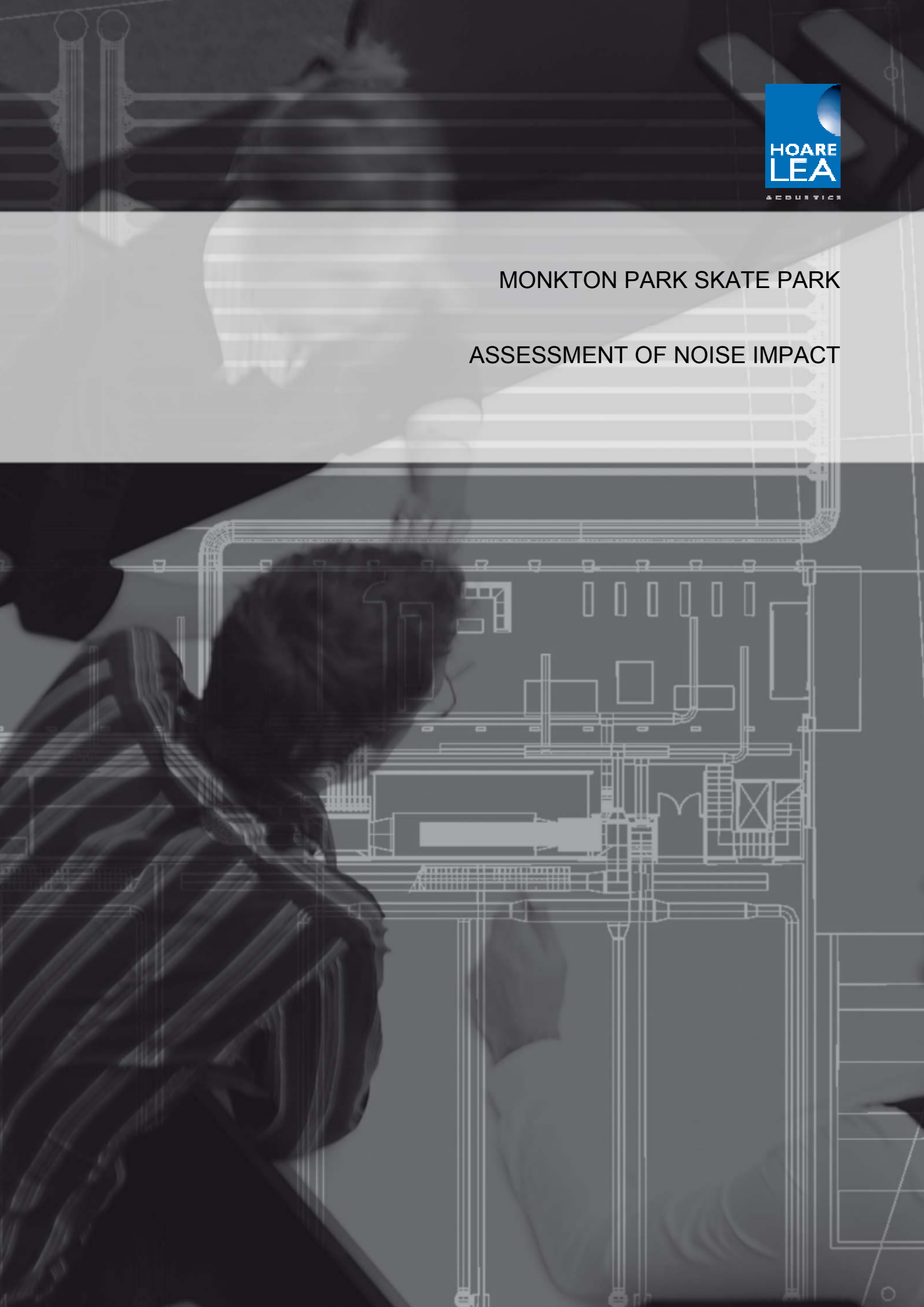

MONKTON PARK SKATE PARK

ASSESSMENT OF NOISE IMPACT

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AUDIT SHEET

REVISION	DESCRIPTION	DATE	ISSUED BY	REVIEWED BY
V1.0	Report	25/06/2013	AJB	BRD
V1.1	Minor textual revisions	27/06/2013	AJB	BRD
V1.2	Calculation parameters and numerical results tables added	01/07/2013	AJB	BRD
V1.3	Results updated to include 5 dB character penalty	05/07/2013	AJB	BRD
V1.4	Part sinking option included	10/07/2013	AJB	

CONTENTS

1. INTRODUCTION & SCOPE OF WORKS

Hoare Lea Acoustics (HLA) has been instructed by Wiltshire Council to carry out a noise impact assessment for a proposed skate park at Monkton Park, Chippenham, partly in recognition of HLA's previous experience in assessing skate park noise from a number of such facilities over the past decade. As a consequence of this instruction, the present report establishes typical noise levels likely to arise from the use of the proposed facility, assesses these likely noise levels with respect to the existing noise climate at the nearest residential properties and, where appropriate, then makes recommendations for noise control measures by way of acoustic screening.

The assessment reported herein has been undertaken in accordance with the request of Wiltshire Council, which was to provide an independent noise assessment to corroborate, or otherwise, a noise assessment undertaken previously by another noise consultant. As a consequence the scope of work reported herein is limited to:

- proposing source noise levels for activities within the proposed skate park development;
- calculating the resultant noise levels at the closest located neighbours to the development
- comparing the calculated noise levels against existing baseline noise levels (as supplied by others); and
- applying the relevant noise assessment criteria (as specified by others) in order to recommend where additional noise mitigation measures in the form of acoustic screening may be required.

In order to complete the requested assessment, Wiltshire Council has supplied HLA with the following information:

- a scaled location plan showing the 'proposed site' and nearby noise sensitive receptors to the north and the south;
- a scaled cross-sectional profile drawn from the nearest receptor to the north, sloping down to the 'potential' site and then across the river to the south receptors, providing the necessary information(distances/ground levels);
- typical lower measured L_{A90} baseline noise levels of 36 dB and 37 dB for residential receptor locations to the north (Sadlers Mead Road) and the south (St Mary's Street);
- a 'best practice' assessment criterion that the L_{Aeq} noise level of operation activity from within the proposed development should not be any greater in level than the supplied L_{A90} baseline noise levels.

In order to provide an objective and fully independent assessment, Wiltshire Council did not supply HLA with any additional information relating to the original noise assessment report. Rather, the Council requested that HLA provide its own data concerning the 'rolling' and 'impact' skateboard noise

arising from the use of concrete skate parks in the form of $L_{Aeq,T}$ and L_{Amax} noise data and undertake its own calculations based on this source data.

In terms of the noise assessment, it was requested that HLA should advise as to what acoustic screening/barrier effects will be required between the proposed skate park and existing receptors in order to ensure that nearby receptors are not adversely affected, it being advised that a 'best practice' design criterion of 0dB (BS4142:1997) should be adopted as the preferred target. However, it was additionally requested that HLA should assess and comment on the impact of predicted L_{Amax} noise levels at receptor positions from the impulsive, shorter term events arising from skate impact noise.

2. DEVELOPMENT PROPOSALS

It is proposed that a new skate park be built in Monkton Park in Chippenham. Monkton Park is bounded to the north and north east by residential properties lying along Sadlers Mead Road, with the closest located dwelling lying approximately 100 m to the north of the proposed development. To the west of the proposed development lie the Monkton Park Council Offices at a similar closest separation distance, with the closest located residential properties in this direction lying at approximately 200 m from the proposed development. Closest to the south of the proposed development lies a retail development, with the closest located residential properties in this direction being located along St Mary's Street at a separation distance of approximately 180 m.

It is proposed that the park be built using a conventional method using concrete and paving slabs.

The location of the proposed development relative to the surrounding area is shown in Figure 1, which also shows a longitudinal transection of the landform between the proposed development and the closest located residential properties which lie to the north and south of the skate park.

