
**437 Wilmslow Road
Withington, Manchester**

Noise Assessment Report

Project: 437 Wilmslow Road & No.2 Swinbourne Grove, Withington

Client: Kava (NW) Limited

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Contents

Section	Page
1. Introduction	4
2. Assessment Guidance & Criteria	5
National Planning Policy Framework	5
Manchester City Council: Planning & Noise Technical Guidance	5
British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings	6
World Health Organisation: Guidelines for community noise (1999)	7
British Standard 4142:2014: Methods for rating and assessing industrial and commercial sound	7
3. Environmental Noise Survey	8
Survey methodology	8
Survey equipment	9
Weather conditions	9
Subjective observations of the acoustic environment	9
Measured indices	10
Results summary	10
4. Assessment & Discussion	13
Internal sound level targets & building envelope sound insulation	13
Building envelope construction and acoustic performance	14
Noise intrusion with windows open	16
Ambient sound level in outdoor living areas	18
5. Ventilation & Noise Mitigation Options	19
Acoustically rated ventilator units	19
Mechanically assisted ventilation	19
Air conditioning system	19
6. Building Services Plant & Equipment	20
Sound level targets for new building services plant	20
7. Conclusion	22
List of Tables, Figures & Appendices	
Table 2.1 – Indoor ambient noise levels for dwellings	6
Table 3.1 – Summary of measured ambient sound pressure levels	11
Table 3.2 – Summary of measured background sound pressure levels	11
Table 4.1 – Internal sound level targets and building envelope sound insulation (new apartments)	13
Table 4.2 – Internal sound level targets and building envelope sound insulation (existing building)	14
Table 6.1 – Sound level targets for new building services plant	21
Figure 3.1 – Site location and survey measurement positions	8
Figure 3.2 – Photographs showing continuous monitoring position	9
Figure 3.3 – Graph showing results of continuous sound level monitoring	12
Figure 6.1 – Diagram showing proposed kitchen extraction	20
Appendix A - Proposed site plan, floor plans and elevations	23
Appendix B - Assessment terminology	37

1. Introduction

- 1.1 RS Acoustic Engineering Ltd has been appointed by Kava (NW) Ltd to undertake a noise assessment with regard to a proposed mixed-use development off Wilmslow Road, Withington, Manchester, M20.
- 1.2 The site sits between Wilmslow Road and Swinbourne Grove and there is a vacant bank (formerly NatWest) within the boundary of the site which will be retained and refurbished in order to provide a commercial/retail unit.
- 1.3 A new four-storey apartment building will be constructed immediately south east of the existing building, on land that is currently being used as a parking area. The proposals are to construct twelve new dwellings consisting of one, two and three bedroom apartments.
- 1.4 In addition, the existing property to the rear of the bank (No.2 Swinbourne Grove) will be converted into six self-contained apartments.
- 1.5 A noise assessment has been undertaken with reference to Manchester City Council's planning guidance, the guidance contained within BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings* and the World Health Organisation document *Guidelines for community noise*.
- 1.6 This assessment is based on the results of an environmental noise survey undertaken at the site by RS Acoustic Engineering. Continuous sound level monitoring was conducted over a number of days in order to establish the existing acoustic environment during the daytime and night-time period.
- 1.7 The measured sound level data has been used to determine the acoustic performance requirements for the building envelope construction and to determine whether it will be suitable to naturally ventilate habitable rooms via opening windows alone.
- 1.8 Appropriate plant noise limits have been determined for the new development based on the measured background sound levels and Manchester City Council's current guidance.
- 1.9 The survey and assessment was conducted by Mr Ryan Swales (BSc(Hons), MIOA), Principal Acoustic Consultant and Member of the Institute of Acoustics.
- 1.10 The results of the noise survey have been presented, along with the assessment criteria and a discussion of the results with respect to the appropriate guidance and targets.
- 1.11 Recommendations regarding sound insulation, ventilation and noise mitigation are also provided within the report.

2. Assessment Guidance & Criteria

National Planning Policy Framework

2.1 The National Planning Policy Framework (NPPF) updated June 2019 sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other developments can be produced. The NPPF supersedes previous guidance notes such as PPG24.

2.2 With regard to noise and pollution, Section 15 of the NPPF states the following:

Planning policies and decisions should contribute to and enhance the natural and local environment by: preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.....

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

Manchester City Council: Planning & Noise Technical Guidance

2.3 With regard to residential developments, Manchester City Council has adopted the following noise criteria:

- Bedrooms (night time - 23.00 - 07.00) 30 dB L_{Aeq} (individual noise events should not normally exceed 45 dB $L_{Amax,F}$ by more than 15 times).
- Living Rooms (daytime - 07.00 - 23.00) 35 dB L_{Aeq}
- Gardens and terraces (daytime) 55 dB L_{Aeq}

2.4 These criteria have been adopted for the following reasons:

- BS 8233: 2014 recognises these levels as a good standard for resting/sleeping conditions.
- The WHO document 'Guidelines for Community Noise' recommends an internal L_{Aeq} of 30 dB for optimal sleep conditions (and no more than 35 dB for internal rooms during daytime).
- The performance of acoustic insulation schemes can often be below that specified, according to the quality of installation, materials, noise spectrum and deterioration / wear and tear of building elements. A high design specification introduces a 'safety margin' should building elements not perform as well as expected ('on-site' performance).
- Performance specification for glazing does not usually take into account the detrimental effect of vents on the sound insulation. Even 'acoustic' vents will reduce the performance of the facade insulation, as they will inherently contain a free open area for air exchange.
- There is a general increase in urban noise levels, which can in the future be reasonably accommodated by these standards.

- The standards support the Local Authority corporate objective to prevent ill-health and improve local people's health and well being.

2.5 With regard to noise from fixed plant and equipment, Manchester City Council's guidance document states the following:

'Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142:2014 and any application for fixed plant, equipment or machinery must demonstrate that:

Externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

2.6 BS 8233 provides guidance regarding acoustic criteria and noise levels appropriate for various types of space that have different functions.

2.7 With regard to dwellings, appropriate internal ambient sound levels are given in Table 2.1 for bedrooms, living rooms and dining rooms. The guidelines take into consideration the effect of internal noise on sleep and also the effect of noise on resting, listening and communicating.

Table 2.1 – Indoor ambient noise levels for dwellings

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq,16hour}$	---
Dining	Dining room/area	40 dB $L_{Aeq,16hour}$	---
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hour}$	30 dB $L_{Aeq,8hour}$

2.8 BS 8233 (Note 7) also suggests that in some circumstances, it may be appropriate to relax the indoor ambient noise level targets by up to 5 dB:

Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved.

2.9 Note 5 also states:

If relying on closed windows to meet the guide values, there needs to be appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.

- 2.10 With regard to outdoor living areas (gardens), the following guidance is given:

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

World Health Organisation: Guidelines for community noise (1999)

- 2.11 The recently superseded guidance document states that to avoid serious annoyance during the daytime and evening period, the ambient L_{Aeq} sound level should not exceed 55 dB $L_{Aeq,16hour}$ in outdoor living areas (gardens and balconies). To avoid moderate annoyance, the L_{Aeq} sound level should not exceed 50 dB $L_{Aeq,16hour}$.
- 2.12 Outside of bedroom windows, the ambient L_{Aeq} sound level should ideally not exceed 45 dB $L_{Aeq,8hour}$ and the maximum level should not typically exceed 60 dB $L_{AFmax,T}$.
- 2.13 With regard to sleep disturbance and maximum L_{AFmax} sound levels, the study undertaken by Vallet & Vernet (1991) suggests that for good sleep, indoor sound pressure levels should not exceed approximately 45 dB L_{Amax} more than 10-15 times per night.

British Standard 4142:2014: Methods for rating and assessing industrial and commercial sound

- 2.14 BS 4142 describes methods for rating and assessing sound of an industrial and/or commercial nature, such as sound from manufacturing processes and fixed mechanical plant/machinery.
- 2.15 The methods described in the standard use outdoor sound levels to assess the likely effect of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.
- 2.16 BS 4142 is not intended to be applied to the derivation of indoor sound levels arising from sound levels outside, or the assessment of indoor sound levels.
- 2.17 The standard has three different methods (subjective, objective and reference) of applying a penalty to tonal, impulsive and intermittent noises, as separate entities.
- 2.18 The current standard no longer indicates significance of noise impacts as giving rise to a 'likelihood of complaint' but rather as an 'indication' of varying degrees of 'adverse impact'.
- 2.19 BS 4142 states that a difference of around +10 dB or more (excess of rating level above the background sound level) is likely to be an indication of a significant adverse impact, depending on the context.
- 2.20 A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- 2.21 The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- 2.22 Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

3. Environmental Noise Survey

Survey methodology

- 3.1 Continuous sound level monitoring was conducted over a 67.5 hour period adjacent to Wilmslow Road.
- 3.2 Measurements were performed from 14:30 hours on Thursday 11th through to 10:00 hours on Sunday 14th April 2019.
- 3.3 The microphone was mounted on the roof of the existing building at a height of approximately 6.5 metres from the ground and approximately 15 metres from the nearside carriageway edge.
- 3.4 A measurement interval of 5 minutes was used during the survey and measurements were considered to be subject to reflections from the parapet wall (as opposed to free-field conditions).
- 3.5 Sample measurements were also conducted at ground floor level to the rear of the site in the existing car park. The measurements were time-synchronised with the monitoring position.
- 3.6 The site location, surrounding area and survey measurement positions are shown in Figure 3.1 and 3.2
- 3.7 The proposed site plan, floor plans and elevations are presented in Appendix A.

