HANKARD ENVIRONMENTAL
ACOUSTICS AND VIBRATION CONSULTING

April 12, 2023

Kevin Kofford, P.E.
Kimley-Horn
2 North Nevada Avenue, Suite 900
Colorado Springs, CO 80903

Re: Noise Study for the Eastwood Village Townhomes Project

Kevin,

Per your request, Hankard Environmental conducted an analysis of noise for the Eastwood Village Townhomes (Project) in El Paso County, Colorado. The Project, which is anticipated to include approximately 107 multifamily units, is proposed to be located on 9.8 acres of vacant land at the northeast corner of State Highway 24 and Marksheffel Road, as shown in Figure 1. The purpose of this analysis is to assess the compatibility of developing residential units at this site given the presence of noise from these roadways. Compatibility is assessed according to El Paso County Land Development Code (LDC). The following provides a description of the applicable noise standards, the noise level prediction methodology employed, and the results of the analysis.

APPLICABLE NOISE STANDARDS

El Paso County Land Development Code (LDC) Section 8.4.2(B)(2)(b) *Environmental Considerations for Noise Hazards for Roadway and Railroad Mitigation* requires an assessment of the feasibility of providing noise reduction measures (mitigation) where traffic, railroad, airport, or military installation noise is present. For this Project, only roadway noise has the potential to be significant, as there are no railroads, airports, or military installations located nearby. For roadway noise, mitigation measures shall be included in a project when noise levels are predicted to exceed 67 dBA (equivalent sound level, or L_{eq}) at outdoor use areas such as patios and decks. While not specified, this limit is assumed to be an hourly equivalent noise level ($L_{eq\ 1\text{-}hour}$), which is common practice on highway noise studies and the time period used by the Federal Highway Administration (FHWA) and the Colorado Department of Transportation (CDOT). The portion of the El Paso County LDC relevant to traffic noise is as follows (Section 8.4.2(B)(2), Noise):

> Types of Noise Mitigation. Where noise levels exceed or are predicted to exceed 67 dBA Equivalent Sound Level (L_{eq}), any or all of the following mitigation measures shall be included in the design:
>
> - Increased building setbacks;
> - Modified site orientation for buildings and outdoor areas;
> - Landscape buffers or tracts;
> - Noise easement;
> - Soil berming;
> - Noise barrier.

