Petaluma North River Apartments

City of Petaluma, California

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jcb Project # 2016-153

Prepared for:

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INTRODUCTION

The proposed Petaluma North River Apartment project consists of two four-story apartment buildings located at 368 and 402 Petaluma Boulevard, North, in Petaluma, California. The proposed project includes a total of 210 units with a mixture of Studio and One & Two Bedroom Units. The site includes 329 parking spaces including on-site and street parking.

The proposed project is adjacent to the Hunt Behrens Plant to the north, and Dairyman's Feed Mill to the southeast. A carwash facility is also located to the north of the project, and a railroad spur line bisects the site, where the future Water Street extension will replace the railroad track. Figure 1 shows the project area. Figure 2 shows the project site plan.

This analysis will assess the potential noise generation from both the transportation noise sources adjacent to, and near the project site, and the potential for adjacent industrial and commercial uses to generate noise levels which may impact the residential portion of the site. Predicted noise levels will be compared to the noise level standards of the City of Petaluma General Plan Noise Element.

ENVIRONMENTAL SETTING

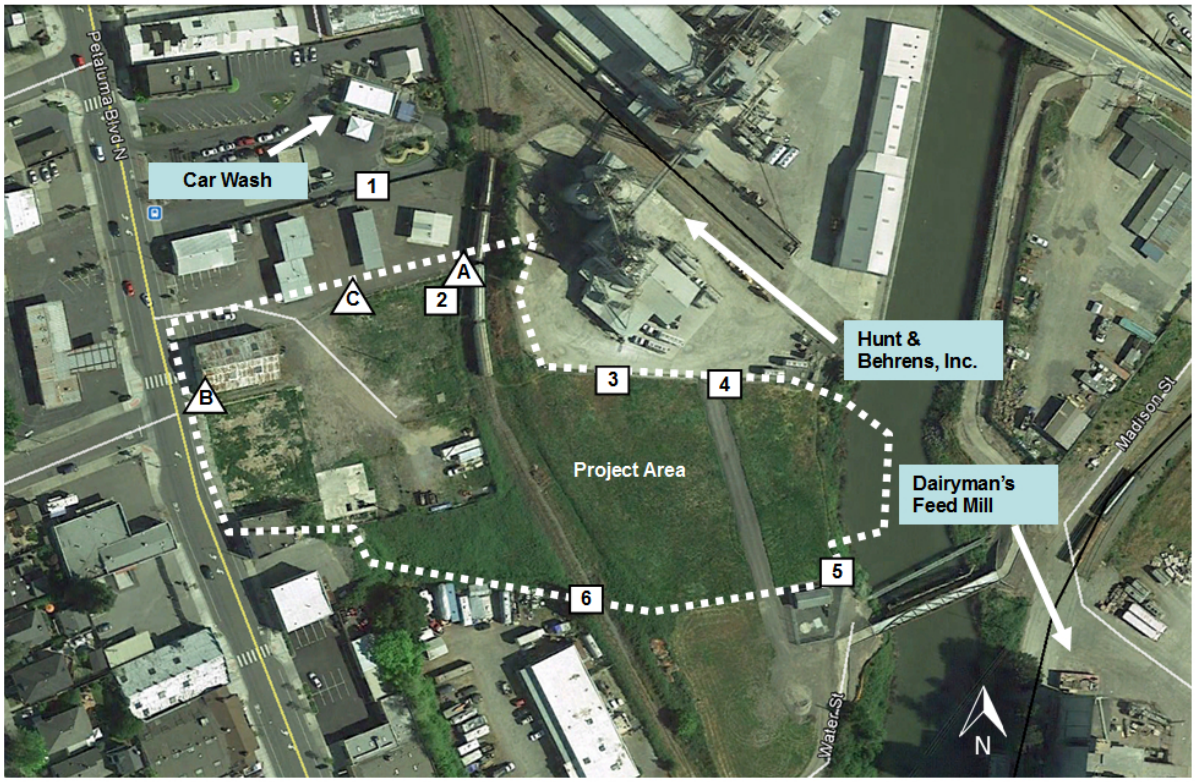
BACKGROUND INFORMATION ON NOISE

Fundamentals of Acoustics

Acoustics is the science of sound. Sound may be thought of as mechanical energy of a vibrating object transmitted by pressure waves through a medium to human (or animal) ears. If the pressure variations occur frequently enough (at least 20 times per second), then they can be heard and are called sound. The number of pressure variations per second is called the frequency of sound, and is expressed as cycles per second or Hertz (Hz).

Noise is a subjective reaction to different types of sounds. Noise is typically defined as (airborne) sound that is loud, unpleasant, unexpected or undesired, and may therefore be classified as a more specific group of sounds. Perceptions of sound and noise are highly subjective from person to person.

Figure 1
Petaluma Apartments
Project Area and Noise Monitoring Sites



△ : 24-hr Noise Monitoring Location

□ : Short-Term Noise Monitoring Locations

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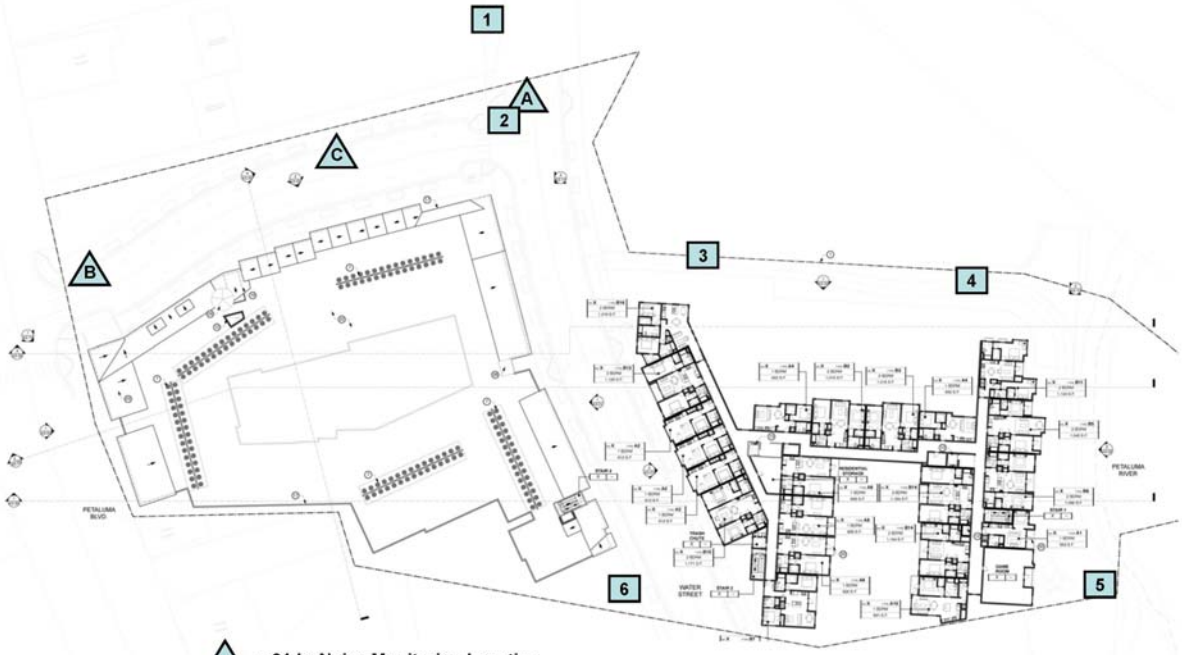
Figure 2
Petaluma Apartments
Project Site Plan and Noise Monitoring Sites



Site Plan Source: BDE Architecture

Measuring sound directly in terms of pressure would require a very large and awkward range of numbers. To avoid this, the decibel scale was devised. The decibel scale uses the hearing threshold (20 micropascals), as a point of reference, defined as 0 dB. Other sound pressures are then compared to this reference pressure, and the logarithm is taken to keep the numbers in a practical range. The decibel scale allows a million-fold increase in pressure to be expressed as 120 dB, and changes in levels (dB) correspond closely to human perception of relative loudness.

The perceived loudness of sounds is dependent upon many factors, including sound pressure level and frequency content. However, within the usual range of environmental noise levels, perception of loudness is relatively predictable, and can be approximated by A-weighted sound levels. There is a strong correlation between A-weighted sound levels (expressed as dBA) and the way the human ear perceives sound. For this reason, the A-weighted sound level has become the standard tool of environmental noise assessment. All noise levels reported in this section are in terms of A-weighted levels, unless otherwise noted.

The decibel scale is logarithmic, not linear. In other words, two sound levels 10 dB apart differ in acoustic energy by a factor of 10. When the standard logarithmic decibel is A-weighted, an increase of 10 dBA is generally perceived as a doubling in loudness. For example, a 70 dBA sound is half as loud as an 80 dBA sound, and twice as loud as a 60 dBA sound.

Community noise is commonly described in terms of the ambient noise level, which is defined as the all-encompassing noise level associated with a given environment. A common statistical tool is the average, or equivalent, sound level (Leq), which corresponds to a steady-state A weighted sound level containing the same total energy as a time varying signal over a given time period (usually one hour). The Leq is the foundation of the composite noise descriptor, Ldn, and shows very good correlation with community response to noise.

The day/night average level (Ldn) is based upon the average noise level over a 24-hour day, with a +10 decibel weighing applied to noise occurring during nighttime (10:00 p.m. to 7:00 a.m.) hours. The nighttime penalty is based upon the assumption that people react to nighttime noise exposures as though they were twice as loud as daytime exposures. Because Ldn represents a 24-hour average, it tends to disguise short-term variations in the noise environment.

Table 1 lists several examples of the noise levels associated with common situations. Appendix A provides a summary of acoustical terms used in this report.

