3.10 Noise

This section provides background information on noise and vibration and applicable noise guidelines and standards for the City of Vacaville and Solano County. This section assesses the potential for noise impacts of the Proposed Project, and potential conflicts with noise standards set forth by the jurisdiction identified above.

3.10.1 Environmental Setting

Environmental Noise Fundamentals

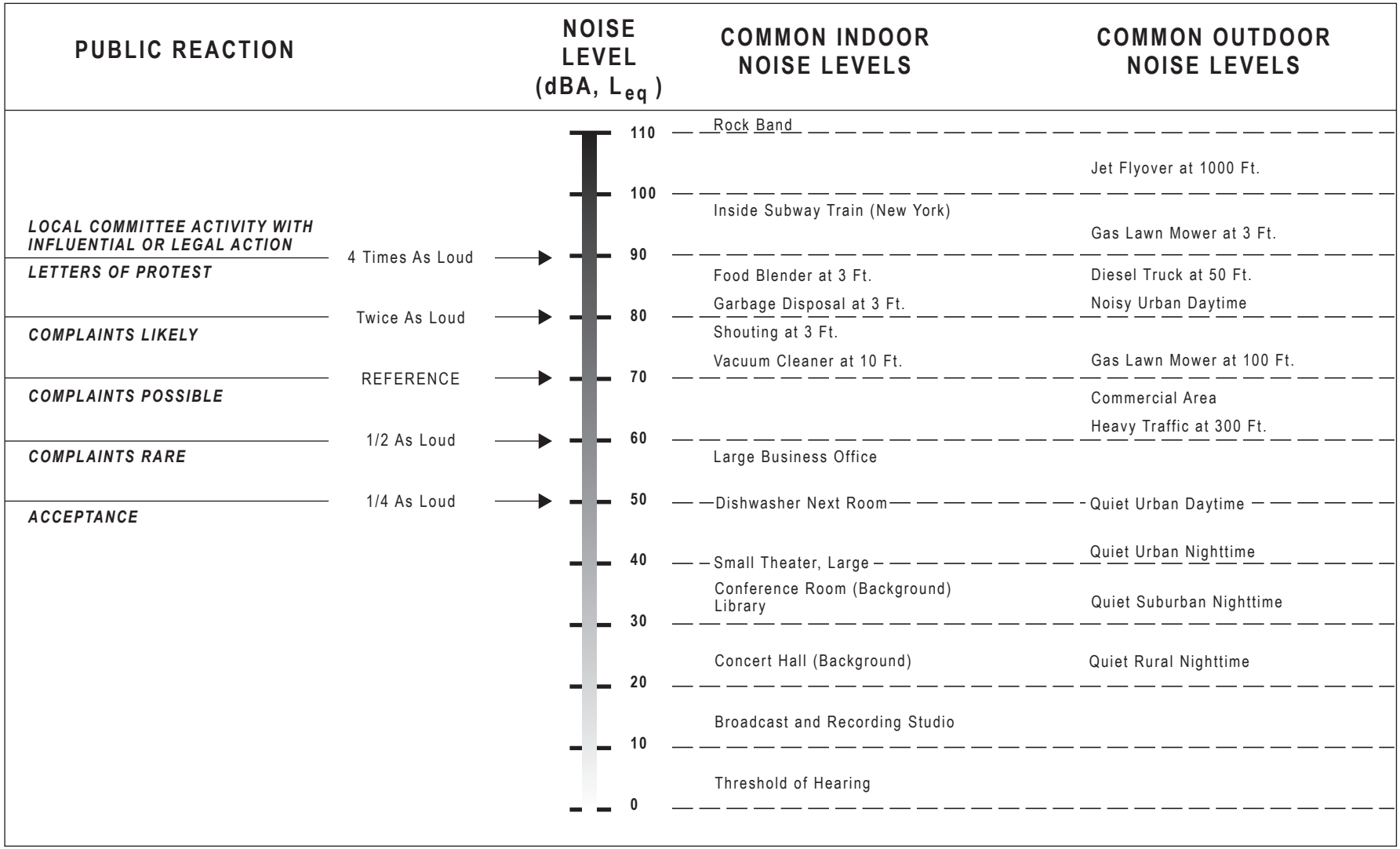
Noise is defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. Pressure waves traveling through air exert a force registered by the human ear as sound.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad ban of frequencies carrying in levels of magnitude (sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequencies spanning 20 to 20,000 Hz. The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the sound frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to extremely low and extremely high frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). A-weighting follows an international standard methodology of frequency weighting and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in **Figure 3.10-1**.

Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time. A noise level is a measure of noise at a given instant in time. The noise levels presented in **Figure 3.10-1** are representative of measured noise at a given instant in time, however, they rarely persist consistently over a long period of time. Rather, community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable.



SOURCE: ESA, 2007

Nut Tree Airport Master Plan EIR . 120526

Figure 3.10-1
Effect of Noise on People

The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment varies the community noise level from instant to instant requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

Leq — the equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

Lmax — the instantaneous maximum noise level for a specified period of time.

L50 — the noise level that is equaled or exceeded 50 percent of the specified time period. The L50 represents the median sound level.

L90 — the noise level that is equaled or exceeded 90 percent of the specified time period. The L90 is sometimes used to represent the background sound level.

Ldn/or DNL — 24-hour average day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night ("penalizing" nighttime noises). Noise between 10:00:00 pm and 6:59:59 am is weighted (penalized) by adding 10 dB to take into account the greater annoyance of nighttime noises.

CNEL — the Community Noise Equivalent Level is the 24-hour average sound level in decibels. For CNEL, the 24-hour day is divided into three categories: day (7:00:00 am to 6:59:59 pm), evening (7:00:00 P.M. to 9:59:59 pm), and night (10:00:00 pm to 6:59:59 am). CNEL evening operations are multiplied by three and nighttime operations are multiplied by ten, resulting in a 4.77 dB and 10 dB penalty for each event, respectively.

As a general rule, in areas where the noise environment is dominated by traffic, the Leq during the peak-hour is generally equivalent to the Ldn at that location (within +/- 2 dB) (Caltrans, 1998).

Effects of Noise on People

The effects of noise on people can be placed into three categories:

- subjective effects of annoyance, nuisance, dissatisfaction;
- interference with activities such as speech, sleep, learning; and
- physiological effects such as hearing loss or sudden startling.

Environmental noise typically produces effects in the first two categories. Workers in industrial plants can experience noise in the last category. There is no completely satisfactory way to measure

the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted: the so called "ambient noise" level. In general, the more a new, single noise event exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in the steady-state A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1 dB cannot be perceived;
- outside of the laboratory, a 3 dB change is considered a just-perceivable difference;
- a change in level of at least 5 dB is required before any noticeable change in human response would be expected; and
- a 10 dB change is subjectively heard as approximately a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dB for hard sites and 7.5 dB for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dB (per doubling distance) is normally assumed for soft sites. Line sources (such as traffic noise from vehicles) attenuate at a rate between 3 dB for hard sites and 4.5 dB for soft sites for each doubling of distance from the reference measurement (Caltrans, 1998).

Fundamentals of Vibration

As described in the Federal Transit Administration's *Transit Noise and Vibration Impact Assessment* (FTA, 2006), ground-borne vibration can be a concern for nearby neighbors of a transit system route or maintenance facility, causing buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, pile-driving and operating heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the affect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (VdB) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration include structures (especially older masonry structures), people (especially residents, the elderly and sick), and vibration sensitive equipment.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and pile-driving during construction. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV (FTA, 2006).

Aircraft Noise

This section describes existing baseline (2011) aircraft noise sources and noise exposure in the vicinity of the Nut Tree Airport, evaluates how the Proposed Projects (Phase I, 2017 and Phase III, 2031) may affect the existing noise environment, and compares the Phase I and Phase III project conditions to the existing baseline noise environment. Included are discussions of aircraft fleet mix and the methods and assumptions used to prepare a CNEL contour map for current and forecasted phase aircraft activity.

