

12. Noise & Vibration

Appendix 12.1

BASELINE NOISE MONITORING

APPENDIX 12.1: BASELINE NOISE SURVEY

A baseline noise survey was undertaken over a typical weekday and weekend period, from Thursday 29 November to Tuesday 4 December 2018. Three un-attended sound level meters were installed at various locations around the Site. Attended short-term measurements were conducted across the Site to discern the spatial variation in noise level. All monitoring locations are shown in Figure 12.1 (Volume 2 of the ES).

The parameters logged throughout the survey period were L_{Aeq} , L_{AFmax} , L_{A90} and L_{A10} . The L_{Aeq} level is the equivalent continuous sound pressure level over the measurement period; L_{Amax} is an indicator of the highest sound level during the measurement period; L_{A90} is used as a descriptor of background noise levels and L_{A10} is the noise level which is achieved for 10% of the monitoring period and is often used to describe road traffic noise.

The monitoring equipment used during the survey period is described in Table 12.1.1. The sound level meters were calibrated both before and after each monitoring period; no drift from the reference level of 94dB was recorded.

Weather conditions were observed as being generally ideal for the measurement of noise and are documented in www.timeanddate.com; the survey was predominantly fine and dry, with a south to south-westerly prevailing wind (<5ms⁻¹), except on the 29th November where wind speeds were approximately 5-10ms⁻¹ but are considered to not have affected measured noise levels significantly. A wind shield was fitted to the monitoring equipment at all times.

Monitoring was undertaken by trained and competent staff holding full membership to the Institute of Acoustics.

Table 12.1.1 Noise Monitoring Equipment

Monitoring Location	Manufacturer	Instrument	Type	Serial No. / Version
LT 1	Larson Davis	Sound Level Meter	LD 820	1500
LT 1	Larson Davis	Pre-Amplifier		
LT 1	Larson Davis	Microphone		
LT 1	Larson Davis	Acoustic Calibrator	CAL200	13096
LT 2	Larson Davis	Sound Level Meter	LD LxT	
LT 2	Larson Davis	Pre-Amplifier		
LT 2	Larson Davis	Microphone		
LT 2	Larson Davis	Acoustic Calibrator	CAL200	13096
LT 3	Larson Davis	Sound Level Meter	LD 820	0637
LT 3	Larson Davis	Pre-Amplifier		
LT 3	Larson Davis	Microphone		
LT 3	Larson Davis	Acoustic Calibrator	CAL200	13096
ST1 to ST6	Larson Davis	Sound Level Meter	LD LxT	

Figures 12.1.1 to 12.1.3 below present the time history plots of the long-term noise monitoring locations LT1 to LT3 respectively.

Figure 12.1.1: Measured Noise Level History Plot Fort Halstead (LT1)

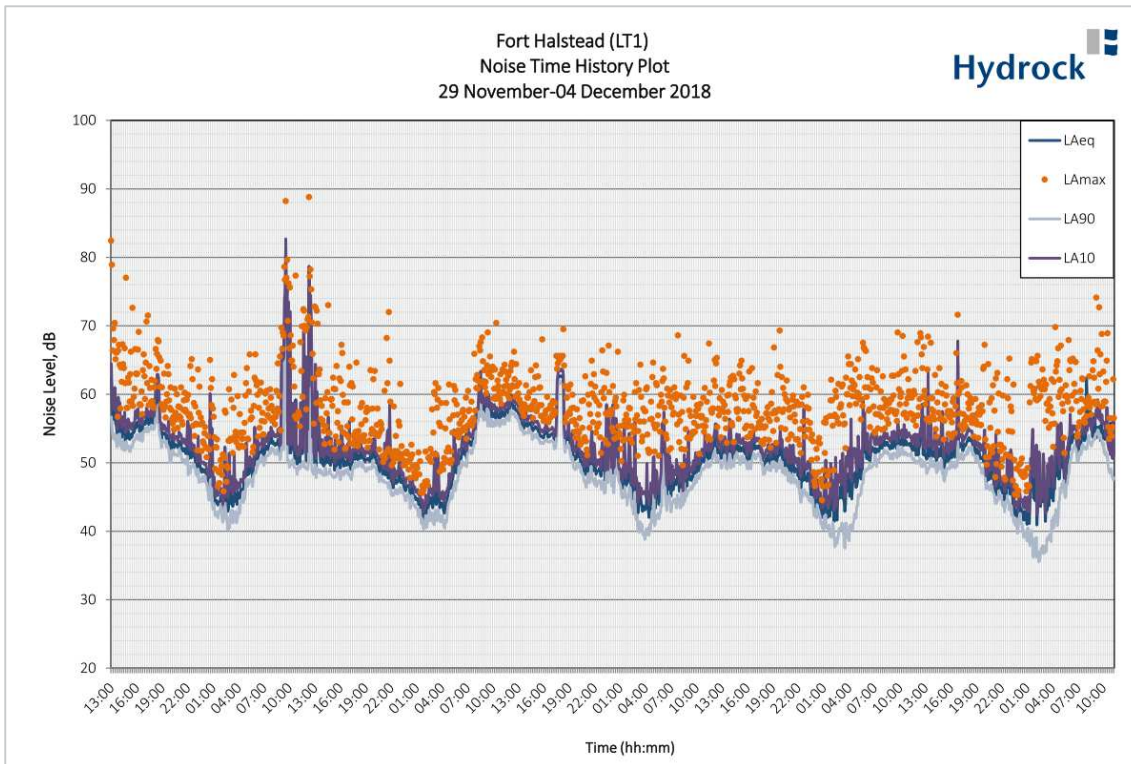


Figure 12.1.2: Measured Noise Level History Plot Fort Halstead (LT2)

