4.8 NOISE

Environmental noise impacts resulting from implementation of the Specific Plan are evaluated in this section. Potential noise impacts associated with implementation of the Specific Plan include the compatibility of the proposed permitted uses with the onsite noise environment, the potential for increased noise levels in existing noise sensitive areas surrounding the Specific Plan area, and the potential for increased traffic noise and vibration along the streets serving the Specific Plan area.

4.8.1 EXISTING SETTING

BACKGROUND INFORMATION ON NOISE

Noise may be defined as unwanted sound, which is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its pitch or its loudness. Pitch is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. Loudness is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave. In addition to the concepts of pitch and loudness, there are several noise measurement scales that are used to describe noise in a particular location. A decibel (dB) is a unit of measurement that indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a tenfold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10-decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities (see Table 4.8-1).

There are several methods of characterizing sound. The most common in California is the A-weighted sound level (dBA). This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 4.8-2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be used. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This energy-equivalent sound/noise descriptor is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events or arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources such as roadways and airports. The accuracy of the predicted models depends upon the distance of the receptor from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Table 4.8-1
Definitions of Acoustical Terms

Term	Definitions
Decibel (dB)	A unit 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).
Frequency (Hertz [Hz])	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level (dBA)	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 frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level during the measurement period.
Community Noise Equivalent Level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7 p.m. to 10 p.m. and after addition of 10 decibels to sound levels measured at night between 10 p.m. and 7 a.m.
Day/Night Noise Level (L_{dn})	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured at night between 10 p.m. and 7 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted noise levels during the measurement period.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Illingworth & Rodkin, Inc., Acoustical Engineers, 2003

Table 4.8-2 Typical Sound Levels Measured in the Environment and Industry			
At a Given Distance from Noise Source	A-Weighted Sound Level in Decibels	Noise Environments	Subjective Impression
	140		
Civil Defense Siren (100’)	130		
Jet Takeoff (200’)	120		Pain Threshold
	110	Rock Music Concert	
Diesel Pile Driver (100’)	100		Very Loud
	90	Boiler Room	
Freight Cars (50’)		Printing Press Plant	
Pneumatic Drill (50’)	80		
Freeway (100’)		In Kitchen with Garbage Disposal Running	
Vacuum Cleaner (10’)	70		Moderately Loud
	60	Data Processing Center	
Light Traffic (100’)	50	Department Store	
Large Transformer (200’)			
	40	Private Business Office	Quiet
Soft Whisper (5’)	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing
	0		

Source: Illingworth & Rodkin, Inc., Acoustical Engineers, 2003

Because sensitivity to noise increases during the evening and at night (excessive noise interferes with the ability to sleep), 24-hour descriptions have been developed that incorporate artificial noise penalties added to quiet-time noise events. The CNEL is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to the evening (7 p.m.–10 p.m.) and a 10 dB addition to nocturnal (10 p.m.–7 a.m.) noise levels. The L_{dn} is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this 3-hour period are grouped into the daytime period.

VIBRATION

Ground vibration from passing vehicles on surface roadways consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the peak particle velocity (PPV) and another is the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. While the RMS vibration velocity amplitudes have been used by some regulatory agencies (particularly the Federal Transportation Authority) to evaluate human response to transportation-related groundborne vibration, Caltrans, citing internal experience and other studies, has adopted a PPV descriptor with units of millimeters per second (mm/sec) or inches per second (in/sec) to evaluate transportation-generated vibration for building damage and human complaints (Caltrans 2002b).

Building damage and people's response to ground vibration caused by surface transportation sources has been best correlated to the vertical velocity component of ground motion. The Transport and Road Research Laboratory in England has studied the reactions of people to and the effects on buildings produced by continuous transportation-related vibration levels (vibration produced by traffic is considered continuous in these studies). The conclusions reached are reproduced in Table 4.8-3.