TABLE 1
TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	--110--	Rock Band
Jet Fly-over at 300 m (1,000 ft)	--100--	
Gas Lawn Mower at 1 m (3 ft)	--90--	
Diesel Truck at 15 m (50 ft), at 80 km/hr (50 mph)	--80--	Food Blender at 1 m (3 ft) Garbage Disposal at 1 m (3 ft)
Noisy Urban Area, Daytime Gas Lawn Mower, 30 m (100 ft)	--70--	Vacuum Cleaner at 3 m (10 ft)
Commercial Area Heavy Traffic at 90 m (300 ft)	--60--	Normal Speech at 1 m (3 ft)
Quiet Urban Daytime	--50--	Large Business Office Dishwasher in Next Room
Quiet Urban Nighttime	--40--	Theater, Large Conference Room (Background)
Quiet Suburban Nighttime	--30--	Library
Quiet Rural Nighttime	--20--	Bedroom at Night, Concert Hall (Background)
	--10--	Broadcast/Recording Studio
Lowest Threshold of Human Hearing	--0--	Lowest Threshold of Human Hearing

Source: Caltrans, Technical Noise Supplement, Traffic Noise Analysis Protocol. November, 2012.

Effects of Noise on People

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

- Subjective effects of annoyance, nuisance, and dissatisfaction
- Interference with activities such as speech, sleep, and learning
- 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 noise 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 A-weighted noise level, the following relationships occur:

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

Stationary point sources of noise – including stationary mobile sources such as idling vehicles – attenuate (lessen) at a rate of approximately 6 dB per doubling of distance from the source, depending on environmental conditions (i.e. atmospheric conditions and either vegetative or manufactured noise barriers, etc.). Widely distributed noises, such as a large industrial facility spread over many acres, or a street with moving vehicles, would typically attenuate at a lower rate.

REGULATORY CONTEXT

State of California Building Code

Title 24 of the State Building Code is applicable to the multi-family residential portion of the project site. The State Noise Insulation Standards referenced in Title 24, Part 2 are also implemented in Appendix Chapter 12 of the Uniform Building Code. Multi-family housing proposed where the exterior noise exposure level is 60 dB Ldn or higher shall be designed to adhere a maximum interior noise level of 45 dB Ldn.

City of Petaluma General Plan Health & Safety Element

The City of Petaluma has a 2025 General Plan which includes a Health & Safety Element which includes noise level criteria for land use compatibility. The following summarizes the policies and criteria applicable to the proposed project:

Policy 10-P-3: Protect public health and welfare by eliminating or minimizing the effects of existing noise problems, and by minimizing the increase of noise levels in the future.

A. Continue efforts to incorporate noise considerations into land use planning decisions, and guide the location and design of transportation facilities to minimize the effects of noise on adjacent land uses.

B. Discourage location of new noise-sensitive uses, primarily homes, in areas with projected noise levels greater than 65 dB CNEL/Ldn. Where such uses are permitted, require incorporation of mitigation measures to ensure that interior noise levels do not exceed 45 dB CNEL/Ldn.

C. Ensure that the City's noise ordinance and other regulations:

- Require that applicants for new noise-sensitive developments in areas subject to noise levels greater than 65 dB CNEL obtain the services of a professional acoustical engineer to provide a technical analysis and design of mitigation measures.
- Require placement of fixed equipment such as air conditioning units and condensers, inside or in the walls of new building or on roof-tops of central units in order to reduce noise impacts on any nearby sensitive receptors.
- Establish appropriate noise-emission standards to be used in connection with the purchase, use, and maintenance of City vehicles.

D. Continue to require control of noise or mitigation measures for any noise-emitting construction equipment or activity. *(The City's Noise ordinance establishes controls on construction-related noise.)*

E. As a part of development review, use Figure 10-2 (*Figure 3 of this Report*) to determine acceptable uses and installation requirements in noise-impacted areas.

F. Discourage the use of sound walls anywhere except along Highway 101 and/or along the NWPRA corridor, without findings that such walls will not be detrimental to the community character. When sound walls are deemed necessary, integrate them into the streetscape.

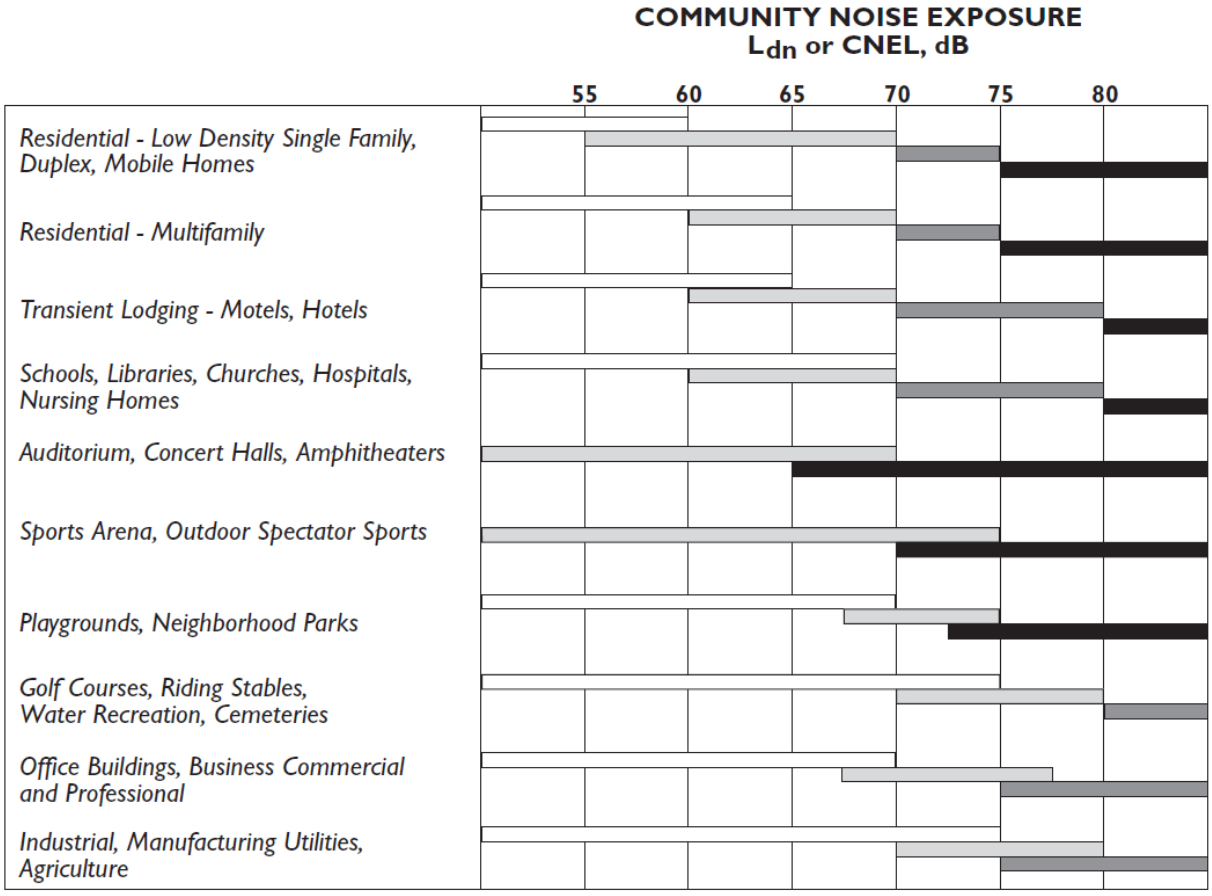
G. In making a determination of impact under the California Environmental quality Act (CEQA), consider an increase of four or more dBA to be "significant" if the resulting noise level would exceed that described as normally acceptable for the affected land use in Figure 10-2 *(Figure 3 of this Report)*: Land Use Compatibility Standards.

City of Petaluma Zoning Ordinance

Noise regulations are set forth in the City's Zoning Ordinance in Section 22-301. The ordinance limits noise-generating construction activities to the hours of 7:00 a.m. to 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and holidays. The zoning ordinance generally establishes an hourly average noise level of 60 dBA. However, the ordinance implies the standard of 60 dBA (hourly average) would apply to construction which occurs outside of the hours of 7:00 a.m. to 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and holidays.

Figure 10-2

Figure 3
Land Use Compatibility Standards



Interpretation

NORMALLY ACCEPTABLE
Specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction without any special noise insulation requirements

Interpretation

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Interpretation

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design

Interpretation

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken

EVALUATION OF THE EXISTING NOISE ENVIRONMENT AT THE PROJECT SITE

Background Noise Levels

j.c. brennan & associates, Inc. conducted continuous 24-hour noise level measurements at three locations on the project site, and short-term noise measurements at six separate locations. The measurements were conducted on Wednesday and Thursday July 29th and 30th, 2015. The intent of the noise level measurements was to quantify noise levels and times of day of operations associated with industrial activities near the site. The short-term noise measurements were conducted to isolate individual noise sources adjacent to the project site. The results of the noise level measurements are shown in Table 2. Appendix B shows the measured background noise levels.

TABLE 2
EXISTING AMBIENT NOISE MONITORING RESULTS
PETALUMA NORTH RIVER APARTMENTS

Site	Location	Date	Average Measured Hourly Noise Levels, (dBA)						
			24-hr CNEL	Daytime (7:00 am - 10:00 pm)			Nighttime (10:00 pm - 7 am)		
				Leq	L50	Lmax	Leq	L50	Lmax
Continuous 24hr Noise Measurement Sites									
A	Northeast Corner of West Parcel	July 29-30, 2015	60 dB	58 dB	54 dB	74 dB	53 dB	45 dB	59 dB
B	West Edge of West Parcel (Adjacent to Petaluma Blvd)	July 29-30, 2015	70 dB	69 dB	65 dB	89 dB	61 dB	48 dB	78 dB
C	North Edge of West Parcel, Center	July 29-30, 2015	61 dB	60 dB	57 dB	76 dB	52 dB	47 dB	67 dB
Short-term Noise Measurement Sites									
1	South Edge of Car Wash	July 29, 2015	N/A	67 dB	65 dB	73 dB	@ 9:27 am		
2	Northeast Corner of West Parcel	July 30, 2015		57 dB	54 dB	75 dB	@ 11:56 am		
3	North Edge of East Parcel, Left Side	July 30, 2015		56 dB	55 dB	63 dB	@ 11:04 am		
4	North Edge of East Parcel, Right Side	July 30, 2015		60 dB	60 dB	66 dB	@ 10:49 am		
5	Southeast Corner of East Parcel	July 30, 2015		61 dB	61 dB	65 dB	@ 10:31 am		
6	On Railroad Tracks at South Edge of Project Area	July 30, 2015		51 dB	51 dB	59 dB	@ 11:23 am		

Source - j.c. brennan & associates, Inc. 2015

EVALUATION OF FUTURE NOISE LEVELS

Existing and Future Traffic Noise Impacts at the Project Site

To predict existing noise levels due to traffic, the Federal Highway Administration Highway Traffic Noise Prediction Model (FHWA RD-77-108) was used. The model is based upon the Calveno reference noise factors for automobiles, medium trucks, and heavy trucks, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, and the acoustical characteristics of the site. The FHWA model was developed to predict hourly L_{eq} values for free-flowing traffic conditions.

