April 8, 2021

Mr. Shawn Danesh
Calvada Development & Construction, Inc.
26996 La Paz Road
Aliso Viejo CA, 92656

SUBJECT: Noise Memorandum – Popeye's Chicken Restaurant Drive Thru Menu Board, Orange, CA

Dear Mr. Danesh;

Birdseye Planning Group (BPG) is pleased to submit this Noise Memorandum addressing sound levels from the drive-thru menu board outside the proposed Popeye's Restaurant in the City of Orange, California. The site is located at 584 North Tustin Street. It is currently developed with a restaurant building. The building would be demolished to accommodate construction of a new Popeye's restaurant with a drive-thru lane. The site is bordered by commercial uses to the north, east and south. Single-family residences are located to the west. The issue raised by the City of Orange staff is whether noise from the menu board speaker would violate the City of Orange Municipal Code for stationary sources (Section 8.25) and adversely affect neighboring residents.

Overview of Sound Measurement

Noise level (or volume) is generally measured in decibels (dB) using the A-weighted sound pressure level (dBA). The A-weighting scale is an adjustment to the actual sound pressure levels to be consistent with that of human hearing response, which is most sensitive to frequencies around 4,000 Hertz (about the highest note on a piano) and less sensitive to low frequencies (below 100 Hertz).

Sound pressure level (SPL) is measured on a logarithmic scale with the 0 dB level based on the lowest detectable sound pressure level that people can perceive (an audible sound that is not zero sound pressure level). Based on the logarithmic scale, a doubling of sound energy is equivalent to an increase of 3 dBA, and a sound that is 10 dBA less than the ambient sound level has no effect on ambient noise. Because of the nature of the human ear, a sound must be about 10 dBA greater than the reference sound to be judged as twice as loud. In general, a 3 dBA change in community noise levels is noticeable, while 1-2 dB changes generally are not perceived. Quiet suburban areas typically have noise levels in the range of 40-50 dBA, while arterial streets are in the 50-60+ dBA range. Normal conversational levels are in the 60-65 dBA range, and ambient noise levels greater than 65 dBA can

interrupt conversations. Noise levels typically attenuate (or drop off) at a rate of 6 dBA per doubling of distance from point sources (i.e., industrial machinery). Noise from lightly traveled roads typically attenuates at a rate of about 4.5 dBA per doubling of distance. Noise from heavily traveled roads typically attenuates at about 3 dBA per doubling of distance. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA. The manner in which older homes in California were constructed (approximately 30 years old or older) generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows. The exterior-to-interior reduction of newer residential units and office buildings construction to California Energy Code standards is generally 30 dBA or more (HMMH, 2006).

In addition to the actual instantaneous measurement of sound levels, the duration of sound is important since sounds that occur over a long period of time are more likely to be an annoyance or cause direct physical damage or environmental stress. One of the most frequently used noise metrics that considers both duration and sound power level is the equivalent noise level (Leq). The Leq is defined as the single steady A-weighted level that is equivalent to the same amount of energy as that contained in the actual fluctuating levels over a period of time (essentially, the average noise level). Typically, Leq is summed over a one-hour period. Lmax is the highest RMS (root mean squared) sound pressure level within the measuring period, and Lmin is the lowest RMS sound pressure level within the measuring period.

The time period in which noise occurs is also important since noise that occurs at night tends to be more disturbing than that which occurs during the day. Community noise is usually measured using Day-Night Average Level (Ldn), which is the 24-hour average noise level with a 10-dBA penalty for noise occurring during nighttime (10 p.m. to 7 a.m.) hours, or Community Noise Equivalent Level (CNEL), which is the 24-hour average noise level with a 5 dBA penalty for noise occurring from 7 p.m. to 10 p.m. and a 10 dBA penalty for noise occurring from 10 p.m. to 7 a.m.

City of Orange Noise Ordinance

Section 8.25.040 of the City of Orange Municipal Code limits exterior noise levels associated with stationary sources to an hourly average (Leq) of 55 dBA during daytime hours (7:00 pm to 10:00 pm) and 50 dBA during nighttime hours (10:00 pm to 7:00 am) at all residential properties. Maximum noise levels at residential properties cannot exceed 70 dBA during daytime hours and 65 dBA during nighttime hours.

