Memorandum

To: Nathan A. Poore
Town Manager
Town of Falmouth, ME

Date: November 9, 2018

Project #: 83953.18

From: Jason Ross, P.E., Director of Noise and Vibration

Re: Falmouth Center Master Plan –Noise Study Peer Review

Introduction

VHB has conducted a peer review of the "Falmouth Plaza Master Plan – Noise" technical memorandum ("the study") dated November 2, 2018 prepared by Stantec Consulting Services Inc. for the proposed expansion of the Falmouth Shopping Center which includes mixed use development consisting of indoor and outdoor athletic facilities, residential, office and retail land uses. VHB understands that the Falmouth Town Council is particularly interested in understanding potential noise effects associated with the proposed rezoning to allow the athletic facilities and outdoor sporting events.

This peer review evaluates the regulatory context used as the basis of the noise study, the methods used to evaluate existing and future noise conditions, the results of the impact assessment, and mitigation recommendations. This peer review includes recommendations for additional analyses and mitigation recommendations that should be provided by the applicant to inform the public and to support decisions made by the Falmouth Town Council regarding the proposed rezoning. Additional background information is provided in the appendix on noise including how it is typically measured and described when evaluating environmental noise effects, what typical noise levels are of common indoor and outdoor noise sources, and how changes in noise are perceived.

Summary of Findings

The study appropriately summarizes the noise standards that apply to the proposed project including the Town of Falmouth Noise Ordinance (Chapter II-12 Nuisances) and the Maine Department of Environmental Protection (DEP) Control of Noise (Chapter 375: No Adverse Environmental Effect Standards of the Site Location of Development Act).

The Town ordinance prohibits loud, boisterous, unnecessary, or unusual noises and reproducing sound, such as that through a public-address (PA) system in a manner that would disturb the peace, quiet and comfort of neighboring inhabitants. Although the proposed development would not include a PA system and most noises associated with athletic fields (such as whistles, crowd noise, and vehicles) would not likely be unusual or unnecessary, the study should address how the proposed use of the development would comply with this noise ordinance and whether any measures (i.e. signs to minimize loud activities, etc.) would be recommended.

Overall, the study only provides an overview of the framework for "... a future study and analysis for noise assessments that will be performed." VHB disagrees that it would be "… premature to conduct such a study at this phase of the project" since this information is an important factor in the site approval process. The study only qualitatively assesses compliance with the DEP rule. Further analysis is warranted to quantitatively assess potential noise effects and provide specific mitigation measures, as necessary. The following describes the additional recommended analyses, some of which are addressed in the study.

101 Walnut Street
PO Box 9151
Watertown, MA 02472-4026
P 617.924.1770

1) A key aspect to the DEP rule is establishing the existing ambient noise conditions. The study does not include ambient noise measurements or data (i.e. population data within 3,000 feet or noise predictions of Route 1, Route 88, or I-495) to support the assumption that pre-development existing noise conditions are not currently equal to or less than 45 dBA (day) and/or 35 dBA (night). As such, the study may be based on sound level limits which are 5 dBA higher than they should be and it may underestimate potential noise effects or mitigation measures that may be warranted. Additionally, the study includes a broad assumption that ambient noise levels might be in the range of 38 to 50 dBA without supporting rationale.

   VHB recommends that at a minimum population data or highway noise modeling are presented to support assumptions on ambient noise conditions. Preferably, VHB recommends that ambient noise measurements be conducted consistent with the methods described in subsection H of the DEP rule. Ambient noise measurements are very important to accurately establish existing noise conditions, evaluate the potential effects of noise from the proposed development, and provide mitigation recommendations.

2) The noise study should accurately and quantitatively assess compliance with the DEP noise limits. The current study is based largely on anecdotal information and general experiences of the consultant. While these observations are not unreasonable, a quantitative analysis is needed to properly predict future noise conditions at protected locations near the development site and to assess compliance.

   VHB recommends that the consultant model noise from the project site with commonly used sound prediction software such as Cadna-A or Soundplan. These sound models are based on internationally accepted methods of predicting sound including effects from terrain, intervening buildings, ground cover, trees, and atmospheric conditions.

   The most important element of the sound predictions is to understand how much noise the sources emit. While there is relatively limited data available in the industry on noise from sporting events at general athletic fields, the model should be based on reasonable assumptions associated with the sound from referee whistles, people in a crowd cheering or yelling during for periods during the game, etc. VHB recommends that in addition to the consultant reviewing noise emissions data that may be available from such sporting events, that the consultant also conduct noise measurements of similar sporting events.

   Although protected locations (residences) in the study area are relatively far from the proposed buildings, the noise assessment should also include predictions of mechanical equipment (i.e. rooftop chillers, fans, etc.). If specific manufacturers, types, and sizes of mechanical equipment are not available at this stage of the project development, assumptions should be made based on typical equipment.

