IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of Notices of Requirement to enable the construction, operation and maintenance of the City Rail Link.

Statement of Evidence of N I Hegley

1 INTRODUCTION

1.1 My name is NEVIL IAN HEGLEY. I am a principal of Hegley Acoustic Consultants. I have more than 40 years' experience in civil engineering and for the last 35 years I have specialised in acoustics. I have an MSc from Southampton University (1975) where I undertook research in acoustics. I am a Chartered Professional Engineer (ID 58104), a Member of the Institution of Professional Engineers New Zealand, the Institution of Civil Engineers United Kingdom and the Acoustical Society of America. I have appeared on the majority of the Standards sub-committees dealing with sound issues since 1977 and I was the Chairman of both the 1984 and 1999 versions of the Construction Noise Standard NZS6803.

1.2 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court's Practice Note and that I agree to comply with its terms. I confirm that I have considered all of the material facts that I am aware of that might alter or detract from the opinions expressed.

1.3 I have been asked by MediaWorks to review the noise aspects of a proposal by City Rail Link and the potential effects of construction works

under and around the MediaWorks site and on the neighbouring "Mt Eden Worksite" on the day to day operation of MediaWorks. This evidence is limited to the effects on MediaWorks, no other sites along the proposed rail link have been considered. I have not considered regenerated noise (noise that originates from ground borne vibration) which has been addressed by Mark Simpson of Noise Mapping Australia. I have only considered airborne noise from activities above the ground although at the receiver position the cumulative effects of airborne and regenerated noise needs to be taken into account.

1.4 I have been involved with more than twenty different rail proposals throughout the country including train noise associated with tunnels and portals plus a number of building designs to control train noise. In addition, I have been involved with underground mining projects, such as the underground mine at Newmont Waihi and projects where rock removal is undertaken.

1.5 The following is a summary of my evidence:

1.5.1 The MediaWorks site contains a number of TV studios, the most sensitive of which is the main TV3 studio in the basement of the building. Those studios are a very sensitive use acoustically as they will ideally have an internal background noise level of 25dBA in order to function appropriately.

1.5.2 Whilst the MediaWorks studios are contained within a converted building, they do perform well in terms of isolation from external noise sources and experience internal background noise levels of 27dBA.

1.5.3 Once the City Rail Link is operating the noise generated by trains operating above ground level should be able to be managed in a way that does not conflict with the performance of the studios. The potential for regenerated noise from the operation of trains in the tunnel will be addressed by Mark Simpson.

1.5.4 The potential for noise generation during the construction phase (other than regenerated noise which is addressed by Mark Simpson) will arise from the works that will be undertaken over an extended period of time (ie several years) from the neighbouring Mt Eden Worksite. That will include the demolition works; the yard preparation works including excavation; the preparation and commencement of tunnelling / mining up to the point where noise levels experienced externally from the works within the tunnel reduce to a minimal level; vehicular movements related to the storage and removal of spoil. It does not appear there is any certainty which machinery will be used or the way this machinery will be used so the acoustic effects are also uncertain but will clearly be significant.

1.5.5 Compliance with the standard construction noise levels will not provide certainty that the required noise level within the studios will be met. I have therefore recommended a condition that requires compliance with a noise level of 25dB L_{Aeq} in the studios.

1.5.6 Given the scale of the inherent incompatibility between the construction activities and the MediaWorks operations I do not consider it appropriate or feasible to leave the decision as to the relevant noise level to a late stage as suggested in Auckland Transport's proposed Condition 21A: Notable Receivers (which envisages discussions between the parties in an effort to reach an agreed position as to the point at which the noise and vibration effects unreasonably interfere with the operations).

1.5.7 It may be that the only practical way of addressing the incompatibility between the construction activities and the MediaWorks operations would be for the studios to be relocated at least during the construction phase (leaving aside the practicality, complexity and cost of that process).