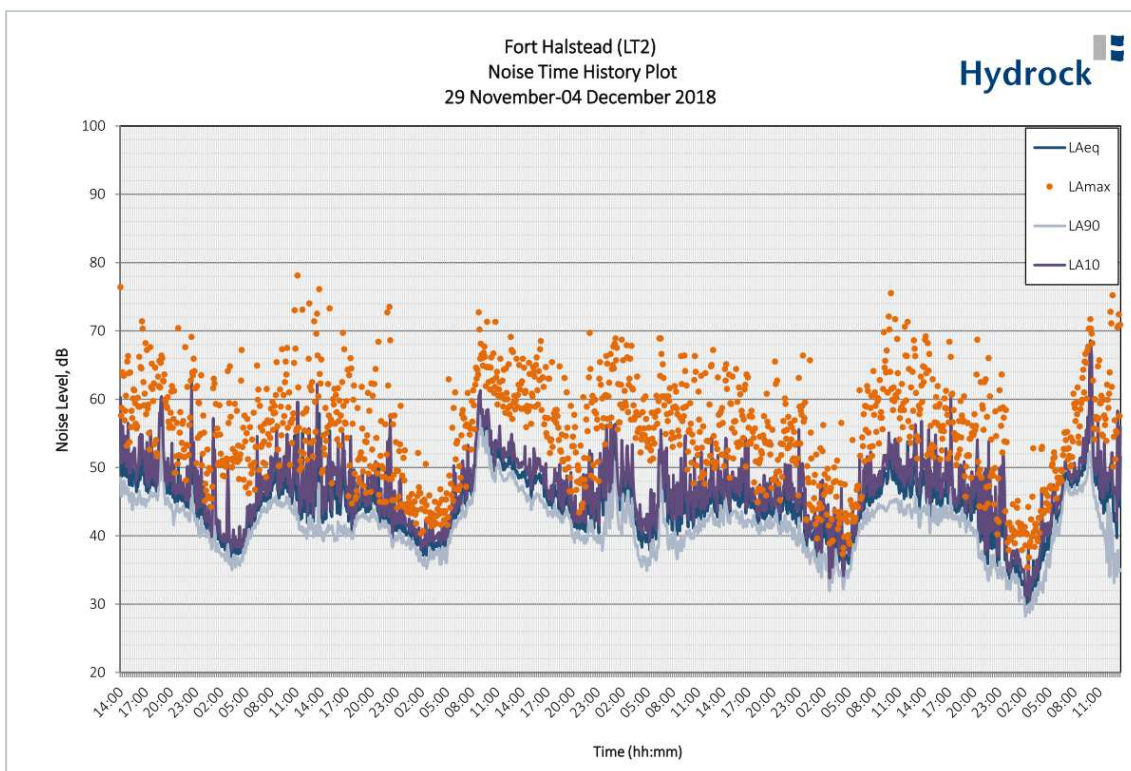
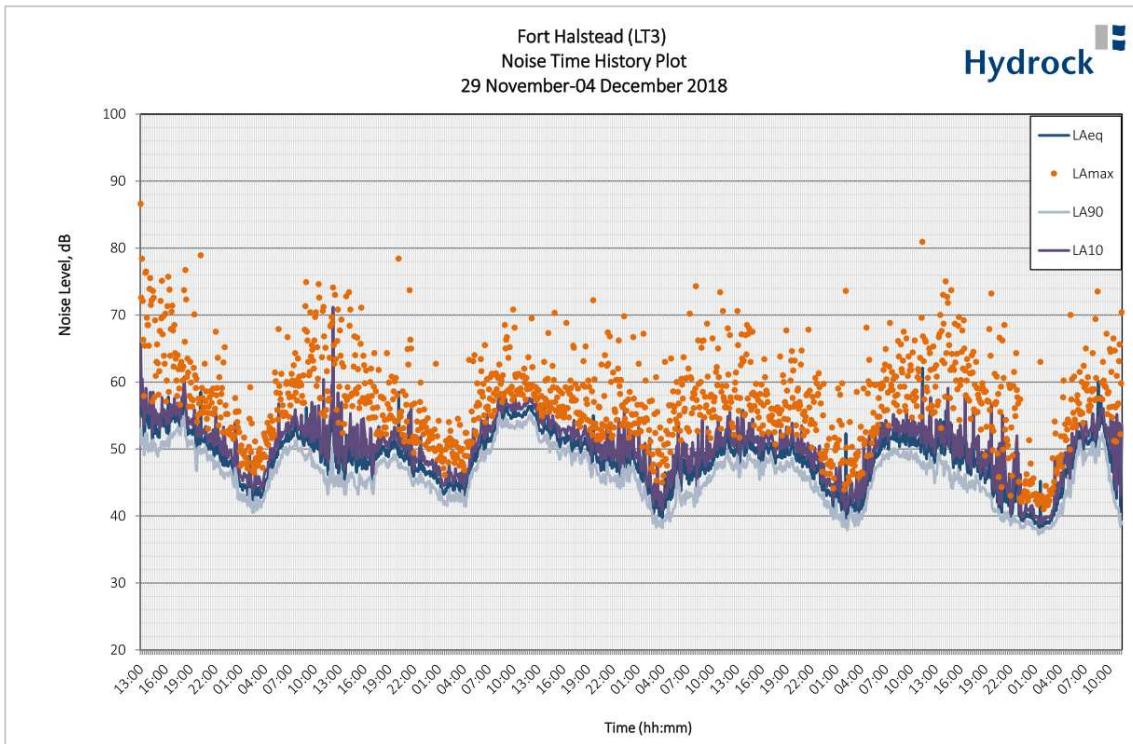


Figure 12.1.3: Measured Noise Level History Plot Fort Halstead (LT3)



Tables 12.1.2 to 12.1.7 below presents the noise data summary of the short-term noise monitoring locations ST1 to ST6 respectively. Short-term noise monitoring at ST1, ST2 and ST3 were undertaken on 29/11/19. Short-term noise monitoring at ST4, ST5 and ST6 were undertaken on 04/12/2019.

Table 12.1.2: Fort Halstead (ST1) Data Summary - Dutchmore Wood (Off Panton Way/Crow Drive)

Date / Time	LAeq, dB	LAFmax, dB	LA10, dB	LA90, dB
29/11/18 / 09:40	37	50	45	35
29/11/18 / 09:50	39	57	46	36
29/11/18 / 10:00	43	58	50	37
29/11/18 / 10:10	45	55	55	36

Table 12.1.3: Fort Halstead (ST2) Data Summary (off Crow Drive)

Date / Time	LAeq, dB	LAFmax, dB	LA10, dB	LA90, dB
29/11/18 / 10:31	45	65	47	38
29/11/18 / 10:41	50	70	53	40
29/11/18 / 10:51	47	62	49	39
29/11/18 / 11:01	48	61	54	39
29/11/18 / 11:11	45	60	49	40
29/11/18 / 11:21	44	61	52	39

Table 12.1.4: Fort Halstead (ST3) Data Summary - Off Fort Road/Armstrong Drive)

Date / Time	LAeq, dB	LAFmax, dB	LA10, dB	LA90, dB
29/11/18 / 11:38	37	40	41	34
29/11/18 / 11:48	42	60	48	35
29/11/18 / 11:58	45	67	49	33
29/11/18 / 12:08	43	61	48	35

