Appendix K

Oaks Business Park SMP-40

Livermore, CA

UPDATE TO ENVIRONMENTAL NOISE STUDY

7 July 2023

Prepared for:

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Salter Project 21-0471

INTRODUCTION

This report summarizes our study of environmental noise of the proposed project (Livermore Oaks Business Park SMP-40) on nearby land uses. The project site is west of Isabel Avenue (State Highway 84), north of Stanley Boulevard, and south of Discovery Drive in Livermore, California. The purpose of the study was to determine whether estimated activity noise and construction noise from the proposed facility will meet the relevant requirements of the City General Plan Noise Element and Noise Ordinance at adjacent land uses.

This report has been updated based on the City's peer reviewer comments from May 2022 and March 2023, and subsequent coordination.

EXECUTIVE SUMMARY

- Noise from the project's loading docks, future intra-project vehicle traffic, and likely HVAC equipment will increase CNEL[1] or DNL[2] noise levels at noise-sensitive receiver locations at most by 2 dB. An increase of 2 dB or less DNL is not expected to be noticeable and is not considered significant.
- Given the minimal projected noise impact from the project, no additional mitigation measures are required.

REPORT ORGANIZATION

This report is organized into the following sections:

- Project Site
- Acoustical Criteria
- Existing Noise Environment
- Noise Impact Assessment
  - Construction Noise
  - Loading Dock and Intra-Project Traffic Noise (Parking Lot)
  - Tenant HVAC Equipment Noise

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[1] Community Noise Equivalent Level (CNEL) – A descriptor for the 24-hour A-weighted average noise level. The CNEL concept accounts for the increased acoustical sensitivity of people to noise during the evening and nighttime hours. Sound levels during the hours from 7 pm to 10 pm are penalized 5 dB; sound levels during the hours from 10 pm to 7 am are penalized 10 dB. A 10-dB increase in sound level is perceived by people to be a doubling of loudness.

[2] Day-Night Average Sound Level (DNL) – A descriptor established by the U.S. Environmental Protection Agency to describe the average day-night level with a penalty applied to noise occurring during the nighttime hours (10 pm - 7 am) to account for the increased sensitivity of people during sleeping hours. Also noted as Ldn. The difference between CNEL and DNL is often less than 1 dB.

PROJECT SITE

The proposed project will have a total area of approximately 40 acres, west of Isabel Avenue (State Highway 84) and between Stanley Boulevard and Discovery Drive in the City of Livermore. Warehouse Building 1 will be about 470,350 square feet with 68 loading docks, while Building 2 will be 288,594 square feet with 63 loading docks. The site is adjacent to existing industrially zoned warehouse facilities with loading docks to the north. Noise-sensitive residential receivers are located across Isabel Avenue to the east about 1,785-feet away from Building 1, and 885-feet away from Building 2. Two berms have been incorporated on the project site: a 6-foot by 125-foot landscape berm on the Northeast corner of the project property line, and a 10-foot by 60-foot screening wall east of Building 2's southern loading docks.

ACOUSTICAL CRITERIA

The following are project criteria and/or guidelines per the City of Livermore and State of California.

City of Livermore 2003-2025 General Plan Noise Element

Policy P4, Objective N-1.1

The Noise Element of the Livermore General Plan (Chapter 9, Policy P4 of Objective N-1.1) contains land use compatibility guidelines for environmental noise in the community. Table 1, below, summarizes these guidelines for residential and industrial land uses[3] in terms of CNEL or DNL. The definitions of each land use category follow below the table.

Table 1: Summary of Table 9-7 – Land Use Compatibility Guidelines for Community Noise CNEL or DNL, dB

Land Use Category	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential Low-Density[4], Single-family, Duplex, Mobile Homes	≤60	55-70	70-75	>75
Industrial, Manufacturing, Utilities, Agricultural	≤75	70-80	>75	--

[3] Table 9-7 of the Noise Element, page 9-27.

[4] Per General Plan Noise Ordinance Objective N-1.4, Policy P4, the criterion for single-family residential back yards is 60 dB CNEL/DNL.

Normally Acceptable: *If the noise level is within the "normally acceptable" level, noise exposure would be acceptable for the intended land use. Development may occur without requiring an evaluation of the noise environment unless the use could generate noise impacts on adjacent uses.*

Conditionally Acceptable: *If the noise level is within the "conditionally acceptable" level, noise exposure would be conditionally acceptable; a specified land use may be permitted only after detailed analysis of the noise environment and the project characteristics to determine whether noise insulation or protection features are required. Such noise insulation features may include measures to protect noise-sensitive outdoor activity areas (e.g., at residences, schools, or parks) or may include building sound insulation treatments such as sound-rated windows to protect interior spaces in sensitive receptors.*

Normally Unacceptable: *If the noise level is within the "normally unacceptable" level, analysis and mitigation are required. Development should generally not be undertaken unless adequate noise mitigation options have been analyzed and appropriate mitigations incorporated into the project to reduce the exposure of people to unacceptable noise levels.*

Clearly Unacceptable: *New construction should not be undertaken unless all feasible noise mitigation options have been analyzed and appropriate mitigation incorporated into the project to adequately reduce exposure of people to unacceptable noise levels.*

Noise Element Objective N-1.5

Objective N-1.5 seeks to reduce the level of noise generated by "stationary mechanical and other noise-generating equipment". Policy P1 states that "the City shall require that industrial and commercial uses be designed and operated to avoid the generation of noise effects on surrounding land uses from exceeding the following noise levels for exterior environments, operating longer than half an hour per hour:

- 55 dBA L50[5] (7:00am to 10:00pm)
- 45 dBA L50 (10:00pm to 7:00am)

Policy P2 allows short-term events to have levels louder than those cited above. For events that occur less than 15 minutes per hour, levels can be increased by 5 dBA; events no more than 5 minutes per hour are allowed an additional 10 dBA, and those taking place one minute or less per hour are allowed an additional 15 dBA. Policy P4 allows an exemption from Policy P1 for motor vehicles on public streets between the hours of 7:00am and 8:00pm. We understand that Policies P1, P2, and P4 could apply to the noise from backup alarms (aka "beepers" or "squawkers").

[5] L50 – The noise level exceeded 50% of the time. For a discussion of environmental acoustics, please refer to Appendix A.

