APPENDIX C

SEMP 003 Construction Noise and Vibration Management Plan

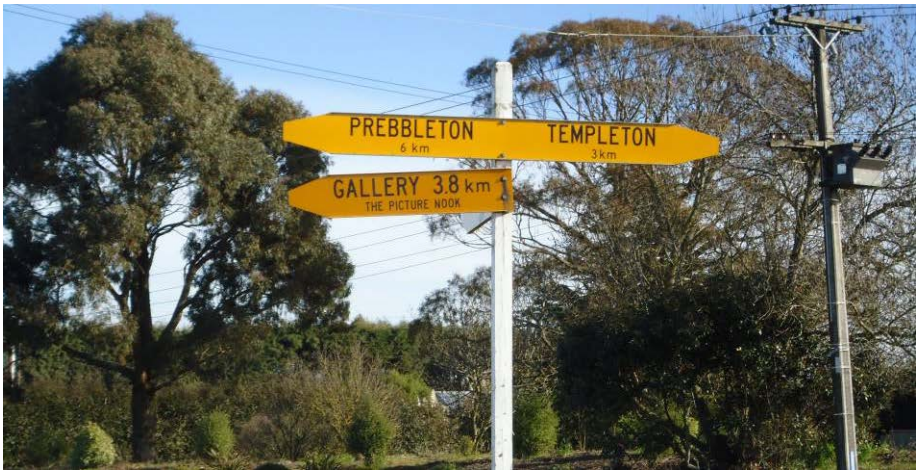
NZ TRANSPORT AGENCY
WAKA KOTAHI

CEMP Appendix C SEMP003

Christchurch Southern Motorway Stage 2 and Main South Road Four Laning

Draft Construction Noise and Vibration Management Plan

November 2012



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Contents

1. Introduction

The NZ Transport Agency (NZTA) seeks to improve access for people and freight to and from the south of Christchurch via State highway 1 (SH1) to the Christchurch City centre and Lyttelton Port by constructing, operating and maintaining the Christchurch Southern Corridor. The Government has identified the Christchurch motorway projects, including the Christchurch Southern Corridor, as a road of national significance (RoNS).

The proposal forms part of the Christchurch Southern Corridor and is made up of two sections: Main South Road Four Laning (MSRFL) involves the widening and upgrading of Main South Road (MSR), also referred to as SH1, to provide for a four-lane median separated expressway; and the construction of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway. The proposed construction, operation and maintenance of MSRFL and CSM2, together with ancillary local road improvements, are referred to hereafter as 'the Project'.

A Construction Environmental Management Plan (CEMP) has been prepared to provide the framework, methods and tools for avoiding, remedying or mitigating environmental effects of the construction phase of the Project. The CEMP is supported by six SEMP including this document relating to Construction Noise and Vibration.

1.1. Proposal description

1.1.1 MSRFL

Main South Road will be increased in width to four lanes from its intersection with Park Lane north of Rolleston, for approximately 4.5 km to the connection with CSM2 at Robinsons Road. MSRFL will be an expressway consisting of two lanes in each direction, a median with barrier separating oncoming traffic, and sealed shoulders. An interchange at Weedons Road will provide full access on and off the expressway. MSFRL will connect with CSM2 via an interchange near Robinsons Road, and SH1 will continue on its current alignment towards Templeton.

Rear access for properties fronting the western side of MSRFL will be provided via a new road running parallel to the immediate east of the Main Trunk rail corridor from Weedons Ross Road to just north of Curraghs Road. For properties fronting the eastern side of MSRFL, rear access is to be provided via an extension of Berketts Drive and private rights of way.

The full length of MSRFL is located within the Selwyn District.

1.1.2 CSM2

CSM2 will extend from its link with SH1 / MSRFL at Robinsons Road for approximately 8.4 km to link with Christchurch Southern Motorway Stage 1(CSM1, currently under construction) at Halswell Junction Road. The road will be constructed to ~~a~~ motorway standard comprising four lanes, with two lanes in each

direction, with a median and barrier to separate oncoming traffic and provide for safety.[1] Access to CSM2 will be limited to an interchange at Shands Road, and a half-interchange with eastward facing ramps at Halswell Junction Road. At four places along the motorway, underpasses (local road over the motorway) will be used to enable connectivity for local roads, and at Robinsons / Curraghs Roads, an overpass (local road under the motorway) will be provided. CSM2 will largely be constructed at grade, with a number of underpasses where elevated structures provide for intersecting roads to pass above the proposed alignment.

CSM2 crosses the Selwyn District and Christchurch City Council boundary at Marshs Road, with approximately 6 km of the CSM2 section within the Selwyn District and the remaining 2.4 km within the Christchurch City limits.

[1] CSM2 will not become a motorway until the Governor-General declares it to be a motorway upon request from the NZTA under section 71 of the Government Roading Powers Act 1989 (GRPA). However, for the purposes of this report, the term "motorway" may be used to describe the CSM2 section of the Project.

2. Purpose and Scope

This Construction Noise and Vibration Management Plan (CNVMP or the Plan) forms part of a comprehensive suite of environmental controls within the Construction Environmental Management Plan (CEMP, Volume 4) for the construction phase of the Project. The CNVMP addresses the potential construction noise and vibration impacts associated with earthworks and construction activities of the Project.

This construction noise and vibration management plan (CNVMP) details noise limits, predicted levels, mitigation measures, monitoring requirements, and communication and complaint procedures, for:

- State Highway: 1
- Project: Christchurch Southern Motorway Stage 2 & Main South Road Four Laning
- Construction location: Rolleston in the south to Halswell Junction Road in the north
- Construction start date: [TBC when known]
- Construction finish date: [TBC when known]
- Designation number: [TBC when known]
- NZTA CSVue permit number: [TBC when known]

This CNVMP identifies the noise and vibration performance standards that must, where practicable, be complied with. It also sets out best practicable options for noise and vibration management for the Project. This CNVMP is intended as a framework for the development and implementation of particular noise and vibration management and control methodologies to minimise adverse effects on the health and safety of residents and to reduce the adverse impact on the environment.

This CNVMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with any changes to the construction methodologies or techniques or the natural environment. The document shall be reviewed annually to ensure that any changes are reflected.

A Glossary of technical terms is contained in **Appendix A**.

This CNVMP will be implemented in accordance with information, management tools and standards as specified on the NZTA website for the management of transport noise located at http://acoustics.nzta.govt.nz/tools.

Contact details

Role	Name	Organisation	Phone	Email
Client		NZTA		
Engineer				
Acoustics advisor				
Contractor				
Contractor's acoustics advisor				
CCC– Noise/ Environmental Health				
SDC – Noise/ Environmental Health				
Public complaint contact number				

[Name of person responsible – TBC when known] will be responsible for ensuring that this construction noise management plan is correctly implemented. [He/she] will review all documentation relating to construction noise before it is issued.

All site personnel will be required to read and sign the construction noise induction form appended to this plan and any relevant schedules. If required, specific training will be provided for site personnel.

3. Project overview

The New Zealand Transport Agency (NZTA) is improving access to and from the south of Christchurch via State Highway 1 (SH1) to the Christchurch City centre and Lyttelton Port, by improving the capacity, safety and alignment of the Christchurch Southern Corridor.

The Project scope includes the widening and upgrading of Main South Road (SH1) to provide for a four-lane median separated expressway along the existing arterial route (MSRFL); and the construction, operation and maintenance of the Christchurch Southern Motorway Stage 2 (CSM2) as a four-lane median separated motorway.

CSM2 will link into Christchurch Southern Motorway Stage 1 (CSM1). CSM1 connects Halswell Junction Road with Brougham Street (SH73) in the east.

3.1 Construction methodology

[This section to be revised once details of construction methods are known]

At this stage, the outline construction methodology includes:

- Enabling works including connecting utilities, erecting construction compounds and fencing;
- Relocation of overhead transmission lines and other network utilities;
- Ground improvements at main structure locations which may involve piling and installation of stone columns;
- Transportation of fill to form approaches to bridge structures;
- Construction of bridge structures;
- Construction of interchanges;
- Excavation of swales and stormwater treatment ponds;
- Work on surrounding roads;
- Road construction which will involve the stripping of topsoil and bringing the road to formation level; and
- Installation of road pavement and street furniture (barriers, signs etc).

These works have been grouped into general Construction Activities, as described in the following table.

Table 1: Construction activities

Construction Activity	Likely Plant and Machinery required
Enabling Works	Heavy earthmoving machinery for road construction and site compound erection.
Topsoil Stripping	Motor-scraper, excavator and trucks.
General Earthworks	Large excavators, spreaders, rollers/compactors and trucks.
Ground Improvements	Rollers/compactors, pile drivers for bored concrete piles and driven steel piles, excavators, truck movements.

