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From : Russell Tipping

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Subject : Environmental Noise Survey, Broughton

Report No : R9098

## 1.0 Scope and objective

The **Industrial Noise and Vibration Centre (INVC)** was requested by Aled Zachery of Airbus Operations Ltd to conduct an environmental noise assessment of the Broughton site. This report details the method, results and findings of the survey.

The survey consisted of both long-term fixed monitoring at locations around the site boundary and short-term spot measurements within the surrounding area.

The noise survey was performed between 4 and 14 September 2018.

## 2.0 Policy and guidance documentation

This section summarises the policy and guidance documentation followed during this assessment.

The (The World Health Organisation) WHO : Guidelines for Community Noise, 1999 gives guidance on target levels for all aspects of noise impacting communities. For dwellings and residential properties, it highlights that the critical effects of noise are sleep disturbance, annoyance and speech interference. In an attempt to minimise these effects, the guidelines recommend criteria for both internal and external living areas

To avoid sleep disturbance noise levels within the bedroom are recommended not to exceed 30 dB  $L_{Aeq}$  for continuous noise or 45 dB  $L_{Amax}$  for single events.

To avoid the majority of people being seriously affected, the day-time level on balconies, terraces and outdoor living areas should not exceed 55 dB  $L_{Aeq}$  for steady continuous noise. To protect the majority of people from being moderately affected during the day, the level should not exceed 50 dB  $L_{Aeq}$ .

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These recommended criteria are given in Table 1.

Specific Environment	Critical Health Effect	L <sub>Aeq</sub> [dB]	Time base [hours]	L <sub>Amax</sub> fast [dB]
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime and evening	35	16	
Inside bedrooms	Sleep disturbance, night-time	30	8	45
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

**Table 1 WHO guidelines for community noise**

The **WHO** document identifies the daytime period as a 16-hour day (07:00 to 23:00 hours), while the night-time is defined as 8-hours (23:00 to 07:00 hours).

The guidelines also give recommendations on the noise level at the façade of a bedroom window, that, if open, would allow undisturbed sleep. This is quoted as 45 dB L<sub>Aeq</sub> and is also shown in Table 1.

BS 4142: 2014, Method for rating and assessing industrial and commercial sound has also been followed during this survey. BS 4142: 2014 is intended to be used to assess the likelihood of complaints, with respect to noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises.

### 3.0 Measurement procedure

#### Long-term monitoring

#### Measurement Equipment

Sound level meter calibrator RION NC-74: 34315114

Sound level meter RION NL-32: 00513543

Sound level meter RION NL-32: 00903345

Sound level meter RION NL-32: 00513545

Long term noise monitors were positioned at 3 locations around the boundary of the Broughton site. The locations of which are shown in Appendix A.

The continuous monitoring was programmed to record both the L<sub>Aeq</sub> and L<sub>A90</sub>. These were logged over 5-minute periods and adjusted in post-processing to give both the 1-hour daytime and 15-minute night-time levels. In addition, the full daytime and night-time L<sub>Aeq,16hr</sub> and L<sub>Aeq,8hr</sub> can also be calculated from the raw logged data.

Continuous monitoring was performed between 4 and 13 September 2018. The weather data for the long-term measurement period is shown in Appendix B

### Short-term spot measurements

#### Measurement Equipment

Sound level meter calibrator 4231: 2651819

Sound level meter B&K 2238: 2652322

In addition to the long-term monitoring, short term spot measurements were taken at specific locations, (identified in Appendix A). All levels measured were time averaged. The spot measurements were logged over a 15-minute period. The parameters recorded included  $L_{Aeq}$  and  $L_{A90}$ . In addition, calibrated digital recordings were also made. This allowed for post processing and detailed frequency analysis to be performed.

The spot measurements were performed on 4 and 5 September 2018 between the hours of 00:00 and 04:00. Due to unforeseen circumstances, (including night-time runway re-surfacing works), the measurements were repeated on 14 and 15 September 2018 between the hours of 00:00 and 04:00. The detailed analysis has been performed on the second set of measurements, as these are considered to best represent typical conditions.

During both the sets of spot measurements the weather conditions were mild with no precipitation. Wind speeds were below 5km/h and the temperature ranged from 11 to 14 °C.

## **4.0 Noise survey results**

### Long-term monitoring

Appendix C shows time versus noise level plots of the logged  $L_{A90,5min}$  and  $L_{Aeq,5min}$  for the full measurement period for all three measurement locations.

The logged 5-minute averages have been processed to give both the day-time 1-hour averages and the night-time 15-minute averages. As defined in BS 4142, the daytime and night-time periods are defined as 07:00 to 23:00 and 23:00 till 07:00 hours, respectively. In addition to this the full day and night-time average  $L_{Aeq,16hr}$  and  $L_{Aeq,8hr}$  have been derived, this is in line with the criteria outlined in WHO community noise guidelines.

The monitoring was performed from 4 to 14 September. It was noted that, following the setup of the equipment, night-time works were being performed on the runway during the evening of 4 September. As these are not considered typical activities, and are only short term, the results of 4 September have not been included in the detailed assessment. They have, however, been included in Appendix C so the variation in levels can be observed.

From the measured and analysed results, the following single value levels have been derived and are considered representative of the current noise environment at each of the measurement positions. Tables 2 and 4 show the derived average level based on a measurement time period of 1 hour and 15 minutes, this assessment is consistent with the procedure defined in BS 4142. Tables 3 and 5 show the derived average levels based on the full night-time and daytime period, 8 hours and 16 hours respectively. This approach is consistent with the WHO guidelines.

**Table 2 Daytime averaged measured noise levels, ref BS4142**

Position location	L <sub>Aeq,1hr</sub> dB	L <sub>A90,1hr</sub> dB
A	52	48
B	49	44
C	48	44

**Table 3 Daytime averaged measured noise levels, ref WHO guidelines**

Position location	L <sub>Aeq,16hr</sub> dB	L <sub>A90,16hr</sub> dB
A	55	48
B	50	43
C	48	42

**Table 4 Night-time averaged measured noise levels, ref BS4142**

Position location	L <sub>Aeq,15min</sub> dB	L <sub>A90,15min</sub> dB
A	44	38
B	45	42
C	38	35

**Table 5 Night-time averaged measured noise levels, ref WHO guidelines**

Position location	L <sub>Aeq,8hr</sub> dB	L <sub>A90,8hr</sub> dB
A	49	43
B	47	41
C	44	39

Comparison of the average levels shown in Tables 3 and 5 with the WHO guidelines indicate that the day-time level meets the L<sub>Aeq,16hour</sub> limit of 55 dB at all three locations.

During the night at position C, the night-time L<sub>Aeq,8hr</sub>, given in Table 5, is below the WHO guideline L<sub>Aeq,8hr</sub> limit of 45 dB.

At position B, the night-time L<sub>Aeq,8hr</sub> is predicted to marginally exceed the WHO guidelines limit. However, it must be remembered that this measurement location is at the site boundary and not at sensitive property. The nearest property to this location is at a distance of 500m. It is considered likely that any noise generated by the site will attenuate over the additional distance and therefore be below the guidelines limit of 45 dB at the properties

At position A, St Marys Way, the  $L_{Aeq,8hr}$  has also been predicted to exceed the WHO night-time guidelines of 45 dB. The noise level measured at this location, is undoubtedly affected by the main road running parallel to St Mary's Way, this is confirmed by the subjective observations taken during the short-term measurements.

