Appendix 4.15-1:

Acoustical Analysis Greentree Development Project

ACOUSTICAL ANALYSIS

GREENTREE DEVELOPMENT PROJECT
VACAVILLE, CALIFORNIA

WJVA Report No. 19-013

PREPARED FOR

GREENTREE DEVELOPMENT GROUP, INC.
2301 NAPA VALLEY HIGHWAY
NAPA, CALIFORNIA 94558

PREPARED BY

WJV ACOUSTICS, INC.
VISALIA, CALIFORNIA

wjv acoustics

May 12, 2021

1. INTRODUCTION

Project Description:

The proposed project (Greentree Development Project) will include a variety of land uses integrated into a cohesive urban plan. Proposed uses include residential development at a variety of densities, with a wide range of housing product types that are responsive to local market needs, including active-adult detached single-family and workforce-oriented housing; commercial retail including neighborhood serving uses; public parks; trails and open space; circulation improvements, and infrastructure facilities. The project site is roughly bisected by Sequoia Drive into a northern portion and a southern portion. Higher density residential, commercial retail, and a family-oriented park are the primary uses planned north of Sequoia Drive. Detached, single-family senior residential development and a senior-oriented park are the primary proposed uses south of Sequoia Drive.

The commercial retail area, envisioned to potentially include a grocery store, drug store, and other neighborhood-serving retail and service uses, will improve access to such services for existing residents living on the south side of U.S. Highway 80 and will support the needs of new residents that will reside within the Greentree development. This will reduce vehicle trips to existing retail and service commercial uses located north of the highway and further to the west. Significant acreage has been dedicated to retention basins that are part of an integrated stormwater management plan. The stormwater plan is designed to accommodate storm water flows, both from existing development west of the project site, and from within the project site. The overall project Development Plan is provided as Figure 1. Detailed project Development Plans for “North of Sequoia Drive” and “South of Sequoia Drive” are provided as Figure 2 and Figure 3, respectively.

Environmental Noise Assessment:

This environmental noise assessment has been prepared to determine if significant noise impacts will be produced by the project and to describe mitigation measures for noise if significant impacts are determined. The environmental noise assessment, prepared by WJV Acoustics, Inc. (WJVA), is based upon the project Development Plan provided by the applicant (dated March 2, 2021), traffic data provided by GHD, reference noise file data previously collected by WJVA and a project site visit on May 22-23, 2019. Revisions to the Development Plan, project traffic information or other project-related information available to WJVA at the time the analysis was prepared may require a reevaluation of the findings and/or recommendations of the report.

Appendix A provides definitions of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported in this analysis are A-weighted sound pressure levels in decibels (dB). A-weighting de-emphasizes the very low and very high frequencies of sound in a manner similar to the human ear. Most community noise standards utilize A-weighted sound levels, as they correlate well with public reaction to noise. Appendix B provides examples of sound levels for reference.

2. THRESHOLDS OF SIGNIFICANCE

The CEQA Guidelines apply the following questions for the assessment of significant noise impacts for a project:

a. Would the project result in generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

b. Would the project result in generation of excessive groundborne vibration or groundborne noise levels?

c. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

a. Noise Level Standards

CITY OF VACAVILLE

General Plan

Chapter 8 (Noise Element) of the City of Vacaville General Plan[1] establishes land use compatibility noise level criteria in terms of the Community Noise Equivalent Level (CNEL) metric. The CNEL is the time-weighted energy average noise level for a 24-hour day, with a 4.77 dB penalty added to noise levels occurring during the evening hours (7:00 p.m.-10:00 p.m.) and a 10 dB penalty added to noise levels occurring during the nighttime hours (10:00 p.m.-7:00 a.m.). The CNEL represents cumulative exposure to noise over an extended period of time and is therefore calculated based upon *annual average* conditions.

The General Plan Noise Element establishes land use compatibility guidelines for specific land use types and noise exposure levels. The Noise Element provides policies to be applied to new developments. General Plan Noise Element policies relevant to the project are provided below.

Policy NOI-P1.1

Require an acoustical analysis for all proposed projects that would locate noise sensitive land uses where the projected ambient noise level is greater than the respective "normally acceptable" noise level as indicated on Table NOI-3 (provided below as Table I), and require mitigation of noise impacts that exceed the land use compatibility standards. Any acoustical analysis prepared pursuant to this Noise Element shall comply with the following:

- Be performed according to a scope of work that has been approved by the Director of Community Development.

- Be the financial responsibility of the applicant.

- Be prepared by a qualified person experienced in the fields of noise assessment and architectural acoustics.

- Include representative noise level measurements with sufficient sampling periods and locations to adequately describe local conditions, predominant noise sources, and peak noise sources.

- Estimate existing and projected cumulative (2035) noise levels in terms of CNEL, and compare those levels to the adopted policies of the Noise Element.

- Recommend appropriate mitigation to achieve compliance with the adopted policies and standards of the Noise Element, giving preference to proper site planning and design over the construction of noise barriers or structural modifications to buildings. Where the noise source in question consists of intermittent single events, the report must address the effects of maximum noise levels in sleeping rooms in terms of possible sleep disturbance.

- Estimate noise exposure after the prescribed mitigation measures have been implemented.

- Describe a post-project monitoring program that could be used to evaluate the effectiveness of the proposed mitigation measures.

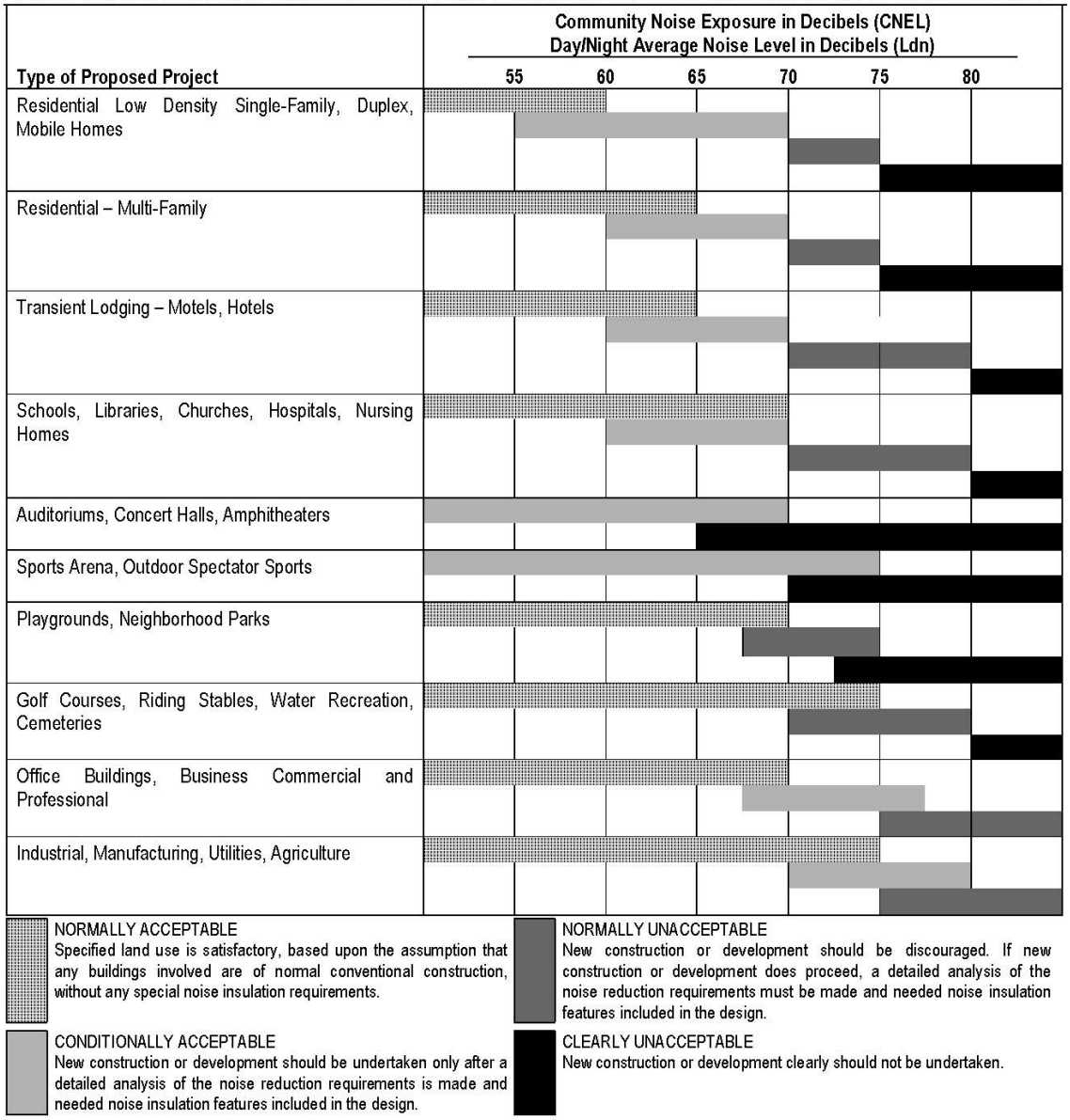
Policy NOI-P1.2
Require that noise created by new transportation and non-transportation noise sources be mitigated, to the extent that is technically and economically feasible, to comply with the noise level standards of Table NOI-3.

Policy NOI-P1.3
Allow minor exceptions to the noise level design standards in Table NOI-3 in circumstances where mitigation requirements are not technically or economically feasible and not consistent with other City goals, standards, and policies.

Policy NOI-P1.4
Prohibit new residential land uses where the exterior noise associated with aircraft operations at Nut Tree Airport or Travis Air Force Base exceeds 60 dB CNEL.

Table I City of Vacaville General Plan Noise Element Land Use Compatibility Standards

TABLE NOI-3 **LAND USE COMPATIBILITY STANDARDS FOR COMMUNITY NOISE ENVIRONMENTS**



Note: This table provides land use compatibility standards for all noise sources. While the prior General Plan established different standards for different noise sources, it has since become common practice to establish one set of land use compatibility standards for all noise sources because it is often difficult to definitively determine which portion of ambient noise levels are attributable to a particular noise source.
Source: State of California General Plan Guidelines, 2003.

Policy NOI-P2.1
Reduce outdoor noise levels in existing residential areas, where economically and aesthetically feasible.