Table 12.1.5: Fort Halstead (ST4) Data Summary

Date / Time	L _{Aeq} , dB	L _{AFmax} , dB	L _{A10} , dB	L _{A90} , dB
04/12/19 / 11:21	52	65	55	44
04/12/19 / 11:31	48	72	48	42
04/12/19 / 11:41	49	70	51	43
04/12/19 / 11:51	48	69	52	43
04/12/19 / 12:01	50	72	55	42

Table 12.1.6: Fort Halstead (ST5) Data Summary - Off Star Hill Road, to the west of Site Boundary)

Date / Time	L _{Aeq} , dB	L _{AFmax} , dB	L _{A10} , dB	L _{A90} , dB
04/12/19 / 12:17	44	56	48	34
04/12/19 / 12:27	45	59	48	36
04/12/19 / 12:37	44	59	50	35
04/12/19 / 12:47	46	58	50	38
04/12/19 / 12:57	48	65	50	39

Table 12.1.7: Fort Halstead (ST6) Data Summary - Off Polhill Road (A224) and near M25.

Date / Time	L _{Aeq} , dB	L _{AFmax} , dB	L _{A10} , dB	L _{A90} , dB
04/12/19 / 13:37	75	80	78	71
04/12/19 / 13:47	76	81	77	72
04/12/19 / 13:57	75	81	79	71

Appendix 12.2

**DEMOLITION AND CONSTRUCTION
NOISE ASSESSMENT**

APPENDIX 12.2: DEMOLITION AND CONSTRUCTION NOISE ASSESSMENT

The noise assessment criteria for the construction works are based on 'The ABC Method' as per BS5228-1:-2009 + A1 2014. Description of this method is shown below on Table 12.2.1.

Table 12.2.1: ABC Method from BS 5228

Assessment Category and Threshold Value Period (L _{Aeq})	Threshold Value, in decibels (dB)		
	Category A ^{A)}	Category B ^{B)}	Category C ^{C)}
Night-time (23.00-07.00)	45	50	55
Evenings and Weekends	55	60	65
Daytime (07.00-19.00) and Saturdays (07.00-13.00)	65	70	75

NOTE 1 A potential significant effect is indicated if the L_{Aeq, T} noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level.

NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total L_{Aeq} noise level for the period increases by more than 3 dB due to construction activity.

NOTE 3 Applied to residential receptors only.

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.

B) Category B: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.

C) Category C: threshold values to use when the ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.