Table 4.8-3
Reaction of People to and Damage to Buildings from Continuous Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.006 to 0.019	Threshold of perception; possibility of intrusion	Damage of any type unlikely
0.08	Vibration readily perceptible	Recommended upper level of vibration to which ruins and ancient monuments should be subjected
0.10	Continuous vibration begins to annoy people	Virtually no risk of architectural damage to normal buildings
0.20	Vibration annoying to people in buildings	Risk of architectural damage to normal dwellings such as plastered walls or ceilings
0.4 to 0.6	Vibration considered unpleasant by people subjected to continuous vibration	Architectural damage and possibly minor structural damage

Source: Whiffen and Leonard 1971

The annoyance levels shown in Table 4.8-3 should be interpreted with care because vibrations may be found to be annoying at much lower levels than those shown, depending on the level of activity or inactivity of the individual. Elderly, retired people or others staying mostly at home, people reading or studying in a quiet environment, and people involved in vibration-sensitive activities are examples of people potentially annoyed by vibration at very low levels. To these and other sensitive individuals, even vibrations at the threshold of perception can be annoying.

Frequently, low-level traffic vibrations can cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. This rattling sound can give rise to vibration complaints even though there is very little risk of actual structural damage. In high-noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise, causing induced vibration in exterior doors and windows.

REGIONAL SETTING

Regional noise sources that influence the ambient noise environment in the Specific Plan area include traffic noise from U.S. 101, general aviation activity from nearby airfields, and jet aircraft overflights associated with air traffic to Oakland, San Jose, and San Francisco International Airports. These sources contribute to background noise levels in the Specific Plan area; they are not significant when compared to local sources of noise.

LOCAL SETTING

The major noise sources in the vicinity of the Specific Plan area are traffic along Doherty Drive and Magnolia Avenue. Secondary noise sources include mechanical equipment on the western portion of the Specific Plan area, including ventilation equipment and loading dock noise associated with Albertsons market and exhaust fans and other mechanical equipment mounted on the rooftops of restaurants. Audible on the Specific Plan area, but not a significant noise generator, is the sound of children playing at Redwood High School and Hall Middle School, and on the Piper Park playing fields.

Noise Contours

The Noise Element of the Larkspur General Plan includes noise projections for the year 1995. The 60 L_{dn} noise contour from Magnolia Avenue is confined to the commercial area adjacent to Magnolia Avenue. The 60 L_{dn} contour from Doherty Drive extends into Subareas 2 and 3. The General Plan noise contours show that the 1995 60 L_{dn} contour is about 210 feet from the center of Doherty Drive. To confirm these data, a 24-hour measurement was conducted along Doherty Drive at the bridge across Larkspur Creek (Location LT1 in Exhibit 4.8-1). The measurement was made at a distance of 39 feet from the center of Doherty Drive. The L_{dn} measured on Tuesday–Wednesday, November 23–24, 1999, was 69 dBA. Because noise levels recede proportionally with distance from the road, one can calculate the existing noise level at greater distances. Based on the noise measurement data, an L_{dn} of 60 dBA would be reached at a distance of 160 feet from the center of Doherty Drive. This means the noise levels are slightly (2 dBA) lower in Subareas 2 and 3 than projected in the Noise Element of the Larkspur General Plan.

Noise levels are lower in portions of Subarea 3 that are located farther from Doherty Drive and Magnolia Avenue. Short-term (10- to 20-minute duration) measurements were conducted on the afternoon of November 24, 1999, at four locations shown in Exhibit 4.8-1. Short-term measurements were made at these locations because of the presence of a constant equipment noise source (locations S1 and S2), or the relative quiet of the immediate area of Subarea 3 with the major noise source being distant traffic (locations S3 and S4). Locations S1 and S2 were located at the fence line adjacent to the commercial area of Subarea 2. Location S1 was directly

Exhibit 4.8-1

behind the Easy Street Café, and the major noise source was an exhaust fan. The noise level was measured at 56 dBA. Assuming that this exhaust fan operates from 6 a.m. until 11 p.m., the L_{dn} at this location would be 58 dBA. Location S2 was adjacent to the Albertsons loading dock area. During the time the measurements were taken, there were no trucks or activity at the loading dock area. The major noise source was mechanical equipment on the Albertsons roof, with an average measured noise level of 51 dBA. Typically, maximum instantaneous noise levels generated by trucks being unloaded and loaded, and then pulling out of the loading area, would be expected to range from 75 to 80 dBA at a similar distance. During loading operations the L_{dn}, which is averaged over a 24-hour period, at this location would be expected to be approximately 57 dBA.

