



Pierce House Sound Study

Presented to the Pierce House Committee

Jason Ross, PE

July 18, 2018

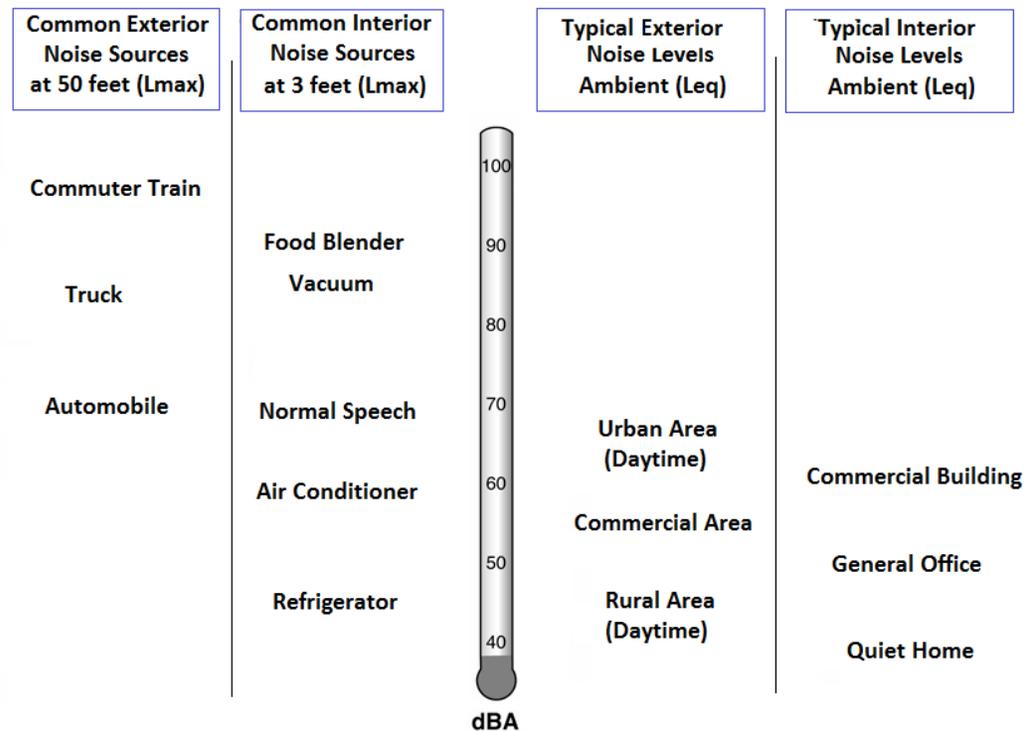
Summary of Findings

- Sound measurements were conducted at eight locations at the Pierce House and the surrounding community between May 23 and 28, 2018 including periods with and without music events
 - At the closest measurement location (28 Weston Road), sound levels were :
 - **58 dBA** during **10-piece band event**
 - **53 dBA** during **DJ event**
 - Ambient sound level increased over ambient by approximately:
 - **19 to 22 dBA** during band event
 - **13 to 14 dBA** (DJ event).
 - At other measurement locations, sound levels were
 - **45 to 49 dBA**
 - **5 to 9 dBA** above ambient conditions
 - Music was audible at several sites including 28 Weston Road, 16 Trapelo Road, 7 Lincoln Road, 16 Lincoln Road, and 40 Weston Rd. Music was faintly audible at 14 Beaver Pond Road and 45 Trapelo Rd.
 - Sound levels exceeded the MassDEP noise regulation at the closest receptor location which limits increases in noise to 10 dBA compared to ambient L90 conditions.

Summary of Findings

- Sound emissions from the facility would need to be reduced by 12 dBA or more not to exceed the MassDEP noise regulation at the closest receptors.
 - By reducing sound levels at the closest receptors such as 22 and 28 Weston Road, it would be expected that noise levels would be reduced throughout the study area
 - Music and activities at the Pierce House may still be audible in the community with sound attenuation
- Strategies to reduce sound from the music events would likely require a combination of measures such as:
 - A distributed house sound system that can more effectively focus sound within the tent and can also control overall sound amplitude.
 - Physical barriers to attenuate sound between the speakers and the community.
 - Continued communications with the community regarding schedule of events.