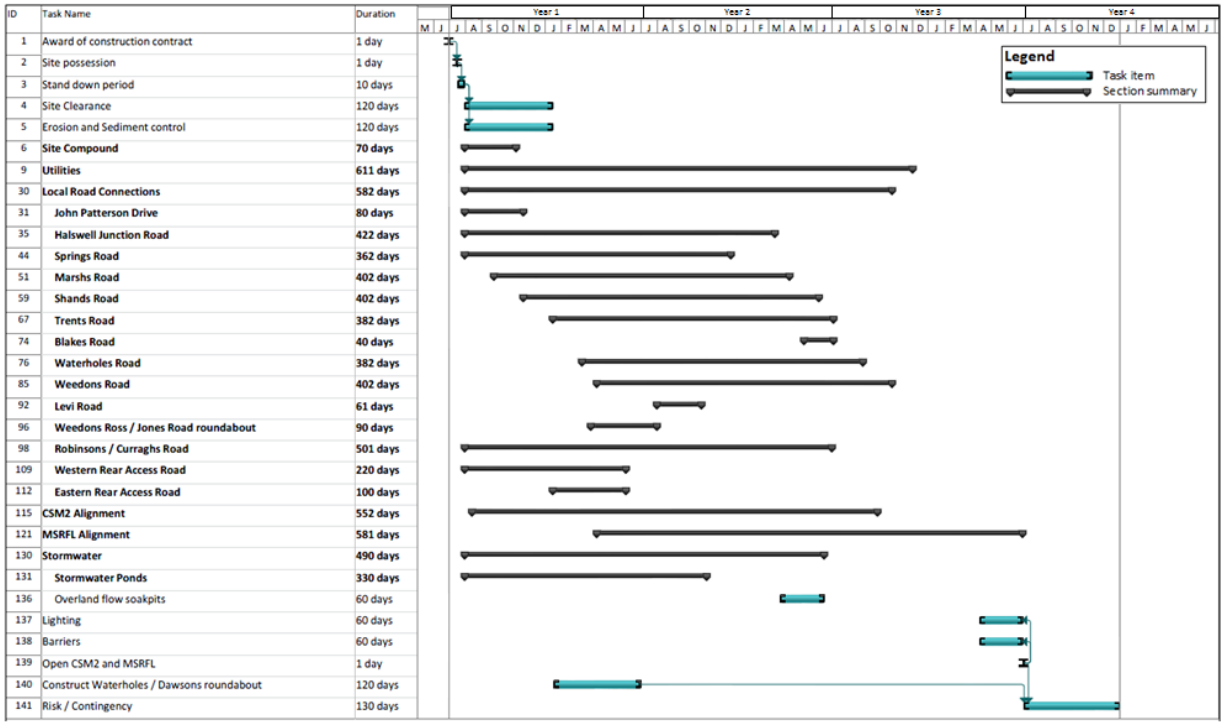
Construction Activity	Likely Plant and Machinery required
Bridge Construction	Mobile cranes, truck movements, concrete pumping, steel sheet piling, excavators, rollers/compactors. (If impact piling is required, a revised noise and vibration assessment should be conducted).
Pavement Construction	Spreader machine, grader, paving roller, vibratory roller, truck movements.
Electricity Network Utilities	Mobile cranes and jointing methods (note, controlled by Transpower).

Note that all of the activities listed may not occur at the same time at all locations. For some construction activities, multiple construction methods are available (such as bored concrete piling or impact steel piling) and the final methodology will be determined during the detailed construction planning process.

3.2 Timeframe

The overall construction timeframe for the entire Project is expected to be four years. The indicative construction timeline for the project is provided in Figure 1.

Figure 1: Indicative construction programme

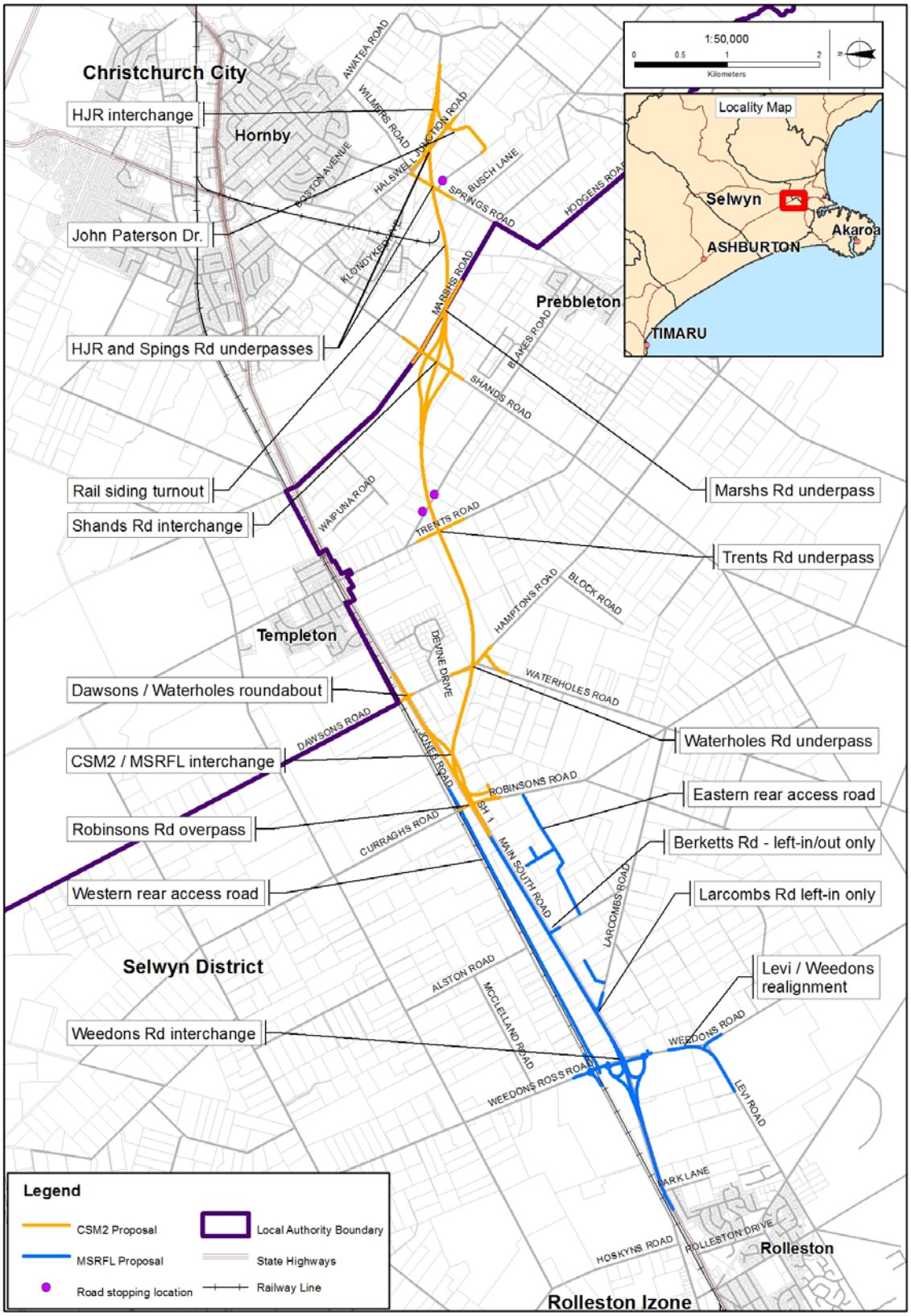


ID	Task Name	Duration
1	Award of construction contract	1 day
2	Site possession	1 day
3	Stand down period	10 days
4	Site Clearance	120 days
5	Erosion and Sediment control	120 days
6	**Site Compound**	**70 days**
9	**Utilities**	**611 days**
30	**Local Road Connections**	**582 days**
31	**John Patterson Drive**	**80 days**
35	**Halswell Junction Road**	**422 days**
44	**Springs Road**	**362 days**
51	**Marshs Road**	**402 days**
59	**Shands Road**	**402 days**
67	**Trents Road**	**382 days**
74	**Blakes Road**	**40 days**
76	**Waterholes Road**	**382 days**
85	**Weedons Road**	**402 days**
92	**Levi Road**	**61 days**
96	**Weedons Ross / Jones Road roundabout**	**90 days**
98	**Robinsons / Curraghs Road**	**501 days**
109	**Western Rear Access Road**	**220 days**
112	**Eastern Rear Access Road**	**100 days**
115	**CSM2 Alignment**	**552 days**
121	**MSRFL Alignment**	**581 days**
130	**Stormwater**	**490 days**
131	**Stormwater Ponds**	**330 days**
136	Overland flow soakpits	60 days
137	Lighting	60 days
138	Barriers	60 days
139	Open CSM2 and MSRFL	1 day
140	Construct Waterholes / Dawsons roundabout	120 days
141	Risk / Contingency	130 days

These durations relate to the entire activity and would not occur for the entire time at all closest receivers. Management and mitigation shall be applied as appropriate (i.e. as machinery progresses along the alignment).

Each receiver will be subject to varying noise levels throughout the construction period which may range from relatively quiet to relatively loud.

Location plan



3.3 Project assessment sectors

The MSRFL/CSM2 alignment has been broken up into 12 sectors for assessment. These sectors are described in south to north direction in Table 2 below, and shown in **Appendix B**.

Table 2: Assessment sectors

Assessment Sector	Description	Sector
MSRFL – South of Weedons	MSRFL from existing four-laning at Rolleston to Weedons Road	12
Weedons Road	MSRFL/Weedons Road Interchange	11
MSRFL – Robinsons to Weedons	Main MSRFL alignment between Weedons Road/Weedons Ross Road and Berketts Road	10
MSRFL – Robinsons to Berketts	Main MSRFL alignment between Berketts Road and Robinsons Road	9
Robinsons Road	CSM2/MSRFL Interchange at Robinsons Road	8
Waterholes Road	Waterholes Road overbridge and realignment	7
CSM2 – Trents to Waterholes	Main CSM2 alignment between Waterholes Road and Trents Road	6
Trents Road	Trents Road overbridge	5
CSM2 – Marshs to Trents	Main CSM2 alignment between Trents Road and Marshs Road	4
Shands Road	CSM2/Shands Road Interchange and Marshs Road overbridge	3
CSM2 – Springs to Shands	Main CSM2 alignment between Shands Road and Springs Road	2
Halswell Junction/Springs Road	Halswell Junction Road/Springs Road Interchange and Springs Road overbridge	1

4. Criteria

4.1 Designation conditions

The following noise and vibration criteria are based on the requirements set out in the designation conditions for the Project. The relevant conditions are attached in full in **Appendix C**.

4.2 Noise performance standards

Construction noise shall be measured and assessed in accordance with NZS 6803:1999 'Acoustics – Construction Noise'.

