Resource & Environmental Consultants Ltd

Noise Impact Assessment

Former New Heys Comprehensive School
Heath Road
Liverpool
L19 4TN

REC Report: 90164
Issued: 23rd November 2012

Prepared for:
Redrow Homes North West

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REC Acoustics

QUALITY ASSURANCE

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Prepared by	John Goodwin		
Signature			
Checked by	Jethro Redmore		
Signature			
Authorised by	Paul Furmston		
Signature			
Project number	90164		

EXECUTIVE SUMMARY

Road Traffic Noise Survey

A Road Traffic Noise Survey has been completed in order to measure the noise impact of vehicles using the surrounding roads upon the proposed residential development.

Noise Impact Assessment

This Noise Impact Assessment has been completed with due regard to the requirements of Liverpool City Council's Environmental Health Department.

This Noise Impact Assessment has identified that the key noise sources within the vicinity of the Site are vehicles using Mather Avenue, Heath Road and Allerton Road. Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure a commensurate level of protection against noise for future occupants.

Subject to the incorporation of the identified mitigation measures, it has been shown that noise should not be considered a constraint to planning consent for the proposed residential development.

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APPENDICES

1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants (REC) Ltd have been commissioned by Redrow Homes North West to undertake a Noise Impact Assessment for a proposed residential development on land occupied by the former New Heys Comprehensive School on Heath Road in Liverpool L19, to be referred to hereafter as 'the Site'.

This study has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact upon the proposed noise-sensitive residential development.

This Noise Impact Assessment has been completed with due regard to the requirements of Liverpool City Council's (LCC) Environmental Health Department.

All acronyms used within this report are defined in the Glossary presented in Appendix II.

1.2 Site Location & Proposed Development

The Site is bound by Mather Avenue to the west, Heath Road to the south, Allerton Road to the east and existing residential dwellings to the north.

The key source of noise impacting upon the Site is road traffic on Mather Avenue, Heath Road and Allerton Road.

This assessment has been undertaken with due regard to the supplied masterplan as shown on the following planning drawings:

- Site Layout, undated.

The masterplan is shown in Figure I of Appendix III

1.3 Limitations

The limitations of this report are presented in Appendix I.

1.4 Confidentiality

REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC; a charge may be levied against such approval.

2.0 ASSESSMENT CRITERIA

2.1 Local Authority Guidance and Criteria – Liverpool City Council Environmental Health Department

REC has contacted Ian Rushforth, Senior Enforcement Officer at LCC to agree the criteria for the Noise Impact Assessment which are as follows:

- The average noise level within bedrooms shall not exceed 30dB $L_{Aeq,8hr}$;
- The maximum noise level in bedrooms shall not exceed 45dB $L_{Amax,fast}$;
- The average noise level within living rooms shall not exceed 35dB $L_{Aeq,16hr}$;
- The noise level within gardens fronting onto Mather Avenue shall not exceed 55dB $L_{Aeq,16hr}$; and,
- The noise level within gardens fronting onto Heath Road and Allerton Road shall not exceed 50dB $L_{Aeq,16hr}$.

2.2 Calculation of Road Traffic Noise 1988

The Calculation of Road Traffic Noise (CRTN) memorandum, produced by the Department of Transport for the Welsh Office, describes the procedures for calculating noise from road traffic. Section III of this memorandum details the shortened measurement procedure whereby measurements of the L_{10} parameter are made over any three consecutive hours between 10:00 and 17:00. From the arithmetic average of the three 1-hour values, the $L_{10,18hr}$ noise levels is derived before derivation of the $L_{Aeq,16hr}$ value.