Traffic volumes for existing and future conditions were obtained from the traffic study conducted for this site by W-trans Whitlock and Weinberger Transportation Inc. *(W-Trans, Traffic Impact Study for North River Landing, for the City of Petaluma, March 28, 2016)* in the form of peak hour intersection movements. The p.m. peak hour traffic volumes were compiled into segment volumes and converted into daily traffic volumes using a factor of 10, as advised by W-Trans. Truck usage and vehicle speeds on the local area roadways were estimated from field observations.

Table 3 shows the existing traffic noise levels in terms of L_{dn} at a reference distance of 100 feet from the centerlines of the existing project-area roadways identified in the traffic study (existing conditions). This table also shows the distances to existing traffic noise contours. A complete listing of the FHWA Model input data is contained in Appendix C.

TABLE 3
EXISTING TRAFFIC NOISE LEVELS AND DISTANCES TO CONTOURS

Roadway	Segment	CNEL @ 100 Feet	Distance to Contours		
			70 dB	65 dB	60 dB
Petaluma Boulevard North	North of Lakeville Street	62 dB	29 ft	63 ft	135 ft
Petaluma Boulevard North	South of Lakeville Street	61 dB	26 ft	55 ft	119 ft
Petaluma Boulevard North	North of Oak Street	61 dB	27 ft	57 ft	123 ft
Petaluma Boulevard North	South of Oak Street	61 dB	25 ft	54 ft	115 ft
Petaluma Boulevard North	North of East Washington Street	61 dB	23 ft	50 ft	109 ft
Petaluma Boulevard North	South of East Washington Street	60 dB	21 ft	45 ft	96 ft
Oak Street	West of Petaluma Boulevard North	51 dB	5 ft	11 ft	24 ft
Washington Street	West of Petaluma Boulevard North	61 dB	24 ft	52 ft	111 ft
East Washington Street	East of Water Street	61 dB	26 ft	57 ft	122 ft
East Washington Street	Northeast of Lakeville Street	61 dB	24 ft	52 ft	112 ft
Water Street North	North of East Washington Street	N-A	N-A	N-A	N-A
Water Street	South of East Washington Street	N-A	N-A	N-A	N-A
Lakeville Street	Northwest of East Washington Street	56 dB	11 ft	25 ft	53 ft
Lakeville Street	Southeast of East Washington Street	59 dB	19 ft	40 ft	87 ft

Notes: Distances to traffic noise contours are measured in feet from the centerlines of the roadways.

Source: FHWA-RD-77-108 with inputs from w-trans 2016, and j.c. brennan & associates, Inc. 2016.

Increases in Traffic Noise Impacts on the Local Street System

As a means of assessing future traffic noise levels as it affects the project site, j.c. brennan & associates, Inc. once again used the FHWA traffic noise prediction model to determine future traffic noise levels. Inputs to the model included future traffic volumes provided by W-trans Whitlock and Weinberger Transportation Inc. *(W-Trans, Traffic Impact Study for North River Landing, for the City of Petaluma, March 28, 2016)*, in the form of peak hour intersection movements. The p.m. peak hour traffic volumes were compiled into segment volumes and converted into daily traffic volumes using a factor of 10. Truck usage and vehicle speeds on the local area roadways were estimated from field observations. Table 4 compares existing traffic noise levels with existing plus pipeline traffic noise levels. Table 5 compares existing traffic noise levels with existing plus pipeline plus project traffic noise levels, and Table 6 compares cumulative traffic noise levels with cumulative plus project traffic noise levels.

Based upon the noise measurement results at Site B, the Petaluma Boulevard traffic noise levels at the nearest building facade will be 64 dB CNEL, at a distance of 125 feet from the roadway centerline. However, based upon the traffic noise calculations, the existing traffic noise level due to Petaluma Boulevard North, at the nearest building facade will be approximately 62 dB CNEL, and the future traffic noise level will be 62 dB CNEL.

TABLE 4
EXISTING AND EXISTING PLUS PIPELINE TRAFFIC NOISE LEVELS

Segment	Traffic Noise Levels (CNEL) @100'			Distance to Contours Existing			Distance to Contours Existing Plus Pipeline		
	Existing	Existing Plus Pipeline	Change	70 dB	65 dB	60 dB	70 dB	65 dB	60 dB
Petaluma Boulevard North									
North of Lakeville St	62 dB	62 dB	0 dB	29 ft	63 ft	135 ft	31 ft	66 ft	142 ft
South of Lakeville St	61 dB	61 dB	0 dB	26 ft	55 ft	119 ft	27 ft	58 ft	124 ft
North of Oak Street	61 dB	62 dB	+1 dB	27 ft	57 ft	123 ft	27 ft	59 ft	127 ft
South of Oak Street	61 dB	61 dB	0 dB	25 ft	54 ft	115 ft	26 ft	56 ft	120 ft
North of E Washington St	61 dB	61 dB	0 dB	23 ft	50 ft	109 ft	26 ft	56 ft	121 ft
South of E Washington St	60 dB	60 dB	0 dB	21 ft	45 ft	96 ft	23 ft	49 ft	105 ft
Oak Street									
West of Petaluma Blvd N	51 dB	51 dB	0 dB	5 ft	11 ft	24 ft	5 ft	11 ft	24 ft
Washington Street									
West of Petaluma Blvd N	61 dB	61 dB	0 dB	24 ft	52 ft	111 ft	25 ft	53 ft	115 ft
East Washington Street									
East of Water St	61 dB	61 dB	0 dB	26 ft	57 ft	122 ft	24 ft	52 ft	111 ft
Northeast of Lakeville St	61 dB	61 dB	0 dB	24 ft	52 ft	112 ft	27 ft	57 ft	124 ft
Water Street North									
North of E Washington St	N-A	45 dB	N-A	N-A	N-A	N-A	2 ft	5 ft	10 ft
Water Street									
South of E Washington St	N-A	44 dB	N-A	N-A	N-A	N-A	2 ft	4 ft	8 ft
Lakeville Street									
Northwest of E Washington St	56 dB	57 dB	+1 dB	11 ft	25 ft	53 ft	12 ft	26 ft	57 ft
Southeast of E Washington St	59 dB	60 dB	+1 dB	19 ft	40 ft	87 ft	20 ft	43 ft	93 ft

Notes: Distances to traffic noise contours are measured in feet from the centerlines of the roadways.

Source: FHWA-RD-77-108 with inputs W-Trans, and j.c. brennan & associates, Inc. 2016.

TABLE 5
EXISTING AND EXISTING PLUS PIPELINE PLUS PROJECT TRAFFIC NOISE LEVELS

Segment	Traffic Noise Levels (CNEL) @100'			Distance to Contours Existing			Distance to Contours Existing Plus Pipeline Plus Project		
	Existing	Existing Plus Pipeline Plus Project	Change	70 dB	65 dB	60 dB	70 dB	65 dB	60 dB
Petaluma Boulevard North									
North of Lakeville St	62 dB	62 dB	0 dB	29 ft	63 ft	135 ft	31 ft	66 ft	143 ft
South of Lakeville St	61 dB	61 dB	0 dB	26 ft	55 ft	119 ft	27 ft	58 ft	125 ft
North of Oak Street	61 dB	62 dB	+1 dB	27 ft	57 ft	123 ft	28 ft	61 ft	130 ft
South of Oak Street	61 dB	61 dB	0 dB	25 ft	54 ft	115 ft	26 ft	56 ft	122 ft
North of E Washington St	61 dB	61 dB	0 dB	23 ft	50 ft	109 ft	27 ft	57 ft	123 ft
South of E Washington St	60 dB	60 dB	0 dB	21 ft	45 ft	96 ft	23 ft	49 ft	106 ft
Oak Street									
West of Petaluma Blvd N	51 dB	51 dB	0 dB	5 ft	11 ft	24 ft	5 ft	11 ft	24 ft
Washington Street									
West of Petaluma Blvd N	61 dB	61 dB	0 dB	24 ft	52 ft	111 ft	25 ft	53 ft	115 ft
East Washington Street									
East of Water St	61 dB	61 dB	0 dB	26 ft	57 ft	122 ft	24 ft	53 ft	113 ft
Northeast of Lakeville St	61 dB	62 dB	+1 dB	24 ft	52 ft	112 ft	27 ft	59 ft	127 ft
Water Street North									
North of E Washington St	N-A	47 dB	N-A	N-A	N-A	N-A	3 ft	6 ft	14 ft
Water Street									
South of E Washington St	N-A	44 dB	N-A	N-A	N-A	N-A	2 ft	4 ft	8 ft
Lakeville Street									
Northwest of E Washington St	56 dB	56 dB	0 dB	11 ft	25 ft	53 ft	12 ft	26 ft	57 ft
Southeast of E Washington St	59 dB	60 dB	+1 dB	19 ft	40 ft	87 ft	20 ft	43 ft	94 ft

Notes: Distances to traffic noise contours are measured in feet from the centerlines of the roadways.

Source: FHWA-RD-77-108 with inputs from W-Trans, and j.c. brennan & associates, Inc. 2016.

