

SOUTHERN SYDNEY FREIGHT LINE

OPERATIONAL NOISE AND VIBRATION MANAGEMENT PLAN

ACOUSTICS AND AIR

REPORT NO. 05032-NM
VERSION K

WILKINSON  MURRAY

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MARCH 2013

PREPARED FOR

AUSTRALIAN RAIL TRACK CORPORATION
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ACOUSTICS AND AIR

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1 INTRODUCTION

The proposed Southern Sydney Freight Line (SSFL) is a single, bi-directional, non-electrified freight line between Sefton and Macarthur. The SSFL is designed to link the Sydney metropolitan freight network with the Australian Rail Track Corporation Ltd (ARTC) network south of Macarthur, and lies within the metropolitan Main South Line corridor. This dedicated freight line is intended to avoid operational restrictions imposed by RailCorp for passenger priority on its tracks.

This Operational Noise and Vibration Management Plan addresses the requirements of Condition 51 of the project's Conditions of Approval (refer to Appendix B), namely:

- Identifying sensitive receivers (including those outside residential areas);
- Identifying the appropriate operational noise and vibration objectives and levels for sensitive receivers;
- Predicting operational noise and vibration impacts at sensitive receivers;
- Examining all "reasonable and feasible" noise and/or vibration mitigation measures;
- Identifying specific physical and managerial measures for controlling noise and vibration including location, type and timing for erection of permanent noise barriers and/or other noise mitigation measures demonstrating best practice;
- Prescribing a Source Control Plan which identifies strategies for source controls including:
 - (i) a program of condition monitoring for the purpose of minimising noise emissions from freight rolling stock and maintenance activities, and
 - (ii) targets, assessment, action and review processes for incorporation and implementation of best practice measures
- Specifying procedures for complaints management, including investigation and monitoring (subject to complainant agreement), and
- Specifying procedures for reviewing the adequacy of operational noise and vibration mitigation measures.

This Operational Noise and Vibration Management Plan also directly addresses the monitoring, reporting and strategy-review requirements of Condition 54 of the Conditions of Approval.

This Plan references Condition L6 of the Environment Protection Licence 3142 which prescribes locomotive noise level limits.

This Plan discusses noise walls in acoustic terms. The design of the walls, including an assessment for the potential for graffiti and other forms of vandalism, is discussed in SSFL Urban Design and Landscape Plan (UDLP) prepared by Caldis Cook Group, ARTC and Aurecon.

2 OPERATIONAL NOISE AND VIBRATION ISSUES

2.1 Potential Sources of Noise and Vibration

The SSFL has potential to generate the following types of noise impacts to receivers:

- Train pass-by noise;
- Noise from maintenance activities (including rail maintenance vehicles),
- Noise from train horns (eg, as they depart),
- Noise from trains at idle locations; and
- Noise from crossovers and turnouts.

The potential for vibration impacts from the operation of the SSFL is contained to the consideration of vibration transmitted to buildings from freight train or maintenance vehicle pass-bys, and is discussed further in Section 7.

2.2 Passby Noise

Noise from train pass-bys is assessed in detail in Section 6, and noise from maintenance activities in Section 6.10.

2.3 Noise from Train Horns

The SSFL is expected to reduce the need for drivers to sound train horns as freight trains will no longer be required to stop (and therefore re-start) at either stations or grade-crossings.

It is noted that Network Rule NTR408 requires that: Rail traffic whistles must be sounded during an approach to:

- level crossings
- shunting movements on adjacent tracks
- crossing or passing movements at sidings and loops
- people or animals near the track, and
- WHISTLE signs
- unless instructed otherwise by signs, tunnel entrances & exits.

The potential for impacts from train horns is not considered further.

2.4 Noise from Trains Idling

During operations without the SSFL, freight trains have had to lie idle at locations in Macarthur, Glenfield, Leightonfield and Sefton. The frequency and duration of idle times depends on traffic on the mainline.

One of the key outcomes for the SSFL is to clear idling points and reduce idling times. Noise impact at all existing idle locations will be significantly reduced.

One permanent idling location at the crossover at Glenfield Overpass is proposed.

2.5 Noise from Crossovers and Turnouts

The noise source level of trains increases at crossovers and turnouts. The noise model included all crossovers and turnouts on the existing mainline and the proposed SSFL. Some of the existing crossovers and turnouts will be removed during construction of the SSFL, and those were removed from the noise model of the SSFL.

To model noise from crossovers and turnouts, noise emission from a section of track 5m either side of the location (total length 10m) was increased in noise level by 10dBA. The noise source for this additional noise was located at track height.

An assessment of the proposed crossovers and turnouts is presented in Section 6.12.

3 IDENTIFICATION OF NOISE SENSITIVE RECEIVERS

Areas surrounding the SSFL vary in their nature, topography and usage. At the northern end, the surrounding areas are predominantly residential and interspersed with areas of commercial and light industrial usage. Progressing towards the south, residential areas become more sporadic and larger areas of industrial and open land uses are apparent.

To quantify the potential for noise impacts from the SSFL, this assessment has given consideration to all types of noise-sensitive receivers adjacent to the SSFL corridor, including residences, schools, hospitals, places of worship, industrial receivers and recreational spaces, and inclusive of specialist receivers such as the Casula Arts Centre, WIN Radio and Warwick Farm Stables (each of which is discussed further in Section 4.1.2).

The noise-sensitive receivers identified as being potentially most affected by SSFL operations are presented in Table 3-1 and Appendix F. Generally, given the more stringent criteria that apply to them, most noise-affected receivers are residential in nature. Where this is not the case, this is noted in Table 3-1. Noise levels at the receivers identified in Table 3-1 determine the requirements for noise mitigation measures, as discussed in Section 6.

In general only the first row of houses facing the railway line was assessed. Houses further away would be shielded by this first row and would therefore have less impact. If it were the case that the houses further back required noise mitigation, then so would the houses in the first row. Noise mitigation would be applied to the first row and this mitigation would also benefit houses further away. In cases where a receiver further back was not shielded, for example upper floors were higher than those in the first row of houses, it was shown by modelling that those upper floors would still be sufficiently shielded by other buildings or noise walls.

3.1 Residential Receivers

The locations in Table 3-1 only represent a sample of all houses along the route, and the number of residences they represent is also listed on Table 3-1. The height of the receiver represents the height above ground of the top floor of the highest building in the represented group rather than the height of the named property. As each point represents several receivers the intent was to use the highest floor of any receiver represented by that point. In many cases this results in a conservative prediction.

As far as possible all potentially impacted residences have been included, including residences above commercial premises wherever they were identified. In the case of apartment buildings, duplexes, semi-detached and town houses, the number of residences represented by a receiver location may not be exact.

In the case of multi-storey buildings, noise was assessed at the highest identified residential floor. Table 3-1 includes the assumed receiver height above ground level.

3.2 Non-Residential Receivers

As described in Section 4.1.2, assessment criteria for most noise-sensitive non-residential receivers, including schools, hospitals, places of worship and childcare centres, are the same as for residences. For this reason, to determine mitigation requirements it is not necessary to explicitly identify all potentially-affected non-residential receivers, provided that they are within the area covered by a representative residential location. Where this is not the case, a specific location is assigned to cover non-residential receivers. Two examples of non-residential receivers covered by the residential assessment are:

- The Salvation Army Citadel at 29 Rudd Road, Leumeah, is 115m from the rail line, which is further from the line than Receiver 1140. It is also lower in height than Receiver 1140 so noise impact is adequately addressed by assessment at Receiver 1140.
- Hurlstone Agricultural College is addressed by assessment at Receiver 866 which is closer to the rail line.

A further non-residential receiver not assessed is the playing fields of Liverpool Boys High School which are closer to the line than assessed residences in Hart Stree, Liverpool. The playing fields cover an extensive area not easily addressed by a single point assessment, and since the noise will be reduced by the SSFL, they were not specifically assessed.

The Casula Regional Arts Centre requires separate assessment as it is assessed under a different criterion (see section 4.1.2). The case of WIN radio, Campbelltown, is also discussed in 4.1.2.

Table 3-2 shows a number of noise-sensitive non-residential receivers located close to the track, and the receiver number under which they can be assessed.

Table 3-1 Noise Sensitive Receivers used for this Assessment

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
2	15 Cooper Rd	Regents Park	1.8	1
3	2 Cooper Rd	Regents Park	1.8	1
4	10 Maude St	Regents Park	4.5	2
7	22 Hope St	Regents Park	4.5	1
8	3 Morris St	Regents Park	4.5	5
10	Units in Dana Pde	Regents Park	4.5	6
12	61 Auburn Rd	Regents Park	4.5	13
16	1A Tewinga Rd	Birong	1.8	5
20	52 Auburn Rd	Birong	1.8	1
22	1 Wellington Rd	Chester Hill	1.8	5
26	10 Hill Rd	Chester Hill	1.8	5
28	47 Wellington Rd	Chester Hill	1.8	6
29	91 Wellington Rd	Chester Hill	4.5	4
31	103B Wellington Rd	Chester Hill	1.8	3
33	113 Wellington Rd	Chester Hill	4.5	5
35	149B Wellington Rd	Chester Hill	9.9	4
38	157 Wellington Rd	Chester Hill	1.8	6
44	177 Wellington Rd	Chester Hill	4.5	8
47	183 Wellington Rd	Chester Hill	1.8	1
50	187 Wellington Rd	Chester Hill	1.8	4
53	195 Wellington Rd	Chester Hill	1.8	2
54	105 Hector St	Chester Hill	1.8	1
55	128 Hector St	Chester Hill	1.8	1
56	7A Waldron Rd	Sefton	4.5	11
60	12-14 Wellington Rd	Sefton	1.8	7
61	21 Waldron Rd	Sefton	4.5	6
66	33A Waldron Rd	Chester Hill	4.5	7
68	30 Wellington Rd	Chester Hill	1.8	10
74	49 Waldron Rd	Chester Hill	4.5	10
79	52 Wellington Rd	Chester Hill	1.8	5
81	56 Wellington Rd (Dbl Storey)	Chester Hill	4.5	2
83	62 Wellington Rd (Dbl Storey)	Chester Hill	4.5	2
84	66 Wellington Rd (Dbl Storey)	Chester Hill	4.5	1
85	Triple Storey - 11 Singe Ln	Chester Hill	7.2	1
86	71 Waldron Rd	Chester Hill	1.8	4
91	81 Waldron Rd	Chester Hill	1.8	6
99	97 Waldron Rd	Chester Hill	1.8	7
105	109 Waldron Rd	Chester Hill	1.8	5
108	115 Waldron Rd	Chester Hill	1.8	2
112	72-74 Wellington Rd	Chester Hill	4.5	5
120	84 Wellington Rd	Chester Hill	4.5	5

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
123	88 Wellington Rd	Chester Hill	4.5	3
125	147 Waldron Rd	Chester Hill	9.9	18
131	157 Waldron Rd	Chester Hill	9.9	7
140	43 Villawood Rd	Villawood	1.8	6
143	3 Kirrang Ave	Villawood	1.8	11
151	11 Wattle Ave	Villawood	1.8	8
160	29 Wattle Ave	Villawood	1.8	11
168	47 Wattle Ave	Villawood	1.8	3
171	109 River Ave	Villawood	1.8	4
175	117 River Ave	Villawood	1.8	4
179	125 River Ave	Villawood	1.8	5
184	2 Lupin Ave	Villawood	1.8	9
189	143 River Ave	Villawood	1.8	5
194	153 River Ave	Villawood	1.8	7
203	171 River Ave	Villawood	1.8	7
208	183 River Ave	Villawood	1.8	3
212	191 River Ave	Villawood	1.8	4
214	125 The Horsley Drive	Villawood	1.8	2
216	1 Edmund St	Carramar	4.5	2
221	55 Wattle Ave	Carramar	4.5	8
230	73 Wattle Ave	Carramar	4.5	6
234	81 Wattle Ave	Carramar	4.5	4
240	102 Wattle Ave	Carramar	7.2	12
247	118 Wattle Ave	Carramar	7.2	9
249	158 Carramar Ave	Carramar	7.2	9
252	170 Sandal Cres	Carramar	7.2	9
254	2 Sanderson St	Carramar	1.8	11
261	234 River Ave	Carramar	1.8	10
265	240 River Ave	Carramar	1.8	4
267	5 Carrmar Ave	Carramar	9.9	12
273	262 River Ave	Carramar	9.9	21
279	197 Carramar Ave	Carramar	9.9	9
282	191 Carramar Ave	Carramar	9.9	9
285	178 Sandal Cres	Carramar	4.5	1
290	4 Ramsay St	Carramar	1.8	1
291	2 Moore St	Carramar	1.8	1
294	4 Moore St	Carramar	1.8	2
296	Cnr Frazer Rd/Moore St	Carramar	1.8	4
300	Eastern end of Frazer Rd	Carramar	1.8	5
306	Western end of Frazer Rd	Carramar	1.8	6
311	1 Shortlands St	Carramar	1.8	8
317	1 Prospect Rd	Carramar	1.8	3
321	7 Prospect Rd	Carramar	1.8	4

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
324	12 Prospect Rd	Carramar	4.5	6
330	24 Premier St	Carramar	1.8	3
333	20 Premier St	Carramar	1.8	1
335	23 Premier St	Carramar	1.8	5
339	17 Premier St	Carramar	1.8	1
349	110 Lansdowne Rd	Canley Vale	1.8	4
354	125 Lansdowne Rd	Canley Vale	4.5	4
358	130 Lansdowne Rd	Canley Vale	1.8	15
363	138 Lansdowne Rd	Canley Vale	1.8	6
368	148 Lansdowne Rd	Canley Vale	1.8	4
371	1 MacKenzie St	Canley Vale	1.8	1
373	150 Lansdowne Rd	Canley Vale	1.8	1
377	26 Senior St	Canley Vale	1.8	4
378	29 Senior St	Canley Vale	1.8	3
382	18 Fifth Ave	Canley Vale	1.8	1
389	139 Carcoola St	Canley Vale	1.8	6
395	136 Carcoola St	Canley Vale	1.8	5
402	4 West St	Canley Vale	1.8	2
403	5 West St	Canley Vale	1.8	2
407	22 First Ave	Canley Vale	1.8	5
409	30 First Ave	Canley Vale	1.8	3
410	38 Broomfield St	Cabramatta	1.8	3
415	48 Broomfield St	Cabramatta	1.8	8
419	54-58 Broomfield St	Cabramatta	7.2	6
423	66 Broomfield St	Cabramatta	7.2	4
424	98 Broomfield St	Cabramatta	7.2	2
425	102 Broomfield St	Cabramatta	7.2	1
429	112 Broomfield (Dbl Storey)	Cabramatta	4.5	6
434	122 Broomfield St	Cabramatta	1.8	5
438	130 Broomfield St	Cabramatta	1.8	5
441	138-142 Broomfield St (Cnr Junction)	Cabramatta	9.9	2
443	4-6 Church St (Three Storey)	Cabramatta	7.2	6
445	225 Railway Pde	Cabramatta	4.5	6
450	230 Railway Pde	Cabramatta	7.2	10
454	234 Railway Pde	Cabramatta	4.5	3
456	237 Railway Pde	Cabramatta	4.5	2
460	148 Broomfield St	Cabramatta	1.8	6
467	162 Broomfield St	Cabramatta	1.8	9
474	176 Broomfield St	Cabramatta	1.8	3
475	10 Sussex St	Cabramatta	1.8	1
478	1 Nicholls St	Warwick Farm	1.8	3
480	3 Station St	Warwick Farm	1.8	3
485	13 Station St	Warwick Farm	1.8	6

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
491	25 Station St	Warwick Farm	1.8	4
498	Most Affected Unit at 1 Manning St	Warwick Farm	4.5	8
499	Most Affected Unit at 3 Manning St	Warwick Farm	4.5	3
500	Liverpool Hospital	Liverpool	10	1
501	Liverpool TAFE	Liverpool	10	1
503	22-24 Remembrance Ave	Liverpool	4.5	24
508	9 Hart St	Liverpool	4.5	21
513	19 Hart St	Liverpool	4.5	9
514	Liverpool Hospital Childcare	Liverpool	1.5	1
515	Most Affected Unit at 4 Riverpark Rd	Liverpool	7.2	15
517	Most Affected Unit at 2 Riverpark Rd	Liverpool	7.2	6
520	(Nthn) Unit at 3 Riverpark Rd	Liverpool	7.2	6
523	(Mid-Lot) Unit at 3 Riverpark Rd	Liverpool	7.2	6
524	(Sthn) Unit 1 at Riverpark Rd	Liverpool	7.2	3
525	(Sthn) Unit 2 at Riverpark Rd	Liverpool	7.2	3
526	(Sthn) Unit 3 Riverpark Rd	Liverpool	7.2	3
528	24 Speed St	Liverpool	7.2	21
536	50 Speed St	Liverpool	9.9	15
538	60 Speed St	Liverpool	9.9	15
542	25 Atkinson St	Liverpool	4.5	6
543	26 Atkinson St	Liverpool	4.5	4
549	14 McGowen Cres	Liverpool	4.5	6
553	22 McGowen Cr	Liverpool	4.5	6
600	36 McGowen Cres	Liverpool	4.5	5
664	33 Birkdale Cr	Liverpool	4.5	5
671	43 Birkdale Cr	Liverpool	4.5	5
676	93 Congressional Dr	Liverpool	4.5	9
683	79 Congressional Dr	Liverpool	4.5	6
688	20 Lakewood Cr	Liverpool	4.5	2
689	11 Lakewood Cr	Liverpool	4.5	1
691	1 Phoenix Cres	Casula	4.5	1
694	14 Lakewood Cres	Casula	4.5	5
706	52 St Andrews Bvde	Casula	4.5	12
713	66 St Andrews Bvde	Casula	4.5	8
721	84 St Andrews Bvde	Casula	4.5	5
723	3 Buckland Rd	Casula	4.5	6
729	15 Buckland Rd	Casula	4.5	7
739	35 Buckland Rd	Casula	1.8	1
743	28 Marsh Pde	Casula	4.5	5
749	40 Marsh Pde	Casula	4.5	5
752	70 Ashcroft Ave	Casula	4.5	5
757	22 Dunmore Cres	Casula	4.5	10
763	32 Buckland Rd	Casula	4.5	5

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
766	40 Buckland Rd	Casula	4.5	2
771	9 Casula Rd	Casula	1.8	6
772	Casula Arts Centre (Nthn end)	Casula	7.2	1
773	Casula Arts Centre (Sthn end))	Casula	7.2	1
782	57 Leacocks Ln	Casula	4.5	10
789	77 Leacocks Ln	Casula	4.5	13
793	105 Leacocks Ln	Casula	4.5	5
798	115 Leacocks Ln	Casula	4.5	9
809	21 Slessor Rd	Casula	1.8	6
813	13 Slessor Rd	Casula	1.8	6
822	1 Foreman St	Glenfield	4.5	7
832	38 Railway Pde	Glenfield	4.5	6
834	44 Railway Pde	Glenfield	4.5	8
841	68 Railway Pde	Glenfield	4.5	7
846	122 Railway Pde	Glenfield	4.5	12
855	2 Wentworth Ave	Glenfield	4.5	2
859	10 Newtown Rd	Glenfield	4.5	10
866	Roy Watts Rd	Glenfield	4.5	1
870	53 Adrian St	Macquarie Fields	1.8	7
874	111 Atchison Rd	Macquarie Fields	1.8	5
881	97 Atchison Rd	Macquarie Fields	1.8	11
890	2 Fraser St	Macquarie Fields	1.8	6
897	1 Edward St	Macquarie Fields	4.5	6
902	1 Clarence St	Macquarie Fields	4.5	5
913	23 Clarence St	Macquarie Fields	4.5	10
922	280 Railway Pde	Macquarie Fields	1.8	9
930	304 Railway Pde	Macquarie Fields	1.8	3
935	314 Railway Pde	Macquarie Fields	1.8	5
940	322 Railway Pde	Macquarie Fields	1.8	4
953	4-8 Gordon Ave	Ingleburn	4.5	6
960	11 Redfern St	Ingleburn	4.5	10
969	1-3 James St	Ingleburn	4.5	5
971	66 Macquarie Rd	Ingleburn	4.5	7
975	74 Macquarie Rd	Ingleburn	1.8	1
978	4 Aero Rd	Ingleburn	1.8	2
979	3 Stanley Rd	Ingleburn	1.8	1
980	5A Stanley Rd	Ingleburn	1.8	1
981	7 Stanley Rd	Ingleburn	1.8	1
982	9 Stanley Rd	Ingleburn	1.8	1
983	11 Stanley Rd	Ingleburn	1.8	1
984	13 Stanley Rd	Ingleburn	1.8	1
988	5B Louise Ave	Ingleburn	1.8	1
995	2 Norwich Rd	Ingleburn	1.8	3

Receiver ID	Street Address	Suburb	Height, m	Number or Residences Represented by Receiver
999	73 Stanley Rd	Ingleburn	1.8	4
1002	79 Stanley Rd	Ingleburn	1.8	2
1004	83 Stanley Rd	Ingleburn	1.8	1
1011	48 Ingleburn Rd	Ingleburn	1.8	2
1015	56 Ingleburn Rd	Ingleburn	4.5	7
1022	72 Ingleburn Rd	Ingleburn	1.8	6
1028	86 Ingleburn Rd	Ingleburn	1.8	6
1034	98 Ingleburn Rd	Ingleburn	1.8	8
1042	114 Ingleburn Rd	Ingleburn	1.8	6
1053	138A Ingleburn Rd	Ingleburn	1.8	8
1059	150 Ingleburn Rd	Ingleburn	1.8	10
1061	73 Freeman Cct	Ingleburn	1.8	5
1067	40 Wilkinson Cres	Ingleburn	1.8	10
1076	22 Wilkinson Cres	Ingleburn	1.8	2
1082	6 Victoria Rd	Minto	4.5	1
1083	4A Victoria Rd	Minto	1.8	4
1088	71 Minto Rd	Minto	1.8	1
1091	1 Durham St	Minto	1.8	6
1096	46A Minto Rd	Minto	1.8	7
1099	40-44 Minto Rd	Minto	1.8	7
1105	28 Minto Rd	Minto	1.8	3
1107	28 Somerset St (Cnr Sussex)	Minto	1.8	3
1112	8 Somerset St	Minto	1.8	9
1114	2 Westmoreland Rd	Leumeah	1.8	40
1121	54-56 O'Sullivan Rd	Leumeah	4.5	2
1125	(Units at) 15 O'Sullivan Rd	Leumeah	4.5	4
1140	(Units at) 43 Rudd Rd	Leumeah	4.5	9
1149	22 Kulgoa St	Leumeah	4.5	1
1153	18 Kulgoa St	Leumeah	4.5	4
1159	5 Watsford Rd (WIN radio studios)	Campbelltown	4.5	1
1160	Church of God Training Centre	Campbelltown	4.5	1
1161	3D Narellen Rd	Campbelltown	1.8	1
1170	2 Padua Ln	Glen Alpine	4.5	7
1175	1 Gilchrist Dr	Glen Alpine	4.5	7
1183	11 Mount Huon Ct	Glen Alpine	4.5	4
1188	9 Charmwood Ct	Glen Alpine	4.5	3
1191	6 Glen Alpine Dr	Glen Alpine	4.5	3
1192	2 Dovedale Cl	Glen Alpine	4.5	2
1193	6 Dovedale Cl	Glen Alpine	4.5	1

Table 3-2 Non-Residential Noise-Sensitive Receivers

Receiver Number	Street Address	Suburb	Receiver Description
423	66 Broomfield St	Cabramatta	Cabramatta Seventh Day Adventist Church
478	1 Nicholls St	Wawrick Farm	Lawrence Hargrave School for Specific Purposes
500	Liverpool Hospital	Liverpool	Hospital
501	Liverpool TAFE	Liverpool	School
514	Liverpool Hospital Child Care Centre	Liverpool	Liverpool Hospital Child Care Centre
772	Casula Regional Arts Centre (northern end)	Casula	Casula Regional Arts Centre (northern end)
773	Casula Regional Arts Centre (southern end)	Casula	Casula Regional Arts Centre (southern end)
1159	5 Watsford Rd	Campbelltown	WIN Radio
1160	Church of God Training Centre	Campbelltown	Church of God Training Centre

4 NOISE & VIBRATION CRITERIA

4.1 Operational Noise Criteria

4.1.1 DECCW and Director-General's Requirements

The DECCW set out its requirements for noise assessment for the SSFL in a letter dated 22 March 2005, and these are reflected in the Environmental Assessment and consent conditions for the project. These all pre-date the release of DECCW's *Interim Guideline for the Assessment of noise from Rail Infrastructure Projects (April 2007)*, which - as at the time of writing this assessment - is the prevailing standard against which noise from rail projects is assessed. The requirements are based on consideration of the *Protection of the Environment Operations Act 1997*. The DECCW considers that the construction and operation of the SSFL requires a variation to Environmental Protection Licence No. 3142 held by the ARTC. For noise assessment, DECCW's key requirements are that:

1. *The noise and vibration impacts of the SSFL line, and the cumulative noise and vibration impacts of the SSFL and activities on RailCorp tracks should be assessed against the planning goals outlined in Chapter 163 of the Environmental Noise Control Manual (ENCM) namely:*

Planning Levels: $L_{Aeq,24hr} = 55\text{dBA}$; and $L_{Amax} = 80\text{dBA}$ for residential receivers

2. *For locations where cumulative noise levels exceed relevant criteria, the relative contributions from the ARTC line and the RailCorp lines should be identified. [Note – this requirement was addressed in the EA for the project and is not repeated in this Plan.]*
3. *Feasible and reasonable mitigation measures should be considered consistent with overall noise impacts from the whole corridor not deteriorating from the existing situation. Where there are exceedances of criteria, the management of the noise contribution from the ARTC proposal and activities on RailCorp tracks on the shared rail corridor should be apportioned as agreed between the two parties.*
4. *Consideration of feasibility and reasonableness should examine a full range of noise mitigation measures including barriers, façade treatment, rolling stock design/maintenance, pricing incentives for quieter operators and curfews for noisier operators.*

The assessment and criteria requirements are further clarified in the requirements of the Director-General of the Department of Planning, which are detailed in Appendix A of Volume 1 of the Environmental Assessment. These indicate that:

- L_{Amax} noise levels should be calculated as the energy-mean noise levels from the loudest type of train pass-by at a receiver;
- for exceedances of the planning goals of less than 5dBA, it would be appropriate for mitigation to focus on strategic source control measures such as longer-term rolling stock improvements;
- for exceedances of the planning goals of 5dBA or greater, consideration must be given to feasible and reasonable mitigation measures such as barriers and acoustic dwelling treatments;

- notwithstanding this, physical mitigation measures are not required where the noise assessment identifies areas where the planning goals are currently being exceeded as a result of existing track operations, provided that it can be demonstrated that the project would not increase noise levels in these areas.

4.1.2 Clarification and Interpretation of the Criteria

Based on the above guidance, the following interpretations and clarifications have been adopted in setting criteria for this project:

- Chapter 163 of the *ENCM* does not indicate whether the “planning” noise levels referred to should be measured under free-field conditions or at a façade. However, because subsequent licence conditions specifically indicate that the same levels apply at 1 metre from a facade, the calculations included a correction for façade reflection, which for train noise was estimated at 2dBA. A correction of 2 dBA is used rather than 2.5 dBA, which is often used for traffic noise, due to the higher frequency of train noise. In addition, validation under Australian conditions indicates that façade reflection may result in a slightly lower increase than in other countries, presumably due to the typical residential construction.
- The time at which these criteria should be calculated is not specified in the Director-General’s requirements. In this Plan, calculations are performed for the year of opening of the SSFL (anticipated to be year 2010 at the time of modelling in 2009), and for the year 2020.
- The interpretation of L_{Amax} noise levels as the energy-mean maximum level from the loudest train type, as described above, was adopted in this assessment.
- The guidance in Point 1 of the DECCW requirements includes criteria only for residences. For most other noise-sensitive receivers, including schools, hospitals, places of worship and childcare centres, the residential criteria were assumed to apply.
- The Casula Regional Arts Centre theatre and art gallery provides a special case. As described in the EA for this project, based on recommendations in Australian Standard 2107, AS 2021 and other considerations, the criterion determined for this receiver is a maximum external noise level of 77 dBA.
- The studios of WIN Radio, 6 Watsford Rd Campbelltown, also represent a special case. Here it can be assumed that the design of the studios is sufficient to provide adequate protection from existing noise. The neighbouring property is a church, and in practice a barrier is required in front of the studios to achieve residential criteria at the church. Hence, future noise levels in the studios will be lower than existing. For this reason, detailed analysis of internal noise levels in the studios is not considered necessary.
- A further special case is horse stables associated with Warwick Farm Racecourse. No accepted criteria exist for assessment of the impact of intermittent noise, such as that from rail traffic, on animals. A discussion of the literature and noise predictions to the stables is given in Section 6.11.
- Using the $L_{Aeq,24hr}$ descriptor, determining the relative contribution of the existing RailCorp and proposed SSFL lines to the total noise level (as described in Point 2 of the DECCW requirements) is relatively straightforward. Such apportioning is not as obvious using the L_{Amax} descriptor — presumably, the loudest train type contributes 100% of the L_{Amax} level. For the SSFL, the $L_{Aeq,24hr}$ noise level is the most important in determining compliance with criteria, and the apportioning of noise between operators was determined with reference to only this descriptor.