2.3 Transport Research Laboratory – Converting the UK Traffic Noise Index $L_{A10,18hr}$ to EU Noise Indices for Noise Mapping

This document provides a method for converting the $L_{A10,18hr}$ level to the L_{night} level using the following formula, applicable to non-motorway roads.

$$L_{night} = 0.90 \times L_{A10,18hr} - 3.77\text{dB}$$

2.4 British Standard BS8233:1999: Sound Insulation and Noise Reduction for Buildings – Code of Practice

The scope of this standard is the provision of recommendations for the control of noise in and around buildings. It suggests appropriate criteria and limits for different situations, which are primarily intended to guide the design of new buildings or refurbished buildings undergoing a change of use, rather than to assess the effect of changes in the external noise climate.

The standard suggests suitable internal noise levels within different types of buildings, including Plots, as shown in Table 2.1.

Table 2.1: BS8233 Recommended Internal Noise Levels

Criterion	Typical Situation	Design Range $L_{Aeq,T}$ dB	
		Good	Reasonable
Suitable resting / sleeping conditions	Living Room	30	40
	Bedroom	30	35
For a reasonable standard in bedrooms at night, individual noise events (measured with fast time weighting) should not normally exceed 45dB L_{Amax}			

BS8233 goes on to recommend noise levels for gardens. According to BS8233, it is desirable that the steady noise level does not exceed $L_{Aeq,T}$ 50dB, and 55dB should be regarded as the upper limit.

3.0 ROAD TRAFFIC NOISE SURVEY

REC has conducted a 3-hour road traffic noise measurement on Mather Avenue, Heath Road and Allerton Road in accordance with the guidelines stated in CRTN. The following noise measurement positions were chosen for the Road Traffic Noise Survey:

- Noise Measurement Position 1 (NMP1): Tuesday 23rd October 2012 from 10:05 – 13:05. Located 5m from the nearside kerbstone of Mather Avenue, which equates to 8.5m from the centre of Mather Avenue. The microphone was located at a height of 1.5m above ground level. Noise sources at this measurement position consisted of road traffic on Mather Avenue only;

- Noise Measurement Position 2 (NMP2): Tuesday 23rd October 2012 from 10:20 – 13:20. Located 4m from the nearside kerbstone of Heath Road, which equates to 7.5m from the centre of Heath Road. The microphone was located at a height of 1.5m above ground level. Noise sources at this measurement position consisted of road traffic on Heath Road only; and,

- Noise Measurement Position 3 (NMP3): Tuesday 23rd October 2012 from 14:00 – 17:00. Located 4m from the nearside kerbstone of Allerton Road, which equates to 7.5m from the centre of Allerton Road. The microphone was located at a height of 2.5m above ground level in order to clear an existing stone boundary wall. Noise sources at this measurement position consisted of road traffic on Allerton Road only.

The weather conditions during the noise survey were conducive towards the measurement of environmental noise, being fine and dry with wind speeds of less than 1.0m/s.

A summary of the measured sound pressure levels are presented in Table 3.1.

Table 3.1: Summary of Measured Noise Levels for NMP1 – NMP3

Measurement Position	Period	Measured Sound Pressure Level (dB), freefield			
		$L_{Aeq,T}$	$L_{Amax,fast}$[1]	$L_{A90,T}$	$L_{A10,T}$
NMP1	Tuesday 23rd October 2012 10:05 – 11:05	64.1	77.2	49.2	68.4
	Tuesday 23rd October 2012 11:05 – 12:05	64.3		48.8	68.8
	Tuesday 23rd October 2012 12:05 – 13:05	64.2		49.4	68.6
NMP2	Tuesday 23rd October 2012 10:20 – 11:20	54.1	64.2	43.9	57.8
	Tuesday 23rd October 2012 11:20 – 12:20	52.7		41.8	55.6
	Tuesday 23rd October 2012 12:20 – 13:20	54.3		43.5	57.0
NMP3	Tuesday 23rd October 2012 14:00 – 15:00	61.1	77.3	41.8	65.6
	Tuesday 23rd October 2012 15:00 – 16:00	61.1		39.9	65.4
	Tuesday 23rd October 2012 16:00 – 17:00	61.9		42.4	66.9

1 10th highest $L_{Amax,fast}$ from three 1-hour periods

The Road Traffic Noise Surveys were completed using the specification of noise measurement equipment shown in Table 3.2.