Figure 3.1 – Site location and survey measurement positions (source: Google Earth)

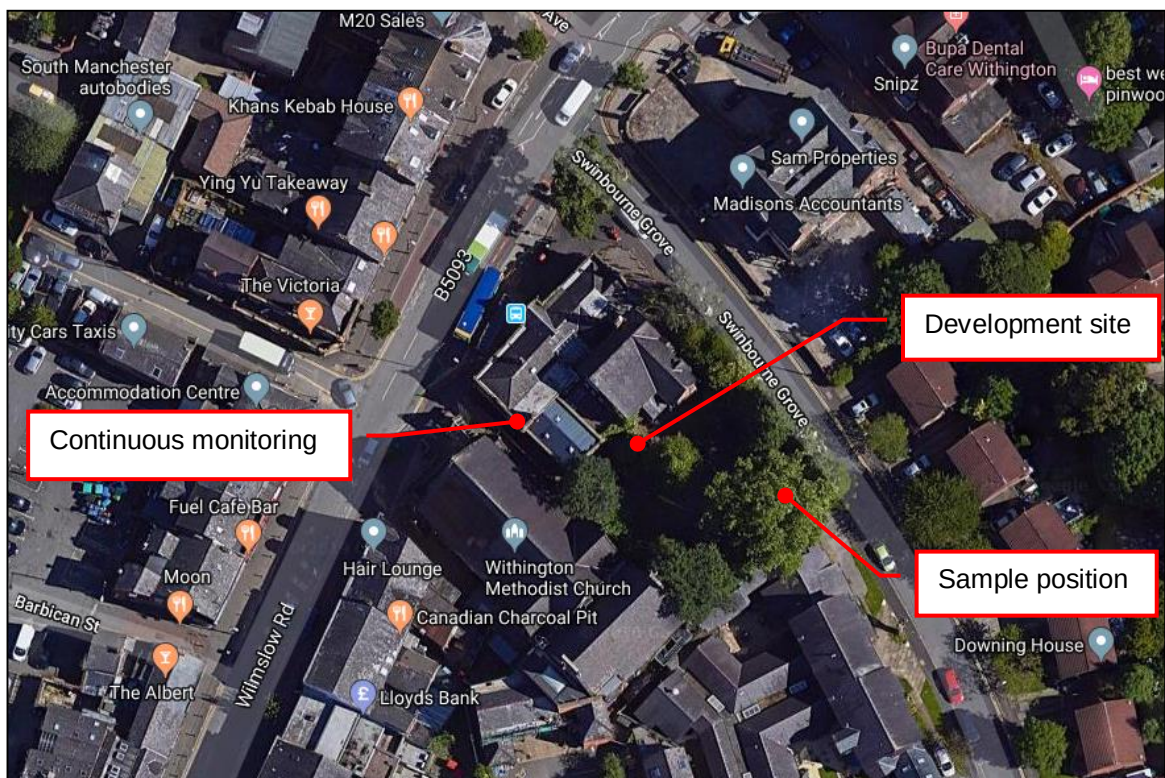


Figure 3.2 – Photographs showing continuous monitoring position



Survey equipment

- 3.8 The survey was conducted using the following equipment:
- Brüel & Kjaer 2250-Light data logging sound level meter, with microphone type 4189 and pre-amplifier type ZC0032.
 - Brüel & Kjaer 4231 acoustic calibrator.
- 3.9 Calibration of the sound level meter and microphone used for the measurements are traceable to accredited laboratories (calibration certificates are available on request).
- 3.10 The calibration of the sound level meter and microphone was checked using a 1 kHz tone at 94 dB prior to and following the measurements performed. The drift in calibration was less than 0.1 dB.

Weather conditions

- 3.11 The weather conditions during the survey were dry and fine with clear sunny spells. Wind speed measurements taken on site were generally less than 2 m/s^{-1} .
- 3.12 The air temperature during the survey ranged between 2°C and 11°C . The overall weather conditions were considered suitable to obtain representative measurements.

Subjective observations of the acoustic environment

- 3.13 Site visits were conducted during the daytime, evening and night-time period to observe the local acoustic environment.
- 3.14 The dominant noise source at the site was observed to be road traffic on Wilmslow Road.
- 3.15 Noise from sporadic vehicle movements on Swinbourne Grove was considered negligible.
- 3.16 During the survey, no disruptions in traffic flow were observed on the local road network (due to road works etc) and therefore traffic conditions were considered to be typical.

- 3.17 There are a number of small retail units, cafe bar's and takeaways adjacent to the development site on Wilmslow Road. However, operational noise associated with such premises was considered negligible and is generally masked by traffic noise from Wilmslow Road.
- 3.18 There is a single condensing unit at ground floor level fixed to the north east facing elevation of the adjacent church. During the daytime, the condenser unit operated sporadically and the noise emitted was just audible in close proximity to the unit. The overall noise emitted was considered to be negligible.
- 3.19 Furthermore, the condensing unit did not operate during the late evening and night-time period. The proposed windows to upper floor habitable rooms will be orientated away from the unit and therefore it is anticipated that condenser related noise will be inaudible.
- 3.20 Other noted noise sources include intermittent activity at adjacent dwellings, pedestrians, birdsong and intermittent high altitude aircraft.

Measured indices

- 3.21 Although a wide range of statistical sound level data was recorded during the survey, the L_{Aeq} , L_{AFmax} and L_{A90} indices are of most interest for this assessment:
- $L_{Aeq,T}$ - The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (used to describe the ambient sound level).
 - $L_{AFmax,T}$ - The A-weighted 'maximum' sound pressure level that occurred during a given period, T (used for the assessment of intermittent loud noises).
 - $L_{A90,T}$ - The noise level that is exceeded for 90% of the measurement time interval, T. L_{A90} is often used to describe the 'background' sound level.
- 3.22 Sound pressure level measurements are taken with an A-weighting (denoted by a subscript 'A', e.g. L_{Aeq}) to approximate the frequency response of the human ear.

Results summary

Continuous sound level monitoring

- 3.23 Table 3.1 overleaf presents a summary of the measured ambient sound pressure levels from the continuous monitoring position. Measured values have been rounded to the nearest whole number.
- 3.24 The daytime $L_{Aeq,5min}$ (five minute) sound pressure levels range between 54 to 69 dB and the night-time $L_{Aeq,5min}$ sound pressure levels range between 37 to 65 dB.
- 3.25 The daytime $L_{Aeq,60min}$ (hourly) sound pressure levels range between 56 to 62 dB and the night-time $L_{Aeq,60min}$ sound pressure levels range between 49 to 60 dB.
- 3.26 Table 3.2 overleaf presents a summary of the measured background L_{A90} sound pressure levels.

Table 3.1 – Summary of measured ambient sound pressure levels

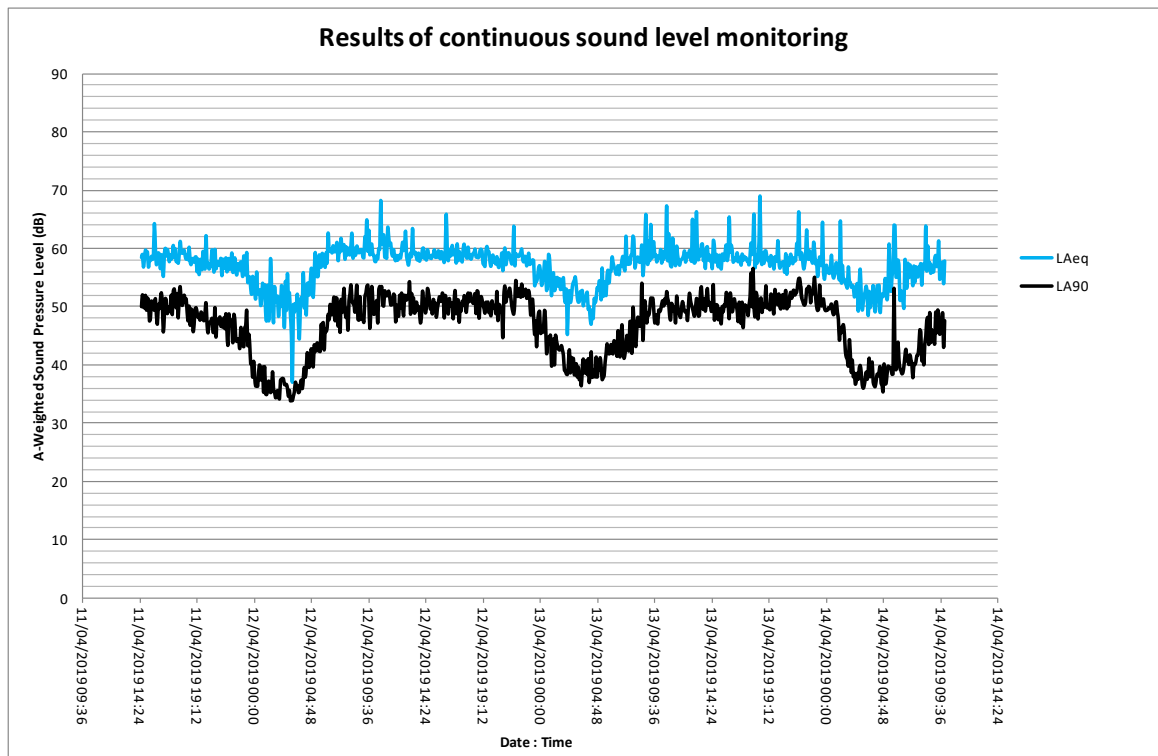
Date	Period	Duration, T (hours)	L _{Aeq,T} dB	Average ¹ L _{AFmax,T} dB	10 th Highest ² L _{AFmax,T} dB
Thursday 11/04/2019 to Friday 12/04/2019	Daytime (14:30-23:00)	8.5	58	---	---
	Night-time (23:00-07:00)	8	55	69	74
Friday 12/04/2019 to Saturday 13/04/2019	Daytime (07:00-23:00)	16	60	---	---
	Night-time (23:00-07:00)	8	55	68	72
Saturday 13/04/2019 to Sunday 14/04/2019	Daytime (07:00-23:00)	16	60	---	---
	Night-time (23:00-07:00)	8	56	69	74
Sunday 14/04/2019	Daytime (07:00-10:00)	3	57	---	---
¹ The arithmetical average L _{AFmax} sound level					
² The 10 th highest value from 96 measurement periods					

Table 3.2 – Summary of measured background sound pressure levels

Date	Period, Hours	Typical ¹ L _{A90,T} dB	Lowest L _{A90,T} dB	Highest L _{A90,T} dB
Thursday 11/04/2019 to Friday 12/04/2019	Daytime (14:30-23:00)	48	43	53
	Night-time (23:00-07:00)	35	34	52
Friday 12/04/2019 to Saturday 13/04/2019	Daytime (07:00-23:00)	51	45	54
	Night-time (23:00-07:00)	38	36	53
Saturday 13/04/2019 to Sunday 14/04/2019	Daytime (07:00-23:00)	50	41	57
	Night-time (23:00-07:00)	39	36	55
Sunday 14/04/2019	Daytime (07:00-10:00)	46	38	49
¹ Considered to be the representative background sound level (from a statistical analysis)				

3.27 The results of the continuous monitoring are presented graphically in Figure 3.3.

Figure 3.3 – Graph showing results of continuous sound level monitoring



Sample measurement results

3.28 The measured sound pressure levels at the sample measurement position were approximately 6 to 7 dB $L_{Aeq,5min}$ lower than those recorded simultaneously at the continuous monitoring position.

4. Assessment & Discussion

Internal sound level targets & building envelope sound insulation

Proposed apartment building

- 4.1 Table 4.1 presents the facade sound levels, the recommended internal sound level targets and the required sound insulation for the proposed apartments.
- 4.2 The highest measured daytime and night-time L_{Aeq} sound level (60 dB $L_{Aeq,16hour}$ and 56 dB $L_{Aeq,8hour}$) has been used for the north west facing elevation (facing Wilmslow Road).
- 4.3 The highest measured L_{Aeq} sound level has been reduced by 6 dB in order to represent the habitable rooms on the north east facing elevation (facing Swinbourne Grove).
- 4.4 The south east facing elevation will be acoustically screened from Wilmslow Road and consequently the facade sound levels will be reduced by approximately 15 to 20 dB. This assessment has applied a conservative estimate of 15 dB.

