



Cross-Spectrum Acoustics Inc.

Massachusetts

Utah

California

August 15, 2025

Dr. Michael Klemens
Chair, Planning & Zoning Commission
Town of Salisbury
PO Box 548
27 Main Street
Salisbury, CT 06068

Project Reference: J2025-1540 – Wake Robin Inn Noise Study Response to Public Comment

Dear Dr. Klemens:

This letter provides responses to public inquiries and comments that were made during the Town of Salisbury Planning & Zoning Commission Special Meetings on August 12 and August 14, 2025, regarding acoustical issues related to the special permit hearing for the Wake Robin Inn expansion.

Sound propagation over water: Several residents made comments about the audibility of sounds from sources across Lake Wononscopomuc such as Camp Sloane. The commission tasked Cross-Spectrum Acoustics (CSA) and the expert for the applicant, Cavanaugh Tocci (CTA) with explaining this phenomenon.

As a general matter, outdoor sound levels decrease with increasing distance – the sound level experienced by a listener at a close distance will be louder than if that listener was further away. Outdoor sound levels decrease at an approximate rate of six to 9 decibels per doubling of distance (the decay rate will depend on a number of local factors). If a sound source (say, two people speaking using raised voices) is observed to emit a sound level of 75 dBA at a distance of five feet, we would expect that source to produce 67-69 dBA at distance of 10 feet, 59-63 dBA at 20 feet, 52-57 dBA at 40 feet, and so on. Based on this math, the observed sound levels would be expected to be inaudible (sound level near 0 dB) at a distance of 6,000 feet. As noted by public comments, town residents are able to clearly hear sounds at these distances if the source is across the lake. This is due to a combination of factors as described below:

Factor 1: Wind direction: sound waves travel more efficiently in the downwind direction (i.e. the direction toward which the wind is blowing) compared with the upwind (against the wind) direction. Figure 1 shows a depiction of this propagation. In the figure, the wind is blowing right to left. Sound waves that are emitted from the source in the upwind (right) direction are directed up into the atmosphere so that noise levels along the ground are lower. Sound waves traveling in the downwind (left) direction are bent towards the ground so that sound levels at ground level tend to be higher.

The prevailing wind direction in the Connecticut region is from the southwest to the northeast. As a result, sounds traveling from sources southwest of Lake Wononscopomuc will be somewhat louder along Sharon Road compared to other directions. This is not to say that sounds would be inaudible in other directions or upwind; rather this is just one factor that determines the audibility of sounds across the lake.

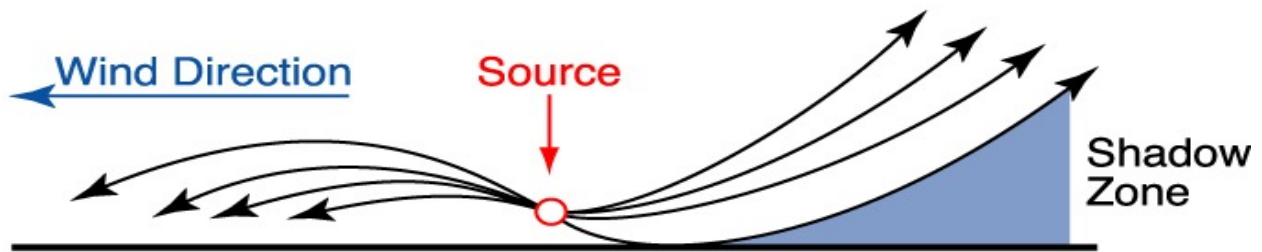


Figure 1. The movement of sound waves in the downwind (left) direction vs the upwind (right) direction. Source: National Transit Institute

Factor 2: Atmospheric conditions can also determine how sound waves travel over long distance. Under normal conditions, the temperature in the atmosphere decreases with increasing altitude (i.e., the air is colder at higher altitudes compared to the ground). This condition is called a “lapse.” As shown in Figure 2, under lapse conditions, sound waves emitted from a source are bent up into the atmosphere, which reduces sound levels at the ground.

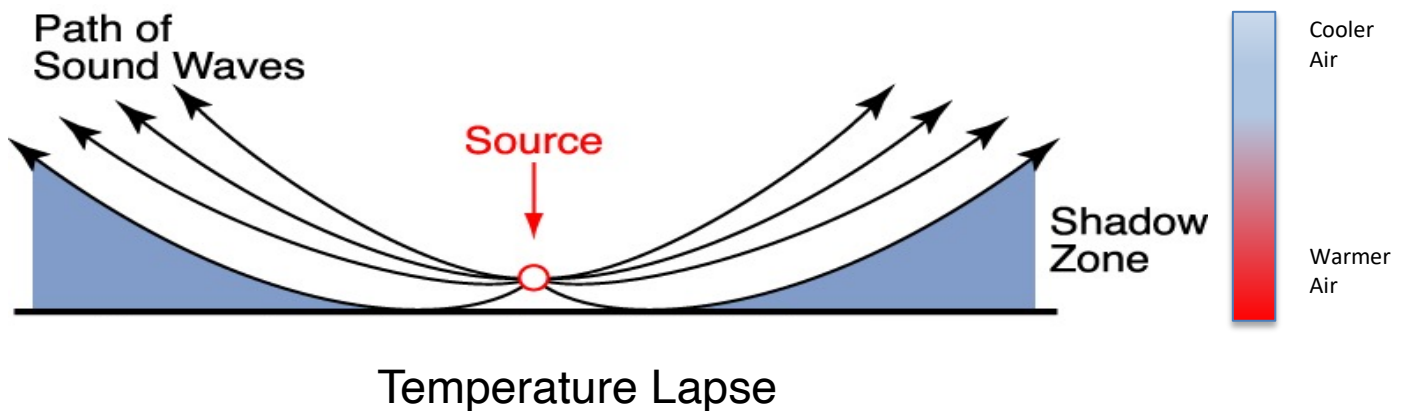


Figure 2. Sound wave path in lapse (temperature decreasing with increasing altitude) conditions. Source: National Transit Institute

There is another atmospheric condition in which temperatures decrease with increasing altitude (i.e. temperatures are colder on the surface compared with higher altitudes). This condition, known as an “inversion,” results in sound waves being bent toward the ground as shown in Figure 3. In this condition, noise levels are higher at the ground compared with lapse conditions.

