CHRISTOPHER JEAN & ASSOCIATES, INC.
ACOUSTICAL CONSULTING SERVICES

November 19, 2021

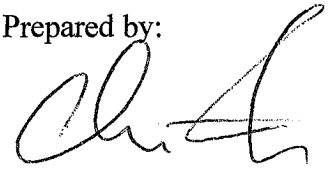
ACOUSTICAL ANALYSIS

CONSTRUCTION NOISE

TENTATIVE TRACT MAP NO. 72739

CITY OF LANCASTER

Prepared by:



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SUMMARY

This analysis has been completed to determine the potential construction noise impacts and the necessary mitigation measures for the proposed Tentative Tract Map No. 72739 project located at West Avenue K and 65th Street West in the City of Lancaster. A list of requirements and recommendations is given in the following summary. Details are discussed in the body of the report.

A. EXTERIOR NOISE CONTROL

Temporary sound barriers 12 feet high should be erected opposite the residential uses nearest the project site as shown in Exhibit 4.

B. NOISE CONTROL BARRIER CONSTRUCTION MATERIALS

The temporary noise control barriers may be constructed using any of the following materials:

(1) Industrial Sound Blankets hung on chain link fencing

(2) 1/2" OSB panels screwed to chain link fencing

Each completed noise control barrier must present a solid face from top-to-bottom and end-to-end. Panel edges should overlap to avoid acoustical leakage.

C. ADDITIONAL MEASURES

In addition to the temporary sound barriers, the project should employ the following measures throughout the duration of the project:

1) Maintain all construction equipment is like-new operating condition including well maintained mufflers, guards and body panels,

2) All work to occur within 500 feet of the nearest existing residential uses shall be scheduled to achieve the shortest possible work durations in these areas,

3) Signs shall be posted within 500 feet of the nearest existing residential uses advising construction workers to avoid creating excessive noise,

The nature of construction work means that there will be unavoidable noise impacts. However, the recommended noise reduction measures should keep most of the existing residents from becoming highly annoyed by project noise levels.

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1.0 INTRODUCTION

This report presents the results of a construction noise impact and nitigation study of the proposed Tentative Tract Map No. 72739 project located at West Avenue K and 65th Street West in the City of Lancaster. This report includes a discussion of the existing exterior community noise environment and the recommendations for control of construction noise on the project site.

A vicinity map showing the general location of the project site is presented in Exhibit 1 – Site Location Map. An aerial photograph of the existing project site and its surroundings is shown on Exhibit 2. The project site plan is shown on Exhibit 3. The project consists of 75 single-family residential lots.

2.0 APPLICABLE NOISE CRITERIA

The City of Lancaster employs a "nuisance" style noise ordinance in its Municipal Code. A "nuisance" style ordinance uses subjective reaction to a specific noise source to define whether it is an impacting nuisance. Finite numerical noise limits are not employed making it difficult to define compliance. The applicable sections of the Lancaster Municipal Code are given below.

8.24.030 - Loud, unnecessary and unusual noises prohibited.

Notwithstanding any other provision of this chapter, and in addition thereto, no person shall make, cause or suffer, or permit to be made upon any premises owned, occupied or controlled by him/her any unnecessary noises or sounds which are physically annoying to persons of ordinary sensitiveness which are so harsh or so prolonged or unnatural or unusual in their use, time, or place as to occasion physical discomfort to the inhabitants of any neighborhood. All animals shall be so maintained.

8.24.040 - Loud, unnecessary and unusual noises prohibited—Construction and building.

Except as otherwise provided in this chapter, a person at any time on Sunday or any day between the hours of eight p.m. and seven a.m. shall not perform any construction or repair work of any kind upon any building or

structure or perform any earth excavating, filling or moving where any of the foregoing entails the use of any air compressor, jack hammer, power-driven drill, riveting machine, excavator, diesel-powered truck, tractor or other earth-moving equipment, hard hammers on steel or iron or any other machine tool, device or equipment which makes loud noises within five hundred (500) feet of an occupied dwelling, apartment, hotel, mobile home or other place of residence.