Table 4.1 – Internal sound level targets and building envelope sound insulation (new apartments)

Elevation	Period	Facade Sound Level dB	Internal Noise Target dB	Required Sound Insulation dB R_w+C_{tr}
North west facing elevation	Daytime $L_{Aeq,16hour}$	60	35 (Living rooms and bedrooms)	25
	Night-time $L_{Aeq,8hour}$	56	30 (Bedrooms)	26
	Night-time $L_{AFmax,5min}$	74	45 (Bedrooms)	29
North east facing elevation	Daytime $L_{Aeq,16hour}$	54	35 (Living rooms and bedrooms)	19
	Night-time $L_{Aeq,8hour}$	50	30 (Bedrooms)	20
	Night-time $L_{AFmax,5min}$	62	45 (Bedrooms)	17
South east facing elevation	Daytime $L_{Aeq,16hour}$	45	35 (Living rooms and bedrooms)	10
	Night-time $L_{Aeq,8hour}$	41	30 (Bedrooms)	11
	Night-time $L_{AFmax,5min}$	59	45 (Bedrooms)	14

- 4.5 A composite sound insulation performance of 29 dB R_w+C_{tr} is required for habitable rooms on the north west facing elevation.
- 4.6 The sound insulation requirements reduce to 20 dB R_w+C_{tr} on the north east facing elevation.
- 4.7 A sound insulation performance of 29 dB R_w+C_{tr} can be achieved with standard thermal (non-acoustic) double glazing.

No.2 Swinbourne Grove

- 4.8 Table 4.2 presents the facade sound levels, the recommended internal sound level targets and the required sound insulation for the proposed dwelling conversion at No.2 Swinbourne Grove.
- 4.9 The highest measured L_{Aeq} sound level has been reduced by 3 dB in order to represent the habitable rooms on the north east facing elevation (facing Swinbourne Grove).
- 4.10 The south east and south west facing elevations will be acoustically screened from Wilmslow Road and consequently the facade sound levels will be reduced by approximately 15 to 20 dB. Again, this assessment has applied a conservative estimate of 15 dB.

Table 4.2 – Internal sound level targets and building envelope sound insulation (existing building)

Elevation	Period	Facade Sound Level dB	Internal Noise Target dB	Required Sound Insulation dB R_w+C_{tr}
North east facing elevation	Daytime $L_{Aeq,16hour}$	57	35 (Living rooms and bedrooms)	22
	Night-time $L_{Aeq,8hour}$	53	30 (Bedrooms)	23
	Night-time $L_{AFmax,5min}$	68	45 (Bedrooms)	23
South east and south west facing elevation	Daytime $L_{Aeq,16hour}$	45	35 (Living rooms and bedrooms)	10
	Night-time $L_{Aeq,8hour}$	41	30 (Bedrooms)	11
	Night-time $L_{AFmax,5min}$	59	45 (Bedrooms)	14

- 4.11 A composite sound insulation performance of 23 dB R_w+C_{tr} is required for habitable rooms on the north east facing elevation.
- 4.12 The sound insulation requirements reduce to 14 dB R_w+C_{tr} on the south east and south west facing elevations.
- 4.13 A sound insulation performance of 23 dB R_w+C_{tr} can be easily achieved with standard thermal (non-acoustic) double glazing or with single glazed secondary units.
- 4.14 Further guidance regarding glazing construction and acoustic performance is provided below.

Building envelope construction and acoustic performance

Proposed apartment building

- 4.15 The proposed external wall construction consists of 15 mm thick brick slips, 90 mm thick EPS insulation, timber battens, 18 mm thick breather membrane, 100 mm steel frame filled with mineral wool insulation, 38 mm service void, 15 mm thick Siniat Megadeco plasterboard (min 12.7 kg/m²).
- 4.16 The sound insulation performance of the external wall is expected to be approximately 45 dB R_w+C_{tr} .
- 4.17 The proposed flat roof construction consists of a single ply roof membrane over an 18 mm OSB deck, 165 mm thick rigid insulation, timber furring, 150 mm deep ceiling joists, 63 mm service void, 15 mm thick Siniat Megadeco plasterboard.
- 4.18 The sound insulation performance of the roof construction is expected to be at least 40 dB R_w+C_{tr} .

- 4.19 Standard double glazing typically provides a sound insulation performance in the region of 25 to 31 dB R_w+C_{tr} .
- 4.20 The glazing is therefore expected to be the weakest element with regard to the building envelope sound insulation (excluding ventilator units).
- 10 mm glass / 16 - 20 mm cavity / 4 mm glass (circa 30 to 31 dB R_w+C_{tr})
 - 6 mm glass / 16 mm - 20 mm cavity / 4 mm glass (circa 29 to 30 dB R_w+C_{tr})
 - 6 mm glass / 16 mm - 20 mm cavity / 6 mm glass (circa 27 to 30 dB R_w+C_{tr})
 - 4 mm glass / 16 mm - 20 mm cavity / 4 mm glass (circa 25 to 27 dB R_w+C_{tr})
- 4.21 Acoustically laminated double glazing commonly used within domestic buildings typically provides a sound insulation performance in excess of 33 dB R_w+C_{tr} .
- 6 mm glass / 16 - 20 mm cavity / 10.8 mm acoustic laminate (circa 35 to 37 dB R_w+C_{tr})
 - 6 mm glass / 16 - 20 mm cavity / 8.8 mm acoustic laminate (circa 34 to 36 dB R_w+C_{tr})
 - 6 mm glass / 16 - 20 mm cavity / 6.8 mm acoustic laminate (circa 33 to 34 dB R_w+C_{tr})
- 4.22 As an example, Pilkington Optiphon is a high performing acoustic laminate that can be used within double glazed systems.
- www.pilkington.com/en-gb/uk/products/product-categories/noise-control/pilkington-optiphon/

No.2 Swinbourne Grove

- 4.23 The external walls are of a traditional double-leaf brickwork construction. The wall construction is expected to provide a sound insulation performance of approximately 45 to 55 dB R_w+C_{tr} .
- 4.24 The roof and ceiling construction consists of a pitched slate roof and internal plasterboard ceiling. The roof and ceiling combination is expected to provide a sound insulation performance of approximately 35 to 45 dB R_w+C_{tr} .
- 4.25 The existing sash windows are single glazed, approximately 3 to 4 mm thick with timber frames. The sound insulation performance of the glazing is expected to be approximately 20 to 25 dB R_w+C_{tr} .
- 4.26 Again, the glazing is expected to be the weakest element with regard to the building envelope sound insulation.
- 4.27 Secondary glazed units will be installed on the front elevation facing Swinbourne Grove. Installing a 4 mm to 6 mm thick secondary unit typically provides an overall sound insulation performance in the region of 30 to 35 dB R_w+C_{tr} (i.e. an improvement of approximately 10 dB).

General comments

- 4.28 The quantity R_w is the weighted sound reduction index expressed in dB. It is a single number quantity for rating airborne sound insulation. The 'C_{tr}' term is added to the single number rating R_w to take account of the characteristics of particular sound spectra (e.g. road traffic).
- 4.29 The acoustic performance of a particular construction may differ slightly between manufacturers and therefore the sound insulation performance should be verified where possible.
- 4.30 To achieve the optimum performance, external windows should be well sealed around the frame when installed. Large gaps between the frame and the brickwork and poorly sealed frames can notably reduce performance.

Noise intrusion with windows open

- 4.31 The level of sound attenuation through an open window is dependent on the type and size of window, the extent of opening, the angle of sound incidence and the characteristics of the noise source in question.
- 4.32 It is considered reasonable to assume a sound attenuation performance of approximately 15 dBA for a partially open window. Partially open windows are expected to provide background ventilation only (as opposed to rapid/purge ventilation).

North west facing elevation (proposed apartments)

- 4.33 Facade sound pressure levels are approximately 60 dB $L_{Aeq,16hour}$ during the daytime and approximately 55 to 56 dB $L_{Aeq,8hour}$ during the night-time.
- 4.34 When assessing noise ingress through an open window, it is appropriate to reduce the measured facade sound levels by approximately -3 dB to give a free-field sound level.
- 4.35 Assuming an open window provides 15 dBA of sound attenuation, the resulting internal sound level will be approximately 42 dB $L_{Aeq,16hour}$ during the daytime and 37 to 38 dB $L_{Aeq,8hour}$ during the night-time.
- 60 dB $L_{Aeq,16hour}$ – 3 dB – 15 dB = 42 dB $L_{Aeq,16hour}$
 - 56 dB $L_{Aeq,8hour}$ – 3 dB – 15 dB = 38 dB $L_{Aeq,8hour}$
- 4.36 The recommended 35 dB $L_{Aeq,16hour}$ daytime and 30 dB $L_{Aeq,8hour}$ night-time sound level targets will therefore be exceeded with windows open.
- 4.37 The night-time maximum sound level target of 45 dB $L_{AFmax,T}$ will also be exceeded.
- 4.38 It should be noted that BS 8233 suggests that ‘reasonable’ acoustic conditions can be achieved where the internal targets are relaxed by 5 dB (i.e. daytime target of 40 dB $L_{Aeq,16hour}$ and a night-time target of 35 dB $L_{Aeq,8hour}$).
- ‘Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved’.*
- 4.39 The relaxed targets will be marginally exceeded within north west facing habitable rooms with windows open.
- 4.40 BS 8233 states where occupants rely on closed windows to meet the internal noise limits, there needs to be appropriate alternative ventilation that does not compromise the facade sound insulation or resulting internal sound level.
- 4.41 BS 8233 also provides the following comment with regard to ventilation:
- The Building Regulations’ supporting documents on ventilation recommend that habitable rooms in dwellings have background ventilation. Where openable windows cannot be relied upon for this ventilation, trickle ventilators can be used and sound attenuating types are available. However, windows may remain openable for rapid or purge ventilation, or at the occupant’s choice.*
- 4.42 It is therefore recommended that an alternative means of ventilation is provided to north west facing habitable rooms.
- 4.43 An appropriate mitigation measure would be to install good quality sound attenuating (acoustically rated) ventilator units to habitable rooms.
- 4.44 It is considered appropriate for windows to remain openable in order to provide rapid or purge ventilation (at the occupant’s choice).

4.45 As an alternative to acoustic ventilator units, a mechanically assisted ventilation system could be installed within the new apartment building.

4.46 However, on the basis of the survey results, mechanically assisted ventilation is considered unwarranted.

4.47 Further guidance regarding ventilation and noise mitigation options are provided in Section 5.

North east facing elevation

4.48 Taking into consideration the degree of screening from Wilmslow Road, the separation distance and the associated reduction in sound level, facade sound pressure levels are expected to be approximately 54 dB $L_{Aeq,16hour}$ during the daytime and 49 to 50 dB $L_{Aeq,8hour}$ during the night-time.

4.49 With windows open, the resulting internal sound level is expected to be approximately 36 dB $L_{Aeq,16hour}$ during the daytime and 31 to 32 dB $L_{Aeq,8hour}$ during the night-time.

- $54 \text{ dB } L_{Aeq,16hour} - 3 \text{ dB} - 15 \text{ dB} = 36 \text{ dB } L_{Aeq,16hour}$
- $50 \text{ dB } L_{Aeq,8hour} - 3 \text{ dB} - 15 \text{ dB} = 32 \text{ dB } L_{Aeq,8hour}$

4.50 The recommended daytime and night-time sound level targets will therefore be marginally exceeded with windows open.

4.51 However, the relaxed targets will be achieved with windows open and the night-time maximum sound level target of 45 dB $L_{AFmax,T}$ will also be achieved.

