parkerjones acoustics

Wroxton Motocross Track

Land at Manor Farm, Balscote, Banbury

Noise Impact Assessment

18th December 2020

First Issue

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Revision History

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Executive Summary and Conclusions

This document has been written to assess the impact of noise 'pollution' generated by Wroxton Motocross Track on the residential properties in the surrounding area, as part of the planning application for the site.

ParkerJones Acoustics Limited (PJA) has attended to monitor a typical weekend event, conducting noise measurements at the track and surrounding area, and then used noise modelling to validate these results and determine noise propagation under different scenarios (i.e. different weather conditions or larger scale events at the track).

In summary, noise emissions from the Motocross track under typical use appear to reach peaks of around:

- 29 – 33 dB $L_{Aeq,1min}$ in the south and central parts of Hornton village, increasing to around 37 dB $L_{Aeq,1min}$ when heading north up the hill out of the village;
- 44 – 46 dB $L_{Aeq,1min}$ at isolated properties closer to the track between Hornton and the A422; and
- around 32 dB $L_{Aeq,1min}$ at the outskirts of the villages to the south (Alkerton and Balscote).

These levels wouldn't be particularly affected by different weather conditions, strong winds would not cause an increase in levels at receptors in the direction of the wind, but would actually benefit those in the opposite direction to the wind.

The two most relevant noise guidelines, BS 8233:2014, and WHO Guidelines, the latter which specifically states it can be used to assess motorsport noise, provide external and internal noise targets which imply that a level of 50 dB L_{Aeq} would be an acceptable level. PJA interpret this as corresponding to the LOAEL – the Lowest Observed Adverse Effect Level referenced in national planning policies. The objective of planning policies is generally to limit impacts to below or equal to the LOAEL – which appears to be the case here.

As per above, noise emissions to the majority of properties in the area, are below this 50 dB L_{Aeq} / LOAEL threshold, particularly true in Hornton where the majority of complaints has been received from with levels of closer to 30 – 35 dB L_{Aeq}. For context, *external* Motocross levels in Hornton are lower than *internal* targets for living rooms and bedrooms. Hence this suggests that whilst noise from the Motocross is audible, it is *not* at a significant enough level to be considered as a statutory noise nuisance, as it is considered to be below the LOAEL. This appears to confirm the findings of the previous monitoring conducted by the Cherwell District Council in 2018/19 in response to complaints received from residents in Hornton. The same is expected true for larger events that may be held, noise levels outside the worst-affected residential property do not exceed 50 dB $L_{Aeq,1min}$, and do not exceed 40 dB in Hornton.

PJA believes that the applicant and operator of the Motocross track should continue to mitigate noise as much as is reasonably possible, by following the guidelines of the *Code of Practice on Noise from Organised Off-Road Motor Cycle Sport* – but that noise should not pose a constraint for achieving planning permission for the development.

Contents

1.0 Introduction

ParkerJones Acoustics Limited (PJA) has been instructed to undertake a Noise Impact Assessment (NIA) to accompany the planning application for the *use of the land for a mixed use of agriculture and as a motorcross track with race meetings for up to 24 days a year (excluding set up, preparation, clear up and private practice sessions)* at the existing Wroxton Motocross Track, located at land at Manor Farm, Balscote, Banbury, which has been operating for over 30 years.

This NIA Report has been written to assess the impact of noise 'pollution' generated by the Motocross track on residential properties in the surrounding area. This has been done by attending to monitor a typical weekend event, conducting noise measurements at the track and surrounding area, and then using noise modelling to validate these results and determine noise propagation under different scenarios (i.e. different weather conditions or larger scale events at the track).

The objective of any NIA is to ensure that the risk of noise impact will be controlled sufficiently, aim to limit the impacts to no greater than the LOAEL – the Lowest Observed Adverse Effect Level – as referenced in national planning policies including the National Planning Policy Framework (NPPF), the Noise Policy Statement for England (NPSE) and the Planning Practice Guidance on Noise (PPG-N).

Whilst every attempt has been made to ensure that this report communicates effectively to a reader who might not have much knowledge of acoustics, some parts are necessarily technical. A glossary of acoustic terminology and concepts is provided in Appendix A.

2.0 Site Description and History

The site in question is the existing Wroxton Motocross Track, located at land at Manor Farm, Balscote, Banbury, under the ownership of Mrs Sandra Kerwood ('the applicant'). The application is for the *use of the land for a mixed use of agriculture and as a motorcross track with race meetings for up to 24 days a year (excluding set up, preparation, clear up and private practice sessions).*

The Site is primarily agricultural land used for grazing of livestock. However, it has been used for regular Motocross events since at least 1981. During this time, the use has occurred under a number of operators, however, for in excess of 12 years (since 2007) the Site has been operated by Mr Brian Pounder as "Banbury Motocross Club".

It is understood that the site is currently used for around 20 race events per year, with setup, clean up, and private practice days in between. Race meetings are held at weekends and are capped between 09:00 and 18:00, with an average race having around 20 – 25 bikes on the track at any one time, though larger races can reach between 35 – 40 participants, using either 2-stroke or 4-stroke machines.

Figure 2.1 shows the site location and relative distances to the residential properties and towns in the surrounding area. It is seen that the closest property is approximately 500m to the north-west ('Hornton Grounds'), with other isolated properties around 680 – 750m away. The nearest village/town is Hornton, approximately 1.1 km to the north, uphill from the track. It is understood that the majority of complaints/objections have come from Hornton (the parish council in particular).

The site has a recent history of investigations into the potential breach of planning control as a result of these objections. In 2018, Cherwell District Council ("the Council") undertook enforcement investigations in to the use of the Site. These investigations resulted in no Enforcement Actions taken, but indicating that further complaints would potentially trigger a further investigation into establishing whether a statutory nuisance exists under the Environmental Protection Act 1990.

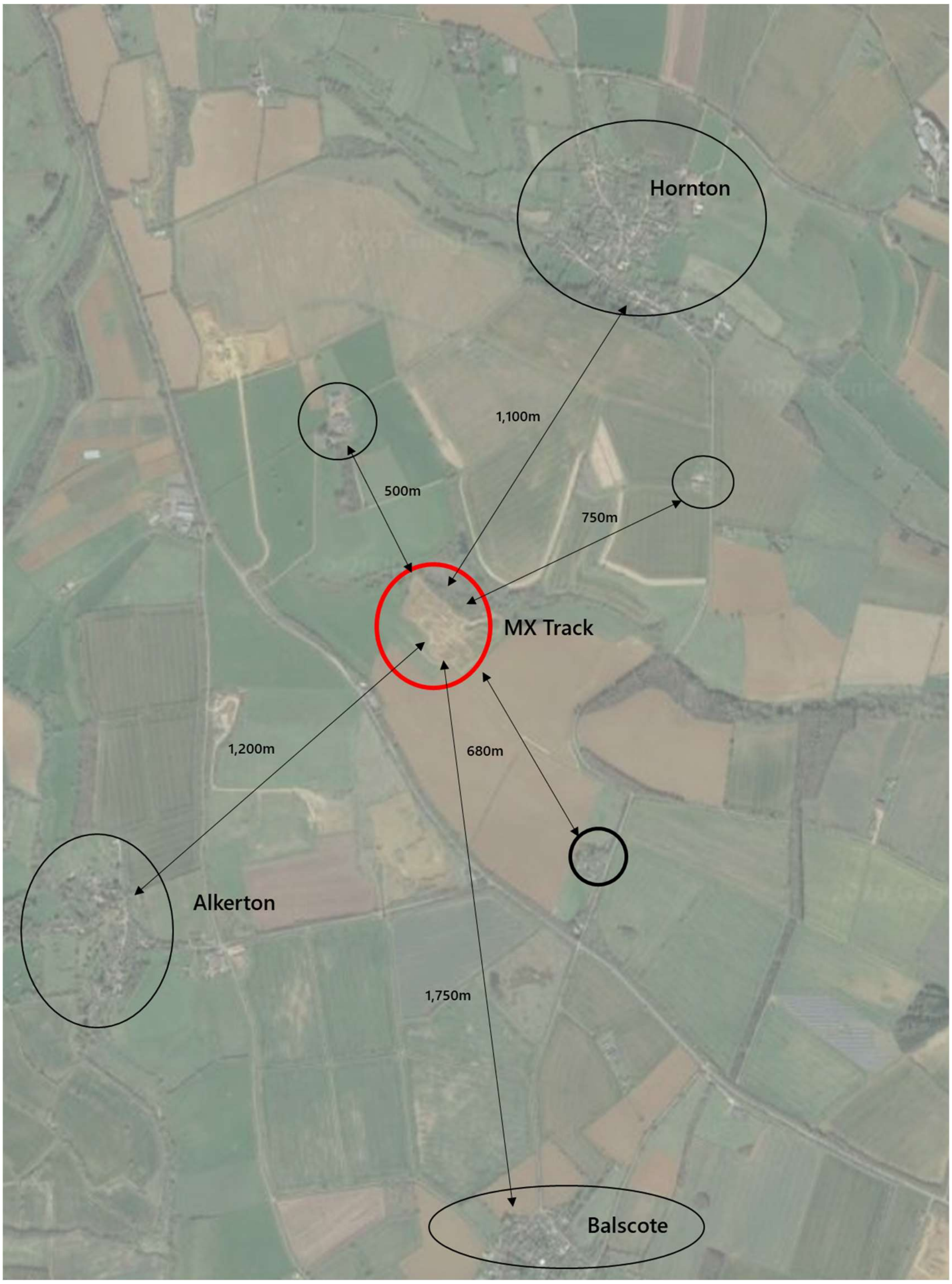
Such an investigation was again instigated in 2019 under case ref. 19/00316/ENFC. A member of the Council came out to monitor noise levels at various points around the village (Hornton) during a large event – finding that noise levels were insufficient to cause any further action to be taken. Hence to this point, a statutory noise nuisance has not been identified in Hornton. PJA has also looked at several small scale residential planning applications in the area (including closer to the track than the village of Hornton) and has not found any reference to potential noise impacts from the motocross track (or the A422 to the south).

Several objections to the site note that the track has grown substantially in recent years – though it appears to PJA that the basic shape and footprint of the track is permanent. The changes that have been made appear to be the possible addition of new straights, corners, jumps etc, but all centrally within the confines of the original footprint of the track. Therefore, the sources of noise (i.e. the motorbikes) have not moved any closer to residents.

According to Mr Pounder, the number of events has not substantially increased in the long term, i.e. an average of 21 events per year happened in three years between 2017 and 2019, compared to an average of 20 events between 2010 and 2012 (albeit a lower number of 14 – 17 events in the years between these periods).

The slight widening of the track may have enabled more bikes to race simultaneously, though not by a substantial amount, the track width appears to have remained the same since around 2009. Whilst more bikes would create noise, every doubling of the number of bikes would equate to an approximate 3 dB increase – which whilst perceptible, does not correspond to a doubling in the perception of noise, i.e. subjectively a 10 dB increase is perceived as twice as loud. It is unlikely that the number of bikes racing at any one time would have more than doubled (or even doubled at all) – as races have a limit on the number of riders per race/per practice session.

Figure 2.1 – Site location and residential properties in the surrounding area



3.0 Relevant Guidelines and Criteria

There are no clear specific guidelines which explicitly outline how noise emissions from Motocross tracks should be assessed at nearby noise sensitive properties. There also does not appear to be any specific assessment methodology which is directly applicable to this development within the planning policies/supplementary planning guidance of Cherwell District Council.

The level of noise nuisance is variable depending upon the level of the noise; the character of the noise; the existing noise levels in the area, the history of noise produced by the offending source and whether it has increased substantially over time; the time of day at which it occurs; and the sensitivity of those/changes in the behaviour of those who are affected by it.

There is no specific fixed 'noise limit' that would apply that would suggest a noise nuisance above the limit or no noise nuisance below the limit. But it shouldn't be assumed that because an offending noise is audible, that it means it is a statutory noise nuisance. The most diligent approach that can be taken where there is no clear specific assessment methodology which is directly applicable, is to make an assessment against several relevant guidelines, as outlined in the following subsections.

3.1 National Planning Policy

3.1.1 National Planning Policy Framework (NPPF)

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF provides a framework within which local people and their council can produce their own distinctive local and neighbourhood plans. With explicit reference to noise, the NPPF states that *"Planning policies and decisions should contribute to and enhance the natural and local environment by … preventing new and existing development from contributing to, being put at unacceptable risk from … noise pollution"*.

3.1.2 Noise Policy Statement for England (NPSE)

The NPPF refers to the Noise Policy Statement for England (NPSE), which applies to most forms of noise including environmental noise. The NPSE sets out the long-term vision of Government policy which is to *"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development."*. It aims that *"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:*

- *avoid significant adverse impacts on health and quality of life;*
- *mitigate and minimise adverse impacts on health and quality of life; and*
- *where possible, contribute to the improvement of health and quality of life."*

The use of the terms *"significant adverse"* and *"adverse"* are key phrases within the NPSE. The guidance establishes the concept of how the level of adverse effect on health and quality of life can be referenced including:

- NOEL – No Observed Effect Level - This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- 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.

Under the first aim of the NPSE ("avoid significant adverse impacts on health and quality of life"), an impact in line with SOAEL should be avoided. Under the second aim ("mitigate and minimise adverse impacts on health and quality of life"), where the impact lies somewhere between LOAEL and SOAEL, requiring that all reasonable steps are taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development, but does not mean that such adverse effects cannot occur.

3.1.3 Planning Practice Guidance on Noise (PPG-N)

The Planning Practice Guidance on Noise (PPG-N) is part of a suite of web-based guidance which is intended to support the implementation of the policies in the NPPF and the NPSE.

It aids in expanding on the definitions form the NPSE of NOEL, LOAEL and SOAEL, by linking these terms to 'examples of outcomes', i.e. changes in behaviour and/or attitude to noise.

The table below summarises the guidance from PPG-N in this regard.

Table 3.1 – Noise exposure hierarchy based on the likely average response – adapted from PPG-N

Perception	Examples of outcomes	Increasing effect level	Action
NOEL - No Observed Effect Level [1]			
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
LOAEL - 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 the 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

Perception	Examples of outcomes	Increasing effect level	Action
SOAEL - 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 a change in the 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 the 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
[1] This line is an assumption of the adverse effect level and is not explicitly referenced by PPG-N, though this appears to be a safe assumption.			

3.2 Motocross Guidelines

3.2.1 Auto-Cycle Union Minimum Standards

The Auto-Cycle Union *'minimum standards for the operation & management of off road motorcycle facilities'* guide (updated August 2019) provides guidelines for motorbike noise at source:

- All motorcycles must comply with a maximum sound level of 96 dB(A) for 4 stroke or 2 stroke engines. The level may be achieved by the fitting of a secure baffle or with a standard silencer system. Any machine failing this test must not be allowed on the track.
- Ideally, all machines must be sound tested before being allowed on the track.

