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Background Noise Assessment

Report No: 3370-R1 – Barns to the rear of Rowling House, North Lane, Cawthorn, S75 4AF.

Client: Mr. M. Shirt

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3370-R1	23/09/2015	Initial Report	
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1. Introduction

Clover Acoustics Ltd has been commissioned by M Booth Design Ltd on behalf of Mr. Michael Shirt to undertake a noise assessment in respect of a proposed conversion of existing barns into residential dwellings at the rear of Rowling House Cottage, North Lane, Cawthorn, S75 4AF.

A baseline noise survey has been carried out over a typical 24-hour period in order to assess the impact of noise from an adjacent commercial operation at the proposed development. The survey was conducted at one monitoring location commencing on Thursday 3rd September 2015.

2. Scope

This report assesses the noise impact generated from existing sources, in this instance the dominant noise source impacting on the proposed development site is occasional road traffic noise and the adjacent commercial operation identified as Naylor Industries.

The scope for this assessment is as follows:

a) A description of the sources of noise which the development site is likely to be subject to i.e. Passing traffic, adjacent commercial activities etc.

b) An assessment of the impact which these sources have on the proposed development, including bedrooms, amenity areas and gardens, having regard to the following sources of guidance and assessment methodologies, where appropriate:

- Noise Policy Statement for England
- BS8233:2014 – Sound Insulation and Noise Reduction for Buildings.
- World Health Organisation – Guidelines for Community Noise 1999.
- Night Noise Guidelines for Europe

Noise Policy Statement for England

A new document dealing with noise was released in March 2012 under the National Planning Policy Framework (NPPF). This document supersedes and replaces Planning Policy Guidance note 24 (PPG24) which previously covered issues related to noise and planning in England. Paragraph 123 of the NPPF states that planning policies and decisions should aim to:

- Avoid noise from giving rise to significant adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life as a result of new development;

- Mitigate and reduce to a minimum other adverse impacts (see Explanatory Note to the Noise Policy Statement for England (DEFRA)) on health and quality of life arising from noise from new development, including through the use of conditions;

- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established (Subject to the provisions of the Environmental Protection Act 1990 and other relevant law); and

- Identify and protect areas of tranquility which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

The Noise Policy Statement for England (NPSE) was developed by DEFRA and published in March 2010 with the stated aim to 'Promote good health and good quality of life through the effective management of noise within the context of Government policy on sustainable development.'

Noise Policy Statement England (NPSE)

Noise Policy Aims

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.**

A further stated aim is outlined in para 2.7:

2.7 In addition, the application of the NPSE should enable noise to be considered alongside other relevant issues and not to be considered in isolation. In the past, the wider benefits of a particular policy, development or other activity may not have been given adequate weight when assessing the noise implications.

The Noise Policy Statement further extrapolates on the aims of the policy with a discussion of key phrases and concepts:

"What do the aims of the Noise Policy Statement for England mean?

2.19 There are several key phrases within the NPSE aims and these are discussed below.

"Significant adverse" and "adverse"

2.20 There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

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.

2.21 Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level
This is the level above which significant adverse effects on health and quality of life occur.[1]

The document goes on to advise that it is *"not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations"* advising that by not having specific SOAEL values the document retains *"necessary policy flexibility until further evidence and guidance is available"*[2]

BS8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings.
BS8233 gives guidance for internal noise levels within buildings to achieve reasonable or good resting/sleeping conditions within residential properties as follows:

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

The building envelope design will be considered to ensure that these internal criteria are met. With regard to night time noise it is noted that reference to a specific level (45dB L_{Amax} derived from WHO guidelines values 1999) has been removed from BS8233:2014. It does however make comment that such a limit may be desirable for specific events: "*NOTE 4 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 $L_{Amax,F}$, depending on the character and number of events per night. Sporadic noise events could require separate values*."

[1] Page 8 NSPE
[2] Page 9 NPSE

World Health Organisation – Guidelines for Community Noise 1999.

The World Health Organisation gives guidance for maximum recommended noise levels outside residential properties as follows:

Specific Environment	Critical health effect	dB L_{Aeq}	Time (hr)	dB L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

WHO Guidelines 1999 indicate that the stated level of 45dB L_{Amax} can be exceeded up to 15 times per night before effects occur. We would view this as representative of the Significant Observed Adverse Effect Level or SOAEL referred to in NSPE derived on the basis that if noise levels are 45 dB L_{Amax} or less, they will not give rise to significant sleep disturbance effects. This should be regarded as a maximum limit. The Lowest Observed Adverse Effect Level or LOAEL would in our view be 42 dB L_{Amax}, since the WHO Night Noise Guidelines for Europe 2009 state that this is the threshold of any observed effect on night time awakening.

3. Site Description

The proposed development is for the conversion of existing barns into two residential dwellings. The proposed dwellings will neighbour an existing residential property. Subjectively the dominant noise source affecting site is occasional road traffic from North Lane and ambient noise from the commercial operation adjacent site. Figure 1 shows the proposed site location.