4.52 On this basis, sound attenuating ventilator units are considered unnecessary for north east facing habitable rooms.

4.53 If necessary, standard (non-acoustic) hit-and-miss trickle vents would be suitable for providing background ventilation.

South facing elevations

4.54 Taking into consideration the degree of screening from Wilmslow Road, the separation distance and the associated reduction in sound level, facade sound pressure levels are expected to be approximately 45 dB $L_{Aeq,16hour}$ during the daytime and 40 to 41 dB $L_{Aeq,8hour}$ during the night-time.

4.55 With windows open, the resulting internal sound level is expected to be approximately 27 dB $L_{Aeq,16hour}$ during the daytime and 22 to 23 dB $L_{Aeq,8hour}$ during the night-time.

- $45 \text{ dB } L_{Aeq,16hour} - 3 \text{ dB} - 15 \text{ dB} = 27 \text{ dB } L_{Aeq,16hour}$
- $41 \text{ dB } L_{Aeq,8hour} - 3 \text{ dB} - 15 \text{ dB} = 23 \text{ dB } L_{Aeq,8hour}$

4.56 The recommended daytime and night-time sound level targets will therefore be achieved with windows open. The night-time maximum sound level target of 45 dB $L_{AFmax,T}$ will also be achieved.

4.57 On this basis, sound attenuating ventilator units are considered unnecessary for south facing habitable rooms.

North east facing elevation (No.2 Swinbourne Grove)

4.58 Taking into consideration the degree of screening from Wilmslow Road, the separation distance and the associated reduction in sound level, facade sound pressure levels are expected to be approximately 57 dB $L_{Aeq,16hour}$ during the daytime and 52 to 53 dB $L_{Aeq,8hour}$ during the night-time.

4.59 With windows open, the resulting internal sound level is expected to be approximately 39 dB $L_{Aeq,16hour}$ during the daytime and 34 to 35 dB $L_{Aeq,8hour}$ during the night-time.

- $57 \text{ dB } L_{Aeq,16hour} - 3 \text{ dB} - 15 \text{ dB} = 39 \text{ dB } L_{Aeq,16hour}$
- $53 \text{ dB } L_{Aeq,8hour} - 3 \text{ dB} - 15 \text{ dB} = 35 \text{ dB } L_{Aeq,8hour}$

- 4.60 The recommended daytime and night-time sound level targets will therefore be slightly exceeded with windows open. The night-time maximum sound level target of 45 dB $L_{AFmax,T}$ will also be slightly exceeded.
- 4.61 However, the relaxed sound level targets will be achieved with windows open.
- 4.62 On this basis, sound attenuating ventilator units are considered unnecessary for north east facing habitable rooms. Standard (non-acoustic) hit-and-miss wall vents or trickle vents should be suitable for providing background ventilation.

South east and south west facing elevations

- 4.63 Taking into consideration the degree of screening from Wilmslow Road, the separation distance and the associated reduction in sound level, facade sound pressure levels are expected to be approximately 45 dB $L_{Aeq,16hour}$ during the daytime and 40 to 41 dB $L_{Aeq,8hour}$ during the night-time.
- 4.64 With windows open, the resulting internal sound level is expected to be approximately 27 dB $L_{Aeq,16hour}$ during the daytime and 22 to 23 dB $L_{Aeq,8hour}$ during the night-time.
- 45 dB $L_{Aeq,16hour}$ – 3 dB – 15 dB = 27 dB $L_{Aeq,16hour}$
 - 41 dB $L_{Aeq,8hour}$ – 3 dB – 15 dB = 23 dB $L_{Aeq,8hour}$
- 4.65 The recommended daytime and night-time sound level targets will therefore be achieved with windows open. The night-time maximum sound level target of 45 dB $L_{AFmax,T}$ will also be achieved.
- 4.66 On this basis, sound attenuating ventilator units are considered unnecessary for south facing habitable rooms.

Ambient sound level in outdoor living areas

- 4.67 With regard to outdoor living areas, BS 8233 provides the following guidelines:
- For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognised that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.*
- 4.68 There are balconies proposed at third floor level on the north east facing elevation (overlooking Swinbourne Grove).
- 4.69 Taking into consideration the orientation of the balconies and the separation distance from Wilmslow Road, the resulting sound level on the balcony area is expected to be generally below 55 dB $L_{Aeq,16hour}$.
- 4.70 Taking into consideration BS 8233 guidance and the resulting sound level, the proposed balconies are considered suitable for the residential development.

5. Ventilation & Noise Mitigation Options

Acoustically rated ventilator units

- 5.1 Manually controlled trickle ventilators (the most common type of background ventilators) can be located over the window frames, in window frames, just above the glass or directly through the wall.
- 5.2 Sound attenuating ventilator units can be installed to habitable rooms, in order to allow background ventilation whilst maintaining a high sound insulation performance from the facade.
- 5.3 With regard to north west facing habitable rooms, the ventilator unit should provide a sound insulation performance of at least 29 dB $D_{n,e,w}$ (in the open position).
- 5.4 Further guidance regarding ventilator performance can be provided once the glazing specification and ventilator type are confirmed.
- 5.5 Example manufacturers of acoustically-rated ventilator units include:
 - www.aereco.co.uk/products-and-systems/
 - www.greenwood.co.uk/acoustic
 - <http://brookvent.co.uk/product/airvent-sm-acoustic/>

Mechanically assisted ventilation

- 5.6 A further option with regard to ventilating and cooling habitable rooms whilst achieving a high facade sound insulation would be to use a mechanical ventilation system, such as a heat recovery system (MVHR) or positive input ventilation system (PIV).
- 5.7 Example suppliers of MVHR and PIV systems include:
 - www.nuaire.co.uk/residential/positive-input-ventilation
 - www.envirovent.com/specifier/products/heat-recovery-systems/
 - www.envirovent.com/specifier/products/positive-input-ventilation/
 - www.greenwood.co.uk/range/5/heat-recovery-mvhr.html
- 5.8 Appropriate ventilation rates depend on the number of bedrooms within the dwelling and the anticipated occupancy rate (refer to Approved Document F for guidance).

Air conditioning system

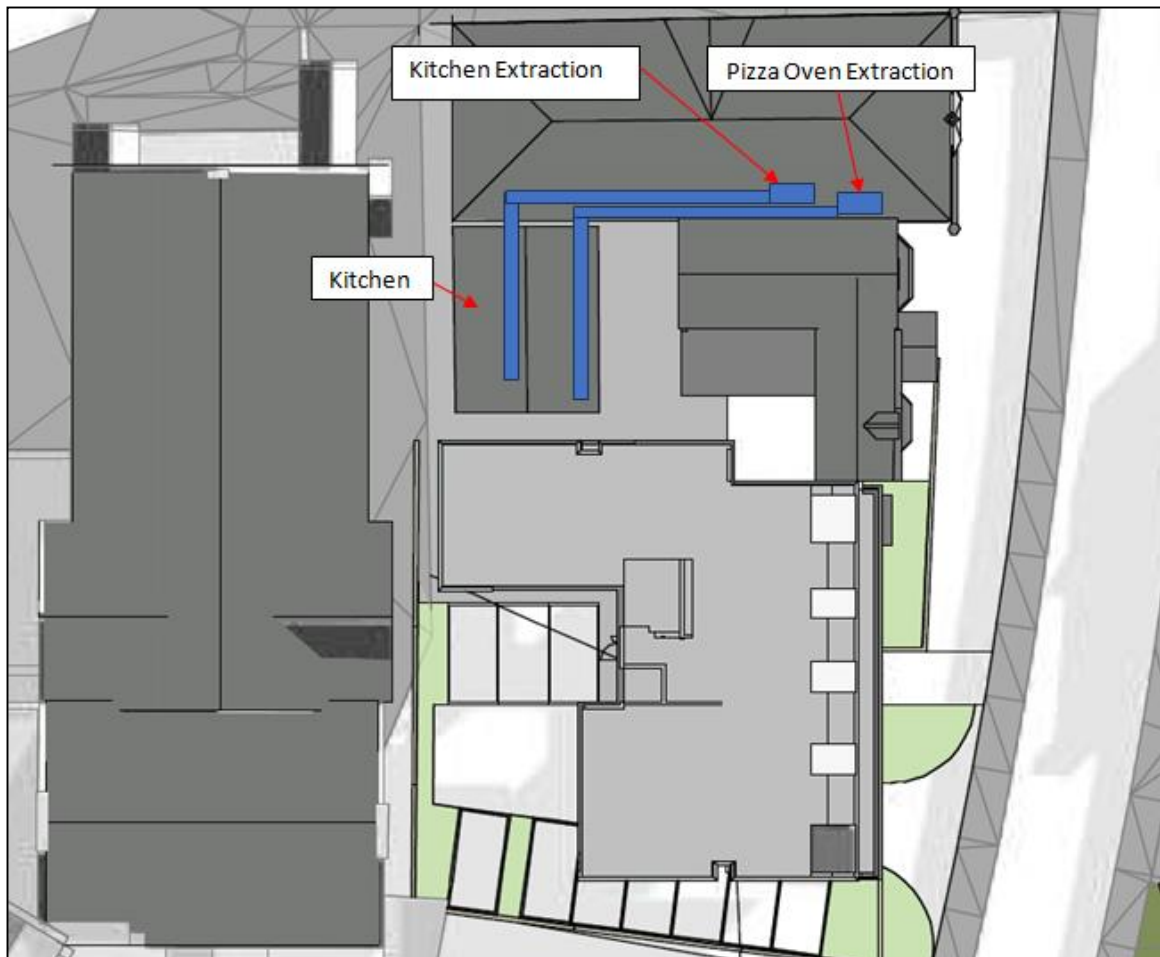
- 5.9 Air-conditioning units can also be used to provide effective cooling and air filtration to habitable rooms.
- 5.10 For example, a split-type air conditioning system provides internal units that can be mounted on the wall, ceiling or directly on the floor.
- 5.11 Example manufacturers of domestic air conditioning systems/units include:
 - www.aircon.panasonic.eu/GB_en/ranges/domestic/
 - www.daikin.co.uk/en_gb/product-group/air-to-air-heat-pumps.html

6. Building Services Plant & Equipment

Sound level targets for new building services plant

- 6.1 The tenant details for the existing building are not yet confirmed and therefore the specification details for mechanical plant and equipment are not available at this time.
- 6.2 However, there will be two extraction fans associated with the ground floor kitchen area.
- 6.3 The nearest noise sensitive receptors will be the new apartments to the south of the extraction point. The nearest residential window is estimated to be approximately 15 metres from the flue termination. The adjacent church elevation is approximately 20 metres from the flue termination.
- 6.4 Figure 6.1 provides an indication of where the extraction ductwork and flue terminations will be located.