The limits outlined in the following tables apply at a distance of one metre from the façade of any occupied building:

Table 3: Project construction noise criteria: residential receivers

Day	Time	$L_{Aeq(1h)}$	L_{AFmax}
Weekdays	0630h – 0730h	55 dB	75 dB
	0730h – 1800h	70 dB	85 dB
	1800h – 2000h	65 dB	80 dB
	2000h – 0630h	45 dB	75 dB
Saturday	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	70 dB	85 dB
	1800h – 2000h	45 dB	75 dB
	2000h – 0630h	45 dB	75 dB
Sundays and public holidays	0630h – 0730h	45 dB	75 dB
	0730h – 1800h	45 dB	75 dB
	1800h – 2000h	55 dB	85 dB
	2000h – 0630h	45 dB	75 dB

Table 4: Project construction noise criteria: commercial and industrial receivers

Time	$L_{Aeq(T)}$*
0730h – 1800h	70 dB
1800h – 0730h	75 dB

* T means an assessment duration of no less than 10 minutes and not exceeding 60 minutes

There may be circumstances where noise limits cannot be achieved, such as night-time work. However appropriate justification and work methodology needs to be carefully considered and provided for through appropriate measures, such as the development of Noise Management Schedules.

4.3 Vibration performance standards

The construction vibration criteria for this Project are based on the draft NZTA vibration guide for managing vibration during construction associated with state highway projects. The guide addresses both building damage and human response to vibration by applying appropriate international vibration standards in a dual category approach, as follows:

4.3.1 Vibration Category A

Category A adopts criteria from British Standard BS 5228-2:2009 and is designed to practically address the human response effects in dwellings during the daytime and night-time periods, and offices during the daytime. For other building types, and offices during the night-time (i.e. unoccupied), the policy reverts to the building damage criteria from German Standard DIN 4150-3:1999.

If measured or predicted vibration levels exceed the Category A criteria then a suitably qualified expert shall be engaged to assess and manage construction vibration and to comply with the Category A criteria. If the Category A criteria cannot be practicably achieved, the Category B criteria shall be applied.

4.3.2 Vibration Category B

Category B is designed to protect buildings against damage and adopts criteria from DIN 4150-3:1999 and BS 5228-2:2009, but retains a higher degree of protection for dwellings at night-time, as contained in the human response criteria of BS 5228-2:2009.

If measured or predicted vibration levels exceed Category B criteria, then construction activity shall only proceed if there is continuous monitoring of vibration levels and effects on buildings at risk of exceeding the Category B criteria, by suitably qualified experts.

Measurements of construction vibration shall be undertaken in accordance with German Standard DIN 4150-3:1999 "Structural Vibration Part 3: Effects of vibration on structures". The Project criteria for construction vibration are given in **Table 5** below:

Table 5: Project construction vibration criteria

Receiver	Details	Category A	Category B
Occupied dwellings	Night-time 2000h - 0630h	0.3 mm/s PPV	1 mm/s PPV
	Daytime 0630h - 2000h	1 mm/s PPV	5 mm/s PPV
Other occupied buildings*	Daytime 0630h - 2000h	2 mm/s PPV	5 mm/s PPV
All other buildings		5 mm/s PPV	BS 5228-2: Table B.2
	Vibration - continuous**		BS 5228-2, 50% of Table B.2 values

* 'Other occupied buildings' is intended to include daytime workplaces such as offices, community centres etc., not industrial buildings. Schools, hospitals, rest homes etc. would fall under the occupied dwellings category.

5. Stakeholder engagement

A key aspect of this construction noise management plan is stakeholder engagement. The site contact(s) for the public for the duration of the works are listed in the table below. In lieu of a specific contact person, the Project team's Environmental Manager or appointed representative will assume the role.

[Table TBC once construction contract is awarded]

Table 6: Public site contacts for construction

Site	Name	Title/Role	Organisation	Phone

There will be the following communication with the community regarding construction noise issues:

- The site contact person or appointed representative will be available on site at all times when construction is being undertaken, and should be contactable by affected parties regarding noise.
- The contact details of this person will be prominently displayed at the entrance to each contractor's yard and at relevant positions around the construction site. These contact details will also be included in any written documentation, particularly for those potentially most affected.
- Prior to the works a newsletter or similar will be distributed to all neighbours within at least 100 metres of the works. The newsletter will provide contact details and will detail the overall nature of the works. The same information will also be published in an advertisement in a local newspaper.
- Individual notification will be provided and meetings offered to all neighbours within 50 metres of the works. For any neighbours within approximately 20 metres of the works individual consultation will be continued throughout the works.
- Further information will be regularly provided to all neighbours with an update on the progress of the works, and the specific activities (including locations) due to be undertaken next. This may be provided by newsletters or possibly by email. Updates will be provided every two or three months.

Prior to any particularly noisy processes identified in a construction noise management schedule, the nearest affected neighbours will be contacted individually. Neighbours will be informed of the proposed timing of the specific works and where practicable any times which are particularly sensitive for neighbours will be avoided.

Further details on at-risk receivers in each Sector are contained in the mitigation options provided in Appendix E]

6. Noise sources

The following table lists all significant equipment proposed to be used on the site. The sound level for each item of equipment has been estimated from library data in British Standard BS 5228-1:2009. During initial site noise monitoring the validity of this data will be confirmed and adjusted where necessary for the major items of equipment.

Table 7: BS5228-1:2009 Typical construction noise levels

Source/Activity	Sound Pressure Level at 10m (dB L_{Aeq})	
	Range	Average
Asphalt Paver	75 – 84	78
Auger piling	75 – 81	78
Bulldozers (up to 350kW/50t)	74 – 86	79
Concrete Mixer Trucks	75 – 80	77
Diesel Generator less than 20kW	65 – 66	65
Diesel Water Pumps	68 – 81	73
Diesel Scissor Lift	70 – 78	74
Concrete/Rock Drilling	85 – 92	89
Dumping Rubble	80 – 80	80
Excavators	65 – 91	77
Hydraulic Breaking	83 – 93	90
Loaders	61 – 91	80
Mobile Crane	67 – 82	73
Pneumatic Breaker (Hand-Held)	82 – 95	87
Excavator-mounted Pulveriser	72 – 80	76
Concrete Pumping	75 – 82	77
Road Planer	68 – 82	75
Rockbreaking (30t Excavator)	85 – 95	91
Road Roller (20t)	73 – 80	77
Rotary Bored Piling	75 – 83	79
Steel Sheet Piling – Hydraulic Jacking	59 – 68	63
Steel Sheet Piling – Vibratory	88	88
Tubular Steel Piling – Drop Hammer	69 – 88	80
Vibratory Compaction	67 – 84	77

The following table contains predicted noise levels at a nominal distance of 100m from the various construction activities associated with the Project.

Table 8: Construction scenarios

Construction Scenario	Predicted Noise Level at 100m (dB L_{Aeq})
Enabling Works	45 – 71
Topsoil Stripping	75
General Earthworks*	57 – 64
Ground Improvements**	57 – 83
Bridge Construction	64 – 83
Pavement Construction*	55 – 63
Electricity Network Utilities***	53

* Upper value assumes multiple items of large plant operating

** Noise emissions highly dependent on construction method and equipment used

***Mobile crane only

Table 9 outlines the Sectors where each of these construction scenarios may occur.

Table 9: Sectors where construction activities may occur

Construction Scenario	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	Sector 12
Enabling Works	*	*	✓	*	*	*	*	*	*	*	*	*
Topsoil Stripping	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
General Earthworks	✓	✓		✓		✓			✓	✓		✓
Ground Improvements**	✓		✓		✓		✓	✓				
Bridge Construction	✓		✓		✓		✓	✓			✓	
Pavement Construction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electricity Network Utilities***	–	–	–	–	–	–	–	–	–	–	–	–

Construction Scenario	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7	Sector 8	Sector 9	Sector 10	Sector 11	Sector 12

* The main compound is likely to be situated to the east of the CSM2/Robinsons Road. The civil/earthworks compound is likely to be situated on the SE corner of the Marshs / Shands intersection, in the space between the intersection and the proposed on ramp. There will be other smaller compounds along the length of the site dependant on the Contractor's requirements.

** Ground improvements will be required at the bridge abutments. At this stage there are no other dynamic ground improvement works planned. A general assessment of effects from this activity has been conducted to inform any future works.

*** There are a number of existing electricity network utilities within the project area that will require protection and/or relocation, in particular the relocation of Transpower's overhead lines at Shands Road Interchange. Construction relating to the relocation or laying of electricity infrastructure is controlled by Transpower and Orion.

7. Mitigation

Indicative construction noise calculations have been conducted for the main items of equipment based on the outline construction methodology and minimum distances to the nearest neighbours. On this basis general noise mitigation measures have been identified for each of the Project Sectors and are described in Appendix E. We note that these outline mitigation measures could be translated into schedules once final construction methodology becomes available.

8. Schedules

For each significant activity/location within 50 metres [distance to be confirmed once detail methodology is known] of neighbours a separate schedule will be prepared. The schedule will identify the potentially affected neighbours and confirm the proposed methodology and equipment to be used.

Predictions of construction noise will be made using an appropriate calculation method, such as the calculator on www.acoustics.nzta.govt.nz. These calculations will be used to identify where specific mitigation measures are required, which will be recorded in the schedule.

The schedule will detail any specific monitoring or communication requirements.

The schedule will be read and signed by all site personnel involved in the work, prior to the activity commencing.

Example schedules are provided on the NZTA website at http://acoustics.nzta.govt.nz/tools/templates.

9. Monitoring

9.1 Requirements – Noise Monitoring

Construction noise monitoring shall be conducted by a suitably qualified and experienced independent consultant [or by the following staff – include if appropriate] in accordance with NZS 6801:2008 and NZS 6803:1999, using the NZTA construction monitoring survey sheet and procedures. (www.acoustics.nzta.govt.nz).

Trained noise monitoring staff:

- [TBC when known]

[Following details of dedicated sound level meter kit should be completed if and when this information is known]

Noise monitoring performed by the staff listed above will be conducted using the dedicated sound level meter kit detailed below which will be stored in [location TBC when known] for the duration of the project. The calibrator will be verified by an accredited laboratory annually and the sound level meter and microphone biannually.

