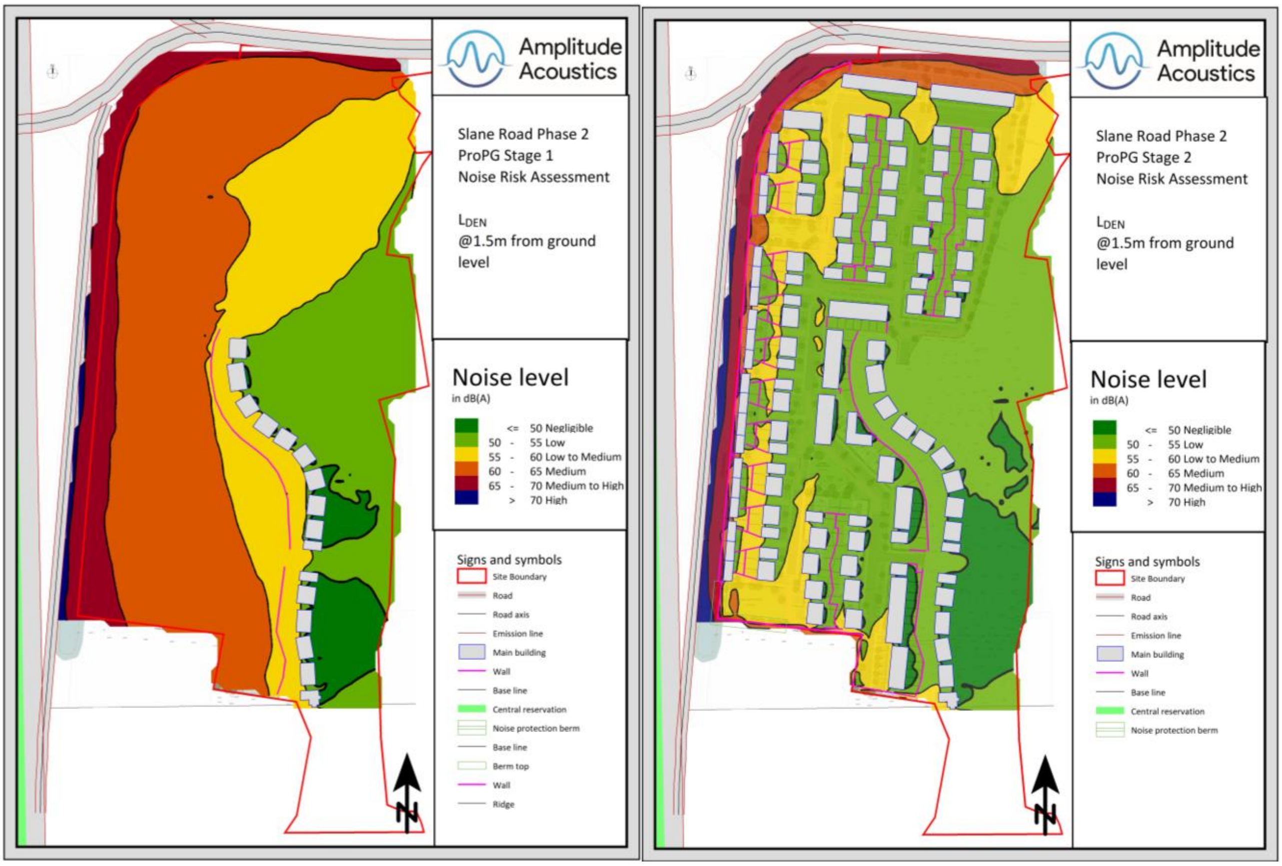


Figure 3. Side-by-side comparison of predicted L_{DEN} road traffic noise contour bands for the existing site without (left side) and with (right side)the development in place. (Scenario 2034)

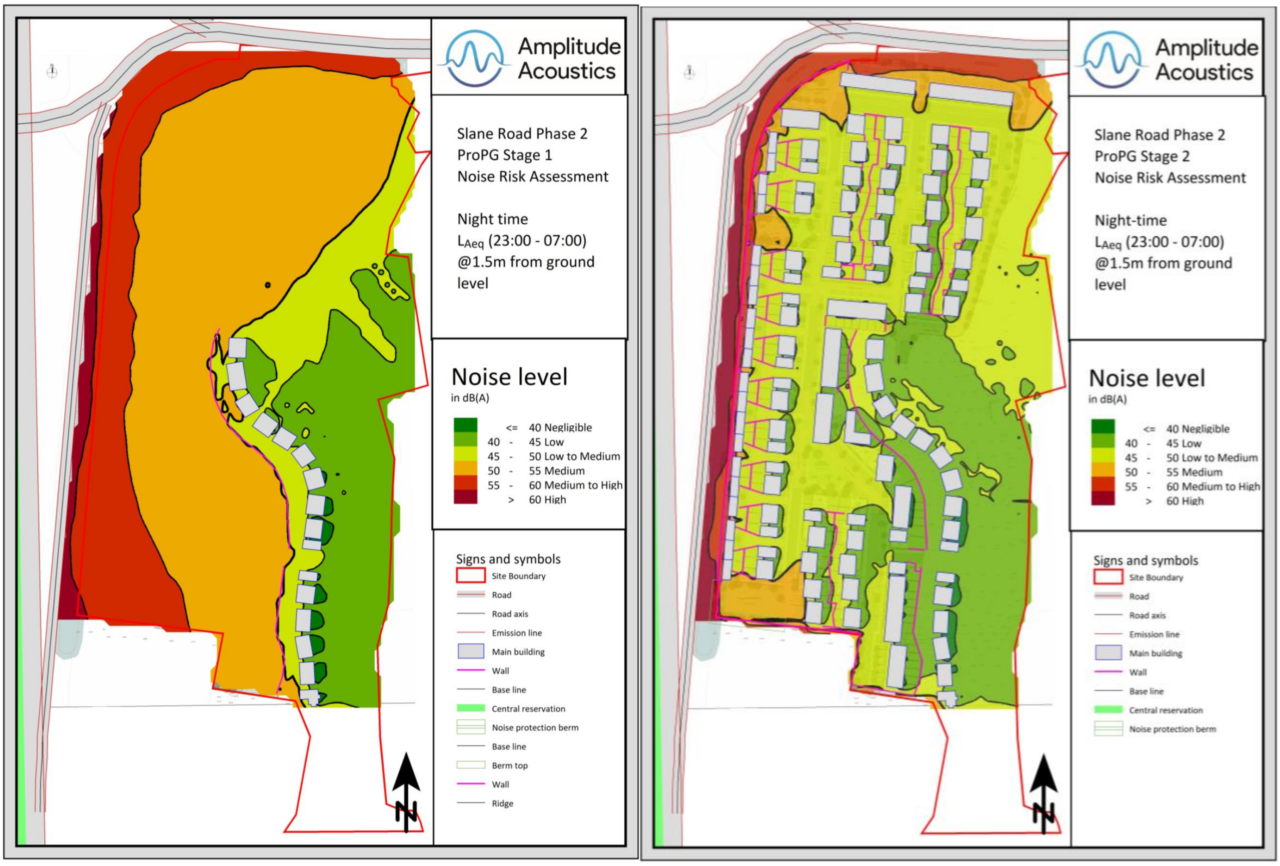


Figure 4. Side-by-side comparison of predicted L_{night} road traffic noise contour bands for the existing site without (left side) and with (right side) the development in place. (Scenario 2034)