2 DESIGN CRITERIA

Operational and Construction Noise Controls

2.1 The site is located in a Mixed Use Zone in the Auckland Council District Plan (Auckland City Isthmus Section). Rule 8.8.10.6(b), Noise, of the Auckland Council District Plan (Isthmus Section) sets the controls at the site boundary as follows:

> The L_{10} noise levels and maximum level (L_{max}), arising from any activity, measured at or within the boundary of any adjacent site (not held in common ownership) within the same mixed use zoning shall not exceed:
>
> | **Mixed Use Zone** | |
> |---|---|
> | 7.00am to 10.00pm | L_{10} 60dBA |
> | 10.00pm to 7.00am | L_{10} 55dBA
L_{max} 75dBA |
>
> The above noise levels shall be measured and assessed in a accordance with the requirements of the NZS 6801:1991 "Measurement of Sound" and NZS 6802:1991 "Assessment of Environmental Sound" or their replacement.
>
> The noise shall be measured with a sound level meter complying at least with the International Standard IEC 651 (1979): Sound Level Meters, Type 1.

2.2 These are the provisions that will be relevant once the City Rail Link is operational. For the operation noise the main concern is regenerated noise, which has been addressed by Mark Simpson.

2.3 Rule 4A.1D of the District Plan sets the controls for any construction noise within the City. It is noted that the evidence of Marshall Day Acoustics (MDA) adopts NZS 6803:1999 *Acoustics — Construction Noise* rather than the requirements of Rule 4A.1D. This is reasonable and agreed with.

Special Characteristics of the MediaWorks Site

2.4 The MediaWorks premises at 3 Flower Street contain studios that have special requirements and acoustic sensitivities that cannot be overlooked

and have been acknowledged in the evidence from MDA where it is stated:

> *… there is also a risk that construction activities could result in an internal noise level that reduces recording quality in TV3 Studios. Further investigation of the actual sound insulation and sensitivity is required to determine the actual sensitivity of these Studios to noise effects. Management of all activities that breach these levels would then be required to ensure BPO is adopted.*

2.5 Given those particular characteristics and sensitivities it is inappropriate to adopt the requirement in NZS6803, which was never developed to take into account the special need of a studio. Specific acoustic performance criteria will need to be adopted in respect of the studios. That is, Auckland Transport will need to meet higher standards in respect of the construction and operational noise experienced in the studios than will need to be met for other activities, in the same way that elevated standards are imposed in terms of residential rather than industrial receivers of noise.

Appropriate Standard for TV Studios

2.6 I consider that the most appropriate design criteria for the studio are set out in AS/NZS 2107:2000 *Acoustics Recommended Design Sound Levels and Reverberation Times for Building Interiors* where it sets specific noise limits for facilities such as those at Flower Street. The recommended design sound levels for different areas of occupancy in buildings, including recording studios, are set out in Table 1 of the Standard as given below.

Type of occupancy/activity	**Recommended design sound level, LA_{eq}, dB(A)**	
	Satisfactory	**Maximum**
See Notes 8 and 9		
STUDIO BUILDINGS		
Drama studios	20	30
Film or television studios	25	30
Music recording studios	20	25
Sound stages	20	25
Talks studios	25	30

2.7 The MediaWorks premises fall into the film or television studio category with satisfactory and maximum levels of 25 and 30dB L_{Aeq} respectively. There are additional criteria, such as the reverberation in the studios which are

already being achieved in the studios and will not change as a result of any work being undertaken outside.

2.8 Notes 8 and 9, referred to in the table, state:

> *8 The overall sound pressure level in dB(A) should conform to the recommended design sound level given in Table 1. In these spaces, a balanced sound pressure level across the full frequency range is essential. These spaces should therefore be evaluated in octave bands across the full frequency spectrum. The recommended maximum sound pressure levels for the individual octave bands corresponding to the overall dB(A) value are given in Appendix C.*
>
> *9 In spaces in which high quality sound recordings are to be made, the levels set for low frequency octave bands should not be exceeded (see Appendix C). Subsequent replay of the recordings may cause an amplification of the ambient sound resulting in an overemphasis of its low frequency components. Specialist advice should always be sought when these spaces are being designed. In some circumstances, for purposes of very high quality recording, lower levels than those specified in Table 1 may be required.*

