APPENDIX E
NOISE

E.1 METHOD OVERVIEW

SOUND AND NOISE

Sound is created by a vibrating source that induces vibrations in the air. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source like ripples on a pond. Sound waves dissipate with increasing distance from the source. Sound waves can also be reflected, diffracted, refracted, or scattered. When the source stops vibrating, the sound waves disappear almost instantly and the sound ceases.

Sound conveys information to listeners. It can be instructional, alarming, pleasant and relaxing, or annoying. Identical sounds can be characterized by different people, or even by the same person at different times, as desirable or unwanted. Unwanted sound is commonly referred to as "noise."

Sound can be defined in terms of three components:

1. Level (amplitude)
2. Pitch (frequency)
3. Duration (time pattern)

E.1.1 SOUND LEVEL

The level of sound is measured by the difference between atmospheric pressure (without the sound) and the total pressure (with the sound). Amplitude of sound is like the relative height of the ripples caused by the stone thrown into the water. Although physicists typically measure pressure using the linear Pascal scale, sound is measured using the logarithmic decibel (dB) scale. This is because the range of sound pressures detectable by the human ear can vary from *1 to 100 trillion units*. A logarithmic scale allows us to discuss and analyze noise using more manageable numbers. The range of audible sound ranges from approximately 1 to 140 dB, although everyday sounds rarely rise above about 120 dB. The human ear is extremely sensitive to sound pressure fluctuations. A sound of 140 dB, which is sharply painful to humans, contains *100 trillion (10^{14}) times more* sound pressure than the least audible sound.

By definition, a 10 dB increase in sound is equal to a tenfold (10^1) increase in the mean square sound pressure of the reference sound. A 20 dB increase is a 100-fold (10^2) increase in the mean square sound pressure of the reference sound. A 30 dB increase is a 1,000-fold (10^3) increase in mean square sound pressure.

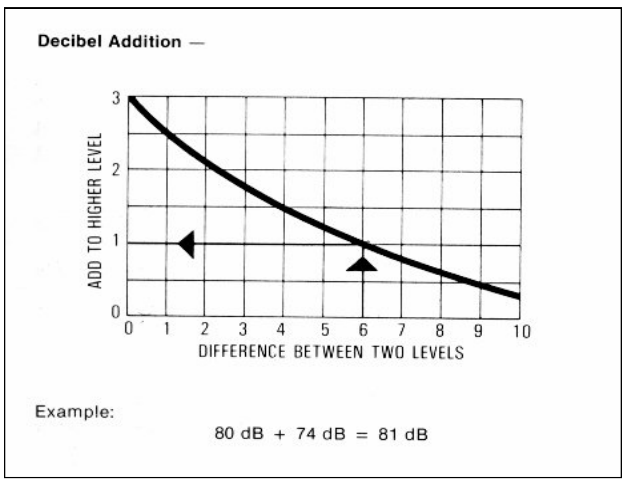
A logarithmic scale requires different mathematics than used with linear scales. The sound pressures of two separate sounds, expressed in dB, are not arithmetically additive. For example, if a sound of 80 dB is added to another sound of 74 dB, the total is a 1 dB increase in the louder sound (81 dB), not the arithmetic sum of 154 dB (See **Exhibit E-1, *Example of Addition of Two Decibel Levels***). If two equally loud noise events occur simultaneously, the sound pressure level from the combined events is 3 dB higher than the level produced by either event alone.

Logarithmic averaging also yields results that are quite different from simple arithmetic. Consider the example shown in **Exhibit E-2, *Example of Sound Level Averaging***. Two sound levels of equal duration are averaged. One has an Lmax of 100 dB, the other 50 dB. Using conventional arithmetic, the average would be 75 dB. The true result, using logarithmic math, is 97 dB. This is because 100 dB has far more energy than 50 dB (100,000 times as much!) and is overwhelmingly dominant in computing the average of the two sounds.