Objective N-1.5 specifically describes “stationary source noises”, so when referring to L_{50} noise levels we analyzed the noise of trucks that are expected to sit in the loading dock area, estimated to be at least 1,025 feet from the nearest residence.

California Department of Transportation (CalTrans) Construction Vibration Criteria

The California Department of Transportation[6] (DOT) provides vibration guidelines for two scenarios: human perception and construction damage. These tables are included below as guidelines for potential project vibration levels. “Transient” vibrations are classified as impulsive events that are short in duration (e.g., debris falling, blasting). “Continuous” vibrations are more sustained vibration events over longer periods of time (e.g., jackhammering, drilling). Table 3 describes the human response to different levels of ground-borne vibration for transient and continuous events.

Table 3: Guideline Vibration Annoyance Potential Threshold Criteria[7]

Human Response	Maximum PPV[8] (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.90	0.10
Severe	2.00	0.40

Table 4 provides a guideline for vibration criteria to assess the damage potential from ground vibration induced by construction equipment. Thresholds for continuous vibrations are lower than those for transient vibrations and are therefore considered more “conservative”. These are standard significance thresholds used in the industry to determine impacts of ground borne vibrations on structures.

6 Transportation and Construction Vibration Guidance Manual September 2013 (DOT Document).

7 This is Table 20 from the DOT document.

8 (PPV): Peak Particle Velocity.

Table 4: Guideline Vibration Damage Potential Threshold Criteria[9]

Structure and Condition	Maximum PPV (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old buildings	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial buildings	2.00	0.50

The immediate adjacent properties are all modern industrial or commercial buildings. Across Isabel Avenue/Highway 84 to the east are existing single-family residences. Based on **Table 4**, we have applied the more stringent residential criteria of 1.0 PPV for transient events and 0.50 PPV for continuous events.

State of California CEQA Guidelines and Impact Criteria

The California Environmental Quality Act (CEQA) contains guidelines that evaluate the significance of noise attributable to a proposed project. This would include (but is not limited to) added traffic noise, mechanical equipment noise, and construction noise. CEQA asks the following applicable questions. Would the project result in:

1. Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?
2. Generation of excessive ground borne vibration or ground borne noise levels?
3. For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public-use airport, would the project expose people residing or working in the project area to excessive noise levels?

CEQA does not define the noise level increase that is considered “substantial”. Typically, the local general plan would establish limits with respect to allowable noise and vibration increases. However, the City of Livermore General Plan does not contain numerical standards of significance for noise increases. For the items above, noise level increases of less than 3 dBA are generally considered less-than-significant. Substantial adverse community response would be expected only for increases of 5 dBA or more.

9 This is Table 19 of the DOT document.

EXISTING NOISE ENVIRONMENT

Project Site Description

To quantify the existing site noise environment, two monitors continuously measured noise levels along the project property lines to the north and east between 2 and 4 November 2021. Table 5 summarizes measured data and **Figure 1**, attached, shows the approximate measurement locations. Locations were selected based not only on project setbacks but also on what nearby locations were accessible via public rights-of-way.

Table 5: Measured Environmental Noise Levels

Site	Location	Measured DNL (dBA)
LT-1	Business Park, approximately 10-feet above grade	65
LT-2	Arroyo Bike Trail, approximately 10-feet above grade	67

Site Noise Context

Noise measurements at the project site (see **Figure 1**), collected data from vehicle pass-bys on nearby roads. Measured on-site noise levels were DNL 65 dB and 67 dB at the project site (see **Figure 1**). LT-1 was placed near the nearest existing warehouse across from residences, and LT-2 was placed on the closest accessible utility pole across from residences. Adjustments were made, as appropriate, to estimate the change in noise levels from the long-term monitor location to the locations of the nearest residences east of Isabel Avenue.

We have combined cumulative existing and future noise sources that would result from the project's completion. Future project sources include the proposed loading dock noise, rooftop HVAC equipment, parking areas, and estimated traffic contribution, while the existing noise sources are the existing traffic. Adding expected noise contribution to the existing noise environment logarithmically would result in a noise level of approximately **DNL 67 dB** from all contributing noise sources upon the project's completion:

DNL 29[a] dB [Future HVAC] + DNL 29[b] dB [employee lot] + DNL 52[c] dB [trucks] = DNL 52[d] dB [future noise level at receivers]

a = cumulative building rooftop HVAC noise
b = employee parking lot noise
c = truck noise at loading docks

d = cumulative future project sources

DNL 67[e] dB [existing traffic] + DNL 51[e] dB [combined future sources] **=** DNL 67[f] dB [future noise level at receivers]

e = measured at project site, see **Figure 1**
e = determined from loading docks + HVAC noise + parking lots
f = calculated

See **Appendix A** for additional information on decibel mathematics.

NOISE IMPACT ASSESSMENT ANALYSIS

We evaluated the following noise sources from the proposed project on the surrounding environment:

- Potential rooftop mechanical equipment noise
- Short-term construction noise and vibration
- Project-related traffic increases

The following summarizes the portion of the CEQA checklist pertaining to noise.

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

A: Permanent Increase in Noise Levels due to Project-Generated Noise

The owner anticipates that tenant office spaces located on the corners of each building will be mechanically ventilated with typical 5-ton package units located above the offices in each corner of each building. No other outdoor mechanical equipment has been specified at this time. Specific equipment will be confirmed during the design phase.

Preliminary sound power level data has been provided for these 5-ton outdoor package fan units indicating that combined noise from these units sums to approximately DNL 29 dB at the nearest property lines. This assumes 24-hour operation of this equipment (in line with the operation hours of the building). The rooftop parapet is assumed to provide acoustical shielding to nearby neighbors because they would break line-of-sight to the nearest receivers.

Depending on the final equipment placement, as well as any specific parapets, barriers, and shielding provided by buildings (which would reduce noise levels at the property lines), noise levels may vary. We do not expect the noise contribution to be significant in these aspects.

B: Predicted Permanent Increase in Noise Levels due Project Traffic Volumes

It has been communicated by the team that the projected truck trips per day will be approximately 90 truck trips in the AM and 122 trips in the PM. Overall, the project would result in a net increase in daily trips by 212, amounting to an overall traffic noise DNL increase of approximately 1 dB. Therefore, this would not result in a significant increase in noise levels at existing adjacent properties.