Noise Primer



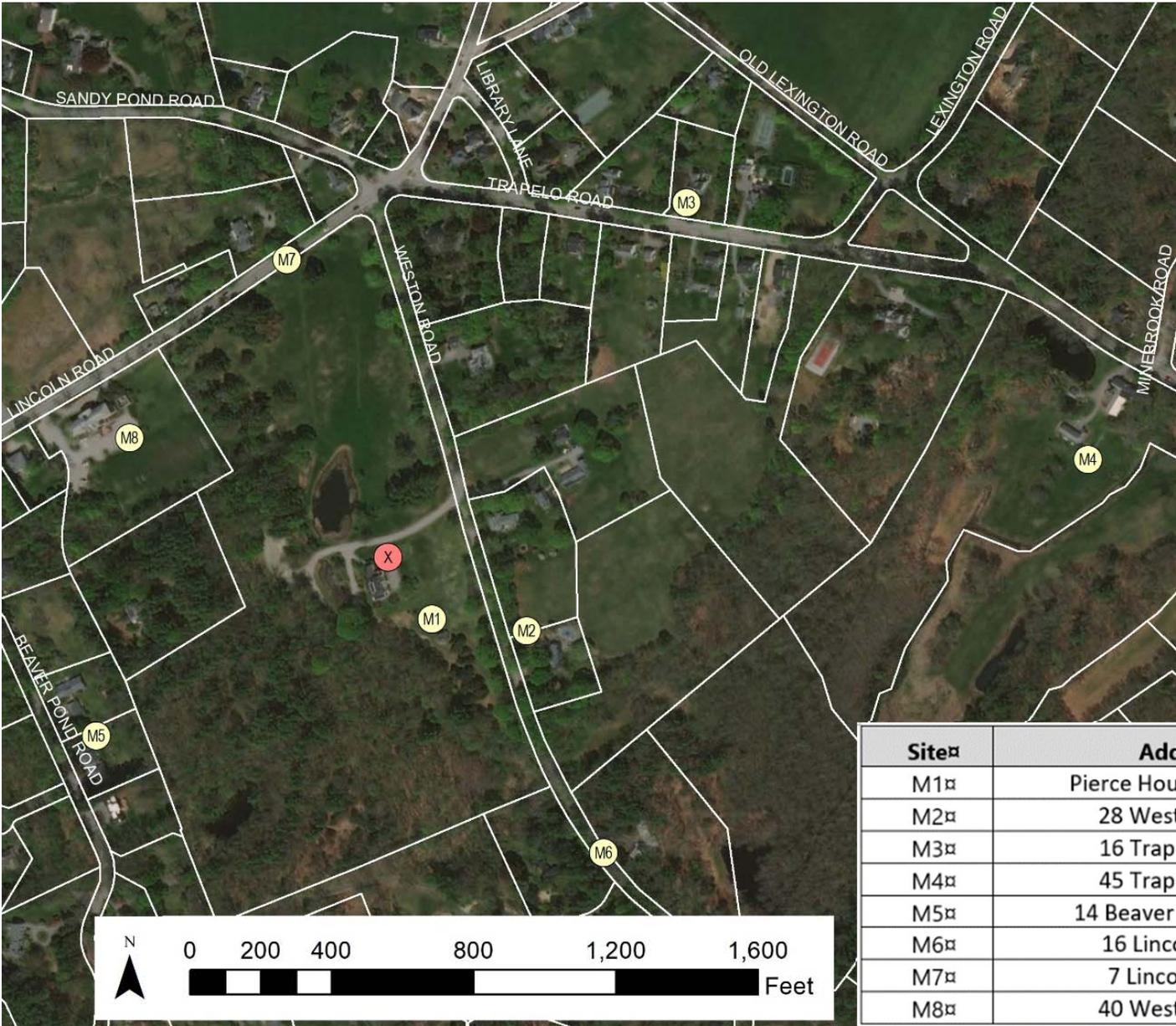
- Sound levels can be described in different ways:
 - Maximum level (Lmax),
 - Statistical level (Lxx) which describes the percentage of time sound levels are a certain level
 - Energy-average level (Leq) which represents fluctuating sound levels in a single value
 - Day-night average (Ldn) which evaluates noise over a 24-hour period

- Perception of change in sound levels
 - A 3 decibel increase in noise is considered to be the limit of a perceptible change
 - A 10 decibel increase or decrease results in a halving or doubling in perceived loudness
 - A 20 decibel increase or decrease results in a quartering or quadrupling in perceived loudness

Noise Regulations and Guidelines

- Town of Lincoln, MA zoning by-law (Section 1) is to promote and conserve the health, safety, morals, and general welfare of the inhabitants of the Town of Lincoln including “the prevention of blight, excessive noise and pollution of the environment...”
- Massachusetts Department of Environmental Protection (MassDEP) noise policy implementing the noise control regulation limits sound from facilities to no more than a 10 dBA increase over ambient and to not include a “pure tone” noise condition. This regulation is generally geared towards permanent fixed-site facilities and equipment.
- The US Environmental Protection Agency (EPA) has noise guidelines that can be used by state or local agencies (it is not a standard or regulation). The EPA guidelines recommend limiting day-night average sound levels to 55 dBA (Ldn) outdoors and 45 dBA indoors. The 55 dBA outdoor limit relates to a constant noise level of 49 dBA. Given the fact sound from the Pierce House does not occur over 24 hours, this guideline does not correspond well to potential effects.
- World Health Organization (WHO) and American National Standards Institute (ANSI) have guidelines to limit long-term permanent noise to 40 dBA at night or 55 dBA at night for countries where the nighttime noise guideline cannot be achieved.