Aircraft CNEL Contours for Baseline Airport Operations

Aircraft operations for the year 2011 were chosen to represent the existing baseline physical conditions at the Nut Tree Airport. The existing baseline (2011) accurately reflected the latest 365 days of aircraft operations being conducted at the Airport at the time the EIR began. The Integrated Noise Model (INM) 7.0c was used to prepare the CNEL contour for the existing baseline conditions (2011). The INM is the industry-standard model used for quantifying aircraft noise exposure of proposed airfield improvement projects for both Federal and State environmental documents. The INM calculates aircraft noise exposure by mathematically combining aircraft performance factors and noise generation characteristics with airport operations factors at a series of grid points near the Airport. The data used in the aircraft noise modeling process included the following information, which is discussed in detail in **Appendix J**:

- Aircraft Fleet Mix
- Time of Day
- Runway Use
- Flight Track and Flight Track Use Percentages

When a user specifies a particular aircraft type from the INM database, the model automatically provides the necessary inputs concerning aircraft power settings, speed, departure profiles, approach profiles, and noise levels. INM Version 7.0b also accounts for the effects of local terrain when calculating the distance between aircraft and the ground they are passing over (slant range distance), but it does not account for buildings or local topographic features that may provide localized acoustical shielding.

Aircraft Operations Data

Federal (FAA Order 1050.1E) and State of California regulations (California Code of Regulations, Title 21, Subchapter 6) require that annual-average day aircraft activity levels be used for calculating aircraft noise exposure expressed in terms of the CNEL. The annual-average day operations are determined by dividing the total number of aircraft operations occurring over the year divided by 365. For the EIR noise analysis, aircraft operations numbers provided in the *Nut Tree Airport Master Plan* (2012) and through discussions with the Airport Manager were used to establish the existing condition at the Nut Tree Airport. **Table 3.10-1** summarize the annual existing operations at the Nut Tree Airport used for noise modeling. The table includes operations and fleet mix data for the existing baseline (2011) condition.

TABLE 3.10-1
2011 EXISTING OPERATIONS AT NUT TREE AIRPORT

Aircraft	2011	Annual-Average Day
Single Engine		
CNA172	16,983	46.53
CNA182	7,613	20.86
CNA206	5,271	14.44
GASEPF	17,569	48.13
GASEPV	32,209	88.24
PA28	9,956	27.28
Multi-Engine Piston		
BEC58P	4,800	13.15
Turboprop		
CNA441	2,420	6.63
Business Jet		
CNA500	1,710	4.68
F10062	1,710	4.68
Helicopter		
BO105	1,250	3.42
Military		
BEC58P	10	0.03
Total	**101,500**	**278.08**

SOURCE: Nut Tree Airport Master Plan (2012), FAA's TAF Data, Nut Tree Airport Manager, ESA Airports (2012)

Temporal Distribution of Aircraft Operations

The temporal distribution of aircraft operations is important for the calculation of the CNEL, because evening operations (7:00:00 pm to 9:59 pm) are multiplied by three and nighttime operations (10:00 pm to 6:59 am) are multiplied by ten. These weightings or penalties are equivalent to adding approximately 4.77 dB to the sound exposure level of each evening flight and 10 dB to the sound exposure level each nighttime flight. These weightings were established in the California airport noise regulations to account for the increased annoyance resulting from aircraft noise intrusions during these timeframes.

The day/evening/night distribution of aircraft operations derived from consultation with the Nut Tree Airport Manager. **Table 3.10-2** presents a summary of the temporal distribution of flights used for noise modeling.

TABLE 3.10-2
TEMPORAL DISTRIBUTION OF BASELINE AIRCRAFT OPERATIONS (2011)

Runway	Day 7:00 am - 6:59 pm	Evening 7:00 pm-9:59 pm	Night 10:00 pm-6:59 am
Arrivals			
02	17.00%	1.34%	0.57%
20	11.50%	0.89%	0.38%
Closed Pattern			
02	20.00%	1.52%	0.65%
20	13%	1.00%	0.44%
Departures			
02	17.00%	1.34%	0.57%
20	11.5%	0.89%	0.38%
Total	**90%**	**7%**	**3%**

SOURCE: Nut Tree Airport Manager, ESA Airports, 2012

Runway Use

The runway at the Nut Tree Airport (Runway 02-20) is 4,700 feet long and 75 feet wide. Through discussions with the Nut Tree Airport Manager, it was confirmed that Runway 20 is utilized 60% of the time while Runway 02 is utilized 40% of the time for all operations including arrivals, departure, and local traffic during all times of the day.

CNEL Contour Preparation

Aircraft operations for the existing baseline (2011) condition at the Nut Tree Airport consist of both itinerant and local operations that include both fixed-wing and helicopter activity. CNEL contours presented in **Figure 3.10-2** were developed using Airport operations numbers derived from the FAA's Terminal Area Forecast (TAF), and the *Nut Tree Airport Master Plan* (2012). Further explanation of INM inputs can be found in **Appendix J**. As noted in Table 3.10-1 above, 101,500 operations occurred at the Nut Tree Airport in 2011.

SOURCE: Bing Maps, 2013; and ESA, 2013

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Figure 3.10-2
2011 Existing CNEL Contours

For the existing baseline 2011 condition, the 60, 65, and 70 dB CNEL contours were modeled to determine the noise exposure to areas in the vicinity of the Nut Tree Airport as shown in **Figure 3.10-2**. The CNEL contours extend off of the Nut Tree Airport along the runway centerline for Runway 02-20, with the 70 dB CNEL contour predominantly remaining on Airport property, except for very small areas off of the approach end of Runway 02, and encompassing 0.16 square miles. The 65 dB CNEL contour also extends along the runway centerline and off airport property to the south by approximately 750 feet, and has an area of 0.32 square miles. The 60 dB CNEL contour encompasses a larger area of land of 0.73 square miles and extends off Airport property to both the north and south. To the north, the 60 dB CNEL contour extends approximately 1,750 feet off of Airport property, and to the south, approximately 3,000 feet of Airport property. The greater size in the noise contours to the south can be attributed to the higher use of Runway 20 as opposed to Runway 02.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others because of the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. Residences, hotels, schools, rest homes, and hospitals are generally more sensitive to noise than commercial and industrial land uses.

The Nut Tree Airport is bounded by I-80 and I-505 to the north and east of the airport. Further to the north of I-505 is a hospital (Kaiser Permanente Hospital) located approximately 3,200 feet northeast of the Nut Tree Airport property boundary. Other properties located north of the Airport, both east and west, include industrial and commercial buildings. To the east of the Airport property boundary is I-80 along with commercial properties. Further east of I-80 and I-505 are residences located approximately 1,750 feet east the Airport property boundary and are overall the closest to the Airport. To the South of the Nut Tree Airport is the Browns Valley Pkwy with a mix of commercial, recreational, institutional, and residential properties. The closest residential property southwest of the Airport is located approximately 2,500 feet southwest from the Airport property boundary off the approach end to Runway 02. There is also an elementary school (Edwin Markham Elementary School) located approximately 2,800 feet southwest of the Airport boundary. Also to the southwest of the Airport are recreational fields that lie between the approach end of Runway 02 and the residential properties to the southwest. To the west of the Airport lies the continuation of the Browns Valley Pkwy as it routes toward the north-northwest as well as a large residential community and a place of worship. The residences to the west are approximately 1,900 feet from the Airport property boundary at their closest point. The New Hope Christian Fellowship Church is located approximately 2,200 feet west of the airport.

There are no noise sensitive receptors within the existing baseline (2011) CNEL contours.

3.10.2 Regulatory Setting

Most environmental noise sources produce varying amounts of noise over time, so the measured sound levels also vary. Governmental agencies have developed a variety of noise descriptors to

quantify, describe, and regulate these sound levels. This discussion defines the descriptors that are typically used to assess noise from aircraft and surface traffic as well as construction-related noise.

Federal

For aviation noise analyses, the FAA has determined that the 24-hour cumulative exposure of individuals to noise resulting from aviation activities must be established in terms of yearly day/night average sound level (DNL) as FAA's primary metric. However, the FAA recognizes CNEL as an alternative metric for assessing aircraft noise exposure in California.