Figure 1 – Proposed Site Location

4. Survey Information

Measurement Instrumentation

The measurement instrumentation used on the survey was as follows:

Equipment	Manufacturer & Type	Serial Number	Calibration Certificate
Sound Level Meter	Norsonic 118	30559	U16612
Acoustic Calibrator	Norsonic 1251	32856	U16611

The equipment was calibrated to comply with section 4.2 of BS7445:1-2003 before and after the surveys. The calibration was as follows:

Meter	Serial	Before		After	
Norsonic 118	30559	113.9	-26.2	113.9	-26.1

Measurements & Timescales

During the survey 1-minute measurements were made over a typical daytime and night-time period over Thursday 3rd September 2015. The measurements were subsequently analysed into hourly periods.

The following measurements are reported: $L_{Aeq,T}$, $L_{A90,T}$, $L_{AMAX,T}$

The measurements and their interpretation shall be in accordance with BS 7445: Parts 1 and 2. All sound pressure levels are in dB (re 20µPa).

Meteorology

During the survey the weather was considered to be mainly dry and mild with an occasional breeze.

Position of Monitoring Equipment

The equipment was positioned at least 1.5 meters from the ground at the façade of the existing barn. The monitoring location is shown in figure 1 above.

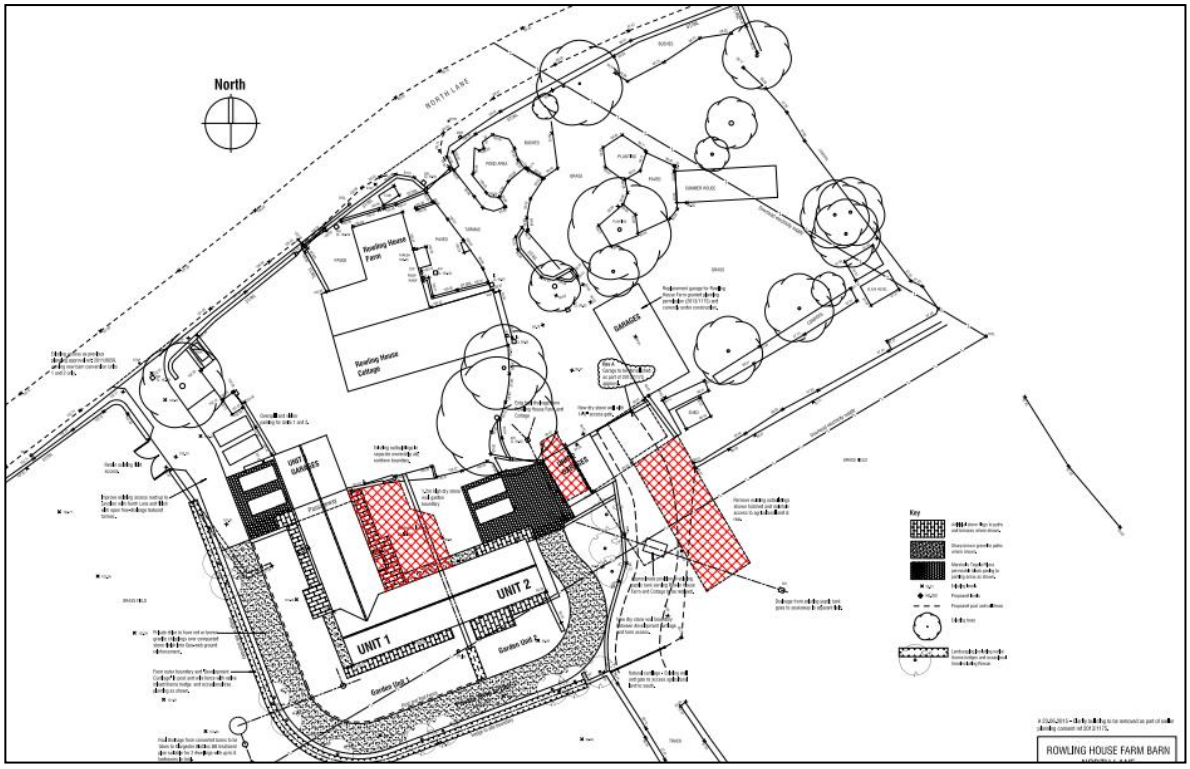


Figure 2 – Proposed Site Plan

5. Survey Results

Background Noise Summary

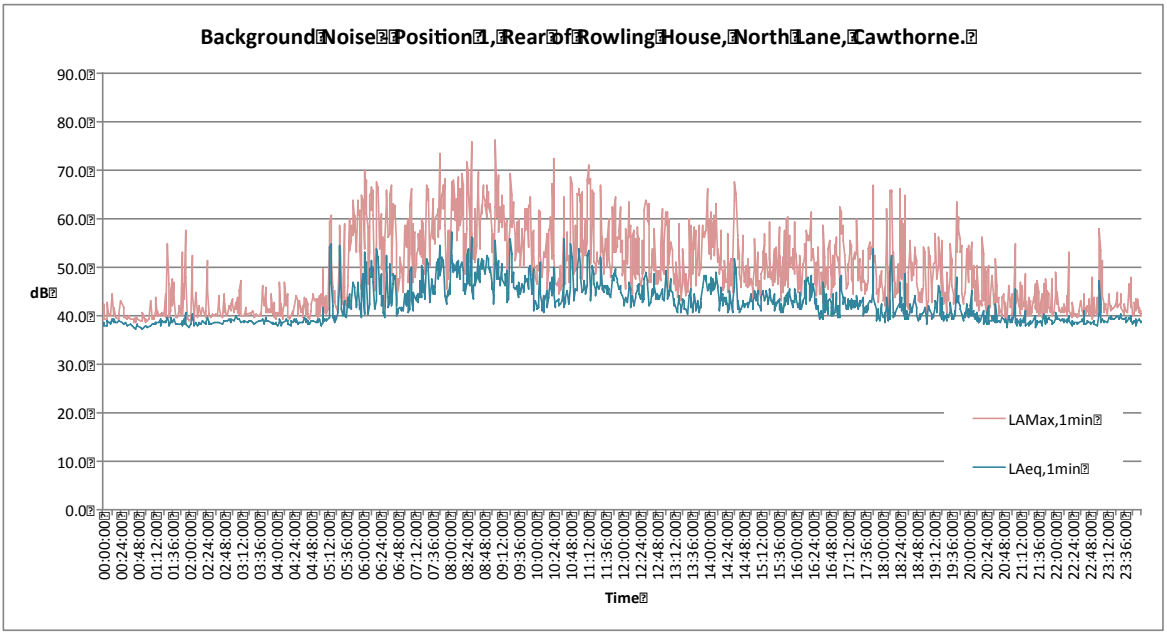
The following tables show the summary of the background noise levels monitored. The reported results represent the free field sound pressure levels.

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Site: Position 1, Rear of Rowling House, North Lane, Cawthorne.
Table: L5 Summary — Start Date: 03/09/2015
Report: 3370-R1 — End Date: 03/09/2015

Hourly Summary

Hour End	LAeq,1Hour	Max LAMax,1min
00:00	39.6	58.0
01:00	38.2	44.6
02:00	38.5	57.7
03:00	38.6	52.3
04:00	38.8	47.2
05:00	38.7	46.7
06:00	45.2	64.6
07:00	47.2	69.9
08:00	47.9	73.4
09:00	49.9	75.7
10:00	48.1	76.3
11:00	46.8	72.2
12:00	47.9	71.1
13:00	44.8	63.6
14:00	44.3	66.3
15:00	44.6	67.6
16:00	43.4	60.4
17:00	43.6	61.3
18:00	43.4	66.9
19:00	42.9	66.0
20:00	41.4	63.5
21:00	39.7	56.3
22:00	39.1	54.6
23:00	38.8	52.9



Data Summary Table Position 1

Monitoring Position 1				
Measurement	Daytime	Hour Ending/ Period	Night-time	Hour Ending/ Period
Maximum dB $L_{Aeq,1hr}$	50	09:00	47	07:00
Minimum dB $L_{Aeq,1hr}$	39	23:00	38	01:00
Average dB $L_{Aeq,16hr}$/$L_{Aeq,8hr}$	45	07:00 – 23:00	42	23:00 – 07:00