Location S3 was located at the south-central edge of the Specific Plan area near the creek. At this location the major noise source was traffic on Meadowood Drive. The L_{eq} was measured at 44 dBA. The L_{dn} at this location is about 50 dBA. In the absence of traffic noise emanating from Meadowood Drive, the background noise levels are very quiet and more typical of a rural area than a suburban area. Noise levels at Location S4 at the southeastern corner of the Specific Plan area were dominated by distant traffic on U.S. 101 and birds. The average noise level measured in the afternoon at this location was 50 dBA, and the L_{dn} at this location is about 55 dBA.

Noise and Vibration from Doherty Drive Traffic

During the scoping session for the previous Draft EIR residents living along Doherty Drive in the vicinity of the "S" curve near Redwood High School raised concerns regarding noise and vibration caused by traffic on Doherty Drive. In response to the residents' concerns, the City requested an evaluation of the potential for increased noise and vibration levels outside of the homes at this location. Because field measurements constitute the most accurate method of accounting for the many variables that can influence traffic-induced vibration, (e.g., soil content, soil conditions) noise and vibration measurements (LT2 through LT4) were conducted at three residences (690 Riviera Circle, 76 Via La Brisa, and 71 Riviera Circle). Groundborne and structureborne vibration measurements were made at these properties. Twenty-four-hour exterior noise measurements were conducted between May 7, 2002, and May 9, 2002. (See Appendix G for photographs of the measurement equipment in place at these properties.)

Noise Measurements

In summary, the noise environments at all the residences along Doherty Drive were found to vary significantly as a result of the traffic flow characteristics on the adjacent portion of Doherty Drive. Another notable variation in the measured sound levels was caused by the noise shielding provided by the existing property line fences, which were higher and more effective at both 76 Via La Brisa and 71 Riviera Circle than at 690 Riviera Circle (Table 4.8-4). Noise measurement locations and site characteristics are as follows:

< *690 Riviera Circle (LT2):* The noise measurement was made in a tree in the yard at approximately 6 feet above grade and 25 feet from the centerline of Doherty Drive between 11 a.m. on May 7 and 11 a.m. on May 8, 2002. Traffic passing on Doherty Drive was stopping and starting at the adjacent four-way stop intersection at Riviera Circle and Doherty Drive. The property line fence between the yard and Doherty Drive was constructed of wood to a height of approximately 5 feet above rear yard grade. The tops of trucks and large vehicles on the roadway were visible over the top of this fence.

< *76 Via La Brisa (LT3):* The noise measurement was made in a tree at approximately 10 feet above grade at the setback of the home's facade, which is approximately 35 feet from the centerline of Doherty Drive, between 1 p.m. on May 8 and 1 p.m. on May 9, 2002. Traffic passing on Doherty Drive generally traveled at constant speeds. The property line fence between the yard and Doherty Drive was constructed of wood to a height of approximately 6 to 7 feet above rear yard grade with a high degree of foliage cover.

< *71 Riviera Circle (LT4):* The noise measurement was made on a patio support post approximately 10 feet above grade approximately 35 feet from the centerline of Doherty Drive, between 12 noon on May 8 and 12 noon on May 9, 2002. Traffic passing on Doherty Drive generally traveled at constant speeds, but was observed to back up occasionally because of crossing traffic from Redwood High School. The property line fence between the yard and Doherty Drive was constructed of wood to a height of approximately 9 feet above rear yard grade.

The results of the noise measurements at these locations are presented in Table 4.8-4.

Table 4.8-4
Results of Noise Measurements at 690 Riviera Circle, 76 Via La Brisa, and 71 Riviera Circle

Measurement (in dBA)	Address/Measurement Location		
	690 Riviera Circle (LT2)	76 Via La Brisa (LT3)	71 Riviera Circle (LT4)
Daytime Average L_{eq} Range	60–67	51–56	50–57
Average Daytime L_{eq}	64	55	55
Nighttime Average L_{eq} Range	46–63	40–52	38–52
Average Nighttime L_{eq}	56	48	47
Maximum Hourly Noise Level Range	68–81	68–77	57–87
Average Maximum Noise Level	77	67	71
Average Day-Night L_{dn}	65	56	56

Vibration Measurements

To measure groundborne and structureborne vibration levels, continuous overnight unmanned measurements were made at 690 and 71 Riviera Circle and short-term manned vibration measurements were made at 76 Via La Brisa. At each of the locations accelerometers were firmly affixed to concrete walkways to measure ground vibration. At 690 Riviera Circle

(LT2) the structure level accelerometer was firmly affixed to the ledge of a window seat in the interior of the home. At 76 Via La Brisa (LT3) and 71 Riviera Circle (LT4) the structure level accelerometer was firmly affixed to exterior decking within 1 foot of the connection to the home's structure. (See Appendix G for photographs of the measurement locations.)