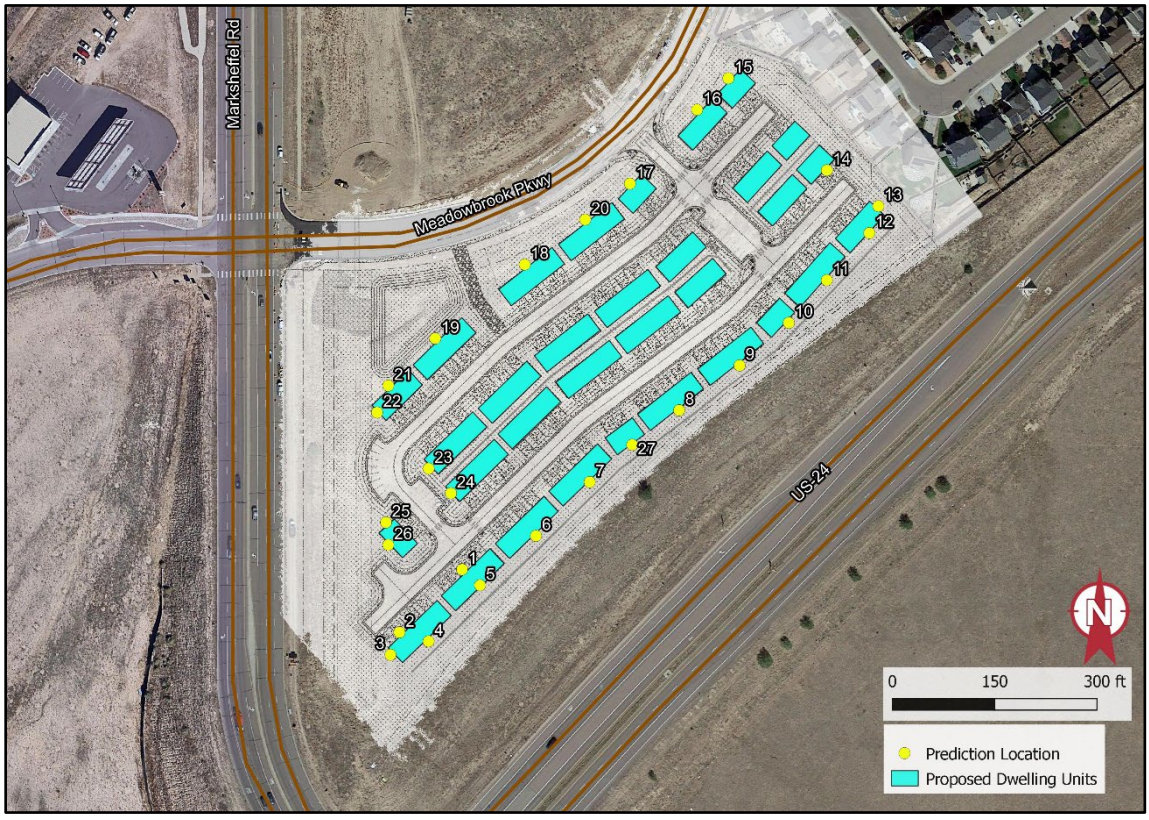


Figure 1 – Project Site Plan

NOISE LEVEL PREDICTION METHODOLOGY

A model of noise from traffic on Highway 24 and Marksheffel Road was created with FHWA's Traffic Noise Model (TNM, v3.1) and used to predict noise levels at the exterior of each building that directly faces any of the subject roadways. Noise levels were predicted in locations representative of proposed outdoor use areas, which includes first floor patios and second floor decks. There are no outdoor use areas associated with third story units. Noise levels at units not facing the subject roads will be substantially less than those reported herein due to a combination of greater distance from roadways and the attenuation provided by intervening structures.

In accordance with the manner in which CDOT conducts roadway noise analyses, noise levels were predicted for both existing (2023) and design-year (2045) traffic and roadway conditions. Figure 2 shows a plan view of the model, which includes all existing roadways and the proposed buildings. Traffic volumes for the analysis were derived from the Project-specific traffic study (Traffic Impact Study, Rockwood Homes, Kimley-Horn, May 2022). Refer to Attachment A for the specific traffic volumes used in this analysis and other model input data.

Particular importance was placed on modeling the terrain, as there is a grassy bench between Highway 24 and the proposed units that significantly blocks line of sight to traffic. A site visit was conducted in March 2023 to verify that terrain was being modeled accurately. Note that Highway 24 is not visible in the picture looking from the site toward Highway 24 in Figure 3.

Figure 2 – Plan View of Acoustic Model

Figure 3 – Picture from Site Toward Highway 24

RESULTS

Table 1 summarizes the predicted noise levels at the dwelling units facing Highway 24, Marksheffel Road, and Meadowbrook Parkway. Predicted noise levels at all receptors are listed in Attachment A. All of the predicted noise levels are less than 67 dBA. A few observations about the predicted levels are as follows:

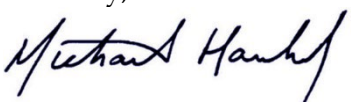
1. Overall, noise levels at exterior outdoor use areas range from 43 to 66 dBA based on 2045 traffic conditions.
2. For 2022 conditions predicted noise levels at exterior outdoor use areas range from 42 to 65 dBA.
3. The loudest levels (66 dBA in 2045) are predicted at 2nd story units facing Highway 24. This makes sense, as this road has the highest traffic speeds among those that border the Project. Additionally, the 2nd level units at these locations have a more direct line of sight to the road than the ground units.
4. Noise levels at the units along Marksheffel Road range from 56 to 64 dBA in 2045.
5. In the interior of the Project, where the outer buildings shield noise from reaching the inner buildings, predicted levels will be less than those reported herein and far less than 67 dBA.
6. This site benefits from the fact that terrain blocks line of sight from the proposed units with outdoor living spaces to Highway 24, which substantially reduces noise propagation.