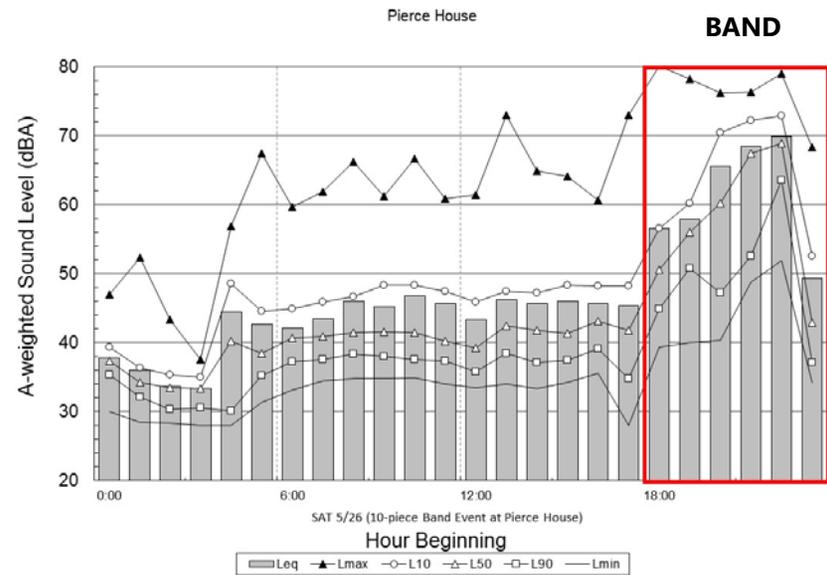
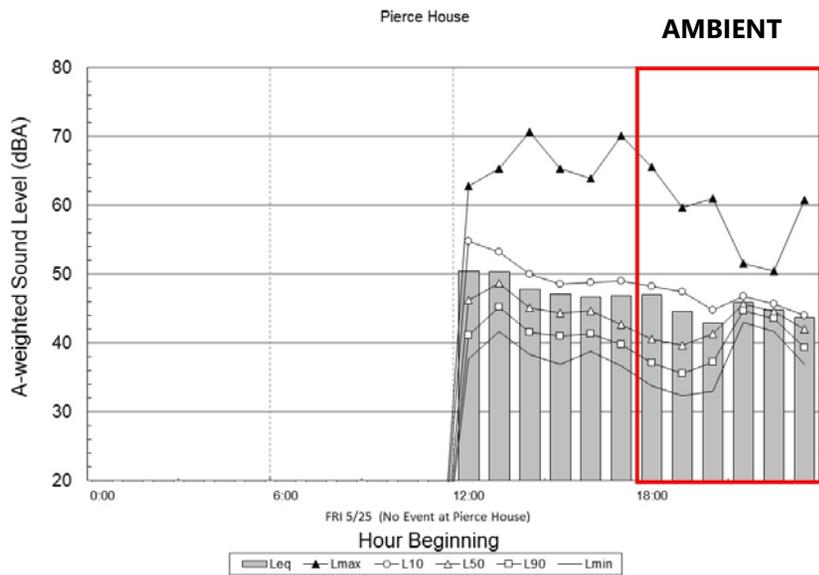
Noise Measurement Locations



