

A16.3 Baseline Noise Surveys

As part of the environmental impact assessment work for the proposed replacement crossing, an assessment of the current noise climate has been carried out. This involved completing both long term and short term noise surveys at various representative locations along the proposed scheme corridor.

1 Long Term Noise Surveys

1.1 Long Term Noise Survey Methods and Locations

1.1.1 This section of the appendix describes the baseline noise survey that has been conducted at long term locations to establish existing noise levels at sensitive locations within the area of the existing and proposed bridge development.

1.1.2 The long term measurement locations have been chosen as a balance between:

- numbers of properties affected;
- distance from the proposed scheme; and
- providing representative ambient noise levels.

1.1.3 The purpose of this exercise was to provide data on noise climates at a sample of long term locations from which predicted noise levels could be verified. These site investigations are also considered important to determine if certain parts of the study area are dominated by noise from sources other than traffic noise, in which case the prediction results would not accurately reflect noise levels in that area. It should be noted that some variance between measured existing noise levels and predicted noise levels for the ambient situation prior to opening of the proposed scheme would be expected. This might be due to, for example, differences in traffic flow levels between the present and the opening year; meteorological conditions at the time of the survey; or inherent variability between any two measurements (Reference: *A Good Practice Guide on the Sources and Magnitude of Uncertainty Arising in the Practical Measurement of Environmental Noise*. Craven N J and Kerry G, University of Salford, 2001. The survey methodology, locations and results are described below.

1.1.4 Surveys were completed over the period between 21 April and 22 May 2009. The measurement locations are shown in Figure 16.2. The measured data are considered to be representative of the ambient noise levels in the vicinity of the sound level meter.

Table 1.1: Noise logger survey address locations

Location No	Location	Sound Level Meter	Modem
1	No.6 Mucklehill Park	Brüel & Kjær 2238 Kit A	Kit A
2	No.8 Whinny Hill Crescent	Rion NL-32 Kit D	Kit B
3	Tigh-na-grian	Brüel & Kjær 2238 Kit B	Kit B
4	Port Edgar	Rion NL-32	Hired
5	No.4 Clufflat Brae	Rion NL-32 Kit A	Kit C
6	No.8 Kirklands Park Grove	Rion NL-32 Kit B	Kit D

1.1.5 The sound level meters were checked for correct calibration before and after each series of measurements. No significant fluctuation in level was recorded throughout each survey period. In addition to this, each sound level meter kit used has a full traceable calibration carried out on an annual basis.

- 1.1.6 Long term measurements were taken over a three week period, where possible, at noise sensitive locations near to the proposed route, although access and security of equipment also governed site selection. The six long term logger locations used are shown in Figure 16.2.
- 1.1.7 The purpose of these measurements was to provide an indication of the variation in noise level at a sample of locations over a period of weeks, to provide long-term measured noise levels to inform construction noise assessments and for verification of the operational noise predictions. The chosen long term logging locations were distributed across the study area to indicate the variation in noise levels that might occur on different days at nearby short term logging locations, or at other areas with similar noise climates and equivalent local noise sources.
- 1.1.8 The results were in the form of 15 minute logged measurements reported as time histories in Long Term Noise Survey Results section.
- 1.1.9 Microphone heights were set 1.2-1.5m above local ground level at least 3.5m away from any reflecting surface in an acoustically 'free-field' condition. The sound level meter and battery pack were stored in a weatherproof cases. A windshield was fitted at all times to minimise the effects of wind induced noise across the microphone diaphragm.

Measurement Location Descriptions

Logger 1 – No.6 Mucklehill Park, Inverkeithing OS Grid Ref 312452N, 682658E

- 1.1.10 The sound level meter was positioned in the rear garden of No.6 Mucklehill Park which is situated to the east of the A90. This location is above the A90 as the road is in cut at this point. This location was chosen as it is considered representative of properties on the western periphery of Inverkeithing north of the Forth.
- 1.1.11 During site visits by Jacobs Arup personnel it was noted that road traffic noise from the A90 dominated the noise climate at this location.

Logger 2 – No. 8 Whinny Hill Crescent, Inverkeithing. OS Grid Ref 312449N, 682455E

- 1.1.12 The sound level meter was located in the rear garden of No. 8 Whinny Hill Crescent to the east of the A90. This location is above the A90 as the road is in cut at this point. This location was chosen, as the Mucklehill Park location, as it is considered representative of properties on the western periphery of Inverkeithing. Also being further south it is closer to the Ferry Toll junction that will experience remodelling as part of the Forth Replacement Crossing scheme.
- 1.1.13 During site visits by Jacobs Arup personnel it was noted that road traffic noise from the A90 dominated the noise climate at this location.

Logger 3 – Tigh-na-grian, Ferry Road, North Queensferry. OS Grid Ref 312503N, 680693E

- 1.1.14 The sound level meter was positioned in the front garden of the property. The location was chosen as Tigh-na-grian is one of the closest properties to the Replacement Forth Crossing main crossing and is also considered to be reasonably representative of ambient noise levels on the north shore of the Forth.
- 1.1.15 During site visits by Jacobs Arup personnel it was noted that the noise climate at this location was dominated by road traffic using the existing Forth Road Bridge.

Logger 4 – Port Edgar, South Queensferry. OS Grid Ref 311890N, 678669E

- 1.1.16 Port Edgar is within a Special Protection Area (see Chapter 11: Estuarine Ecology, and Figure 10.1). The sound level meter was positioned at one of the Port Edgar quays, which was considered

to be representative of the ambient noise levels that would be experienced in the area, especially by wildlife and specifically birds as discussed in Chapter 11 (Estuarine Ecology).

1.1.17 As Port Edgar is situated west of the existing bridge, the traffic noise from the bridge dominates the ambient noise at this location. During site visits by Jacobs Arup personnel it was noted that other short term noise sources associated with harbour activities also contributed to the local noise climate.

Logger 5 – No. 4 Clufflat Brae, South Queensferry. OS Grid Ref 311688N, 678542E

1.1.18 The sound level meter was positioned in the rear garden of No.4 Clufflat Brae. This location was felt to be representative of a large residential area, located east of the fields where the new bridge will land.

1.1.19 At the time of site visits road traffic noise was audible and considered to be the main noise source in this area.

Logger 6 – No. 8 Kirklands Park Grove, Kirkliston. OS Grid Ref 311787N, 674936E

1.1.20 The sound level meter was positioned in the rear garden of Kirklands Park Grove, on the west edge of Kirkliston. Kirklands Park Grove is located at the foot of the embankment of the M9 spur. This location was felt to be representative of a large residential area, located close to the M9 spur, which will continue to be used by road traffic using the proposed Forth Replacement Crossing.

1.1.21 During site visits Jacobs Arup personnel noted that road traffic noise from the M9 spur was dominant at this location with some contribution from aircraft.