The guideline does *not* provide any method of assessing noise emissions at noise-sensitive properties.

3.2.2 Code of Practice on Noise from Organised Off-Road Motor Cycle Sport

Guidance on noise from organised off-road motorcycling was developed by the Noise Council together with representatives of the Auto-Cycle Union (the '*Code of Practice on Noise from Organised Off-Road Motor Cycle Sport*', published in 1994).

The guidance recommends measures aimed at reducing noise with attention to providing noise reduction at source and restricting operational times. The main guidance is to reduce noise at source by imposing maximum noise limits for the bikes in use – the same as the limits in Section 3.2.1, when measured at 0.5m from the tailpipe of the bike, at an angle of 45 degrees. This method of noise measurement has to comply with The Official Federation of International Motor Cyclist tests.

This guideline does not provide a method of assessing noise emissions at noise-sensitive locations.

3.3 Residential Noise Impact Guidelines

3.3.1 World Health Organisation (WHO) Environmental Noise Guidelines

The WHO document *Guidelines for Community Noise 1999* has recently been superseded by the *Environmental Noise Guidelines for the European Region*. However, the updated guidance states that *'all WHO guidelines for community noise (CNG) indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid'*.

The 1999 document gives the following description of community noise:

"Community noise (also called environmental noise, residential noise or domestic noise) is defined as noise emitted from all sources except noise at the industrial workplace. Main sources of community noise include road, rail and air traffic, industries, construction and public work, and the neighbourhood. Typical neighbourhood noise comes from premises and installations related to the catering trade (restaurant, cafeterias, discotheques, etc.); from live or recorded music; sport events including motor sports; playgrounds; car parks; and domestic animals such as barking dogs."

Hence based upon the highlighted phrase above, this guideline appears applicable. The document sets out guidance as to noise levels at which there will be an unacceptable impact on the local community. WHO guidelines indicate:

- To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB L_{Aeq} for a steady, continuous noise.
- To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB L_{Aeq}.

These targets are regularly applied to residential developments across the UK. PJA believe that the lower limit of 50 dB L_{Aeq} corresponds to the LOAEL – the Lowest Observed Adverse Effect Level referenced in national planning policies (see Section 3.1) - the level above which adverse effects on health and quality of life can begin to be detected.

3.3.2 BS 8233:2014

BS 8233:2014 '*Guidance on Sound Insulation and Noise Reduction for Buildings*' suggests appropriate criteria and limits for different situations. This includes internal noise criteria for residential developments. The limits with BS 8233:2014 are similar to those in the WHO's *'Guidelines for Community Noise* and *Night Noise Guidelines for Europe'* document.

Table 4 of BS 8233:2014 provides internal ambient noise level (IANL) limits for dwellings from *"steady external noise sources"*. These are summarised in Table 3.2 below.

Table 3.2 – BS 8233:2014 internal ambient noise level (IANL) upper limits

Activity	Location	Daytime (07:00 – 23:00)
Resting	Living Room	35 dB $L_{Aeq,16hr}$
Dining	Dining Room/Area	40 dB $L_{Aeq,16hr}$
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16hr}$

In Annex G.1 of BS 8233:2014 it suggests that "*if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB*". Therefore, a noise limit directly outside of the nearest residential windows could be set based upon the values above plus 15 dB.

Therefore, to meet internal noise targets in nearby residential dwellings, noise should not exceed 50 dB $L_{Aeq,16hrs}$ during the daytime when measured/calculated directly outside of a residential bedroom or living room window.

These targets are regularly applied to residential developments across the UK and the limits can be considered to correspond to the LOAEL – the Lowest Observed Adverse Effect Level.

3.3.3 BS 4142:2014

BS 4142:2014 *'Methods for rating and assessing industrial and commercial sound'* is one of the most common standards used to assess the noise impact from a noise generating development on existing noise-sensitive receptors. It is typically used to assess noise emissions from plant and machinery, within the context of the existing sound environment. However, <u>it is not applicable in this case</u> as BS 4142:2014 explicitly states in paragraph 1.3 that:

"The standard is not intended to be applied to the rating and assessment of sound from:

a) recreational activities, including all forms of motorsport;..."

4.0 Assessment

4.1 Noise Survey

PJA has attended the site and surrounding area to conduct noise monitoring on Sunday 6th December 2020, during a typical weekend practice session, including:

- informal/practice races held between 09:00 and 16:30 – more or less constant throughout the day with a slightly lesser number around 12:45 – 13:15;
- typically 20 – 30 bikes on the track at any one time;
- a mixture of 2-stroke and 4-stroke bikes;
- several hundred attendees.

The meeting was held shortly after the relaxation of national Covid-19 restrictions – though was understood to be a very well attended event given the time of year. Unfortunately, PJA were not able to monitor a formal 'race day' because of Covid-19 restrictions coinciding with the deadlines imposed for the planning application. However, noise modelling has been conducted later in this report to account for potentially larger events, and events in different weather conditions.

4.1.1 Methodology

PJA conducted noise monitoring at a range of positions around the surrounding area and the track itself. The locations of the monitoring position are shown in Figure 4.1. The positions are referenced depending upon which set of noise monitoring equipment was used (mainly for PJA's benefit in interpreting the data, as three sets of equipment were used).

The surveyor was informed ahead of time that temperature checks at the entrance to the site would likely cause delays if arriving early, hence the surveyor went to the surrounding area first to conduct measurements at positions P1 and P2, before heading to the track, to install a noise monitor by the track itself (T1), to conduct test measurements behind two bikes' exhausts (a two-stroke and a four-stroke), and take other 'spot' measurements more centrally in the track (S1). The surveyor then moved to the property to the west (P3). Positions P1, P2, P3 were pre-determined before the survey to represent the properties that are believed to be the most affected.

Subsequently, the surveyor was then able to move around the area and take several other spot measurements of between 5 and 15-minutes in length at various positions around Hornton, and the villages to the south. It could be seen in Hornton that the noise exposure varied somewhat from the centre of the village to the edge due to topography, as Hornton is effectively uphill from the track and then down into a valley. For example, positions P1, S2 and S6 are approximately 30m higher than some of the positions taken more centrally in the village (S3, S4, S8).

The noise monitor from the track (T1) was collected at around 14:10 – as it was believed the event was planned to end around 14:30, though it was subsequently learnt (and heard through measurements in the surrounding area) that the event continued until 16:30.

Each of the three sound level meters were set to log noise levels over continuous 1-minute averaging periods with a 1-second time history rate. In many noise assessments, a 5-minute or 15-minute averaging period is used – however it was clear in this case that a shorter measurement period would be beneficial to capture subtle changes in noise between races/practice starting and ending (there appeared to be a 1 – 2 minute lull in motocross activity every 15 – 20 minutes) and to reflect the fact that noise levels at many of the receptor positions are influenced by local road traffic which is very intermittent in nature.

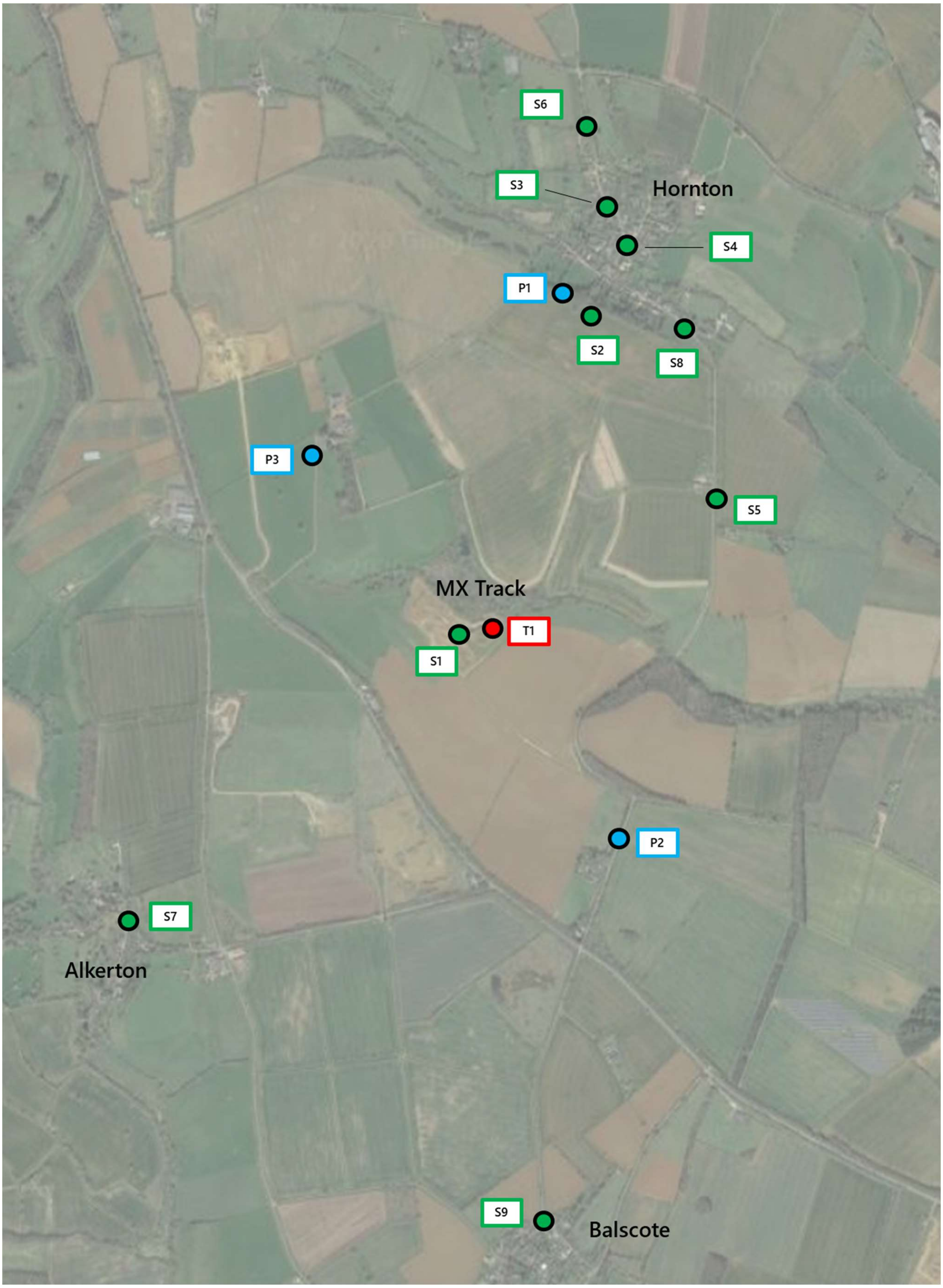
The following noise indices were recorded (amongst others):

- $L_{Aeq,T}$: The A-weighted equivalent continuous noise level over the measurement period T. This parameter is typically considered as a good representation of the average ambient sound level;
- $L_{A90,T}$: The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level' and is therefore used in determining the representative background noise level – it is useful in determining the contribution from a consistent but low level noise source such as distant road traffic from the A-road to the south, and from the Motocross track itself; and
- $L_{AFmax,T}$: The maximum A-weighted noise level during the measurement period T and the best representation of short high noise level 'events';

Weather conditions during the survey were dry, cold (temperatures around freezing), and calm, with a slight southerly breeze at times (maximum 2-3 mph).

Appendix B contains further information on the methodology of the survey, including photographs taken from the measurements and the equipment used.

Figure 4.1 – Noise monitoring positions


S6
S3
Hornton
S4
P1
S2
S8
P3
S5
MX Track
T1
S1
P2
S7
Alkerton
S9
Balscote

4.1.2 Results

Measurements at Source

Table 4.1 below provides a summary of noise levels measured trackside – with graphs provided in Appendix C.1. Noise levels at both positions are seen to peak at around 89 dB $L_{Aeq,1min}$, with an average closer to 83 dB $L_{Aeq,1min}$. For the majority of the measurement period, the track was believed to be occupied by around 20 – 30 bikes at a time (observed when the surveyor was on-site).

Table 4.1 – Summary of noise levels at the trackside positions

Location	Period	Logarithmic Average L_{Aeq} (dB)	Mean L_{A90} (dB)	Estimated Motocross Noise L_{Aeq} (dB)	Notes
T1 Trackside (52.091010, -1.433051)	11:43 – 14:11	83	70	83	Graphs in Appendix C.1 Noise relatively consistent throughout the day with a slight lull around 12:45 – 13:15 (bikes still practising but less as many people stop for lunch). A cyclical pattern in noise levels at the measurement position indicates small pauses between races/practice sessions.
S1 Centre of track (52.090864,-1.435180)	12:01 – 12:05	89	86	89	Position surrounded with track on all sides – hence peak noise levels slightly higher than at position T1.

In addition the surveyor two measurements of two bikes, one 2-stroke (250cc) and one 4-stroke (450cc) machine, at a distance of 1m behind the exhaust – measuring levels of 89 dB(A) and 93 dB(A) respectively. The surveyor was not aware of the measurement procedure described in Section 3.2 at the time, which involves measuring at 0.5m. Based on a distance loss correction, the levels above would equate to 92 dB(A) and 96 dB(A) respectively – just within the acceptable limits (and therefore it is seen that the survey included measurements with the noisiest bikes allowable).

Measurements at Receptors

Table 4.2 below provides a summary of noise levels measured in the surrounding area. Appendix C contains the set of noise data at each position, as well as a direct comparison of noise levels from the trackside and receptor positions where this was possible.

Some of the summarised results state '(exc cars)' or '(inc cars)' – detailing the average noise levels with and without cars passing by the monitoring position on the local road (as many of the monitoring positions are inevitably close to roads with vehicles passing every minute or two). This has been done as inevitably the noise level measured from a passing car will vary depending upon the distance from which it was measured. The levels *without* cars are a better representation of noise levels outside of surrounding properties/in gardens.

It is seen that the Motocross is most audible at positions outside of Hornton, nearer to isolated properties. Though in all cases, noise from the Motocross is not the dominant noise source, as road traffic noise is more prevalent, including consistent noise along the A422 as well as intermittent traffic along smaller local roads. Even at the properties closest to the track (positions P2 and P3), there is no clear obvious correlation between L_{Aeq} or L_{A90} noise levels at the receptor varying significantly depending upon what the noise levels are at the track (background L_{A90} levels are fairly consistent because of road traffic from the A422) – as demonstrated by several graphs in Appendix C.

Evidently, noise from the motocross is audible, but it doesn't appear to be having a significant impact on the overall noise levels when compared to other environmental noise sources. Hence an estimate of noise emissions from the Motocross has been given at each location based upon the analysis of the data and subjective audibility – as the exact noise emissions are too low to be directly measurable because of the influence of other noise sources.

Noise levels from the track in Hornton are relatively low and faintly audible. As described earlier, the majority of properties in Hornton sit within a valley that somewhat screens the village from the noise produced by the track in comparison to other isolated properties outside of the village, or even further north of the village. Noise levels in Hornton (where the bulk of complaints are believed to be from) are not significantly higher than those measured at the edge of Alkerton and Balscote to the south of the track.