Policy NOI-P2.2
Discourage residential areas from directly abutting Interstate 80 or 505.

Policy NOI-P2.3
Design subdivisions to minimize the transportation-related noise impacts to adjacent residential areas.

Policy NOI-P2.4
Maintain smooth street surfaces adjacent to land uses that are sensitive to noise intrusion.

Policy NOI-P2.5
Encourage the use of open space, earthen berms, parking, accessory buildings, and landscaping to buffer new and existing development from noise. Use sound walls only when other methods are not practical or when recommended by an acoustical expert as part of a mitigation program.

Policy NOI-P2.6
Require that the effects of sound walls on noise levels in surrounding areas be considered and taken into account in the design, location, and construction of sound walls.

Policy NOI-P4.1
Preclude the generation of annoying or harmful noise through conditions of approval on stationary noise sources, such as construction and property maintenance activity and mechanical equipment.

Although not explicitly stated in the City's General Plan, it is common to ensure interior noise levels attributable to exterior sources not exceed 45 dB CNEL (or L_{dn}) within residential land uses. This is consistent with Title 24 of the California Code of Regulations for residential construction and consistent with U.S. Department of Housing and Urban Development (HUD). The intent of the interior noise level guideline is to provide an acceptable noise environment for indoor communication and sleep.

Municipal Code
Section 14.09.127.120 (Noise) of the City of Vacaville Municipal Code[2] (Noise Ordinance) provides additional noise standards applicable to the project. For transportation noise sources (vehicle traffic, aircraft, railroad, etc.) the municipal code provides standards that are identical to those described above from the General Plan Noise Element, including the assumed interior noise level standard of 45 dB CNEL. The municipal code also provides noise standards applicable to non-transportation (stationary) noise sources. Table II provides the City of Vacaville Municipal Code noise standards for non-transportation noise sources. The municipal code states that in the case existing ambient noise levels already exceed the noise level standards provided in Table II, then applicable standards would be come 3 dB higher than the existing ambient noise levels.

TABLE II

NON-TRANSPORTATION NOISE LEVEL STANDARDS, DBA
CITY OF VACAVILE MUNICIPAL CODE

Land Use Category	Noise Level Descriptor	Exterior Noise Levels		Interior Noise Levels	
		Daytime (7 am-10 pm)	Nighttime (10 pm-7 am)	Daytime (7 am-10 pm)	Nighttime (10 pm-7 am)
Residential	Hourly Leq	50	45	45	35
Transient Lodging	Maximum	70	65	--	--
Hospitals, Nursing Homes	Hourly Leq	50	45	45	35

Source: City of Vacaville Municipal Code

State of California

There are no state noise standards that are applicable to the project.

Federal Noise Standards

There are no federal noise standards that are applicable to the project.

b. Construction Noise and Vibration

The City of Vacaville General Plan Noise Element provides guidance to minimize the impacts of construction noise.

Policy NOI-P4.1
Preclude the generation of annoying or harmful noise through conditions of approval on stationary noise sources, such as construction and property maintenance activity and mechanical equipment.

Policy NOI-P4.2
Require the following construction noise control measures:

- Equip all internal combustion engine-driven equipment with intake and exhaust mufflers that are in good condition and appropriate for the equipment.

- Locate stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a construction area.

- Utilize "quiet" air compressors and other stationary noise sources where technology exists.

- Limit hours of operation of outdoor noise sources through conditions of approval.

Additionally, Section 14.09.127.090 (Hours of Construction) of the City of Vacaville Municipal Code[2] provides guidance in regards to allowable hours of construction:

> *No construction or grading equipment shall be operated nor any outdoor construction or repair work shall be permitted within 500 feet from any occupied residence between dusk (one-half hour after sunset) and seven a.m. Monday through Saturday, and no such grading or construction activities shall be allowed on Sundays or holidays except as provided for herein:*
>
> *1. Interior work which would not create noise or disturbance noticeable to a reasonable person of normal sensitivity in the surrounding neighborhood shall not be subject to these restrictions;*
>
> *2. Construction or repair work performed by or under the direction of a homeowner at his or her residence is exempt from these restrictions on Sundays and holidays, but such construction or repair work shall be limited to the hours between eight a.m. and dusk.*
>
> *B. A request for an exception to the permitted construction hours and days may be granted by the Director for emergency work, to offset project delays due to inclement weather, for 24-hour construction projects, or other similar occurrences.*
>
> *C. City projects undertaken by or on behalf of the City's Public Works Department shall be exempt from these provisions.*

TABLE III

GUIDELINE VIBRATION ANNOYANCE POTENTIAL CRITERIA

Human Response	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely Perceptible	0.04	0.01
Distinctly Perceptible	0.25	0.04
Strongly Perceptible	0.9	0.1
Severe	2.0	0.4

Source: Caltrans

TABLE IV

GUIDELINE VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile, historic buildings, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Caltrans

3. SETTING

The project site is located adjacent to and west of Leisure Town Road and south of US Highway 80 (I-80), within the City of Vacaville. The project site is generally bisected by Sequoia Drive. The project site generally consists of land formerly used as a golf course, and is surrounded by existing residential land uses to the west, south and to the east (immediately east of Sequoia Drive, and across Leisure Town Road). Additionally, the project site surrounds pockets of existing residential land uses that originally surrounded the former golf course. There is an existing church land use located south of (and adjacent to) the project site and agricultural land uses and undeveloped land located east of the project site.

a. Background Noise Level Measurements

Existing noise levels in the project vicinity are dominated by traffic noise along Leisure Town Road, Orange Drive and other local roadways, noise associated with landscaping activities and other sources common with residential land uses, construction activities and aircraft overflights. Measurements of existing ambient noise levels in the project vicinity were conducted between May 22, 2019 and May 23, 2019. Long-term (24-hour) ambient noise level measurements were conducted at five (5) locations (sites LT-1, LT-2, LT-3, LT-4 and LT-5). Ambient noise levels were measured for a period of 24 continuous hours at each of the five locations. Site LT-1 was located within the northern portion of the project site, north of Sequoia Drive, in the vicinity of existing residential land uses. Site LT-2 was located within the northern portion of the project site, north of the former golf course parking lot. Site LT-3 was located south of Sequoia Drive, in the vicinity of both existing and proposed residential land uses. Site LT-4 was located within the southwestern portion of the project site, in the vicinity of both existing and proposed residential land uses. Site LT-5 was located south of Sequoia Drive, within the project site, in the vicinity of proposed and existing residential land uses. The locations of the long-term noise monitoring sites are provided on Figure 4.

Measured hourly energy average noise levels (L_{eq}) at site LT-1 ranged from a low of 47.5 dB between 9:00 p.m. and 10:00 p.m. to a high of 61.9 dBA between 1:00 p.m. and 2:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-1 ranged from 53.3 to 83.5 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 45.8 to 53.5 dBA. The L_{90} is a statistical descriptor that defines the noise level exceeded 90% of the time during each hour of the sample period. The L_{90} is generally considered to represent the residual (or background) noise level in the absence of identifiable single noise events from traffic, aircraft and other local noise sources. The measured CNEL value at site LT-1 was 60.9 dB. Figure 5 graphically depicts hourly variations in ambient noise levels at site LT-1 and provides a photograph of measurement site.

Measured hourly energy average noise levels (L_{eq}) at site LT-2 ranged from a low of 52.1 dB between midnight and 1:00 a.m. to a high of 59.0 dBA between 6:00 a.m. and 7:00 a.m. Hourly maximum (L_{max}) noise levels at site LT-2 ranged from 57.8 to 82.9 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 49.6 to 57.5 dBA. The measured CNEL value at site LT-2 was 62.2 dB. Figure 6 graphically depicts hourly variations in ambient noise levels at site LT-2 and provides a photograph of measurement site.

Measured hourly energy average noise levels (L_{eq}) at site LT-3 ranged from a low of 47.2 dB between 3:00 a.m. and 4:00 a.m. to a high of 54.6 dBA between 2:00 p.m. and 3:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-3 ranged from 53.1 to 75.8 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 44.1 to 51.5 dBA. The measured CNEL value at site LT-3 was 57.1 dB. Figure 7 graphically depicts hourly variations in ambient noise levels at site LT-3 and provides a photograph of measurement site.

Measured hourly energy average noise levels (L_{eq}) at site LT-4 ranged from a low of 47.6 dB between 6:00 p.m. and 7:00 p.m. to a high of 54.6 dBA between 1:00 p.m. and 2:00 p.m. Hourly maximum (L_{max}) noise levels at site LT-4 ranged from 56.5 to 80.9 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 42.1 to 50.2 dBA. The measured CNEL value at site LT-4 was 57.5 dB. Figure 8 graphically depicts hourly variations in ambient noise levels at site LT-4 and provides a photograph of measurement site.

Measured hourly energy average noise levels (L_{eq}) at site LT-5 ranged from a low of 45.3 dB between 11:00 p.m. and midnight to a high of 52.4 dBA between 7:00 a.m. and 8:00 a.m. Hourly maximum (L_{max}) noise levels at site LT-5 ranged from 51.0 to 76.7 dBA. Residual noise levels at the monitoring site, as defined by the L_{90}, ranged from 41.9 to 49.5 dBA. The measured CNEL value at site LT-5 was 55.1 dB. Figure 9 graphically depicts hourly variations in ambient noise levels at site LT-5 and provides a photograph of measurement site.

Additionally, short-term (15-minute) ambient noise level measurements were conducted at five (5) locations (Sites ST-1 through ST-5). Two (2) individual measurements were taken at each of the five short-term sites to quantify ambient noise levels in the morning and afternoon hours. The locations of the long-term and short-term noise monitoring sites are shown in Figure 4.

Table V summarizes short-term noise measurement results. The noise measurement data included energy average (L_{eq}) maximum (L_{max}) as well as five individual statistical parameters. Observations were made of the dominant noise sources affecting the measurements. The statistical parameters describe the percent of time a noise level was exceeded during the measurement period. For instance, the L_{90} describes the noise level exceeded 90 percent of the time during the measurement period, and is generally considered to represent the residual (or background) noise level in the absence of identifiable single noise events from traffic, aircraft and other local noise sources.