2.9 Appendix C of AS/NZS2107 sets the following maximum recommended octave band sound pressure levels for studio buildings:

Maximum Recommended Octave Band Sound Pressure Levels

Sound pressure level dB(A)	**Maximum permissible octave band sound pressure level, dB re 20μPa**								
	Octave band centre frequency, Hz								
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
20	60	42	32	24	19	15	12	10	8
25	65	47	37	29	24	20	17	15	13
30	70	52	42	34	29	25	22	20	18

2.10 I have measured the noise level in the existing TV3 studio at 27dB L_{Aeq}. In addition, measurements show the sound spectrum within the TV3 studio is within the octave band levels as recommended in the above table. These levels were controlled by cooling fans in recording equipment operating. The ventilation system was operating although they did not control the measured level of 27dB.

2.11 It is important to understand that it is not just the L_{Aeq} noise level that is important to control for studios as the L_{Aeq} level is an averaging process. There will be high levels and low levels from the proposed construction

noise in the vicinity of the recording studios which may themselves create problems even if the L_{Aeq} noise limits are met. That is because studios require consistently quite conditions if broadcasts are not be compromised by external sound sources.

2.12 To demonstrate how any intruding noise can influence the recording studio I have plotted below in black the noise levels that I have recorded at the presenter's desk in the TV3 studio without the studio operating and then plotted in red and blue examples of other noise sources that have exactly the same average level (27dB L_{Aeq}) over the identical measurement period of approximately six minutes. The results are shown on Figure 1.

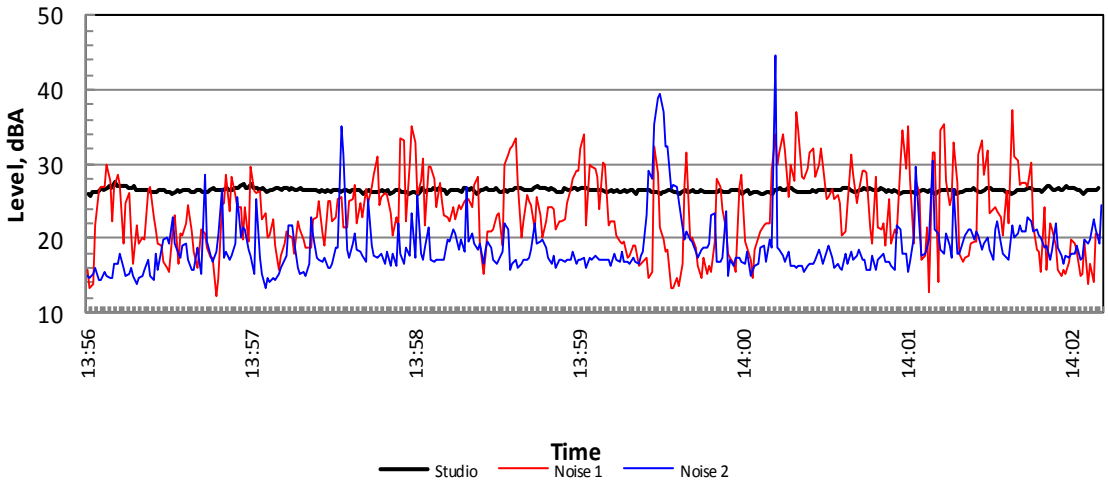

Figure 1. Effects of Noise in the Studio

(Each sound = 27dB L_{Aeq})

3 NOISE LEVELS

3.1 Noise Source 1 is general mechanical plant activity and Noise Source 2 shows three trucks passing plus a number of smaller vehicles. These noise traces were taken from noise recordings I have undertaken at other sites and are not considered to be noticeably different to many other examples that would demonstrate a similar result. They are certainly not extreme examples of what may occur, such as blasting or pile driving.