Table 3.2: Noise Measurement Equipment

Measurement Positions	Equipment Description	Manufacturer & Type No.	Serial No.	Calibration Due Date
NMP1 & NMP3	Sound Level Meter	01dB-Metravib Black Solo	65211	2nd May 2013
	Pre-amplifier	01dB-Metravib PRE21S	15667	
	Microphone	Microtech Gefell GmbH MCE212	103328	
	Calibrator	01dB-Metravib Cal 21	34113643	23rd March 2013
NMP2	Sound Level Meter	CEL 490	087900	8th February 2014
	Pre-amplifier	CEL 495	000103	
	Microphone	CEL 251	0253	
	Calibrator	CEL 110/1	269387	3rd February 2013

4.0 NOISE IMPACT ASSESSMENT

For the purposes of this assessment, the 16-hour daytime average ($L_{eq,t}$) noise level has been calculated based on the shortened measurement procedure detailed in CRTN. The 8-hour night-time $L_{eq,t}$ noise level has been calculated based on the procedure detailed in the Transport Research Laboratory document.

The respective daytime and night-time noise levels have been derived using the following calculations:

1. Derivation of the $L_{A10,18hr}$ noise level by using the following formula:

$$L_{10,18hr} = L_{10,3hr} – 1dB$$

2. Derivation of the $L_{Aeq,16hr}$ noise level by using the following formula:

$$L_{eq,16hr} – L_{10,18hr} – 2dB$$

3. Derivation of the night-time $L_{Aeq,8hr}$ noise level by using the following formula:

$$L_{night}\ (L_{eq,8hr}) = 0.90 \text{ x } L_{10,18hr} – 3.77dB$$

Table 4.1 details the calculated daytime and night-time road traffic noise levels from Mather Avenue, Heath Road and Allerton Road.

Table 4.1: Derivation of Daytime and Night-time Road Traffic Noise Level for NMP1 – NMP3

Measurement Position	Period	Calculated L_{Aeq} (dB)	10th Highest Measured $L_{Amax,fast}$ (dB)	Measurement Distance from Centre of Road (m)
NMP1	Daytime (07:00 – 23:00)	65.6	77.2	8.5
	Night-time (23:00 – 07:00)	57.1		
NMP2	Daytime (07:00 – 23:00)	50.8	64.2	7.5
	Night-time (23:00 – 07:00)	43.4		
NMP3	Daytime (07:00 – 23:00)	63.0	77.3	7.5
	Night-time (23:00 – 07:00)	54.7		

The Noise Impact Assessment has calculated the noise level for the Plots which border onto each road.

In determining the level of noise impact at the Plots it is necessary to distance-correct the measured noise levels and the following equation has been used to determine the resulting noise levels:

$$L_{Aeq,2} = L_{Aeq,1} - (10 \times \log (D2/D1)$$

Where
$L_{Aeq,2}$ = noise level under investigation
$L_{Aeq,1}$ = measured noise level
D2 = distance under investigation
D1 = measurement distance

The following equation has been used to determine the resulting noise level from the night-time measured maximum noise levels:

$$L_{Amax,fast,2} = L_{Amax,fast,1} - (20 \times \log (D2/D1)$$

Where
$L_{Amax,fast,2}$ = noise level under investigation
$L_{Amax,fast,1}$ =measured noise level
D2 = distance under investigation
D1 = measurement distance

4.1 Mather Avenue

Table 4.2 details the calculated daytime noise level for the garden areas of the Plots which border onto Mather Avenue.