5.5 External Amenity Areas

Figure 5 below shows a side-by-side comparison of predicted L_{day} traffic noise levels for the existing conditions (adjusted for the forecast traffic increase by 2034) with and without the development in place, with light green indicating levels in the 50 – 55dBA range and dark green indicating levels below 50dBA.

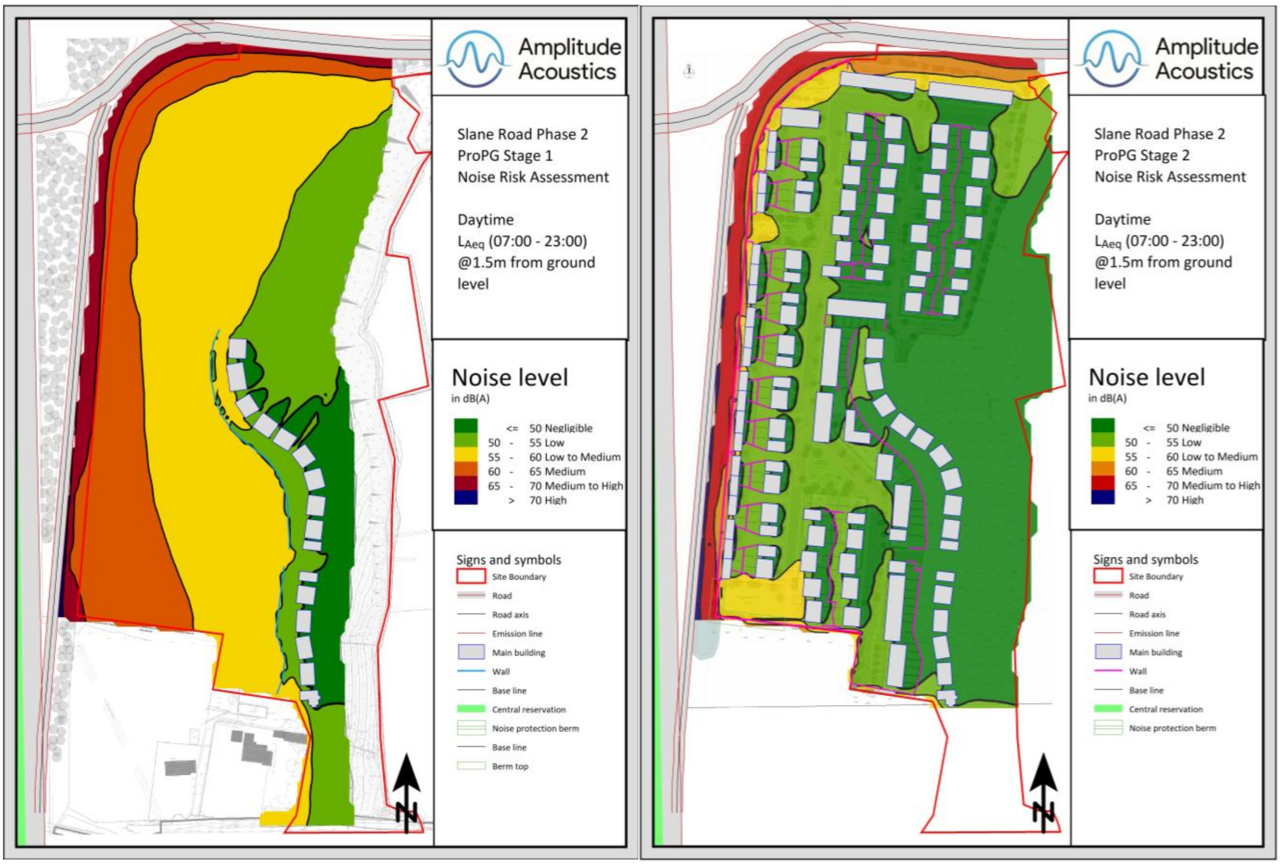


Figure 5 Side-by-side comparison of predicted L_{day} road traffic noise contour bands for the existing site without (left side) and with (right side) the development in place. (Scenario 2034)

The existing area of the site along the southwest boundary is the most exposed to noise from the M1 motorway. Under existing conditions, this area of the site is exposed to noise levels in the range 60 – 70dB L_{day} ($L_{Aeq,16hr}$). ProPG 2017 states that areas intended for external amenity should ideally have noise levels in the range of 50 – 55dB L_{day} ($L_{Aeq,16hr}$). It also states, however:

> *"These guideline values may not be achievable in all circumstances where development might be desirable. In such a situation, development should be designed to achieve the lowest practicable noise levels in these external amenity spaces."*

However, by introducing the the screening provided by the proposed development buildings, as well as the proposed acoustic perimeter noise walls and berms, the the noise levels in all private gardens are predicted to remain below 55dB L_{day} ($L_{Aeq,16hr}$) in all instances as can be observed in Figure 5. In summary, predicted noise levels in these private gardens areas are:

- Without mitigation: 50 – 70dB L_{day} ($L_{Aeq,16hr}$)
- With mitigation (proposed walls and buildings): <55dB L_{day} ($L_{Aeq,16hr}$) in all instances.

Notably this assessment also includes for the predicted noise increase due to forecast traffic growth which was not included for in the noise assessment of the parent scheme. Consequently it is considered an improvement on the parent scheme design.

6 Noise Intrusion Assessment

Following the site measurements and modelling, a BS EN ISO 12354-3 noise intrusion assessment was undertaken, and the façade sound insulation requirements were determined. The construction requirements for the façade are provided in Section 6.1 of this report. By implementing the design guidance in this section, the internal noise criteria outlined in Table 1 will be achieved. The glazing and ventilation requirements specified apply to all floors of the proposed buildings.