Night dB $L_{Amax,}$[3]	–	–	65	05:40

The daytime hourly equivalent continuous sound pressure levels at the proposed development ranged between 39dB $L_{Aeq,1hr}$ and 50dB $L_{Aeq,1hr}$ with an average level during the daytime period of 45dB $L_{Aeq,16hr}$.

The night-time hourly equivalent continuous sound pressure levels at the proposed development ranged between 38dB $L_{Aeq,1hr}$ and 47dB $L_{Aeq,1hr}$ with an average level during the night-time period of 42dB $L_{Aeq,8hr}$. The 15th highest[3] night-time individual noise event between the hours of 23:00 and 07:00 was 65dB L_{Amax}.

6. Design Criteria

Internal Design Criteria

The internal design criteria proposed is in line with the guidance from BS8233:2014 for indoor ambient noise levels within spaces when they are unoccupied.

Area	Internal Level, dB(A)
Living Rooms (07:00 – 23:00)	35dB
Dining Rooms (07: - 23:00)	40dB
Bedrooms (23:00 – 07:00)	30dB

As the nature of the noise affecting site may during the night time period be sporadic the previously referred to level of 45dB L_{Amax} should be considered in line with the discussion in section 2 of this report. The follow section gives recommendations for achieving the proposed internal design criteria.

[3] The 15th highest LAMAX has been selected as in line with good sleep conditions identified in "The Guidelines for Community Noise" Section 3.4 Sleep Disturbance.

7. Mitigation

Glazing Design The internal design criteria can be achieved through a glazing performance requirement. The following table summarises the recorded levels on site and show the glazing performance requirement to achieve the criteria. This uses the simple calculation method from the Appendix in BS8233:2014. Standard forms of construction are assumed therefore it is likely the glazing will be the lowest performing façade element.

Monitoring Position 1	Living Room Areas	Dining Room Areas	Bedroom Areas	
Average Case Levels	45 dB $L_{Aeq,16hr}$	45 dB $L_{Aeq,16hr}$	42dB $L_{Aeq,8hr}$	65 dB L_{AMAX}
Internal Design Criteria	35dB(A)	40 dB(A)	30 dB(A)	45 dB L_{AMAX}
Glazing Performance Requirement	**10dB R_{TRA}**	**5 dB R_{TRA}**	**12dB R_{TRA}**	**20dB R_{TRA}**

The glazing performance requirement is based on the traffic corrected sound reduction index R_{TRA}. The single event L_{Amax} criteria exceeds the night-time average $L_{Aeq,8hr}$ criteria and will be used in the specification of glazing to this façade.