Figure 6.1 – Diagram showing proposed kitchen extraction



- 6.5 Since the plant specification is not yet available, it is considered appropriate to set external noise level targets based on the measured background sound levels and the criteria set by Manchester City Council.
- 6.6 Taking into consideration the separation distance to adjacent receptors, it is anticipated that acoustic silencers will be required for the outlet of both extraction systems.
- 6.7 Although the precise hours of plant operation are unknown at this stage, it is considered prudent to assume that plant items may operate during the night-time or early morning hours, as well as during the daytime period.

- 6.8 The future tenant will need to undertake a noise assessment once plant details are confirmed, so that appropriate noise control measures can be determined.
- 6.9 Taking into account MCC's requirements, the sound rating level (L_{Aeq}) from all new building services plant should be at least 5 dB below the typical background sound level ($L_{A90,T}$).
- 6.10 BS 4142 states '*Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context*'.
- 6.11 Table 6.1 presents the applicable sound level targets for new fixed plant items. It is considered prudent to use the lowest typical background sound level when determining appropriate targets.
- 6.12 The sound level targets should be achieved at approximately 1 metre from the nearest residential window. Where free-field measurements are undertaken, the sound level targets may be reduced by 3 dB.

Table 6.1 – Sound level targets for new building services plant

Period, Hours	Typical Background Sound Level $L_{A90,5min}$ dB	Target Rating Level $L_{Aeq,T}$ dB
Daytime (07:00-23:00)	46	41
Night-time (23:00-07:00)	35	30

7. Conclusion

- 7.1 The proposed building envelope construction will provide sufficient sound insulation for the new apartment building.
- 7.2 Standard thermal (non-acoustic) double glazing will provide sufficient sound insulation for the proposed apartment building.
- 7.3 A glazed unit comprising of 6 mm glass / 16 - 20 mm cavity / 4 mm glass should provide sufficient sound insulation for habitable rooms on the north west facing elevation of the apartment building.
- 7.4 An alternative construction may be used so long as the unit provides a minimum sound insulation performance of 29 dB R_w+C_{tr} .
- 7.5 The performance requirements notably reduce for the north east and south facing elevations of the apartment building.
- 7.6 Secondary glazing will provide sufficient sound insulation for the habitable rooms within No.2 Swinbourne Grove. If the existing single glazed windows are to be replaced, standard thermal double glazing will also provide sufficient sound insulation.
- 7.7 With windows open, the recommended daytime and night-time sound level targets will be exceeded within north west facing habitable rooms of the apartment building.
- 7.8 An alternative means of ventilation should therefore be provided to north west facing habitable rooms. An appropriate mitigation measure would be to install good quality sound attenuating ventilator units to habitable rooms.
- 7.9 As an alternative to acoustic ventilator units, a mechanically assisted ventilation system could be installed within the apartment building. However, on the basis of the survey results, mechanically assisted ventilation is considered unwarranted.
- 7.10 Sound attenuating ventilator units are considered unnecessary for the north east and south facing habitable rooms. Standard (non-acoustic) hit-and-miss trickle vents may be used to provide background ventilation.
- 7.11 For all elevations, it is considered appropriate for windows to remain openable in order to provide rapid or purge ventilation.
- 7.12 The recommended daytime and night-time sound level targets will be slightly exceeded within the north east facing habitable rooms of No.2 Swinbourne Grove. However, the relaxed sound level targets will be achieved with windows open.
- 7.13 On this basis, sound attenuating ventilator units are considered unnecessary for north east facing habitable rooms. Standard (non-acoustic) hit-and-miss wall vents or trickle vents should be suitable for providing background ventilation.
- 7.14 The recommended daytime and night-time sound level targets will be achieved with windows open on the south facing elevations.
- 7.15 Taking into consideration the orientation of the balconies and the separation distance from Wilmslow Road, the resulting sound level on the balcony area is expected to be generally below 55 dB $L_{Aeq,16hour}$.
- 7.16 Appropriate noise limits have been determined for new building services plant based on the measured background sound levels and the criteria set by Manchester City Council.
- 7.17 On the basis of the measured sound levels and identified mitigation measures, the proposed site is considered suitable for residential development.

Appendix A

Proposed site plan, floor plans and elevations

Figure A.1 – Proposed site plan and survey measurement positions

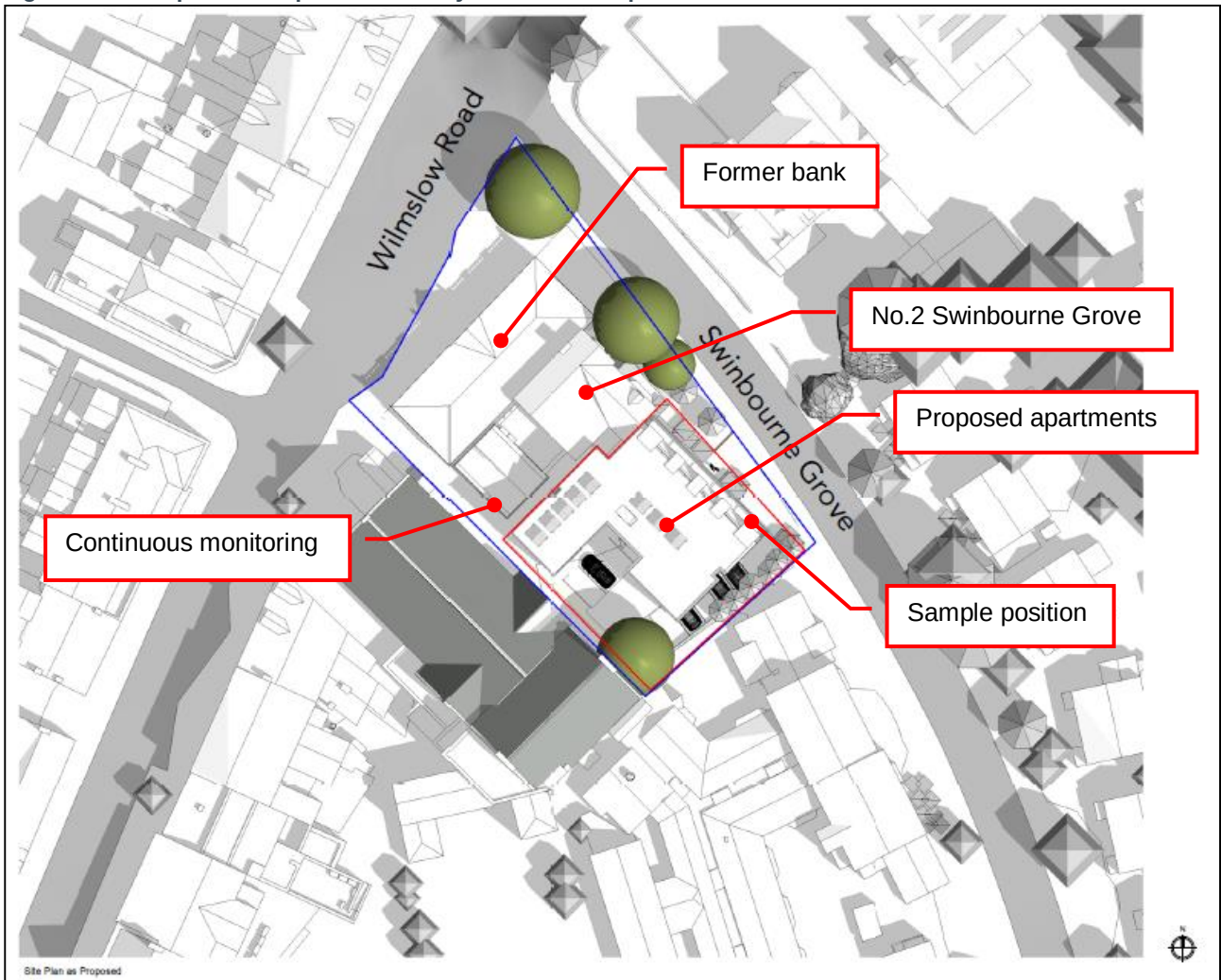


Figure A.2 – Proposed ground floor plan (proposed apartments)

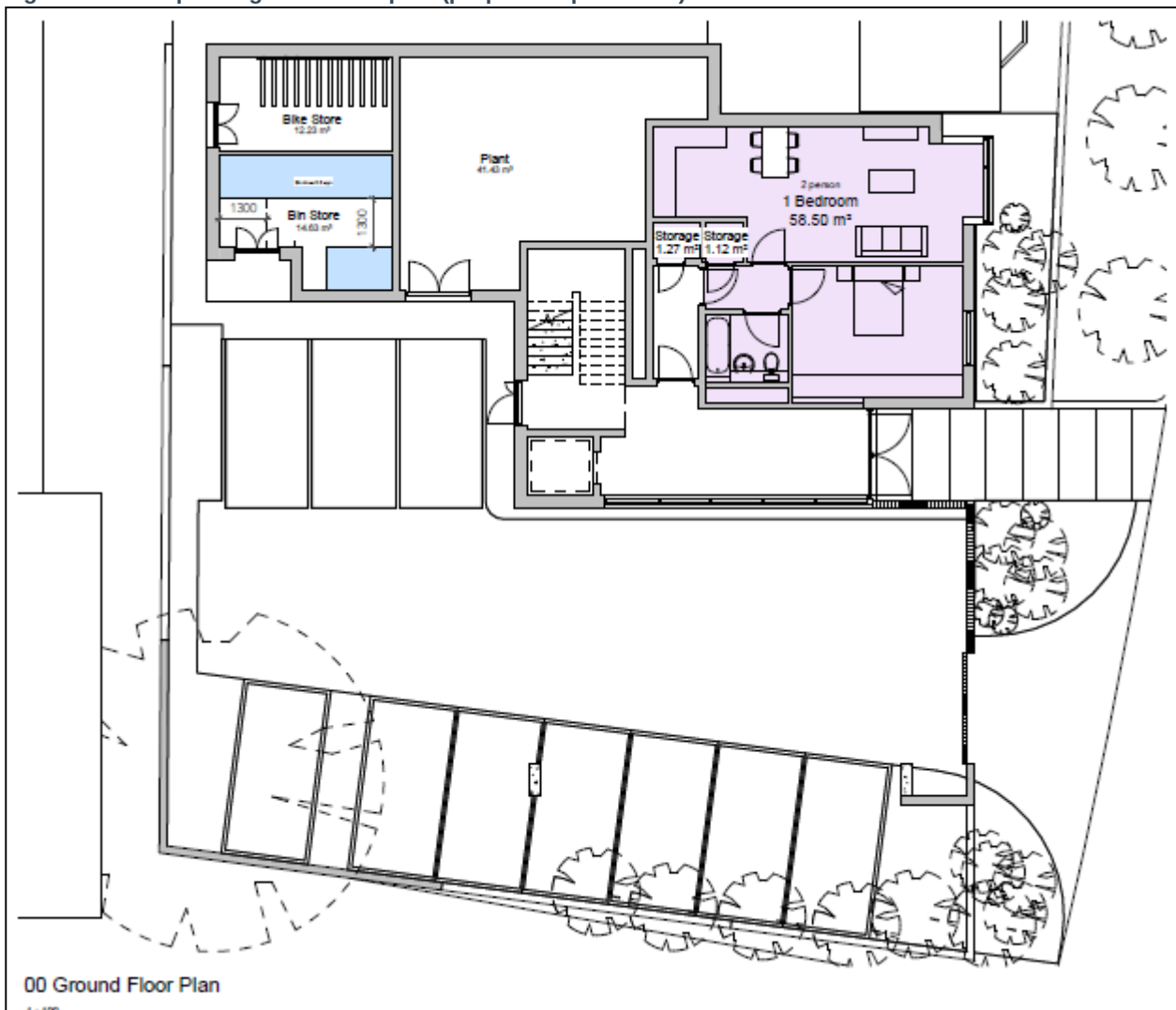


Figure A.3 – Proposed first floor plan (proposed apartments)

