

EL MIRAGE AIRPORT RUNWAY EXTENSION NOISE ANALYSIS AND ASSESSMENT STUDY



GENERAL ATOMICS

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1.0 Executive Summary

- The existing ambient noise levels around El Mirage Field / Adelanto Airport is below DNL¹ 60 dBA; DNL 60 dBA is the County's threshold of acceptability for residential land uses.
- Modeling of existing and future aircraft DNL noise levels was conducted utilizing the Federal Aviation Administration's Aviation Environmental Design Tool.
- Both present and future (with east runway extension) noise levels meet the County's acoustical criteria.

2.0 Project Description

El Mirage Field is used by General Atomics for test flights of unmanned aerial vehicles (UAV) along with associated chase plane flights. An east extension of the primary runway 07/25 is planned at El Mirage Field / Adelanto Airport (El Mirage). As a part of this runway extension, the County requires a noise analysis to determine whether the runway extension will result in noise impacts to adjacent sensitive receivers.

This report summarizes the results of our ambient noise monitoring along with an analysis of existing and future (with runway extension) aircraft noise levels.

3.0 Acoustical Criteria

Per our discussion with the San Bernardino Planning Department, for residential land uses adjacent to mobile noise sources (such as aircraft), the San Bernardino County Development Code stipulates an interior noise standard of L_{dn} (DNL) or CNEL² 45 dBA and an exterior noise standard of DNL or CNEL 60 dBA.³ We have utilized the DNL metric in this analysis.

4.0 Ambient Measurements

Four long-term (i.e., over 24-hour) measurements were conducted from April 25 to 27, 2017, to quantify the existing noise environment. The measurements started and ended around midday. During the measurements, the temperature ranged from a low of 51° F to a high of 72° F, and averaged 62° F; the humidity ranged from 30% to 60%, averaging 43%. Finally, the wind speed ranged from 3 miles per hour (mph) to 37 mph, averaging 20 mph. Winds were elevated during the measurement period, which is not atypical for the high desert. Note that aircraft at El Mirage were not flying during the ambient measurements.

¹ Day/Night Average Sound Level (L_{dn} or DNL): A descriptor established by the U.S. Environmental Protection Agency to describe the average day-night level with a 10 dB penalty applied to noise occurring during the nighttime hours (10 pm to 7 am) to account for the increased sensitivity of people during sleeping hours. A 10 dB increase in sound level is perceived by people to be twice as loud.

² Community Noise Equivalent Level (CNEL): A metric for the 24-hour A-weighted average noise level. The CNEL metric accounts for the increased sensitivity of people to noise during the evening and nighttime hours. From 7 pm to 10 pm, sound levels are penalized by 5 dB; from 10 pm to 7 am, sound levels are penalized by 10 dB. A 10 dB increase in sound level is perceived by people to be twice as loud.

³ 2007 San Bernardino County Development Code §83.01 Table 83-3

The figure below shows the locations of the long-term (LT) locations, numbered LT-1 through LT-4, and sensitive residential receivers, circled with an orange line.