Glazing Configurations

The table below is a summary of the typical performance of Pilkington glazed units as detailed in *Pilkington Design Guide "Glass & Noise Control" – Technical Bulletin May 1997*. Glazing from any other manufacturer can be used providing it can be shown that it will achieve the glazing performance requirements above.

Pilkington Configurations	dB R_{TRA}	Position 1	
		Living/Dining	Bed
Double Glazing			
4.12.4	25	✓	✓
6.12.6	26	✓	✓
6.12.6-4pvb[4]	27	✓	✓
10.12.4	29	✓	✓
10.12.6	32	✓	✓
10.12.6-4pvb	34	✓	✓
Secondary Glazing			
6.100.4 Secondary	37	✓	✓
6.150.4 Secondary	39	✓	✓
10.200.6 Secondary	45	✓	✓

Monitoring Position 1 – The minimum Pilkington glazing configuration to achieve 10dB R_{TRA} within living room areas is 4.12.4 double glazing with a performance of 25dB R_{TRA}. The minimum Pilkington glazing configuration to achieve 20dB R_{TRA} within bedroom areas is 4.12.4 double glazing with a performance of 25dB R_{TRA}. Alternative manufacturers may be selected as long as the selected glazing unit acoustic performance achieves the specified dB R_{TRA} requirement.

[4] PVB laminated glass - polyvinyl butyrain.

World Health Organisation – Guidelines for Community Noise 1999.

The World Health Organisation gives guidance for maximum recommended noise levels outside residential properties as follows:

Specific Environment	Critical health effect	dB L_{Aeq}	Time (hr)	dB L_{Amax}
Outdoor living area	Serious annoyance, daytime and evening	55	16	-
	Moderate annoyance, daytime and evening	50	16	-
Outside bedrooms	Sleep disturbance, window open (outdoor values)	45	8	60

The current noise climate below the level identified for moderate annoyance in respect of the outdoor living areas at the boundary of site. Whilst external L_{Amax} levels exceeded the guideline value internal criterion from BS8233:2014 can be achieved with the prescribed glazing solution

8. Conclusion

The site has been surveyed in line with the recommendations in BS7445:1 – 2003 and BS7445:2 – 1991. This report has shown that the target internal noise levels for bedroom and living/dining areas in accordance with internal ambient levels from the guidance in BS8233:2014 can be achieved by using the correct glazing specification.

Monitoring Position 1

In living/dining areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 10dB R_{TRA} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 4.12.4 double glazing with a performance of 25dB R_{TRA}.

In bedroom areas to achieve the design target internal ambient levels from the guidance in BS8233:2014 a glazing specification with a performance of 20dB R_{TRA} is required. Based on the Pilkington Design Guide performance tables, the glazing configuration that will achieve this performance is 4.12.4 double glazing with a performance of 25dB R_{TRA}.

Care should be taken with regard to selection of ventilation so it shall not compromise the glazing specification and as such we would recommend Greenwood Airvac. Please contact Greenwood for the correct selection of acoustic vents based on our glazing performance specification.
Greenwood Airvac Contact: Mike Beck – M:07801 039584



Steve Clow MIOA
Acoustic Consultant

9. Appendix

Glossary of Terms

Specific Noise Source
The noise source under investigation for assessing the likelihood of complaints.

Specific Noise Level, $L_{Aeq,T}$
The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.

Rating Level, $L_{A,T}$
The specific noise level plus any adjustment for the characteristic features of the noise.

Background Noise Level, $L_{A90,T}$
The A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90 % of a given time interval, T.

Residual Noise
The ambient noise remaining at a given position in a given situation when the specific noise source is suppressed to a degree such that it does not contribute to the ambient noise.

Ambient Noise
Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Reference Time Interval, T
The specified interval over which an equivalent continuous A-weighted sound pressure level is determined.

$L_{Aeq,T}$
The A-weighted equivalent continuous sound level – the sound level of a notionally steady sound having the same energy as the fluctuating sound over a specified measurement period, T.

$L_{A10,T}$
The A-weighted sound level exceeded for 10% of the specified measurement period, T.

L_{Amax}
The highest short duration A-weighted sound level recorded during a noise event.

A-Weighting
The 'A' weighting is a correction term applied to the frequency range in order to approximate to the sensitivity of the human ear to noise. It is generally used to obtain an overall noise level from octave or third octave band frequencies.

Octave Band
A frequency band in which the upper limit of the band is twice the frequency of the lower limit.

One-third-octave Band
A frequency band in which the upper limit of the band is 1/3 times the frequency of the lower limit.

