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September 23, 2014
Project No. 46-069

Mr. Chris Perri
Apple Homes Development, Inc.
15 Sherman Court
Scotts Valley, CA 95066

Subject: Traffic Noise Assessment Study for the Planned "The Terrace at Scotts Valley" Townhouse Development, Scotts Valley Drive, Scotts Valley

Dear Mr. Perri:

This report presents the results of a noise assessment study for the planned "The Terrace at Scotts Valley" townhouse development along Scotts Valley Drive in Scotts Valley, as shown on the Tentative Grading Plan, Ref. (a). The noise exposures at the site were evaluated against the standards of the City of Scotts Valley General Plan Noise Element, Ref. (b). The analysis of the on-site sound level measurements indicates that the existing noise environment is due primarily to vehicular traffic sources on Scotts Valley Drive and Mt Hermon Road, with a minor influence from operations at the adjacent Shell service station car wash. The results of the analysis reveal that the noise exposures are within limit of the standards. Mitigation measures will not be required.

Section I of this report contains a summary of our findings. Subsequent sections contain the site, traffic and project descriptions, analyses, and evaluations. Attached hereto are Appendices A, B and C, which include the list of references, descriptions of the applicable standards, definitions of the terminology, descriptions of the acoustical instrumentation used for the field survey, general building shell controls, and the on-site noise measurement data and calculation tables.

I. Summary of Findings

The noise assessment results presented in the findings are shown in reference to the City of Scotts Valley Noise Element, which utilizes the Day-Night Level (DNL) 24-hour noise descriptor to define community noise impacts, and specifies that exterior noise exposures at residential areas are limited to 60 dB DNL. In addition, interior noise exposures are limited to 45 dB DNL.

Row townhouses are now regulated by the California Residential Code and are considered attached single-family homes. The CRC does not contain environmental noise standards.

The noise exposures shown below are without the application of mitigation measures and represent the noise environment for existing and proposed site conditions.

A. Exterior Noise Exposures

- The existing exterior noise exposure at the most impacted planned building setback from Scotts Valley Drive at the northerly end of the site, 117 ft. from the centerline of the road, is 58 dB DNL. Under future traffic conditions, the noise exposure is predicted to increase to 59 dB DNL.

- The existing exterior noise exposure at the most impacted planned building setback from Mt. Hermon Road at the southerly end of the site, 208 ft. from the centerline of Mt. Hermon Road, 235 ft. from the centerline of Scotts Valley Drive and 88 ft. from the center of the Shell station car wash tunnel exit, is 58 dB DNL. Of this 58 dB DNL, 56 dB DNL is due to Mt. Hermon Road traffic, 51 dB DNL is due to Scotts Valley Drive traffic and 50 dB is due to the Shell car wash. Under future traffic conditions, the noise exposure is predicted to increase to 59 dB DNL, with 57 dB DNL due to Mt. Hermon Road traffic, 52 dB due to Scotts Valley Drive traffic and 50 dB DNL due to the Shell car wash.

The exterior noise exposures at the planned building setbacks will be within the 60 dB DNL limit of the City of Scotts Valley Noise Element standard. Noise mitigation measures for exterior areas of the site will not be required.

B. <u>Interior Noise Exposures</u>

- The interior noise exposures in the most impacted living spaces closest to Scotts Valley Drive at the northerly end of the site will be 33 and 34 dB DNL under existing and future traffic conditions, respectively.

- The interior noise exposures in the most impacted living spaces closest to Mt. Hermon Road, Scotts Valley Drive and the Shell car wash at the southerly end of the site will be 33 and 34 dB DNL under existing and future traffic conditions, respectively.

The interior noise exposures will be within the 45 dB DNL limit of the City of Scotts Valley Noise Element standards. Noise mitigation measures for the interior living spaces will not be required.

II. Site, Traffic and Project Descriptions

The planned development site is a vacant parcel located on the east side of Scotts Valley Drive and north side of Mt. Hermon Road in Scotts Valley. The site slopes up to the east and north away from the adjacent roadways. Surrounding land uses include single-family residential adjacent to the east, a vacant parcel adjacent to the north, a vacant parcel adjacent to the south and retail/commercial uses across Scotts Valley Drive to the west.

The on-site noise environment is controlled primarily by traffic sources on Scotts Valley Drive and Mt. Hermon Road. The most recent traffic volume data from 2012 indicates the Scotts Valley Drive carries an Average Daily Traffic (ADT) of 16,382 vehicles. Mt. Hermon Road carries an ADT of approximately 32,960 vehicles, as reported by the City of Scotts Valley, Ref. (c).