- Between Ingleburn and Glenfield it is proposed to use an existing passing loop for the SSFL operations. No work is to be undertaken on this track, but because the project would involve a significant intensification of use on this existing line, some assessment of the resulting noise impacts is required. In this Plan, the “planning” goals as described above are adopted for noise-sensitive receivers in this section of the track in the same way as they are for sections where a new line is to be constructed.

4.1.3 Application of “Feasible & Reasonable” to the Design of Mitigation Measures

The final selection of noise mitigation is guided by definitions of “feasible and reasonable” outlined in the Project Approval:

- Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context.
- Feasible relates to engineering considerations and what is practical to build.
- Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.

Using the above definitions, outlined in the requirements of the DECCW and the Director-General, the application of “feasible and reasonable” to the design of mitigation measures was interpreted as described in the following paragraphs.

The planning noise goals described above were adopted in all cases for assessment of operational noise impacts, both before and after the introduction of the proposal. Where predicted noise levels 10 years after the opening of the project exceeded these planning goals, mitigation measures were considered to be required, provided these measures were deemed “feasible and reasonable”.

Where the project would **not** result in an increase in existing noise levels, provision of further mitigation as part of the project is not considered “feasible and reasonable”, even though the final noise levels may exceed the planning criteria. An increase in noise levels is determined to occur if:

- there would be an increase in noise levels immediately following the opening of the proposal (expected in year 2010);
OR
- the predicted noise level 10 years after opening of the project (nominally, year 2020) is higher than the predicted level in the absence of the project (the “do nothing” case), taking account of the projected growth in traffic on the line in both cases.

Where the project **would** result in an increase in existing noise levels, and where the planning goals are exceeded by at least 5dB at a time 10 years after opening, provision of mitigation measures is considered “feasible and reasonable”, and the nature of such mitigation is set out in this Plan. In this case, the mitigation is designed to achieve the planning criteria, even though existing noise levels may exceed those criteria.

Any proposed mitigation measures must also be “feasible and reasonable” in terms of its practicality and consistency with other community goals. In particular, noise barriers up to a height that is generally considered feasible in engineering terms are considered “feasible and reasonable”. The maximum barrier height considered in this report is 4.2 metres above the local ground (generally 4m above track height).

4.2 Operational Vibration Criteria

Various Standards, such as German Standard DIN 4150 and British Standard BS 7385 : Part 2 – 1993, set vibration limits to protect buildings against damage resulting from operational vibration. Guidelines for human comfort within buildings are given by the DECCW in their technical guideline *Environmental Noise Management: Assessing Vibration*, and these are based on BS 6472:1992. Of all the considerations, the human comfort limits are the most stringent, in the sense that where compliance with these limits is achieved, compliance with the other objectives would also be achieved.

4.2.1 Prevention of Building Damage

The German Standard DIN 4150 suggests a limit for short-term vibration in residential buildings in terms of peak particle vibration velocity (PPV). This limit depends on the vibration frequency, but is as low as 5 millimetres per second at 10 Hertz. Similarly, the British Standard BS 7385 : Part 2 – 1993 sets a limit that also depends on the vibration frequency, but is as low as 7.5 millimetres per second PPV (at 4.5 Hertz). For the likely frequency content associated with trains, a limit of approximately 10 millimetres per second PPV can be conservatively applied, based on either of these Standards.

For commercial receivers in modern reinforced concrete framed structures, higher limits of 25 millimetres per second would apply in accordance with the British Standard. For vibration-sensitive heritage buildings, a vibration limit of 3 millimetres per second is suggested by DIN 4150. However, it is understood that there are no such buildings close to the proposed track.

4.2.2 Prevention of Disturbance of Human Comfort

British Standard BS 6472:1992 sets vibration limits for human comfort in terms of a vibration dose value (VDV), which is expressed in units of metres per second^{1.75}. This is calculated from the weighted acceleration measured during each pass-by, and summed over pass-bys using a root-mean-squad procedure. Vibration should be measured at the point of entry to the affected person, which is often taken to occur at the centre of a floor span. However, vibration levels measured in the ground outside a residence can generally be taken as a conservative estimate of these levels.

Criteria derived from BS 6472:1992, expressed in terms of the VDV are listed in Table 4-1. These criteria define conditions that the Standard describes as giving “low probability of adverse comment”, and do not necessarily imply that vibration would not be detectable.

Table 4-1 Vibration Criteria

Location	Daytime (6.00am-10.00pm)		Night Time(10.00pm-6.00am)	
	Preferred value	Maximum value	Preferred value	Maximum Value
Critical working areas (e.g. hospital operating theatres, precision laboratories)	0.1	0.2	0.1	0.2
Residential buildings	0.2	0.4	0.13	0.26
Offices, schools, education institutions and places of worship	0.4	0.8	0.4	0.8
Workshops	0.8	1.6	0.8	1.6

5 CONSIDERATION OF FEASIBLE AND REASONABLE NOISE & VIBRATION MITIGATION MEASURES

5.1 Definition of Feasible and Reasonable

This section assesses the “feasibility and reasonableness” of strategies for the reduction of operational noise and vibration from the project in order to implement best practice methods. This is not just the barrier design, but the managerial response that reduces idling, braking and acceleration of freight trains.

As described in Section 4.1.3, the final selection of noise mitigation is guided by definitions outlined in the Project Approval:

- Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context.
- Feasible relates to engineering considerations and what is practical to build.
- Reasonable relates to the application of judgement in arriving at a decision, taking into account: mitigation benefits, cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.

The final selection of noise mitigation represents best practice in railway design and operation.

5.2 Summary of Mitigations Included and Considered

Table 5-1 summaries all noise mitigation techniques and strategies that were considered. There are three broad categories: design considerations relating to the track and alignment; at source mitigations; and mitigations between source and receiver or at receiver itself.

Some of the mitigation techniques require more detailed discussion, and the table lists the section of this report where the item is discussed.

Table 5-1 Summary of Mitigations

Mitigation	Comments	Section where discussed
Track Design considerations		
Track alignment	The track is deliberately located on the western side of the existing line in the southern section and on the eastern side in the northern section. This minimises the number of residences exposed to increased noise levels as a result of the project.	5.3
Bridge Design	New bridges structures are designed as either concrete or composite concrete / steel structures, which would avoid additional noise generation by the bridge structures themselves.	5.3
Flyover Location	The proposed passing loop is located on the Glenfield flyover structure, minimising noise impact from trains parked on the loop.	5.3
Vertical geometry design to limit locomotive and rolling stock noise	The track has been designed to be as flat as possible to avoid either run-ins or train stretching which can be experienced with sharp vertical geometry. There are no significant grades on the line except at the flyover which is away from noise sensitive receivers.	

Mitigation	Comments	Section where discussed
At Source Mitigations		
Reduction of train speed	Not considered reasonable	5.4
Use of quiet trains	Passenger fleet not controlled by ARTC	5.5
Restriction on number of movements	Not an efficient way to mitigate noise	5.6
Pricing incentives and curfews	No legal nor prudent opportunities	5.7
Reduced noise from idling	This is a key outcome for the SSFL	
Continuously welded tracks	The standard calls for and the design follows CWR so that joints are eliminated	
Rail dampers	Not specifically included, and would give minimal noise reduction	
Track design (rail pad stiffness; rail fastener design)	Elastic fasteners are specified to eliminate rail movement and normal pads are also specified.	
Reduction of train lengths	This is not proposed – while this can reduce noise of individual trains because of shorter by pass events it would increase the number of events and make the mitigation ineffective.	
Exclusion of noisier trains	All trains using the line must comply with the noise conditions in ARTC's EML.	
Retrofitting of existing rolling stock with composite brake blocks to reduce wheel flattening	Composite blocks have been in use for in Australia for a long time. ARTC also has wheel impact detectors located around its network to identify flat wheels and instigate appropriate mitigating action	
Low profile noise barriers located close to the track	Not considered necessary or practical.	
Mitigations between source and receiver or at receiver		
Noise barriers	Most realistic and wide-ranging option for mitigation available	5.9
Architectural treatment	May be appropriate at some dwellings	5.10
Earth mounds	The land available does not allow consideration of earth mounds. Where mitigation required noise walls are used as for the same mitigation there is a much smaller footprint required.	
Tunnels	Two types of tunnel were considered: covering the tracks with a roof, and sub-surface alignments through a bored tunnel. Covered tunnels were considered unreasonable compared to noise walls because of costs and the extra required footprint. Sub-surface alignments were considered unreasonable due to costs and practicability especially running diesel locomotives over that distance in a tunnel.	
Property boundary fences	Noise walls were preferred where mitigation was required. Noise walls closer to the source provide better mitigation for the same height – hence a 4m noise wall can in many cases provide mitigation to a two-storey residence. A boundary fence for a two-storey residence would probably need to be higher, depending on local constraints. In many instances a property boundary fence would mean a noise wall in front of a property. Gaps for access and side streets would reduce the mitigation provided by the wall.	

5.3 Noise Mitigation Measures Incorporated Into Project Design

The following noise mitigation measures are incorporated into the project design:

- The track is deliberately located on the western side of the existing line in the southern section and on the eastern side in the northern section. This minimises the number of residences exposed to increased noise levels as a result of the project.
- New bridges structures are designed as either concrete or composite concrete / steel structures, which would avoid additional noise generation by the bridge structures themselves.
- The proposed passing loop is located on the Glenfield flyover structure, minimising noise impact from trains parked on the loop.

5.4 Reduction of Train Speeds

Slower trains may create lower maximum noise levels, and hence a reduction of train speed would reduce maximum noise levels at residences near the SSFL. However, train pass-bys would also take longer and reductions in L_{Aeq} would be lower. In any case, one of the purposes of the SSFL is to allow more efficient transport of both freight and passengers through the rail corridor, and restrictions on train speed would prevent this. This option is not, therefore, considered to comprise reasonable and feasible mitigation.

5.5 Use of Quiet Trains

The calculations described in Section 6 allow for an increase in the proportion of Tangara trains in the passenger fleet. A faster introduction of quieter passenger trains may provide a small reduction in overall noise levels. However, this is not under the control of ARTC.

At most locations noise exposure is dominated by the noise from freight operations, and in terms of $L_{Aeq,24hr}$, the levels are dominated by noise from freight wagons. Investigation of more efficient mufflers or other noise control systems for locomotives may result in a reduction in maximum noise levels, but a reduction in $L_{Aeq,24hr}$ noise levels would also require attention to noise from wagons. This noise is generated at the wheel-rail interface, close to the ground, which can be treated by noise barriers – see Section 5.9.

5.6 Restrictions on Number of Movements

$L_{Aeq,24hr}$ noise levels could be reduced by restricting the number of train movements on the SSFL, for example, by limiting the number of operations or by pricing mechanisms (discussed in more detail in Section 5.7). However, simply limiting numbers of operations would not be an efficient method of reducing L_{Aeq} . For example, if the number of freight operations was halved, the reduction in $L_{Aeq,24hr}$ would be less than 3dBA. This compares with calculated exceedances of the “planning” criteria of up to 20dBA in the absence of mitigation.

5.7 Pricing Incentives and Curfews

ARTC examined the use of pricing incentives for quieter operators and curfews for noisier operators. As background, Rail Operators using the ARTC network are required to enter into an Access Agreement(s). In doing so there are legal and contractual obligations imposed on either party, relating to performance of rolling stock, and complying with relevant design standards such as clearance envelopes, axle loads and speeds.

The Agreement also includes an access charge regime, an opportunity to 'lock in' train time paths on the network (that is, up to 10-year contracts), and arrangements for generally operating their train services also using un-contracted time train paths.

All of the Rail Operators, in conjunction with their related customers, negotiate logistical matters such as train time paths to enable mutually acceptable outcomes, to suit and accommodate all related access times with originating and terminating points of the journey – and those respective parties.

It is paramount in the role that ARTC plays, to as far as practical, accommodate all such requests from the Rail Operator and their customers to maximise the capacity of train paths on the rail network to ensure rail's role in the overall logistics chain is sustainable.

All Rail Operators, when complying with the terms and conditions of the ARTC Access Agreement, are charged transparent rates and these are based on the type of train configuration and distance operated over a given rail corridor.

To explore or initiate a variation on the access pricing regime on the basis of a train noise grading would firstly be met with extensive legal discussions and intensive meetings and discussions with ACCC, as part of the Access Undertaking. Additionally, Rail Operators survive on separate performance contract arrangements with a wide variety of freight forwarders and third parties, locomotive and rolling stock maintainers and providers, as well as 'end users' in the logistics chain.

There are no legal nor prudent opportunities to open up negotiations with Rail Operators based on the possibility of train path curfews, nor pricing alterations due to the noise footprint or requested time train paths.

5.8 Other Site-Specific Mitigation Measures

Other measures sometimes proposed to mitigate noise under certain specific circumstances include lubrication of rail tracks on tight radius curves (which do not occur on this section of track), greater monitoring of train wheel flats and the reduction in the number of track discontinuities. Some of these noise control measures could be incorporated into the rail design. However, they would not (in general) result in a significant lowering of the predicted L_{Aeq} level. The use of concrete sleepers instead of timber sleepers has not been shown to be of significant benefit in reducing the noise emission levels from train pass-bys, although some noise benefit would result in that their deployment typically results in a lowered requirement for track maintenance and therefore fewer exposures to maintenance works for residences.

5.9 Noise Barriers

For the reasons outlined above, noise barriers are considered to represent the only realistic wide-ranging technique for achieving the level of noise reduction required to meet the "planning" noise criteria at residences where noise levels would increase due to the project. However, depending on their height, barriers can present disadvantages in regard to urban design, potential overshadowing and (in some cases) detailed engineering considerations, such as design for wind loadings. Mitigation of the project's operational noise by means of noise barriers is discussed further in Section 8.

Where noise barriers do not achieve the planning goal when compared to pre-project noise levels, but do provide a noise reduction, additional treatment is not required.

5.10 Treatment to Individual Buildings

A further possible noise mitigation measure is to apply treatment to individual buildings, to limit internal noise levels within the building. This typically involves provision of air-conditioning or mechanical ventilation to allow external windows to be kept closed, and in some cases upgrading the acoustic performance of windows and other building elements.

For this project, given the number of receivers where exceedance of the relevant criteria is predicted, provision of treatment to all such receivers is considered impractical. Provision of barriers is generally considered a more cost-effective mitigation measure, because it provides a reduction in both external and internal noise levels.

For some projects, treatment of buildings is considered as an alternative to barriers where it is not possible to achieve the relevant criterion using barriers alone. However, for this project, such treatment is not considered 'reasonable' due to:

- the large number of receivers at which predicted noise levels after barrier treatment still exceed the "planning" noise criteria, and
- the fact that after barrier treatment, all such receivers would experience a reduction in noise compared with the existing situation, and most would receive a substantial reduction.

In one case however, the provision of treatment to individual buildings is considered preferable to barriers. This applies to residences backing onto Warwick St, Warwick Farm - a compact group of multi-storey apartment blocks, where barrier treatments would be relatively ineffective for residences on the upper levels. Suitable mitigation measures will be reviewed in collaboration with an independent noise consultant.

5.11 Reduced Noise from Idling

During operations without the SSFL, freight trains have had to lie idle at locations in Macarthur, Glenfield, Leightonfield and Sefton. The frequency and duration of idle times depends on traffic on the mainline.

One of the key outcomes for the SSFL is to clear idling points and reduce idling times. Noise impact at all existing idle locations will be significantly reduced.

The idling location at the Glenfield Crossover is positioned so that a train idling, even for an extended time, would not increase the $L_{Aeq,24hr}$ at any residential location. The nearest residence is approximately 260m from the idling point. Train noise is dependant on speed: slowing to a stop, then restarting. Idling at this location would not result in an increase in $L_{Aeq,24hr}$ from trains to any residence.

6 PREDICTED OPERATIONAL NOISE LEVELS

6.1 Noise Model

6.1.1 Calculation Procedure

Noise levels at each of the receivers listed in Table 3-1 were calculated using the software package CadnaA (Computer Aided Noise Abatement). The predictions of rail noise were generally performed in accordance with the document Calculation of Railway Noise 1995 (CRN) published by Her Majesty's Stationary Office on behalf of the Department of Transport in the UK. The model calculates noise levels at the affected receivers accounting for attenuation due to distance, atmospheric absorption, shielding due to natural topography or purpose-built noise barriers or buildings, and the effect of acoustically soft ground.

6.1.2 Calculation of L_{Amax}

L_{Amax} noise levels are not typically calculated using the CRN model. However, a method for determining L_{Amax} from the Cadna CRN module was provided by Datakustik, the program developers.

L_{Amax} can be determined for one receiver from one train source by selecting the "passby" option and reading off the maximum of a time trace printed out by the program. Because this is a relatively slow, manual process, it was impractical to repeat the procedure at all locations. L_{Amax} levels were predicted at locations where they might have an influence on the outcome.

The prediction of L_{Amax} included the effect of train speed.

6.1.3 Model Data Inputs

The topography in the model was based on a composite of 2m contour SSFL survey data obtained from Aurecon. The receiver locations were determined from Aerial photography. The track locations were determined from SSFL design drawings and drawings of the existing tracks provided by Aurecon.

As well as noise walls, the model takes into account other elements that provide noise mitigation, such as earth mounds, naturally occurring hills, any buildings between the line and receiver, and cuttings constructed for the existing mainline. Embankments, cutting and earthmounds are noted in the the SSFL Urban Design and Landscape Plan (UDLP) prepared by Caldis Cook Group, ARTC and Aurecon.

Data regarding number of movements, speeds, train types and mix is based on advice from Halcrow, and is consistent with that used in the EA for the project.

A summary of model inputs is shown in Table 6-1. Details of specific inputs are described in later sections as noted in the table.

Table 6-1 Summary of Model Inputs

Input	Assumption	Source	Detail Section
Topography	2m contour data	Aurecon	
Buildings	Modelled in CadnaA	Site visit, aerial surveys	
Receiver locations	Façade facing railway, top level of multi-storey buildings	Site visit, aerial surveys	
Calculation Algorithm	CadnaA CRN module		
Embankments, cuttings	Modelled in CadnaA from UDLP	Modelled in CadnaA from UDLP	
Train movements on SSFL		Halcrow	6.5
Train movements on existing line		Halcrow	6.4
Main Line Train Speeds		Halcrow	6.3
Freight Train Maximum Speed on SSFL	Sefton to Glenfield – 80 km/h (the Sydney Metropolitan speed limit for freight trains) Glenfield to Campbelltown – 115 km/h.	Halcrow	6.3
Train mix	80km/h for passenger trains. For freight see Table 6-4	Halcrow	6.5
Electric Passenger train mix	For 2010, 50% Tangara and 25% each for K sets and S sets were assumed. For 2020, 75% Tangara and 12.5% each for K sets and S sets was assumed;	Halcrow	6.5
Diesel Passenger train mix	An equal mix of XPT and Endeavour trains was assumed,	Halcrow	6.5
Freight Train mix	A total of 60% 81 class locomotives and 40% NR class was assumed. The mean length was assumed to be 900 metres in 2010 and 1,000 metres in 2020	Halcrow	6.5
Freight train locomotives	An average of 2.5 locos per train was allowed for NR-hauled trains, and 2 per train for other loco types.	Halcrow	6.5
Freight Train Maximum Speed	Sefton to Glenfield – 80 km/h (the Sydney Metropolitan speed limit for freight trains) Glenfield to Campbelltown – 115 km/h.	Halcrow	6.3

Input	Assumption	Source	Detail Section
Source noise levels	Medium wheel defect		
	Passenger train source height 0.5m.	RailCorp Train	
	Diesel source height: exhaust 4m, engine 2m, track 0.5m.	Noise Database	
Crossovers and Turnouts	Noise 5m either side increases by 10dBA		2.5 and 6.12

6.1.4 Differences to Model used in Environmental Assessment

Several modifications to the design presented in the Environmental Assessment have been included. Some of these relate to barriers for noise mitigation described in Section 8. The modifications are:

- The barrier at Kirrang Avenue, Villawood, was drawn incorrectly in the EA – the full extent of the barrier is to approximately the beginning of Kirrang Ave;
- At Sefton Station there is a gap in the barrier due to the required access to the Station precinct;
- At Cooper Road, Birrong, the design was changed to create a deeper cut which negated the need for noise mitigation at this location;
- Liverpool Hospital – the childcare centre east of the line was not assessed in previous drafts of this report due. It has now been reinstated and assessed.

6.2 Number of Movements

Current and projected future movements for the three relevant sections of track are as shown in Table 6-2 for both freight and passenger services.

Currently, some freight operations run via Granville and Fairfield rather than via Sefton, and it is likely that some operations using the SSFL would also use this route, and hence would not operate on the Sefton – Cabramatta section. This is estimated to apply to five movements per day in 2010 and seven per day in 2020, most of these being at night. However, for the purpose of noise assessment it is conservatively assumed that all freight movements would run on the entire length of the SSFL.

Four scenarios were considered in the calculations:

- “2010 Before” (ie. immediately before the opening of the SSFL) – movement numbers for 2010 with all movements on the existing tracks;
- “2010 After” (ie. immediately after the opening of the SSFL) - movement numbers for 2010 with most freight movements on the SSFL;
- “2020” – movement numbers for 2020 with most freight movements on the SSFL; and
- “2020 No SSFL” – this represents predicted noise levels in 2020 if the project were not to proceed. ARTC has indicated that the SSFL’s specific contribution to the additional freight traffic generated on this section of line is between a quarter and a third of the total growth. Therefore, this scenario includes two thirds of the growth in freight traffic between 2010 and 2020 as shown in Table 6-2, with other traffic at the 2010 levels. All traffic is on the existing lines.

In the “2010 After” and “2020” scenarios, the following freight movements were assumed to occur on the existing tracks:

“2010 After”: 4 trains per day on each of the Up and Down tracks (50% day, 50% night);

“2020”: 6 trains per day on each of the Up and Down tracks (50% day, 50% night).

Table 6-2 Train Movements per Day

Year	Time Period	Train Type	Sefton - Cabramatta		Cabramatta - Glenfield		Glenfield - Campbelltown	
			Down	Up	Down	Up	Down	Up
2010	Day (7am-10pm)	Electric Passenger	53	52	60	64	90	89
		Diesel Passenger	4	3	4	3	6	5
		Freight	9	11	9	11	9	11
	Night (10pm-7am)	Electric Passenger	13	12	23	21	27	28
		Diesel Passenger	0	1	0	1	0	1
		Freight	8	5	8	5	8	5
2020 (with SSFL)	Day (7am-10pm)	Electric Passenger	53	52	60	64	98	97
		Diesel Passenger	0	0	0	0	6	5
		Freight	18	18	18	18	18	18
	Night (10pm-7am)	Electric Passenger	13	12	23	21	27	28
		Diesel Passenger	0	0	0	0	0	1
		Freight	13	13	13	13	13	13

The short section of track east of Auburn Road, Birrong, carries only freight movements for both the existing and proposed tracks. Movement numbers here would be equal to the freight movements for the Sefton – Cabramatta section shown in Table 6-2.

Table 6-2 shows a reduction in Diesel passenger trains for the year 2020. It is expected that diesel passenger trains will be predominantly using the East Hills Line north of Glenfield.

6.3 Train Speeds for SSFL

The proposed line speeds for the SSFL are:

- Sefton to Glenfield – 80 km/h (the Sydney Metropolitan speed limit for freight trains)
- Glenfield to Campbelltown – 115 km/h.

The train speeds on the existing lines were reviewed by Halcrow in December 2009 in order to determine where the proposed speeds would not be reached.

The train types used in the model represented:

- A Superfreighter capable of meeting 115 km/h A2 timings. The model used a train with 3 NR class locos, 3900t gross and 1434m long.
- A Freight train capable of meeting 80 km/h C2 timings. The model used a train with 2 off 81 class locos, 2260t gross and 560m long.

The maximum achievable speeds of non-stop freight trains are given in Table 6-3.

Table 6-3 Maximum Achievable Speeds of Non-Stop Trains

Location	Down A2	Down C2	Up A2	Up C2
Carramar station, 25.892 km	80 (speed limit)	80 (speed limit)	80 (speed limit)	80 (speed limit)
Liverpool Station, 35.681 km	80 (speed limit)	80 (speed limit)	80 (speed limit)	80 (speed limit)
Macquarie Fields station, 43.802 km	80	78	115 (speed limit)	80 (train limit)

All freight trains on the Sydney side of Glenfield are subject to the Sydney Metropolitan speed restriction of 80 km/h.

On the down line south of Glenfield there is a 1 in 100 gradient. This is reflected in speeds below the speed limit of 115 km/h at Macquarie Fields.

6.4 Train Speeds for Existing Lines

For noise assessment the project was considered in three sections: Sefton to Cabramatta; Cabramatta to Glenfield; and Glenfield to Cambelltown. The review of existing speeds gives the train speeds for the three track sections as presented in Table 6-4.

The speed of passenger and freight trains on the mainline was assumed to be the same with and without the SSFL.

Electric passenger trains were assumed to travel at 80 km/h in all sections.

While diesel passenger trains are capable of exceeding 80 km/h, they have to travel between the suburban trains. Hence the speed of diesel passenger trains was assumed to be the same as passenger trains.

Restrictions on the speed of freight trains on the existing mainline are:

- At Liverpool Station, 35.681 km, the line speed on the down line is 60 km/h and on the up line is 65 km/h – this gives the effective speed limits of freight trains on the Cabramatta to Glenfield section;]
- The down gradient from 43,490 km restricts speed of A2 superfreighters to 80 km/h, and C2 trains to 78 km/h, at Macquarie Fields ; and
- All C2 trains are limited to 80 km/h.

These restrictions will remain on mainline, however only the metropolitan speed limit and speed limit due to gradients will apply to the SSFL. The modelled speeds are given in Table 6-4.

Table 6-4 Maximum Train Speeds, kilometres per hour

Line	Train Type	Sefton - Cabramatta		Cabramatta - Glenfield		Glenfield - Campbelltown	
		Down	Up	Down	Up	Down	Up
SSFL	Freight A2	80	80	80	80	80	115
	Freight C2	80	80	80	80	78	80
Mainline	Freight A2	80	80	60	65	80	95
	Freight C2	80	80	60	65	78	80
Mainline	Diesel Passenger	80	80	80	80	80	80
	Electric Passenger	80	80	80	80	80	80

6.5 Train Types & Mix

Predicted train movement numbers were available only for the three classes of train shown in Table 6-2. For each of these classes, a mixture of actual train types was assumed as follows:

- electric passenger trains – For 2010, 50% Tangara and 25% each for K sets and S sets were assumed. For 2020, 75% Tangara and 12.5% each for K sets and S sets was assumed;
- diesel passenger trains – An equal mix of XPT and Endeavour trains was assumed, and
- freight trains – A total of 60% 81 class locomotives and 40% NR class was assumed. The mean length was assumed to be 900 metres in 2010 and 1,000 metres in 2020.

The source height for passenger trains was set at 0.5 metres above rail level. Freight operations were modelled as three separate sources – locomotive engine at 2 metres above rail level, locomotive exhaust at 4 metres and freight wagons at 0.5 metres. The noise level from the locomotive engine was set at 5dBA below the total from the locomotive.

An average of 2.5 locos per train was allowed for NR-hauled trains, and 2 per train for other loco types.

6.6 Source Noise Levels

Source noise levels (and spectra) for the various types of rolling stock were taken from RailCorp's Rail Noise Database, which is based on extensive measurements conducted by Wilkinson Murray and others. The levels are the average over all types of trains operational during 2002. It was assumed that the mix of trains has not changed since then.

For comparison, Table 6-5 shows noise levels from relevant sources at 15 metres and 80 kilometres per hour. The values are for rolling stock with "medium" wheel defects, and represent energy-mean measured noise levels.

Noise levels are given in terms of Sound Exposure Level (SEL). This is noise level over one second that contains the same energy as an L_{Aeq} measured over any period. It is used to compare L_{Aeq} measurements done over different periods.

Table 6-5 Comparative Source Noise Levels for Rolling Stock at 15 metres and 80 kilometres per hour

Rolling Stock	Estimated Speed (km/h)	Noise Level at 15m (dBA)	
		SEL	L _{Amax}
Loco – NR Class	80	95.8	91.0
Loco – 81 Class	80	94.3	89.7
Freight Wagons	80	85.7*	89.5
XPT	80	94.0	89.8
Endeavour	80	89.5	85.9
Tangara Set	80	87.7	82.3
K Set	80	91.6	86.5
S Set	80	90.4	85.1

Note: * For freight wagons, SEL is not an appropriate measure – the value shown is L_{Aeq} during the pass-by.

6.7 Results of Noise Modelling

6.7.1 Precedence of L_{Aeq} over L_{Amax} in assessing impacts

Preliminary calculations indicated that requirements for mitigation would be dictated by needing to achieve compliance with the L_{Aeq} rather than the L_{Amax} goal. Accordingly, this assessment focuses on the project's L_{Aeq} noise emission levels. The scenario in which the L_{Amax} has greatest possibility of superseding L_{Aeq} in importance as the controlling factor for mitigation is when receivers are situated close to the rail line.