While Section 8.24.030 appears to state that any noise that creates a complaint is considered to be a violation of the City's Noise Ordinance, Section 8.24.040 allows construction noise to occur anytime between the hours of 7:00 a.m. and 8:00 p.m. Monday through Saturday. However, Section 8.24.040 does not specifically exempt construction noise occurring during the allowed hours.

As the ambiguity of Sections 8.24.030 and 8.24.040 make it difficult to define construction noise compliance with the "nuisance" limits of the Noise Ordinance, the City's Development Code does require that exterior noise be mitigated to 45 dBA CNEL on the interior of new residential structures. Since the Development Code assumes that an interior noise limit of 45 dBA CNEL will not annoy local residents, the analysis will use this interior noise limit to define compliance.

Please see Noise Rating Methods (Appendix 1) for an explanation of the commonly applicable acoustical terminology.

3.0 EXISTING NOISE LEVELS

3.1 ROADWAYS

The existing roadway noise impact was projected using the Federal Highway Administration's Highway Noise Prediction Model (FHWA RD-77-108) together with several roadway and site parameters that determine the projected impact of vehicular traffic noise. These include the roadway cross-section (e.g. number of lanes), the roadway active width, the average daily traffic (ADT), the vehicle travel speed, the percentage of auto and truck traffic, the roadway grade, the angle of view, the site conditions ("hard" or "soft" site), and the percentage of average daily traffic that flows each hour throughout a 24 hour period.

The existing traffic volume of 3,000 ADT was estimated using the year 2014 ADT volumes published by the Traffic Engineering Department of the City of Lancaster. The percentage of truck traffic was taken from a standard arterial mix. The same source was used to project the distribution by time of day. The input data is listed in Table 1 on the following page.

TABLE 1

TRAFFIC INPUT DATA

	% DAY	% EVENING	% NIGHT	% VOLUME
Autos	75.51	12.57	9.34	100.0
Medium Trucks	1.56	0.09	0.19	100.0
Heavy Trucks	0.64	0.02	0.08	100.0

Volume = 3,000 ADT on West Avenue K

Speed = 55 MPH

The existing traffic noise calculation is contained in Appendix 2 and shows that the existing residential uses nearest the project site (northeast corner) are exposed to exterior noise levels no higher than 53 dBA CNEL. This results in interior noise levels no higher than 43 dBA CNEL with windows open.

3.2 RAILROAD

There are no railroad operations in the vicinity of the project site. Railroad noise does not impact the site.

3.3 AIRCRAFT

There are no concentrated aircraft operations in the vicinity of the project site. Aircraft noise does not impact the site.

4.0 CONSTRUCTION NOISE LEVELS

Construction activities can include noise sources ranging from simple hand tools up to very large machines used for grading, excavation and foundation preparation. As the project site is already flat and nearly build-ready, only minor grading and excavation will be necessary. This means that the most prolonged noise sources will be the use of saws, pneumatic nailers, air compressors, and construction vehicles used to move building materials. Even so, each construction phase will occupy the area of the project site adjacent to existing residential uses for limited time periods. For instance, grading and excavation of the project site could take a month although such operations occurring in proximity to existing residential might only take a week

before moving on to other portions of the site. The same will occur for the foundation, framing, roofing, drywall, paint and landscaping phases.

A list of typical construction noise sources likely to be used on this project and the 50 foot reference noise levels are given in Table 2 on the following page.