The Shell service station car wash is a roll-over type self-service car wash. The entrance to the wash tunnel faces north and the exit faces south. A vacuum facility is located just outside the tunnel exit along with a tire filling and water station. A compressor that operates the car wash dryers and tire filling is situated in this service area. The car wash is open 24 hour per day, seven days per week.

The planned project includes the construction of 20 townhouse units in four buildings. Ingress and egress to the site will be by way of a project driveway off of Scotts Valley Drive. The Tentative Grading Plan is shown in Figure 1 on page 5.

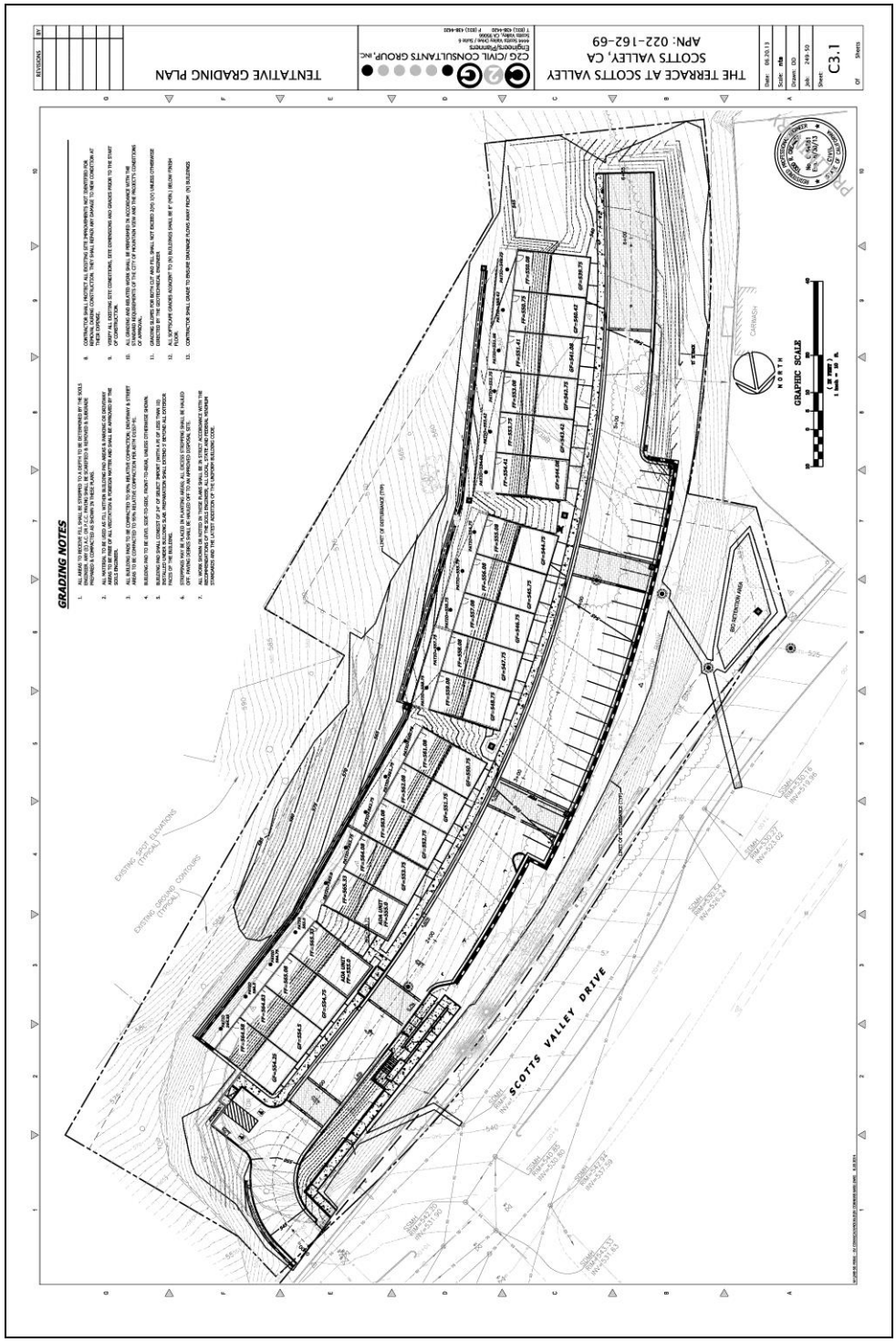

FIGURE 1 – SITE PLAN

III. Analysis of the Noise Levels

A. Existing Noise Levels

To determine the existing noise environment at the site, continuous recordings of the sound levels were made at two locations. Location 1 was 117 ft. from the centerline of Scotts Valley Drive at the northerly end of the project buildings. Location 2 was 208 ft. from the centerline of Mt. Hermon Road, 235 ft. from the centerline of Scotts Valley Drive and 88 ft. from the center of the Shell service station car wash tunnel exit. These locations correspond to the most impacted units closest to Scotts Valley Drive and to Mt. Hermon Road. The measurement locations are shown Figure 2 on page 7. The measurements were made on September 9-10, 2014. The noise levels were recorded and processed using Larson-Davis LDL 812 Precision Integrating Sound Level Meters. The meters yield, by direct readout, a series of descriptors of the sound levels versus time, as described in Appendix B.

The measured descriptors include the L_1, L_{10}, L_{50}, and L_{90}, i.e., those levels that are exceeded 1%, 10%, 50%, and 90% of the time. Also measured were are the maximum and minimum levels, and the continuous equivalent-energy levels (L_{eq}), which are used to calculate the DNL. The measurements were made for a total period of 24 hours at each location and included recordings of the noise levels during representative hours of the daytime and nighttime periods of the DNL index. The results of the measurements are shown on the data table in Appendix C.

As shown in the data tables, the L_{eq}'s at measurement Location 1, 117 ft. from the centerline of Scott Valley Drive, ranged from 55.0 to 61.1 dBA during the daytime and from 45.8 to 56.6 dBA at night.

The L_{eq}'s at the measurement Location 2, 208 ft. from the centerline of Mt. Hermon Road, 235 ft. from the centerline of Scotts Valley Drive and 88 ft. from the car wash, ranged from 54.1 to 60.8 dBA during the daytime and from 45.0 to 56.2 dBA at night.