6.1 Building Envelope Design

Using the noise levels predicted across the residential site, and the internal break-in noise criteria, glazing acoustic performance specifications for the residential dwellings have been developed.
It is noted the orientation of the bedrooms are interior of the development site (facing the east as identified by the red dots in the Figure 6 below), this reduces the impact of the traffic noise into the rooms and allows a reduction of the glazing requirements for the same. Figure 6 below shows the orientation of the house and the respective bedroom windows. The M1 is located to the west.

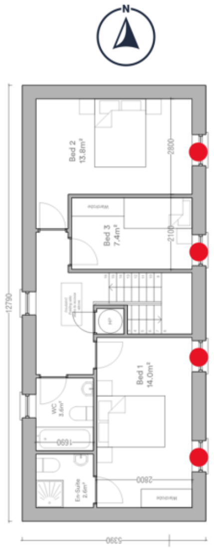


Figure 6. Representative most exposed dwelling

6.1.1 Façade Requirements, Windows and Doors

The indicative façade glazing requirements for the development are shown in Table 7. It is a requirement that the composite façade elements, including the glazing, as a minimum, achieve the same sound insulation performance as the glazing specified. Glass from various manufacturers is available that will meet the acoustic requirements, however alternative glass/manufacturers and configurations may not achieve the same acoustic performance and should be approved by the acoustic consultant prior to selection. A mark-up of the required glazing specification is included for in Appendix C: Glazing Mark-Ups.

Table 7: Glazing requirements

Glazing Type (Example Build-up)	Glazing Acoustic Performance R_w[1]	1/1 Octave Band Minimum Performance Requirements R dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
GL1 (6mm + 12mm + 6mm)	**32**	16	20	19	29	38	36	45	45
GL2 (10mm + 12mm + 6mm)	**37**	22	26	27	34	40	38	46	46

Glazing Type (Example Build-up)	Glazing Acoustic Performance Rw[1]	1/1 Octave Band Minimum Performance Requirements R dB							
		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
GL3 (6mm + 12mm + 16.2mm)	**41**	31	26	31	40	42	44	48	48

1. The performance of a double and triple-glazed system is significantly improved by varying the pane thicknesses, e.g. 1 x 4mm pane + 2 x 6 mm panes. Different glazing options which achieve the acoustic performance requirements can be considered.

6.1.2 Background Ventilation Requirements

The table below sets out the performance requirement for the ventilation elements to comply with the 'whole dwelling ventilation' condition when windows need to be closed to avoid noise ingress.

Table 8: Acoustic performance of example ventilation options, D (dB)

Ventilation Type	Element Level Difference at Octave Band Centre Frequency (Hz)								$D_{n,ew}$
	63	125	250	500	1k	2k	4k	8k	
Vent 1 – example DucoMax Corto 25SR	33	35	30	31	34	44	42	42	36
Vent 2 – example Renson AK38	26	31	33	42	43	39	44	44	41
Vent 3 – example Renson AK40	27	32	33	42	45	52	56	56	44

One (1) trickle ventilator or air inlet has been assumed per room. Where more ventilators are used, the acoustic performance of the ventilators would need to be upgraded by 10*log(N); being N the number of ventilators per room.

Provision of mechanical ventilation will reduce the performance required for the glazing. This should be reviewed during the detailed design stage.

6.1.3 Wall Constructions

The current proposed external wall constructions have been assessed and determined to meet the break in noise criteria. This is based on the wall achieving a minimum SRI of 54dB Rw.

6.2 External Amenity Spaces

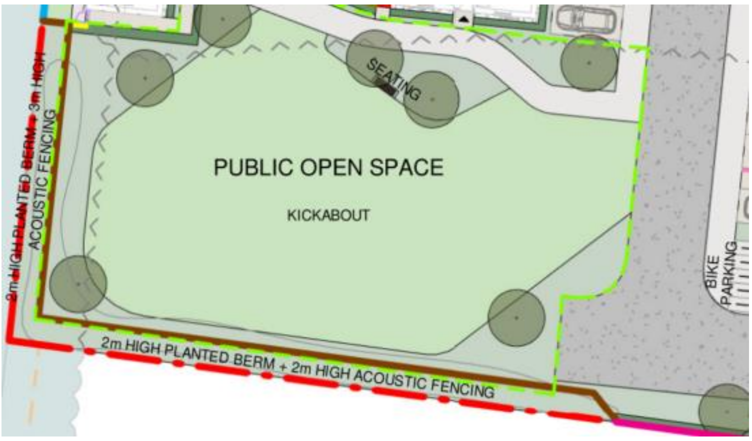
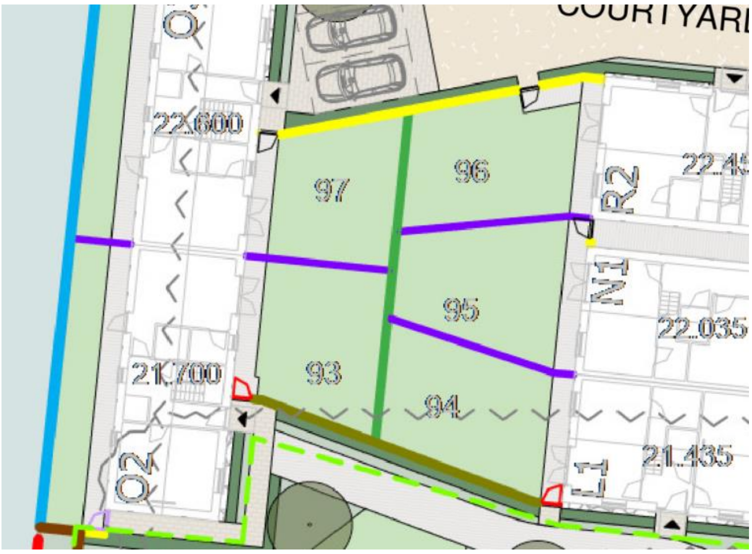
6.2.1 Noise Barriers

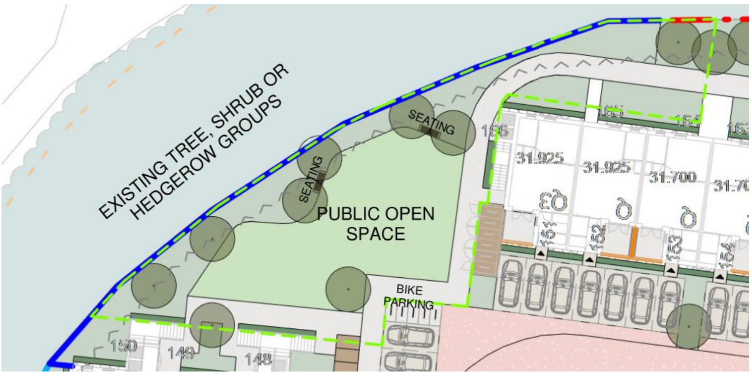
The development will include noise walls and a combination of berm and acoustic wall on various areas of the boundary as displayed on the next page.