   The noise study should also address the sound from maintenance activities such as mowing the fields.

3) An accurate quantitative noise assessment is required to determine whether noise mitigation is warranted and what specific measures would be effective for the development to comply with applicable noise standards. The study identifies potential noise attenuation techniques such as sound barrier walls or berms, time of use restrictions and specialty equipment, but actual recommendations are needed. These mitigation measures are reasonable and practical approaches that could be effective in minimizing potential noise effects. Other

mitigation measures that may be necessary include providing the public with information on the schedule of events at the proposed facility and providing the public with a means to communicate any noise concerns to the property owner. Specific measures and their effectiveness should be provided upon completion of a quantitative noise assessment.

Attachment: Fundamentals of Sound Appendix

Appendix: Fundamentals of Sound

Sound is the rapid fluctuation of air pressure. Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, work, communication or recreation. How people perceive sound depends on several measurable physical characteristics including:

Sound Level - Sound level is based on the amplitude change in pressure. Sound level is often described by its "loudness" or "intensity". Humans can hear a wide range of sound levels. Therefore, sound levels are measured on a logarithmic scale of decibels (dB) relative to 20 micro-pascals. The decibel scale compresses the audible range of acoustic pressure levels, which can vary from the threshold of hearing (0 dB) to the threshold of pain (120 dB).

Because sound levels are measured in decibels, when you add the sound level from multiple sources, the addition is not linear. For example, if there are two equal sources of sound, the overall total sound increases 3 dB. So, if there are two noise sources that are each 60 dB, the total sound level including both sources is 63 dB.

The way humans perceive changes in sound level generally follow the following relationships:

- A 3-dB increase is the smallest difference in sound level that can be perceived in most environments.
- A 10-dB increase is generally perceived as a doubling in loudness to the average person.

Frequency - Sounds are comprised of acoustic energy distributed over a range of frequencies (such as high-pitched and low-pitched sounds). Frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Humans can generally hear sound in frequencies from 20 to 20,000 Hz; however, the human ear does not perceive sound equally loud in all frequencies. To compensate for this, a frequency filter known as A-weighting is commonly used to evaluate environmental noise levels and sound levels are denoted as "dBA".

- Sound levels reported in octave or one-third-octave frequency bands are often used to describe the frequency content of different sounds. Some sources of sound, such as whistles or horns, can generate "pure tones" which is when there is a concentration of sound within a narrow frequency range. Humans can hear pure tones very well and such conditions can be annoying.

Since sound levels change from moment-to-moment, there are a variety of sound level descriptors used for environmental noise analyses. The following is a list of common sound level descriptors:

Energy-Average Sound Level (Leq) is a single value that represents the same acoustic energy as the fluctuating levels that exists over a given period of time. The Leq takes into account how loud noise events are during the period, how long they last, and how many times they occur. Leq is commonly used to describe environmental noise and relates well to human annoyance.

Day-night Average Sound Level (Ldn) is similar to the Leq in that it is a single that represents the same acoustic energy as the fluctuating levels that exists over a 24-hour period. The Ldn takes into account how loud sound events are, how long they last, how many times they occur over a 24-hour period, and whether they occur during the day (7:00 AM to 10:00 PM) or night (10:00 PM to 7:00 AM). Sound that occurs during the night is given a 10-decibel penalty to account for the increased human sensitivity to noise at night. If sound levels are constant over a 24-hour period, the Ldn level is 6.4 dB greater than the Leq level due to the 10-decibel nighttime penalty.

