Bickerdike
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NOISE ASSESSMENT AT CLYST HONITON BYPASS SITE

Report to

Rob Martin
The Clerk,
Clyst Honiton Parish Council,
14 Station Road,
Yeoford,
Crediton EX17 5HU

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Bickerdike Allen Partners is an integrated practice of Architects, Acousticians, and Construction Technologists, celebrating over 60 years of continuous practice.

Architects: Design and project management services which cover all stages of design, from feasibility and planning through to construction on site and completion.

Acoustic Consultants: Expertise in planning and noise, the control of noise and vibration and the sound insulation and acoustic treatment of buildings.

Construction Technology Consultants: Expertise in building cladding, technical appraisals and defect investigation and provision of construction expert witness services.

Sustainability Consultants: Energy Conservation and Environmental Specialists and registered assessors for the Code for Sustainable Homes.

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1.0 MARCH 2023 REPORT UPDATE

Bickerdike Allen Partners LLP (BAP) were appointed by Clyst Honiton Parish Council to undertake a noise assessment for the Clyst Honiton Bypass Site. This was to accompany a planning application to develop houses, business units and a community facility as part of a Neighbourhood Plan Development Order, on the piece of Land labelled the Clyst Honiton Bypass Site. A noise assessment was prepared and issued in 2020 (BAP report reference A11317_01_RP001_3.0 dated 9th June 2020).

The 2020 BAP report included a review of the Bypass Site against the most recent noise contours for Exeter Airport available at the time. These contours are different from those currently used by the local planning authority East Devon District Council (EDDC). This report clarifies and publishes the currently available information regarding aircraft noise. The involvement of BAP is listed below in chronological order with the noise contours available.

1. **2000 -** BAP were commissioned by EDDC to carry out an independent noise impact appraisal of Exeter Airport with specific reference to proposed residential developments in the vicinity[1].
2. **2009 Masterplan Contours**. BAP were instructed by the airport owners, Balfour Beatty Management, to calculate noise contours. The contours were published[2] within the masterplan.. The contours were based on the 2006 actual aircraft movements factored up to allow for predicted growth by 2015 & 2030. The forecasts assumed considerable growth in the 2015 and 2030 scenarios.
3. **2015** – BAP were commissioned by EDDC to update the 2000 study[3]. This included a review of future noise contours for the airport. The report states "*Until further air noise contours are generated by Exeter Airport, a reasonable approach is to assume that current and future air noise levels are represented by the contour plots in Appendix 4*." These were the **2009 Masterplan contours**.
4. **2017 Joint Noise Study** – BAP were commissioned to carry out a noise assessment by Exeter Airport and Devon County Council (DCC) in relation to the Sky Park development[4]. This included further air noise contours based on updated information as by this time the 2015 actual aircraft movements were available. These were used as the basis for updated

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[1] EDDC Local Plan Report Proposed Residential Developments around Exeter Airport July 2001 Ref A5441/R2A
[2] A7677.R01D.MM.PH dated 15th January 2008
[3] A9894-R03-PH dated 29th April 2016
[4] A9975 R01-LBA dated 13th April 2017

2030 forecasts which assumed limited growth. These contours were significant smaller than the 2009 Masterplan. These contours were not issued to EDDC.

5. **2021 Cranbrook Application** – BAP were requested to provide additional information for the Cranbrook/Treasbeare Garden Village Planning application (Ref 22/1532/MOUT). The information provided was consistent with the **2009 Masterplan** contours[5].

This report now includes both the **2009 Masterplan** and the **2017 Joint Study** contours. As a worst-case scenario, and also to be consistent with the Cranbrook site, the much older **2009 Masterplan** contours can be used. The residential part of the Bypass Site development does not exceed 63 dB $L_{Aeq,16h}$ when tested against these contours. As will be seen within this report 63 dB $L_{Aeq,16h}$ is considered a "significant observed adverse effect level" and applications for residential development above this threshold should normally be opposed. Although the residential part of the site is not above this level, it is still exposed to both aircraft and road traffic noise and noise mitigation has already been recommended. This noise mitigation should be secured by planning condition.

The 2017 Joint Study contours provide evidence that the Masterplan contours are potentially too conservative. Based on the more recent contours the residential part does not exceed the 60 dB $L_{Aeq,16h}$ contour for aircraft noise. This does not significantly change the conclusion of the noise assessment. The noise is not enough that development should normally be refused but noise mitigation will still be required.

A scheme of noise mitigation is normally submitted at reserved matters stage and/or to discharge a pre-commencement planning stage planning condition. It is recommended that this scheme should include an assessment against the most relevant future forecasts contours subject to agreement in writing with the local planning authority.

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[5] BAP report A11404_MO001_3.0 dated 29 September 2021

2.0 INTRODUCTION

Bickerdike Allen Partners LLP (BAP) have been appointed by Clyst Honiton Parish Council to undertake a noise assessment for the Clyst Honiton Bypass Site. This is in support of a planning application to develop houses, business units and a community facility as part of a Neighbourhood Plan Development Order on the piece of Land labelled the Clyst Honiton Bypass Site.

The proposed development site is exposed to the general ambient noise from distant and local roads, the noise of aircraft operations from Exeter Airport, including both noise from airborne aircraft and noise from aircraft on the ground and also the noise from ground running of aircraft engines at the engine test facility. The Skypark and nearby delivery depots, in light of their commercial and industrial nature, will generate some noise as well, as a result of day to day activities and vehicular movements to and from the various buildings.

The purpose of this assessment is to appraise the noise conditions at the site and to provide, where necessary, recommendations on measures to mitigate noise based on current industry standards.

This report presents the results of our analysis, comments on the suggested layout and orientation of the proposed development and advises on sound insulation performance requirements for the external walls, glazing and ventilation strategy.

3.0 PLANNING POLICIES, GUIDELINES AND ACOUSTIC DESIGN CRITERIA

A key requirement of this study is to identify the noise criteria against which to judge the acceptability of the noise climate, having regard to the nature of the noise and the building use.

Consideration will be given to National and Local Planning Guidance, such as that produced by Devon District Council, as well as recognised British Standards and other noise related guidelines to suggest appropriate criteria to protect the amenity of the occupants of buildings and spaces from the surrounding noise environment.

3.1 National Planning Policy Framework (NPPF) (2019)

The National Planning Policy Framework (NPPF) published February 2019, sets out the UK Government's planning policies for England and how these are expected to be applied. It is designed to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

Government’s current planning policy concerning noise is embodied in the National Planning Policy Framework (NPPF), and more specifically the Noise Policy Statement for England (NPSE).

The aim of planning policies and decisions with respect to noise is addressed in paragraph 180 of the NPPF:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life[6];

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason;

and

c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation"

3.2 Noise Policy Statement for England (March 2010)

The Noise Policy Statement for England (NPSE) provides the framework for noise management decisions to be made that ensure noise levels do not place an unacceptable burden on society.

The stated aims of the Noise Policy Statement for England are to:

- *"Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development;*
- *Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development; and*
- *Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development."*

[6] See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010)

The NPSE introduces the concepts of NOEL (No Observed Effect Level), LOAEL (Lowest Observed Adverse Effect Level) and SOAEL (Significant Observed Adverse Effect Level). The definition of each is as follows:

- NOEL – No observed effect level. This is the level below which no effect can be detected.
- LOAEL – Lowest observed adverse effect level. This is the level above which adverse effects on health and quality of life can be detected.
- SOAEL – Significant observed adverse effect level. This is the level above which significant adverse effects on health and quality of life occur.

3.3 Planning Practice Guidance – Department of Communities and Local Government

On 6 March 2014, the Department for Communities and Local Government (DCLG) launched a web-based resource providing planning practice guidance to assist local authorities in local planning matters. Guidance on noise is provided in a separate guidance note reference ID30 which was last updated on 22nd July 2019. This guidance is available at:

https://www.gov.uk/guidance/noise--2

It provides guidance on how to determine the noise impact, advising that local planning authorities should take account of the acoustic environment and in so doing consider:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

It states that in line with the Explanatory Note of the Noise Policy Statement for England, this would include identifying whether the overall effect of the noise exposure is, or would be, above or below the "significant observed adverse effect level" and the "lowest observed adverse effect level" for a given situation. These boundary levels are described in the guidance as follows:-

- Significant observed adverse effect level: This is the level of noise exposure above which significant adverse effects on health and quality of life occur.
- Lowest observed adverse effect level: this is the level of noise exposure above which adverse effects on health and quality of life can be detected.
- No observed effect level: this is the level of noise exposure below which no effect at all on health or quality of life can be detected.

Guidance is provided on how to recognise when noise could be a concern. It explains that when noise is not noticeable, there is by definition no effect. As the noise exposure increases, it can slightly affect the acoustic character of an area but not to the extent there is a perceived change in quality of life. At this noise exposure level, no specific noise mitigation measures are required. As the exposure increases further, the lowest observed adverse effect level boundary is crossed. The noise starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).

The guidance advises that above the significant observed adverse effect level boundary, the planning process should be used to avoid this effect occurring, by use of appropriate mitigation such as by altering the design and layout. Such decisions must be made taking account of the economic and social benefit of the activity causing the noise, but it is undesirable for such exposure to be caused.

At the highest extreme, noise exposure would cause extensive and sustained changes in behaviour without an ability to mitigate the effect of noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be prevented from occurring. This is known as the Unacceptable Adverse Effect Level.

Guidance on an interpretation of these boundaries is given below, based on the likely average response.

Perception	Examples of Outcome	Increasing Effect Level	Action
Not noticeable	No effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

Table 1 - Current Planning Policy Guidance on noise

The planning guidance also specifically addresses the situation of a new residential development being located close to an existing business that gives rise to noise and states:

The potential effect of a new residential development being located close to an existing business that gives rise to noise should be carefully considered. Development proposed in the vicinity of existing businesses, community facilities or other activities may need to put suitable mitigation measures in place to avoid those activities having a significant adverse effect on residents or users of the proposed scheme.

In these circumstances the applicant (or "agent of change") will need to clearly identify the effects of existing businesses that may cause a nuisance (including noise, but also dust, odours, vibration and other sources of pollution) and the likelihood that they could have a significant adverse effect on new residents/users. In doing so, the agent of change will need to take into account not only the current activities that may cause a nuisance, but also those activities that businesses or other facilities are permitted to carry out, even if they are not occurring at the time of the application being made.

3.4 World Health Organisation (WHO)

The WHO document "Guidelines for community noise"[7] provides a range of aspirational noise targets aimed at protecting the health and wellbeing of the community. They therefore set out noise targets which represent desirable goals for minimising the adverse effects of noise on health as opposed to setting absolute noise limits for planning purposes.

Specific environment	Critical health effects	L_{Aeq} [dB(A)]	Time base (hours	L_{Amax} fast [dB]
Outdoor living areas	Serious annoyance, daytime and evening Moderate annoyance, daytime and evening	55 50	16 16	- -
Dwellings indoors	Speech intelligibility & moderate annoyance daytime and evening	35	16	-
Inside bedrooms	Sleep disturbance, night-time	30	8	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

Table 2 – WHO guidelines

[7] Guidelines for community noise, edited by Berglund, Lindvall, Schwela, World Health Organisation, 1999

The table provides both internal and external guidelines. For open windows the WHO report assumes a reduction of 15 dB between the internal level and the external level.

Night-time Noise

Research studies in the field of the effects of aircraft noise at night are on-going and a working party for the World Health Organisation produced guidelines in 2009[8] reporting the latest findings concerning night noise from transportation sources and its effects on health and sleep. These guidelines acknowledge that the effect of noise on people at night depends not just on the magnitude of noise of a single event but also the number of events. It considers that in the long term, over a year, these effects can be described using the $L_{night,outside}$ index. This is essentially equivalent to the $L_{Aeq,8h}$ index commonly used in the UK, but instead of being based on aircraft activities during the average summer night, is based on the average annual night.

These guidelines were prepared by a working group set up to provide scientific advice to the Member States for the development of future legislation and policy action in the area of assessment and control of night noise exposure. The working group reviewed available scientific evidence on the health effects of night noise, and derived health-based guideline values. Although this provides guidance to the European Community in general and has no policy status, it provides a description of recent research into the health effects of noise and provides guidance on noise targets.

The following night noise guideline values are recommended by the working group for the protection of public health from night noise:

- Night noise guideline (NNG) $L_{night,outside}$ equal to 40 dB
- Interim target (IT) $L_{night,outside}$ equal to 55 dB

The NNG is a health-based limit to aspire towards whereas the IT represents a feasibility based intermediate target. This is borne out to some extent by the recent Strategic Noise Mapping work undertaken across European Member States in compliance with the Environmental Noise Directive. For night noise, Member States have been required to produce noise maps in terms of the $L_{night,outside}$ index no lower than 50 dB for strategic planning purposes.

[8] Night Noise Guidelines for Europe, World Health Organisation, 2009

The relationship between night noise exposure and health effects can be summarised as shown in Table 3.

$L_{night,outside}$ dB[1]	Relationship between night noise exposure and health effects
< 30	No effects on sleep are observed except for a slight increase in the frequency of body movements during sleep due to night noise
30 – 40	There is no sufficient evidence that the biological effects observed at the level below 40 dB $L_{night,outside}$ are harmful to health
40 – 55	Adverse health effects are observed at the level above 40 dB $L_{night,outside}$, such as self-reported sleep disturbance, environmental insomnia, and increased use of somnifacient drugs and sedatives
> 55	Cardiovascular effects become the major public health concern, which are likely to be less dependent on the nature of the noise

Note: (1) Equivalent to $L_{Aeq,8h}$

Table 3 - WHO guidance on the relationship between night noise exposure and health effects

3.5 BS8233:2014

The British Standard BS8233:2014 "*Sound insulation and noise reduction for buildings – Code of practice*" provides guidance on the control of external noise and is a revision of its 1987 (and later 1999) predecessor that informed PPG 24. The standard presents a number of design ranges for indoor noise levels in spaces when they are unoccupied. These are generally in keeping with guidance set by the World Health Organisation (1999) and also the 1999 version of BS 8233. The design criteria for intrusive noise relevant to residential accommodation are presented in Table 4.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB $L_{Aeq, 16hour}$	-
Dining	Dining room/area	40 dB $L_{Aeq, 16hour}$	-
Sleeping (daytime)	Bedroom	35 dB $L_{Aeq, 16hour}$	30 dB $L_{Aeq, 8hour}$

Table 4 – Indoor ambient noise levels for dwellings

NOTE

Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{AFmax} , depending on the character and number of events per night. Sporadic noise events could require separate values.

The withdrawn 1999 version of BS8233 document included a guideline for noise maxima at night. "For a reasonable standard in bedrooms at night, individual noise events (measured with F time-weighting) should not normally exceed 45 dB $L_{A,max}$". This was consistent with the 1999 World

Health Organisation Publication Guidelines for Community Noise. The current 2014 document does not provide a guideline value. In our experience the 45 dB $L_{AF,max}$ criterion is still a desirable level not to be exceeded for “regular” events. The definition of regular is subjective with different professionals taking different approaches. The World Health Organisation Guidelines referred to 10-15 events per night and this is frequently taken as a test for “regular” events.

For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.

Other locations, such as balconies, roof gardens and terraces, are also important in residential buildings where normal external amenity space might be limited or not available, i.e. in flats, apartment blocks, etc. In these locations, specification of noise limits is not necessarily appropriate. Small balconies may be included for uses such as drying washing or growing pot plants, and noise limits should not be necessary for these uses. However, the general guidance on noise in amenity space is still appropriate for larger balconies, roof gardens and terraces, which might be intended to be used for relaxation. In high-noise areas, consideration should be given to protecting these areas by screening or building design to achieve the lowest practicable levels. Achieving levels of 55 dB $L_{Aeq,T}$ or less might not be possible at the outer edge of these areas, but should be achievable in some areas of the space.

3.6 Offices - British Council for Offices 2019 Guide (BCO)

The proposed development site includes retail/commercial/industrial uses. These are generally not defined as “noise sensitive” in planning terms. However there may be some uses which are sensitive to noise , the most likely being office use. Guidance is available in the BCO Guide 2019.

External noise intrusion levels should not be more than the following ratings when measured in terms of $L_{eq,T}$ – where T is the duration of the normal working day, typically 8 hours between 09:00 and 17:00.

Room	Residual external noise after attenuation by the building façade, NR $L_{Aeq,8h}$	Equivalent dB $L_{Aeq,T}$ dB (NR ≈ dB(A) – 6)
Open plan office	NR40($L_{eq,T}$)	46
Speculative offices	NR38($L_{eq,T}$)	44
Cellular offices / meeting rooms	NR35($L_{eq,T}$)	41

Table 5: Indoor ambient noise levels in spaces when they are unoccupied

In addition, to avoid speech interference, regular individual noise events - e.g. scheduled aircraft or passing trains -should not normally be more than 55 dB $L_{A01,one\ hour}$, in open plan/speculative offices or 50 dB $L_{A01,one\ hour}$ in Cellular offices/meeting rooms. Rain noise should be controlled so it does not exceed 60 dB $L_{Aeq,T}$ during heavy rainfall.

In the case of naturally ventilated buildings, it may be appropriate to accept higher external noise intrusion levels than shown above in maximum ventilation mode, provided occupants have the choice to open or close windows or ventilation openings. For example +5dB relaxation of $L_{eq,T}$ levels and/or +5 to 10 dB relaxation of $L_{Amax(fast)}$ levels depending on frequency of occurrence and character of noise.

3.7 Commercial and Industrial buildings - British Standard 4142: 2014

British Standard: 2014 “*Method for rating and assessing industrial and commercial sound*” (BS4142: 2014) describes methods for rating sound of an industrial and/or commercial nature to assess its likely effects on people who might be inside or outside a dwelling or premises used for residential purposes upon which the sound is incident.

The standard specifies that an initial estimate of the impact of the specific sound can be obtained by subtracting the measured background sound level from the rating level and then considering the following:

- Typically, the greater this difference, the greater the magnitude of the impact;

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context;
- The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact.
- Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The rating level is defined in BS 4142: 2014 as the sound level of the source plus any penalties for the characteristic features of the sound, such as tonality and impulsivity among others.

This standard is usually used to set maximum permissible noise breakout from an industrial or commercial building usually as the result of mechanical plant noise.

3.8 UK Aviation Policy Framework (March 2013)

The Aviation Policy Framework (APF) was published in March 2013 by the Department for Transport (DfT). The APF defines the Government's objectives and policies on the impacts of aviation in the UK.

On managing aviation's environmental impacts, and specifically noise, it states in paragraph 3.12 that the Government's overall objective on noise is to *"Limit and where possible reduce the number of people in the UK significantly affected by aircraft noise".*

It goes on in 3.13 to state that *"This is consistent with the Government's Noise Policy, as set out in the Noise Policy Statement for England (NPSE) which aims to avoid significant adverse impact on health and quality of life."*

Guidance is provided on the noise metric used to rate airborne noise in paragraph 3.13 where it states *"To provide historic continuity, the Government will continue to ensure that noise exposure maps are produced for the noise-designated airports on an annual basis providing results down to a level of 57 dB LAeq,16hour."*

The noise index is described in a footnote as *"the A-weighted average sound level over the 16 hour period of 07.00-23.00. This is based on an average summer day when producing noise contour maps at the designated airports."*

In paragraph 3.17 the interpretation of the contour is given as *"We will continue to treat the 57 dB LAeq,16hour contour as an average level of day time aircraft noise marking the approximate onset of significant community annoyance. However, this does not mean that all people within this contour will experience significant adverse effects from aircraft noise. Nor does it mean that no-one outside of this contour will consider themselves annoyed by aircraft noise."*

Under the heading "*Noise insulation and compensation"* the APF states that:

"The Government continues to expect airport operators to offer households exposed to levels of noise of 69 dB LAeq,16h or more, assistance with the cost of moving.

The Government also expects airport operators to offer acoustic insulation to noise sensitive buildings, such as schools and hospitals, exposed to levels of noise of 63 dB LAeq,16h or more. Where acoustic insulation cannot provide an appropriate or cost-effective solution, alternative mitigation measures should be offered."

With regard to airport development it continues:

"Where airport operators are considering developments which result in an increase in noise, they should review their compensation schemes to ensure that they offer appropriate compensation to those potentially affected. As a minimum, the Government would expect airport operators to offer

financial assistance towards acoustic insulation to residential properties which experience an increase in noise of 3dB or more which leaves them exposed to levels of noise of 63 dB LAeq,16h or more."

3.9 Local Authority Guidance - New East Devon Local Plan

The Local policies are contained in the New East Devon Local Plan which was adopted on the 28th January 2016. This includes a specific strategy, N°.17, relating to development at or near Exeter International Airport which is repeated below.

"Strategy 17 - Future Development at or near of Exeter International Airport:

The Local Plan recognises the importance of airport expansion and encourages supporting infrastructure to provide for its direct airport related growth.

It is recognised that many operational uses do not require planning permission and these developments, where compatible with safe and efficient airport operation and where they do not have adverse impacts on land within operational boundaries, will be supported. The Habitats Regulations require the Appropriate Assessment of any project where the likelihood of significant effects on European wildlife sites cannot be ruled out.

Developments that are near to or could be affected by noise from the airport will not be allowed unless evidence is provided that current or futures users or occupiers of new dwellings, schools, open spaces or other sensitive uses will not be significantly adversely affected, taking proposed mitigations into account, by airport related noise."

The Inspector's Report on the New Local Plan reinforces the above, clarifying (in paragraph 64 of the report) that Exeter Airport is a major employer while making clear that new development that would compromise air safety or prejudice future expansion will not be permitted.

Strategy 17 is therefore consistent with the NPSE, and the concept of SOAEL, as it seeks that new noise sensitive development will not be significantly adversely affected by noise. Although the NPSE introduces the concepts of LOAEL and SOAEL it does not assign any numerical values to them.

During consultation with Janet Wallace, an Environmental Health Officer with East Devon District Council (EDDC), BAP were advised that reference should be made to a previous BAP commissioning by EDDC. During that work, BAP carried out an independent noise impact assessment of Exeter International Airport with specific reference to proposed developments in the vicinity. "*EDDC Development Management and Environmental Health Joint Airport Noise Study*" 2016 Consideration was given to the Local, National and EU guidance for planning and aviation noise and guidance was provided on noise bands that can be adopted for the assessment of the planning suitability of a site by EDDC. This guidance has been adopted in this report.

3.10 2016 EDDC Development Management and Environmental Health Joint Airport Noise Study

This assessment carried out by Bickerdike Allen Partners considered the above criteria and presented a number of noise exposure bands to aid in the assessment of development around the airport. These are summarised below.

The situation with regard to residential development is summarised in Table 5 for the daytime period and Table 6 for the night-time period.

Noise Bands for Evaluation	Air Noise dB $L_{Aeq,16h}$	Ground Noise dB $L_{Aeq,16h}$	Road Traffic Noise dB $L_{Aeq,16h}$	Industrial Noise (Rating Level)
A – noise not a consideration	< 54	< 50	< 55	< background
LOAEL				
B – mitigation important[1]	54 - < 60	50 - < 55	55 - < 60	0 - 5 dB above background
C– opposition and mitigation	60 - < 63	55 - < 60	60 - < 63	6 - 9 dB above background
SOAEL				
D – opposition	63 and greater	60 and greater	63 and greater	≥ 10 dB above background

Note: [1] Mitigation required to ensure noise level on external amenity areas is no greater than 55 dB $L_{Aeq,16h}$.

Table 5 – Residential Recommended Noise Bands – Daytime

The local authority is likely to take account of various factors in determining a planning application for residential development on noise grounds, such as its size, location and whether it is a new development site or an application for an infill development. A slight relaxation in the above criteria might apply, for example, for infill developments where existing housing already exists.