The noise barrier can be made of various materials with an acoustic performance of Rw 30 or above. Transparent noise barriers are available if required to conserve light. Where a door or operable panels need to be included in the noise wall care should be taken to ensure this does not impair its acoustic performance by including overlapping threshold seals.

Benefits of noise barriers have been predicted based upon height above existing topographic elevations, i.e. the height of noise walls should be set at the specified height above the existing terrain elevation at the wall locations shown in drawings. Referencing of wall heights from topographical elevations at alternative locations may result in reductions to performance of the noise barrier. Walls and acoustic barriers layouts and design have been developed in coordination with JFOC Architects and NMP Landscape Architects.   Table 9 below describes the noise barrier details and extent. The details have been adopted and implemented in the site layout plan included in Appendix A for reference.

Table 9: Noise barrier details and extent.

Treatment	Description	Location (Green Lines)
Comb. 1	**Colour Key:** Brown (West)– 2m Berm + 3m Acoustic Fencing Brown (South)– 2m Berm + 2m Acoustic Fencing Pink (South)– – 4m Acoustic Fencing **Absorption:** None required. **Height:** a. 2 m planted berm + 3 m acoustic fence b. 2 m planted berm + 2 m acoustic fence c. 4m acoustic fence to the east. **Proximity:** At the boundary	
Detail of south-west noise barriers	**Colour Key:** Yellow – 2m block Wall Light Green – 2m block wall Brown –3m block Wall Light Blue – 2m Acoustic Wall Purple – 2m timber panel fence (for illustration only, not relied upon for acoustics) **Absorption:** None required. **Proximity:** As displayed	

Treatment	Description	Location (Green Lines)
Noise Wall	**Colour Key:** Blue – 2m Acoustic Fence Other walls as indicated above. **Absorption:** None required. **Height:** 2 m **Proximity:** As displayed.	
Noise Wall	**Colour Key:** Blue – 2m Acoustic Fence **Absorption:** None required. **Height:** 2 m acoustic fence **Proximity:** As displayed.	

Details of common treatments that can be used for the barrier are provided in Table 10 below.

Table 10: **Details for common treatments.**

Treatment	Details
Noise wall	The noise wall should be constructed of a material with a surface density of typically 15kg/m^2, unless otherwise noted. Examples of suitable materials to construct the noise wall include: • 100mm thick concrete block. • 100mm thick RC concrete. • Multivario Transparent Noise Barrier • Continuous precast concrete panel wall • Concrete Post with Concrete Wall Panel (reviewed and all gaps filled with mortar or grout) There should be no cracks or gaps between individual barrier elements, between the barrier or ground, or where the ends of the barrier join another structure.

7 Conclusion

A ProPG Noise Risk Assessment and traffic noise intrusion assessment with outdoor amenity have been carried out for a proposed residential development on a greenfield site adjacent to the M1 and the R168 on the outskirts of Drogheda, Co. Louth.

The assessment includes for the forecast increase in traffic volume and associated increase in noise levels outlined in the TII document Project Appraisal Guidelines Unit 5.3 'Travel Demand Projections'. Façade specifications for the glazing and façade elements have been developed to meet the internal noise criteria based on the predicted noise levels and measured noise levels.

To improve outdoor amenity area noise levels, a combination of 2m wall, 3m, 4m wall and a berm have been considered to reduce the traffic noise impact on the site, in addition to the screening provided by the development buildings.

Provided that the construction details in Section 6.1 are implemented in full, the internal noise levels in the residential properties are predicted to meet the internal noise criteria. The acoustic screening due to the introduction of the development buildings, boundary noise walls and berms significantly reduces the noise on-site to below the 55dB threshold for all private gardens and are therefore considered acceptable with regard to ProPG guidance.

Notably, the proposed development can be considered as an improvement on the existing planning permission for the site as it:

1. Predicts the noise levels across the site based on forecast traffic growth rather than preexisting levels only
2. The layout plan reduces the noise levels across the site more than the parent scheme due to more effective use of layout to screen the noise from the M1.