At only one location was there a case that the L_{Amax} criterion was not satisfied, but the L_{Aeq} criterion was. That was Receiver 1160, the Church of God Training Centre, Campbelltown.

6.7.2 Summary of Results

Table 6-6 indicates the predicted L_{Aeq} noise levels (without noise mitigation) for all receivers considered by this assessment. In all cases, these are the values which determine the application of noise criteria at residences. Table 6-6 also shows L_{Amax} noise levels at non-residential receivers and at a selection of residential receivers located closest to the rail line.

Locations where mitigation measures should be considered under the guidelines in Section 4.1 are indicated in the "Mitigation Required" column of Table 6-6 as "Yes". In each case, the grounds on which mitigation is justified are given in the footnotes to the Table.

Note that each assessed receiver as shown in Table 6-6 may represent a number of actual residences or other receivers. The number of actual receivers represented is shown in Table 3-1.

The following points may be noted from this Table:

- For 127 of the 258 assessed receiver locations, the future (2020) noise levels are not predicted to increase as a result of the introduction of the SSFL. As such no noise mitigation is required. (This scenario is signified by the use of a "No(1)" in the Comments column of Table 6-6.) Noise levels decrease as many freight trains would be shifted to a track further from the residences. As noise from freight trains contributes significantly to the noise at these receivers, moving the freight away from them reduces the total noise level.
- For 20 of the assessed receiver locations, noise levels are predicted to decrease immediately after the project's opening, but predicted L_{Aeq} noise levels in the "2020 With SSFL" case are very slightly (less than 0.5dBA) higher than the "2020 No SSFL" case. This minor exceedance is not considered significant, particularly considering the nature of the assumptions involved in predicting rail traffic volumes more than ten years in the future, with and without the proposed project. Hence, provision of mitigation measures in these cases is not considered "feasible and reasonable". (This scenario is signified by "No(2)" in the Comments column in Table 6-6.)
- For 17 assessed receiver locations the predicted future noise levels will increase by more than 0.5dB due to the introduction of the SSFL, but the 2020 noise levels will remain within 5dBA of the 55dBA "planning" criterion (Section 4.1.1). Hence noise mitigation is not required (noted as "No(3)" in Table 6-6.)
- In other cases where 2020 noise levels exceed the planning criteria and are predicted to increase, the predicted exceedance is greater than 5dBA. Hence consideration of such mitigation is necessary. Such receivers have "Yes" in the Mitigation Required column of Table 6-6.
- At 15 assessed receiver locations, and particularly in the section of track in the region of Liverpool and Casula, small increases are predicted at a number of individual locations. A decision was made that provision of mitigation in this case would be contingent on the results of noise monitoring conducted after opening of the project. These receivers are identified in Table 6-6 by the "No (4)" in the Mitigation Required column
- At the Church of God, 5 Watford Road – Receiver 1160 in Table 6-6, residential noise criteria are assumed to apply, as noted in Section 4.1.2, and on this basis a barrier is required. This is the only receiver where the L_{Aeq} criterion was satisfied, yet the L_{Amax} levels increased significantly. This barrier also will have the effect of reducing noise levels at the adjacent WIN Radio studios, Receiver 1159, which is considered an acceptable outcome for these premises.
- As detailed in Section 5.7, the residences in Manning Street, Warwick Farm will be more effectively shielded from noise by means of individually treating the residential buildings rather than by providing noise barriers at the rail corridor boundary.
- At the Liverpool Hospital Childcare Centre (Receiver 514) the residential criteria were assumed to apply. Noise mitigation is therefore required.

Table 6-6 Calculated Noise Levels at Receivers in the Absence of Noise Mitigation

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
2	15 Cooper Rd	Regents Park	61.6	58.1	63.6	60.6					No(1)
3	2 Cooper Rd	Regents Park	61.9	55.8	64	57.8					No(1)
4	10 Maude St	Regents Park	65.7	61.6	67.7	64.7					No(1)
7	22 Hope St	Regents Park	66.6	62.3	68.6	64.3					No(1)
8	3 Morris St	Regents Park	67.3	62.9	69.4	64.9					No(1)
10	Units in Dana Pde	Regents Park	66.5	61.2	68.5	63					No(1)
12	61 Auburn Rd	Regents Park	68.9	64.1	70.8	65.3					No(1)
16	1A Tewinga Rd	Birong	58.6	53	60.6	54.4					No(1)
20	52 Auburn Rd	Birong	51.9	48.9	53.8	50.4					No(1)
22	1 Wellington Rd	Chester Hill	55.8	54.4	57.7	55.6					No(1)
26	10 Hill Rd	Chester Hill	56.4	53.4	58.4	55.4					No(1)
28	47 Wellington Rd	Chester Hill	63.1	62.1	64.9	65.1					No(2)
29	91 Wellington Rd	Chester Hill	61.7	62.3	63.5	66.4					Yes
31	103B Wellington Rd	Chester Hill	60.8	61.3	62.6	63.8	84.7	84.9	84.7	84.9	Yes
33	113 Wellington Rd	Chester Hill	64.3	65.3	66.1	67.7					Yes
35	149B Wellington Rd	Chester Hill	65.3	66.4	67.1	68.8					Yes
38	157 Wellington Rd	Chester Hill	60.4	59.8	62.4	62.1					No(1)
44	177 Wellington Rd	Chester Hill	62.8	63.2	64.6	64.5					Yes
47	183 Wellington Rd	Chester Hill	58.7	60	60.5	62.4					Yes
50	187 Wellington Rd	Chester Hill	62.8	63.9	64.6	66.4	84.6	81.2	84.6	81.2	Yes
53	195 Wellington Rd	Chester Hill	63.2	63.4	65	66.3					Yes
54	105 Hector St	Chester Hill	62.1	62.1	63.9	65.4					Yes
55	128 Hector St	Chester Hill	62.6	63.9	64.5	68.3					Yes
56	7A Waldron Rd	Sefton	65.5	64.9	67.3	66.9					No(1)
60	12-14 Wellington Rd	Sefton	62.4	62.9	64.3	65.6					Yes
61	21 Waldron Rd	Sefton	59.7	59.5	61.7	62.1					No(2)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
66	33A Waldron Rd	Chester Hill	67.5	65.8	69.3	68.5					No(1)
68	30 Wellington Rd	Chester Hill	60.6	61.3	62.4	65					Yes
74	49 Waldron Rd	Chester Hill	63.4	62.3	65.2	64.2					No(1)
79	52 Wellington Rd	Chester Hill	59.7	57.4	61.5	60.1					No(1)
81	56 Wellington Rd (Dbl Storey)	Chester Hill	65.6	62.6	67.4	65.9					No(1)
83	62 Wellington Rd (Dbl Storey)	Chester Hill	67.5	65.9	69.3	68.1					No(1)
84	66 Wellington Rd (Dbl Storey)	Chester Hill	56.8	53.9	58.7	56.5					No(1)
85	Triple Storey - 11 Singe Ln	Chester Hill	66.1	62.4	67.9	66.7					No(1)
86	71 Waldron Rd	Chester Hill	62.8	62.6	64.6	64.8					No(2)
91	81 Waldron Rd	Chester Hill	61.9	61.6	63.7	63.7					No(1)
99	97 Waldron Rd	Chester Hill	64.6	62.2	66.4	64.2					No(1)
105	109 Waldron Rd	Chester Hill	61.1	59.8	63	61.9					No(1)
108	115 Waldron Rd	Chester Hill	59.5	58.8	61.4	61.1					No(1)
112	72-74 Wellington Rd	Chester Hill	64.2	63.6	66	66	89.4	91.9	89.4	91.9	No(1)
120	84 Wellington Rd	Chester Hill	66.2	67.9	68	70.5					Yes
123	88 Wellington Rd	Chester Hill	66.2	67.5	67.9	70					Yes
125	147 Waldron Rd	Chester Hill	66.8	66.2	68.6	68.4					No(1)
131	157 Waldron Rd	Chester Hill	65.5	64.8	67.3	67.1	87.9		87.9		No(1)
140	43 Villawood Rd	Villawood	57.9	57.3	59.9	59.7					No(1)
143	3 Kirrang Ave	Villawood	59.7	60.1	61.7	62.5					Yes
151	11 Wattle Ave	Villawood	61.4	62	63.2	64.3	84	83.5	84	83.5	Yes
160	29 Wattle Ave	Villawood	62.7	63.9	64.5	66.4					Yes
168	47 Wattle Ave	Villawood	65.3	66.7	67.1	69.2					Yes
171	109 River Ave	Villawood	61.3	58.6	63.1	60.6					No(1)
175	117 River Ave	Villawood	59.9	58.3	61.7	60.5					No(1)
179	125 River Ave	Villawood	58.8	57.8	60.7	60.1					No(1)
184	2 Lupin Ave	Villawood	56.9	56.4	58.8	58.8					No(1)
189	143 River Ave	Villawood	59.1	58.6	61	61					No(1)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
194	153 River Ave	Villawood	61.7	60.5	63.6	62.8					No(1)
203	171 River Ave	Villawood	62.5	61.7	64.3	63.8					No(1)
208	183 River Ave	Villawood	61.3	59.9	63.1	62					No(1)
212	191 River Ave	Villawood	60.4	59	62.2	61.1					No(1)
214	125 The Horsley Dr	Villawood	58.6	57.4	60.4	59.5					No(1)
216	1 Edmund St	Carramar	66.7	68.6	68.4	71.3					Yes
221	55 Wattle Ave	Carramar	65.7	69.1	67.5	71.8	94.1	96.1	94.1	96.1	Yes
230	73 Wattle Ave	Carramar	66.1	68	67.8	70.6					Yes
234	81 Wattle Ave	Carramar	67.2	68.6	68.9	71.1					Yes
240	102 Wattle Ave	Carramar	62.2	63.1	64	65.5					Yes
247	118 Wattle Ave	Carramar	63.4	64.2	65.1	66.7					Yes
249	158 Carramar Ave	Carramar	62.3	63	64.1	65.5					Yes
252	170 Sandal Cres	Carramar	64.7	64.9	66.5	67.3	86.2	86.1	86.2	86.1	Yes
254	2 Sanderson St	Carramar	64.4	62.6	66.2	64.6					No(1)
261	234 River Ave	Carramar	59.4	58.1	61.2	60.1					No(1)
265	240 River Ave	Carramar	58.3	57.1	60.1	59.1					No(1)
267	5 Carrmar Ave	Carramar	63.9	63	65.7	65.3					No(1)
273	262 River Ave	Carramar	64.1	61.7	65.8	63.7					No(1)
279	197 Carramar Ave	Carramar	65.2	64.2	67	66.4					No(1)
282	191 Carramar Ave	Carramar	65	64.2	66.8	66.4					No(1)
285	178 Sandal Cres	Carramar	67.1	65	68.8	67					No(1)
290	4 Ramsay St	Carramar	65.4	62.5	67.1	65					No(1)
291	2 Moore St	Carramar	69	66.6	70.7	69					No(1)
294	4 Moore St	Carramar	64.4	62.9	66.2	65.3					No(1)
296	Cnr Frazer Rd/Moore St	Carramar	60.8	60.4	62.6	62.8					No(2)
300	Eastern end of Frazer Rd	Carramar	61.8	62.8	63.5	65.4					Yes
306	Western end of Frazer Rd	Carramar	62.3	62.7	64.1	65.3					Yes
311	1 Shortlands St	Carramar	62.9	62.5	64.7	64.7					No(1)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
317	1 Prospect Rd	Carramar	62.3	61.6	64.1	63.8					No(1)
321	7 Prospect Rd	Carramar	61.7	60.2	63.5	62.4					No(1)
324	12 Prospect Rd	Carramar	65.6	64.8	67.4	66.9	91.3	91.3	91.3	91.3	No(1)
330	24 Premier St	Carramar	62.8	61.3	64.5	63.3					No(1)
333	20 Premier St	Carramar	62.7	60.8	64.4	62.8					No(1)
335	23 Premier St	Carramar	67.1	64.7	68.9	66.6					No(1)
339	17 Premier St	Carramar	64.2	62.1	66	64					No(1)
349	110 Lansdowne Rd	Canley Vale	55.9	55.2	57.7	57.4					No(1)
354	125 Lansdowne Rd	Canley Vale	63.2	64.2	65	66.7					Yes
358	130 Lansdowne Rd	Canley Vale	62.8	63.9	64.6	66.4					Yes
363	138 Lansdowne Rd	Canley Vale	63.3	64.4	65	67	84.5	86.6	84.5	86.6	Yes
368	148 Lansdowne Rd	Canley Vale	63.6	64.8	65.3	67.4					Yes
371	1 MacKenzie St	Canley Vale	62.7	63.9	64.4	66.5					Yes
373	150 Lansdowne Rd	Canley Vale	63.7	64.8	65.5	67.4					Yes
377	26 Senior St	Canley Vale	67.6	65.5	69.4	67.5					No(1)
378	29 Senior St	Canley Vale	63	61.2	64.8	63.4					No(1)
382	18 Fifth Ave	Canley Vale	63.5	61.3	65.3	63.5					No(1)
389	139 Carcoola St	Canley Vale	61.6	59.8	63.4	61.9					No(1)
395	136 Carcoola St	Canley Vale	62.4	61	64.1	63.1					No(1)
402	4 West St	Canley Vale	66.5	64.2	68.3	66.2					No(1)
403	5 West St	Canley Vale	63.9	61.5	65.7	63.7					No(1)
407	22 First Ave	Canley Vale	59	57	60.8	59.2					No(1)
409	30 First Ave	Canley Vale	62.9	60.9	64.7	63					No(1)
410	38 Broomfield St	Cabramatta	63.4	64.7	65.2	67.2	84.8	86.6	84.8	86.6	Yes
415	48 Broomfield St	Cabramatta	64	64.7	66.1	67.2					Yes
419	54-58 Broomfield St	Cabramatta	66.5	66.5	68.5	68.8					No(2)
423	66 Broomfield St	Cabramatta	64.7	66.7	67.8	69.2					Yes
424	98 Broomfield St	Cabramatta	62.7	63.5	64.5	65.6					Yes

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
425	102 Broomfield St	Cabramatta	63.8	65.2	65.6	67.3					Yes
429	112 Broomfield (Dbl Storey)	Cabramatta	63.8	65.3	65.5	67.9					Yes
434	122 Broomfield St	Cabramatta	63.1	65	64.7	67.5					Yes
438	130 Broomfield St	Cabramatta	63.2	65.2	64.8	67.7					Yes
441	138-142 Broomfield St (Cnr Junction)	Cabramatta	63.8	65.2	65.4	67.7					Yes
443	4-6 Church St (Three Storey)	Cabramatta	60.6	59.6	62.5	61.8					No(1)
445	225 Railway Pde	Cabramatta	64.1	62.8	65.8	65					No(1)
450	230 Railway Pde	Cabramatta	64.6	63.7	66.2	66.1					No(1)
454	234 Railway Pde	Cabramatta	63.7	63	65.2	65.1					No(1)
456	237 Railway Pde	Cabramatta	63.7	63	65.3	65.1					No(1)
460	148 Broomfield St	Cabramatta	63.2	65.1	64.8	67.7	85.3	87.8	85.3	87.8	Yes
467	162 Broomfield St	Cabramatta	63.1	65.2	64.7	67.7					Yes
474	176 Broomfield St	Cabramatta	62.1	64.5	63.7	67.4					Yes
475	10 Sussex St	Cabramatta	62.8	63.5	64.4	68.2					Yes
478	1 Nicholls St	Warwick Farm	63.7	61.9	65.3	63.9					No(1)
480	3 Station St	Warwick Farm	63.6	61.8	65.2	63.7					No(1)
485	13 Station St	Warwick Farm	63.3	61.5	64.9	63.4	84.6		84.6		No(1)
491	25 Station St	Warwick Farm	62.4	60.8	64	62.7					No(1)
498	Most Affected Unit at 1 Manning St	Warwick Farm	61.8	65.3	63.5	68					Yes
499	Most Affected Unit at 3 Manning St	Warwick Farm	61.7	65.3	63.4	68.1					Yes
500	Liverpool Hospital	Liverpool	65.9	65.4	67.5	67.5					No(1)
501	Liverpool Tafe	Liverpool	68.6	67.3	70.7	69					No(1)
503	22-24 Remembrance Ave	Liverpool	58.8	57.4	60.4	59.3					No(1)
508	9 Hart St	Liverpool	58.9	57.4	60.5	59.4					No(1)
513	19 Hart St	Liverpool	59	57.5	60.7	59.6					No(1)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
514	Liverpool Hostpital Childcare	Liverpool	64.5	67.1	66.1	69.8					Yes
515	Most Affected Unit at 4 Riverpark Rd	Liverpool	64.5	67.1	66.1	69.8	76.8	83.3	76.8	83.3	Yes
517	Most Affected Unit at 2 Riverpark Rd	Liverpool	58.9	60.7	60.4	63.3					Yes
520	(Nthn) Unit at 3 Riverpark Rd	Liverpool	62	63.8	63.4	66.5					Yes
523	(Mid-Lot) Unit at 3 Riverpark Rd	Liverpool	62.5	63.9	64	66.4					Yes
524	(Sthn) Unit 1 at Riverpark Rd	Liverpool	65.6	66.8	67.1	70.3					Yes
525	(Sthn) Unit 2 at Riverpark Rd	Liverpool	65.7	66.3	67.2	70.2					Yes
526	(Sthn) Unit 3 Riverpark Rd	Liverpool	65.7	65.9	67.2	69.9					Yes
528	24 Speed St	Liverpool	68.2	65.9	69.7	67.5					No(1)
536	50 Speed St	Liverpool	66.6	65.1	68.1	67	90.5		90.5		No(1)
538	60 Speed St	Liverpool	64.9	64	66.4	66					No(1)
542	25 Atkinson St	Liverpool	67.1	66.4	68.6	68.3					No(1)
543	26 Atkinson St	Liverpool	67.1	66.3	68.6	68.4					No(1)
549	14 McGowen Cres	Liverpool	64.6	63.6	66.1	65.7					No(1)
553	22 McGowen Cr	Liverpool	63.3	62.6	64.8	65.5					No(4)
600	36 McGowen Cres	Liverpool	63.4	64.1	65	66.6					No(4)
664	33 Birkdale Cr	Liverpool	66.6	66	68.1	68.1					No(1)
671	43 Birkdale Cr	Liverpool	67.4	66.7	68.9	68.7					No(1)
676	93 Congressional Dr	Liverpool	66.3	65.9	67.8	67.9					No(2)
683	79 Congressional Dr	Liverpool	67	65.9	68.5	68.4					No(1)
688	20 Lakewood Cr	Liverpool	68.4	67.5	69.9	69.5					No(1)
689	11 Lakewood Cr	Liverpool	64.9	64.5	66.4	66.6					No(2)
691	1 Phoenix Cres	Casula	62.4	62.1	63.9	64.2					No(2)
694	14 Lakewood Cres	Casula	66.1	65.3	67.6	67.1					No(1)
706	52 St Andrews Bvde	Casula	68.1	67.2	69.6	69.2					No(1)
713	66 St Andrews Bvde	Casula	66.7	66.2	68.2	68.3	85.8	85.8	85.8	85.8	No(2)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
721	84 St Andrews Bvde	Casula	66.7	66.1	68.2	68.1					No(1)
723	3 Buckland Rd	Casula	63.5	63.4	65	65.6					No(4)
729	15 Buckland Rd	Casula	68	67.2	69.5	69.3					No(1)
739	35 Buckland Rd	Casula	51.3	51.9	52.9	54.4					No(3)
743	28 Marsh Pde	Casula	51.2	51.3	52.8	53.7					No(3)
749	40 Marsh Pde	Casula	53.2	53.7	54.7	56.1					No(3)
752	70 Ashcroft Ave	Casula	50.5	51	52	53.4					No(3)
757	22 Dunmore Cres	Casula	60.8	60.7	62.3	62.9					No(4)
763	32 Buckland Rd	Casula	57.7	57.7	59.3	60.1					No(4)
766	40 Buckland Rd	Casula	61.7	61.2	63.2	63.4					No(2)
771	9 Casula Rd	Casula	58.5	58.4	59.9	60.7					No(4)
772	Casula Arts Centre (Nthn end)	Casula	63.9	65.6	65.4	68.2					Yes
773	Casula Arts Centre (Sthn end)	Casula	63	65.7	64.6	68.4	85.1	89.1	85.1	89.1	Yes
782	57 Leacocks Ln	Casula	40.3	41.1	41.9	43.5					No(3)
789	77 Leacocks Ln	Casula	44.6	46.2	46.1	48.4					No(3)
793	105 Leacocks Ln	Casula	41.5	42	43	44.4					No(3)
798	115 Leacocks Ln	Casula	44.7	45.8	46.2	48.1					No(3)
809	21 Slessor Rd	Casula	55.2	55.2	56.7	56.8					No(2)
813	13 Slessor Rd	Casula	55.9	56	57.4	57.7					No(3)
822	1 Foreman St	Glenfield	64.2	63.6	65.8	65.6					No(1)
832	38 Railway Pde	Glenfield	63.9	63.6	65.5	65.6					No(2)
834	44 Railway Pde	Glenfield	63.2	63.5	64.8	65.1					No(4)
841	68 Railway Pde	Glenfield	63.4	63.3	64.9	64.8					No(1)
846	122 Railway Pde	Glenfield	61.9	63	63.6	64.8					Yes
855	2 Wentworth Ave	Glenfield	62.5	62.8	64.3	64.5					No(4)
859	10 Newtown Rd	Glenfield	57.3	58	59	59.7					No(3)
866	Roy Watts Rd	Glenfield	60.7	60.8	61.4	61.3	73	73	73	73	No(4)
870	53 Adrian St	Macquarie Fields	55.9	55.7	57.7	57.1					No(1)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	2010 No SSFL	2010 After SSFL	2020 No SSFL	2020 With SFFL	
874	111 Atchison Rd	Macquarie Fields	62.1	61.6	63.9	63	82	82	82	82	No(1)
881	97 Atchison Rd	Macquarie Fields	60.6	60.7	62.4	62.4					No(4)
890	2 Fraser St	Macquarie Fields	57	57.2	58.7	58.7					No(3)
897	1 Edward St	Macquarie Fields	61.8	61.9	63.6	63.5					No(4)
902	1 Clarence St	Macquarie Fields	60.8	61.1	62.6	62.8					No(4)
913	23 Clarence St	Macquarie Fields	56.9	56.9	58.8	58.7					No(1)
922	280 Railway Pde	Macquarie Fields	64.1	62.4	65.9	64.1					No(1)
930	304 Railway Pde	Macquarie Fields	62.9	62.8	64.6	65.1					No(2)
935	314 Railway Pde	Macquarie Fields	64.2	63.6	65.9	65.8					No(1)
940	322 Railway Pde	Macquarie Fields	63.3	61.9	65.1	64					No(1)
953	4-8 Gordon Ave	Ingleburn	66.8	65.8	68.6	68					No(1)
960	11 Redfern St	Ingleburn	65.3	64.7	67.1	67					No(1)
969	1-3 James St	Ingleburn	68.5	67.9	70.2	70.1					No(1)
971	66 Macquarie Rd	Ingleburn	62	61.9	63.8	64.3					No(2)
975	74 Macquarie Rd	Ingleburn	63.2	62.9	64.9	65.2					No(2)
978	4 Aero Rd	Ingleburn	58.7	59.1	60.4	61.5					Yes
979	3 Stanley Rd	Ingleburn	62.3	63	64.1	65.5					Yes
980	5A Stanley Rd	Ingleburn	62.6	63.3	64.3	65.8					Yes
981	7 Stanley Rd	Ingleburn	62.6	63.3	64.3	65.7					Yes
982	9 Stanley Rd	Ingleburn	63	63.6	64.7	66	84	85.5	84	85.5	Yes
983	11 Stanley Rd	Ingleburn	63.2	63.5	64.8	65.9	83.6		83.6		Yes
984	13 Stanley Rd	Ingleburn	63.6	63.7	65.3	66					Yes
988	5B Louise Ave	Ingleburn	59	59.2	60.6	61.5					Yes
995	2 Norwich Rd	Ingleburn	64	64.9	65.8	67.4					Yes
999	73 Stanley Rd	Ingleburn	63.9	64.7	65.7	67.2	85.8	88	85.8	88	Yes
1002	79 Stanley Rd	Ingleburn	63.8	64.1	65.6	66.6					Yes
1004	83 Stanley Rd	Ingleburn	63.9	64.4	65.7	66.9					Yes
1011	48 Ingleburn Rd	Ingleburn	64.5	64.1	66.3	66.3					No(1)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010	2010	2020	2020	2010	2010	2020	2020	
			No SSFL	After SSFL	No SSFL	With SFFL	No SSFL	After SSFL	No SSFL	With SFFL	
1015	56 Ingleburn Rd	Ingleburn	63.9	63.5	65.7	65.7					No(1)
1022	72 Ingleburn Rd	Ingleburn	63.6	62.7	65.4	64.9					No(1)
1028	86 Ingleburn Rd	Ingleburn	64	62.7	65.8	65.4					No(1)
1034	98 Ingleburn Rd	Ingleburn	66.1	63	68	65.2					No(1)
1042	114 Ingleburn Rd	Ingleburn	63.8	62.3	65.5	64.9					No(1)
1053	138A Ingleburn Rd	Ingleburn	64	62.6	65.8	65.3					No(1)
1059	150 Ingleburn Rd	Ingleburn	63.5	62.3	65.3	65.6					No(2)
1061	73 Freeman Cct	Ingleburn	61.6	60.6	63.3	62.9					No(1)
1067	40 Wilkinson Cres	Ingleburn	63.1	62	64.8	64.6					No(1)
1076	22 Wilkinson Cres	Ingleburn	61	60.6	62.7	63.1					No(2)
1082	6 Victoria Rd	Minto	63.9	62.5	65.7	65.4					No(1)
1083	4A Victoria Rd	Minto	64.2	62.8	66	65.9					No(1)
1088	71 Minto Rd	Minto	70.3	68.2	72.1	70.7					No(1)
1091	1 Durham St	Minto	64.2	62.8	65.9	65.2					No(1)
1096	46A Minto Rd	Minto	63.6	62.5	65.4	65.3					No(1)
1099	40-44 Minto Rd	Minto	63	62	64.7	64.8					No(2)
1105	28 Minto Rd	Minto	64	62.4	65.7	65					No(1)
1107	28 Somerset St (Cnr Sussex)	Minto	64.1	64	65.8	68.1					Yes
1112	8 Somerset St	Minto	63.8	65	65.5	69.2					Yes
1114	2 Westmoreland Rd	Leumeah	43.1	43.3	44.8	45.7					No(3)
1121	54-56 O'Sullivan Rd	Leumeah	65.5	64.6	67.2	67.2					No(1)
1125	(Units at) 15 O'Sullivan Rd	Leumeah	69.6	67.4	71.3	70.2	90.3		90.3		No(1)
1140	(Units at) 43 Rudd Rd	Leumeah	63	61.7	64.8	64.3					No(1)
1149	22 Kulgoa St	Leumeah	68.5	66.7	70.2	69.1					No(1)
1153	18 Kulgoa St	Leumeah	66.1	64.5	67.8	66.9					No(1)
1159	5 Watsford Rd	Campbelltown	57.6	57.3	59.4	60					No(3)
1160	Church of God Training Centre	Campbelltown	67	65.7	68.6	67.7	87.2	90.7	87.2	90.7	Yes
1161	3D Narellen Rd	Campbelltown	50.9	51	52.7	53.7					No(3)

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Mitigation Required?
			2010	2010	2020	2020	2010	2010	2020	2020	
			No SSFL	After SSFL	No SSFL	With SFFL	No SSFL	After SSFL	No SSFL	With SFFL	
1170	2 Padua Ln	Glen Alpine	61.2	60.5	62.8	63.2	80.4	80.4	80.4	80.4	No(2)
1175	1 Gilchrist Dr	Glen Alpine	60.5	59.8	62.1	62.3					No(2)
1183	11 Mount Huon Ct	Glen Alpine	47.4	47.6	49	50.2					No(3)
1188	9 Charmwood Ct	Glen Alpine	55.1	54.7	56.6	57.8					No(3)
1191	6 Glen Alpine Dr	Glen Alpine	55.5	55.1	57.1	58.2					No(3)
1192	2 Dovedale Cl	Glen Alpine	60.2	59.6	61.8	62.8					No(4)
1193	6 Dovedale Cl	Glen Alpine	61.8	61.1	63.4	64.3					No(4)

Notes: Reason for not considering noise mitigation:

1. no increase in noise level due to SSFL
2. decrease at opening (2010), less than 0.5dBA increase in 2020
3. within 5dBA of planning level
4. more than 5dBA above planning level but small increase at individual residences

6.8 Liverpool Hospital

Given the importance of Liverpool Hospital and its proximity to the rail corridor, noise and vibration findings from Sections 6.7 and 7.1 are discussed herewith.

6.8.1 Noise

There is no increase in noise level for Liverpool Hospital due to the SSFL, as shown in Table 6-6 for Receiver 500, and no noise mitigation measures are required for the SSFL. However, at the Liverpool Hospital Childcare Centre (Receiver 514) the residential criteria were assumed to apply, and noise mitigation is therefore required for the Centre. The location of the noise barrier is shown in Figure 8-1(c).