In addition, by reviewing Appendix D - the night-time levels time plot at position A, it can be seen that during the period 23:00 to 04:30 hours, the spread of measured levels across the nights is ~ 10 dB. Whereas the following period, 4.30 to 07:00 hours, the spread in results reduces to ~5 dB and the average level has increased. This reduction in spread is likely due to a more consistent and re-occurring noise event, i.e. increase traffic noise due to the rush hour. The average noise level is also likely to be affected by the high levels measured on both 7 and 10 September between the hours of 02:20 and 03:20 hours.

Tables 2 and 4 show the average levels based on the shorter measurement time periods of 1 hour and 15 minutes, as stipulated in BS 4142. These shorter time periods allow for a more transient understanding of the noise environment. These average levels indicate that although at all positions the night-time noise levels increase between the periods of 04:30 and 07:00 hours, due to off-site road traffic noise, the average  $L_{Aeq,15min}$  across the whole night-time period is below 45 dB.

The previous noise survey performed in 2016, included long term measurements at positions A, B and C. These were reported as levels averaged over a 1-week period and are shown in Table 6. As the levels have been averaged over the full week, they do not give an indication of the variation between the day and night-time periods. As a result, the  $L_{Aeq,1week}$  level will be distorted by the large variation seen between the middle of the day and night. **INVC** do not consider this the most appropriate measure to assess the impact of the site.

**Table 6 Reported levels from 2016**

Position location	$L_{Aeq,1week}$ dB	$L_{A90,1week}$ dB
A	56	36
B	52	39
C	52	35

Despite this, a comparison has been made between the current daytime levels, as seen in both Tables 2 and 3, and the levels measured in 2016. This comparison shows a slight decrease in levels. This is likely to be due to a change in weather conditions and/or traffic conditions.

Short-term spot measurements

The tables below summarises the overall noise levels measured during the short-term spot measurements. The measurements were undertaken between the hours of 00:00 and 04:00 on both 4 and 14 September 2018.

Tables 7 and 8 also include the levels measured during the previous survey performed in January 2016. Although there is some variation when compared to the measured levels recorded in 2016, the variations seen are small, in most cases less than 3 dB or less

The only exception to this is at positions 5 and 6. At position 5 the current  $L_{Aeq}$  is 8 dB higher, whilst at position 6 the current level is 8 dB lower. It is worth noting that both these locations are near a main road. It is likely that the change in level is due to varying traffic conditions and not a change in noise level generated by the Airbus site.

**Table 7 Measured short-term  $L_{Aeq,15min}$**

Position location	$L_{Aeq,15min}$ dB		
	4/5 Sept 2018	14/15 Sept 2018	Jan 2016
1	59	47	50
2	49	46	48
3	46	43	42
4	47	43	44
5	49.5	55	47
6	51	37	49/45
7	38	36	41/39

**Table 8 Measured short-term  $L_{A90,15min}$**

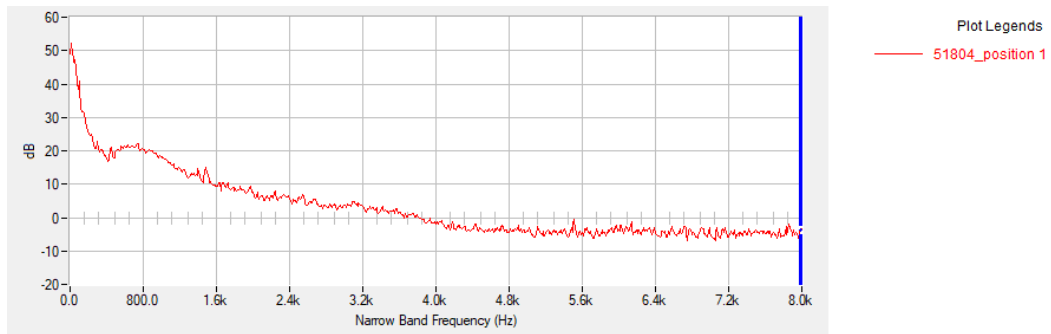
Position location	$L_{A90,15min}$ dB		
	4/5 Sept 2018	14/15 Sept 2018	Jan 2016
1	55	39.5	35
2	43.5	39.5	41
3	41	36	37
4	38	33.5	37
5	37.5	35	32
6	33	34.5	38/32
7	31	32	36/36

In addition to the overall levels, calibrated digital recordings were taken at each location. These have been analysed to generate the associated frequency spectra. The section below presents both these spectra and a brief summary of the noise environment at the measurement locations.

Position 1: St Mary's Way

The background noise level at this location was dominated by road traffic noise. In addition to this, the runway maintenance works being undertaken may have added to the overall noise level.

Figure 1 shows the measured frequency spectrum for position 1. The analysis has not identified any dominant tonal characteristics.



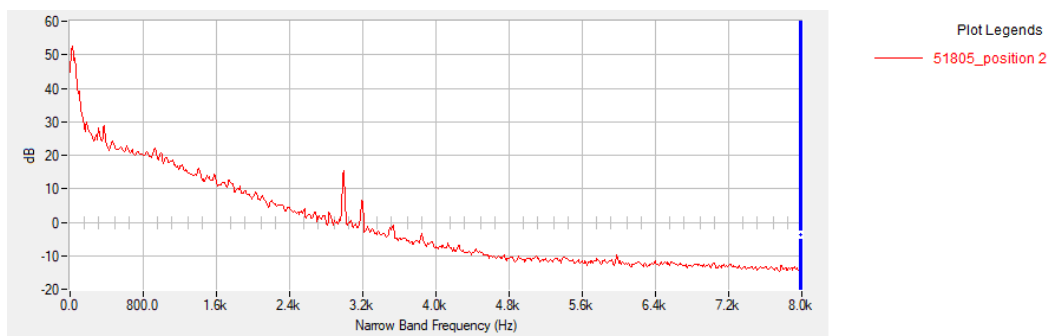
**Figure 1 Measured frequency spectrum for position 1**

Comparison of the current noise level with that measured in 2016, shows that there is a drop of 3 dB in the overall  $L_{Aeq}$ , but an increase in the  $L_{A90}$  of 4/5 dB.

Position 2: Car park to the rear of The Glynne Arms

At this location the contribution to the overall noise level included distant road traffic, truck loading, reversing beepers and car movements, all originating from the Airbus site.

Figure 2 shows the measured frequency spectrum for position 2. the analysis has identified two tonal peaks at 2.99kHz and 3.2kHz, these are thought to be related to the reversing beepers.



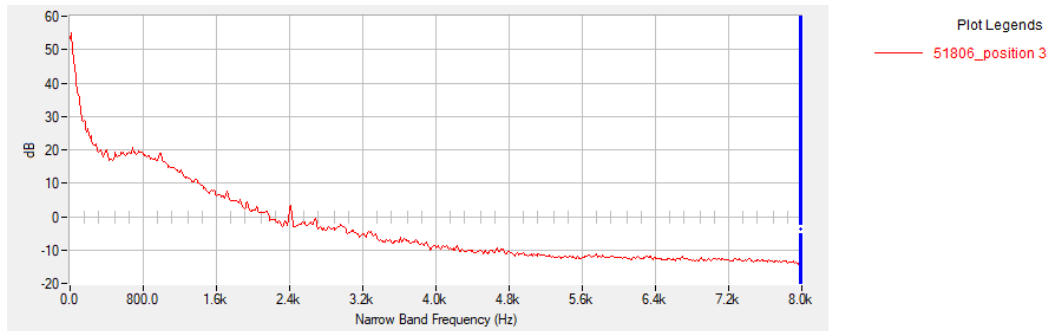
**Figure 2 Measured frequency spectrum for position 2**

Comparing the levels measured with the 2016 results shows that both the  $L_{Aeq}$  and the  $L_{A90}$  have decreased by ~2 dB.