C: Temporary Increase in Noise Levels due to Construction

Construction activities will likely include the use of heavy equipment for grading and other activities, through completion of buildings and landscaping. Heavy trucks would travel to, from, and within the site hauling soil, equipment, and building materials. Smaller equipment, such as jackhammers, pneumatic tools, and saws could also be used throughout the demolition and construction phases in various areas. The noise and vibration associated with these activities would be generated within the entire project area.

Based on our experience with similar projects' construction methods and phasing, our preliminary understanding and assumptions of expected equipment is shown in Table 6. Reference levels for construction equipment are listed in Table 7, both at the reference distance of 50-feet and at 884-feet, which is the distance from Building 1 to the residences across Isabel Avenue.

Table 6: List of Typical Construction Equipment and Phasing

Phase	Equipment
Demolition	Concrete/Industrial Saws, Excavators, Rubber-Tired Dozers, Tractors/Loaders/Backhoes
Site Preparation	Graders, Rubber-Tired Dozers, Tractors/Loaders/Backhoes
Grading/Excavation	Excavators, Drill Rig for Shoring Beams (Caisson Drilling), Rubber-Tired Dozers, Tractors/Loaders/Backhoes
Trenching	Tractor/Loader/Backhoe, Excavators
Building Exterior	Cranes, Forklifts, Generator Sets, Tractors/Loaders/Backhoes, Welders
Building Interior/ Architectural Coating	Air Compressors, Aerial Lift
Paving/Landscaping/ Site Concrete	Cement and Mortar Mixers, Paving Equipment, Rollers, Tractors/Loaders/Backhoes

Table 7: Construction Equipment Reference Noise Levels[10]

Typical Equipment	Estimated Maximum Instantaneous L_{max}[11] Noise Level (dBA at 50 feet)	Estimated Maximum Instantaneous L_{max} Noise Level (dBA at 884 feet)
Aerial Lift	83	26
Air Compressors	81	24
Cement and Mortar Mixers	85	28
Concrete/Industrial Saws	76	19
Cranes	83	26
Drill Rig for Shoring Beams (Caisson Drilling)	85	28
Excavators	85	28
Forklifts	83	26
Generator Sets	81	24
Graders	85	28
Paving Equipment	89	32
Rollers	74	17
Rubber-Tired Dozers	85	28
Tractors/Loaders/Backhoes	84	27
Welders	73	16

Actual construction noise levels will vary based on distance to each piece of equipment or work area from the receiver and shielding from adjacent buildings and construction elements.

The following is a list of measures that could be adopted by the contractor to reduce the impact of construction noise on neighbors:

1. Consistent with the Livermore Municipal Code, construction will be limited to weekdays between the hours of 7:00 a.m. and 8:00 p.m. and Saturdays through Sunday between the hours of 9:00 a.m. and 6:00 p.m.

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10 Equipment noise levels at 50-feet are from Section 9, Federal Highway Administration Highway Traffic Noise Construction Noise Handbook (August 2006) and Table 12-2, Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

11 L_{max} (Maximum Sound Level) – The maximum sound level for a specified measurement period of time as defined in ASTM E1686.

2. There are currently no immediately adjacent residential receivers, but Industrial-zoned PDI parcels are immediately north of the proposed project site. Unless residences are built immediately adjacent to this property prior to the construction, a noise barrier is not required.
3. Contractors shall utilize "quiet" models of air compressors and other stationary noise sources where technology exists.
4. Internal combustion engine-driven equipment shall be equipped with mufflers which are in good condition and appropriate for the equipment.
5. Stationary noise-generating equipment, such as air compressors and portable power generators, shall be located as far away as possible from adjacent property lines.
6. Staging areas and construction material areas shall be located as far away as feasible from adjacent residences.
7. All unnecessary idling of internal combustion engines should be prohibited.
8. The contractor should designate a "noise disturbance construction superintendent" who will be responsible for tracking and responding to any complaints about construction noise. The noise disturbance construction superintendent will determine the cause of the noise complaint (e.g., starting too early, bad muffler, etc.) and will require that reasonable measures are implemented to correct the problem. The telephone number for the noise disturbance construction superintendent will be posted at the construction site and included in any construction notices sent to neighbors.

Would the project result in generation of excessive ground-borne vibration or ground-borne noise levels?

A: Permanent Increase in Vibration Levels due to Project-Generated Vibration

The planned use for the site, as warehouse buildings, is not expected to generate significant amounts of ground-borne noise or vibration.

B: Temporary Increase in Vibration Levels due to Construction

The nearest and most sensitive adjacent receivers include residences to the east approximately 500 feet from the closest area of construction on the project site. Industrial-zoned parcels to the north are assumed to be less sensitive.

Project construction may include activities such as the use of concrete saws, excavation and grading, and the use of rolling stock equipment (tracked vehicles, compactors, etc.). Typical construction vibration levels at 50-feet are listed in Table 8, below. Most of the construction will occur set back from the property line. As indicated in the criteria section above, the risk of damage to nearby structures may begin to occur at a limit of 1.0 in/sec PPV for transient vibration events and 0.50 PPV for continuous events.

Table 8: Example Construction Vibration Levels[12]

Equipment	PPV at 50 ft. (in/sec)[13]
Vibratory Roller	0.049
Hydraulic Breaker	0.03 to 0.08
Large Bulldozer	0.03
Loaded Trucks	0.03
Excavator	0.03
Caisson/pier drilling	0.03
Jackhammer	0.01
Small Bulldozer	0.001
Crane, Forklift, Bobcat	No significant vibration

Based on the vibration levels shown in Table 8, construction equipment is not expected to cause structural damage to adjacent properties because project construction is not expected to exceed the thresholds for new residential buildings or commercial/industrial structures as shown above in Table 4. Ground borne noise would also not be expected to be significant at these vibration levels.

FUTURE LOADING DOCK AND INTRA-PROJECT TRAFFIC NOISE

Future Loading Dock Calculation Methodology

Operational noise from the proposed facility is expected to consist primarily of tractor-trailers accessing loading dock areas. To estimate truck noise at the proposed facility, we referenced recently measured noise levels at a local distribution facility which involved semi-trucks similar in size to those that are expected to access the proposed project's facility.