3. ASSESSMENT CRITERIA

In order to assess the potential noise impact of the proposed development, it will be necessary to compare predicted noise levels for the development with established guidance and criteria. Wiltshire Council has advised HLA that a 'best practice' assessment standard of 0 dB (BS4142:1997) should be adopted for the purpose of setting noise limits. The basic assessment principle of BS4142:1997 is set out below.

BS4142:1997. British Standard BS 4142:1997 'Method for rating industrial noise affecting mixed residential and industrial areas' provides an objective method for assessing the likelihood of complaint for noise from industrial and commercial operations by comparison of the background noise level with the Rating Level for the source in question. The Rating Level is derived by correction of the source noise level (either measured or predicted) for tone and character. For the case of skate park noise a

character correction of 5 dB is added to the actual L_{Aeq} noise level to arrive at the Rating Level due to the nature of the noise which can include audible impulsive and other features. The likelihood of complaint increases as the Rating Level exceeds the background, as indicated in the following table. The assessment method applies to free field external sound levels.

Rating Level	BS 4142 assessment
10dB or more below background	Complaints unlikely
5dB above background	Marginal significance
10dB or more above background	Complaints likely

BS 8233:1999. In addition to the Council's specific requirements in relation to BS4142:1997, additional guidance may also be obtained from British Standard BS 8233:1999 'Sound insulation and noise reduction for buildings – Code of Practice' on appropriate acoustic criteria for different building types, including dwellings. The Standard advises criteria and limits for noise levels within dwellings and also within gardens and amenity areas. The criteria are based on guidance from the World Health Organisation. The BS8233 internal design criteria for dwellings are set out in the following table.

Location	Reasonable	Good
Living rooms	$L_{Aeq,T}$ 40dB	$L_{Aeq,T}$ 30dB
Bedrooms (at night)	$L_{Aeq,T}$ 35dB L_{Amax} 45dB	$L_{Aeq,T}$ 30dB

BS 8233 Table 10 additionally advises that an open window provides a sound reduction of the order of 10 to 15dB. It may therefore be concluded that, in order to achieve the BS 8233 'reasonable' standard when windows are open, external levels should be limited to L_{Aeq} 50 dB to 55 dB during daytime and L_{Aeq} 45 dB to 50 dB/ L_{Amax} 55 dB to 60 dB during night time.

In the case of gardens and external amenity areas, BS 8233 advises that a level of $L_{Aeq,T}$ 50dB is desirable and that a level of $L_{Aeq,T}$ 55 dB should be considered an upper limit. These values correlate with the daytime external limit values derived above.

4. RESULTS

4.1 Background sound levels

Background L_{A90} sound levels at residential receptor locations against which the calculated skate park noise levels can be assessed were supplied to HLA by Wiltshire Council as being typically levels of 36 dB to 37 dB. Therefore, as a conservative design criterion, the present report has adopted a baseline background noise level of L_{A90} 35 dB at all residential receptor locations against which to assess the skate park noise.

4.2 Skateboard Noise Levels

Typical operational sound pressure levels of riders performing a series of tricks, as measured independently by HLA, are summarised in the following table. All results relate to the typical sound pressure levels measured with a closest point of approach of approximately 3 m between the rider and the noise measurement location. The measurements on which the results of the following table are based are shown in full including octave band data in Appendix 1 to this report.

Measurement	Activity	L_{Aeq} Range, dB	L_{Amax} Range, dB
1	Background Noise	60	69
2-5, 10-12, 14-15	Skateboard Run	62 - 69	71 - 87
6-9	Micro scooter Run	61 - 73	72 - 88
16	BMX Run	65	86

Typically, the noisiest activities either come from the ‘slap’ of the skateboard hitting either the concrete after a jump or a metal rail in order to ‘grind’. In order to ‘grind’, there is contact of metal on metal when either the skateboard trucks or the BMX pegs ride along the ‘grind rail’ – a metal pole that riders slide along. Both of these activities result in the higher L_{Amax} noise levels as shown above.

It is additionally noted that the Rating Levels for skate park noise for use in a BS4142:1997 based assessment would be 5 dB higher than the stated L_{Aeq} ranges due to the addition of a character correction penalty.

5. RESULTS & DISCUSSION

5.1 Results

Using the ISO 9613-2 noise propagation prediction methodology, the site has been acoustically modelled using a source based on the acoustic characteristics shown as Measurement 11 in

Appendix 2. All levels are specified in terms of the sound pressure levels measured at 3 m from the source.

Measurement 11 has been selected is this equates to the upper measured level for a skateboard run, which is likely to form the majority use of the facility, especially when accounting for the potential effects of multiple simultaneous users. It should additionally be noted, however, that the source data adopted for the calculations has been normalised from Measurement 11 in Appendix 1 to an L_{Aeq} of 65.5 dB(A), which equates to a Rating Level of 70.5 dB(A), and an L_{Amax} of 88.5 dB(A), thereby accounting for the maximum L_{Amax} level of an individual impact noise event reported in Appendix 2. This maximum was associated with the micro-scooter run of Measurement 9.

For the case of simultaneous use by 5 skateboards, the overall L_{Aeq} source level has increased to account for 5 individual sources each operating at 65.5 dB(A). Thus the overall effective source level at 3 m is 72.5 dB(A), which equates to corresponding Rating Level of 77.5 dB(A). The L_{Amax} source level has remained the same at 88.5 dB(A) at 3 m as this level is associated with individual events and will not add together in the same manner as the L_{Aeq} level.

The modelling undertaken by HLA has considered 3 scenarios:

- the use of a single skateboard in line with Measurement 11, with the resultant L_{Aeq} (Rating Level) noise map being shown in Figure 2;
- the simultaneous use of 5 skateboards, each in line with Measurement 11, with the resultant L_{Aeq} (Rating Level) noise map being shown in Figure 3; and
- the use of one or more skateboards in line with Measurement 11, with the resultant L_{Amax} noise map being shown in Figure 4 (this L_{Amax} result is independent of the number of skateboards being used at any one time as the result depends on the individual impact noise arising from any one skateboard).

The parameters adopted in the ISO9613-2 calculation methodology are as follows:

Source height = 1.0 m

Receiver height = 1.5 m

Source levels = see preceding paragraph

Ground factor = 1 (soft) over playing fields and gardens and 0 (hard) over skate park

Humidity = 70%

Temperature = 10 degrees Celcius

All results are shown as noise contour plots over the general area surrounding the skate park in Figures 2 to 7 of the report. However, in order to aid numerical comparison, summary numerical results are additionally presented in the Table at the end of this section corresponding to four selected

point locations, three of these being located along Sadlers Mead Road and the fourth being located along St Mary's Street. These point assessment locations are indicated as points R1 to R4 on Figure 1(B). The respective distances from the centre of the skate park to these locations are: 97 m, 128 m, 193 m and 152 m.

The results of Figure 2 and Figure 3 indicates that Rating Levels of up to L_{Aeq} 46.5 dB may result at the closest located residential properties to the north of the development site in the absence of any acoustic mitigation measures. This calculated Rating Level lies above the assessment criterion of 35 dB(A) and it is therefore identified that some acoustic screening will be required.

The results of Figure 4 indicate that the highest L_{Amax} levels expected to occur at the closest located residential receptor locations will be approximately 57.9 dB. This level may just exceed that which is deemed 'acceptable' for outdoor amenity areas in accordance with the preceding discussion relating to BS8233:1999.

In light of the foregoing results, Figure 5 shows the results of introducing an acoustic barrier around the skate park (in the areas indicated by the solid black line on Figure 5) when considering the case of a single skateboard. Figure 6 shows the results for 5 skateboards operating simultaneously. The height of the barrier is between 1.6 m and 4.2 m, as indicated on each of Figures 5 to 7. The effect of this acoustic barrier would be to reduce Rating Levels to L_{Aeq} 35 dB or less at all residential receptor locations, and also to reduce L_{Amax} levels to below approximately 50 dB(A) at all such locations, as shown in Figure 7.