D) 19.00-23.00 weekdays, 13.00-23.00 Saturdays and 07.00-23.00 Sundays

Appendix 12.3

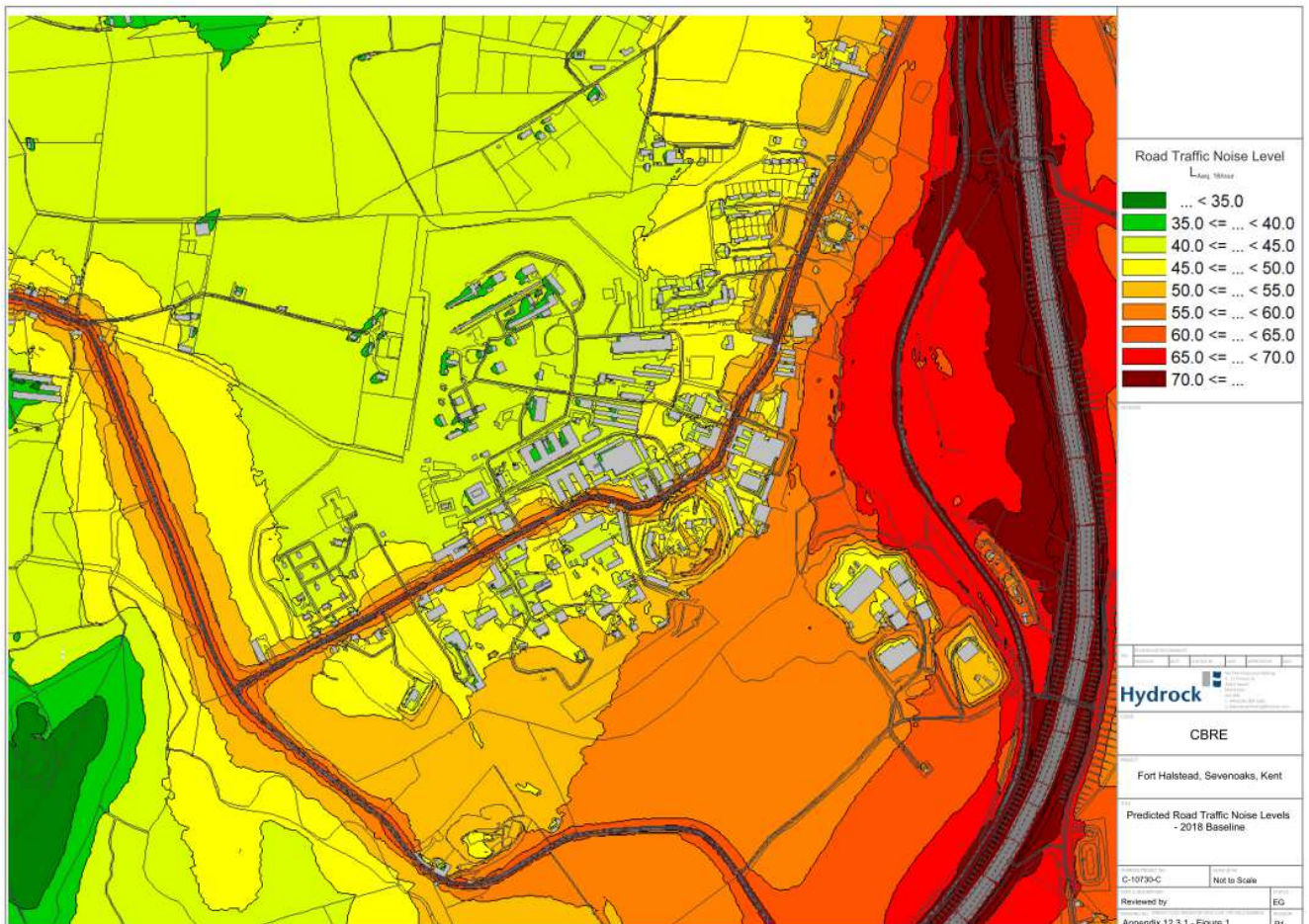
ROAD TRAFFIC NOISE ASSESSMENT CALCULATIONS

APPENDIX 12.3: ROAD TRAFFIC NOISE ASSESSMENT

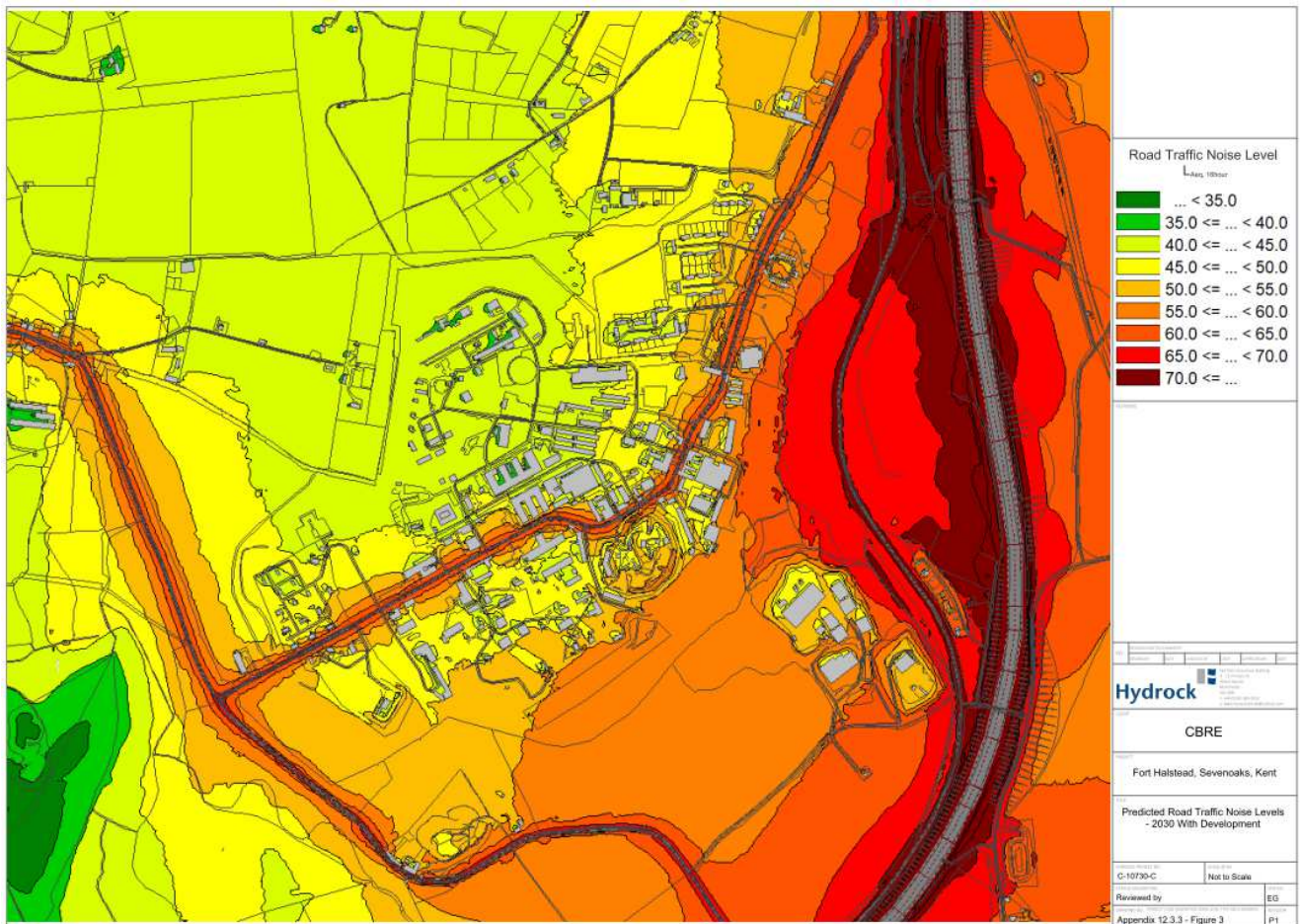
Road Link	2018 Base L10 18hr, dBA	2030 Without Development, dBA	2030 With Development, dBA	Difference 2030 Without - With Development, dBA
M25	86.4	87.0	86.9	-0.1
Crow Drive	58.7	61.8	62.6	0.8
Star Hill (S)	62.8	63.4	64.9	1.5
Polhill	68.6	69.5	69.4	-0.1
Otford Lane	54.2	55.1	56.6	1.5
A224 London Rd	65.6	66.3	66.4	0.1
Star Hill (N)	61.6	62.4	62.7	0.3
Main Rd/Halstead	60.0	60.8	60.9	0.1

Table 12.3.1: Differences in the Road Traffic Basic Noise Level (BNL), dB LA10,18hr