The instrumentation used to conduct the vibration measurements was a Larson Davis Laboratories Human Vibration Meter model 100 (HVM100) equipped with a seismic grade, low noise accelerometer (PCB, Model 393B31, 10 V/g). This system is capable of measuring accurately very low vibration levels (down to 1 μg). To enable continuous overnight unmanned measurements at 690 and 71 Riviera Circle, the vibration meter was set up to measure both PPV levels and 10-second RMS velocity levels. For the short-term vibration measurements at 76 Via La Brisa the RMS averaging time was changed to 1 second.

Continuous vibration measurements were made at 690 Riviera Circle over a 24-hour period between 11 a.m. on May 7 and 11 a.m. on May 8, 2002 and at 71 Riviera Circle over a continuous 24-hour period between 12 noon on May 8 and 12 noon on May 9, 2002. During these periods simultaneous noise measurements were made with exceedance levels set at 75 dBA to establish loud noise events such as trucks passing by on Doherty Drive.

Short-term, manned, spot vibration measurements were made at 76 Via La Brisa on the afternoon of May 9, 2002, during individual truck and bus pass-bys. The results of the vibration measurements at these locations are presented in Table 4.8-5.

Table 4.8-5
Results of Vibration Measurements at 690 Riviera Circle, 76 Via La Brisa, and 71 Riviera Circle

Measurement	Address/Measurement Location		
	690 Riviera Circle (LT2)	76 Via La Brisa (LT3)	71 Riviera Circle (LT4)
Sound Levels of Passing Trucks (dBA)	76-81	68-77	73-78
Maximum Exterior Groundborne PPV Vibration Levels (in/sec)	0.031	0.006	0.038
Maximum Structureborne PPV Vibration Levels (in/sec)	0.027	0.005	0.031
Traffic Events Producing Noise Levels Exceeding 75 dBA	70+	2	6
Groundborne or Structureborne PPV Measurements Reaching Readily Perceptible Levels	None	None expected[1]	None
General PPV Levels (in/sec)	< 0.01	< 0.01	< 0.01

Note: [1] Based on short-term, manned, spot noise and vibration measurements and on comparison with continuous noise and vibration measurements.
Source: Illingworth & Rodkin, Inc., Acoustical Engineers

Conclusions

The following conclusions can be drawn from the noise and ground vibration information collected at the existing residences along Doherty Drive:

1. Noise levels appear to have been reduced significantly outside of the two homes where higher fences have been constructed (76 Via La Brisa and 71 Riviera Circle). Higher fences appear to be effective in reducing noise levels; however, even with fences in place, the L_{dn} was measured at 56 dBA, or 1 dBA over the City's goal for outdoor noise levels.

2. Because of the relatively low groundborne and structureborne vibration levels measured, the perceived vibrations in the homes are most likely caused by high noise levels produced by passing trucks or high-volume car stereos inducing light elements into secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. This rattling sound can give rise to vibration complaints even though there is very little risk of actual structural damage. The peak ground vibration levels measured are in the category where vibration can be intrusive, but would not be expected to cause building damage of any type.

These conclusions were confirmed by a vibration study conducted for Doherty Drive in 2000 by Municon Consultants as cited by Miller Pacific Engineering Group (see Appendix C-3). This study also concluded that vibration along Doherty Drive near Redwood High School is within perceptible range for people but well below the threshold for causing damage to structures. This study further states that vibrations are somewhat reduced when smooth pavements replace rough asphalt.

REGULATORY SETTING

The Noise Element of the Larkspur General Plan identifies noise and land use compatibility standards for various land uses and contains goals and policies to control noise levels in Larkspur. The stated goal in the Noise Element of the General Plan is to reduce the adverse effects of noise on persons living or working in Larkspur. The Noise Element sets forth a standard for an outdoor noise level not in excess of an L_{dn} of 55 dBA and an indoor noise level not in excess of 45 dBA for residential development. For nonresidential projects, the noise and land use compatibility standards for outdoor noise exposure are shown in Exhibit 4.8-2.