Appendix A: General Arrangement Plan

Figure 7. Site layout

Appendix B: Noise Contours

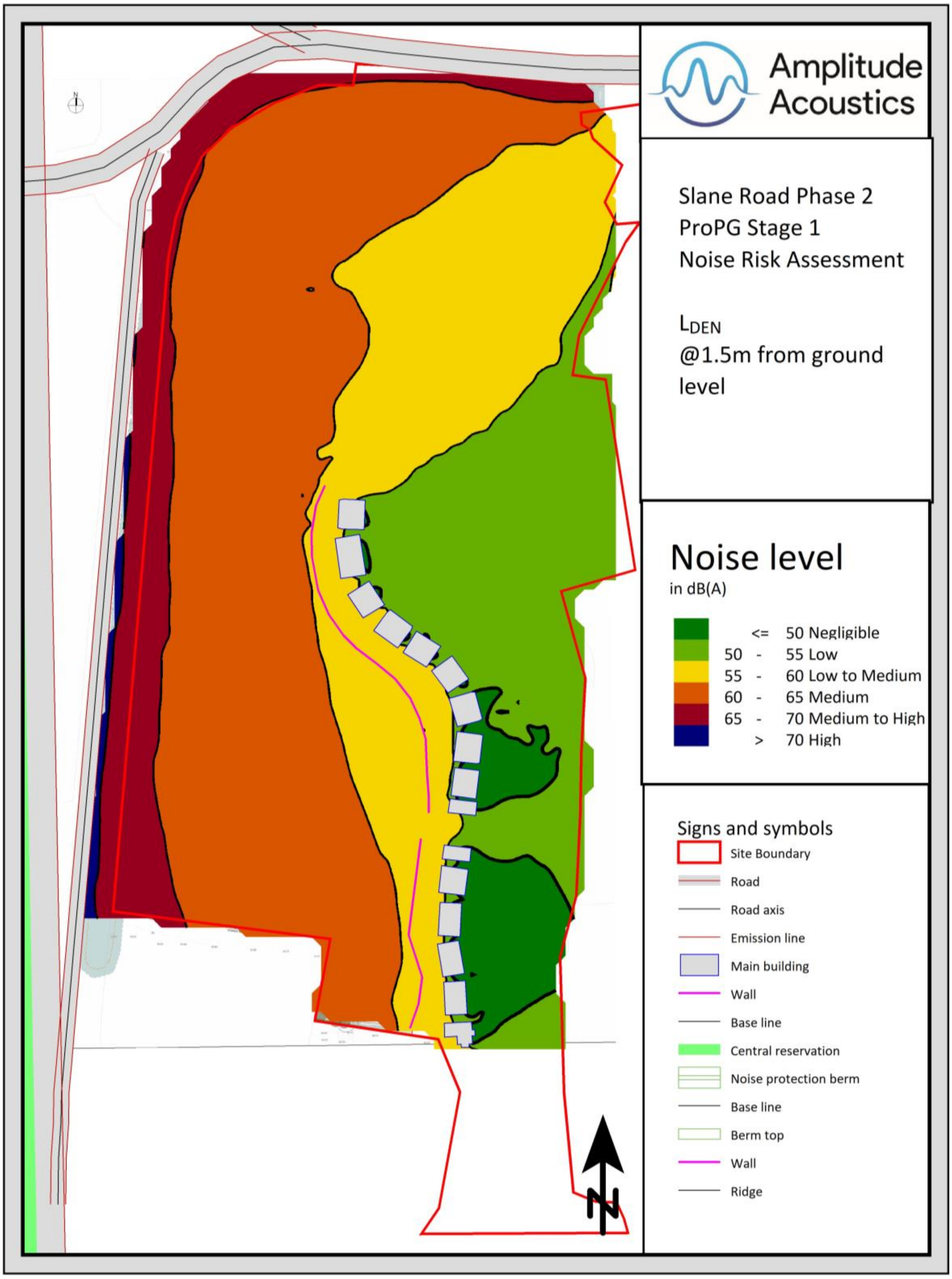


Figure 8. L_{DEN} Noise Contour Map for Stage 1 (2034 Scenario)

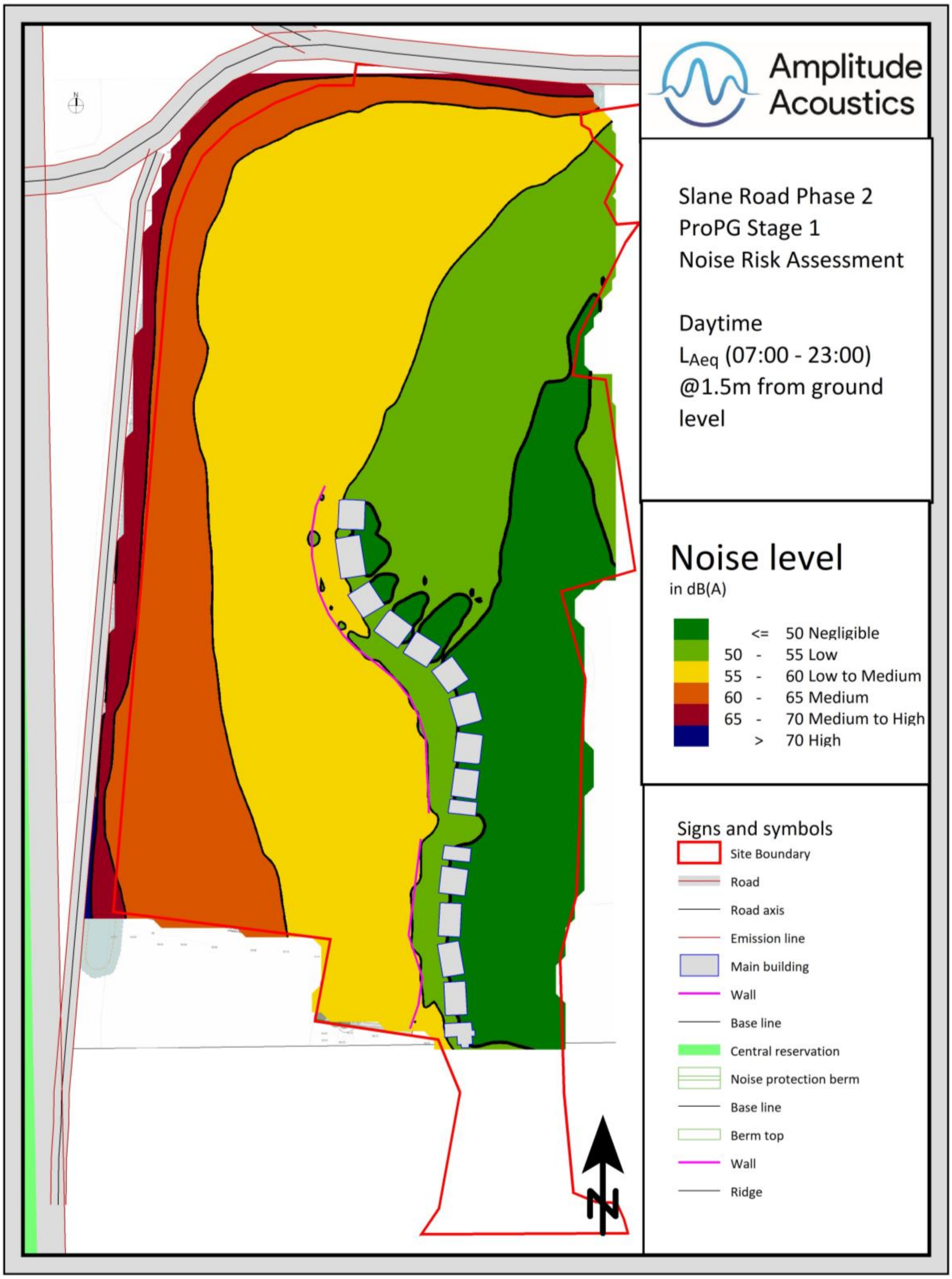


Figure 9. L_{DAY} Noise Contour Map for Stage 1 (2034 Scenario)