1.2 Long Term Noise Survey Results

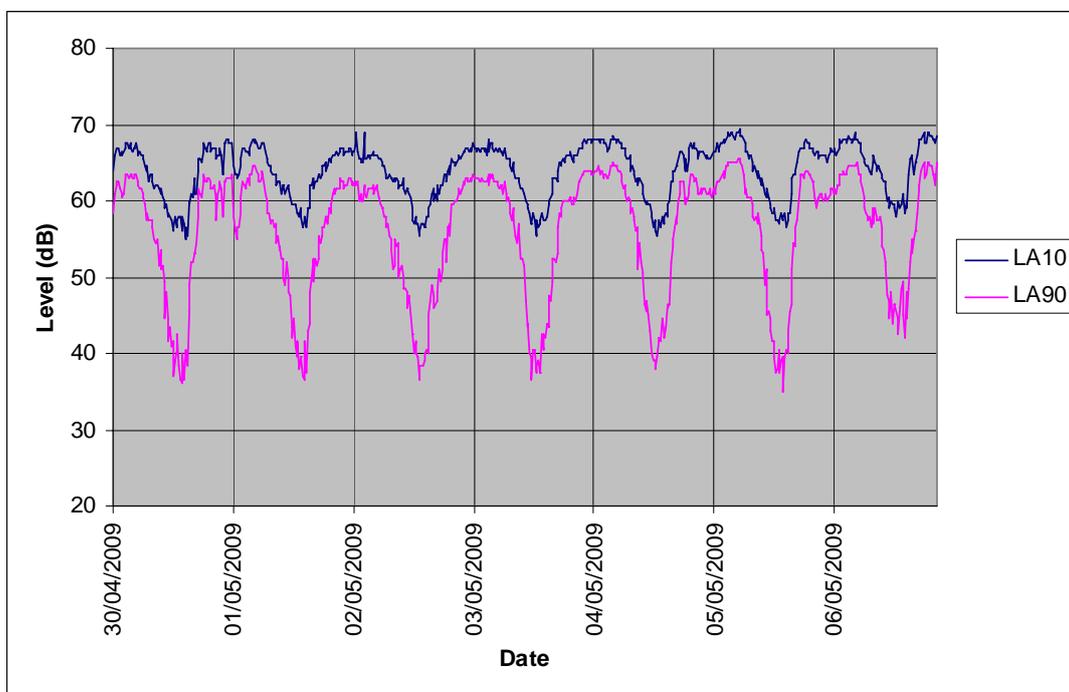


Chart 1: Logger 1 - Long term noise record, Mucklehill Park, Inverkeithing (no dB_{LA10} or dB_{LA90} data between 21 to 29 April. Instrumentation failure 7 May to 10 May)

Forth Replacement Crossing
 DMRB Stage 3 Environmental Statement
 Appendix A16.3: Baseline Noise Surveys

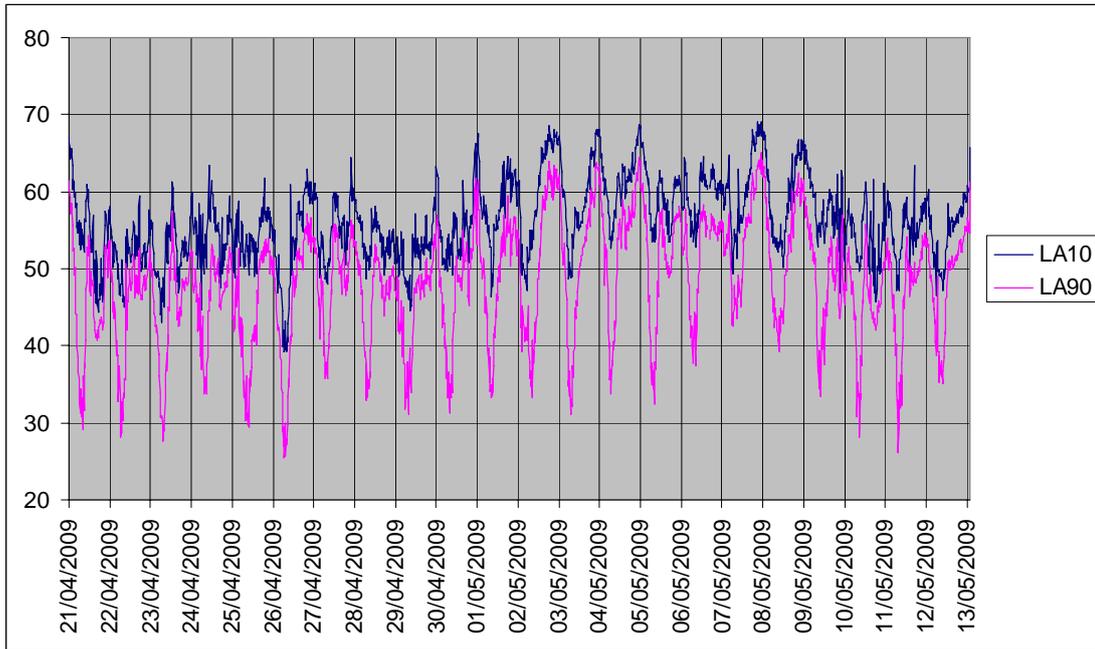


Chart 2: Logger 2 - Long term noise record, Whinny Hill Crescent, Inverkeithing

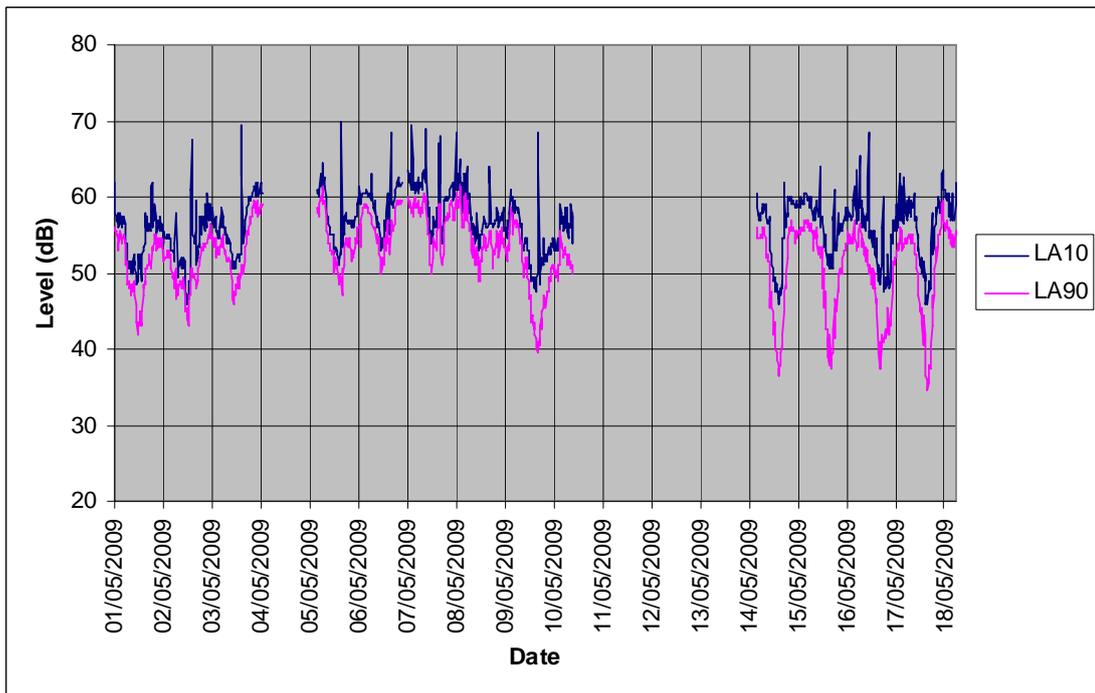


Chart 3: Logger 3 - Long term noise record, Tigh-na-grian, Ferry Road, North Queensferry (instrumentation failure 04 May to 05 May and 10 May to 14 May)