Short-term noise measurements were conducted for 15-minute periods at each of the five sites. Sites ST-1 and ST-2 were located along Leisure Town Road. Sites ST-3 ST-4 and ST-5 were located within the project site away from heavier trafficked roadways. The overall noise measurement data indicate that noise in the project vicinity is highly influenced by vehicular traffic and noise associated with landscaping activities and other sources common with residential land uses.

TABLE V

SUMMARY OF SHORT-TERM NOISE MEASUREMENT DATA
GREENTREE DEVELOPMENT, VACAVILLE
MAY 22 & 23, 2019

Site	Time	A-Weighted Decibels, dBA							Sources
		L_{eq}	L_{max}	L_2	L_8	L_{25}	L_{50}	L_{90}	
ST-1	8:07 a.m.	59.1	72.4	61.8	60.4	58.5	55.7	53.9	TR, AG, AC
ST-1	4:35 p.m.	58.3	68.4	60.8	59.5	58.2	56.8	54.6	TR, AC
ST-2	8:30 a.m.	61.4	72.0	69.0	66.8	65.2	60.6	56.0	TR, AG
ST-2	5:03 p.m.	63.7	71.4	70.1	67.9	64.8	61.2	57.4	TR, AG
ST-3	8:55 a.m.	59.1	68.4	61.5	60.0	58.4	56.0	55.5	TR, AG, AC
ST-3	5:30 p.m.	57.8	60.1	59.8	59.2	58.4	57.6	56.4	TR, AG
ST-4	9:20 a.m.	55.2	66.6	60.0	57.8	56.3	53.2	52.0	TR, B, D
ST-4	5:55 p.m.	55.8	69.4	61.6	58.8	55.8	54.1	52.2	TR, AC
ST-5	9:48 a.m.	52.1	69.4	56.5	63.7	51.4	48.6	47.2	TR, V
ST-5	6:17 p.m.	50.9	67.2	55.0	52.9	51.2	49.9	48.0	TR, V, D

TR: Traffic AC: Aircraft AG: Agricultural Activities V: Voices B: Birds D: Barking Dogs

Source: WJV Acoustics, Inc.

4. NOISE IMPACTS TO EXISTING SENSITIVE RECEPTORS, AND MITIGATION MEASURES

a. Project Traffic Noise Impacts on Existing Noise-Sensitive Land Uses Outside Project Site (Less Than Significant)

WJVA utilized the FHWA Traffic Noise Model[4] to quantify expected project-related increases in traffic noise exposure along roadways in the project vicinity. The FHWA Model is a standard analytical method used by state and local agencies for roadway traffic noise prediction. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles) and heavy trucks (3 or more axles), with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA Model was developed to predict hourly L_{eq} values for free-flowing traffic conditions, and is generally considered to be accurate within ±1.5 dB. To predict CNEL values, it is necessary to determine the hourly distribution of traffic (day/night split) for a typical day and adjust the traffic volume input data to yield an equivalent hourly traffic volume.

Average Daily Traffic (ADT) volumes were calculated based on traffic data provided by GHD. Traffic volumes were applied by WJVA to model existing conditions traffic noise exposure levels, existing plus project conditions traffic noise exposure levels, cumulative conditions traffic noise exposure levels, as well as to determine the project contribution to cumulative conditions. Posted vehicle speeds were documented by WJVA staff during the field visit. Truck percentages and the day/night distribution of traffic were estimated by WJVA, based upon previous studies conducted since project-specific data were not available from government sources. The Noise modeling assumptions (traffic volumes, day/night split, vehicle speed and truck percentages) used to calculate project traffic noise are provided as Appendix C.

Traffic noise exposure levels for specific scenarios were calculated based upon the FHWA Model and the above-described model inputs and assumptions. Project-related significant impacts would occur if an increase in traffic noise associated with the project would result in noise levels exceeding the City's applicable noise level standards at the location(s) of sensitive receptors. There may be receptor locations at which traffic noise exposure levels already exceed The City's exterior noise level standards, prior to the addition of project-related traffic increases. In such situations, for the purpose of this analysis a significant impact was also assumed to occur if traffic noise levels were to increase by 3 dB at sensitive receptor locations where noise levels already exceed the City's applicable noise level standards (without the project), as 3 dB generally represents the threshold of perception in change for the human ear.

The City's exterior noise level standard for residential land uses is 60 dB CNEL. Traffic noise was modeled at seventeen (17) receptor locations (R-1 through R-17). The seventeen modeled receptors are located at roadway setback distances representative of the sensitive receptors (residences) along each analyzed roadway segment. The receptor locations are described below and provided graphically on Figure 10 and Figure 11.

- R-1: Residence located approximately 75 feet from the centerline of Leisure Town Rd.
- R-2: Residence located approximately 100 feet from the centerline of Leisure Town Rd.
- R-3: Residence located approximately 85 feet from the centerline of Leisure Town Rd.
- R-4: Residence located approximately 10 feet from the centerline of Leisure Town Rd.
- R-5: Residence located approximately 80 feet from the centerline of Leisure Town Rd.
- R-6: Residence located approximately 80 feet from the centerline of Ulatis Dr.
- R-7: Residence located approximately 80 feet from the centerline of Leisure Town Rd.
- R-8: Residence located approximately 60 feet from the centerline of Leisure Town Rd.
- R-9: Residence located approximately 90 feet from the centerline of Leisure Town Rd.
- R-10: Residence located approximately 55 feet from the centerline of Marshall Rd.
- R-11: Residence located approximately 100 feet from the centerline of Leisure Town Rd.
- R-12: Residence located approximately 160 feet from the centerline of Nut Tree Rd.
- R-13: Residence located approximately 90 feet from the centerline of Yellowstone Dr.
- R-14: Residence located approximately 90 feet from the centerline of Yellowstone Dr.
- R-15: Residence located approximately 140 feet from the centerline of White Sands Dr.
- R-16: Residence located approximately 70 feet from the centerline of Yellowstone Dr.
- R-17: Residence located approximately 130 feet from the centerline of Sequoia Dr.

Existing Conditions

Table VI provides Existing and Existing Plus Project traffic noise exposure levels at the seventeen analyzed receptor locations. The receptor locations are representative of existing residential land uses located along the analyzed roadway segments. Noise levels described in Table VI do not take into account any acoustical shielding that may be provided by existing sound walls, structures or topography, and should be considered a worst-case assessment of traffic noise exposure at the receptor locations.

Reference to Table VI indicates that project-related traffic would not result in an exceedance of the City's noise level standards at any sensitive receptor location nor result in an increase of 3 dB at any sensitive receptor locations where noise levels already exceed the City's noise level standard without the implementation of the project.

It is important to note that project buildout would likely occur over a period of approximately ten years, and as such project-related noise increases would not be realized for numerous years. While the exact buildout timeline is uncertain, the increases described in Table VI would not occur immediately.

TABLE VI

PROJECT-RELATED INCREASES IN TRAFFIC NOISE, dB, L_{dn}
GREENTREE DEVELOPMENT, VACAVILLE
EXISTING CONDITIONS

Modeled Receptor	Existing	Existing Plus Project	Change	Significant Impact?
R-1	65	66	1	No
R-2	65	66	1	No
R-3	64	65	1	No
R-4	63	64	1	No
R-5	64	65	1	No
R-6	58	58	0	No
R-7	64	65	1	No
R-8	64	64	0	No
R-9	64	64	0	No
R-10	59	59	0	No
R-11	62	63	1	No
R-12	59	59	0	No
R-13	51	52	1	No
R-14	51	52	1	No
R-15	37	37	0	No
R-16	52	53	1	No
R-17	44	45	1	No

Source: WJV Acoustics, Inc.
GHD

Cumulative Conditions

Table VII provides Cumulative traffic noise exposure levels at the seventeen analyzed representative receptor locations, and also provides what the project contribution would be to Cumulative conditions. Reference to Table VII indicates that the project's contribution to Cumulative traffic noise exposure levels at the modeled representative receptor locations would not result in an exceedance of the City's noise level standards nor result in an increase of 3 dB at any sensitive receptor locations where noise levels already exceed the City's noise level standard without the implementation of the project. Consequently, the project contribution to cumulative noise levels would be less than considerable and the project would not have a significant cumulative impact.

TABLE VII

PROJECT-RELATED INCREASES IN TRAFFIC NOISE, dB, L_{dn}
GREENTREE DEVELOPMENT, VACAVILLE
CUMULATIVE CONDITIONS

Modeled Receptor	Cumulative Conditions Without Project Contribution	Cumulative Conditions	Project Contribution	Significant Impact?
R-1	68	68	0	No
R-2	67	68	1	No
R-3	67	67	0	No
R-4	65	66	1	No
R-5	67	67	0	No
R-6	62	63	1	No
R-7	67	67	0	No
R-8	65	65	0	No
R-9	66	66	0	No
R-10	59	59	0	No
R-11	64	65	1	No
R-12	59	59	0	No
R-13	52	53	1	No
R-14	52	53	1	No
R-15	39	39	0	No
R-16	53	54	1	No
R-17	46	46	0	No

Source: WJV Acoustics, Inc.
GHD

It should be noted, while reference to Table VI and Table VII indicate that noise levels at numerous receptor locations would be expected to increase by approximately 1 dB as a result of project implementation, many of these identified 1 dB increases are the result of numerical rounding. Overall, modeled noise results indicate that only five receptor locations would be expected to see project-related noise increases over 0.5 dB (R-6, R-11, R-13, R-14 and R-16).

b. Project Noise Impacts From Operational On-Site Sources (Less Than Significant)

The project would include approximately 19.7 acres of land uses identified as Commercial, north of Sequoia Drive. A wide variety of noise sources can be associated with commercial land use designations. Figure 12 provides the Urban Design Illustrative Plan, which provides the locations of proposed commercial land uses in relation to existing sensitive receptors. The closest existing sensitive receptors to proposed commercial uses are located at a setback distance of 500 feet or greater. Additionally, proposed residential buildings would be located between the existing sensitive receptors and the proposed commercial land uses. From the perspective of the City's noise standards, noise sources not associated with transportation sources are considered

stationary noise sources. Typical examples of stationary noise sources associated with commercial land uses include:

- HVAC/Mechanical equipment
- Truck deliveries
- Loading Docks
- Compactors
- Parking lot activities (closing of car doors and trunks, stereos, alarms etc.)