Per FAA standards, a significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of CNEL 1.5 dB or more at above CNEL 65 dB noise exposure when compared to the baseline condition. In addition, a significant noise impact would occur if noise sensitive land uses are newly exposed to levels of 65 dB CNEL or higher as a result of the proposed project.

State

The noise descriptor most commonly used to describe aircraft and surface transportation noise is referred to as a "cumulative" noise descriptor. Such descriptors present the amount of noise occurring at a given location over a defined period of time in numerical terms. Depending upon the descriptor used, this period can be as brief as one hour, but is usually calculated for an annualized 24-hour period. Cumulative noise descriptors can be used to present noise exposure from a specific source, such as a roadway or an airport, to describe total noise exposure from all noise sources affecting a specific location. Per the California Code of Regulations (CCR), Title 21, Subchapter 6, §5001, the cumulative noise descriptor required for aircraft noise analyses in the State of California is the CNEL.

Community Noise Equivalent Level

As described above, CNEL is the 24-hour average sound level in decibels with an additional weighting placed on evening (7:00:00 pm – 9:59:59 pm) and nighttime (10:00:00 pm – 6:59:59 AM) operations to account for the increased sensitivity people have to noise events during these hours. For calculation purposes, this means that each aircraft event occurring during the evening hours is treated as if three noise events occurred, and each aircraft noise event occurring during the nighttime hours is treated as if ten aircraft noise events occurred. These penalties for the evening and nighttime hours are included in the CNEL to account for the assumption that noise events occurring during the evening and nighttime hours are more intrusive or annoying to the average person than events occurring during the daytime hours.

The CNEL is similar to the DNL descriptor used by the FAA for the evaluation of airport improvement projects and in the Part 150 noise compatibility planning process in states other than California. The CNEL and DNL are generally considered equivalent descriptors of the community noise environment within plus or minus 1.5 dB. The only difference between the two descriptors is that the CNEL includes the evening (7:00:00 pm – 9:59:59 pm) weighting penalty, while the DNL does not.

The CNEL is calculated by mathematically combining the number of single events that occur during a 24-hour day with how loud the events were and what time of day they occurred. Because of the interrelationship between the weighted number of daily noise events and the noise levels generated by the events, it is possible to have the same CNEL value for an area exposed to a few loud events as for an area exposed to many quieter events.

Per Title 21, Subchapter 6, of the CCR, the maximum acceptable outdoor level of aircraft noise for persons living in the vicinity of airports is 65 dB CNEL.

California Code of Regulations

California Code of Regulations has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure, as shown in **Figure 3.10-3**. The State of California also establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the State pass-by standard is consistent with the federal limit of 80 dB.

The State pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials. The State has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of 45 dB DNL in any habitable room. They require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than 60 dB DNL. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local

Nut Tree Airport / Land Use Compatibility Plan

As more fully described in Section 3.**9** ~~X~~, Land Use, the Solano County Airport Land Use Commission (ALUC) oversees the development of land uses within the airport influence area of Nut Tree Airport. Development in this area is guided by land use compatibility policies set forth in the *Nut Tree Airport / Land Use Compatibility Plan* (ALUCP). Compatibility policies include standards that determine acceptable noise levels for a variety of land uses in the vicinity of the Airport.

According to the ALUCP the maximum CNEL considered normally acceptable for residential uses within the vicinity of the Airport is 60 dBA. For commercial uses such as office or retail, a range of 50 to 60 dBA CNEL is considered acceptable, 60 to 70 dBA is considered marginally acceptable, and 70 to 75 is considered marginally unacceptable (Solano County, 1988).

SOURCE: State of California, Governor's Office of Planning and Research, 2003. *General Plan Guidelines*.

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Figure 3.10-3

Land Use Compatibility for Community Noise Environment

City of Vacaville General Plan

The *City of Vacaville General Plan* contains the following considerations for guidance in determining Noise and Land Use Compatibility Policies:

- The standard for maximum exterior transportation noise levels in sensitive land use areas, as defined in Table 10-1, is 60 dB DNL. However, exceptions may occur where 65 dB DNL is acceptable in unique situations (e.g., sound walls greater than eight feet in height adjoining arterial streets or where sound walls would obstruct pedestrian paths between a subdivision and an arterial street). In such exceptions, the 60 dB DNL standard should be applied where outdoor use is a major consideration (e.g., backyards in single-family housing developments and recreation areas in multi-family housing projects).
- The standard for maximum exterior non-transportation noise levels in sensitive land use areas, as defined in Table 10-4, is 50 dBA Leq (hourly average) and a maximum peak level of 70 dBA.The indoor noise level, as required by the State of California Noise Insulation Standards, must not exceed a DNL of 45 dB in lodging places and dwelling places other than detached single-family dwellings. The City recognizes this standard as the maximum acceptable indoor noise level in detached single-family homes.
- New residential developments should be precluded where the exterior noise exceeds 60 dB CNEL due to aircraft, consistent with the Airport Land Use Plans for Nut Tree Airport and Travis Air Force Base. This standard recognizes the peak occurrences associated with aircraft.
- Appropriate interior and exterior noise standards in commercial, industrial, and office buildings are the standards established by the California Division of Occupational Safety and Health (Cal-OSHA) and the Federal Department of Labor, Occupational Safety and Health Administration. This apples to the ambient noise in work places, as well as retail and dining areas, and also addresses the length of exposure to harmful noise levels. The standards are designed to indicate harmful noise levels and do not address annoyance, which is much more subjective. In the case of non-residential land uses, it is appropriate to assume that consumers will eat and shop in those environments where they can shop, eat and converse within their self-defined comfort levels.
- If an area is currently below the desired noise standard, an increase in noise up to the maximum should not automatically be allowed. The impact of a Proposed Project on an existing land use should be evaluated in terms a significant increase in existing noise levels, regardless of the compatibility policies or criteria.

Table 3.10-3 shows Table 10-1 from the General Plan, Noise & Land Use Compatibility Policy For Transportation Sources. **Table 3.10-4** shows Table 10-4 from the General Plan, Noise & Land Use Compatibility For Non-Transportation Sources.

TABLE 3.10-3
NOISE AND LAND USE COMPATIBILITY POLICY FOR TRANSPORTATION SOURCES[1]

	Community Noise Exposure - Unmitigated Day/Night Average Noise Level (DNL) in Decibels (dB)										
	Noise Standard (DNL)		Noise Contour								
Land Use Category	**Interior**	**Exterior**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**
Residential	45	60[2]									
Transient Lodging Motels, Hotels	45	--[3]									
Hospitals, Nursing Homes	45	60[4]									
Other Uses[5]	--	--									

Normally acceptable with typical conditions of approval (setbacks, walls, fences and standard building practices).

Conditionally acceptable – subject to noise study to demonstrate noise can be reduced to normally acceptable levels with acceptable mitigation.

Normally unacceptable – regardless of measures implemented to reduce noise.

1. This table establishes the maximum transportation noise levels that persons should be exposed to and helps determine the type of review necessary when land uses are proposed within existing noise contours. For the purposes of the Noise Element, transportation noise sources are defined as traffic on public roadways, railroad line operations and aircraft in flight.
2. In multi-family/attached unit projects, applies to courtyards, patios, private areas and activity areas.
3. Areas designed for outdoor activity should be located away from noise sources.
4. Applies to courtyards, patios, private areas and activity areas.
5. Other uses are subject to federal and state OSHA noise exposure standards.

TABLE 3.10-3 (CONTINUED)
NOISE AND LAND USE COMPATIBILITY POLICY FOR TRANSPORTATION SOURCES

Land Use Category	Airport/Land Use Noise Compatibility Criteria CNEL, dBA					
	50	55	60	65	70	75
Residential						
Schools, Libraries, Hospitals, Nursing Homes						
Churches, Auditoriums, Concert Halls						
Transportation, Parking, Cemeteries						
Offices, Retail Trade						
Service Commercial, Wholesale Trade, Warehousing, Light Industrial						
Extractive Industrial, General Manufacturing, Utilities						
Cropland						
Livestock Breeding						
Playgrounds, Parks, Zoos						
Golf Courses, Riding Stables, Water Recreation						
Outdoor Spectator Sports						
Amphitheaters						

Clearly Acceptable – The activities associated with the specified land use can be carried out with essentially no interference from the noise exposure.