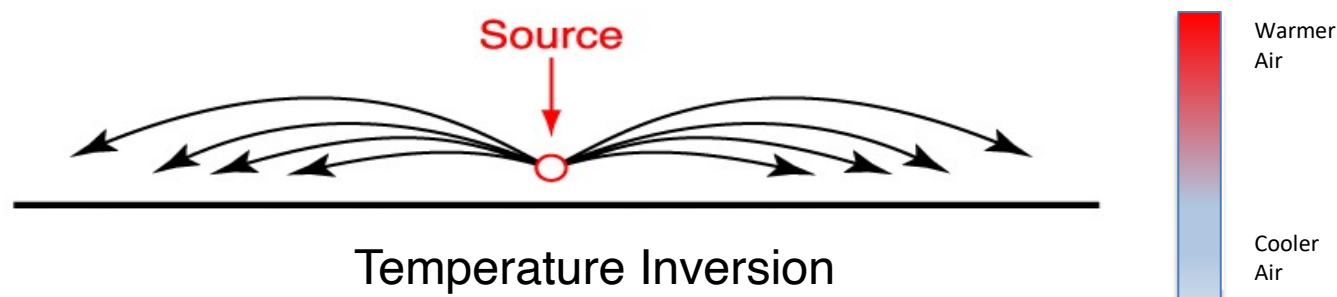


Figure 3. Sound wave path in inversion (temperature increasing with increasing altitude) conditions. Source: National Transit Institute

Lakes and other large bodies of water tend to remain at constant temperatures during the day which the air above it warms and cools with exposure to the sun. In these conditions, inversions can develop over lakes resulting in sound waves bending toward the ground and correspondingly louder sound levels at the ground.

Factor 3: The hardness of the surface can affect the resulting loudness and audibility of sound across long distances. As sound propagates across “soft” ground (grass, foliage, tilled land), some of the sound is absorbed by the ground which results in lower noise levels at a receiver. As sound propagates across “hard” ground (asphalt or concrete pavement, hard packed ground), sound waves will bounce off the surface and create higher sound levels at the receiver compared to soft ground conditions. The surface of large bodies of water appears as hard ground to sound waves, and sound is not attenuated the same way as would be expected for sound waves traveling for softer ground.

The combination of these three factors can result in sound sources across lakes being audible much more than would be expected given the large distances. It is important to note that even under these conditions, sound levels still decrease with increasing distance; the resulting decrease is just not as much as would be expected under more normal conditions.

Noise prediction software based on the ISO 9613¹ standard (used for the Cavanaugh Tocci sound study²) account for downwind conditions and hard/soft surfaces. The ISO 9613 standard explicitly does not account for the inversion conditions that can occur over water. The noise level propagation effects related to inversions over water would only occur for sources and homes located across the body of water. These effects would not be observed if the source and receivers are on the same side of the lake. Therefore, it would be appropriate to not consider these effects when predicting noise levels at homes immediately surrounding the Wake Robin Inn since there is no large body of water between them.

A comment during the August 14th public meeting mentioned that topography (hills, valleys, etc.) have an effect on sound propagation. This is correct. The ISO 9613 standard, and noise prediction

¹ ISO Standard 9613-2, Acoustics of sound during propagation outdoors – Part 2: General method of calculation.

² “Wake Robin Inn, Salisbury, CT Sound Analysis,” Letter from Gregory C. Tocci, Cavanaugh Tocci, to Steven Cohen and Jonathan Marrale, Aradev LLC, April 29, 2025

software based on this standard, takes into account the presence of topographical features such as hills and valleys.


Noise from pool background music: several residents discussed concerns regarding music being broadcast continuously at the outdoor pool. It is not clear from the CTA sound study if poolside music is incorporated into the “pool” source analysis in the report; this should be clarified.

If an analysis indicates that poolside music will meet State of Connecticut and Town of Salisbury limit, we encourage the applicant to consider a number of methods to minimize the audibility of pool music on abutters:

- The pool sound system should be designed by an experienced acoustician or sound system designer to ensure that speaker coverage does not leak beyond the pool area.
- The pool sound system should be made up of many small, distributed speakers operating at lower sound levels rather than fewer larger speakers that may need to operate a higher volume for acceptable coverage.
- Speakers should be mounted as low as possible (ground mounting preferable, but no higher than six feet from the ground) and should have narrow directivity to reduce unintended sound leakage.
- The pool sound system should not operate when there are indoor or other outdoor events with music.

If you have any questions or comments, please feel free to call me at (413) 315-5770 ext. 701, or email hsingleton@csacoustics.com.

Sincerely,



Herbert Singleton Jr, PE (Massachusetts), INCE Bd. Cert.
President
Cross-Spectrum Acoustics, Inc.