Noise Bands for Evaluation	Air Noise dB $L_{Aeq,8h}$ (dB L_{Amax})	Ground Noise dB $L_{Aeq,8h}$	Road Traffic Noise dB $L_{Aeq,8h}$	Industrial Noise (Rating Level)
A – noise not a consideration	< 40 (< 60) (1)	N/A	<40	< background
LOAEL				
B – mitigation important	40 - < 50 (60 – 70) (1)	N/A	40 - < 50	0 -5 dB above background
C – opposition and mitigation	50 - < 55 (70 - 80) (1)	N/A	50 - < 55	6 - 9 dB above background
SOAEL				
D – opposition	55 and greater (>80) (1)	55 and greater	55 and greater	≥ 10 dB above background

Note: (1) Actual limit may vary according to how often noise events occur during the night.

Table 6 – Residential Recommended Noise Bands – Night-time

Other land uses were also considered and are summarised below. The response categories for daytime noise by development type are given in Table 7.

Type of Development	Environmental Noise, dB $L_{Aeq,T}$						
	≤50	53	55	58	60	63	65
Residential[1] – new	A	A	B	B	C	D	D
Residential[1] – infill	A	A	B	B	B	C	D
Hotels	A	A	A	A	A	B	B
Educational[1] / Community	A	B	B	C	C	D	D
Medical[1]	A	B	B	C	C	D	D
Offices	A	A	A	A	B	B	B
Commercial / Retail	A	A	A	A	A	A	A
Entertainment	A	A	A	A	A	B	B
Industrial	A	A	A	A	A	A	A
Sport/Recreational/Amenity	A	A	B	C	C	C	D

Note: [1] Ground running noise > 50 dB $L_{Aeq,1h}$ equates to Noise Band C

Table 7 - Recommended Response Categories – Daytime

The response categories for night-time noise by development type are given in Table 8.

Type of development	Noise Bands, dB $L_{Aeq,8h}$ (dB L_{Amax})			
	<40 (<60)	40 - < 50 (60 - 70)	50- < 55 (70 – 80)	> 55 (>80)
Residential – new	A	B	C	D
Residential – infill	A	B	C	D
Hotels	A	A	B	B
Educational / Community	A	B	C	D
Medical	A	B	C	D
Offices	A	A	B	B
Commercial / Retail	A	A	A	A
Entertainment	A	A	A	B
Industrial	A	A	A	A

Table 8 - Recommended Noise Bands – Night-time

A) Green — Noise shouldn't be a consideration for development suitability.

B) Yellow — Ensure adequate noise mitigation is provided for in the design and planning as well as in the implementation of any developments

C) Orange — normally oppose but, if minded to permit the development, noise mitigation measures should be provided for in the design and demonstrated by post testing as having achieved their aim.

D) Red — normally oppose any development of a noise sensitive nature.

4.0 THE SITE

The proposed development site is located to the west of Exeter Airport and is to contain houses, business units, a community facility and open spaces. It is understood that the proposed Business Use Classes are A1, B1, D1 and D2.

To the east, the site is bounded by Clyst Honiton Bypass. Exeter Airport is located approximately 200m to the east. Clyst Honiton village is located to the west of the site with green land areas in between. A site plan can be found in Figure 1.

Figure 1 - Proposed development site plan (highlighted in red)

Figure 2 below, shows an indicative development masterplan. The residential part of the development is proposed to be located to the northern part of the site whilst the commercial units (cyan) to the southern part of it.

The 63 dB contour line shown in the drawing is from the **2009 Masterplan** noise contours.

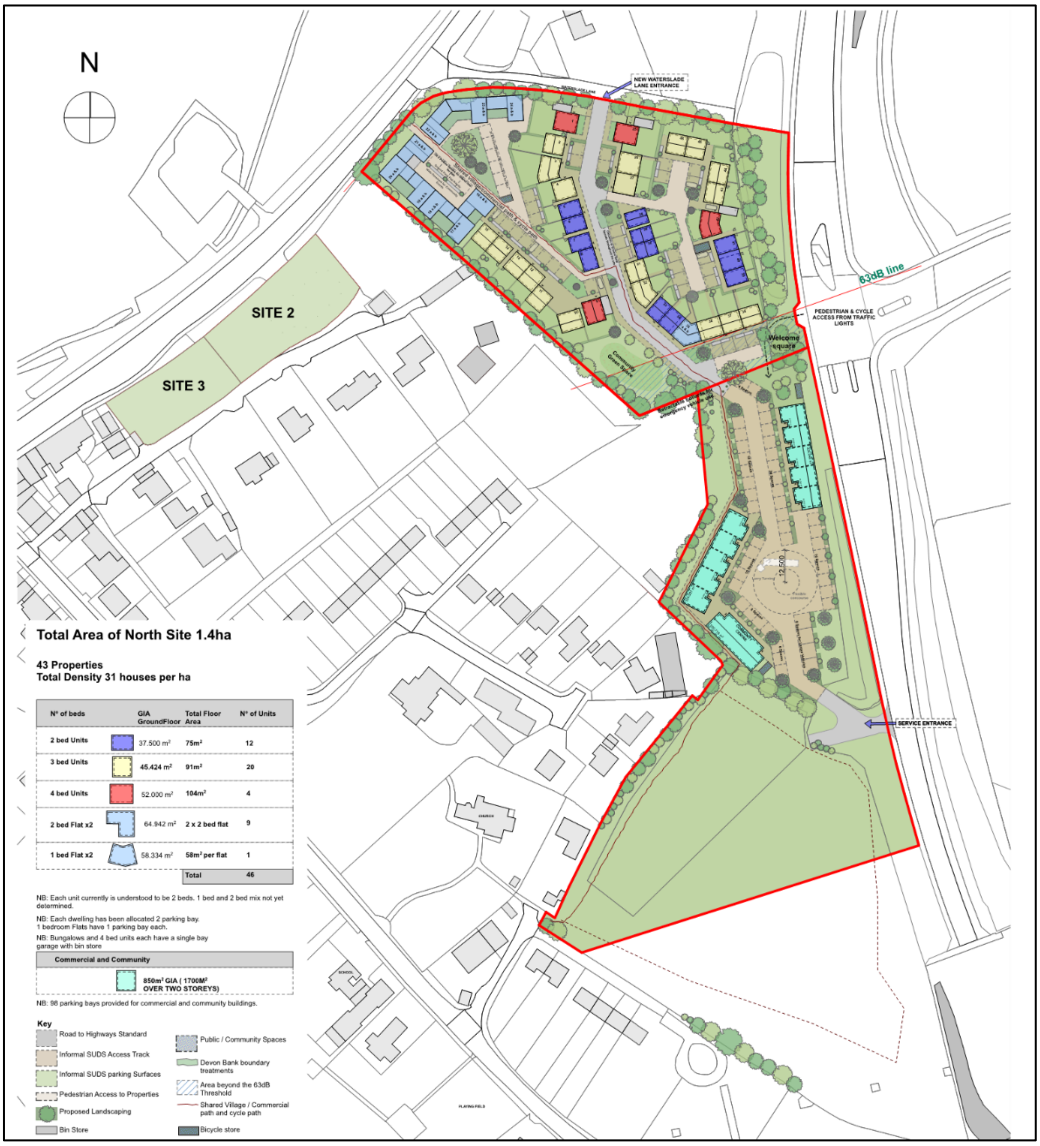

Figure 2 – Indicative development masterplan

It is understood that the non-residential units site are to be split into commercial units for small and medium sized businesses, including retail.

5.0 NOISE SOURCES

The noise environment around the proposed development site is exposed to a combination of the following:

- General ambient noise from distant and local roads and in particular the Clyst Honiton Bypass which runs along the eastern site boundary;
- Noise of aircraft operations at Exeter Airport, including both noise from airborne aircraft and noise from aircraft on the ground;
- Noise from ground running of aircraft engines at the engine test facility;
- Noise from the Skypark located to the east of the development site. The Skypark is to contain areas of office including ancillary use with B1a planning, industrial units with B1c/B2 planning use, a hotel and pub and to the east, recreation areas and a café in the centre of the complex;
- Use of any freight/deliveries from the operation of DPD and Lidl delivery depot.

6.0 NOISE MONITORING

A series of noise monitoring exercises has been undertaken, comprising both attended and unattended noise monitoring at various locations around the proposed development site.

6.1 Long Term Noise Monitoring

An unattended environmental noise survey has been undertaken by BAP over a period of 15 no consecutive days, between 28th January 2020 and 11th February 2020. This was to establish by means of detailed daytime and night-time noise measurements, the existing environmental levels at suitable locations around the development site so as to inform the specification and design.

Figure 3 - Location of Unattended and Attended Noise Monitoring Positions

<u>Measurement Positions</u>

Figure 3, shows the location of the two long term noise monitors used, MP1 and MP2. Both unattended monitors were placed on a pole at height of approximately 2.5m from local ground. The development site is benefited by the local topography which involved an earth bund along the Clyst Honiton Bypass. The height however varies from 0m to approximately 3m, as one moves from south towards the northern site boundary. MP1 had a direct line of sight to Clyst Honiton Bypass.

<u>Measurement Equipment</u>

A 01dB Duo Smart monitor was used at position MP1 and a Norsonic 140 sound level meter was used at position MP2. Both sound level meters were checked for calibration before and after measurement, and no significant drift was observed. The microphones were fitted with protective windshields for the measurements.

<u>Noise Survey Methodology</u>

Noise monitoring was undertaken over sequential 1-sec intervals at each measurement position for the duration of the survey. In total, data was recorded for a period of two consecutive weeks.

Weather Conditions

Weather conditions were dry with light wind during the vast majority of the monitoring period. However, following close monitoring of weather conditions during the duration of the survey, the last two days of the survey have been adversely affected by a storm and have been excluded from our analysis.

A full-time history in terms of L_{Aeq}, L_{Amax} and L_{A90} noise levels for both sound level meters is presented in Appendix 2 and summarised in Table 9 below. The long term weather information, is also presented in the Appendix 3 for the period of the survey. Raw data can be made available on request.

Location	**$L_{Aeq,T}$ (dB)**		**L_{A90} (dB) Avg$^{(1)}$**	
	16h (Day)	**8h (Night)**	**16h (Day)**	**8h (Night)**
MP1	59	55	53	45
MP2	57	53	52	44

Table 9 - Summary of unattended noise level measurements, free-field

Note (1) – Determined from the arithmetic average of all daytime and night time $L_{A90,15min}$ values.

6.2 Attended Noise Monitoring

Attended noise measurements of were undertaken simultaneously with the unattended noise survey. These were taken at several positions to establish the spatial variation of noise around the site.

Figure 3 shows the location of the attended noise measurements around the site. Positions MP1 and MP2 show the location of the long-term noise monitors.

Measurement Equipment

The noise survey was carried out in accordance with BS 7445[9] using a 140 Norsonic Sound Level Meter. The sound level meter was checked for calibration before and after measurement, using a Norsonic Type 1251 calibrator, and, no significant drift was observed.

Noise Survey Methodology

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[9] BS 7445:Part 1:2003 Description and measurement of environmental noise – Part 1: Guide to quantities and procedures

A 15-minute sample was taken at each of the S1-S3 positions. Three 15-minute measurements and traffic counts were made at position S4. All measured data was considered to be representative of the ambient noise level during the daytime.

Measurement Positions

The attended noise measurements were undertaken at positions S1 to S4 on the 28th and 29th January 2020. All attended measurements were taken at height of 1.5m from local ground. Position S4 was located on the road side at approximately 3m from Clyst Honiton Bypass.

The dominant source of ambient noise observed on the eastern side of the site, at position S4, when there was no aircraft activity occurring, was road traffic noise from the Clyst Honiton Bypass. The level of noise from Clyst Honiton bypass was found to be lower at positions S1 to S3. At position S2, road traffic noise from York Terrace is the dominant source. At positions S1 & S3 distant road traffic noise from the A30 and M5 is clearly audible. No ground noise from the airport was audible during the attended noise survey. No industrial sound from any of the surrounding operators was audible during the attended survey. Table 10 shows a summary of the free-field noise levels.

Location	$L_{Aeq,15min}$ (dB)	Comments
S1	56	Distant M5/A30 traffic 54-56dB. Traffic on bypass far less audible. Cars on York terrace approx. 58dB.
S2	57	Distant M5/A30 traffic 50-52dB. Traffic on bypass almost inaudible. Cars/lorries on York terrace 58-62dB.
S3	53	Distant M5/A30 traffic 50-53dB. Traffic on bypass almost inaudible. Cars/lorries on York terrace 52-55dB.
S4 (1)	69	Traffic on bypass dominant 65-70dB. Lorries 80-87dB.
S4 (2)	68	Traffic on bypass dominant 65-70dB. Lorries 80-87dB.
S4 (3)	68	Traffic on bypass dominant 65-70dB. Lorries 80-87dB.

Table 10 - Summary of attended noise level measurements

6.3 Air Noise - Aircraft Departure/Arrival Events

A flight log for the measurement period has yet to be received from the airport identifying when, during the survey period, aircraft departed and arrived at the airport. It has not therefore been possible yet to correlate fully peak noise events with the flight log to separate out noise produced by aircraft air noise from road traffic events. Airborne aircraft noise events however, have been identified with a reasonable level of accuracy in the early morning hours, based on the level and spectrum content.

Road traffic noise from the A30 and M5 was audible at locations further away from the main roads in the immediate vicinity of the development site. Aircraft ground noise from Exeter Airport was not audible. Delivery noise from the nearby DPD depot was not audible.

Long term measurements of road traffic noise have been used to validate the road traffic noise prediction model.

7.0 NOISE PREDICTIONS

7.1 Air Noise – 2009 Masterplan Daytime $L_{Aeq,16h}$

The term air noise refers to noise from aircraft that are airborne or on an airport runway during take-off or landing. The total air noise to which local communities are exposed over a given period depends on the noise emitted by individual aircraft and the total number of aircraft movements (arrivals and departures) in that period. An overall measure of air noise exposure can be depicted by noise contours.

As discussed in Section 1.0 there are two sets of contours which have been produced. The contours which EDDC currently use are those from the 2009 Masterplan.

The numbers of aircraft movements (commercial and private propeller and jet aircraft – include of military aircraft and helicopters) into and out of the airport and used for the production of the noise contours, are presented in Table 12 below.

Year	Annual Aircraft Movements
2030 (Predicted)	79,000

Table 11 - Number of Annual Aircraft Movements

The contours can be seen in Appendix 4.

7.2 Air Noise – 2017 Joint Study Contours Daytime $L_{Aeq,16}$

The numbers of aircraft movements (commercial and private propeller and jet aircraft – include of military aircraft and helicopters) into and out of the airport and used for the production of the noise contours, are presented in Table 12 below.

Year	Annual Aircraft Movements
2015 (actual)	34,864
2030 (Predicted)	38,990

Table 12 - Number of Annual Aircraft Movements

Predictions were undertaken using the Integrated Noise Model (INM). Current and future noise contours have been generated in terms of:

- Daytime $L_{Aeq,16h}$ average summer day (as is convention in the UK);
- Night-time $L_{Aeq,8h}$ average summer night;

Predictions were also undertaken using INM to determine typical maximum noise levels likely to arise at key receptors at the development site as a result of departure by the noisiest aircraft in use at Exeter (Boeing 737-800 - departure Runway 26).

Air noise contours have been produced for the following scenarios:

- 2015: Existing Scenario
- 2030: Future Scenario

These contours provide an estimate of current daytime and night time air noise levels around Exeter Airport for 2015 as well as predicted future air noise levels for 2030.

To allow for the worst-case situation, any local screening effects from airborne aircraft noise have been ignored in this analysis. This is common for all aircraft noise prediction models.

Large scale noise contours can be found in Appendix 4. Figure 4 shows the variation in aircraft noise based on “current” conditions. The 57, 60 and 63 dB $L_{Aeq,16h}$ contours all cross the development site. These contours are referred to as “current” as they are most representative of recent activity prior to the main operator at Exeter, Flybe, going into administration.

Current activity at the airport is less than 2015 and future activity is uncertain. This assessment is based on a worst case scenario 38,990 flights.

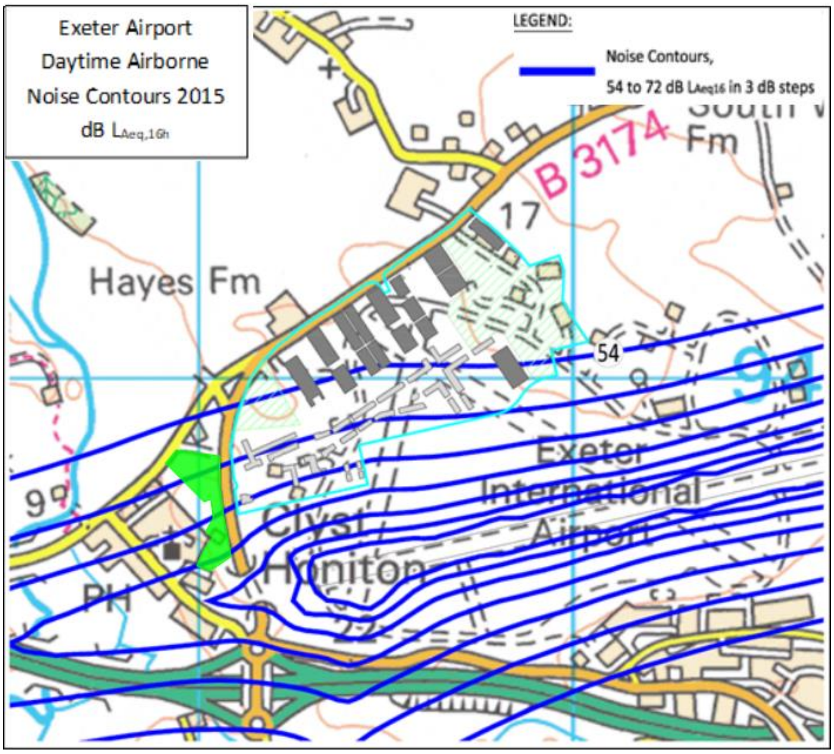

Figure 4 - 2015 Daytime Noise Contours

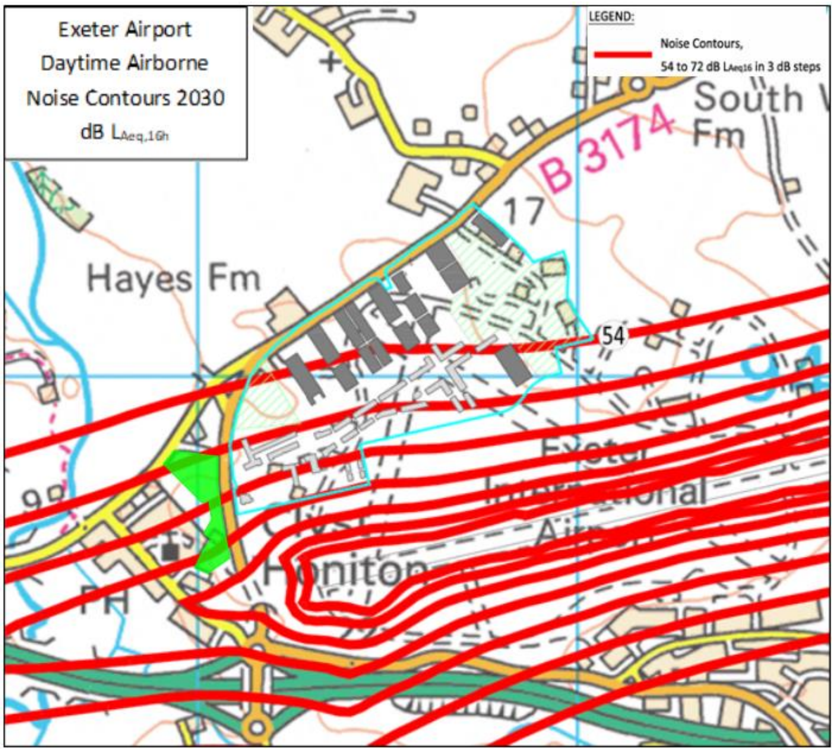

Figure 5 - 2030 Daytime Noise Contours

Figure 5 above shows the exposure of the site based on a worst case future development scenario. The illustrative masterplan appears to have been drawn up using the 60 dB $L_{Aeq,16h}$ daytime noise contour as a constraint.

This places the residential element in aircraft noise exposure category B.

The commercial/retail element is within aircraft noise exposure category A.

7.3 Air noise – Night time $L_{Aeq,8h}$

Contours for both the 2015 and 2030 scenarios are presented in Appendix 4. It can be seen that for the 2015 scenario the site is exposed to noise levels of between 48 and 54 dB $L_{Aeq,8h}$. For the 2030 scenario the site is exposed to night noise levels of between 51 and 57 dB $L_{Aeq,8h}$. The residential element of the site is exposed to levels of less than 54 dB $L_{Aeq,8h}$.

This places the residential element in aircraft night noise exposure category C.

Night noise does not influence the commercial/retail uses and therefore the night time noise exposure category is A.

7.4 Air Noise – Night-time noise maxima

In the assessment of environmental noise it is common to assess noise from individual noise events using the noise "max" metric. This is a noise parameter which would correspond to an isolated loud event such as a passing truck or aircraft. Based on WHO internal noise guidelines it is desirable that noise levels inside bedrooms do not regularly exceed 45 dB $L_{AF,max}$. There is no universally accepted method to define what "normally" is. Recent guidance[10] advocates that there should be no more than 10 events per night. "*In most circumstances in noise sensitive rooms at night (e.g. bedrooms) good acoustic design can be used so that individual noise events do not normally exceed 45dB $L_{Amax,F}$ more than 10 times a night. However, where it is not reasonably practicable to achieve this guideline then the judgement of acceptability will depend not only on the maximum noise levels but also on factors such as the source, number, distribution, predictability and regularity of noise events (see Appendix A).*"

This assessment is relatively straightforward to development sites exposed to road traffic noise as there will usually be at least 10 events that create high noise maxima, i.e. at least 10 HGVs during the period 23:00-07:00. As will be seen later this analysis has been done for this site for road traffic noise (Appendix 2).

This assessment is less straightforward with regards to this site regarding aircraft noise events. A review of movement data (before the collapse of Flybe) demonstrates that there are a small number of flights (2-3) between 05:30 and 07:00 when people would normally sleep. 2030 forecasts indicate that this could increase to up to 6 during this sensitive night time period.

Depending on the wind direction, the site will be affected by either arrivals or departures. As the site is to the west of the airport, it will be affected by departures more often. The most common, and loudest, operation was predicted to be a departure by the Boeing 737-800. This was forecast to occur about once per night. Appendix 4 includes typical representative L_{Amax} zones within the proposed development site at which the typical maximum air noise levels have been determined. The maximum noise levels, in terms of L_{ASmax}, are predicted to be in the order of 80-85 dB L_{ASmax}.

This predicted noise level was found to be significantly higher than the "typical" measured L_{Amax} level of 70 dB $L_{AF,max}$ created by road traffic.

This places the residential element in aircraft night noise exposure category D. Although the categorisation process for night time maxima has the following note

"Actual limit may vary according to how often noise events occur during the night."

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[10] Professional Practice Guidance on Planning and Noise – ProPG May 2017

Mitigation for night time noise is discussed below. It is practicable to mitigate and minimise this potential adverse effect to acceptable internal acoustic standards.

7.5 Ground Noise

Ground noise is commonly referred to as noise produced by aircraft activities and use of ancillary equipment on the ground, that is, by sources other than by aircraft in flight, taking off or landing. Sources of ground noise include:

- taxiing and manoeuvring aircraft;
- aircraft auxiliary power units (APU’s);
- testing of aircraft engines (ground running);
- mobile ground equipment, e.g. ground power units (GPU’s).

Airport ground noise is heard in the context of off-airport noise sources, such as road traffic noise, together forming the background noise audible around an airport. The most dominant contributor to the background noise climate in the areas surrounding Exeter International Airport is road traffic. Airport ground noise will be audible for locations close to the airport boundary and in areas beyond where background noise levels are low.