6.8.2 Vibration

As stated in Section 7.1, the closest buildings to either the existing or proposed future tracks are at a distance of approximately 15 metres (this includes the Liverpool Hospital). In the measurements described in Section 7, PPV values measured in the ground from either freight or passenger services did not exceed 1 millimetre per second at 10 metres from the track for any pass-by. It is clear, therefore, that a limit of 10 millimetres per second for building damage would be easily met at 15 metres, and no mitigation measures are required.

6.9 Impact on Recreational Areas

The only significant recreational area potentially affected by noise from the SSFL is the Leacock Regional Park, in Casula. This park is immediately adjacent to the existing rail line, and is in the area of the proposed bridge over the existing rail lines. At a location of 40 metres from the existing track, maximum existing noise levels in this area during the pass-by of a freight train would be approximately 87dBA. With the SSFL, including the bridge, maximum noise levels at the same position would increase by approximately 5dBA to approximately 92dBA. This change would be definitely noticeable, and would result in some loss of amenity in these areas. Toward the western side of the park, close to Leacocks Lane, maximum noise levels from existing movements would be below 70dBA. With the SSFL, these levels will increase by approximately 2dBA, which is unlikely to be noticeable.

6.10 Noise from Maintenance Activities

Maintenance of the proposed track will involve activities very similar to current maintenance of the existing track, namely:

- minor repairs, such as spot sleeper replacement and replacement of broken or defective rail, as required;
- regular maintenance, such as track resurfacing, ballast re-profiling and rail grinding, and
- major maintenance, including ballast cleaning or replacement, and large-scale replacement of rail, on a time scale of 15 – 30 years.

There are no standard criteria for assessment of noise from these intermittent activities. However, for receivers where operational noise levels would decrease as a result of the project, it likely follows (depending on the nature of the works) that noise from future maintenance works would also be lower than existing maintenance noise. Further, the *frequency* of maintenance for the SSFL is expected to be lower than for the existing track due to the use of

concrete sleepers (which require less maintenance) and it being more recently constructed.

For receivers where operational noise levels would increase as a result of the project, measures to mitigate general operation noise, as described in Section 8, would also have the effect of significantly reducing noise from maintenance of both the existing and proposed tracks.

It is concluded that the adoption of the mitigation measures described in Section 8 would ensure that noise from maintenance of the proposed track would not significantly increase existing noise levels at any location. Indeed, in many instances, the project will reduce the exposure of residents to noise from maintenance works.

6.11 Impact on Wawrick Farm Stables

Noise levels are predicted to increase at the Wawrick Farm Stables as the SSFL track is closer than the mainline, and it is in an area where freight train speed on the SSFL will be faster than existing speeds on the mainline.

The predicted increase in $L_{Aeq,24hr}$ is 3 to 4dBA (up to 70dBA at the worst affected stable). The predicted increase in L_{Amax} is 3 to 5dBA (from 86 to 91dBA at the worst affected stable)

There have been a limited number of studies of the effects of environmental noise on animals, with most concentrating on the effects of aircraft noise. A summary of the most significant studies is provided in K.M. Mancini, D.N. Gladwin, R. Villela and M.G. Cavendish (1988) "Effects of aircraft noise and sonic booms on domestic animals and wildlife: A literature synthesis" published by the Engineering and Services Centre U.S. Air Force and the Fish and Wildlife Service, U.S. Department of the Interior. The impacts of subsonic aircraft noise (or general non-impulsive environmental noise) can be assumed to be similar to impacts of general mining noise, and the effects of sonic booms can be assumed to be similar to those of blasting.

In domestic livestock, general noise at levels of about 90 dBA and above has been noted to temporarily increase levels of stress-related hormones and increase heart rate. At higher levels of about 105 dBA, reduced feed consumption was noted in one study. In wild animals, the most thoroughgoing studies have been of arctic caribou and pronghorns in New Mexico. For these animals, startle responses can result from low-altitude overflights at about 70 dBA, with escape or strong panic reactions at higher levels. One study indicates "no reaction" at overflight levels of 60 dBA and "strong reaction" at about 77dBA. At levels over about 100 dBA, physiological effects including hearing damage have been found in species including laboratory rodents.

Most studies indicate a high level of habituation to sources with similar noise levels to those from rail traffic at the stables.

A case study in Huybregts, C (2008) "Protecting horses from excessive music noise – a case study" also acknowledges that there are no criteria for predicting noise impact on thoroughbred horses. Surveys on race days showed typical L_{Aeq} levels in stalls of 55-70dBA. The author then posits a criterion of 65dBA L_{Aeq} for a new intrusive noise source, and notes the importance of removing visual stimuli associated with the noise source. No L_{Amax} levels were reported, but from the L_{Aeq} data shown there would be L_{Amax} events above 90dBA on race days.

From these studies we recommend that suitable indoor goals for stables would be L_{Aeq} 65dBA, and L_{Amax} 80dBA. This is considered conservative as horses would most likely be quickly habituated to noises above this level.

As the stables are enclosed there would be a reduction in noise levels, compared to the external

level, of at 5-10dBA (assuming the stables are naturally ventilated).

L_{Aeq} the noise level inside the stables is predicted to be at most 60-65dBA. The predicted change in maximum noise level during a train passby is at most 5dBA, up to an indoor level of 80-85dBA. Originally, it was recommended that the fabric of the stables should be upgraded where necessary, at no cost to the stable owner(s), to ensure an internal level at least 10dBA quieter than the external level. However, inspection prior to construction found that some of the stables were not fully enclosed, and one was too dilapidated to be reasonably considered for building works. For stables that are not enclosed, upgrading the "fabric of the stables" is not meaningful; there are no walls to treat and provision of ventilation is of no concern.

The Department approved ARTC's request to allow for the construction of an acoustic Colorbond fence immediately behind the stables within the rail corridor which will ensure an internal noise level at least 10dBA quieter than the external level. This would ensure that the stated goals would be achieved at all stables.

6.12 Noise Impacts from Crossovers and Turnouts

While crossovers and turnouts increase noise level, their effect is local - noise increases significantly only at residences within 30-40m of the crossover or turnout, and generally by less than 2dBA.

As the crossovers and turnouts were included in all models, this localised increase in noise applies with and without the SSFL, and in general it was found that they had no implication for recommendations for noise mitigation, even at locations where crossovers and turnouts will be removed.

There is one exception - at residences near Crossover 356. This is a new turnout to be introduced as a result of the SSFL project, but located on the city side of the study area as shown on Figure 8-1(a). Receivers close to this turnout therefore have no Receiver number and were not included in the standard noise model. The residences potentially impacted are 31, 33, 35, 37, 39, 41 Cutcliffe Ave, Regents Park. Given their proximity to the main line, their existing noise level would most likely exceed $L_{Aeq,24hr}$ 60dBA, and is predicted to increase by 1dBA due to Crossover 356. Those residences could be considered for architectural treatment.

7 OPERATIONAL VIBRATION LEVELS

Wilkinson Murray has undertaken a series of vibration measurements due to train pass-bys at three locations close to the existing Main Northern Rail Line through Hornsby (Wilkinson Murray, 2005). At each location, measurements were made at approximately 10 metres, 20 metres and 30 metres from the line, as well as within a nearby residence. The types of operations on this Line are similar to those considered in the present report, and hence data from these measurements can be used to predict vibration levels from current and future movements for this study.

7.1 Assessment of Potential for Building Damage

The closest buildings to either the existing or proposed future tracks are at a distance of approximately 15 metres (this includes the Liverpool Hospital.) In the measurements described above, PPV values measured in the ground from either freight or passenger services did not exceed 1 millimetre per second at 10 metres from the track for any pass-by. It is clear, therefore, that a limit of 10 millimetres per second for building damage would be easily met at 15 metres.

7.2 Assessment of Potential for Disturbance to Human Comfort

Table 7-1 shows summary values of VDV recorded for individual train pass-bys at each of the three measurement sites, at 10 metres from the track. The highest values recorded were a VDV of 0.027 for freight movements, and 0.023 for electric passenger movements.

Table 7-1 Measured Vibration Dose Values for Individual Pass-bys

Location	Summary (rmq) Vibration Dose Values for Individual Pass-bys at 10 metres, metres per second ^{1.75}	
	Freight	Electric Passenger
A	.027	.020
B	.013	.009
C	.024	.023

An overall VDV can be calculated for each scenario at 10 metres from the track, using the above maximum values for each movement and assumed movement numbers given in Table 6-2. (The definition of night time differs slightly between Table 6-2 and BS 6472, — the “night” train movements include all movements up to 7.00am, whereas the Standard applies to movements up to 6.00am — but this is in the direction of giving conservatively high predicted night time values). Results of this calculation are shown in Table 7-2.

It is clear from Table 7-2 that the VDV criteria of 0.2 (daytime) and 0.13 (night time) would be met even at 10 metres from every track. This represents a value that would provide a “low probability of adverse comment”, rather than a vibration level that would be undetectable.

Table 7-2 Calculated Total Vibration Dose Values at 10m from the SSFL

Scenario	Period	Total Vibration Dose Value, metres per second ^{1.75}		
2010	Day	0.080	0.083	0.089
	Night	0.061	0.066	0.069
2020	Day	0.083	0.086	0.094
	Night	0.068	0.071	0.074

8 NOISE MANAGEMENT MEASURES

This section presents the noise barrier design to be adopted in response to the criteria and requirements documented in Section 4, and the calculated noise levels shown in Section 6. The noise barrier design reflects the resolutions of community consultation, as well as the constraints imposed by engineering feasibility and other design issues.

8.1 Consultation with Key Stakeholders

With consideration of the ONVMP and Condition of Approval 52, ARTC consulted extensively with affected property owners, relevant councils and community liaison group meetings (CLGs).

- Ten meetings were held between September and November 2009 with affected property owners, both residential and business, to discuss the noise walls proposed to be constructed. Only people living or working in the immediate vicinity of each proposed noise wall were invited, with a total of 1290 invitations being letter-boxed. The meetings were not open public meetings. Attendance at meetings was low, with three meetings attracting no residents or business owners. Details of all ten meetings and the issues raised at each are contained in the facilitator's report in Appendix C.
- Discussions about noise walls with the four Local Councils were held as part of the discussions on the UDLP between February 2009 and April 2010. Details of those discussions are contained in the meetings' summary in Appendix D.
- All three CLGs have been kept informed of the noise wall meetings with affected property owners. CLG members were informed of meetings prior to their occurrence, and they discussed the noise walls all at their meetings in late 2009. The record of discussions is contained in the CLG Minutes on the SSFL website: <http://www.ssfl.artc.com.au/community-consultation>

There were no changes in noise barrier height or location as a result of these consultations.

8.2 Engineering Feasibility and other Design Issues

Barriers were designed to achieve the targets set out in Section 4, with the only constraint being a maximum barrier height of 4.2 metres above ground. The detailed design took into consideration:

- Shadow analysis for north facing sites in residential areas;
- Assessment of local flooding impacts; and
- Assessment of potential for graffiti and other forms of vandalism.

In most cases, barriers have an acoustically absorptive surface on the rail side to limit reverberant build-up of noise between the side of a train and the barrier, which would otherwise increase noise levels for receivers on the opposite side of the barrier. The absorptive surface is not necessary if there is no noise-sensitive receiver opposite the barrier. ARTC Drawing Number CI-115 indicates that absorptive barriers required a "Minimum Noise Reduction Coefficient of 0.4 at 250Hz". This will be achieved using Woodtex panels on the absorptive side of the barriers.

Figure 8-1 provides a schematic indication of where barriers are required for the project, and the type of barriers to be installed. Details of the noise walls including their locations are contained in the Urban Design & Landscape Plan which has been approved by the Department

of Planning, and in a separate supporting folder of engineering and architectural design drawings.

Table 8-1 summarises noise barrier information from the detailed design drawings and includes locations (start and finish chainages) and timing of erection of noise barriers.

Table 8-3 indicates the operational noise levels expected from the project before opening (no barriers), immediately after opening (with barriers) and 10 years after opening (with barriers). The table includes comments on mitigation, and indicates residences that will benefit from noise barriers, including those where noise mitigation was not considered reasonable and feasible.

Figure 8-1(c) indicates the small group of residences in Warwick Farm for which mitigation is likely better effected as treatment to the individual houses rather than as a noise barrier at the rail corridor (as discussed in Section 5.10). These and a small number of other residences are described in Section 8.4 where acoustic architectural treatments have been proposed as noise control options where there is no reasonable and feasible means of reducing the source noise. The locations to be considered for architectural treatment are shown in Table 8-3.

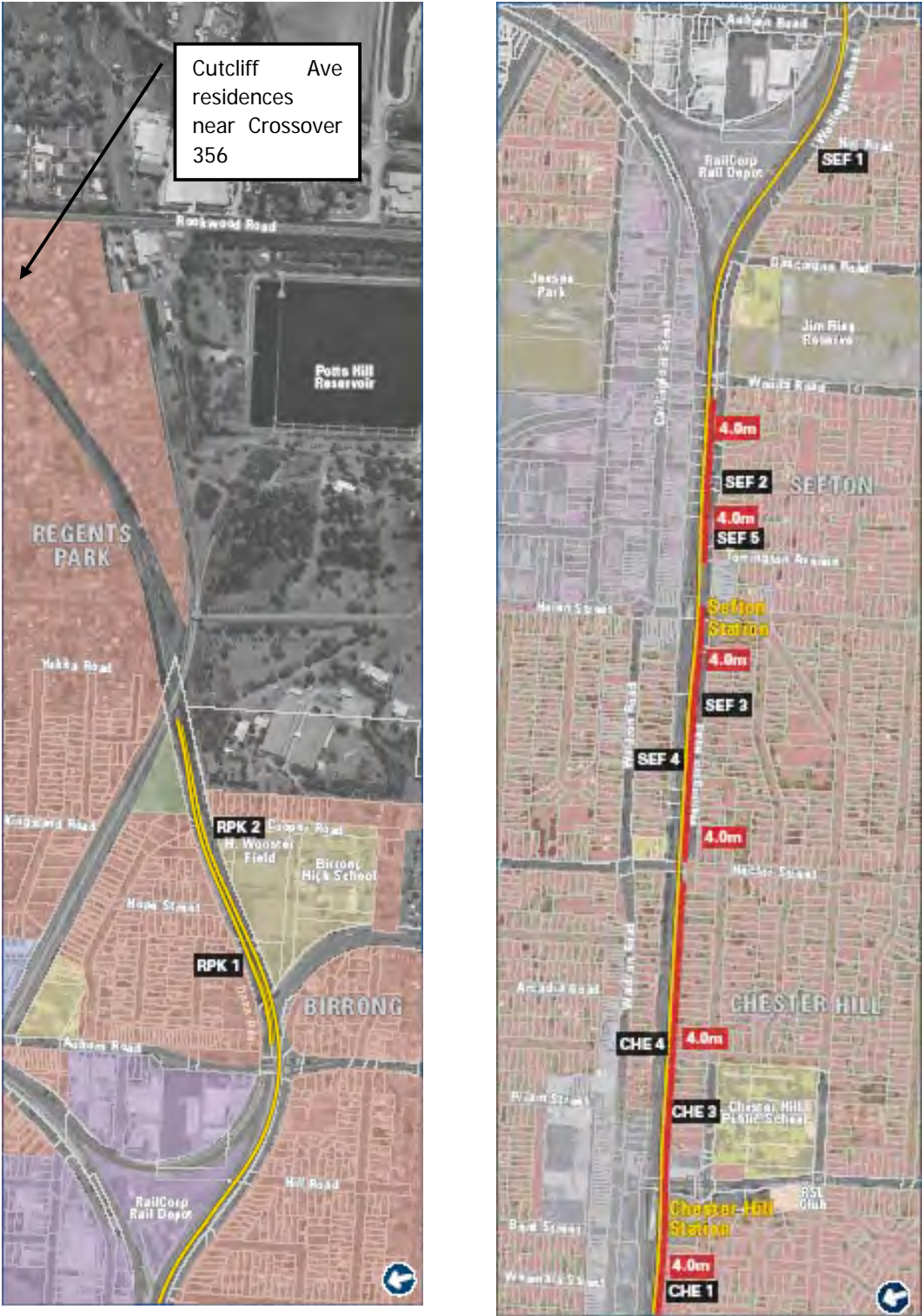


Figure 8-1(a) Approximate Noise Barrier Locations & Heights

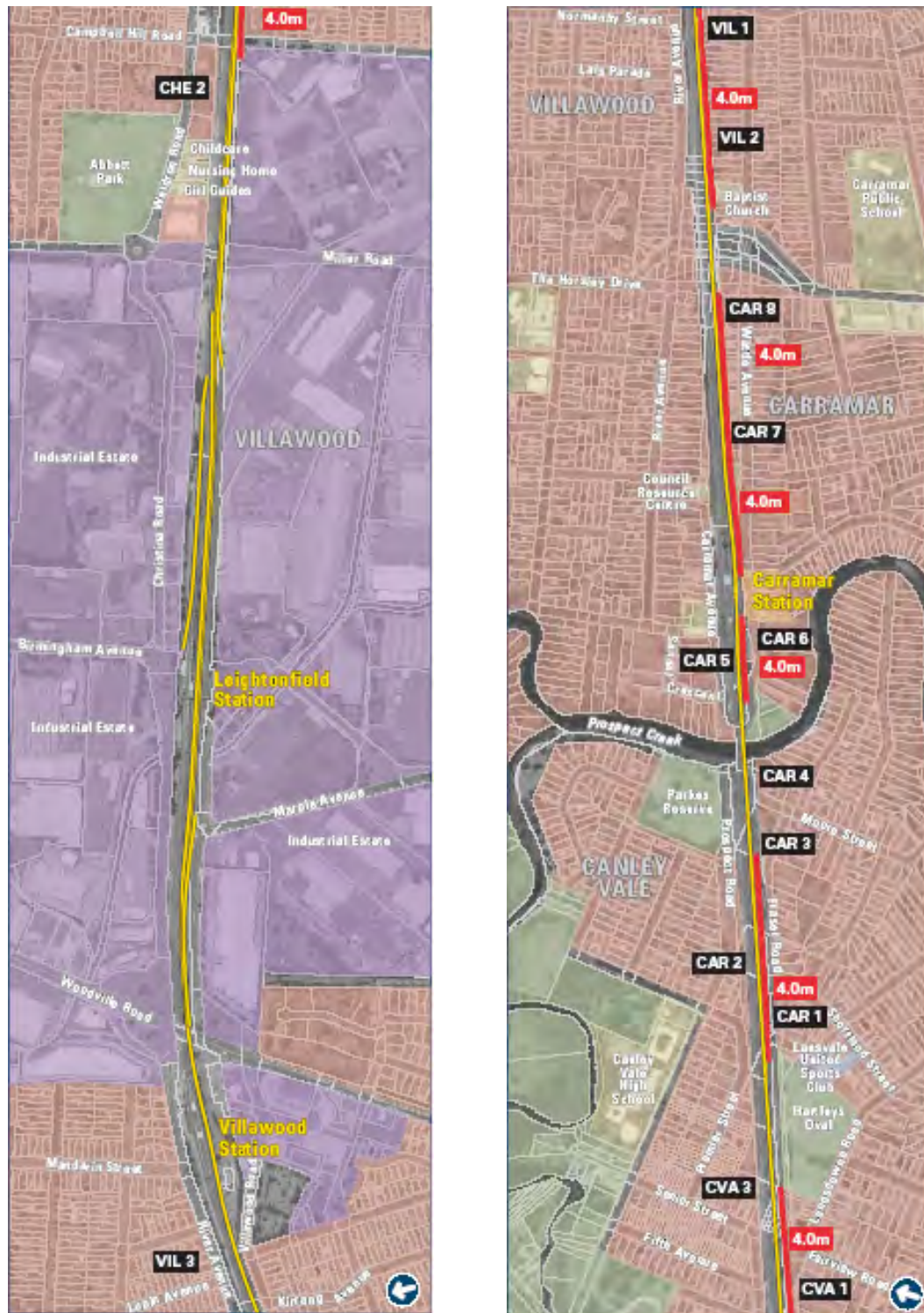


Figure 8-1(b) Approximate Noise Barrier Locations & Heights

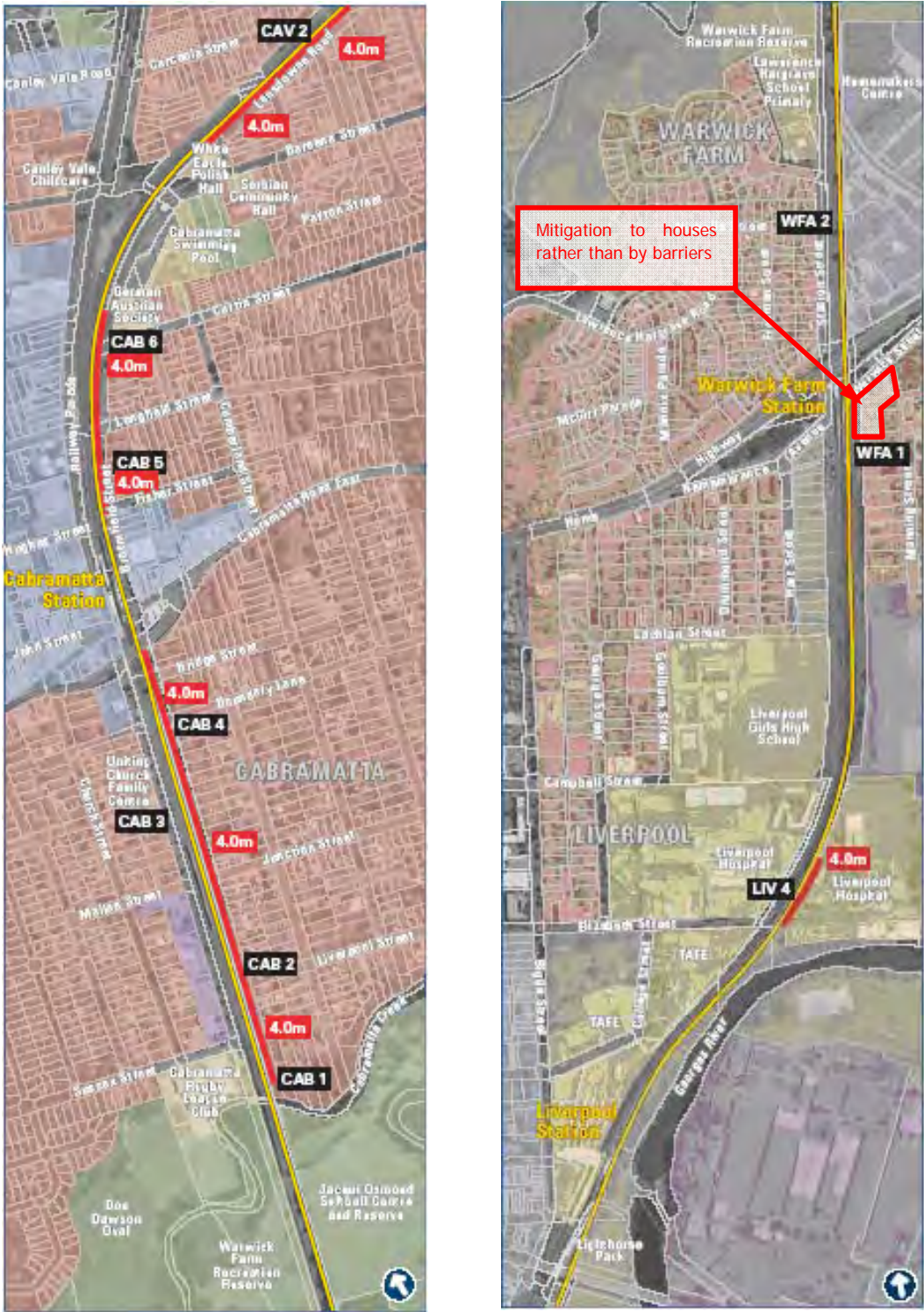


Figure 8-1(c) Approximate Noise Barrier Locations & Heights



Figure 8-1(d) Approximate Noise Barrier Locations & Heights



Figure 8-1(e) Approximate Noise Barrier Locations & Heights



Figure 8-1(f) Approximate Noise Barrier Locations & Heights



Figure 8-1(g) Approximate Noise Barrier Locations & Heights

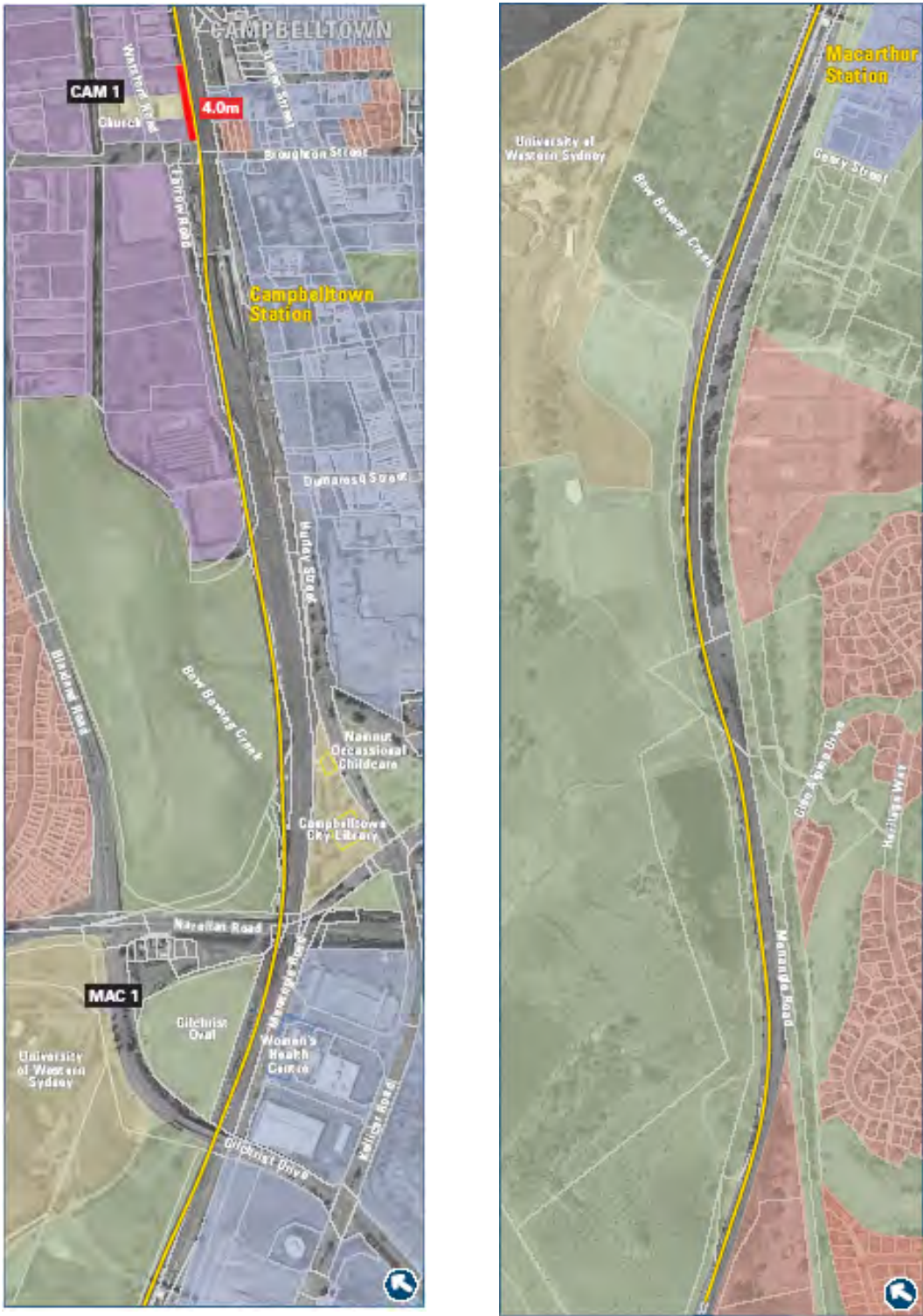


Figure 8-1(h) Approximate Noise Barrier Locations & Heights

Table 8-1 Type and Timing of Erection of Noise Barriers

Noise Barrier Number	Track m ←Macarthur	Track m Sydney→	Length of Noise Barrier (m)	Timing of Erection
4	20,942	20,791	151	21.12.10 – 16.05.11
5	21,079	20,933	146	06.10.10 – 12.05.11
7	21,139	21,077	62	25.01.11 – 03.03.11
8	21,510	21,165	345	18.10.10 – 19.05.11
9	21,610	21,504	106	10.11.10 – 01.04.11
10	21,882	21,650	232	01.03.11 – 06.05.11
11	21,909	21,878	31	17.05.11 – 06.06.11
12	22,066	21,903	163	21.12.10 – 18.04.11
14	22,532	22,248	284	10.11.10 – 24.03.11
15	25,248	24,828	420	2012 tbc ¹
16	25,860	25,369	491	2012 tbc
17	25,972	25,909	63	2012 tbc
18	26,061	25,979	82	2012 tbc
19	26133	26061	72	2012 tbc
20	26,799	26,401	398	2012 tbc
21	27,624	27,000	624	2012 tbc
22	28,128	27,893	235	2012 tbc
22c	28,197	28,122	75	2012 tbc
24	31,910	31,776	134	2012 tbc
25	32,236	32,149	87	2012 tbc
26	32,291	32,236	55	2012 tbc
27	32,454	32,291	163	2012 tbc
28	32,874	32,454	420	2012 tbc
30	35,010	34,897	113	2012 tbc
32	36,130	35,954	176	2012 tbc
33	36,155	36,122	33	2012 tbc
34	36,224	36,182	42	2012 tbc
35	36,290	36,216	74	2012 tbc
37	38,706	38,599	107	2012 tbc
38	38,763	38,706	57	2012 tbc
39	45,477	45,310	167	2012 tbc
42	49,566	49,378	188	2012 tbc
43	49,650	49,566	84	2012 tbc
45	54,411	54,269	142	2012 tbc