The Noise Element also requires that projects in the city be evaluated for their potential to create noise impacts. However, the Noise Element does not contain quantitative standards for judging how much of an increase in noise would be deemed significant. According to the EPA, a change in noise level of at least 5 dB is required before any noticeable change in community response would be expected (EPA 1971). For the purposes of this EIR, an ambient noise level increase of 5 dBA or more would be considered a substantial increase.

Exhibit 4.8-2

4.8.2 ENVIRONMENTAL IMPACTS

THRESHOLDS OF SIGNIFICANCE

Implementation of the Specific Plan would have a significant impact if it were to 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 increase in ambient noise levels in the project vicinity above levels existing without the project;
- a substantial temporary or periodic increase in ambient noise levels in the vicinity above levels existing without the project;
- exposure of people residing or working in the project area to excessive noise levels, for a project located within an airport land use plan, or where such a plan has not been adopted, located within 2 miles of a public airport or public use airport;
- exposure of people residing or working in the project area to excessive noise levels, for a project within the vicinity of a private airstrip.

The only criteria applicable to the Specific Plan are the first four, as the Specific Plan area is not located in close proximity to either a private or public airport. Vibration impacts are considered significant if ground vibration levels as a result of the Specific Plan would exceed a PPV of 0.08 in/sec, a level at which structural damage would not occur. Projected traffic noise levels were modeled based on data and traffic scenarios from the traffic study conducted for the Specific Plan; definitions of traffic scenarios, such as Existing, Existing Plus Specific Plan, Existing Plus Cumulative (No Build), and Existing Plus Cumulative Plus Specific Plan, are in Section 4.7, Traffic and Circulation, of this EIR.

PROJECT-LEVEL IMPACTS

Impact
4.8-1

Incompatibility of Noise Sensitive Land Uses with Existing Noise Environment. *Depending on the actual development, residential land uses could be incompatible with the existing noise environment. This impact is considered **potentially significant**.*

The Specific Plan would permit the development of multifamily residential uses in all three subareas and single-family residential uses in Subarea 3. Depending on the type and location of development within the Specific Plan Area, residential and other noise sensitive land uses could be incompatible with the existing noise environment. This impact is considered potentially significant.

Impact **4.8-2**

Increased Noise Levels during Construction. *Noise levels from construction activities could occasionally be annoying and interfere with outdoor activity. This impact is considered **potentially significant**.*

At times construction in the Specific Plan area would cause noise levels at adjacent residential development to increase. During the time when construction takes place within 1,000 feet of residences, noise levels could occasionally be annoying and interfere with outdoor activity. This impact is considered potentially significant.

Impact **4.8-3**

Increase in Traffic Noise. *Noise levels would generally increase by less than 1 dBA along Magnolia Avenue, Doherty Drive, and other Specific Plan area roadways as a result of traffic generated by Specific Plan development. Noise levels at residential uses along Doherty Drive and Magnolia Avenue currently exceed an Ldn of 55 dBA, which is considered the "normally acceptable" limit for noise at residential uses within Larkspur. However, implementation of the Specific Plan, by itself, would not substantially increase noise levels and would not cause the noise levels to exceed this threshold of significance. This impact is considered **less than significant**.*

Section 4.7, Traffic and Circulation, of this Draft EIR indicates that traffic volumes would increase as a result of implementation of the Specific Plan. To determine the increase in noise levels along roadways in the Specific Plan area, the increase from existing to existing-plus-Specific Plan a.m. and p.m. peak-hour traffic volumes was analyzed. Traffic volumes would increase by 0–12%, except on Meadowood Drive east of Magnolia Avenue. Average noise levels produced by traffic generally increase at a rate of 3 dB per doubling of volumes or 10 x log(n), where n equals the percentage increase in the volume of traffic, with the same or similar makeup of vehicles on a roadway (i.e., percentage of autos, trucks, buses, etc.). Table 4.8-6 provides a summary of percentage increase and dB increase on project roadway segments.

Considering that the makeup of the traffic would remain essentially constant, a 0–12% increase in traffic volumes would result in an increase in average traffic noise levels of 0.5 dB or less. Traffic on Meadowood Drive east of Magnolia Avenue is projected to increase by up to 142% of existing volumes under the existing-plus-Specific Plan scenario. This would produce an increase in the average traffic noise level of nearly 4 dB, which is not considered to be an audible noise level increase in terms of community noise perception. Furthermore, Meadowood Drive currently has low traffic volumes, and this increase in traffic noise would not cause noise levels to exceed an L_{dn} of 55 dBA.