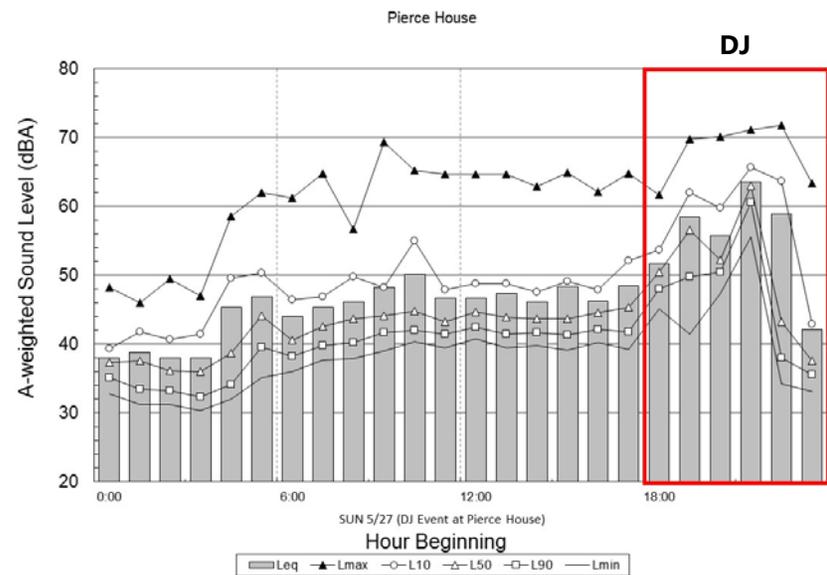
Pierce House Grounds



Pierce House Grounds



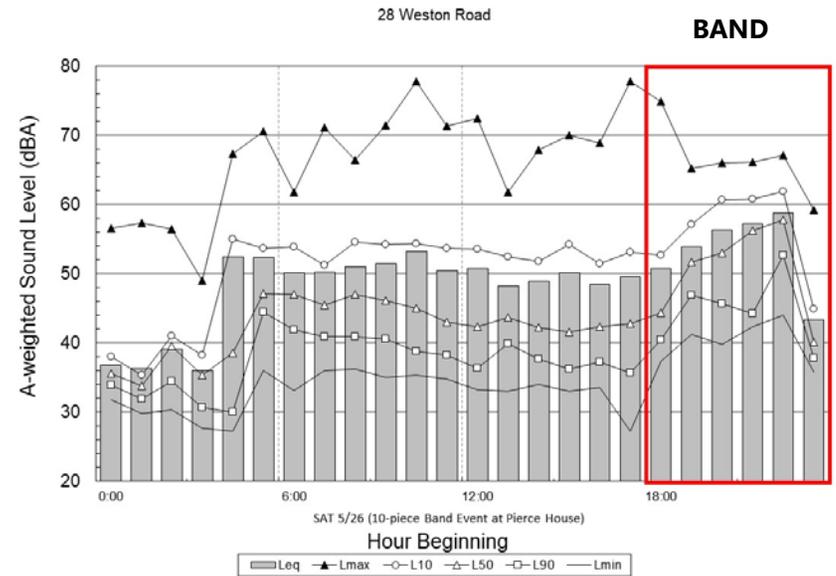
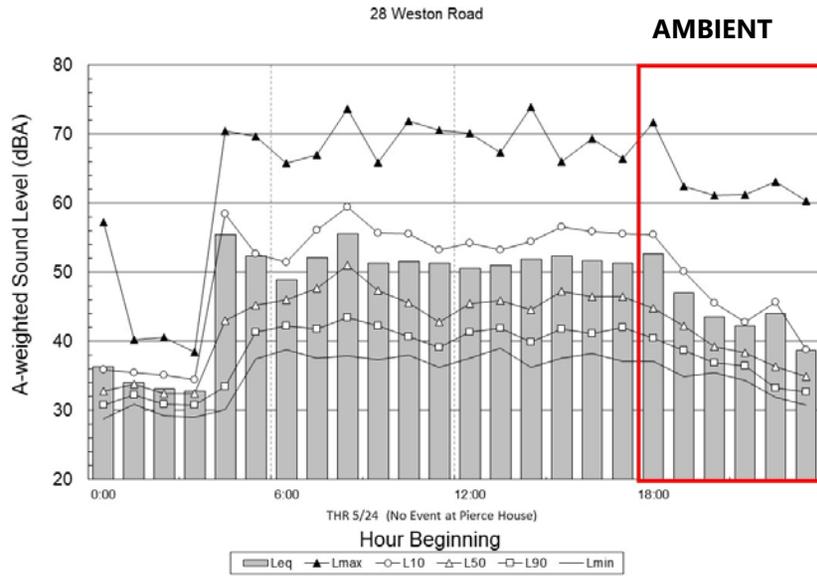
Hour Beginning	May 25 Ambient (L90)	May 25 Ambient (L50)	Band Event May 26 (L50)	DJ Event May 27 (L50)
6:00 PM	37	41	51	50
7:00 PM	36	40	56	57
8:00 PM	37	41	60	52
9:00 PM	45	46	67	63
10:00 PM	44	45	69	--*
11:00 PM	39	42	--*	--*