As an alternative to the modelled acoustic barrier in the form of an above ground screen, the same effective acoustic mitigation could be achieved by part sinking the level of the skate park within the surrounding ground, coupled with a lower height above ground acoustic screen. This scenario has also been modelled. Clearly there exist a number of different combinations of sink depth and screen height, but the results provided In Figure 8 have assumed a sink depth of 2.5 m for the skate park floor relative to the immediately surrounding ground level coupled with the introduction of a 2.1 m high acoustic screen to the complete north boundary only, with limited returns of the same height along the northerly extents of the east and west boundaries, as indicated in Figure 8. Whilst no corresponding figure is shown for the maximum levels in this scenario, these levels lie below L_{Amax} 45 dB at all four receiver locations R1 to R4.

Figure	Scenario	Calculated Sound Pressure Level at Location, dB(A)			
		R1	R2	R3	R4
2	Single user, no screening, L_{Aeq}	39.7	36.2	32.1	34.7
3	Five users, no screening, L_{Aeq}	46.5	43.3	39.0	41.4
4	Single/Multiple user, no screening, L_{Amax}	57.9	54.5	50.4	52.8
5	Single user, screening, L_{Aeq}	28.6	26.1	22.2	28.4
6	Five users, screening, L_{Aeq}	35.0	31.9	31.1	35.0
7	Single/Multiple user, screening, L_{Amax}	44.6	41.6	39.1	45.8
8	Five users, part sunk + screening, L_{Aeq}	34.9	33.7	31.9	32.1

Summary table of numerical results

N.B. All L_{Aeq} levels refer to the Rating Level derived in accordance with BS4142:1997 and include a 5 dB character correction penalty. Highlighted cells show where the calculated Rating Level exceeds the Rating Level 35 dB(A) target criterion.

5.2 BS4142 assessment

The BS 4142 assessment indicates that the skate park would comply with Wiltshire Council's '0 dB' assessment criterion, even with multiple skateboards operating at any one time, provided the identified degree of acoustic screening is incorporated into the development. This conclusion has been based on comparing higher activity noise levels with the lower measured background levels.

5.3 BS 8233 Assessment

Section 3.3 advises that, in order to achieve the BS 8233 'reasonable' criteria within bedrooms at night when windows are open, external levels at the building façade should not exceed L_{Aeq} 45-50dB or L_{Amax} 55-60dB. In order to achieve the 'good' standard, external levels should not exceed L_{Aeq} 40-45dB.

The calculated 'worst case' noise level at the nearest sensitive residential property, accounting for the identified degree of acoustic screening being incorporated into the development, is L_{Aeq} 35dB and L_{Amax} 45.8dB when taking into effect attenuation through distance, screening and localised changes in terrain height. These levels would achieve the BS 8233 'good' standard requirement for open windows. All calculated levels are also below BS 8233 requirements for gardens and external amenity areas.

6. CONCLUSIONS

Assessment has been made for the proposed skatepark at Monkton Park, Chippenham in order to determine the noise impact upon residents in nearby dwellings.

Calculations have been based upon noise data measured at a similar style park.

Assessment in accordance with Wiltshire Councils 'best practice' requirement of 0 dB (BS 4142:1997) has been undertaken against typical lower background L_{A90} noise levels measured around the site of 36 dB to 37 dB.

The assessment has indicated that, in order to satisfy the foregoing 0 dB (BS 4142:1997) requirement, it will be necessary to include an acoustic barrier around the site with a screening height of between 1.6 m (to the southern and eastern boundaries of the skate park) and 4.2 m (to the northern and part of the eastern boundaries of the skate park). Alternative options involving sinking the ground level of the skate park coupled with a lesser degree of above ground acoustic screening have also been demonstrated to be capable of providing the overall acoustic mitigation required.

The calculations further indicate that, with the aforementioned screening incorporated into the design, both the 0 dB (BS 4142:1997) criterion can be achieved and also the BS 8233 'good' internal standard can be achieved at the nearest dwellings when windows are open and that BS 8233 criteria for gardens can also be achieved.