TABLE 2

AVERAGE MAXIMUM NOISE LEVELS AT 50 FEET
FROM COMMON CONSTRUCTION EQUIPMENT

EQUIPMENT DESCRIPTION	MAX LEVEL AT 50 FEET
Backhoe	78
Compactor	83
Concrete Mixer Truck	79
Concrete Pump Truck	81
Concrete Saw	90
Dozer	82
Drum Mixer	80
Dump Truck	76
Excavator	81
Flat Bed Truck	74
Front End Loader	79
Generator	81
Grader	89
Jackhammer	89
Paver	77
Pickup Truck	75
Pneumatic Tools	85
Roller	80
Saw	76

Table 2 shows that maximum noise levels as high as 90 can occur for certain construction noise sources. However, in order to compare these noise sources to the compliance goal of 45 dBA CNEL, the analysis must convert the Table 2 levels to average noise levels. The actual duration of use of each source will determine the average noise level. For instance, a pickup

truck might drive by a receiver once in an hour. A passing pickup truck might be audible at a certain receiver point for around 30 seconds. If only one truck passes in an hour, the resulting average noise level is only 54 dBA Leq. On the other hand, a generator could run continuously throughout a workday. In this case, the average noise level would be similar to the maximum level.

Table 3 on the following page lists the likely 50 foot average noise levels for each construction noise sources given in Table 2.

TABLE 3

LIKELY AVERAGE NOISE LEVELS AT 50 FEET
FROM COMMON CONSTRUCTION EQUIPMENT

EQUIPMENT DESCRIPTION	LEQ AT 50 FEET
Backhoe	68
Compactor	78
Concrete Mixer Truck	79
Concrete Pump Truck	81
Concrete Saw	80
Dozer	72
Drum Mixer	80
Dump Truck	66
Excavator	71
Flat Bed Truck	54
Front End Loader	69
Generator	81
Grader	79
Jackhammer	79
Paver	67
Pickup Truck	55
Pneumatic Tools	75
Roller	70
Saw	66

In addition to the fact that some construction noise sources will be in a fixed position all day, many construction noise sources will move around the site and/or be used for only portions of the workday. As the analysis must compare the construction noise sources to the 24 hour

CNEL noise limit, the likely average noise level for each noise source over 24 hour period is listed in Table 4.

TABLE 4

24 HOUR CNEL NOISE LEVELS AT 50 FEET
FROM COMMON CONSTRUCTION EQUIPMENT

EQUIPMENT DESCRIPTION	24 HOUR CNEL AT 50 FEET
Backhoe	60
Compactor	70
Concrete Mixer Truck	70
Concrete Pump Truck	72
Concrete Saw	69
Dozer	61
Drum Mixer	74
Dump Truck	52
Excavator	63
Flat Bed Truck	40
Front End Loader	61
Generator	76
Grader	71
Jackhammer	71
Paver	59
Pickup Truck	41
Pneumatic Tools	64
Roller	62
Saw	55

The results of Table 4 show that most of the construction noise sources will exceed the exterior noise level of 55 dBA CNEL needed to achieve 45 dBA CNEL on the interior of the nearest residential uses. Noise reduction measures will be necessary to achieve compliance with an interior noise limit of 45 dBA CNEL.

5.0 MITIGATION MEASURES

Because of the mostly mobile noise sources on a construction site, passive means of noise reduction, such as temporary sound barriers, are only partially effective. If a means of creating movable temporary sound barriers can be devised, then reduction of construction noise levels can be more effective.

Temporary sound barriers can be fabricated by attaching either 1/2" thick sheets of OSB or industrial sound blankets to sections of chain link fencing. If movable chain link fence sections with tubular steel footings are used, then the temporary sound barriers can be moveable, too. Barrier shielding calculations contained in Appendix 3 show that temporary sound barriers eight feet (8') high will provide around 7 dBA of noise reduction at the first floor level but no reduction at the second floor level. Sound barriers twelve feet (12') high will provide around 11 dBA of noise reduction at the first floor level and 6 dBA at the second floor level. Thus, it is recommended that temporary sound barriers 12 feet high be erected opposite the residential uses nearest the project site as shown in Exhibit 4.

Although such temporary sound barriers cannot provide sufficient noise reduction to meet the 45 dBA CNEL interior noise limit for all construction noise sources, the existing residents can achieve an additional 10 dBA of noise reduction by simply closing their windows. Since these residences are equipped with air conditioning, the need to close windows to maintain an acceptable interior noise environment does not present a hardship.