TABLE 6
CUMULATIVE AND CUMULATIVE PLUS PROJECT TRAFFIC NOISE LEVELS

Segment	Traffic Noise Levels (CNEL) @ 100'			Distance to Contours Cumulative			Distance to Contours Cumulative Plus Project		
	Cumulative	Cumulative Plus Project	Change	70 dB	65 dB	60 dB	70 dB	65 dB	60 dB
Petaluma Boulevard North									
North of Lakeville St	64 dB	64 dB	0 dB	38 ft	83 ft	178 ft	39 ft	83 ft	179 ft
South of Lakeville St	63 dB	63 dB	0 dB	34 ft	73 ft	156 ft	34 ft	73 ft	157 ft
North of Oak Street	62 dB	62 dB	0 dB	29 ft	63 ft	137 ft	30 ft	65 ft	139 ft
South of Oak Street	62 dB	62 dB	0 dB	28 ft	60 ft	129 ft	28 ft	61 ft	130 ft
North of E Washington St	62 dB	62 dB	0 dB	29 ft	62 ft	133 ft	29 ft	63 ft	135 ft
South of E Washington St	62 dB	62 dB	0 dB	30 ft	65 ft	141 ft	31 ft	66 ft	142 ft
Oak Street									
West of Petaluma Blvd N	51 dB	51 dB	0 dB	6 ft	12 ft	26 ft	6 ft	12 ft	26 ft
Washington Street									
West of Petaluma Blvd N	61 dB	61 dB	0 dB	25 ft	53 ft	115 ft	25 ft	54 ft	116 ft
East Washington Street									
East of Water St	62 dB	62 dB	0 dB	28 ft	60 ft	129 ft	28 ft	61 ft	131 ft
Northeast of Lakeville St	62 dB	62 dB	0 dB	27 ft	58 ft	126 ft	28 ft	60 ft	129 ft
Water Street North									
North of E Washington St	45 dB	47 dB	+2 dB	2 ft	5 ft	10 ft	3 ft	7 ft	14 ft
Water Street									
South of E Washington St	45 dB	45 dB	0 dB	2 ft	5 ft	10 ft	2 ft	5 ft	10 ft
Lakeville Street									
Northwest of E Washington St	59 dB	59 dB	0 dB	18 ft	39 ft	85 ft	18 ft	39 ft	85 ft
Southeast of E Washington St	61 dB	61 dB	0 dB	26 ft	56 ft	121	26 ft	56 ft	122 ft

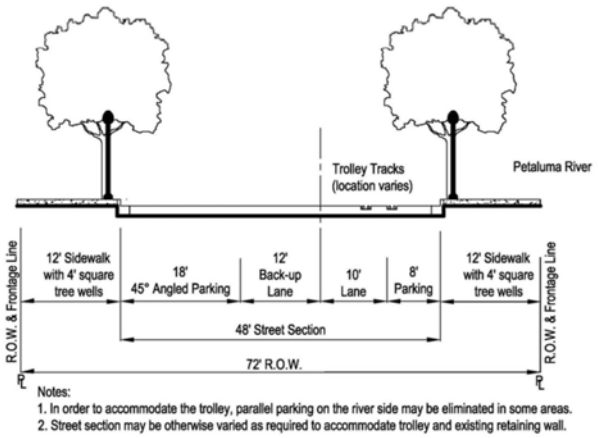
Notes: Distances to traffic noise contours are measured in feet from the centerlines of the roadways.

Source: FHWA-RD-77-108 with inputs from W-Trans, and j.c. brennan & associates, Inc. 2016.

Railroad Noise Levels

There is a railroad spur line which bisects the project site. Although this line may be removed, and the Water Street extension will occupy that site the City anticipates that a future trolley service track will occupy the right-of-way along Water Street. This is referred to in the SmartCode. The following Figure 4 shows an illustration of the location of the potential trolley service.

Figure 4
Smartcode Potential Trolley Service Location along Water Street Illustration



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A trolley service is generally an electrified train which travels at fairly slow speeds. The overall noise levels are similar to a light rail train. Noise levels conducted for the trolley train in San Diego indicated that maximum noise levels due to trolley's are approximately 80 dB at a distance of 50-feet. Based upon the analysis conducted for the San Diego trolley operations, the CNEL due to 60 trolley operations per day was 61 dBA at 50-feet (*Final Environmental Impact Statement, San Diego United States Courthouse, City of San Diego California, March 1996*).

The Northwest Pacific (NWP) rail line has an at-grade crossing with Lakeville Street at approximately 500 feet northeast of the site. This track can carry freight traffic and SMART commuter rail traffic. The previous analysis conducted by Illigworth and Rodkin, Inc. for the site indicated that future railroad noise levels would be less than 60 dB CNEL at the project site.

Industrial Noise Impacts

Based upon the site visit and noise measurement data shown in Table 2, the primary industrial noise sources are the Hunt & Behrens plant, the Dairyman's Feed Mill and the car wash to the north. Detailed notes were taken in the field during the noise measurements. The primary noise sources at the Hunt & Behrens and Dairyman's Feed Mill included air flow through grain silos, air handling equipment and truck traffic. The primary noise sources associated with the car wash were the drier blowers and vacuum stations.

Based upon the project design and the setbacks, the building facades will be exposed to industrial noise source levels. However, due to the orientation of each facade, the buildings facades will generally be exposed to noise levels associated with individual noise sources, and not the cumulative noise exposure from all sources.

The noise measurement results shown in Table 2 indicate that the project site building facades will be exposed to industrial noise levels less than the City of Petaluma noise level standard of 65 dB CNEL. It is also apparent from the noise level measurement data shown in Appendix B, that the industrial noise sources do not operate 24-hours per day, and generally operate between 6:00 a.m. and 7:00 p.m.

Interior Noise Levels at the Project Site:

Standard construction practices, consistent with the uniform building code typically provides an exterior-to-interior noise level reduction of approximately 25 dBA, assuming that air conditioning is included for each unit, which allows residents to close windows for the required acoustical isolation. Based upon the measured and calculated traffic and industrial noise levels, it is not expected that the site will be exposed to noise levels which exceed 65 dB CNEL. Therefore, typical construction practices are expected to result in compliance with the interior noise level standard of 45 dB CNEL. However, building facades which face industries and Petaluma Boulevard North will experience periodic maximum noise levels which may be considered annoying. Therefore, it is recommended that the building facades which face the industries and Petaluma Boulevard Noise include windows with a minimum STC rating of 32. It is also

recommended that PTAC units are not used for primary heating and air conditioning. It is recommended that central systems or VTAC units are included for the units.

On-Site Roof-top Mechanical Equipment Noise Levels:

There are approximately 250 condenser units located on top of the buildings. There is a 9-foot tall parapet along the edge of the roof. Using ASHRAE equations and published data for centrifugal forward curved blade fans, the sound power levels for a single units is approximately 58 dBA. The overall sound power for 250 condenser units would be approximately 81 dBA. Assuming that the sound power is located at the edge of the building, the sound level at 100-feet would be approximately 50 dBA, and below the existing ambient noise levels.

Construction Noise Levels:

Construction of the project is expected to occur for a total of 18 months. The primary noise impacts will occur during site preparation, installation of utilities and excavation of the site. The duration of these activities are expected to occur for 2 to 4 months. The primary noise sources will include a front-end loader, dump truck, concrete pump truck, backhoe and paver. During the construction of the project including related infrastructure, noise from construction activities would add to the noise environment in the project vicinity. Activities involved in construction would generate maximum noise levels, as indicated in Table 7, ranging from 76 to 82 dB at a distance of 50 feet. Construction activities would be temporary in nature and are anticipated to occur during normal daytime working hours.

Table 7
Construction Equipment Noise

Type of Equipment	Maximum Level, dB at 50 feet
Backhoe	78
Dump Truck	76
Front-end Loader	79
Concrete Pump Truck	82
Paver	77

Source: *Roadway Construction Noise Model User's Guide*. Federal Highway Administration. FHWA-HEP-05-054. January 2006.

The primary construction area of the project site is located approximately 250-feet from the nearest residences which are located at the northeast and southeast corners of Oak Street and Kentucky Street. Based upon those distances, and the maximum noise levels shown in Table 5, the maximum noise levels at the nearest residences are expected to range between 57 dBA and 63 dBA, while including some shielding due to intervening building facades. To determine the hourly Leq noise levels at the nearest residences, j.c. brennan & associates, Inc. utilized the Federal Highway Administration Roadway Noise Construction Model (RCNM) which assigns the average use of individual pieces of equipment and calculates the overall hourly Leq of all sources. For this analysis, it was assumed that the loudest noise would occur during the

grading, excavation and pouring of the foundation when the majority of heavy equipment occurs on the site. Therefore, it was assumed that the heavy equipment would include a backhoe, front-end loader, dump truck and concrete pump truck as the main noise sources.

Based upon the results of the RCNM calculations, the hourly Leq associated with the construction phase would be approximately 61.0 dBA Leq, while all equipment is operating. Therefore, the construction noise would exceed the hourly average noise level standard of 60 dBA Leq outside of the hours of 7:00 a.m. to 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and holidays.

One additional concern is the noise associated with installing piers or piles on the project site. The project proponent has stated that the preferred method is to have drilled piers and not to use pile driving. The drilling of piers is also expected to be of short duration, ranging between 1 and 2 weeks. Using the RCNM model, the predicted noise levels at the nearest residential units is 65 dBA Lmax and the hourly average is expected to be 58 dBA.

Based upon this analysis, all construction activities would be required to occur between the hours of 7:00 a.m. to 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and holidays. Based upon correspondence from the City of Petaluma, the common practice of the City is to restrict construction to the hours of 8 a.m. to 6 p.m., Monday through Friday, and between 9 a.m. and 5 p.m. on Saturdays.

CONCLUSIONS OF IMPACTS

The project will comply with the City of Petaluma noise level standards.