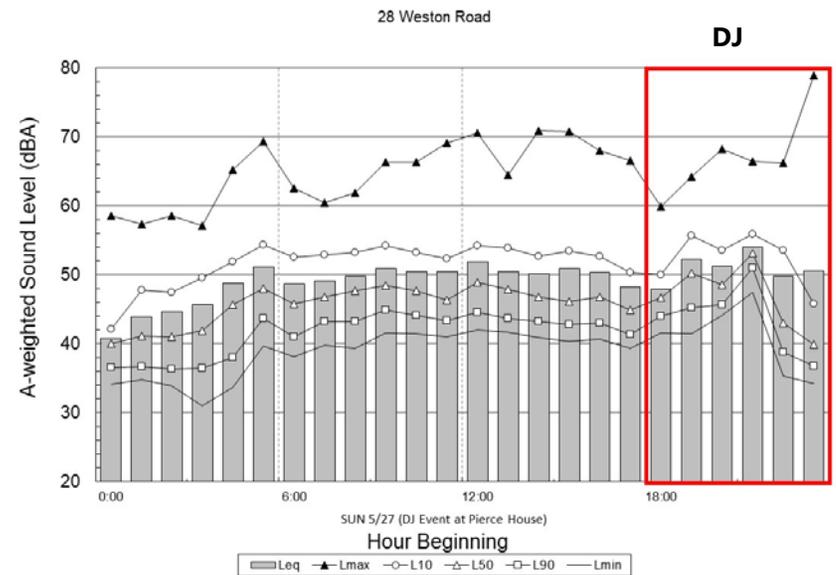
28 Weston Road



28 Weston Road



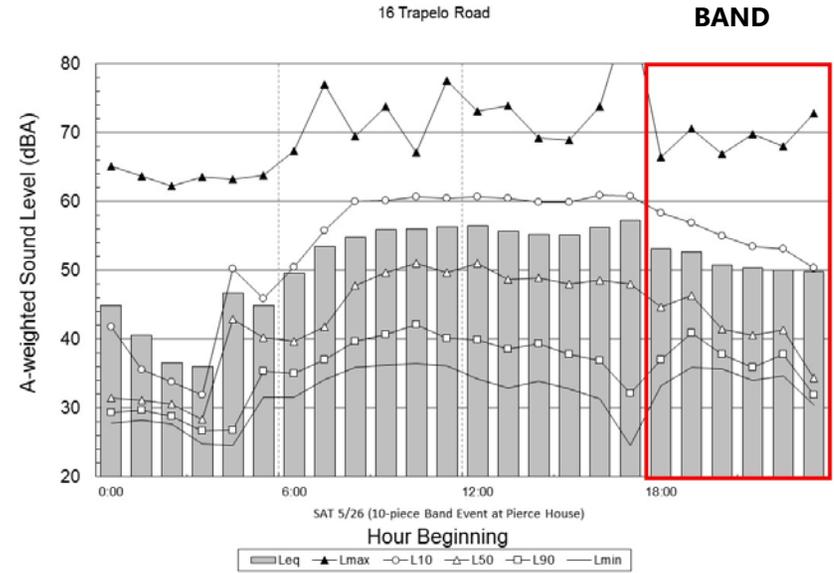
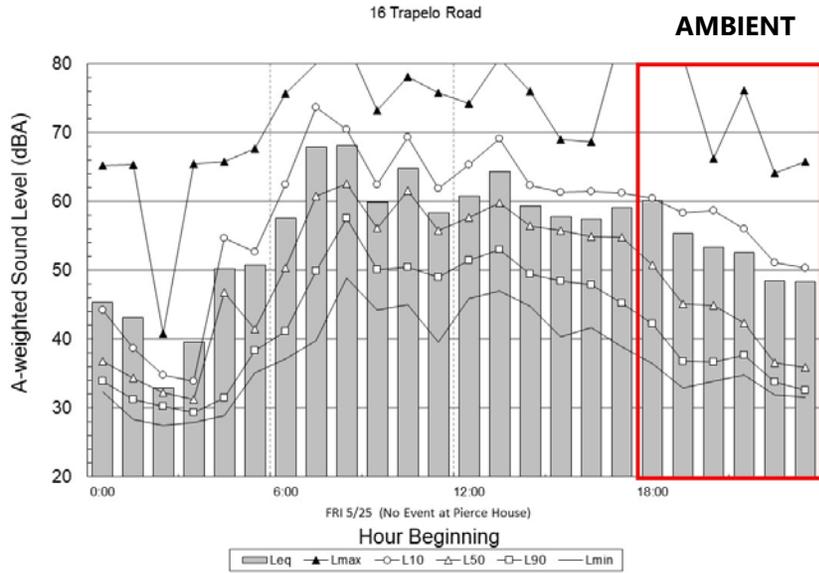
Hour	3-Day Avg Ambient (L50)	3-Day Avg Ambient (L90)	Band Event May 26 (L50)	Band L50 Increase over Ambient L50	Band L50 Increase over Ambient L90	DJ Event May 27 (L50)	DJ L50 Increase over Ambient L50	DJ L50 Increase over Ambient L90
6:00 PM	43	39	44	+1	+5	47	+3	+8
7:00 PM	41	38	52	+10	+14	50	+9	+12
8:00 PM	41	37	53	+12	+16	49	+8	+12
9:00 PM	41	39	56	+16	+17	53	+13	+14
10:00 PM	38	36	58	+19	+22	--	--	--
11:00 PM	37	35	--	--	--	--	--	--