Calculations for resulting noise levels due to on-site truck and car trip generation durations and activities were based on the measurements at this local distribution facility with ancillary information provided to us for that project on 15 February 2018.

Based on the assumptions described below, estimated noise levels were then compared to applicable criteria to determine if noise from the proposed facility would exceed the City's noise goals (described above) at adjacent residences.

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12 Table 12-2, Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

13 Using a value of *n* = 1.5 per FTA recommendation, where *n* is the attenuation rate through the ground

Traffic volumes produced by the proposed project were provided by TJKM in March 2022. Their study estimated that a total of 212 truck trips[14] would occur at the facilities throughout the 24 hours of operation. Overton Moore Properties provided further details about the potentially likely distribution of those trucks each hour throughout the 24-hour operation period.

Intra-Project Traffic Analysis Methodology

Intra-project traffic noise will consist of traffic noise associated with future warehouse employee vehicles within the designated parking lots. To estimate vehicle noise at the employee parking lots, we referenced the TJKM provided traffic volumes for the proposed project.

Noise Source Analysis and Assumptions

Future Loading Docks

Our analysis estimated future noise from the facility based on the following assumptions discussed with the client via email, and per the overall site plan:

1. Trucks will enter and exit the site from Atlantis Court and Challenger Street, from the north (via Discovery Drive).
2. Non-truck noises associated with loading/unloading activity (i.e., forklifts, rolling doors, carts, pallet crushing, items dropping), are assumed to be located near the dock doors and are included in our analysis.
3. An average truck trip (not including unloading/loading) is estimated to last for a cumulative period of about 2 minutes and be at least 1025 feet from the nearest residential property line.
4. Trucks occupy the loading dock in their loading area that is nearest to noise-sensitive receiver (Residents across Isabel Avenue, to the east of the building).
5. Total number of loading docks: 130 (68 in Building 1 and 62 in Building 2)
6. Number and distribution of truck trips is based on TJKM's traffic study estimate, with approximately 212 per day and the following truck traffic volume distribution (per email):
   - AM Peak is 7-9 AM - 14%
   - 9-4 PM - 60%
   - PM Peak is 4 PM - 6 PM - 14%
   - 6 PM - 10 PM – 10%
   - 10 PM - 7 AM – 2%

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14 Email correspondence provided on 3/11/22 confirmed the 212 daily truck trips as 20% of total vehicle trips based in ITE data (TJKM Study)

7. Building 2 provides substantial acoustical shielding for most of Building 1 and its operations to the eastern residents. Because of this, Building 1 is not expected to have a meaningful impact on the residential receivers' sound environment to the east.
8. Loading docks in Building 2 are located on the north and south facades, configured to maintain the maximum possible distance away from the residential area to the east.
9. North-facing docks of Building 2 will have a direct line-of-sight to the warehouse to the north. We assume that some shielding is provided by the perpendicular orientation of the docks of Building 1, which would slightly reduce our overall calculated noise contribution of the loading docks to the northern warehouse receivers because of the partial line-of-sight.
10. 24-hour operation assumed.
11. Loading docks not in use on each building have closed doors.
12. A typical truck "trip" consists of the following events (estimated sound levels based on aforementioned measurements at similar facilities):
    a. Truck passby (arrival, departure at slow speed): 69 dBA at 30 feet
    b. Truck airbrakes: 72 dBA at 25 feet
    c. Truck backup alarm: 79 dBA at 30 feet
    d. Brief idle before engine shutoff: 70 dBA at 25 feet
    e. Truck engine ignition and airbrakes: 71 dBA at 25 feet
    f. Truck accelerating from stop: 74 dBA at 25 feet
    g. Truck noise source reference heights[15] (above grade)
        i. Passby, brief idle, acceleration, and ignition: 8 feet
        ii. Back-up beeper and airbrake: 2.5 feet
        iii. Topographical site analysis included in Section C3.1 of the Grading and Drainage Plan show potential terrain shielding of about three feet between the dock elevation and receivers to the east of Isabel Avenue

Intra-Project Traffic Noise

Our analysis estimated future noise from the facility parking lots is based on the following assumptions:

1. Employees will enter and exit the site from Atlantis Court and Challenger Street, from the north (via Discovery Drive).
2. Once on site, vehicles will move at 15 miles per hour or less.
3. Vehicles will be spread out evenly amongst the seven parking areas.

[15] Truck source heights excerpted from Caltrans Technical Noise Supplement document (TeNS) document dated October 1998.

4. An average vehicle trip is estimated to last for a cumulative period of about 2 minutes and be at least 550 feet from the nearest residential property line.
5. Similar proportional percentages were assumed for vehicle trips in the project parking lots as were the truck trips, as shown in the distribution below.
    - AM Peak is 7 AM - 9 AM- 14%
    - 9 AM – 4 PM -60%
    - PM Peak is 4 PM -6 PM -14%
    - 7 PM - 10 PM 10%
    - 10 PM - 7 AM 2%

Estimated Future Noise Levels

Future Average Noise Levels (CNEL/DNL)

We estimated noise levels at local receptors from the sources described in the previous section. To account for future increases in local traffic noise levels (growth in traffic on Isabel Avenue and other local roadways), we added 1 dB DNL to the measured levels[16] (see Table 5 above).

We calculated the acoustical impact of project traffic increase due to both projects SMP-39 and SMP-40 with the provided peak hour traffic volumes for the cumulative without project and cumulative with project scenarios. The analysis used the FHWA-RD-77-108 traffic noise calculation model. The figures below show the various calculations for the intersections of interest (i.e., 5, 9, 10, and 11) as provided to us via the traffic volume study developed for both SMP-39 and SMP-40.

Figure A: Intersection Map Legend

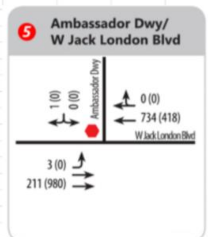
[16] The California Department of Transportation assumes a traffic volume increase of three-percent per year, which corresponds to a 1 dBA increase in DNL over a ten-year period.