The car wash noise levels at the measurement location 88 ft. from the exit end of the car wash tunnel were measured to be 53 dBA for the sprayers, 59 dBA for the dryers and 56 dBA for the compressor that operates the dryer system. The entire wash and dry cycle take approximately 3 minutes (2 minutes wash, 1 minute dry). Although, no one used the vacuum system during the site visits, the continuous noise measurements at Location 2 captured all operational noise from the Shell service station.

FIGURE 2 – NOISE MEASUREMENT LOCATIONS

B. Future Noise Levels

Future traffic volume data for Scotts Valley Drive and Mt. Hermon Road were not available from the City of Scotts Valley. A review of previous projects in the area indicate that the traffic volumes have reduced over the past few years due to economic conditions. However, the traffic volumes from the mid-90's were approximately the same as they were for 2012. For the purposes of this study, we are estimating an annual average traffic volume growth rate of 1% per year. Over a 20 year horizon, a 1% per growth is equivalent to a 22% increase in traffic volume. A 22% increase in traffic volume yields a 1 dB increase in the traffic noise levels.

V. Evaluation of the Noise Exposures

A. Exterior Noise Exposures

To evaluate the on-site noise exposures against the 60 dB DNL standard of the City of Scotts Valley Noise Element, the DNLs' for the survey locations were calculated as decibel averages of the measured L_{eq}'s as they apply to the daily subperiods of the DNL index. A Nighttime weighting factor was applied to account for the increased human sensitivity to noise during nighttime hours. The DNL was calculated using the standard formula shown in Appendix B and the results are shown in Appendix C.

The results of the calculations reveal that the existing noise exposure at measurement Location 1 and planned building setback of 117 ft. from the centerline of Scotts Valley Drive is 58 dB DNL. Under future conditions, the noise exposure is estimated to increase to 59 dB DNL.

The existing noise exposure at measurement Location 2 and the planned minimum setback of 208 ft. from Mt. Hermon Road, 235 ft. from Scotts Valley Drive and 88 ft. from the Shell car wash, is 58 dB DNL. Under future traffic conditions, the noise exposure is estimated to increase to 59 dB DNL.

The exterior noise exposures at the site are within the 60 dB DNL limit of the City of Scotts Valley Noise Element standards. Noise mitigation measures for the exterior areas will not be required.

B. Interior Noise Exposures

To determine the interior noise exposures, a 25 dB reduction was applied to the exterior noise exposures to represent the attenuation provided by a typical building shell under a closed window condition. This condition assumes that residential living units will have standard dual-pane thermal insulating windows that are kept closed all of the time for noise control as the Mechanical Code will require full time supplemental ventilation.