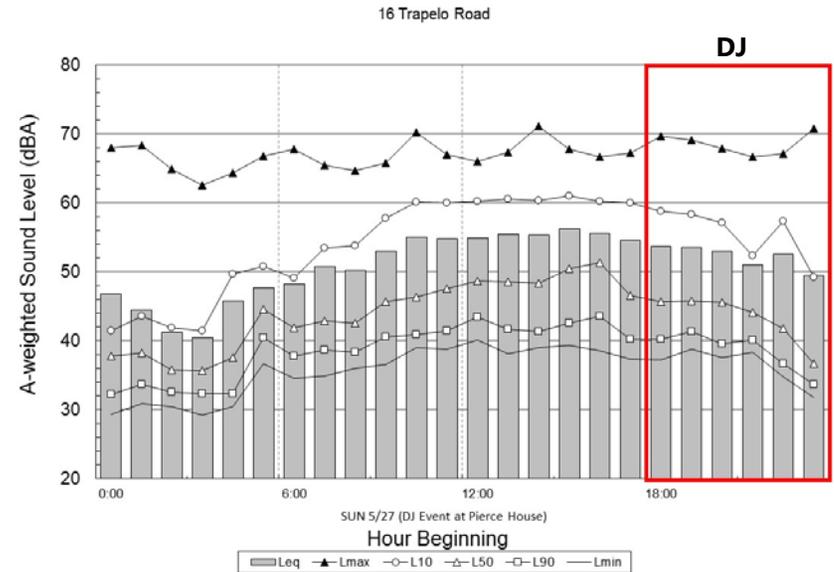
16 Trapelo Road



16 Trapelo Road



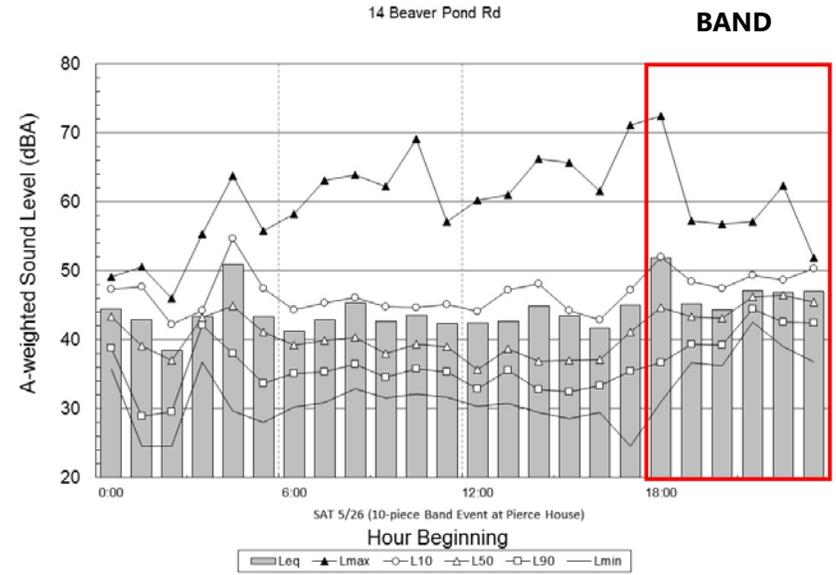
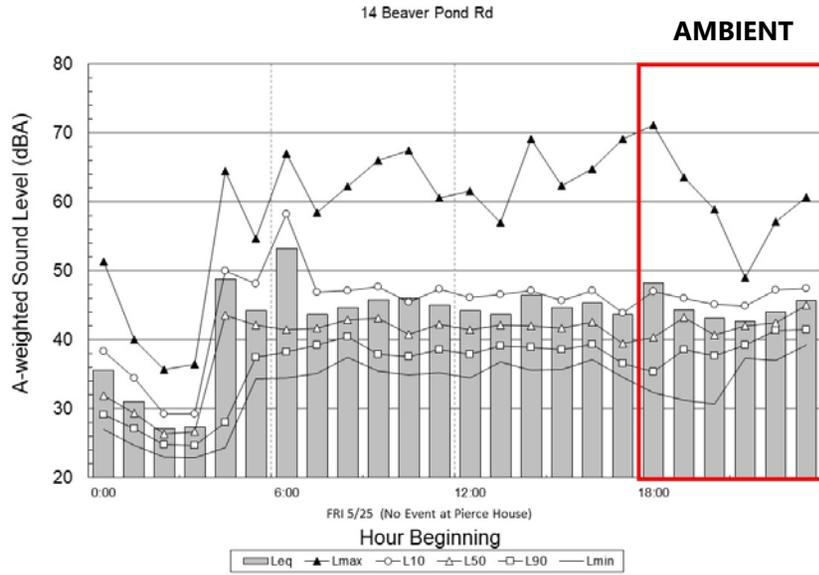
Hour	3-Day Avg Ambient (L50)	3-Day Avg Ambient (L90)	Band Event May 26 (L50)	Band L50 Increase over Ambient L50	Band L50 Increase over Ambient L90	DJ Event May 27 (L50)	DJ L50 Increase over Ambient L50	DJ L50 Increase over Ambient L90
6:00 PM	53	45	45	-9	0	46	-8	+1
7:00 PM	49	40	46	-3	+6	46	-3	+6
8:00 PM	45	38	41	-4	+3	46	0	+8
9:00 PM	40	36	41	0	+5	44	+4	+8
10:00 PM	36	33	41	+5	+8	--*	--*	--*
11:00 PM	36	33	--*	--*	--*	--*	--*	--*