The running of aircraft engines at high power levels for test and maintenance purposes currently gives rise to noticeable levels of ground noise around the vicinity of the airport. The use of APU’s and aircraft taxiing also produce ground noise although at generally lower levels. The relative impact of these different sources of ground noise is controlled by their magnitude and duration.

<u>Ground Noise from Aircraft Activities (excluding Ground Running)</u>

From previous BAP work and observations with regard to Exeter Airport operational activities, it was found that the general ground noise is associated with various aircraft activities, such as taxiing, manoeuvring and running of auxiliary power units.

The magnitude of ground noise varies with the intermittent operation of the airport. The sporadic nature of aircraft departures and arrivals, and the varied taxi routes followed depending on runway usage and aircraft type, means that predictions required a detailed knowledge of how and when aircraft operate at the airport. Observations on site during our site visits did not indicate that ground noise from aircraft activities is audible at the proposed site location.

The reliable prediction of ground noise from aircraft activities depends on a detailed knowledge of how aircraft operate at an airport over a typical day. Information required includes aircraft types and movements, taxi routes utilised during departures and arrivals from all runways, use of aprons and aircraft stands, how long aircraft operate auxiliary power units or ground power units prior to departure and after arrival, and how long aircraft hold on taxiways or runways prior to departure.

Figure 6 below represents an output of a ground noise model around Exeter Airport. The modelling methodology can be found in Appendix 5. Noise maps covering further scenarios (current and future, day and night) can also be found in Appendix 5.

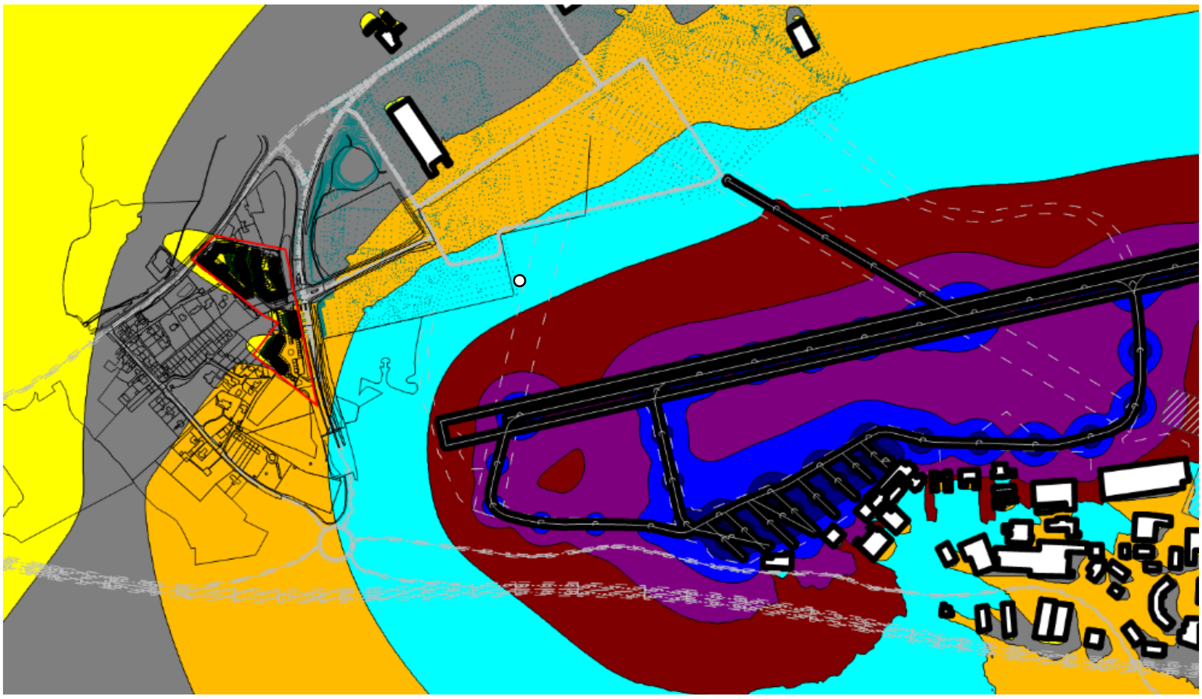


Figure 6- Daytime aircraft ground noise

Currently, the $L_{Aeq,16hrs}$ at a height of 1.5m incident on the residential part of the site along the Clyst Honiton Bypass, is predicted to be in the order of 50-55 dB. The commercial units located to the southern part of the site are exposed to slightly higher Ground Noise (in the order of 55-60 dB) due to the less screening effect provided by the local topography, as discussed above.

The residential element of the site is classified as being within aircraft ground noise expsoure category A/B.

Attended measurements and observations on site found that noise from aircraft ground operations was inaudible on the site. This may be due to the masking effect of road traffic noise which was measured to be between 57-59 dB $L_{Aeq,16h}$ at the two long term monitor positions.

BAP consider that, for this location, the ground noise model may be over-predicting the actual noise exposure on the site. This is understandable based on the prediction methodology. Ground noise is predicted using ISO 9613:1996 methodology. This always assumes downwind conditions, i.e. a worst case sceanrio. The attended measurements and most of the unattended survey were carried out with the prevailing south westerly winds, i.e. taking ground noise away from the development site. The above predicted levels will be more likely of the less common downwind conditons, i.e. easterly winds.

In 2030, the modernisation of the aircraft fleet and the additional screening effect of the fully developed Skypark is expected to have a beneficial effect in lowering those Ground Noise levels further, as can be seen in Appendix 5. This suggests that the ground noise from the airport, contributes to the general noise received over the day and night, however, with a relatively small contribution within the proposed development site.

Similar considerations apply for the exposure of the proposed development site at a higher level of 4.5m. At this height, the screening effect from the local topography would be minimal but the ground noise level contribution from the airport is also anticipated to be relatively small within the proposed development site.

7.6 High Power Engine Ground Running (Engine Test Facility)

An assessment has been undertaken to determine the noise levels expected at the proposed development relating to high power engine ground running at the airport both now and in the future.

Previous on-site measurements from BAP are presented below in Table 13 (July – October 2016) to provide some context regarding the duration and noise level of these short term events.

Aircraft Type	No. of ground runs	Average duration (min:sec)	Average noise level, dB L_{Aeq}	Range of noise maxima, dB L_{AFmax}
BAe 146-200	3	7:03	65	68 – 73
Boeing 737-300	1	1:35	67	75
Dash 8-400	21	6:52	66	57 – 88
Embraer 145	1	2:48	64	72
Embraer 170	6	8:59	64	69 – 75
Embraer 195	6	5:06	65	70 – 80
OVERALL TOTAL/AVERAGE	38	6:42	66	57 – 88

Table 13 - High Power Ground Running Noise Levels at NMP1

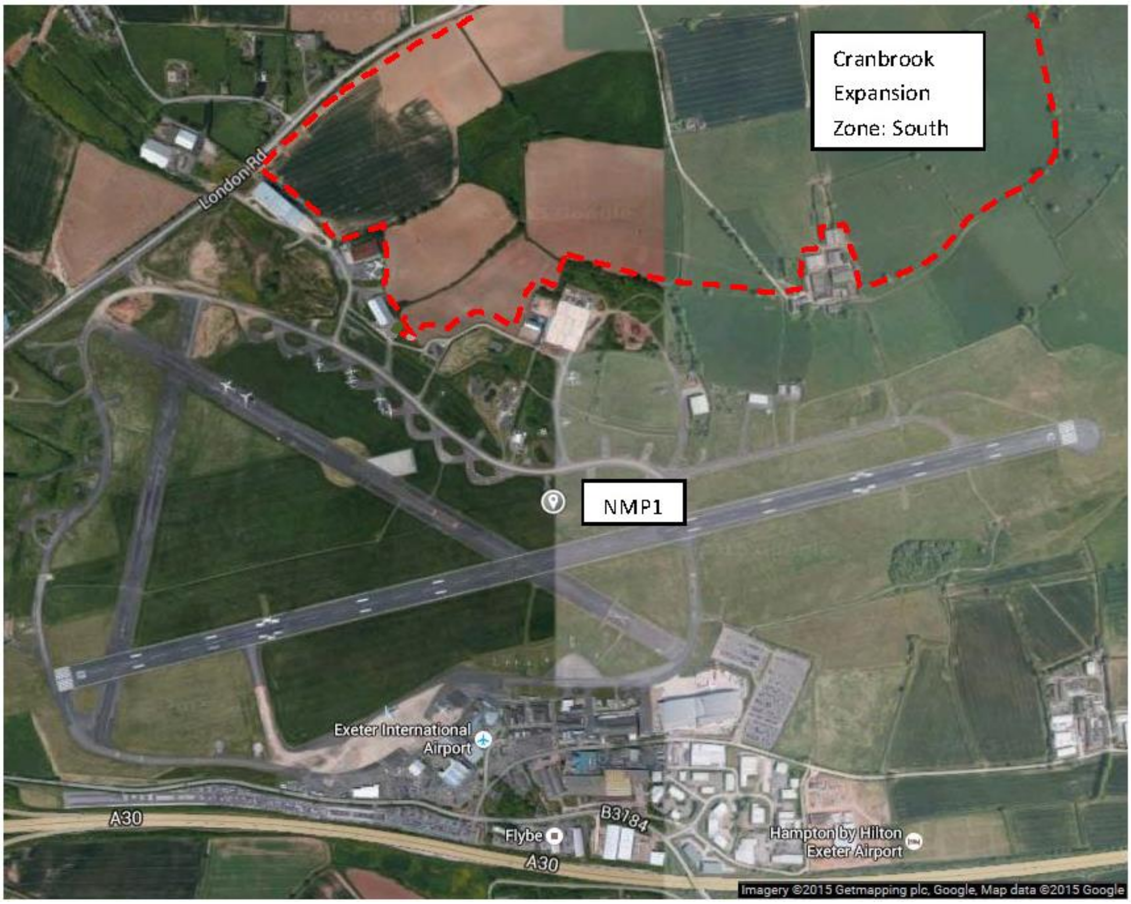


Figure 7 - Location of NMP1 noise monitor

CadnaA ISO 9613 noise modelling has been used as a means of predicting the spread of noise emissions from high power engine ground running around the airport, taking account of the directionality, height of aircraft engines, ground absorption and local topography.

Figure 8 below represents an output of the High Power Running model prepared for Exeter Airport and the effects on the proposed development. Detailed larger scale figures can be found in Appendix 6.

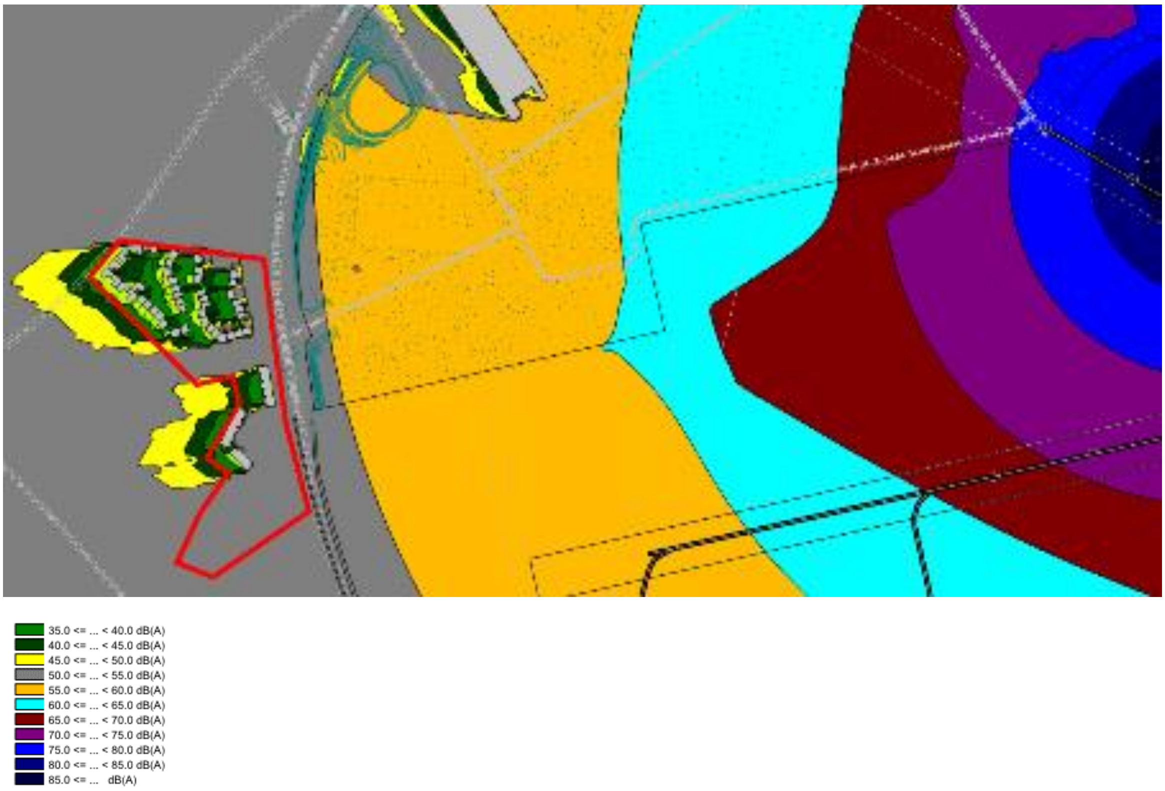


Figure 8 - High power ground run - Dash 8-400 dB $L_{Aeq,1h}$

The duration of individual ground runs is variable and will depend on factors such as the reason for the ground run, for example the testing of an engine after maintenance, and the aircraft type concerned. Runs may also include periods at high power interspersed with longer periods at lower power settings leading to an overall duration of an hour or more. This can make high power ground running a very distinctive sound with the potential to cause significant disturbance to the locality.

General ground noise from aircraft operations is often assessed over the 16 hour day, and one method of assessment would be to include ground running as a source of ground noise, spreading the noise energy over a suitable time frame, say 30 minutes (for schools) or one hour (for hospitals and residential accommodation). This method has been adopted above in presenting average ground running noise levels measured at NMP1 during recent noise survey work. Given its specific characteristics however, it can also be likened to an industrial source and, as a worst case, could be assessed on this basis using BS 4142: 2014 +A1 2019.

In broad terms, this would compare the noise produced during ground running, in terms of L_{Aeq}, with the prevailing background noise, making any adjustment for character, such as tonality, impulsivity and/or intermittency of the noise. This type of assessment, although conservative, is a means of ensuring that the amenity of any residents is adequately protected from the use of the airport's engine test facility.

The background noise level on the development site is around 52-53 dB $L_{A90,15min}$ during the day. This would suggest, ignoring any character corrections, that a short term noise level of 57-58 dB $L_{Aeq,1h}$ would be permissible on land for noise sensitive development based on a typical day-time engine ground run. It is understood that engine testing is not conducted at night and is not proposed to be undertaken at night in the future.

The Noise Maps can be found in Appendix 6 which contains plans showing predictions of ground running noise for a Dash 8-400 aircraft when operating at the Exeter Airport ground run-up base. This aircraft is the loudest and (up until recently) the most common aircraft that uses the engine test facility currently, and may continue to do so in the future.

Contours are shown in two forms. Firstly, contour plans show what maximum noise levels are expected during high power ground running with a single engine operating at (or near) full power. Secondly, contour plans showing the average noise level predicted to result over one hour during which ground running occurs. During this one-hour period, it is assumed that the aircraft is undertaking a typical ground run comprising periods of inactivity and also low and high-power ground running. This average level of activity has been determined from a previous detailed assessment of the ground running undertaken by BAP in 2017 that took place over a month period at the airport over the summer.

In the absence of any current (i.e. 2020) data, contours are shown firstly for 2015, when the SkyPark contains only a few buildings, and secondly for 2030, when the SkyPark is assumed to be fully built. The 2020 noise contours are expected to lie in between those contours.

The above predictions demonstrate that noise from high powered engine ground runs is unlikely to be a significant noise source that would impact on the development of the site for noise sensitive development, i.e. residential or schools.

BAP have requested information form Exeter airport to correlate our unattended noise data with records of high powered ground runs. At the time of writing this information was not available.

7.7 Road Traffic

BAP have previously carried out a road traffic noise assessment for this area. This noise prediction model has been updated to take into account the indicative masterplan for the development site and validated against long term noise measurements made on the site including attended traffic counts.

The assessment of road traffic noise has been undertaken using the calculation method given in the Department of Transport Calculation of Road Traffic Noise publication (CRTN). During our noise survey on site, BAP have carried out additional indicative road traffic counts to update and calibrate the our 2015 road traffic model to its “current” 2020 version. These traffic counts were found to be higher than those used to build our original 2015 road traffic CADNA model and they correlate well with our current measurements on site.

Figure 8 below represents an output of the current road traffic model prepared around the proposed development. Predictions of road traffic noise have also been undertaken for the future road traffic noise levels with the Skypark development in 2030 completed (Figure 9). Larger scale plans can be found in Appendix 7.

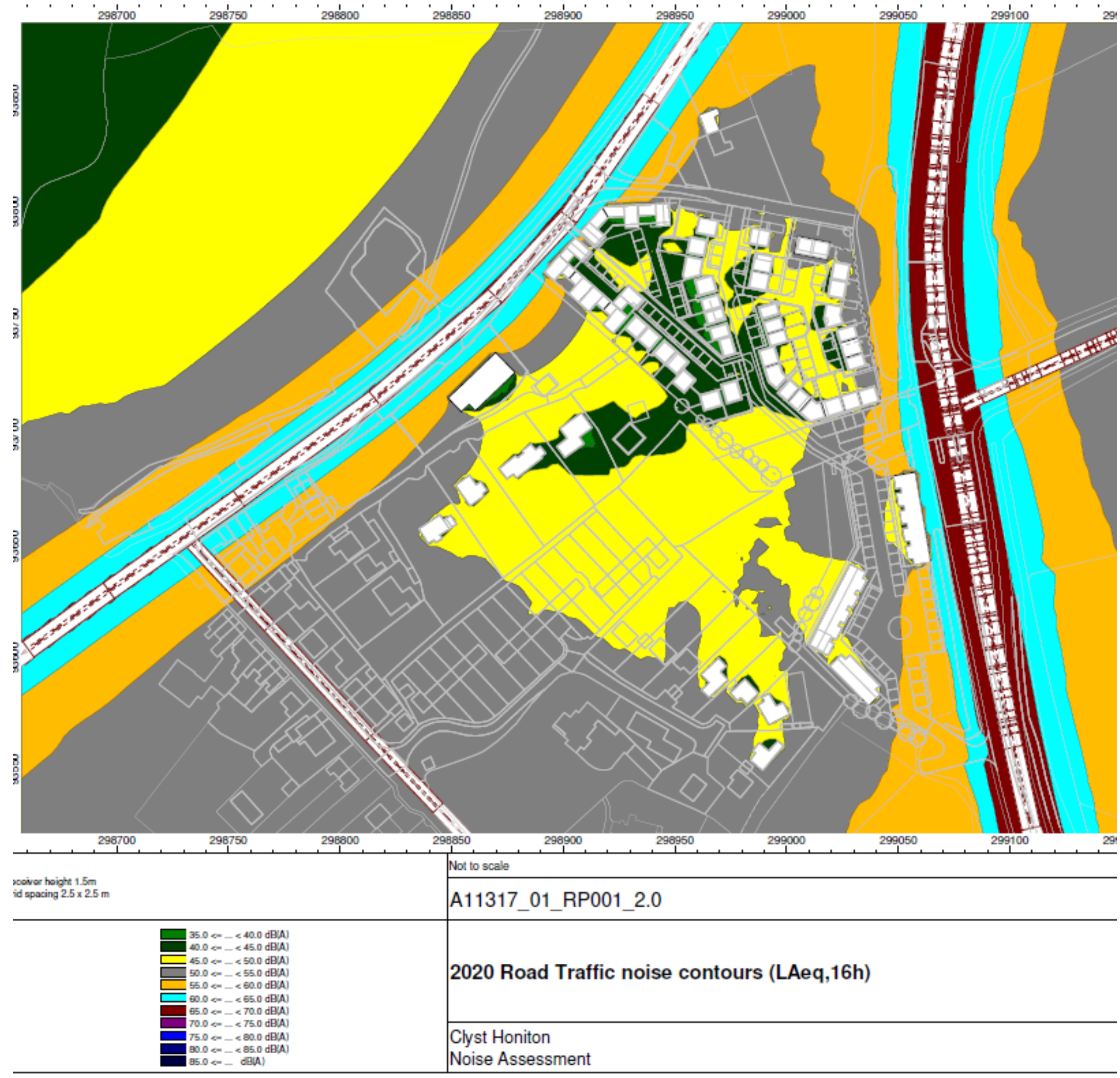


Figure 9 - Current 2020 road traffic noise levels, daytime LAeq,16h

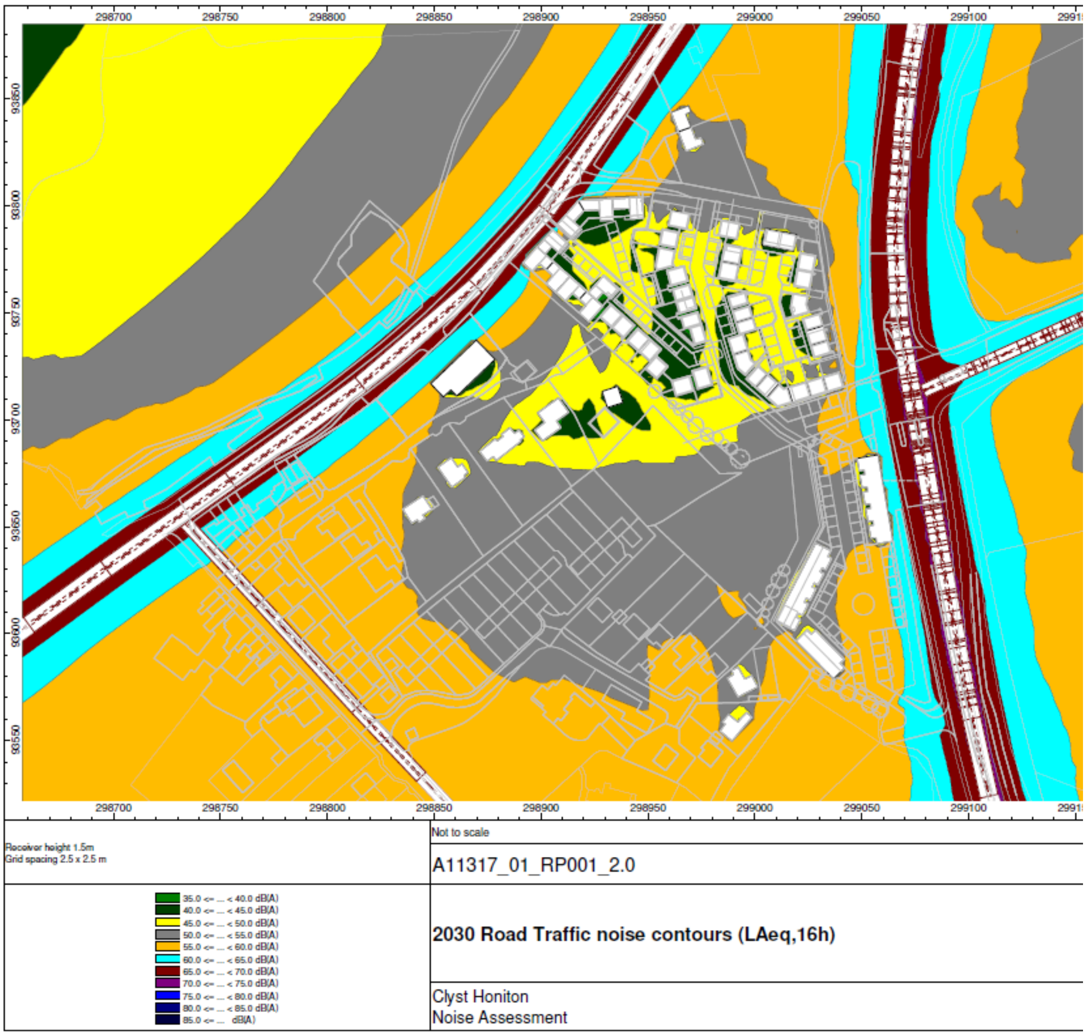


Figure 10 - Future road traffic noise predictions, dB $L_{Aeq,16h}$

With regards to residential amenity an assessment of noise maxima needs to be carried out to assess sound levels from noise events, i.e. passing HGVs. This development site is exposed to regular noise events at night from road traffic and much less frequent events from aircraft.