However, the following recommendations are provided to ensure that single noise events do not result in interior noise levels which are considered to be annoying:

1. The proposed project residential building facades which face industries and Petaluma Boulevard North should include windows with a minimum STC rating of 32;

2. It is also recommended that through-wall PTAC units are not used for primary heating and air conditioning. It is recommended that central systems or VTAC units are included for the units;

3. All construction activities would be required to occur between the hours of 7:00 a.m. to 10:00 p.m. on weekdays and 9:00 a.m. and 10:00 p.m. on weekends and holidays. Based upon correspondence from the City of Petaluma, the common practice of the City is to restrict construction to the hours of 8 a.m. to 6 p.m., Monday through Friday, and between 9 a.m. and 5 p.m. on Saturdays.

Appendix A

Acoustical Terminology

Acoustics	The science of sound.
Ambient Noise	The distinctive acoustical characteristics of a given space consisting of all noise sources audible at that location. In many cases, the term ambient is used to describe an existing or pre-project condition such as the setting in an environmental noise study.
Attenuation	The reduction of an acoustic signal.
A-Weighting	A frequency-response adjustment of a sound level meter that conditions the output signal to approximate human response.
Decibel or dB	Fundamental unit of sound, A Bell is defined as the logarithm of the ratio of the sound pressure squared over the reference pressure squared. A Decibel is one-tenth of a Bell.
CNEL	Community Noise Equivalent Level. Defined as the 24-hour average noise level with noise occurring during evening hours (7 - 10 p.m.) weighted by a factor of three and nighttime hours weighted by a factor of 10 prior to averaging.
Frequency	The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or hertz.
Ldn	Day/Night Average Sound Level. Similar to CNEL but with no evening weighting.
Leq	Equivalent or energy-averaged sound level.
Lmax	The highest root-mean-square (RMS) sound level measured over a given period of time.
L(n)	The sound level exceeded a described percentile over a measurement period. For instance, an hourly L50 is the sound level exceeded 50% of the time during the one hour period.
Loudness	A subjective term for the sensation of the magnitude of sound.
Noise	Unwanted sound.
Peak Noise	The level corresponding to the highest (not RMS) sound pressure measured over a given period of time. This term is often confused with the "Maximum" level, which is the highest RMS level.
RT_{60}	The time it takes reverberant sound to decay by 60 dB once the source has been removed.
Sabin	The unit of sound absorption. One square foot of material absorbing 100% of incident sound has an absorption of 1 sabin.
Threshold of Hearing	The lowest sound that can be perceived by the human auditory system, generally considered to be 0 dB for persons with perfect hearing.
Threshold of Pain	Approximately 120 dB above the threshold of hearing.
Impulsive	Sound of short duration, usually less than one second, with an abrupt onset and rapid decay.
Simple Tone	Any sound which can be judged as audible as a single pitch or set of single pitches.

Appendix B
Petaluma Apartments
24hr Continuous Noise Monitoring - Site A
Wednesday, July 29, 2015 - Thursday, July 30, 2015

Hour	Leq	Lmax	L50	L90
11:00	56.2	70.8	55.4	52.7
12:00	57.8	78.0	56.2	53.9
13:00	56.9	66.7	56.8	52.5
14:00	54.5	74.8	52.8	50.6
15:00	56.1	71.9	53.5	51.2
16:00	54.5	70.7	52.1	49.5
17:00	51.2	64.4	50.3	47.3
18:00	50.8	69.1	49.3	46.2
19:00	51.1	66.1	49.3	45.3
20:00	49.5	63.7	48.5	45.0
21:00	48.7	67.1	46.5	43.3
22:00	46.0	63.3	43.7	41.0
23:00	43.5	54.9	41.7	40.3
0:00	42.7	57.2	41.0	40.1
1:00	41.6	54.9	40.5	39.3
2:00	40.7	54.5	39.6	38.4
3:00	41.3	54.2	39.8	38.3
4:00	46.1	57.5	45.1	41.8
5:00	56.0	63.9	49.9	47.0
6:00	60.7	73.8	60.8	54.5
7:00	61.4	75.6	61.2	60.2
8:00	61.4	69.4	61.3	60.3
9:00	62.0	100.3	61.8	58.1
10:00	62.0	99.6	61.7	54.9

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	62	49	58	61	41	53
Lmax (Maximum)	100	64	74	74	54	59
L50 (Median)	62	46	54	61	40	45
L90 (Background)	60	43	51	54	38	42

Computed Ldn, dB	60
% Daytime Energy	84%
% Nighttime Energy	16%

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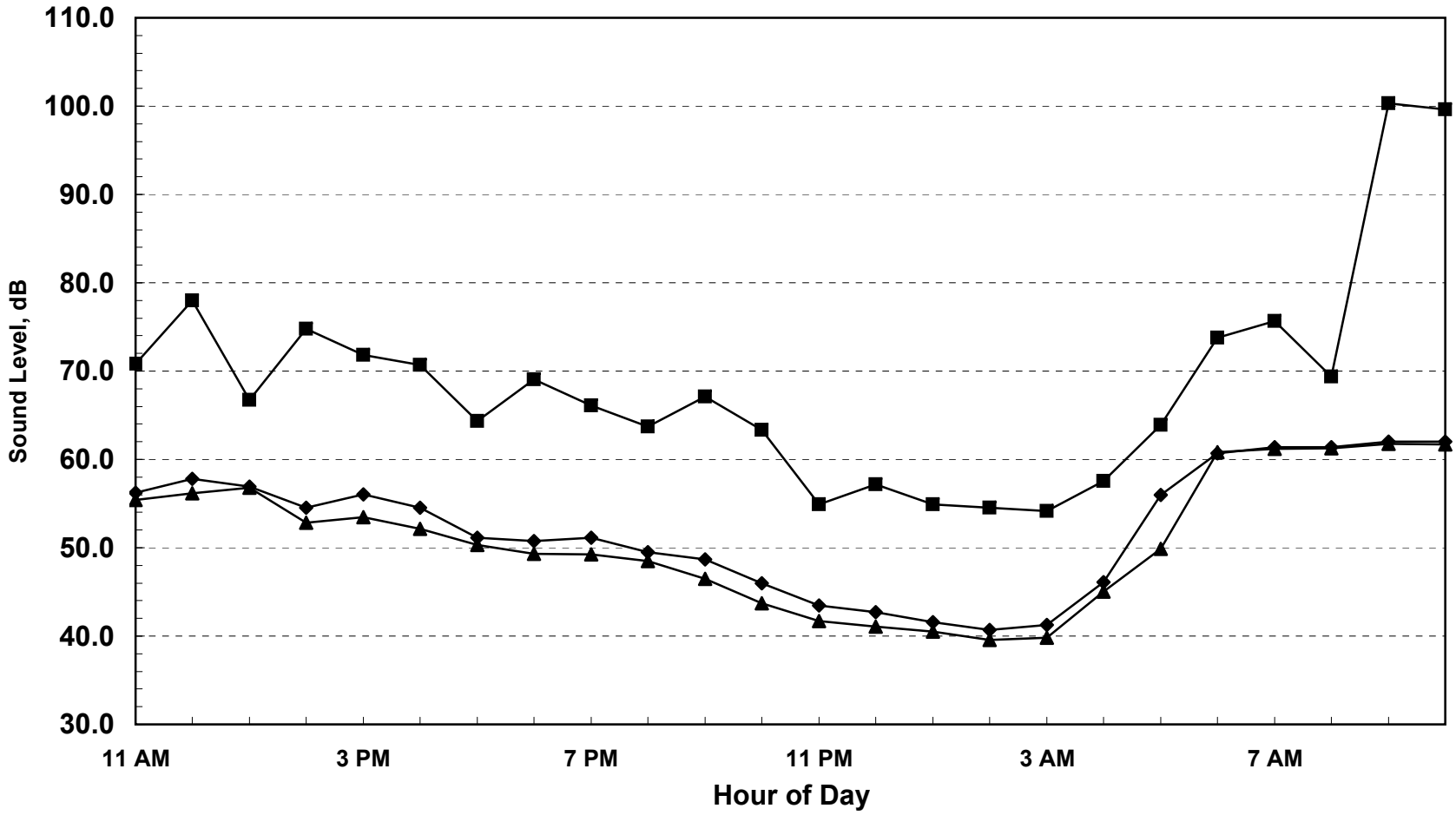
Appendix B

Petaluma Apartments

24hr Continuous Noise Monitoring - Site A

Wednesday, July 29, 2015 - Thursday, July 30, 2015



Ldn = 60 dB

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Appendix B
Petaluma Apartments
24hr Continuous Noise Monitoring - Site B
Wednesday, July 29, 2015 - Thursday, July 30, 2015

Hour	Leq	Lmax	L50	L90
11:00	66.9	89.2	64.3	57.0
12:00	73.7	106.6	65.2	57.3
13:00	66.3	82.0	64.5	57.8
14:00	68.4	94.4	65.3	55.7
15:00	72.0	101.6	66.2	59.2
16:00	68.5	88.6	67.0	60.1
17:00	67.9	83.1	67.0	60.2
18:00	67.7	89.4	65.7	56.4
19:00	67.0	88.7	64.9	54.1
20:00	65.0	79.1	62.7	50.6
21:00	65.5	88.7	60.1	48.6
22:00	62.4	80.0	55.7	44.7
23:00	59.2	74.2	48.1	41.2
0:00	57.6	78.2	44.2	40.0
1:00	54.9	76.9	40.5	38.7
2:00	53.2	75.3	39.8	37.9
3:00	51.8	70.7	39.9	37.5
4:00	56.3	76.2	43.6	39.1
5:00	62.2	81.0	54.0	47.1
6:00	67.6	89.5	63.1	52.8
7:00	67.2	86.6	64.2	53.6
8:00	67.2	81.6	65.7	56.0
9:00	67.1	84.8	65.6	57.7
10:00	67.5	85.1	65.1	57.0

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	74	65	69	68	52	61
Lmax (Maximum)	107	79	89	90	71	78
L50 (Median)	67	60	65	63	40	48
L90 (Background)	60	49	56	53	37	42