3.2 A longer measurement period would enable even greater variation in the noise level providing the number of excess noise events is limited. For

example, a single event generating significant noise in the context of an otherwise low level might still comply with the L_{Aeq} requirements despite being much louder than the events shown on Figure 1.

3.3 From the example shown as Noise Source 1 on Figure 1 a level 6 – 7dB above the studio noise environment could be generated regularly and still comply with the same measured level as the existing noise level. For Noise Source 2 the existing studio noise could be exceeded by as much as 18dB over a six minute period and be within the current design level. As a guide, an increase of 10dB sounds twice as loud and an increase of 20dB four times as loud, so an increase of 18dB would have a significant impact on any recording being undertaken at the time.

Matthew Harrison's Evidence re Channel 7 Studios in Sydney

3.4 In paragraph 31 of Matthew Harrison's evidence for Auckland Transport he states that at "*Channel 7's News Studio in Martin Place, Sydney … we were provided recommendations to ensure that the noise level in the studio achieved a noise level criterion of not less than NR30 and not more than NR35. I propose that a similar noise level criterion could also be successfully applied for the TV3 Studios particularly for regenerated construction noise impacts. I further recommend that ambient noise level measurements be conducted in the existing studio spaces to provide a benchmark level against which a proposed increase in the TV Studio noise level criterion to 35 - 40dBA can be compared*".

3.5 When taking into account the existing noise level of 27dB in the TV3 studio the proposal to allow a level of up to 40dB (which is approximately NR35) is would have a significant impact and well above the level recommended for a studio. This is demonstrated in Figure 2 where I have plotted the same noise traces as used in Figure 1 but increased Noise Sources 1 and 2 to have a level of 40dB over the monitoring period.

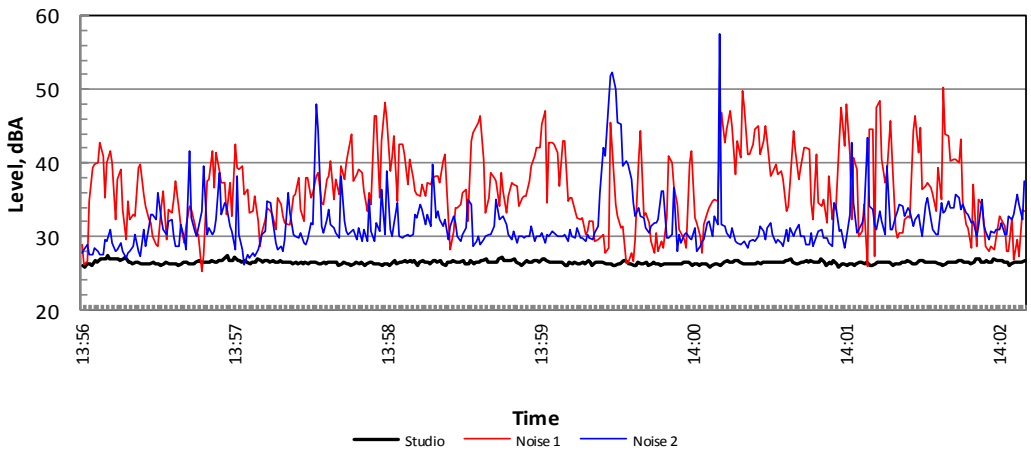

Figure 2. Effects of 40dB L_{Aeq} in the Studio
(Studio 27dB, Noise Sources 1 & 2 40dB L_{Aeq}

3.6 As can be seen from Figure 2, a level of 40dB is adopted as suggested then a transient machine working outside would result in levels as high as 58dB, or 31dB above the existing ambient sound within the studio, an increase from 27dB of approximately eight times. There is little doubt such an increase is excessive and would have a serious negative effect on any recording and could expect to be heard by the viewers.

Conclusion

3.7 When taking the above into account it is recommended the design level should be set at 25dB L_{Aeq} for any construction noise to allow the on-going use of the existing recording studio.