Normally Acceptable – Noise is a factor to be considered in that slight interference with outdoor activities may occur. Conventional construction methods will eliminate most noise intrusions upon indoor activities.

Marginally Acceptable – The indicated noise exposure will cause moderate interference with outdoor activities and with indoor activities when windows are open. The land use is acceptable on the conditions that outdoor activities are minimal and construction features which provide sufficient noise attenuation are used (e.g., installation of air conditioning so that windows can be kept closed). Under other circumstances, the land use should be discouraged.

Normally Unacceptable – Noise will create substantial interference with both outdoor and indoor activities. Noise intrusion upon indoor activities can be mitigated by requiring special noise insulation construction. Land uses which have conventionally constructed structures and/or involve outdoor activities which would be disrupted by noise should generally be avoided.

Clearly Unacceptable – Unacceptable noise intrusion upon land use activities will occur. Adequate structural noise insulation is not practical under most circumstances. The indicated land use should be avoided unless strong overriding factors prevail and it should be prohibited if outdoor activities are involved.

SOURCE: City of Vacaville, 2007. *City of Vacaville General Plan Noise Element*, December 2007.

TABLE 3.10-4
NOISE AND LAND USE COMPATIBILITY POLICY FOR NON-TRANSPORTATION SOURCES[1]

		Exterior Noise Levels[2,3,4,5]		Interior Noise Levels[2,3,4,5]	
Land Use Category	**Noise Level Descriptor**	**Daytime** (7 am – 10 pm)	**Nighttime** (10 pm to 7 am)	**Daytime** (7 am – 10 pm)	**Nighttime** (10 pm to 7 am)
Residential	Hourly L_{eq}, dBA	50[6]	45[6]	45	35
	Maximum Level, dBA	70[6]	65[6]	--	--
Transient Lodging	Hourly L_{eq}, dBA	--[7]	--[7]	45	35
Hospital, Nursing Homes	Hourly L_{eq}, dBA	50[8]	45[8]	45	35
Other[9]	Hourly L_{eq}, dBA	--	--	--	--
	Maximum Level, dBA	--	--	--	--

Each of the noise levels specified above shall be lowered by five dB for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These noise level standards do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).

1. This table establishes the maximum non-transportation noise levels that persons should be exposed to. For the purposes of the Noise Element, non-transportation noise sources may include industrial operations, outdoor recreation facilities, HVAC unites, loading docks, construction equipment, etc.
2. Compliance with the noise level standards is to be measured at the affected locations of the land use category.
3. If the existing noise levels exceed that of a proposed noise generator, these standards would not be applied to the new noise source unless the additional noise generated would increase the projected, combined noise levels a minimum of three decibels.
4. These standards are applicable to land use determinations and entitlements. They are not applicable for nuisance abatement within residential areas.
5. Exceptions to the standards may be approved for public parks or playground upon a finding that the facility has been designed in a manner that practically limits the noise impact upon other land uses.
6. In multi-family/attached unit projects, applies to courtyards, patios, private areas and activity areas.
7. Areas designed for outdoor activity should be located away from noise sources.
8. Applies to courtyards, patios, private areas and activity areas.
9. Other uses are subject to federal and state OSHA noise exposure standards.

SOURCE: City of Vacaville, 2007. *City of Vacaville General Plan Noise Element*, December 2007.

The following is a list of policies identified in the Vacaville General Plan as they pertain directly to the development of this project.

Guiding Policies

1. Ensure that land uses in the vicinity of Nut Tree Airport or potentially affected by Travis Air Force Base are compatible with airport operations and are consistent with the Airport Land Use Plan for both airports. (Policy 6.6-G 2)
2. Require new residential projects and outdoor activity areas in lodging, hospital and nursing/convalescent home projects to meet acceptable exterior noise level standards as given in Tables 10-1 and 10-4; discourage residential areas directly abutting Interstate 80 or 505. (Policy 10.6-G 1)
3. Minimize vehicular noise sources and noise emanating from transportation activities; control noise at its source to maintain existing noise levels, and in no case exceed acceptable noise levels as established in the Noise and Land Use Compatibility Guidelines, Table 10-1. (Policy 10.6-G 4)
4. Noise created by transportation noise sources shall be mitigated so as not to exceed the interior and exterior noise level standards of Table 10-1. (Policy 10.6-G 9)
5. Noise created by non-transportation noise sources shall be mitigated so as not to exceed the interior and exterior noise level standards of Table 10-4. (Policy 10.6-G 10)

6. New residential land uses shall be precluded where the exterior noise associated with aircraft operations a Nut Tree Airport or Travis Air Force Base exceeds 60 dB CNEL. (Policy 10.6-G 12)

Implementing Policies

1. Land use changes and development proposals within the Vacaville planning area shall be consistent with the Nut Tree Airport Land Use Plan and are subject to review per the Solano County Airport Land Use Compatibility Review Procedures. (Policy 2.1-I 12)
2. Continue to implement the "Airport/Land Use Compatibility Plan for the Nut Tree Airport" (Nut Tree ALUP) through land use development code regulations adopted by the City. (Policy 6.6-I 1)
3. Update aircraft noise projections as future operations at the Nut Tree Airport and Travis Air Force Base are projected to change. (Policy 10.6-I 24)
4. Limit construction, delivery and through truck traffic to designated routes; maintain smooth street surfaces adjacent to land uses which are sensitive to noise intrusion. (Policy 10.6-I 18)

City of Vacaville Municipal Code

The City of Vacaville Municipal Code 14.09.127.090 regulates noise as a result of construction activity:

A. No construction or grading equipment shall be operated nor any outdoor construction repair work shall be permitted within 500 feet from any occupied residence between dusk (one-half hour after sunset) and seven am 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 am and dusk.

B. A request for an exception to the permitted construction hours and days may be granted by the Director of 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.

Notably, the City of Vacaville Municipal Code, Section 14.09.127.120 (4.e.), states that construction activity related to public improvement projects where the Director has determined that full compliance with the noise standards cannot practically be achieved is exempt.

The City of Vacaville Municipal Code 14.09.127.160 regulates vibration as a result of construction activity:

A. No vibration shall be allowed to occur or be apparent to a reasonable person of normal sensitivity off-site or to an adjacent use on the same site, except that the ground vibration caused by moving vehicles or temporary construction activities is exempted from this provision.

3.10.3 Analysis, Impacts, and Mitigation

Methodology and Assumptions

Forecasted Aircraft Operations

As detailed in the Nut Tree Airport Master Plan, aircraft operations at the Nut Tree Airport are expected to increase. The forecasted aircraft operations for the Phase I (2017) and Phase III (2031) are shown in **Tables 3.10-5** and **3.10-6** respectively.

TABLE 3.10-5
PHASE I (2017) AIRCRAFT OPERATIONS AT NUT TREE AIRPORT

Aircraft	2017	Annual-Average Day
Single Engine		
CNA172	17,625	48.29
CNA182	7,901	21.65
CNA206	5,470	14.99
GASEPF	18,232	49.95
GASEPV	33,426	91.58
PA28	10,332	28.31
Multi-Engine Piston		
BEC58P	5,122	14.03
Turboprop		
CNA441	3,660	10.03
Business Jet		
CNA500	2,442	6.69
F10062	2,442	6.69
Helicopter		
BO105	1,624	4.45
Military		
BEC58P	11	0.03
Total	108,286	296.67

SOURCE: Nut Tree Airport Master Plan (2012), Nut Tree Airport Manager, ESA Airports, 2012

TABLE 3.10-6
PHASE III (2031) AIRCRAFT OPERATIONS AT NUT TREE AIRPORT

Aircraft	2031	Annual-Average Day
Single Engine		
CNA172	19,095	52.32
CNA182	8,560	23.45
CNA206	5,926	16.24
GASEPF	19,754	54.12
GASEPV	36,215	99.22
PA28	11,194	30.67
Multi-Engine Piston		
BEC58P	6,023	16.50
Turboprop		
CNA441	8,124	22.26
Business Jet		
CNA500	4,781	13.10
F10062	4,781	13.10
Helicopter		
BO105	2,865	7.85
Military		
BEC58P	13	0.04
Total	127,330	348.85

SOURCE: Nut Tree Airport Master Plan (2012), Nut Tree Airport Manager, ESA Airports, 2012

Aircraft Operations Impact Analysis

As discussed earlier, all INM input data used to determine future year Proposed Projects CNEL contours will remain the same as the existing baseline (2011) except the projected aircraft operations for Phase I (2017) and Phase III (2031), and the annual itinerant versus local percentages as discussed in **Appendix J**. Other changes include the shifting of the runway 200 feet to the north for the Phase I (2017) contours, and the 600 foot runway extension (5,300 feet by 75 feet) included in the Phase III (2031) contours.