Data Appendix –

Site: Position 1, Rear of Rowling House, North Lane, Cawthorne.
Table: 2 - Night LAMax Events
Start Date: 03/09/2015
Report: 3370-R1
End Date: 03/09/2015

Date	Time	LAF(max)	Date	Time	LAF(max)	Date	Time	LAF(max)	Date	Time	LAF(max)	Date	Time	LAF(max)
03/09/15	23:00	39.6	03/09/15	00:36	39.6	03/09/15	02:12	39.3	03/09/15	03:48	40.8	03/09/15	05:24	42.0
03/09/15	23:01	45.5	03/09/15	00:37	39.4	03/09/15	02:13	39.5	03/09/15	03:49	41.3	03/09/15	05:25	40.8
03/09/15	23:02	58.0	03/09/15	00:38	39.7	03/09/15	02:14	41.9	03/09/15	03:50	40.8	03/09/15	05:26	43.7
03/09/15	23:03	53.4	03/09/15	00:39	39.3	03/09/15	02:15	39.9	03/09/15	03:51	41.3	03/09/15	05:27	53.4
03/09/15	23:04	40.6	03/09/15	00:40	39.1	03/09/15	02:16	39.7	03/09/15	03:52	40.5	03/09/15	05:28	58.6
03/09/15	23:05	51.4	03/09/15	00:41	39.0	03/09/15	02:17	39.6	03/09/15	03:53	40.7	03/09/15	05:29	58.5
03/09/15	23:06	44.1	03/09/15	00:42	39.2	03/09/15	02:18	41.8	03/09/15	03:54	44.4	03/09/15	05:30	47.8
03/09/15	23:07	42.4	03/09/15	00:43	38.7	03/09/15	02:19	42.0	03/09/15	03:55	41.4	03/09/15	05:31	44.1
03/09/15	23:08	40.8	03/09/15	00:44	39.5	03/09/15	02:20	40.7	03/09/15	03:56	40.4	03/09/15	05:32	42.5
03/09/15	23:09	41.7	03/09/15	00:45	38.4	03/09/15	02:21	40.6	03/09/15	03:57	42.7	03/09/15	05:33	44.6
03/09/15	23:10	42.2	03/09/15	00:46	38.1	03/09/15	02:22	39.5	03/09/15	03:58	39.6	03/09/15	05:34	59.0
03/09/15	23:11	41.4	03/09/15	00:47	39.7	03/09/15	02:23	41.0	03/09/15	03:59	40.6	03/09/15	05:35	45.7
03/09/15	23:12	40.3	03/09/15	00:48	39.2	03/09/15	02:24	51.3	03/09/15	04:00	39.3	03/09/15	05:36	43.6
03/09/15	23:13	40.6	03/09/15	00:49	39.1	03/09/15	02:25	45.5	03/09/15	04:01	39.8	03/09/15	05:37	42.1
03/09/15	23:14	44.3	03/09/15	00:50	39.0	03/09/15	02:26	40.4	03/09/15	04:02	39.8	03/09/15	05:38	42.4
03/09/15	23:15	42.3	03/09/15	00:51	39.0	03/09/15	02:27	39.8	03/09/15	04:03	40.5	03/09/15	05:39	46.3
03/09/15	23:16	43.4	03/09/15	00:52	39.1	03/09/15	02:28	40.1	03/09/15	04:04	40.0	03/09/15	05:40	47.9
03/09/15	23:17	41.1	03/09/15	00:53	38.7	03/09/15	02:29	40.0	03/09/15	04:05	46.7	03/09/15	05:41	60.0
03/09/15	23:18	41.9	03/09/15	00:54	38.9	03/09/15	02:30	39.6	03/09/15	04:06	39.8	03/09/15	05:42	59.4
03/09/15	23:19	41.7	03/09/15	00:55	40.6	03/09/15	02:31	39.7	03/09/15	04:07	39.6	03/09/15	05:43	53.5
03/09/15	23:20	41.3	03/09/15	00:56	40.0	03/09/15	02:32	40.4	03/09/15	04:08	42.3	03/09/15	05:44	55.4
03/09/15	23:21	41.3	03/09/15	00:57	39.5	03/09/15	02:33	39.9	03/09/15	04:09	39.4	03/09/15	05:45	58.7
03/09/15	23:22	41.4	03/09/15	00:58	38.4	03/09/15	02:34	39.6	03/09/15	04:10	40.9	03/09/15	05:46	56.6
03/09/15	23:23	41.7	03/09/15	00:59	39.4	03/09/15	02:35	40.0	03/09/15	04:11	42.5	03/09/15	05:47	63.8
03/09/15	23:24	42.5	03/09/15	01:00	39.1	03/09/15	02:36	40.2	03/09/15	04:12	46.7	03/09/15	05:48	59.6
03/09/15	23:25	42.0	03/09/15	01:01	38.9	03/09/15	02:37	40.1	03/09/15	04:13	43.4	03/09/15	05:49	57.2
03/09/15	23:26	44.7	03/09/15	01:02	39.0	03/09/15	02:38	40.5	03/09/15	04:14	42.1	03/09/15	05:50	60.5
03/09/15	23:27	41.6	03/09/15	01:03	39.1	03/09/15	02:39	40.1	03/09/15	04:15	43.7	03/09/15	05:51	53.0
03/09/15	23:28	41.9	03/09/15	01:04	39.2	03/09/15	02:40	40.4	03/09/15	04:16	44.3	03/09/15	05:52	53.4
03/09/15	23:29	41.4	03/09/15	01:05	39.1	03/09/15	02:41	44.2	03/09/15	04:17	39.5	03/09/15	05:53	63.7