The interior noise exposures in the most impacted living spaces closest to Scotts Valley Drive at the north end of the project will 33 and 34 dB DNL under existing and future traffic conditions, respectively. The interior noise exposures in the most impacted living spaces closet to Mt. Hermon Road, Scotts Valley Drive and the Shell car wash will be up to 33 and 34 dB DNL under existing and future traffic conditions, respectively. Thus, the interior noise exposures will be within the 45 dB DNL standard of the City of Scotts Valley Noise Element. Noise mitigation measures for the interior living spaces will not be required.

The above report presents a noise assessment study for the planned "The Terrace at Scotts Valley" townhouse development along Scotts Valley Drive in Scotts Valley. The study findings for present conditions are based on field measurements and other data and are correct to the best of our knowledge. Future noise exposures were based on estimates made by Edward L. Pack Associates, Inc. from information provided by the City of Scotts Valley. However, significant deviations in the future traffic volumes, changes in motor vehicle technology, speed limits, noise regulations, or other future changes beyond our control may produce long-range noise results different from our estimates.

If you have any questions or would like an elaboration on this report, please call me.

Sincerely,

EDWARD L. PACK ASSOC., INC.

Jeffrey K. Pack
President

Attachments: Appendices A, B, and C

APPENDIX A

References:

(a) Tentative Grading Plan, The Terrace at Scotts Valley, by C2G/Civil Consultants Group, June 20, 2013

(b) Noise Element of the General Plan, City of Scotts Valley, 1993

(c) Information on Existing and Future Traffic Volumes Provided by Ms. Kimarie Jones, City of Scotts Valley Transportation Department, by Telephone to Edward L. Pack Associates, Inc., September 22, 2014

APPENDIX B

Noise Standards, Terminology, Instrumentation, and General Building Shell Controls

1. Noise Standards

A. City of Scotts Valley Noise Element Standards

The Noise Element of the Scotts Valley General Plan specifies the use of the Day-Night Level (DNL) 24-hour noise descriptor to describe the noise environment for residential land use.

The noise standards specify a limit of 60 dB DNL for exterior areas at residential locations. For interior living spaces of residences, a limit of 45 dB DNL is specified.

2. Terminology

A. Statistical Noise Levels

Due to the fluctuating character of urban traffic noise, statistical procedures are needed to provide an adequate description of the environment. A series of statistical descriptors have been developed which represent the noise levels exceeded a given percentage of the time. These descriptors are obtained by direct readout of the Sound Level Meters. Some of the statistical levels used to describe community noise are defined as follows:

L_1 - A noise level exceeded for 1% of the time.

L_{10} - A noise level exceeded for 10% of the time, considered to be an "intrusive" level.

L_{50} - The noise level exceeded 50% of the time representing the "mean" sound level.

L_{90} - The noise level exceeded 90 % of the time, designated as a "background" noise level.

L_{eq} - The continuous equivalent-energy level is that level of a steady-state noise having the same sound energy as a given time-varying noise. The L_{eq} represents the decibel level of the time-averaged value of sound energy or sound pressure squared and is used to calculate the DNL and CNEL.

B. Day-Night Level (DNL)

Noise levels utilized in the standards are described in terms of the Day-Night Level (DNL). The DNL rating is determined by the cumulative noise exposures occurring over a 24-hour day in terms of A-Weighted sound energy. The 24-hour day is divided into two subperiods for the DNL index, i.e., the daytime period from 7:00 a.m. to 10:00 p.m., and the nighttime period from 10:00 p.m. to 7:00 a.m. A 10 dBA weighting factor is applied (added) to the noise levels occurring during the nighttime period to account for the greater sensitivity of people to noise during these hours. The DNL is calculated from the measured L_{eq} in accordance with the following mathematical formula:

$$DNL = 10\log_{10}[((L_d) \,\&\, (L_n+10))/24]$$

where:

L_d =	L_{eq} for the daytime (7:00 a.m. to 10:00 p.m.)
L_n =	L_{eq} for the nighttime (10:00 p.m. to 7:00 a.m.)
24	indicates the 24 hour period
&	denotes decibel addition

C. A-Weighted Sound Level

The decibel measure of the sound level utilizing the "A" weighted network of a sound level meter is referred to as "dBA". The "A" weighting is the accepted standard weighting system used when noise is measured and recorded for the purpose of determining total noise levels and conducting statistical analyses of the environment so that the output correlates well with the response of the human ear.