Position 3: Copse Lane

At this location the contribution to the overall noise level included road traffic noise and Airbus site noise. This included contribution from the AHU located close to the building opposite.

Figure 3 shows the measured frequency spectrum for position 3. The analysis has not identified any dominant tonal characteristics.



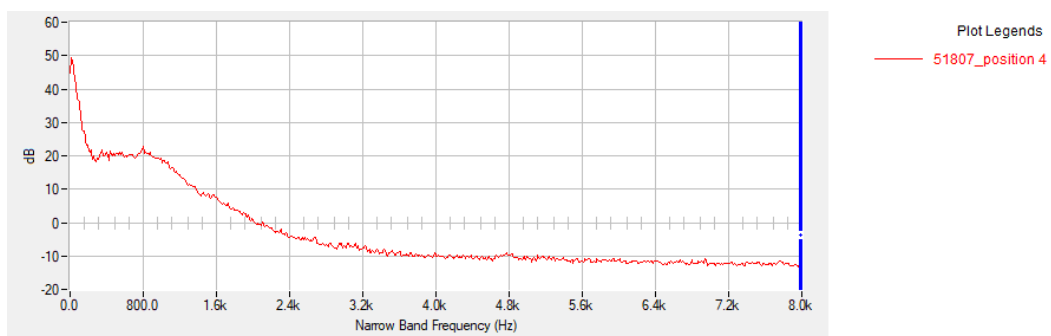
**Figure 3 Measured frequency spectrum for position 3**

Comparing the current noise levels with the 2016 results, shows that the  $L_{Aeq}$  has decreased by 1 dB whilst the  $L_{A90}$  has increased by 1 dB.

Position 4: Well House Farm

At this location the contribution to the overall noise level included road traffic noise. In addition the Airbus site was marginally audible.

Figure 4 shows the measured frequency spectrum for position 4. The analysis has not identified any dominant tonal characteristics.



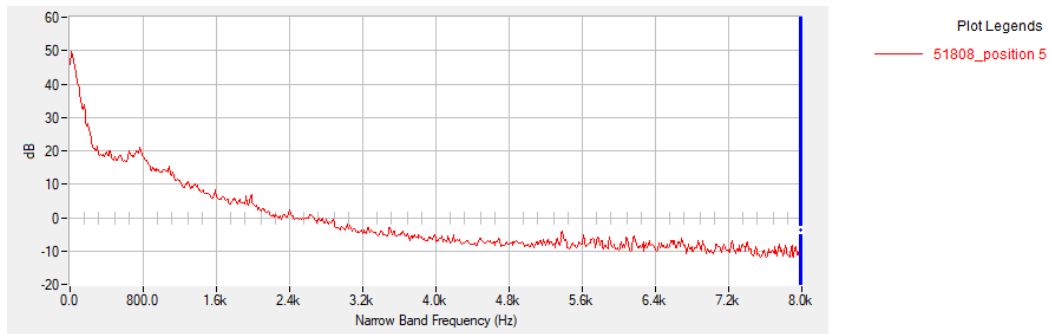
**Figure 4 Measured frequency spectrum for position 4**

Comparing the current noise levels with the 2016 results shows that the  $L_{Aeq}$  has decreased by 1 dB, whilst the  $L_{A90}$  has increased by 1 dB.

**Position 5: Cop House Farm**

At this location the contribution to the overall noise level included road traffic noise, helicopter noise, and distant site works including dump truck, loading/unloading and reversing beepers.

Figure 5 shows the measured frequency spectrum for position 5. The analysis has not identified any dominant tonal characteristics.



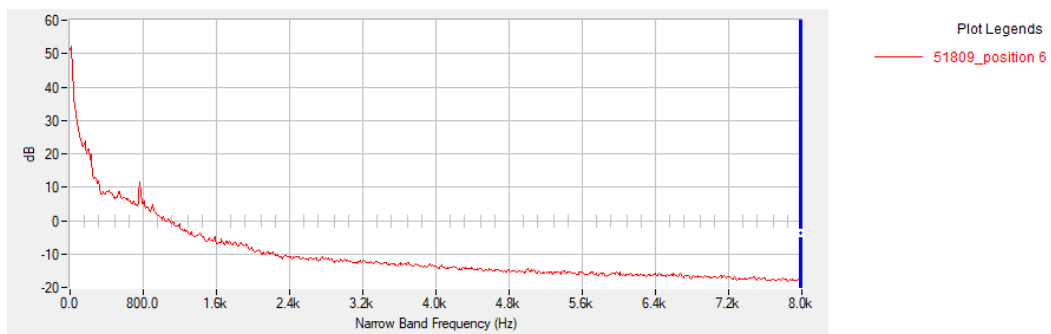
**Figure 5 Measured frequency spectrum for position 5**

Comparing the current noise levels with the 2016 results shows that the  $L_{Aeq}$  has decreased by 1 dB whilst the  $L_{A90}$  has increased by 1 dB.

**Position 6: Beeches Farm**

At this location the overall noise level was influenced by distant road traffic noise, mechanical noise from the HVAC unit located on the Airbus security gate and site works, loading and unloading of dumper truck, from within the main site

Figure 6 shows the measured frequency spectrum for position 6. The analysis has identified a tonal characteristic at 764 Hz.



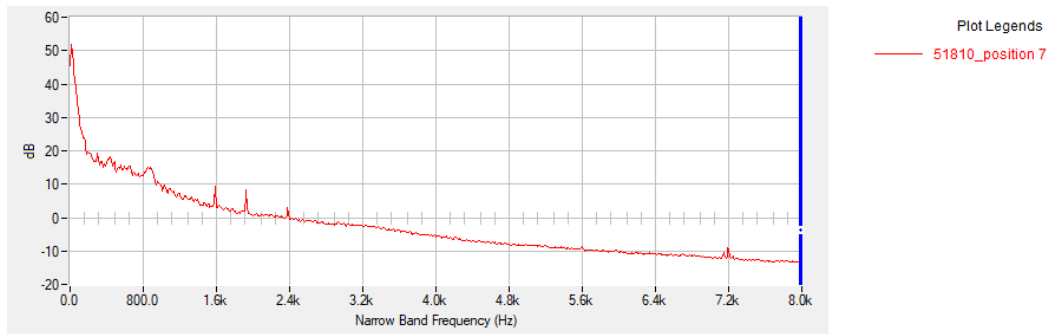
**Figure 6 Measured frequency spectrum for position 6**

Comparing the current noise levels with the 2016 results shows that the  $L_{Aeq}$  has decreased by 8 dB whilst the  $L_{A90}$  is similar.

Position 7: Manor Crescent

At this location the contribution to the overall noise level included distant road traffic and reversing beepers from the Airbus site.

Figure 7 shows the measured frequency spectrum for position 7. The analysis has identified tonal characteristics at 1.6 and 1.9kHz.



**Figure 7 Measured frequency spectrum for position 7**

Comparing the current noise levels with the 2016 results shows that the  $L_{Aeq}$  has decreased by 3 dB whilst the  $L_{A90}$  decreased by 4 dB.