Because of the setback distance between existing sensitive receptors to the project's proposed commercial land uses (500 feet or greater), noise levels associated with such stationary noise sources would not be expected to exceed any City of Vacaville noise level standard or result in noise levels exceeding existing ambient noise levels at the locations of existing sensitive receptors.

c. Noise from Construction (Less Than Significant With Mitigation)

Construction noise would occur at various locations within and near the project site through the buildout period. Existing sensitive receptors could be located as close as 100 feet from construction activities. Table VIII provides typical construction-related noise levels at distances of 100 feet, 200 feet, and 300 feet.

Construction noise is not considered to be a significant impact if construction is limited to daytime hours and construction equipment is adequately maintained and muffled. The City of Vacaville municipal code limits hours of construction activities (if occurring within 500 feet of an occupied residence) to between 7:00 a.m. and one-half hour after sunset with no activities permitted on Sundays and holidays. Extraordinary noise-producing activities (e.g., pile driving) are not anticipated. Construction noise impacts could result in annoyance or sleep disruption for nearby residents if nighttime operations were to occur or if equipment is not properly muffled or maintained.

TABLE VIII

TYPICAL CONSTRUCTION EQUIPMENT MAXIMUM NOISE LEVELS, dBA

Type of Equipment	100 Ft.	200 Ft.	300 Ft.
Concrete Saw	84	78	74
Crane	75	69	65
Excavator	75	69	65
Front End Loader	73	67	63
Jackhammer	83	77	73
Paver	71	65	61
Pneumatic Tools	79	73	69
Dozer	76	70	66
Rollers	74	68	64
Trucks	80	72	70
Pumps	74	68	64
Scrapers	81	75	71
Portable Generators	74	68	64
Backhoe	80	74	70
Grader	80	74	70

Source: FHWA
Noise Control for Buildings and Manufacturing Plants, Bolt, Beranek & Newman, 1987

Project buildout is expected to occur over a period of approximately ten years. As such, no one area of sensitive receptors would be subjected to prolonged exposure of construction noise, as a result of phased construction activities dispersed across the overall project area.

Potential Impact:
A noise impact could occur if construction activities do not incorporate appropriate mitigation measures and best management practices.

Mitigation Measures:
Noise levels associated with construction activities may be effectively mitigated by incorporating noise mitigation measures and appropriate best management practices. The following mitigation measures and best management practices should be applied during periods of project construction.

- Construction activities occurring within 500 feet of an occupied residence are limited to the hours of 7:00 a.m. to one-half hour after sunset, with no construction on Sundays and Holidays.

- All construction equipment shall be properly maintained and muffled as to minimize noise generation at the source.

- Noise-producing equipment shall not be operating, running, or idling while not in immediate use by a construction contractor.

- All noise-producing construction equipment shall be located and operated, to the extent possible, at the greatest possible distance from any noise-sensitive land uses.

- Locate construction staging areas, to the extent possible, at the greatest possible distances from any noise-sensitive land uses.

- Signs shall be posted at the construction site and near adjacent sensitive receptors displaying hours of construction activities and providing the contact phone number of a designated noise disturbance coordinator.

d. Vibration Impacts (Less Than Significant)

The dominant sources of man-made vibration are sonic booms, blasting, pile driving, pavement breaking, demolition, diesel locomotives, and rail-car coupling. None of these activities are anticipated to occur with construction or operation of the proposed project. Vibration from construction activities could be detected at the closest sensitive land uses, especially during movements by heavy equipment or loaded trucks and during some paving activities (if they were to occur). Typical vibration levels at distances of 25 feet, 100 feet and 300 feet are summarized by Table IX. These levels would not be expected to exceed any significant threshold levels for annoyance or damage, as provided above in Table III and Table IV.

TABLE IX

TYPICAL VIBRATION LEVELS DURING CONSTRUCTION

	PPV (in/sec)		
Equipment	**@ 25´**	**@ 100´**	**@ 300´**
Bulldozer (Large)	0.089	0.011	0.006
Bulldozer (Small)	0.003	0.0004	0.00019
Loaded Truck	0.076	0.01	0.005
Jackhammer	0.035	0.005	0.002
Vibratory Roller	0.210	.03	0.013
Caisson Drilling	0.089	.01	0.006

Source: *Caltrans*

Vibration levels could at times be barely perceptible to distinctly perceptible (as described above in Table III) at existing sensitive receptors during periods of construction activities. However, vibration levels associated with construction activities would not be expected to result in any structural damage (as described above in Table IV) to existing residences and buildings in proximity to construction activities.

After full project build out, it is not expected that ongoing operational activities will result in any vibration impacts at nearby sensitive uses. Activities involved in trash bin collection could result in minor on-site vibrations as the bin is placed back onto the ground. Such vibrations would not be expected to be felt at the closest off-site sensitive uses. Additional mitigation is not required.

5. NOISE IMPACTS TO PROPOSED ON-SITE SENSITIVE RECEPTORS, AND MITIGATION MEASURES

a. Traffic Noise Impacts To Proposed On-Site Receptors (Less Than Significant With Mitigation)

The proposed project includes sensitive receptors (residential land uses) that could be impacted by traffic noise exposure adjacent to arterial roadways, specifically Leisure Town Road, Orange Drive and US Interstate 80 (I-80). WJVA used the above-described FHWA traffic noise model and traffic noise modeling assumptions to determine the distances from the center of the roadways to the 60 dB CNEL and 70 dB CNEL noise exposure contours.

Table X provides the distances from the center of the arterial roadways adjacent to the project site to the 60 dB CNEL and 70 dB CNEL noise exposure contours. Table X provides the contour distances for Cumulative plus project conditions (I-80 contour distances calculated based upon Caltrans most recent 2019 traffic counts and truck percentages) as they represent a worst-case assessment of noise exposure at proposed sensitive receptor locations. Additionally, contour setback distances provided in Table X should be considered generalized, and do not take into account any site-specific acoustic conditions such as shielding provided by any intervening topography, existing buildings or sound walls.

TABLE X

DISTANCES TO TRAFFIC NOISE CONTOURS
GREENTREE DEVELOPMENT, VACAVILLE
CUMULATIVE CONDITIONS

Roadway Segment (Description)	Distance (feet) to 60 dB CNEL	Distance (feet) to 70 dB CNEL
Leisure Town Road (north of Sequoia Drive)	246	53
Leisure Town Road (south of Sequoia Drive)	238	51
Orange Drive (west of Leisure Town Road)	133	29
US I-80	1,660	358

Source: WJV Acoustics, Inc.
GHD

Potential Impact:
A noise impact could occur if the outdoor activity areas of proposed sensitive receptors are located within the cumulative conditions 60 dB CNEL traffic noise contours. Based upon the project development plan (Figure 1), residential land uses are proposed adjacent to Leisure Town Road and Orange Drive and in the vicinity of I-80 (R6, R7). If the outdoor activity areas of these residential land uses are located along these roadways within the 60 dB CNEL contour (as described in Table X), a noise impact could occur. Such impacts could occur along Leisure Town Road, Orange Drive and in certain proximities to I-80.

Mitigation Measures:
Noise levels from transportation noise sources may be effectively mitigated by incorporating noise mitigation measures into the project design that consider the geographical relationship between the noise sources of concern and potential receptors, the noise-producing characteristics of the sources and the path of transmission between noise sources and sensitive receptors. Options for noise mitigation include the use of increased setbacks and the construction of sound walls.

Outdoor activity areas of proposed multi-family residential developments must be located at minimum setback distances provided above in Table X, from each respective roadway or incorporate necessary mitigation measures to ensure exterior noise levels do not exceed the 60 dB CNEL exterior noise level standard. Potential mitigation measures that could be implemented if such outdoor activity areas are located within these setback distances provided in Table X include the following:

- Locating outdoor activity areas in centrally located/interior areas where the residential construction provides acoustic shielding from roadway noise.

- Construction of sound walls

b. Noise Impacts from Operational On-Site Sources (Less Than Significant With Mitigation)

The project would include a variety commercial and retail uses near the northern portion of the project site (see Figure 12). While the exact tenants/uses were not known at the time of this analysis, anticipated uses include a Grocery Store, Drug Store, Drive-Thru Restaurant and numerous smaller retails stores.

A wide variety of noise sources can be associated with these land use designations. The noise levels produced by such sources can also be highly variable and could potentially impact existing off-site and proposed on-site sensitive receptors. Mitigation measures typically incorporated into project design would include increased setback distances, sound walls, limited hours of operation and noise source equipment enclosures, shielding and screening measures. Typical examples of stationary noise sources associated with such land uses include:

- HVAC/Mechanical equipment
- Truck deliveries
- Loading Docks
- Parking lot activities (vehicle movements, closing of car doors and trunks, stereos, alarms etc.)
- Drive Thru operations

Mechanical Equipment

It is assumed that the project would include roof-mounted HVAC units on the proposed commercial buildings. The heating, ventilating, and air conditioning (HVAC) requirements for the buildings would likely require the use of multiple packaged roof-top units. For the purpose of noise and aesthetics, roof-mounted HVAC units are typically shielded by means of a roof parapet. WJVA has conducted reference noise level measurements at numerous commercial and retail buildings with roof-mounted HVAC units, and associated noise levels typically range between approximately 45-50 dB at a distance of 50 feet from the building façade.

Based upon the Urban Design Illustrative Plan (Figure 12), the closest proposed new residential land uses to potential roof-mounted HVAC equipment at new commercial land uses could be located as close as 150 feet. Taking into account the standard rate of noise attenuation with increased distance from a point source (-6 dB/doubling of distance), noise levels associated with the operation of roof-mounted HVAC units would be approximately 35-40 dB at the closest sensitive receptor property line. Such levels do not exceed any City of Vacaville noise level standard or exceed existing (without project) ambient noise levels.

Truck Movements

At the time of this analysis, a specific truck access route (or routes) had not been designated. However, trucks would be expected to access proposed commercial retail uses for various deliveries. The precise locations, frequency and times of truck deliveries was not known at the time of this analysis.

WJVA has conducted measurements of the noise levels produced by slowly moving trucks for a number of studies. Such truck movements would be expected to produce noise levels in the range of 65 to 70 dBA at a distance of 100 feet. The range in measured truck noise levels is due to differences in the size of trucks, their speed of movement and whether they have refrigeration units in operation during the pass-by.