A pair of conclusions may be reached by this analysis. At homes along Doherty Drive, Magnolia Avenue, and others in the Specific Plan area, noise levels would continue to exceed the City's noise and land use compatibility guidelines. However, implementation of the Specific Plan, by itself, would not cause the existing noise levels to substantially increase or to exceed the thresholds of significance discussed above. For this reason, this impact is considered less than significant.

Table 4.8-6 Traffic and Noise Level Increases from Existing Scenario to Existing Plus Specific Plan Scenario				
Roadway Segment	A.M. Peak Hour		P.M. Peak Hour	
	Percentage Increase in Traffic	Noise Level Increase (dB)	Percentage Increase in Traffic	Noise Level Increase (dB)
Magnolia Avenue Northwest of Bon Air Road	4%	0.2	7%	0.3
Magnolia Avenue Doherty Drive to Bon Air Road	4%	0.2	6%	0.2
Magnolia Avenue Ward Street/Meadowood to Doherty Drive	6%	0.3	12%	0.5
Magnolia Avenue King Street/Monte Vista to Ward Street/Meadowood Drive	4%	0.2	7%	0.3
Magnolia Avenue South of King Street/Monte Vista Avenue	5%	0.2	8%	0.3
Doherty Drive Magnolia Avenue to Larkspur Plaza	6%	0.3	9%	0.4
Doherty Drive Larkspur Plaza to Piper Park	6%	0.2	9%	0.4
Doherty Drive Piper Park to Rivera Circle	5%	0.2	9%	0.4
Doherty Drive Riviera Circle to East Riviera Circle	6%	0.2	8%	0.3
Doherty Drive East Riviera Circle to Lucky Drive	6%	0.3	9%	0.4
Lucky Drive East Riviera Circle to Fifer Avenue	5%	0.2	8%	0.3
Lucky Drive North of Fifer Avenue	5%	0.2	8%	0.3
Fifer Avenue Lucky Drive to Tamal Vista Boulevard	4%	0.2	8%	0.3
Fifer Avenue Tamal Vista Boulevard to U.S. 101	5%	0.2	5%	0.2
Tamal Vista Boulevard Fifer to Wornum Drive	2%	0.1	4%	0.2
Tamal Vista Boulevard South of Wornum Drive	0%	0.0	0%	0.0
Bon Air Road North of Magnolia Avenue	0%	0.0	0%	0.0
East Ward Street West of Magnolia Avenue	0%	0.0	0%	0.0
Meadowood Drive East of Magnolia Avenue	75%	2.4	142%	3.8
King Street West of Magnolia Avenue	0%	0.0	0%	0.0
Monte Vista East of Magnolia Avenue	0%	0.0	0%	0.0
Larkspur Plaza North of Doherty Drive	0%	0.0	0%	0.0
Riviera Circle North of Doherty Drive	0%	0.0	0%	0.0
Wornum Drive East of Tamal Vista Boulevard	2%	0.1	5%	0.2
Source: Illingworth & Rodkin, Inc., Acoustical Engineers, 2003				

Impact 4.8-4

<u>Potential Increase in Vibration.</u> *The maximum PPV measured at any of the three homes evaluated was 0.038 in/sec, well below the applicable threshold of significance. The traffic generated by development within the Specific Plan area is not expected to significantly increase the existing level of vibration produced at homes in the plan area. This impact is considered **less than significant**.*

The maximum PPV level measured at any of the three homes evaluated was 0.038 in/sec. This was well below the threshold of significance used in this analysis (a maximum PPV of 0.08 in/sec). The groundborne and structureborne PPV vibration levels used to evaluate transportation-generated vibration for building damage and human complaints are the maximum levels, rather than average levels. These levels are dependent on vibration levels produced by individual vehicular pass-bys; therefore, the increase or decrease in these levels cannot be calculated directly based on increases in traffic volumes, as can average noise levels (see previous discussion). However, individual pass-bys of potentially vibration-inducing vehicles, such as delivery trucks and heavy equipment used during construction of the various future projects that may be routed to Doherty Drive, can be additive, producing higher groundborne vibration levels if they occur simultaneously.