Table 4.2 – Summary of measured noise levels at the receptor positions in the surrounding areas

Location	Period	Logarithmic Average L_{Aeq} (dB)	Mean L_{A90} (dB)	Estimated Motocross Noise L_{Aeq} (dB)	Notes
P1 South boundary of Hornton (52.100506, -1.430171)	09:14 – 10:35	53	35	30 - 33	Graphs in Appendix C.2 Motocross faintly audible but not dominant – noise from distant road traffic to the south and intermittent traffic to the north also audible/more dominant. Birdsong was a significant noise source.
P2 East of Stratford Road (52.085020, -1.427561)	09:14 – 10:35	59	46	40 - 43	Graphs in Appendix C.3 Motocross more audible than an Hornton – dominant noise source road traffic from the A422 and intermittent vehicles along Stratford Road.
P3 Hornton Grounds (52.095878, -1.441622)	12:52 – 13:05 [1]	50	37	40 - 43	Graphs in Appendix C.4 Motocross more audible than an Hornton – dominant noise source road traffic from the A422. Measurement was cut short [1] and coincided with a slightly quieter period at the track – hence the estimated noise contribution is inflated to reflect the expect noise when the track is at peak noise emissions.
S2 South boundary of Hornton (52.100021, -1.428908)	10:25 – 10:29	37	36	30 - 33	Motocross faintly audible – similar to position P1.
S3 North side of Hornton on Millers Lane (52.103008,-1.428179)	13:29 – 13:40	46 (exc cars) 69 (inc cars)	30	28 - 31	Graphs in Appendix C.5 Motocross faintly audible – noise mostly from cars driving through the village, which were frequent during the monitoring here.
S4 Central Hornton on Millers Lane (52.101992,-1.427272)	13:42 – 13:47	36 (exc cars) 52 (inc cars)	31	32 – 35	Graphs in Appendix C.6 Motocross faintly audible – noise also from cars driving through the village.
S5 Manor Farm (52.094627, -1.423171)	14:24 – 14:28	42 (exc cars) 56 (inc cars)	38	40 - 43	Motocross more notable at this location between car passing's – louder than at the locations in Hornton.

Location	Period	Logarithmic Average L_{Aeq} (dB)	Mean L_{A90} (dB)	Estimated Motocross Noise L_{Aeq} (dB)	Notes
S6 North of Hornton on Millers Lane (52.105277,-1.429011)	14:34 – 14:40	35 (exc cars) 56 (inc cars)	28	31 - 34	Motocross faintly audible, though slightly louder than at positions further south in Hornton – noise also from cars driving out of the village.
S7 Alkerton Cross Roads (52.082773, -1.450373)	15:48 – 16:01	43 (exc cars) 50 (inc cars)	32	28 - 31	Motocross barely audible, noise mainly from the roads in the area.
S8 Near Hornton Sports Pavilion – east side of Hornton (52.099641,-1.424698)	15:22 – 15:36	40 (exc cars) 46 (inc cars)	30	28 - 31	Motocross faintly audible – noise mainly from children playing in the park, people walking past, and cars driving past.
S9 Balscote cross roads with Chapel Lane (52.074417,-1.431013)	15:48 – 16:01	40 (exc cars) 52 (inc cars)	33	28 - 31	Motocross barely audible – noise mainly from cars in the area, and horses on the road.
1 – A longer measurement was planned but was interrupted by the residents of Hornton Grounds.					

4.2 Noise Modelling

As discussed in the previous section, an estimate of noise emissions from the Motocross has been given at each location based upon the analysis of the data and subjective audibility – as the exact noise emissions are too low to be directly measurable because of the influence of other noise sources.

Therefore, a 3D noise map model has been constructed of the site and surrounding area, based upon the highest/worst-case source noise levels from the trackside, and using topography data available from the Ordnance Survey. Further technical detail on the model is given in Appendix D.

The purpose of the model is to:

- Help validate the estimated noise contributions at the receptor - as the noise model purely looks at Motocross noise in the absence of all other environmental noise sources that would have been present during the survey, i.e. road traffic;
- Predict noise levels at all points in the surrounding area – to identify any potential 'noisier areas' that may not have been identified during the survey;
- Look at potential noise emissions from a bigger event with a greater number of bikes riding simultaneously – as a worst-case;
- Look at the effect of different weather conditions, as temperature and wind speed/direction can influence noise propagation significantly over long distances;

Several scenarios have been modelled, based upon:

- The event that was monitored and the weather conditions at the time of the survey (cold and minimal wind);
- The same-sized event but at different temperatures to reflect noise propagation in different seasons (as sound will refract downwards or upwards depending on temperature);
- The same-sized event at a mild temperature (seen to be the worst case) and strong winds in either a northerly direction towards Hornton, or a southerly direction away from Hornton (again as sound will refract downwards or upwards depending on wind direction in strong winds);
- A larger event based upon 40 bikes on the track at a time rather than 20 – 30, for example, a large entry field championship event compared to regular race meetups/practices.

A summary of the results is given overleaf in Table 4.3. These correspond to the noise maps in Appendix D.

Table 4.3 – Summary of modelled noise levels at the receptor positions in the surrounding areas

Location	As per the day of the survey Figure D.1 # of Bikes: 20 - 30 Temp: 0 degrees Wind: Minimal	Same sized event – mild conditions Figure D.2 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Minimal	Same sized event – warm conditions Figure D.3 # of Bikes: 20 - 30 Temp: 20 degrees Wind: Minimal	Same sized event – hot conditions Figure D.4 # of Bikes: 20 - 30 Temp: 30 degrees Wind: Minimal	Same sized event – mild/windy conditions (north) Figure D.5 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Strong northerly	Same sized event – mild/windy conditions (south) Figure D.6 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Strong southerly	Larger event – mild conditions Figure D.7 # of Bikes: 40 Temp: 10 degrees Wind: Minimal
P1 South boundary of Hornton (52.100506, -1.430171)	33.3	33.6	33.2	32.6	33.6	23.8	36.6
P2 East of Stratford Road (52.085020, -1.427561)	43.9	45.0	44.3	42.7	41.1	44.1	48.6
P3 Hornton Grounds (52.095878, -1.441622)	45.3	46.5	45.8	43.9	45.9	44.7	49.3
S2 South boundary of Hornton (52.100021, -1.428908)	32.3	32.6	32.2	31.8	32.5	22.7	35.6
S3 North side of Hornton on Millers Lane (52.103008,-1.428179)	29.1	29.1	28.9	28.7	29.1	19.3	32.2
S4 Central Hornton on Millers Lane (52.101992,-1.427272)	33.0	33.1	32.8	32.5	33.1	23.2	36.6

Location	As per the day of the survey Figure D.1 # of Bikes: 20 - 30 Temp: 0 degrees Wind: Minimal	Same sized event – mild conditions Figure D.2 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Minimal	Same sized event – warm conditions Figure D.3 # of Bikes: 20 - 30 Temp: 20 degrees Wind: Minimal	Same sized event – hot conditions Figure D.4 # of Bikes: 20 - 30 Temp: 30 degrees Wind: Minimal	Same sized event – mild/windy conditions (north) Figure D.5 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Strong northerly	Same sized event – mild/windy conditions (south) Figure D.6 # of Bikes: 20 - 30 Temp: 10 degrees Wind: Strong southerly	Larger event – mild conditions Figure D.7 # of Bikes: 40 Temp: 10 degrees Wind: Minimal
S5 Manor Farm (52.094627, -1.423171)	45.8	47.0	46.2	44.2	46.9	43.8	49.5
S6 North of Hornton on Millers Lane (52.105277,-1.429011)	37.2	38.0	36.7	35.0	38.0	28.1	40.9
S7 Alkerton Cross Roads (52.082773, -1.450373)	32.3	32.6	31.9	31.3	25.4	32.2	35.3
S8 Near Hornton Sports Pavilion – east side of Hornton (52.099641,-1.424698)	31.3	31.5	31.2	30.9	31.4	21.6	34.0
S9 Balscote cross roads with Chapel Lane (52.074417,-1.431013)	31.7	32.2	31.1	30.1	25.2	32.2	35.8

The results of the first scenario from Table 4.3 (replicating conditions from the survey) are seen to be close to or slightly higher than the estimated noise contributions from the survey by around 1 – 4 dB. This is not surprising as the model is based upon the highest $L_{Aeq,1min}$ values at source, not the average. The results provide a good indication that the model is accurate.

The worst-case increase from a change in temperature is 1.2 dB at 10 degrees (from Figure D.1 to D.2). Again, this is not surprising as ISO 9613-2:1996 – a standard for calculating noise propagation – is based upon a temperature of 10 degrees). This is not a significant increase.

The change in noise levels from wind direction is almost nothing in the direction that the wind is blowing (Figure D.2 to D.5). This can be seen in Figures D.5 and D.6; the wind direction has the effect of making it much quieter to receptors in the opposite direction to which the wind is blowing – it does not make it noisier to receptors in the direction of the wind compared to if it was calm.

This is because sound travelling in the direction of the wind is refracted down towards the ground. Some of this sound energy is reflected back off the ground or absorbed by it. The level of ground absorption is high on greenfield land, which accounts for the majority of the surrounding area. On the other hand, if sound is travelling against the wind direction, it is refracted upwards towards the sky, and therefore does not carry as far over long distances.

The perception of most people is that noise levels increase when the wind is blowing in their direction. But it is actually the contrast between wind directions, for example, if the wind were blowing away from the receptor (causing a noise shadow zone) initially, and then either stopped blowing or changed direction towards the receptor, then a noticeable difference would be observed. But if there was no wind in the first place, and then the wind started blowing in the direction of the receptor, there would not be much difference in terms of noise perception.

Hence as the wind conditions on the day were relatively calm (< 3 mph), it is not expected that a windy day would cause noise levels to rise at the nearest receptors.

Finally, Figure D.7 represents an increase in the number of bikes on the track (from 20 to 30 up to 40) – a more substantial increase of 3 – 5 dB is seen. The increase is somewhat dependent upon where the bikes are on the track, i.e. a larger number of bikes would presumably mean that the race fields are more spread out, therefore with noise sources (bikes) covering more areas of the track. Theoretically, if all of the bikes were stationary, and the number was doubled, the total noise emission would be increase by 3 dB – but because they may be spread out more, the increase may be as much as 5 dB. But evidently, this would change on a minute-by-minute basis.

4.3 Analysis and Conclusions

In summary, noise emissions from the Motocross track under typical use (20 – 30 bikes at a time) appear to reach peaks of around:

- 29 – 33 dB $L_{Aeq,1min}$ in the south and central parts of Hornton village, increasing to around 37 dB $L_{Aeq,1min}$ when heading north up the hill out of the village;
- 44 – 46 dB $L_{Aeq,1min}$ at isolated properties closer to the track between Hornton and the A422; and
- around 32 dB $L_{Aeq,1min}$ at the outskirts of the villages to the south (Alkerton and Balscote).

These levels wouldn't be particularly affected by different weather conditions, strong winds would not cause an increase in levels at receptors in the direction of the wind, but would actually benefit those in the opposite direction to the wind.

The two most relevant noise guidelines, BS 8233:2014, and WHO Guidelines, the latter which specifically states it can be used to assess motorsport noise, provide external and internal noise targets which imply that a level of 50 dB L_{Aeq} would be an acceptable level. PJA interpret this as corresponding to the LOAEL – the Lowest Observed Adverse Effect Level referenced in national planning policies (see Section 3.1). Planning policy generally aims to mitigate noise to below the LOAEL.

As per above, noise emissions to the majority of properties in the area, are below this 50 dB L_{Aeq} / LOAEL threshold, particularly true in Hornton where the majority of complaints has been received from with levels of closer to 30 – 35 dB L_{Aeq}. For context, *external* Motocross levels in Hornton are lower than *internal* targets for living rooms and bedrooms. Hence this suggests that whilst noise from the Motocross is audible, it is *not* at a significant enough level to be considered as a statutory noise nuisance. This appears to confirm the findings of the previous monitoring conducted by the Cherwell District Council. The same is true for larger events that may be held, noise levels outside the worst-affected residential property do not exceed 50 dB $L_{Aeq,1min}$.

Appendix A – Acoustic Terminology and Concepts

A.1 – Glossary

Table A.1 – Glossary of acoustic terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. It is defined as 20 times the logarithm of the ratio of the root-mean-square pressure of the sound and a reference pressure (2x10-5 Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
Frequency	Sound can occur over a range of frequencies extending from the very low, such as the rumble of thunder, up to the very high such as the crash of cymbals. Sound is generally described over the frequency range from 63Hz to 4000Hz (4kHz). This is roughly equal to the range of frequencies on a piano.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time, would contain the same amount of acoustical energy as the A-weighted fluctuating sound measured over that period. This parameter is typically considered as a good representation of the 'average' overall noise level. It is referred to technically as the A-weighted equivalent continuous sound level and is a dB(A) as defined above.
$L_{A90,T}$	The A-weighted noise level that is exceeded for 90% of the measurement period T. This parameter is often considered as the 'average minimum level'.
$L_{AFmax,T}$	The maximum A-weighted noise level during the measurement period T.

A.2 – Subjective Changes in Noise Level

Table A.2 – Subjective loudness from an increase or decrease in sound pressure level

Change in sound pressure level	Relative change in sound power energy (multiplier)		Change in apparent subjective loudness (for mid-frequency range)
	Decrease	Increase	
3 dB	1/2	2	'Just perceptible'
5 dB	1/3	3	'Clearly noticeable'
10 dB	1/10	10	'Half or twice as loud'
20 dB	1/100	100	'Much quieter, or louder'

Appendix B – Noise Survey Methodology

B.1 – Survey Equipment

The monitoring equipment used for the baseline noise survey is detailed in the table below. The sound level meter was calibrated before and after the survey, with no significant drifts of greater than 0.5 dB observed. The sound level meter has been calibrated to a traceable standard within the 24 months preceding the survey, and the calibrators have been calibrated to a traceable standard within the 12 months preceding the survey. The equipment complies with the standards of as BS EN 60942:2003 Class 1 device.