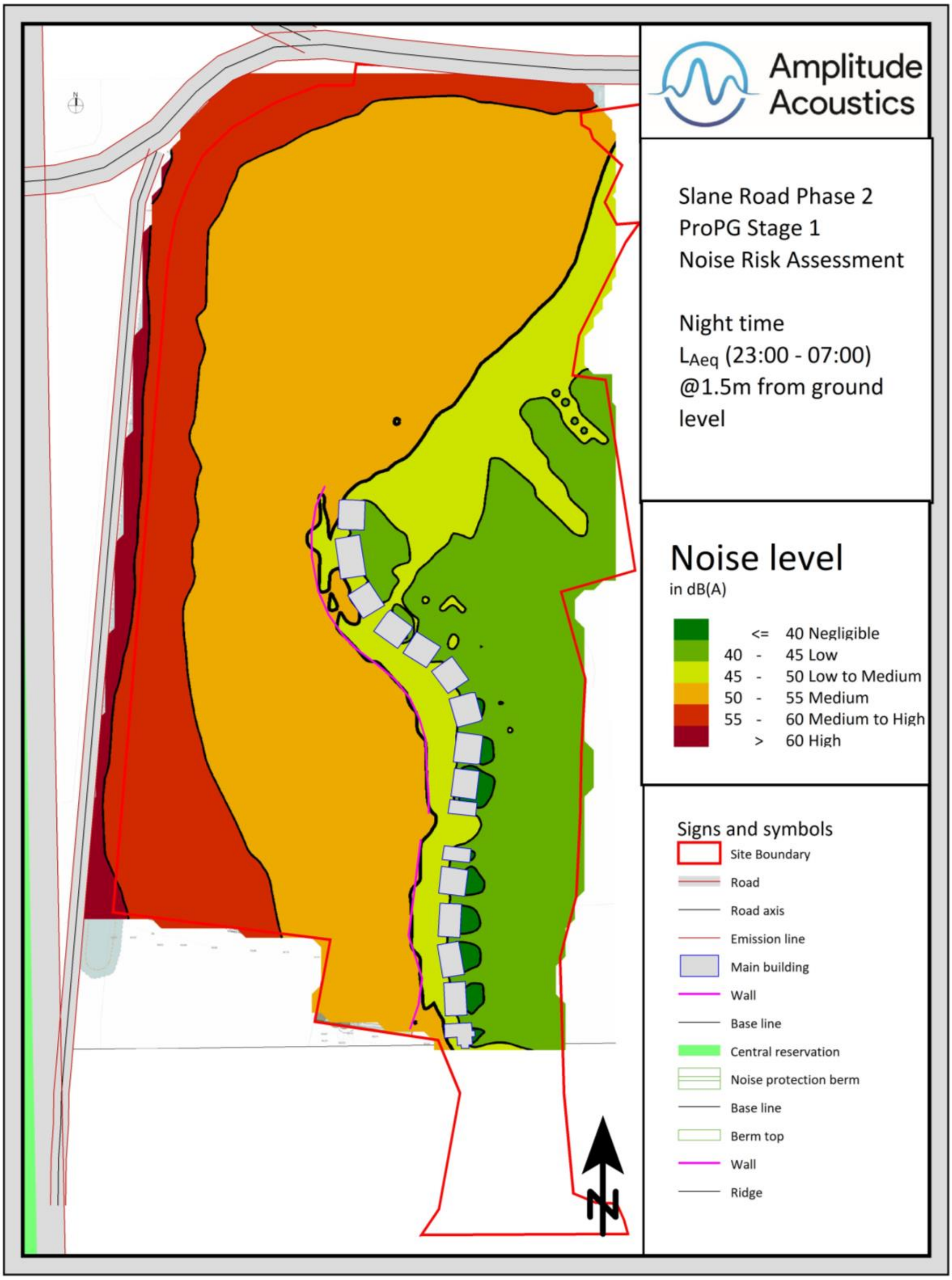


Figure 10. L_{NIGHT} Noise Contour Map for Stage 1 (2034 Scenario)