In addition to the temporary sound barriers, the project should employ the following measures throughout the duration of the project:

1) Maintain all construction equipment is like-new operating condition including well maintained mufflers, guards and body panels,

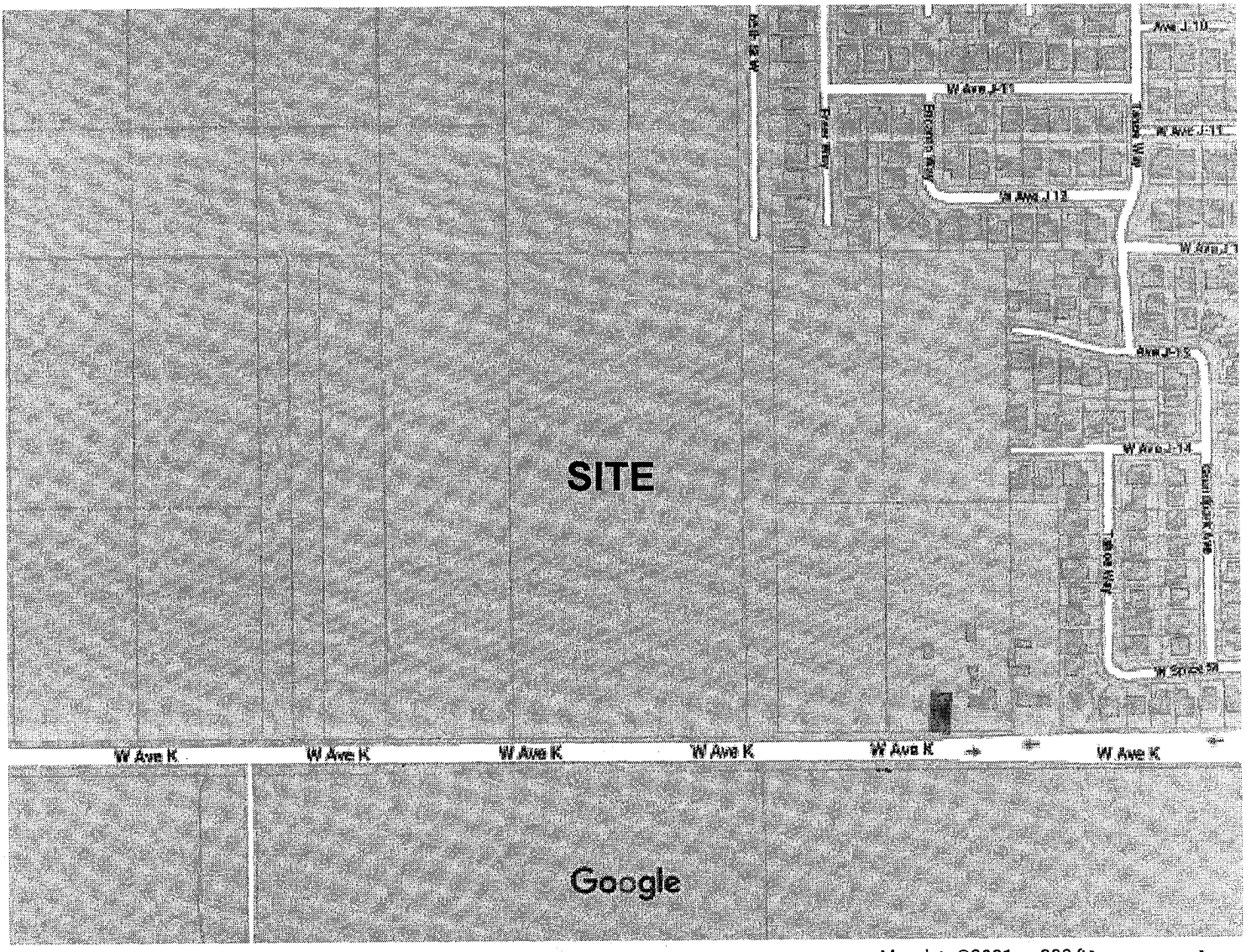
2) All work to occur within 500 feet of the nearest existing residential uses shall be scheduled to achieve the shortest possible work durations in these areas,