The applicable noise standard for truck movements occurring at proposed commercial land uses would be a maximum daytime noise level of 70 dB and a maximum nighttime noise level of 65 dB. In order to avoid exceeding such maximum noise levels, truck movements occurring within the proposed commercial/retail land uses should do so as such to maintain a minimum setback distance of approximately 100 feet during the daytime hours of 7:00 a.m. to 10:00 p.m. and a minimum setback distance of approximately 180 feet during the nighttime hours of 10:00 p.m. to 7:00 a.m. from outdoor activity areas of proposed nearby and adjacent multi-family residential developments.

Potential Impact:

Noise levels associated with truck movements could exceed the City's 70 dB L_{max} daytime noise level standard and 65 dB L_{max} nighttime noise level standard at the outdoor activity areas of proposed multi-family residential land uses if proper setback distances are not maintained.

Mitigation Measures:

Commercial/retail land uses proposed for the project should develop site-specific truck access routes in the vicinity of proposed sensitive receptors. All truck movements occurring within

proposed commercial/retail areas should maintain a minimum setback of approximately 100 feet during daytime hours and approximately 180 feet during nighttime hours, from outdoor activity areas of proposed sensitive receptors.

Loading Docks

The proposed commercial uses associated with the project would likely include loading docks at the larger retail establishments, particularly the Grocery Store development. The Urban Design Illustrative Plan (Figure 12) indicates that a loading dock would be located at the rear of the Grocery Store, adjacent to Orange Drive. The loading dock would be located at least 500 feet from any proposed residential sensitive receptor.

Based upon noise level measurements conducted by WJVA for other studies, loading dock noise levels would be expected to be in the range of 44-62 dBA at a distance of 500 feet. Such levels would not exceed the City's daytime (70 dB) or nighttime (65 dB) maximum noise level standard.

If additional loading docks were included at other proposed commercial/retail uses, associated noise levels could potentially exceed the City's maximum nighttime noise level standard of 65 dB if they were to be located within 315 feet of a sensitive receptor and could potentially exceed the City's daytime noise level standard of 70 dB if they were to be located within 150 feet of a sensitive receptor.

Potential Impact:

Noise levels associated with loading dock activities could exceed the City's 70 dB L_{max} daytime noise level standard and 65 dB L_{max} nighttime noise level standard at the outdoor activity areas of proposed multi-family residential land uses if proper setback distances are not maintained or mitigation measures are provided.

Mitigation Measures:

Loading docks located within 315 feet of a sensitive receptor could result in noise levels exceeding the City's daytime maximum noise level standard of 70 dB. Loading docks located within 150 feet of a sensitive receptor could result in noise levels exceeding the City's daytime maximum noise level standard of 65 dB. Any proposed loading docks should be located at the above-described minimum setback distances (depending on if daytime vs nighttime deliveries were expected) or incorporate sufficient mitigation measures (sound walls) to mitigate noise levels to below the City's noise level standards at sensitive receptor locations.

Parking Lot Activities

Noise due to traffic in parking lots is typically limited by low speeds and is not usually considered to be significant. Human activity in parking lots that can produce noise includes voices, stereo systems and the opening and closing of car doors and trunk lids. Such activities can occur at any time. The noise levels associated with these activities cannot be precisely defined due to variables such as the number of parking movements, time of day and other factors. It is typical for a passing car in a parking lot to produce a maximum noise level of 60 to 65 dBA at a distance of 50 feet, which is comparable to the level of a raised voice. Parking areas of proposed commercial uses would not be located closer than 50 from any proposed sensitive receptor, and noise levels

associated with parking lot activities would not be expected to exceed any City of Vacaville noise level standards.

Drive Thru Retail

According to the Urban Design Illustrative Plan (Figure 12) the project could include a drive-thru retail store. The drive-thru retail store would be located approximately 175 feet from proposed residential sensitive receptors. Noise levels associated with drive-thru retail are typically limited to vehicle movements and amplified speech associated with customers and employee interactions using the amplified menu board.

In order to assess potential project noise levels associated with drive-thru operations, WJVA utilized reference noise levels previously measured at a Wendy's drive-thru restaurant located in Visalia, California. Measurements were conducted during the early afternoon of July 11, 2011 between 12:45 p.m. and 1:45 p.m. using the previously-described noise monitoring equipment.

The microphone used by customers to order food and the loudspeaker used by employees to confirm orders are both integrated into a menu board that is located a few feet from the drive-thru lane at the approximate height of a typical car window. Vehicles would enter the drive-thru lane from the west and then turn to the north along the east side of the restaurant.

Reference noise measurements were obtained at a distance of approximately 40 feet from the menu board containing the microphone/loudspeaker system at an angle of about 45° toward the rear of the vehicle being served. This provided a worst-case exposure to sound from the loudspeaker system since the vehicle was not located directly between the loudspeaker and measurement location. Cars were lined up in the access lane during the noise measurement period indicating that the drive-through lane was operating at or near a peak level of activity.

Each ordering cycle was observed to take approximately 60 seconds including vehicle movements. A typical ordering cycle included 5-10 seconds of loudspeaker use with typical maximum noise levels in the range of 60-62 dBA at the 40 foot-reference location. Vehicles moving through the drive-thru lane produced noise levels in the range of 55-60 dBA at the same distance. Vehicles parked at the ordering position (between the menu board and measurement site) were observed to provide significant acoustic shielding during the ordering sequence. The effects of such shielding are reflected by the noise measurement data. Noise levels were measured to approximately 60 dB L_{eq} at the measurement site, and included noise from all sources, including the loudspeaker, vehicle movements and HVAC equipment.

At the setback location of the closest proposed residential sensitive receptors, noise levels associated with drive thru retail operations would be expected to produce noise levels of approximately 48-50 dB L_{max} and approximately 47 dB L_{eq}. While such noise levels could exceed the City's 45 dB Leq nighttime noise level standard, reference to noise levels measured at ambient noise monitoring site L-2 indicated that existing ambient noise levels already exceed such noise levels, and would therefore not result in a noise impact.

c. Noise Impacts from Nearby Airports or Airstrips (No Impact)

The Project site is located approximately one mile from the Nut Tree Airport. WJVA has reviewed the Nut Tree Airport Master Plan, which provides the airport noise contours. No portion of the project site is located within any of the airport noise contours, and noise associated with the airport would not result in a significant impact on proposed noise-sensitive receptors within the project site. The Nut Tree Airport Noise Contours are provided as Figure 13.

6. IMPACT SUMMARY

This impact summary addresses only the noise impacts determined to be "potentially significant" and summarizes the mitigation measures that would be required to reduce noise levels to a "less than significant" level or states that the impact may be significant an unavoidable. Potential impacts and correlating mitigation measures are described in detail above, and summarized below.

- **CONSTRUCTION NOISE AT EXISTING SENSITIVE RECEPTOR LOCATIONS**
  Potential Impact:
  A noise impact could occur if construction activities do not incorporate appropriate mitigation measures and best management practices.

  Mitigation Measures:
  Noise levels associated with construction activities may be effectively mitigated by incorporating noise mitigation measures and appropriate best management practices. The following mitigation measures and best management practices should be applied during periods of project construction.

  - Construction activities occurring within 500 feet of an occupied residence are limited to the hours of 7:00 a.m. to one-half hour after sunset, with no construction on Sundays and Holidays.

  - All construction equipment shall be properly maintained and muffled as to minimize noise generation at the source.

  - Noise-producing equipment shall not be operating, running, or idling while not in immediate use by a construction contractor.

  - All noise-producing construction equipment shall be located and operated, to the extent possible, at the greatest possible distance from any noise-sensitive land uses.

  - Locate construction staging areas, to the extent possible, at the greatest possible distances from any noise-sensitive land uses.

  - Signs shall be posted at the construction site and near adjacent sensitive receptors displaying hours of construction activities and providing the contact phone number of a designated noise disturbance coordinator.

  This impact is considered less than significant with mitigation.

- **TRAFFIC NOISE AT PROPOSED RESIDENTIAL LAND USES**

  Potential Impact:

  A noise impact could occur if the outdoor activity areas of proposed sensitive receptors are located within the cumulative conditions 60 dB CNEL traffic noise contours. Based upon the project development plan (Figure 1), residential land uses are proposed adjacent to Leisure Town Road and Orange Drive and in the vicinity of I-80 (R6, R7). If the outdoor activity areas of these residential land uses are located along these roadways within the 60 dB CNEL contour (as described in Table X), a noise impact could occur. Such impacts could occur along Leisure Town Road, Orange Drive and in certain proximities to I-80.

  Mitigation Measures:

  Noise levels from transportation noise sources may be effectively mitigated by incorporating noise mitigation measures into the project design that consider the geographical relationship between the noise sources of concern and potential receptors, the noise-producing characteristics of the sources and the path of transmission between noise sources and sensitive receptors.

  Outdoor activity areas of proposed multi-family residential developments must be located at minimum setback distances provided above in Table X, from each respective roadway or incorporate necessary mitigation measures to ensure exterior noise levels do not exceed the 60 dB CNEL exterior noise level standard. Potential mitigation measures that could be implemented if such outdoor activity areas are located within these setback distances provided in Table X include the following:

  - Locating outdoor activity areas in centrally located/interior areas where the residential construction provides acoustic shielding from roadway noise.

  - Construction of sound walls

  This impact is considered less than significant with mitigation.

- **NOISE IMPACTS FROM COMMERCIAL/RETAIL STATIONARY SOURCES**

  Potential Impact:

  Noise levels associated with truck movements could exceed the City's 70 dB L_{max} daytime noise level standard and 65 dB L_{max} nighttime noise level standard at the outdoor activity areas of proposed multi-family residential land uses if proper setback distances are not maintained.

  Mitigation Measures:

  Commercial/retail land uses proposed for the project should develop site-specific truck access routes in the vicinity of proposed sensitive receptors. All truck movements occurring within proposed commercial/retail areas should maintain a minimum setback of approximately 100 feet during daytime hours and approximately 180 feet during nighttime hours, from outdoor activity areas of proposed sensitive receptors.