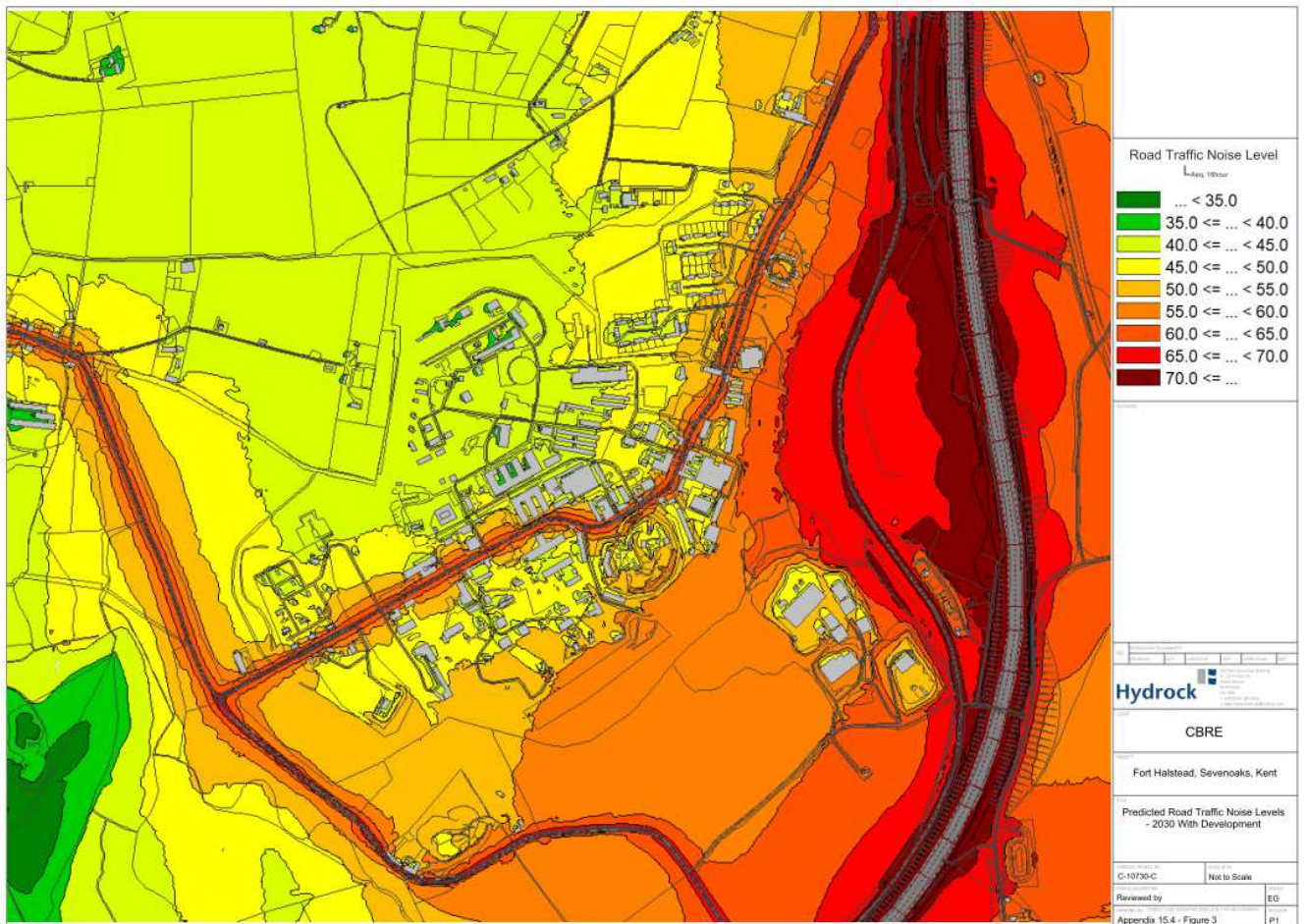
Appendix 12.3.1 - Predicted Noise Levels - 2018 Baseline



Appendix 12.3.2 - Predicted Noise Levels - 2030 Without Development



Appendix 12.3.3 - Predicted Noise Levels - 2030 With Development



Appendix 12.3.4 - Predicted Noise Levels - Without and With the Development



Appendix 12.4

TRACE MINERAL EXPLOSIVES SUMMARY

APPENDIX 12.4 TRACE MINERAL EXPLOSIVES SUMMARY

The baseline noise environment includes noise from trace mineral explosions, associated with the operations of DSTL and QinetiQ within the site boundary. DSTL are in the process of relocating their operations and are scheduled to fully vacate the site by 2021. QinetiQ are expected to continue operations in to the foreseeable future, however various elements of their operation will be relocated within the site boundary. The relocation will effectively increase the distance between existing residential receptors and noise sources associated with the operations.

Noise impacts at existing noise sensitive receptors is only expected to be reduced over time, and therefore impacts would be **negligible** as result of the proposed development.

Assessment Methodology

There are no established maximum (L_{AFmax}) health-based guideline values for individual noise events above which observed health effects start to occur or demonstrate to be dependent on the exposure level at which to assess noise associated with trace explosive research activities associated with QinetiQ's future operations.

It is understood that testing is limited to weekdays and during normal site working hours.

When assessing the noise impact of maximum instantaneous short-lived (<1 second) trace material explosive events that may occur from the QinetiQ site on the amenity of future occupants and at nearest sensitive receptors, the criteria presented in Table 5 were used. The criteria are based on adaptation of the recommended WHO maximum criterion for individual noise events in residential bedrooms at night of 45dB L_{AFmax} to avoid sleep disturbance, incorporating a +5dB daytime relaxation to account for the daytime assessment period in question. This noise criteria was previously established and agreed by SDC for the previous ES Chapter.

The category of impact increases proportionately based on the magnitude of the event and the frequency of the events to reflect the notion that the louder and/or the greater the number of events the greater the likely impact on the local population as supported by research referred to in the WHO guidelines that identifies that up to 10 to 15 occurrences per night of the limiting maximum noise level may be considered acceptable. This methodology is considered a robust approach that will provide a good indication as to the significance of potential noise impacts on the amenity and health of the most exposed population during daytime hours when trace mineral explosive activities are likely to occur. This follows consultation with SDC and use of data from the previous ES Chapter.

Figure 12.4.1 - QinetiQ Trace Material Explosive Locations



Table 12.4.1: Noise Criteria for Trace Material Detonation Activities

Noise Levels, dB LAFmax		Number of Events Per Day	Definition	Significance
Inside	Outside			
>50	<65	1-2	Level to avoid disturbance and annoyance at which the impact is not of concern.	Insignificant
51-57	66-72	3-5	Level is undesirable but of limited concern.	Minor Adverse Significance
58-64	73-79	>5	Level at which there is an increased possibility of disturbance and annoyance. The impact gives rise to some concern but is likely to be tolerable depending on scale and event numbers.	Moderate Adverse Significance
>65	>80	>5	Level at which there is an increased possibility of serious disturbance and annoyance and should be considered unacceptable.	Major Adverse Significance

The methodology used to calculate the above noise levels is shown below.

$$Lp2 = Lp1 - Rav + 10\log S - 20\log r - 14$$

Where:

Lp2 is the sound pressure level at the receiver, in dB;

Lp1 is the sound pressure level inside the plant room next to the plant room wall, in dB

Rav is the average sound reduction index for the complete plant room, in dB

S is radiating area, in m²;

r is the distance between the plant room wall and receiver, in m.

Potential Impacts

Table 12.4.2 presents predicted maximum noise levels from trace explosive detonations both externally and internally at the nearest future proposed sensitive receptor within the Development, assuming partially open windows, and the scale of impact in line with the assessment criteria presented in Table 12.4.1, at which insignificant impacts are reasonably expected.