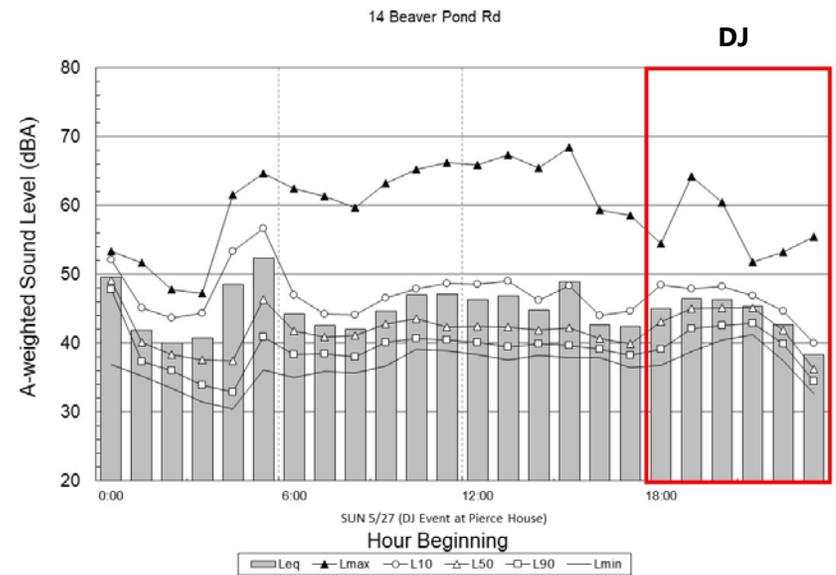
14 Beaver Pond Road



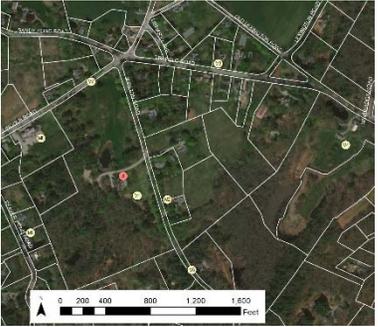
14 Beaver Pond Road



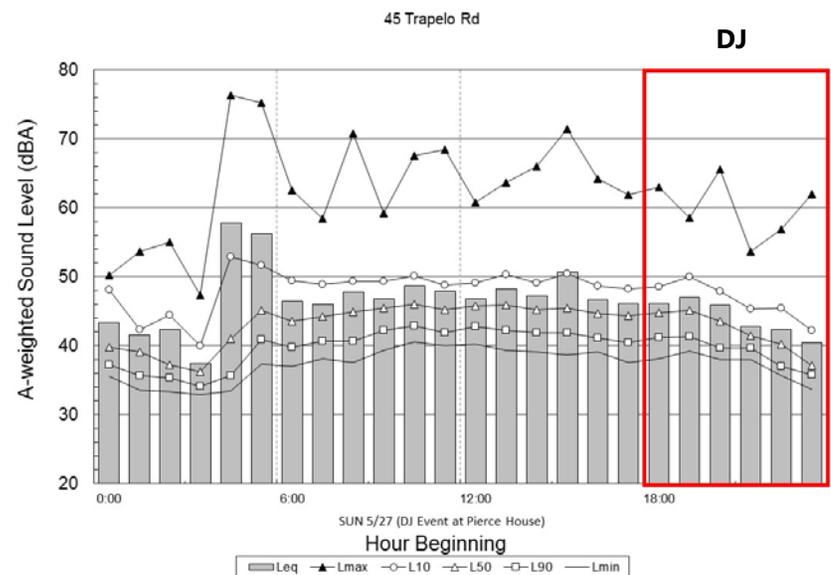
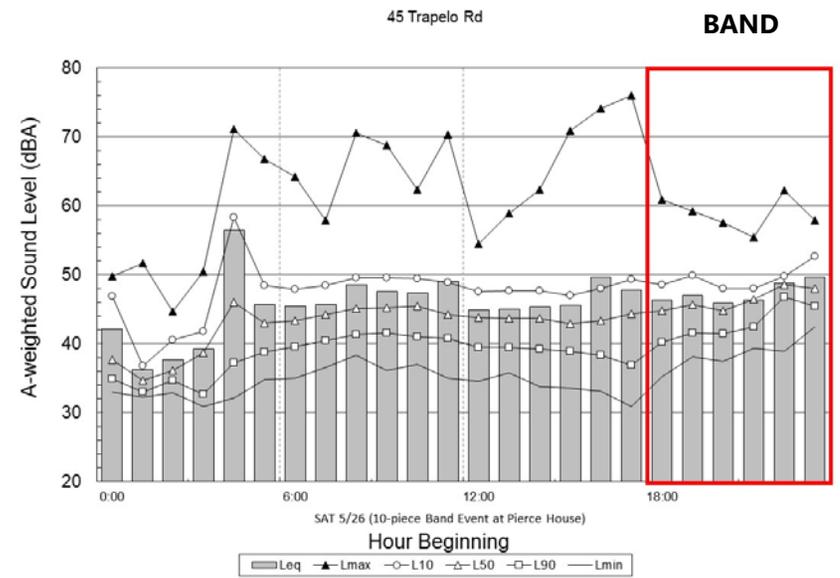
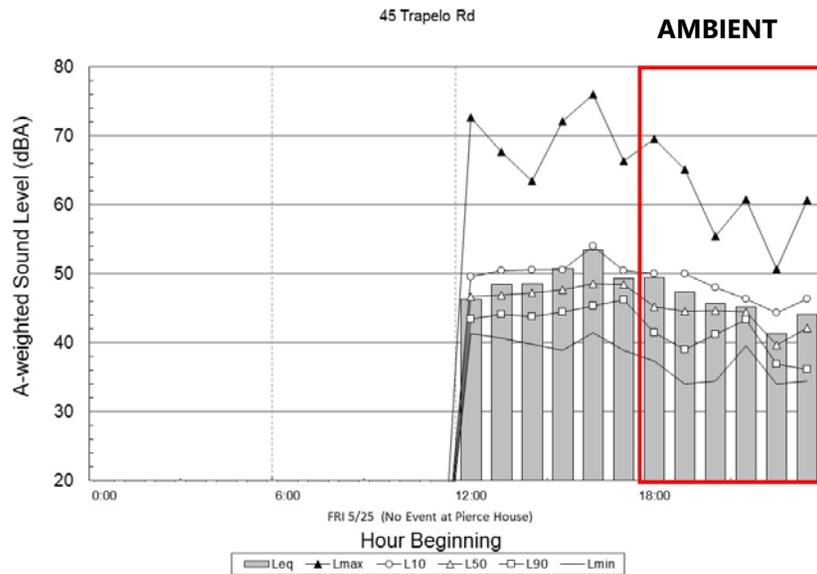
Hour	3-Day Avg Ambient (L50)	3-Day Avg Ambient (L90)	Band Event May 26 (L50)	Band L50 Increase over Ambient L50	Band L50 Increase over Ambient L90	DJ Event May 27 (L50)	DJ L50 Increase over Ambient L50	DJ L50 Increase over Ambient L90
6:00 PM	42	38	45	+3	+7	43	+1	+5
7:00 PM	45	40	43	-1	+3	45	0	+5
8:00 PM	45	41	43	-1	+2	45	+1	+4
9:00 PM	42	38	46	+5	+8	45	+4	+7
10:00 PM	39	37	46	+7	+9	--	--	--
11:00 PM	40	35	--	--	--	--	--	--



45 Trapelo Road



45 Trapelo Road



Hour	1-Day Avg Ambient (L50)	1-Day Avg Ambient (L90)	Band Event May 26 (L50)	Band L50 Increase over Ambient L50	Band L50 Increase over Ambient L90	DJ Event May 27 (L50)	DJ L50 Increase over Ambient L50	DJ L50 Increase over Ambient L90
6:00 PM	45	41	45	0	+4	45	0	+4
7:00 PM	45	39	46	+1	+7	45	0	+6
8:00 PM	45	41	45	0	+4	44	-1	+3
9:00 PM	44	43	46	+2	+3	41	-3	-2
10:00 PM	40	37	49	+9	+12	--*	--*	--*
11:00 PM	42	36	48	--*	--*	--*	--*	--*