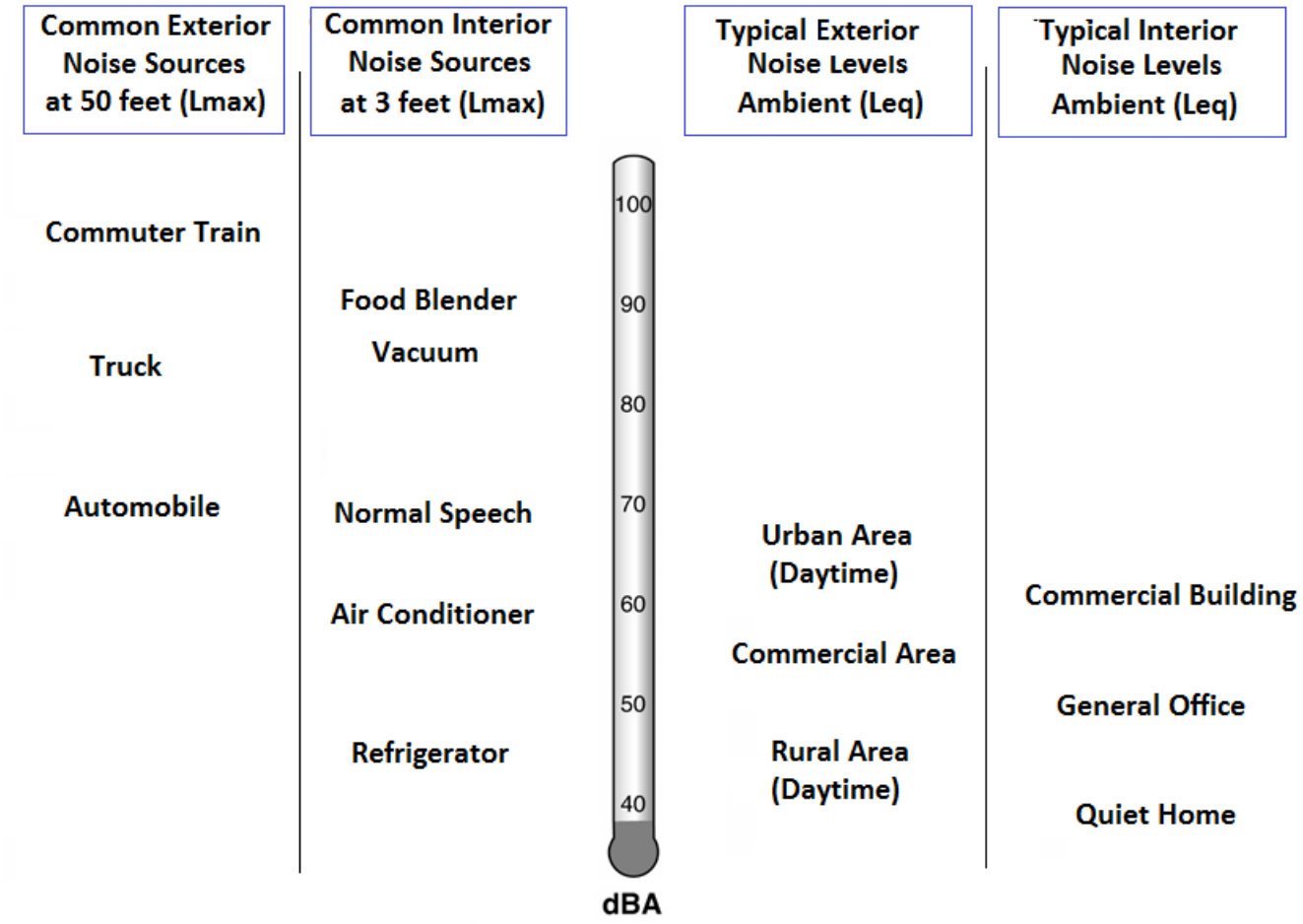
Statistical Sound Levels – Sound level metrics such as L01, L10, L50 or L90 represent the levels are exceeded for a particular percentage of time over a given period. For example, L10 is the level which is exceeded for 10 percent of

the time. Therefore, it represents the higher end of the range of sound levels. The L90, on the other hand, is the level that is exceeded 90 percent of the time and therefore is representative of the background sound level.

Maximum Sound Level (Lmax) is the highest sound level generated by a source. For a moving source such as a car, this typically occurs when the car is closest to the listener. For stationary equipment, the maximum sound level occurs when the operating conditions are loudest (i.e. when the fans on an air-conditioner are set at the highest speed). The following table and figure present sound levels of common outdoor and indoor sources.

Maximum Sound Level of Common Outdoor and Indoor Source

Outdoor Source	Sound Level (dBA)	Indoor Source
	110	Rock Band at 5 m
Jet Over Flight at 300 m	**105**	
	100	Inside New York Subway Train
Gas Lawn Mower at 1 m	**95**	
	90	Food Blender at 1 m
Diesel Truck at 15 m	**85**	
Noisy Urban Area—Daytime	**80**	Garbage Disposal at 1 m
	75	Shouting at 1 m
Gas Lawn Mower at 30 m	**70**	Vacuum Cleaner at 3 m
Suburban Commercial Area	**65**	Normal Speech at 1 m
	60	
Quiet Urban Area—Daytime	**55**	Quiet Conversation at 1 m
	50	Dishwasher Next Room
Quiet Urban Area—Nighttime	**45**	
	40	Empty Theater or Library
Quiet Suburb—Nighttime	**35**	
	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime	**25**	Empty Concert Hall
Rustling Leaves	**20**	
	15	Broadcast and Recording Studios
	10	
	5	
Reference Pressure Level	**0**	Threshold of Hearing


Common Exterior Noise Sources at 50 feet (Lmax)
Common Interior Noise Sources at 3 feet (Lmax)
Typical Exterior Noise Levels Ambient (Leq)
Typical Interior Noise Levels Ambient (Leq)
Commuter Train
Truck
Automobile
Food Blender
Vacuum
Normal Speech
Air Conditioner
Refrigerator
100
90
80
70
60
50
40
dBA
Urban Area (Daytime)
Commercial Area
Rural Area (Daytime)
Commercial Building
General Office
Quiet Home