

BARANGAROO SOUTH – BUILDING C1 NOISE AND VIBRATION MANAGEMENT PLAN

6/03/2019 | Revision No: 2



Sub-plan Revision Status				
Date	Revision	Purpose and Summary of Amendments	Reviewed by	Approved by
[15/06/2018]	[1]	[For issue and use]	[James Kennelly/ Dipankar Mukherjee]	[Jerome Johnson]
[06/03/2019]	[2]	[Including proposed out of hours works]	[James Kennelly/ Dipankar Mukherjee]	[Jerome Johnson]
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NOISE & VIBRATION RELATED ACRONYMS & GLOSSARY

ABL	The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (LA90) for each period.
CFEMP	Construction Framework Environmental Management Plan
COA	Development Consent Conditions of Approval.
CRM	Customer Relationship Manager database
DECCW	NSW Department of Environment, Climate Change and Water (see EPA).
DP&E	NSW Department of Planning and Environment (formerly DP&I).
EPA	Environment Protection Authority (formerly part of OEH, DECCW)
EPL	Environmental Protection Licence, issued by EPA.
LA1	The LA1 level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the LA1 level for 99% of the time.
LA10	The LA10 level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the LA10 level for 90% of the time. The LA10 is a common noise descriptor for environmental noise and road traffic noise.
LAeq	The equivalent continuous sound level (LAeq) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
LA50	The LA50 level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the LA50 level for 50% of the time.
LA90	The LA90 level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the LA90 level for 10% of the time. This measure is commonly referred to as the background noise level.
Maximum Noise Level (LAMax)	The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.
OEH	Office of Environment and Heritage (see EPA)
RBL	The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.
Secretary	Secretary of DP&E

1. SCOPE OF PROJECT AND SUB PLAN

	Project specific information
Scope:	This <i>Noise & Vibration Management Sub-plan</i> details prevention and management measures for noise and vibration associated construction activities. It defines mitigation measures to be implemented, a monitoring program that enables control of the impacts of construction activities on potentially affected receivers, and contingency measures that may be implemented if complaints are received or exceedences are measured. This Sub-plan forms part of the Lendlease Building (LLB) EHS management system and the C1 Barangaro South EHS Management Plan, which has been updated to include requirements of the Construction Environmental Management Plan (CEMP) outlined within Condition C3 of development consent SSD 8529. This sub-plan must be read in conjunction with the Lendlease GMRs, the Project EHS Plan, and the Lendlease Building Workplace Delivery Code. These documents detail Lendlease's approach and commitment to pro-active and responsible site management.
Objectives:	• Comply with relevant noise and vibration guidelines. • Avoid or minimise adverse noise impacts from construction through remediation and construction methodologies, and appropriate management measures. • Minimise generation of noise and vibration from construction activities that could affect site personnel, neighbouring residences, businesses and other community members. • Establish and maintain good relations with the community and neighbouring sites.
Key issues & Risks:	During construction works, nearby residential and commercial receivers may be affected by related noise and vibration. Residential and commercial receivers that surround the site and may be affected by noise and vibration are detailed in Appendix C. To establish pre-construction background noise levels, unattended noise loggers were installed at eight representative noise sensitive locations in the area. The Rating Background Levels (RBLs) were then determined based on the EPA's 2009 Interim Construction Noise Guidelines for each of the locations. The RBL values for each of the time periods (Day/Evening/Night) are provided in Appendix C. Noise generating activities and equipment that will occur during construction are also described in Appendix C. The noise criteria (Noise Management Levels – NMLs) identified in noise assessments is that at sensitive receivers the $L_{Aeq(15\text{ min})}$ noise contribution from construction should not exceed: • Rating Background Level (RBL) plus 5 or 10dBA, depending on time of day, at sensitive receivers. • Highly noise affected level of 75dB(A). The noise criteria is only applicable to noise emissions related to construction activities associated with the project, and does not include allowance for contributions from other prevailing noise sources not associated with the project. Construction Noise & Vibration Assessments Modelling was undertaken in noise assessments to estimate construction related noise levels within day, evening and night periods at noise sensitive receivers. It used construction methodologies, equipment and sequencing to predict noise levels for representative noise scenarios. Information relating to the modelling is included in Appendix C. The modelled noise levels were assessed against applicable noise goals and limits at the sensitive receivers identified in Appendix C. With measures in place as specified in this plan, and discussed in Appendix C, the modelled noise levels at sensitive receivers indicate that Interim Construction Noise Guideline goals would generally be met. Additional modelling was undertaken in February 2019 to assess out of hours works in and around the C1 building. Again, the modelled noise levels at sensitive receivers indicate that Interim Construction Noise Guideline goals would generally be met for the proposed out of hours works.