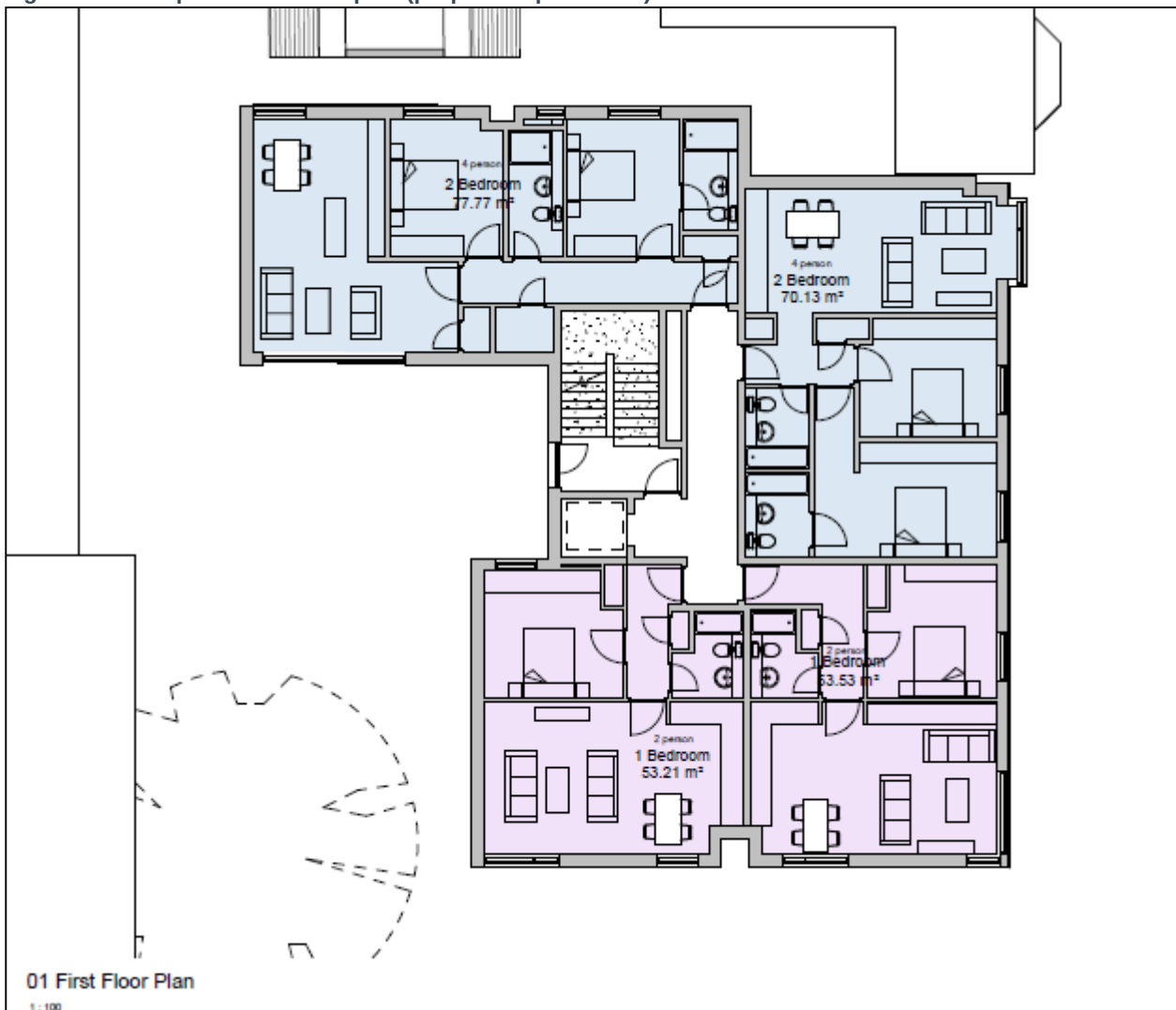


Figure A.4 – Proposed second floor plan (proposed apartments)

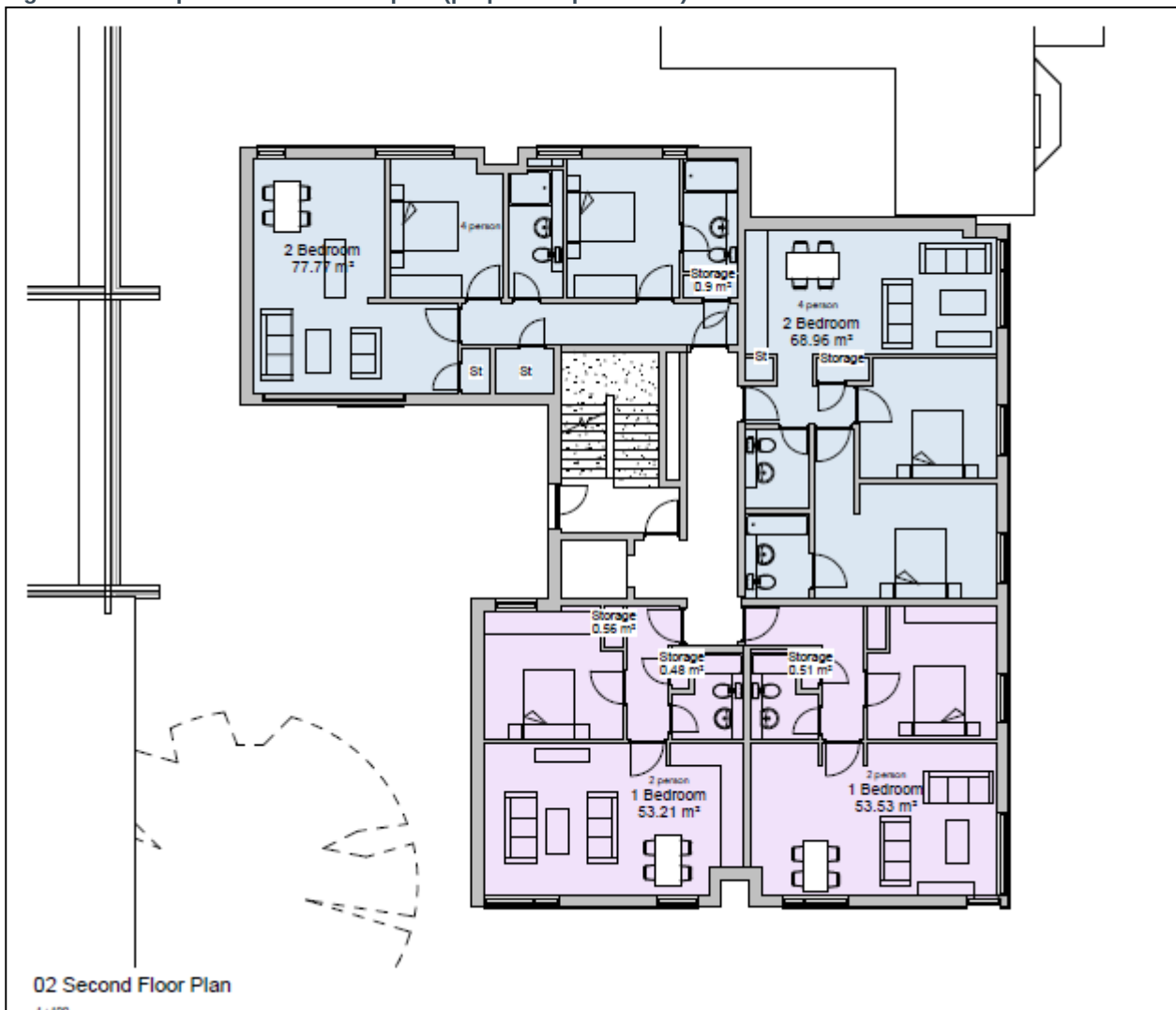


Figure A.5 – Proposed third floor plan (proposed apartments)

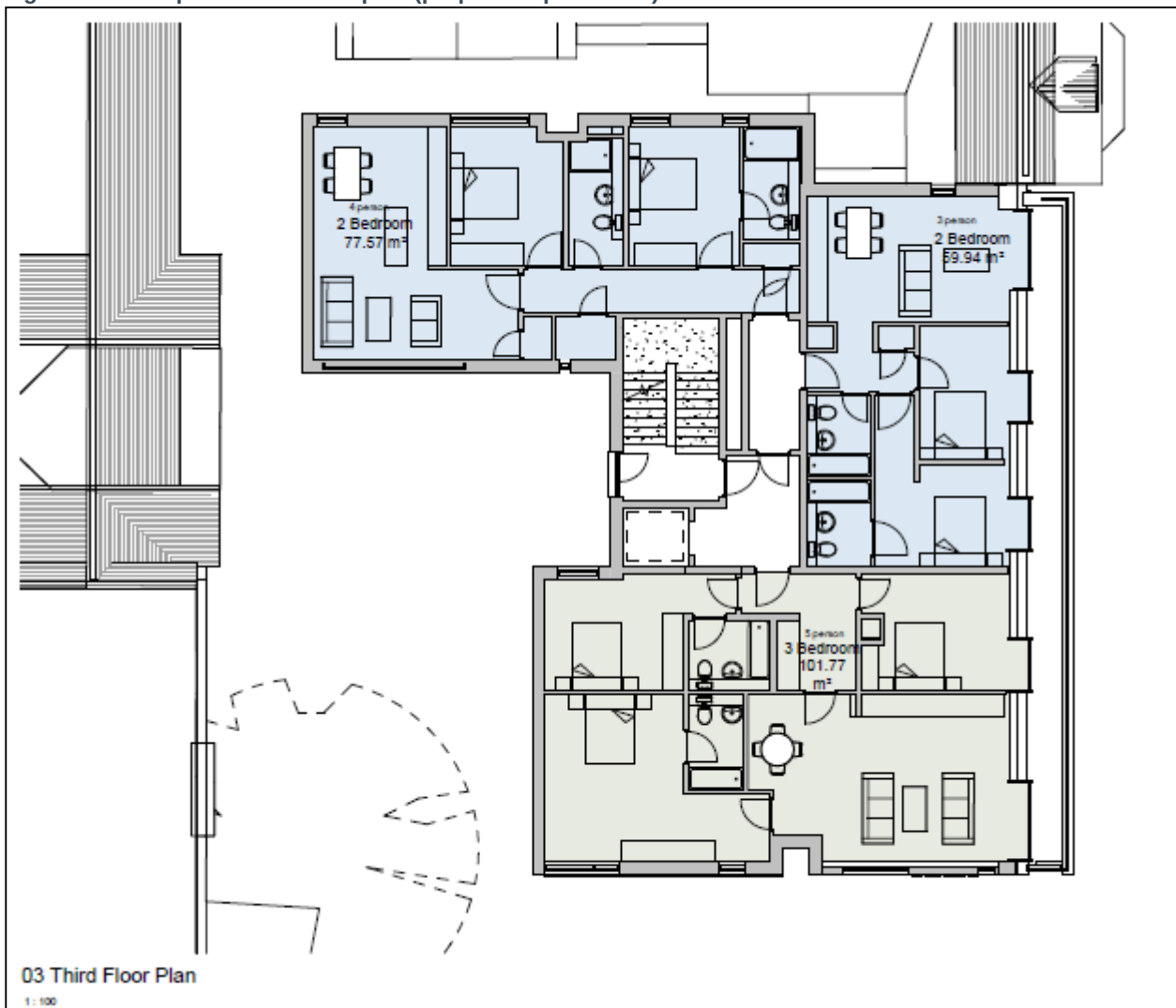


Figure A.6 – Proposed elevations (apartments)