Human perceptions of changes in sound pressure are less sensitive than a sound level meter. People typically perceive a tenfold increase in sound pressure, a 10 dB increase, as a doubling of loudness. Conversely, a 10 dB decrease in sound pressure is normally perceived as half as loud. In community settings most people perceive a 3 dB increase in sound pressure (a doubling of the sound pressure or energy) as just noticeable. (In laboratory settings, people with good hearing are able to detect changes in sounds of as little as 1 dB.)

Exhibit E-1:

EXAMPLE OF ADDITION OF TWO DECIBEL LEVELS



Source: *Information on Levels*. USEPA. March 1974.

E.1.2 SOUND FREQUENCY

The pitch (or frequency) of sound can vary greatly from a low-pitched rumble to a shrill whistle. If we consider the analogy of ripples in a pond, high frequency sounds are vibrations with tightly spaced ripples, while low rumbles are vibrations with widely spaced ripples. The rate at which a source vibrates determines the frequency. The rate of vibration is measured in units called "Hertz" -- the number of cycles, or waves, per second. One's ability to hear a sound depends greatly on the frequency composition. Humans hear sounds best at frequencies between 1,000 and 6,000 Hertz. Sound at frequencies above 10,000 Hertz (high-pitched hissing) and below 100 Hertz (low rumble) are much more difficult to hear.

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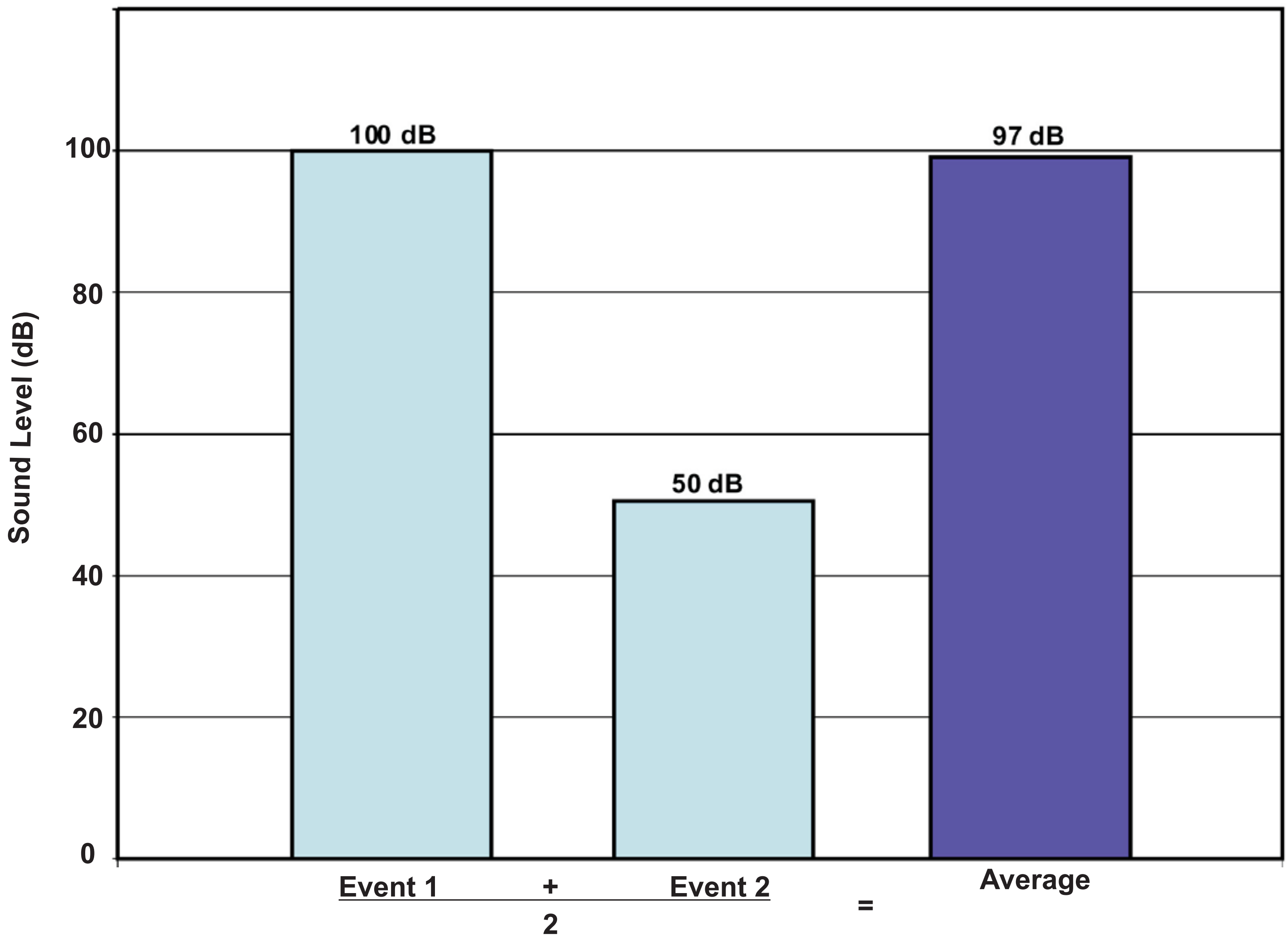
Assume two sound levels of equal duration...
What is the average level?