Construction Impact Analysis

Construction Noise

Noise impacts from short-term construction activities could exceed noise thresholds and could result in a significant construction impact if short-term construction activity occurred outside of the permitted daytime hours and/or within 500 feet of an occupied residence as established by the City's municipal code.

Noise generated from construction equipment/operations varies greatly depending on factors such as operation being performed and equipment type, model, age, and condition. Noise associated with heavy equipment diesel engine operations often dominates the noise environment in the vicinity of construction sites. Stationary sources such as generators, pumps, and compressors may

also produce a significant contribution to noise exposure. Maximum noise exposure from typical construction equipment operations is approximately 75-90 dBA (L_{max} at 50 feet), with noise from heavy demolition operations having the highest noise production. Noise from typical construction would not be expected to exceed 90 dBA at 50 feet. Please refer to **Table 3.10-7** for typical construction noise levels.

TABLE 3.10-7
TYPICAL NOISE LEVELS FROM DEMOLITION/
CONSTRUCTION EQUIPMENT OPERATIONS

Construction Equipment	Noise Exposure Level, dBA L_{max} @ 50 Feet
Air Compressor	81
Backhoe	80
Ballast Equalizer	82
Ballast Tamper	83
Compactor	82
Concrete Mixer (Truck)	85
Concrete Pump (Truck)	82
Concrete Vibrator	76
Crane-Derrick	88
Crane-Mobile	83
Dozer	85
Generator	81
Grader	85
Impact Wrench	85
Jack Hammer	88
Loader	85
Paver	89
Pneumatic Tool	85
Pump	76
Rail Saw	90
Roller	74
Saw	76
Scarifier	83
Scraper	89
Shovel	82
Spike Driver	77
Tie Cutter	84
Tie Handler	80
Tie Inserter	85
Heavy Diesel Truck	88

SOURCES: FTA, 2006.

Worst-case project construction noise exposure was calculated based on a reference noise exposure level of 90 dBA (L_{max}) at 50 feet, and the application of standard spherical divergence (-6 dB per doubling of distance). Additional construction noise attenuation from air and ground absorption was not considered in order to provide the most conservative estimate of noise exposure. Noise attenuation from intervening structures was considered where applicable.

Construction noise impacts are assessed based on a comparative analysis of the noise levels resulting from the project relative to ambient noise levels. Analysis of temporary construction noise effects is based on assumed worst-case equipment operations noise levels, the attenuation of those noise levels due to distance, and the attenuation of those noise levels from intervening barriers/structures where applicable.

Construction Vibration

Vibration from construction is evaluated for potential impacts at sensitive receptors. Typical activities evaluated for potential building damage due to construction vibration include demolition, excavation, and drilling in close proximity to occupied structures. The groundborne vibration is also evaluated for perception to eliminate annoyance, as specified by the City's Municipal Code.

The various peak particle velocity (PPV) and root mean squared (RMS) velocity levels (L_v)for the types of construction equipment that would operate during the construction of the Proposed Project are identified in **Table 3.10-8**. Pile driving operations are not expected to be required for the Proposed Project. Based on the information presented in **Table 3.10-8**, vibration could reach as high as approximately 0.089 in/sec PPV at 25 feet from the source activity, depending on the type of construction equipment in use. This corresponds to an RMS velocity level of 87 VdB.

TABLE 3.10-8
VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

	Approximate PPV (in/sec)					Approximate L_v (VdB)				
Equipment	**25 Feet**	**50 Feet**	**60 Feet**	**75 Feet**	**100 Feet**	**25 Feet**	**50 Feet**	**60 Feet**	**75 Feet**	**100 Feet**
Large Bulldozer	0.089	0.031	0.024	0.017	0.011	87	78	76	73	69
Caisson Drilling	0.089	0.031	0.024	0.017	0.011	87	78	76	73	69
Loaded Trucks	0.076	0.027	0.020	0.015	0.010	86	77	75	72	68
Jackhammer	0.035	0.012	0.009	0.007	0.004	79	70	68	65	61
Small Bulldozer	0.003	0.001	0.0008	0.0006	0.0004	58	49	47	44	40

SOURCE: FTA, 2006; ESA, 2012.

Vibration propagates according to the following expression, based on typical ground propagation conditions:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

Where PPV (equip) is the peak particle velocity in inches per second (in/sec) of the equipment adjusted for distance, PPV (ref) is the reference peak particle velocity (in/sec) associated with the equipment at 25 feet (see Table 3.10-8), and D is the distance from the equipment to the receiver. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration and is often used in monitoring vibration because it is related to the stresses experienced by structures.

To determine the potential for annoyance, the RMS vibration level (L_v) at any distance (D) is estimated based on the following equation:

$$L_v(D) = L_v(25\text{ ft}) - 30\log(D/25)$$

Construction vibration impacts are assessed based on a comparative analysis of the vibration levels resulting from the project relative to assumed existing vibration conditions. Analysis of temporary construction vibration effects is based on assumed worst-case operations vibration production and attenuation due to distance.

Significance Criteria

Consistent with the CEQA *Guidelines* Appendix G, the Proposed Project would result in a significant impact on the environment if it would result in:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- A substantial permanent or temporary increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan, would the project expose people residing or working in the project area to excessive noise levels; or
- For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels

The Proposed Project would result in significant noise impacts if it would generate noise or vibration levels in excess of the following thresholds:

Construction Noise. The Proposed Project would result in a significant construction impact if construction activity were to occur outside of the daytime hours permitted by the City noise ordinance.

Vibration. The Proposed Project would result in a significant vibration impact if buildings were to be exposed to the FTA building damage ground-borne vibration threshold level of 0.2 PPV or if sensitive individuals were to be exposed to the FTA human annoyance response ground-borne vibration threshold level of 80 RMS.

Aircraft Noise. Because aircraft noise is regulated by federal and state standards, local agencies typically do not implement restrictions on noise generated by aircraft in flight. Therefore, federal and state standards are utilized when assessing potential noise impacts associated with aircraft operations. The cumulative noise metric used to describe the Airport's noise environment is CNEL. This metric was first developed by the California Department of Transportation-Division of Aeronautics and is now incorporated in state law (California Administrative Code Title 25, Art. 4, Sec. 1092). It is accepted by the FAA for noise impact analyses related to airports in California (FAA Order 1050.1E, Section 14.1). Both the State of California and FAA define the 65 dB CNEL contour as the threshold of noise compatibility with noise sensitive uses (e.g., residences, schools, and churches). Therefore, a significant noise impact would occur if noise sensitive land uses are newly exposed to levels of 65 dB CNEL or higher as a result of the proposed project. In addition, per FAA standards, a significant noise impact would occur if analysis shows that the proposed action will cause noise sensitive areas to experience an increase in noise of CNEL 1.5 dB or more at above CNEL 65 dB noise exposure when compared to the baseline condition. **Additionally, the EIR also considers significance criteria as defined in Table 3.10-3 for identifying potential noise impacts associated with the Proposed Project.**

Traffic Noise. The significance of project-related noise impacts can be determined by comparing estimated project-related noise levels to existing noise levels. An increase of at least 3 dB is usually required before most people will perceive a change in noise levels, and an increase of 5 dB is required before the change will be clearly noticeable. A common practice is to assume that minimally perceptible to clearly noticeable increases of 3–5 dB represent a significant increase in ambient noise levels. A sliding scale is commonly used to identify the significance of noise increases, allowing greater increases at lower absolute sound levels than at higher sound levels. This approach is based on research that relates changes in noise to the percentage of individuals that would be highly annoyed by the change. The significance criteria for changes in noise from project operations are as follows:

1. A 3-dB DNL increase in noise as a result of project operations if the existing noise level already exceeds the "normally acceptable range" for the land use (60 dB DNL or less for residential uses).
2. A 5-dB DNL increase in noise as a result of project operations if the existing noise level is in the "normally acceptable range" and the resulting level is within the "normally acceptable range" for the land use.