Figure A.7 – Proposed basement (No.2 Swinbourne Grove)

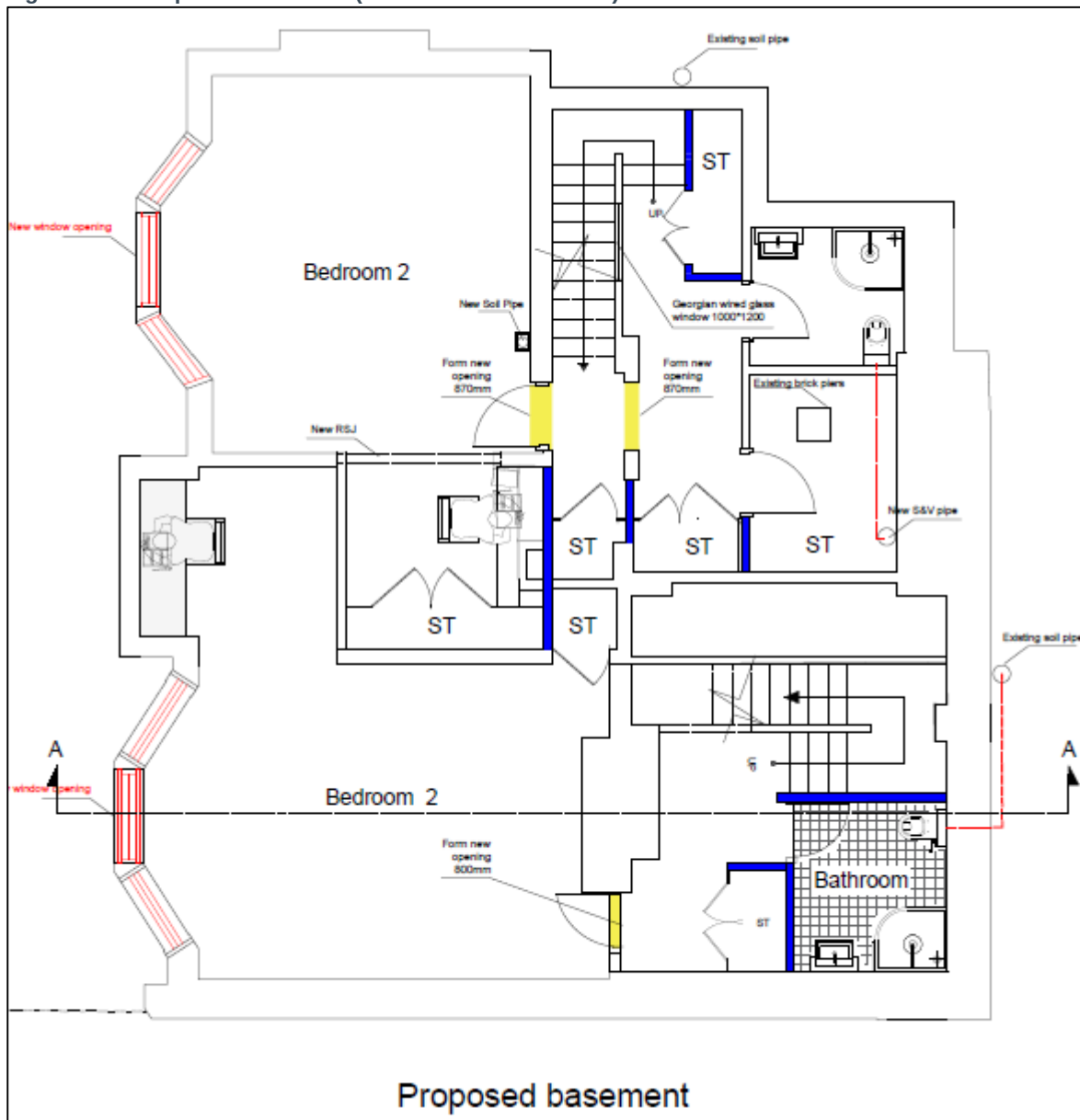


Figure A.8 – Proposed ground floor (No.2 Swinbourne Grove)

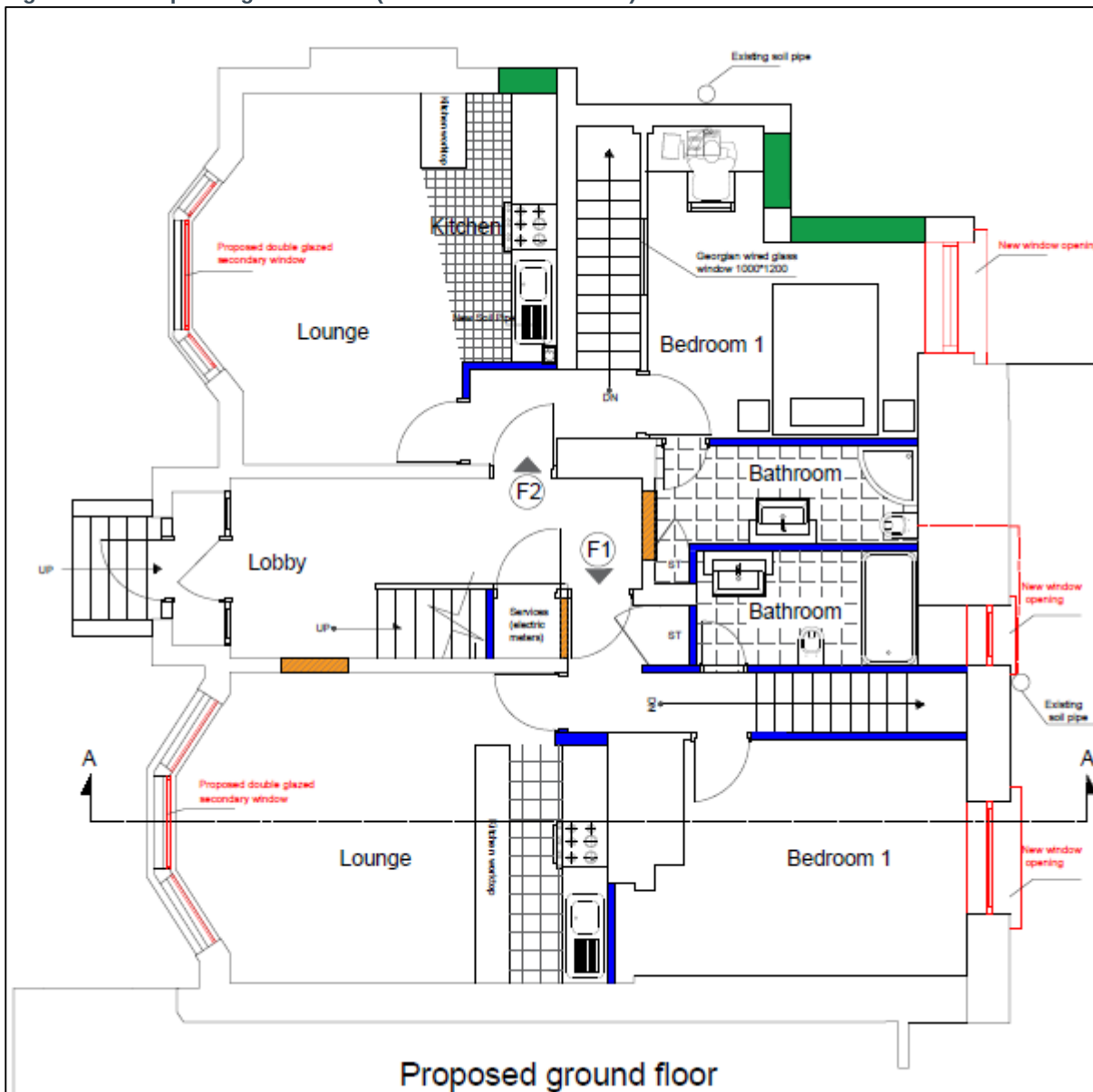


Figure A.9 – Proposed first floor (No.2 Swinbourne Grove)