Figure B: Traffic Volume Analysis for Intersection 5

Traffic Impact Analysis
Livermore SMP-39 Site
23-0142
Intersection 5 (Ambassador Dwy/ W Jack London Blvd)

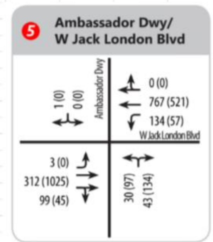
Cumulative Peak Hour

	W Jack London, East Bound		
	left	straight	right
AM	3	211	0
PM	0	980	0
	W Jack London, West Bound		
	left	straight	right
AM	0	734	0
PM	0	418	0



Cumulative existing + Project Peak Hour

	W Jack London, East Bound		
	left	straight	right
AM	3	312	99
PM	0	1025	45
	W Jack London, West Bound		
	left	straight	right
AM	134	767	0
PM	57	521	0



Cumulative overall tot	East Bound	West Bound	Total:
	1191	1152	2343

		Cumulative	Cumul+Proj	dB increase	delta
Total on W Jack London Blvd	AM	948	1315	1.4	367
	PM	1398	1648	0.7	250

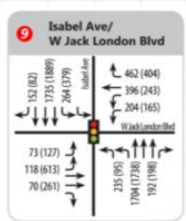
	Cumulative	Cumul+Proj	dB increase
Total overall increase	2346	2963	1.0

Figure C: Traffic Volume Analysis for Intersection 9

Traffic Impact Analysis
Livermore SMP-39 Site
23-0142
Intersection 9 (Isabel/ W Jack London Blvd)

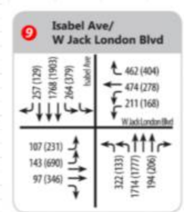
Cumulative Peak Hour

	W Jack London, East Bound		
	left	straight	right
AM	73	118	70
PM	127	613	261
	W Jack London, West Bound		
	left	straight	right
AM	204	396	462
PM	165	243	404
	Isabel, North Bound		
	left	straight	right
AM	235	1704	192
PM	95	1738	198
	Isabel, South Bound		
	left	straight	right
AM	264	1735	152
PM	379	1889	82



Cumulative existing + Project Peak Hour

	W Jack London, East Bound		
	left	straight	right
AM	107	143	97
PM	231	690	346
	W Jack London, West Bound		
	left	straight	right
AM	211	474	462
PM	168	278	404
	Isabel, North Bound		
	left	straight	right
AM	322	1714	194
PM	133	1777	206
	Isabel, South Bound		
	left	straight	right
AM	264	1768	257
PM	379	1903	129



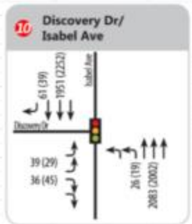
Cumulative overall tot	East Bound	West Bound	Northbound	Southbound	Total:
	731	639	3442	3624	8436

		Cumulative	Cumul+Proj	dB increase	delta	total proj generated trips	el Generated	Generated trips
Total on W Jack London Blvd	AM	1323	1494	0.5	171	1471	0.739633	0.260367
	PM	1813	2117	0.7	304			
Total on Isabel	AM	4282	4519	0.2	237			
	PM	4381	4527	0.1	146			

	Cumulative	Cumul+Proj	dB increase
Total overall increase	11799	12657	0.3

Figure D: Traffic Volume Analysis for Intersection 10

Traffic Impact Analysis
Livermore SMP-39 Site
23-0142
Intersection 10 (Isabel/Discover Drive)

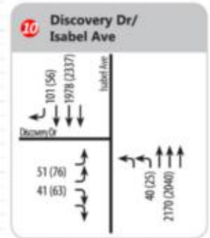


Cumulative Peak Hour

	left	straight	right
Isabel, North Bound			
AM	26	2083	0
PM	19	2002	0
Isabel, South Bound			
AM	0	1951	61
PM	0	2252	39
Discover Dr, East Bound			
AM	39	0	36
PM	29	0	45

Cumulative existing + Project Peak Hour

	left	straight	right
Isabel, North Bound			
AM	40	2170	0
PM	25	2040	0
Isabel, South Bound			
AM	0	1978	101
PM	0	2337	56
Discover Dr, East Bound			
AM	51	0	41
PM	76	0	63



Cumulative overall tot	North Bound	South Bound	West Bound
	4085	4203	0

Total:
8288

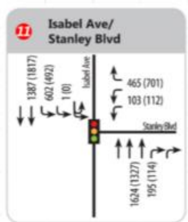
		Cumulative	Cumul+Proj	dB increase	delta
Total on Isabel Avenue	AM	4121	4289	0.2	168
	PM	4312	4458	0.1	146
Total on Discover Drive	AM	75	92	0.9	17
	PM	74	139	2.7	65

total proj generated trips	al Generated	Generated trips
1009	0.918731	0.081269

	Cumulative	Cumul+Proj	dB increase
Total overall increase	8582	8978	0.2

Figure E: Traffic Volume Analysis for Intersection 11

Traffic Impact Analysis
Livermore SMP-39 Site
23-0142
Intersection 11 (Isabel/ Stanley Blvd)

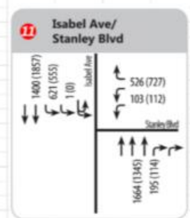


Cumulative Peak Hour

	left	straight	right
Isabel Ave, North Bound			
AM	0	1624	195
PM	0	1327	114
Isabel Ave, South Bound			
AM	603	1387	0
PM	492	1817	0
Stanley Blvd, West Bound			
AM	103	0	465
PM	112	0	701

Cumulative existing + Project Peak Hour

	left	straight	right
Isabel Ave, North Bound			
AM	0	1664	195
PM	0	1345	114
Isabel Ave, South Bound			
AM	622	1400	0
PM	555	1857	0
Stanley Blvd, West Bound			
AM	103	0	526
PM	112	0	727



Cumulative overall tot	North Bound	South Bound	West Bound
	2951	3204	0

Total:
6155

		Cumulative	Cumul+Proj	dB increase	delta
Total on Isabel Ave	AM	3809	3881	0.1	72
	PM	3750	3871	0.1	121
Total on Stanley Blvd	AM	568	629	0.4	61
	PM	813	839	0.1	26

total proj generated trips	al Generated	Generated trips
893	0.902576	0.097424

	Cumulative	Cumul+Proj	dB increase
Total overall increase	8940	9220	0.1

As shown above, the increase in traffic due to the project would be approximately 1 to 2 dBA to the DNL when combined.