To determine how many vibration events at the maximum measured level of 0.038 in/sec would have to occur at the same time to reach the 0.08 in/sec threshold of significance, the measured PPV level was converted to energy terms (decibels). (When groundborne velocity is expressed in a dB scale, the reference velocity is set at 1 x 10-6 in/sec, which equals 0 VdB, and 1 in/sec equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is commonly used for vibration decibels to reduce confusion with sound decibels.) The decibel equivalent levels for simultaneous vibration producing events at 0.038 in/sec (92 VdB) were then logarithmically added. (Decibels, which are logarithmic quantities, do not follow the normal [algebraic] rules of addition and subtraction. Instead decibels are first converted to energy equivalents and these energy equivalents are then added or subtracted and then converted back to a decibel value.) The summed decibel levels were then converted back to PPV units (in/sec) to determine how many simultaneous events would need to occur to reach the threshold of significance.

The results of this analysis showed that a minimum of four vibration-producing events, such as the passage of four heavy trucks, would have to occur simultaneously to cause groundborne vibration levels to reach the significance threshold at the homes along Doherty Drive. Such an occurrence is not expected on Doherty Drive, particularly due to the physical restrictions imposed by Doherty Drive's two-lane configuration and alignment. Because of their lighter weight, individual vehicles smaller than heavy trucks do not typically cause groundborne vibrations at locations along the roadway. As such, impacts related to groundborne vibration would be less than significant.

CUMULATIVE IMPACTS

Based on the level of development proposed and a review of traffic volume information contained in Section 4.7, Traffic and Circulation, of this Revised Draft EIR, cumulative traffic volumes would increase as a result of implementation of the Specific Plan. An analysis of the Traffic and Noise Level Increases from Existing Plus Cumulative (No Specific Plan) Scenario to Existing Plus Cumulative Plus Specific Plan Scenario (refer to Table 4.8-7) shows that traffic volumes would increase by 0–10%, except on Meadowood Drive east of Magnolia Avenue. Considering that the makeup of the traffic would remain essentially constant, a 0–10% increase in traffic volumes would result in an increase in average traffic noise levels of less than 0.5 dB. Existing Plus Cumulative Plus Specific Plan traffic volume on Meadowood Drive, east of Magnolia Avenue, is projected to increase by up to 132% over Existing Plus Cumulative (No Specific Plan) volumes. This would produce an increase in average traffic noise levels of nearly 4 dB, which is not considered a substantial increase. However, under the Existing Plus

Cumulative (No Specific Plan) scenario, Meadowood Drive would have low traffic volumes, and this increase in traffic noise would not be expected to cause noise levels to exceed an L_{dn} of 55 dBA.

Table 4.8-7
Traffic and Noise Level Increases from Existing Plus Cumulative (No Specific Plan) Scenario to Existing Plus Cumulative Plus Specific Plan Scenario

Roadway Segment	A.M. Peak Hour		P.M. Peak Hour	
	Percentage Increase in Traffic	Noise Level Increase (dB)	Percentage Increase in Traffic	Noise Level Increase (dB)
Magnolia Avenue Northwest of Bon Air Road	4%	0.2	7%	0.3
Magnolia Avenue Doherty Drive to Bon Air Road	3%	0.1	5%	0.2
Magnolia Avenue Ward Street/Meadowood to Doherty Drive	5%	0.2	10%	0.5
Magnolia Avenue King Street/Monte Vista to Ward Street/Meadowood Drive	3%	0.1	6%	0.3
Magnolia Avenue South of King Street/Monte Vista Avenue	4%	0.2	6%	0.3
Doherty Drive Magnolia Avenue to Larkspur Plaza	5%	0.2	8%	0.4
Doherty Drive Larkspur Plaza to Piper Park	4%	0.2	7%	0.4
Doherty Drive Piper Park to Rivera Circle	4%	0.2	7%	0.4
Doherty Drive Riviera Circle to East Riviera Circle	4%	0.2	8%	0.3
Doherty Drive East Riviera Circle to Lucky Drive	5%	0.2	7%	0.4
Lucky Drive East Riviera Circle to Fifer Avenue	4%	0.2	7%	0.3
Lucky Drive North of Fifer Avenue	4%	0.2	6%	0.3
Fifer Avenue Lucky Drive to Tamal Vista Boulevard	4%	0.2	7%	0.3
Fifer Avenue Tamal Vista Boulevard to U.S. 101	3%	0.1	4%	0.2
Tamal Vista Boulevard Fifer to Wornum Drive	1%	0.1	3%	0.2
Tamal Vista Boulevard South of Wornum Drive	0%	0.0	0%	0.0
Bon Air Road North of Magnolia Avenue	0%	0.0	0%	0.0
East Ward Street West of Magnolia Avenue	0%	0.0	0%	0.0
Meadowood Drive East of Magnolia Avenue	71%	2.3	132%	3.8
King Street West of Magnolia Avenue	0%	0.0	0%	0.0
Monte Vista East of Magnolia Avenue	0%	0.0	0%	0.0
Larkspur Plaza North of Doherty Drive	0%	0.0	0%	0.0
Riviera Circle North of Doherty Drive	0%	0.0	0%	0.0
Wornum Drive East of Tamal Vista Boulevard	2%	0.1	4%	0.2