Computed Ldn, dB	70
% Daytime Energy	90%
% Nighttime Energy	10%

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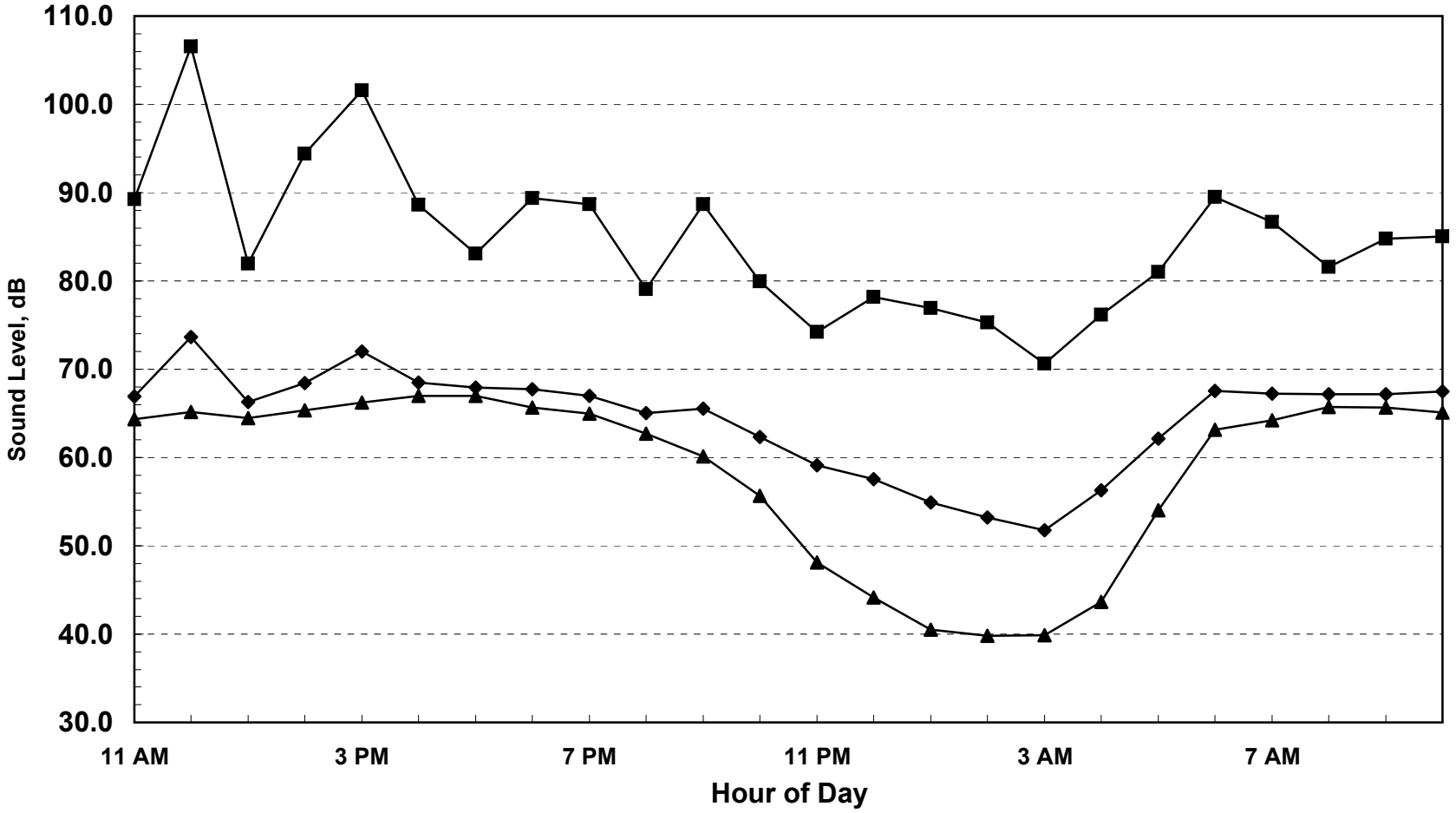
Appendix B

Petaluma Apartments

24hr Continuous Noise Monitoring - Site B

Wednesday, July 29, 2015 - Thursday, July 30, 2015



Ldn = 70 dB

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Appendix B
Petaluma Apartments
24hr Continuous Noise Monitoring - Site C
Wednesday, July 29, 2015 - Thursday, July 30, 2015

Hour	Leq	Lmax	L50	L90
11:00	58.4	69.4	56.7	53.7
12:00	61.4	83.4	59.0	55.8
13:00	58.9	72.1	57.8	55.2
14:00	60.2	83.6	57.9	54.2
15:00	60.8	76.6	58.3	54.7
16:00	60.3	73.3	58.0	54.1
17:00	58.9	76.2	56.4	52.4
18:00	60.2	78.7	55.7	51.1
19:00	57.6	75.4	55.2	50.9
20:00	56.3	73.8	54.5	49.2
21:00	54.2	72.4	50.9	46.3
22:00	49.3	69.2	46.7	43.1
23:00	46.3	60.3	44.0	42.2
0:00	45.4	61.7	43.4	42.0
1:00	46.6	66.8	42.8	41.2
2:00	46.5	62.1	43.3	40.9
3:00	46.5	64.0	42.9	40.6
4:00	49.2	63.9	47.7	45.3
5:00	55.5	74.7	52.2	48.2
6:00	58.9	76.5	58.2	55.3
7:00	59.7	74.1	58.6	57.4
8:00	59.2	66.2	58.8	57.9
9:00	65.9	82.6	61.5	58.3
10:00	61.8	81.9	60.0	55.8

	Statistical Summary					
	Daytime (7 a.m. - 10 p.m.)			Nighttime (10 p.m. - 7 a.m.)		
	High	Low	Average	High	Low	Average
Leq (Average)	66	54	60	59	45	52
Lmax (Maximum)	84	66	76	76	60	67
L50 (Median)	61	51	57	58	43	47
L90 (Background)	58	46	54	55	41	44

Computed Ldn, dB	61
% Daytime Energy	92%
% Nighttime Energy	8%

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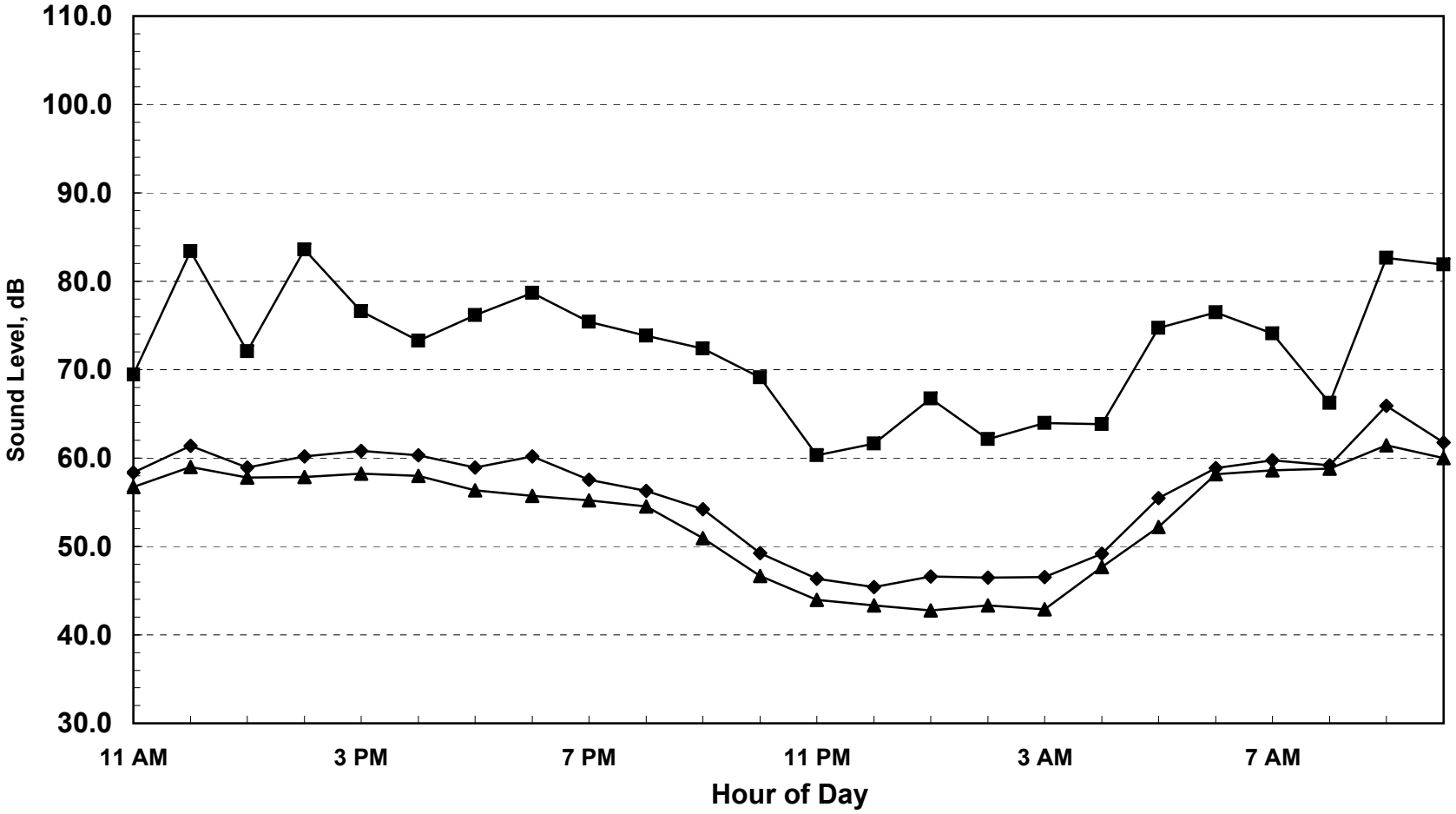
Appendix B