Table 10: Sound level meter kit details

Equipment	Make	Model	Serial	Last verification
Sound level meter				
Software				
Microphone				
Calibrator				
Wind shield				
Tripod				
Other				

Monitoring will be conducted as follows,

- Baseline monitoring prior to construction work commencing at positions representative of noise sensitive locations within 300 metres of construction activity.
- When the works start to verify the sound levels assumed for each of the major items of equipment, and to assess the effectiveness of noise control measures and implementation of this plan.
- At regular intervals during the works, at least every two weeks, to check ongoing compliance with the construction noise limits.
- During critical phases of construction, such as during the use of heavy earth moving machinery, rock breaking, and other noisy activities within 50 metres of neighbours.
- As required by a construction noise management schedule.
- In response to reasonable complaints being received.

Following each noise survey, the results will be reported on the NZTA survey report template and any issues discovered will be investigated. Results will be recorded on the project web page on www.acoustics.nzta.govt.nz.

9.2 Requirements – Vibration Monitoring

Construction vibration levels shall be monitored and assessed by a suitably qualified and experienced person in accordance with the requirements of German Standard DIN 4150-3:1999 *"Structural vibration – Part 3: Effects of vibration on structures"*.

The following persons are trained vibration monitoring staff:

- [TBC when known]

Monitoring will be conducted as follows,

- Baseline monitoring prior to construction work commencing at positions representative of vibration sensitive locations within 50 metres of construction activity;
- By a suitably qualified and experienced acoustic/vibration specialist.
- At monthly intervals throughout construction, but not at pre-arranged times or locations.
- During critical phases of construction, such as during the use of heavy earth moving machinery, rock breaking, and other vibration generating activities within 50 metres of neighbours.
- As required by a construction vibration management schedule.
- In response to reasonable complaints being received.

Following each vibration survey, the results will be reported on the NZTA survey report template and any issues discovered will be investigated. Results will be recorded on the project web page on www.acoustics.nzta.govt.nz.

9.3 Contingency measures

Prior to commencing construction works, appropriate procedures should be put in place in the event that measurements result in a non-compliance with the Project criteria. These should include the following:

- For noise, the process should include further measurement to be undertaken where necessary to determine the extent of non-compliance and preparation of a report outlining the non-compliance and, if required, potential mitigation and management measures.
- For vibration, the process should include a building condition survey and a report prepared by a suitably qualified person, including photographs, detailing the state of repair of the existing structure, and an opinion as to whether any damage may be due to construction activity. Subsequent additional monitoring and other management as required. Upon implementation of any additional mitigation measures, further measurements shall be undertaken to confirm the effectiveness of those mitigation measures.
- The Environmental Manager shall liaise with affected receivers throughout the process.

10. Complaints

The following procedure shall be followed for all noise and vibration complaints:

1. All noise and vibration complaints should be immediately directed to [TBC when known].
2. As soon as the complaint is received it will be recorded on the project web page on www.acoustics.nzta.govt.nz.
3. An initial response will be made and recorded on the project web page. Depending on the nature of the complaint the initial response could be to immediately cease the activity pending investigation, or to replace an item of equipment. However, in some cases it might not be practicable to provide immediate relief. The complainant and council will be informed of actions taken. Contact details for council are recorded in the Introduction section of this plan.
4. Where the initial response does not address the complaint, further investigation, corrective action and follow-up monitoring shall be undertaken as appropriate. The complainant [and council] will be informed of actions taken.
5. All actions will be recorded on the project web page and the complaint will then be closed.

Proposed Designation Condition DC.38 requires that:

(a) At all times during construction work, the Requiring Authority shall maintain a permanent register(s) of any public or stakeholder feedback received and any incidents or non-compliance noted by the contractor, in relation to the construction of the Project. The register(s) shall include:
   i. the name and contact details (as far as practicable) of the person providing feedback or contractor observing the incident/ non-compliance;
   ii. identification of the nature and details of the feedback/ incident; and
   iii. location, date and time of the feedback/ incident.

(b) The Requiring Authority shall promptly investigate any adverse feedback, incident or non-compliance. This shall include, but need not be limited to:
   i. recording weather conditions at the time of the event (as far as practicable), and including wind direction and approximate wind speed if the adverse feedback or incident relates to dust;
   ii. recording any other activities in the area, unrelated to the Project that may have contributed to the adverse feedback/ incident/ non-compliance, such as non-Project construction, fires, traffic accidents or unusually dusty conditions generally (if applicable);
   iii. investigating other circumstances surrounding the incident.

(c) In relation to Condition DC.37(b), the Requiring Authority shall:
   i. record the outcome of the investigation on the register(s);
   ii. record any remedial actions or measures undertaken to address or respond to the matter on the register(s);
   iii. respond to the initiator, in closing the feedback loop, if practicable; and
   iv. where the adverse feedback or incident was in relation to a non-compliance, the Manager shall be notified in writing of the matter within 5 working days of the non-compliance, and inform of the remedial actions undertaken.

(d) The register(s) shall be maintained on site and shall be made available to the Manager upon request.

11. CNVMP review

This CNVMP, including environmental controls and procedures, shall be reviewed to ensure that it remains applicable to the activities being carried out.

The CNVMP will be reviewed by the contractor after confirmation of the resource consent and designation conditions and will be revised in accordance with these conditions. The CNVMP will be updated, with the necessary approval, throughout the course of the Project to reflect material changes associated with changes to construction techniques or the natural environment. Consultation with the Selwyn District Council and Christchurch City Council, or nominated representative will be required for any relevant revisions of a material nature for the CNVMP.

A management review of the CNVMP will be undertaken at least annually by the Project management team and the NZTA environmental representative. The management review will be organised by the Project Manager, and the Project team will be informed of any changes to this plan through the regular project communications processes.

The review will take into consideration:

- Significant changes that affect the noise and/or vibration generation;
- Key changes to roles and responsibilities within the Project;
- Changes in industry best practice standards;
- Changes in methodology or management in response to noise and/or vibration monitoring showing non-compliance;
- Changes in legal or other requirements (social and environmental legal requirements, consent conditions, NZTA objectives and relevant policies, plans, standards, specifications and guidelines);
- Sensitive receivers not present during the previous review of the CNVMP; and
- Public complaints.

Reasons for making changes to the CNVMP will be documented. A copy of the original CNVMP document and subsequent versions will be kept for the Project records, and marked as obsolete. Each new/updated version of the CNVMP documentation will be issued with a version number and date to eliminate obsolete CNVMP documentation being used.

12. Documentation

12.1. File

A construction noise and vibration management file will be held by [TBC] and kept [TBC]. All electronic files relating to construction noise and vibration will be kept in [TBC]. The construction noise and vibration management file will contain the following sections:

- Section 1 – Construction noise and vibration management plans
  - This Construction Noise and Vibration Management Plan and any revisions
  - Construction Noise Management Schedules
  - Construction Vibration Management Schedules
  - Construction noise and vibration induction sheets
- Section 2 – Consultation and complaints registers
- Section 3 – Noise and vibration monitoring
  - Site survey sheets and associated aerial photographs
  - Site survey summary sheet
  - Survey reports
  - Survey and equipment operating procedures
  - Current and past equipment kit details and calibration summary
  - Copies of calibration certificates
- Section 4 – Mitigation register

12.2. Web site

The following information will also be recorded on the project construction noise web page on www.acoustics.nzta.govt.nz:

- This Construction Noise and Vibration Management Plan and any revisions,
- Construction Noise Management Schedules,
- Construction Vibration Management Schedules,
- Noise survey results, and
- Complaints and any subsequent outcomes, follow up or mitigation.

The project area on this web site will be administered by [TBC]. It will be made accessible to the following people listed in the contacts table in the Introduction of this plan.

12.3. Reporting

The following information will be provided to the key project contacts as listed in the contacts table in the Introduction of this plan, within the timeframes stated.

Information	Timeframe
Construction Noise and Vibration Management Plan	At least one week before works commence
Construction Noise Management Schedules	At least one week before specific works commence
Construction Vibration Management Schedules	At least one week before specific works commence
Noise or vibration survey report	Within one week of monitoring
Noise or vibration complaint initial report	Within twenty-four hours
Noise or vibration complaint closed	Within one week of closing complaint

This information will all be sent by email with files in pdf format.

Appendix A: Glossary

Noise

Ambient Noise	Ambient Noise is the all-encompassing noise associated with any given environment and is usually a composite of sounds from many sources near and far.
A-weighting	A frequency filter which is applied to a measurement of sound so as to more closely approximate the frequency bias of the human ear.
dB	Decibel – the basic measurement unit of sound. It is a logarithmic ratio of measured sound pressure level with respect to a reference level of 20 micropascals.
$L_{Aeq(T)}$	The A-weighted, time averaged sound level (on a logarithmic/energy basis) over the measurement period T (e.g. between 10 and 60 minutes).
L_{AFmax}	The maximum A-weighted sound level recorded during the measurement period. Measured with fast time weighting i.e. a 125 millisecond time constant
L_{A10}	The A-weighted sound level which is equalled or exceeded for 10% of the measurement period.
L_{A90}	The A-weighted sound level which is equalled or exceed for 90% of the measurement period. L_{A90} is an indicator of the mean minimum noise level and is used in New Zealand as the descriptor for background noise
L_{A95}	The A-weighted sound level which is equalled or exceed for 95% of the measurement period.
L_{Zpeak}	The peak instantaneous pressure level recorded during the measurement period, with a flat (i.e. no) frequency weighting.
Noise	A sound that is unwanted by, or distracting to, the receiver.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *"Acoustics – Measurement of Sound"*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *"Acoustics – Environmental Noise".*
NZS 6803:1999	New Zealand Standard NZS 6803:1999 "*Acoustics – Construction Noise*".