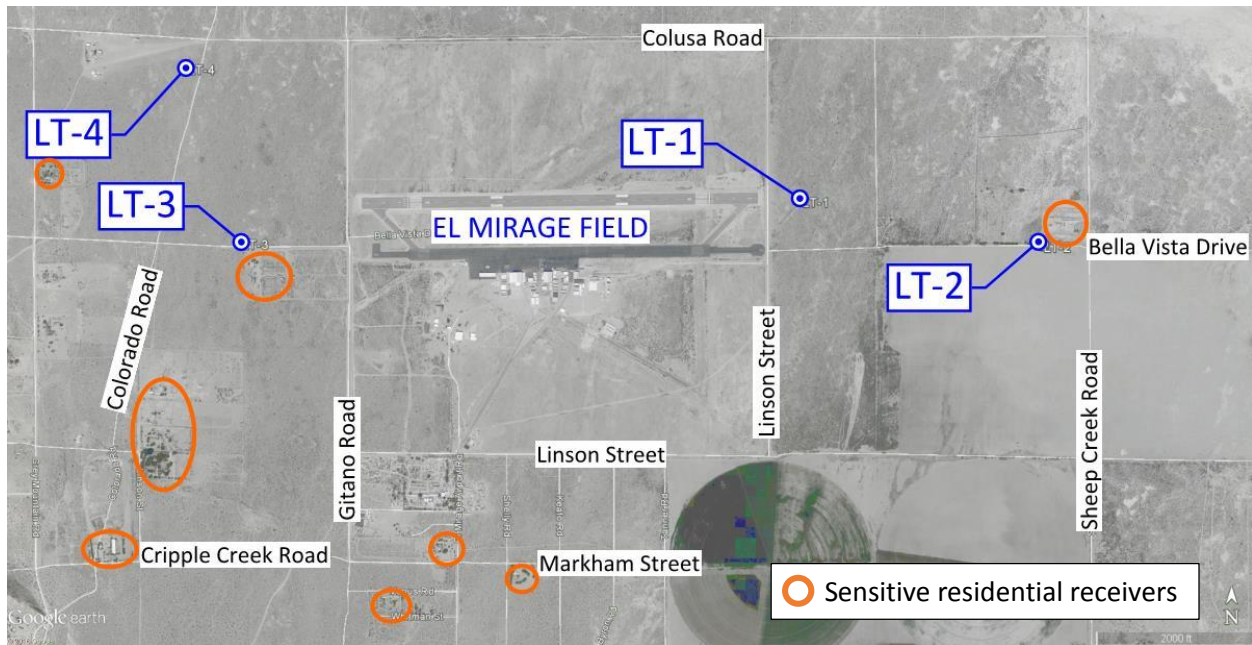


Figure 1: Long-Term Measurement Locations

5.0 Ambient Measurement Results

The DNL values are presented in the table below.

Table 1: El Mirage Field Long-Term Daily Average Levels

Location	Measured DNL (dBA)	Corrected DNL (dBA)
LT-1	60.0	52.1
LT-2	58.0	45.3
LT-3	58.4	49.7
LT-4	60.0	54.1

Due to high wind speeds, the DNL values presented in Table 1 were corrected by logarithmically subtracting wind generated noise from the measurement data.⁴ The figures below show the hourly sound levels as measured and after the wind noise correction, charted against the average hourly wind speed throughout the duration of the long-term measurements. The first graph shows data for the measurement locations east of El Mirage (LT-1 and LT-2) and the second graph the data for locations west of El Mirage (LT-3 and LT-4).

⁴ Hessler, George H., et al. "Experimental Study to Determine Wind-Induced Noise and Windscreen Attenuation Effects on Microphone Response for Environmental Wind Turbine and Other Applications." *Noise Control Engineering Journal* v56. n4(2008): p305.