Table 4.2: Calculation of Daytime Outdoor Garden Noise Levels

Plot	Daytime Calculated L_{Aeq} (dB)	Measurement Distance (m)	Distance to Garden (m)	Calculated Noise Level in Garden (dB)	Noise Criteria Level (dB)	Difference +/- (dB)
8	65.6	8.5	23.7	61.1	55	+6.1
66 – 73 / 3 - 7	65.6	8.5	14.8	63.2	55	+8.2

Table 4.2 has indicated that the daytime noise level from road traffic in the garden area of the above Plots exceeds the agreed criteria level. Accordingly Section 5 considers the appropriate level of mitigation required in order to reduce this noise level to meet the agreed criteria.

In addition to noise levels in garden areas, it is necessary to consider internal noise levels within habitable rooms.

Table 4.3 details the calculated noise levels for the habitable rooms (bedrooms and living rooms) in the Plots which lie closest to Mather Avenue using standard thermal double glazing. The now revoked Planning Policy Guidance Note 24 (PPG24) suggests that the sound reduction index afforded by such glazing set in a standard brick-block wall will reduce external to internal noise levels by approximately 33dB.

Table 4.3: Calculation of Internal Noise Levels

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
1 - 8	Daytime Living Rooms (07:00 – 23:00)	61.7	33	28.7	35	-6.3
	Night-time Bedrooms (23:00 – 07:00)	53.2	33	20.2	30	-9.8
		69.5	33	36.5	45	-8.5
73	Daytime Living Rooms (07:00 – 23:00)	62.8	33	29.8	35	-5.2
	Night-time Bedrooms (23:00 – 07:00)	54.2	33	21.3	30	-8.7
		71.5	33	38.6	45	-6.4
66 – 72	Daytime Living Rooms (07:00 – 23:00)	61.4	33	28.4	35	-6.6
	Night-time Bedrooms (23:00 – 07:00)	52.9	33	19.9	30	-10.1
		68.9	33	35.9	45	-9.1

Table 4.3 indicates that standard thermal double glazing will be sufficient in reducing external noise levels to below the internal criteria noise levels. As such acoustic glazing is not considered necessary. Given that the remaining Plots lie further from Mather Avenue, it is not necessary to undertake calculation for these Plots as the noise level at their facades will be lower.

During summer months it may be necessary to open windows in order to provide a supply of fresh air. Table 4.4 has determined the internal noise levels for the Plots detailed in Table 4.3. BS8233 suggests that the sound reduction index of a partially open window will attenuate noise by approximately 12dB.

Table 4.4: Calculation of Internal Noise Levels – Windows Open

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
1 - 8	Daytime Living Rooms (07:00 – 23:00)	61.7	12	49.7	35	+14.7
	Night-time Bedrooms	53.2	12	41.2	30	+11.2

	(23:00 – 07:00)	69.5	12	57.5	45	+12.5
73	Daytime Living Rooms (07:00 – 23:00)	62.8	12	50.8	35	+15.8
	Night-time Bedrooms (23:00 – 07:00)	54.2	12	42.2	30	+12.2
		71.5	12	59.5	45	+14.5
66 – 72	Daytime Living Rooms (07:00 – 23:00)	61.4	12	49.4	35	+14.4
	Night-time Bedrooms (23:00 – 07:00)	52.9	12	40.9	30	+10.9
		68.9	12	56.9	45	+11.9

Table 4.4 indicates that the internal target noise levels will be exceeded if windows in habitable rooms, facing Mather Avenue are opened. Accordingly Section 5 considers alternative ventilation to opening windows.

4.2 Heath Road

Table 4.5 details the calculated daytime noise level for the garden areas of the Plots which border onto Heath Road.

Table 4.5: Calculation of Daytime Outdoor Garden Noise Levels

Plot	Daytime Calculated L_{Aeq} (dB)	Measurement Distance (m)	Distance to Garden (m)	Calculated Noise Level in Garden (dB)	Noise Criteria Level (dB)	Difference +/- (dB)
49 / 10	50.8	7.5	14.8	47.8	50	-2.2
4 – 8 / 50	50.8	7.5	11.8	48.8	50	-1.2

Table 4.5 indicates that the daytime noise level from road traffic in the garden area of the above Plots meets the agreed criteria and so no further consideration towards mitigation is required.