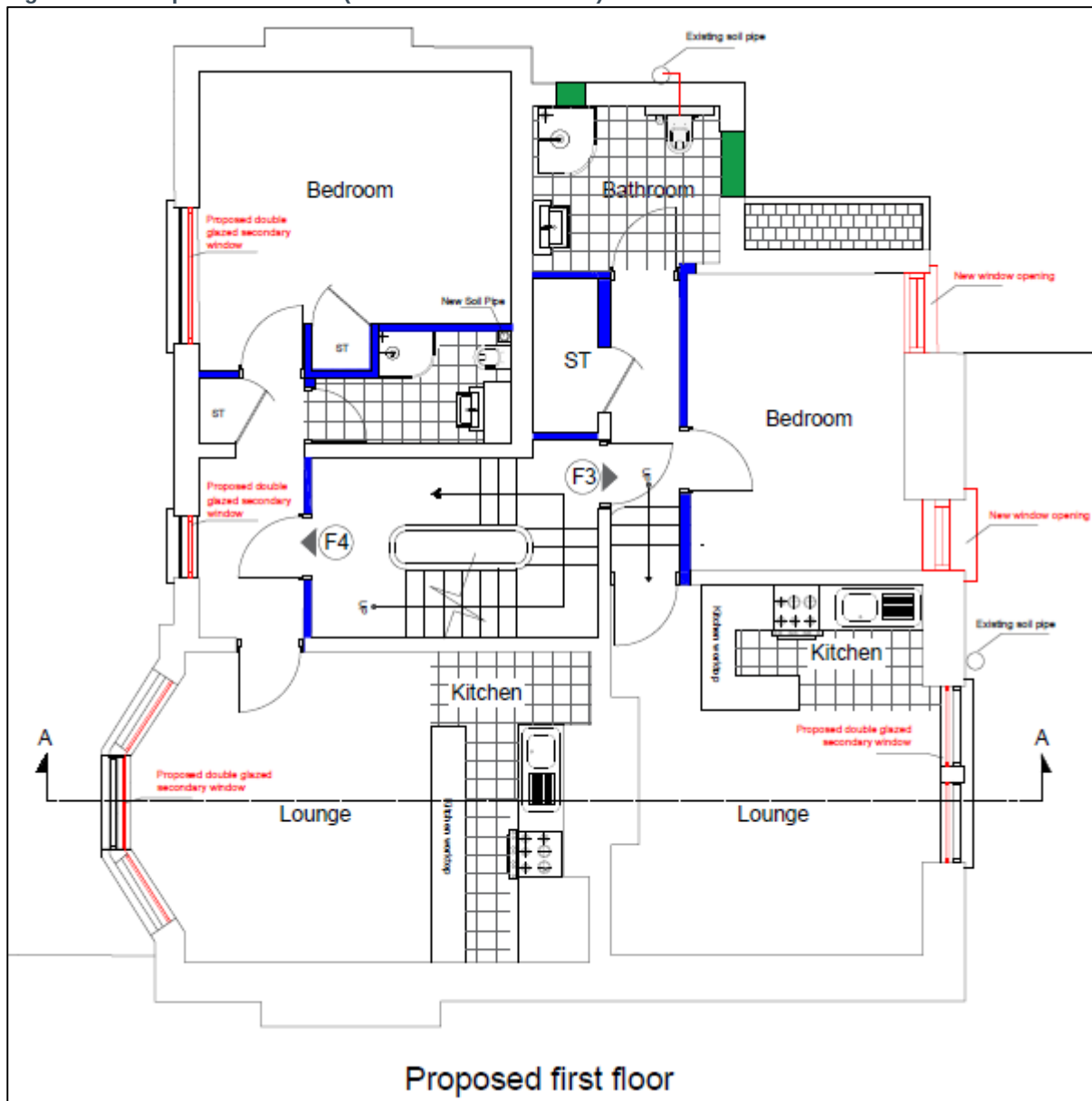


Figure A.10 – Proposed second floor (No.2 Swinbourne Grove)

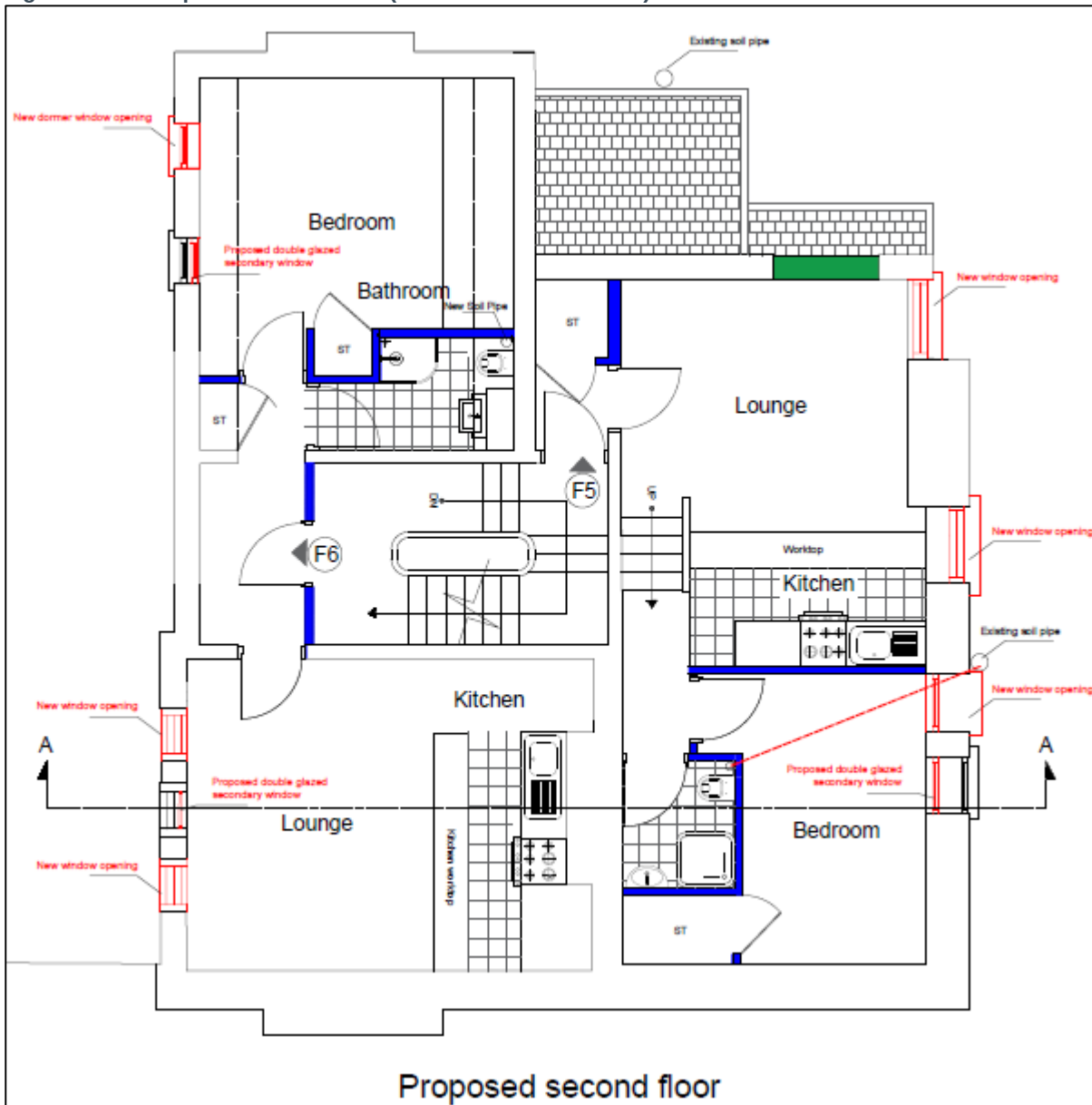
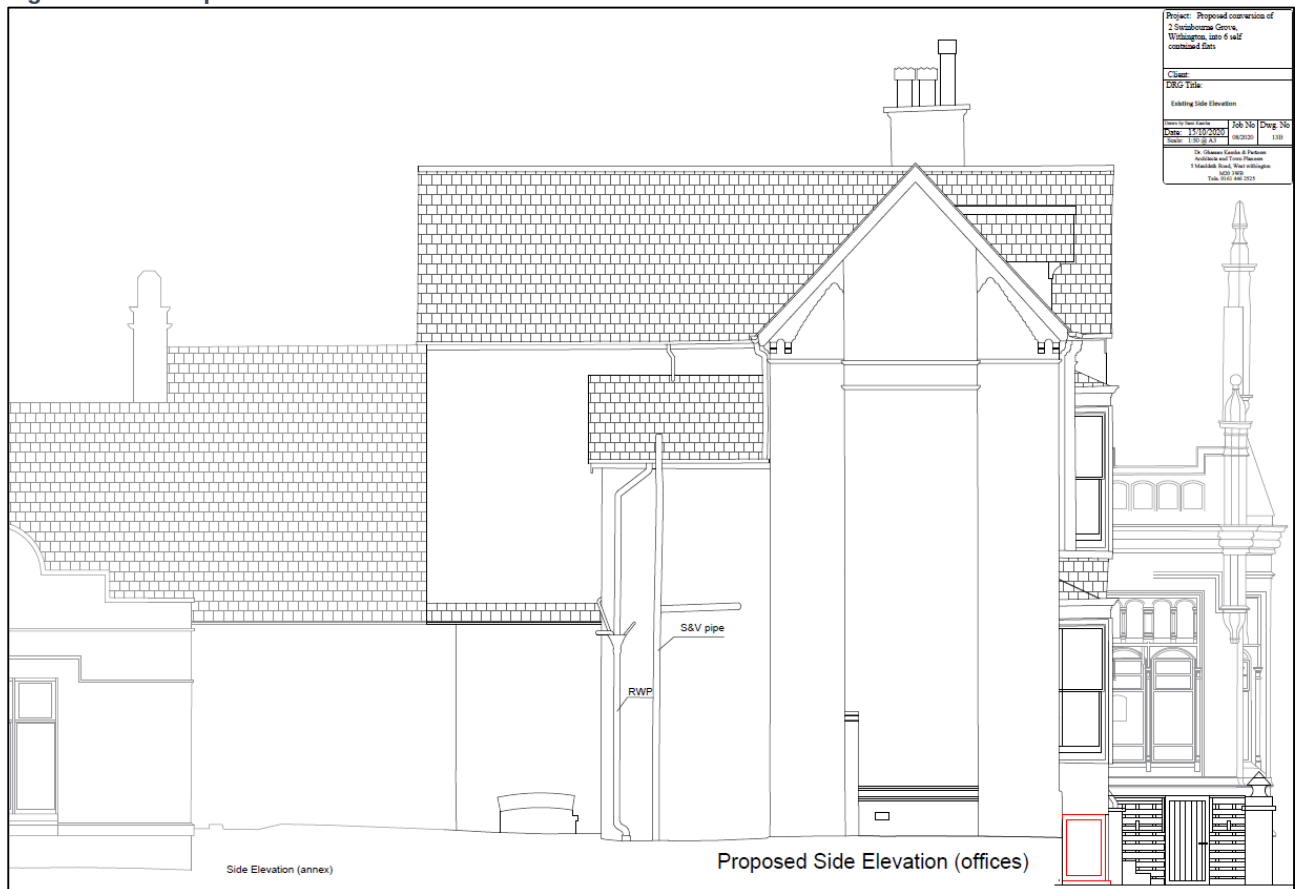


Figure A.11 – Proposed front elevation



Figure A.12 – Proposed side elevation



Appendix B

Assessment terminology

Assessment terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure ($2 \times 10^{-5} \text{Pa}$).
dB(A)	The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq} , L_{A90} etc, according to the parameter being measured.
Acoustic environment	Sound from all sources as modified by the environment.
Ambient sound level	The totally encompassing sound in a given situation at a given time; it is usually composed of sound from many sources, near and far.
Equivalent continuous sound level - $L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period (commonly used to describe the 'ambient' sound level).
Maximum sound level - $L_{AFmax,T}$	The A-weighted 'maximum' sound pressure level that occurred during a given period, T (commonly used for the assessment of intermittent loud noises).
Background sound level - $L_{A90,T}$	The sound pressure level that is exceeded for 90% of the measurement time interval, T. $L_{A90,T}$ is often used to describe the 'background' sound level.
Habitable room	Any room used or intended to be used for sleeping, cooking, living or eating purposes (enclosed spaces such as bath or toilet facilities, service rooms, corridors, laundries, hallways, utility rooms or similar spaces are excluded from this definition).
R_w	The weighted sound reduction index expressed in dB. A single number quantity for airborne sound insulation rating.
Free-field level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other significant reflective surfaces. Generally as measured outside and away from buildings (>3.5metres).
Specific sound source	Sound source being assessed.
Specific sound level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T.
Rating level $L_{Ar,T}$	Specific sound level plus any adjustment for the characteristic features of the sound.