Source: Illingworth & Rodkin, Inc., Acoustical Engineers, 2003

At homes along Doherty Drive, Magnolia Avenue, and others in the Specific Plan area, noise levels would continue to exceed the City's noise and land use compatibility guidelines.

Implementation of the Specific Plan, by itself, would not cause the noise levels to exceed the thresholds of significance discussed above. Because Specific Plan-generated traffic noise increase would not be perceptible under cumulative conditions where existing traffic noise already exceed the City's standards, this cumulative impact is less than significant.

Due to the two-lane configuration and alignment of Doherty Drive, the simultaneous occurrence of four vibration-producing events would not be expected under the cumulative conditions. As such, cumulative impacts related to groundborne vibration would be less than significant.

4.8.3 MITIGATION MEASURES

PROJECT MITIGATION MEASURES

No mitigation measures are required for the following less-than-significant impacts.

4.8-3: Increase in Traffic Noise

4.8-4: Potential Increase in Vibration

The following mitigation measures are recommended for potentially significant impacts.

Impact
4.8-1
mitigation

Incompatibility of Noise Sensitive Land Uses with Existing Noise Environment.

(a) Conduct Acoustical Evaluation.

The City shall include the following new policy in the Specific Plan.

New Policy: Site plans for all development projects within the Specific Plan area shall be evaluated by an acoustical engineer to ensure that residential outdoor use areas are protected to a level not in excess of an L_{dn} of 55 dBA. The acoustical evaluation shall be reviewed by the City. Measures that could be used to achieve reduction in noise are increasing the distance between the outdoor use areas and any noise sources (for example, the Albertsons loading dock), using the buildings themselves to shield outdoor spaces, and constructing sound walls, earth berms, or combined sound walls and earth berms adjacent to noise sources.

(b) Provide Mechanical Ventilation.

The City shall include the following new policy in the Specific Plan.

New Policy: Mechanical ventilation, which may include air condition or fans, shall be required where the outdoor noise level at the exterior of new residential uses exceeds an L_{dn} of 60 dBA.

Impact
4.8-2
mitigation

Increased Noise Levels during Construction.

Minimize Amount and Duration of Noise Intrusion During Construction and Take Measures to Correct Problems.

The City shall include the following new policy in the Specific Plan.

New Policy: The developer shall take the following measures to minimize noise intrusion during construction in the Specific Plan area:

1. Limit construction to the hours of 7 a.m. to 6 p.m. on weekdays, and 9 a.m. to 5 p.m. on Saturdays, Sundays, or legal holidays in accordance with Chapter 9.54 of the Larkspur Municipal Code.
2. Ensure that all equipment driven by internal combustion engines are equipped with mufflers that are in good condition and appropriate for the equipment.
3. Use "quiet" models of air compressors and other stationary noise sources where technology exists.
4. Locate stationary noise-generating equipment as far as possible from sensitive receptors when sensitive receptors adjoin or are near a remediation or construction project area.
5. Prohibit unnecessary idling of internal combustion engines.
6. Designate a "noise disturbance coordinator" responsible for responding to any local complaints about construction noise. The disturbance coordinator will determine the cause of the noise complaints (e.g., starting too early, bad muffler) and institute reasonable measures warranted to correct the problem. Post the telephone number for the disturbance coordinator at a location clearly and easily visible to the public on the construction site.

4.8.4 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Following implementation of the above mitigation measures, project-level and cumulative impacts would be less than significant.