Impacts and Mitigation Measures

Impact 3.10-1: Would the Proposed Project phases expose persons to noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies? (*Potentially Significant*)

Phase I Projects

Construction

Based on **Figure 2-4** (Project Description) and other aerial photos of the project area, Phase I project construction is expected to be about 1,000 feet removed from the closest existing commercial use to the south, 1,300 feet removed from the closest existing park/recreation use to

the west, and 2,800 feet removed from the closest existing residential use to the west. Assuming standard spherical spreading loss (-6 dB per doubling of distance) and a reference construction noise level of 90 dBA L_{max} at 50 feet, worst-case construction noise levels at the closest existing commercial, park/recreation, and residential uses is not expected to exceed 64 dBA L_{max}, 62 dBA L_{max}, and 55 dBA L_{max}, respectively. Assuming that substantial construction operations would occur for no more than 40% the typical construction day, then construction noise exposure would not be expected to exceed 60 dBA L_{eq}, 58 dBA L_{eq}, and 51 dBA L_{eq} at the closest existing commercial, park/recreation, and residential uses, respectively.

Calculated, worst case Phase I construction noise exposure would not be expected to exceed the City's 70 dBA L_{max} maximum daytime noise exposure limit, but may exceed the established 50 dBA L_{eq} hourly daytime limit at the closest noise-sensitive uses (i.e., residential). Phase I construction noise exposure would not be expected to significantly increase ambient noise levels in the vicinity of existing noise-sensitive uses.

The City of Vacaville Municipal Code, Section 14.09.127.120 (4.e.), states that construction activity related to public improvement projects where the Director has determined that full compliance with the noise standards cannot practically be achieved is exempt. In this case, it is expected that construction noise exposure may be satisfactorily mitigated at the closest residential receivers to the west with implementation of Mitigation Measure 3.10-1.

Operation

As discussed in Section 3.10.1, Environmental Setting, noise associated with current operations covers a large area; however, there are currently no noise sensitive receptors within the 65 dB CNEL contour for the existing baseline (2011) condition. Implementation of the Proposed Project phases is forecasted to add 6,786 (approximately 19 operations per day) annual aircraft operations during Phase I (2017).

Noise contours depicted in **Figure 3.10-4** represent the potential noise impact associated only with the forecasted Phase I (2017) aircraft operations as compared to the existing baseline (2011) noise contours. The contours reflect the 200 foot shift in Runway 02-20 to the north with small increases in the contour to the north and south along the runway centerline. Increases in contour size are shown in **Table 3.10-9**.

Per FAA standards, a significant noise impact would occur if analysis showed that the proposed action will cause noise sensitive areas to experience an increase in noise of CNEL 1.5 dB or more above CNEL 65 dB noise exposure when compared to the baseline condition. However, because no homes are currently located within the existing 65 dB CNEL contour, or would be located in the 65 dB CNEL contour following the forecasted growth of aircraft operations over the next five years, no impact related to federal noise standards would occur. Furthermore, because the forecasted growth in operations at the Airport over the next five years would not result in the exposure of new sensitive receptors to the 65 dB or 60 dB CNEL contour, neither state nor ~~local~~ **City of Vacaville** standards **(as detailed in Table 3.10-3)** associated with aircraft operations would be exceeded. **Furthermore, other existing land uses in the vicinity of the Airport would not be exposed to aircraft-related noise in excess of established City standards.** As such, potential impacts related to an increase in the CNEL contours associated with forecasted aircraft operation growth over the next five years are considered to be less than significant.

SOURCE: Bing Maps, 2013; and ESA, 2013

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Figure 3.10-4
2011 Existing CNEL Contours versus
2017 Phase I CNEL Contours

TABLE 3.10-9
COMPARISON OF CNEL CONTOUR AREAS IN THE EXISTING CONDITION AND PROPOSED PROJECT PHASE I (2017)

	Area (Square Miles)		
CNEL	Existing (2011) Contours	Proposed Project Phase I (2017) Contours	Difference
60	0.73	0.78	0.05
65	0.32	0.33	0.01
70	0.16	0.17	0.01

SOURCE: ESA Airports, 2012.

Phase I Projects operations would result in an increase of 923 new daily vehicle trips on the roadway network. Using the FHWA Highway Traffic Noise Prediction Model, traffic noise levels were analyzed for the six roadway segments with adjacent sensitive receptors in the Proposed Project vicinity. The segments analyzed and results of the modeling are shown in **Table 3.10-10**. Estimated noise levels shown in **Table 3.10-10** correspond to a distance of approximately 50 feet from the centerline of applicable roadway segments. The incremental increase of traffic noise on the modeled roadways from Phase I Projects would be less than one dB, which would be a negligible effect on noise levels along the respective roadways. This would be considered a less-than-significant impact on noise without mitigation.

Project Build-out

Construction

Based on **Figure 2-4** (Project Description) and other aerial photos of the project area, build-out construction is expected to be about 600 feet removed from the closest park/recreation use to the west, 800 feet removed from the closest commercial use to the east, and 2,000 feet removed from the closest existing residential use to the west. Assuming standard spherical spreading loss (-6 dBA per doubling of distance) and a reference construction noise level of 90 dBA L_{max} at 50 feet, worst-case construction noise levels at the closest existing park/recreation, commercial, and residential uses would be approximately 68 dBA L_{max}, 66 dBA L_{max}, and 58 dBA L_{max}, respectively. Assuming that substantial construction operations would occur for no more than 40% the typical construction day, then construction noise exposure would be expected to be approximately 64 dBA L_{eq}, 62 dBA L_{eq}, and 54 dBA L_{eq} at the closest existing park/recreation, ommercial, and residential uses, respectively.

Calculated, worst case Phase I construction noise exposure would not be expected to exceed the City's 70 dBA L_{max} maximum daytime noise exposure limit, but may exceed the established 50 dBA L_{eq} hourly daytime limit at the closest noise-sensitive uses (i.e., residential). Project build-out construction noise exposure would not be expected to significantly increase ambient noise levels in the vicinity of existing noise-sensitive uses.

TABLE 3.10-10
EXISTING AND PROJECTED PM PEAK-HOUR TRAFFIC NOISE LEVELS ALONG ROADWAYS IN THE PROJECT VICINITY

	Peak-Hour Noise Level, dBA, Leq[1]										
Roadway Segment	Existing (A)	Existing + Appr Projects (B)	Existing +Appr Projects + Project (C)	Incremental Increase (C-A)	Significant? (Yes or No)[2]	Cumulative Near Term No Project (D)	Cumulative Near Term + Project (E)	Incremental Increase (E-A)	Cumulatively Significant? (Yes or No)[2]	Incremental Increase (E-D)	Project Cumulatively Considerable? (Yes or No)[2]
1. Orange Dr north of Nut Tree Rd	68.5	69.2	69.3	0.8	No	72.1	72.1	3.6	Yes	0.1	No
2. Orange Dr south of Nut Tree Rd	67.5	67.5	67.5	0.0	No	68.0	68.1	0.6	No	0.0	No
3. Nut Tree Rd east of Orange Dr	68.0	68.3	68.3	0.3	No	70.8	70.8	2.8	No	0.0	No
4. Vaca Valley Pkwy south of Crocker Dr	60.0	60.2	60.5	0.5	No	61.5	61.7	1.7	No	0.2	No
5. E Monte Vista north of Browns Valley Pkwy	67.2	67.8	67.8	0.6	No	70.1	70.1	3.0	Yes	0.0	No
6. E Monte Vista south of Browns Valley Pkwy	67.8	68.4	68.4	0.6	No	70.1	70.1	2.4	No	0.0	No

BOLD values show potentially significant noise increases prior to any mitigation.