**5.0 Conclusion**

A comprehensive noise survey has been undertaken by **INVC**. Long term measurements have been performed at 3 fixed locations around the perimeter of the site, whilst short-term measurements have been performed at seven locations within the surrounding area. Detailed results of these surveys are contained in section 4 and Appendices C - D.

The short-term measurements performed produced similar results to those obtained in 2016. The only exception to this was at positions 5 and 6. However, at these locations, the variation in levels is not considered to be due to the Airbus site, but associated with road traffic noise.

The long-term measurements have shown that at locations B and C the level measured falls in line with the WHO guidelines night-time  $L_{Aeq,8hr}$  limit of 45 dB. At position A, although the measured  $L_{Aeq,8hr}$  exceeds the 45 dB limit, it has been shown that this is likely to have been caused by early morning rush hour, and that over the majority of the night-time period the level falls below an  $L_{Aeq,15min}$  of 45 dB.

Based on the assessment performed by **INVC**, it is considered reasonable to conclude that the Airbus Broughton site meets the requirements set out in section 2 and that there is no increase in noise contribution from the previous 2016 survey.

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## Appendix A – Measurement Positions

Long term positions



Position A: St Marys Way

Position B: Site perimeter, near radar tower in the direction of Salty

Position C: Site perimeter, rear of properties on Manor Crescent

Short term measurement positions



Position 1: St Mary's Way

Position 2: Car park to the rear of The Glynne Arms

Position 3: Copse Lane

Position 4: Well house Farm

Position 5: Cop House Farm

Position 6: Beeches Farm

Position 7: Manor Crescent



### Appendix B – Weather Data

**Weather History Table**  
**September 4, 2018 - September 14, 2018**

2018 Sep	Temperature			Dew Point			Humidity			Speed			Pressure			Precip. Accum.
	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg	Gust	High	Avg	Low	Sum
4	22 °C	16.8 °C	11.8 °C	17.4 °C	13.8 °C	11.7 °C	99 %	92 %	61 %	7 kph	2 kph	17 kph	1024 hPa	1023 hPa	1022 hPa	1 mm
5	22.4 °C	16.2 °C	10.1 °C	15.1 °C	11.1 °C	8.9 °C	99 %	78 %	45 %	7 kph	2 kph	19 kph	1023 hPa	1022 hPa	1020 hPa	0 mm
6	19.3 °C	14.6 °C	10 °C	14.9 °C	11.6 °C	8.7 °C	99 %	92 %	60 %	9 kph	2 kph	18 kph	1020 hPa	1017 hPa	1014 hPa	3 mm
7	20.3 °C	15.2 °C	10.1 °C	13.1 °C	10.3 °C	7.5 °C	99 %	83 %	47 %	9 kph	3 kph	19 kph	1016 hPa	1014 hPa	1013 hPa	0 mm
8	18.8 °C	14.3 °C	9.7 °C	18.7 °C	14.1 °C	9.6 °C	99 %	99 %	99 %	7 kph	1 kph	15 kph	1015 hPa	1014 hPa	1012 hPa	7.9 mm
9	20.6 °C	16.9 °C	13.3 °C	17.9 °C	15.1 °C	13.2 °C	99 %	95 %	70 %	13 kph	4 kph	28 kph	1016 hPa	1014 hPa	1011 hPa	3 mm
10	18 °C	14.6 °C	11.1 °C	16.7 °C	13.1 °C	10.8 °C	99 %	89 %	69 %	11 kph	4 kph	26 kph	1018 hPa	1015 hPa	1012 hPa	0 mm
11	21 °C	16.4 °C	11.7 °C	17.2 °C	13.9 °C	10.4 °C	99 %	89 %	58 %	10 kph	3 kph	19 kph	1019 hPa	1015 hPa	1011 hPa	10.9 mm
12	20.7 °C	15.3 °C	9.9 °C	13.3 °C	10.9 °C	9.2 °C	99 %	83 %	53 %	7 kph	2 kph	16 kph	1023 hPa	1021 hPa	1018 hPa	3.3 mm
13	20.6 °C	15.5 °C	10.4 °C	13.5 °C	11.4 °C	10 °C	99 %	84 %	55 %	11 kph	4 kph	24 kph	1023 hPa	1021 hPa	1019 hPa	0.5 mm
14	18.3 °C	14.6 °C	11 °C	17.6 °C	13.7 °C	10.8 °C	99 %	98 %	80 %	7 kph	2 kph	13 kph	1019 hPa	1017 hPa	1015 hPa	2.3 mm