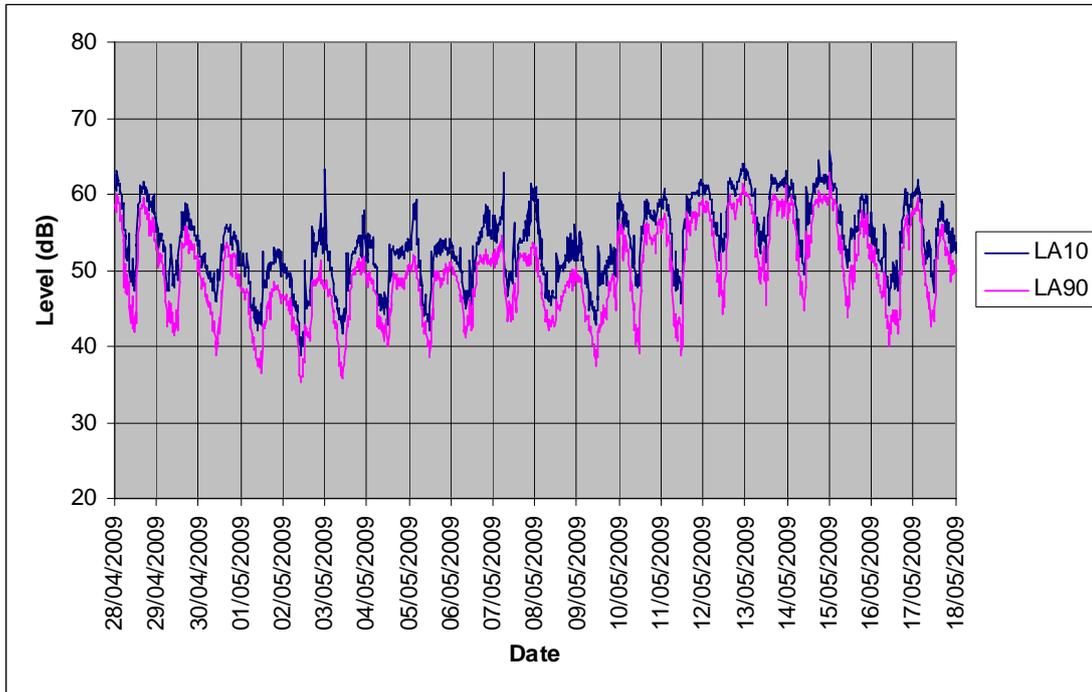


Chart 4: Logger 4 - Long term noise record, Port Edgar, South Queensferry (instrumentation failure 18 May to 29 May)

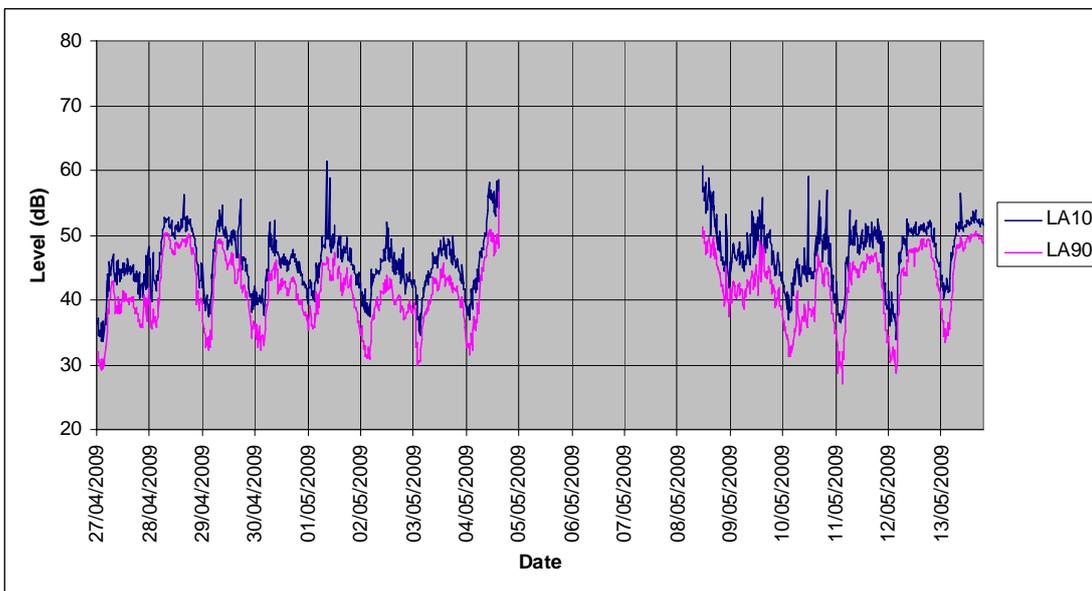


Chart 5: Logger 5 - Long term noise record, Clufflat Brae, South Queensferry (instrumentation failure 04 May to 08 May)