	Project specific information
Key Legislation / Standards / Guidance	<i>Protection of the Environment Operations Act 1997 (NSW) (POEO Act)</i> The POEO Act is the key piece of environment protection legislation, and regulates activities via: • environment protection licencing, as per Schedule 1; • regulation of scheduled and non-scheduled activities; • environmental protection offences and penalties; and • establishment of a general duty to notify of environmental harm. <i>Protection of the Environment Operations (Noise Control) Regulation 2017 (NSW)</i> This regulation controls noise emissions from vehicles and vessels, and provides for inspection and testing of noise emissions. <i>Interim Construction Noise Guidelines, DECCW 2009</i> Deals with the assessment of noise from construction activities and advises on best practice approaches to minimise noise impacts. It is aimed at managing noise from construction works regulated by EPA, and is used to set statutory conditions in licences or other regulatory instruments. <i>Assessing vibration: A Technical Guideline, DECC 2006</i> This document is based on guidelines contained in BS 6472-1992, and presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. It does not address motion sickness, occupational vibration, blasting vibration effects or vibration-induced damage to buildings or structures. <i>Australian Standard AS2436 (1981) Guide to Noise Control on Construction, Maintenance and Demolition Sites.</i> <i>AS 1055.1-1997 Acoustics – Description and measurement of environmental noise</i> <i>British Standard 6472: Guide to evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)</i> <i>British Standard 7385: Part 2 – Evaluation and measurement of vibration in buildings</i>
Site Control Measures:	Site specific controls, monitoring, reporting and performance measurements have been identified in this Sub-plan to minimise and where possible prevent, the impacts of construction noise and vibration on the environment and community. These are as described in the Mitigation Measures table in Section 2. All controls comply with Lendlease GMRs. <u>Noise:</u> • Contractors that are deemed to potentially be undertaking noisy works will submit a Safe Work Method Statement which details the schedule of construction equipment which describes the equipment types to be used, noise levels these will generate if applicable, expected time and duration of use, and any measures required to ensure the noise levels are acceptable (such as screen mufflers). • All typical plant and equipment used during remediation and construction works will be within the maximum noise levels specified (at 7 metres) assumed in noise modelling of the project. • All personnel on the project will be made aware of the risks of construction noise exposure through the site induction. Workers on out of hours works shifts will be given additional awareness training on the need to minimise noise disturbance at residences, and to minimise metal hammering and rattle gun use. • Lendlease will undertake noise monitoring as outlined below.

Project specific information																										
	Hours of operation																									
	Construction will be undertaken during construction hours prescribed in condition D1 of SSD 8529:																									
	7.00 am to 7.00 pm Monday to Friday inclusive; 7.00 am to 5.00 pm on Saturdays; - No work on Sundays or public holidays.																									
	Exceptions to Normal Hours of Operation - Out of Hours Works																									
	Development consent Condition D1 of SSD 8529 states out of hours works may occur if required:																									
	a) by the Police or a public authority (not the Applicant) for the delivery of vehicles, plant or materials; or																									
	b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm.																									
	Notification of such activities must be given to affected residents before undertaking the activities or as soon as is practical afterwards.																									
	Furthermore, rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours:																									
	a) 9 am to 12 pm, Monday to Friday;																									
b) 2 pm to 5 pm, Monday to Friday; and																										
c) 9 am to 12 pm, Saturday.																										
Lendlease have proposed the following additional out of hours works, that are subject to Department of Planning and Environment approval:																										
<table><tr><th>Activity</th><th>Days</th><th>Hours</th></tr><tr><td>Dismantling of Class B Hoarding</td><td>Mondays to Fridays</td><td>7pm-7am</td></tr><tr><td>Dismantling of Class A hoarding works</td><td>Sundays</td><td>8am-5pm</td></tr><tr><td>Dismantling of Tower Crane</td><td>Sundays</td><td>8am-5pm</td></tr><tr><td>Dismantling of Tower Crane</td><td>Sundays</td><td>8am-5pm</td></tr><tr><td>Paving works around the C1 Building</td><td>Sundays</td><td>8am-5pm</td></tr><tr><td>Services commissioning works (inside building)</td><td>Mondays to Fridays</td><td>7pm-7am</td></tr><tr><td></td><td>Saturdays and Sundays</td><td>5am-7pm</td></tr></table>			Activity	Days	Hours	Dismantling of Class B Hoarding	Mondays to Fridays	7pm-7am	Dismantling of Class A hoarding works	Sundays	8am-5pm	Dismantling of Tower Crane	Sundays	8am-5pm	Dismantling of Tower Crane	Sundays	8am-5pm	Paving works around the C1 Building	Sundays	8am-5pm	Services commissioning works (inside building)	Mondays to Fridays	7pm-7am		Saturdays and Sundays	5am-7pm
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Further information regarding noise modelling of these proposed works are included in Appendix C.																										
Vibration																										
When planning for construction work that include vibration work, all practical efforts to protect vibration sensitive buildings and amenity of building occupiers will be made. All activities involving vibrating rollers will be performed in accordance with the safe working distances to buildings and structures as outlined in Appendix D.																										