3) Signs shall be posted within 500 feet of the nearest existing residential uses advising construction workers to avoid creating excessive noise,

The nature of construction work means that there will be unavoidable noise impacts. However, the recommended noise reduction measures should keep most of the existing residents from becoming highly annoyed by project noise levels.

EXHIBIT 1
SITE LOCATION

Google Maps W Ave K



Map data ©2021 200 ft

EXHIBIT 2
AERIAL PHOTO

Imagery ©2021 Maxar Technologies, U.S. Geological Survey, USDA Farm Service Agency, Map data ©2021 200 ft

EXHIBIT 4
BARRIER LOCATIONS

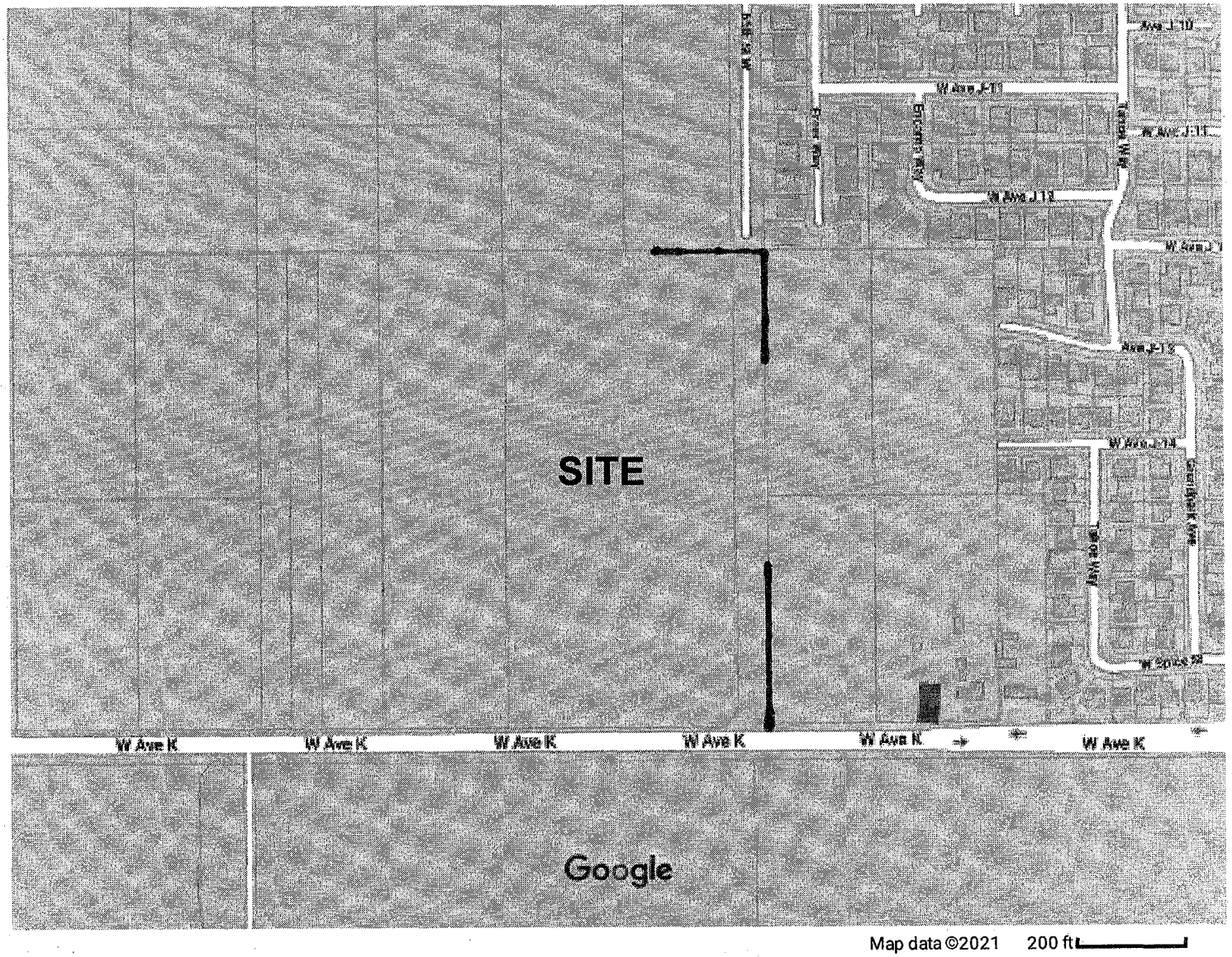
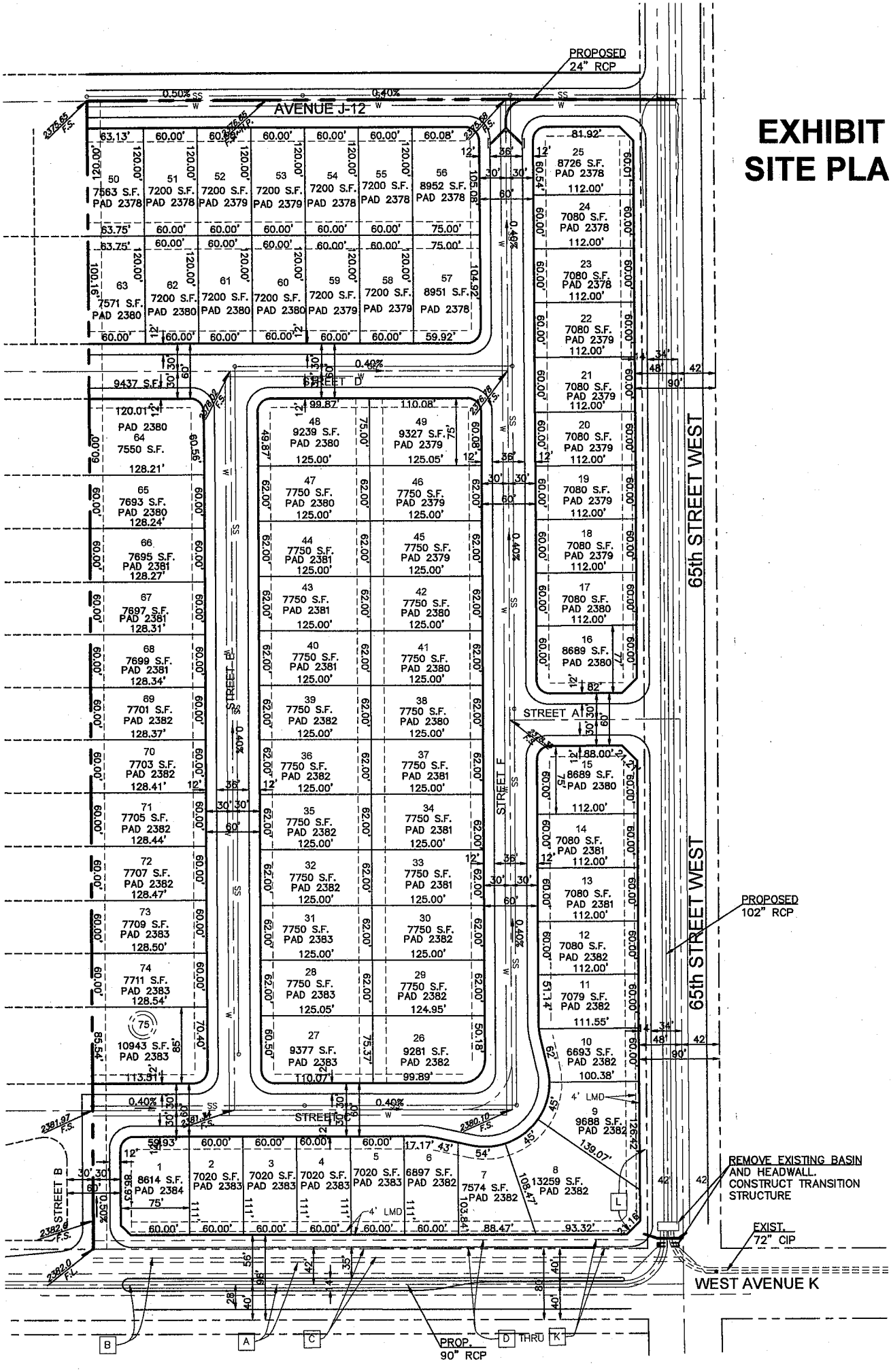