Other Sites

7 Lincoln Road

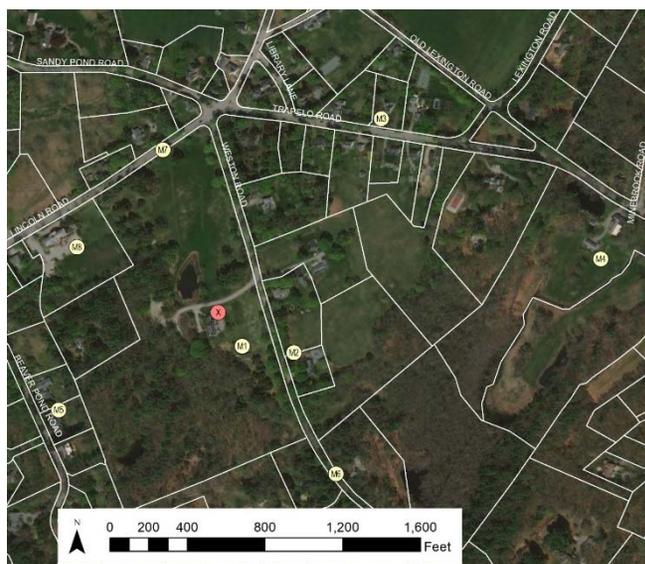
Date	Period	Event	Overall A-weighted Sound Level (dBA)					
			Lmin	L10	L50	L90	Lmax	Leq
Saturday May 26	9:23 to 9:34 PM	Band (10-piece)	53	65	60	57	79	63

16 Lincoln Road

Date	Period	Event	Overall A-weighted Sound Level (dBA)					
			Lmin	L10	L50	L90	Lmax	Leq
Saturday May 26	9:03 to 9:17 PM	Band (10-piece)	46	56	51	49	69	54

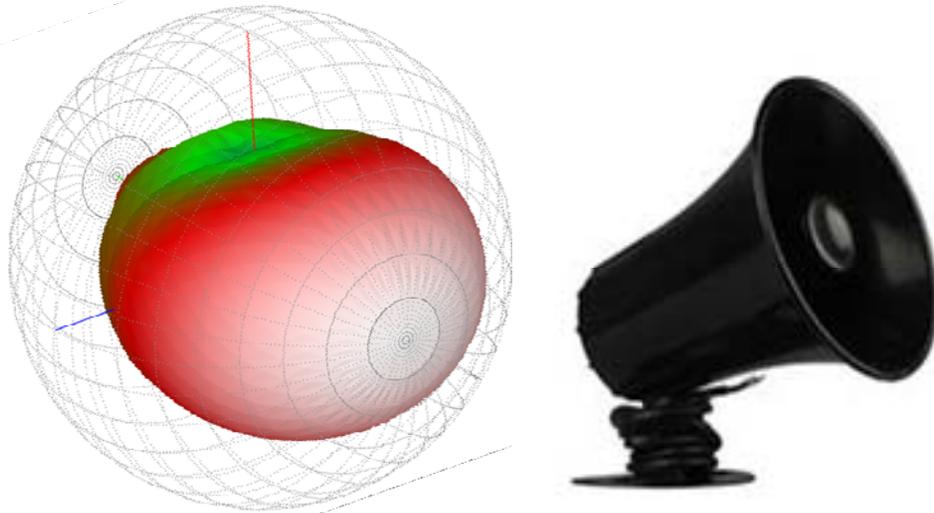
40 Weston Road

Date	Period	Event	Overall A-weighted Sound Level (dBA)					
			Lmin	L10	L50	L90	Lmax	Leq
Saturday May 26	8:34 to 8:45 PM	Band (10-piece)	38	52	47	42	75	52

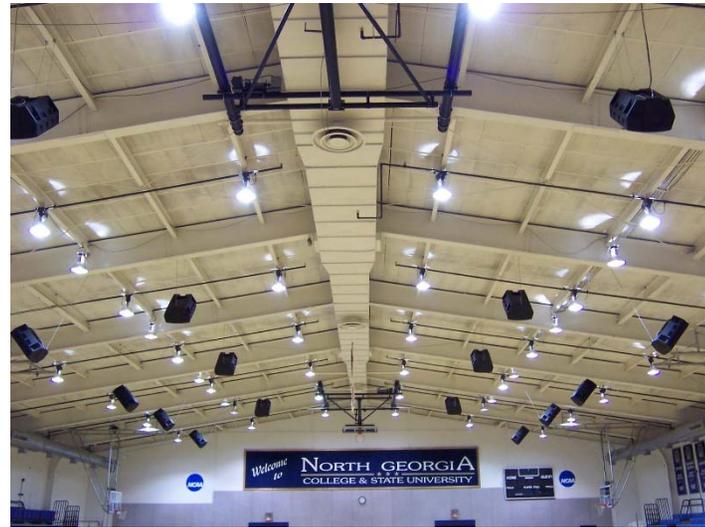


Mitigation Strategies – Source Control

Directive Speakers



Distributed Speaker System



Amplifier Controls



Keep Speakers Close to Patrons



Mitigation Strategies – Path Control

Enclose Party Tent Area



Partial Party Tent Enclosure



Heavier Party Tent Material



Absorptive Panels





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