03/09/15	23:30	42.7	03/09/15	01:06	39.3	03/09/15	02:42	41.5	03/09/15	04:18	39.9	03/09/15	05:54	60.7
03/09/15	23:31	44.4	03/09/15	01:07	43.1	03/09/15	02:43	40.0	03/09/15	04:19	39.1	03/09/15	05:55	61.5
03/09/15	23:32	41.5	03/09/15	01:08	39.2	03/09/15	02:44	39.9	03/09/15	04:20	39.3	03/09/15	05:56	53.0
03/09/15	23:33	41.8	03/09/15	01:09	39.8	03/09/15	02:45	39.8	03/09/15	04:21	40.0	03/09/15	05:57	54.8
03/09/15	23:34	41.6	03/09/15	01:10	39.2	03/09/15	02:46	39.5	03/09/15	04:22	40.0	03/09/15	05:58	45.5
03/09/15	23:35	40.4	03/09/15	01:11	39.4	03/09/15	02:47	44.5	03/09/15	04:23	40.9	03/09/15	05:59	64.6
03/09/15	23:36	42.2	03/09/15	01:12	40.9	03/09/15	02:48	40.7	03/09/15	04:24	40.3	03/09/15	06:00	63.7
03/09/15	23:37	42.1	03/09/15	01:13	41.1	03/09/15	02:49	43.9	03/09/15	04:25	42.1	03/09/15	06:01	62.6
03/09/15	23:38	40.9	03/09/15	01:14	43.6	03/09/15	02:50	40.4	03/09/15	04:26	41.9	03/09/15	06:02	53.7
03/09/15	23:39	40.9	03/09/15	01:15	39.9	03/09/15	02:51	40.0	03/09/15	04:27	42.0	03/09/15	06:03	69.9
03/09/15	23:40	41.1	03/09/15	01:16	40.9	03/09/15	02:52	40.3	03/09/15	04:28	44.1	03/09/15	06:04	62.4
03/09/15	23:41	40.8	03/09/15	01:17	39.9	03/09/15	02:53	40.4	03/09/15	04:29	43.2	03/09/15	06:05	67.8
03/09/15	23:42	40.8	03/09/15	01:18	40.1	03/09/15	02:54	40.5	03/09/15	04:30	39.8	03/09/15	06:06	61.1
03/09/15	23:43	46.6	03/09/15	01:19	40.3	03/09/15	02:55	40.3	03/09/15	04:31	39.6	03/09/15	06:07	58.3
03/09/15	23:44	41.5	03/09/15	01:20	39.8	03/09/15	02:56	41.9	03/09/15	04:32	40.1	03/09/15	06:08	46.6
03/09/15	23:45	47.8	03/09/15	01:21	39.5	03/09/15	02:57	41.1	03/09/15	04:33	43.2	03/09/15	06:09	52.9
03/09/15	23:46	44.0	03/09/15	01:22	40.7	03/09/15	02:58	42.3	03/09/15	04:34	43.5	03/09/15	06:10	64.9
03/09/15	23:47	40.6	03/09/15	01:23	40.7	03/09/15	02:59	43.4	03/09/15	04:35	40.6	03/09/15	06:11	65.5
03/09/15	23:48	39.8	03/09/15	01:24	39.9	03/09/15	03:00	42.1	03/09/15	04:36	42.1	03/09/15	06:12	66.4
03/09/15	23:49	40.4	03/09/15	01:25	39.8	03/09/15	03:01	40.6	03/09/15	04:37	39.6	03/09/15	06:13	61.5
03/09/15	23:50	42.8	03/09/15	01:26	44.3	03/09/15	03:02	41.0	03/09/15	04:38	40.1	03/09/15	06:14	65.8
03/09/15	23:51	41.8	03/09/15	01:27	39.5	03/09/15	03:03	40.7	03/09/15	04:39	40.3	03/09/15	06:15	60.7
03/09/15	23:52	43.4	03/09/15	01:28	39.6	03/09/15	03:04	42.6	03/09/15	04:40	43.7	03/09/15	06:16	45.0
03/09/15	23:53	41.0	03/09/15	01:29	39.5	03/09/15	03:05	41.2	03/09/15	04:41	39.8	03/09/15	06:17	48.7
03/09/15	23:54	41.7	03/09/15	01:30	54.8	03/09/15	03:06	43.8	03/09/15	04:42	43.5	03/09/15	06:18	54.9
03/09/15	23:55	43.4	03/09/15	01:31	46.4	03/09/15	03:07	40.6	03/09/15	04:43	42.2	03/09/15	06:19	66.8
03/09/15	23:56	40.6	03/09/15	01:32	39.6	03/09/15	03:08	40.5	03/09/15	04:44	39.5	03/09/15	06:20	67.6
03/09/15	23:57	41.7	03/09/15	01:33	41.1	03/09/15	03:09	40.2	03/09/15	04:45	40.2	03/09/15	06:21	65.9
03/09/15	23:58	40.1	03/09/15	01:34	45.0	03/09/15	03:10	45.1	03/09/15	04:46	40.0	03/09/15	06:22	66.6
03/09/15	23:59	41.0	03/09/15	01:35	47.4	03/09/15	03:11	47.2	03/09/15	04:47	39.4	03/09/15	06:23	53.6
03/09/15	00:00	39.7	03/09/15	01:36	42.6	03/09/15	03:12	40.0	03/09/15	04:48	40.9	03/09/15	06:24	57.7
03/09/15	00:01	42.4	03/09/15	01:37	41.9	03/09/15	03:13	40.3	03/09/15	04:49	42.4	03/09/15	06:25	60.9
03/09/15	00:02	39.1	03/09/15	01:38	46.9	03/09/15	03:14	39.8	03/09/15	04:50	43.8	03/09/15	06:26	49.5