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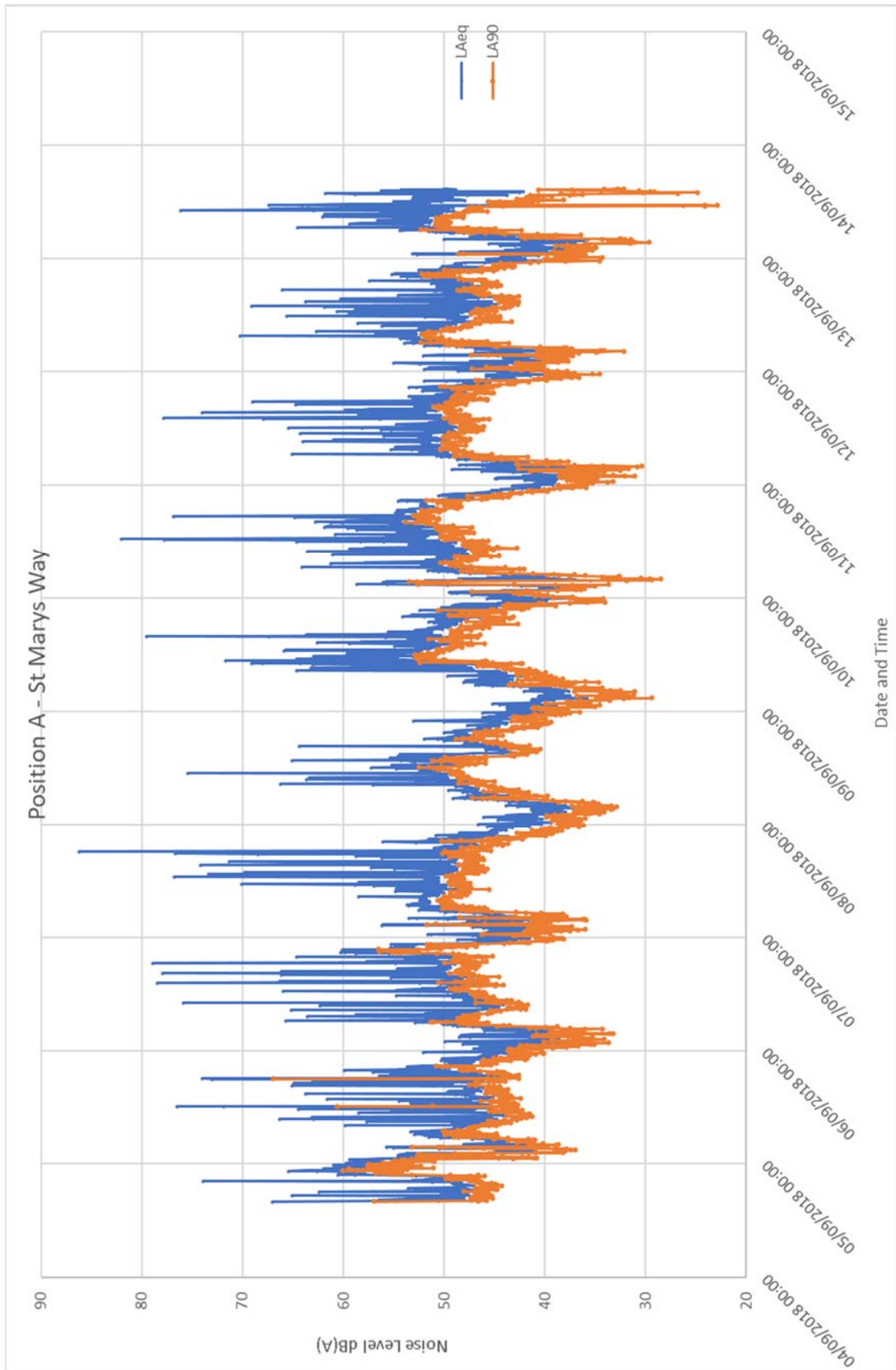
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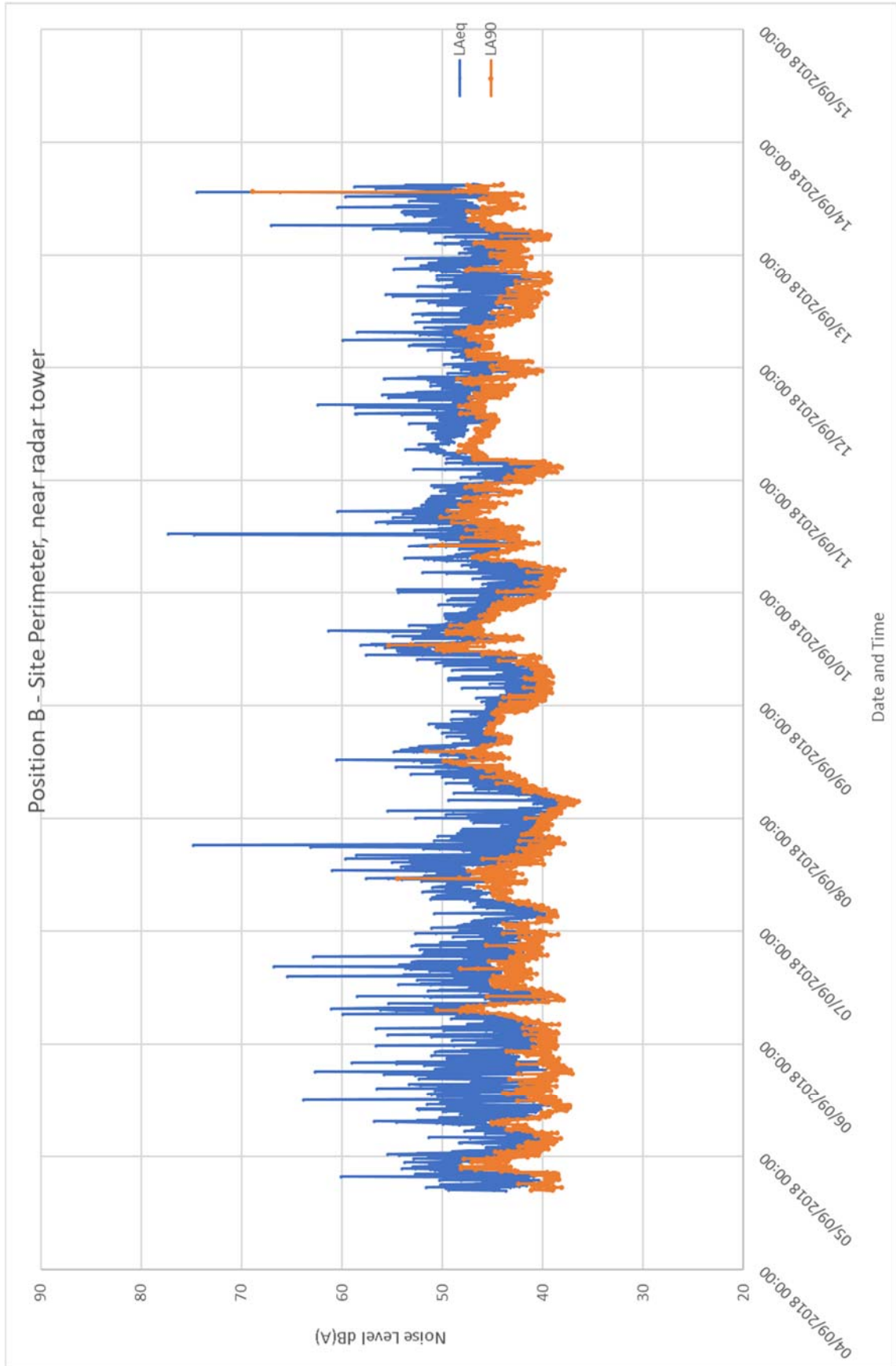
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**Appendix C – Long term monitoring 5-minute logged results**