Vibration

BS 5228-2:2009	British Standard BS 5228-2:2009 "Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration". This is the standard adopted for this Project to assess human response to construction.
DIN 4150-3:1999	German Standard DIN 4150-3:1999 "Structural Vibration – Part 3: Effects of vibration on structures". This standard is generally adopted in NZ to assess building damage.
PPV	Peak Particle Velocity, measured in mm/s. This is the standard metric for assessing construction vibration levels.
Risk contour	The closest distance to a vibration source at which a measurement would be expected to comply with the risk assessment criteria

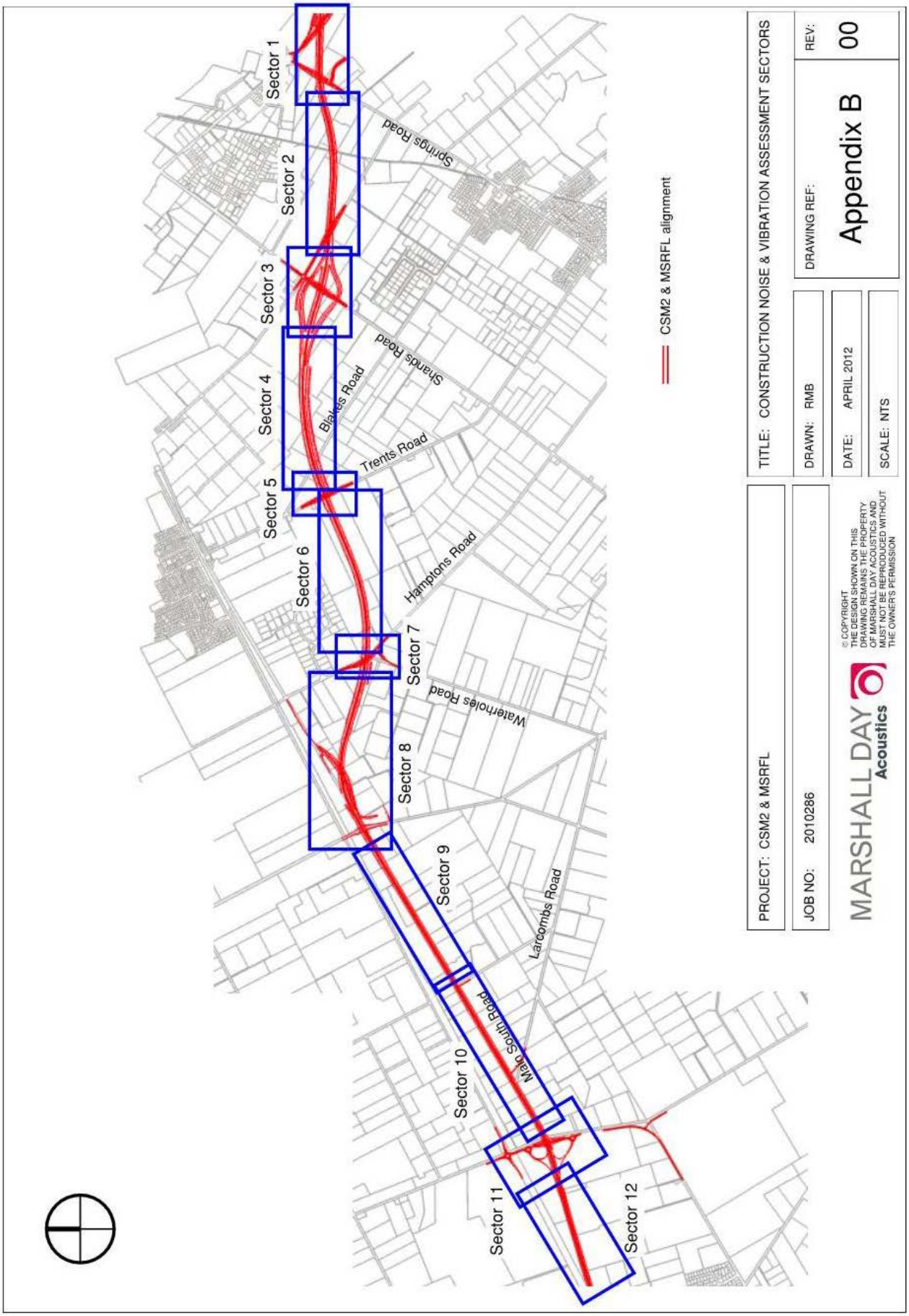
General

AEE	Assessment of Environmental Effects. A document relating to, and assessing the effects of a specific element of the Project e.g. Noise, Air Quality, Traffic, Vibration
CNVMP	Construction Noise and Vibration Management Plan. This document.
"Suitably qualified acoustics specialist"	A person who has sufficient qualifications and experience in the relevant field(s) of acoustics (noise and/or vibration) to undertake robust measurements and assessments i.e. a Member of the Acoustical Society of New Zealand.
SSCNMP	Site Specific Construction Noise Management Plan
SSCVMP	Site Specific Construction Vibration Management Plan

Appendix B: Project assessment sectors map

(Following page)

[To be updated as required]


Sector 1
Sector 2
Sector 3
Sector 4
Sector 5
Sector 6
Sector 7
Sector 8
Sector 9
Sector 10
Sector 11
Sector 12
Springs Road
Shands Road
Blakes Road
Trents Road
Hamptons Road
Waterholes Road
Larcombs Road
Main South Road
CSM2 & MSRFL alignment
TITLE: CONSTRUCTION NOISE & VIBRATION ASSESSMENT SECTORS
DRAWING REF: Appendix B
REV: 00
DRAWN: RMB
DATE: APRIL 2012
SCALE: NTS
PROJECT: CSM2 & MSRFL
JOB NO: 2010286
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Appendix C: Project designation conditions

(Following page)

[To be added when confirmed]

Appendix D: Construction noise and vibration induction

Project: CSM2/MSRFL

There are several residential and commercial neighbours in close proximity to the works, where noise limits apply. To ensure limits are achieved, all staff are responsible for good noise management.

1. When arriving at work, please drive slowly on site and keep revs to a minimum. Keep stereos off and do not slam doors.
2. No shouting or swearing on site. Either walk over and talk to somebody or use a radio/phone.
3. Be careful with tools and equipment. Place them down and do not drop them.
4. Do not drag materials on the ground. Place them down when you arrive at the work area.
5. Equipment and vehicles should not be left running when not in use.
6. When loading trucks try not to drop material from a height. Load softer material at the bottom.
7. Noise enclosures should always have all doors/hatches closed when the equipment is in use.
8. Stationary equipment such as pumps and generators should be located away from neighbours.
9. All equipment is to be well maintained.
10. No noisy works shall be conducted outside the hours of 0630h to 2000h Monday to Saturday except as specifically permitted by the CNVMP.
11. If you see anything/anyone making unnecessary noise then stop it/them. If the source cannot be stopped then report it to [TBC].
12. It is essential that good relationships are maintained with the local community. Any queries from members of the public should be responded to politely and referred to [TBC]. Staff shall assist the public to make contact with this person. Staff shall not enter into debate or argue with members of the public.
13. No potentially noisy or vibratory work is to be conducted until all staff involved in the task have read and signed the Management Schedule for that task.

Name	Company	Signed	Date

Appendix E: Noise Mitigation

(Following Pages)

Noise mitigation

The following sections provide indicative mitigation requirements for sensitive locations within each sector along the Project alignment. This information may be translated into schedules for specific dwellings once detailed methodology has been developed. Schedules should be developed in line with the templates available on the NZTA website http://acoustics.nzta.govt.nz/tools/templates.

South of Weedons Road (Sector 12)

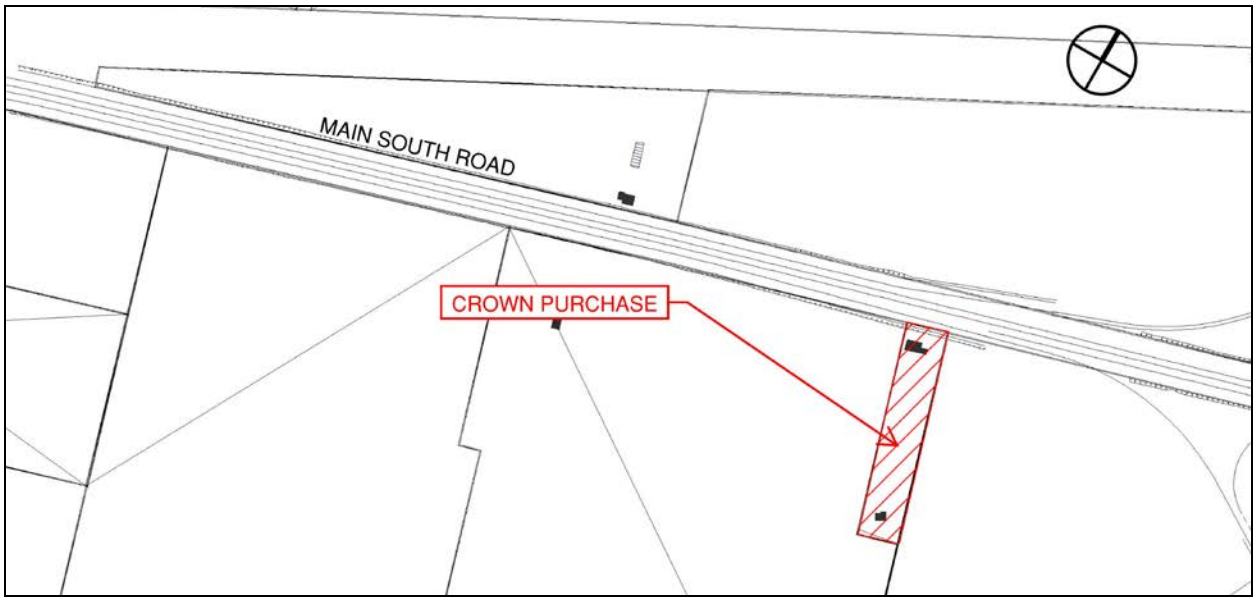

Table 11: Sector 12 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	
Bridge Construction			See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
Ground Improvements			See general mitigation section for a discussion on Ground Improvements and Piling Techniques.