(100dB + 50dB) / 2 = 97dB

The decibel (dB) scale is logarithmic -
100 dB is 100,000 times more energy than 50 dB!

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Example of Sound Level Averaging

Exhibit:
E-2

If we are attempting to measure sound in a way that approximates what our ears hear, we must give more weight to sounds at the frequencies we hear well and less weight to sounds at frequencies we do not hear well. Acousticians have developed several weighting scales for measuring sound. The A-weighted scale was developed to correlate with the judgments people make about the loudness of sounds. The A-weighted decibel scale (dBA) is used in studies where audible sound is the focus of inquiry. The U.S. Environmental Protection Agency (USEPA) has recommended the use of the A-weighted decibel scale in studies of environmental noise.[1] Its use is required by the FAA in airport noise studies.[2] For the purposes of this analysis, dBA was used as the noise metric and dB and dBA are used interchangeably.

E.1.3 DURATION OF SOUNDS

The duration of sounds – their patterns of loudness and pitch over time – can vary greatly. Sounds can be classified as *continuous* like a waterfall, *impulsive* like a firecracker, or *intermittent* like aircraft overflights. Intermittent sounds are produced for relatively short periods, with the instantaneous sound level during the event roughly appearing as a bell-shaped curve. An aircraft event is characterized by the period during which it rises above the background sound level, reaches its peak, and then recedes below the background level.

E.2 STANDARD NOISE DESCRIPTORS

Given the multiple dimensions of sound, a variety of descriptors, or metrics, have been developed for describing sound and noise. Some of the most commonly used metrics are discussed in this section. They include:

1. Maximum Level (**Lmax**)
2. Time Above Level (**TA**)
3. Sound Exposure Level (**SEL**)
4. Equivalent Sound Level (**Leq**)
5. Day/Night Average Sound Level (**DNL**)
6. Community Noise Equivalent Level (CNEL)

E.2.1 MAXIMUM LEVEL (LMAX)

Lmax is simply the highest sound level recorded during an event or over a given period of time. It provides a simple and understandable way to describe a sound event and compare it with other events. In addition to describing the peak sound

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1 Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety. U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, P. A-10.

2 "Airport Noise Compatibility Planning." 14 CFR Part 150, Sec. A150.3.

level, Lmax can be reported on an appropriate weighted decibel scale (A-weighted, for example) so that it can disclose information about the frequency range of the sound event in addition to the loudness.

Lmax, however, fails to provide any information about the duration of the sound event. This can be a critical shortcoming when comparing different sounds. Even if they have identical Lmax values, sounds of greater duration contain more sound energy than sounds of shorter duration. Research has demonstrated that for many kinds of sound effects, the total sound energy, not just the peak sound level, is a critical consideration.