Table 9 below summarizes the estimated DNL levels at the closest property plane to the east of the building, under the assumption that the facility would receive its trucking and commuting employee activities during the 24 hours of operation.

Table 9: Calculated 24-Hour Future Facility Noise at Nearest Noise-Sensitive Land Uses: CNEL/DNL, dBA

Nearby Receiving Locations	Existing Noise at Receiver (Residences)	Loading Docks at Receiver	Intra-Project Traffic Noise Levels at Receiver	Combined Existing plus Project	Change (dBA)
East Property Line (Residences across Isabel)	67	52	29	67	<1
North Property Line (Neighboring Warehouse)	65	62	34	67	+2

The calculated increase in DNL at the residential property line with the project and future traffic noise levels (near term 2025) will be less than 1 dB. At the northern industrial uses, a DNL 2 dB change is predicted. A change of 2 dB or less is not expected to be noticeable and is not considered significant.

Our calculations of maximum noise levels assume that the trucks operating at the closest docks to the residences will be active at the same proportion as stated above. The noise analysis also assessed the increase in traffic noise levels resulting from project traffic in combination with future traffic noise level increases on the surrounding roadway network resulting from other anticipated development in the region. The resultant cumulative increase is 2 dB. This would not be considered a significant increase to the predicted project operation noise environment.

Future L_{50} Noise Levels

The following assumptions were made about the 24-hour operation of the project in our estimated L_{50} calculations:

- The volume of expected truck trips is consistent with the truck trip distribution established in comment 6 of the Noise Source Analysis and Assumptions section (i.e., a maximum of 1 truck per hour at nighttime, or 2% of trucks between 10:00 pm and 6:00 am).
- The 6- and 10-foot berms will be incorporated into the project.
- Backup alarms are expected to be at a height of approximately 2.5 feet.
- Trucks do not move great distances when their backup alarm is engaged.

Table 10 summarizes the estimated daytime and nighttime L_{50} for the proposed project. Since backup alarms for nighttime are predicted to occur less than 15 minutes per hour, the criterion can increase by 5 dBA per Policy P2. However, since back up alarms would be more than 15 minutes per hour during the daytime, no additional increases are accounted for in our analysis.

Table 10: Calculated 24-Hour Future Facility L_{50} Value: L_{50}, dBA

Time of Day	Estimated L_{50} Value	Criterion L_{50} Value
Daytime (7am-10pm)	50 dBA	55 dBA
Nighttime (10pm-7am)	35 dBA	50 dBA

Although our calculations of overall operational L_{50} noise levels do not exceed the allowable values stated by the City (i.e., Policy P1, Objective N-1.5), backup alarm noise may be audible at residences to the east during quieter nighttime hours. It is our understanding that other current similar projects in the vicinity have caused local neighbor complaints due to trucks' back-up alarms at those locations in the past.

Back-up alarms were assumed to be 79 dB at a reference distance of 30 feet. The distance attenuation between the loading dock to the façade of the nearest residence provides a 31 dB reduction. Although backup alarms would be audible from the residences, the L_{50} threshold of 50 dBA will not be exceeded due to the limited number of trips during this timeframe (estimated at 4 trips in 9-hour time frame).

Calculations assumed the source height of these backup alarms to be approximately 2.5 feet from grade. The incorporation of the proposed 6- and 10-foot-tall berms would adequately obstruct the direct line-of-sight of these backup alarms to the residential receivers. The dimensions of the proposed berms are calculated to reduce intermittent noise levels (such as those produced by backup alarms) by up to 6 dB at the closest residents.

Quieter backup alarms (aka "squawkers"), which are becoming more prevalent in delivery vehicles for various large e-commerce websites, and other vendors, may be used by trucking operators visiting this site in the future, therefore beeper noise has the potential to be reduced. A best practice for consideration would be to implement these alternative devices in other truck populations in the future.

CONCLUSIONS AND COMMENTS

1. Future cumulative project site noise from rooftop HVAC equipment, loading dock-generated noise, stationary trucks, and employee vehicles, is not expected to significantly impact receivers to the east or to the north. The calculated increase in CNEL/DNL for the warehouse receivers to the north will be 2 dB, while the closest residential receivers across Isabel Avenue will have a <1dB increase from the existing environment under the expected 24-hour operations.

   A change of 2 dB or less is not considered significant for residents to the east or the commercial neighbors to the north of the project site. A cumulative DNL of 67 dB for the receivers does not exceed the industrial 75 dB DNL threshold defined in Table 9-7 of the Livermore Noise Element as well as the L_{50} level from Objective N-1.5 of the General Plan.

   Considering the 1,025-foot distance between the nearest loading dock and the closest residents, and the trucks being a stationary source rather than a moving vehicle once the leaving the loading dock area of the project site, the city's L_{50} criterion is not applicable once a truck begins moving closer to the residential area. Given the minority of expected project truck trips conducted in the nighttime hours (less than 1 trip per hour on average), noise from stationary trucks at the nearest loading dock are expected to comply with the City's L_{50} nighttime requirement assuming backup alarms are not continuously operating for more than 30 minutes per hour.

2. It is our understanding that there are no State or Federal requirements for noise levels of backup alarms except for OSHA, which only requires them to be "significantly louder" than the surrounding environment. Because the background noise levels around most facilities are not known, manufacturers typically increase the alarm volume to compensate.

   Best practices to reduce alarm audibility at the facility to be evaluated would be to require users to limit alarm volume levels, employ signal personnel, lights, and other means to notify people about ongoing truck activities within the facility.

* * *

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APPENDIX A: FUNDAMENTAL CONCEPTS OF ENVIRONMENTAL NOISE

This section provides background information to aid in understanding the technical aspects of this report.

Three dimensions of environmental noise are important in determining subjective response. These are:

- The intensity or level of the sound
- The frequency spectrum of the sound
- The time-varying character of the sound

Airborne sound is a rapid fluctuation of air pressure above and below atmospheric pressure. Sound levels are usually measured and expressed in decibels (dBA), with 0 dBA corresponding roughly to the threshold of hearing.