FIGURE 1(A) –SITE PLAN INCLUDING TRANSECTION THROUGH THE SITE

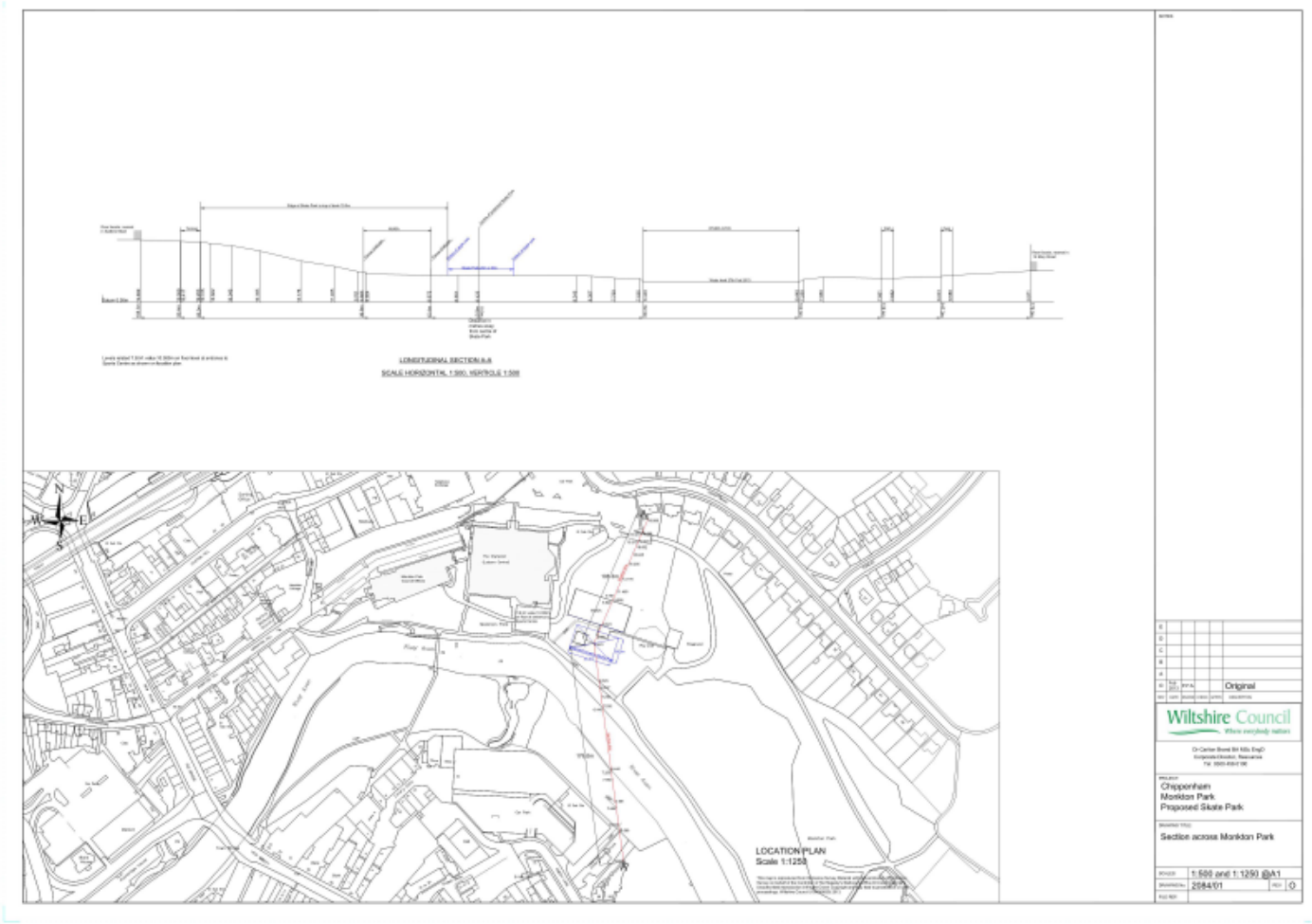


FIGURE 1(B) –SITE PLAN SHOWING NOISE ASSESSMENT LOCATIONS

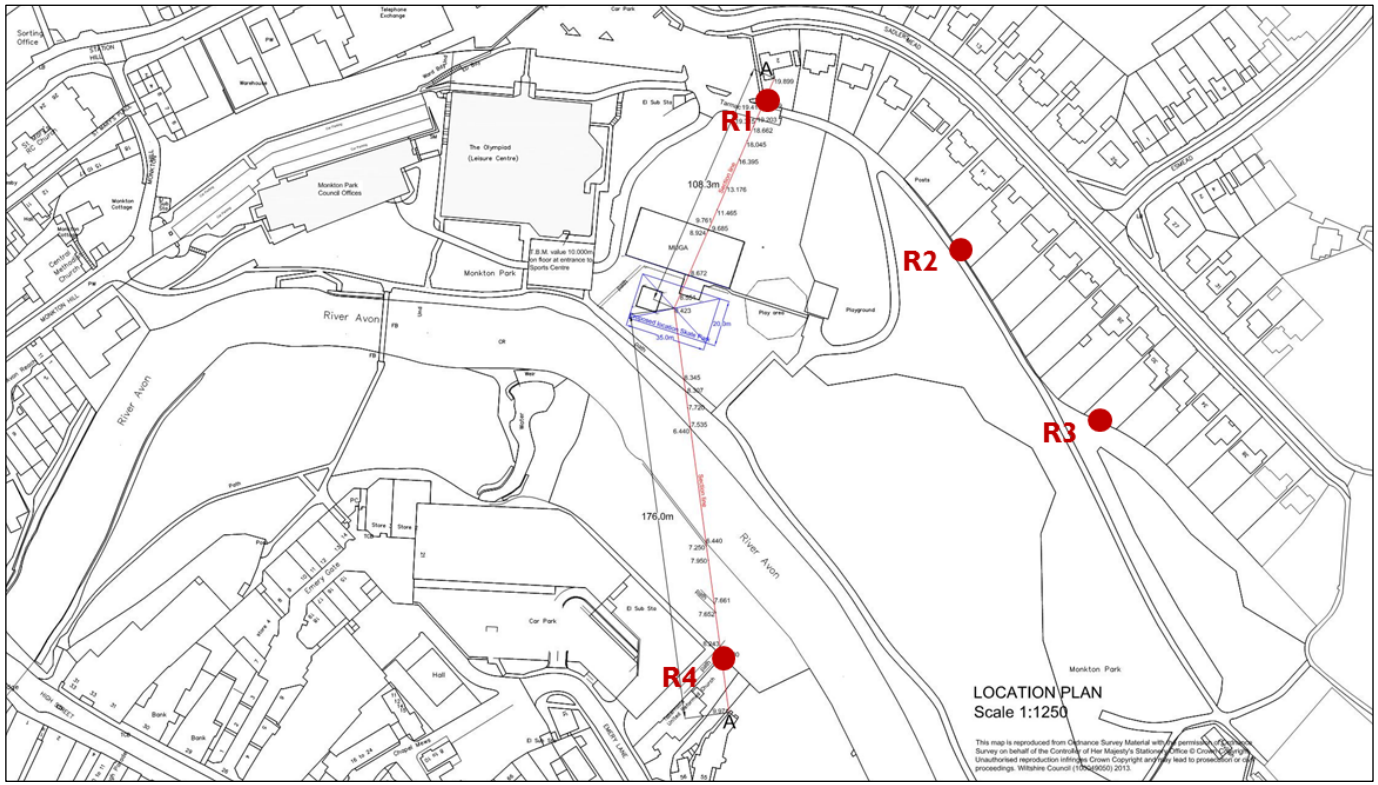


FIGURE 2 – BS4142:1997 RATING LEVEL (L_{Aeq} + 5dB) NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 WITH A SINGLE SKATEBOARD

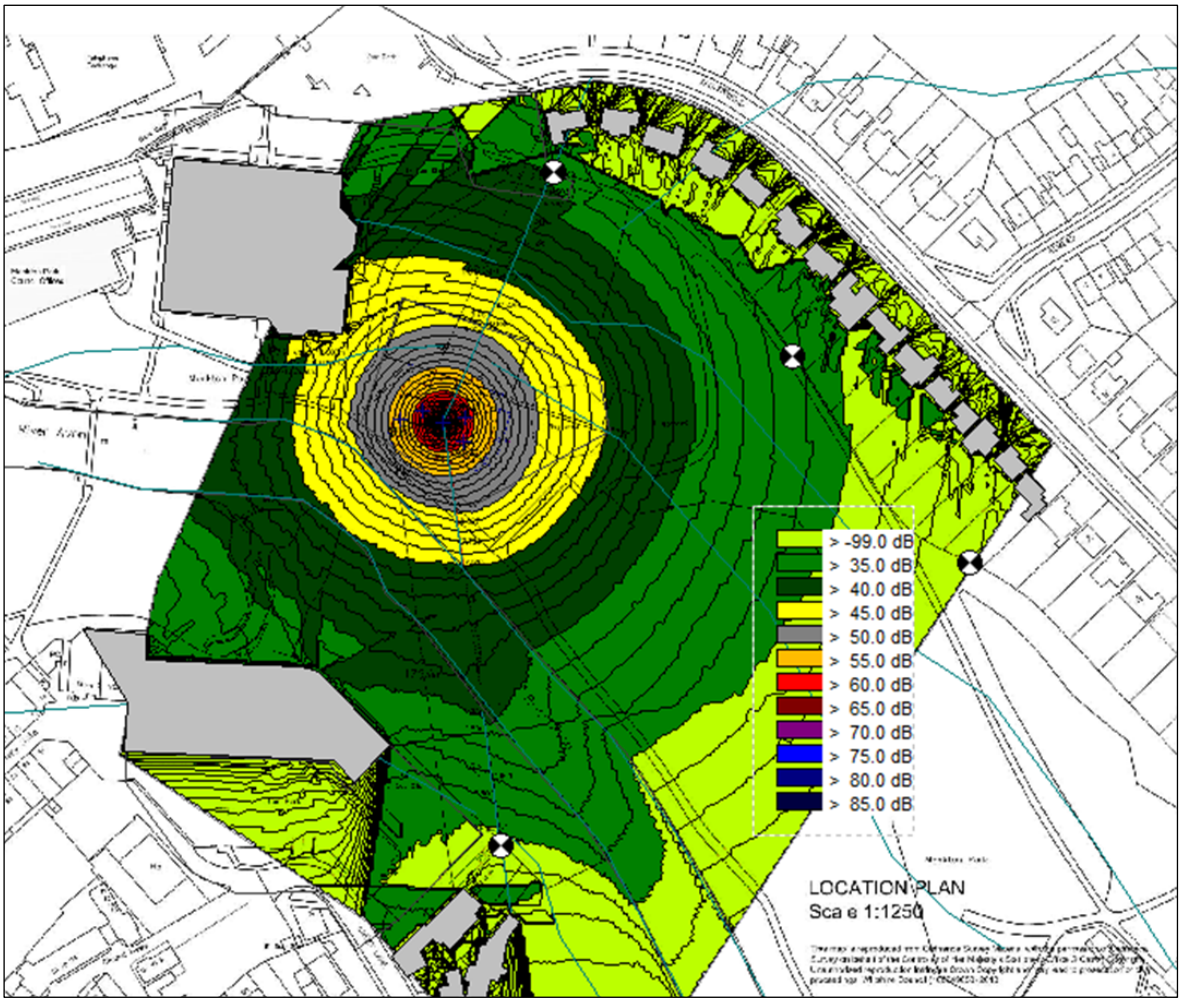


FIGURE 3 – BS4142:1997 RATING LEVEL (L_{Aeq} + 5dB) NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 WITH FIVE SKATEBOARDS OPERATING SIMULTANEOUSLY