EXHIBIT 3
SITE PLAN



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APPENDIX 1

NOISE RATING METHODOLOGY

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NOISE RATING METHODOLOGY

The A-weighted decibel (dBA) or "A" scale on a sound level meter is typically used for environmental noise measurements because the weighting characteristics of the "A" scale approximate the subjective response of the human ear to a broad frequency band noise source by discriminating against the very low and very high frequencies of the audible sound spectrum.

Since community noise is seldom constant, varying from moment to moment and throughout the day, the "A" weighted noise level needs to be further described to provide meaningful data. The Environmental Protection Agency, the Federal Department of Transportation, several foreign countries and many private consultants are now using three time-exceeded percentile figures to describe noise, which are:

(1) L_{90} is the noise level that is exceeded 90 percent of any sample measurement period (such as 24 hours) and is often used to describe the background or ambient noise level.

(2) L_{50} is the noise level that is exceeded 50 percent of any sample measurement period. It is generally considered to represent the median noise level.

(3) L_{10} is the noise level that is exceeded 10 percent of any sample measurement period. It is a good descriptor of fluctuating noise sources such as vehicular traffic. It indicates the near-maximum noise levels that occur for groups of single noise events. Being related to the subjective annoyance to community noise, the L_{10} is a good design tool in the planning of acoustical barriers.

More recent noise assessment methods are based on the equivalent energy concept where Leq(x) represents the average energy content of a fluctuating noise source over a sample measurement period. The subscript (x) represents the period over which the energy is computed and/or measured. Current practice references the time quantity to either one (1) hour, eight (8) hours, or twenty-four (24) hours. When referenced to one (1) hour, Leq is also called the HNL (Hourly Noise Level).

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Since Leq is the summation of the functional products of noise level and duration, many different combinations of noise levels, duration times and time histories can produce similar Leq values. Thus a value of Leq(24) equals 50 means only that the average noise level is 50 dB. During that 24-hour period, there can be times when the noise level is higher than 50 dB and times when it is lower than 50 dB.

If the period of the measurement is only a single event, the energy content is not averaged. The energy expression for a single event is simply the sum of the functional product of the noise level and duration time of the event. This term is called the Le or SENEL (Single Event Noise Exposure Level). The summation of Le values averaged over one hour is Leq(1), over eight hours is Leq(8), over 24 hours is Leq(24), etc.

Leq is further refined into Ldn (Level Day-Night) and CNEL (Community Noise Equivalent Level), where noise that occurs during certain hours of the day are weighted (or penalized) in an attempt to compensate for the general perception that such noise is more annoying during these time periods (typically evening and nighttime hours).

(1) Ldn is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a ten (10) dBA weighting penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. The Ldn is a noise rating method recommended by the Environmental Protection Agency because it takes into account those subjectively more annoying noise events that occur during normal sleeping hours.