Petaluma Apartments

24hr Continuous Noise Monitoring - Site C

Wednesday, July 29, 2015 - Thursday, July 30, 2015



Ldn = 61 dB

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2016-153 Petaluma Apartments
Description: Exisiting
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Petaluma Boulevard North	North of Lakeville Street	18160	90		10	2	2	30	100	
2	Petaluma Boulevard North	South of Lakeville Street	14960	90		10	2	2	30	100	
3	Petaluma Boulevard North	North of Oak Street	15870	90		10	2	2	30	100	
4	Petaluma Boulevard North	South of Oak Street	14370	90		10	2	2	30	100	
5	Petaluma Boulevard North	North of East Washington Street	13130	90		10	2	2	30	100	
6	Petaluma Boulevard North	South of East Washington Street	10940	90		10	2	2	30	100	
7	Oak Street	West of Petaluma Boulevard North	1820	90		10	2	2	25	100	
8	Washington Street	West of Petaluma Boulevard North	18520	90		10	2	2	25	100	
9	East Washington Street	East of Water Street	21270	90		10	2	2	25	100	
10	East Washington Street	Northeast of Lakeville Street	18800	90		10	2	2	25	100	
11	Water Street North	North of East Washington Street		90			2	2	25	100	
12	Water Street	South of East Washington Street		90			2	2	25	100	
13	Lakeville Street	Northwest of East Washington Street	4460	90		10	2	2	30	100	
14	Lakeville Street	Southeast of East Washington Street	9430	90		10	2	2	30	100	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2016-153 Petaluma Apartments
Description: Exisiting
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Petaluma Boulevard North	North of Lakeville Street	58.0	51.8	58.9	62
2	Petaluma Boulevard North	South of Lakeville Street	57.2	51.0	58.1	61
3	Petaluma Boulevard North	North of Oak Street	57.4	51.2	58.3	61
4	Petaluma Boulevard North	South of Oak Street	57.0	50.8	57.9	61
5	Petaluma Boulevard North	North of East Washington Street	56.6	50.4	57.5	61
6	Petaluma Boulevard North	South of East Washington Street	55.8	49.6	56.7	60
7	Oak Street	West of Petaluma Boulevard North	45.8	40.6	48.2	51
8	Washington Street	West of Petaluma Boulevard North	55.8	50.6	58.3	61
9	East Washington Street	East of Water Street	56.4	51.2	58.9	61
10	East Washington Street	Northeast of Lakeville Street	55.9	50.7	58.3	61
11	Water Street North	North of East Washington Street				
12	Water Street	South of East Washington Street				
13	Lakeville Street	Northwest of East Washington Street	51.9	45.7	52.8	56
14	Lakeville Street	Southeast of East Washington Street	55.2	48.9	56.1	59

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2016-153 Petaluma Apartments
Description: Exisiting
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Petaluma Boulevard North	North of Lakeville Street	13	29	63	135	291
2	Petaluma Boulevard North	South of Lakeville Street	12	26	55	119	255
3	Petaluma Boulevard North	North of Oak Street	12	27	57	123	266
4	Petaluma Boulevard North	South of Oak Street	12	25	54	115	249
5	Petaluma Boulevard North	North of East Washington Street	11	23	50	109	234
6	Petaluma Boulevard North	South of East Washington Street	10	21	45	96	207
7	Oak Street	West of Petaluma Boulevard North	2	5	11	24	51
8	Washington Street	West of Petaluma Boulevard North	11	24	52	111	239
9	East Washington Street	East of Water Street	12	26	57	122	263
10	East Washington Street	Northeast of Lakeville Street	11	24	52	112	242
11	Water Street North	North of East Washington Street					
12	Water Street	South of East Washington Street					
13	Lakeville Street	Northwest of East Washington Street	5	11	25	53	114
14	Lakeville Street	Southeast of East Washington Street	9	19	40	87	188

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Petaluma Boulevard North	North of Lakeville Street	19580	90		10	2	2	30	100	
2	Petaluma Boulevard North	South of Lakeville Street	16090	90		10	2	2	30	100	
3	Petaluma Boulevard North	North of Oak Street	16680	90		10	2	2	30	100	
4	Petaluma Boulevard North	South of Oak Street	15180	90		10	2	2	30	100	
5	Petaluma Boulevard North	North of East Washington Street	15450	90		10	2	2	30	100	
6	Petaluma Boulevard North	South of East Washington Street	12480	90		10	2	2	30	100	
7	Oak Street	West of Petaluma Boulevard North	1820	90		10	2	2	25	100	
8	Washington Street	West of Petaluma Boulevard North	19380	90		10	2	2	25	100	
9	East Washington Street	East of Water Street	18560	90		10	2	2	25	100	
10	East Washington Street	Northeast of Lakeville Street	21780	90		10	2	2	25	100	
11	Water Street North	North of East Washington Street	500	90		10	2	2	25	100	
12	Water Street	South of East Washington Street	370	90		10	2	2	25	100	
13	Lakeville Street	Northwest of East Washington Street	4990	90		10	2	2	30	100	
14	Lakeville Street	Southeast of East Washington Street	10440	90		10	2	2	30	100	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Petaluma Boulevard North	North of Lakeville Street	58.4	52.1	59.2	62
2	Petaluma Boulevard North	South of Lakeville Street	57.5	51.3	58.4	61
3	Petaluma Boulevard North	North of Oak Street	57.7	51.4	58.5	62
4	Petaluma Boulevard North	South of Oak Street	57.3	51.0	58.1	61
5	Petaluma Boulevard North	North of East Washington Street	57.3	51.1	58.2	61
6	Petaluma Boulevard North	South of East Washington Street	56.4	50.2	57.3	60
7	Oak Street	West of Petaluma Boulevard North	45.8	40.6	48.2	51
8	Washington Street	West of Petaluma Boulevard North	56.0	50.8	58.5	61
9	East Washington Street	East of Water Street	55.8	50.7	58.3	61
10	East Washington Street	Northeast of Lakeville Street	56.5	51.3	59.0	61
11	Water Street North	North of East Washington Street	40.1	35.0	42.6	45
12	Water Street	South of East Washington Street	38.8	33.6	41.3	44
13	Lakeville Street	Northwest of East Washington Street	52.4	46.2	53.3	56
14	Lakeville Street	Southeast of East Washington Street	55.6	49.4	56.5	60

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Petaluma Boulevard North	North of Lakeville Street	14	31	66	142	305
2	Petaluma Boulevard North	South of Lakeville Street	12	27	58	124	268
3	Petaluma Boulevard North	North of Oak Street	13	27	59	127	275
4	Petaluma Boulevard North	South of Oak Street	12	26	56	120	258
5	Petaluma Boulevard North	North of East Washington Street	12	26	56	121	261
6	Petaluma Boulevard North	South of East Washington Street	11	23	49	105	226
7	Oak Street	West of Petaluma Boulevard North	2	5	11	24	51
8	Washington Street	West of Petaluma Boulevard North	11	25	53	115	247
9	East Washington Street	East of Water Street	11	24	52	111	240
10	East Washington Street	Northeast of Lakeville Street	12	27	57	124	267
11	Water Street North	North of East Washington Street	1	2	5	10	22
12	Water Street	South of East Washington Street	1	2	4	8	18
13	Lakeville Street	Northwest of East Washington Stree	6	12	26	57	123
14	Lakeville Street	Southeast of East Washington Stree	9	20	43	93	201

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Petaluma Boulevard North	North of Lakeville Street	19,770	90		10	2	2	30	100	
2	Petaluma Boulevard North	South of Lakeville Street	16,280	90		10	2	2	30	100	
3	Petaluma Boulevard North	North of Oak Street	17,260	90		10	2	2	30	100	
4	Petaluma Boulevard North	South of Oak Street	15,550	90		10	2	2	30	100	
5	Petaluma Boulevard North	North of East Washington Street	15,830	90		10	2	2	30	100	
6	Petaluma Boulevard North	South of East Washington Street	12,680	90		10	2	2	30	100	
7	Oak Street	West of Petaluma Boulevard North	1,820	90		10	2	2	25	100	
8	Washington Street	West of Petaluma Boulevard North	19,500	90		10	2	2	25	100	
9	East Washington Street	East of Water Street	19,040	90		10	2	2	25	100	
10	East Washington Street	Northeast of Lakeville Street	22,570	90		10	2	2	25	100	
11	Water Street North	North of East Washington Street	810	90		10	2	2	25	100	
12	Water Street	South of East Washington Street	370	90		10	2	2	25	100	
13	Lakeville Street	Northwest of East Washington Street	4,990	90		10	2	2	30	100	
14	Lakeville Street	Southeast of East Washington Street	10,510	90		10	2	2	30	100	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Petaluma Boulevard North	North of Lakeville Street	58.4	52.2	59.3	62
2	Petaluma Boulevard North	South of Lakeville Street	57.6	51.3	58.4	61
3	Petaluma Boulevard North	North of Oak Street	57.8	51.6	58.7	62
4	Petaluma Boulevard North	South of Oak Street	57.4	51.1	58.2	61
5	Petaluma Boulevard North	North of East Washington Street	57.4	51.2	58.3	61
6	Petaluma Boulevard North	South of East Washington Street	56.5	50.2	57.4	60
7	Oak Street	West of Petaluma Boulevard North	45.8	40.6	48.2	51
8	Washington Street	West of Petaluma Boulevard North	56.1	50.9	58.5	61
9	East Washington Street	East of Water Street	56.0	50.8	58.4	61
10	East Washington Street	Northeast of Lakeville Street	56.7	51.5	59.1	62
11	Water Street North	North of East Washington Street	42.2	37.1	44.7	47
12	Water Street	South of East Washington Street	38.8	33.6	41.3	44
13	Lakeville Street	Northwest of East Washington Street	52.4	46.2	53.3	56
14	Lakeville Street	Southeast of East Washington Street	55.7	49.4	56.5	60