Note 1: Timing of erection of noise barrier in 2012. Dates to be confirmed with the final alliance

Table 8-2 Calculated Noise Levels at Receivers with Noise Mitigation Installed

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010 No SSFL	After SSFL	2020 No SSFL	with SFFL	2010 No SSFL	After SSFL	2020 No SSFL	with SFFL		
			SSFL	with Barriers	SSFL	with Barriers	SSFL	with Barriers	SSFL	with Barriers		
2	15 Cooper Rd	Regents Park	61.6	58.1	63.6	60.6					Ok	-
3	2 Cooper Rd	Regents Park	61.9	55.8	64	57.8					Ok	-
4	10 Maude St	Regents Park	65.7	61.6	67.7	64.7					Ok	-
7	22 Hope St	Regents Park	66.6	62.3	68.6	64.3					Ok	-
8	3 Morris St	Regents Park	67.3	62.9	69.4	64.9					Ok	-
10	Units in Dana Pde	Regents Park	66.5	61.2	68.5	63					Ok	-
12	61 Auburn Rd	Regents Park	68.9	64.1	70.8	65.3					Ok	-
16	1A Tewinga Rd	Birong	58.6	53	60.6	54.4					Ok	-
20	52 Auburn Rd	Birong	51.9	48.8	53.8	50.3					Ok	-
22	1 Wellington Rd	Chester Hill	55.8	54.4	57.7	55.6					Ok	-
26	10 Hill Rd	Chester Hill	56.4	53.3	58.4	55.3					Ok	-
28	47 Wellington Rd	Chester Hill	63.1	62.1	64.9	65.1					Ok	-
29	91 Wellington Rd	Chester Hill	61.7	61.7	63.5	66					Two storey house near bridge – consider architectural treatment for upper level	Yes
31	103B Wellington Rd	Chester Hill	60.8	54.7	62.6	57.6	84.7	77.9	84.7	77.9	Achieves planning goal with barrier	Yes
33	113 Wellington Rd	Chester Hill	64.3	60.3	66.1	62.7					Achieves planning goal with barrier	Yes
35	149B Wellington Rd	Chester Hill	65.3	61.8	67.1	63.8					Achieves planning goal with barrier	Yes
38	157 Wellington Rd	Chester Hill	60.4	48.6	62.4	50.9					Ok	Yes

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010 No SSFL	2010 After SSFL with Barriers	2020 No SSFL	2020 After SSFL with Barriers	2010 No SSFL	2010 After SSFL with Barriers	2020 No SSFL	2020 After SSFL with Barriers		
44	177 Wellington Rd	Chester Hill	62.8	54.6	64.6	54.1					Achieves planning goal with barrier	Yes
47	183 Wellington Rd	Chester Hill	58.7	52.8	60.5	55.4					Achieves planning goal with barrier	Yes
50	187 Wellington Rd	Chester Hill	62.8	54.6	64.6	57.3	84.6	83.1	84.6	83.1	Achieves planning goal with barrier	Yes
53	195 Wellington Rd	Chester Hill	63.2	55.5	65	58.4					Achieves planning goal with barrier	Yes
54	105 Hector St	Chester Hill	62.1	58.5	63.9	62.6					Achieves planning goal with barrier	Yes
55	128 Hector St	Chester Hill	62.6	60.4	64.5	65.9					Unavoidable gap in barrier - consider architectural treatment	Yes
56	7A Waldron Rd	Sefton	65.5	64.9	67.3	66.9					Ok	Yes
60	12-14 Wellington Rd	Sefton	62.4	57.5	64.3	61.2					Achieves planning goal with barrier	Yes
61	21 Waldron Rd	Sefton	59.7	59.5	61.7	62.1					Ok	-
66	33A Waldron Rd	Chester Hill	67.5	65.8	69.3	68.5					Ok	Yes
68	30 Wellington Rd	Chester Hill	60.6	56.5	62.4	57.6					Achieves planning goal with barrier	Yes
74	49 Waldron Rd	Chester Hill	63.4	62.3	65.2	64.2					Ok	Yes
79	52 Wellington Rd	Chester Hill	59.7	53.5	61.5	56					Ok	Yes
81	56 Wellington Rd (Dbl Storey)	Chester Hill	65.6	58.6	67.4	65.1					Ok	Yes
83	62 Wellington Rd (Dbl Storey)	Chester Hill	67.5	65.8	69.3	68.1					Ok	-
84	66 Wellington Rd (Dbl Storey)	Chester Hill	56.8	53.1	58.7	55.9					Ok	-
85	Triple Storey - 11 Singe Ln	Chester Hill	66.1	62.4	67.9	66.7					Ok	-
86	71 Waldron Rd	Chester Hill	62.8	62.6	64.6	64.8					Ok	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
				Barriers		Barriers		Barriers		Barriers		
91	81 Waldron Rd	Chester Hill	61.9	61.6	63.7	63.6					Ok	-
99	97 Waldron Rd	Chester Hill	64.6	58.9	66.4	62.2					Ok	Yes
105	109 Waldron Rd	Chester Hill	61.1	50.4	63	57.9					Ok	Yes
108	115 Waldron Rd	Chester Hill	59.5	49.1	61.4	55.8					Ok	Yes
112	72-74 Wellington Rd	Chester Hill	64.2	53.1	66	55.4	89.4	77.7	89.4	77.7	Ok	Yes
120	84 Wellington Rd	Chester Hill	66.2	61.5	68	63.8					Achieves planning goal with barrier	Yes
123	88 Wellington Rd	Chester Hill	66.2	59.7	67.9	62					Achieves planning goal with barrier	Yes
125	147 Waldron Rd	Chester Hill	66.8	66.2	68.6	68.4					Ok	-
131	157 Waldron Rd	Chester Hill	65.5	64.8	67.3	67.1	87.9		87.9		Ok	-
140	43 Villawood Rd	Villawood	57.9	56.7	59.9	59.1					Ok	-
143	3 Kirrang Ave	Villawood	59.7	51.6	61.7	54					Achieves planning goal with barrier	Yes
151	11 Wattle Ave	Villawood	61.4	55.6	63.2	58	84	81.1	84	81.1	Achieves planning goal with barrier	Yes
160	29 Wattle Ave	Villawood	62.7	54.9	64.5	57.4					Achieves planning goal with barrier	Yes
168	47 Wattle Ave	Villawood	65.3	59.3	67.1	61.9					Achieves planning goal with barrier	Yes
171	109 River Ave	Villawood	61.3	58.6	63.1	60.6					Ok	-
175	117 River Ave	Villawood	59.9	58.3	61.7	60.5					Ok	-
179	125 River Ave	Villawood	58.8	57.8	60.7	60.1					Ok	-
184	2 Lupin Ave	Villawood	56.9	56.4	58.8	58.8					Ok	-
189	143 River Ave	Villawood	59.1	58.6	61	61					Ok	-
194	153 River Ave	Villawood	61.7	60.5	63.6	62.8					Ok	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
			Barriers		Barriers		Barriers		Barriers			
203	171 River Ave	Villawood	62.5	61.7	64.3	63.8					Ok	-
208	183 River Ave	Villawood	61.3	59.9	63.1	62					Ok	-
212	191 River Ave	Villawood	60.4	59	62.2	61.1					Ok	-
214	125 The Horsley Drive	Villawood	58.6	57.4	60.4	59.5					Ok	-
216	1 Edmund St	Carramar	66.7	60.7	68.4	63.3					Achieves planning goal with barrier	Yes
221	55 Wattle Ave	Carramar	65.7	55	67.5	57.6	94.1	84.5	94.1	84.5	Achieves planning goal with barrier	Yes
230	73 Wattle Ave	Carramar	66.1	57.7	67.8	60.2					Achieves planning goal with barrier	Yes
234	81 Wattle Ave	Carramar	67.2	57.7	68.9	60.2					Achieves planning goal with barrier	Yes
240	102 Wattle Ave	Carramar	62.2	56	64	58.4					Achieves planning goal with barrier	Yes
247	118 Wattle Ave	Carramar	63.4	61.2	65.1	63.7					Achieves planning goal with barrier	Yes
249	158 Carramar Ave	Carramar	62.3	59.1	64.1	61.5					Achieves planning goal with barrier	Yes
252	170 Sandal Cres	Carramar	64.7	60.6	66.5	62.9	86.2	83.2	86.2	83.2	Achieves planning goal with barrier	Yes
254	2 Sanderson St	Carramar	64.4	62.6	66.2	64.6					Ok	-
261	234River Ave	Carramar	59.4	58.1	61.2	60.1					Ok	-
265	240 River Ave	Carramar	58.3	57.1	60.1	59.1					Ok	-
267	5 Carrmar Ave	Carramar	63.9	63	65.7	65.3					Ok	-
273	262 River Ave	Carramar	64.1	61.7	65.8	63.7					Ok	-
279	197 Carramar Ave	Carramar	65.2	64.2	67	66.4					Ok	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?		
			2010		2020		2010		2020					
			2010	After	2020	with	2010	After	2020	with				
			No	SSFL	No	SFFL	No	SSFL	No	SFFL				
			SSFL	with	SSFL	with	SSFL	with	SSFL	with				
			Barriers		Barriers		Barriers		Barriers					
282	191 Carramar Ave	Carramar	65	64.2	66.8	66.4						Ok	-	
285	178 Sandal Cres	Carramar	67.1	65	68.8	67						Ok	-	
290	4 Ramsay St	Carramar	65.4	62.4	67.1	64.9						Ok	-	
291	2 Moore St	Carramar	69	66.6	70.7	69						Ok	-	
294	4 Moore St	Carramar	64.4	62.8	66.2	65.2						Ok	-	
296	Cnr Frazer Rd/Moore St	Carramar	60.8	59.9	62.6	62.3						Ok	-	
300	Eastern end of Frazer Rd	Carramar	61.8	57.3	63.5	59.9						Achieves planning goal with barrier	Yes	
306	Western end of Frazer Rd	Carramar	62.3	54.4	64.1	57						Achieves planning goal with barrier	Yes	
311	1 Shortlands St	Carramar	62.9	53.1	64.7	55.6						Ok	-	
317	1 Prospect Rd	Carramar	62.3	61.6	64.1	63.8						Ok	-	
321	7 Prospect Rd	Carramar	61.7	60.2	63.5	62.4						Ok	-	
324	12 Prospect Rd	Carramar	65.6	64.8	67.4	66.9	91.3	91.3					Ok	-
330	24 Premier St	Carramar	62.8	61.3	64.5	63.3						Ok	-	
333	20 Premier St	Carramar	62.7	60.8	64.4	62.8						Ok	-	
335	23 Premier St	Carramar	67.1	64.7	68.9	66.6						Ok	-	
339	17 Premier St	Carramar	64.2	62	66	64						Ok	-	
349	110 Lansdowne Rd	Canley Vale	55.9	52.8	57.7	55.1						Ok	-	
354	125 Lansdowne Rd	Canley Vale	63.2	55.9	65	58.4						Achieves planning goal with barrier	Yes	
358	130 Lansdowne Rd	Canley Vale	62.8	54.9	64.6	57.5						Achieves planning goal with barrier	Yes	
363	138 Lansdowne Rd	Canley Vale	63.3	55	65	57.7	84.5	80.7	84.5	80.7			Achieves planning goal with barrier	Yes

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
			Barriers		Barriers		Barriers		Barriers			
368	148 Lansdowne Rd	Canley Vale	63.6	54.5	65.3	57.1					Achieves planning goal with barrier	Yes
371	1 MacKenzie St	Canley Vale	62.7	54	64.4	56.6					Achieves planning goal with barrier	Yes
373	150 Lansdowne Rd	Canley Vale	63.7	54.2	65.5	56.8					Achieves planning goal with barrier	Yes
377	26 Senior St	Canley Vale	67.6	65.5	69.4	67.5					Ok	-
378	29 Senior St	Canley Vale	63	61.2	64.8	63.4					Ok	-
382	18 Fifth Ave	Canley Vale	63.5	61.3	65.3	63.5					Ok	-
389	139 Carcoola St	Canley Vale	61.6	59.8	63.4	61.9					Ok	-
395	136 Carcoola St	Canley Vale	62.4	61	64.1	63.1					Ok	-
402	4 West St	Canley Vale	66.5	64.2	68.3	66.2					Ok	-
403	5 West St	Canley Vale	63.9	61.5	65.7	63.7					Ok	-
407	22 First Ave	Canley Vale	59	57	60.8	59.2					Ok	-
409	30 First Ave	Canley Vale	62.9	60.9	64.7	63					Ok	-
410	38 Broomfield St	Cabramatta	63.4	55.8	65.2	58.5	84.8	82.4	84.8	82.4	Achieves planning goal with barrier	Yes
415	48 Broomfield St	Cabramatta	64	55.4	66.1	58					Achieves planning goal with barrier	Yes
419	54-58 Broomfield St	Cabramatta	66.5	60.7	68.5	63.1					Ok	Yes
423	66 Broomfield St	Cabramatta	64.7	61.1	67.8	63.5					Achieves planning goal with barrier	Yes
424	98 Broomfield St	Cabramatta	62.7	61.6	64.5	63.9					Achieves planning goal with barrier	Yes
425	102 Broomfield St	Cabramatta	63.8	61.4	65.6	63.7					Achieves planning goal with barrier	Yes

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers	No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers		
429	112 Broomfield (Dbl Storey)	Cabramatta	63.8	58.8	65.5	61.3					Achieves planning goal with barrier	Yes
434	122 Broomfield St	Cabramatta	63.1	55.2	64.7	57.8					Achieves planning goal with barrier	Yes
438	130 Broomfield St	Cabramatta	63.2	56.1	64.8	58.7					Achieves planning goal with barrier	Yes
441	138-142 Broomfield St (Cnr Junction)	Cabramatta	63.8	60	65.4	62.4					Achieves planning goal with barrier	Yes
443	4-6 Church St (Three Storey)	Cabramatta	60.6	59.6	62.5	61.8					Ok	-
445	225 Railway Pde	Cabramatta	64.1	62.8	65.8	65					Ok	-
450	230 Railway Pde	Cabramatta	64.6	63.7	66.2	66.1					Ok	-
454	234 Railway Pde	Cabramatta	63.7	63	65.2	65.1					Ok	-
456	237 Railway Pde	Cabramatta	63.7	63	65.3	65.1					Ok	-
460	148 Broomfield St	Cabramatta	63.2	55.1	64.8	57.8	85.3	81.2	85.3	81.2	Achieves planning goal with barrier	Yes
467	162 Broomfield St	Cabramatta	63.1	54.7	64.7	57.3					Achieves planning goal with barrier	Yes
474	176 Broomfield St	Cabramatta	62.1	56.4	63.7	60					Achieves planning goal with barrier	Yes
475	10 Sussex St	Cabramatta	62.8	63	64.4	67.8					Barrier not feasible - investigate architectural treatment	-
478	1 Nicholls St	Warwick Farm	63.7	61.9	65.3	63.9					Ok	-
480	3 Station St	Warwick Farm	63.6	61.8	65.2	63.7					Ok	-
485	13 Station St	Warwick Farm	63.3	61.5	64.9	63.4	84.6		84.6		Ok	-
491	25 Station St	Warwick Farm	62.4	60.8	64	62.7					Ok	-
498	Most Affected Unit at 1 Manning St	Warwick Farm	61.8	65.3	63.5	68					Barrier not feasible - investigate architectural treatment	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers	No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers		
499	Most Affected Unit at 3 Manning St	Warwick Farm	61.7	65.3	63.4	68.1					Barrier not feasible - investigate architectural treatment	-
500	Liverpool Hospital	Liverpool	65.9	65.4	67.5	67.5					Ok	-
501	Liverpool TAFE	Liverpool	68.6	67.3	70.7	69					Ok	-
503	22-24 Remembrance Ave	Liverpool	58.8	57.4	60.4	59.3					Ok	-
508	9 Hart St	Liverpool	58.9	57.4	60.5	59.4					Ok	-
513	19 Hart St	Liverpool	59	57.5	60.7	59.6					Ok	Yes
514	Liverpool Hostpital Childcare	Liverpool	64.5	55.7	66.1	58.5					Achieves planning goal with barrier	Yes
515	Most Affected Unit at 4 Riverpark Rd	Liverpool	64.5	55.7	66.1	58.5	76.8	75.8	76.8	75.8	Achieves planning goal with barrier	Yes
517	Most Affected Unit at 2 Riverpark Rd	Liverpool	58.9	54.1	60.4	56.7					Achieves planning goal with barrier	Yes
520	(Nthn) Unit at 3 Riverpark Rd	Liverpool	62	59.5	63.4	62.1					Achieves planning goal with barrier	Yes
523	(Mid-Lot) Unit at 3 Riverpark Rd	Liverpool	62.5	57.1	64	59.6					Achieves planning goal with barrier	Yes
524	(Sthn) Unit 1 at Riverpark Rd	Liverpool	65.6	60.7	67.1	64.6					Achieves planning goal with barrier on Shepherd Rd, Bridge	Yes
525	(Sthn) Unit 2 at Riverpark Rd	Liverpool	65.7	58	67.2	61					Achieves planning goal with barrier on Shepherd Rd, Bridge	Yes
526	(Sthn) Unit 3 Riverpark Rd	Liverpool	65.7	57.6	67.2	60.7					Achieves planning goal with barrier on Shepherd Rd, Bridge	Yes
528	24 Speed St	Liverpool	68.2	65.9	69.7	67.5					Ok	-
536	50 Speed St	Liverpool	66.6	65.1	68.1	67	90.5		90.5		Ok	-
538	60 Speed St	Liverpool	64.9	64.3	66.4	66.3					Ok	-
542	25 Atkinson St	Liverpool	67.1	66.4	68.6	68.3					Ok	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
				Barriers		Barriers		Barriers		Barriers		
543	26 Atkinson St	Liverpool	67.1	66.3	68.6	68.4					Ok	-
549	14 McGowen Cres	Liverpool	64.6	63.6	66.1	65.7					Ok	-
553	22 McGowen Cr	Liverpool	63.3	62.6	64.8	65.5					Monitoring required ¹	-
600	36 McGowen Cres	Liverpool	63.4	64.1	65	66.6					Monitoring required ¹	-
664	33 Birkdale Cr	Liverpool	66.6	66	68.1	68.1					Ok	-
671	43 Birkdale Cr	Liverpool	67.4	66.7	68.9	68.7					Ok	-
676	93 Congressional Dr	Liverpool	66.3	65.9	67.8	67.9					Ok	-
683	79 Congressional Dr	Liverpool	67	65.9	68.5	68.4					Ok	-
688	20 Lakewood Cr	Liverpool	68.4	67.5	69.9	69.5					Ok	-
689	11 Lakewood Cr	Liverpool	64.9	64.5	66.4	66.6					Ok	-
691	1 Phoenix Cres	Casula	62.4	62.1	63.9	64.2					Ok	-
694	14 Lakewood Cres	Casula	66.1	65.3	67.6	67.1					Ok	-
706	52 St Andrews Bvde	Casula	68.1	67.2	69.6	69.2					Ok	-
713	66 St Andrews Bvde	Casula	66.7	66.2	68.2	68.3	85.8		85.8		Ok	-
721	84 St Andrews Bvde	Casula	66.7	66.1	68.2	68.1					Ok	-
723	3 Buckland Rd	Casula	63.5	63.4	65	65.6					Monitoring required ¹	-
729	15 Buckland Rd	Casula	68	67.2	69.5	69.3					Ok	-
739	35 Buckland Rd	Casula	51.3	51.9	52.9	54.4					Ok	-
743	28 Marsh Pde	Casula	51.2	51.3	52.8	53.7					Ok	-
749	40 Marsh Pde	Casula	53.2	53.7	54.7	56.1					Ok	-
752	70 Ashcroft Ave	Casula	50.5	51	52	53.4					Ok	-
757	22 Dunmore Cres	Casula	60.8	60.7	62.3	62.9					Monitoring required ¹	-
763	32 Buckland Rd	Casula	57.7	57.7	59.3	60.1					Monitoring required ¹	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
			Barriers		Barriers		Barriers		Barriers			
766	40 Buckland Rd	Casula	61.7	61.2	63.2	63.4					Ok	-
771	9 Casula Rd	Casula	58.5	58.4	59.9	60.7					Monitoring required ¹	-
772	Casula Arts Centre (Nthn end)	Casula	63.9	58.6	65.4	61.1					Special Use - Architectural Treatment	Yes
773	Casula Arts Centre (Sthn end)	Casula	63	59	64.6	61.4	85.1	84	85.1	84	Special Use - Architectural Treatment	Yes
782	57 Leacocks Ln	Casula	40.3	41.1	41.9	43.5					Ok	-
789	77 Leacocks Ln	Casula	44.6	46.2	46.1	48.4					Ok	-
793	105 Leacocks Ln	Casula	41.5	42	43	44.4					Ok	-
798	115 Leacocks Ln	Casula	44.7	45.8	46.2	48.1					Ok	-
809	21 Slessor Rd	Casula	55.2	55.2	56.7	56.8					Ok	-
813	13 Slessor Rd	Casula	55.9	56	57.4	57.7					Ok	-
822	1 Foreman St	Glenfield	64.2	63.6	65.8	65.6					Ok	-
832	38 Railway Pde	Glenfield	63.9	63.6	65.5	65.6					Ok	-
834	44 Railway Pde	Glenfield	63.2	63.5	64.8	65.1					Monitoring required ¹	-
841	68 Railway Pde	Glenfield	63.4	63.3	64.9	64.8					Ok	-
846	122 Railway Pde	Glenfield	61.9	63	63.6	64.8					Two storey house – consider architectural treatment for upper level	-
855	2 Wentworth Ave	Glenfield	62.5	62.8	64.3	64.5					Monitoring required ¹	-
859	10 Newtown Rd	Glenfield	57.3	58	59	59.7					Ok	-
866	Roy Watts Rd	Glenfield	60.7	60.8	61.4	61.3	73		73		Monitoring required ¹	-
870	53 Adrian St	Macquarie Fields	55.9	55.7	57.7	57.1					Ok	-
874	111 Atchison Rd	Macquarie Fields	62.1	61.6	63.9	63	82		82		Ok	-
881	97 Atchison Rd	Macquarie Fields	60.6	60.7	62.4	62.4					Monitoring required ¹	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
			Barriers		Barriers		Barriers		Barriers			
890	2 Fraser St	Macquarie Fields	57	57.2	58.7	58.7					Ok	-
897	1 Edward St	Macquarie Fields	61.8	61.9	63.6	63.5					Monitoring required ¹	-
902	1 Clarence St	Macquarie Fields	60.8	61.1	62.6	62.8					Monitoring required ¹	-
913	23 Clarence St	Macquarie Fields	56.9	56.9	58.8	58.7					Ok	-
922	280 Railway Pde	Macquarie Fields	64.1	62.4	65.9	64.1					Ok	-
930	304 Railway Pde	Macquarie Fields	62.9	62.8	64.6	65.1					Ok	-
935	314 Railway Pde	Macquarie Fields	64.2	63.6	65.9	65.8					Ok	-
940	322 Railway Pde	Macquarie Fields	63.3	61.9	65.1	64					Ok	-
953	4-8 Gordon Ave	Ingleburn	66.8	65.8	68.6	68					Ok	-
960	11 Redfern St	Ingleburn	65.3	64.7	67.1	67					Ok	-
969	1-3 James St	Ingleburn	68.5	67.9	70.2	70.1					Ok	-
971	66 Macquarie Rd	Ingleburn	62	61.9	63.8	64.3					Ok	-
975	74 Macquarie Rd	Ingleburn	63.2	62.9	64.9	65.2					Ok	-
978	4 Aero Rd	Ingleburn	58.7	56.2	60.4	58.7					Achieves planning goal with barrier	Yes
979	3 Stanley Rd	Ingleburn	62.3	57.4	64.1	60.1					Achieves planning goal with barrier	Yes
980	5A Stanley Rd	Ingleburn	62.6	57.2	64.3	59.9					Achieves planning goal with barrier	Yes
981	7 Stanley Rd	Ingleburn	62.6	57.2	64.3	59.8					Achieves planning goal with barrier	Yes
982	9 Stanley Rd	Ingleburn	63	57.3	64.7	60	84	81.8	84	81.8	Achieves planning goal with barrier	Yes
983	11 Stanley Rd	Ingleburn	63.2	57.7	64.8	60.3	83.6		83.6		Achieves planning goal with barrier	Yes
984	13 Stanley Rd	Ingleburn	63.6	58.7	65.3	61.3					Achieves planning goal	Yes

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers	No SSFL	SSFL with Barriers	No SSFL	SFFL with Barriers		
											with barrier	
988	5B Louise Ave	Ingleburn	59	56.5	60.6	59					Achieves planning goal with barrier	Yes
995	2 Norwich Rd	Ingleburn	64	62.8	65.8	65.3					Achieves planning goal with barrier	Yes
999	73 Stanley Rd	Ingleburn	63.9	64.6	65.7	67.1	85.8	87.9	85.8	87.9	Barrier not feasible - investigate architectural treatment	-
1002	79 Stanley Rd	Ingleburn	63.8	64	65.6	66.5					Barrier not feasible - investigate architectural treatment	-
1004	83 Stanley Rd	Ingleburn	63.9	63.9	65.7	66.4					Monitoring required ¹	Yes
1011	48 Ingleburn Rd	Ingleburn	64.5	64.1	66.3	66.3					Ok	-
1015	56 Ingleburn Rd	Ingleburn	63.9	63.5	65.7	65.7					Ok	-
1022	72 Ingleburn Rd	Ingleburn	63.6	62.7	65.4	64.9					Ok	-
1028	86 Ingleburn Rd	Ingleburn	64	62.7	65.8	65.4					Ok	-
1034	98 Ingleburn Rd	Ingleburn	66.1	63	68	65.2					Ok	-
1042	114 Ingleburn Rd	Ingleburn	63.8	62.3	65.5	64.9					Ok	-
1053	138A Ingleburn Rd	Ingleburn	64	62.6	65.8	65.3					Ok	-
1059	150 Ingleburn Rd	Ingleburn	63.5	62.3	65.3	65.6					Ok	-
1061	73 Freeman Cct	Ingleburn	61.6	60.6	63.3	62.9					Ok	-
1067	40 Wilkinson Cres	Ingleburn	63.1	62	64.8	64.6					Ok	-
1076	22 Wilkinson Cres	Ingleburn	61	60.6	62.7	63.1					Ok	-
1082	6 Victoria Rd	Minto	63.9	62.5	65.7	65.4					Ok	-
1083	4A Victoria Rd	Minto	64.2	62.8	66	65.9					Ok	-
1088	71 Minto Rd	Minto	70.3	68.2	72.1	70.7					Ok	-
1091	1 Durham St	Minto	64.2	62.8	65.9	65.2					Ok	-

Receiver ID	Street Address	Suburb	L _{Aeq,24hr} (dBA)				L _{Amax} (dBA)				Comments After Initial Mitigation Design Applied to New Speeds	Benefits from Barrier?
			2010		2020		2010		2020			
			2010	After	2020	with	2010	After	2020	with		
			No	SSFL	No	SFFL	No	SSFL	No	SFFL		
			SSFL	with	SSFL	with	SSFL	with	SSFL	with		
			Barriers		Barriers		Barriers		Barriers			
1096	46A Minto Rd	Minto	63.6	62.5	65.4	65.3					Ok	-
1099	40-44 Minto Rd	Minto	63	62	64.7	64.8					Ok	-
1105	28 Minto Rd	Minto	64	62.4	65.7	65					Ok	-
1107	28 Somerset St (Cnr Sussex)	Minto	64.1	58.7	65.8	61.7					Possibly Industrial - Under Review	-
1112	8 Somerset St	Minto	63.8	61.6	65.5	64.3					Possibly Industrial - Under Review	-
1114	2 Westmoreland Rd	Leumeah	43.1	43.3	44.8	45.7					Ok	-
1121	54-56 O'Sullivan Rd	Leumeah	65.5	64.6	67.2	67.2					Ok	-
1125	(Units at) 15 O'Sullivan Rd	Leumeah	69.6	67.4	71.3	70.2	90.3		90.3		Ok	-
1140	(Units at) 43 Rudd Rd	Leumeah	63	61.7	64.8	64.3					Ok	-
1149	22 Kulgoa St	Leumeah	68.5	66.7	70.2	69.1					Ok	-
1153	18 Kulgoa St	Leumeah	66.1	64.5	67.8	66.9					Ok	-
1159	5 Watsford Rd	Campbelltown	57.6	55.5	59.4	58.4					Ok	Yes
1160	Church of God Training Centre	Campbelltown	67	55.8	68.6	58.5	87.2	81.1	87.2	81.1	Achieves planning goal with barrier	Yes
1161	3D Narellen Rd	Campbelltown	50.9	51	52.7	53.7					Ok	-
1170	2 Padua Ln	Glen Alpine	61.2	60.5	62.8	63.2	80.4		80.4		Ok	-
1175	1 Gilchrist Dr	Glen Alpine	60.5	59.8	62.1	62.3					Ok	-
1183	11 Mount Huon Ct	Glen Alpine	47.4	47.6	49	50.2					Ok	-
1188	9 Charmwood Ct	Glen Alpine	55.1	54.7	56.6	57.8					Ok	-
1191	6 Glen Alpine Dr	Glen Alpine	55.5	55.1	57.1	58.2					Ok	-
1192	2 Dovedale Cl	Glen Alpine	60.2	59.6	61.8	62.8					Monitoring required ¹	-
1193	6 Dovedale Cl	Glen Alpine	61.8	61.1	63.4	64.3					Monitoring required ¹	-

Note: 1 "Monitoring required" indicates residences where small noise increases are predicted, but provision of mitigation would be contingent on the results of noise monitoring conducted after opening of the project.