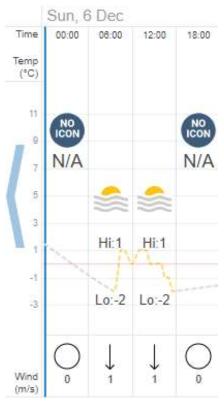
Table B.1 – Equipment used for the noise survey

Measurement Positions	Name	Serial Number	Last Calibrated	Calibration Due
T1	SVAN 949 Class 1 Sound Level Meter	9720	Oct-19	Oct-21
	SV22 Class 1 Microphone	4012386	Oct-19	Oct-21
P#	SVAN 949 Class 1 Sound Level Meter	9719	Oct-19	Oct-21
	SV22 Class 1 Microphone	4011862	Oct-19	Oct-21
S#	Pulsar Quantifier 95 Class 1 Sound Level Meter	B21270	Oct-20	Oct-22
	Pulsar MK:244 Class 1 Microphone	20043748	Oct-20	Oct-22
All	Pulsar 105 Acoustic Calibrator	53698	Oct-20	Oct-21

B.2 – Meteorological Conditions

During the survey, weather conditions were cold (around freezing), dry, and with very slight southerly windspeeds of up to 1 ms^{-1} / 3 mph (the microphone was fitted with a weather protection kit/windshield nonetheless). These weather conditions are suitable for the measurement of environmental noise in accordance with BS 7445 '*Description and Measurement of Environmental Noise*'. The weather data below has been sourced from https://www.timeanddate.com/weather/@2633471/historic?month=12&year=2020.

Figure B.1 – Meteorological conditions during the survey



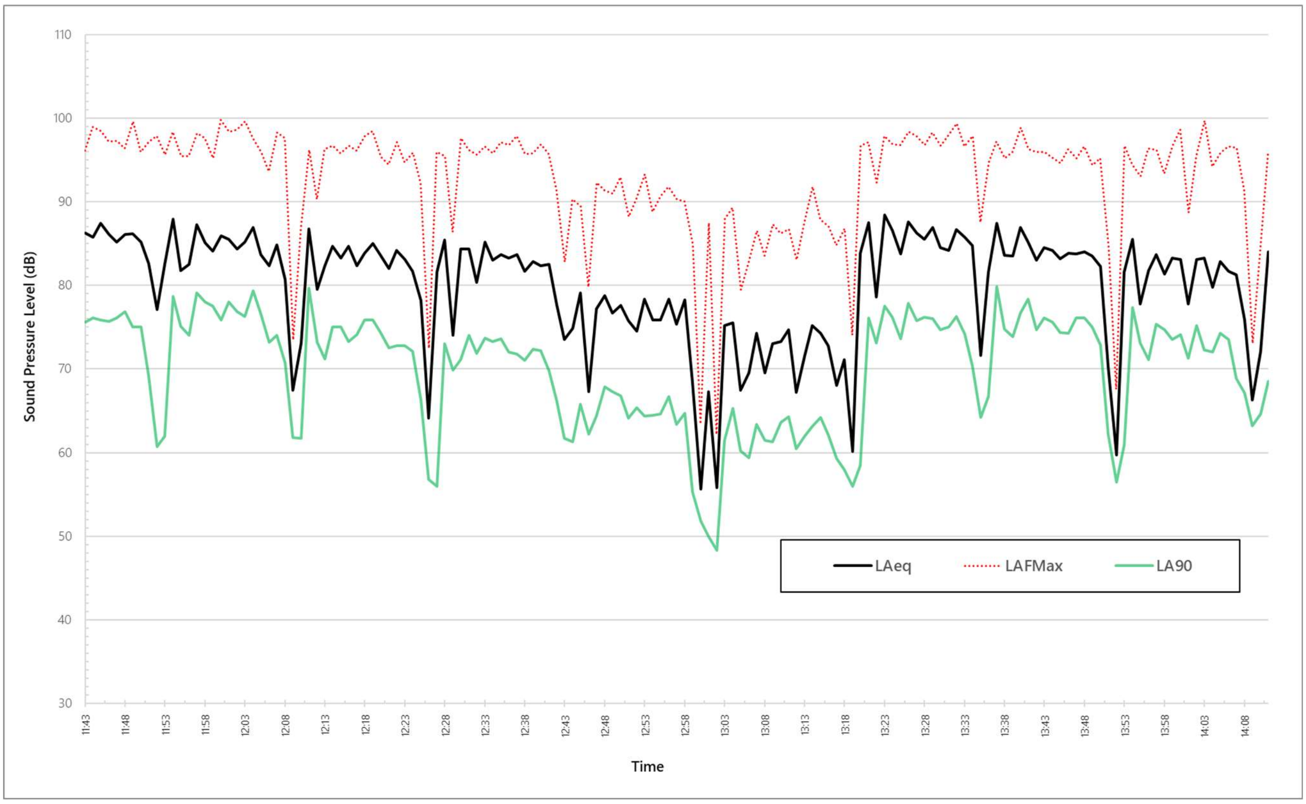
B.3 – Photographs

Figure B.2 – Photographs from the survey on the 6th December

Appendix C – Noise Survey Results

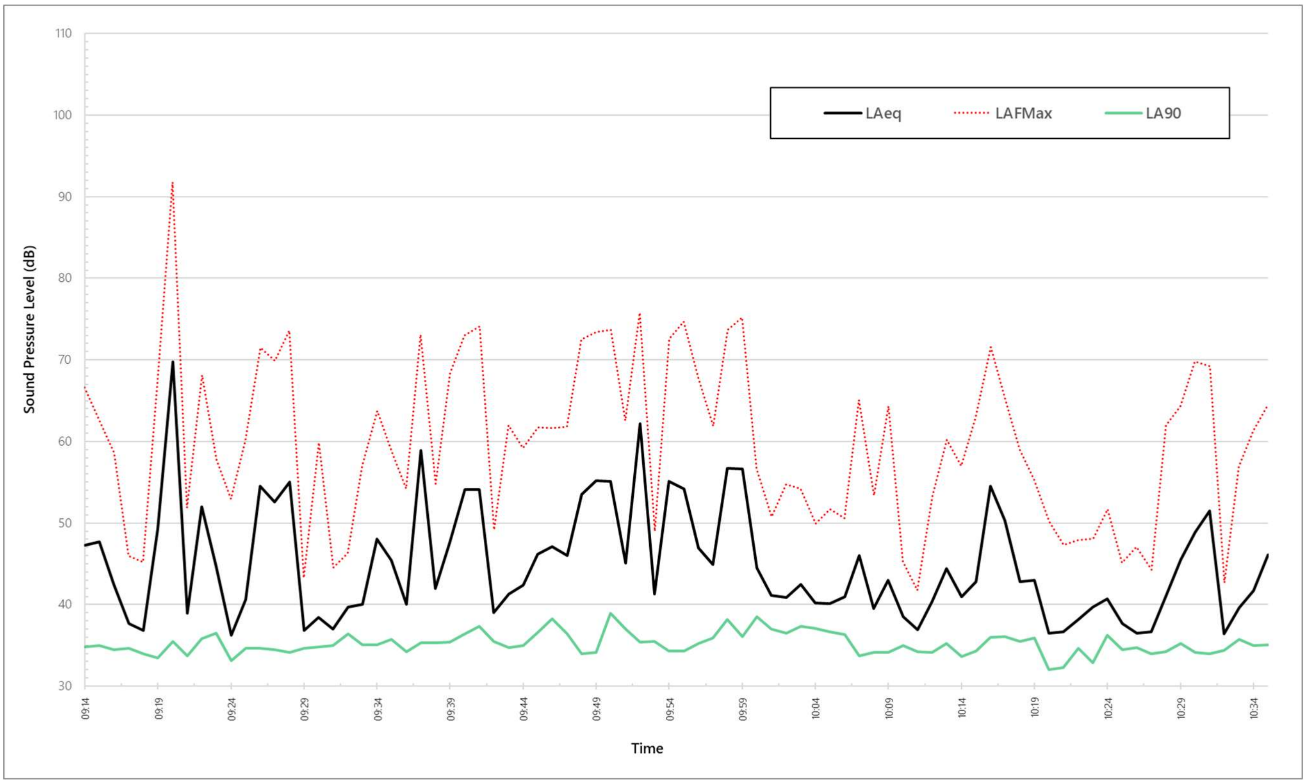
C.1 – T1 (Trackside)

Figure C.1 – Measured levels from position T1 (trackside)



C.2 – P1 (South boundary of Hornton)

Figure C.2 – Measured levels from position T1 (trackside)



C.3 – P2 (East of Stratford Road)