Table 4.6 has calculated the noise levels for the habitable rooms (bedrooms and living rooms) in the Plots which lie closest to Heath Road using standard thermal double glazing.

Table 4.6: Calculation of Internal Noise Levels

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
49 / 10	Daytime Living Rooms (07:00 – 23:00)	49.4	33	16.4	35	-18.6
	Night-time Bedrooms (23:00 – 07:00)	42.0	33	9.0	30	-21.0
		61.4	33	28.4	45	-16.6
4 – 8 / 50	Daytime Living Rooms (07:00 – 23:00)	47.0	33	14.0	35	-21.0
	Night-time Bedrooms (23:00 – 07:00)	39.7	33	6.7	30	-23.3
		56.7	33	23.7	45	-21.3

Table 4.6 indicates that standard thermal double glazing will be sufficient in reducing external noise levels to below the internal criteria noise levels. As such acoustic glazing is not considered necessary. Given that the remaining Plots lie further from Heath Road, it is not necessary to undertake calculation for these Plots as the noise level at their facades will be lower.

During summer months it may be necessary to open windows in order to provide a supply of fresh air. Table 4.7 determines the internal noise levels for the Plots detailed in Table 4.6.

Table 4.7: Calculation of Internal Noise Levels – Windows Open

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
49 / 10	Daytime Living Rooms (07:00 – 23:00)	49.4	12	37.4	35	+2.4
	Night-time Bedrooms (23:00 – 07:00)	42.0	12	30.0	30	0.0
		61.4	12	49.4	45	+4.4
4 – 8 / 50	Daytime Living Rooms (07:00 – 23:00)	47.0	12	35.0	35	0.0
	Night-time Bedrooms	39.7	12	27.7	30	-2.3

	(23:00 – 07:00)	56.7	12	44.7	45	-0.3

Table 4.7 indicates that the internal target noise levels will be exceeded if windows in habitable rooms facing Heath Road are opened. Accordingly Section 5 considers alternative ventilation to opening windows.

4.3 Allerton Road

Table 4.8 details the calculated daytime noise level for the garden areas of the Plots which border Allerton Road.

Table 4.8: Calculation of Daytime Outdoor Garden Noise Levels

Plot	Daytime Calculated L_{Aeq} (dB)	Measurement Distance (m)	Distance to Garden (m)	Calculated Noise Level in Garden (dB)	Noise Criteria Level (dB)	Difference +/- (dB)
1 - 3	63.0	7.5	11.8	61.0	50	+11.0
4	63.0	7.5	8.9	62.2	50	+12.2

Table 4.8 indicates that the daytime noise level from road traffic in the garden area of the above Plots exceeds the agreed criteria and so Section 5 will consider the mitigation measures required in order to reduce this noise level.

Table 4.9 details the calculated noise levels for the habitable rooms (bedrooms and living rooms) in the Plots which lie closest to Allerton Road using standard thermal double glazing.

Table 4.9: Calculation of Internal Noise Levels

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
1 - 3	Daytime Living Rooms (07:00 – 23:00)	58.9	33	25.9	35	-9.1
	Night-time Bedrooms (23:00 – 07:00)	50.6	33	17.6	30	-12.4
		69.1	33	36.1	45	-8.9
4	Daytime Living Rooms (07:00 – 23:00)	61.0	33	28.0	35	-7.0
	Night-time Bedrooms (23:00 – 07:00)	52.7	33	19.7	30	-10.3
		73.3	33	40.3	45	-4.7

Table 4.9 indicates that standard thermal double glazing will be sufficient in reducing external noise levels to below the internal criteria noise levels. As such acoustic glazing is not considered necessary. Given that the remaining Plots lie further from Allerton Road, it is not necessary to undertake calculation for these Plots as the noise level at their facades will be lower.