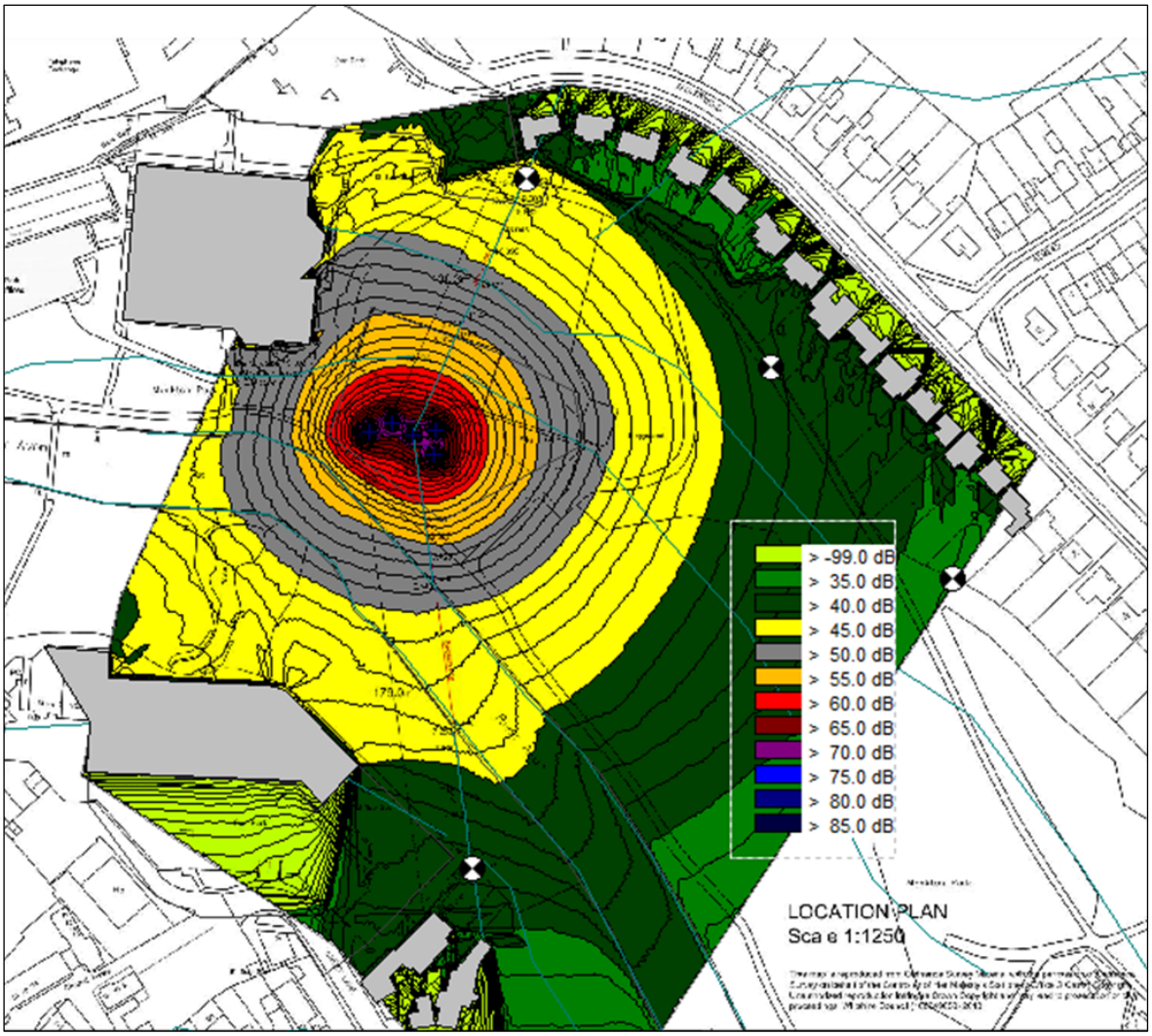


FIGURE 4 – L_{Amax} NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1

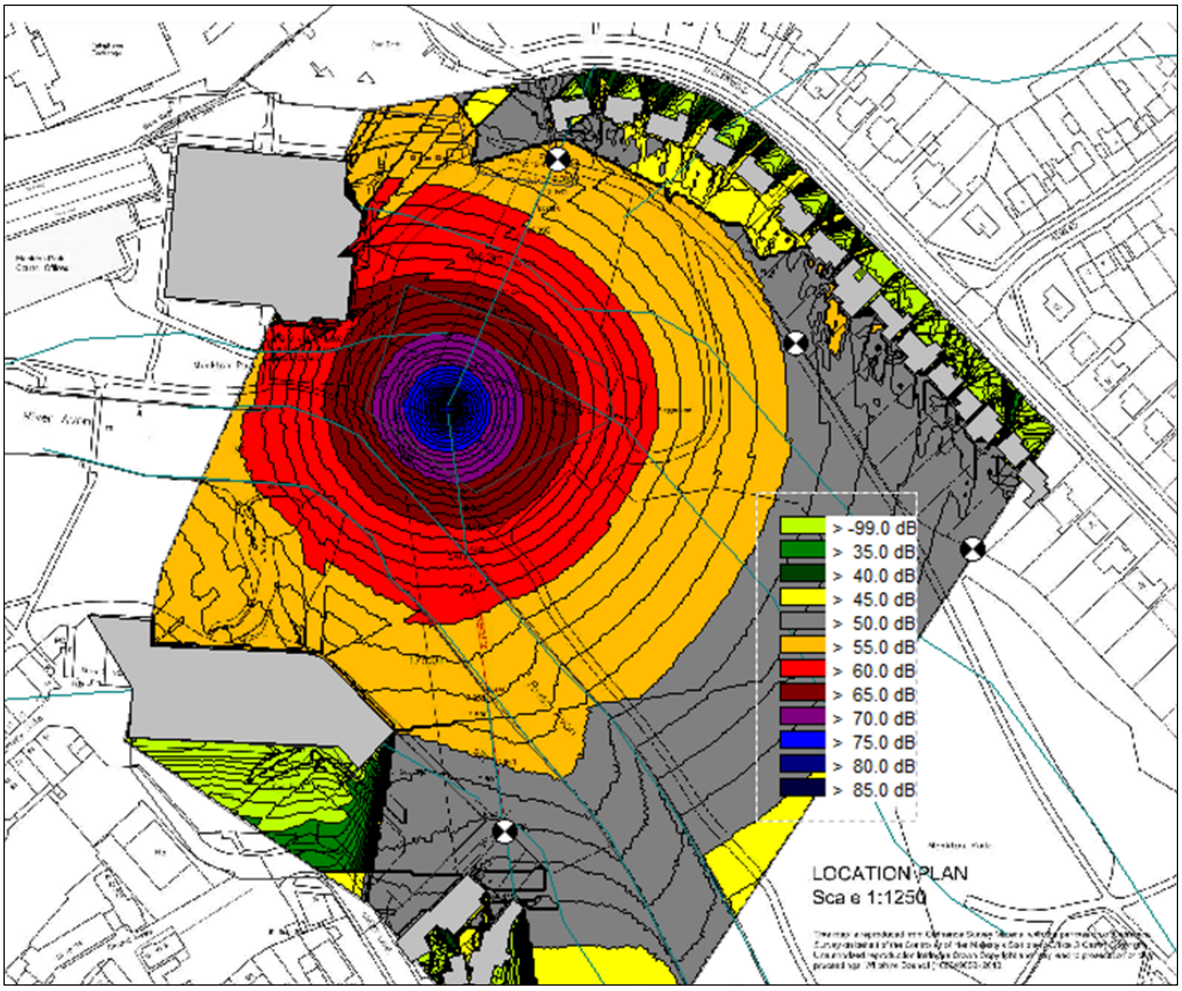
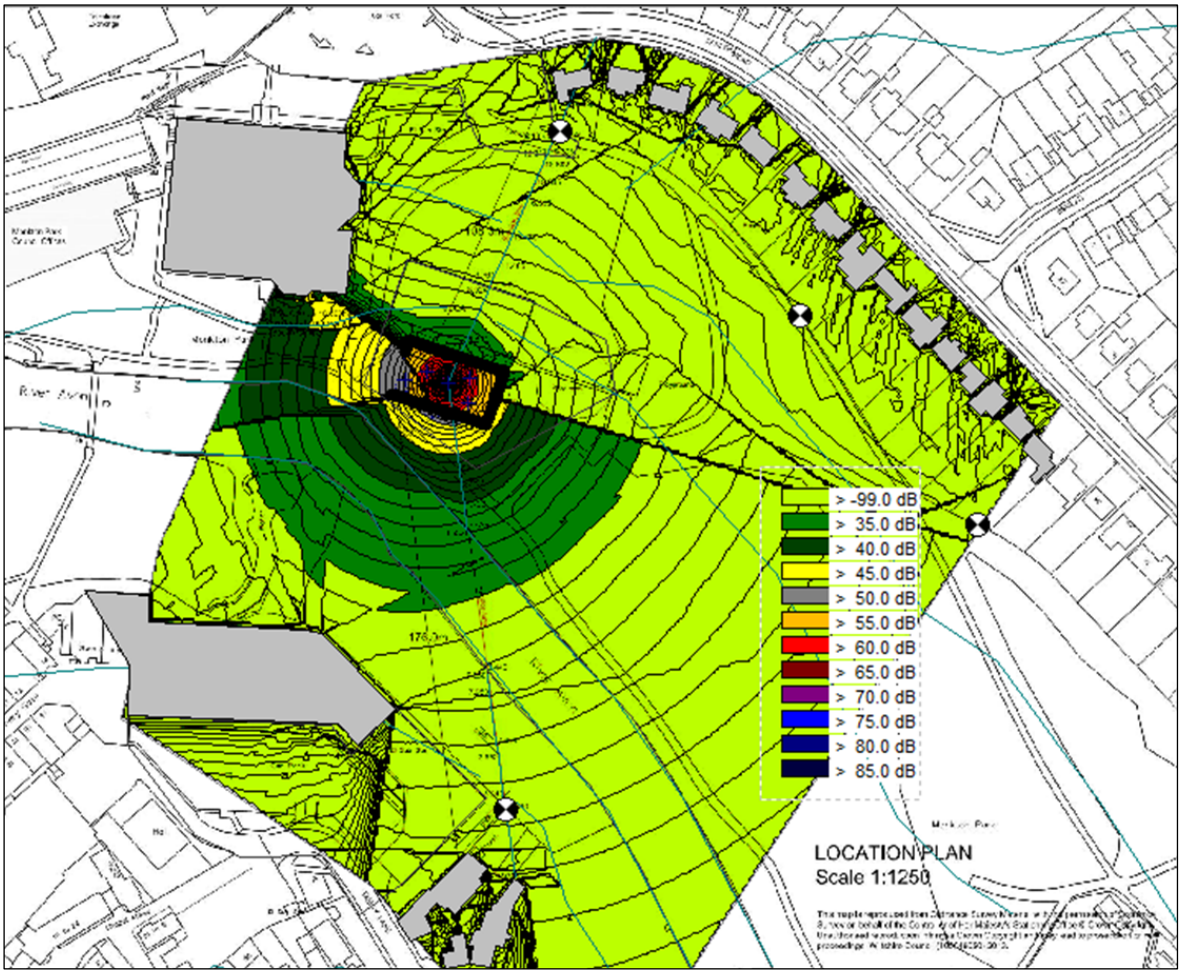


FIGURE 5 – BS4142:1997 RATING LEVEL (L_{Aeq} + 5dB) NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 WITH A SINGLE SKATEBOARD AND INCLUDING FOR THE EFFECTS OF A 1.6 m TO 4.2 m HIGH ACOUSTIC BARRIER, AS INDICATED.