2. MITIGATION MEASURES

Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
PLANNING / GENERAL							
NV1.	Install a 2.4m noise barrier/hoarding along the site boundaries, with minimum 17mm thick structural plywood.	■	■	Perimeter of construction site	Noise assessments	Construction Manager	Prior to construction
NV2.	Ensure all fixed plant at the work sites are appropriately selected, and where necessary, fitted with silencers, acoustical enclosures and other noise attenuation measures.	■	■	Entire project	Noise assessments	EHS Manager	Throughout construction
NV3.	Arrange work sites to avoid or minimise truck movements, and ensure vehicles enter and exit work sites in a forward direction.	■	■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV4.	Position noisy plant and equipment as far apart as is practicable from each other and consider whether orientation and location of the plant can reduce noise impacts at sensitive receivers.	■	■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV5.	Locate equipment away from the façade of T1 childcare and podium where feasible and practical.	■	■	Entire project	C4 SSD 8529, Noise assessments	Project Engineers	Throughout construction
NV6.	Procedures and management measures in the existing site-wide environmental management plan should continue to be applied during the construction of Commercial Building C1.	■	■	Entire project	Commercial Building C1 EIS	Project Engineers	Throughout construction
CONSTRUCTION							
NV7.	Install all noise controls identified in this plan as early as is practical prior to the relevant stage of construction.		■	Entire project	Noise assessments	EHS Manager (Environment)	Throughout construction
NV8.	Install non-tonal and / or automatically adjusting reversing alarms on site equipment.	■	■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV9.	Use only silenced generators and compressors.	■	■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV10.	Minimise vehicles and plant idling when not in use.		■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV11.	Minimise metal hammering and rattle gun use during out of hours works		■	Out of hours works	Noise assessments	Construction Manager	Out of hours works
NV12.	Prevent vehicles and plant queuing and idling outside the site, particularly prior to the construction start time.		■	Outside site entrances	Noise assessments	Project Engineers	Throughout construction

Ref.	Mitigation Measure	Design	Construction	Relevant Location / Activity	Relevant Approval Conditions	Responsibility	Timing
NV13.	Ensure that equipment is operated in the correct manner including repair of defective mufflers, tightening/correction of rattling parts and components and repair of leakages in compressed airlines.		■	Entire project	Noise assessments	Project Engineers	Throughout construction
NV14.	Ensure that vibratory compactors must not be used closer than 30 metres from residential buildings unless vibration monitoring confirms compliance with the vibration criteria specified below.		■	Entire project	Noise assessments	Construction Manager	As required
NV15.	Focus early morning works on the southern and western side of the C1 building during the night period where practicable and feasible, to reduce impact at receivers in Hickson Road.		■	Out of hours works	Noise assessments	Construction Manager	Out of hours works
NOTIFICATION							
NV16.	Notifications in accordance with Community Communications Strategy. Ensure that this includes planned out of hours works such as crane and hoarding dismantling, and paving works.	■	■	Entire project	Best Practice	Community Relations Manager	As required

3. MONITORING

Detail	Frequency	Standards	Reporting	Action if non-complying	Responsibility
Attended noise monitoring: - in response to complaints, as per table 1 below; or - where specific monitoring is needed.	As required.	NMLs below. AS 1055	As required	Follow noise response table below. Seek professional acoustic input if required.	EHS Manager Noise Specialist
Attended vibration monitoring: - in response to complaints, as per table 1 below; or - where specific monitoring is needed (e.g. where vibration is produced near structures to confirm working distances).	As required.	EPA guidelines BS6472 DIN4150 Part 3	As required	Cease relevant activities, and/or implement additional measures. Seek professional vibration input if required.	EHS Manager Vibration Specialist
Unattended noise monitoring: performed at two locations determined to be representative of the most sensitive receivers	During demolition works	NMLs below. AS 1055	As required	Follow noise response table below. Seek professional acoustic input if required.	EHS Manager Noise Specialist