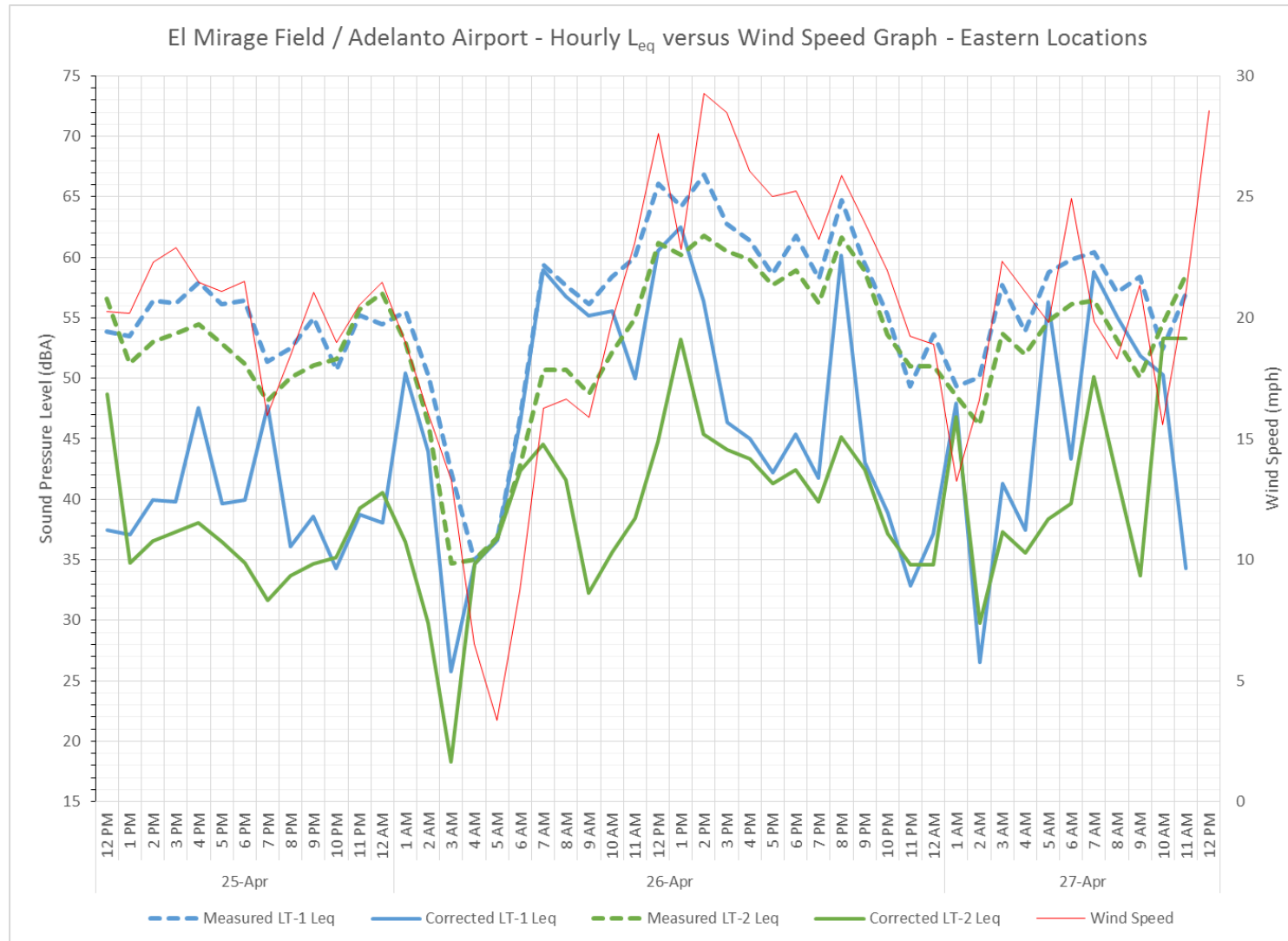


Figure 2: Hourly L_{eq} versus Hourly Wind Speed Graph, Eastern Locations

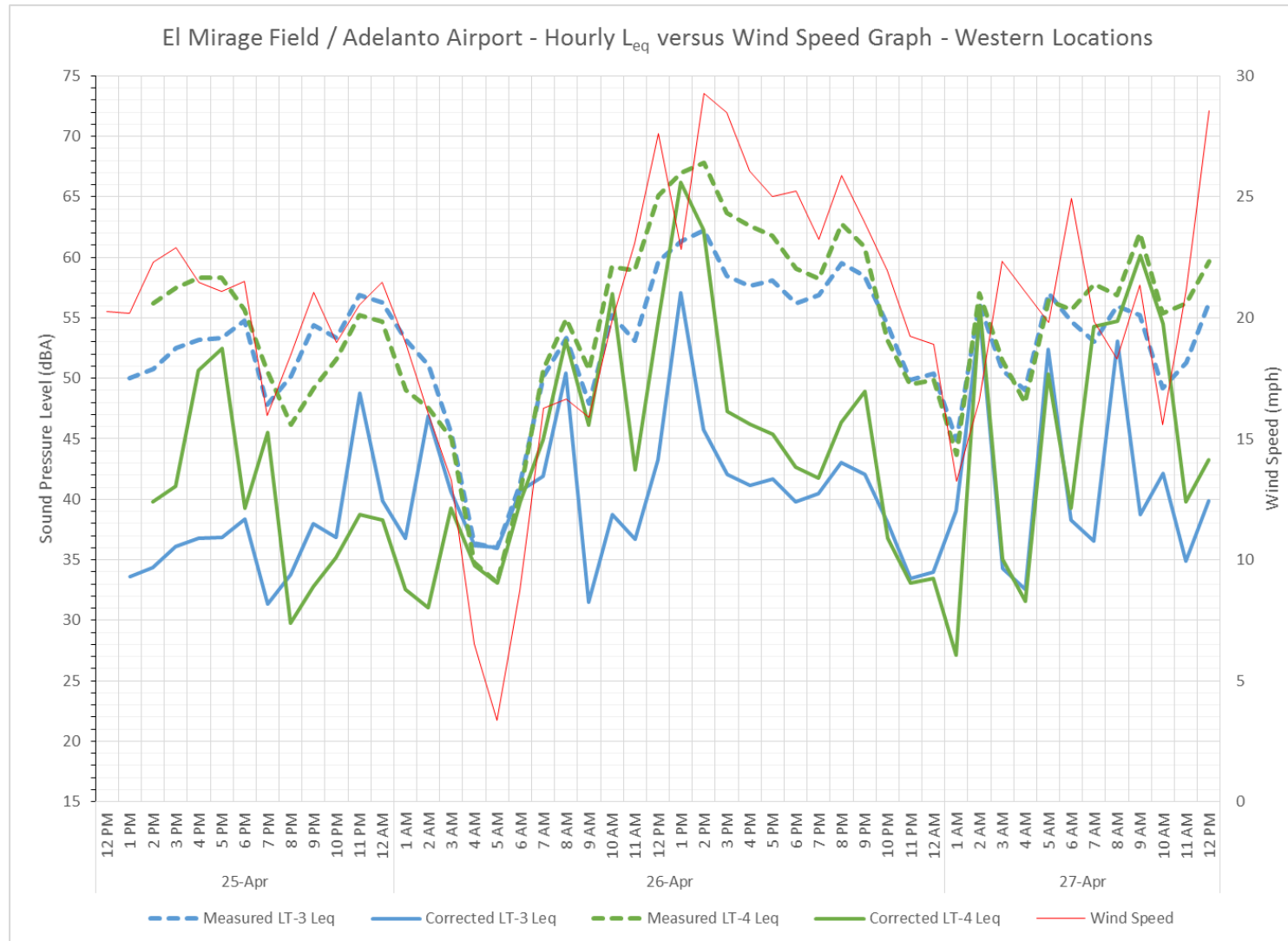


Figure 3: Hourly Calculated L_{eq} versus Hourly Wind Speed Graph

6.0 Aircraft Noise Modeling

In order to calculate the noise from current and future aircraft operations, we used the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) 2C SP2. This model calculates noise levels in/around the airport based upon the type of aircraft used, flight tracks, and frequency of operations (flights).

6.1 Modeling Assumptions/Procedure

The noise modeling utilized the assumptions outlined in Table 2.

Table 2: AEDT Noise Modeling Assumptions

Item	Data Provided by General Atomics	AEDT Input
Drone Aircraft	Predator A, Predator B	King Air 100
Chase Aircraft Type	Cessna 210, S35 Bonanza, Mooney M20, Piper Comanche PA 24, Cessna 182, Cessna 172	Cessna 210
Number of Operations	484 UAV flights per year 290 Chase plane flights per year	1.33/day – UAV 0.79/day – chase plane
Runway Usage	None	82% Runway 25 (takeoff to the west) 18% Runway 7 (takeoff to the east) Based on analysis of USGS wind data ⁵
Flight Paths	See Figure 4	See Figure 4

The above data was input into the AEDT noise model utilizing the flight paths shown in Figure 4. Noise exposure, in terms of DNL, was then calculated around the airport area including at the four long-term measurement locations. The only difference between the existing and future conditions is the lengthening of the runway to the east and the resultant flight path changes.

⁵ <https://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/california/daggett/>