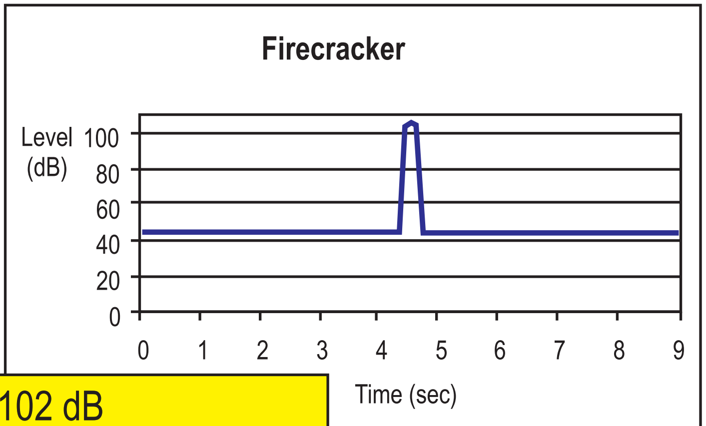
E.2.2 TIME ABOVE LEVEL (TA)

The "time above," or TA, metric indicates the amount of time that sound at a particular location exceeds a given sound level threshold. TA is often expressed in terms of the total time per day that the threshold is exceeded. The TA metric explicitly provides information about the duration of sound events, although it conveys no information about the peak levels during the period of observation.

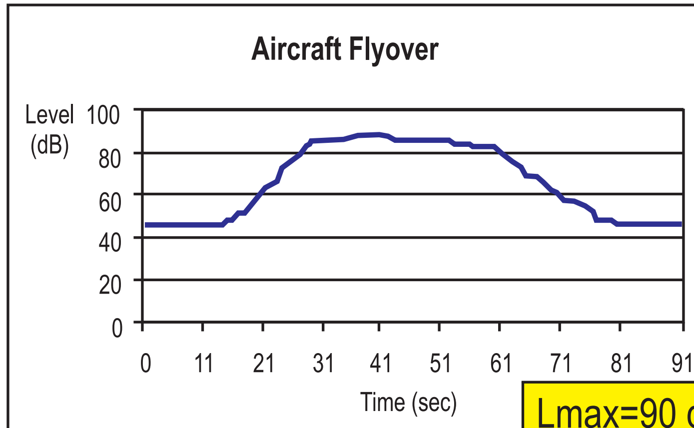
E.2.3 SOUND EXPOSURE LEVEL (SEL)

The sound exposure level, or SEL metric, provides a way of describing the total sound energy of a single event. In computing the SEL value, all sound energy occurring during the event, within 10 dB of the peak level (Lmax), is mathematically integrated over one second. (Very little information is lost by discarding the sound below the 10 dB cut-off, since the highest sound levels completely dominate the integration calculation.) Consequently, the SEL is always greater than the Lmax for events with a duration greater than one second. SELs for aircraft overflights typically range from five to 10 dB higher than the Lmax for the event.

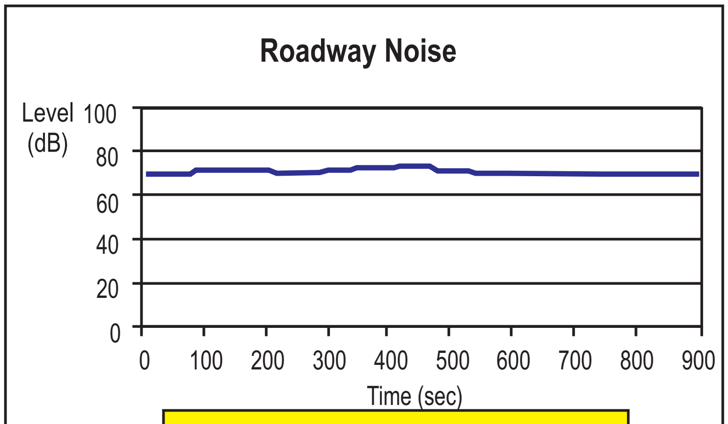
Exhibit E-3, *Comparison of Different Types of Sounds* shows graphs of instantaneous sound levels for three different events: an aircraft flyover, roadway noise, and a firecracker. The Lmax and the duration of each event differ greatly. The pop of the firecracker is quite loud, 102 dB but lasts less than a second. The aircraft flyover has a considerably lower Lmax at 90 dB, but the event lasts for over a minute. The Lmax from the roadway noise is even quieter at only 72 dB, but it lasts for 15 minutes. By considering the loudness and the duration of these very different events simultaneously, the SEL metric reveals that the total sound energy of all three is identical. This can be a critical finding for studies where total noise dosage is the focus of study. As it happens, research has shown conclusively that noise dosage is crucial in understanding the effects of noise on animals and humans.