NOISE MANAGEMENT LEVELS OF NEARBY RECEIVERS

Location	Construction Noise Management Level, L _{Aeq} – dBA				Highly noise affected Noise Level, L _{Aeq} – dBA
	Day	Evening	Night	Saturday (extended)	
1 – Hickson Road Residences	64	56	50	57	75
2 – R8 Residences	65	56	49	53	75
3 – High St, Miller Point	57	49	46	50	75
4 – Merriman St, Millers Point	56	49	45	51	75
5 – Balmain East	59	50	45	51	75
6 – Darling Island	57	49	44	55	75
All Commercial Properties			70		
Schools / Preschools			55*		
Parks / Outdoor Play Areas			65		

* The external NML of 65 / 55dBA is based on a 20 / 10dBA reduction through a closed and open window respectively to meet an internal level of 45dBA.

NOISE RESPONSE TABLE - ADDITIONAL NOISE MITIGATION MEASURES

Scenario	Mitigation measures LAeq(15 minute) noise level above NML	
	0 to 10 dBA Noticeable	> 10 dBA Clearly audible – potentially intrusive
Approved hours, no complaints received	Implement reasonable and feasible mitigation measures as documented in this plan.	Review noise data and current work practices.
Approved hours, complaint(s) received	Follow procedures outlined within the Community and Stakeholder Engagement Strategy to address complaint	Follow procedures outlined within the Community and Stakeholder Engagement Strategy to address complaint

APPENDIX A: BACKGROUND

Barangaroo is located on the north western edge of the Sydney Central Business District (CBD). The redevelopment is bounded by Sydney Harbour to the west and north, the historic precinct of Millers Point and The Rocks to the east; and by a range of new commercial development to the south.

The Barangaroo site has been divided into three distinct redevelopment areas – Headland Park, Barangaroo Central and Barangaroo South. Lendlease Millers Point (LLMP) was successfully appointed to develop Barangaroo South in 2009. Barangaroo Central and Headland Park are being managed separately by the BDA.

The footprint of building C1 is entirely within the Stage 1A area of Barangaroo South.

This management sub-plan covers construction of building C1, and is updated when needed to reflect the various stages of work. The current scope of this management sub-plan is summarised below.

Approval	Phase	Construction Activities	Incl. in sub-plan	Status
SSD 8529	Building C1	• construction of a seven-storey commercial building (maximum height RL 33.2), comprising retail on the ground floor and commercial on levels one to six; • provision of an outdoor terrace on level 6 of the building; • installation of photovoltaic cells on the rooftop of the building; • business and building identification signage zones; • allocation and use of 18 car spaces within the approved basement below and provision of end-of-trip facilities • public domain works; and • alterations to basement structures below.	Yes	Ongoing

APPENDIX B: PLANNING APPROVAL REQUIREMENTS

RETAIL BUILDING C1 (SSD 8529)