During summer months it may be necessary to open windows in order to provide a supply of fresh air. Table 4.10 determines the internal noise levels for the Plots detailed in Table 4.9.

Table 4.10: Calculation of Internal Noise Levels – Windows Open

Plot	Period	Calculated Noise Level at Façade (dB)	Attenuation Afforded by Standard Thermal Double Glazing (dB)	Calculated Internal Noise Level (dB)	Internal Noise Criteria Level (dB)	Difference +/- (dB)
1 - 3	Daytime Living Rooms (07:00 – 23:00)	58.9	12	46.9	35	+11.9
	Night-time Bedrooms (23:00 – 07:00)	50.6	12	38.6	30	+8.6
		69.1	12	57.1	45	+12.1
4	Daytime Living Rooms (07:00 – 23:00)	61.0	12	49.0	35	+14.0
	Night-time Bedrooms (23:00 – 07:00)	52.7	12	40.7	30	+10.7
		73.3	12	61.3	45	+16.3

Table 4.10 indicates that the internal target noise levels will be exceeded if windows in habitable rooms facing Allerton Road are opened. Accordingly Section 5 considers alternative ventilation to opening windows.

5.0 MITIGATION

This section has determined the mitigation measures required in order to reduce the noise level impact to meet the agreed criteria.

5.1 Mather Avenue

The previous section has determined that the noise levels in garden areas for Plot 8, Plots 66 – 73 and Plots 3 – 7 are in excess of the criteria noise levels. It has been shown that standard thermal double glazing will be sufficient in controlling external noise levels, however if windows are opened then the internal target noise levels will be exceeded.

Table 5.1 has determined the height of the acoustic fence which should run along the boundary of the garden areas which front onto Mather Avenue.

Table 5.1: Calculation of Acoustic Fence Height

Period	Plot	Calculated Noise Level in Garden with no Fence (dB)	Noise Criteria Level (dB)	Difference +/- (dB)	Required Path Difference (m)	Required Acoustic Fence Height (m)
Daytime (07:00 – 23:00)	8	61.1	55.0	+6.1	0.01	1.7
	66 – 73 / 3 - 7	63.2	55.0	+8.2	0.06	2.1

Table 5.1 details the required height of the acoustic fences which will need to be installed along the boundary of the garden areas with Mather Avenue in order to ensure the relevant criteria are achieved.

The acoustic fence should have a minimum mass of 12.5kg/m^2, be free from holes and be sealed at its base. The precise location of the acoustic fence is shown in Figure II of Appendix III.

In the interests of controlling internal noise levels without the need to open windows to provide fresh air to rooms, it is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit for the living rooms of the habitable rooms which face Mather Avenue. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.2 Heath Road

The previous section has determined that the noise levels in garden areas which border onto Heath Road are below the agreed criteria. It has been shown that standard thermal double glazing will be sufficient in controlling external noise levels, however if windows are opened for Plot 49 and Plot 10, then the internal target noise levels will be exceeded.

In the interests of controlling internal noise levels without the need to open windows to provide fresh air to rooms, it is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit for the habitable rooms which face Heath Road. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

5.3 Allerton Road

The previous section has determined that the noise levels in garden areas for Plots 1 – 3 and Plot 4 are in excess of the criteria noise levels. It has been shown that standard thermal double glazing will be sufficient in controlling external noise levels however if windows are opened then the internal target noise levels will be exceeded.

Table 5.2 has determined the height of the acoustic fence which should run along the boundary of the garden areas which front Allerton Road.

Table 5.2: Calculation of Acoustic Fence Height

Period	Plot	Calculated Noise Level in Garden with no Fence (dB)	Noise Criteria Level (dB)	Difference +/- (dB)	Required Path Difference (m)	Required Acoustic Fence Height (m)
Daytime (07:00 – 23:00)	1 – 3	61.0	50.0	+11.1	0.25	2.3
	4	59.2	50.0	+9.2	0.1	2.1

Table 5.2 details the required height of the acoustic fences which will need to be installed along the boundary of the garden areas with Allerton Avenue.