Project Site Setting

To gather data on the sound environment at the project site, two weekday morning 15-minute noise measurements and one 5-minute spot measurement was taken on April 7, 2021 using an ANSI Type II integrating sound level meter. The 15-minute monitoring locations were located along the western site boundary, one on the north side of the existing building and the other on the south side, adjacent

to the property line and rear yard of the single-family residence(s) located west of the site. The predominant noise source was traffic operating on Tustin Street though other sources including the operation of power tools at a neighboring residence and vehicles in the McDonald's restaurant drive-thru line north of the site were audible. The temperature during monitoring was 70 degrees Fahrenheit with a slight breeze. The spot measurement was taken along the western site boundary of the McDonald's restaurant drive-thru aisle located adjacent to and north of the site. The purpose was to establish typical noise levels at the western property line associated with operation of the menu board speaker at the adjacent restaurant. As stated, traffic operations are the primary source of noise at Site 1 and 2. During monitoring at Site 1, 621 cars/light trucks, 10 medium (two-axle/6 tires) and 2 heavy (all other vehicles with more than three axles) trucks passed the site on Tustin Street. Traffic volumes were not counted during monitoring at Site 2 but are presumed to be similar given the comparison between the measured noise levels at Site 1 and Site 2. Monitoring Site 3 was screened from traffic noise by the restaurant building. Noise levels at this location were predominantly generated by idling vehicles in the drive-thru lanes.

Baseline noise levels are shown in Table 1 below. Measurement locations are shown in Figure 1. As shown, under baseline conditions, noise levels at Sites 1 and 2 exceed the 55 dBA daytime exterior standard for residential properties. Measured noise at Site 3 is below the 55 dBA daytime exterior standard.

Table 1
Measured Sound Levels

Location	Measured Leq
Site 1 – North side of project site	57.0 dBA
Site 2 – South side of project site	56.2 dBA
Site 3 – West side of McDonald's parking lot	53.3 dBA

Drive Thru Window Speakers Sound Characteristics

Speaker noise is an intermittent, variable noise source and subject to change based on volume settings. Based on field observations, speaker noise is typically screened by the vehicle at the menu board and is audible as a conversational source. Table 2 shows measured noise levels at varying distances from a menu board speaker.

As shown in Table 2, the reference SPL at 32 feet (54 dBA) is similar to the measured noise level at the same distance from the McDonald's menu speaker (i.e., 53.3 dBA). It is important to note that speakers are mounted in a variety of different enclosures. Further, the building, the adjacent car and even other cars in proximity all effect the direction and attenuation rate. Speaker noise is also intermittent rather than a constant source. These factors all make the sound more directional and the decay rate less predictable. Based on the planned orientation of the speaker board, sound would project to the south rather than west towards the western property boundary. Noise contour data