No.	Original Ref.	Relevant Requirement	Reference
1.	B33	Details of noise mitigation measures for all mechanical plant are to be detailed on the Construction Certificate drawings. Certification from an appropriately qualified acoustic engineer that the proposed measures will achieve compliance with the requirements of the NSW Industrial Noise Policy and other guidelines applicable to the development is required to be submitted to the Certifying Authority and the Secretary prior to the issue of the relevant Construction Certificate.	This sub-plan
2.	C4	Prior to the commencement of works, an updated Noise and Vibration Management Plan for Barangaroo South prepared by a suitably qualified person shall be submitted to the EPA for review and submitted to the PCA. The Plan must be consistent with and adopt all recommendations of the Barangaroo South C1 Commercial Building Construction and Operational Noise Report (prepared by Wilkinson Murray dated August 2017). The Noise and Vibration Management Plan must establish Noise Management Levels for the closest residential properties, including the provision of reasonable and feasible noise mitigation measures. The Noise and Vibration Management Plan must also include practical measures to minimise noise impacts, specifically on Saturdays. Prior to the commencement of works, a copy of the CNVMP must be submitted to Council, the Barangaroo Delivery Authority and the Secretary.	This sub-plan
3.	D1	Construction, including the delivery of materials to and from the site, may only be carried out between the following hours: a) between 7 am and 7 pm, Mondays to Fridays inclusive; b) between 7 am and 5 pm, Saturdays. c) No construction work may be carried out on Sundays or public holidays Activities may be undertaken outside of these hours if required: a) by the Police or a public authority (not the Applicant) for the delivery of vehicles, plant or materials; or b) in an emergency to avoid the loss of life, damage to property or to prevent environmental harm. Notification of such activities must be given to affected residents before undertaking the activities or as soon as is practical afterwards. Rock breaking, rock hammering, sheet piling, pile driving and similar activities may only be carried out between the following hours: a) 9 am to 12 pm, Monday to Friday; b) 2 pm to 5 pm, Monday to Friday; and c) 9 am to 12 pm, Saturday.	Mitigation measures
4.	D2	The development must be constructed with the aim of achieving the construction noise management levels detailed in the Interim Construction Noise Guideline (Department of Environment and Climate Change, 2009). All feasible and reasonable noise mitigation measures must be implemented and any activities that could exceed the construction noise management levels must be identified and managed in accordance with the Construction Environmental Management Plan.	Mitigation measures
5.	D3	Any noise generated during the construction of the development must not be offensive noise within the meaning of the Protection of the Environment Operations Act 1997 or exceed approved noise limits for the Subject Site.	Mitigation measures
6.	D4	Heavy vehicles and oversized vehicles must not queue or idle on Hickson Road awaiting access to the Subject Site.	Mitigation measures

No.	Original Ref.	Relevant Requirement	Reference
7.	D5	The Applicant must schedule intra-day 'respite periods' for construction activities predicted to result in noise levels in excess of the "highly noise affected" levels, including the addition of 5 dB to the predicted levels for those activities identified in the Interim Construction Noise Guideline as being particularly annoying to noise sensitive receivers.	Mitigation measures
8.	D6	Vibration caused by construction at any residence or structure outside the subject site must be limited to: a) for structural damage vibration to buildings (excluding heritage buildings), British Standard BS 7385 Part 2—1993 Evaluation and Measurement for Vibration in Buildings; b) for structural damage vibration to heritage buildings, German Standard DIN 4150 Part 3 Structural Vibration in Buildings Effects on Structure; and c) for human exposure to vibration, the evaluation criteria presented in British Standard BS 6841- Guide to Evaluate Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) for low probability of adverse comment.	Mitigation measures
9.	D13	The Applicant must ensure the requirements of the Construction Environmental Management Plan, Construction Noise and Vibration Management Plan, Air Quality Management Plan, Waste Management Plan, Construction Pedestrian Traffic Management Plan and Erosion Sediment Control Plan required by Part C of this consent are implemented during construction.	This sub-plan

APPENDIX C: NOISE ASSESSMENT AND MONITORING LOCATIONS

The following material provides relevant information required by the various MCOAs, and is based on information in the following noise assessment documents:

- **Barangaroo South C1 Commercial Building Construction & Operational Noise Report**, Wilkinson Murray, August 2017, Report No. 10232-C1, Version B.
- **Barangaroo South Building C1, Application for Out of Hours Work Noise Assessment**. Wilkinson Murray. 22 February 2019.

2017 noise and vibration assessment

Noise assessments determined that that construction noise from the C1 site will be more than 10dBA below the cumulative noise levels of other construction works, thereby not resulting in any increase in construction noise levels at surrounding residences.

C1 construction noise levels at nearby residences predicted by noise assessments will be relatively low by construction standards, as shown by Column 5 of Table D-1. It was concluded that the C1 works will not result in cumulative construction noise increase at surrounding noise sensitive receivers.

Table D-1: Predicted cumulative noise impacts from C1 construction works.

Residences	Block 4 Remediation Works	Block 5 Remediation Works	Stage 1B Basement & Crown	C1 Construction	Cumulative (without C1 Works)	Cumulative (with C1 Works)
38 Hickson Rd	71	67	67	57	74	74
R8 Residences	51	60	60	51	63	64
37 High St	55	66	55	47	67	67
Balmain East	49	48	44	36	52	52

Notwithstanding, management procedures contained in the Lendlease Building C1 Barangaroo South EHS Management Plan will be consistently applied to C1 construction works.