Position A: St Mary's Way

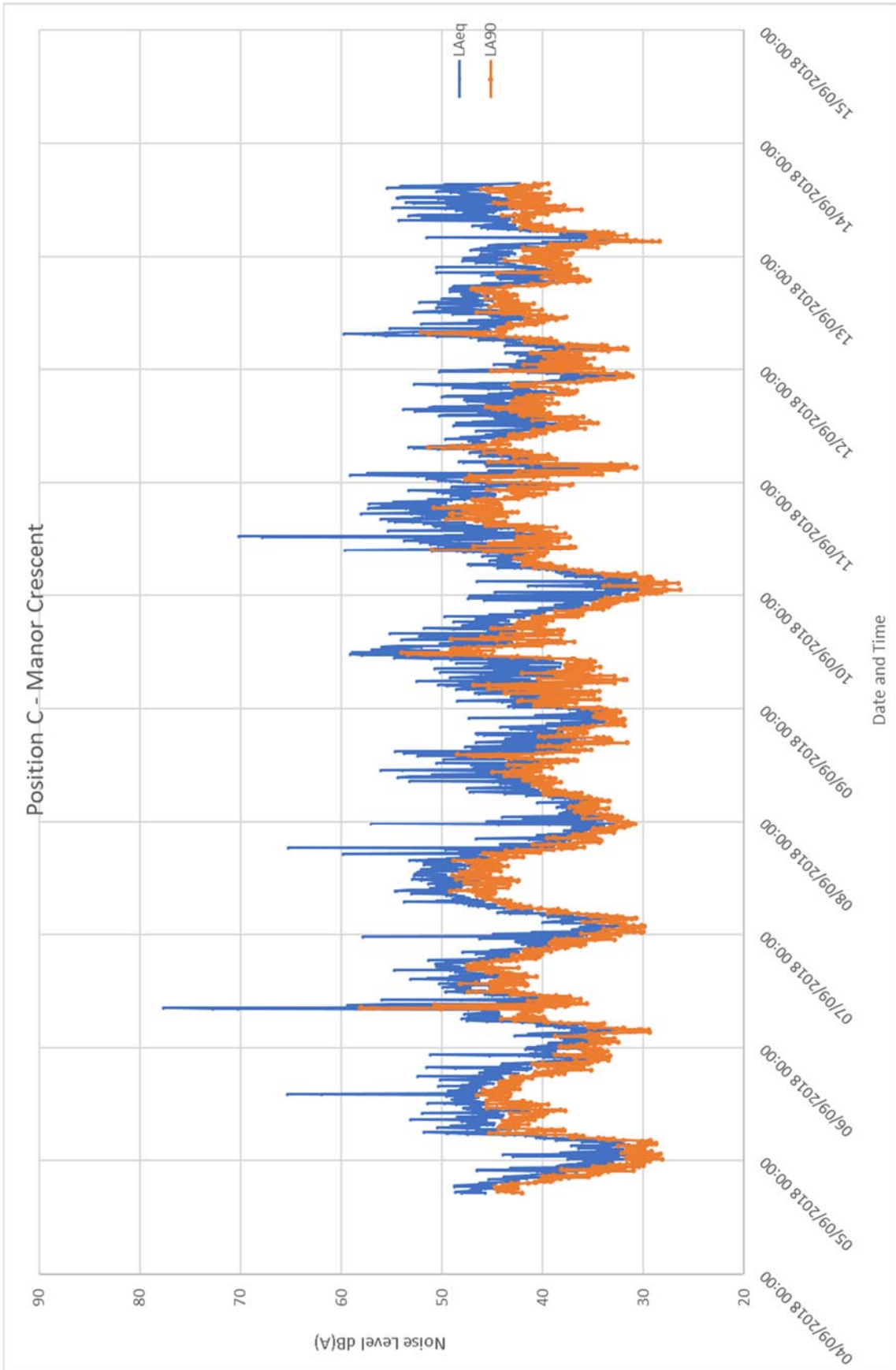


Position B: Site perimeter, near radar tower in the direction of Salty



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Position C: Site perimeter, rear of properties on Manor Crescent



### Appendix D – Long term monitoring 15min and 1 hour logged averages

Position A: St Mary's Way - LAeq

Time	Night-time LAeq,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:02	58	46	45	45	44	41	44	45	48		
23:17	58	45	43	44	43	42	41	43	45		
23:32	60	44	46	44	42	40	41	44	43		
23:47	59	49	43	43	44	43	42	43	44		
00:02	58	45	46	44	43	42	40	46	44		
00:17	57	45	46	42	42	44	41	47	43		
00:32	58	44	50	41	43	45	39	49	42		
00:47	58	43	44	42	43	44	40	48	49		
01:02	52	45	45	43	41	48	41	46	49		
01:17	50	39	43	41	40	47	42	45	42		
01:32	54	45	44	44	44	43	45	49	45		
01:47	54	41	44	42	41	39	40	51	43		
02:02	53	46	45	43	41	40	39	45	39		
02:17	43	40	46	39	40	39	41	42	40		
02:32	42	40	54	39	40	42	41	43	41		
02:47	44	44	52	40	38	54	44	43	44		
03:02	48	45	46	40	40	55	40	42	44		
03:17	54	47	46	40	39	56	46	48	38		
03:32	53	38	45	38	39	52	43	48	40		
03:47	43	42	46	40	39	41	39	45	37		
04:02	46	41	52	41	39	45	45	44	46		
04:17	45	43	47	39	40	44	47	41	46		
04:32	44	43	45	41	40	43	44	44	46		
04:47	45	46	45	43	41	43	44	45	43		
05:02	45	47	46	43	40	44	44	47	45		
05:17	47	47	49	46	43	48	47	49	48		
05:32	50	50	50	48	46	50	48	51	50		
05:47	50	49	51	47	46	51	47	49	51		
06:02	51	53	52	44	45	47	50	53	54		
06:17	51	61	50	47	44	49	49	51	50		
06:32	50	49	51	46	46	60	60	52	60		
06:47	52	51	53	47	45	51	50	53	53		
8 hour	54	49	49	43	43	50	48	48	49		49
Max	60	61	54	48	46	60	60	53	60		
Min	42	38	43	38	38	39	39	41	37		
Mean	51	45	47	43	42	46	44	47	45		45
Modal	58	45	46	44	40	43	41	45	43		44

Time	Daytime LAeq,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:02		49	55	52	47	45	54	42	60	54	
08:02		52	55	53	57	54	50	40	56	55	
09:02		59	53	51	54	57	56	42	52	55	
10:02		50	65	52	65	65	55	42	51	66	
11:02		56	49	60	52	59	51	43	56	60	
12:02		67	56	66	53	58	73	45	54	52	
13:02		53	50	65	56	57	54	47	60		
14:02		54	68	52	52	56	54	55	54		
15:02	56	48	50	64	45	69	57	52	54		
16:02	52	55	68	61	54	56	58	52	50		
17:02	55	58	51	67	48	51	66	57	56		
18:02	54	66	68	75	49	50	54	56	49		
19:02	48	54	56	49	49	49	52	52	52		
20:02	63	52	56	51	46	51	53	57	53		
21:02	56	49	56	47	46	49	49	50	51		
22:02	61	47	53	45	47	47	47	68	49		
16 hour	55	59	62	65	55	60	63	57	55	56	55
Max	63	67	68	75	65	69	73	68	60	66	
Min	48	47	49	45	45	45	47	40	49	52	
Mean	56	54	57	57	51	55	55	50	53	56	54
Modal	56	49	56	52	47	57	54	42	56	55	52

report



Position A: St Marys Way - LA90

Time	Night-time LA90,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:02	53	42	41	40	40	36	40	38	43		
23:17	54	41	39	38	39	36	38	36	39		
23:32	56	42	39	38	39	35	37	39	37		
23:47	56	44	39	38	38	36	38	39	39		
00:02	55	43	41	38	39	39	36	40	38		
00:17	54	43	42	38	39	40	36	43	38		
00:32	54	40	45	38	41	40	35	45	37		
00:47	53	40	41	38	40	42	37	43	44		
01:02	42	41	42	38	37	43	37	41	44		
01:17	43	36	39	37	35	45	36	42	37		
01:32	52	36	39	39	38	40	37	42	37		
01:47	52	38	39	39	37	36	34	41	37		
02:02	47	39	41	38	37	37	35	38	36		
02:17	39	35	39	35	35	36	38	38	35		
02:32	38	36	49	35	34	38	36	39	37		
02:47	38	37	48	36	32	48	39	40	37		
03:02	43	40	40	36	34	52	35	39	35		
03:17	50	40	41	35	34	53	39	43	31		
03:32	49	34	39	33	34	47	35	44	33		
03:47	40	38	38	36	33	30	32	39	32		
04:02	41	38	47	35	33	31	36	37	33		
04:17	42	37	41	35	35	34	41	34	40		
04:32	42	36	41	36	36	36	40	38	41		
04:47	42	41	40	38	36	39	39	39	39		
05:02	43	42	40	39	36	42	41	42	42		
05:17	45	45	46	42	38	46	44	46	46		
05:32	48	48	48	46	43	48	47	49	48		
05:47	47	47	47	44	42	46	44	46	46		
06:02	49	51	49	41	37	42	49	51	51		
06:17	46	47	47	42	39	45	47	47	46		
06:32	48	48	48	43	42	48	48	50	49		
06:47	50	48	50	43	40	49	48	51	50		
8 hour	50	43	44	40	38	45	42	44	43	43	
Max	56	51	50	46	43	53	49	51	51		
Min	38	34	38	33	32	30	32	34	31		
Mean	47	41	43	38	37	41	39	42	40	40	
Modal	42	40	39	38	39	36	36	39	37	39	