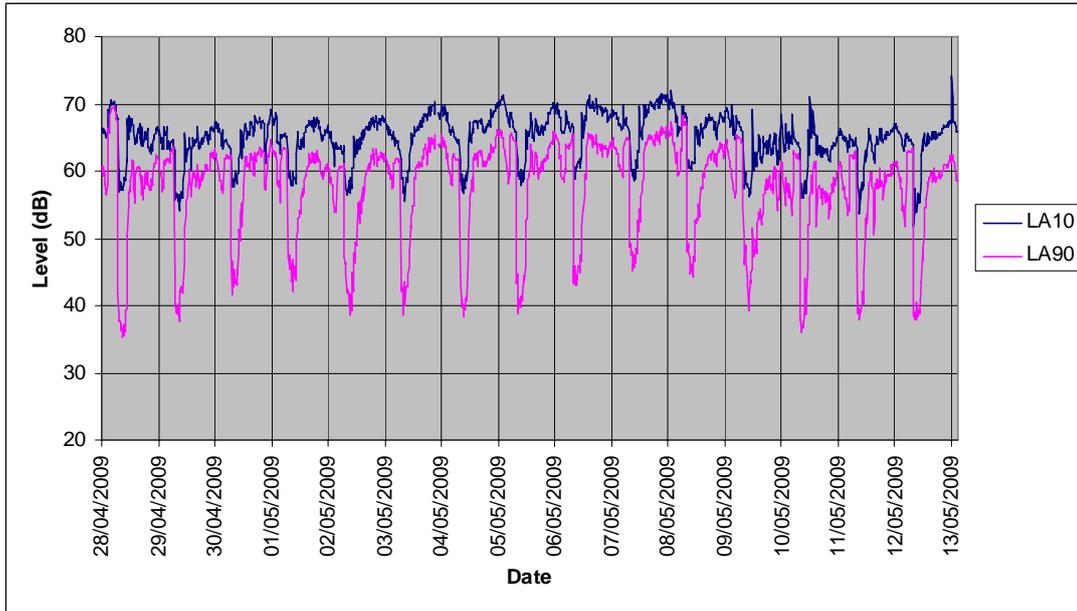


Chart 6: Logger 6 - Long term noise record, Kirklands Park Grove, Kirkliston

1.3 Summary of Long Term Noise Survey Results

Table 1.2: Logger 1 - Mucklehill Park – day, evening and night results

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa																	
	0800 – 1800						1800 – 2200						2200 – 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
21st April	-	-	-	-	-	-	64	72	54	-	-	-	57	65	41	-	-	-
22nd April	61	67	52	-	-	-	63	72	52	-	-	-	59	67	40	-	-	-
23rd April	64	72	56	-	-	-	62	69	52	-	-	-	56	65	40	-	-	-
24th April	63	71	54	-	-	-	61	70	51	-	-	-	53	63	38	-	-	-
25th April	57	68	49	-	-	-	56	67	46	-	-	-	55	65	37	-	-	-
26th April	64	72	54	-	-	-	63	73	52	-	-	-	53	63	36	-	-	-
27th April	63	70	56	-	-	-	59	67	49	-	-	-	54	63	40	-	-	-
28th April	58	68	52	-	-	-	56	67	49	-	-	-	44	-	-	-	-	-
29th April	61	68	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30th April	63	69	55	-	-	-	63	72	54	67	65	59	59	67	42	63	60	48
1st May	65	73	57	68	66	61	64	71	54	68	66	60	60	71	41	64	61	48
2nd May	64	73	56	68	66	61	62	72	49	67	64	57	57	68	38	63	60	46
3rd May	65	72	57	68	66	62	64	74	54	68	66	60	59	67	38	63	59	44
4th May	66	73	59	69	67	63	64	72	56	68	66	61	60	69	44	64	61	49
5th May	66	75	58	69	67	63	65	73	57	69	67	62	61	70	44	65	61	49
6th May	66	75	58	69	67	62	64	74	54	68	65	60	62	71	47	66	63	52
7th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- L_{A1}, L_{A10} and L_{A90} not recorded.

Table 1.3: Logger 1 - Mucklehill Park – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
21st April	-	-	-	-
22nd April	-	-	65	-
23rd April	55	-	61	-
24th April	56	-	63	-
25th April	53	-	62	-
26th April	51	-	57	-
27th April	51	-	63	-
28th April	50	-	57	-
29th April	-	-	-	-
30th April	-	-	64	--
1st May	46	58	64	66
2nd May	47	60	63	65
3rd May	44	59	64	65
4th May	56	59	65	65
5th May	59	59	65	66
6th May	57	59	65	66
*7th May	59	61	-	-

- L_{A10} not recorded.

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.4: Logger 2 - Whinny Hill Crescent – day, evening and night results

Date (2009)	Noise Levels in dB re 2x10 ⁻⁵ Pa																	
	0800 - 1800						1800 – 2200						2200 - 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
21st April	-	-	-	-	-	-	61	69	48	66	63	55	53	63	36	59	56	42
22nd April	52	66	43	56	51	46	51	61	40	56	53	46	49	58	36	54	50	40
23rd April	52	64	46	57	53	49	51	58	41	55	52	45	52	59	35	55	52	40
24th April	52	63	44	56	52	47	54	64	40	59	55	48	54	63	38	60	56	44
25th April	53	65	46	59	54	49	52	66	41	60	54	46	49	61	31	57	53	38
26th April	54	64	47	59	56	51	50	58	41	53	51	45	40	54	26	48	42	29
27th April	57	65	48	61	59	53	55	65	43	60	56	49	53	61	41	57	54	46
28th April	55	66	48	60	56	51	55	65	46	61	57	51	52	62	39	58	54	44
29th April	52	66	45	59	53	48	50	60	39	55	52	44	49	60	36	55	50	41
30th April	53	62	46	57	54	49	56	63	44	59	56	50	50	61	37	56	53	41
1st May	57	66	49	60	57	52	60	68	47	63	61	54	52	64	36	59	55	42
2nd May	59	71	50	65	61	54	54	69	41	59	54	46	55	64	36	59	56	43
3rd May	64	72	56	68	66	61	61	71	49	66	62	55	47	60	31	55	50	35
4th May	62	70	55	66	63	58	61	70	50	66	63	56	56	66	41	62	58	47
5th May	62	69	54	66	64	58	63	71	53	68	65	59	56	66	40	62	58	46
6th May	57	66	50	62	59	54	59	68	49	63	60	54	56	66	43	62	58	48
7th May	59	68	52	64	61	55	58	68	49	63	60	53	54	63	44	59	56	49
8th May	65	72	57	68	66	61	63	70	49	66	62	55	51	62	40	58	54	45
9th May	62	69	54	66	64	58	60	71	49	66	63	55	54	64	36	60	57	44
10th May	55	65	45	60	56	50	55	69	45	62	57	50	49	61	30	57	52	36
11th May	52	67	43	59	52	46	55	66	46	61	57	51	52	62	36	58	53	42
12th May	55	66	48	60	56	51	55	69	46	62	57	50	50	60	37	55	51	42
13th May	56	66	50	61	57	53	-	-	-	-	-	-	-	-	-	-	-	-

Forth Replacement Crossing
 DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.5: Logger 2 - Whinny Hill Crescent – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2×10^{-5} Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
21st April	-	-	55	61
22nd April	54	56	51	51
23rd April	48	50	51	52
24th April	49	51	53	54
25th April	53	55	53	54
26th April	49	53	53	53
27th April	48	46	56	57
28th April	52	53	55	57
29th April	50	53	51	53
30th April	49	49	54	54
1st May	51	53	57	57
2nd May	50	53	57	58
3rd May	52	55	63	64
4th May	51	54	61	62
5th May	56	57	62	63
6th May	55	57	58	59
7th May	55	57	58	60
8th May	53	56	63	63
9th May	50	53	61	62
10th May	52	55	55	56
11th May	52	54	53	54
12th May	51	53	54	55
13th May	48	50	-	-

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.6: Logger 3 - Tigh-na-grian – day, evening and night results