  Potential Impact:

  Noise levels associated with loading dock activities could exceed the City's 70 dB L_{max} daytime noise level standard and 65 dB L_{max} nighttime noise level standard at the outdoor activity areas of proposed multi-family residential land uses if proper setback distances are not maintained or mitigation measures are provided.

  Mitigation Measures:

  Loading docks located within 315 feet of a sensitive receptor could result in noise levels exceeding the City's daytime maximum noise level standard of 70 dB. Loading docks located within 150 feet of a sensitive receptor could result in noise levels exceeding the City's daytime maximum noise level standard of 65 dB. Any proposed loading docks should be located at the above-described minimum setback distances (depending on if daytime vs nighttime deliveries were expected) or incorporate sufficient mitigation measures (sound walls) to mitigate noise levels to below the City's noise level standards at sensitive receptor locations.

  This impact is considered less than significant with mitigation

7. SOURCES CONSULTED

1. City of Vacaville General Plan.

2. City of Vacaville Municipal Code

3. California Department of Transportation, *Transportation and Construction Vibration Guidance Manual,* September 2013.

4. Federal Highway Administration, *Traffic Noise Model, Version 2.5,* April 14, 2004

FIGURE 1: OVERALL DEVELOPMENT PLAN

FIGURE 2: NORTH OF SEQUOIA DRIVE DEVELOPMENT PLAN

Source: CBG 2019, EMC Planning Group 2019, Google Earth 2019

Figure 3
North of Sequoia Drive Development Plan
Greentree Development Project

FIGURE 3: SOUTH OF SEQUOIA DRIVE DEVELOPMENT PLAN

LAND USE SUMMARY - SOUTH

LAND USE	LOTS	% OF TOTAL LOTS	AREA (AC)	% OF TOTAL AREA
42' x 100'	107	59	15.4	23%
50' x 100'	82	41	13.2	19%
PARK	—	—	5.6	8%
OPEN SPACE / TOTAL DETENTION	—	—	22.6	34%
DETENTION BASIN / WATER QUALITY	—	—	7.1	10%
LEISURE TOWN ROAD DEDICATION	—	—	0.9	1%
RIGHT OF WAY / ROAD	—	—	0.4	1%
CITY WELL SITE	—	—	1.0	1%
TOTAL	189	100%	70.4	100%