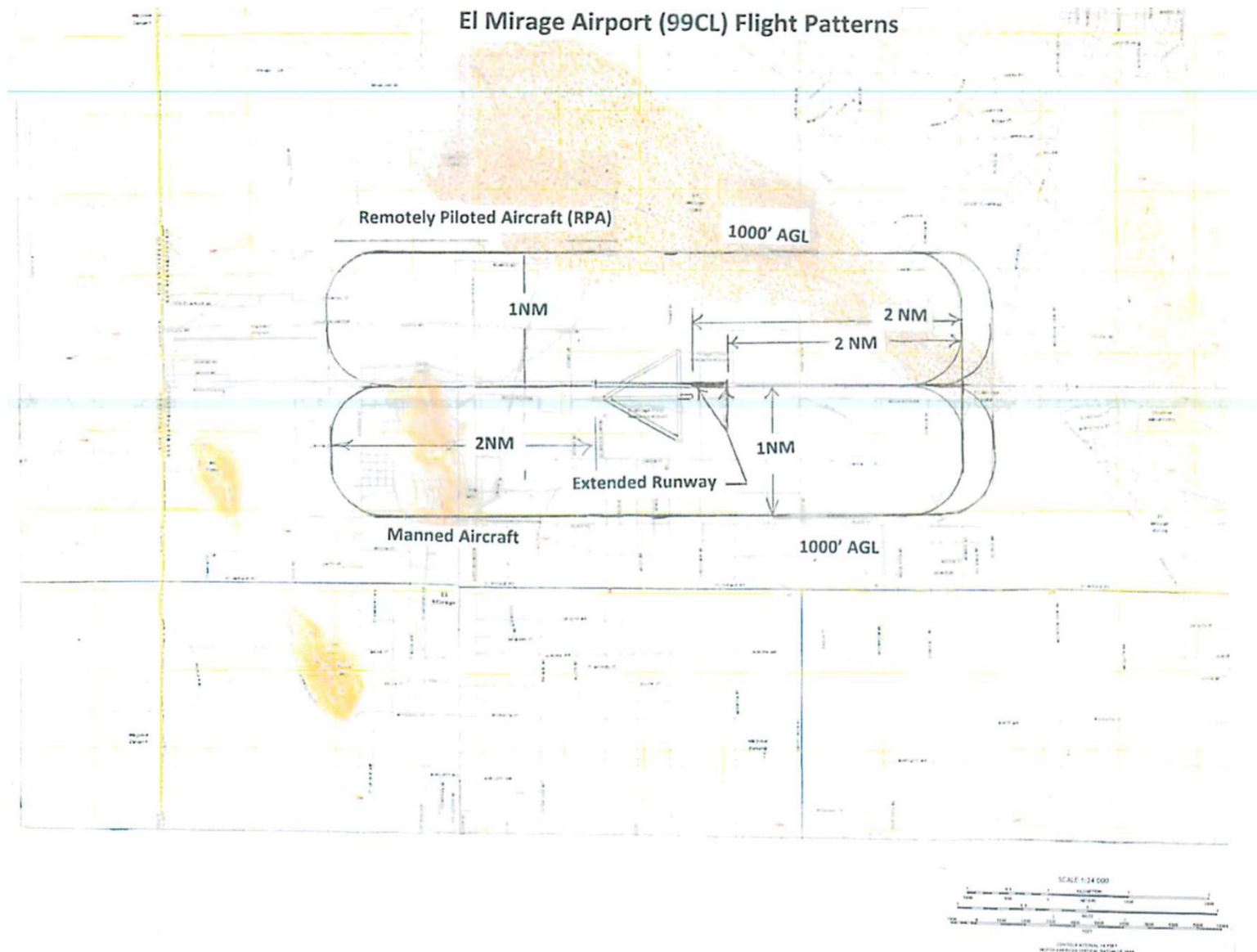


Figure 4: El Mirage Flight Paths

6.2 Modeling Results

Table 4 summarizes the results of our noise modeling and compares the noise levels to the existing ambient measurement data (corrected for wind noise).

Table 3: Calculated Existing and Future Aircraft Noise Levels

Location	Correct Ambient DNL (dBA)	Existing Exterior Flight DNL (dBA)	Existing Interior Flight DNL (dBA)	Future Flight Exterior DNL (dBA)	Future Flight Interior DNL (dBA)
LT-1	52.1	51.5	-	75.3	-
LT-2	45.3	40.9	20.9	41.0	21.0
LT-3	49.7	44.7	24.7	41.7	21.7
LT-4	54.1	38.4	18.4	36.9	16.9

Note: Location 1 is part of the El Mirage property and is not a sensitive receiver. Interior noise levels were calculated assuming a typical building facade noise reduction of 20 to 25 dBA; we used 20 dBA to be conservative.

Figures 5 and 6 show a present and future (with runway extension) aircraft noise contours.