Date (2009)	Noise levels in dB re 2*10 ⁻⁵ Pa																	
	0800 – 1800						1800 – 2200						2200 – 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
27th April	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28th April	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29th April	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30th April	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1st May	-	-	-	-	-	-	55	61	51	57	55	52	51	61	45	55	52	47
2nd May	55	66	51	60	56	53	53	63	47	57	54	49	53	61	47	55	52	48
3rd May	56	66	52	60	57	54	56	67	52	59	56	53	51	60	47	54	52	48
4th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5th May	-	-	-	-	-	-	61	65	56	62	61	59	55	61	50	57	55	52
6th May	58	66	54	61	59	56	58	66	55	61	59	56	58	63	53	60	58	55
7th May	60	69	57	65	62	59	61	66	57	64	62	59	58	64	53	60	58	55
8th May	61	68	57	63	61	58	56	62	53	58	57	54	56	62	51	59	56	53
9th May	57	63	53	59	57	55	55	62	52	58	56	53	53	61	42	55	52	45
10th May	53	63	48	58	54	51	55	69	48	62	57	51	-	-	-	-	-	-
11th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14th May	-	-	-	-	-	-	56	67	49	61	57	52	54	63	42	57	53	45
15th May	58	66	53	62	59	56	57	67	52	62	58	54	53	64	40	59	54	45
16th May	57	70	52	63	58	54	57	72	50	63	58	52	51	62	40	56	52	44
17th May	57	71	50	64	58	53	56	71	49	63	57	52	47	57	38	53	50	42

Table 1.7: Logger 3 - Tigh-na-grian – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2*10 ⁻⁵ Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
27th April	-	-	-	-
28th April	-	-	-	-
29th April	-	-	-	-
30th April	-	-	-	-
1st May	-	-	-	-
2nd May	50	52	54	55
3rd May	53	51	55	56
4th May	-	-	-	-
5th May	-	-	-	-
6th May	55	54	58	58
7th May	57	57	61	62
8th May	58	58	59	60
9th May	56	57	56	57
10th May	53	51	54	55
11th May	-	-	-	-
12th May	-	-	-	-
13th May	-	-	-	-
14th May	-	-	-	-
15th May	52	51	58	59
16th May	52	53	57	58
17th May	50	52	56	56

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.8: Logger 4 - Port Edgar – day, evening and night results

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa																	
	0800 – 1800						1800 – 2200						2200 – 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
28th April	-	-	-	-	-	-	58	64	53	61	59	56	54	62	46	56	54	49
29th April	57	65	53	60	58	55	52	59	47	55	53	49	51	59	43	54	52	46
30th April	54	62	50	57	55	52	49	58	45	53	51	47	50	57	42	53	50	45
1st May	52	63	48	56	53	50	48	58	44	52	49	46	45	57	38	50	46	41
2nd May	49	61	44	55	51	47	47	57	42	51	49	45	44	55	38	48	44	40
3rd May	52	64	46	59	54	48	48	59	43	53	49	45	42	57	36	48	44	39
4th May	52	63	48	58	54	50	50	63	46	57	52	48	47	59	42	51	48	44
5th May	51	62	47	56	53	49	54	68	48	62	56	50	47	56	42	51	48	44
6th May	52	62	48	55	53	50	50	60	47	55	51	48	49	59	44	53	49	45
7th May	54	67	50	60	56	51	55	68	51	60	56	53	51	61	45	55	51	47
8th May	55	68	50	62	57	52	50	61	45	56	51	47	47	57	42	51	48	44
9th May	51	63	47	56	52	49	49	63	44	56	51	46	46	58	39	51	47	42
10th May	53	62	47	56	53	50	55	62	51	58	56	53	49	58	41	54	51	45
11th May	57	66	53	61	58	55	56	64	51	59	57	54	53	58	44	55	52	47
12th May	59	67	56	62	60	58	58	64	54	61	59	57	56	63	48	58	56	51
13th May	61	68	57	64	62	59	59	67	55	62	60	57	56	62	50	59	56	52
14th May	60	67	57	63	61	59	58	67	54	62	59	56	56	62	49	58	56	52
15th May	61	69	58	64	62	60	58	65	54	61	59	56	53	63	46	57	54	49
16th May	56	65	52	59	57	54	50	60	46	54	52	48	48	59	40	52	49	44
17th May	58	66	53	60	58	55	58	65	54	60	59	56	50	59	43	55	52	46

Table 1.9: Logger 4 - Port Edgar – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
28th April	-	-	57	57
29th April	51	52	56	56
30th April	49	51	53	54
1st May	47	49	51	52
2nd May	44	45	48	50
3rd May	42	43	50	51
4th May	44	45	51	52
5th May	46	47	52	53
6th May	45	46	51	52
7th May	47	48	54	55
8th May	49	50	54	54
9th May	46	48	50	51
10th May	45	46	53	53
11th May	50	51	56	57
12th May	50	51	58	59
13th May	53	54	60	61
14th May	54	55	59	60
15th May	54	55	60	61
16th May	52	53	55	55
17th May	46	48	57	57
18th Mayl	-	-	57	57

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.10: Logger 5 - Clufflat Brae – day, evening and night results

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa																	
	0800 – 1800						1800 – 2200						2200 – 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
21st April	-	-	-	-	-	-	44	58	39	49	45	41	43	54	36	47	43	38
22nd April	47	61	42	52	48	44	45	59	39	51	46	41	43	54	35	46	43	38
23rd April	52	67	40	56	48	42	43	59	38	48	44	40	41	51	33	44	40	36
24th April	47	65	39	52	46	41	42	58	35	49	43	38	43	53	35	47	43	38
25th April	50	65	45	57	51	47	52	65	42	56	49	44	41	55	31	46	41	34
26th April	46	63	39	53	47	42	48	61	37	51	45	40	34	45	30	39	36	32
27th April	45	63	37	51	44	40	43	60	35	49	43	37	47	56	39	50	46	41
28th April	51	64	47	55	52	49	49	61	44	53	50	46	45	54	37	48	44	40
29th April	49	63	44	55	50	46	45	60	39	51	44	40	42	51	35	46	42	37
30th April	47	61	41	51	47	43	43	56	37	49	45	40	43	54	37	47	44	39
1st May	50	64	42	54	50	44	44	58	38	50	46	41	41	55	33	47	42	35
2nd May	46	62	38	52	46	41	44	60	36	49	44	38	40	53	35	45	41	37
3rd May	46	62	41	52	47	43	47	60	39	51	45	41	37	51	32	43	39	34
4th May	54	64	45	57	54	48	46	57	42	51	48	44	43	55	38	48	44	40
5th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7th May	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8th May	-	-	-	-	-	-	45	57	40	50	47	43	45	57	38	50	46	41
9th May	49	63	42	54	50	44	45	60	39	52	46	41	41	54	33	47	42	36
10th May	47	60	38	52	47	40	48	61	41	54	49	43	38	49	30	43	40	34
11th May	48	62	43	54	50	46	48	63	42	54	49	44	43	53	34	46	42	36
12th May	50	62	46	54	51	48	49	60	45	53	50	47	46	55	38	49	45	40
13th May	51	64	48	56	52	49	-	-	-	-	-	-	-	-	-	-	-	-

Table 1.11: Logger 5 - Clufflat Brae – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2×10^{-5} Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{A10}	L _{Aeq}	L _{A10}
21st April	-	-	-	-
22nd April	40	41	46	47
23rd April	40	41	50	47
24th April	38	38	46	45
25th April	40	42	50	49
26th April	38	40	46	45
27th April	41	37	45	44
28th April	43	44	50	50
29th April	42	42	48	48
30th April	39	41	46	46
1st May	41	43	48	48
2nd May	40	40	45	45
3rd May	39	40	46	46
4th May	39	41	52	51
5th May	42	43	-	-
6th May	-	-	-	-
7th May	-	-	-	-
8th May	-	-	-	-
9th May	45	47	47	48
10th May	39	41	46	46
11th May	40	40	48	48
12th May	40	40	49	50
13th May	43	44	-	-