03/09/15	00:03	39.0	03/09/15	01:39	43.6	03/09/15	03:15	40.1	03/09/15	04:51	44.6	03/09/15	06:27	49.3
03/09/15	00:04	39.1	03/09/15	01:40	43.5	03/09/15	03:16	39.9	03/09/15	04:52	44.3	03/09/15	06:28	56.1
03/09/15	00:05	39.3	03/09/15	01:41	39.6	03/09/15	03:17	40.0	03/09/15	04:53	44.3	03/09/15	06:29	49.6
03/09/15	00:06	42.6	03/09/15	01:42	39.8	03/09/15	03:18	41.6	03/09/15	04:54	43.0	03/09/15	06:30	41.8
03/09/15	00:07	39.8	03/09/15	01:43	39.9	03/09/15	03:19	40.3	03/09/15	04:55	43.4	03/09/15	06:31	55.5
03/09/15	00:08	39.6	03/09/15	01:44	39.6	03/09/15	03:20	39.8	03/09/15	04:56	40.4	03/09/15	06:32	63.8
03/09/15	00:09	40.2	03/09/15	01:45	41.0	03/09/15	03:21	40.2	03/09/15	04:57	39.5	03/09/15	06:33	65.8
03/09/15	00:10	39.8	03/09/15	01:46	42.0	03/09/15	03:22	40.3	03/09/15	04:58	43.5	03/09/15	06:34	65.0
03/09/15	00:11	39.5	03/09/15	01:47	40.0	03/09/15	03:23	40.5	03/09/15	04:59	42.0	03/09/15	06:35	56.1
03/09/15	00:12	39.6	03/09/15	01:48	39.9	03/09/15	03:24	40.7	03/09/15	05:00	44.1	03/09/15	06:36	55.9
03/09/15	00:13	44.6	03/09/15	01:49	53.1	03/09/15	03:25	40.2	03/09/15	05:01	40.1	03/09/15	06:37	56.7
03/09/15	00:14	39.9	03/09/15	01:50	49.0	03/09/15	03:26	39.9	03/09/15	05:02	44.3	03/09/15	06:38	64.9
03/09/15	00:15	39.8	03/09/15	01:51	40.0	03/09/15	03:27	40.2	03/09/15	05:03	44.1	03/09/15	06:39	66.7
03/09/15	00:16	41.8	03/09/15	01:52	46.4	03/09/15	03:28	41.1	03/09/15	05:04	40.2	03/09/15	06:40	48.1
03/09/15	00:17	40.0	03/09/15	01:53	43.4	03/09/15	03:29	40.1	03/09/15	05:05	49.6	03/09/15	06:41	48.9
03/09/15	00:18	39.6	03/09/15	01:54	57.7	03/09/15	03:30	39.7	03/09/15	05:06	40.6	03/09/15	06:42	60.3
03/09/15	00:19	39.9	03/09/15	01:55	47.9	03/09/15	03:31	40.2	03/09/15	05:07	43.8	03/09/15	06:43	62.9
03/09/15	00:20	39.8	03/09/15	01:56	39.2	03/09/15	03:32	40.3	03/09/15	05:08	40.8	03/09/15	06:44	59.9
03/09/15	00:21	39.4	03/09/15	01:57	39.0	03/09/15	03:33	40.1	03/09/15	05:09	44.1	03/09/15	06:45	62.6
03/09/15	00:22	40.2	03/09/15	01:58	39.7	03/09/15	03:34	40.1	03/09/15	05:10	40.2	03/09/15	06:46	54.6
03/09/15	00:23	40.1	03/09/15	01:59	38.8	03/09/15	03:35	40.2	03/09/15	05:11	40.4	03/09/15	06:47	43.5
03/09/15	00:24	40.3	03/09/15	02:00	39.0	03/09/15	03:36	40.3	03/09/15	05:12	41.2	03/09/15	06:48	42.0
03/09/15	00:25	43.2	03/09/15	02:01	39.1	03/09/15	03:37	39.9	03/09/15	05:13	41.5	03/09/15	06:49	47.6
03/09/15	00:26	43.1	03/09/15	02:02	39.1	03/09/15	03:38	40.5	03/09/15	05:14	55.6	03/09/15	06:50	45.2
03/09/15	00:27	43.0	03/09/15	02:03	39.0	03/09/15	03:39	40.2	03/09/15	05:15	59.1	03/09/15	06:51	47.8
03/09/15	00:28	41.7	03/09/15	02:04	52.3	03/09/15	03:40	39.8	03/09/15	05:16	60.7	03/09/15	06:52	52.0
03/09/15	00:29	39.7	03/09/15	02:05	44.4	03/09/15	03:41	46.1	03/09/15	05:17	51.2	03/09/15	06:53	49.9
03/09/15	00:30	39.8	03/09/15	02:06	40.3	03/09/15	03:42	44.3	03/09/15	05:18	45.7	03/09/15	06:54	48.9
03/09/15	00:31	39.5	03/09/15	02:07	39.0	03/09/15	03:43	42.1	03/09/15	05:19	44.3	03/09/15	06:55	50.0
03/09/15	00:32	39.7	03/09/15	02:08	39.1	03/09/15	03:44	42.5	03/09/15	05:20	42.8	03/09/15	06:56	45.2
03/09/15	00:33	39.3	03/09/15	02:09	44.9	03/09/15	03:45	45.8	03/09/15	05:21	45.1	03/09/15	06:57	44.7
03/09/15	00:34	39.5	03/09/15	02:10	40.2	03/09/15	03:46	40.7	03/09/15	05:22	42.8	03/09/15	06:58	58.4
03/09/15	00:35	40.1	03/09/15	02:11	39.6	03/09/15	03:47	42.6	03/09/15	05:23	41.7	03/09/15	06:59	56.0