Source: CBG 2021, EMC Planning Group 2021, Google Earth 2019

Figure 4
South of Sequoia Drive Development Plan
Greentree Development Project

FIGURE 4: LOCATIONS OF LONG-TERM AND SHORT-TERM MEASUREMENT SITES

FIGURE 5: HOURLY NOISE LEVELS AT SITE LT-1

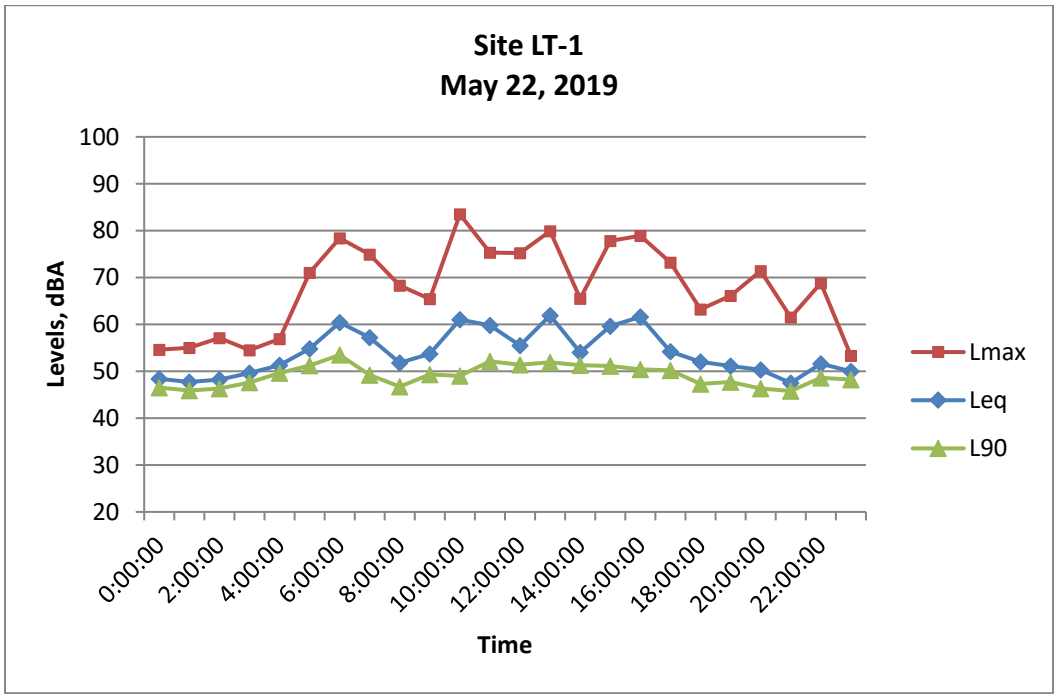


FIGURE 6: HOURLY NOISE LEVELS AT SITE LT-2

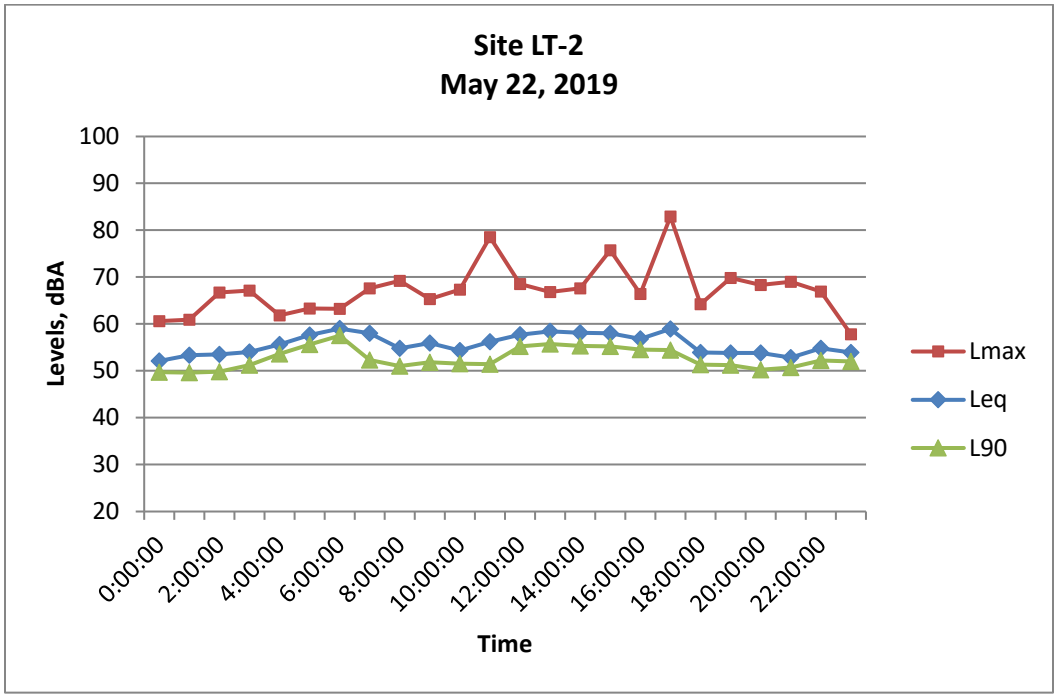


FIGURE 7: HOURLY NOISE LEVELS AT SITE LT-3

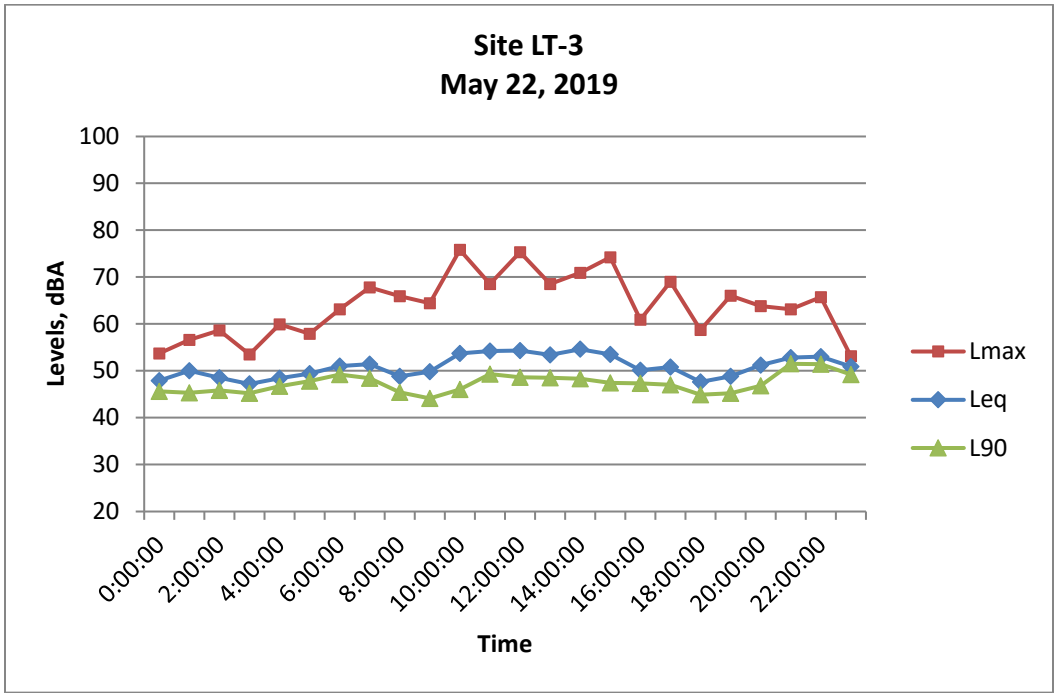


FIGURE 8: HOURLY NOISE LEVELS AT SITE LT-4

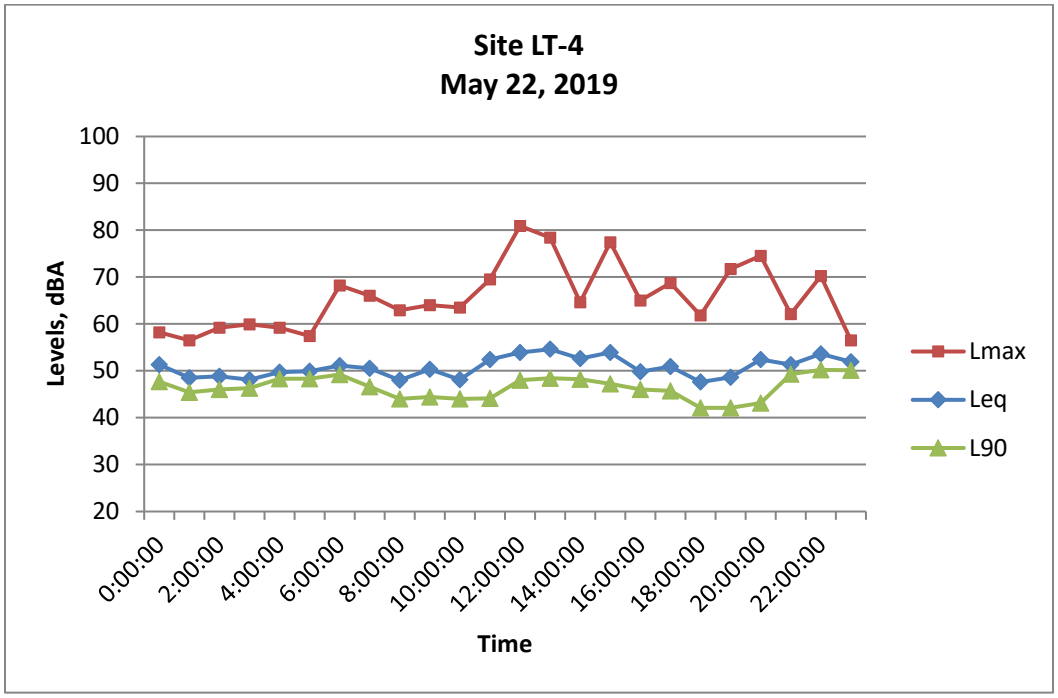


FIGURE 9: HOURLY NOISE LEVELS AT SITE LT-5

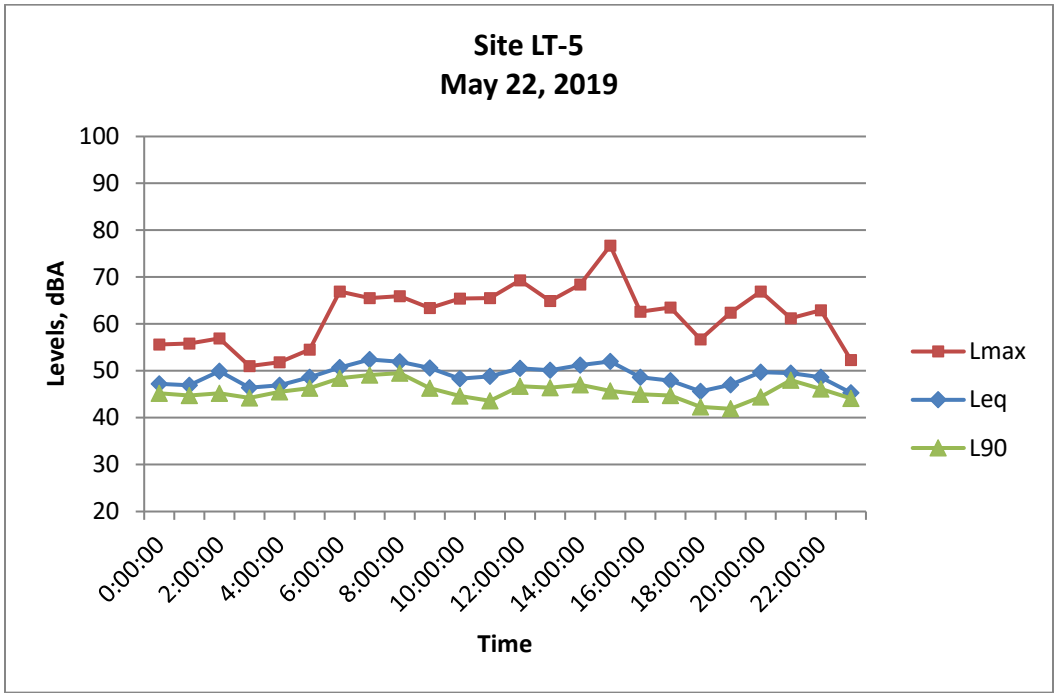


FIGURE 10: MODELED TRAFFIC NOISE RECEPTORS (NORTH)

FIGURE 11: MODELED TRAFFIC NOISE RECEPTORS (SOUTH)

FIGURE 12: URBAN DESIGN PLAN

FIGURE 13: NUT TREE AIRPORT NOISE CONTOURS

APPENDIX A-1

ACOUSTICAL TERMINOLOGY

AMBIENT NOISE LEVEL: The composite of noise from all sources near and far. In this context, the ambient noise level constitutes the normal or existing level of environmental noise at a given location.

CNEL: Community Noise Equivalent Level. The average equivalent sound level during a 24-hour day, obtained after addition of approximately five decibels to sound levels in the evening from 7:00 p.m. to 10:00 p.m. and ten decibels to sound levels in the night before 7:00 a.m. and after 10:00 p.m.

DECIBEL, dB: A unit for describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

DNL/L_{dn}: Day/Night Average Sound Level. The average equivalent sound level during a 24-hour day, obtained after addition of ten decibels to sound levels in the night after 10:00 p.m. and before 7:00 a.m.

L_{eq}: Equivalent Sound Level. The sound level containing the same total energy as a time varying signal over a given sample period. L_{eq} is typically computed over 1, 8 and 24-hour sample periods.

NOTE: The CNEL and DNL represent daily levels of noise exposure averaged on an annual basis, while L_{eq} represents the average noise exposure for a shorter time period, typically one hour.

L_{max}: The maximum noise level recorded during a noise event.

L_n: The sound level exceeded "n" percent of the time during a sample interval (L_{90}, L_{50}, L_{10}, etc.). For example, L_{10} equals the level exceeded 10 percent of the time.

ACOUSTICAL TERMINOLOGY

NOISE EXPOSURE CONTOURS: Lines drawn about a noise source indicating constant levels of noise exposure. CNEL and DNL contours are frequently utilized to describe community exposure to noise.

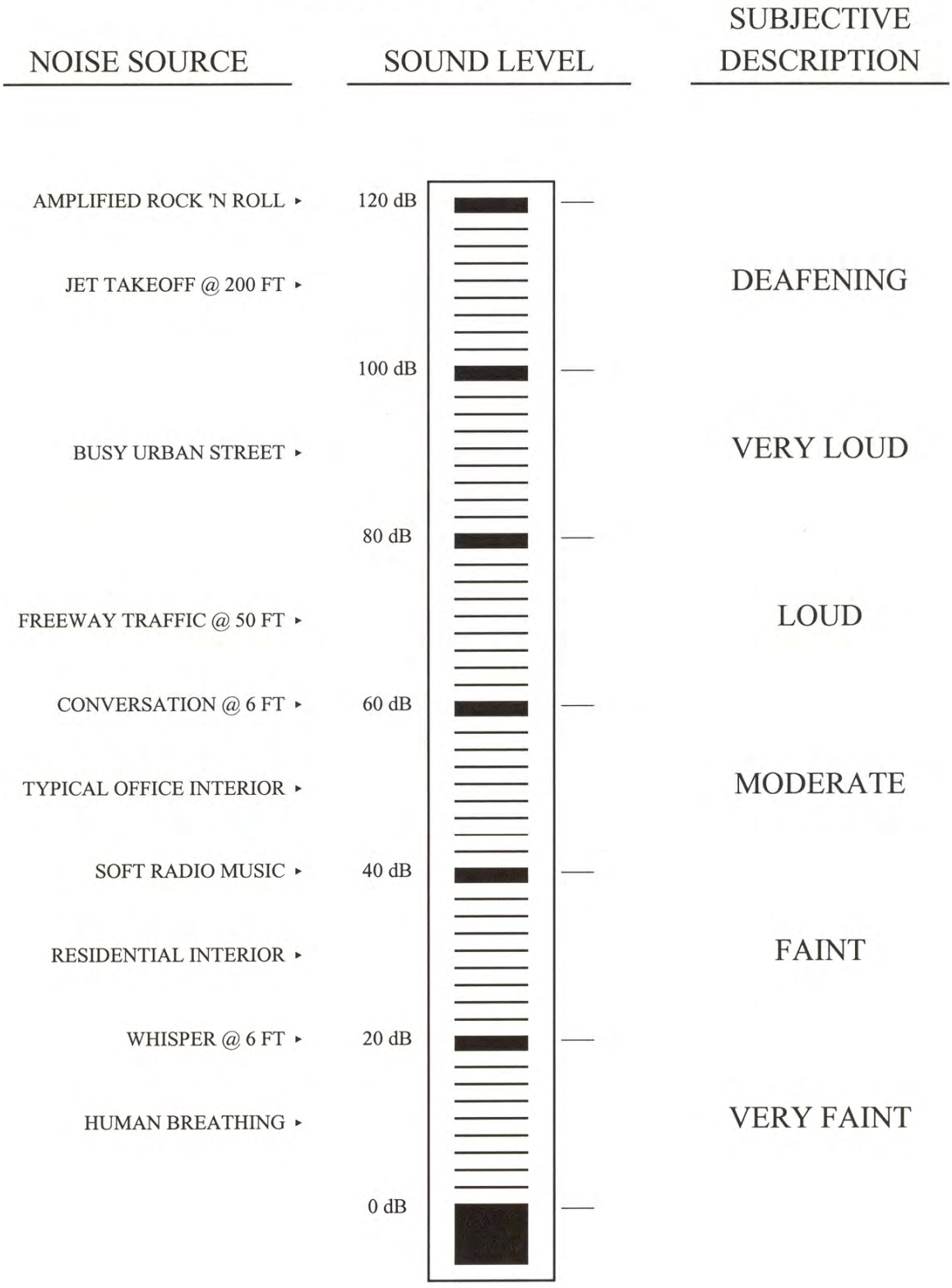
NOISE LEVEL REDUCTION (NLR): The noise reduction between indoor and outdoor environments or between two rooms that is the numerical difference, in decibels, of the average sound pressure levels in those areas or rooms. A measurement of "noise level reduction" combines the effect of the transmission loss performance of the structure plus the effect of acoustic absorption present in the receiving room.