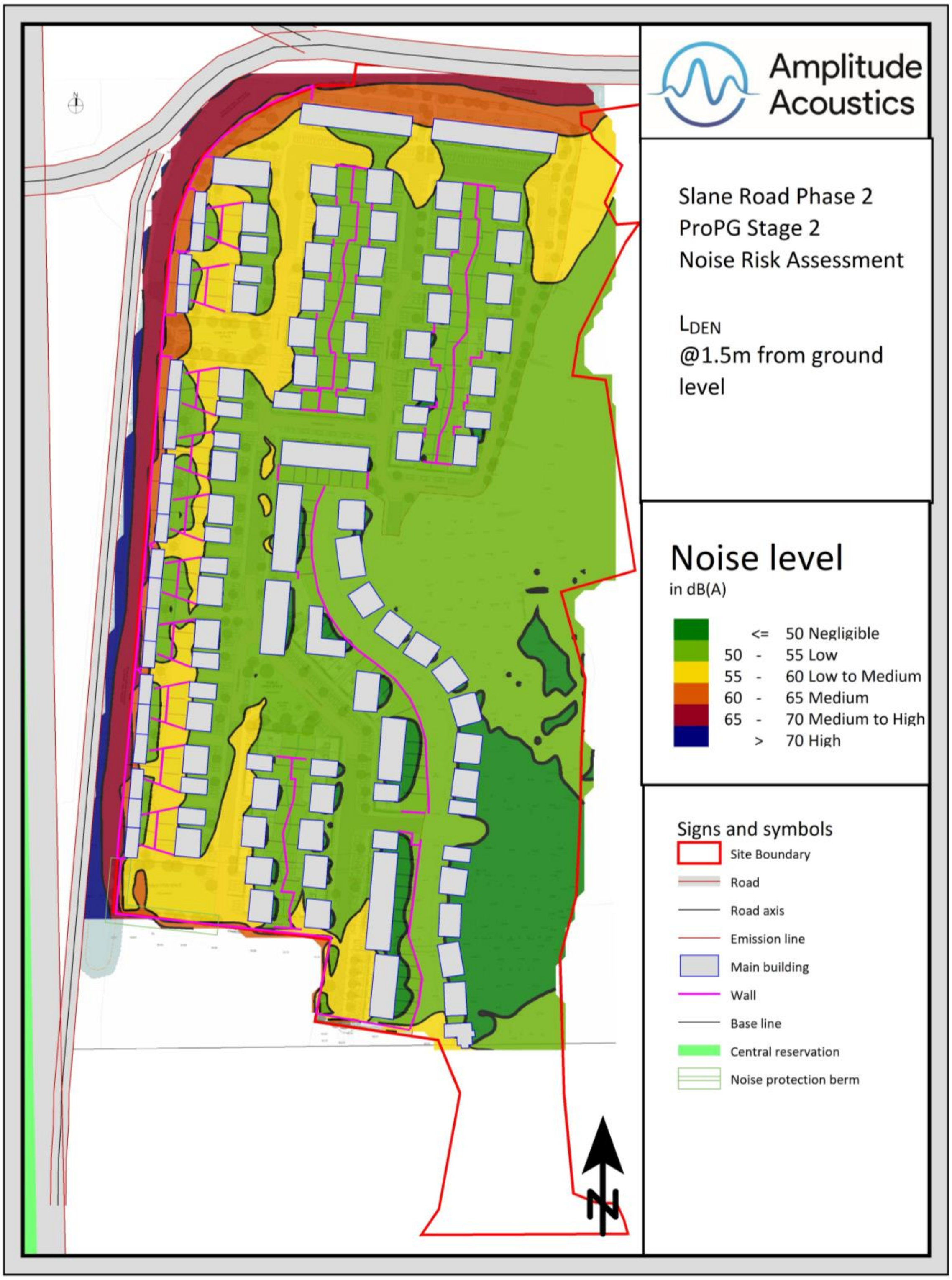


Figure 11. L_{DEN} Noise Contour Map for Stage 2 (2034 Scenario)

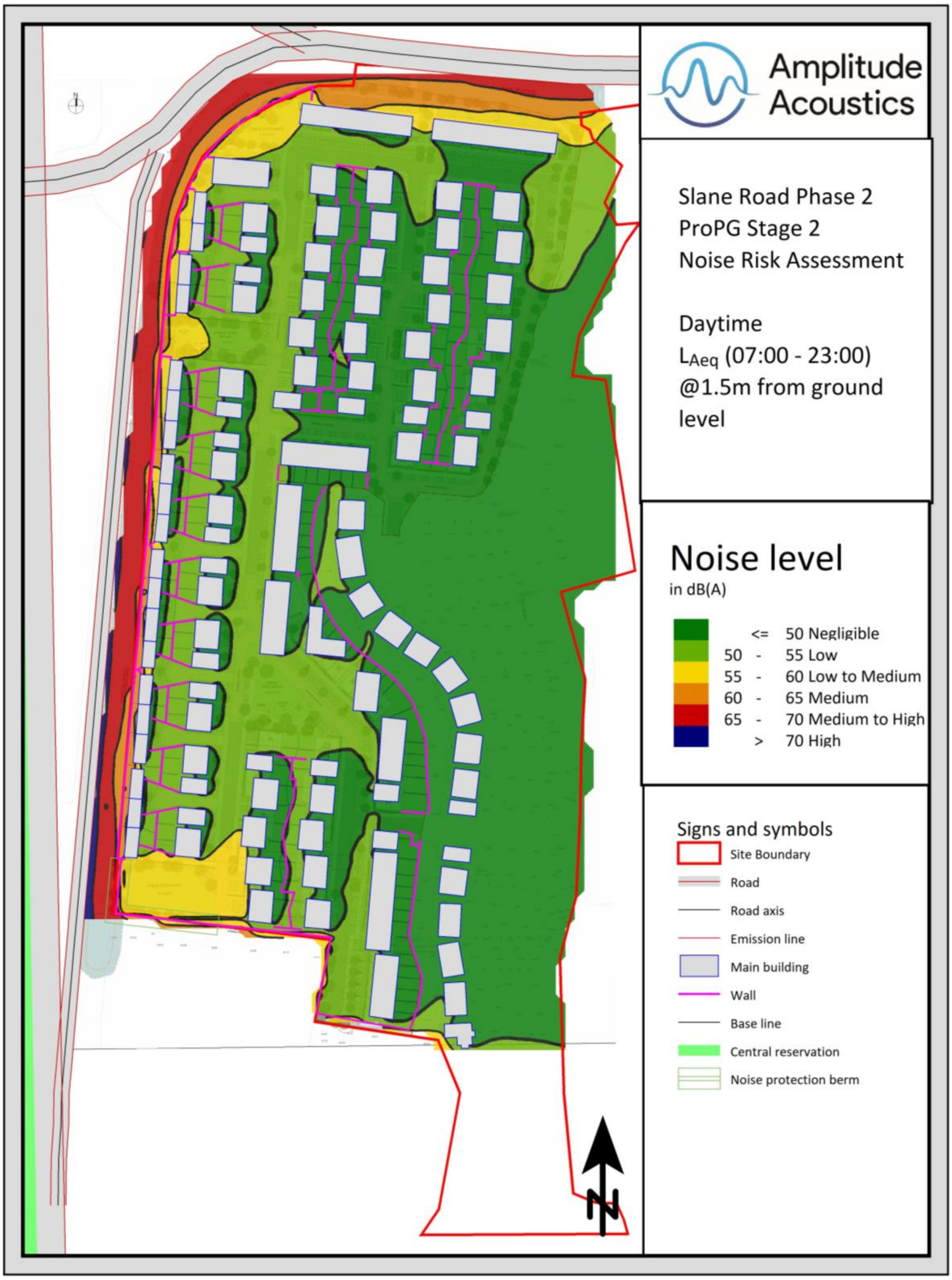


Figure 12. L_{DAY} Noise Contour Map for Stage 2 (2034 Scenario)