1. Noise levels were determined using FHWA Traffic Noise Prediction Model (FHWA RD-77-108).
2. Traffic noise is considered significant if the incremental increase in noise is greater than 5 dB Leq in a noise environment of 60 dBA CNEL or less and the resultant noise level is also 60 dBA CNEL or less, or an increase of 3 dB L_{eq} in a noise environment already greater than 60 dBA CNEL.

The City of Vacaville Municipal Code, Section 14.09.127.120 (4.e.), states that construction activity related to public improvement projects where the Director has determined that full compliance with the noise standards cannot practically be achieved is exempt. In this case, it is expected that construction noise exposure may be satisfactorily mitigated at the closest residential receivers to the west with implementation of Mitigation Measure 3.10-1.

Operation

Noise contours depicted in **Figure 3.10-5** represent the potential noise impact associated only with the forecasted Phase III (2031) aircraft operations as compared to the existing baseline (2011) noise contours. The contours reflect the 200 foot shift in Runway 02-20 to the north as well as a 600 foot runway extension to the north. Larger increases in the contour can be seen due to the increased number of total annual aircraft operations of 25,830 (approximately 71 operations per day) for the cumulative Phase III (2031) development. The noise contours increased predominantly on the north side of the Airport; however, the increases are small and mostly remain on Airport property.

Because noise sensitive land are not currently located in the 65 dB CNEL contour, and forecasted (2031) growth in aircraft operations would not result in the exposure of new homes to the 65 dB CNEL contour, impacts under federal noise standards would not occur (see **Table 3.10-3**). Furthermore, while the number aircraft operations at Nut Tree Airport are forecasted to increase over the course of the Master Plan's 20-year planning horizon, this increase would not result in the exposure of new sensitive receptors to the 65 or 60 dB CNEL contour. Therefore operation of the Proposed Project would not exceed state or ~~local~~ **City of Vacaville** standards associated with aircraft operations. **Furthermore, other existing land uses in the vicinity of the Airport would not be exposed to aircraft-related noise in excess of established City standards.** The increases in the 65 dB CNEL contour size are shown in **Table 3.10-11**.

TABLE 3.10-11
COMPARISON OF CNEL CONTOUR AREAS IN THE EXISTING CONDITION AND PROPOSED PROJECT PHASE III (2031)

	Area (Square Miles)		
CNEL	Existing (2011) Contours	Proposed Project Phase I (2031) Contours	Difference
60	0.73	0.91	0.18
65	0.31	0.39	0.07
70	0.16	0.19	0.03

SOURCE: ESA Airports, 2012.

SOURCE: Bing Maps, 2013; and ESA, 2013

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Figure 3.10-5
2011 Existing CNEL Contours versus
2031 Phase III CNEL Contours

Project build-out operations would result in an increase of 1,093 new daily vehicle trips on the roadway network. To assess the cumulative impact of project traffic on roadside noise levels, noise level projections were made using the FHWA Noise Prediction Model. Estimated noise levels shown in **Table 3.10-10** above correspond to a distance of approximately 50 feet from the centerline of applicable roadway segments. As depicted in **Table 3.10-10**, although the project in conjunction with cumulative development would result in substantial and significant increases in noise compared to existing conditions on roadway segment 1 and 5, the project itself would not be cumulatively considerable. The project would not increase noise levels by 3 dBA or more on any of the roadway segments. Thus, it is considered to have a less-than-significant cumulative impact on noise without mitigation.

Mitigation Measures

Measure 3.10-1: Implement construction noise BMPs. Construction noise exposure may be mitigated to comply with the established City of Vacaville Municipal Code requirements with implementation of the following.

- Confirm that all heavy construction equipment include factory approved/supplied mufflers and other standard noise-reducing engine devices.
- Minimize heavy equipment engine idling whenever possible.
- Stage all heavy construction away from noise sensitive uses.
- Limit construction operations to between the hours of 7 am and 5 pm, Monday thru Saturday. Construction shall not be conducted on Sundays or federal holidays.

Impact Significance after Mitigation: Implementation of this mitigation will ensure that noise generate by construction activity in locations closest to sensitive receptors will remain at or below standards established by the City of Vacaville. In doing so, the Proposed Project will remain consistent with applicable local noise policies, and potential construction noise impacts on nearby sensitive receptors would be less than significant.

Impact 3.10-2: Would the Proposed Project expose persons and structures to excessive groundborne vibration or groundborne noise levels? (*Less Than Significant*)

Phase I Projects

Construction Impacts

As shown in **Table 3.10-8,** use of heavy equipment for project construction generates vibration levels up to 0.089 PPV or 87 RMS at a distance of 25 feet and attenuates quickly with distance. Ground-borne vibration and noise levels would be less-than-significant in comparison to FTA thresholds at 50 feet from the construction equipment. Since Phase I project construction is expected to be about 1,000 feet removed from the closest existing commercial use to the south, 1,300 feet removed from the closest existing park/recreation use to the west, and 2,800 feet removed from the closest existing residential use to the west, equipment operation during Proposed Project construction would generate ground-borne vibration and noise levels that would

not exceed the FTA criteria of 0.2 PPV for structural damage and 80 RMS for human annoyance. This would be a less-than-significant impact without mitigation.

Operational Impacts

Given the distance between the Airport and the nearest sensitive receptors, operations of general aviation aircraft such as departing, landing or taxiing to and from Runway 02-20 would not expose persons and structures to any level of groundborne vibration. Similarly, impacts from groundborne noise levels caused by taxiing aircraft, or aircraft engine testing and repair are considered to be minor due to the distance between the Proposed Project site and the nearest sensitive receptors. The closest residential uses, which are west of the Proposed Project site, are located outside the current existing baseline (2011), and Proposed Project Phase I (2017). Given that aircraft in flight generate higher noise levels, than when taxiing, impacts associated with groundborne noise levels from moving aircraft on the closest sensitive receptors are considered to be less than significant.

Project Build-out

Construction Impacts

As stated in the Phase I impacts discussion above, ground-borne vibration and noise levels would be less-than-significant in comparison to FTA thresholds at 50 feet from the construction equipment. Since build-out construction is expected to be about 600 feet removed from the closest park/recreation use to the west, 800 feet removed from the closest commercial use to the east, and 2,000 feet removed from the closest existing residential use to the west, equipment operation during Proposed Project construction would generate ground-borne vibration and noise levels that would not exceed the FTA criteria of 0.2 PPV for structural damage and 80 RMS for human annoyance. This would be a less-than-significant impact without mitigation.

Operational Impacts

As stated in the Phase I (2017) impacts discussion above, Phase III (2031) operations of general aviation aircraft such as departing, landing, or taxiing to and from Runway 02-20 would not expose persons and structures to an excessive level of groundborne vibration. Similarly, impacts from groundborne noise levels caused by taxiing aircraft, or aircraft engine testing and repair are considered to be minor due to the distance between the Proposed Project site and the nearest sensitive receptors. The closest residential uses, which are west of the Proposed Project site, are located outside Proposed Project Phase III (2031) 65 CNEL contour. Given that aircraft in flight generate higher noise levels, than when taxiing, impacts associated with groundborne noise levels from moving aircraft on the closest sensitive receptors are considered to be less than significant.

Mitigation Measures: None required.

Impact 3.10-3: Would activities associated with the Proposed Project permanently or temporarily increase ambient noise levels at nearby land uses? (*Potentially Significant*)

Phase I Projects

Construction Impacts

As described under Impact 3.10-1, construction of the Phase I Projects would result in a temporary, but potentially significant noise impact by exceeding the City's standard of 50 dBA L_{eq} hourly daytime limit for noise-sensitive uses (i.e., residential). As described under Impact 3.10-1, construction of Phase I projects could result in an exceedance of this standard by 1 dBA L_{eq}; however, that exceedance could be reduced to less-than-significant levels with implementation of Mitigation Measure 3.10-1.