Time	Daytime LA90,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:02		47	47	50	45	41	49	38	52	50	
08:02		45	45	49	46	42	48	36	50	50	
09:02		43	43	48	47	45	46	36	48	48	
10:02		43	45	48	48	48	46	37	46	47	
11:02		44	46	48	50	52	47	36	46	43	
12:02		51	47	49	49	51	49	39	46	42	
13:02		45	48	48	49	49	49	44	45		
14:02		44	47	47	46	48	50	48	44		
15:02	46	45	46	48	42	49	50	49	44		
16:02	47	46	48	47	43	48	52	49	47		
17:02	46	46	48	48	45	48	52	48	47		
18:02	46	56	47	47	47	46	51	49	45		
19:02	46	46	48	46	46	45	49	48	48		
20:02	48	49	52	46	43	47	50	48	51		
21:02	52	45	53	42	41	46	45	48	47		
22:02	57	44	48	40	42	42	42	49	44		
16 hour	48	48	48	48	46	48	49	46	48	44	48
Max	57	56	53	50	50	52	52	49	52	50	
Min	46	43	43	40	41	41	42	36	44	34	
Mean	49	46	47	47	46	47	48	44	47	44	46
Modal	46	45	48	48	46	48	49	48	46	50	48

Position B: Site perimeter, near radar tower in the direction of Salty - LAeq

Time	Night-time LAeq,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:02	48	41	43	43	44	45	48	44	46		
23:17	50	43	44	45	44	44	47	44	50		
23:32	50	46	50	40	44	42	44	46	44		
23:47	46	52	43	41	45	46	44	46	46		
00:02	48	44	47	49	44	50	44	46	46		
00:17	51	44	46	40	43	47	45	47	47		
00:32	53	41	48	44	44	51	47	48	46		
00:47	47	46	46	46	44	44	45	46	46		
01:02	48	43	47	43	42	43	44	44	44		
01:17	44	42	47	40	42	42	45	45	46		
01:32	44	47	45	52	45	41	44	46	46		
01:47	45	41	45	40	43	43	42	47	46		
02:02	44	51	44	41	42	44	46	48	47		
02:17	41	40	46	39	42	41	50	48	48		
02:32	43	42	44	40	42	42	42	48	49		
02:47	47	46	42	39	42	44	41	47	46		
03:02	47	44	41	40	42	41	42	47	43		
03:17	40	53	43	39	42	43	42	48	43		
03:32	41	47	40	38	44	43	47	48	42		
03:47	45	42	47	45	45	42	46	49	47		
04:02	47	44	40	40	43	46	44	46	45		
04:17	43	45	42	40	42	48	47	47	42		
04:32	42	44	42	40	43	39	48	51	43		
04:47	43	44	43	41	42	45	48	50	48		
05:02	43	43	44	41	42	43	49	46	51		
05:17	45	46	44	46	46	44	49	48	45		
05:32	46	44	44	43	43	44	50	47	53		
05:47	45	47	45	43	46	46	50	56	47		
06:02	46	47	45	44	45	45	50	48	47		
06:17	45	55	45	46	44	45	50	47	62		
06:32	45	48	46	42	44	46	52	48	51		
06:47	49	50	49	44	42	49	51	50	50		
8 hour LAeq	47	47	45	44	44	45	47	48	50	47	
Max	53	55	50	52	46	51	52	56	62		
min	40	40	40	38	42	39	41	44	42		
mean	46	45	45	42	43	44	46	47	45	45	
modal	45	44	44	40	42	44	44	48	44	44	

Time	Daytime LAeq,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:02		52	54	49	45	44	50	51	52	49	
08:02		45	49	49	47	44	46	50	48	51	
09:02		46	43	49	48	48	47	49	47	50	
10:02		47	50	49	49	50	49	49	47	52	
11:02		48	47	52	50	52	48	49	49	50	
12:02		54	49	52	52	55	68	49	46	52	
13:02		48	48	51	48	51	49	48	48	64	
14:02		50	55	49	52	50	48	53	47	53	
15:02		48	48	52	49	54	52	52	50	44	
16:02	41	46	57	50	46	49	52	53	46		
17:02	47	50	49	53	46	49	53	50	48		
18:02	46	53	53	64	47	47	50	51	46		
19:02	51	49	48	46	48	48	49	48	46		
20:02	48	51	48	45	47	46	49	49	49		
21:02	51	47	47	44	46	46	47	51	50		
22:02	50	47	45	43	46	46	49	47	47		
16 hour LAeq	45	50	51	54	48	50	57	50	48	54	50
Max	51	54	57	64	52	55	68	53	52	64	
min	0	45	43	43	45	44	46	47	46	49	
mean	42	49	49	50	48	49	51	50	48	53	49
modal	51	47	48	49	46	46	49	49	47	50	49

Position B: Site perimeter, near radar tower in the direction of Salty - LA90

Time	Night-time LA90,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:02	45	39	39	40	43	41	45	41	43		
23:17	46	41	40	40	42	40	45	41	43		
23:32	45	39	42	39	42	40	42	43	42		
23:47	43	39	41	40	42	40	42	43	44		
00:02	42	40	42	40	41	42	42	43	44		
00:17	42	40	42	39	42	43	43	45	44		
00:32	43	39	42	40	42	41	42	43	43		
00:47	43	41	43	39	42	40	42	43	43		
01:02	43	40	42	39	40	39	41	43	42		
01:17	40	39	43	39	40	39	41	43	42		
01:32	40	40	42	39	42	40	40	45	43		
01:47	41	40	40	39	40	40	39	45	45		
02:02	42	40	40	38	42	41	42	45	44		
02:17	40	39	40	38	41	39	40	46	45		
02:32	39	39	40	38	40	40	40	47	46		
02:47	41	40	40	38	39	40	39	46	44		
03:02	40	40	39	38	40	39	39	47	41		
03:17	39	41	39	38	40	39	40	47	40		
03:32	40	40	39	37	40	39	41	47	40		
03:47	39	40	39	38	41	39	40	46	40		
04:02	40	39	39	38	40	39	42	45	42		
04:17	40	40	40	38	40	40	45	45	40		
04:32	40	41	40	39	40	38	47	46	41		
04:47	39	41	40	39	39	39	46	45	41		
05:02	40	42	40	40	40	39	46	45	43		
05:17	41	42	40	40	40	40	46	46	42		
05:32	43	43	42	41	41	41	47	46	45		
05:47	43	43	42	41	41	42	47	47	44		
06:02	43	44	42	41	40	41	47	47	45		
06:17	42	44	43	41	40	42	48	46	45		
06:32	42	45	43	41	40	43	47	46	45		
06:47	44	47	44	41	40	45	47	47	45		
8 hour LA90	42	41	41	39	41	41	44	45	43		41
Max	46	47	44	41	43	45	48	47	46		
min	39	39	39	37	39	38	39	41	40		
mean	42	41	41	39	41	40	43	45	41		42
modal	40	40	40	39	40	40	42	45	40		40

Time	Daytime LA90,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:02		44	47	44	42	40	46	47	48	46	
08:02		40	44	44	43	41	44	47	46	46	
09:02		39	39	45	44	42	45	46	44	45	
10:02		38	41	44	45	42	46	46	43	44	
11:02		40	41	47	48	48	44	45	43	44	
12:02		40	44	45	47	51	44	45	42	44	
13:02		42	43	45	46	47	44	45	42	58	
14:02		41	43	42	48	44	45	47	41	46	
15:02		40	43	43	45	48	47	47	42	39	
16:02	35	40	43	41	44	47	48	47	42		
17:02	40	40	43	41	44	47	47	46	41		
18:02	40	38	42	39	45	45	47	45	40		
19:02	39	39	41	40	45	45	46	44	40		
20:02	42	39	42	41	45	44	46	46	44		
21:02	46	40	41	40	44	43	44	46	44		
22:02	45	41	41	40	44	42	46	43	43		
16 hour LA90	38	40	43	43	45	46	46	46	43	48	43
Max	46	44	47	47	48	51	48	47	48	58	
min	0	38	39	39	42	40	44	43	40	44	
mean	36	40	42	43	45	45	46	46	43	47	44
modal	40	40	41	44	44	42	46	47	42	46	44