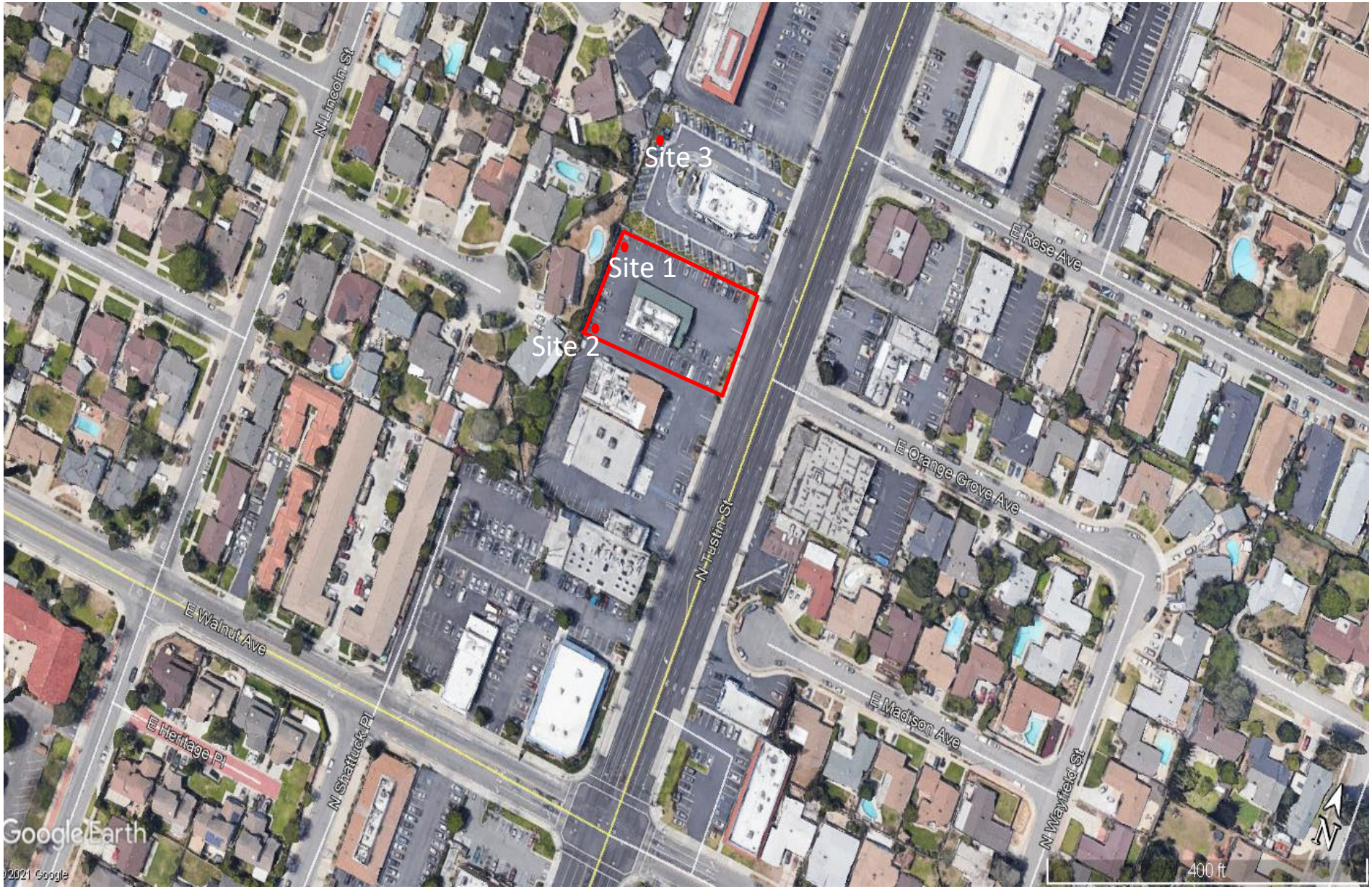

Figure 1—Measurement Locations - Project Site

Table 2
Measured Sound Pressure Levels

Distance	Measured Sound Pressure Level
1 foot	84 dBA
2 feet	78 dBA
4 feet	72 dBA
8 feet	66 dBA
16 feet	60 dBA
32 feet	54 dBA

Source: HME, 2010

show that sound levels at 90 degrees from the speaker are approximately 30 dBA less than noise levels that project straight at 0 degrees. Provided speaker noise associated with the proposed Popeye's restaurant is similar to the reference noise level and measured noise level discussed above, the southerly projection would reduce noise projecting to the west to below background conditions at the western property line.

Concrete Masonry Wall Attenuation

The project site is separated from the neighboring residential neighborhood by an approximately 8-foot tall concrete masonry unit (CMU) wall. Residences west of the wall are located approximately 4 feet below the site elevation. Both conditions contribute to the attenuation of sound levels generated by traffic on Tustin Street as well as on-site activities. Based on measured ambient conditions on-site (57 dBA), the addition of speaker noise/idling vehicles (54 dBA assuming a worst-case direct projection) would equal a combined level of 58.4 dBA at the western property line provided the speaker noise is a constant source. The combined noise level is a conservative estimate given the fact that the speaker noise is an intermittent source and would project south rather than directly west.

The CMU wall and elevation differential would attenuate noise levels west of the wall. Assuming the speaker is located 1 meter above the ground, the wall is 2.2 meters in height and the residences are at approximately 1 meter, the combine traffic noise and on-site speaker noise would attenuate to approximately 32.4 dBA. This does not account for the variability of noise sources on the site and activities occurring on the residential properties that also contribute to ambient conditions. However, speaker noise would be within the 55 dBA daytime exterior and 50 dBA nighttime standards.

Automatic Volume Control Sound System

Automatic Volume Control (AVC) is commonly installed as part of the outdoor speaker system. These systems are used to reduce the outbound sound pressure level based (i.e., speaker volume) on ambient noise. When AVC is active, the outbound level is reduced to a level that is 15 dB above the ambient noise level at the speaker post microphone, but it never increases the level above what would be heard with AVC turned off. While site conditions indicate noise levels west of the site would meet

exterior day and nighttime standards at residences west of the site, the AVC feature can considerably reduce the SPL during quiet periods and may help satisfy local sound abatement requirements.

Thank you for the opportunity to assist with this project. Should you have questions or require additional information, please let me know. I can be reached at 760-712-2199 or via e-mail at ryan@birdseyeplanninggroup.com.

Regards,

Ryan Birdseye
Principal