It was noted during the Road Traffic Noise Survey that there was a boundary wall which runs the length of the Site boundary with Allerton Road. If this wall is to be retained as part of the development, then as an alternative to an acoustic fence, the height of the wall could be increased to meet the heights specified in Table 5.2.

In the interests of controlling internal noise levels without the need to open windows to provide fresh air to rooms, it is recommended that a through-frame window mounted trickle ventilator is incorporated into the glazing unit for the living rooms of the habitable rooms which face Allerton Road. One such acoustic trickle ventilator is as follows:

- Greenwoods EAR42W Trickle Ventilator, which provides acoustic attenuation of up to 42 dB $D_{n,e,w} + C_{tr}$ in its open position.

The trickle ventilator should be combined with a Mechanical Extract Ventilation (MEV) or a Passive Extract Ventilation (PEV) system which extracts air from the habitable rooms.

6.0 CONCLUSION

REC Ltd has been commissioned by Redrow Homes North West to undertake a Noise Impact Assessment for a proposed residential development on land occupied by the former New Heys Comprehensive School on Heath Road in Liverpool L19.

This Noise Impact Assessment has been completed with due regard to the requirements of LCC's Environmental Health Department.

This assessment has been undertaken to identify key noise sources in the vicinity of the Site which may have the potential to impact the proposed noise-sensitive residential development.

This Noise Impact Assessment has identified that the key noise sources within the vicinity of the Site are road vehicles using Mather Avenue, Heath Road and Allerton Road. Accordingly, appropriate consideration has been given towards the mitigation measures required to ensure a commensurate level of protection against noise for future occupants.

It should be noted that all of the calculations performed in this assessment are based on worst-case assumptions and so the actual level of noise within external amenity areas and internal habitable rooms is likely to be lower than those calculated.

Subject to the incorporation of the identified mitigation measures, it is anticipated that a commensurate level of protection would be incorporated into the scheme for residential development.

APPENDIX I LIMITATIONS

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client as indicated in Section 1.2.

2. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

3. This report presents an interpretation of the geotechnical information established by excavation, observation and testing. Whilst every effort is made in interpretative reporting to assess the soil conditions over the Site it should be noted that natural strata vary from point to point and that man made deposits are subject to an even greater diversity. Groundwater conditions are dependent on seasonal and other factors. Consequently there may be conditions present not revealed by this investigation.

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APPENDIX II GLOSSARY OF ACOUSTICAL TERMINOLOGY

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude, but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by a number of other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

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.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

An indication of the range of sound levels commonly found in the environment is given in the following table.

Typical sound levels found in the environment

Sound Level	Location
0 dB(A)	Threshold of hearing
20 to 30 dB(A)	Quiet bedroom at night
30 to 4 0dB(A)	Living room during the day
40 to 50 dB(A)	Typical office
50 to 60 dB(A)	Inside a car
60 to 70 dB(A)	Typical high street
70 to 90 dB(A)	Inside factory
100 to 110 dB(A)	Burglar alarm at 1m away
110 to 130 dB(A)	Jet aircraft on take off
140 dB(A)	Threshold of pain

Acoustic Terminology

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 ($2x10^{-5}$Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq, T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} & L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time and as such can be regarded as the 'average maximum level'. Similarly, L_{90} is the 'average minimum level' and is often used to describe the background noise. It is common practice to use the L_{10} index to describe traffic noise.
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 reflective surfaces. Generally as measured outside and away from buildings.
Fast	A time weighting used in the root mean square section of a sound level meter with a 125millisecond time constant.
Slow	A time weighting used in the root mean square section of a sound level meter with a 1000millisecond time constant.