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Table 1.12: Logger 6 - Kirklands Park Grove – day, evening and night results

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa																	
	0800 – 1800						1800 – 2200						2200 – 0800					
	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}	L _{Aeq}	L _{Amax}	L _{Amin}	L _{A1}	L _{A10}	L _{A90}
21st April	-	-	-	-	-	-	65	73	60	69	66	62	61	69	50	65	62	53
22nd April	62	75	53	67	64	58	64	74	60	69	66	62	62	71	50	67	63	54
23rd April	64	74	56	69	66	61	66	73	62	68	66	63	61	69	50	65	61	53
24th April	63	76	55	69	65	59	63	68	59	66	64	61	60	70	48	65	61	51
25th April	62	76	52	68	64	57	66	73	61	69	67	63	61	70	49	65	60	52
26th April	64	76	56	69	66	60	65	73	60	69	66	62	59	64	49	61	57	49
27th April	64	75	56	69	66	60	67	71	61	69	67	64	68	73	51	68	64	55
28th April	65	77	55	71	67	61	68	73	61	70	68	64	64	72	47	68	64	51
29th April	63	75	55	69	65	59	63	72	58	68	65	60	60	69	48	65	61	51
30th April	64	74	56	68	65	60	63	74	55	68	65	60	61	70	50	66	63	54
1st May	65	75	58	69	67	62	64	72	57	68	66	61	61	71	48	66	63	53
2nd May	64	75	56	69	66	61	61	72	52	67	64	57	60	70	44	66	62	50
3rd May	65	75	56	69	67	61	63	73	55	68	65	60	58	67	44	63	60	47
4th May	67	76	60	71	69	64	65	76	56	70	67	61	62	70	49	67	63	53
5th May	66	76	59	70	68	63	67	76	57	72	69	63	63	71	50	67	64	54
6th May	66	74	58	70	68	63	65	76	56	70	67	61	64	73	52	69	65	56
7th May	67	74	59	71	69	64	65	78	58	71	68	62	64	73	53	68	65	56
8th May	68	77	61	73	70	65	66	75	57	70	68	62	64	72	51	68	65	55
9th May	66	76	58	70	68	63	65	76	54	71	67	60	61	71	47	66	62	52
10th May	62	74	52	68	64	58	63	74	51	69	65	58	60	67	47	64	61	48
11th May	61	73	51	66	63	57	62	73	50	68	65	57	61	70	48	66	62	52
12th May	63	75	54	69	65	59	63	74	51	69	65	57	61	71	48	66	61	51
13th May	64	76	55	70	66	60	-	-	-	-	-	-	-	-	-	-	-	-

Table 1.13: Logger 6 - Kirklands Park Grove – 18-hour day and 6-hour night

Date (2009)	Noise levels in dB re 2x10 ⁻⁵ Pa			
	0000 – 0600		0600 – 2400	
	L _{Aeq}	L _{Aeq}	L _{Aeq}	L _{A10}
21st April	-	-	64	66
22nd April	59	61	63	64
23rd April	60	61	65	66
24th April	58	59	63	64
25th April	57	60	64	64
26th April	56	58	64	65
27th April	59	59	67	66
28th April	61	62	66	67
29th April	60	61	63	65
30th April	57	59	63	65
1st May	60	61	65	66
2nd May	59	61	63	65
3rd May	58	60	64	66
4th May	60	62	66	68
5th May	59	61	66	68
6th May	60	62	66	67
7th May	62	63	67	68
8th May	61	63	68	69
9th May	61	63	65	67
10th May	59	60	62	64
11th May	60	61	62	64
12th May	59	60	63	65
13th May	58	59	-	-

2 Short Term Noise Surveys

2.1 Short Term Noise Survey Methods and Locations

- 2.1.1 In addition to the long term unattended surveys, short term attended surveys were undertaken at other locations to provide additional information on the range of noise climates across the study area.
- 2.1.2 Surveys were carried out at various locations on various dates detailed in the following sections. These survey locations are shown in Figure 16.2.
- 2.1.3 In all instances the sound level meter was checked for correct calibration before and after each series of measurements. No significant fluctuation in level was recorded throughout each survey period. In addition to this, each sound level meter kit used by Arup Acoustics has a full traceable calibration carried out on an annual basis.
- 2.1.4 In all instances the sound level meter was mounted on a tripod, with the microphone set approximately 1.2m above ground level. A windshield was fitted to the microphone to minimise the effects of wind-induced noise across the microphone diaphragm.
- 2.1.5 Measurements were made in broad accordance with the procedure set out in the document “Calculation of Road Traffic Noise” (UK Department of Transport).

- 2.1.6 Measurements of ten to fifteen minutes duration were made at each location, dependent upon conditions at the measurement location. In each case, the time period was considered appropriate to provide a good representation of the typical noise climate at each measurement location.
- 2.1.7 All measurements were taken in an acoustically hemispherical ‘free field’ condition, at least 3.5 m away from any vertical acoustical reflective surfaces. Most locations were chosen to provide a representative indication of the typical ambient noise level at residential properties close to the proposed scheme. This information was used to help validate the acoustic road noise model used for the predictive noise calculations, refer to Section 16.2 of Chapter 16, and to determine ambient noise levels to information the assessment of construction noise, refer to Chapter 19..
- 2.1.8 Surveys were also completed at Port Edgar and on the northern shore to represent locations where terns are known to loaf and to nest. These areas were highlighted following discussion with the Ecology team and more detailed information is provided within Chapter 11, Estuarine Ecology.

2.2 Short Term Noise Survey Results

Surveying 09 December 2008

- 2.2.1 The noise surveys were carried out by Jacobs Arup personnel. Meteorological conditions during the noise survey periods on 09 December 2008 were cold and damp with a light breeze (1-3 m/s). It is considered that no unusual events occurred during the survey periods and the measurement data provided a true and fair representation of the background noise levels at the various measurement locations.
- 2.2.2 Measurements were undertaken with sound level measuring equipment conforming to British Standard EN 61672, Type 1. The sound level meter measured a full range of parameters in octave bands, including L_{eq} , L_{10} , L_{90} , and $L_{max,F}$. The meter was set to fast response time averaging (125ms) and stored all measured data after every measurement period.