Position C: Site perimeter, rear of properties on Manor Crescent - LAeq

Time	Night-time LAeq,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:00	38	40	43	35	36	35	48	38	47		
23:15	35	39	39	41	35	43	45	39	46		
23:30	34	40	53	52	36	36	42	49	46		
23:45	35	39	37	37	36	37	44	46	46		
00:00	34	40	42	42	37	43	47	42	46		
00:15	35	40	38	35	41	34	49	41	44		
00:30	34	38	38	35	42	41	50	42	45		
00:45	39	38	36	39	42	33	51	41	43		
01:00	33	37	36	40	42	30	49	42	44		
01:15	41	35	35	35	40	31	48	41	46		
01:30	37	37	35	37	46	34	55	41	46		
01:45	34	36	34	38	42	34	43	41	44		
02:00	34	37	35	37	41	40	53	38	41		
02:15	33	39	37	37	43	32	42	39	45		
02:30	35	40	38	37	42	34	41	40	44		
02:45	34	38	38	35	38	42	39	41	40		
03:00	36	40	38	38	41	33	36	39	38		
03:15	33	36	35	38	46	32	39	41	33		
03:30	33	36	35	36	39	33	42	41	34		
03:45	34	35	38	37	42	35	35	39	36		
04:00	35	34	38	39	47	36	44	37	47		
04:15	38	38	40	36	46	35	47	36	36		
04:30	38	38	43	36	42	35	46	38	36		
04:45	40	39	44	37	46	38	43	39	38		
05:00	41	37	41	38	48	38	42	41	35		
05:15	41	41	42	38	43	38	42	40	38		
05:30	47	44	44	40	46	40	45	42	42		
05:45	49	46	45	40	48	43	43	43	42		
06:00	49	47	46	41	44	42	45	44	45		
06:15	45	46	46	46	46	46	46	44	44		
06:30	45	46	47	42	47	45	44	44	46		
06:45	48	45	51	41	45	43	46	46	44		
8 hour LAeq	42	41	44	41	44	39	47	42	44	44	44
Max	49	47	53	52	48	46	55	49	47		
min	33	34	34	35	35	30	35	36	33		
mean	38	39	40	39	42	37	45	41	41	41	41
modal	34	40	38	37	42	35	42	41	38	38	38

Time	Daytime LAeq,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:00		47	46	48	43	45	44	50	55	47	
08:00		48	69	49	46	43	46	48	48	49	
09:00		46	52	51	48	44	52	47	46	46	
10:00		46	47	49	47	48	48	44	45	48	
11:00		47	46	49	48	56	51	42	45	49	
12:00		48	48	51	45	54	61	44	49	50	
13:00		48	48	51	46	50	48	43	48	48	
14:00		57	49	50	51	49	47	46	48	49	
15:00		48	47	51	42	49	52	49	47	46	
16:00		46	49	47	43	45	53	47	48		
17:00	46	46	50	51	40	47	52	45	47		
18:00	47	46	48	55	43	46	54	46	43		
19:00	44	46	45	41	41	45	53	42	42		
20:00	43	42	44	41	39	41	50	47	44		
21:00	39	38	41	38	36	38	47	41	43		
22:00	40	43	41	36	39	39	49	36	44		
16hour	40	48	58	50	45	49	53	46	48	46	48
Max	47	57	69	55	51	56	61	50	55	50	
min	0	38	41	36	36	38	43	36	42	46	
mean	32	46	48	47	44	46	50	45	46	48	47
modal	0	46	48	51	43	45	52	46	48	49	48

Position C: Site perimeter, rear of properties on Manor Crescent - LA90

Time	Night-time LA90,15min dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018		
23:00	32	35	37	32	34	31	42	32	42		
23:15	31	34	34	32	32	32	39	35	41		
23:30	30	35	34	31	33	32	38	43	40		
23:45	30	35	33	32	34	31	40	41	40		
00:00	30	37	35	32	35	31	43	38	41		
00:15	31	38	33	33	37	30	46	39	38		
00:30	31	36	31	33	40	29	47	40	40		
00:45	30	35	32	35	40	30	47	37	38		
01:00	29	34	33	33	39	27	44	39	39		
01:15	29	33	31	33	38	29	43	37	41		
01:30	32	35	31	34	42	30	43	39	40		
01:45	30	34	30	36	38	31	40	38	40		
02:00	31	34	32	36	37	33	38	36	35		
02:15	31	37	32	36	40	29	39	37	38		
02:30	31	35	35	35	39	28	39	38	39		
02:45	31	35	34	34	36	29	35	39	36		
03:00	32	34	33	37	37	30	32	37	34		
03:15	30	31	31	36	43	29	32	40	30		
03:30	29	31	32	35	36	30	37	39	32		
03:45	30	30	34	36	38	30	33	37	34		
04:00	30	32	35	36	43	32	40	33	35		
04:15	33	35	36	34	42	32	44	32	34		
04:30	34	35	39	34	38	33	43	34	34		
04:45	36	35	39	35	43	36	40	36	35		
05:00	37	35	38	37	45	36	40	35	33		
05:15	37	38	39	36	38	36	40	38	36		
05:30	43	40	42	38	38	39	42	40	40		
05:45	44	41	43	38	37	40	41	41	39		
06:00	41	43	43	37	33	38	43	41	41		
06:15	38	42	43	39	38	41	44	40	41		
06:30	40	41	44	38	36	40	42	41	41		
06:45	44	42	44	39	36	41	43	43	41		
8 hour LA90	36	37	38	36	39	35	42	39	39	39	
Max	44	43	44	39	45	41	47	43	42		
min	29	30	30	31	32	27	32	32	30		
mean	33	36	36	35	38	33	41	38	37	37	
modal	30	35	34	36	38	30	40	39	35	35	

Time	Daytime LA90,1hour dB										Average daily dB(A)
	04/09/2018	05/09/2018	06/09/2018	07/09/2018	08/09/2018	09/09/2018	10/09/2018	11/09/2018	12/09/2018	13/09/2018	
07:00		43	42	45	40	38	42	48	48	42	
08:00		42	52	46	40	36	41	44	44	42	
09:00		41	43	47	41	36	44	43	42	40	
10:00		40	39	46	43	38	41	41	40	41	
11:00		43	43	45	41	50	42	39	41	42	
12:00		44	44	47	40	48	40	37	44	42	
13:00		44	44	47	42	43	40	38	44	43	
14:00		45	44	45	44	43	42	41	44	43	
15:00		44	43	46	37	43	45	43	44	39	
16:00		44	45	44	37	40	47	42	45		
17:00	42	43	46	43	34	42	46	42	44		
18:00	44	40	44	38	38	41	48	40	38		
19:00	41	38	41	37	37	39	46	38	38		
20:00	39	39	41	37	34	37	45	41	40		
21:00	35	35	38	35	33	35	42	37	38		
22:00	34	36	37	34	34	33	43	33	40		
16hour	36	42	45	44	40	43	44	42	43	39	42
Max	44	45	52	47	44	50	48	48	48	43	
min	0	35	37	34	33	33	40	33	38	40	
mean	29	41	43	43	38	40	43	40	42	42	41
modal	0	44	44	45	40	43	42	41	44	42	44