2019 out of hours works noise assessment

The assessment indicated that compliance with out of hours noise management levels are achieved at all surrounding residential receivers with the exception of a marginal exceedance of nightworks associated with type B hoarding removal. The main contributor to this exceedance was identified as Franna cranes at the North Eastern end of the C1 site. Accordingly the following mitigation measures were recommended:

- Focus early morning works on the southern and western side of the building during the night period where practicable and feasible.

It was noted that where noise levels are within 2 dB of the noise management levels then noise will be, at times audible at residences. Therefore the following measures should be adopted:

- Notify, via Lend Lease Community Relations, the surrounding community when crane installation and removal activities are planned.
- Instruct workers of the issue of noise transmission to residences so that they are aware of the requirement to minimise noise emission to residences. This would include avoiding, as much as possible, metal hammering.

These measures have been included in the mitigation measures in this Sub-Plan.

APPENDIX D: VIBRATION GUIDELINES

VIBRATION GUIDELINES FOR RESTRICTION

Roller Class & Weight Range	Centrifugal Force Range	Example of Rollers	Distance from Building		Remarks
			A	B	
Very Light Less than 1.25 tonnes	10-20kN	Coates 32RD tandem Davleco 32CR tandem	3m	--	Maintenance and patching rollers. Generally not restricted for normal
Light 1 to 2 tonnes	20-50kN	Coates 42RD tandem Pannell 54T drawn	5m	--	Generally not restricted for normal road use.
Medium 2 to 4 tonnes	50-100kN	Coates 66Tdrawn Davleco 66 drawn	6m	12m	
Medium-Heavy 4 to 6 tonnes	100-200kN	Coates 72Tdrawn Davleco 72 drawn Pacific V12 drawn Raypo Rascal 400	12m	24m	Not advised for city and suburban streets.
Heavy 7 to 11 tonnes	200-300kN	Coates 78Tdrawn Pacific V24D drawn Raypo Rascal 600	25m	50m	Restricted. Not advised built-up areas.
Very Heavy 12 tonnes and over	Over 300kN	Coates 96Tdrawn Pacific V36D drawn	25m	50m	Restricted to major construction areas away from structures and buildings.

A - to prevent damage to buildings

B - Values suggested keeping claims and complaints to an acceptably low level. For complaints to be stopped completely in residential areas, these values may need to be increased still further.

APPENDIX E: ANALYSIS OF POSSIBLE NOISE REDUCTION MEASURES

The following table provides an evaluation of whether measures are reasonable and feasible to implement.

Noise Reduction Measure	Measure type	Day or Night	Reasonable and feasible?
In previous documents			
Minimise equipment use especially during off peak hours.	Procedure	Night	Yes – reduce equipment used whenever practical.
Use temporary barriers or berms to shield construction equipment. Examples include: - Stacking containers around noisy equipment; - Constructing a noise barrier around operating equipment such as dewatering pumps.	Shielding	Day & night	Yes – provide hoardings around the site, and barriers for pumps and static plant if needed.
Restricting times when noisy work is carried out (respite periods).	Procedure	Day	Yes – provide periods of relief when practical during noise intensive activities such as rock breaking.
Placement of work compounds, parking areas, equipment and material stockpile sites away from noise-sensitive locations.	Design	Day & night	Variable – some equipment cannot be placed away from noise-sensitive receivers due to the constrained nature of the site, and proximity to receivers. Current location of work compounds and emissions control systems are away from noise-sensitive receivers.
Where noise barriers/walls are to be constructed, program this as early as possible to reduce noise impacts on neighbouring residents.	Procedure	Day & night	Yes – hoardings will be built at the commencement of construction.
Ensure that least noisy construction methods, vehicles, plant and equipment are used, and adopting alternative construction measures.	Quiet equipment	Day & night	Yes – timber construction methods used. Otherwise generally not feasible due to specialised construction equipment required.
Consider alternatives to, or curtailing of reversing alarms.	Quiet equipment	Day & night	Yes – non-tonal alarms for on-site equipment.
Prevent vehicles and plant queuing and idling outside construction hours.	Procedure	Day & night	Yes – procedural.
Based on current construction methods			
Silenced generators.	Quiet equipment	Day & night	Yes
Quiet compressors & pumps.	Quiet equipment	Day & night	Yes
Notify community two days in advance of noisy or planned out of hours activities.	Procedure	Day & night	Yes
Focus early morning works on the southern and western side of C1 during the night period.	Procedure	Day & night	Yes
Verification of noise model by monitoring equipment.	Procedure	Day & night	Yes, if/when operating as per predicted scenarios to enable comparison.