The "frequency" of a sound refers to the number of complete pressure fluctuations per second in the sound. The unit of measurement is the cycle per second (cps) or hertz (Hz). Most of the sounds, which we hear in the environment, do not consist of a single frequency, but of a broad band of frequencies, differing in level. The name of the frequency and level content of a sound is its sound spectrum. A sound spectrum for engineering purposes is typically described in terms of octave bands, which separate the audible frequency range (for human beings, from about 20 to 20,000 Hz) into ten segments.

Many rating methods have been devised to permit comparisons of sounds having quite different spectra. Surprisingly, the simplest method correlates with human response practically as well as the more complex methods. This method consists of evaluating all of the frequencies of a sound in accordance with a weighting that progressively de-emphasizes the importance of frequency components below 1000 Hz and above 5000 Hz. This frequency weighting reflects the fact that human hearing is less sensitive at low frequencies and at extreme high frequencies relative to the mid-range.

The weighting system described above is called "A"-weighting, and the level so measured is called the "A-weighted sound level" or "A-weighted noise level." The unit of A-weighted sound level is sometimes abbreviated "dBA." In practice, the sound level is conveniently measured using a sound level meter that includes an electrical filter corresponding to the A-weighting characteristic. All U.S. and international standard sound level meters include such a filter. Typical sound levels found in the environment and in industry are shown in **Figure A-1.**

Although a single sound level value may adequately describe environmental noise at any instant in time, community noise levels vary continuously. Most environmental noise is a conglomeration of distant noise sources, which results in a relatively steady background noise having no identifiable source. These distant sources may include traffic, wind in trees, industrial activities, etc. and are relatively constant from moment to moment. As natural forces change or as human activity follows its daily cycle, the sound level may vary slowly from hour to hour. Superimposed on this slowly varying background is a succession of identifiable noisy events of brief duration. These may include nearby activities such as single vehicle pass-bys, aircraft flyovers, etc. which cause the environmental noise level to vary from instant to instant.

To describe the time-varying character of environmental noise, statistical noise descriptors were developed. "L10" is the A-weighted sound level equaled or exceeded during 10 percent of a stated time period. The L10 is considered a good measure of the maximum sound levels caused by discrete noise events. "L50" is the A-weighted sound level that is equaled or exceeded 50 percent of a stated time period; it represents the median sound level. The "L90" is the A-weighted sound level equaled or exceeded during 90 percent of a stated time period and is used to describe the background noise.

As it is often cumbersome to quantify the noise environment with a set of statistical descriptors, a single number called the average sound level or "L_{eq}" is now widely used. The term "L_{eq}" originated from the concept of a so-called equivalent sound level which contains the same acoustical energy as a varying sound level during the same time period. In simple but accurate technical language, the L_{eq} is the average A-weighted sound level in a stated time period. The L_{eq} is particularly useful in describing the subjective change in an environment where the source of noise remains the same but there is change in the level of activity. Widening roads and/or increasing traffic are examples of this kind of situation.

In determining the daily measure of environmental noise, it is important to account for the different response of people to daytime and nighttime noise. During the nighttime, exterior background noise levels are generally lower than in the daytime; however, most household noise also decreases at night, thus exterior noise intrusions again become noticeable. Further, most people trying to sleep at night are more sensitive to noise. To account for human sensitivity to nighttime noise levels, a special descriptor was developed. The descriptor is called the L_{dn} (Day/Night Average Sound Level), which represents the 24-hour average sound level with a penalty for noise occurring at night. The L_{dn} computation divides the 24-hour day into two periods: daytime (7:00 am to 10:00 pm); and nighttime (10:00 pm to 7:00 am). The nighttime sound levels are assigned a 10 dBA penalty prior to averaging with daytime hourly sound levels.

For highway noise environments, the average noise level during the peak hour traffic volume is approximately equal to the L_{dn}.

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

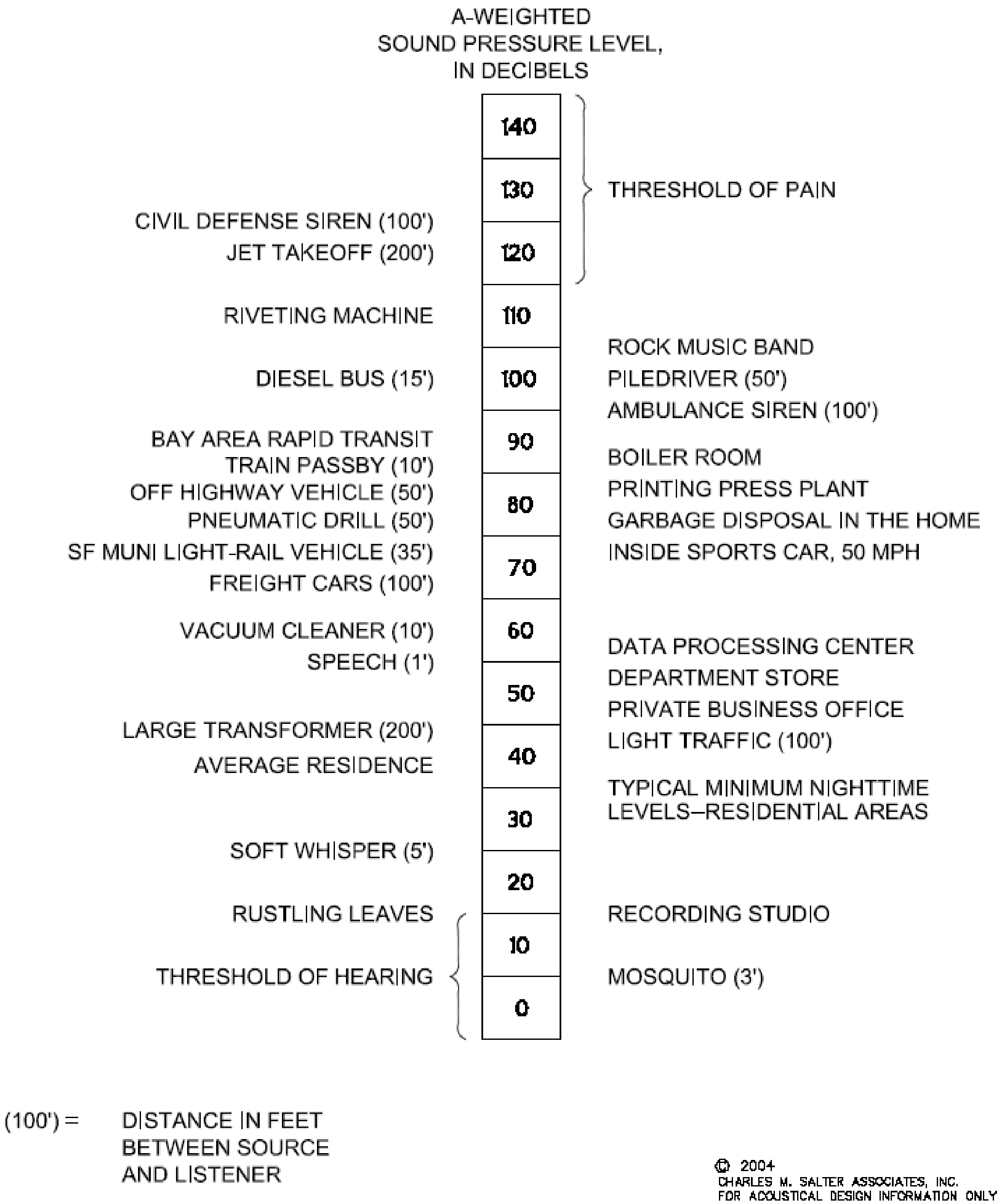
- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, and learning
- Physiological effects such as startle, hearing loss