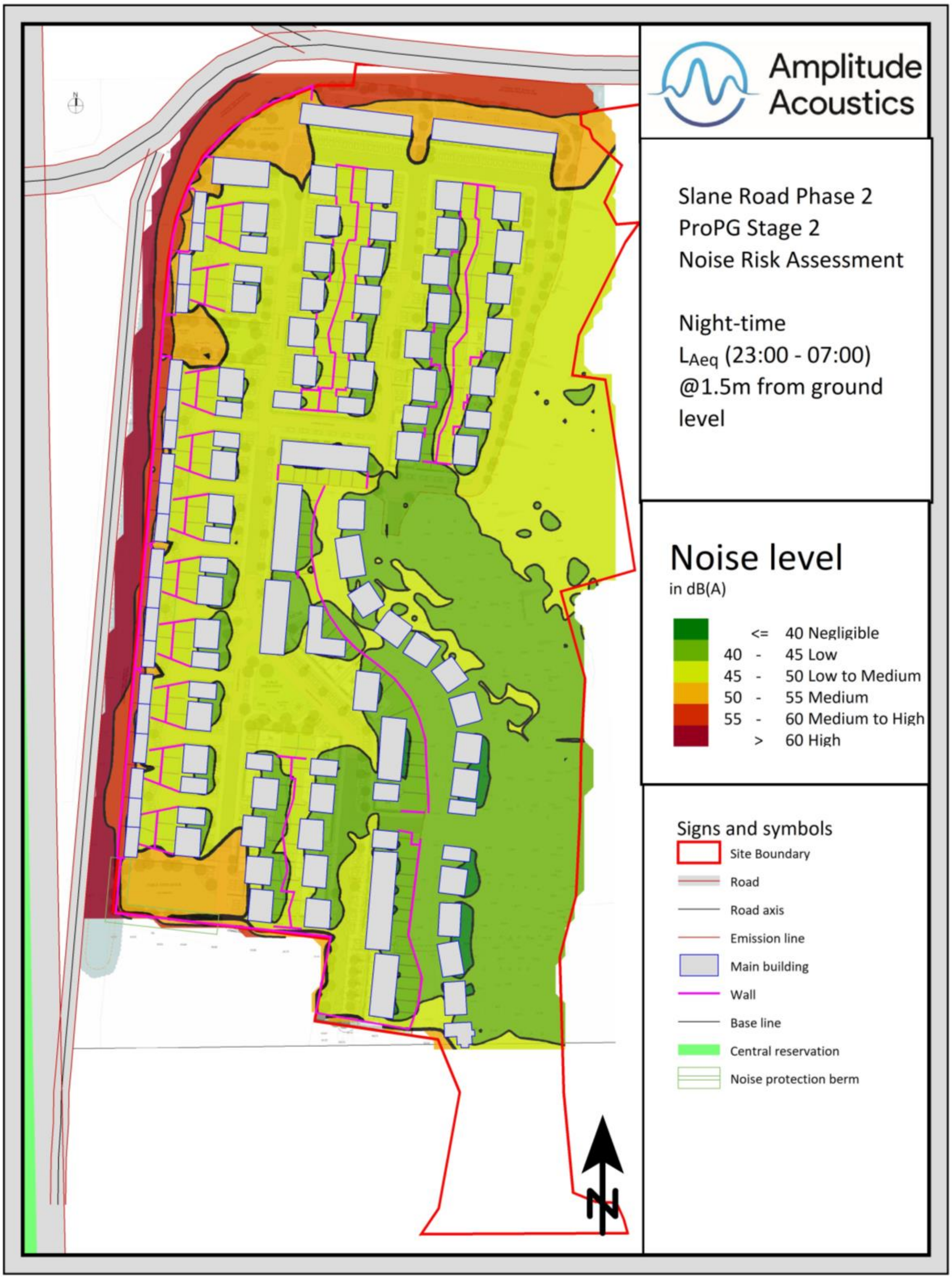


Figure 13. L_{NIGHT} Noise Contour Map for Stage 2 (2034 Scenario)

Appendix C: Glazing Mark-Ups

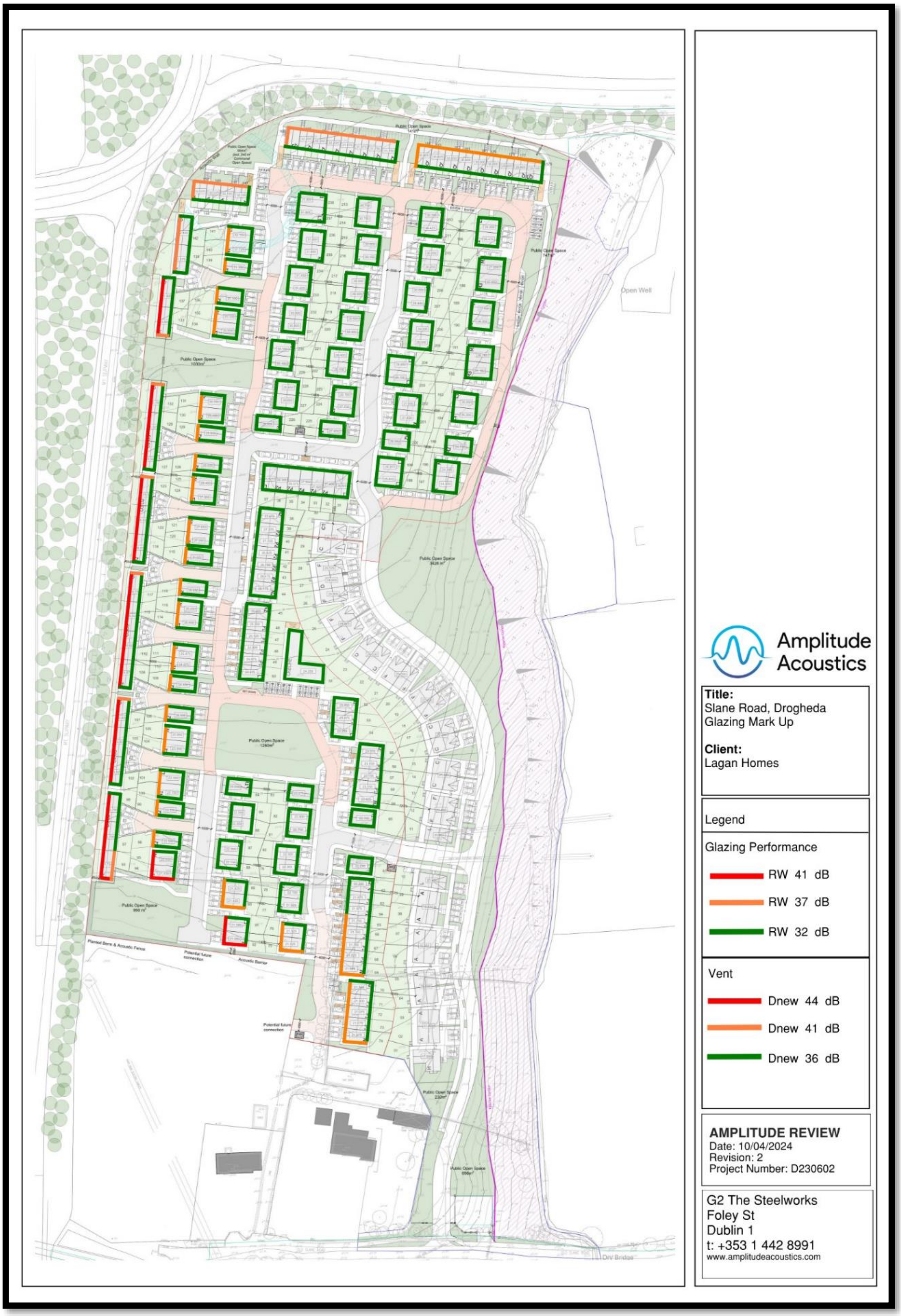


Figure 14. Glazing markup for the proposed development