Figure C.3 – Measured levels from position P2

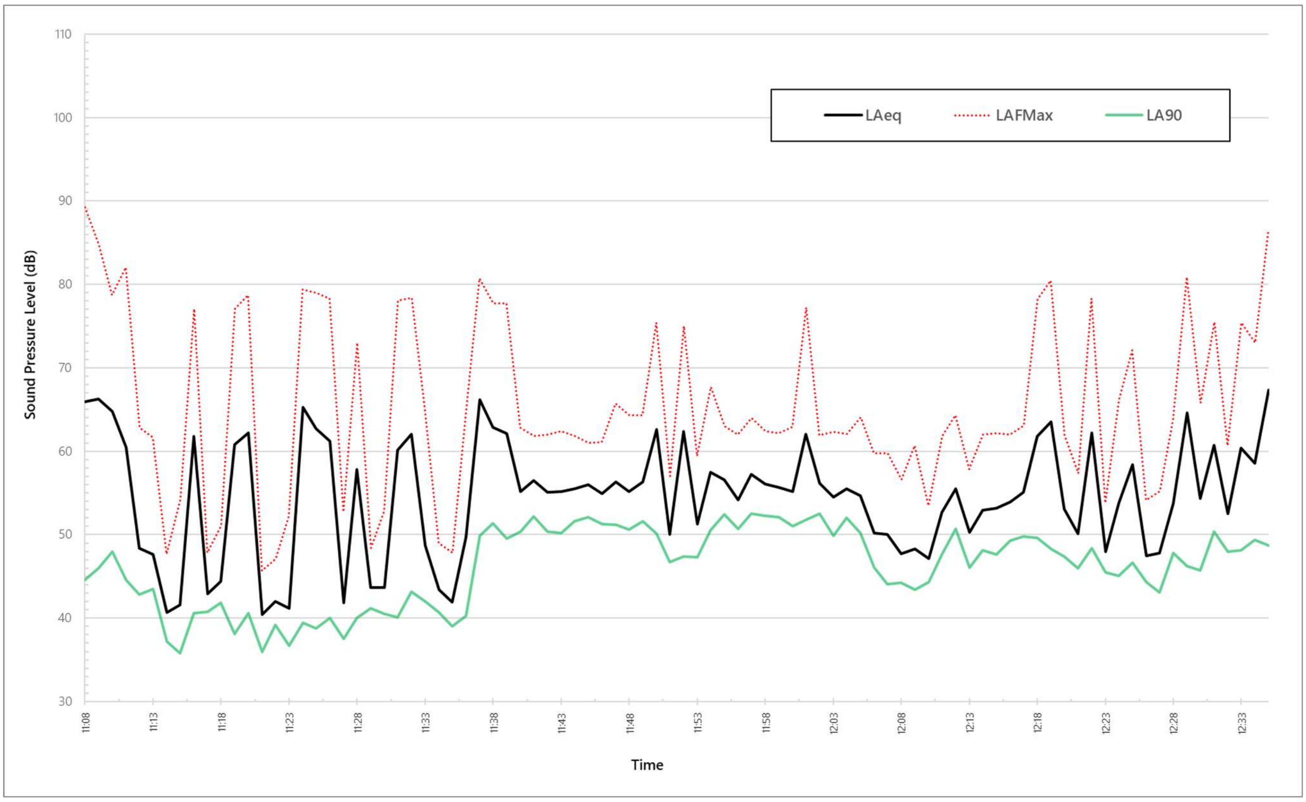


Figure C.4 – Measured L_{Aeq} levels from Track (T1) vs P2

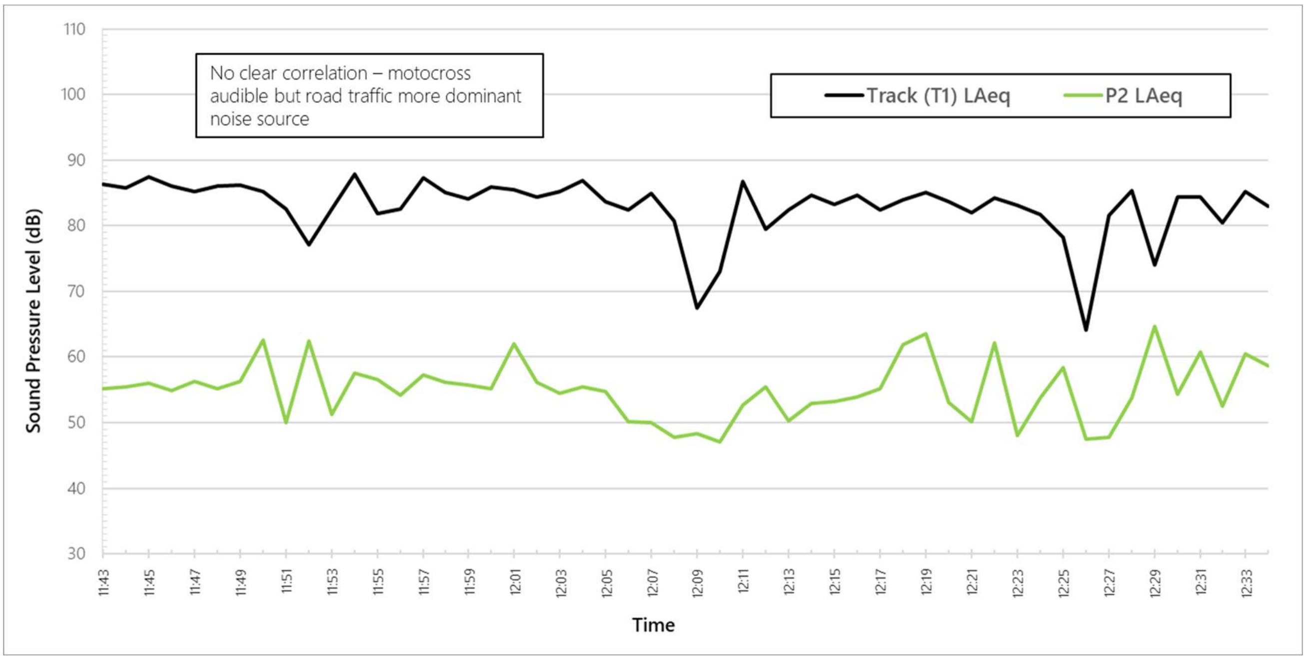


Figure C.5 – Measured L_{A90} levels from Track (T1) vs P2

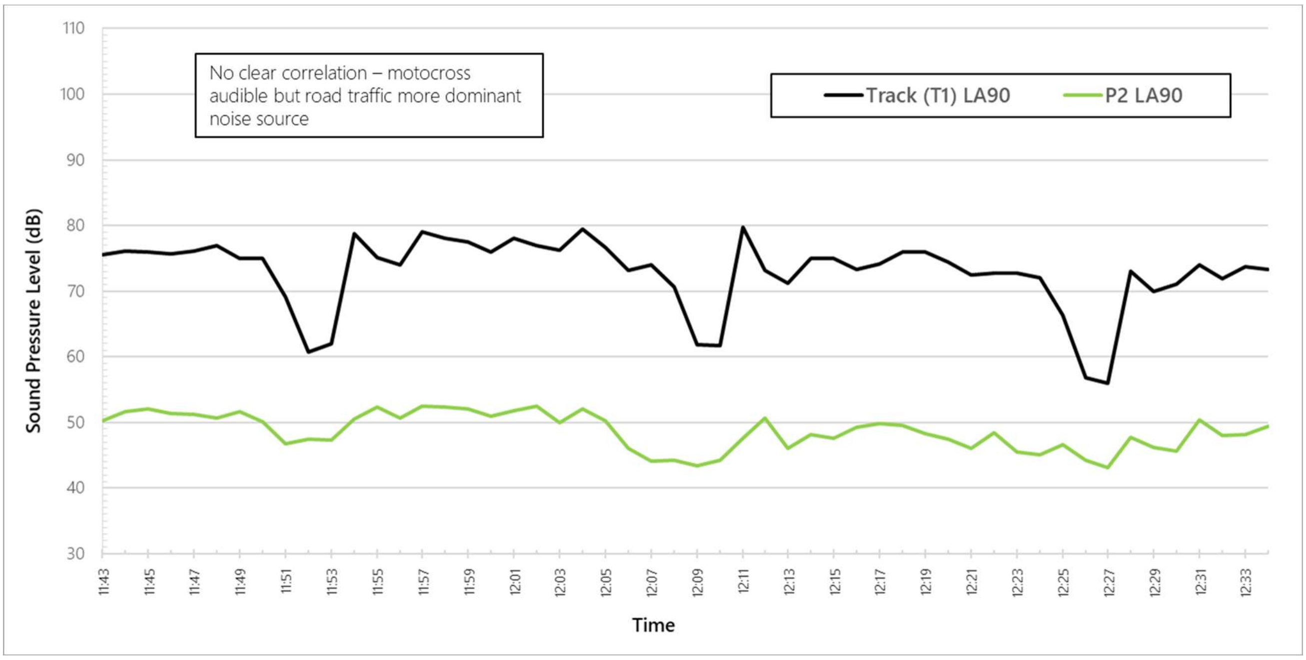
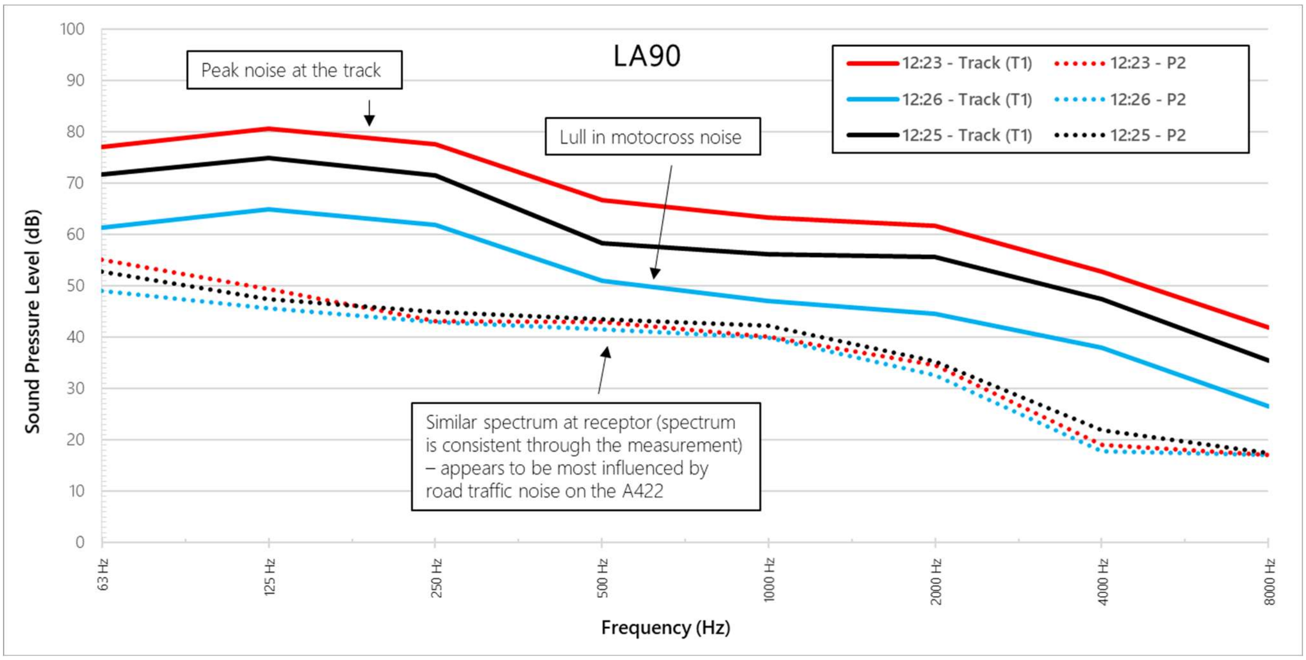


Figure C.6 – Measured 1/1 octave band L_{A90} levels from selected measurements at Track (T1) vs P2



C.4 – P3 (Hornton Grounds)

Figure C.7 – Measured levels from position P3

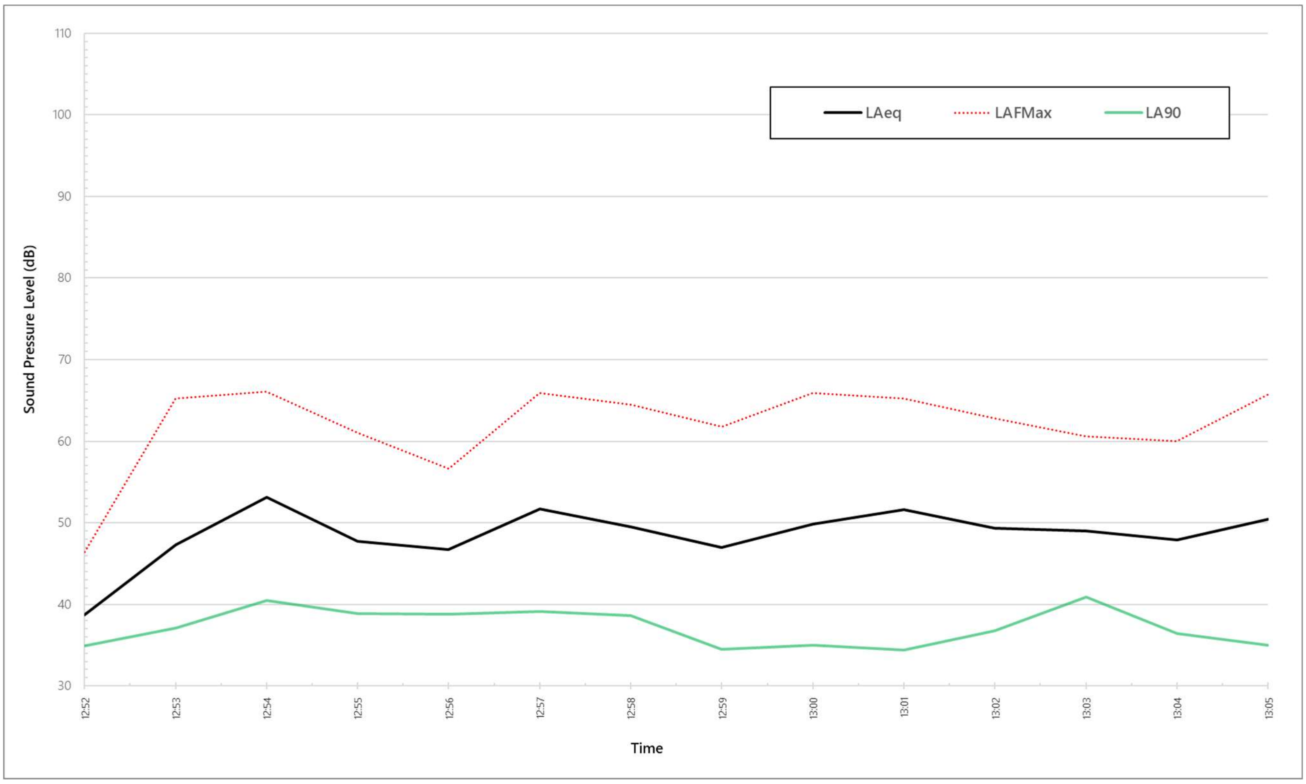


Figure C.8 – Measured L_{Aeq} levels from Track (T1) vs P3

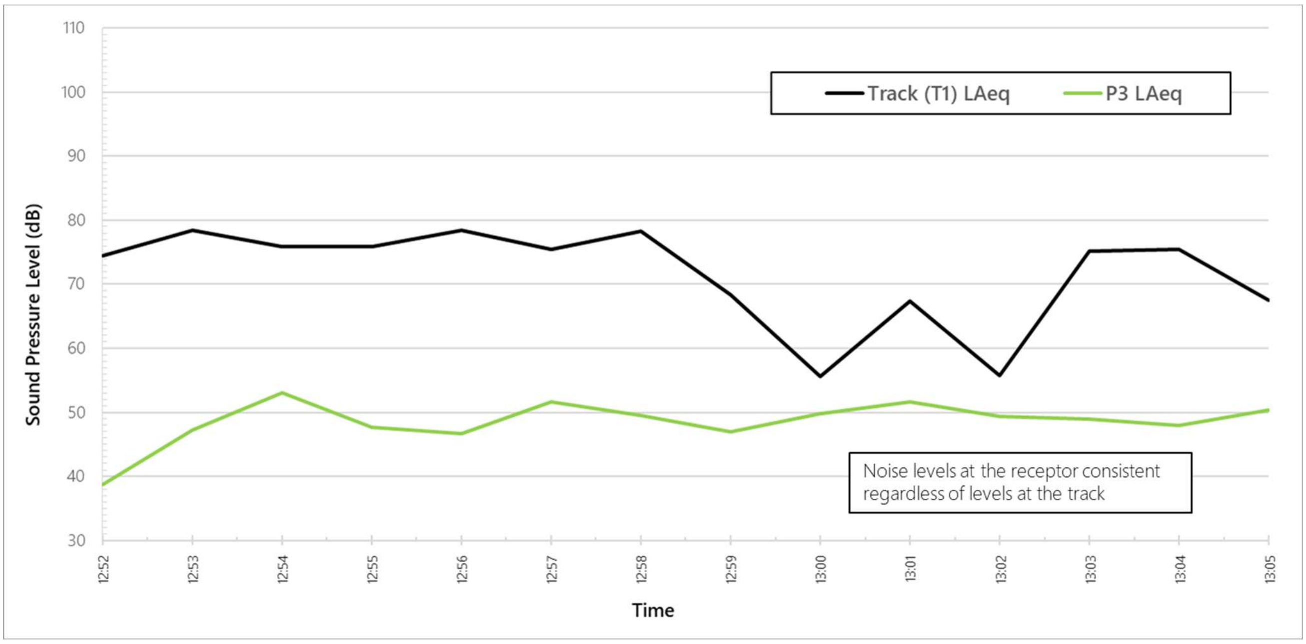


Figure C.9 – Measured L_{A90} levels from Track (T1) vs P3

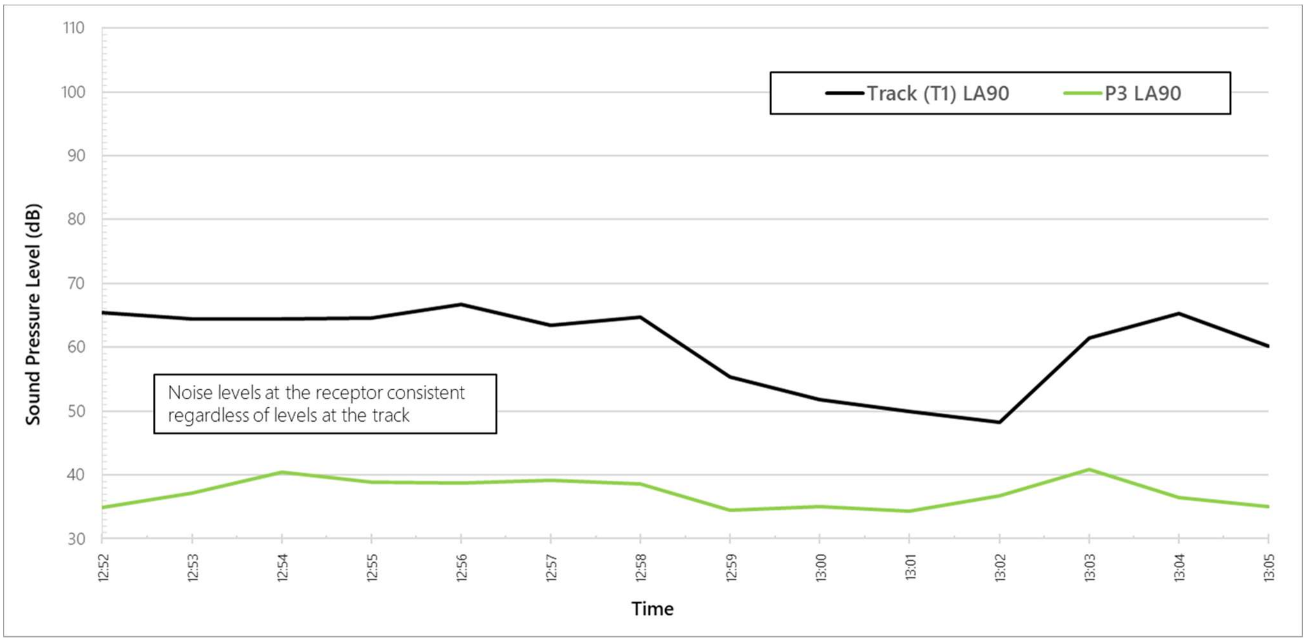
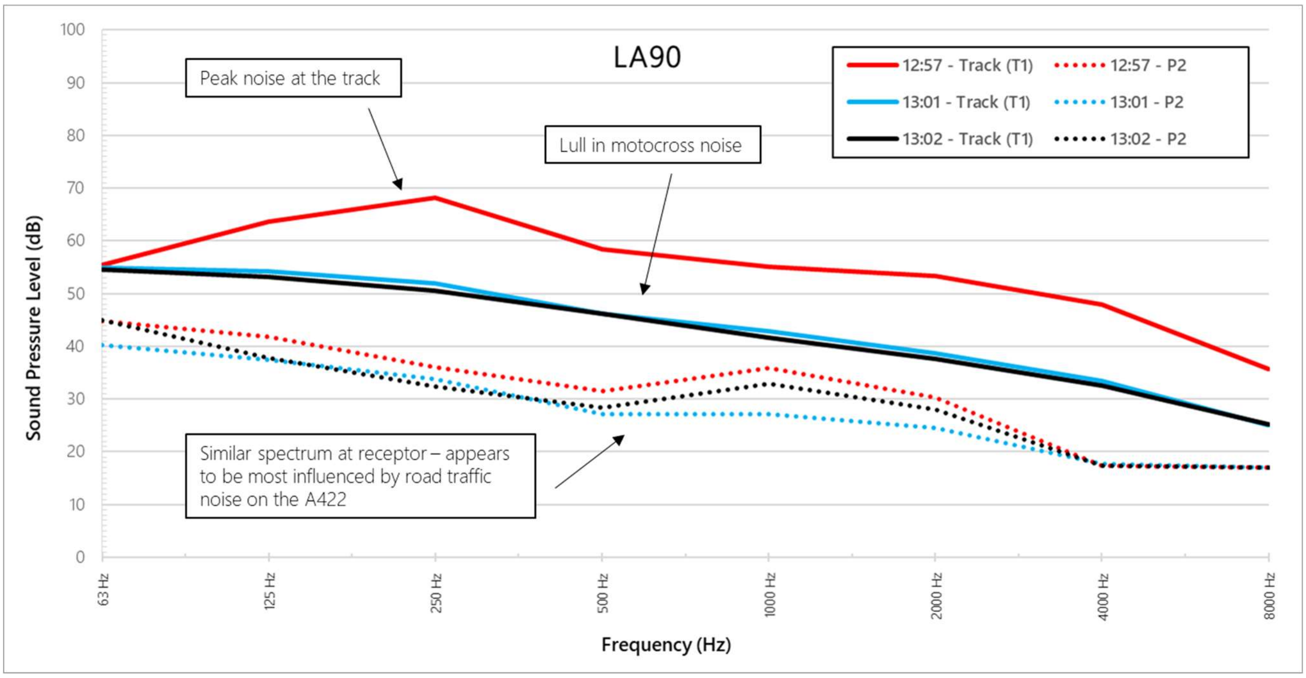