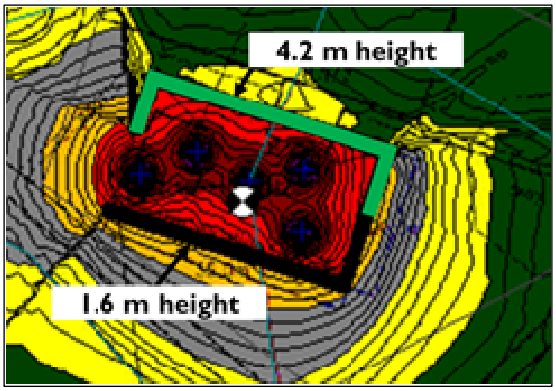
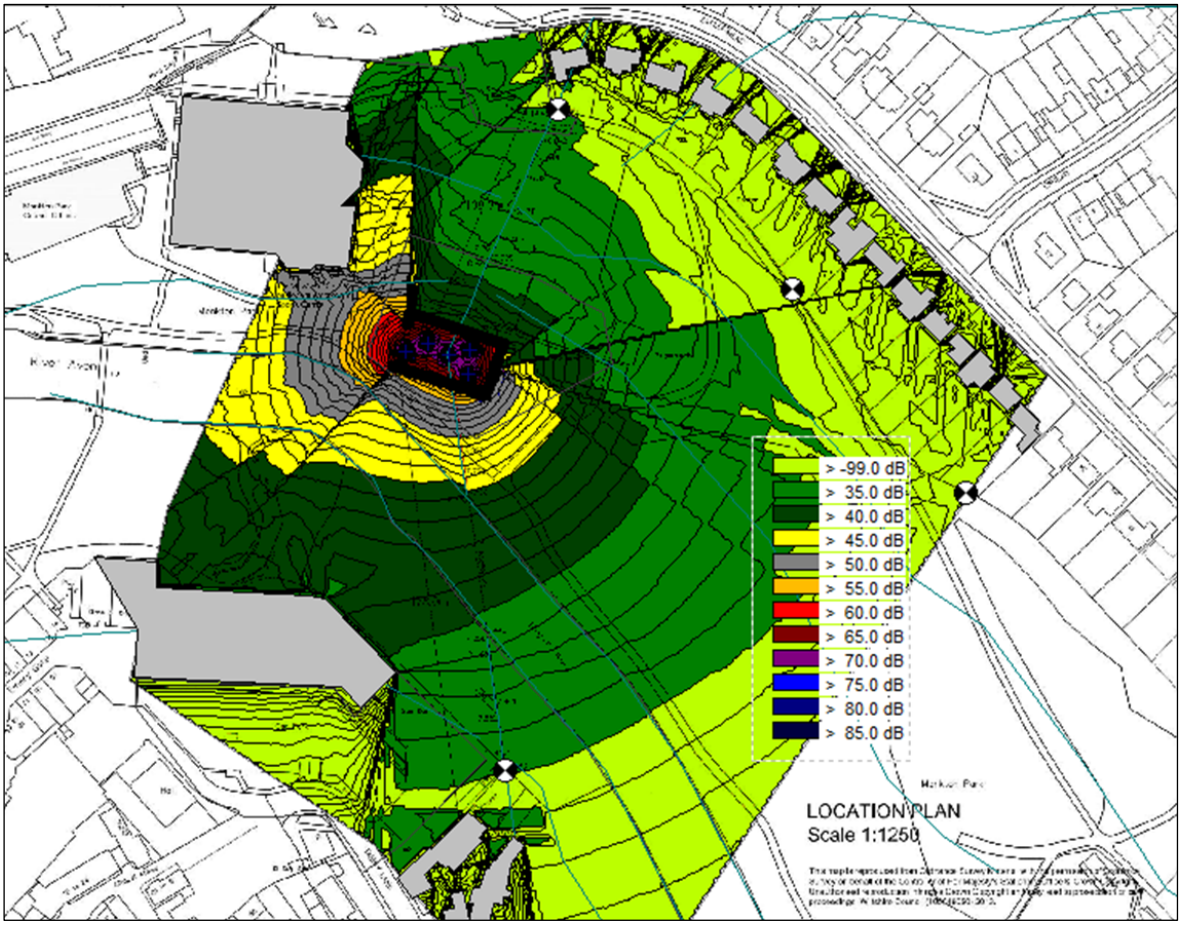


FIGURE 6 – BS4142:1997 RATING LEVEL (L_{Aeq} + 5dB) NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 WITH FIVE SKATEBOARDS OPERATING SIMULTANEOUSLY (THESE BEING DISPERSED AROUND THE SKATE PARK, AS INDICATED) AND INCLUDING FOR THE EFFECTS OF A 1.6 m TO 4.2 m HIGH ACOUSTIC BARRIER, AS INDICATED.