8.3 Relative Contribution from SSFL and Existing Lines

An analysis of the relative contribution of movements on the new SSFL and existing RailCorp lines to the total $L_{Aeq,24hr}$ noise level was included in the Environmental Assessment for the SSFL. The findings are summarised here.

In most cases the predicted noise exposure in 2020 would be due to freight operations on the SSFL. Exceptions are:

At Receivers 171 to 179 (Villawood – Catchments VIL1 and VIL2 in the EA) a cutting would provide shielding for the SSFL.

At Receivers 292 to 294 (Carramar – Catchment CAR4 in the EA) the major contributor to noise exposure would continue to be trains on the existing Prospect Creek Bridge.

It should be noted that, in the absence of the SSFL, existing and additional freight trains would continue to operate on the existing Main South Line tracks. Therefore, the development of the SSFL would result in a reduction in noise from these existing tracks. This noise reduction is inherent in the noise predictions.

8.4 Architectural Treatments

Acoustic architectural treatments have been proposed as noise control options where there is no reasonable and feasible means of reducing the source noise. The locations to be considered for architectural treatment are shown in Table 8-3.

The details of architectural treatments depend on the existing construction and ventilation of the dwellings, as well as the exposure to rail noise. The required construction would be determined by an acoustic consultant on a case by case basis.

Provision of architectural treatment would be done during the construction phase unless the requirement is dependent on the results of monitoring. The timing of the provision of treatment would be negotiated with each property owner. Where possible it would be completed prior to substantial construction to assist with noise mitigation during the construction period.

Table 8-3 Buildings Considered for Architectural Treatment

Receiver Number	Address	Suburb	Addresses to be Considered
29	91 Wellington Rd	Chester Hill	Two storey house near bridge - consider architectural treatment for upper level
55	128 Hector St	Chester Hill	Unavoidable gap in barrier. Single house affected Barrier not feasible
475	10 Sussex St	Cabramatta	- investigate architectural treatment to single house at western end of Sussex St
498	Units at 1 Manning St	Warwick Farm	Four units facing rail line to consider.
499	Units at 3 Manning St	Warwick Farm	Four units to consider
772	Casula Arts Centre (Northern end)	Casula	Special Use - Architectural Treatment
773	Casula Arts Centre	Casula	Special Use

Receiver Number	Address	Suburb	Addresses to be Considered
	(Southern end)		- Architectural Treatment
846	122 Railway Pde	Glenfield	Two storey house - consider architectural treatment for upper level
999	73 Stanley Rd	Ingleburn	Barrier not feasible - investigate architectural treatment to 2 Norwich, 67, 69, 71, 73, 75 Stanley Rd (6 houses)
1002	79 Stanley Rd	Ingleburn	Barrier not feasible - investigate architectural treatment to 77, 79, 81 Stanley Rd (3 houses)

9 SOURCE CONTROL PLAN

This section presents the Source Control Plan being developed by ARTC for the SSFL. ARTC is committed to:

- Working with NSW Government agencies, in particular with DECCW and DoP to achieve a reduction in train noise;
- Developing a National Complaints Policy for noise (i.e. where do people report noise issues to). This is described in Section 11;
- Developing a Source Control Plan.

The Source Control Plan identifies strategies for source controls, as defined in Condition of Approval 51, including:

1. *A program of condition monitoring for the purpose of minimising noise emissions from locomotives, freight rolling stock and maintenance activities;*
2. *Targets, assessment, action and review processes for incorporation and implementation of best practice measures.*

9.1 Monitoring of Locomotives, Freight Rolling Stock and Maintenance Activities

9.1.1 Wayside Noise Monitoring Program

ARTC has installed wayside monitoring equipment on key locations across the rail network to improve safety and allow condition monitoring of “above rail” performance. This includes monitoring of curving noise generated by interstate rolling stock using the RailSQAD system in the Adelaide Hills in South Australia, which monitors wheel squeal and flanging noise.

Wheel Impact and Load Detectors (WILD) and Acoustic Bearing Monitors (RailBAM) are installed at Metford in northern NSW, and are also planned for installation at Exeter in southern NSW, together with a wheel profile monitor. These predictive, performance based systems allow rail operators to take proactive action to address rolling stock maintenance issues before they become more serious defects (for example wheel flats).

ARTC proposes to work with the EPA to develop a wayside noise monitoring program for the SSFL to assist in identifying and managing noise emissions from locomotives and freight rolling stock.

As a requirement of its Environment Protection Licence (EPL) 3142, ARTC has completed a pilot study meeting Condition PRP 3 (Audit of the Noise Performance of Locomotives on ARTC's network); refer Appendix E:

- ARTC submitted a detailed work plan for the audit of the noise performance of freight locomotives to EPA for approval. This included noise performance indicators and details of how and when access to the noise monitoring results would be granted to the locomotive operators. The work plan was approved by EPA in April 2009;
- ARTC conducted a pilot program of wayside noise monitoring of locomotives in accordance with the work plan between February and June 2010, using noise monitoring terminals and train consist data collected from the WILD site at Metford;
- ARTC reported to EPA on the noise monitoring results of the pilot program.

ARTC's existing monitoring programs and the results of the pilot study outlined above are

informing the development of a wayside monitoring program for the SSFL. ARTC is currently negotiating with the EPA to develop a wayside monitoring program as a Pollution Reduction Program (PRP) to be included in EPL 3142. The status of negotiations, which commenced in May 2011, is that the EPA is to advise of its requirements for consideration by ARTC.

The objectives of the wayside monitoring program will be to:

- Identify noisy locomotives and wagons, as well as assisting in understanding the operational and environmental conditions under which noise is generated;
- Inform operators of locomotives and rolling stock causing unacceptable noise on the SSFL and assist in identifying the noise source;
- Include predictive condition monitoring of railway rolling stock which will detect wheel impacts and faults for vehicles passing Metford and Exeter;
- Inform regulators of compliance with noise goals specified in ARTC's Environment Protection Licence (EPL 3142);
- Allow for accurate and timely complaint handling;
- Inform the development of reasonable and feasible noise mitigation techniques;
- Consider the use of new and existing noise/condition monitoring technologies where specific issues are identified along the SSFL.

9.1.2 Locomotive Approvals

In accordance with EPL 3124, ARTC must seek the EPA's approval to permit the operation of:

- Each class or type of locomotive, whether new or existing, that has not previously operated on the NSW rail network, and
- Any locomotive that has been substantially modified since it was last used on the NSW rail network.

Type testing of locomotives must be undertaken in accordance with Australian Standard AS 23 AS2377-2002 (Acoustics – Methods for the Measurement of Railbound Vehicle Noise) and the EPL Condition L6. For compliance testing of a class or type of locomotive, EPA requires noise test results from a representative number of locomotives from that class or type.

All operators will be required to provide testing by a qualified acoustic engineer to demonstrate that the noise emission from each item of rolling stock complies with Condition L6 of the EPL, described in Section 9.2 and attached as Appendix E.

9.1.3 Freight Rolling stock

The freight rolling stock to operate on the SSFL will be owned by Operators rather than ARTC. As noted in Section 9.1.1, the wayside monitoring program developed in conjunction with the EPA will identify "noisy" vehicles and provide information to the respective rolling stock operators.

9.1.4 Maintenance

ARTC undertakes rail maintenance in accordance with its Standards to ensure the safety of the network, including:

Rail Grinding

The main objectives of ARTC's rail grinding operation are to:

- Progressively establish rail profiles that improve the wheel/rail interaction characteristics, and hence reduce rail (and wheel) wear, surface defects, and the risk of unstable vehicle performance (hunting), as well as increasing the rail wear life;
- Rectify or control existing rail surface defects, and hence reduce the risk of rail failures and track deterioration;
- Control rail surface condition so that defects such as Rolling Contact Fatigue do not shield/prevent efficient Ultrasonic Testing of rail;

All rail grinding work is conducted in accordance with ARTC's *Rail Grinding Standard for Plain Track EMT-01-02*, other ARTC Standards and Environmental Licenses, all relevant OH&S requirements, relevant legislation and relevant Safeworking requirements.

Standard EMT-01-02 includes a section on monitoring and control which specifies the frequency of field audits of the grinding operations which is determined by the volume and type of traffic using the line.

Welds

Welding of rails is carried out to meet ARTC's *Rail Weld Geometry Standard ETM-01-01* which sets out the welding of rails, standards of finished weld, limits on welds adjacent to joints and other welds, semi-finished welds, visual inspection, and ultrasonic testing of new welds.

Ultrasonic Testing

ARTC's *Ultrasonic Testing by Continuous Rail Flaw Detection Vehicle ETE-01-02* establishes the requirements to be met whilst testing ARTC track and the rail testing schedule for NSW.

Existing maintenance activities improve rail life and reduce energy use and wheel wear. By default, removal of wheel and rail defects also assists with reducing noise generation.

ARTC is working cooperatively with operators to understand the operational and environmental conditions under which noise is generated. Where specific techniques emerge from these studies with the potential to reduce rail generated noise, these will be incorporated into the maintenance schedule for the SSFL.

9.2 Targets

9.2.1 General Noise Limits

Wayside noise monitoring will assist in identifying compliance with Condition L6 of ARTC's EPL. Condition L6.1 defines **General Noise Limits**. It is an objective of the EPL to progressively reduce noise levels to the goals of 65 dB(A)_{Leq}, (day time from 7am – 10pm), 60 dB(A)_{Leq}, (night time from 10pm – 7am) and 85dB(A) (24 hr) max. pass-by noise, at one metre from the façade of affected residential properties through the implementation of Pollution Reduction Programs.

9.2.2 Locomotive Noise Limits

Condition L6.2 defines **Locomotive Noise Limits** and includes general noise limits (Condition L6.2.1), limits for tonality (Condition L6.2.2) and limits for low-frequency noise (Condition L6.2.3).

General Noise Limits for Locomotives

Operating Condition Speed	Speed and Location of Measurement	Noise Limit At a microphone height of 1.5 m above ground level
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15 metre contour	70 dB(A) _{Max}
All other throttle settings under self load with compressor radiator fans and air conditioning operating	Stationary 15 metre contour	87 dB(A) _{Max} 95 dB Linear _{Max}
All service conditions	As per Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by EPA	87 dB(A) _{Max} 95 dB Linear _{Max}

Limits for Tonality

The EPL states that all external noise must be non-tonal. For the purpose of this condition, external noise is non-tonal if the sound pressure level in each unweighted (linear) one-third octave band does not exceed the level of the adjacent bands on both sides by:

- 5 dB if the centre frequency of the band containing the tone is above 400 Hz; and
- 8 dB if the centre frequency of the band containing the tone is between 160 and 400 Hz, inclusively; and
- 15 dB if the centre frequency of the band containing the tone is below 160 Hz.

Limits for Low-Frequency Noise

The EPL states that all external noise must not exhibit an undue low-frequency component; that linear noise levels must not exceed the A-weighted noise levels by more than 15 dB.

9.2.3 Railway Maintenance and Construction Activities

Condition O3.1 of the EPL describes minimising noise from railway maintenance and construction activities. This objective recognises that operational and other factors constrain when these activities can be carried out. These factors include avoiding disruptions during peak periods for passenger services and ensuring that programmed track closures facilitate the efficient completion of maintenance and construction activities. Night time and weekend work will be required for some activities. ARTC is required to implement reasonable and feasible noise mitigation and management measures to minimise any offensive noise likely to be generated by railway construction and maintenance activities, as described in Section 9.4.

9.3 Assessment

Condition L6 of the EPL also describes assessment requirements. Condition L6.3 describes **Locomotive Noise Emission Test Methods**. Application for approval as required by Condition L6.1 must be supported by type testing of the locomotive using procedures that are consistent with the requirements of Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA. The type testing must provide all necessary measurement parameters for demonstrating compliance

with the locomotive noise limits in Condition L6.2.

Condition L6.4 describes the **Approval of Locomotives Not Meeting All EPA Limits**. The EPA may approve locomotives that do not comply with all limits prescribed by Condition L6.2, provided that the application for approval demonstrates that:

- (a) The noise emission performance of the locomotive is consistent with current best practice; and
- (b) All measures for minimising the extent of any non-compliance have been investigated and those that are identified as reasonable and feasible have been implemented; and
- (c) None of the non-compliances will result in unacceptable environmental impacts.

Results of the SSFL **noise monitoring program** will be assessed in accordance with the noise goals detailed in ARTC's EPL 3142.

Assessment of **complaints** will occur as required.

9.4 Actions

9.4.1 Locomotives and Freight Rolling Stock

ARTC works with the rail operators to cooperatively review needs for wayside condition monitoring across the network through the Wayside Steering Committee. The Committee meets several times each year to review performance trends and exchange information on rolling stock related issues. This model facilitates the following actions:

- Joint review of needs and funding arrangements for new wayside devices, between the above rail operators and ARTC;
- The review of noise related issues on the ARTC network through Noise Abatement Workshops held by the Wayside Steering Committee at regular intervals, between ARTC and Operators;
- The industry working together to facilitate a better understanding of curving noise in particular; Noise Abatement Workshops include one session where the operators and ARTC can co-operatively discuss various noise related issues produced by rail and rolling stock interaction, and a second session where EPA representatives attend and noise issues and opportunities collectively identified by the operators and ARTC are further discussed and actions reviewed;
- For the SSFL, ARTC would provide reports at agreed intervals to the EPA to meet Environmental Licence conditions; the reports would include analysis of noise monitoring data collected at periodic intervals.

ARTC also co-operates with industry partners through the Rail Cooperative Research Council Project R105 on curving noise. The main partners on this project are Railcorp, Queensland Rail, ARTC, Pacific National, University of Queensland and University of Wollongong. This work enables ARTC to continually improve its approach to noise monitoring and management, and to stay informed of best practice technologies.

9.4.2 Railway Maintenance and Construction Activities

ARTC already implements and will continue to implement reasonable and feasible noise mitigation and management measures to minimise noise generated by these activities,

including, where practicable:

- Maximising the offset distance between noisy plant items and nearby residential receivers;
- Avoiding the simultaneous operation of two or more noisy plant items in close vicinity and adjacent to residential receivers;
- Scheduling the noisiest activities during the normal business hours, between 7am and 6pm Monday to Friday and 8am and 1pm Saturday, or where this is not possible, to less sensitive times of day;
- Providing periods of respite if activities occur for extended periods during the night;
- Minimising consecutive night time activities in the same locality;
- Orienting equipment away from residential receivers;
- Carrying out loading and unloading away from residential receivers;
- Siting site access points and roads as far as possible away from residential receivers;
- Using structures to shield residential receivers from noise;
- Planning for and conducting night time activities in ways that eliminate or minimise the need for audible warning alarms.

ARTC notifies residents of any proposed railway maintenance or construction activity which is to be conducted outside normal business hours and which is likely to create disturbance for those residents. ARTC provides this notification at least five days prior to the commencement of the activities, except where:

- ARTC first becomes aware of the need to undertake these activities less than five days prior to the proposed commencement date, in which case the notification is provided as soon as practicable after becoming aware of the need to undertake the activities; or
- The activities are emergency maintenance and ARTC first became aware of the need to undertake the activities within 72 hours of the time at which they must be commenced.

ARTC operates, during its operating hours, a telephone complaints line to receive any complaints from the public in relation to its activities.

9.4.3 Pollution Reduction Programs

The results of all PRPs and Environmental Improvement Plans (EIPs) undertaken as part of the ARTC's environmental licences in NSW and South Australia will be incorporated into ARTC's operations to ensure that best practice in noise management is being achieved. In this context, best practice will be considered as part of any investigation of reasonable and feasible mitigation measures.

9.5 Review Processes

Under Condition 54 of the project's Conditions of Approval (Appendix B) ARTC will, at 1, 2, 5 and 10 years from commencement of Project operations:

- (a) monitor and review the adequacy and effectiveness of noise and vibration mitigation measures against noise and vibration objectives stated in the Operation Noise and Vibration Management Plan; and

- (b) review, and revise if required, the Source Control Plan; and
- (c) review advances in noise standards and best practice noise mitigation technology as well as any State or Federal Government initiatives to manage rail noise.

If monitoring indicates any substantial exceedance of stated or emerging noise and vibration objectives, as a result of the Project, ARTC will identify and implement any additional reasonable and feasible mitigation measures.

ARTC will submit a report of the monitoring and review to the Director-General within four months of the relevant monitoring period, unless otherwise agreed to by the Director-General. Additional reasonable and feasible mitigation measures identified will be installed or implemented to the satisfaction of the Director-General in consultation with DECCW and affected receivers.

The monitoring and review, and any subsequent mitigation measures will be verified by an independent noise and vibration expert at ARTC's expense. The independent expert must be approved by the Director-General prior to the relevant review period.

For the purposes of this condition, a substantial exceedance is considered to be an exceedance of the L_{Aeq} objective by 2dBA, as measured or assessed over a one week period, or exceedance of the L_{Amax} objective by 2dBA, measured or assessed as the energy-mean maximum noise.

10 COMPLIANCE MONITORING AND REPORTING

10.1 Goals for Monitoring

Condition 54 of the Project's Conditions of Approval (Appendix B) requires that the Project undertake ongoing monitoring with a view to confirming the effectiveness of its mitigation measures and identifying the need for any additional mitigation required.

Further, Table 8-2 nominates residences where it is not considered reasonable and feasible to provide noise mitigation before appropriate noise monitoring has been carried out.

This section outlines a monitoring strategy that takes into account the limitations in accuracy of noise modelling and monitoring as described in the Environmental Assessment, Technical Paper 2 – Noise and Vibration Assessment. The Technical Paper noted that in general, agreement between measured and predicted noise levels was good. The following points are noted as limitations of model validation:

- The model used the predictive procedures developed for the Rail Noise Database (Wilkinson Murray, 2000), including corrections for speed, distance from the track and shielding which are determined independently for each third-octave band between 10 hertz and 400 hertz. In developing the database, these predictions were validated only for distances up to 40 metres from the track. However, at larger distances, the predictions are considered to be conservatively high;
- Although a comparison is presented for all three train types (electric passenger, diesel passenger and freight), the limited number of measured diesel passenger and freight movements means that a comparison for these types is less reliable than for electric passenger movements;
- Measured noise levels were significantly over-predicted at location A at Leumeah (Table 10-1). Inspection at this location revealed that recorded noise levels were approximately 5dBA lower on the second measurement day compared with the first, and the operator indicated that train speeds appeared to be significantly lower. Variability between different movements was also quite large at this location. It is presumed that speed variability is a feature of this location, which is between Leumeah and Campbelltown Railway Stations. In final calculations, the rated maximum speed was still conservatively adopted;
- At location D at Casula (Table 10-1), SEL levels, but not L_{Amax} levels, appeared to be significantly overpredicted. This is presumably due to the fact that this location is much further from the track than the others (180 metres from the nearest track), and the effective angle of view is lower than assumed in the modelling procedures. In final calculations, a correction of -5dBA was added to the predicted SEL levels at this and the two nearby catchment areas;
- There may have been some under-prediction of L_{Amax} levels at locations B (Minto) and E (Liverpool) (Table 10-1), possibly due to local track conditions near these locations. However, in the absence of a clear reason for this effect, it was not included in final modelling.

Because the changes in noise with and without the SSFL (as shown in Table 8-2) are in some cases less than the accuracy of short term monitoring, hence there are limitations to the accuracy of measurements to validate the noise model. It is therefore proposed to augment the monitoring using one or two permanent monitors capable of determining the long term

change in $L_{Aeq,24hr}$ to greater accuracy.

Note that the monitoring discussed in this section is for the purpose of determining compliance with noise criteria, and is separate from the monitoring discussed above in Section 9.1 for condition monitoring.

10.2 Monitoring of Noise Levels at Residences

Monitoring of operational noise levels will be undertaken at 1, 2, 5 and 10 years after the opening of the SSFL. This will be directed at measuring L_{Amax} noise levels from freight operations on the SSFL, which can be directly compared with the predicted levels shown in Table 8-2. L_{Aeq} levels can be estimated from the measured L_{Amax} levels, and also compared with values shown in Table 8-2.

Measurements would be acquired using unattended noise monitors left in the field for at least 7 days, with recorded maximum levels being later correlated with known freight movements. This will allow maximum noise levels to be determined to within an accuracy of 1-2 dBA for that 7 day period.

Monitoring will be undertaken from at least 13 sites, including the 10 sites used for noise monitoring as reported in the EA for the project. These are listed in Table 10-1, but as they may be subject to alteration during the 10 year life of the monitoring phase, they are indicative. Monitoring will also be done at the three monitoring sites in Casula which formed part of a 2009 study conducted by TCA, and which are also included in Table 10-1.

Table 10-1 Monitoring Locations

Location	Address
A	22 Kulgoa Street, Leumeah
B	16 Somerset Street, Minto
C	24 Railway Parade, Glenfield
D	21 Slessor Road, Casula
E	86/3 Riverpark Drive, Liverpool
F	150 Broomfield Street, Cabramatta
G	18 Fraser Road, Canley Vale
H	75 Wattle Avenue, Carramar
I	Unit 1/113 Wellington Rd, Sefton
J	33 Wellington Road, Birrong
K	Casula
L	Casula
M	Casula

10.3 Permanent Monitoring Equipment and Procedures

As discussed, short-term (7 to 14 days) measurements have at best an accuracy of 1-2dBA for long term train noise exposure. To increase the accuracy requires measurement of many more trains. It is proposed to install 1 or 2 permanent noise monitors (depending on availability of suitable locations) to “calibrate” the short term measurements.

The monitoring will commence at least 6 months prior to the opening of the SSFL. The $L_{Aeq,24hr}$ will then be determined at the permanent location. The noise monitors will operate in conjunction with wheel detectors to ensure the recorded noise levels are due to trains.

Increasing accuracy in determination of $L_{Aeq,24hr}$ is dependant on the number of trains passes. To determine this to within 0.5dBA accuracy would require continuous monitoring for approximately 8 weeks. Hence, reporting of noise levels from the long term monitoring will be in terms of a running 8 week average.

10.4 Action from Monitoring

Where monitoring shows a clear indication that:

- for locations with a direct exposure to the rail corridor (ie, where no barrier exists), monitored noise levels (L_{Amax} or L_{Aeq}) exceed the levels at that location in the absence of the SSFL (refer to "2010 Before" column in Table 8-2); or
- for locations with no direct exposure to the rail corridor monitored levels exceed the predicted values shown for that location in Table 8-2,

then:

- further monitoring and/or modelling shall be undertaken to determine the extent of the identified exceedance; and
- noise mitigation measures shall be investigated to rectify the situation and implemented where found to be feasible and reasonable. The mitigation measures will be determined in consultation with affected property owners and/or occupiers.

A report of the monitoring results must be submitted to the Director-General within 4 months of the relevant monitoring period and be verified by an independent expert approved by the Director-General.

11 COMPLAINTS MANAGEMENT

Complaints will be managed under the ARTC Complaints Strategy. This Strategy and associated plan will be finalised prior to the opening of the SSFL.

ARTC is already required to record pollution complaints and operate a telephone complaints line under its Environmental Protection Licence (EPL) 3142 (at Appendix E). The relevant conditions are:

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:

- (a) the date and time of the complaint;*
- (b) the method by which the complaint was made;*
- (c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;*
- (d) the nature of the complaint;*
- (e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and*
- (f) if no action was taken by the licensee, the reasons why no action was taken.*

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

The Complaints Strategy will assist in determining whether noise and/or vibration monitoring is required in response to a complaint. In the first instance this may involve analysis of wayside monitoring to determine if abnormally noisy trains were using the SSFL. The requirement for monitoring would be confined to circumstances where the monitoring would have the potential to influence the provision of mitigation based on the criteria of Section 4.1.1 (in the case of noise) or Section 4.2 (in the case of vibration).

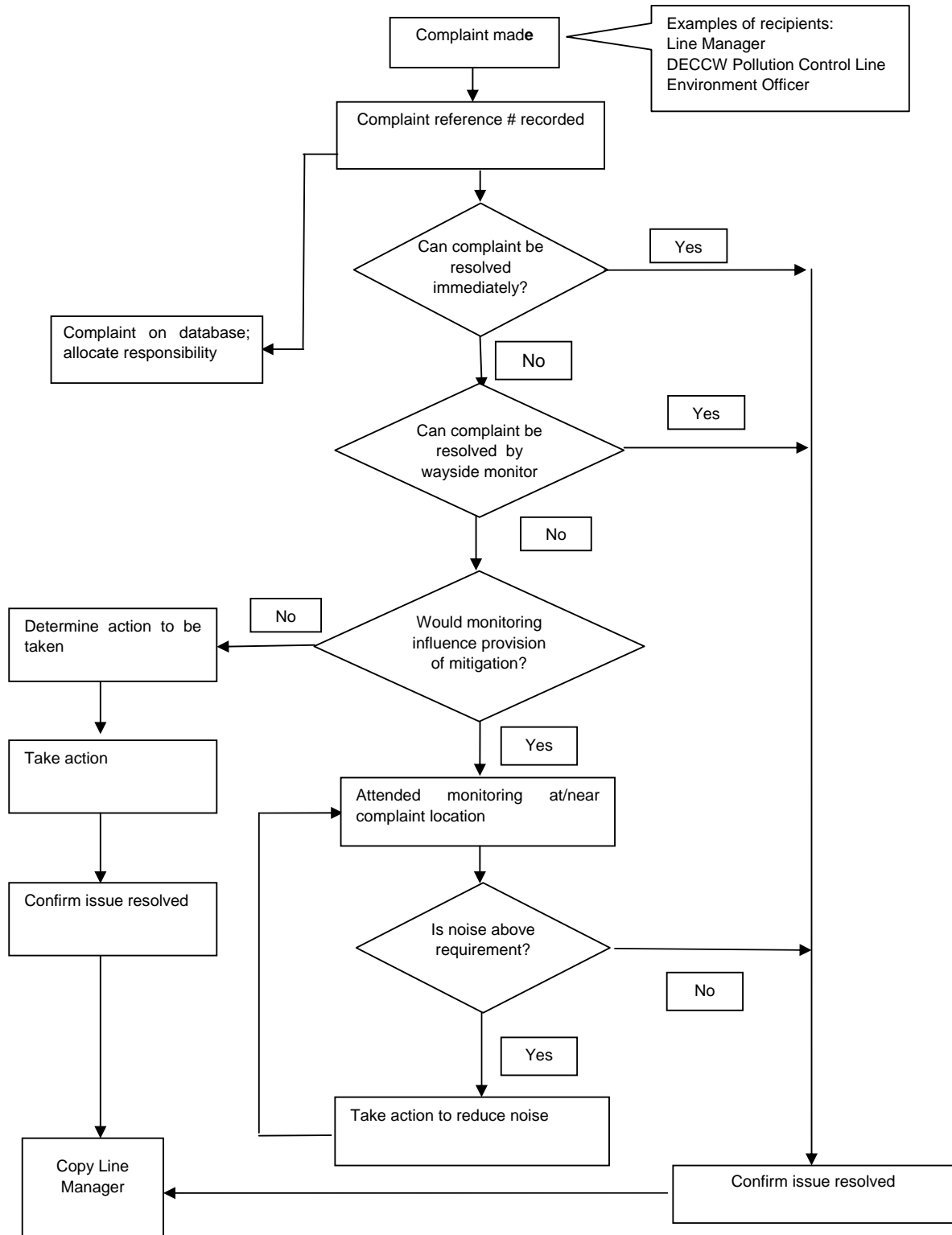
Where the Strategy deems it to be necessary, attended monitoring is to be undertaken at the site of the complaint as soon as possible after the complaint is received. Monitoring is to include measurement of the A-weighted and Linear L_{max} noise levels (or in the case of vibration, the Peak Particle Velocity or Vibration Dose Value as appropriate) of pass-by(s) of the train set(s) relevant to the source of the complaint. The monitoring is to be undertaken as near as practicable to the site to which the complaint relates. The results of the noise monitoring must be verified by an acoustic engineer and then logged against the initial record of complaint.