Table 1.4.2: Predicted Maximum ($L_{A_{fmax}}$) Noise Levels at the Nearest Noise Sensitive Receptor (Crow Drive)

Receptor	Location	External Predicted Receiver Noise Level, dB $L_{A_{fmax}}$	Internal Predicted Receiver Noise Level, dB $L_{A_{fmax}}$	Approximate Distance to Receiver (m)	Net Equivalent Quantity (NEQ) of Trace Material, Kg	Significance
NSR A	X8, X9-Location (Semi-Open Firing Chamber)*	55dB**	42dB***	615	0.50	Insignificant
	X19-Location (Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	60**	47***	640	0.13****	Insignificant
NSR B	X8, X9-Location (Semi-Open Firing Chamber)*	56dB**	43dB***	550	0.50	Insignificant
	X19-Location (Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	61**	48***	560	0.13****	Insignificant
NSR C	X8, X9-Location (Semi-Open Firing Chamber)*	54dB**	41dB***	770	0.50	Insignificant
	X19-Location 2 (Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	58**	45***	715	0.13****	Insignificant

NSR D	X8, X9-Location (Semi-Open Firing Chamber)*	51dB**	38dB***	950	0.50	Insignificant
	X19-Location Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	56**	43***	1000	0.13****	Insignificant
NSR E	X8, X9-Location (Semi-Open Firing Chamber)*	62dB**	49dB***	270	0.50	Insignificant
	X19-Location Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	66**	53***	325	0.13****	Minor Adverse Significance
NSR F	X8, X9-Location (Semi-Open Firing Chamber)*	62dB**	49dB***	270	0.50	Insignificant
	X19-Location Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	66**	53***	325	0.13****	Insignificant
NSR G	X8, X9-Location (Semi-Open Firing Chamber)*	60dB**	47dB***	360	0.50	Insignificant
	X19-Location Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	64**	51***	410	0.13****	I Minor Adverse Significance
NSR H	X8, X9-Location (Semi-Open Firing Chamber)*	59dB**	46dB***	380	0.50	Insignificant
	X19-Location Semi-Open Firing Chamber)	Noise data N/A due insignificant noise emissions	-	-	-	N/A
	Downs Range (Semi Open Range)	64**	51***	380	0.13****	Insignificant

* Predicted external noise level takes into account that activities take place within a semi open firing chamber. Due to lack of available information, attenuation of a semi-open chamber has been assumed to be approximately 28dB; half the attenuation specified within the previous ES Chapter report for the fully enclosed chamber.

** Predicted external noise level at the receiver without taking any additional attenuation included into calculations (e.g., screening and barrier attenuation due to existing intervening buildings, topography, vegetation etc.)

**** Predicted internal noise levels at the receiver without taking any additional attenuation included into calculations (e.g., screening and barrier attenuation due to existing intervening buildings, topography, vegetation etc.). Internal noise levels were predicted based on the assumption that a partially open window provided 13dB attenuation as per previous ES methodology.*

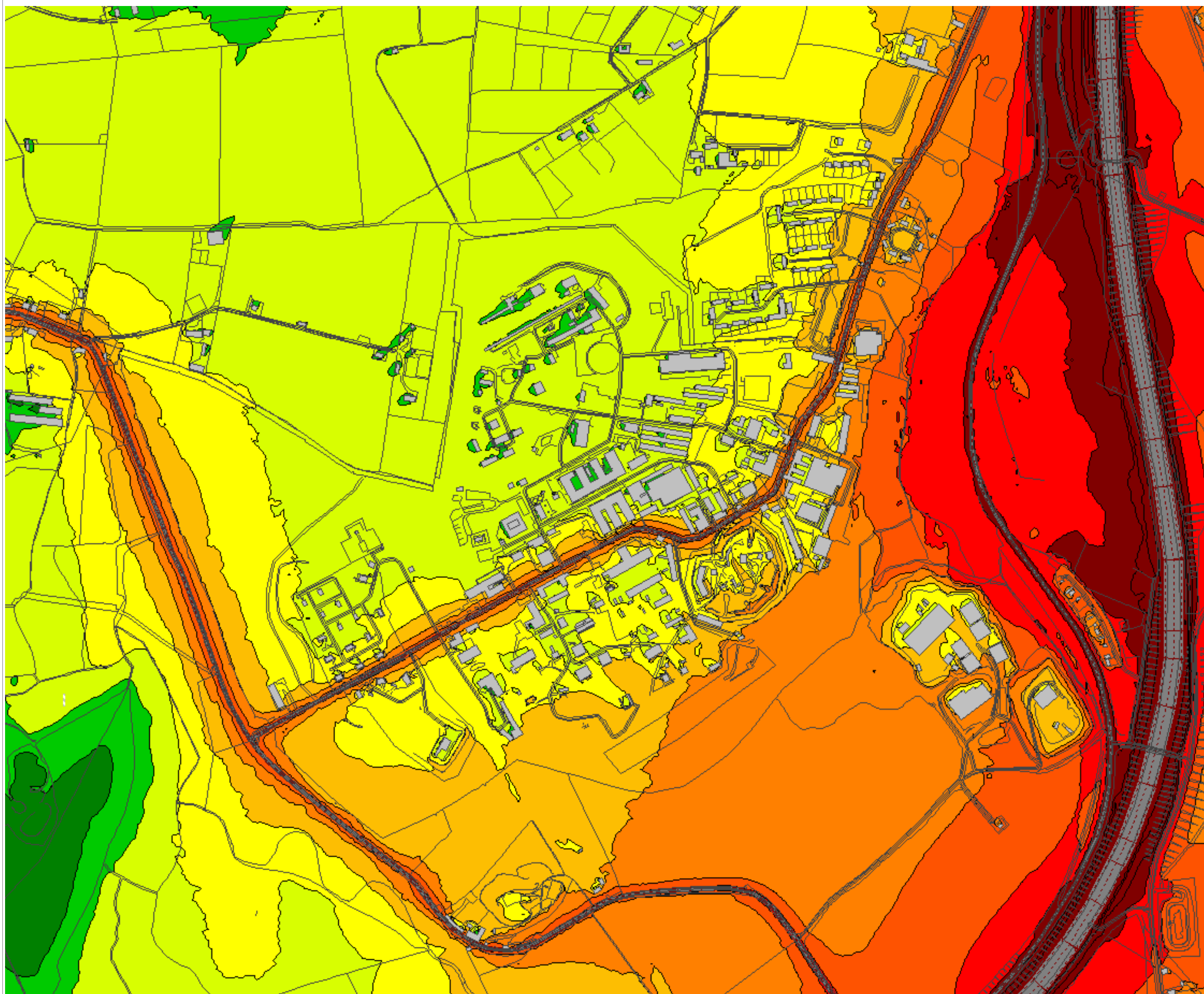
*****5dB correction has been applied for the Downs Range Location due to an increased NEQ value from previous operations.*

Based on assessment findings, trace material explosive detonations are predicted to satisfy both the external and internal noise assessment criteria, with noise during the detonation process considered to be, at worst, **minor adverse significance** at proposed sensitive receptors.