Table: 3 - LAMax Events Ranked

#	Date	Time	LAF(max)
1	03/09/15	06:03	69.9
2	03/09/15	06:05	67.8
3	03/09/15	06:20	67.6
4	03/09/15	06:19	66.8
5	03/09/15	06:39	66.7
6	03/09/15	06:22	66.6
7	03/09/15	06:12	66.4
8	03/09/15	06:21	65.9
9	03/09/15	06:14	65.8
10	03/09/15	06:33	65.8
11	03/09/15	06:11	65.5
12	03/09/15	06:34	65.0
13	03/09/15	06:10	64.9
14	03/09/15	06:38	64.9
15	03/09/15	05:59	64.6
16	03/09/15	05:47	63.8
17	03/09/15	06:32	63.8
18	03/09/15	05:53	63.7
19	03/09/15	06:00	63.7
20	03/09/15	06:43	62.9
21	03/09/15	06:01	62.6
22	03/09/15	06:45	62.6
23	03/09/15	06:04	62.4
24	03/09/15	05:55	61.5
25	03/09/15	06:13	61.5
26	03/09/15	06:06	61.1
27	03/09/15	06:25	60.9
28	03/09/15	05:16	60.7
29	03/09/15	05:54	60.7
30	03/09/15	06:15	60.7
31	03/09/15	05:50	60.5
32	03/09/15	06:42	60.3
33	03/09/15	05:41	60.0
34	03/09/15	06:44	59.9
35	03/09/15	05:48	59.6
36	03/09/15	05:42	59.4
37	03/09/15	05:15	59.1
38	03/09/15	05:34	59.0
39	03/09/15	05:45	58.7
40	03/09/15	05:28	58.6
41	03/09/15	05:29	58.5
42	03/09/15	06:58	58.4
43	03/09/15	06:07	58.3
44	03/09/15	23:02	58.0
45	03/09/15	01:54	57.7
46	03/09/15	06:24	57.7
47	03/09/15	05:49	57.2
48	03/09/15	06:37	56.7
49	03/09/15	05:46	56.6
50	03/09/15	06:28	56.1
51	03/09/15	06:35	56.1
52	03/09/15	06:59	56.0
53	03/09/15	06:36	55.9
54	03/09/15	05:14	55.6
55	03/09/15	06:31	55.5
56	03/09/15	05:44	55.4
57	03/09/15	06:18	54.9
58	03/09/15	01:30	54.8
59	03/09/15	05:57	54.8
60	03/09/15	06:46	54.6
61	03/09/15	06:02	53.7
62	03/09/15	06:23	53.6
63	03/09/15	05:43	53.5
64	03/09/15	23:03	53.4
65	03/09/15	05:27	53.4
66	03/09/15	05:52	53.4
67	03/09/15	01:49	53.1
68	03/09/15	05:51	53.0
69	03/09/15	05:56	53.0
70	03/09/15	06:09	52.9
71	03/09/15	02:04	52.3
72	03/09/15	06:52	52.0
73	03/09/15	23:05	51.4
74	03/09/15	02:24	51.3
75	03/09/15	05:17	51.2
76	03/09/15	06:55	50.0
77	03/09/15	06:53	49.9
78	03/09/15	05:05	49.6
79	03/09/15	06:29	49.6
80	03/09/15	06:26	49.5
81	03/09/15	06:27	49.3
82	03/09/15	01:50	49.0
83	03/09/15	06:41	48.9
84	03/09/15	06:54	48.9
85	03/09/15	06:17	48.7
86	03/09/15	06:40	48.1
87	03/09/15	01:55	47.9
88	03/09/15	05:40	47.9
89	03/09/15	23:45	47.8
90	03/09/15	05:30	47.8
91	03/09/15	06:51	47.8
92	03/09/15	06:49	47.6
93	03/09/15	01:35	47.4
94	03/09/15	03:11	47.2
95	03/09/15	01:38	46.9
96	03/09/15	04:05	46.7

Position 1 - Data

Photo Appendix



View of Barn Building



View across site toward commercial boundary