If the acoustic monitoring indicates that noise from the considered train set(s) is above the noise levels indicated in Section L6 of EPL 3142, the ARTC must initiate corrective actions that will reduce the train's pass-bys noise levels. Such actions may include ordering the owner of the set to remove it from the SSFL tracks until appropriate maintenance is conducted and a test report as described in Section 9.2 indicates compliance with the relevant noise emission levels.

Subject to the agreement of the complainant, a second round of noise monitoring of the considered train set may be undertaken from the site of the original monitoring within two weeks of the train set being re-introduced to the operational network. Where noise monitoring does not indicate that the train's noise emission levels have reduced to the levels expressed in RailCorp's Rail Noise Database for the relevant train set, the ARTC Officer should notify the Line Manager with a recommendation for further action to be taken against the owner of the set.

ARTC shall log all of the above matters in a single report that shall include all noise monitoring results, actions and recommendations. This report is to be submitted to the Line Manager and a copy kept in a central Complaints Database.

A flowchart for complaints management is shown on Figure 11-1.

Figure 11-1 Complaints Management Flowchart

12 PERIODIC REVIEW OF ADEQUACY OF THE PLAN

In order to maintain its integrity, this Operational Noise and Vibration Management Plan shall be reviewed by ARTC in each of Years 1, 2, 5 and 10 after the commencement of the Project immediately after the completion of the compliance noise monitoring indicated in Section 0. This review process shall directly respond to the requirements of Condition 54 of the Project's Approval and shall comment explicitly on at least the following items:

- the adequacy of noise and vibration mitigation measures adopted by the Project;
- current best practices for operational noise and vibration mitigation for freight operations;
- the currency of guidelines and Standards referenced by this Plan, and
- to which government departments and industry agencies the latest version of the Plan is to be sent.

Note

All materials specified by Wilkinson Murray (Sydney) Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Version	Status	Date	Prepared by	Checked by
A	Draft	28 May 2009	David Borella	Rob Bullen
B	Draft	19 June 2009	David Borella	Rob Bullen
C	Draft	3 August 2009	David Borella	Rob Bullen
D	Draft	8 March 2010	George Jenner	Rob Bullen
E	Draft	6 May 2010	George Jenner	Rob Bullen
F	Draft	17 May 2010	George Jenner	-
G	Draft	2 September 2010	George Jenner	Rob Bullen
H	Draft	21 September 2010	George Jenner	Rob Bullen
H	Final	13 October 2010	George Jenner	Rob Bullen

APPENDIX A

GLOSSARY OF TERMS

GLOSSARY

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph overleaf, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) 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.

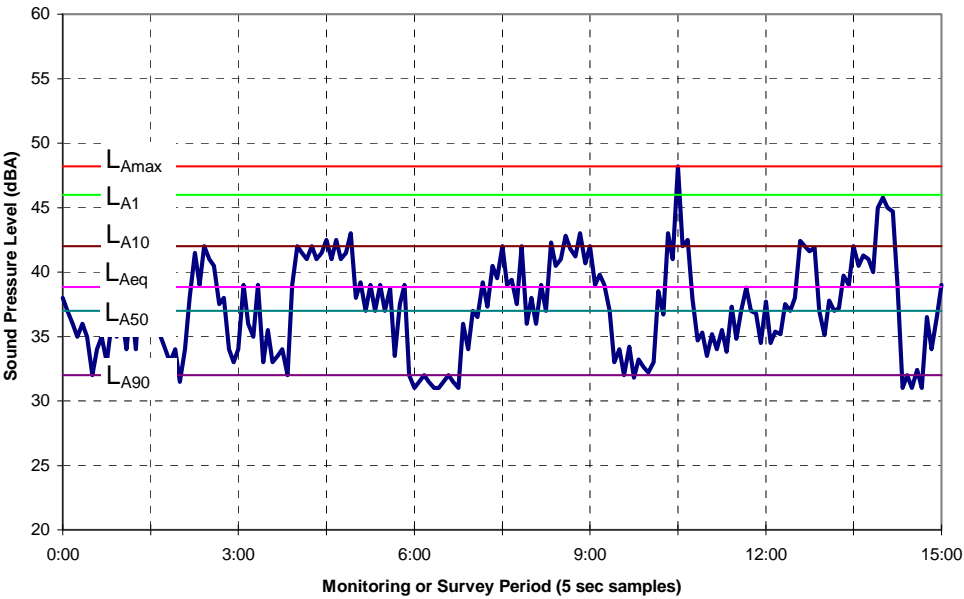
L_{A50} – The L_{A50} level is the noise level which is exceeded for 50% of the sample period. During the sample period, the noise level is below the L_{A50} level for 50% of the time.

L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

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 (L_{A90}) for each period.

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.

SEL – The noise level over one second that contains the same energy as an L_{Aeq} measured over any period. Used to compare L_{Aeq} measurements done over different periods.



APPENDIX B

CONDITIONS OF APPROVAL
(RELATING TO NOISE & VIBRATION)

Condition 51

The Proponent must prepare an Operation Noise and Vibration Management Plan (ONVMP) no later than 6 months from the commencement of construction (or as otherwise agreed by the Director-General). The Plan must confirm noise and vibration control measures in order to achieve the Director-General's Requirements for Environmental Assessment. The Plan must be prepared in consultation with Relevant Government Departments, Relevant Councils, Stakeholders and the CLG(s) and approved by the Director-General.

The ONVMP must include details of noise and vibration control measures to be implemented during the Operation stages including:

- (a) identification of sensitive receivers (including those outside residential areas);
- (b) identification of the appropriate operational noise and vibration objectives and levels for sensitive receivers;
- (c) predictions of operational noise and vibration impacts at sensitive receivers;
- (d) examination of all Reasonable and Feasible noise and/or vibration mitigation measures;
- (e) identification of specific physical and managerial measures for controlling noise and vibration including location, type and timing of erection of permanent noise barriers and/or other noise mitigation measures demonstrating best practice;
- (f) a Source Control Plan which identifies strategies for source controls including:
 - i a program of condition monitoring for the purpose of minimising noise emissions from freight rolling stock and maintenance activities;
 - ii targets, assessment, action and review processes for incorporation and implementation of best practice measures;
- (g) procedures for complaints management, including investigation and monitoring (subject to complainant agreement); and
- (h) procedures for reviewing the adequacy of operational noise and vibration mitigation measures.

The Proponent is to implement the identified noise and vibration control measures and make the ONVMP publicly available.

If the Director-General considers that the ONVMP does not adequately confirm noise and vibration control measures commensurate with the Director-General's Requirements for Environmental Assessment, the Director-General may direct the Proponent to have the adequacy of noise and vibration control measures identified in the ONVMP independently verified by a noise and vibration expert. The verification will be undertaken at the Proponent's expense and the independent expert must be approved by the Director-General.

Condition 52

Where required, the Proponent must install physical noise and vibration mitigation measures, subject to:

- (a) consultation with directly affected property owners, Relevant Councils and the CLG(s); and
- (b) detailed design taking into consideration:
 - i shadow analysis for north facing sites in residential areas;
 - ii assessment of local flooding impacts; and
 - iii assessment of potential for graffiti and other forms of vandalism.

Condition 53

All noise barriers installed must have absorptive surfaces on the rail side to minimise the impacts of noise reflection.

Condition 54

At 1, 2, 5 and 10 years from commencement of Project operations the Proponent must:

- (a) monitor and review the adequacy and effectiveness of noise and vibration mitigation measures against noise and vibration objectives stated in the Operation Noise and Vibration Management Plan; and
- (b) review, and revise if required, the Source Control Plan; and
- (c) review advances in noise standards and best practice noise mitigation technology as well as any State or Federal Government initiatives to manage rail noise.

If monitoring indicates any substantial exceedance of stated or emerging noise and vibration objectives, as a result of the Project, the Proponent must identify and implement any additional Reasonable and Feasible mitigation measures.

A report of the monitoring and review must be submitted to the Director-General within 4 months of the relevant monitoring period, unless otherwise agreed to by the Director-General. Additional Reasonable and Feasible mitigation measures identified must be installed or implemented to the satisfaction of the Director-General in consultation with DECCW and affected receivers. Southern Sydney Freight Line Project Approval 24 July 2007

The monitoring and review, and any subsequent mitigation measures must be verified by an independent noise and vibration expert at the Proponent's expense. The independent expert must be approved by the Director-General prior to the relevant review period.

For the purposes of this condition, a substantial exceedance is considered to be an exceedance of the L_{Aeq} objective by 2dBA, as measured or assessed over a one week period, or exceedance of the L_{Amax} objective by 2dBA, measured or assessed as the energy-mean maximum noise.

APPENDIX C

SSFL NOISE WALLS, FACILITATOR'S REPORT FOR MEETINGS WITH RESIDENTS AND BUSINESS OWNERS

Southern Sydney Freight Line Noise Walls Facilitator's Report for Meetings with Residents and Business Owners September - November 2009

Faye Hargreaves Consulting Pty Ltd and ARTC held a series of meetings with residents and business owners to discuss the noise walls proposed to be constructed as part of the Southern Sydney Freight Line project. Only people living or working in the immediate vicinity of each proposed noise wall were invited. They were not open public meetings.

Faye Hargreaves facilitated each meeting, introduced team members and explained that the purpose of the meeting was to provide information on the location and height of the proposed noise wall and to seek community input into its detailed design. The ARTC representative gave a presentation on the Southern Sydney Freight Line project, explained why noise walls need to be constructed as part of the project, and provided details of the location and height of the noise wall in that particular area. At some of the meetings a representative from Caldis Cook, the urban designers who prepared the Urban Design and Landscape Plan, were present in order to answer questions.

The following table documents the issues raised at each meeting.

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
Villawood Senior Citizens Centre, Mon 14 th Sep 2009 at 6pm	Residents of 160 houses/units on Villawood Road and Wattle Ave	Faye Hargreaves Gerhard Malan Stephen Ormiston (79 Wattle Av) Mai Ormiston (79 Wattle Av) Mr Ormiston (70 Wattle Av) Yugu An (75 Wattle Av) Qi Shan An (75 Wattle Av) Shu Fen Jiang (75 Wattle	<ul style="list-style-type: none"> Concerned about noise walls blocking light into windows of residences as they will be very close. Concerned about the potential for more diesel fumes coming from more trains and impacts of the associated smell/pollution on families in the area. There should be noise walls on both sides of the train line as average noise is likely to increase 	<ol style="list-style-type: none"> Addressed in Section 8 of ONVMP. Shadow diagrams prepared for UDLP. Not applicable to noise walls. Addressed in Sections 5 and 8 of ONVMP. Barriers will have an acoustically absorptive surface

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
		Av) Geoff Ashton (1 Kirrang Av) Anthony Chidiac (42 Villawood Rd) Janette du Buisson Perrine (73 Koonoona Ave) Gavin du Buisson Perrine (20 Wattle Av) Jeff Parkin (77 Koonoona Av) Bedron Moses (11 Wattle Av) Bei Tram (69 Wattle Av) Amy Nguyen (1 Edmunds St)	<p>on both sides as the number of freight trains increases.</p> <ul style="list-style-type: none"> Disappointed with the noise study results as some of the machines weren't working during the study and some of the results had to be guessed based on other studies. Noise walls of 4.8m are not high enough as some of the houses are double storey buildings. Concerned about vibration impacts from the trains. Need to know exact locations of noise walls – the level of detail available in the presentation is not sufficient. Concerned about security as 	<p>on the rail side to limit reverberant build-up of noise between the side of a train and the barrier, which would otherwise increase noise levels for receivers on the opposite side of the barrier.</p> <ol style="list-style-type: none"> As noted in Section 3, as far as possible, all potentially impacted residences were included in the study. All receivers used in study are listed in Table 3.1 and shown in Figure 3.1(a) to (p). As described in Section 4.1.3, any proposed mitigation measures must be “feasible and reasonable” in terms of practicality and consistency with other community goals. The maximum barrier height considered feasible in engineering terms is 4.2m above ground level (generally 4m above track height). Vibration impacts are addressed in the report, in Sections 2.1, 4.2 and 7. Exact locations are shown in the UDLP available to the community, and in detailed engineering drawings being made available to local Councils. People hiding behind the noise

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
			<p>people can hide behind the noise walls and won't be seen from the residences adjacent to them.</p> <ul style="list-style-type: none"> Concerned that the noise walls will attract graffiti. 	<p>walls will be inside the rail corridor, an area off-limits to the general public.</p> <p>9. As noted in Section 1, the design of the walls, including an assessment for the potential for graffiti and other forms of vandalism, is discussed in the UDLP.</p>
Cabramatta Community Centre, Tue 15 th Sep 2009 at 6pm	Residents of 70 houses/units on Broomfield Street.	Faye Hargreaves Gerhard Malan John Verhoeven No residents		
Chester Hill Community Centre, Tue 22 nd Sep 2009 at 7pm	Residents of 130 houses/units on Wellington Road	Faye Hargreaves John Verhoeven Stephen Caldis S Iacono (183 Wellington Rd) G Howe (161 Wellington Rd) Z Chen (165 Wellington Rd) Stephen Ormiston (79 Wattle Av) Mai Ormiston (79 Wattle Av)	<ul style="list-style-type: none"> The proposed noise walls are not high enough to block noise coming from the top of trains. Concerned about security as people can hide behind the noise walls and won't be seen from the residences adjacent to them. Asked when they will be built – would like it to be as soon as possible. Concerned about vibration impacts Some trees were removed without any notification to residents. 	<p>10. See comments 5 and 8 above.</p> <p>11. Noted.</p> <p>12. See comment 6.</p> <p>13. This has been addressed, with regular ARTC-Council-contractor meetings to identify and resolve issues, approvals, etc</p>
Liverpool Central Library, Thu 24 th Sep at 6pm	Residents of 500 unit blocks on Riverpark Drive and Shepherd	Faye Hargreaves John Verhoeven Amy Cropley	<ul style="list-style-type: none"> Would like to see vegetation/vines growing up the noise walls to prevent graffiti. 	<p>14. This suggestion is included in wall designs where appropriate, and is shown in the UDLP.</p>

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
	Street	Ilifa Kesic (71/3 Riverpark Dr) Maree Stacy (55/1 Riverpark Dr) Vlayko Denjovik (8/4 Riverpark Dr)	<ul style="list-style-type: none"> The vegetation should be native and seeds should be sourced locally. Would like the look of the noise walls to be sympathetic to the local environment. Suggested consultation with the local Aboriginal community concerning appropriate designs. 	<p>15. This is identified in the UDLP.</p> <p>16. This is identified in the UDLP.</p> <p>17. All the community, including the Aboriginal community, is included in the design process through their local Councils and Community Liaison Groups.</p>
HJ Daley Library, Campbelltown, Mon 28 th Sep at 6.30pm	Occupants of 50, mostly commercial, buildings on Farrow Rd and Watsford Rd	Faye Hargreaves John Verhoeven Amy Cropley Cordelia Peters (4 Watsford Rd)	<ul style="list-style-type: none"> Pleased that her church will be protected by a noise wall. Their 10am services on Sundays are often interrupted by the noise of freight trains going past. 	18. Noted. The church is sensitive receiver ID 1160.
Cabramatta Community Hall, Wed 30 th Sep at 6.00pm	Occupants of 100 houses, units and businesses on Broomfield St and First Av	Faye Hargreaves Dan Hickey Bunthy Kong (166 Broomfield St) Noel Freeman (14 First Av) Stephen Ormiston (79 Wattle Av) Mai Ormiston (79 Wattle Av)	<ul style="list-style-type: none"> Happy about the project and that they are getting noise walls to protect their houses. Would like more notice of community impacts such as bridge closures. 	<p>19. Noted.</p> <p>20. Not applicable to noise walls. Followed up separately.</p>
Ingleburn Community Centre, Thu 1 st Oct at 7.00pm	Occupants of 100 houses and businesses on Stanley Rd and	Faye Hargreaves Glen Devenish Rada Anton (13 Stanley Rd)	<ul style="list-style-type: none"> Happy about where the noise walls are going to be. Suggested the noise walls have a different shape and overhang 	<p>21. Noted.</p> <p>22. Engineering requirements determine the shape and</p>

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
	Broadhurst Rd	D May (67 Stanley Rd) Hemant Kulkarni (2 Norwich Rd) J Eldridge (27 Ivanhoe St) Elyza Eldridge (27 Ivanhoe St) Vyasa Schiemer (3/21 Stanley Rd)	towards the rail track rather than being straight. <ul style="list-style-type: none"> Asked how much an embankment reduced noise compared to a noise wall. 	positioning of the noise walls. 23. Engineering requirements determine the location of the noise walls.
Minto Indoor Sports Centre, Tue 6 th Oct at 7.00pm	Occupants of 80, mostly commercial, buildings on Sommerset St	Faye Hargreaves Glen Devenish No residents or business owners		
Leumeah Scout Hall, Thu 8 th Oct at 7.00pm	Residents of 100 houses on Hollylea Rd and Kialba Rd	Faye Hargreaves Dan Hickey No residents or business owners		
Liverpool Council, Thu 26 th Nov at 9.00am	Representatives from the Casula Powerhouse and Liverpool Council	Faye Hargreaves John Verhoeven David Cook Natalie (artist) Nikita Karvounis (Business Manager, Casula Powerhouse) Steven Alderton (Director, Casula Powerhouse) Vince Capaldi (Liverpool Council)	<ul style="list-style-type: none"> Asked whose responsibility it is to maintain the noise wall once it's been constructed? Concerned about graffiti on the noisewall and visual impact on users of the Casula Powerhouse. There should be mitigation measures to prevent the noise wall from being tagged. Asked what Railcorp's response time is to remove graffiti and if that only applies to offensive graffiti. 	24. RailCorp. 25. See comment 9. 26. See comment 9. 27. See comment 9.

Meeting Details	People Invited	People Present	Issues Raised	Incorporation of Issues into ONVMP and UDLP
		<p>Jeff Organ (Liverpool Council)</p> <p>Cleo King Hung Pang (Liverpool Council)</p>	<ul style="list-style-type: none"> ▪ The noise wall will block the view of the Casula Powerhouse from the rail corridor – currently rail passengers can see the venue and they can advertise to thousands of rail passengers. ▪ Need a vegetation management plan to stop people getting to the noise wall – would prefer fast growing vegetation. ▪ Would like to see a drawing of what the noise wall will look like once completed. ▪ Happy with the proposed artwork. ▪ Would like the noise wall to become a feature rather than an eyesore – possibly incorporating the artwork and the incredible wildlife in the area. ▪ Asked that Casula Powerhouse be treated as a unique location. 	<p>28. Jointly explored possible options, without finding a practical solution.</p> <p>29. This suggestion is included for that part of the wall design where appropriate, and is shown in the UDLP.</p> <p>30. ARTC will provide a drawing.</p> <p>31. Noted.</p> <p>32. This is the aim of the design in the UDLP.</p> <p>33. It is receiver ID 772 and 773, and is featured in the UDLP.</p>

APPENDIX D

SSFL NOISE WALL DISCUSSIONS WITH LOCAL COUNCILS

Item	Item Description	Status April 2010	Drawings / Reports / Other Information
Bankstown City Council			
Table 1 Feedback 13 February 2009			
1.7	Theme A, being images of natural local plants is accepted for the Bankstown walls	Design of pattern for Bankstown Noise Walls has been completed. Closed	UD-NW-560[A] BANKSTOWN LGA NW PATTERN
1.8	On the upper retaining wall a trellis is proposed yet no details are included. There is no reference to vines anywhere else within report, and no vines listed within the planting section	Design of Trellis & plant selection completed. Through the Bankstown LGA no trellis are required - the noise walls will be screened using large screening plants. Species include <i>Acacia falcata</i> , <i>Acacia floribunda</i> , <i>Acacia linifolia</i> , <i>Acacia longissima</i> , <i>Acacia terminalis</i> , <i>Banksia marginata</i> , <i>Hakea dactyloides</i> , <i>Dodenea triquetra</i> . Closed	UD-NW-550[A] NOISE WALL TRELLIS & STAGGERING LA01 Landscape Package 1
1.9	A trellis system is unlikely to be successful - typically vines chase the sun and will result in sparse growth at bottom section of the wall and lush growth sitting at the top. Where the wall faces south, the plants at base will have difficulty establishing. An alternate approach could be to include a climbing fig (<i>Ficus pumila</i>), or ivy (<i>Hedera helix</i> , <i>Parthenocissus tricuspidata</i>) or similar, or preferably have greater/ taller tree canopy screen in front.	Design of Trellis & plant selection completed. Through the Bankstown LGA no trellis are required - the noise walls will be screened using large screening plants. Species include <i>Acacia falcata</i> , <i>Acacia floribunda</i> , <i>Acacia linifolia</i> , <i>Acacia longissima</i> , <i>Acacia terminalis</i> , <i>Banksia marginata</i> , <i>Hakea dactyloides</i> , <i>Dodenea triquetra</i> . Closed	UD-NW-550[A] NOISE WALL TRELLIS & STAGGERING LA01 Landscape Package 1
1.10	The colour scheme of charcoal and red is accepted for the Bankstown area.	Refer to UDLP 4.2. Closed	UD-RW-0200[A] RETAINING WALL 020 URBAN DESIGN PLAN AND ELEVATION; UD-RW-0400[A] RETAINING WALL 040 URBAN DESIGN PLAN AND ELEVATION; UD-RW-0700[A] RETAINING WALL 070 URBAN DESIGN PLAN AND ELEVATION; UD-RW-0800[A] RETAINING WALL 080 URBAN DESIGN PLAN AND ELEVATION; UD-RW-1000[A] RETAINING WALL 100 URBAN DESIGN PLAN AND ELEVATION; UD-RW-1001[A] RETAINING WALL 100 URBAN DESIGN ELEVATION
1.11	Intermittent and random horizontal pattern incorporating predominantly charcoal with red or almond patterns through the walls is the preferred colour scheme arrangement in the Bankstown area.	Refer to UDLP 4.2. Closed	Refer to Item 1.10
1.18	No vine planting is specifically mentioned for trellis system proposed.	Trellis system is not required in the Bankstown LGA refer to LA01 Landscape Package 1 for details of planting along the rail corridor through Bankstown. Closed	LA01 Landscape Package 1
Table 2 Meeting 3 August 2009			
2.9	Themes on noise walls needs to be finalised	Theme for Bankstown Noise Walls has been designed. Closed	UD-NW-560[A] BANKSTOWN LGA NW PATTERN
Table 10 Meeting 23 November 2009			
10.7	<p>Noise Walls</p> <p>- Noise walls within BCC are to be a combination of light and dark grey (Shale Grey and Windspray)</p> <p>Themed noise walls to be used in selected locations and will consist of "natural plants" imprinted into Hebel Panels.</p>	<p>Colours have been selected to ensure that they can be easily respecified by any painting contractor. Any graffiti will be painted out. The time frame to be agreed between ARTC/BCC/RailCorp. Closed</p> <p>Closed</p>	UD-NW-040 SSFL NOISE WALL 4 URBAN DESIGN PLAN AND ELEVATION SHEET 1; UD-NW-041 SSFL NOISE WALL 4 URBAN DESIGN ELEVATION SHEET 2; UD-NW-050 SSFL NOISE WALL 5 URBAN DESIGN PLAN AND ELEVATION SHEET 1; UD-NW-051 SSFL NOISE WALL 5 URBAN DESIGN ELEVATION SHEET 2; UD-NW-070 SSFL NOISE WALL 7 URBAN DESIGN PLAN AND ELEVATION; UD-NW-080 SSFL NOISE WALL 8 URBAN DESIGN PLAN AND ELEVATION SHEET 1; UD-NW-081 SSFL NOISE WALL 8 URBAN DESIGN ELEVATION SHEET 2; UD-NW-082 SSFL NOISE WALL 8 URBAN DESIGN ELEVATION SHEET 3; UD-NW-090 SSFL NOISE WALL 9 URBAN DESIGN PLAN AND ELEVATION; UD-NW-100 SSFL NOISE WALL 10 URBAN DESIGN PLAN AND ELEVATION SHEET 1; UD-NW-101 SSFL NOISE WALL 10 URBAN DESIGN ELEVATION SHEET 2; UD-NW-120 SSFL NOISE WALL 12 URBAN DESIGN PLAN AND ELEVATION; UD-NW-140 SSFL NOISE WALL 14 URBAN DESIGN PLAN AND ELEVATION SHEET 1; UD-NW-141 SSFL NOISE WALL 14 URBAN DESIGN ELEVATION

Item	Item Description	Status April 2010	Drawings / Reports / Other Information
	Specification of colours/paint specifications for noise walls to be provided to BCC.	Closed	
	Time frames for removal of graffiti to be subject to future agreement between ARTC/BCC/RailCorp.	Closed	
Fairfield City Council			
Table 3 Feedback February 2009			
3.2	The large scale nature of the noise walls must not create any flooding problems.	Noise wall design includes use of gabions to facilitate water movement. No flooding impacts. Closed	
3.3	Graffiti resistant materials must be used to sufficiently deter graffiti of the noise walls until such time as the plants are able to grow over the wall.	The colours for the Noise walls are based on Colorbond powercoat colours to ensure that it is easy to respecify them. A maintenance agreement (between ARTC, Council and RailCorp) will be put into place to ensure that graffiti on the noise walls is dealt with as quickly as possible. Closed	
3.4	Public meetings be arranged in addition to Community Liaison Group meetings, to enable the broader community to be informed of and have an input into the UDLP, with sample materials being made available for inspection.	UDLP has been published on SSFL website. All community consultation is in accordance with requirements of Conditions of Approval (CoA) and Statement of Commitments (SoC) And being consulted to each of the LGA's. Presentation to the Fairfield CLG on the UDLP 03/02/2010. CCG available for further presentations to the CLG if required. Closed	
3.7	Public art offerings are to be provided at the Cabramatta Station which creatively enhance a well considered and designed precinct for Cabramatta east, and add an element of surprise and delight.	Popperbox engaged by ARTC 11/08/09 for Cabramatta Stn and involve community consultation. Meetings held on 28/8/09 and 17/9/09. Closed	
3.8	A creative and pleasing rhythm of treatments are to be provided along the length of the SSFL track/noise walls	Refer to Item 3.7. Closed	
3.9	Clear and timely communications are to be committed to between the ARTC, the architects, artist and Council, so that the artist can have timely input into	Refer to Item 3.7. Closed	
3.10	A clear and timely graffiti removal/maintenance program, which is sensitive to artistic works, be developed.	Two key strategies have been adopted to mitigate the impact of graffiti: 1) Noise walls will have a painted finish and any graffiti will be painted over in accordance with the agreement between ARTC, Fairfield City Council and RailCorp. Colours have been selected from a limited palette to ensure that it is easy to specify the correct colours. 2) Where possible, the noise walls will be covered by plants either large screening plants or climbing plants that are supported by wire trellis system. Closed	
Table 4 Meeting 3 August 2009			
4.8	FCC dissatisfied with the process of appointing community artist for Public Art. Following pressure from ARTC/CCG to facilitate the procurement of the artist, nothing has happened since 26th May when all procurement activities were concluded. All that is required is a contract from ARTC. This matter appears to be resting with CCG. This matter is urgent as it will delay community consultation in regards to the noise walls.	Refer to Item 3.7 for meetings held between FCC, Popperbox and CCG. Closed	
4.16	CCG to confirm that plantings will be done in front of all noise walls to soften the visual effect.	Where possible trellis plantings and screening shrubs will be planted in front of noise walls. Due to limited space, there will be no planting in front of Noise Walls 18 (Carramar Station); NW22 (North Broomfield St); NW 24 (Cabramatta Station); NW 25, 26 and 27 (South Broomfield Street). Closed	
Table 5 Meeting			
5.1	No noise wall issues		
Table 11 Meeting 26 October 2009			
11.7	Hebel Panels have been selected for use. Depending on width of area available – trellis are available in some areas only.	Refer to Item 4.16. Closed	
11.22	Paint and coating noise walls is preferred to anti-graffiti proof and has been developed as the preferred RailCorp strategy. - Time framing to be between RailCorp and ARTC for removal of graffiti	Noted. Closed	

Item	Item Description	Status April 2010	Drawings / Reports / Other Information
Liverpool City Council			
Table 6 Feedback April 2009			
6.8	Proposed themes for public artworks, artistic fences and design guidelines to be coordinated by council's public art manager or relevant committees. There may be a requirement to incorporate public art into noise wall or street furniture and this will be discussed and determined by such committee.	Artists appointed on 11/8/09. Meetings held on 31/8/09 and 17/9/09. Artists have undertaken community consultation for the proposed artworks. Closed	
Table 7 Meeting 4 August 2009			
7.6	Public Art	Refer to Item 6.8. Closed	
Table 12 Meeting 12 September 2009			
12.3	<p>Noise Barriers - Casula Arts Centre</p> <p>- LCC requested that a deterrent to graffiti on the rail side of the noise barriers be provided.</p> <p>ARTC indicated that rail side of barrier has noise absorption requirements that need to be obtained, and it has to be maintainable.</p> <p>ARTC to investigate feasible methods for graffiti prevention on the rail side of the noise wall at Casula Station.</p>	<p>On the rail side of the Noise Barriers - 'Woodtex' is used to absorb noise. The Woodtex has a rough surface that is difficult to paint and the product also absorbs some of the paint finish.</p> <p>The product is bolted to the Hebel panels and if need be the Woodtex can be turned over fairly easily to hide any graffiti.</p> <p>Closed</p>	
Campbelltown City Council			
Table 9 Meeting 4 August 2009			
9.11	Public Art - contact Lisa Havilah urgently	ARTC meeting with CCC to discuss how to progress public art in Campbelltown (22/04/10)	
Table 13 Meeting 12 November 2009			
13.3	<p>Noise Barriers</p> <p>- CCC requested a say in the design of engravings.</p> <p>ARTC indicated that a public artist will work with CCC.</p> <p>CCC has recently adopted "city labelling". ARTC can use "gateway" designs where appropriate.</p>	CCC invited to participate in selection of public artist for Minto and Leumeah stations and for the Noise Wall patterns.	