Table 1 – Summary of Predicted Noise Levels (dBA, one-hour L_{eq})

Receptor Locations		2023	2045
Along US-24	Ground Floor Patio	42 to 57	43 to 58
Along US-24	2nd Floor Deck	54 to 65	56 to 66
Along Marksheffel Road	Ground Floor Patio	54 to 61	56 to 62
Along Marksheffel Road	2nd Floor Deck	56 to 63	58 to 64
Along Meadowbrook Parkway	Ground Floor Patio	53 to 58	54 to 60
Along Meadowbrook Parkway	2nd Floor Deck	55 to 60	56 to 62
Interior Buildings		< 65	< 66

Thank you for commissioning Hankard Environmental to conduct this analysis. Please let me know if have any questions.

Sincerely,



Michael Hankard, Full Member of INCE and ASA
Principal Acoustical Consultant

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ATTACHMENT A
Noise Modeling Details

Model: FHWA's Traffic Noise Model (TNM), version 3.1. General model settings included "hard soil" as the default ground type, 68 degrees Fahrenheit, and 50% relative humidity.

Roadway Locations: The locations of the roadways were obtained using aerial photography and elevations were estimated based on contours provided by the Project.

Traffic Volumes: The traffic volumes for the analysis were derived from the Project-specific traffic study (Traffic Impact Study, Kimley-Horn, May 2022), and are listed in Table A1, below. Specifically, existing conditions (2023) peak-hour traffic volumes on Highway 24, Marksheffel Road, and Meadowbrook Parkway were estimated from the data in that report's Figure 8, Key Intersection 1 and 2. Heavy vehicle percentages were taken from the intersection count sheets in the report's Appendix A, split evenly between medium and heavy trucks. Future conditions (2045) peak-hour traffic volumes were estimated from the data in the report's Figure 9, Key Intersection 1 and 2, and heavy vehicle percentages were kept the same as the 2023 data.

Traffic Speeds: Traffic speeds for each road were assumed to be the posted speed, which is 65 mph on Highway 24, 50 mph on Marksheffel Road, and 25 mph on Meadowbrook Parkway.

Receptors: The location of each receptor point included in the model is shown in Figure 1, above. Points were located to represent specific dwelling units in each building located along Highway 24, Marksheffel Road, and Meadowbrook Parkway. Predictions at dwelling unit locations were made at each point for two different elevations (5 feet above ground to represent patios, 15 feet above ground to represent 2nd floor balconies). Refer to Table A3 for the geographic locations of all receptor locations.

Terrain: The Project is located lower in elevation than Highway 24 and the intersection of US-24 and Marksheffel Road. The fact that terrain blocks line of sight from the proposed units with outdoor living spaces to Highway 24 substantially reduces noise propagation. This was included in the TNM model using Terrain Lines.

Barriers: Each of the proposed buildings was modeled as a barrier in TNM. The height of the buildings and floors was taken from Project plans.

Table A1 – Traffic Volumes Used in Noise Analysis

Roadway	Year	Time	Autos	Medium Trucks	Heavy Trucks	Total	Heavy Vehicle %
Highway 24							
Eastbound	**2023**	Morning	455	16	16	487	6.50%
		Afternoon	1112	14	14	1141	2.50%
	2045	Morning	771	27	27	825	6.50%
		Afternoon	1736	22	22	1780	2.50%
Westbound	**2023**	Morning	1306	15	15	1335	2.20%
		Afternoon	551	15	15	581	5.10%
	2045	Morning	1839	21	21	1880	2.20%
		Afternoon	1001	27	27	1055	5.10%
Marksheffel Road							
Northbound	**2023**	Morning	854	11	11	875	2.40%
		Afternoon	1646	30	30	1706	3.50%
	2045	Morning	1562	19	19	1600	2.40%
		Afternoon	1563	28	28	1620	3.50%
Southbound	**2023**	Morning	1683	23	23	1730	2.70%
		Afternoon	879	15	15	908	3.20%
	2045	Morning	2345	33	33	2410	2.70%
		Afternoon	2115	35	35	2185	3.20%
Meadowbrook Parkway							
Eastbound	**2023**	Morning	79	5	5	88	10.70%
		Afternoon	181	6	6	193	6.20%
	2045	Morning	116	7	7	130	10.70%
		Afternoon	249	8	8	265	6.20%
Westbound	**2023**	Morning	243	2	2	247	1.60%
		Afternoon	95	1	1	97	1.60%
	2045	Morning	290	2	2	295	1.60%
		Afternoon	128	1	1	130	1.60%

Table A2 – Predicted Noise Levels (dBA, L_{eq})