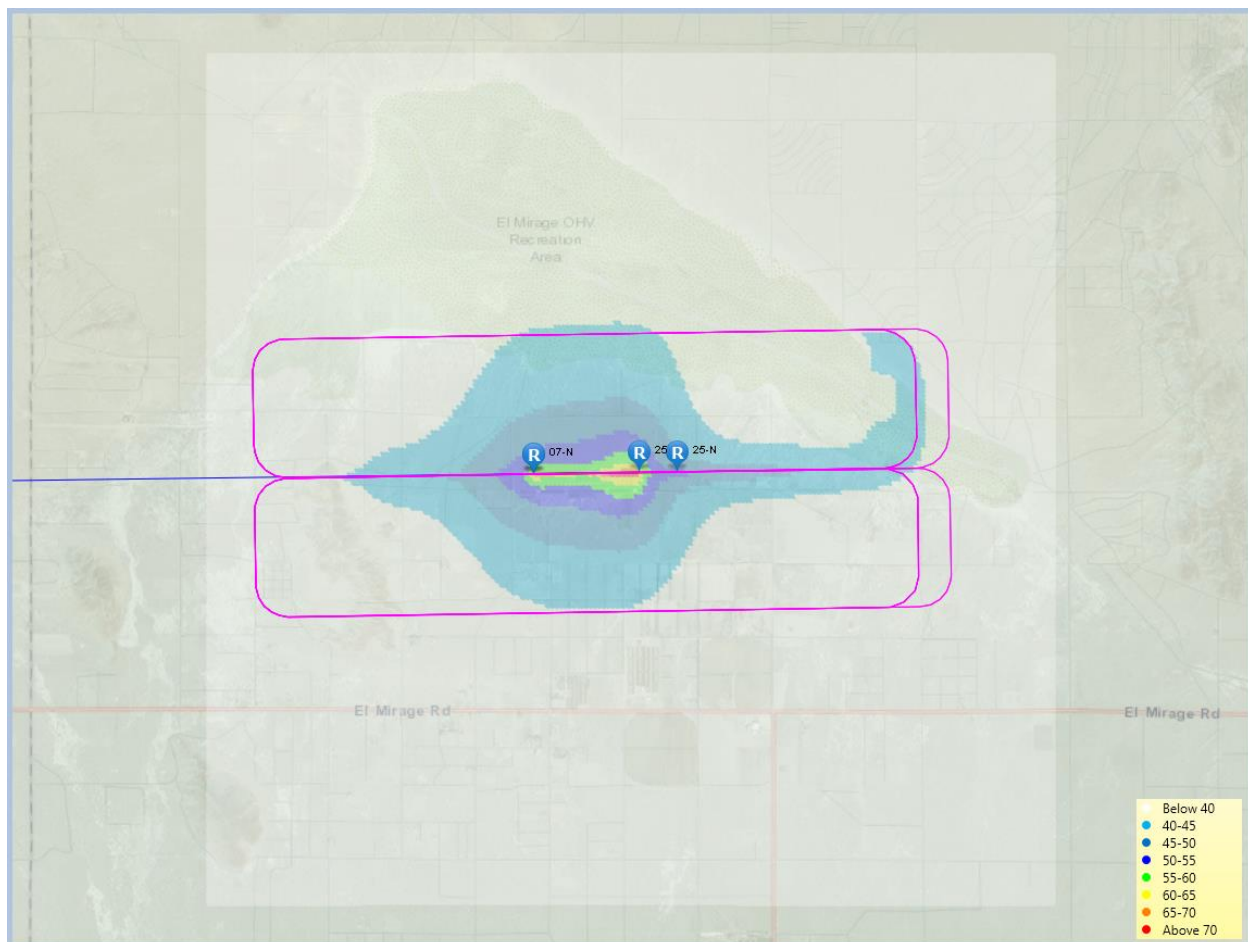


Figure 5: Present Day DNL Noise Contours



Figure 6: Future (with east runway extension) DNL Noise Contours

6.3 Analysis/Discussion

As can be seen from Table 3 and the figures, there is an increase in noise at the east side of the airport with the runway extension. This is to be expected, as aircraft landing to the west will touch down earlier (i.e., further to the east) than the current configuration. There is a large increase in noise at the LT-1 measurement location; however, this location is on General Atomics' property and is located at the new runway extension. The noise levels at this location are provided for informational purposes only.

At the west side of the airport, future noise levels will decrease by 2 to 3 dBA due to the flight path's shift eastward. As a reference, a change in noise level of less than 3 dBA is generally not noticeable to the average person.

The County's threshold of acceptability is DNL 60 dBA. Aircraft noise levels at or above DNL 60 dBA only occur on General Atomics' property. At all three sensitive receiver locations, interior noise levels are predicted to be significantly below the County's 45 dBA criterion (see Table 3).

The extension of the runway to the east does not noticeably change noise levels at sensitive receivers and aircraft noise levels meet the County's threshold of DNL 60 dBA at the exterior and 45 dBA at the interior.