Weedons Road (Sector 11)

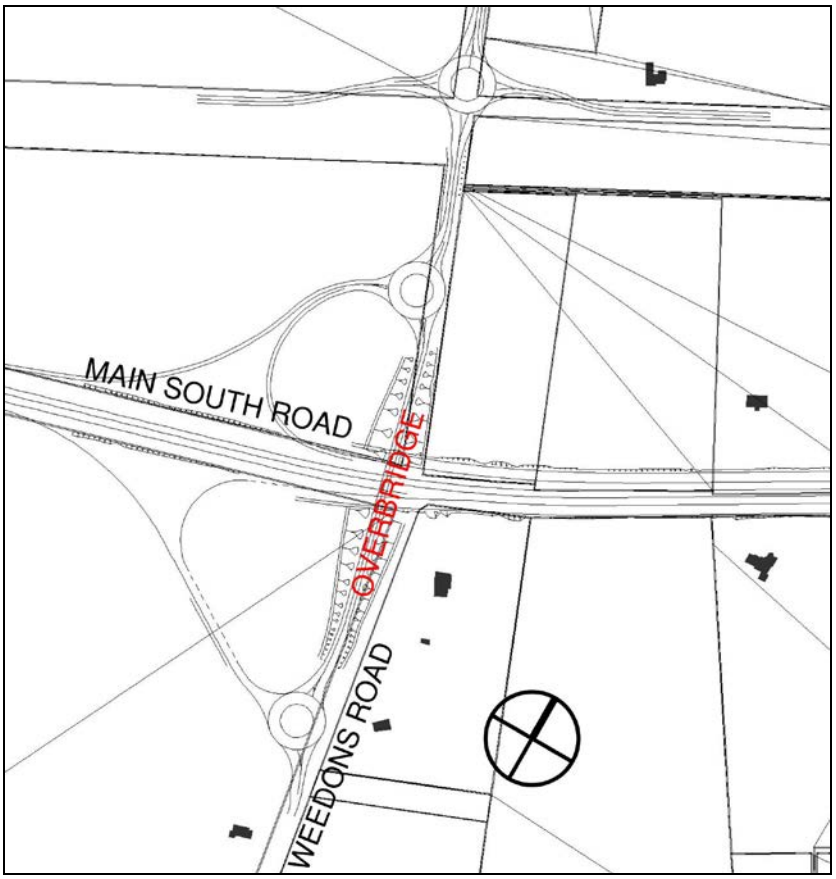

Table 12: Sector 11 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Weedons Road overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

MSRFL – Berketts to Weedons (Sector 10)

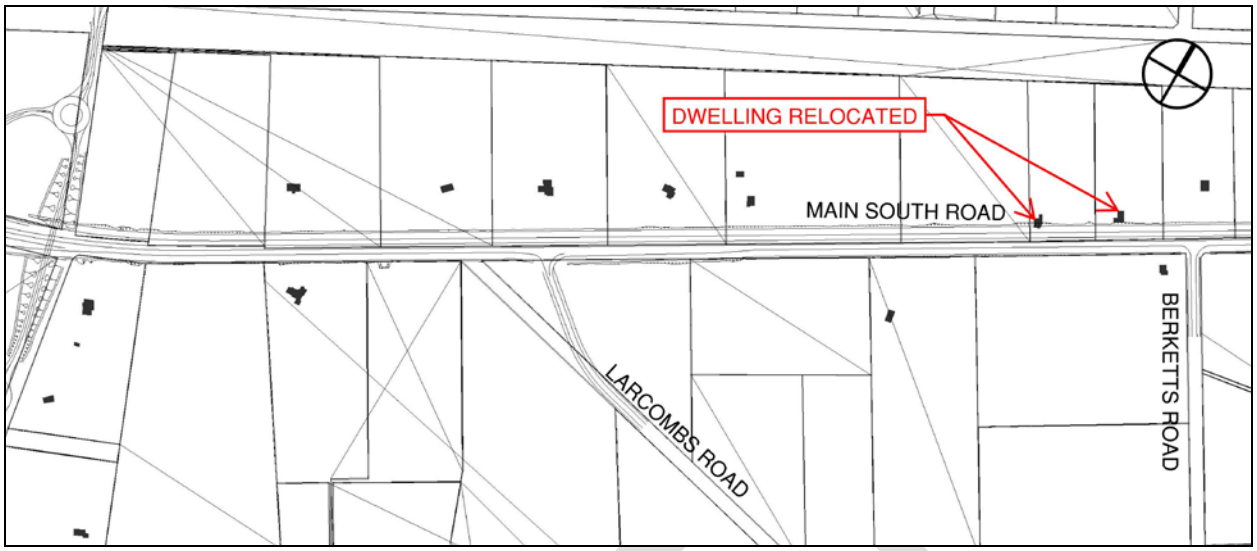

Table 13: Sector 10 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

MSRFL – Robinsons to Berketts (Sector 9)

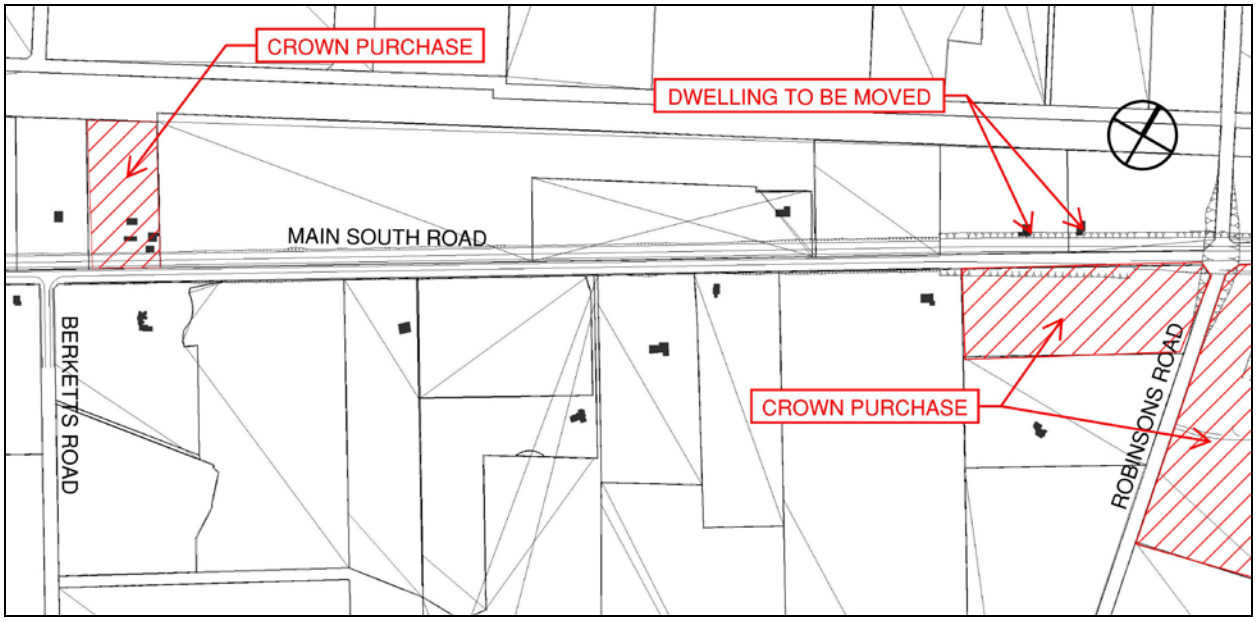

Table 14: Sector 9 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Robinsons Road (Sector 8)

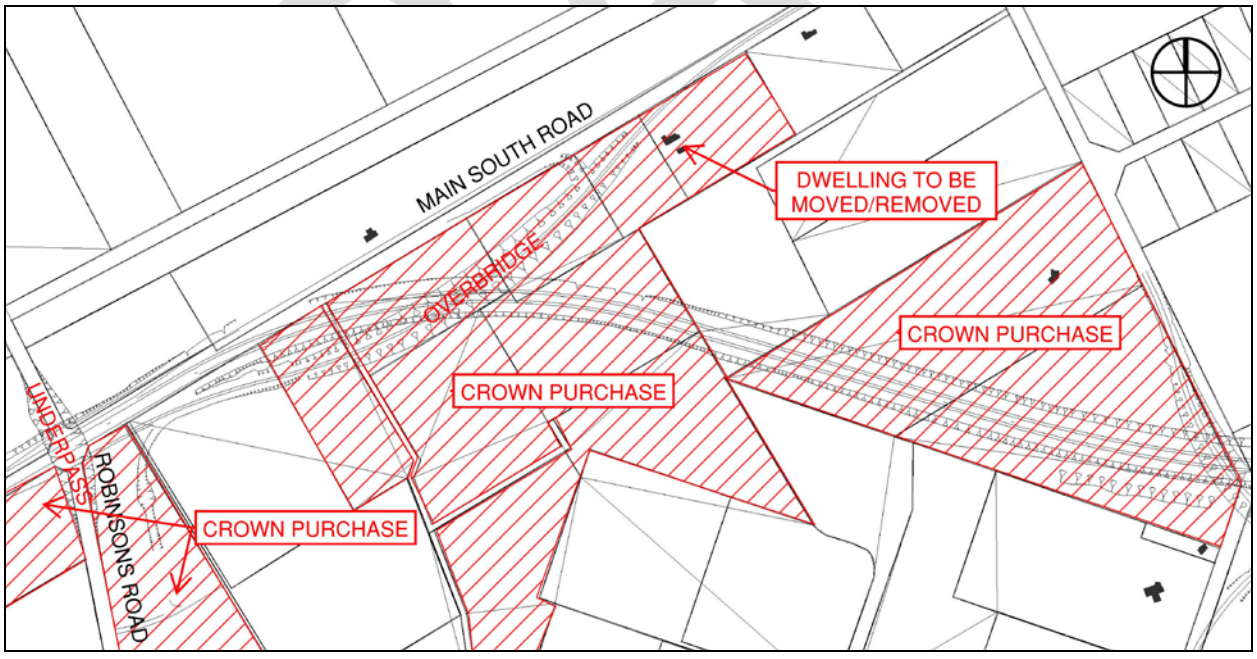

Table 15: Sector 8 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northern end of MSRFL overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of MSRFL overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Waterholes Road (Sector 7)