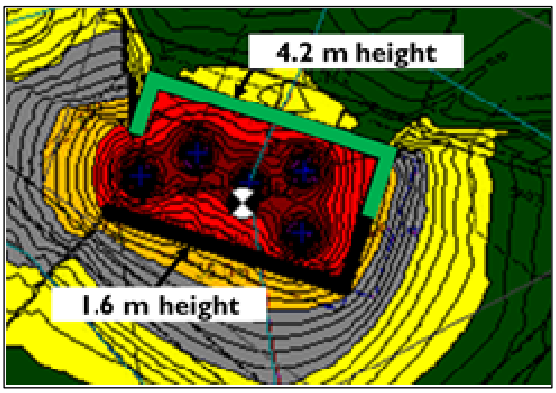
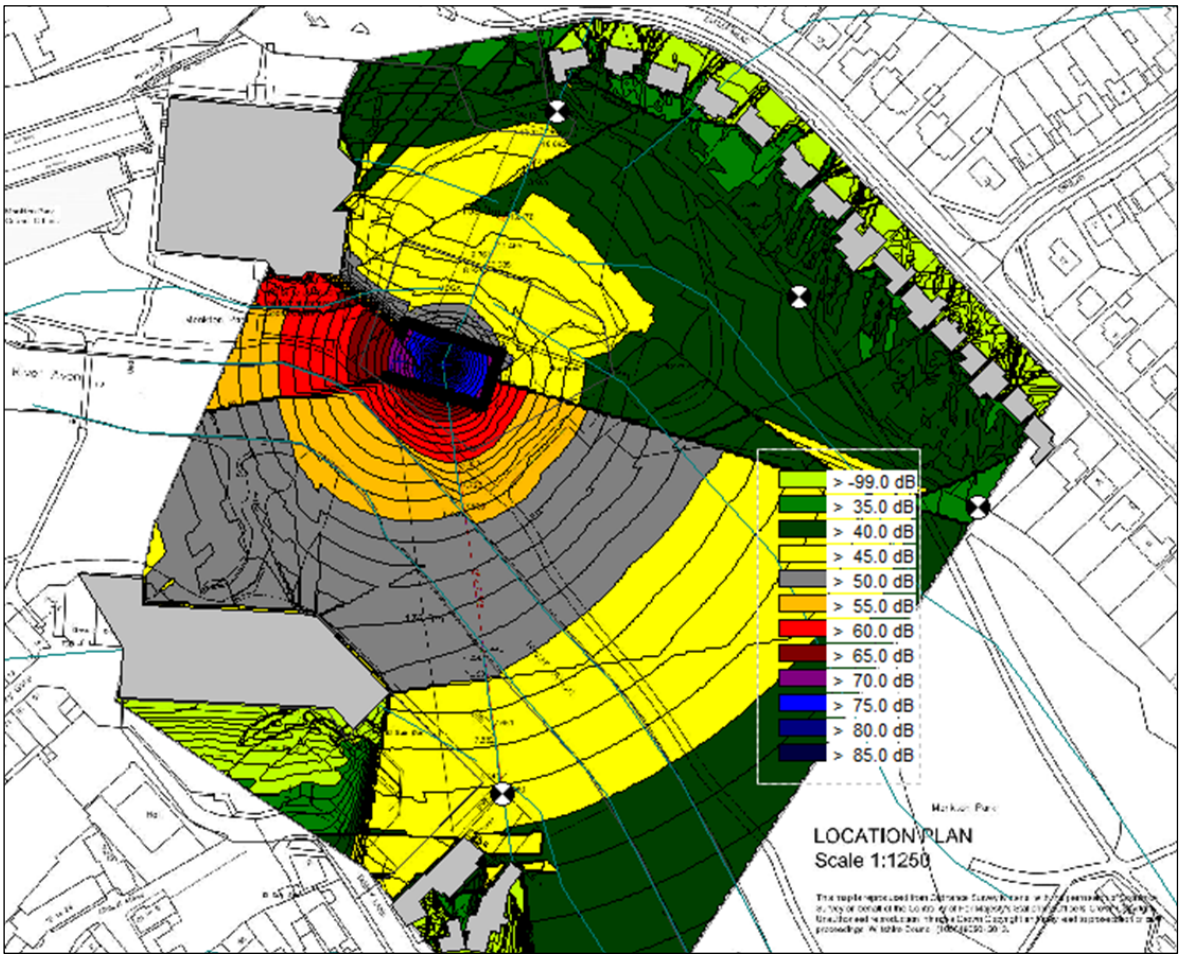


FIGURE 7 – L_{Amax} NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 INCLUDING FOR THE EFFECTS OF A 1.6 m TO 4.2 m HIGH ACOUSTIC BARRIER, AS INDICATED.