The predicted noise levels can be compared to and justified against the existing noise climate of the area, with noise monitoring results demonstrating that individual external maximum noise events (e.g. from vehicle pass by) of around 65dB L_{AFmax} are not atypical in the immediate locality. It is considered that once the Site is operational and Crow Drive is in use by public vehicles, maximum noise events (L_{Amax}) are greater in level and occur more regularly compared to a short-lived trace explosive event - supporting the conclusion that such trace mineral explosive events would not be of a magnitude, frequency or duration that would materially prejudice the existing noise climate and future residential amenity within the Proposed Development during the daytime periods in question.

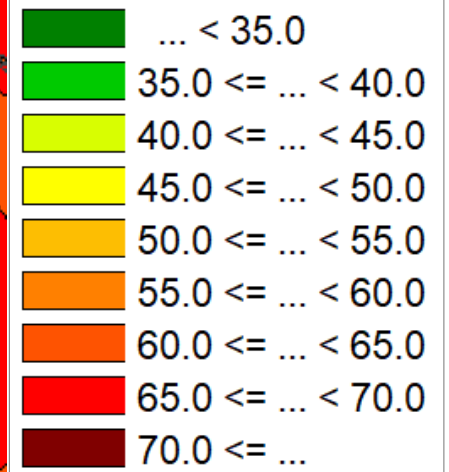
Appendix 12.3.1

PREDICTED BASELINE 2018



Road Traffic Noise Level

$L_{Aeq, 16hour}$



REVISIONS

REV	REVISION NOTES/COMMENTS	DATE	CHECKED BY	DATE	APPROVED BY	DATE

Hydrock Northern Assurance Building
 9-21 Princess St
 Albert Square
 Manchester
 M2 4DN
 t: +44 (0)161 804 5550
 e: ManchesterCentral@hydrock.com

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PROJECT
 Fort Halstead, Sevenoaks, Kent

TITLE
 Predicted Road Traffic Noise Levels
 - 2018 Baseline

HYDROCK PROJECT NO.
C-10730-C

SCALE @ A3
 Not to Scale

STATUS DESCRIPTION
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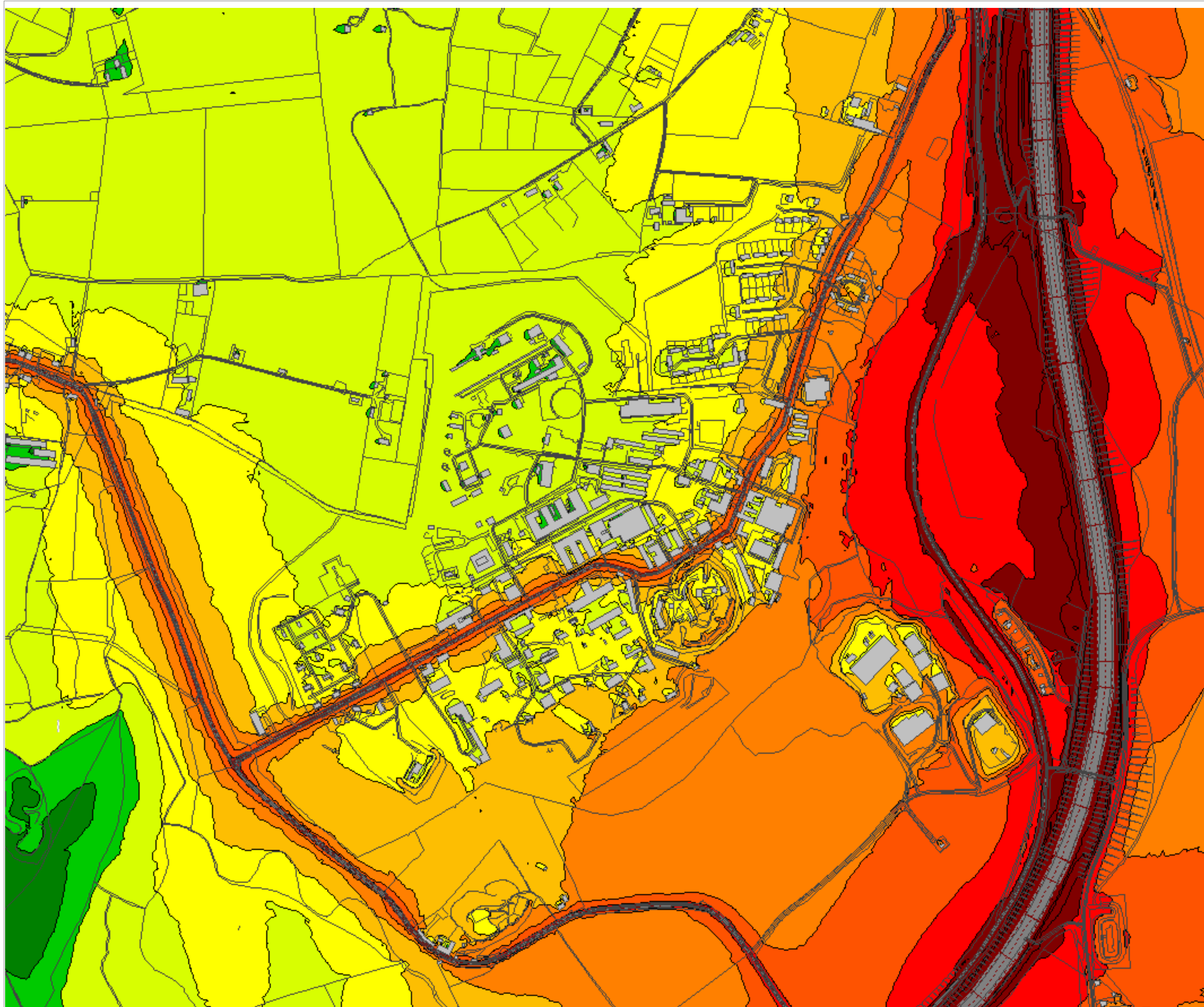
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 Appendix 12.3.1 - Figure 1

REVISION
 P1

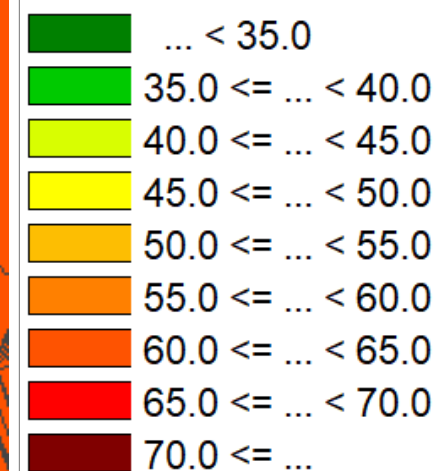
Appendix 12.3.2

2030 WITHOUT



Road Traffic Noise Level

$L_{Aeq, 16hour}$



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Hydrock Northern Assurance Building
9-21 Princess St
Albert Square
Manchester
M2 4DN
t: +44 (0)161 804 5550
e: ManchesterCentral@hydrock.com