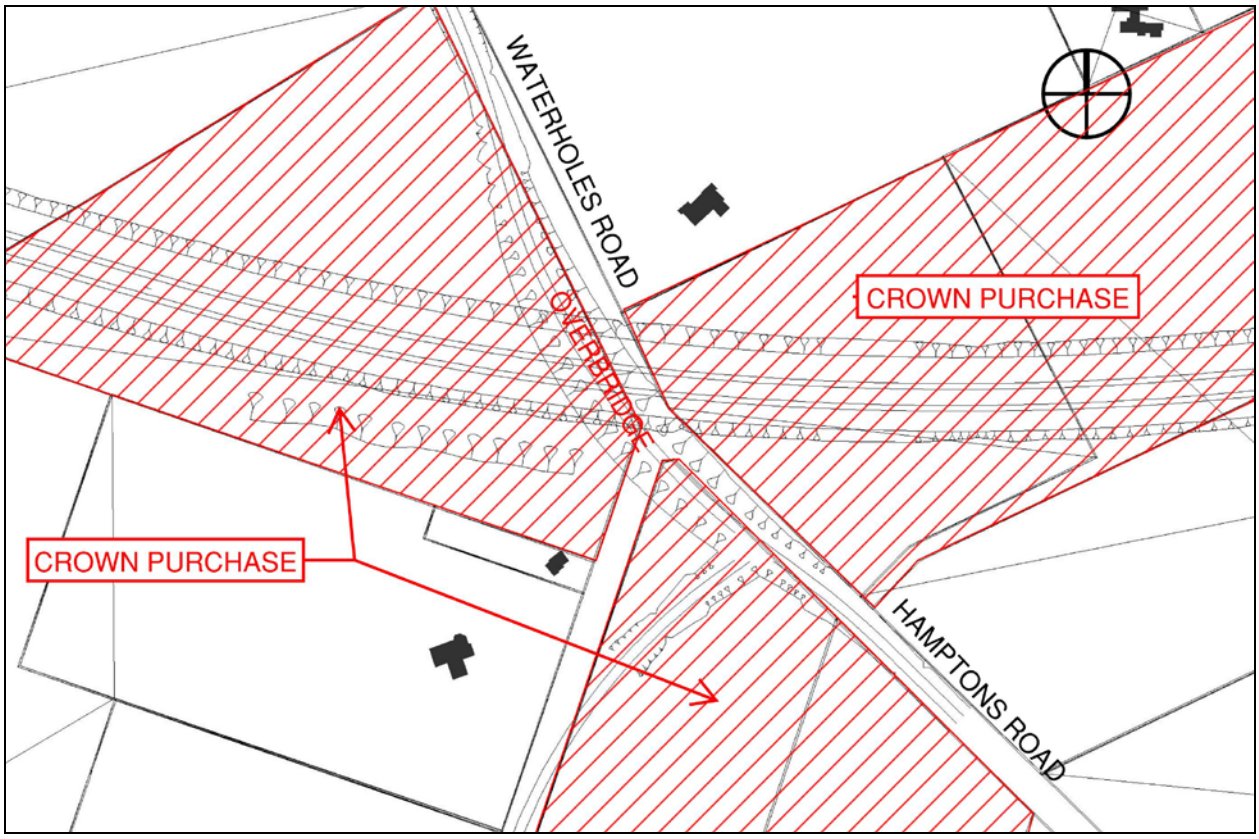

Table 16: Sector 7 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday..
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Waterholes Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Trents to Waterholes (Sector 6)

Table 17: Sector 6 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Trents Road (Sector 5)

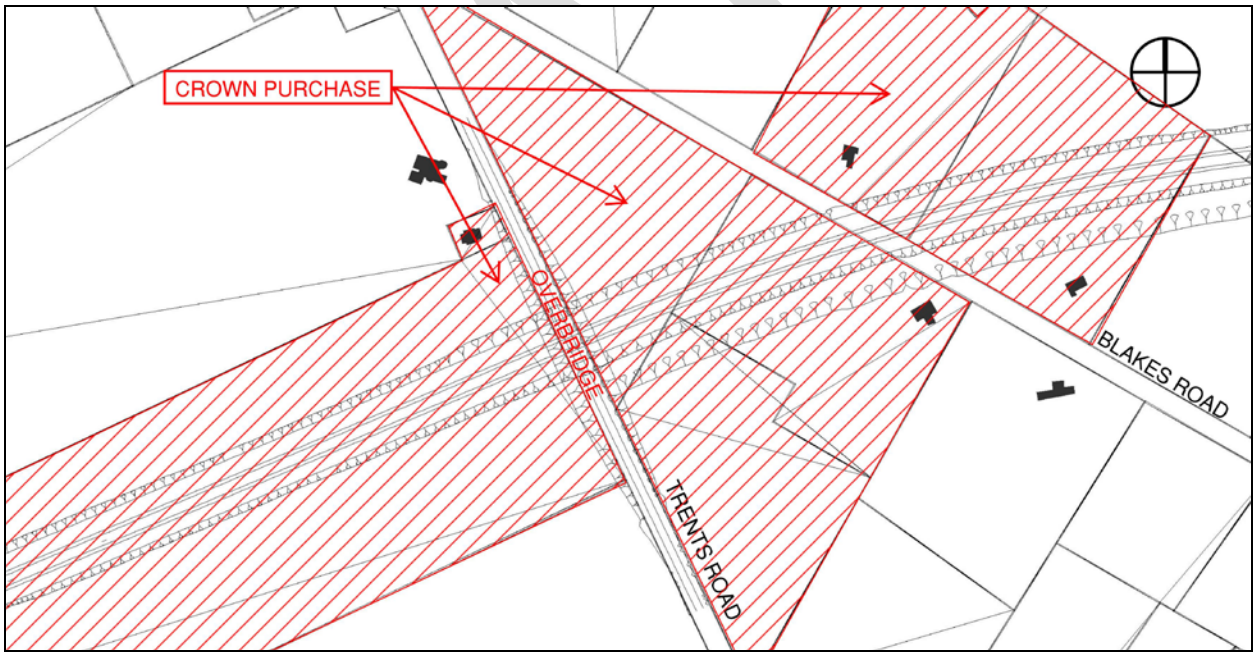

Table 18: Sector 5 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northern end of Trents Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Trents Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Marshs to Trents (Sector 4)

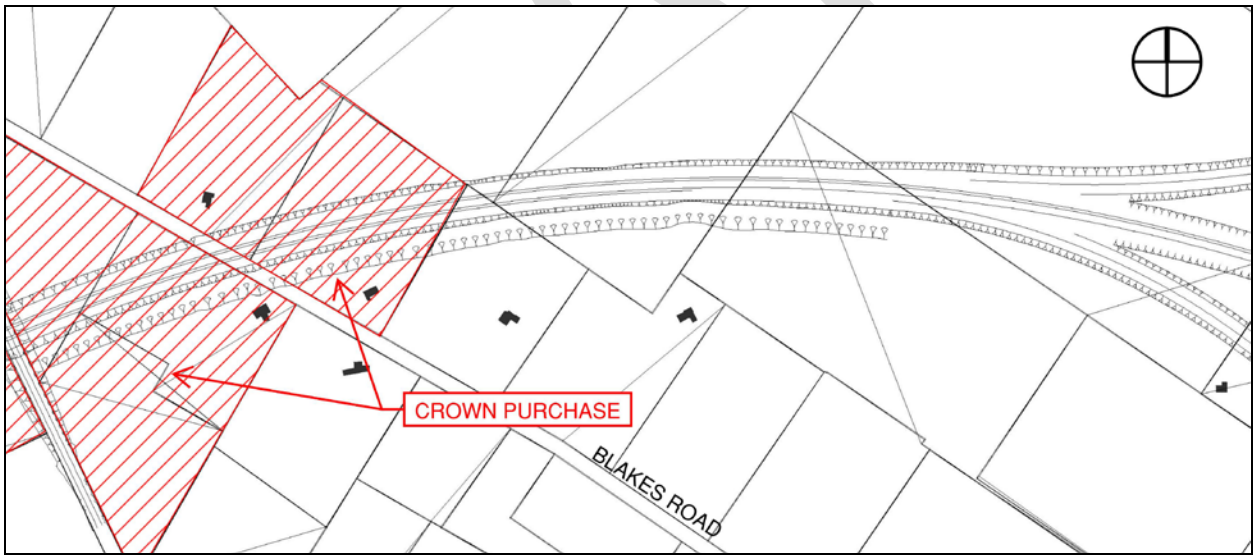

Table 19: Sector 4 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Unlikely to exceed 70 dB L_{Aeq} daytime noise criterion. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Shands Road (Sector 3)