APPENDIX E

SSFL ENVIRONMENT PROTECTION LICENCE



Environment Protection Licence

Licence - 3142



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Licence Details

Number:	3142
Anniversary Date:	05-September
Review Due Date:	07-Nov-2013

Licensee

AUSTRALIAN RAIL TRACK CORPORATION LIMITED
GOUGER STREET PO BOX 10343
ADELAIDE SA 5000

Licence Type

Premises

Premises

AUSTRALIAN RAIL TRACK CORPORATION LTD
GPO BOX 14
SYDNEY NSW 2001

Scheduled Activity

Crushing, grinding or separating
Railway systems activities

Fee Based Activity

Railway systems activities

Scale

0 - All

Region

Metropolitan
Level 3, NSW Govt Offices, 84 Crown Street
WOLLONGONG NSW 2500
Phone: 02 4224 4100
Fax: 02 4224 4110

PO Box 513 WOLLONGONG EAST
NSW 2520

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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Separate to the requirements under this licence the licensee has other statutory obligations, including those arising under the Transport Administration Act 1998 and the Rail Safety Act 1993.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

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Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees.

The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

AUSTRALIAN RAIL TRACK CORPORATION LIMITED
GOUGER STREET PO BOX 10343
ADELAIDE SA 5000

subject to the conditions which follow.

1 Administrative conditions

A1 What the licence authorises and regulates

A1.1 Not applicable.

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- A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity
Crushing, grinding or separating
Railway systems activities

Fee Based Activity	Scale
Railway systems activities	0 - All

- A1.3 Not applicable.

- A1.4 Except as expressly provided by another condition of this licence, this licence does not authorise any of the following activities in relation to the NSW rail network being an activity that would constitute the beginning of, or any subsequent step in:

- the extension of the NSW rail network, by the laying of track, beyond the land that is the subject of this licence as at the date that the transfer of this licence takes effect;
- the duplication of track laid in a residential area that is in or on land that is the subject of this licence as at the date that the transfer of this licence takes effect.

The removal of a length of track and its replacement by another length of track in the same location does not constitute the beginning of, or any subsequent step in an activity referred to in paragraph (a) or (b).

The construction of any of the following:

- cross-over
- siding
- turnout
- yard
- loops
- refuges
- relief lines

or the reopening of disused lines beyond the land that is the subject of this licence as at the

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date that the transfer of this licence takes effect does not constitute the beginning of, or any subsequent step in, an activity referred to in paragraph (a) except where it will result in significant noise impacts in residential areas.

Note: The EPA and the Licensee should co-operate to ensure that the requirements of the Environmental Planning and Assessment Act 1979 (EP&A Act) and the POEO Act are complied with as efficiently as possible, including where possible by concurrently progressing the processes under the two Acts for the assessment, licensing and approval of an activity or development.

A1.5 The scheduled activity "Crushing, grinding or separating" only applies to the premises of the Minimbah Rail Project as defined at condition A2.2 (4) of this licence.

A2 Premises to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
AUSTRALIAN RAIL TRACK CORPORATION LTD
GPO BOX 14
SYDNEY
NSW
2001
See condition A2.2 for the full description of the licenced premises.

A2.2 The full description of the licensed premises is as follows:

- Until 12.01 am 16 January 2011, "The land and infrastructure defined, from time to time, as "Land", "Additional Land", "Infrastructure" and "ARTC Infrastructure" respectively in the Deed of Lease between ARTC, the State Rail Authority of New South Wales ("SRA") and the Rail Infrastructure Corporation ("RIC"), executed on 4 June 2004, as that document is amended or varied from time to time ("Lease"), to the extent that such land and infrastructure is owned, leased or licensed by, or otherwise vested in SRA or RIC and is the subject of a lease or licence to ARTC by virtue of the Lease, or is otherwise owned by or vested in ARTC, and is under the management or control of ARTC.
- After 12.01 am 16 January 2011, "The land and infrastructure comprising the "Country Regional Network" as that term is defined, from time to time, in the Country Regional Network Management Agreement, between ARTC, SRA and RIC, signed on 4 June 2004, as that document is amended or varied from time to time ("CRNMA"). The infrastructure which forms part of the "Country

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Regional Network" includes the infrastructure defined, from time to time, as "Infrastructure" under the CRNMA.

3. "The land, and the infrastructure comprising the "Infrastructure" and the "ARTC Infrastructure", in the "Freight Corridor", as those terms are defined respectively from time to time in the Deed of Variation to Deed of Agreement for Metropolitan Freight Network Lease and Licence ("Deed of Variation") between Rail Corporation New South Wales ("RailCorp") and Australian Rail Track Corporation Ltd ("ARTC") and the land and infrastructure comprising "Property" and "Rail Infrastructure" as those terms are defined respectively from time to time in the Deed of Licence between Sydney Ports Corporation and RailCorp vested in ARTC on as those documents are amended or varied from time to time, to the extent that all such land and infrastructure is owned, leased or licensed by or otherwise vested in RailCorp and is the subject of a lease or licence to ARTC by virtue of the Deed of Variation, or is otherwise owned by or vested in ARTC, and is under the management or control of ARTC."
4. At a date to be confirmed, "The land, and the infrastructure comprising the "Infrastructure" and the "ARTC Infrastructure", in the "Freight Corridor", as those terms are defined respectively from time to time in the Deed of Second Variation to Deed of Agreement for Metropolitan Freight Network Lease and Licence ("Deed of Second Variation") between Rail Corporation New South Wales ("RailCorp") and Australian Rail Track Corporation Ltd ("ARTC") and the land and infrastructure comprising "Property" and "Rail Infrastructure" as those terms are defined respectively from time to time in the Deed of Licence between Sydney Ports Corporation and ARTC ("Sydney Ports Licence") as those documents are amended or varied from time to time, to the extent that all such land and infrastructure is owned, leased or licensed by or otherwise vested in RailCorp or Sydney Ports Corporation and is the subject of a lease or licence to ARTC by virtue of the Deed of Second Variation or the Sydney Ports Licence, or is otherwise owned by or vested in ARTC, and is under the management or control of ARTC."
5. The land and infrastructure comprising "Property" and "Rail Infrastructure" in the Sydney Ports Licence is referenced in maps named "ARTC Botany Yard 1 EPL - 3142 Variation of MFN take up" dated 03/11/2008 and timed 11:49:12 and "ARTC MFN 2 – Botany" Dated 13/08/09 timed 10:19:43 Rev 3.0 25/08/09 prepared by the Australian Rail Track Corporation (held on EPA File LIC07/1555-08).
6. The land defined as "Property Acquisition / Lease Area" in Figures 1 to 9 dated 24 June 2009 submitted with the licence variation application received by the EPA on 29 June 2009 for the construction of the Minimbah Bank Rail Project as described in Project Approval 08_0060 issued by the Minister for Planning on 22 May 2009.
7. The land denoted "Variation Boundary" and defined by a red dotted line on the map named "Kiacatoo Licence Variation" Document no. AET900.205-C-GIS-001 prepared by Kellogg, Brown & Root P/L dated 8 February 2010 (held on EPA File LIC07/1555-08).
8. Land owned by ARTC comprising the whole of the land described in the Certificates of Titles Auto Consol 11132-54 dated 20 April 1999 and auto Consol 12074-195 dated 20 April 1999.

A3 Other activities

A3.1 Not applicable.

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A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- (a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- (b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

A4.2 Notwithstanding condition A4.1 above, the reference to "licence application" in condition A4.1 is a reference to only those licence applications (including supporting documentation) submitted by ARTC to the EPA on or after 17 August 2004.

A5 Objectives of this licence

A5.1 The principal objectives of this licence are to:

- (a) minimise offensive noise levels, to the extent practicable, of railway operations and their impact on communities surrounding the "premises",
- (b) facilitate the implementation of noise reduction programs for the "premises".

2 Discharges to air and water and applications to land

P1 Location of monitoring/discharge points and areas

P1.1 Not applicable.

P1.2 Not applicable.

P1.3 Not applicable.

3 Limit conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must

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comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Load limits

L2.1 Not applicable.

L2.2 Not applicable.

L3 Concentration limits

L3.1 Not applicable.

L3.2 Not applicable.

L3.3 Not applicable.

L4 Volume and mass limits

L4.1 Not applicable.

L5 Waste

Not applicable

L6 Noise Limits

L6.1 Approvals for Locomotives

The licensee must seek approval from the EPA prior to permitting operation on the “premises” of:

1. a class or type of locomotive, whether new or existing, that has not been operated on the NSW rail network; or
2. a locomotive that has been substantially modified since it was last used on the NSW rail network

EPA approval will be on the basis of compliance with the locomotive noise limits in Condition L6.2.

This condition L6 does not apply to the operation of a locomotive solely for the purposes of conducting noise or other tests that are required for the locomotive’s acceptance by the EPA, the licensee or any person concerned with the design, manufacture, supply or acquisition of the locomotive, provided that multiple pass bys do not occur adjacent to residential premises in the course of the testing.

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Note: EPA approval for a class or type of locomotive will require noise test results from a representative number of locomotives from that class or type.

L6.1 General Noise Limits

L6.1.1 General Noise Limits

It is an objective of this Licence to progressively reduce noise levels to the goals of 65 dB(A)Leq, (day time from 7am – 10pm), 60 dB(A)Leq, (night time from 10pm – 7am) and 85dB(A) (24 hr) max pass-by noise, at one metre from the façade of affected residential properties through the implementation of the Pollution Reduction Programs.

L6.2 EPA Locomotive Noise Limits

L6.2.1 General Noise Limits

Operating Condition	Speed & Location of Measurement	Noise Limit at a microphone height of 1.5 metres above ground level
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15 metre contour	70 dB(A) Max
All other throttle settings under self load with compressor radiator fans and air conditioning operating	Stationary 15 metre contour	87 dB(A) Max 95 dB Linear Max
All service conditions	As per Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA	87 dB(A) Max 95 dB Linear Max

L6.2.2 Limits for Tonality

All external noise must be non-tonal. For the purpose of this condition, external noise is non-tonal if the sound pressure level in each unweighted (linear) one-third octave band does not exceed the level of the adjacent bands on both sides by:

- 5 dB if the centre frequency of the band containing the tone is above 400 Hz; and
- 8 dB if the centre frequency of the band containing the tone is between 160 and 400 Hz, inclusively; and
- 15 dB if the centre frequency of the band containing the tone is below 160 Hz.

L6.2.3 Limits for Low-Frequency Noise

All external noise must not exhibit an undue low-frequency component. To comply with this requirement, linear noise levels must not exceed the A-weighted noise levels by more than 15 dB.

L6.3 Locomotive Noise Emission Test Methods

Application for approval as required by L6.1 must be supported by type testing of the locomotive using procedures that are consistent with the requirements of Australian Standard AS2377-2002 (Acoustics – Methods for the measurement of railbound vehicle noise) except as otherwise approved by the EPA. The type testing must provide all necessary measurement parameters for demonstrating compliance with the locomotive noise limits in L6.2.

Information supplied to the EPA as part of the application for approval must fulfil the requirements of Section 11 of AS2377-2002 for reporting.

Note: The measurement parameters required in L6.2 differ in some cases from those identified in AS2377-2002. The test procedures, measurement equipment and environmental conditions applied in supporting the application to the EPA for approval are to yield all parameters identified in L6.2 but are otherwise to be applied in a manner that is consistent with the requirements of AS2377-2002. The 15 metre contour specified in L6.2.1 is to be represented by the 12 measurement points shown in AS2377-2002, Figure 1.

L6.4 Approval of Locomotives Not Meeting All EPA Limits

The EPA may approve locomotives that do not comply with all limits prescribed by L6.2, provided that the application for approval demonstrates that:

- a) the noise emission performance of the locomotive is consistent with current best practice; and
- b) all measures for minimising the extent of any non-compliance have been investigated and those that are identified as reasonable and feasible have been implemented; and
- c) none of the non-compliances will result in unacceptable environmental impacts.

4 Operating conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- (a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- (b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

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- (a) must be maintained in a proper and efficient condition; and
- (b) must be operated in a proper and efficient manner.

O3 Railway Maintenance and Construction Activities

O3.1 The objective of this condition is to minimise noise from railway maintenance and construction activities, recognising that operational and other factors constrain when these activities can be carried out on the “premises”. These factors include avoiding disruptions during peak periods for passenger services and ensuring that programmed track closures facilitate the efficient completion of maintenance and construction activities. Night time and weekend work will be required for some activities.

The licensee must implement reasonable and feasible noise mitigation and management measures to minimise any offensive noise likely to be generated by railway construction and maintenance activities, including, where practicable:

- (a) maximising the offset distance between noisy plant items and nearby residential receivers;
- (b) avoiding the simultaneous operation of two or more noisy plant items in close vicinity and adjacent to residential receivers;
- (c) scheduling the noisiest activities during the normal business hours (normal business hours are between 7am and 6pm Monday to Friday and 8am and 1pm Saturday), or where this is not possible, to less sensitive times of day;
- (d) providing periods of respite (quiet) if activities occur for extended periods during the night;
- (e) minimising consecutive night time activities in the same locality;
- (f) orienting equipment away from residential receivers;
- (g) carrying out loading and unloading away from residential receivers;
- (h) siting site access points and roads as far as possible away from residential receivers;
- (i) using structures to shield residential receivers from noise; and
- (j) planning for and conducting night time activities in ways that eliminate or minimise the need for audible warning alarms.

O3.2 The licensee must notify residents of any proposed railway maintenance or construction activity which is to be conducted outside normal business hours and which is likely to create offensive noise for those residents. (Normal business hours are between 7am and 6pm Monday to Friday and 8am and 1pm Saturday).

O3.3 The notification required by condition O3.2 must be provided at least 5 days prior to the commencement of the applicable railway maintenance or construction activities, except where:

- (a) the licensee first becomes aware of the need to undertake the railway maintenance or construction activities less than 5 days prior to the proposed commencement date, in which case the notification must be provided as soon as practicable after becoming aware of the need to undertake the railway maintenance or construction activities; or

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- (b) the activities are emergency maintenance and the licensee first becomes aware of the need to undertake the emergency maintenance within 72 hours of the time at which it must be commenced, in which case the notification requirements of condition O3.2 do not apply.

For the purposes of this condition, “emergency maintenance” means unplanned railway maintenance activities occurring when it is determined by the licensee that the railway infrastructure is unsafe or unreliable and can include construction activities to repair an unsafe condition.

- O3.4 The licensee must provide a central telephone contact number to the EPA whereby the following details regarding *any* railway maintenance or construction activities conducted by or on behalf of the Licensee outside normal business hours can be accessed (normal business hours are between 7am and 6pm Monday to Friday and 8am and 1pm Saturday):
- (a) dates and times a proposed activity;
 - (b) location of a proposed activity;
 - (c) type(s) work to be performed in conducting the activity;
 - (d) plant and equipment to be used; and
 - (e) **contact name and telephone number of a person who will be on site during the carrying out of the activity** and who is authorised by the Licensee to take action, including the cessation of the activity or any part of it, if so directed by the EPA. A contact person must be contactable 24 hrs a day via the supplied telephone number(s) during the whole of the period that the activity takes place outside normal business hours.

The licensee must provide the EPA with the central telephone contact number required by this condition when requested by an authorised officer of the EPA.

O4 Air

- O4.1 Significant dust generating activities on the premises must be managed in a proper and efficient manner to minimise dust emissions from the premises.

5 Monitoring and recording conditions

M1 Monitoring records

- M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.
- M1.2 All records required to be kept by this licence must be:
- (a) in a legible form, or in a form that can readily be reduced to a legible form;
 - (b) kept for at least 4 years after the monitoring or event to which they relate took place; and
 - (c) produced in a legible form to any authorised officer of the EPA who asks to see them.
- M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:

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- (a) the date(s) on which the sample was taken;
- (b) the time(s) at which the sample was collected;
- (c) the point at which the sample was taken; and
- (d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 Not applicable.

M3 Testing methods - concentration limits

M3.1 Not applicable.

M3.2 Not applicable.

M4 Recording of pollution complaints

M4.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M4.2 The record must include details of the following:

- (a) the date and time of the complaint;
- (b) the method by which the complaint was made;
- (c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- (d) the nature of the complaint;
- (e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
- (f) if no action was taken by the licensee, the reasons why no action was taken.

M4.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M4.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M5 Telephone complaints line

M5.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M5.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a

complaints line so that the impacted community knows how to make a complaint.

- M5.3 Conditions M5.1 and M5.2 do not apply until 3 months after:
- (a) the date of the issue of this licence or
 - (b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M6 Requirement to monitor volume or mass

- M6.1 Not applicable.

6 Reporting conditions

R1 Annual return documents

What documents must an Annual Return contain?

- R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
- (a) a Statement of Compliance; and
 - (b) a Monitoring and Complaints Summary.
- A copy of the form in which the Annual Return must be supplied to the EPA accompanies this licence. Before the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

Period covered by Annual Return

- R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

- R1.3 Where this licence is transferred from the licensee to a new licensee:
- (a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
 - (b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

- R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:

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- (a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
- (b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

Deadline for Annual Return

- R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

Notification where actual load can not be calculated

- R1.6 Not applicable.

Licensee must retain copy of Annual Return

- R1.7 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

Certifying of Statement of Compliance and signing of Monitoring and Complaints Summary

- R1.8 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
- (a) the licence holder; or
 - (b) by a person approved in writing by the EPA to sign on behalf of the licence holder.
- R1.9 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

R2 Notification of environmental harm

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

- R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.
- R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

R3 Written report

- R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
- (a) where this licence applies to premises, an event has occurred at the premises; or

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(b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence, and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:

- (a) the cause, time and duration of the event;
- (b) the type, volume and concentration of every pollutant discharged as a result of the event;
- (c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
- (d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
- (e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
- (f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
- (g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

General conditions

G1 Copy of licence kept at the premises

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

Pollution studies and reduction programs

PRP 3 Audit of the Noise Performance of Locomotives on ARTC's network

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The licensee is required to comply with PRP 3 outlined in table 3.1 below by completing each described action in the program within the set timeframe. PRP 3 is a key initial step in managing locomotive noise from the rail network. DECC believes it is essential to get an understanding of the noise performance of different locomotives to enable the locomotive noise issue to be effectively addressed. This PRP requires ARTC to monitor the noise performance of locomotives using its network and provide this data to locomotive operators and the EPA.

PRP 3.1 Audit of the Noise Performance of Locomotives

	Action	Timeframe
a.	Submit a detailed work plan for the audit of the noise performance of freight locomotives to the EPA for approval. This should include noise performance indicators and details of how and when access to the noise monitoring results will be granted to the locomotive operators.	Completed.
b.	Pilot program of trackside noise monitoring of locomotives in accordance with the work plan referred to in paragraph a.	January – July 2010
c.	Report to the EPA on the noise monitoring results of pilot program against reporting indicators identified in the work plan referred to in paragraph a.	Bi monthly reporting during monitoring period. Reports due: 19 March 2010, 14 May 2010 16 July 2010

Note – The suitability of the trackside noise monitoring program and the length of monitoring period to achieve the PRP objective will be assessed at the completion of the pilot program.

PRP 4 Reduction of Coal Dust Emissions from Locomotive Loads

The licensee is required to comply with PRP 4 outlined in table 4.1 below by completing each described action in the program within the set timeframe. Coal dust emissions generated during the transportation of coal by rail is becoming a significant environmental issue and community concern. PRP 4 aims to significantly reduce coal dust emissions from locomotive coal loads by requiring ARTC to implement appropriate technology to significantly reduce coal dust emissions.

PRP 4.1 Reduction of Coal Dust Loads from Locomotive Loads

	Action	Timeframe
a.	Submit a workplan to the EPA for approval outlining how appropriate technology will be adopted to significantly	Partially Complete

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	reduce coal dust emissions on the NSW ARTC rail network, in conjunction with relevant stakeholders including coal mines and locomotive operators.	
aa.	Submit report on Stage 1 of the workplan to the EPA.	5 February 2010.
b.	Implement the proposal as approved by the EPA.	To be advised

Note – Following the submission of the draft report on Stage 1 the EPA will meet with ARTC to discuss the report outcomes. The EPA will then vary the licence to include a timeframe for implementation of the workplan (Stage 2) by ARTC.

PRP 5 Review of Safety Related Practice that Causes a Noise Nuisance

The licensee is required to comply with PRP 5 outlined in table 5.1 below by completing each described action in the program within the set timeframe. PRP 5 aims to address a specific community concern associated with a safety related practice that has the potential to cause a noise nuisance.

PRP 5.1 Review of Safety Related Practice that Causes a Noise Nuisance

	Action	Timeframe
a.	Undertake a review of the following network safety practice which causes a noise disturbance to the community: i. use of detonators as a standard warning device during trackwork (rather than as an emergency device)	31 January 2009 – 1 November 2009
b.	Report to the EPA on the outcomes of the review. The report should include: ▪ details of national and international practice to achieve the same safety outcomes and discussion of whether these practices are feasible and reasonable for the ARTC network.	31 January 2010

Note – Following completion of the review, the EPA will meet with ARTC to discuss the outcomes of the review.

Special conditions

Minimbah Bank Rail Project

E1 Definitions

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- E1.1 The Minimbah Bank Rail Project means the construction of approximately 10.8 kilometres of heavy rail line and associated infrastructure and works as described in Project Approval 08_0060 issued by the Minister for Planning on 22 May 2009.

E2 Blasting limits

- E2.1 The overpressure level from blasting operations at the premises must not exceed 115dB(Lin Peak) for more than five percent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure the overpressure level are not to be taken into account in determining whether or not the limits has been exceeded.
- E2.2 The overpressure level from blasting operations at the premises must not exceed 120dB(Lin Peak) at any time. Error margins associated with any monitoring equipment used to measure the overpressure level are not to be taken into account in determining whether or not the limits has been exceeded.
- E2.3 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 5mm/s for more than five percent of the total number of blasts over each reporting period. Error margins associated with any monitoring equipment used to measure peak particle velocity are not to be taken into account in determining whether or not the limit has been exceeded.
- E2.4 Ground vibration peak particle velocity from the blasting operations at the premises must not exceed 10mm/s at any time. Error margins associated with any monitoring equipment used to measure peak particle velocity are not to be taken into account in determining whether or not the limit has been exceeded.

E3 Blast Monitoring and Reporting

- E3.1 To monitor the blasting limits at conditions E2.1, E2.2, E2.3 and E2.4:
- (a) Airblast overpressure and ground vibration levels must be measured at or near the nearest residence or noise sensitive location that is most likely to be most affected by the blast and that is not owned by the licensee or subject to a private agreement between the owner of the residence or noise sensitive location and the licensee as to an alternative limit for all blasts carried out in or on the premises; and
 - (b) Instrumentation used to measure the airblast overpressure and ground vibration levels must meet the requirements of Australian Standard 2187.2 of 1993.
- E3.2 The results of the blast monitoring required by conditions E3.1 must be submitted to the EPA upon request or otherwise at the end of each reporting period. The following information relating to each blast must be included with the Annual Return:
- (a) the date and time of the blast
 - (b) the location of the blast on the premises
 - (c) the blast monitoring results at each blast monitoring location; and
 - (d) an explanation for any missing blast monitoring results.

E4 Operational Noise Verification Report

- E4.1 Within 12 months of the completion of construction of the Minimbah Bank Rail Project, the licensee must engage an independent and qualified person or team to complete an operational noise verification audit of the project. The operational noise verification audit report must be submitted to the Regional Manager Hunter, DECC within one month of completion of the audit.

The audit report will:

- Assess the operational performance of the project against the noise and vibration level predictions in the documents "*Minimbah Bank Third Track – Environmental Assessment*" prepared by GHD on behalf of ARTC and dated October 2008 and "*Minimbah Bank Third Track – Environmental Assessment Submissions Report including Preferred Project Report*" prepared by GHD on behalf of ARTC and dated February 2009.
- Where there is any exceedance of predicted noise and vibration levels, identify all reasonable and feasible mitigation measures to mitigate these exceedances and a timetable for the implementation of these measures;
- Include a review of the effectiveness of any environmental impact mitigation works already installed.

Dictionary

Special Dictionary

Railway System Licence Dictionary

In this licence, unless the contrary is indicated, the terms below have the following meanings:

NSW rail network	The NSW rail system as defined by the Transport Administration Act ,1988 as it exists from time to time.
Rail Undertaking	Is the 'Scheduled Activity' as defined in this licence.
Offensive noise	As defined in the Protection of the Environment Operations Act, 1997 (POEO)
Locomotive	a powered vehicle primarily intended for hauling freight and/or passenger rolling stock or a rail vehicle comprising part of a diesel-multiple unit, but does not include: <ul style="list-style-type: none"> a vehicle used for maintenance of track or other infrastructure, or a vehicle used or intended to be used solely for heritage purposes.
Substantially modified	the major upgrading, replacement, restructuring or reconfiguration of one or more of the principal noise-emitting components of a locomotive, including where applicable: <ul style="list-style-type: none"> the combustion engine; the engine exhaust system; the traction system, including traction motors and gearboxes; the electrical supply system, including alternators, invertors and control equipment; cooling systems; and the dynamic braking system;

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but does not include the routine maintenance of the locomotive.

General Dictionary

In this licence, unless the contrary is indicated, the terms below have the following meanings:

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection	Has the same meaning as in the Protection of the Environment Administration Act 1991

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legislation	
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 1998.
flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 1998
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Ms Penny Finlay

Environment Protection Authority

(By Delegation)

Date of this edition - 18-Jan-2011

End Notes

- | | |
|---|---|
| 1 | Licence varied by notice 1007100, issued on 17-Jul-2001, which came into effect on 11-Aug-2001. |
| 2 | Licence varied by notice 1010600, issued on 15-Aug-2001, which came into effect on 09-Sep-2001. |
| 3 | Licence varied by notice 1011934, issued on 05-Oct-2001, which came into effect on 05-Oct-2001. |
| 4 | Licence varied by notice 1012143, issued on 29-Nov-2001, which came into effect on 24-Dec-2001. |

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End Notes

5	Licence varied by notice 1015602, issued on 01-May-2002, which came into effect on 26-May-2002.
6	Licence varied by notice 1018132, issued on 12-Jun-2002, which came into effect on 13-Jun-2002.
7	Licence varied by notice 1023724, issued on 19-Dec-2002, which came into effect on 23-Dec-2002.
8	Licence varied by notice 1028108, issued on 01-Jul-2003, which came into effect on 16-Jul-2003.
9	Licence varied by notice 1029702, issued on 01-Aug-2003, which came into effect on 01-Aug-2003.
10	Licence varied by notice 1030573, issued on 31-Oct-2003, which came into effect on 06-Nov-2003.
11	Licence varied by notice 1032289, issued on 09-Dec-2003, which came into effect on 30-Dec-2003.
12	Licence varied by notice 1033638, issued on 31-Dec-2003, which came into effect on 25-Jan-2004.
13	Licence fee period changed by notice 1040177 on 25-Aug-2004.
14	Licence transferred through application 142914, approved on 06-Sep-2004, which came into effect on 05-Sep-2004.
15	Licence varied by notice 1040462, issued on 06-Sep-2004, which came into effect on 06-Sep-2004.
16	Licence varied by change to record due to LGA amalgamation, issued on 03-Nov-2004, which came into effect on 03-Nov-2004.
17	Licence varied by notice 1052119, issued on 22-Sep-2005, which came into effect on 17-Oct-2005.
18	Licence varied by notice 1092348, issued on 30-Sep-2008, which came into effect on 30-Sep-2008.
19	Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
20	Licence varied by notice 1093829, issued on 14-Nov-2008, which came into effect on 14-Nov-2008.
21	Licence varied by notice 1103541, issued on 08-Jul-2009, which came into effect on 08-Jul-2009.
22	Licence varied by notice 1105912, issued on 04-Sep-2009, which came into effect on 04-Sep-2009.
23	Licence varied by notice 1108138, issued on 28-Oct-2009, which came into effect on 28-Oct-2009.
24	Licence varied by notice 1110207, issued on 23-Dec-2009, which came into effect on 23-Dec-2009.
25	Licence varied by notice 1112635, issued on 18-May-2010, which came into effect on 18-May-2010.
26	Licence varied by notice 1121864, issued on 05-Jan-2011, which came into effect on 05-Jan-2011.
27	Licence varied by notice 1123526, issued on 07-Jan-2011, which came into effect on 07-Jan-2011.
28	Licence varied by notice 1123725, issued on 14-Jan-2011, which came into effect on 14-Jan-2011.

Environment Protection Licence

Licence - 3142



Environment,
Climate Change
& Water

End Notes

29	Licence varied by notice 1123791, issued on 18-Jan-2011, which came into effect on <date to be advised>.
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