

HARRIS MILLER MILLER & HANSON INC.

77 South Bedford Street
Burlington, MA 01803
T 781.229.0707
F 781.229.7939
W www.hmmh.com

March 11, 2015

Mr. Michael Andrade
Graves Engineering, Inc.
100 Grove Street
Worcester, MA 01605

via email at MAndrade@gravesengineering.com



Subject: Review of Environmental Sound Study report on proposed motocross park at Sunset City in Charlton, MA.

Reference: HMMH Project 307230

Dear Mr. Andrade:

Harris Miller Miller & Hanson Inc. (HMMH) was retained by Graves Engineering, Inc. and the Charlton Planning Board to review the subject Environmental Sound Study for a proposed motocross park at Sunset City in Charlton, MA. We have reviewed a report dated March 6, 2015 prepared by Cavanaugh Tocci Associates, Inc. (CTA), as well as site plans for the proposed development prepared by Bertin Engineering.

This letter presents HMMH's initial comments. A more thorough review may be conducted after the preliminary comments are addressed. After an executive summary, we have grouped our detailed comments into three categories: 1) prediction of motocross noise levels and intrusion in the community, 2) characterization of the ambient background L90 sound level, and 3) interpretation of the MassDEP noise policy.

Executive Summary

HMMH has conducted modeling of the predicted sound levels and intrusiveness of motocross activity at the proposed tracks at Sunset City in Charlton, MA. We have predicted sound levels under "worst-case" atmospheric conditions favorable to sound propagation, such as downwind and with a temperature inversion, which is common on summer evenings. We based our estimates on noise emissions that we measured from dozens of individual motocross bikes racing at the Moto-X 338 facility in Southwick, MA in 2010. We believe that source data to be very solid.

HMMH's predicted sound levels from racing days and practice days are much higher than what are given in the CTA report. Our predicted maximum levels are up to 73 dBA from the beginning of a race on the Main Track as heard at Site R1, the nearest home to the east. Sound levels would only be slightly less at the homes on Sydney Circle, averaged over time, or on practice days. The facility would not be in compliance with the MassDEP noise policy regarding increases in existing ambient sound levels (a maximum increase of 10 decibels), since increases could be over 40 dB on a momentary basis and 35 dB on average. Further, in our experience, and also stated in the CTA report, motocross racing noise is tonal in character. Therefore, it is likely that a pure tone condition would also exist, per MassDEP's

HARRIS MILLER MILLER & HANSON INC.

Mr. Michael Andrade, Graves Engineering, Inc.

March 11, 2015

Page 2

noise policy. These predicted sound levels do not account for the potential benefit of vegetation, but the maximum reduction in noise from it would be only about 10 decibels.

HMMH has consulted on several projects involving race track noise over the past 10 to 15 years. Some of the projects involved existing or new facilities where noise complaints were being addressed. In our experience, in rural areas where daytime background sound levels are in the 30s or 40s dBA (similar to the Charlton community), sound levels from vehicle racing that are in the 60s or 70s dBA can be very intrusive and highly objectionable. Such noise intrusion often leads to legal action if it occurs on a regular basis, such as every weekend. Since an increase in sound level of 10 dB is considered twice as loud, an increase of 30 dB would be heard as 8 times as loud, and 40 dB would be heard as approximately 16 times as loud. The proposed Sunset City motocross park would have a very substantial noise impact on the surrounding community unless very significant noise abatement measures were undertaken.

Prediction of Motocross Noise Levels and Intrusion into the Community

HMMH has recent experience with the measurement and prediction of motocross in central Massachusetts. We collected a substantial amount of individual vehicle pass-by noise emission data during a day of motocross racing at Moto-X 338 in Southwick, MA. Several dozen bikes were racing that day, so we believe we have a representative sample of noise source levels from bikes that race in Massachusetts. The energy-average emission level (L_{max} pass-by level) of all of the bike pass-bys normalized to 50 ft was 95 dBA.

In the case of weekend day racing at the proposed Main Track at the Sunset City park, 20 bikes operating would add 13 dBA to the total sound energy of one bike [$10 \log(20) = 13$ dB] being emitted at once on the track as a whole. At the start of races, all of the bikes are started at once in a mass start, so near the northern part of the main track, including the section north of the practice track, all 20 bikes will be bunched together at the start of each race and for the first few minutes. So a worst-case average noise emission for the 20 bikes in the northern area is $95 + 13 = 108$ dBA at 50 feet.