3.8 It is noted that the Construction Standard (NZS6803) acknowledges that higher noise levels are generally reasonable for construction works as the noise is of limited duration and communities will usually tolerate a higher noise level provided it is no louder than necessary, and occurs within appropriate hours of the day. However, this is not the case for some specialised activities and a recording studio that does not have a choice of when it is used is one such activity. It is because higher noise levels are not always reasonable that the word “usually” was included in the above statement rather than the word “always” or some such word.

4 ANTICIPATED NOISE LEVELS

Extent of Proposed Compliance with NZS6803

4.1 MDA[1] have stated that Auckland Transport will attempt to comply with the requirements of NZS6803 although they adopt the approach that for most large scale construction projects, exceedances of the construction noise limits for short durations are common. MDA state that providing these exceedances are of short duration and the BPO will be implemented to avoid, remedy and mitigate construction noise, the construction noise levels would be reasonable and acceptable.

4.2 Auckland Transport's proposed noise condition 21A envisages MediaWorks and Auckland Transport agreeing an appropriate construction noise level for the studios. In my opinion the appropriate level for the studios is clearly 25dB L_{Aeq}. That is the widely accepted design level for such facilities and is very close to level observed by me at the MediaWorks studios of 27dB.

4.3 A higher noise control would not provide any certainty for controlling noise to the MediaWorks studios and is expected to result in noise well above the existing studio environment required. This would result in unacceptable conditions for broadcasting

4.4 I am not sure whether Mr Fitzgerald's suggestion that there be flexibility for construction noise level compliance is intended by him to apply also to the MediaWorks studios. In any event, I find it surprising that the argument most large scale construction projects breach consent conditions has been offered as a reason to adopt conditions that effectively dismiss any noise controls set out in NZS6803. Putting aside the open admission projects have been undertake previously without any intention to comply with noise conditions I believe that were such an approach applied to the studios in this case, it would render impractical any possibility of there being

[1] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraph 15

compatibility between the construction and the operation of a recording studio, that must work to specific time constraints and has an audience with high expectations. If Auckland Transport is unable to provide a noise environment that allows MediaWorks to fulfil its existing obligations then the only solution is for the studios to be relocated for the duration of the proposed works.

4.5 Mr Fitzgerald has stated[2] "*With an understanding of the existing noise environment, relevant noise performance standards and case studies, I have proposed Project Criteria for the control of noise effects from construction noise in accordance with the assessment provisions of the Construction Noise Standard (NZS 6803:1999)*". He then negates these design criteria by stating "*Where circumstances arise which result in a predicted or actual exceedance of the Project Criteria then consultation with affected parties would be undertaken in accordance with the Communication and Consultation Plan and provisions of the CEMP. I consider this process is appropriate to achieve BPO*."

Anticipated Noise Levels

4.6 In paragraph 58 of his evidence Mr Fitzgerald states "*noise levels of 75 - 80dB L_{Aeq} are predicted on parts the Ruru Street Apartments and TV3 façades … the duration of this activity in combination with intermittent blasting is predicted to be 2 months. 75 - 80dB L_{Aeq} (excluding blasting) on the façade of a building is estimated to result in an internal noise level of 45 - 50dB L_{Aeq} … this noise level is typically acceptable … further works are required to understand the sound insulation and noise sensitivity of activities at TV3*".

4.7 I consider the issues posed by blasting below. Leaving that issue aside, not only is 75 – 80dB up to 10dB in excess of the requirements of NZS6803 but the predicted internal noise level for TV3 is as much as 10dB above the upper level recommended by Mr Harrison on behalf of City Rail Link and 25dB above the satisfactory level recommended in AS/NZS2107.

4.8 Despite Mr Fitzgerald's own recommendation I cannot see any reference to work undertaken to understand the sound insulation and noise sensitive activities at TV3. Based on the evidence, it appears the actual level that may be experienced at TV3 is not known other than it will be at least 80dB at the façade. Such a level is expected to prohibit the use of the TV3 Studio and make other activities, such as editing, impractical.

4.9 Operational noise has not been addressed with any certainty and as the exact location of the portal is not provided I am only able to considered the operational noise in general terms. Provided the track is designed and maintained to minimise noise to neighbours it should be practical to achieve a noise level that is within the expectations of MediaWorks.