3. Instrumentation

The on-site field measurement data were acquired by the use of one or more of the sound analyzer listed below. The instrumentation provides a direct readout of the L exceedance statistical levels including the equivalent-energy level (L_{eq}). Input to the meters was provided by microphones extended to a height of 5 ft. above the ground. The "A" weighting network and the "Fast" response setting of the meters were used in conformance with the applicable standards. The Larson-Davis meters were factory modified to conform to the Type 1 performance standards of ANSI S1.4. All instrumentation was acoustically calibrated before and after field tests to assure accuracy.

Bruel & Kjaer 2231 Precision Integrating Sound Level Meter
Larson Davis LDL 812 Precision Integrating Sound Level Meter
Larson Davis 2900 Real Time Analyzer

4. Building Shell Controls

The following additional precautionary measures are required to assure the greatest potential for exterior-to-interior noise attenuation by the recommended mitigation measures. These measures apply at those units where closed windows are required.

- Unshielded entry doors having a direct or side orientation toward the primary noise source must be 1-5/8" or 1-3/4" thick, insulated metal or solid-core wood construction with effective weather seals around the full perimeter. Mail slots should not be used in these doors or in the wall of a living space, as a significant noise leakage can occur through them.

- If any penetrations in the building shell are required for vents, piping, conduit, etc., sound leakage around these penetrations can be controlled by sealing all cracks and clearance spaces with a non-hardening caulking compound.

- Ventilation openings shall not compromise the acoustical integrity of the building shell.

APPENDIX C

On-Site Noise Measurement Data and Calculation Tables

DNL CALCULATIONS

CLIENT: APPLE HOMES DEVELOPMENT
FILE: 46-069
PROJECT: THE TERRACE AT SCOTTS VALLEY
DATE: 9/10-11/2014
SOURCE: SCOTTS VALLEY DR., MT. HERMON RD.

LOCATION 1 Scotts Valley Dr.
Dist. To Source 117 ft.

TIME	Leq	10^Leq/10		
7:00 AM	59.3	851138.0		
8:00 AM	60.1	1023293.0		
9:00 AM	60.0	1000000.0		
10:00 AM	59.5	891250.9		
11:00 AM	59.4	870963.6		
12:00 PM	60.6	1148153.6		
1:00 PM	61.1	1288249.6		
2:00 PM	59.4	870963.6		
3:00 PM	59.2	831763.8		
4:00 PM	60.1	1023293.0		
5:00 PM	59.2	831763.8		
6:00 PM	58.9	776247.1		
7:00 PM	57.2	524807.5		
8:00 PM	56.0	398107.2		
9:00 PM	55.0	316227.8	SUM=	1239142.4
10:00 PM	52.2	165958.7	Ld=	60.9
11:00 PM	51.6	144544.0		
12:00 AM	48.9	77624.7		
1:00 AM	54.2	263026.8		
2:00 AM	46.0	39810.7		
3:00 AM	45.8	38018.9		
4:00 AM	48.0	63095.7		
5:00 AM	54.0	251188.6		
6:00 AM	56.6	457088.2	SUM=	1500356.4
			Ld=	61.8

Daytime Level= 60.9
Nighttime Level= 71.8
DNL= 58
24-Hour Leq= 50.6

LOCATION 2 Mt. Hermon Rd., Scotts Valley Dr.
Dist. To Source 208 ft., 235 ft.

TIME	Leq	10^Leq/10		
7:00 AM	57.5	562341.3		
8:00 AM	58.0	630957.3		
9:00 AM	58.9	776247.1		
10:00 AM	60.8	1202264.4		
11:00 AM	58.4	691831.0		
12:00 PM	59.1	812830.5		
1:00 PM	59.4	870963.6		
2:00 PM	58.3	676083.0		
3:00 PM	59.5	891250.9		
4:00 PM	59.1	812830.5		
5:00 PM	58.4	691831.0		
6:00 PM	57.8	602559.6		
7:00 PM	57.5	562341.3		
8:00 PM	55.7	371535.2		
9:00 PM	54.1	257039.6	SUM=	1190916.1
10:00 PM	52.3	169824.4	Ld=	60.8
11:00 PM	53.9	245470.9		
12:00 AM	47.2	52480.7		
1:00 AM	45.4	34673.7		
2:00 AM	45.0	31622.8		
3:00 AM	45.1	32359.4		
4:00 AM	48.6	72443.6		
5:00 AM	53.7	234422.9		
6:00 AM	56.2	416869.4	SUM=	1290167.7
			Ld=	61.1

Daytime Level= 60.8
Nighttime Level= 71.1
DNL= 58
24-Hour Leq= 50.1