Figure C.10 – Measured 1/1 octave band L_{A90} levels from selected measurements at Track (T1) vs P3



C.5 – S3 (North side of Hornton on Millers Lane)

Figure C.11 – Measured L_{Aeq} levels from Track (T1) vs S3

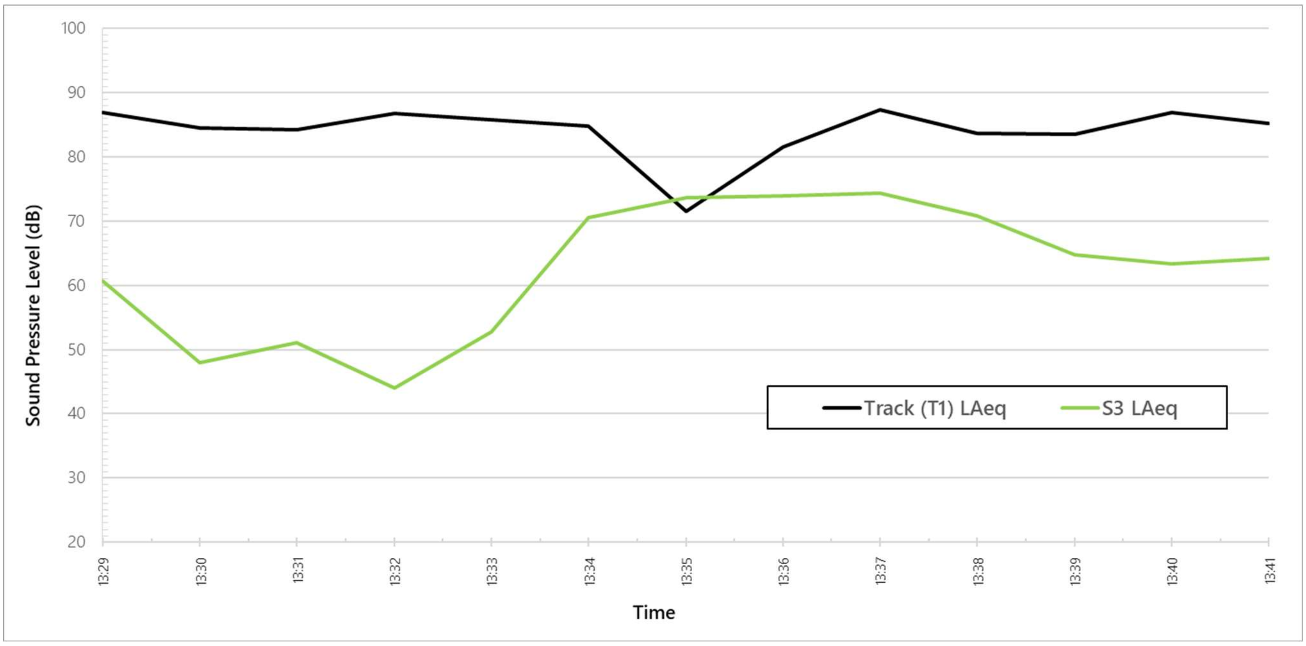
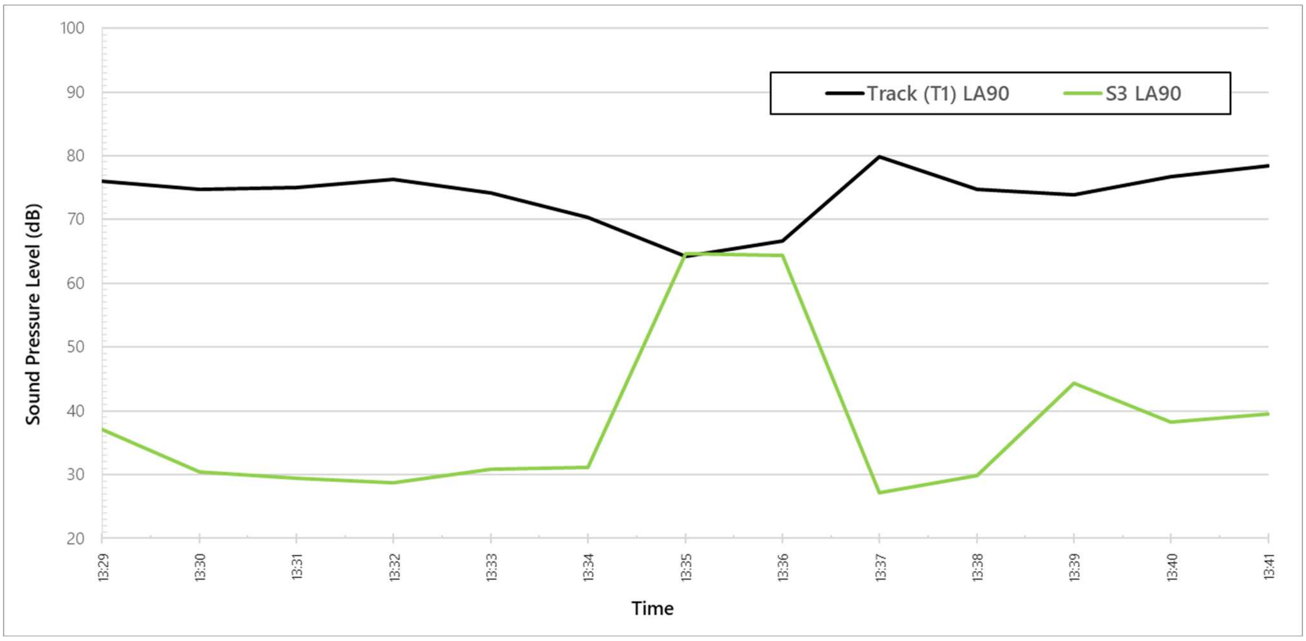


Figure C.12 – Measured L_{A90} levels from Track (T1) vs S3



C.6 – S4 (Central Hornton on Millers Lane)

Figure C.13 – Measured L_{Aeq} levels from Track (T1) vs S4

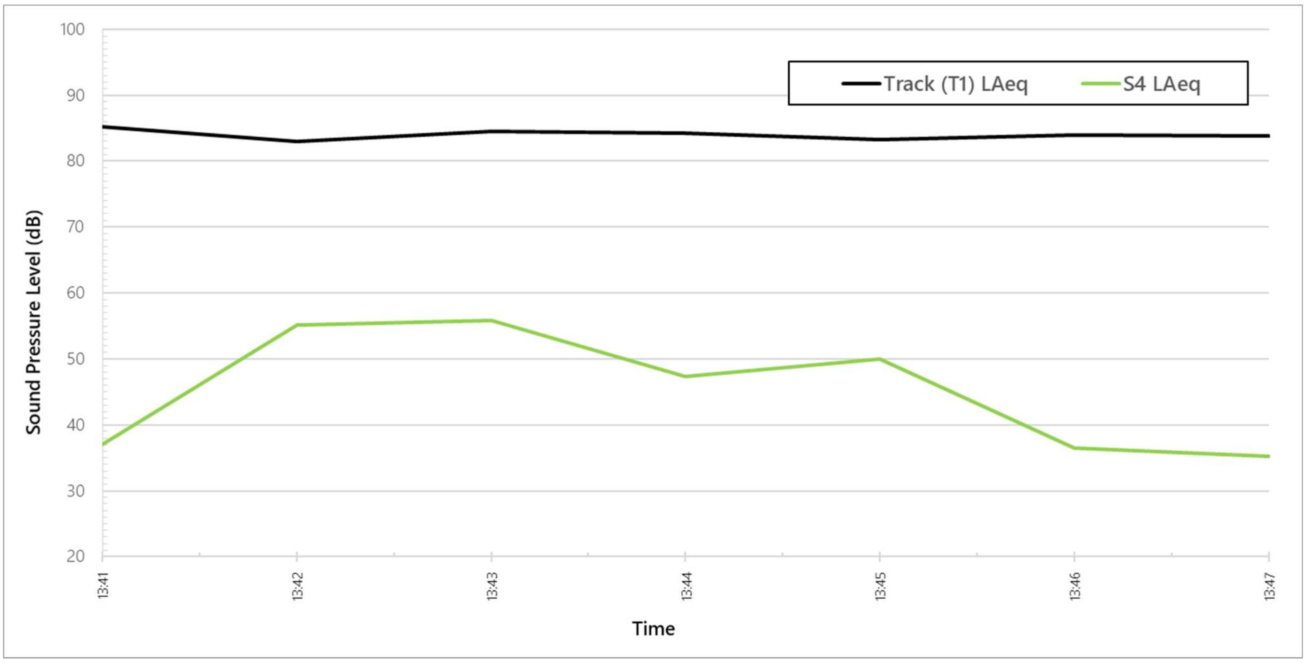
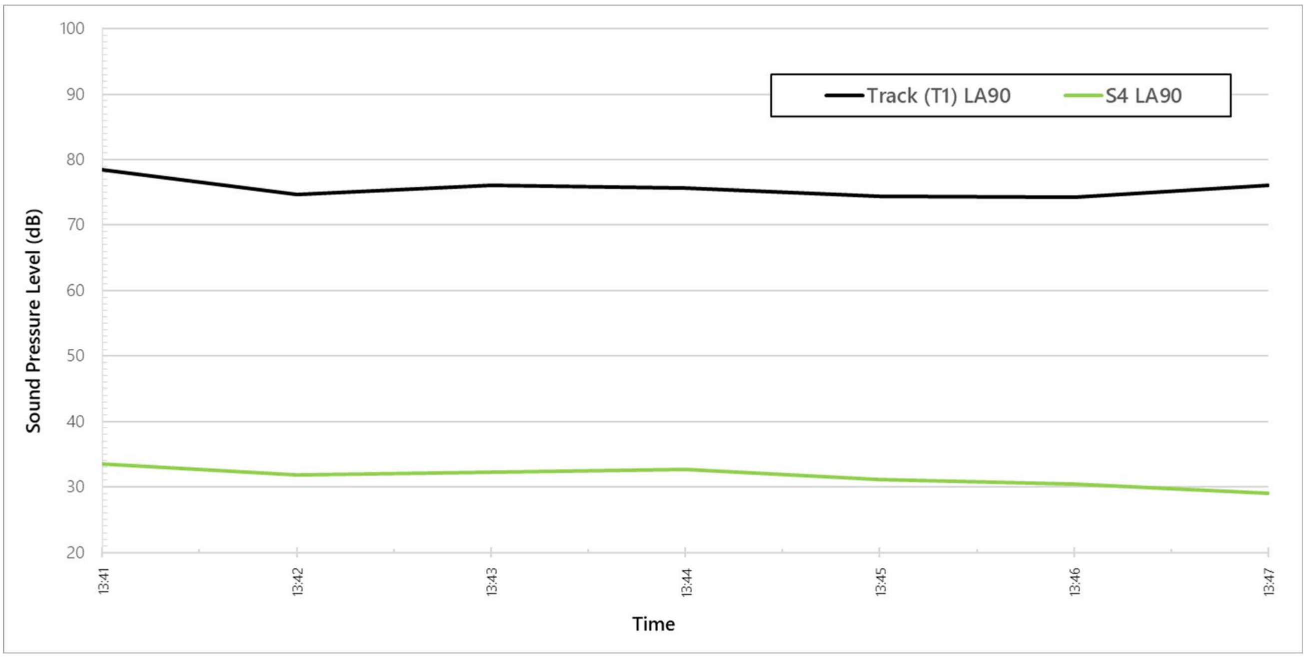


Figure C.14 – Measured L_{A90} levels from Track (T1) vs S4



C.7 – Other Measurement Locations

Table C.1 – Measurement data from other positions not already covered in graphs in the previous sub-sections

Location	Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A90} (dB)
S2	10:25	38.1	50.2	36.1
	10:26	37.0	47.8	35.3
	10:27	36.7	39.8	35.6
	10:28	37.5	47.0	36.0
	10:29	36.3	52.3	35.3
S1	12:01	89.3	92.8	88.2
	12:02	89.7	93.9	87.7
	12:03	89.3	94.1	87.2
	12:04	89.2	94.1	86.2
	12:05	85.4	92.6	79.8
250cc 2 Stroke - 1m Bike Measurement	12:15	88.6	94.3	82.1
450cc 4 Stroke - 1m Bike Measurement	12:16	92.6	94.3	90.2
S5	14:24	63.3	77.8	42.6
	14:25	40.7	55.7	35.5
	14:26	39.4	50.1	35.9
	14:27	44.7	49.9	42.2
	14:28	41.9	48.3	39.0
S6	14:34	50.3	70.1	29.9
	14:35	58.6	72.3	29.7
	14:36	34.5	50.9	26.6
	14:37	61.1	75.8	28.9
	14:38	34.5	49.4	26.6
	14:39	54.0	67.8	27.0
	14:40	55.7	71.2	26.9
S7	14:57	42.8	49.1	31.2
	14:58	54.9	64.4	32.4
	14:59	53.1	67.0	30.3
	15:00	44.7	61.9	29.9
	15:01	40.8	59.4	28.5
	15:02	41.9	54.9	30.3
	15:03	50.9	60.5	38.4
	15:04	53.0	65.5	31.9
	15:05	50.4	62.5	33.4
	15:06	44.3	58.5	31.7
	15:07	41.0	58.6	32.7
S8	15:22	52.1	70.1	30.3
	15:23	41.1	64.3	27.8
	15:24	35.3	46.7	27.7
	15:25	38.1	54.4	30.7
	15:26	36.1	51.0	26.2
	15:27	38.4	55.5	28.6
	15:28	55.2	72.3	32.1
	15:29	42.8	56.9	28.9
	15:30	34.6	48.7	27.3

Location	Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{A90} (dB)
	15:31	37.5	47.9	30.7
	15:32	42.3	61.3	32.4
	15:33	40.2	56.6	30.5
	15:34	35.4	45.9	29.8
	15:35	39.1	52.6	29.8
	15:36	44.3	55.8	32.5
S9	15:48	53.2	76.2	33.6
	15:49	35.8	47.3	32.5
	15:50	35.1	43.9	30.8
	15:51	38.5	54.9	31.7
	15:52	53.6	64.7	37.6
	15:53	49.3	66.3	37.6
	15:54	50.6	64.5	40.8
	15:55	55.0	66.0	42.4
	15:56	54.5	62.7	48.5
	15:57	57.3	62.6	49.0
	15:58	53.2	61.0	47.2
	15:59	40.8	53.4	33.7
	16:00	53.8	64.2	34.7
	16:01	42.7	55.0	40.0

Appendix D – Noise Mapping/Predictions

The noise predictions within this report have been undertaken using the proprietary software CadnaA® by DataKustik, a 3-D noise mapping package which implements a wide range of national and international standards, guidelines and calculation algorithms, including those set out in ISO 9613-2:1996.