4.10 It is recommended that operational noise compliance is ensured by including a design limit exactly the same as proposed for the construction noise. That is, the noise should not exceed a level of 25dB L_{Aeq} and the octave band design limits as set out in Appendix C of AS/NZS2107 and given in paragraph 2.9 above for compliance with 25dB. To ensure compliance the track should be designed and the proposed design provided to Auckland Council a minimum of six months prior to the operation of the track.

Blasting

4.11 It has been suggested[3] "*typical airblast noise can be mitigated through communicating exactly when blasts would occur ahead of time, and having an audible countdown sequence (such as sirens at 5 minutes, 1 minute etc. before the blast)*". A mitigation option recommended[4] is that a "*specific communication and consultation plan should be developed with 'notable' noise sensitive receivers to manage the adverse effects from construction noise (including, but not limited to TV3 …)*".

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[2] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraph 75
[3] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraph 68
[4] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraph 69

4.12 A series of sirens followed by blast noise during the use of the studio would be unacceptable. However, if the blast was scheduled to a specific time when there was not a live broadcast, such as during an advertisement break this could overcome the problem of excessive noise causing a disruption. If such an option were to be implemented the one issue that would need to be resolved is what to do if there was a misfire and when there was a second window for any blast.

Possible Remedial Action

4.13 Remedial actions considered[5], such as selecting low noise machinery, noise barriers, temporary mobile enclosures and enclosing and/or attenuating machinery and maintaining mechanical plant, are all tagged "as far as practicable". On that basis none of this work is required to be implemented. In any event, I am far from convinced that such remedial steps would enable compliance with the 25 dB L_{Aeq} level required within the studio.

4.14 I note that in Mr Fitzgerald's paragraph 66, second to last bullet point, the temporary relocation of noise sensitive receivers has been suggested. In paragraph 82 Mr Fitzgerald has stated that "*mitigation and management measures such as temporary relocation of sensitive receivers, provision of mechanical ventilation to enable windows to remain closed, or investigation of alternative construction methods/locations may be required*".

4.15 It is my opinion that with the noise levels predicted by MDA this relocation option would need to be implemented for TV3. The only basis on which I consider relocation would not be necessary in response to the construction noise would be if the proposal were approved on conditions that ensure compliance at all times with the 25dB L_{Aeq} level required within the studio and even in that case I remain concerned by the possibility of one off noise events which cause adverse effects.

4.16 Rather than avoiding noise problems through early prediction and design

[5] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraph 66

the approach offered by Mr Fitzgerald is "*to ensure affected parties are kept informed, particularly in advance of noisy construction works, and are aware of the steps to make a complaint and how it is subsequently dealt with*". This statement misses the point. By the time noisy construction work has been undertaken the damage has been done and it is too late to avoid, remedy or mitigate the damage caused.

Response to MediaWorks Submission

4.17 In his response to the MediaWorks submission Mr Fitzgerald has stated[6]

> *With respect to the construction noise effects assessment, I consider internal levels of up to 50dB L_{Aeq} received in commercial office spaces is typically acceptable during the daytime. However in paragraph 4(a) of MediaWorks submission, they state "the operational requirement for the studio is 25dB". In general, I agree with this statement for some studio types and activities. I also consider that some studio uses would be highly noise sensitive (i.e. during recording sessions and live broadcasts, whereas broadcasting of recorded material would be less so). In my opinion, the actual noise limits suitable for each activity type undertaken by MediaWorks should be determined through the CEMP consultation and monitoring framework. … it would be important to manage all activities that breach these levels, so that the BPO to avoid unreasonable noise is adopted.*

4.18 I agree with the initial part of this statement that 25dB for the studios should be the design requirement. The part that I do not support is that the control of noise should *be determined through the CEMP consultation and monitoring framework.*

4.19 The noise level as received in the studios is critical for the operation of the facility and in my opinion it is not appropriate to leave this to subsequent consultations.