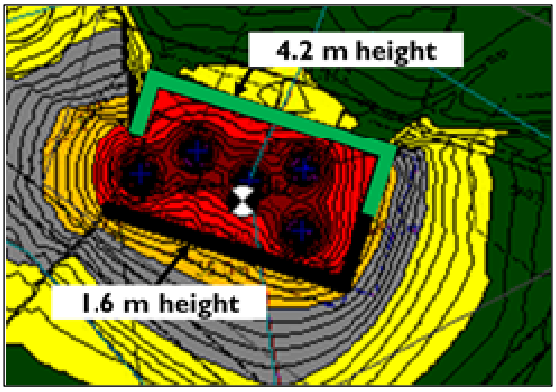
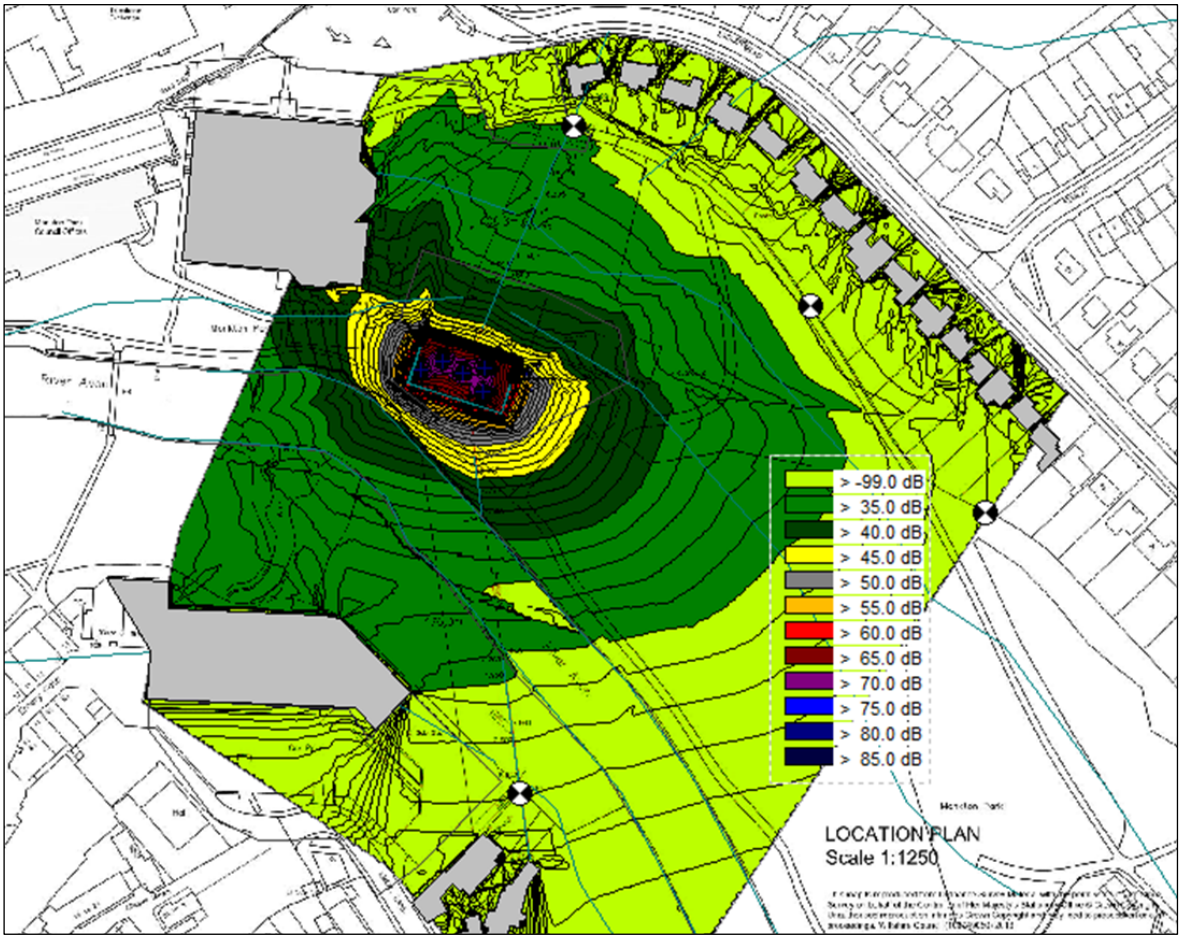
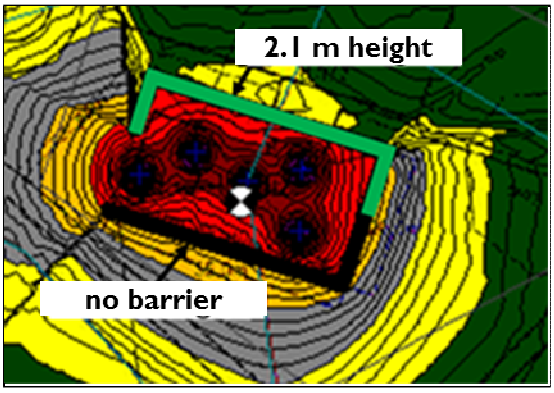


FIGURE 8 – BS4142:1997 RATING LEVEL (L_{Aeq} + 5dB) NOISE MAP BASED ON 'MEASUREMENT 11' OF APPENDIX 1 WITH FIVE SKATEBOARDS OPERATING SIMULTANEOUSLY (THESE BEING DISPERSED AROUND THE SKATE PARK, AS INDICATED) AND INCLUDING FOR THE EFFECTS OF SINKING THE GROUND LEVEL OF THE SKATE PARK BY 2.5 m BELOW THE IMMEDIATELY SURROUNDING GROUND LEVEL COUPLED WITH THE INTRODUCTION OF A 2.1 m HIGH ACOUSTIC BARRIER, AS INDICATED





APPENDIX 1 –SKATE PARK SOUND PRESSURE LEVELS AT APPROXIMATELY 3 m

Meas. #	Activity		Frequency (Hz) 63	125	250	500	1k	2k	4k	A
1	Background Noise Level	Leq	69.8	64.0	60.5	53.3	55.5	51.9	43.5	59.6
		Lmax	72.7	66.2	62.5	61.4	65.8	62.5	55.9	69.0
2	1 x Skateboard Run	Leq	73.1	66.0	61.0	66.0	64.4	62.2	56.1	69.2
		Lmax	77.4	69.6	70.3	82.0	79.6	77.2	69.4	84.4
3	1 x Skateboard Run	Leq	73.0	65.4	61.2	61.8	62.4	61.5	57.0	67.3
		Lmax	77.0	70.9	70.5	79.7	79.4	78.5	73.7	83.0
4	1 x Skateboard Run	Leq	71.2	64.7	59.6	59.6	60.2	56.9	48.2	63.9
		Lmax	75.7	69.5	69.0	71.8	72.1	69.6	59.6	75.7
5	1 x Skateboard Run	Leq	71.4	65.4	61.1	59.3	60.4	59.6	53.6	65.2
		Lmax	74.8	68.3	72.3	72.2	74.6	77.5	75.1	81.2
6	1 x Micro Scooter Run	Leq	67.8	60.8	58.2	54.0	56.6	54.5	50.9	61.1
		Lmax	70.8	63.3	60.3	61.4	65.6	66.5	65.9	71.9
7	1 x Micro Scooter Run	Leq	71.3	65.7	61.0	58.5	59.7	58.4	53.7	64.5
		Lmax	75.5	69.2	68.1	70.5	68.3	68.3	65.1	73.1
8	1 x Micro Scooter Run	Leq	71.1	65.3	67.8	67.6	65.9	67.1	66.1	73.2
		Lmax	75.2	69.6	77.0	76.8	76.4	80.9	79.1	85.6
9	1 x Micro Scooter Run	Leq	72.4	67.0	61.6	62.7	64.7	62.7	57.7	68.8
		Lmax	81.1	78.5	78.9	83.5	84.7	83.3	79.2	88.5
10	1 x Skateboard Run	Leq	69.9	66.9	58.3	56.9	60.1	60.3	57.2	65.6
		Lmax	74.8	74.2	67.5	71.6	76.9	78.8	79.0	81.9
11	1 x Skateboard Run	Leq	70.9	65.1	59.3	56.3	57.0	59.0	53.2	63.6
		Lmax	75.9	71.1	65.5	72.0	73.1	84.1	78.1	86.5
12	1 x Skateboard Run	Leq	69.6	61.8	58.9	56.2	57.5	54.3	49.5	61.6
		Lmax	73.7	66.4	65.5	69.0	69.1	65.1	62.9	72.3
13	1 x Skateboard Run	Leq	71.4	66.1	60.1	55.7	57.2	54.8	49.7	61.7
		Lmax	77.1	69.7	63.6	66.4	65.7	64.9	62.7	70.5
14	1 x BMX Run	Leq	70.5	65.8	63.1	60.4	60.4	59.2	52.3	65.3
		Lmax	76.8	73.3	76.8	79.2	77.7	81.9	74.8	85.5

GLOSSARY OF TERMS

Decibel (dB)

The decibel is the unit used to quantify sound pressure levels. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro-Pascals to 100 Pascals). Therefore, a logarithmic scale is used to describe sound pressure levels and also sound intensity and power levels. The logarithm is taken to base 10, hence, an increase of 10 dB in sound pressure level is equivalent to an increase by a factor of 10 in the sound pressure level (measured in Pascals). Subjectively, this increase would correspond to a doubling of the perceived loudness of sound.

A-Weighting

The 'A' weighting is a correction term applied to the frequency range in order to approximate to the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies. An 'A' weighted sound level is written as dB(A).

$L_{Aeq,T}$

The A-weighted equivalent continuous sound level – the level of a notionally steady sound having the same energy as the true fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter. It is the preferred descriptor for environmental noise in accordance with BS 7445:1993.

$L_{A90,T}$

The A-weighted noise level exceeded for 90% of the specified measurement period (T). This is generally taken to indicate the prevailing background noise level.

L_{Amax}

The highest short duration A-weighted sound level recorded during a noise event.