APPENDIX III FIGURES

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Figure 1

NMP1 – NMP3

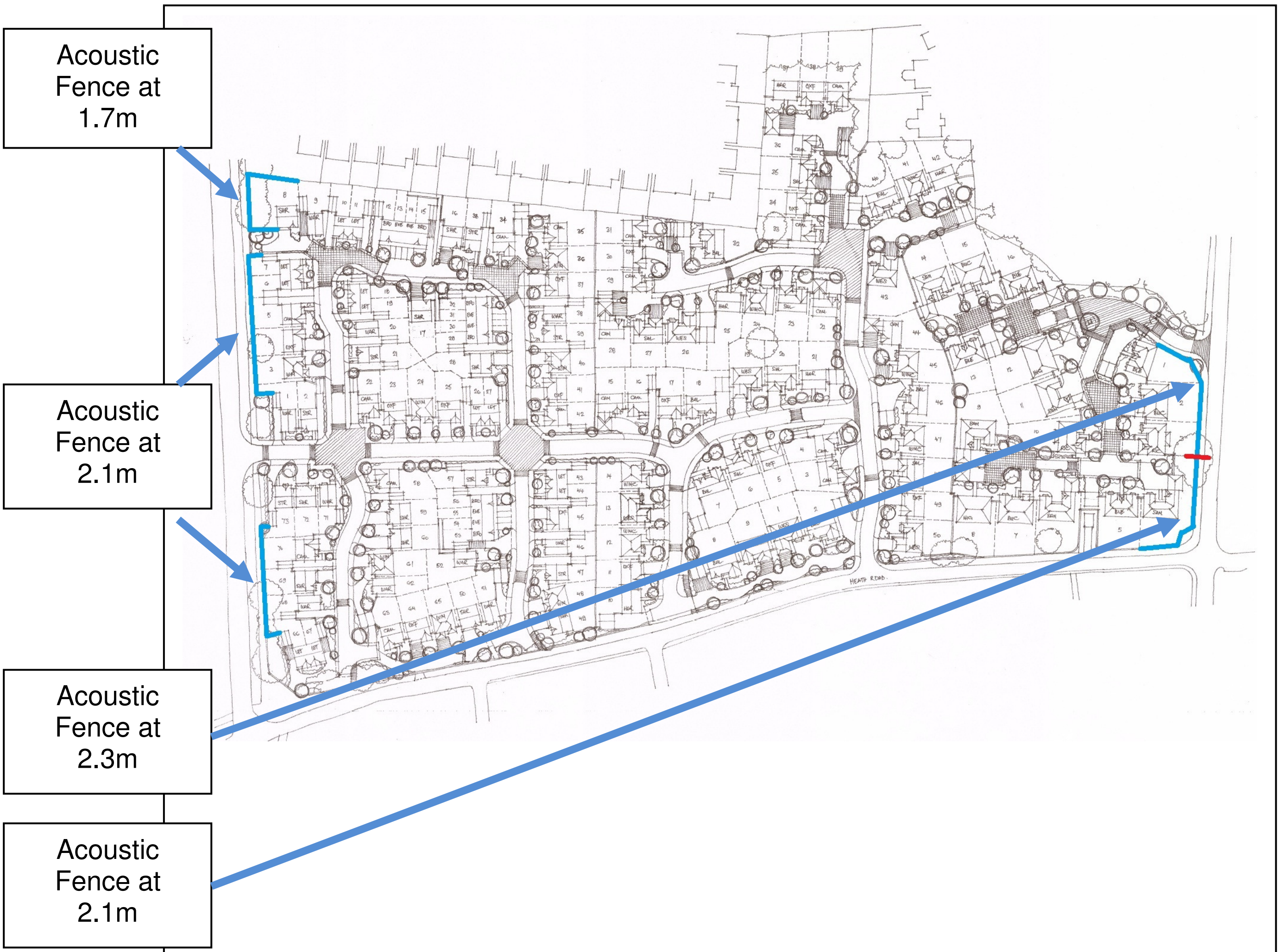

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Figure 2

Proposed Acoustic Fence Locations