CLIENT
CBRE

PROJECT
Fort Halstead, Sevenoaks, Kent

TITLE
Predicted Road Traffic Noise Levels
- 2030 Without Development

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SCALE @ A3
Not to Scale

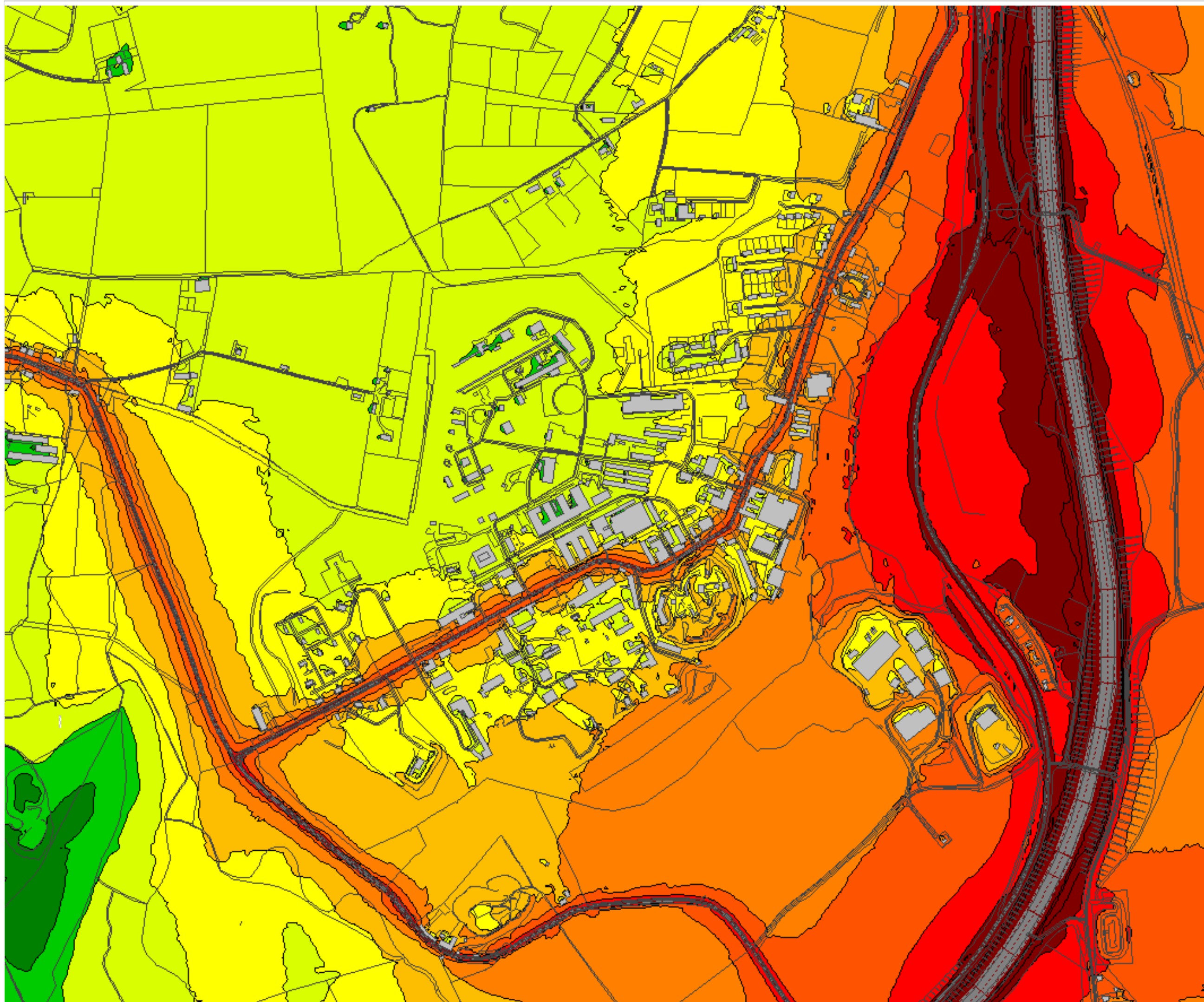
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Appendix 12.3.2 - Figure 2

REVISION
P1

Appendix 12.3.3
2030 WITH



Road Traffic Noise Level

$L_{Aeq, 16hour}$

- ... < 35.0
- 35.0 <= ... < 40.0
- 40.0 <= ... < 45.0
- 45.0 <= ... < 50.0
- 50.0 <= ... < 55.0
- 55.0 <= ... < 60.0
- 60.0 <= ... < 65.0
- 65.0 <= ... < 70.0
- 70.0 <= ...

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Hydrock Northern Assurance Building
9-21 Princess St
Albert Square
Manchester
M2 4DN
t: +44 (0)161 804 5550
e: ManchesterCentral@hydrock.com

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**Predicted Road Traffic Noise Levels
- 2030 With Development**

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Not to Scale

STATUS DESCRIPTION
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EG

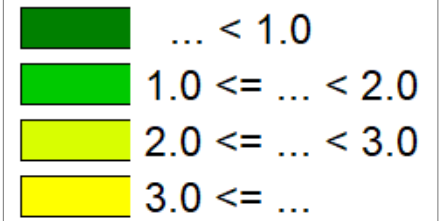
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Appendix 12.3.3 - Figure 3 REVISION
P1

Appendix 12.3.4

ROAD TRAFFIC NOISE ASSESSMENT



Change in Road Traffic Noise Level
 $L_{Aeq, 16hour}$



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Hydrock Northern Assurance Building
 9-21 Princess St
 Albert Square
 Manchester
 M2 4DN
 t: +44 (0)161 804 5550
 e: ManchesterCentral@hydrock.com

CLIENT
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Fort Halstead, Sevenoaks, Kent

TITLE
Change in Road Traffic Noise Levels - 2030 Without and With Development

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C-10730-C

SCALE @ A3
Not to Scale

STATUS DESCRIPTION Reviewed by	STATUS EG
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) Appendix 12.3.4 - Figure 4	REVISION P1