Long term unattended noise data demonstrate that the measured external night time noise maxima at MP1 lie between (50 and 86 dBA) and do not normally exceed 70 dB $L_{AF,max}$ (free field) by more than ten times at night (Appendix 2).

At MP2, which is located further away from Clyst Honiton Bypass, the L_{Amax} values were found to lie between a similar range but they do not normally exceed 64 $L_{AF,max}$ (free field) by more than ten times at night.

Based on the above objective assessment noise levels for road traffic place the site within noise exposure categories B & C.

7.8 Commercial/Industrial Noise

The development site is close to two large industrial parks. A large Lidl distribution centre to the north of the site and to the east of the site the “Sky Park” development which is partially constructed and includes the DPD delivery depot.

During the attended daytime noise survey no commercial/industrial sound was audible on the development site. An additional site visit was made during the evening and early morning when periods of background sound were lower and no commercial/industrial sound was audible.

The commercial/industrial uses will influence the site by virtue of the road traffic (existing and future) but this is assessed above under road traffic noise.

The SkyPark development itself was granted outline planning consent in 2010 (Local authority reference 06/3300/MOUT). This outline consent included the following planning conditions. Reserved matters applications are likely to require adequate control of noise from external plant or machinery to protect existing residential dwellings in Clyst Honiton.

“46. - Noise Control No development shall commence until a Noise Control Plan detailing a noise management system to be implemented during the demolition and construction phase of the development and tailored to the specific needs of the construction works, the site and the surrounding area to mitigate the effects of noise from the development is submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved Noise Control Plan. (Reason - To protect the occupiers of buildings in the vicinity from excessive noise.)”

47 External Plant or Machinery

Details shall be submitted with the reserved matters to show external plant or machinery which shall not be installed on any building within the site without the prior approval of the Local Planning Authority. The development shall proceed only in accordance with those approved details. (Reason - In the interests of local amenity.)”

Based on the results of the above observations noise from these industrial operations does not present a significant impact on the development site.

8.0 NOISE MITIGATION

8.1 Introduction

Based on the outcomes of the above analysis and noise criteria from Section 2, the general noise mitigation requirements for the proposed building types and amenity areas have been identified. The site is exposed to significant levels of road and aircraft noise which requires mitigation.

Consideration has been given to methods for reducing noise emissions to acceptable levels and the introduction of noise reducing measures at or close to receptors as appropriate.

8.2 Residential development – aircraft noise

The residential part of the development is located to the northern part of the site and its exposure to aircraft noise, as a worst case in 2030, is predicted to lie within the range of 57-60 dB $L_{Aeq,\ 16hrs}$ during the day and 51-54 dB $L_{Aeq,8hrs}$ at night.

A typical dwelling with no specific measures to mitigate external sound will provide an approximate reduction in noise of around 25 dB. BS 8233:2014 recommends a guideline desirable noise level of 35 dB $L_{Aeq,16h}$ in noise sensitive habitable rooms during the daytime and 30 dB $L_{Aeq,8h}$ at night (with windows closed and background ventilation provided).

It is therefore feasible to achieve these internal average noise standards with a standard specification dwelling. The details of the sound insulation performance will however need to be assessed in detail (ideally as part of a standard planning condition) as some standard ventilation strategies (Approved Document F System 1 for example) are exceptionally poor with regards to the control of external noise and should be avoided.

Night time noise maxima from aircraft are more of a concern and a standard specification dwelling will not be appropriate for bedrooms. The number of movements is unlikely to exceed the ≥10 events per night to be classified as “regular”. But it is considered that without additional mitigation for the bedrooms there is a potential risk of disturbance due to a small number of early morning flights.

The noise assessment has found that a design case of 80-85 dB $L_{AF,max}$ would be representative for these early morning flights based on predictions. Measurements indicate that the prediction model may be over-predicting sound levels. Measured levels at both monitors are closer to 80 dB $L_{AF,max}$. BAP have requested flight data from Exeter airport to correlate the measurements with activity to quantify more accurately typical noise maxima. At the time of writing this information was not available.

These levels of noise will require additional noise mitigation to protect future occupants. The exact details of the mitigation will need to be developed when further details are available on dwelling design and the above issue regarding representative levels has been resolved. These mitigation are likely to comprise;

- Dwellings with conventional brick/block cavity walls to provide a high level of resistance against external noise.
- Room-in-roof bedrooms are not recommended.
- High acoustic performance double glazed windows. Initial predictions indicate that the performance of the windows will need to exceed ≥37 dB R_w+C_{tr} AND ≥41 dB R_w[11]. This can be achieved with high performing windows with heavy laminated acoustic glass such as 10/16/8.8mm Pilkington Optiphon (or similar). For these high performing windows the performance of the frame and seals are vital to ensuring good performance.
- To control noise transmission via the roof the loft cavity will need sound absorption material to comprise at least ≥100mm ≥10kg/m^3 mineral wool. Insulation is usually required for thermal reasons. However the insulation material must be a mineral wool material to also provide acoustic insulation.
- The bedrooms must have no conventional trickle/slot ventilators. A single high acoustic performance ventilator is acceptable. This would need to have an acoustic performance of ≥50 dB $D_{n,e,w}$[12].
- The bedrooms will need a form of alternative ventilation to provide the option of sleeping with windows closed and a reasonable level of ventilation. Windows must not be sealed closed. The ventilation should be designed to comply with both Building Regulations

[11] The minimum acoustic performance figures are applicable to the window systems as a whole, including frames, glazing and any insulated panels. Compliance with the specification should be demonstrated by laboratory testing in accordance with the BS EN ISO 10140 series and rated in accordance with BS EN ISO 717-1:1997 Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Tests from the recently superseded BS EN ISO 140-3: 1995 would also be acceptable. Tests should be carried out by a laboratory with UKAS (or European equivalent) third party equivalent. Test reports shall be submitted to the project acoustic consultant for approval.

[12] For unit ventilators, the measurements are based on BS EN ISO 10140-2:2010 "Laboratory measurement of airborne sound insulation of building elements" and rated in accordance with BS EN ISO 717-1:2013 "Acoustics – Rating of sound insulation in buildings and of building elements Part 1. Airborne sound insulation".

requirements for ventilation and also should provide adequate control of overheating risk. There are proprietary acoustic ventilation units that are designed for this bedroom application where low running noise levels and high resistance to external sound are required. The performance specification above can be achieved using units such as Titon Sonair and Siegenia Aeropac. These allow future residents the option to close their windows and have a high level of ventilation. It is recommended that residents are also given the opportunity to open their windows. Other mechanical options will be available.

With regards to aircraft noise the modelling demonstrates that the recommended desirable garden levels will be exceeded. The relevant text from BS8233:2014 is reproduced below/

"*For traditional external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB $L_{Aeq,T}$, with an upper guideline value of 55 dB $L_{Aeq,T}$ which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable. In higher noise areas, such as city centres or urban areas adjoining the strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development needs can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited."*

There are no reasonably practicable methods to control aircraft noise in gardens. In reality the impact on future residents is unlikely to be significant. The noise source is intermittent. Provided steady traffic noise is controlled to an acceptable level (see below) the adverse effects will be limited to each individual aircraft passby. During each passby (around 30 seconds) conversation will be difficult within the garden and this would be a distraction. However the impact, in planning terms, would not be considered unacceptable.

It is feasible that the dwellings could be provided with an amenity space that does control external aircraft noise in the form of a conservatory for a house or a winter garden for a flat. Although it is debatable whether these spaces could be classed as an "external" amenity space.

There will also be ground noise from the airport. This will be in the form of steady ground noise from taxiing and APUs running on stand. There will also be some intermittent ground noise form high powered engine ground runs for maintenance purposes. This is not significant for this development site and no mitigation measures are required. The mitigation measures for road traffic noise (see below) will however have an incidental benefit of reducing aircraft ground noise at this site.

8.3 Residential development – road traffic noise

Steady road traffic noise can potentially adversely affect future residents outside in their gardens, inside their homes during the daytime (annoyance) or in their bedrooms at night (sleep disturbance). Due to aircraft noise exposure BAP have recommended a high standard of noise mitigation for all the bedrooms. This will far exceed the required noise mitigation to protect future occupants against sound from passing road traffic and HGVs. Even with an increase in HGV use along the bypass to service the surrounding industrial units the sound levels inside bedrooms can still meet recommended internal standards.

The noise modelling carried out based on the indicative masterplan demonstrates that for most of the site external noise levels within rear gardens (assuming a minimum 1.8m standard garden fence) will be within recommended noise guidelines (BS8233:2014).

The masterplan could develop/change further. This could change the layout and/or the topography of the site. Any change in development would need to be assessed to ensure adequate mitigation for gardens. This could be controlled via a planning condition to submit a scheme of noise control at reserved matters stage.

Mitigation will be required either through the layout of the site including location of gardens themselves and/or through the use of noise screening. The screening could be via purpose built barriers, landscaped bunds or a combination of both.

8.4 Commercial/Retail

Commercial and retail developments, such as shops, etc are not normally considered noise sensitive although their design should take account of the local noise environment to ensure acceptable acoustic conditions are provided for the future occupants. The location of such buildings can sometimes bring a noise benefit to a development site, separating and protecting noise sensitive receptors from major noise sources, such as the main road.

If any of the commercial/retail/industrial units will include any noise sensitive uses (such as offices) then these will need to be designed (typically at fit out stage) to include adequate mitigation to control noise ingress to meet guideline (i.e. BCO 2019) noise standards.

The commercial/retail units have the potential to disturb occupants of existing and future residential properties via noise breakout from mechanical plant and/or deliveries. This can and should be controlled using standard planning conditions based on BS4142:2014. An example is provided below.

"*Any plant, equipment or ducting system to be used in pursuance of this permission shall be so installed, retained and operated that the rating level at the boundary of any nearby residence shall not exceed the prevailing background noise level measured at the time of the assessment. All assessments to be in accordance with BS4142:2014 Method for Rating and Assessing Industrial and Commercial Sound.*

Reason: to protect the amenity of residents from unacceptable noise."

8.5 Construction noise

The construction of the development site has the potential to adversely impact existing residential properties during the temporary construction phase. This short term effect should be mitigated through the use of standard local authority conditions on construction noise control, usually through the use of standard working hours and the submission of construction environmental management plan CEMP. The noise condition used for the adjacent SkyPark would be reasonable and is reproduced below for guidance.

"*Noise Control No development shall commence until a Noise Control Plan detailing a noise management system to be implemented during the demolition and construction phase of the development and tailored to the specific needs of the construction works, the site and the surrounding area to mitigate the effects of noise from the development is submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved Noise Control Plan. (Reason - To protect the occupiers of buildings in the vicinity from excessive noise.)*

Noise Control Plan

In respect of Condition 46 it should be noted that, as a minimum, the Noise Control Plan

should cover:-

• procedures for ensuring compliance with statutory or other identified noise control limits, with the possible production and use of a Construction Noise and Vibration Management Plan;

• procedures for ensuring that all works are carried out according to the principle of "Best Practicable Means"

• general induction training for site operatives and specific training for staff having responsibility for particular aspects of controlling noise from the site;

• a noise monitoring / auditing programme

• Liaison with the local authority and the community.

In order to demonstrate the adoption of Best Practicable Means to control noise emission from the site, the following conditions and measures are applicable:-

1. Contractors should bring to site and employ on the works only the most environmental acceptable and quietly operating plant and equipment compatible with the safe and efficient execution of the works.

2. Noise emitted by any plant item should not exceed the limits quoted in either the relevant EC Directive or UK Statutory Instrument and should be no greater than the relevant values quoted in the current version of BS 5228.

3. All items of plant operating on the site in intermittent use should be shut down in the intervening periods between uses.

4. Any compressors brought onto site should be silenced or sound reduced models fitted with acoustic enclosures;

All pneumatic tools should be fitted with silencers or mufflers;

6. The excavation and demolition of existing structures should, wherever possible, be undertaken without the use of pneumatic breakers;

7. Wherever possible, the use of hydraulic attachments or other means of crushing concrete and hard materials should be used in preference to pneumatic breakers. Where the use of impact hammers is necessary, their attachment to larger and heavier excavators often can reduce the level of vibration;

8. Care should be taken when erecting or striking scaffolds to avoid impact noise from banging steel. All operatives undertaking such activities should be instructed on the importance of handling the scaffolds to reduce noise to a minimum;

9. Deliveries should be programmed to arrive during daytime hours only. Care should be taken when unloading vehicles to minimise noise. Delivery vehicles should be routed so as to minimise disturbance to local residents. Delivery vehicles should be prohibited from waiting on the highway or within the site with their engines running;

10. No radios or music should be played on the site.

11. All plant items should be properly maintained and operated according to the manufacturers' recommendations in such a manner as to avoid causing excessive noise.

12. All plant should be sited so that the noise impact at nearby noise sensitive is minimised or otherwise controlled. Local hoardings, screens or barriers should be erected as necessary to shield particularly noisy activities."

NB: As an alternative to a NCP the developer may wish to consider undertaking a

Section 61 agreement under the Control of Pollution Act 1964 with East Devon District

Council.

9.0 SUMMARY

The general propose of this assessment is to ensure that the proposed development site can be developed and fully utilised without any significant adverse effects of noise from aircraft operations at Exeter Airport and road traffic noise from the surrounding road network.

A set of noise criteria has been proposed with the aim of ensuring acceptable noise conditions for noise sensitive buildings and amenity areas. An assessment has been undertaken of all significant sources of noise in the vicinity of the proposed development site including air noise and ground noise from aircraft operations at Exeter Airport, noise from use of the airport's engine testing facility and road traffic noise from the adjacent Clyst Honiton Bypass, York Terrace and those further away A30 and M5. Consideration has also been given to the noise likely to be generated by road traffic within SkyPark once it has been fully built out. Account has been taken of air and road traffic both now and in the future.

The assessment has confirmed that noise mitigation will be required to comply with national and local policies regarding the assessment of environmental noise. Based on the illustrative masterplan a scheme of noise mitigation has been presented. This will enable suitable environmental conditions for future residents and users of the site with regards to noise.

Theo Niaounakis	**David Trew**
for Bickerdike Allen Partners LLP	**Partner**

APPENDIX 1

GLOSSARY OF ACOUSTIC TERMINOLOGY

The Decibel, dB

The unit used to describe the magnitude of sound is the decibel (dB) and the quantity measured is the sound pressure level. The decibel scale is logarithmic and it ascribes equal values to proportional changes in sound pressure, which is a characteristic of the ear. Use of a logarithmic scale has the added advantage that it compresses the very wide range of sound pressures to which the ear may typically be exposed to a more manageable range of numbers. The threshold of hearing occurs at approximately 0 dB (which corresponds to a reference sound pressure of 2 x 10^{-5} Pascals) and the threshold of pain is around 120 dB.

The sound energy radiated by a source can also be expressed in decibels. The sound power is a measure of the total sound energy radiated by a source per second, in watts. The sound power level, L_w is expressed in decibels, referenced to 10^{-12} watts.

Frequency, Hz

Frequency is analogous to musical pitch. It depends upon the rate of vibration of the air molecules that transmit the sound and is measure as the number of cycles per second or Hertz (Hz). The human ear is sensitive to sound in the range 20 Hz to 20,000 Hz (20 kHz). For acoustic engineering purposes, the frequency range is normally divided up into discrete bands. The most commonly used bands are octave bands, in which the upper limiting frequency for any band is twice the lower limiting frequency, and one-third octave bands, in which each octave band is divided into three. The bands are described by their centre frequency value and the ranges which are typically used for building acoustics purposes are 63 Hz to 4 kHz (octave bands) and 100 Hz to 3150 Hz (one-third octave bands).

A-weighting

The sensitivity of the ear is frequency dependent. Sound level meters are fitted with a weighting network which approximates to this response and allows sound levels to be expressed as an overall single figure value, in dB(A).

Environmental Noise Descriptors

Where noise levels vary with time, it is necessary to express the results of a measurement over a period of time in statistical terms. Some commonly used descriptors follow.

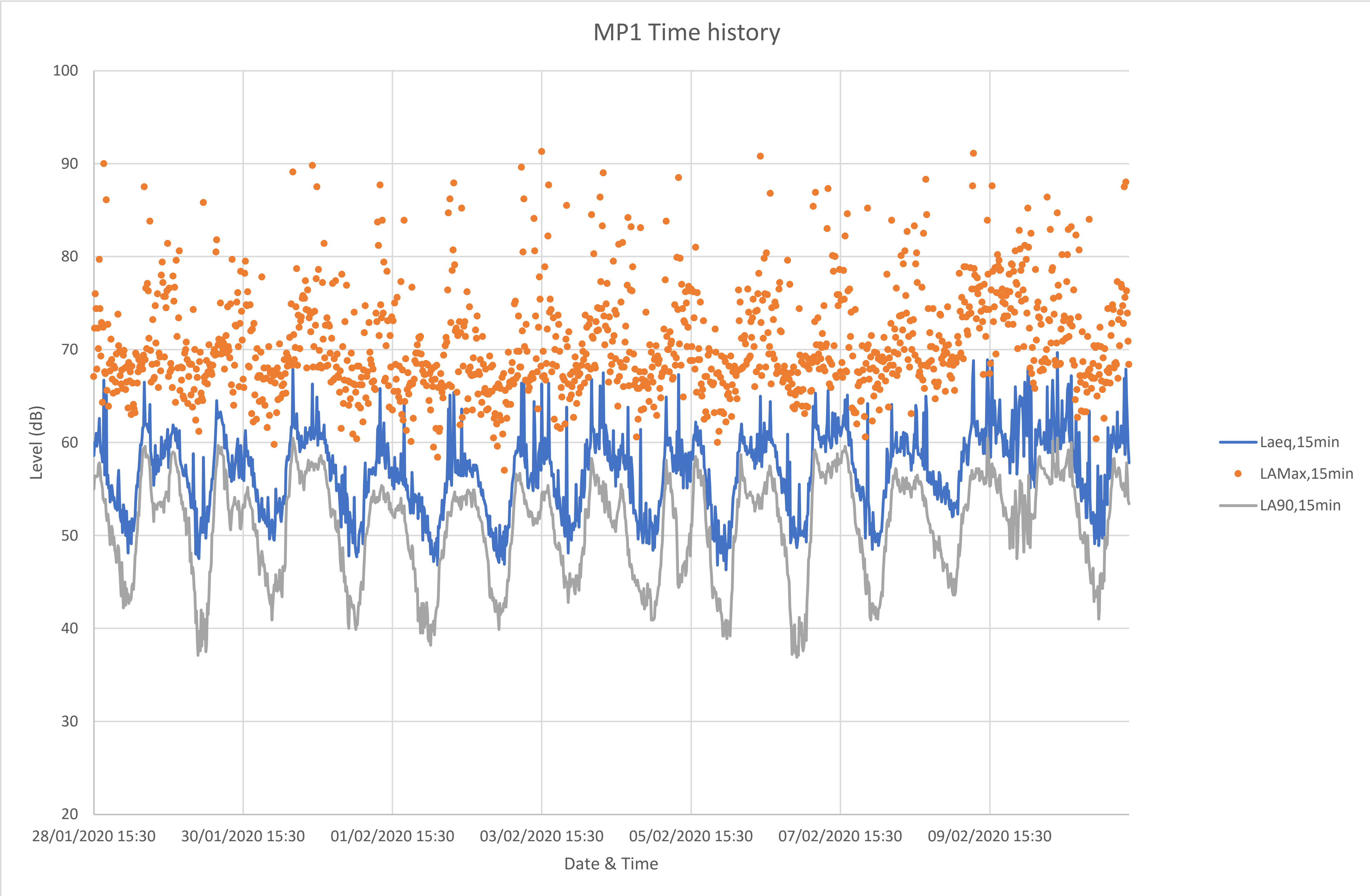
Statistical Term	Description
$L_{Aeq, T}$	The most widely applicable unit is the equivalent continuous A-weighted sound pressure level (LAeq, T). It is an energy average and is defined as the level of a notional sound which (over a defined period of time, T) would deliver the same A-weighted sound energy as the actual fluctuating sound.
L_{A90}	The level exceeded for 90% of the time is normally used to describe background noise.
$L_{Amax,T}$	The maximum A-weighted sound pressure level, normally associated with a time weighting, F (fast), or S (slow)

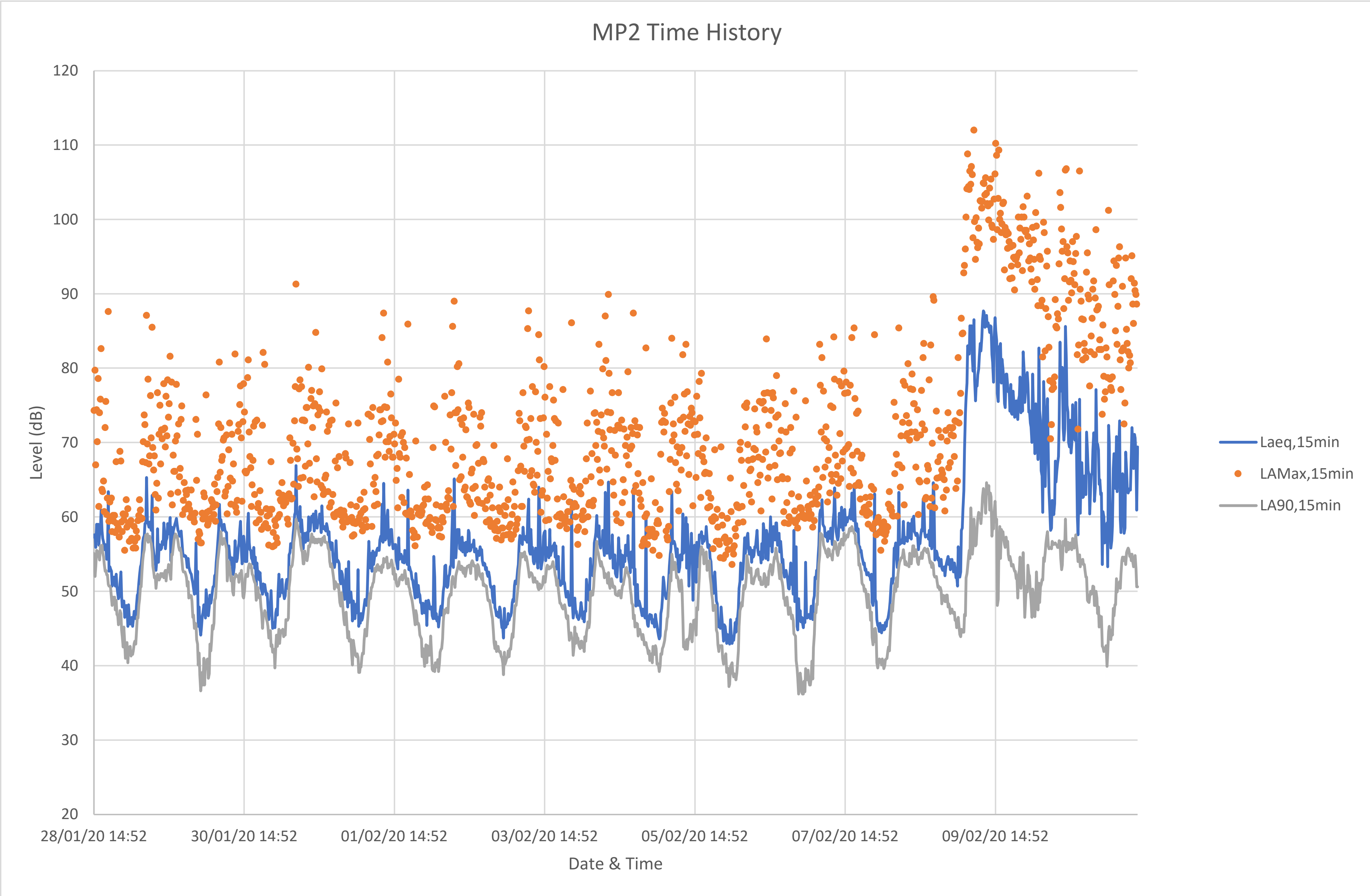
Sound Transmission in Rooms

Sound energy is reflected from the room surfaces and this gives rise to reverberation. At short distances from a sound source, the sound level will fall off at a rate of 6 dB per doubling of distance, as it would in the open air – this is known as the direct field. Beyond a certain distance, the effect of reverberation takes over and the level ceases to fall off significantly with distance from the source. This is known as the reverberant field. For receiver positions in this part of the room, sound levels can be reduced by applying sound absorbing finishes to the surfaces of the room. A 3 dB reduction can normally be obtained by doubling the absorption present, which corresponds to halving the reverberation time (see below).