The sound levels associated with environmental noise usually produce effects only in the first two categories. Unfortunately, there has never been a completely predictable measure for the subjective effects of noise nor of the corresponding reactions of annoyance and dissatisfaction. This is primarily because of the wide variation in individual thresholds of annoyance and habituation to noise over time.

Thus, an important factor in assessing a person's subjective reaction is to compare the new noise environment to the existing noise environment. In general, the more a new noise exceeds the existing, the less acceptable the new noise will be judged.

With regard to increases in noise level, knowledge of the following relationships will be helpful in understanding the quantitative sections of this report:

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



TYPICAL SOUND LEVELS
MEASURED IN THE
ENVIRONMENT AND INDUSTRY

FIGURE A1

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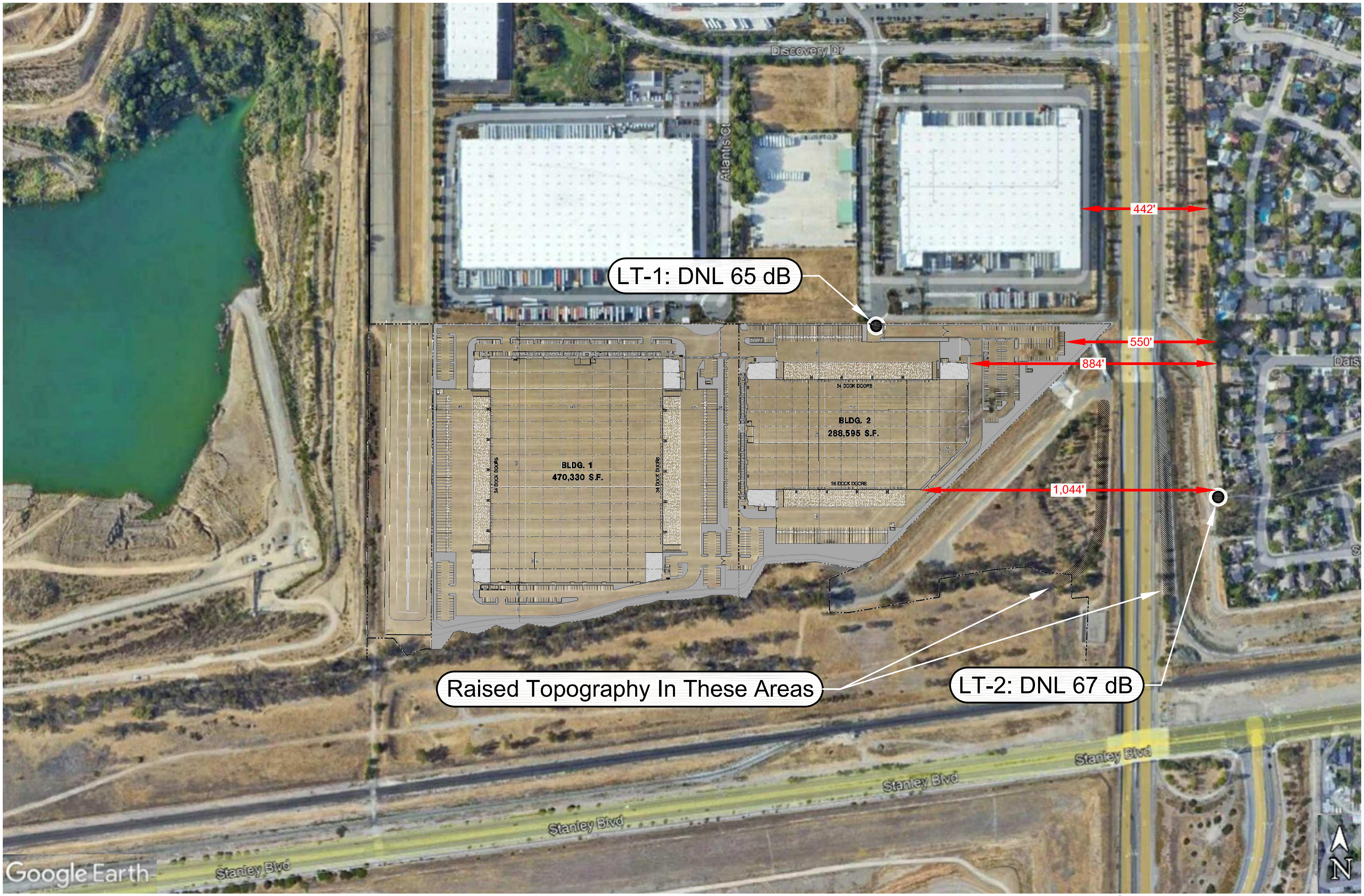

OAKS BUSINESS PARK – SMP–40
MEASUREMENT LOCATIONS AND MEASURED
NOISE LEVELS

FIGURE 1

Salter # 21–0471

MEV/ECS 02.21.23