The noise model accounts for the topography of the land based on data available from the Ordnance Survey. All of the objects within the model (buildings, roads, barriers, foliage, etc) have been imported from OpenStreetMap – or inserted manually.

The noise model has employed:

- a ground absorption factor of 0 on roads and buildings and across the village of Hornton as a worst case (to represent a hard sound reflective surface), 1 on greenfield land, i.e. fields, and 0.5 on mixed ground – as specified in ISO 9613-2:1996;
- a maximum reflection factor of three where buildings and barriers are assumed to have a 'smooth' reflective façade, as a worst-case;
- receptor points and noise contour heights at 1.5m above ground.

The temperature and wind speed/direction has been adjusted for various scenarios.

The noise levels shown upon the graph are $L_{Aeq,1min}$ values.

It can be seen that the source noise levels have been set to represent the highest values of $L_{Aeq.1min}$ determined from the survey.

Figure D.1 – Conditions as per the day of the survey – 20-30 bikes – temperature 0 degrees - minimal wind

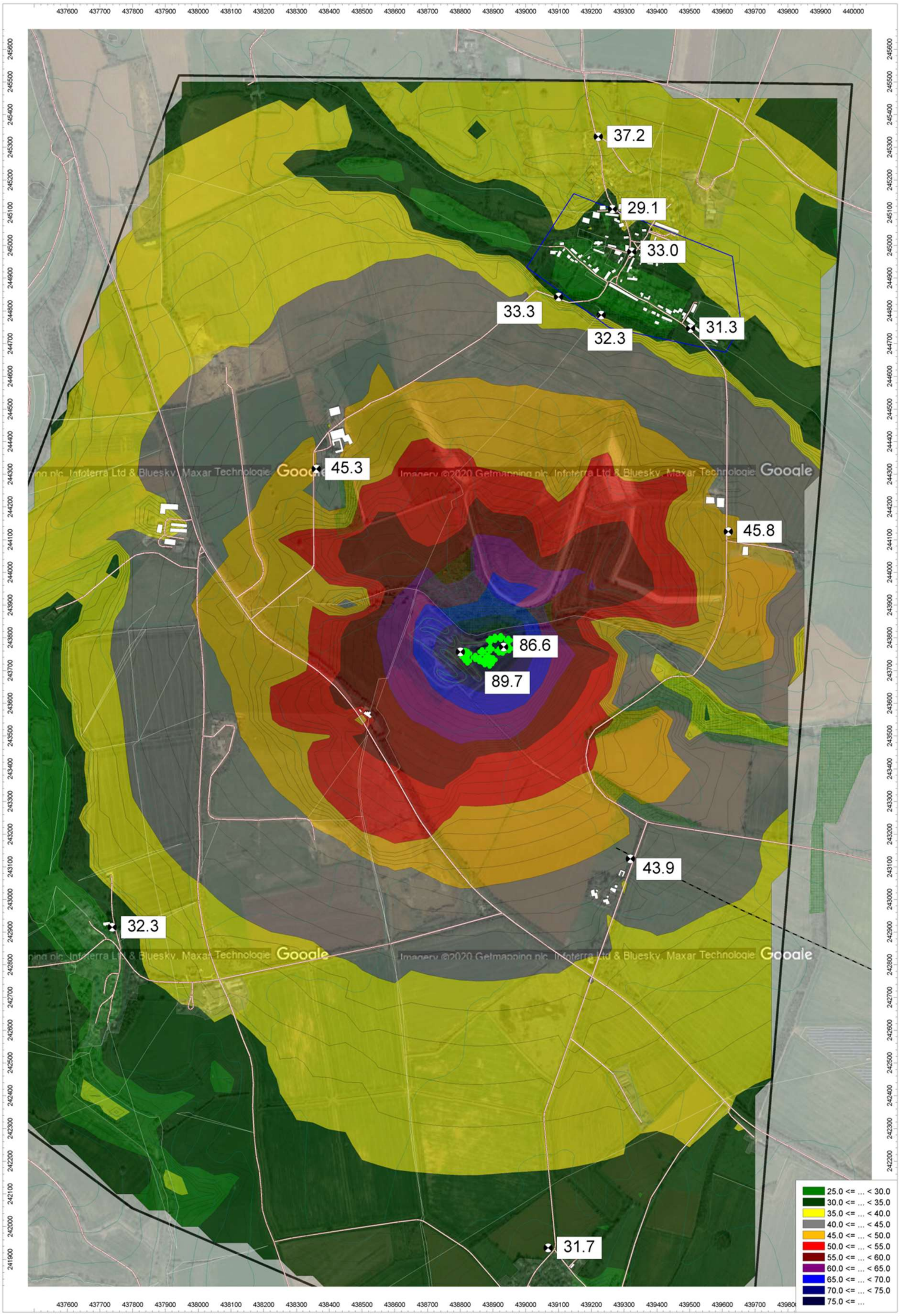


Figure D.2 – Same event size/different weather conditions - 20-30 bikes – temperature 10 degrees - minimal wind

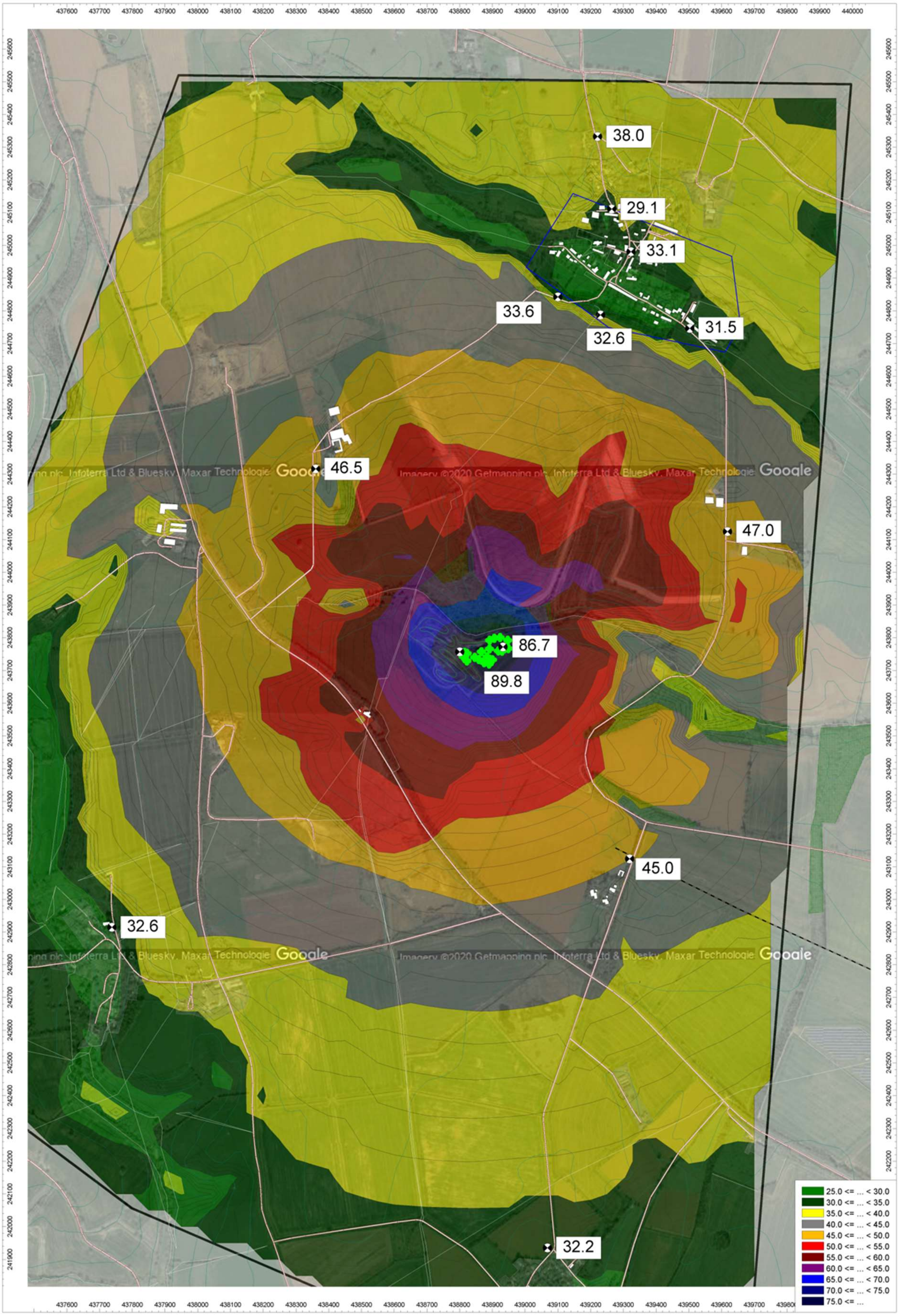


Figure D.3 – Same event size/different weather conditions - 20-30 bikes – temperature 20 degrees - minimal wind

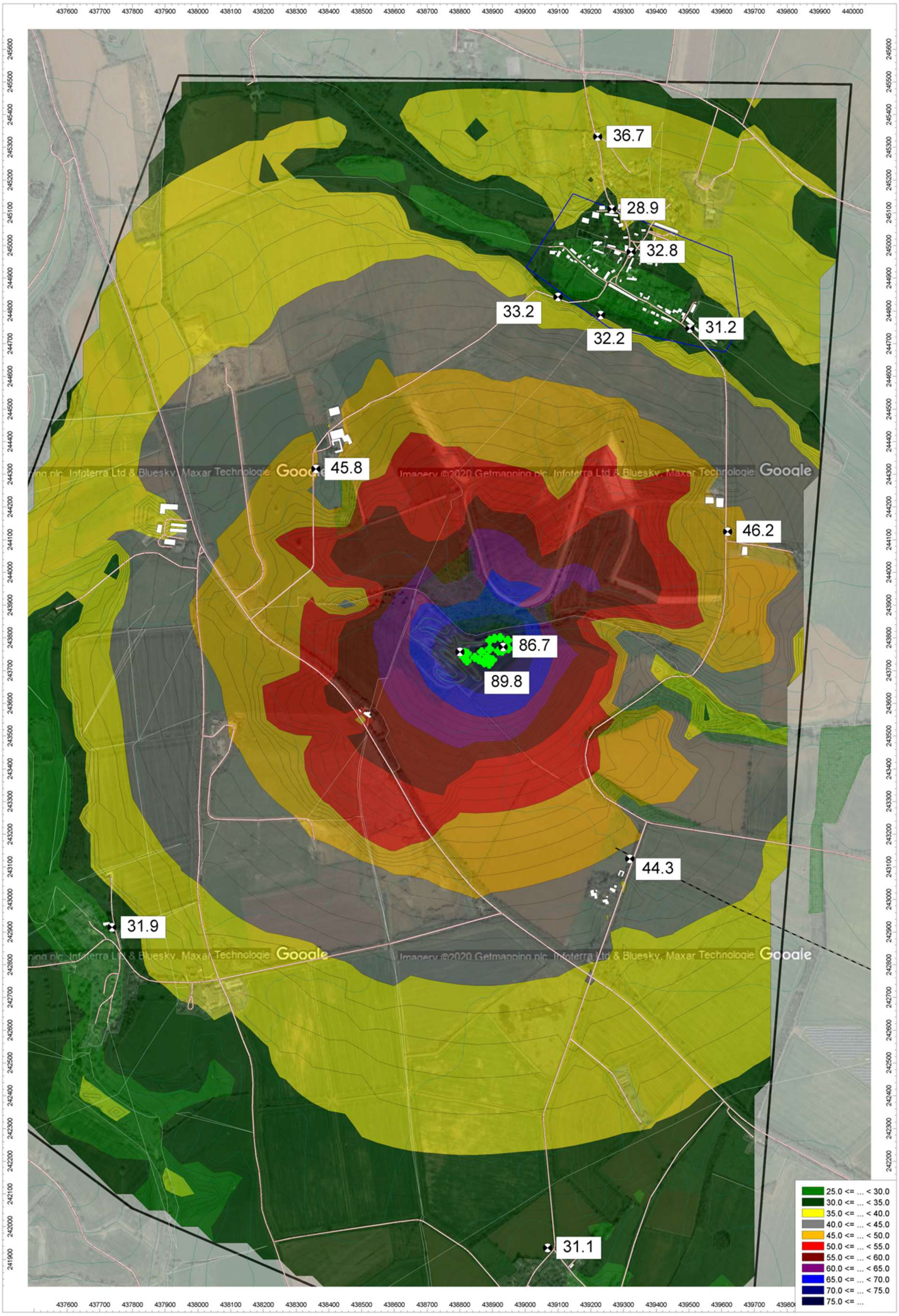


Figure D.4 – Same event size/different weather conditions - 20-30 bikes – temperature 30 degrees - minimal wind