The closest home to the motocross tracks appears to be at Site R1, shown in Figure 1 in the CTA report. The distance from the northeastern part of the Main Track (which is shortly after the start) to R1 appears to be approximately 2360 feet. The distance from this part of the Main Track to the homes on Sydney Circle is approximately 3000 ft. To compute the estimated sound levels in the community, we used the equations for sound propagation in ISO 9613-2, a conservative ground-absorption factor of 0.5, and we did not account for shielding by terrain, since the site is somewhat elevated compared with the surrounding area, with no significant intervening hills. Sound tends to travel an elevated, downward curving path under atmospheric conditions favorable to sound propagation such as downwind or with a temperature inversion, which is common on warm summer evenings. Such a path does not interact with objects near the ground very significantly except near the ends of the path. So, we expect that trees and terrain will have minimal influence on the sound levels in the surrounding community under such conditions favorable to propagation. It is prudent to

HARRIS MILLER MILLER & HANSON INC.

Mr. Michael Andrade, Graves Engineering, Inc.

March 11, 2015

Page 3

do an initial assessment assuming such conditions to determine the potential for noise impact under worst-case conditions. The computed propagation losses from 50 ft to the nearest residences are in the range of 35 to 37 dB without accounting for any attenuation from vegetation, and up to 47 dB with vegetation. With softer ground assumed ($G = 0.7$), computed losses are 37 to 39 dB without vegetation. Using simple hemispherical divergence [$20 \log(\text{distance}/50)$], the computed losses are 33 to 36 dB without vegetation.

Maximum motocross sound levels at R1 after the start of a Main Track race with 20 bikes are predicted to be up to 73 dBA (108 minus 35) without accounting for vegetation and 63 dBA assuming full vegetation attenuation at R1. Sound levels are predicted to be about 2 decibels lower at the Sydney Circle homes. Average hourly Leq sound levels are predicted to be about 3 to 5 dB lower than the maximum values, assuming favorable sound propagation conditions throughout the hour.

Sound levels from the Practice Track are predicted to be only slightly lower than those from the Main Track. With 12 bikes operating at once, the source emission levels are up to 106 dBA at 50 feet, so maximum levels at R1 are estimated to be between 61 and 71 dBA under favorable sound propagation conditions, depending on the benefit provided by vegetation.

We cannot reconcile the very significant differences between these predictions and those given in the CTA report. At a minimum, the report should state the assumed source noise emission levels for the motocross bikes.

Clearly, HMMH's predicted sound levels from racing would not be in compliance with the MassDEP noise policy regarding increases in existing ambient L90 sound levels, since increases could be over 40 dB on a momentary basis and 35 dB on average. Further, in our experience, and also stated in the CTA report, motocross racing noise is tonal in character. Therefore, it is likely that a pure tone condition would also exist, per MassDEP's noise policy.

HMMH has consulted on several projects involving race track noise over the past 10 to 15 years. Some of the projects involved existing or new facilities where noise complaints were being addressed. In our experience, in rural areas where daytime background sound levels are in the 30s or 40s dBA, sound levels from vehicle racing that are in the 60s or 70s dBA can be very intrusive and highly objectionable. Such noise intrusion often leads to legal action if it occurs on a regular basis, such as every weekend. Since an increase in sound level of 10 dB is considered twice as loud, an increase of 30 dB would be heard as 8 times as loud, and 40 dB would be heard as approximately 16 times as loud.

Characterization of the Background L90 Sound Level

Since the existing background sound measurements were made in the winter during a period when it was significantly windy much of the time, we believe that only the days with low winds should be used to represent the existing ambient background sound levels. Wind can be one of the most significant sources of ambient sound in rural areas. Summertime winds are generally low compared to other times of the year, and it will be the summer days and

HARRIS MILLER MILLER & HANSON INC.

Mr. Michael Andrade, Graves Engineering, Inc.

March 11, 2015

Page 4

early evenings with calm or light winds that will generate both the atmospheric conditions favorable to propagation of racing sound and also quiet background sound levels. This approach would result in characterizing the existing background sound level as a few decibels quieter than the approach taken in the report, where the average minimum for all days was used.

Interpretation of the MassDEP Noise Policy

The heading “Design Goals for Sunset City Complex Sound” on page 4 of the report implies that MassDEP’s noise limits represent design goals. MassDEP representatives have suggested in the past that a facility’s sound levels be designed to be no more than about 5 decibels higher than the ambient L90.

Acoustical consultants and MassDEP have not always been consistent in the metric used to characterize the sound level of the noise source. Both L_{max} and L_{eq} have been used, depending on the nature of the sound source and also MassDEP region. It may be prudent to evaluate the potential for compliance with MassDEP policy using both metrics of the sound level from the source.

Please feel free to contact me if you have any questions or comments.

Sincerely,

HARRIS MILLER MILLER & HANSON INC.

A handwritten signature in black ink that reads "Christopher W. Menge". The signature is written in a cursive, flowing style.

Christopher W. Menge, INCE
Senior Vice President and Principal Consultant