Table 2.1: Instrumentation used for environmental noise survey

Kit Number	Equipment	Manufacturer	Model Number	Serial Number
AAcG Kit J	Precision grade sound level meter	Brüel and Kjær	2260	2520521
AAcG Kit J	½" diameter pre-polarised condenser microphone	Brüel and Kjær	4189	2543252
AAcG Kit J	Type 1 sound pressure level calibrator	Brüel and Kjær	4231	2545642
N/A	Laser Range Finder	Bosch	DLE 50	886464194
AAcG Kit A	Handheld Anemometer	Kestrel	1000	1744765
AAcG Kit A	GPS Receiver	Garmin	eTrex H	16Q238818

Measurement Location Descriptions

- 2.2.3 Measurement locations 7, 8 and 9 are all located west of South Queensferry at Echline Fields.
- 2.2.4 Location 7 was carried out in a field west of a large residential area. The dominant noise source was vehicular noise from traffic using the Forth Road Bridge, and to a lesser extent the A904, as well as occasional contribution from aircraft and intermittent distant site works at Linn Mill.
- 2.2.5 Location 8 was carried out in the same field as location 7 and with the large residential area to the east, but approximately 70m due south. The dominant noise source was vehicular noise from traffic using the Forth Road Bridge and the A904, as well as noise contribution from aircraft and distant site works at Linn Mill.

- 2.2.6 Location 9 was carried out in the same field as locations 7 and 8 but located on the western edge of the field, near residences on Linn Mill. The dominant noise source was distant road traffic noise with some contribution from aircraft and occasional site works at Linn Mill in the vicinity of location 9.
- 2.2.7 Location 10 was carried out at Dundas Home Farm close to the existing A90 and due south of the existing bridge. Access within Dundas Home Farm was unclear at the time so a location along the access road was chosen for measurements. The dominant noise source was distant traffic noise and occasional aircraft overhead.
- 2.2.8 Location 11 is west of location 10 and very close to a residential building (White Lodge) on the outskirts of Dundas Estate. The dominant noise source was distant traffic noise.
- 2.2.9 A noise measurement was planned for location 12 however this location is within the grounds of Dundas Estate and access was unclear at the time of the survey so measurements were not undertaken for this location as it was considered not reasonably practicable to do so.

Surveying 26 January 2009

- 2.2.10 The noise surveys were carried out by Jacobs Arup personnel. Meteorological conditions during the noise survey periods on 26 January 2009 were cool and dry with a light breeze (1-2m/s). It is considered that no unusual events occurred during the survey periods and the measurement data provided a true and fair representation of the background noise levels at the various measurement locations.
- 2.2.11 Measurements were undertaken with sound level measuring equipment conforming to British Standard EN 61672, Type 1. The sound level meter measured octave band values with real time analysis giving statistical and L_{Aeq} and $L_{Amax,F}$ noise levels. The meter was set to fast response and stored all measured data after every measurement period.

Table 2.2: Instrumentation used for environmental noise survey

Kit Number	Equipment	Manufacturer	Model Number	Serial Number
AAcLED Kit B	Precision grade sound level meter	Norsonic	140	1403431
AAcLED Kit B	½" diameter pre-polarised condenser microphone	Norsonic	1225	98540
AAcLED Kit B	Type 1 sound pressure level calibrator	RION	NC74	35173566
AAcG Kit A	GPS Receiver	Garmin	eTrex H	16Q238818

Measurement Location Descriptions

- 2.2.12 Location 4 was located adjacent to Admiralty House, St Margaret's Hope. The dominant source of noise was due to road traffic on the existing Forth Road Bridge. There was also birdsong and occasional sounds of small aircraft in addition to a boat on the Forth.
- 2.2.13 Location 5 was located on the north bank of the Forth, close to Ferry Craig House. The soundscape was dominated by road traffic noise coming from the existing Forth Road Bridge. There were audible clunks from heavy vehicles going over the expansion joints on the suspended sections of the bridge.
- 2.2.14 Location 6 was located on western side of the Queensferry Hotel. The dominant source of noise was again road traffic from the existing Forth Road Bridge with some contribution from local traffic passing along the B981 below the hotel.

Surveying 28 January 2009

- 2.2.15 The noise surveys were carried out by Jacobs Arup personnel. Meteorological conditions during the noise survey periods on 28 January 2009 were cool and dry with a light breeze (1-2m/s). It is considered that no unusual events occurred during the survey periods and the measurement data provided a true and fair representation of the background noise levels at the various measurement locations.
- 2.2.16 Measurements were undertaken with sound level measuring equipment conforming to British Standard EN 61672, Type 1. The sound level meter measured octave band values with real time analysis giving statistical and L_{Aeq} and $L_{Amax,F}$ noise levels. The meter was set to fast response and stored all measured data after every measurement period.

Table 2.3: Instrumentation used for environmental noise survey

Kit Number	Equipment	Manufacturer	Model Number	Serial Number
AAcLED Kit B	Precision grade sound level meter	Norsonic	140	1403431
AAcLED Kit B	½" diameter pre-polarised condenser microphone	Norsonic	1225	98540
AAcLED Kit B	Type 1 sound pressure level calibrator	RION	NC74	35173566
AAcG Kit A	GPS Receiver	Garmin	eTrex H	16Q238818

Measurement Location Descriptions

- 2.2.17 Location 1 was located on the western edge of Inverkeithing to the rear of properties on Hillfield Crescent. The dominant noise source was road traffic noise from the A90 with occasional contribution from birdsong and occasional distant construction noise.
- 2.2.18 Location 2 was located on the western periphery of Inverkeithing at some recreational ground on Manse Road/Whinny Hill Crescent. The dominant noise source arose from road traffic on the A90 with occasional contribution from local road traffic and distant scrap yard activity.
- 2.2.19 Location 3 was located on Lothians View at the top of Castlandhill. The dominant noise source arose from road traffic on the A90 with occasional contribution from birdsong.
- 2.2.20 Location 13 was located on the playing field of Kirkliston Leisure Centre beside Kirklands Park Street. The dominant noise source arose from road traffic on the A90 with occasional contribution from birdsong.
- 2.2.21 Location 14 was located beside the Kirkliston Primary School off Pentland Road. At the time of the noise surveys the dominant noise source arose from pupils at the school so the survey results are considered invalid. Further measurements were carried out at Location 16, which was chosen as a reasonable proxy to Location 14.
- 2.2.22 Location 15 was located close to properties on Cotlaws/King Edwards Way on the southwestern edge of Kirkliston. The dominant noise source arose from road traffic on the M9.
- 2.2.23 Location 16 was located on recreational land south of Kirkliston Primary School accessed from Pentland Road towards the southwestern edge of Kirkliston. The dominant noise source arose from road traffic on the M9 with occasional contribution from aircraft.

Surveying 18, 19 and 20 March 2009

- 2.2.24 The noise surveys were carried out by Jacobs Arup personnel. Meteorological conditions during the noise survey periods on 18, 19 and 20 March 2009 were cool and dry with a light to moderate

breeze (2-4m/s) during each day. It is considered that no unusual events occurred during the survey periods and the measurement data provided a true and fair representation of the background noise levels at the various measurement locations.

2.2.25 Measurements were undertaken with sound level measuring equipment conforming to British Standard EN 61672, Type 1. The sound level meter measured octave band values with real time analysis giving statistical noise levels. The meter was set to fast response and stored all measured data after every measurement period.