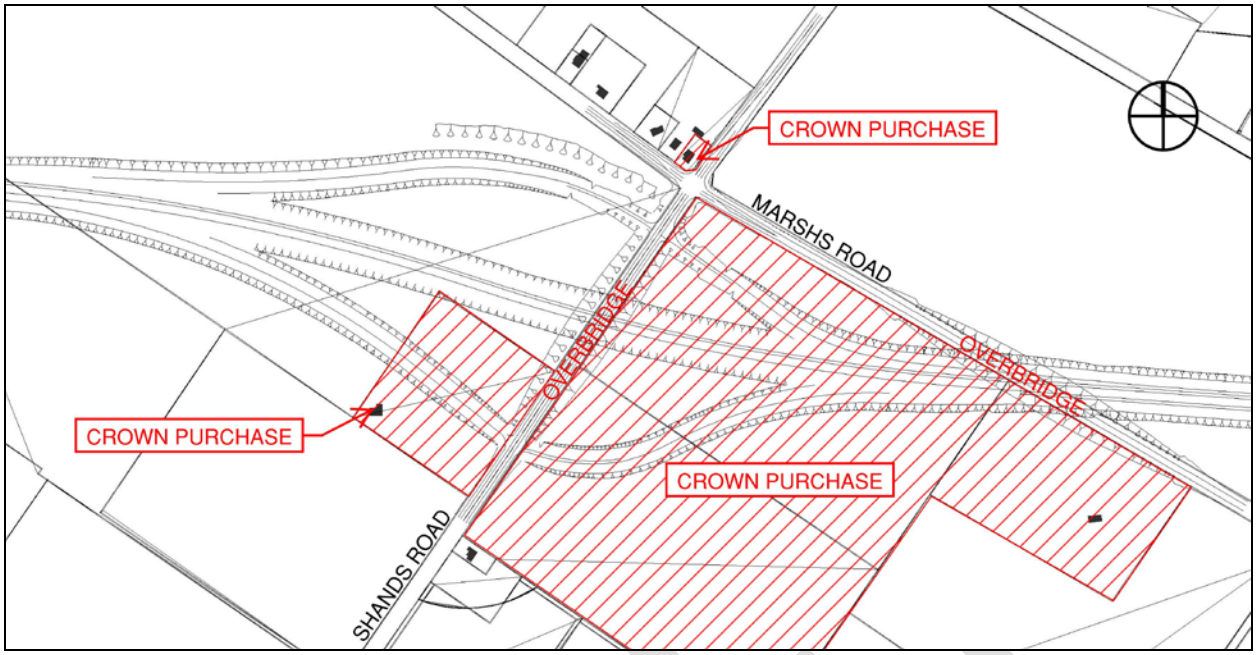

Table 20: Sector 3 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at northen end of Shands Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Shands Rd and Marshs Road overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

CSM2 – Shands to Marshs (Sector 2)

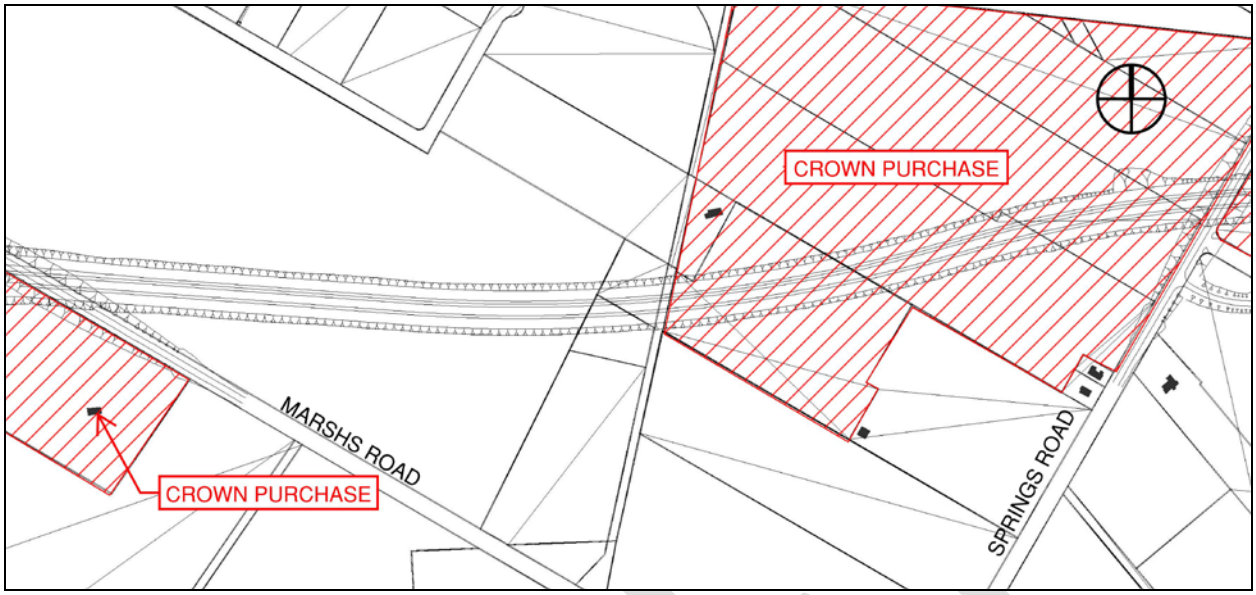

Table 21: Sector 2 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Unlikely to exceed 70 dB L_{Aeq} daytime noise criterion. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.
General Earthworks	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	

Halswell Junction/Springs Road (Sector 1)

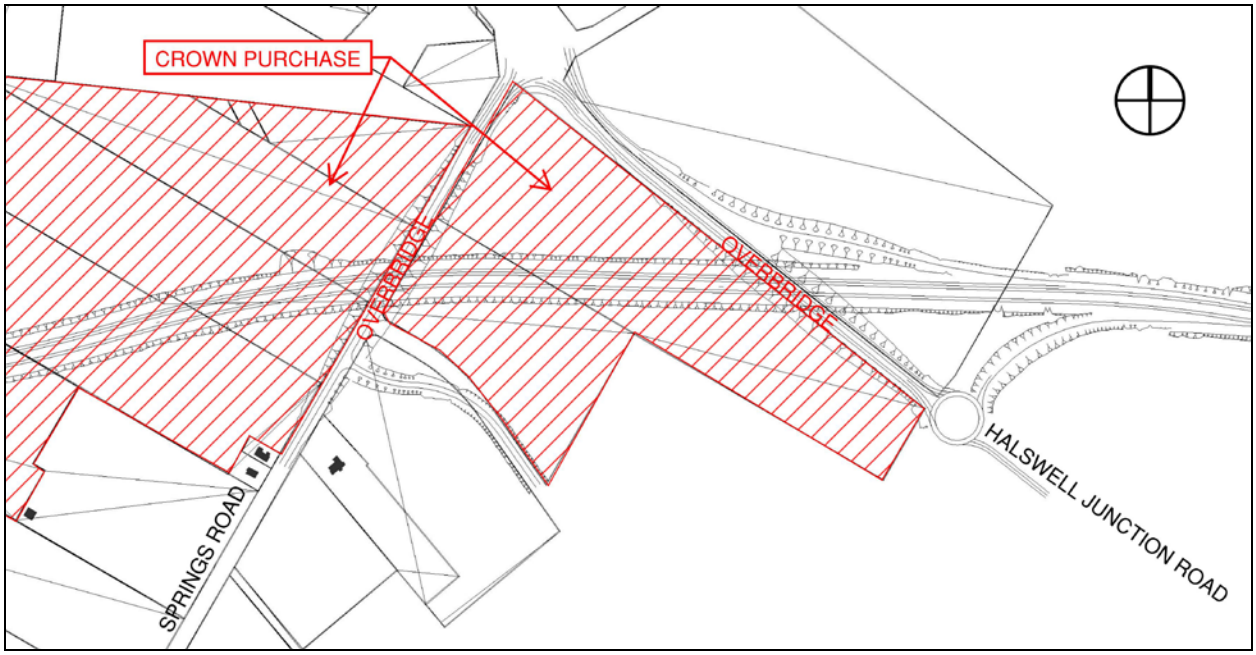

Table 22: Sector 1 construction activities and potential to exceed the Project noise criteria

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
Enabling Works	Heavy machinery e.g. excavators, compactors, rollers.	Potential to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time. Likely to exceed night-time 45 dB L_{Aeq} noise criteria.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday.
	General site erection	Potential to exceed 45dB L_{Aeq} night-time criteria for short periods of time.	
Topsoil Stripping	Motor scraper	Likely to exceed 70 dB L_{Aeq} daytime noise criterion for short periods of time when within 180m of occupied residential dwellings. Will significantly exceed 45 dB L_{Aeq} night-time criterion.	Restrict motor scraper use to 0730 – 1800 Monday to Saturday.

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
General Earthworks (Main Alignment)	Heavy machinery e.g. excavators, compactors, spreaders.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
General Earthworks (Bridges)	Heavy machinery e.g. excavators, compactors, spreaders.	Unlikely to exceed daytime noise criteria except where works occur within 50m of occupied dwellings (at southern end of Springs Road overbridge). Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	Restrict use of heavy machinery to 0730 – 2000 Monday to Friday and 1730 – 1800 on Saturday, or ensure minimum setback distance of 900m to any occupied residential dwelling and 50m from any occupied commercial building.
Ground Improvements	Vibratory construction techniques and most piling activities	Likely to exceed 70 dB L_{Aeq} daytime noise criterion.	See general mitigation section for a discussion on Ground Improvements and Piling Techniques.
	Rollers/compactors, bored concrete piles.	Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	
Bridge Construction	Abutment preparation – driven steel piles	Likely to exceed daytime noise criteria during construction of Springs Rd overbridge.	See general mitigation section for a discussion on noise mitigation and management for Ground Improvements, Piling Techniques for night-time works.
	Abutment preparation – auger piles	Unlikely to exceed daytime noise criteria, except when occurring within 50m of occupied residential dwellings. Likely to exceed 45 dB L_{Aeq} night-time noise criterion.	

Scenario	Activity	Potential to exceed limit	Indicative Mitigation
	Installation of precast bridge structures	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 250m of occupied residential dwellings.	
Pavement Construction	Multiple items operating simultaneously.	Likely to exceed 45 dB L_{Aeq} night-time noise.	Restrict use of loud construction machinery to 0730 – 2000 Monday to Saturday.
	Single item of plant operating	Likely to exceed 45 dB L_{Aeq} night-time noise criterion when occurring within 300m of occupied residential dwellings.	