4.20 I consider that it is desirable for the following steps to be required by way of condition:

[6] Evidence of Craig Fitzgerald, Marshall Day Acoustics paragraphs 102 and 103

4.20.1 A specific noise level should be set within the studios (and for the reasons set out above I consider 25dB to be appropriate) that must be complied with during the works.

4.20.2 Prior to any work commencing Auckland Transport should provide a certificate from an appropriately qualified acoustic consultant confirming that the construction works will achieve the specified standard (combined with compliance with the spectrum set out in paragraph 2.8 above).

4.20.3 The works will be monitored to verify compliance with the standard. In the event of non-compliance it will be necessary to cease all noisy construction work to determine how the noise will be controlled prior to further construction works being carried out.

4.21 I do note that, as pointed out above, regeneration noise has been addressed by Mr Simpson and this needs to be included in the overall assessment of the noise received in the studios.

Proposed Conditions

4.22 The following is an example of a condition that in my opinion would satisfy the MediaWorks submission with respect to noise in the studios:

i) Construction noise shall be managed so the noise does not exceed the following limits within 2m of the recording location in any studio.

Sound pressure level dB L_{Aeq}	**Maximum permissible octave band sound pressure level, dB re 20μPa**								
	Octave band centre frequency, Hz								
	31.5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
25	65	47	37	29	24	20	17	15	13

ii) Prior to any work commencing Auckland Transport will provide to Auckland Council a certificate from an appropriately qualified acoustic consultant confirming that the construction works will achieve the specified standard.

iii) The noise level shall be monitored an appropriately qualified acoustic consultant once any noisy construction work commences

within 300m of the studios and each week (unless otherwise requested by MediaWorks) until construction work begins to move away from the closest point to the studios. In the event the above limits are exceeded, construction shall be stopped immediately until remedial work has been completed. Once construction works recommence the noise shall be monitored to confirm compliance with the above limits.

iv) A minimum of six months prior to the operation of the line Auckland Transport will provide to Auckland Council a certificate from an appropriately qualified acoustic consultant confirming that the operation noise as assessed within 2m of the recording location will not exceed the levels as set out in condition (i) within any studio.

v) Prior to operating any train a test train(s) shall be run to demonstrate compliance with the noise limits as set out in condition (i) will be achieved. The results shall be provided to Auckland Council within 1 week of testing.

vi) Within one month and again three months of any train operating on the line Auckland Transport will provide to Auckland Council a certificate from an appropriately qualified acoustic consultant confirming that the noise levels as measured within 2m of the recording location and set out in condition (i) are being complied with.

vii) In the event that monitoring by an appropriately qualified acoustic consultant within 2m of the recording location identifies that the noise levels as measured and set out in condition (i) are not being complied with at any time, immediate steps shall be taken to achieve compliance. In the event it is not practical to achieve the set noise limits MediaWorks are to be relocated to a location that will achieve the noise levels as set out in condition (i) at Auckland Transport's expense.

viii) The noise shall be measured in accordance with the requirements of NZS6801:2008 Acoustics - Measurement of Environmental Sound.

4.23 Any other conditions or terms that enable the construction works or operational noise to exceed the above noise limits should be excluded from applying to the MediaWorks studios.

5 CONCLUSIONS

5.1 For the MediaWorks studios it is a critical aspect of the operation that noise is controlled to within an appropriate level to ensue broadcast standards are not compromised.

5.2 Generalisations for noise control via a CEMP are not considered to be reasonable for the studios which cannot modify work around noise intrusion into the studios. Studios must be used in accordance with strict timetables but also need to be available at all times to address breaking news. Specific noise limits and compliance conditions are sought in order to satisfy the submissions from MediaWorks.

5.3 The recommended noise conditions as set out above should resolve any concerns of MediaWorks and based on MDA's evidence is a reasonable expectation of Auckland Transport. On-going monitoring is sought to ensure compliance and is considered to be reasonable in this case when taking into account the significant adverse impact any noncompliance would have on broadcasts.

Nevil Hegley
26 July 2013