(2) CNEL is the sound level in dBA that corresponds to the average energy content of the noise being measured over a 24-hour period but includes a five (5) dBA penalty for noise that occurs during the evening hours between 7:00 PM and 10:00 PM, and a ten (10) dBA penalty for noise that occurs during the nighttime hours between 10:00 PM and 7:00 AM. For typical highway vehicular traffic situations, computer analysis has shown that the Ldn and CNEL values correlate within 0.5 dBA.

The percentile figures L_{10}, L_{50} and L_{90} can be directly scaled from a graphical recording of the measured noise sample over a particular time period. These figures can also be measured directly using modern automatic noise measuring equipment. Measurement of the parameters Le, Leq, Ldn and CNEL requires even more sophisticated and correspondingly expensive noise measuring equipment. As a result, engineers have devised ways of estimating Leq (and hence, Ldn) using standard instrumentation and methods.

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APPENDIX 2

EXISTING TRAFFIC NOISE CALCULATIONS

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FHWA RD-77-108 HIGHWAY NOISE PREDICTION MODEL

PROJECT NAME :TTM 72739
SITE LOCATION :LANCASTER
DESCRIPTION :WEST AVENUE K
SITE TYPE :HARD

INPUT DATA	AUTO	MEDIUM TRUCK	HEAVY TRUCK
SPEED	55	55	55
% DAY	75.51	1.56	.64
% EVENING	12.57	0.09	0.02
% NIGHT	9.34	.19	.08
% VOLUME	100	100	100

VOLUME 3000

	----AVERAGE HOURLY NOISE LEVELS AT 50 FEET----				
	DAY	EVENING	NIGHT	24 HOUR	CNEL
AUTO	62.90	61.13	55.07	60.99	64.26
MEDIUM TRK.	55.91	49.54	48.01	53.61	56.68
HEAVY TRK.	55.89	46.86	48.11	53.51	56.58
TOTAL	64.36	61.57	56.53	62.33	65.55

NOISE LEVEL AT SPECIFIED DISTANCES

DISTANCE	CNEL
50	65.55
75	63.79
100	62.54
125	61.57
150	60.78
175	60.11
200	59.53
225	59.02
250	58.56
275	58.14
300	57.77
325	57.42
350	57.10
375	56.80
400	56.52
450	56.00
500	55.55
550	55.13
600	54.76
650	54.41
700	54.09

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APPENDIX 3

BARRIER SHIELDING CALCULATIONS

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BARRIER NOISE REDUCTION ANALYSIS,WALL HEIGHT VARIABLE

REFERENCE SOURCE LEVEL AT 50 FEET

SOURCE.....= 76

PROJECT.....TTM NO 72739
DESCRIPTION..TEMPORARY SOUND BARRIER
SOURCE HEIGHT..... 5
SOURCE ELEVATION..... 0
RECEIVER ELEVATION..... 0
BARRIER ELEVATION..... 0
RECEIVER HEIGHT..... 5
DISTANCE TO SOURCE..... 50
DISTANCE TO RECEIVER... 50
NOISE LEVEL..... 70.0

WALL HEIGHT		TNL	TIL
8.00	62.75	62.75	7.23
FN	0.1791		
12.00	58.47	58.47	11.51
FN	0.9736		

BARRIER NOISE REDUCTION ANALYSIS,WALL HEIGHT VARIABLE

REFERENCE SOURCE LEVEL AT 50 FEET

SOURCE.....= 76

PROJECT.....TTM NO 72739
DESCRIPTION..TEMPORARY SOUND BARRIER -- SECOND FLOOR
SOURCE HEIGHT..... 5
SOURCE ELEVATION..... 0
RECEIVER ELEVATION..... 10
BARRIER ELEVATION..... 0
RECEIVER HEIGHT..... 5
DISTANCE TO SOURCE..... 50
DISTANCE TO RECEIVER... 50
NOISE LEVEL..... 70.0

WALL HEIGHT		TNL	TIL
8.00	69.98	69.98	0.00
FN	0.0000		
12.00	63.70	63.70	6.28
FN	0.0783		