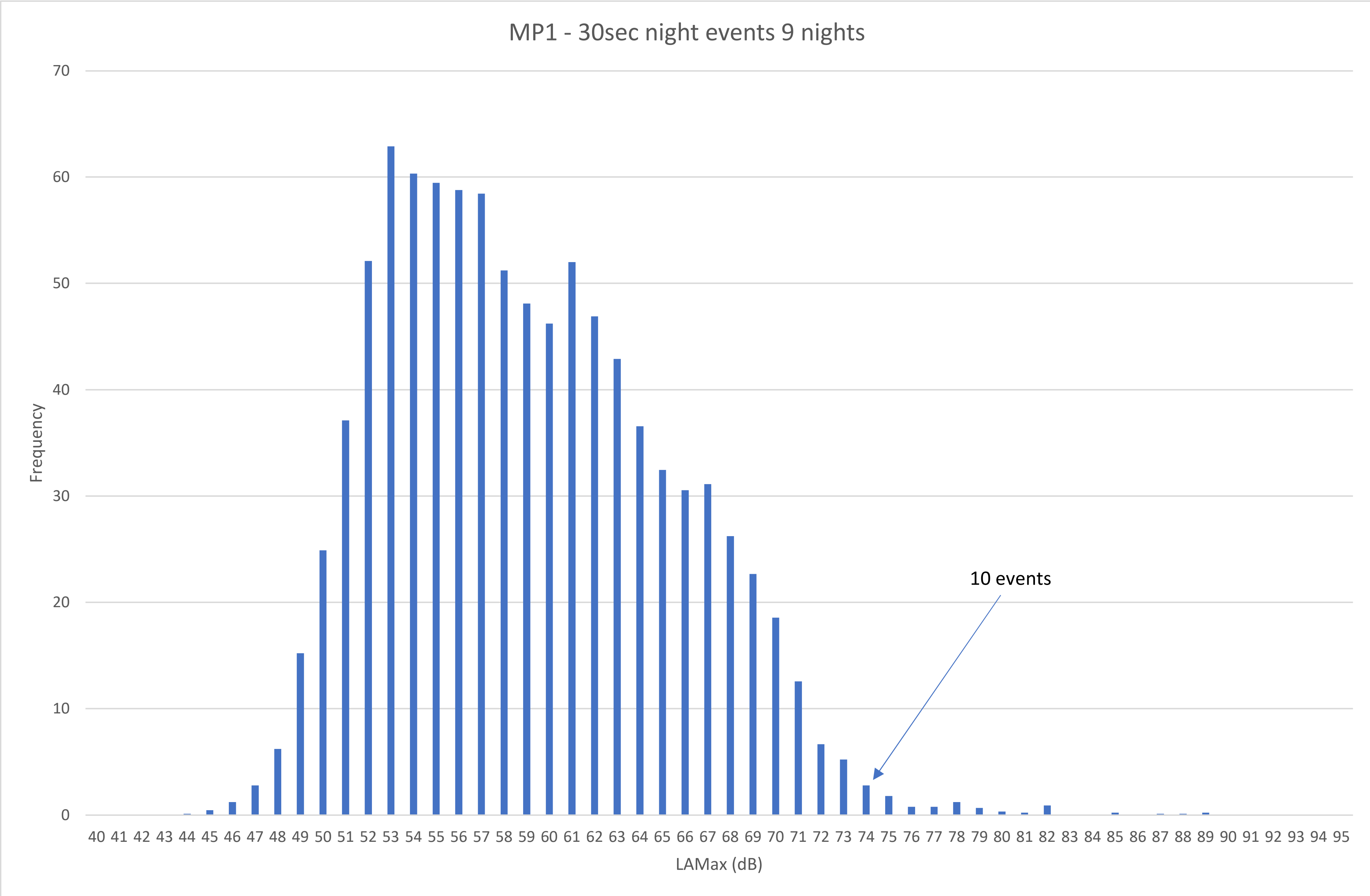
APPENDIX 2

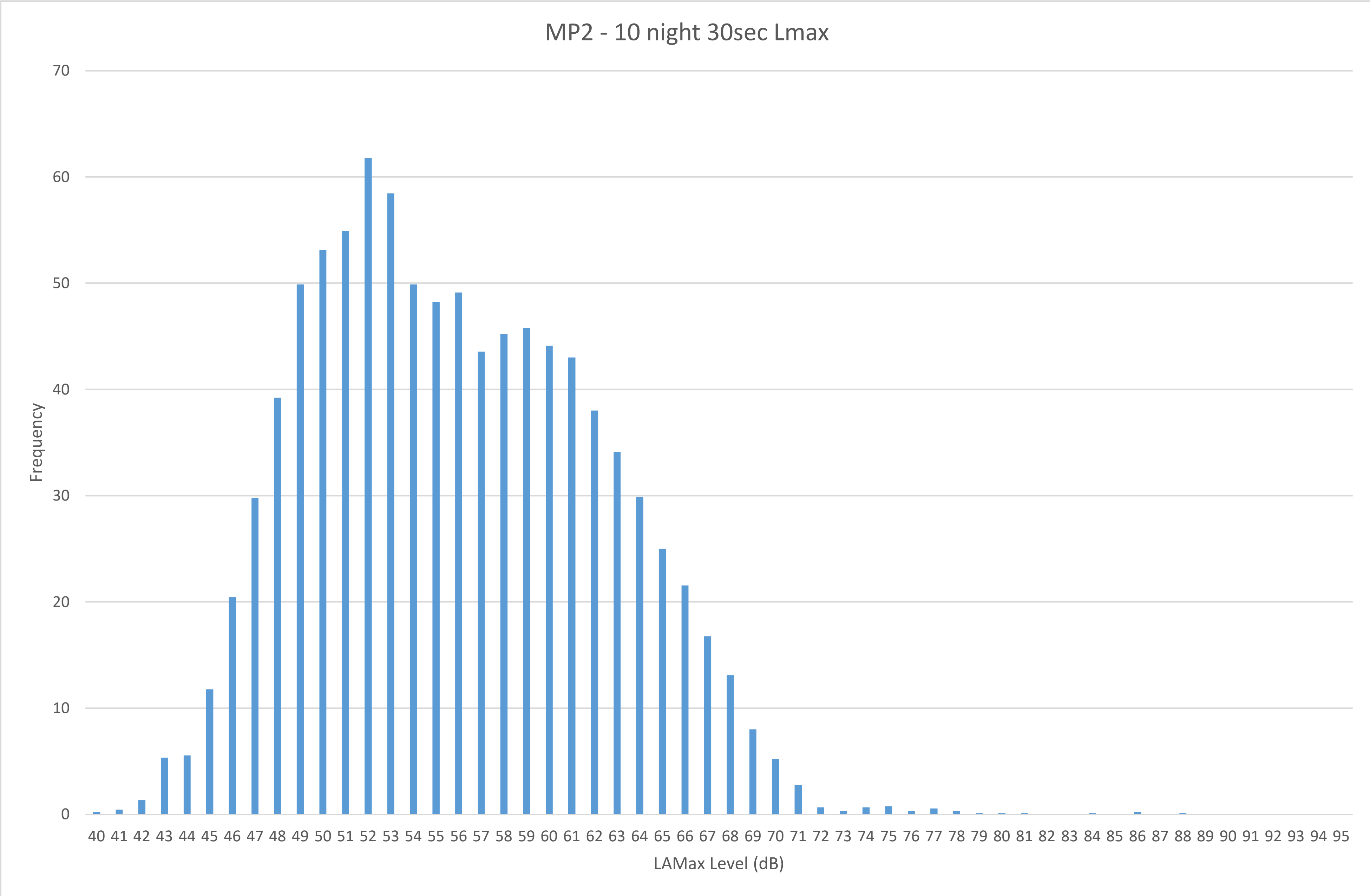
LONG TERM UNATTENDED SURVEY RESULTS


MP1 Time history
Level (dB)
100
90
80
70
60
50
40
30
20
28/01/2020 15:30
30/01/2020 15:30
01/02/2020 15:30
03/02/2020 15:30
05/02/2020 15:30
07/02/2020 15:30
09/02/2020 15:30
Date & Time
Laeq,15min
LAMax,15min
LA90,15min



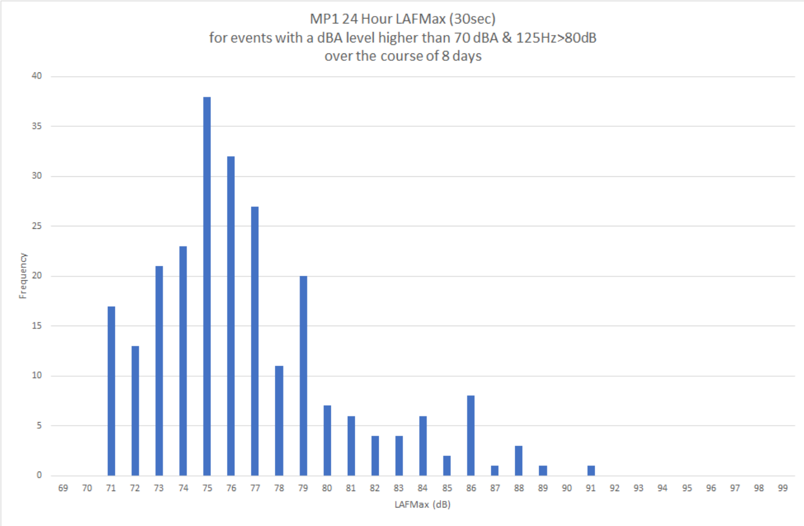
MP2 Time History
120
110
100
90
80
70
60
50
40
30
20
Level (dB)
28/01/20 14:52
30/01/20 14:52
01/02/20 14:52
03/02/20 14:52
05/02/20 14:52
07/02/20 14:52
09/02/20 14:52
Date & Time
Laeq,15min
LAMax,15min
LA90,15min

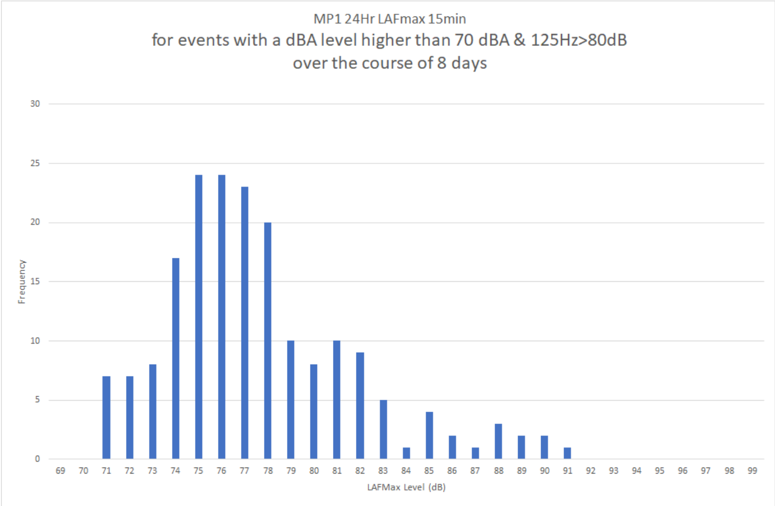

MP1 - 30sec night events 9 nights
Frequency
0
10
20
30
40
50
60
70
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95
LAMax (dB)
10 events

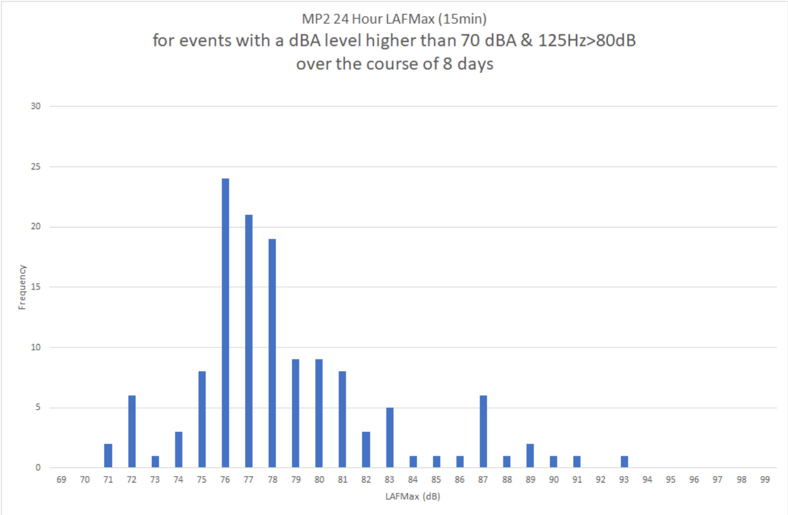


MP2 - 10 night 30sec Lmax
Frequency
LAMax Level (dB)
0
10
20
30
40
50
60
70
40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95

24-hour LAmax analysis for events with a dBA level higher than 70 dBA & 125Hz>80dB over the course of 8 days.
(In the absence of flight log data, event with those attributes are likely to be associated with aircraft departures)





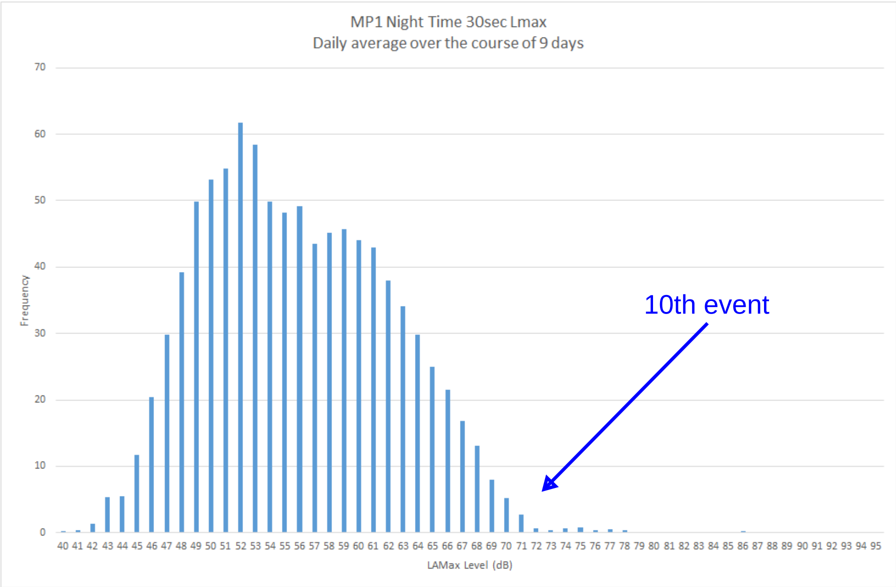


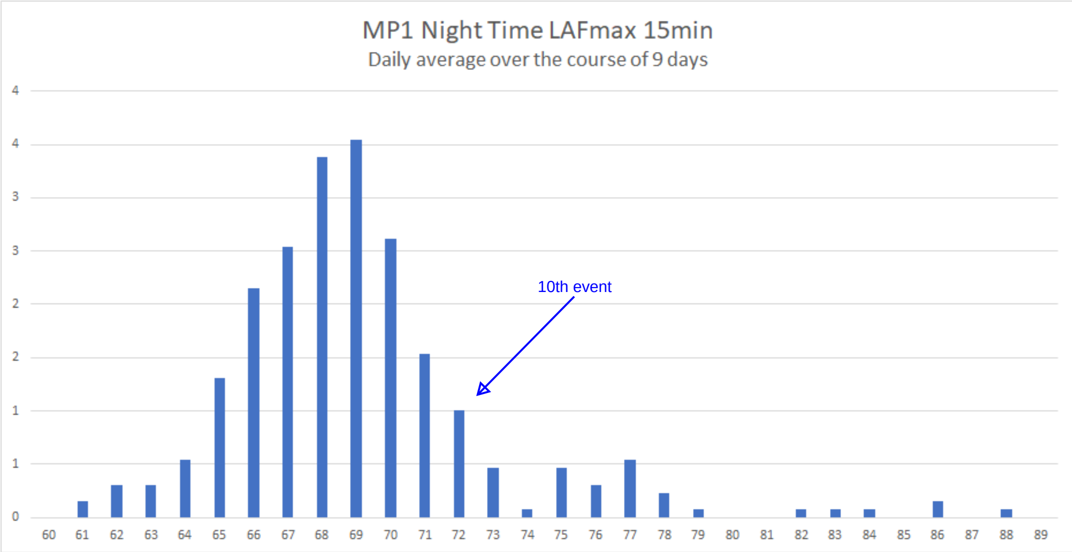
Comment on night time events with a dBA level higher than 70 dBA & 125Hz>80dB:

The analysis of events from both measurement locations MP1 and MP2 with those attributes occurring during the night time period of 8 days, vary from 70- 87 dB LAmax. The most of them are lower than 80dBA and only two events are higher, at 82-83 and 86-87dBA. The timing and level of those higher in level events are almost identical at both MP1 and MP2.

Night Time LAmax analysis

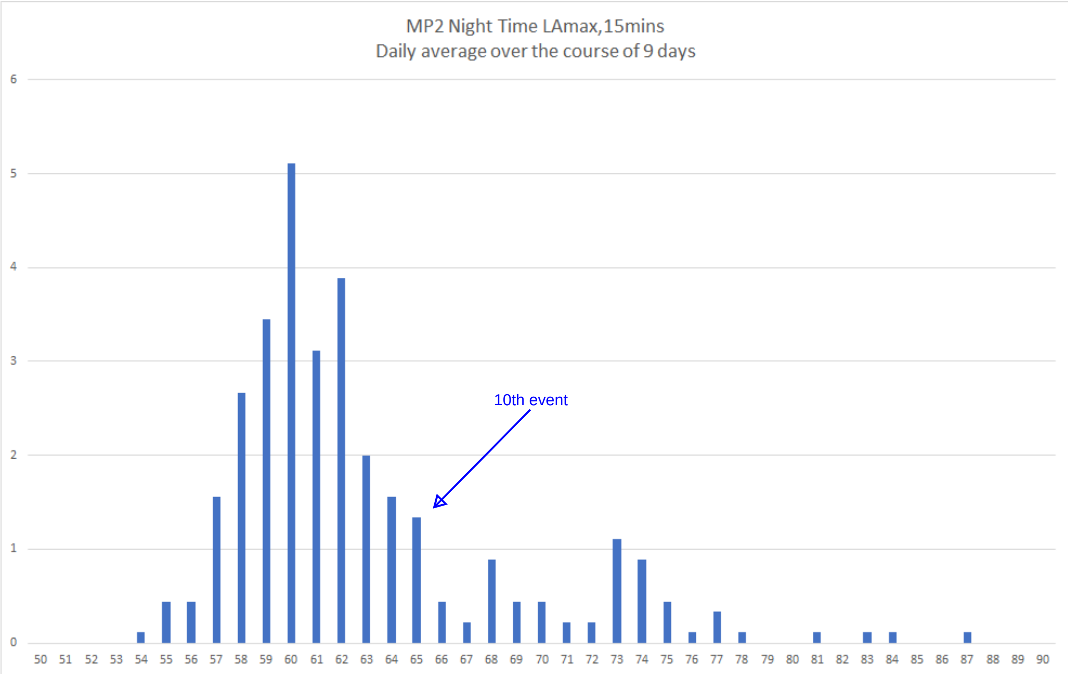
MP1:





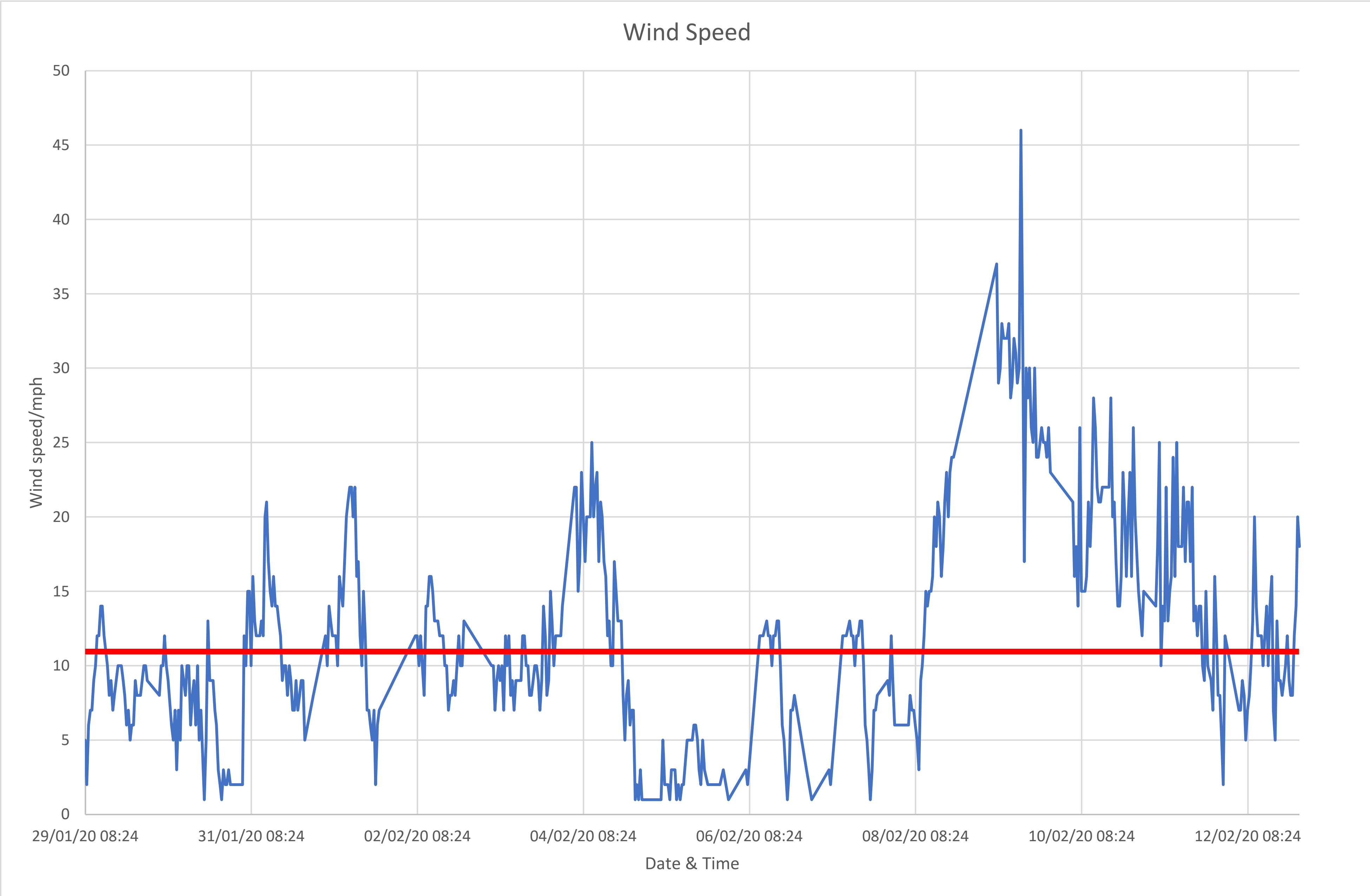
MP2:

LAmax,30 sec analysis NOT AVAILALABLE for MP2



APPENDIX 3

LONG TERM WEATHER INFORMATION



Wind Speed
Wind speed/mph
50
45
40
35
30
25
20
15
10
5
0
29/01/20 08:24
31/01/20 08:24
02/02/20 08:24
04/02/20 08:24
06/02/20 08:24
08/02/20 08:24
10/02/20 08:24
12/02/20 08:24
Date & Time

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Partners
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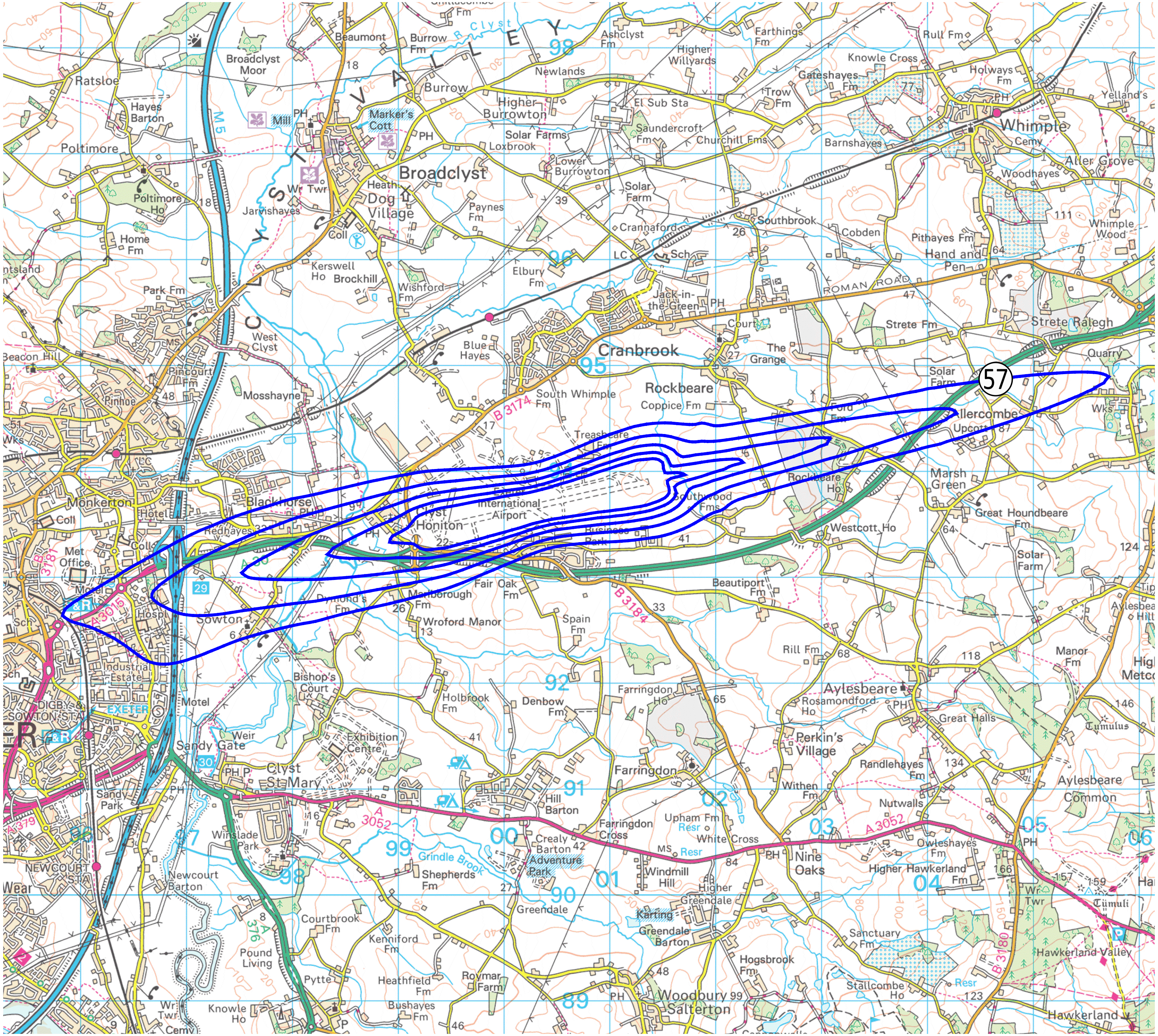
Acoustics
Technology

APPENDIX 4

AIRBORNE AIRCRAFT NOISE CONTOURS



This drawing contains Ordnance Survey data
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LEGEND:

Noise contours, 57 to 69 dB $L_{Aeq,16h}$ in 3 dB steps, from BAP report A9894-R03-PH dated 03/05/2016 and based on 2009 Masterplan forecasts provided by the airport

REVISIONS

Bickerdike Allen Partners
Architecture Acoustics Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
F: 0207 625 0250

Clyst Honiton Bypass Site
Noise Assessment

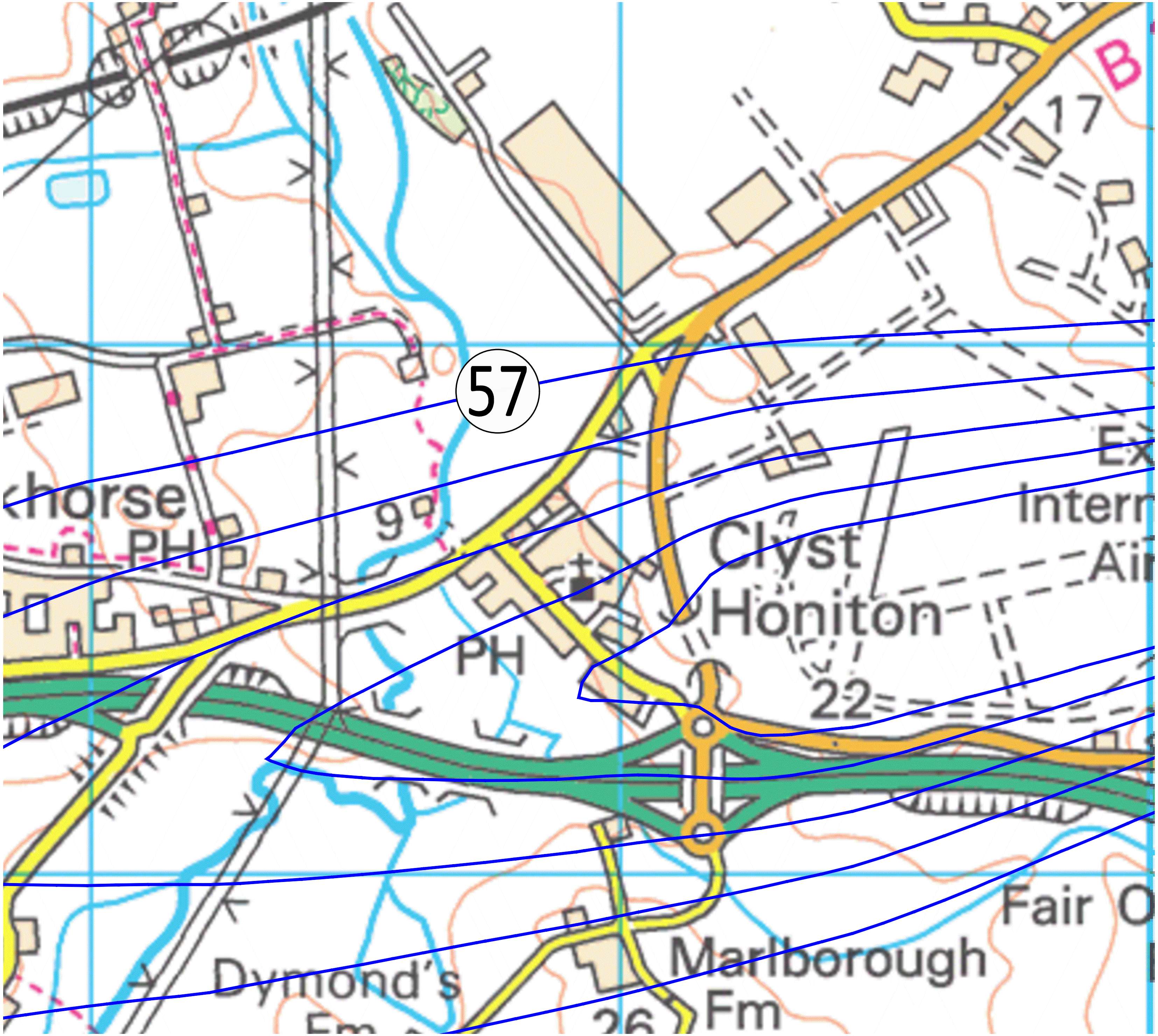
Airborne Aircraft Noise Contours
2030 Forecast Average Summer Daytime
(2009 Masterplan)

DRAWN: MP CHECKED: DT

DATE: March 2023 SCALE: 1:50,000@A4

FIGURE No:

A11371_01_DR001_1.0



LEGEND:

Noise contours, 57 to 69 dB $L_{Aeq,16h}$ in 3 dB steps, from BAP report A9894-R03-PH dated 03/05/2016 and based on 2009 Masterplan forecasts provided by the airport

REVISIONS

Bickerdike
Allen
Partners
Architecture
Acoustics
Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
F: 0207 625 0250

Clyst Honiton Bypass Site
Noise Assessment

Airborne Aircraft Noise Contours
2030 Forecast Average Summer Daytime
(2009 Masterplan)

DRAWN: MP

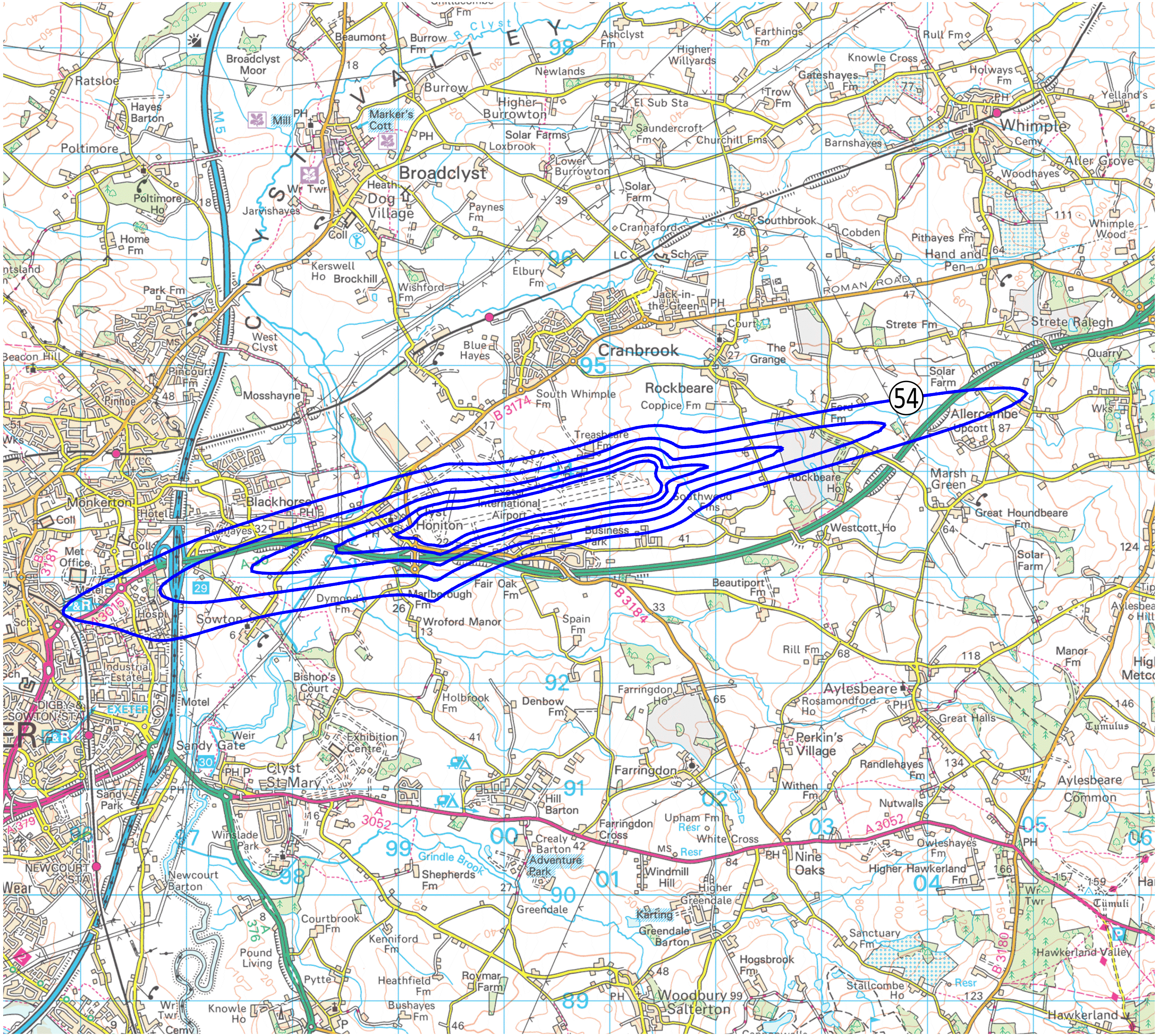
CHECKED: DT

DATE: March 2023

SCALE: 1:10,000@A4

FIGURE No:

A11371_01_DR002_1.0



LEGEND:

Noise contours, 54 to 66 dB $L_{Aeq,16h}$ in 3 dB steps, from BAP report A9975-R01a-LBA dated 13/04/2017 and based on 2017 Joint Noise Study forecasts provided by the airport in relation to SkyPark development

REVISIONS

Bickerdike Allen Partners
Architecture
Acoustics
Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
F: 0207 625 0250

Clyst Honiton Bypass Site
Noise Assessment

Airborne Aircraft Noise Contours
2030 Forecast Average Summer Daytime
(2017 Joint Noise Study)

DRAWN: MP CHECKED: DT

DATE: March 2023 SCALE: 1:50,000@A4

FIGURE No:

A11371_01_DR003_1.0

LEGEND:

Noise contours, 54 to 66 dB $L_{Aeq,16h}$ in 3 dB steps, from BAP report A9975-R01a-LBA dated 13/04/2017 and based on 2017 Joint Noise Study forecasts provided by the airport in relation to SkyPark development

REVISIONS

Bickerdike
Allen
Partners
Architecture
Acoustics
Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
F: 0207 625 0250

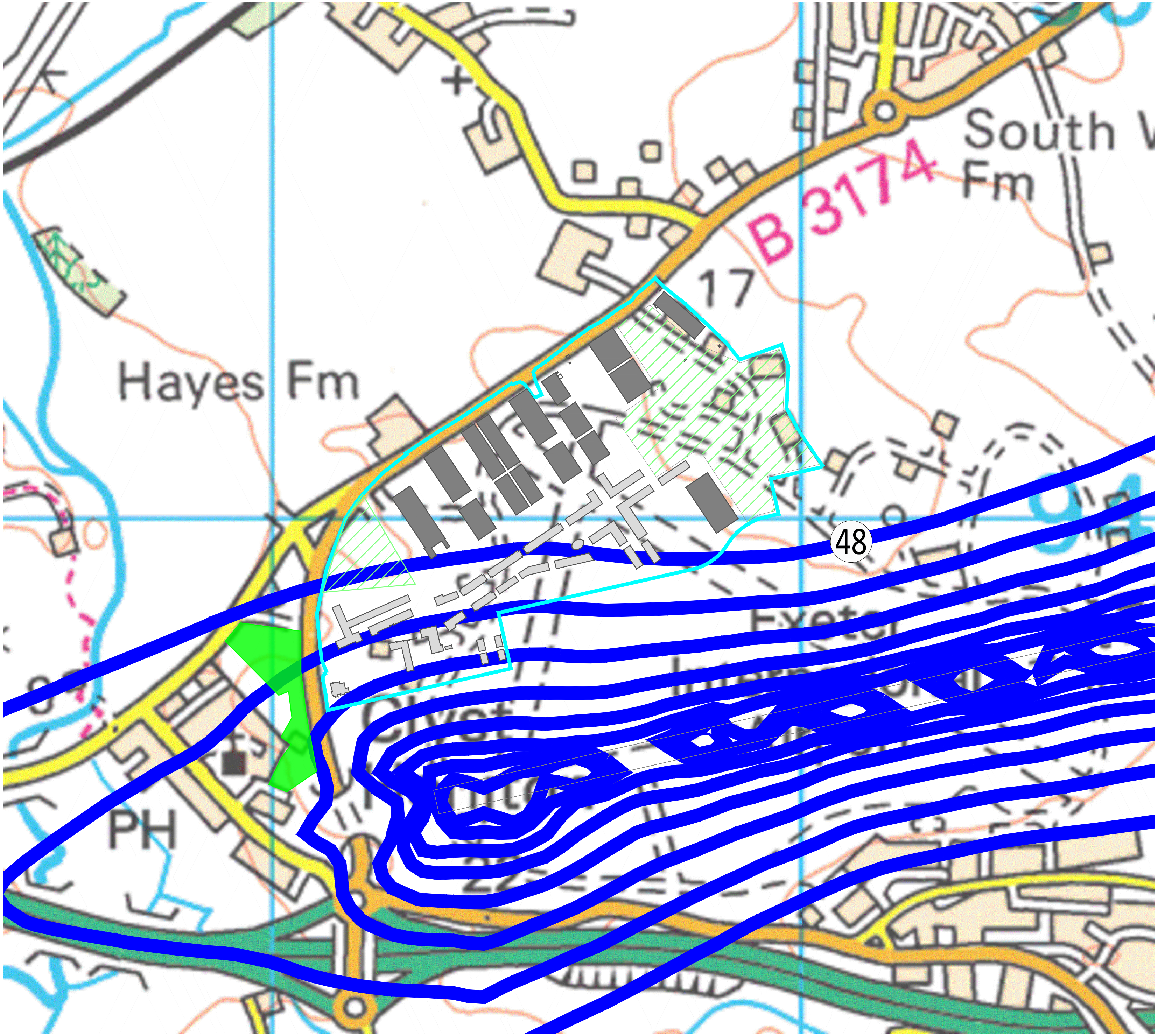
Clyst Honiton Bypass Site
Noise Assessment

Airborne Aircraft Noise Contours
2030 Forecast Average Summer Daytime
(2017 Joint Noise Study)

DRAWN: MP
CHECKED: DT

DATE: March 2023
SCALE: 1:10,000@A4

FIGURE No:
A11371_01_DR004_1.0



LEGEND:

	Noise Contours, 48 to 69 dB L_{Aeq8} in 3 dB steps
	Skypark Boundary
	Offices / Hotel / Pub
	Industry
	Amenity area

REVISIONS

Bickerdike Allen Partners
Architecture Acoustics Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
F: 0207 625 0250

Exeter and Devon Airport
Joint Noise Study

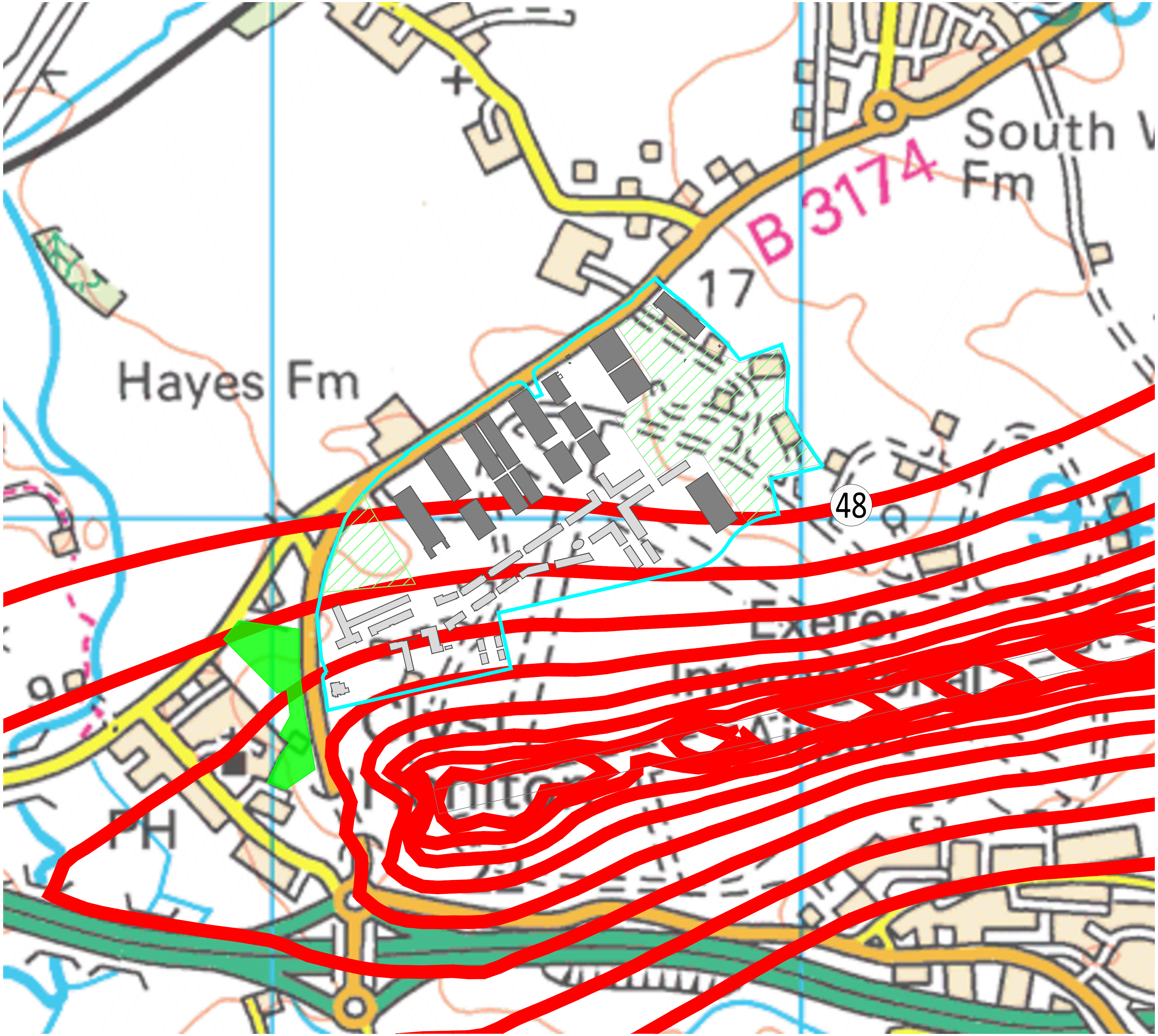
Airborne Aircraft Noise Contours
2015 Average Summer Night Time

DRAWN: LBA CHECKED: PH

DATE: February 2017 SCALE: 1:10000@A4

FIGURE No:

A9975-R01-13B



LEGEND:

- Noise Contours, 48 to 69 dB L_{Aeq8} in 3 dB steps
- Skypark Boundary
- Offices / Hotel / Pub
- Industry
- Amenity area

REVISIONS

Bickerdike Allen Partners
Architecture
Acoustics
Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com T: 0207 625 4411
www.bickerdikeallen.com F: 0207 625 0250

Exeter and Devon Airport
Joint Noise Study

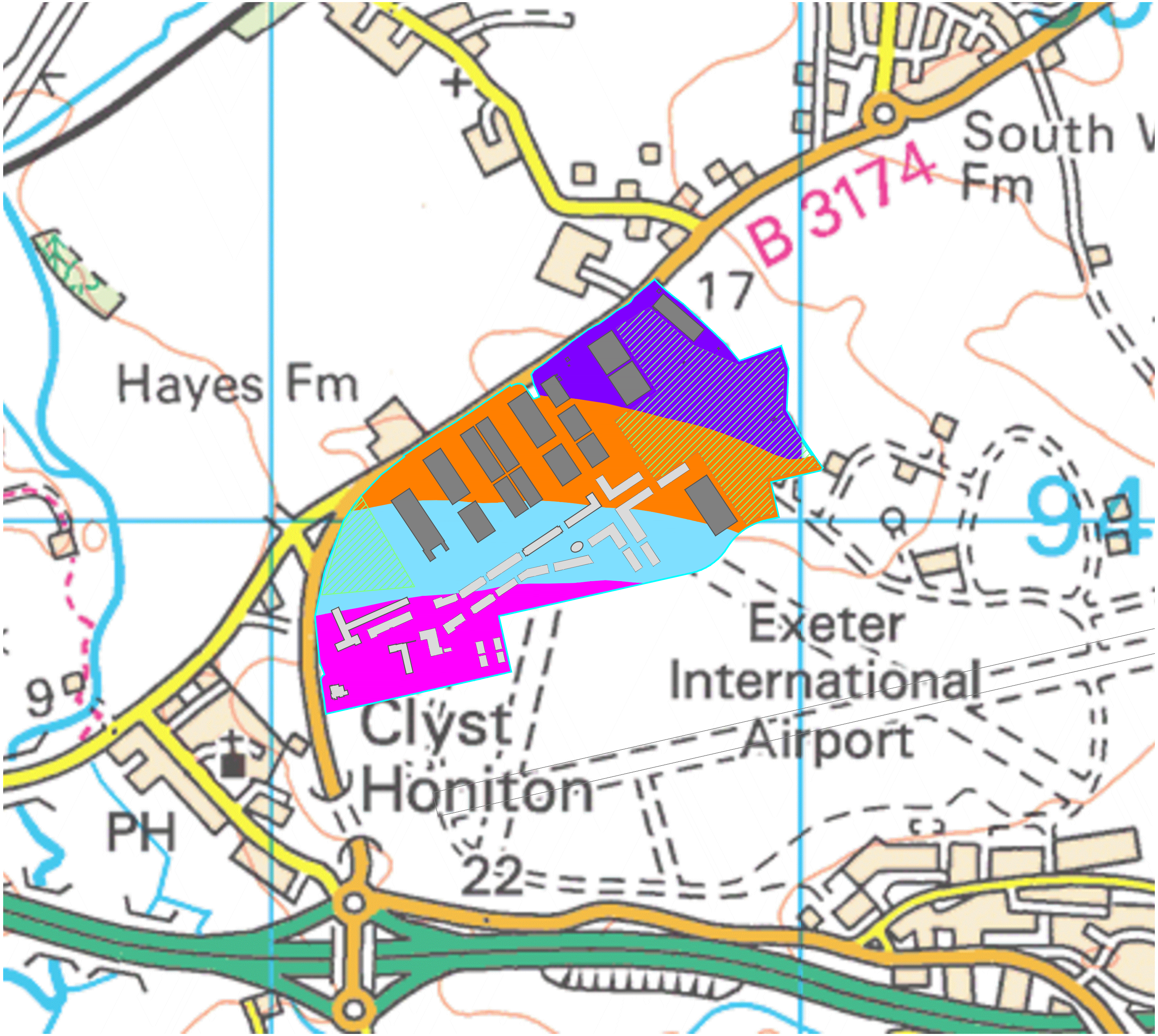
Airborne Aircraft Noise Contours
2030 Forecast Average Summer Night Time

DRAWN: LBA CHECKED: PH

DATE: February 2017 SCALE: 1:10000@A4

FIGURE No:

A9975-R01-14B



LEGEND:

- Zone A - 80-85 dB L_{Amax}
- Zone B - 75-80 dB L_{Amax}
- Zone C - 70-75 dB L_{Amax}
- Zone D - 65-70 dB L_{Amax}
- Skypark Boundary
- Offices
- Industry
- Hotel
- Amenity area

REVISIONS

Bickerdike Allen Partners
Architecture Acoustics Technology

121 Salusbury Road, London, NW6 6RG
Email: mail@bickerdikeallen.com
www.bickerdikeallen.com
T: 0207 625 4411
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Exeter and Devon Airport
Joint Noise Study

Typical Maximum Noise Levels
Boeing 737-800 Departure Runway 26

DRAWN: LBA CHECKED: PH

DATE: February 2017 SCALE: 1:10000@A4

FIGURE No: A9975-R01-19

APPENDIX 5

GROUND NOISE MODELLING METHODOLOGY & CONTOURS

MODELLING METHODOLOGY

This section of the report gives an overview of the CadnaA ground noise model developed for the CADP application. This section supplements the information presented in the report.

Input Data

The input data for the model is based on the summer movement and aircraft mix data provided to BAP. Reference noise levels and information on the duration of activities were determined by reference to previous studies at Exeter and from survey measurements. The modelling assumptions section below sets out the durations of activities observed at Exeter, and also the reference noise levels used.

Software

A computer model of the airfield and surroundings has been prepared using the environmental noise calculation software CadnaA. Incorporating buildings and barriers, the software calculates the propagation of noise from noise sources to receptors using the methodology set out in ISO 9613-2 “Attenuation of sound during propagation outdoors – General method of calculation”. As a worst case, the ground, and buildings and barriers are modelled to be reflective.

Methodology

The airfield is simplified into a number of noise source locations. These locations represent segments of an aircraft’s taxi route. By assigning a noise level to each source representing the ground activity at that location (i.e. taxiing, manoeuvring, APU, engine start-up, hold), the noise at a given receiver is calculated from the contribution of all these sources taking into account propagation and any noise barriers and reflectors. Sources representing Stands have been included in all ground noise calculations.

Specifically, for each source at a given location, a sound power level is determined based on the associated sound level, L_{Aeq}, at the reference distance of 152 m. Each source has an associated duration of activity applicable to the source location under consideration. The source sound power level is weighted according to this duration, and also according to the overall assessment period, for example 16 hours. A further weighting is applied to account for the times the source event will occur in the period of interest, based on the number of aircraft movements. This weighting takes account of the number of westerly and easterly operations whose taxi routes pass through the source location. This information is then fed into the CadnaA model to derive by receiver location the overall $L_{\text{Aeq},T}$ ground noise levels, based on the duration of interest.

MODELLING ASSUMPTIONS

The following general assumptions have been used to apply to an overall generic type of aircraft. These assumptions have been used in Environmental Statements examined at Public Inquiries on Airport Developments elsewhere, without serious challenge. On-site observations at LCY, whilst indicating considerable variation between individual aircraft operations have shown that assumptions regarding the duration of different airport operations are generally appropriate.

Aircraft movement numbers and aircraft mix are given in the tables below.

	Number of Movements Summer 2015	
Type	**Day (16h)**	**Night (8h)**
Total	8559	463
Large Jets	2	0
Medium Jets	1085	217
Corporate jets	195	3
Turbo-prop	7277	243

Number of aircraft movements

Type	**%**	
	Day (16h)	**Night (8h)**
Large Jets	0.00	0.00
Medium Jets	0.13	0.47
Corporate jets	0.02	0.01
Turbo-prop	0.85	0.52

Aircraft mix (%)

Details of departure and arrival activities are given in the tables below.

Activity		Details
Auxiliary Power Unit (APU)		10 min for all rotations
Engine start-up (idle)		60 s
Manoeuvres	90 degrees 180 degrees	10 s 20 s
Hold at edge of runway (prior to getting onto runway)		60 s
Taxiing speed (used in conjunction with model sector length to determine sector duration)	on apron on runway	10 m/s 10 m/s
Hold at start of roll		60 s

Durations of departure activities

Activity		Details
Manoeuvres	90 degrees 180 degrees	10 s 20 s
Taxiing speed (used in conjunction with model sector length to determine sector duration)	on apron on runway	10 m/s 10 m/s
Engine running on stand		60 s

Durations of arrival activities

Runway Splits

08 - 25% (day) and 35% (night)

26 - 75% (day) and 65% (night)

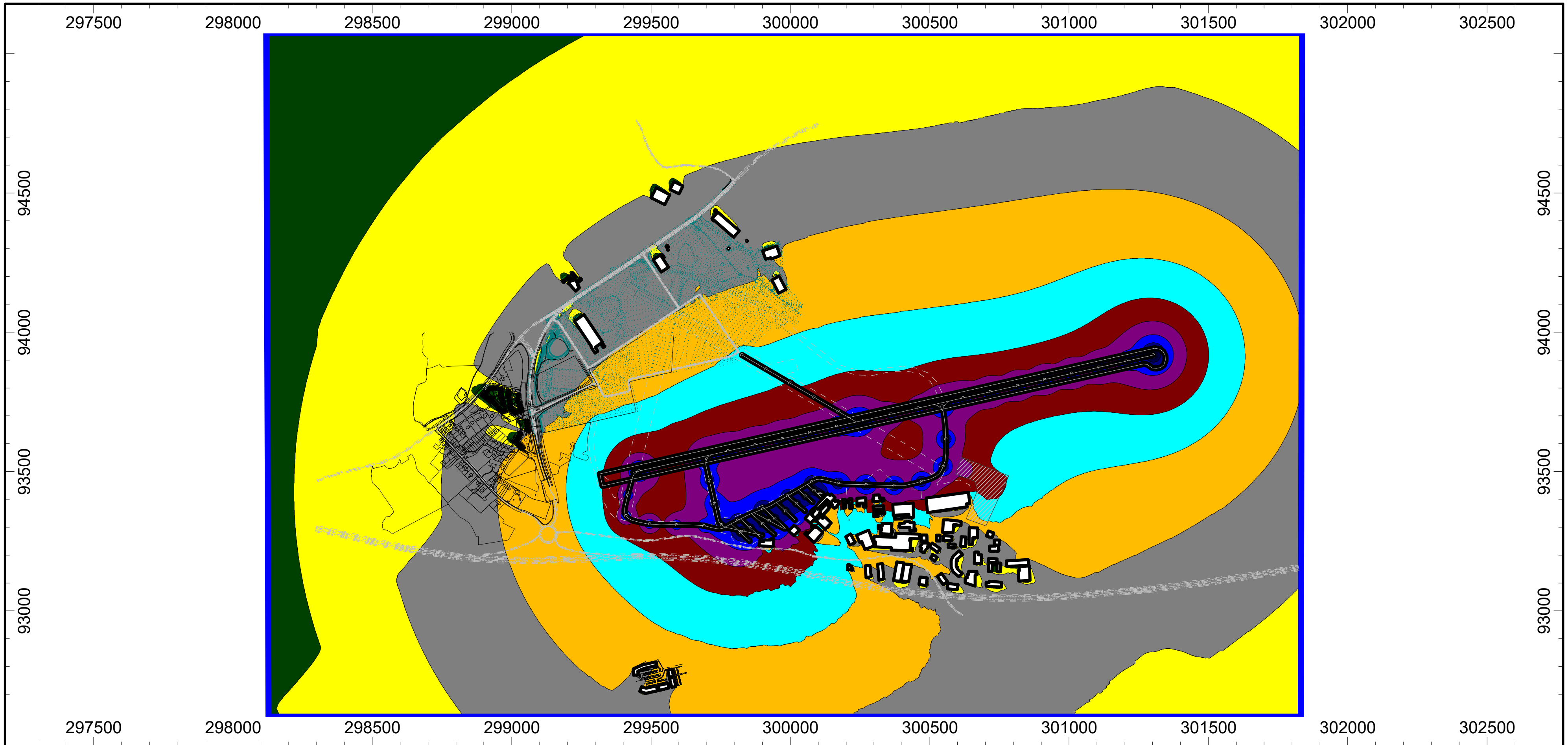
Modal split

The modal split of different operations at LCY are 66 % movements on Runway 27 and 34 % movements on Runway 09.

Reference noise levels

Activity	Level , dB(A)			
	Large Jets	Medium Jets	Corporate Jets	Turbo Prop
Taxi	74	73	67	78
Manoeuvre	79	78	72	80
Start-up	74	72	67	78
APU	63	65	65	64

Sound Levels (L_{Aeq}) at 152 m



Not to scale

March 2020

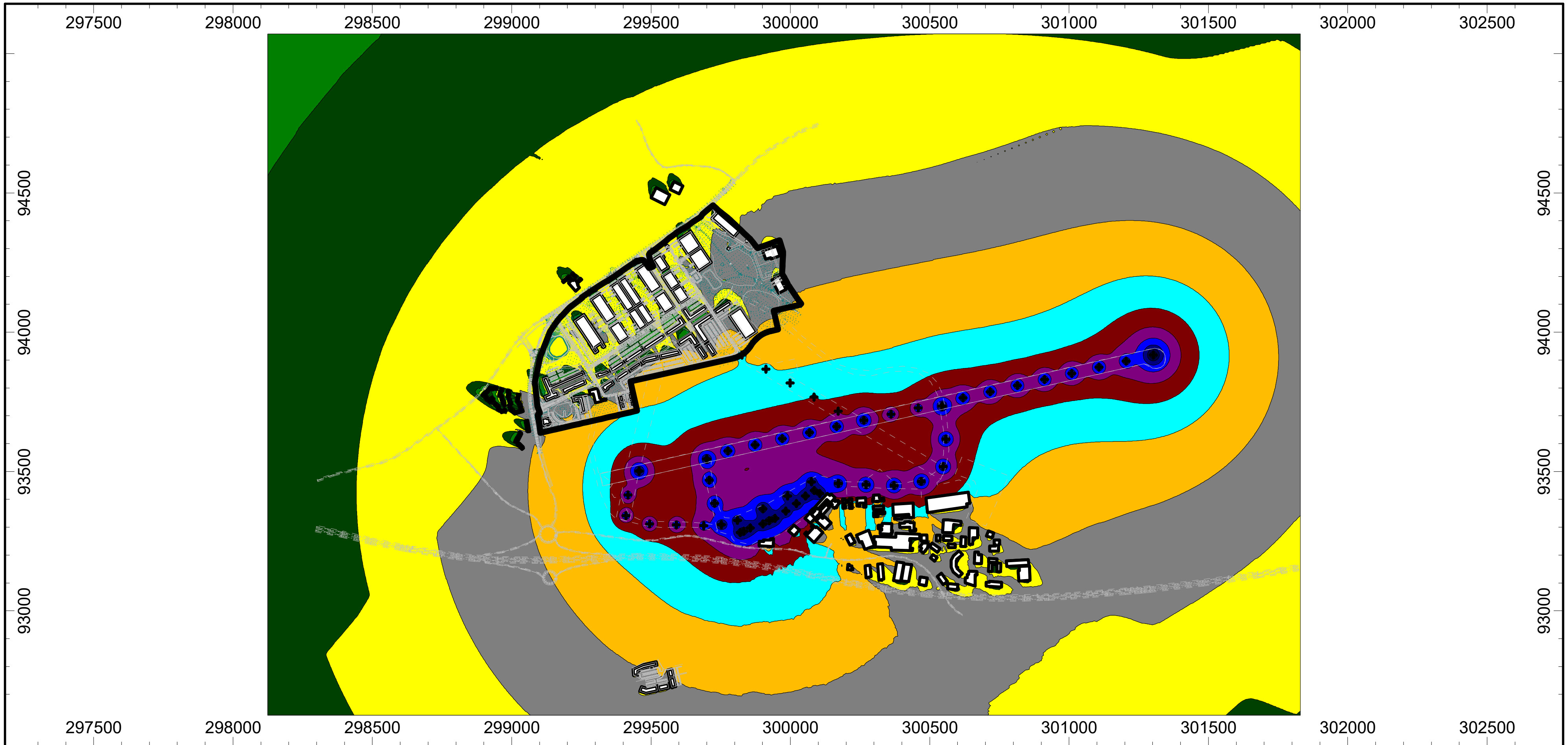
Receiver height 1.5m
Grid spacing 5 x 5 m

A11317_00_RP001_1.0

Legend
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2015 Ground noise from aircraft activities (Leq,16Hr Day)

Clyst Honiton
Noise Study



Not to scale

March 2020

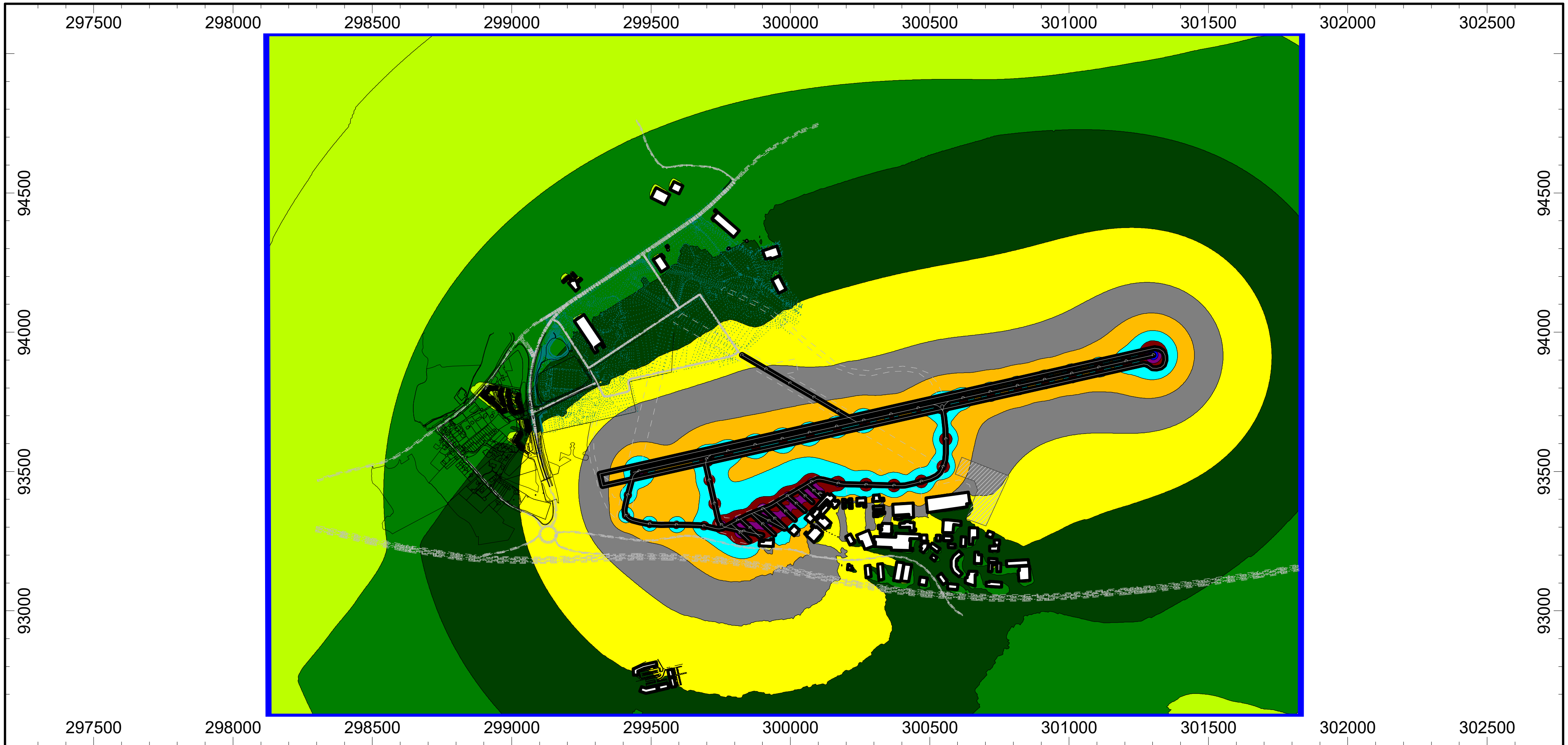
Receiver height 1.5m
Grid spacing 5 x 5 m

A11317_00_RP001_1.0

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2030 Ground noise from aircraft activities (Leq,16Hr Day)

Clyst Honiton
Noise Study



Receiver height 4.5m Grid spacing 5 x 5 m	Not to scale	March 2020
	A11317_00_RP001_1.0	
35.0 <= ... < 40.0 dB(A) 40.0 <= ... < 45.0 dB(A) 45.0 <= ... < 50.0 dB(A) 50.0 <= ... < 55.0 dB(A) 55.0 <= ... < 60.0 dB(A) 60.0 <= ... < 65.0 dB(A) 65.0 <= ... < 70.0 dB(A) 70.0 <= ... < 75.0 dB(A) 75.0 <= ... < 80.0 dB(A) 80.0 <= ... < 85.0 dB(A) 85.0 <= ... dB(A)	**2015 Ground noise from aircraft activities (Leq,8Hr Night)**	
	Clyst Honiton Noise Study	

Receiver height 4.5m Grid spacing 5 x 5 m	Not to scale	March 2020
	A11317_00_RP001_1.0	

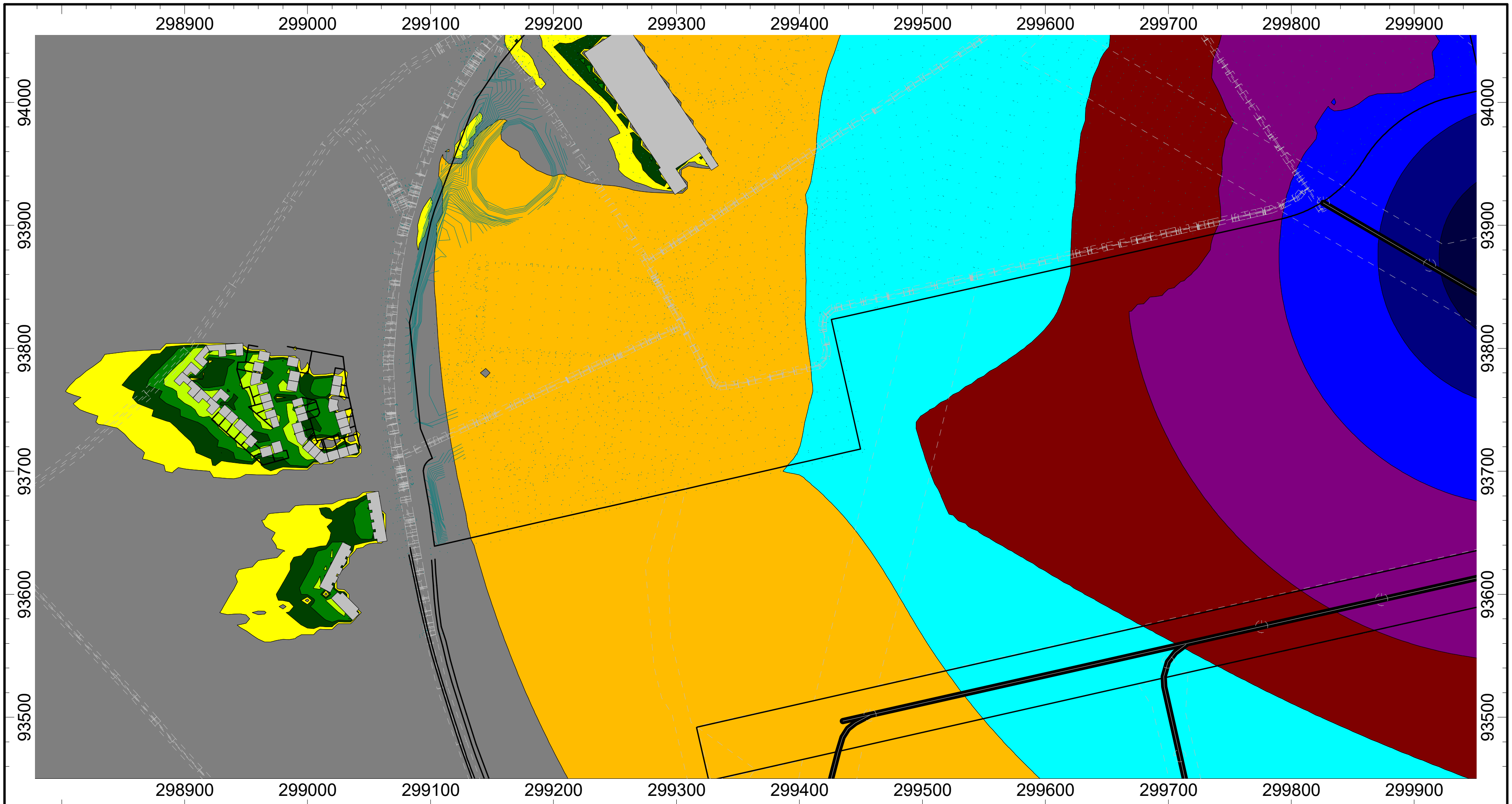
Legend
35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2030 Ground noise from aircraft activities (Leq,8Hr Night)