Table 2.4: Instrumentation used for environmental noise survey

Kit Number	Equipment	Manufacturer	Model Number	Serial Number
AAcLED Kit B	Precision grade sound level meter	Norsonic	140	1403431
AAcLED Kit B	½" diameter pre-polarised condenser microphone	Norsonic	1225	98540
AAcLED Kit B	Type 1 sound pressure level calibrator	RION	NC74	35173566
AAcG Kit A	GPS Receiver	Garmin	eTrex H	16Q238818

Measurement Location Descriptions

2.2.26 Location 20 was located on northern shore of the Forth to the west of St. Margaret's Hope. The dominant source of noise was again road traffic from the A90 from a north easterly direction with some contribution from waves lapping on the shore and birdsong. This location was difficult to access so only one measurement was conducted but has been included for completeness.

2.2.27 Location 21 was located on northern shore of the Forth underneath the existing Forth Road Bridge. The dominant source of noise was road traffic from the A90 above. Only two measurements were possible.

2.2.28 Location 22 was located on the northern shore of the Forth along the pier/jetty at North Queensferry. The dominant source of noise was road traffic from the existing Forth Road Bridge. There were contributions from the maintenance activity noise on the Forth Railway Bridge and occasional train horn and movement noise.

2.2.29 Location 23 was located on southern shore of the Forth at the northern end of the western breakwater at Port Edgar. The dominant source of noise was road traffic noise from the existing Forth Road Bridge. There were occasional contributions from train movements and associated train horns on the Forth Railway Bridge.

2.2.30 Location 17 was located in the Inverkeithing Cemetery at the south west edge of Inverkeithing. The dominant source of noise arose from road traffic on the A90 with occasional contributions from trains and birdsong.

2.2.31 Location 18 was located on Ferry Hills Road, Jamestown. The dominant source was local road traffic and occasional train movements.

2.2.32 Location 19 was located on Ferry Hills Road, Jamestown further south than Location 18. The dominant source of noise arose from road traffic on the A90 with occasional contributions from local traffic and scrapyard activity.

2.3 Summary of Short Term Noise Survey Results

Table 2.5: Short term attended noise survey results

Measurement Location	Date	Start time	Duration	Noise levels in dB re 2x10 ⁻⁵ Pa			
				L _{A90}	L _{Aeq}	L _{A10}	L _{Amax}
1	28/01/2009	14:10	10:00	49	53	55	62
1	28/01/2009	14:58	10:00	48	51	52	59
1	28/01/2009	15:55	10:00	53	56	58	63
2	28/01/2009	14:27	10:00	52	56	58	62
2	28/01/2009	15:15	10:00	53	56	57	65
2	28/01/2009	16:13	10:00	54	56	57	64
3	28/01/2009	14:42	10:00	56	59	61	64
3	28/01/2009	15:36	10:00	59	61	62	66
3	28/01/2009	16:31	10:00	61	63	64	71
4	26/01/2009	14:40	10:00	44	47	48	58
4	26/01/2009	15:33	10:00	42	43	44	50
4	26/01/2009	16:21	10:00	47	49	50	57
5	26/01/2009	15:00	10:00	55	57	59	63
5	26/01/2009	15:49	10:00	56	57	58	64
5	26/01/2009	16:37	10:00	56	58	59	67
6	26/01/2009	14:20	10:00	55	57	59	64
6	26/01/2009	15:15	10:00	55	57	59	66
6	26/01/2009	16:07	10:00	57	59	60	63
7 [%]	09/12/2008	11:30	10:00	42	47	49	70
7 [%]	09/12/2008	12:27	10:00	42	45	46	64
7	18/03/2009	10:06	10:00	40	43	45	54
7	18/03/2009	10:55	10:00	42	45	46	65
7	18/03/2009	11:46	10:00	42	45	47	59
8 [%]	09/12/2008	11:50	10:00	45	49	52	62
8 [%]	09/12/2008	12:40	10:00	45	47	49	62
8	18/03/2009	10:20	10:00	42	45	47	59
8	18/03/2009	11:13	10:00	43	46	47	71
8	18/03/2009	12:07	10:00	42	46	48	57
9 [%]	09/12/2008	12:10	10:00	41	45	48	61
9 [%]	09/12/2008	13:00	10:00	40	42	44	54
9	18/03/2009	10:37	10:00	41	43	46	57
9	18/03/2009	11:29	10:00	41	44	46	56
9	18/03/2009	12:29	10:00	41	43	45	53
10	09/12/2008	14:38	10:00	48	50	51	59
10	09/12/2008	16:07	10:00	48	49	50	70
10	09/12/2008	16:23	10:00	47	51	49	76
11	09/12/2008	14:00	10:00	46	50	52	66
11	09/12/2008	15:17	10:00	44	48	50	66
11	09/12/2008	16:50	10:00	45	50	49	81 ^{&}
13	28/01/2009	10:21	10:00	60	62	64	67
13	28/01/2009	11:14	10:00	57	60	63	65
13	28/01/2009	12:14	10:00	54	58	60	67

Forth Replacement Crossing
DMRB Stage 3 Environmental Statement
Appendix A16.3: Baseline Noise Surveys

Measurement Location	Date	Start time	Duration	Noise levels in dB re 2x10 ⁻⁵ Pa			
				L _{A90}	L _{Aeq}	L _{A10}	L _{Amax}
14	28/01/2009	10:37	10:00	57	63	64	84
14	28/01/2009	11:32	10:00	52	55	58	70
14	28/01/2009	12:29*	10:00	55	80	82	101
15	28/01/2009	10:55	10:00	67	72	74	77
15	28/01/2009	11:52	10:00	69	72	74	77
15	28/01/2009	12:46	10:00	69	73	75	78
16	18/03/2009	14:03	10:00	56	59	61	70
16	18/03/2009	14:58	10:00	57	59	61	70
16	18/03/2009	16:07	10:00	57	59	61	65
17	20/03/2009	10:20	10:00	45	52	49	71
17	20/03/2009	11:19	10:00	44	53	51	72
17	20/03/2009	12:10	10:00	45	53	49	76
18	20/03/2009	10:47	10:00	51	66	70	81
18	20/03/2009	11:35	10:00	50	67	70	84
18	20/03/2009	12:29	10:00	46	67	71	82
19	20/03/2009	11:01	10:00	50	61	62	78
19	20/03/2009	11:55	10:00	47	63	64	83
19	20/03/2009	12:44	10:00	47	64	66	84
20 [§]	19/03/2009	12:27	10:00	55	58	60	65
21 [#]	19/03/2009	11:37	10:00	61	68	71	78
21 [#]	19/03/2009	14:39	10:00	66	70	73	80
22 [#]	19/03/2009	12:00	10:00	53	59	60	79
22 [#]	19/03/2009	14:57	10:00	58	61	63	75
23	19/03/2009	10:49	10:00	55	57	58	68
23	19/03/2009	11:02	10:00	56	58	59	69
23	19/03/2009	13:05	10:00	56	58	59	71

% Only two time periods were covered on this visit so additional measurements were completed on 18/03/09.

& L_{Amax} due to car horn from passing car.

* Measurement affected by school bell and children close to microphone

§ Only one measurement undertaken at this location due to practical constraints

Only two measurements were completed at these locations due to practical constraints