Receptor ID	Floor	Predicted Noise Level $L_{eq\ (1\text{-}hour)}$ (dBA)			
		2023		2045	
		Morning	Afternoon	Morning	Afternoon
Receiver-1	G	55	55	57	57
Receiver-2	G	58	59	60	60
Receiver-3	G	60	61	62	62
Receiver-4	G	49	49	51	50
Receiver-5	G	42	43	44	43
Receiver-6	G	48	47	50	50
Receiver-7	G	48	47	49	49
Receiver-8	G	48	47	50	49
Receiver-9	G	46	45	47	47
Receiver-10	G	52	51	54	53
Receiver-11	G	55	54	56	56
Receiver-12	G	57	56	58	58
Receiver-13	G	57	56	58	58
Receiver-14	G	54	53	55	55
Receiver-15	G	53	53	54	54
Receiver-16	G	53	54	55	55
Receiver-17	G	54	55	56	56
Receiver-18	G	56	56	57	57
Receiver-19	G	58	58	60	60
Receiver-20	G	55	55	56	56
Receiver-21	G	59	59	60	60
Receiver-22	G	61	61	62	62
Receiver-23	G	56	56	58	58
Receiver-24	G	54	55	56	56
Receiver-25	G	58	59	60	60
Receiver-26	G	59	60	61	61
Receiver-27	G	48	47	50	49
Receiver-1	2	56	57	58	58
Receiver-2	2	60	61	62	62
Receiver-3	2	62	63	64	64
Receiver-4	2	57	56	58	58
Receiver-5	2	54	54	56	56

Receptor ID	Floor	Predicted Noise Level $L_{eq\ (1\text{-}hour)}$ (dBA)			
		2023		2045	
		Morning	Afternoon	Morning	Afternoon
Receiver-6	2	64	64	66	66
Receiver-7	2	65	64	66	66
Receiver-8	2	65	64	66	66
Receiver-9	2	63	62	65	64
Receiver-10	2	62	61	63	63
Receiver-11	2	61	60	63	63
Receiver-12	2	61	60	63	63
Receiver-13	2	59	58	61	60
Receiver-14	2	56	56	58	58
Receiver-15	2	55	55	56	56
Receiver-16	2	55	55	57	57
Receiver-17	2	56	56	58	58
Receiver-18	2	57	58	59	59
Receiver-19	2	60	60	62	62
Receiver-20	2	57	57	58	58
Receiver-21	2	62	62	63	63
Receiver-22	2	63	63	64	64
Receiver-23	2	58	59	60	60
Receiver-24	2	57	57	59	59
Receiver-25	2	62	62	63	63
Receiver-26	2	62	62	63	63
Receiver-27	2	65	64	66	66

Table A3 – Receptor Locations

Name	NAD83 UTM13N		Height above ground (m)
	X (m)	Y (m)	
Receiver-1	527618	4300590	1.5/4.5
Receiver-2	527590	4300562	1.5/4.5
Receiver-3	527586	4300552	1.5/4.5
Receiver-4	527603	4300558	1.5/4.5
Receiver-5	527626	4300583	1.5/4.5
Receiver-6	527651	4300605	1.5/4.5
Receiver-7	527675	4300629	1.5/4.5
Receiver-8	527715	4300661	1.5/4.5
Receiver-9	527742	4300681	1.5/4.5
Receiver-10	527764	4300700	1.5/4.5
Receiver-11	527781	4300719	1.5/4.5
Receiver-12	527800	4300740	1.5/4.5
Receiver-13	527804	4300752	1.5/4.5
Receiver-14	527781	4300768	1.5/4.5
Receiver-15	527737	4300809	1.5/4.5
Receiver-16	527723	4300795	1.5/4.5
Receiver-17	527693	4300762	1.5/4.5
Receiver-18	527646	4300726	1.5/4.5
Receiver-19	527606	4300693	1.5/4.5
Receiver-20	527673	4300746	1.5/4.5
Receiver-21	527585	4300672	1.5/4.5
Receiver-22	527580	4300660	1.5/4.5
Receiver-23	527603	4300635	1.5/4.5
Receiver-24	527613	4300624	1.5/4.5
Receiver-25	527584	4300611	1.5/4.5
Receiver-26	527585	4300601	1.5/4.5
Receiver-27	527694	4300646	1.5/4.5