Operational Impacts

As described under Impact 3.10-1, the Airport's updated Master Plan that aircraft operations would increase over the baseline condition in the next five years (i.e., Phase I). The effect of these new operations is displayed in **Figure 3.10-4**, which shows that forecasted aircraft operations and the 200 foot shift in the runway will have a perceptible effect on the existing baseline (2011) noise contours at the Nut Tree Airport. However, the larger 65 and 60 dB CNEL noise contours, as a result of increased aircraft operations, remain over compatible land uses, and as such, permanent impacts to the ambient noise levels of nearby land uses are considered less than significant.

In regards to on-road vehicular traffic, the incremental increase in noise on the roadway network would be negligible. The impact on sensitive land uses in the vicinity would be less-than-significant without mitigation.

Project Build-out

Construction Impacts

As described under Impact 3.10-1, construction of the Project build-out would result in a temporary potentially significant noise impact that would be reduced to less-than-significant levels with implementation of Mitigation Measure 3.10-1.

Operational Impacts

Aircraft operations over the full 20-year planning horizon identified in the Airport's Master Plan updated are forecasted to grow to 127,300; a 25,830 increase over the existing baseline (2011) condition. The effect of these new contours is displayed in **Figure 3.10-5**, which shows the forecasted aircraft operations along with a 200 foot shift of the runway and 600 foot runway extension will have a perceptible effect on the existing baseline (2011) noise contours at the Nut Tree Airport. However, the larger 65 and 60 dB CNEL noise contours, as a result of increased aircraft operations, remain over compatible land uses, and as such, permanent impacts to the ambient noise levels of nearby land uses are considered less than significant.

As depicted in **Table 3.10-10**, in regards to on-road vehicular traffic from the Project build-out, although cumulative noise would be a substantial increase in comparison to existing noise levels along the modeled roadways, the Proposed Project itself would not result in cumulatively considerable noise. The incremental increase in noise on the roadway network associated with

Project build-out traffic would be negligible and the impact on sensitive land uses in the vicinity would be less-than-significant without mitigation.

Mitigation Measure

> **Measure 3.10-2:** ~~See~~ **Implement Measure 3.10-1: Implement Construction Noise BMPs.**
>
> **Impact Significance after Mitigation:** Implementation of this mitigation measure will ensure that ambient noise levels at nearby noise sensitive land uses do not experience construction-related noise at levels beyond what has been determined to be acceptable by the City of Vacaville. With implementation of this measure, potential noise impacts to nearby residents related to construction of all phases of the Proposed Project are considered less than significant.

Impact 3.10-4: For a project located within an airport land use plan, would the Proposed Project expose people residing or working in the project area to excessive noise levels? (*Less Than Significant*)

Phase I Projects and Project Build-out

As described in Impact 3.10-1, forecasted increases in aircraft operations over the full 20-year planning horizon of Nut Tree Airport's Master Plan update would not result in an aircraft noise-related impact to residential uses, as no homes would be located within the 60 dB CNEL contour. Therefore, potential noise impacts to people living in the vicinity of the Airport are considered less-than-significant and no conflict with ALUCP noise compatibility policies would occur. Furthermore, higher noise levels associated with the 70 dB CNEL contour would not affect businesses surrounding the project site, as the 70 dB contour remains almost entirely on Airport property (see **Figure 3.10-5**). Therefore, potential impacts associated with exposure of existing commercial land uses to noise levels in excess of what has been determined by the ALUCP to be compatible are considered less than significant.

Land uses identified in the Proposed Project primarily consist of aircraft hangars and other airport-supportive uses that are generally considered compatible with the higher noise levels associated with airport environs. A small portion of the proposed apron expansion would be located within the 2031 70 dB CNEL contour. A small portion of the proposed hangars would be located in the 65-70 dB CNEL contour, and the remainder of the proposed land uses, including the proposed non-aviation office and general commercial/industrial uses, would be located in the 60-65 dB CNEL contour range. Therefore, the Proposed Project would not conflict with applicable noise compatibility policies set forth in the ALUCP, and overall impacts associated with the exposure of people living or working in the vicinity of the Airport are considered less than significant.

Mitigation Measures: None required.

Impact 3.10-5: For a project located within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels (*No Impact*)?

Phase I Projects

The Proposed Project Phase I (2017) is not located within the vicinity of a private airstrip. Therefore, people working at the Proposed Project would not be exposed to excessive noise levels from a private airstrip. There is no impact.

Project Build-out

The Proposed Project Phase III (2031) is not located within the vicinity of a private airstrip. Therefore, people working at the Proposed Project would not be exposed to excessive noise levels from a private airstrip. There is no impact.

Mitigation Measures: None required.

Cumulative Impacts

Impact 3.10-6: Would noise associated with the Proposed Project, in combination with other local development, result in cumulatively considerable noise increases? (*Potentially Significant*)

There are development projects currently in the construction or planning process located in the vicinity of the Proposed Project as shown in **Figure 2-5** and listed in **Table 2-7**. When considered alone, the Proposed Project would generate noise by adding more traffic to the area, construction activities, and airport operations. In combination with other projects, there is the potential for cumulative increases in noise levels.

With respect to noise associated with cumulative increases to vehicle traffic, **Table 3.10-10** shows the future cumulative traffic noise with and without the Proposed Project. As depicted in **Table 3.10-10**, although cumulative noise associated with on-road traffic would experience a substantial increase, in comparison to existing noise levels along the modeled roadways, the Proposed Project itself would not result in a cumulatively considerable traffic noise impact.Therefore, the Proposed Project would have a less than significant cumulative traffic noise impact.

Other projects in the vicinity also have the possibility of conducting construction activities at the same time as the Proposed Project. As described under Impact 3.10-1, construction of the Phase I Projects would result in a temporary, potentially significant noise impact that would be reduced to less-than-significant levels with implementation of Mitigation Measure 3.10-1. All of the projects that could be constructed concurrently with the Proposed Project would produce short-term, intermittent noise levels and would likely incorporate similar mitigation as the Proposed Project. Construction noise from other projects is not expected to generate significantly increased noise levels at sensitive receptors in combination with the Proposed Project, given the distance between the Proposed Project site, other projects, and the nearest sensitive receptors located west of the

Airport (see **Figure 2-5**). Therefore, construction noise levels related to cumulative projects identified in **Table 2-7** would not result in cumulatively considerable impacts, and implementation of Mitigation Measure 3.10-1 will ensure that the Proposed Project would not result in a cumulatively considerable construction noise impact.

The future noise and vibration impacts associated with airport operations of the Proposed Project were discussed in above in Impacts 3.10-1, 3.10-2, 3.10-3, and 3.10-4 and were determined to be less-than-significant without mitigation given that noise sensitive receptors would not be affected by the forecasted contours depicted in **Figure 3.10-5**.

In summary, implementation of the Proposed Project, when considered cumulatively with other past, present, or future projects near the Airport, would not result in less-than-significant cumulative impacts associated with vehicle traffic noise and aircraft operation-related noise. And with implementation of Mitigation Measure 3.10-1, potential cumulative impacts associated with construction noise are considered less-than-significant.

Mitigation Measure

See Mitigation Measure 3.10-1: Implement Construction Noise BMPs.

Impact Significance after Mitigation: Implementation of this measure will ensure that the Proposed Project would not expose nearby residential land uses to construction noise levels in excess of City standards. In doing so, potential noise impacts associated with the cumulative development of projects in the vicinity of Nut Tree Airport are considered less than significant.

3.10.4 References

Caltrans, 1998. *Technical Noise Supplement*. October 1998.

City of Vacaville, 2007. *City of Vacaville General Plan Noise Element*. December 2007.

City of Vacaville and Solano County, 2012. *Nut Tree Airport Master Plan*, prepared by The Barnard Dunkelberg Company, 2010, Amended 2012

Daly, Dave, Airport Manager, 2012. Nut Tree Airport, telephone and email communication, August 2012 – November 2012

Federal Aviation Administration, 2012. official terminal area forecast website, aspm.faa.gov/main/taf.asp, accessed on August 2012

Federal Transit Administration (FTA), 2006. *Transit Noise and Vibration Impact Assessment*. May 2006.

Solano County, 1988. *Nut Tree Airport / Land Use Compatibility Plan*. Adopted May 1988.

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