Clyst Honiton
Noise Study

APPENDIX 6

GROUND RUNNING NOISE CONTOURS



Receiver height 1.5m
Grid spacing 5 x 5 m

Not to scale

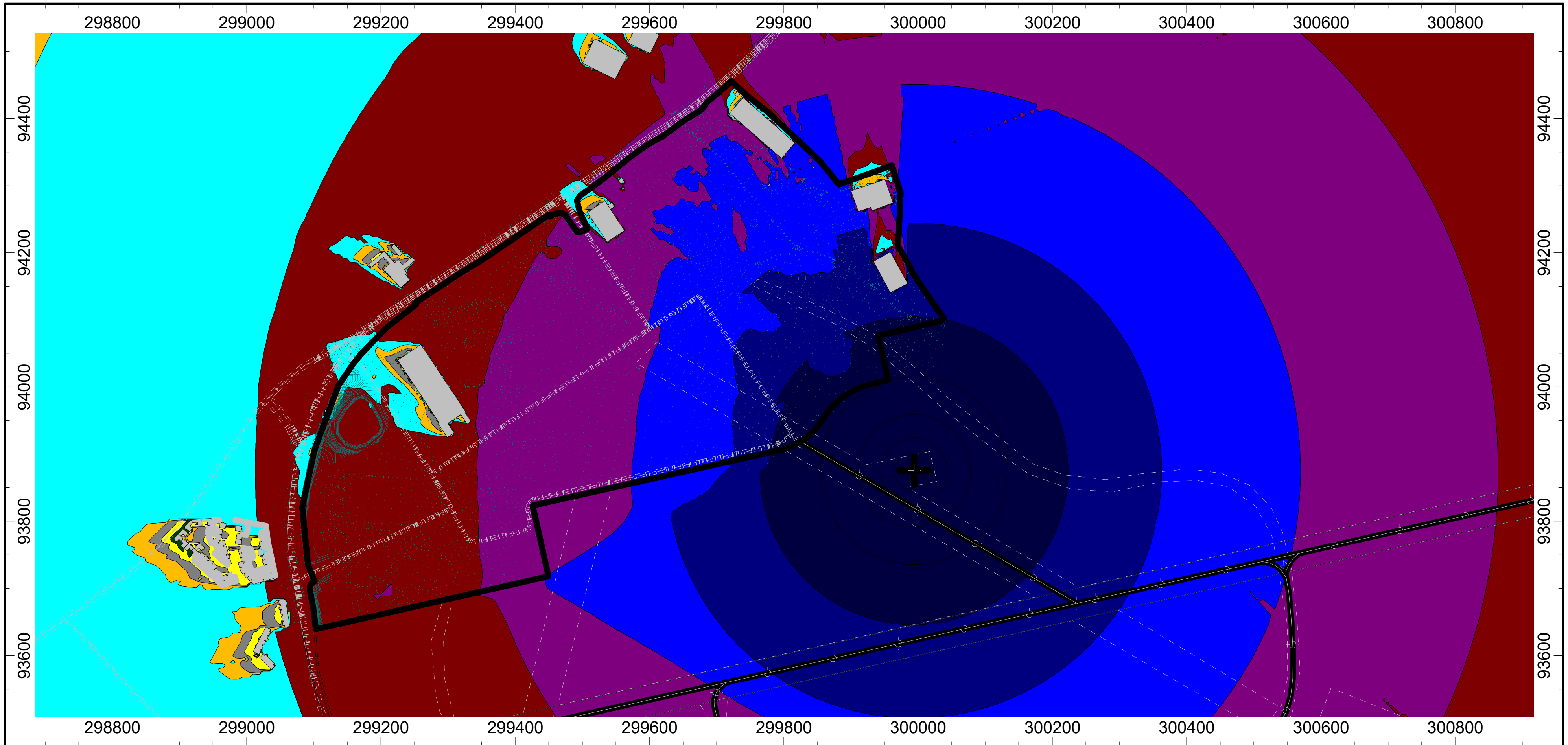
March 2020

A11317_01_RP001_1.0

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2015 Engine Test Run Dash 8-400 as a source (LAeq,1h)

Clyst Honiton noise study



Receiver height 1.5m
Grid spacing 5 x 5 m

Not to scale	March 2020

A11317_01_RP001_1.0

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2015 Engine Test Run Dash 8-400 as a source (LAmax)

Clyst Honiton noise study

Receiver height 1.5m
Grid spacing 5 x 5 m

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

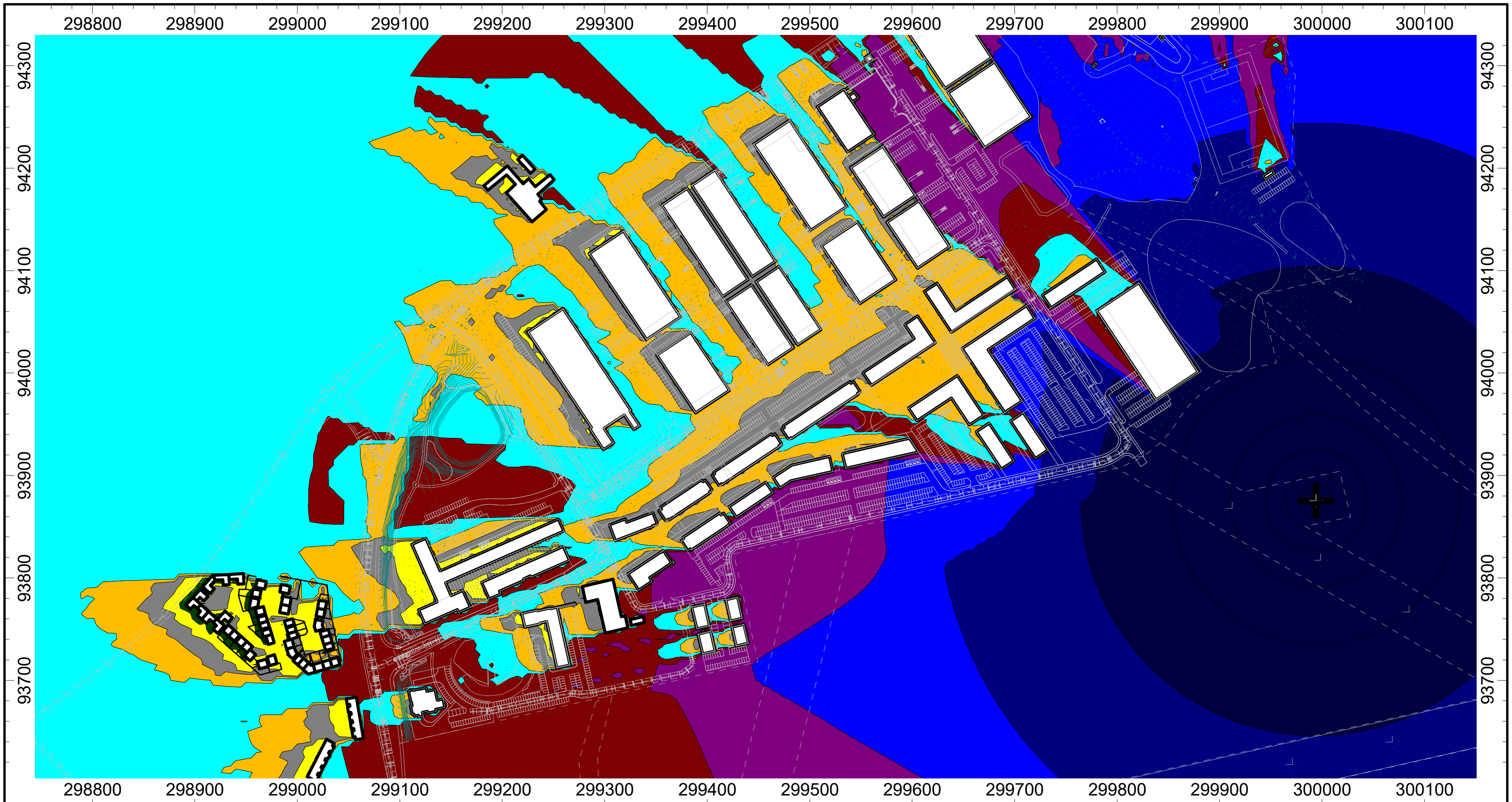
Not to scale

March 2020

A11317_01_RP001_1.0

2030 Engine Test Run Dash 8-400 as a source (LAeq,1h)

Clyst Honiton noise study



Not to scale

March 2020

Receiver height 1.5m
Grid spacing 5 x 5 m

A11317_01_RP001_1.0

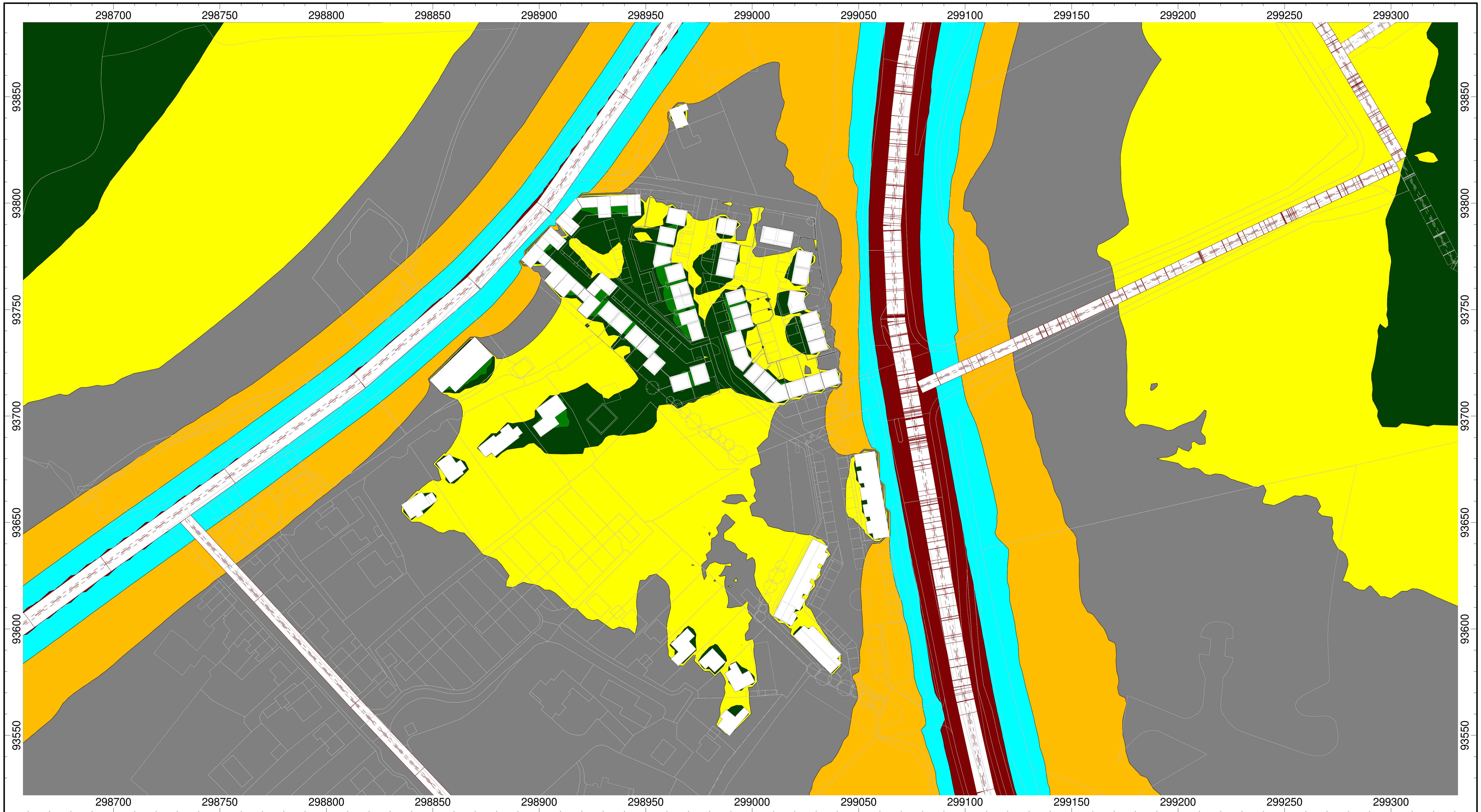
- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... < 75.0 dB(A)
- 75.0 <= ... < 80.0 dB(A)
- 80.0 <= ... < 85.0 dB(A)
- 85.0 <= ... dB(A)

2030 Engine Test Run Dash 8-400 as a source (LAmax)

Clyst Honiton noise study

APPENDIX 7

ROAD TRAFFIC NOISE CONTOURS



Not to scale

February 2020

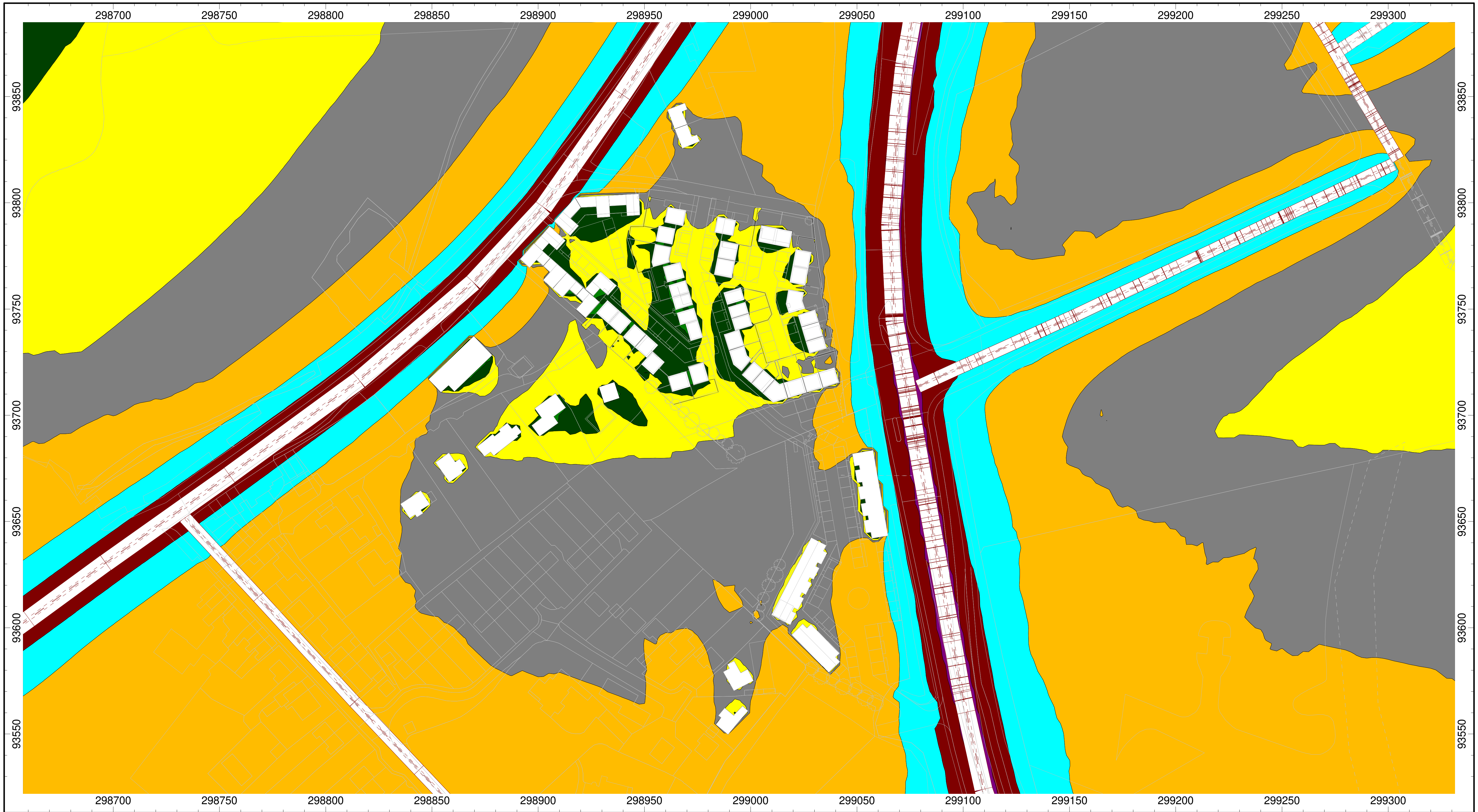
Receiver height 1.5m
Grid spacing 2.5 x 2.5 m

A11317_01_RP001_2.0

- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... < 75.0 dB(A)
- 75.0 <= ... < 80.0 dB(A)
- 80.0 <= ... < 85.0 dB(A)
- 85.0 <= ... dB(A)

2020 Road Traffic noise contours (LAeq,16h)

Clyst Honiton
Noise Assessment



Receiver height 1.5m
Grid spacing 2.5 x 2.5 m

Not to scale

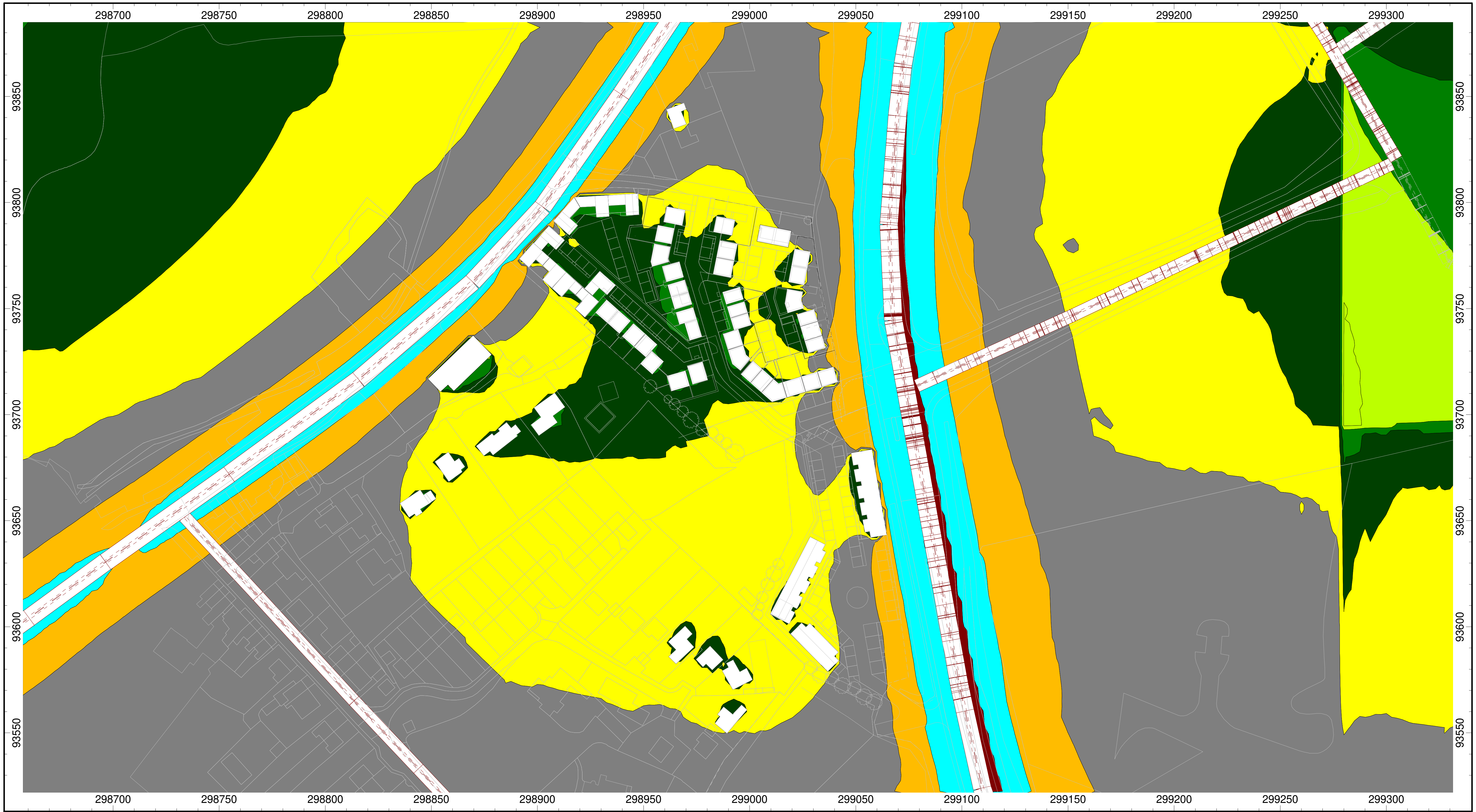
February 2020

A11317_01_RP001_2.0

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2030 Road Traffic noise contours (LAeq,16h)

Clyst Honiton
Noise Assessment



Receiver height 4m
Grid spacing 2.5 x 2.5 m

Not to scale

February 2020

A11317_01_RP001_2.0

- 35.0 <= ... < 40.0 dB(A)
- 40.0 <= ... < 45.0 dB(A)
- 45.0 <= ... < 50.0 dB(A)
- 50.0 <= ... < 55.0 dB(A)
- 55.0 <= ... < 60.0 dB(A)
- 60.0 <= ... < 65.0 dB(A)
- 65.0 <= ... < 70.0 dB(A)
- 70.0 <= ... < 75.0 dB(A)
- 75.0 <= ... < 80.0 dB(A)
- 80.0 <= ... < 85.0 dB(A)
- 85.0 <= ... dB(A)

2020 Road Traffic noise night contours (LAeq,8h)

Clyst Honiton
Noise Assessment

Receiver height 4m
Grid spacing 2.5 x 2.5 m

Not to scale

February 2020

A11317_01_RP001_2.0

35.0 <= ... < 40.0 dB(A)
40.0 <= ... < 45.0 dB(A)
45.0 <= ... < 50.0 dB(A)
50.0 <= ... < 55.0 dB(A)
55.0 <= ... < 60.0 dB(A)
60.0 <= ... < 65.0 dB(A)
65.0 <= ... < 70.0 dB(A)
70.0 <= ... < 75.0 dB(A)
75.0 <= ... < 80.0 dB(A)
80.0 <= ... < 85.0 dB(A)
85.0 <= ... dB(A)

2030 Road Traffic noise night contours (LAeq,8h)

Clyst Honiton
Noise Assessment