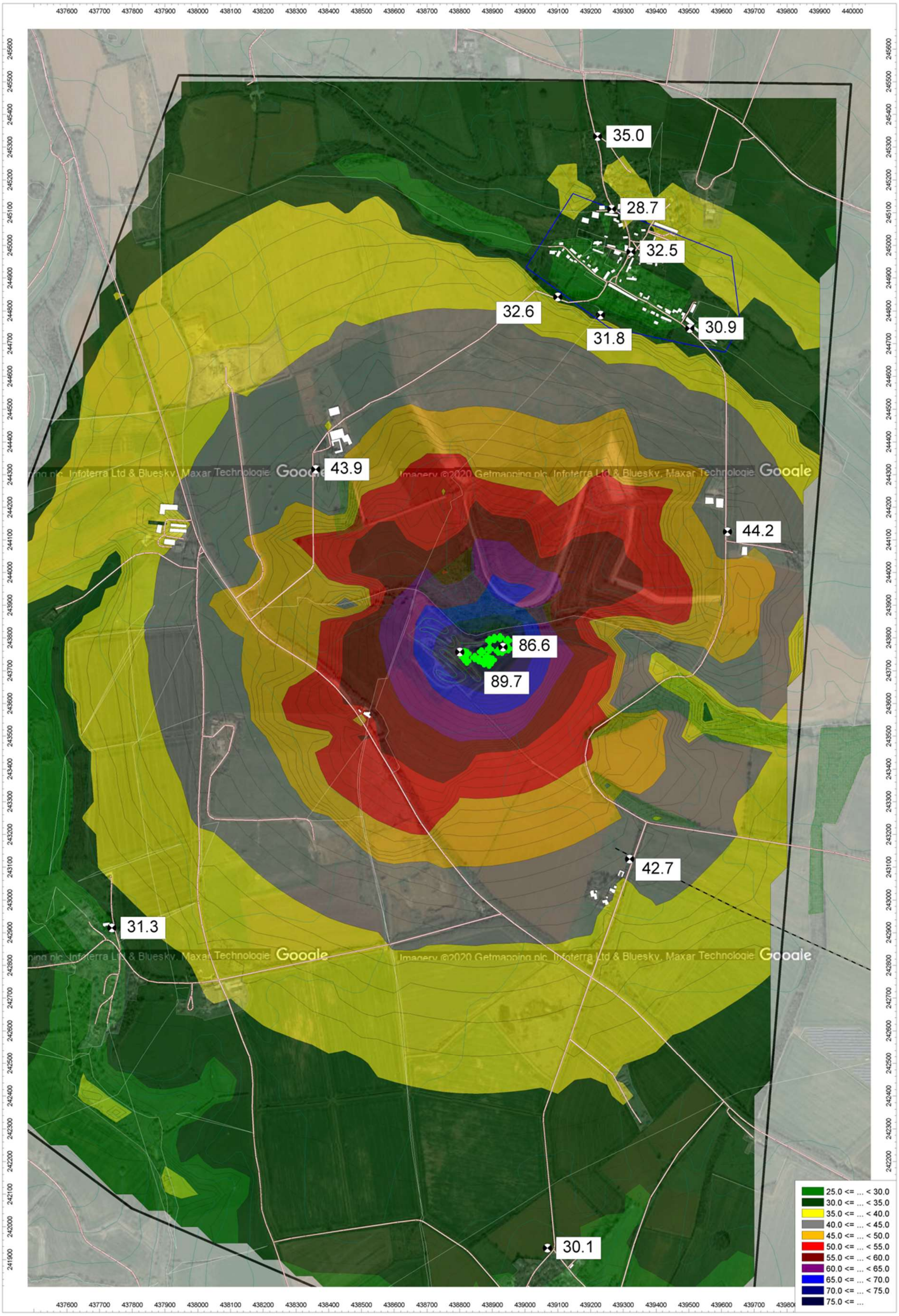


Figure D.5 – Same event size/different weather conditions - 20-30 bikes – temperature 10 degrees – strong northerly wind

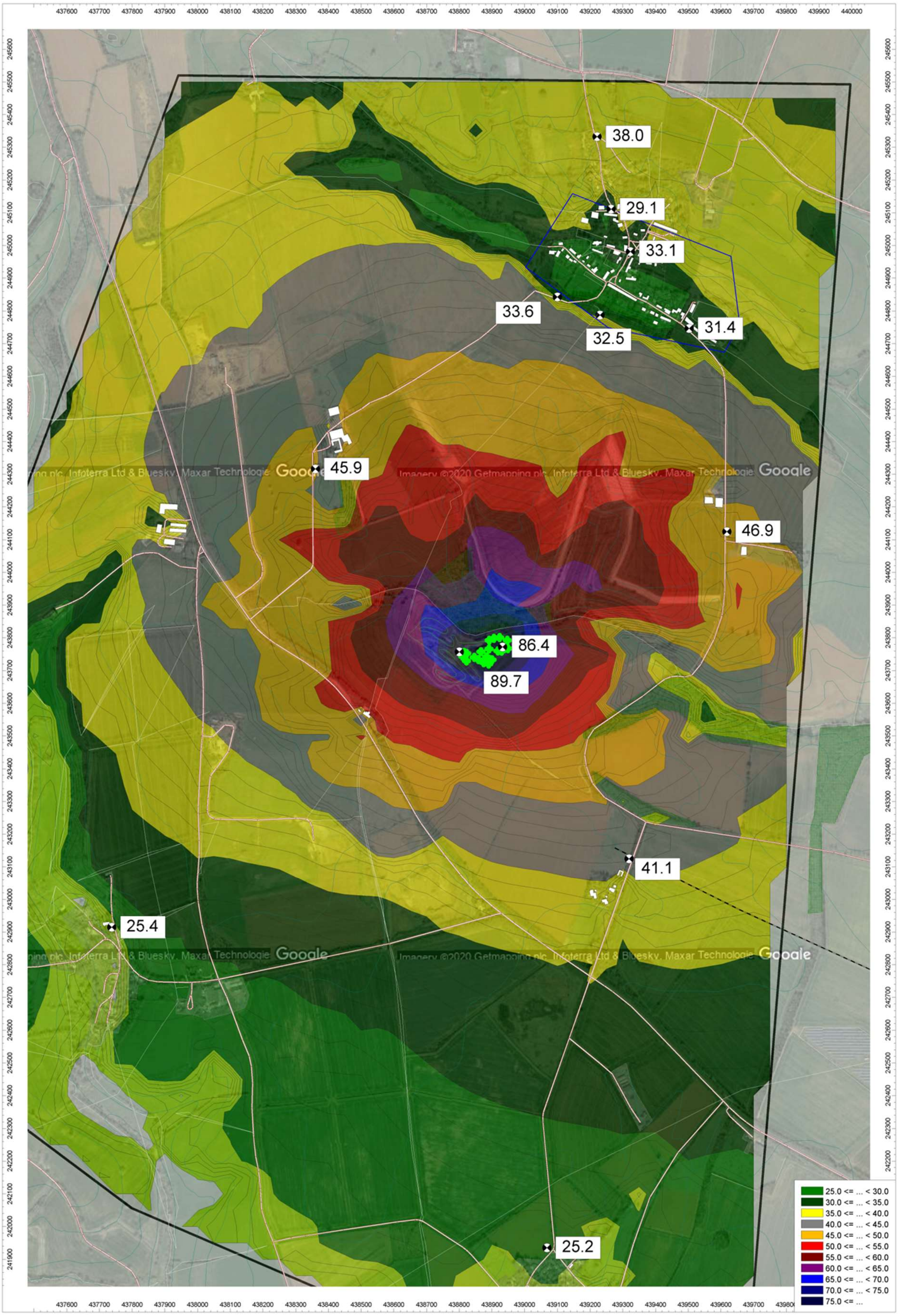


Figure D.6 – Same event size/different weather conditions - 20-30 bikes – temperature 10 degrees – strong southerly wind

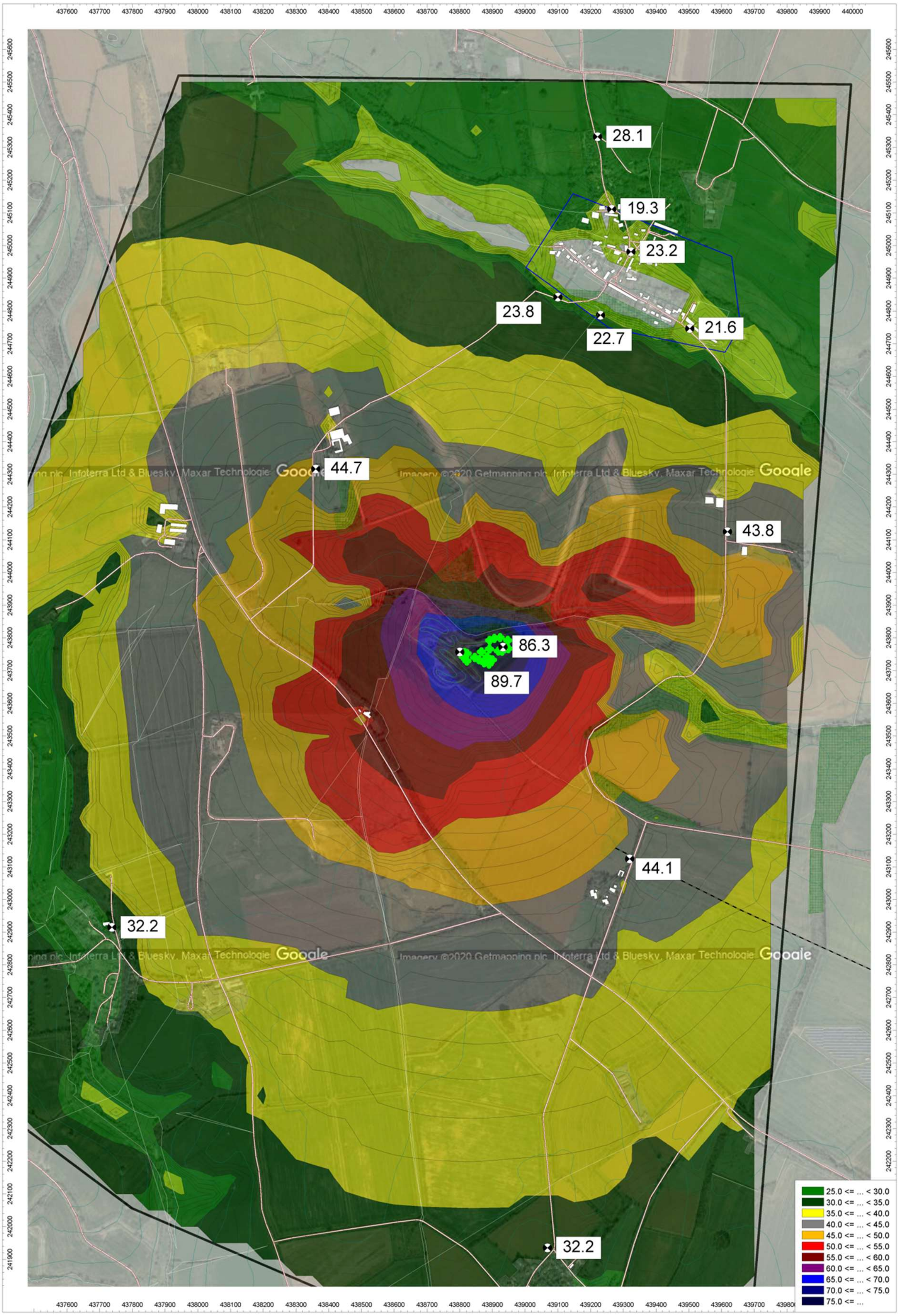
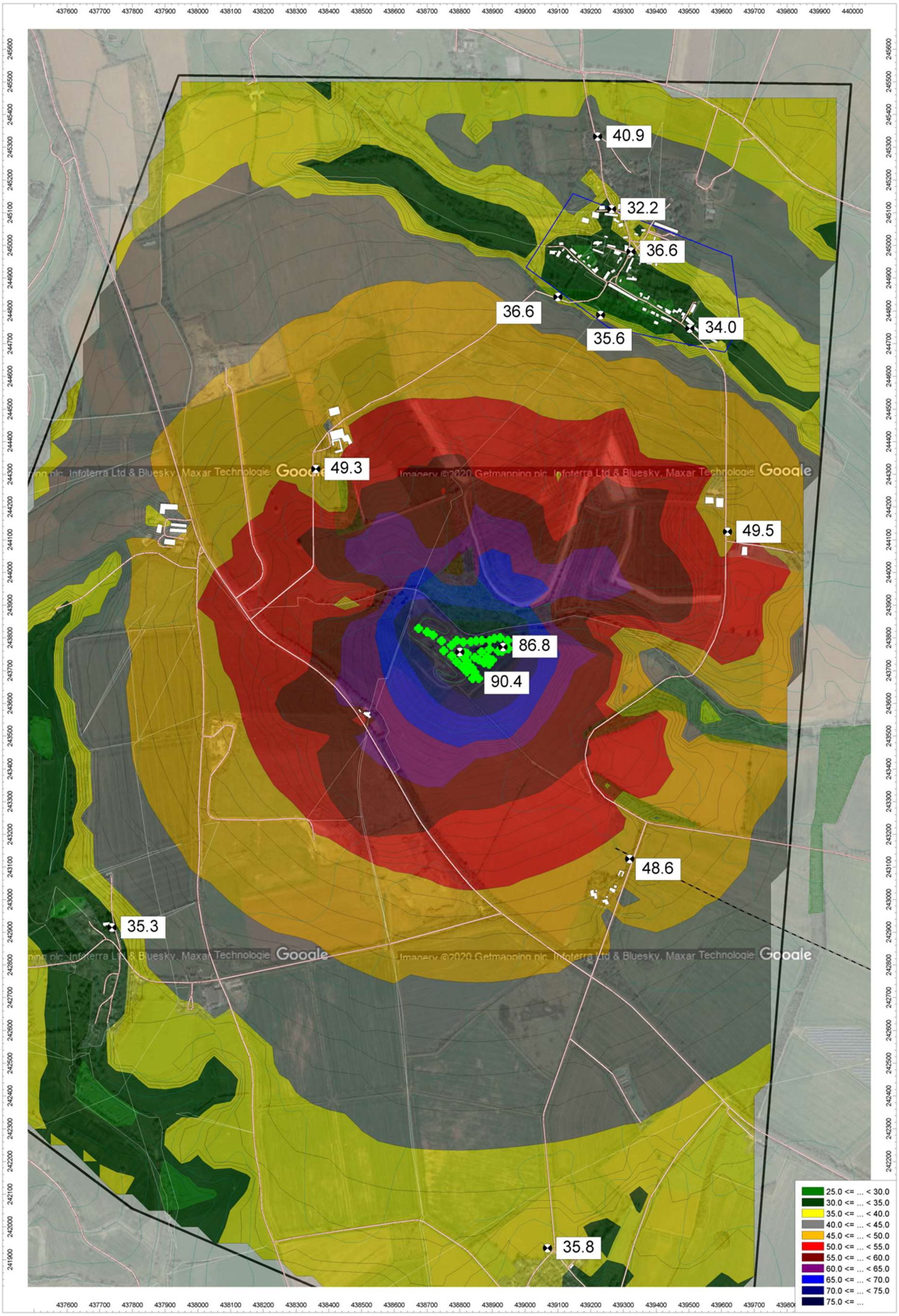


Figure D.7 – Larger event size/mild weather conditions - 40 bikes – temperature 10 degrees – minimal wind



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