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2016-153 Petaluma Apartments
Description: Exisiting Plus Pipeline Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Petaluma Boulevard North	North of Lakeville Street	14	31	66	143	307
2	Petaluma Boulevard North	South of Lakeville Street	13	27	58	125	270
3	Petaluma Boulevard North	North of Oak Street	13	28	61	130	281
4	Petaluma Boulevard North	South of Oak Street	12	26	56	122	262
5	Petaluma Boulevard North	North of East Washington Street	12	27	57	123	265
6	Petaluma Boulevard North	South of East Washington Street	11	23	49	106	229
7	Oak Street	West of Petaluma Boulevard North	2	5	11	24	51
8	Washington Street	West of Petaluma Boulevard North	12	25	53	115	248
9	East Washington Street	East of Water Street	11	24	53	113	244
10	East Washington Street	Northeast of Lakeville Street	13	27	59	127	273
11	Water Street North	North of East Washington Street	1	3	6	14	30
12	Water Street	South of East Washington Street	1	2	4	8	18
13	Lakeville Street	Northwest of East Washington Stree	6	12	26	57	123
14	Lakeville Street	Southeast of East Washington Stree	9	20	43	94	202

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2016-153 Petaluma Apartments
Description: Cumulative
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Petaluma Boulevard North	North of Lakeville Street	27,620	90		10	2	2	30	100	
2	Petaluma Boulevard North	South of Lakeville Street	22,700	90		10	2	2	30	100	
3	Petaluma Boulevard North	North of Oak Street	18,500	90		10	2	2	30	100	
4	Petaluma Boulevard North	South of Oak Street	16,910	90		10	2	2	30	100	
5	Petaluma Boulevard North	North of East Washington Street	17,760	90		10	2	2	30	100	
6	Petaluma Boulevard North	South of East Washington Street	19,400	90		10	2	2	30	100	
7	Oak Street	West of Petaluma Boulevard North	2,110	90		10	2	2	25	100	
8	Washington Street	West of Petaluma Boulevard North	19,510	90		10	2	2	25	100	
9	East Washington Street	East of Water Street	23,170	90		10	2	2	25	100	
10	East Washington Street	Northeast of Lakeville Street	22,350	90		10	2	2	25	100	
11	Water Street North	North of East Washington Street	520	90		10	2	2	25	100	
12	Water Street	South of East Washington Street	520	90		10	2	2	25	100	
13	Lakeville Street	Northwest of East Washington Street	9,080	90		10	2	2	30	100	
14	Lakeville Street	Southeast of East Washington Street	15,480	90		10	2	2	30	100	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2016-153 Petaluma Apartments
Description: Cumulative
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Petaluma Boulevard North	North of Lakeville Street	59.9	53.6	60.7	64
2	Petaluma Boulevard North	South of Lakeville Street	59.0	52.8	59.9	63
3	Petaluma Boulevard North	North of Oak Street	58.1	51.9	59.0	62
4	Petaluma Boulevard North	South of Oak Street	57.7	51.5	58.6	62
5	Petaluma Boulevard North	North of East Washington Street	57.9	51.7	58.8	62
6	Petaluma Boulevard North	South of East Washington Street	58.3	52.1	59.2	62
7	Oak Street	West of Petaluma Boulevard North	46.4	41.2	48.8	51
8	Washington Street	West of Petaluma Boulevard North	56.1	50.9	58.5	61
9	East Washington Street	East of Water Street	56.8	51.6	59.2	62
10	East Washington Street	Northeast of Lakeville Street	56.7	51.5	59.1	62
11	Water Street North	North of East Washington Street	40.3	35.1	42.8	45
12	Water Street	South of East Washington Street	40.3	35.1	42.8	45
13	Lakeville Street	Northwest of East Washington Street	55.0	48.8	55.9	59
14	Lakeville Street	Southeast of East Washington Street	57.3	51.1	58.2	61

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2016-153 Petaluma Apartments
Description: Cumulative
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Petaluma Boulevard North	North of Lakeville Street	18	38	83	178	384
2	Petaluma Boulevard North	South of Lakeville Street	16	34	73	156	337
3	Petaluma Boulevard North	North of Oak Street	14	29	63	137	294
4	Petaluma Boulevard North	South of Oak Street	13	28	60	129	277
5	Petaluma Boulevard North	North of East Washington Street	13	29	62	133	286
6	Petaluma Boulevard North	South of East Washington Street	14	30	65	141	304
7	Oak Street	West of Petaluma Boulevard North	3	6	12	26	56
8	Washington Street	West of Petaluma Boulevard North	12	25	53	115	248
9	East Washington Street	East of Water Street	13	28	60	129	278
10	East Washington Street	Northeast of Lakeville Street	13	27	58	126	271
11	Water Street North	North of East Washington Street	1	2	5	10	22
12	Water Street	South of East Washington Street	1	2	5	10	22
13	Lakeville Street	Northwest of East Washington Stree	8	18	39	85	183
14	Lakeville Street	Southeast of East Washington Stree	12	26	56	121	261

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Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model

Data Input Sheet

Project #: 2016-153 Petaluma Apartments
Description: Cumulative Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	ADT	Day %	Eve %	Night %	% Med. Trucks	% Hvy. Trucks	Speed	Distance	Offset (dB)
1	Petaluma Boulevard North	North of Lakeville Street	27,810	90		10	2	2	30	100	
2	Petaluma Boulevard North	South of Lakeville Street	22,890	90		10	2	2	30	100	
3	Petaluma Boulevard North	North of Oak Street	19,080	90		10	2	2	30	100	
4	Petaluma Boulevard North	South of Oak Street	17,280	90		10	2	2	30	100	
5	Petaluma Boulevard North	North of East Washington Street	18,140	90		10	2	2	30	100	
6	Petaluma Boulevard North	South of East Washington Street	19,600	90		10	2	2	30	100	
7	Oak Street	West of Petaluma Boulevard North	2,110	90		10	2	2	25	100	
8	Washington Street	West of Petaluma Boulevard North	19,630	90		10	2	2	25	100	
9	East Washington Street	East of Water Street	23,650	90		10	2	2	25	100	
10	East Washington Street	Northeast of Lakeville Street	23,140	90		10	2	2	25	100	
11	Water Street North	North of East Washington Street	830	90		10	2	2	25	100	
12	Water Street	South of East Washington Street	520	90		10	2	2	25	100	
13	Lakeville Street	Northwest of East Washington Street	9,080	90		10	2	2	30	100	
14	Lakeville Street	Southeast of East Washington Street	15,550	90		10	2	2	30	100	

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Predicted Levels

Project #: 2016-153 Petaluma Apartments
Description: Cumulative Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

Segment	Roadway Name	Segment Description	Autos	Medium Trucks	Heavy Trucks	Total
1	Petaluma Boulevard North	North of Lakeville Street	59.9	53.6	60.8	64
2	Petaluma Boulevard North	South of Lakeville Street	59.0	52.8	59.9	63
3	Petaluma Boulevard North	North of Oak Street	58.2	52.0	59.1	62
4	Petaluma Boulevard North	South of Oak Street	57.8	51.6	58.7	62
5	Petaluma Boulevard North	North of East Washington Street	58.0	51.8	58.9	62
6	Petaluma Boulevard North	South of East Washington Street	58.4	52.1	59.2	62
7	Oak Street	West of Petaluma Boulevard North	46.4	41.2	48.8	51
8	Washington Street	West of Petaluma Boulevard North	56.1	50.9	58.5	61
9	East Washington Street	East of Water Street	56.9	51.7	59.3	62
10	East Washington Street	Northeast of Lakeville Street	56.8	51.6	59.2	62
11	Water Street North	North of East Washington Street	42.4	37.2	44.8	47
12	Water Street	South of East Washington Street	40.3	35.1	42.8	45
13	Lakeville Street	Northwest of East Washington Street	55.0	48.8	55.9	59
14	Lakeville Street	Southeast of East Washington Street	57.4	51.1	58.2	61

Appendix C

FHWA-RD-77-108 Highway Traffic Noise Prediction Model
Noise Contour Output

Project #: 2016-153 Petaluma Apartments
Description: Cumulative Plus Project
Ldn/CNEL: Ldn
Hard/Soft: Soft

			-------- Distances to Traffic Noise Contours --------				
Segment	Roadway Name	Segment Description	75	70	65	60	55
1	Petaluma Boulevard North	North of Lakeville Street	18	39	83	179	386
2	Petaluma Boulevard North	South of Lakeville Street	16	34	73	157	339
3	Petaluma Boulevard North	North of Oak Street	14	30	65	139	300
4	Petaluma Boulevard North	South of Oak Street	13	28	61	130	281
5	Petaluma Boulevard North	North of East Washington Street	13	29	63	135	290
6	Petaluma Boulevard North	South of East Washington Street	14	31	66	142	306
7	Oak Street	West of Petaluma Boulevard North	3	6	12	26	56
8	Washington Street	West of Petaluma Boulevard North	12	25	54	116	249
9	East Washington Street	East of Water Street	13	28	61	131	282
10	East Washington Street	Northeast of Lakeville Street	13	28	60	129	278
11	Water Street North	North of East Washington Street	1	3	7	14	30
12	Water Street	South of East Washington Street	1	2	5	10	22
13	Lakeville Street	Northwest of East Washington Stree	8	18	39	85	183
14	Lakeville Street	Southeast of East Washington Stree	12	26	56	122	262

Appendix D

Roadway Construction Noise Model (RCNM),Version 1.0

Report date ########
Case Description Building at Nearest Site

		---- Receptor #1 ----		
		Baselines (dBA)		
Description	Land Use	Daytime	Evening	Night
Nearest Re	Residential	60	60	50

Description	Impact Device	Usage(%)	Equipment Spec Lmax (dBA)	Actual Lmax (dBA)	Receptor Distance (feet)	Estimated Shielding (dBA)
Concrete Pump Truck	No	20		81.4	250	5
Dump Truck	No	40		76.5	250	5
Front End Loader	No	40		79.1	250	5
Backhoe	No	40		77.6	250	5

	Calculated (dBA)		Results Noise Limits (dBA)			
			Day		Evening	
Equipment	*Lmax	Leq	Lmax	Leq	Lmax	Leq
Concrete Pump Truck	62.4	55.4	N/A	N/A	N/A	N/A
Dump Truck	57.5	53.5	N/A	N/A	N/A	N/A
Front End Loader	60.1	56.2	N/A	N/A	N/A	N/A
Backhoe	58.6	54.6	N/A	N/A	N/A	N/A
Total	62.4	61	N/A	N/A	N/A	N/A

*Calculated Lmax is the Loudest value.