SEL or SENEL: Sound Exposure Level or Single Event Noise Exposure Level. The level of noise accumulated during a single noise event, such as an aircraft overflight, with reference to a duration of one second. More specifically, it is the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on a reference pressure of 20 micropascals and a reference duration of one second.

SOUND LEVEL: The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the response of the human ear and gives good correlation with subjective reactions to noise.

SOUND TRANSMISSION CLASS (STC): The single-number rating of sound transmission loss for a construction element (window, door, etc.) over a frequency range where speech intelligibility largely occurs.

APPENDIX B
EXAMPLES OF SOUND LEVELS



APPENDIX C

TRAFFIC NOISE MODELING CALCULATIONS

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
May 12, 2021

Project #:	19-013
Description:	Existing
Ldn/Cnel:	Ldn
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	Leisure Town Rd	s/o Gilley Way R-1	17720	83	7	10	2	1	40	75	
2	Gilley Way	w/o Leisure Town Rd	2150	83	7	10	2	1	40	100	
3	Leisure Town Rd	s/o Poplar Rd R-2	19020	83	7	10	2	1	40	75	
4	Leisure Town Rd	s/o Maple Rd R-3	18970	83	7	10	2	1	40	85	
5	Leisure Town Rd	s/o Sequoia Dr R-4	17730	83	7	10	2	1	40	100	
6	Leisure Town Rd	n/o Ulatis R-5	16810	83	7	10	2	1	40	80	
7	Ulatis Dr	w/o Leisure Town Rd R-6	3930	83	7	10	2	1	40	80	
8	Leisure Town Rd	s/o Ulatis Dr. R-7	17120	83	7	10	2	1	40	80	
9	Elmira Dr	w/o Leisure Town Rd. R-8	9170	83	7	10	2	1	40	60	
10	Leisure Town Rd	s/o Elmira Dr R-9	16830	83	7	10	2	1	40	90	
11	Marshall Rd	w/o Leisure Town Rd R-10	2630	83	7	10	2	1	40	55	
12	Leisure Town Rd	s/o Marshall Rd R-11	14850	83	7	10	2	1	40	100	
13	Orange Dr	n/o Gilley Wy	6640	83	7	10	2	1	45	100	
14	Nut Tree Rd	w/o Yellowstone Dr R-12	13270	83	7	10	2	1	40	160	
15	Yellowstone Dr.	s/o Teton Dr R-13	2770	83	7	10	2	1	25	90	
16	Yellowstone Dr.	n/o Teton Dr R-14	2500	83	7	10	2	1	25	90	
17	White Sands Dr	n/o Teton Dr R-15	230	83	7	10	2	1	25	140	
18	Yellowstone Dr	n/o Rushmore Dr R-16	2520	83	7	10	2	1	25	70	
19	Sequoia Dr	w/o Yellowstone Dr R-17	990	83	7	10	2	1	25	130	
20	Sequoia Dr	e/o Yellowstone Dr	2410	83	7	10	2	1	25	100	
21	US 80	at Leisure Town	134000	83	7	10	3.8	4.6	65	645	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
April 8, 2021

Project #:	19-013
Description:	Existing + project
Ldn/Cnel:	Ldn
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	Leisure Town Rd	s/o Gilley Way R-1	22170	83	7	10	2	1	40	75	
2	Gilley Way	w/o Leisure Town Rd	2250	83	7	10	2	1	40	100	
3	Leisure Town Rd	s/o Poplar Rd R-2	21640	83	7	10	2	1	40	75	
4	Leisure Town Rd	s/o Maple Rd R-3	21590	83	7	10	2	1	40	85	
5	Leisure Town Rd	s/o Sequoia Dr R-4	20250	83	7	10	2	1	40	100	
6	Leisure Town Rd	n/o Ulatis R-5	19250	83	7	10	2	1	40	80	
7	Ulatis Dr	w/o Leisure Town Rd R-6	4050	83	7	10	2	1	40	80	
8	Leisure Town Rd	s/o Ulatis Dr. R-7	19340	83	7	10	2	1	40	80	
9	Elmira Dr	w/o Leisure Town Rd. R-8	9170	83	7	10	2	1	40	60	
10	Leisure Town Rd	s/o Elmira Dr R-9	18630	83	7	10	2	1	40	90	
11	Marshall Rd	w/o Leisure Town Rd R-10	2630	83	7	10	2	1	40	55	
12	Leisure Town Rd	s/o Marshall Rd R-11	16620	83	7	10	2	1	40	100	
13	Orange Dr	n/o Gilley Wy	6640	83	7	10	2	1	45	100	
14	Nut Tree Rd	w/o Yellowstone Dr R-12	14640	83	7	10	2	1	40	160	
15	Yellowstone Dr.	s/o Teton Dr R-13	3660	83	7	10	2	1	25	90	
16	Yellowstone Dr.	n/o Teton Dr R-14	3340	83	7	10	2	1	25	90	
17	White Sands Dr	n/o Teton Dr R-15	230	83	7	10	2	1	25	140	
18	Yellowstone Dr	n/o Rushmore Dr R-16	3140	83	7	10	2	1	25	70	
19	Sequoia Dr	w/o Yellowstone Dr R-17	1040	83	7	10	2	1	25	130	
20	Sequoia Dr	e/o Yellowstone Dr	3130	83	7	10	2	1	25	100	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
April 8, 2021

Project #:	19-013
Description:	Cumulative
Ldn/Cnel:	Ldn
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	Leisure Town Rd	s/o Gilley Way R-1	32350	83	7	10	2	1	40	75	
2	Gilley Way	w/o Leisure Town Rd	2950	83	7	10	2	1	40	100	
3	Leisure Town Rd	s/o Poplar Rd R-2	31250	83	7	10	2	1	40	75	
4	Leisure Town Rd	s/o Maple Rd R-3	31200	83	7	10	2	1	40	85	
5	Leisure Town Rd	s/o Sequoia Dr R-4	29750	83	7	10	2	1	40	100	
6	Leisure Town Rd	n/o Ulatis R-5	30500	83	7	10	2	1	40	80	
7	Ulatis Dr	w/o Leisure Town Rd R-6	9200	83	7	10	2	1	40	80	
8	Leisure Town Rd	s/o Ulatis Dr. R-7	31050	83	7	10	2	1	40	80	
9	Elmira Dr	w/o Leisure Town Rd. R-8	13350	83	7	10	2	1	40	60	
10	Leisure Town Rd	s/o Elmira Dr R-9	26400	83	7	10	2	1	40	90	
11	Marshall Rd	w/o Leisure Town Rd R-10	2950	83	7	10	2	1	40	55	
12	Leisure Town Rd	s/o Marshall Rd R-11	22200	83	7	10	2	1	40	100	
13	Orange Dr	n/o Gilley Wy	9250	83	7	10	2	1	45	100	
14	Nut Tree Rd	w/o Yellowstone Dr R-12	15100	83	7	10	2	1	40	160	
15	Yellowstone Dr.	s/o Teton Dr R-13	3400	83	7	10	2	1	25	90	
16	Yellowstone Dr.	n/o Teton Dr R-14	3150	83	7	10	2	1	25	90	
17	White Sands Dr	n/o Teton Dr R-15	300	83	7	10	2	1	25	140	
18	Yellowstone Dr	n/o Rushmore Dr R-16	3150	83	7	10	2	1	25	70	
19	Sequoia Dr	w/o Yellowstone Dr R-17	1350	83	7	10	2	1	25	130	
20	Sequoia Dr	e/o Yellowstone Dr	3050	83	7	10	2	1	25	100	

WJV Acoustics, Inc
FHWA-RD-77-108
Calculation Sheets
April 8, 2021

Project #:	19-013
Description:	Cumulative + project
Ldn/Cnel:	Ldn
Site Type:	Soft

Contour Levels (dB)	60	65	70	75					

Segment	Roadway Name	Segment Description	ADT	%Day	%Evening	%Night	%Med	%Heavy	Speed	Distance	Offset
1	Leisure Town Rd	s/o Gilley Way R-1	33080	83	7	10	2	1	40	75	
2	Gilley Way	w/o Leisure Town Rd	3050	83	7	10	2	1	40	100	
3	Leisure Town Rd	s/o Poplar Rd R-2	33870	83	7	10	2	1	40	75	
4	Leisure Town Rd	s/o Maple Rd R-3	33820	83	7	10	2	1	40	85	
5	Leisure Town Rd	s/o Sequoia Dr R-4	32270	83	7	10	2	1	40	100	
6	Leisure Town Rd	n/o Ulatis R-5	32840	83	7	10	2	1	40	80	
7	Ulatis Dr	w/o Leisure Town Rd R-6	11320	83	7	10	2	1	40	80	
8	Leisure Town Rd	s/o Ulatis Dr. R-7	33270	83	7	10	2	1	40	80	
9	Elmira Dr	w/o Leisure Town Rd. R-8	13350	83	7	10	2	1	40	60	
10	Leisure Town Rd	s/o Elmira Dr R-9	28200	83	7	10	2	1	40	90	
11	Marshall Rd	w/o Leisure Town Rd R-10	2950	83	7	10	2	1	40	55	
12	Leisure Town Rd	s/o Marshall Rd R-11	25770	83	7	10	2	1	40	100	
13	Orange Dr	n/o Gilley Wy	9250	83	7	10	2	1	45	100	
14	Nut Tree Rd	w/o Yellowstone Dr R-12	15470	83	7	10	2	1	40	160	
15	Yellowstone Dr.	s/o Teton Dr R-13	4290	83	7	10	2	1	25	90	
16	Yellowstone Dr.	n/o Teton Dr R-14	3990	83	7	10	2	1	25	90	
17	White Sands Dr	n/o Teton Dr R-15	300	83	7	10	2	1	25	140	
18	Yellowstone Dr	n/o Rushmore Dr R-16	3770	83	7	10	2	1	25	70	
19	Sequoia Dr	w/o Yellowstone Dr R-17	1450	83	7	10	2	1	25	130	
20	Sequoia Dr	e/o Yellowstone Dr	3770	83	7	10	2	1	25	100	
21	Orange Dr	w/o Leisure Town Rd.	10150	83	7	10	2	1	45	100	