Lmax=102 dB
SEL=100 dB
Leq=105
Event Duration=0.3 seconds



Lmax=90 dB
SEL=100 dB
Leq=82
Event Duration=70 seconds



Lmax=72 dB
SEL=100 dB
Leq=71
Event Duration=900 seconds

Comparison of Different Types of Sound

E.2.4 EQUIVALENT SOUND LEVEL (LEQ)

The equivalent sound level (Leq) metric may be used to define cumulative noise dosage, or noise exposure, over a period of time. In computing Leq, the total noise energy over a given period of time, during which numerous events may have occurred, is logarithmically averaged over the time period. The Leq represents the steady sound level that is equivalent to the varying sound levels actually occurring during the period of observation. For example, an 8-hour Leq of 67 dB indicates that the amount of sound energy in all the peaks and valleys that occurred in the 8-hour period is equivalent to the energy in a continuous sound level of 67 dB. Leq is typically computed for measurement periods of 1 hour, 8 hours, or 24 hours, although any time period can be specified.

Exhibit E-4, *Relationship Among Sound Metrics* shows the relationship of Leq to Lmax and SEL. In this example, a single aircraft event lasting 18 seconds is represented. The instantaneous noise levels for the event range from 64 to an Lmax of 101 dBA. The area under the curve represents the sound energy accumulated during the entire event. The compression of this energy into a single second results in an SEL of 105 dBA. The Leq average of the sound energy for each second during the event would be 93 dB. If this event were the only event to occur during an hour, the aircraft sound energy for the other 3,582 seconds would be considered to be zero. When converted to an hourly LEQ, the level would be nearly 70 dB of Leq. This again indicates the dominance of loud events in noise summation and averaging computations.

Leq is a critical noise metric for many kinds of analysis where total noise dosage, or noise exposure, is under investigation. As already noted, noise dosage is important in understanding the effects of noise on both animals and people. Indeed, research has led to the formulation of the "equal energy rule." This rule states that it is the total acoustical energy to which people are exposed that explains the effects the noise will have on them. That is, a very loud noise with a short duration will have the same effect as a lesser noise with a longer duration if they have the same total sound energy.

E.2.5 DAY/NIGHT AVERAGE SOUND LEVEL (DNL)

The DNL metric is really a variation of the 24-hour Leq metric. Like Leq, the DNL metric describes the total noise exposure during a given period. Unlike Leq, however, DNL, by definition, can only be applied to a 24-hour period. In computing DNL, an extra weight of 10 dB is assigned to any sound levels occurring between the hours of 10:00 p.m. and 7:00 a.m. This is intended to account for the greater annoyance that nighttime noise is presumed to cause for most people. Recalling the logarithmic nature of the dB scale, this extra weight treats one nighttime noise event as equivalent to 10 daytime events of the same magnitude.

As with Leq, DNL values are strongly influenced by the loud events. For example, 30 seconds of sound of 100 dB, followed by 23 hours, 59 minutes, and 30 seconds of silence would compute to a DNL value of 65 dB. If the 30 seconds occurred at night, it would yield a DNL of 75 dB.

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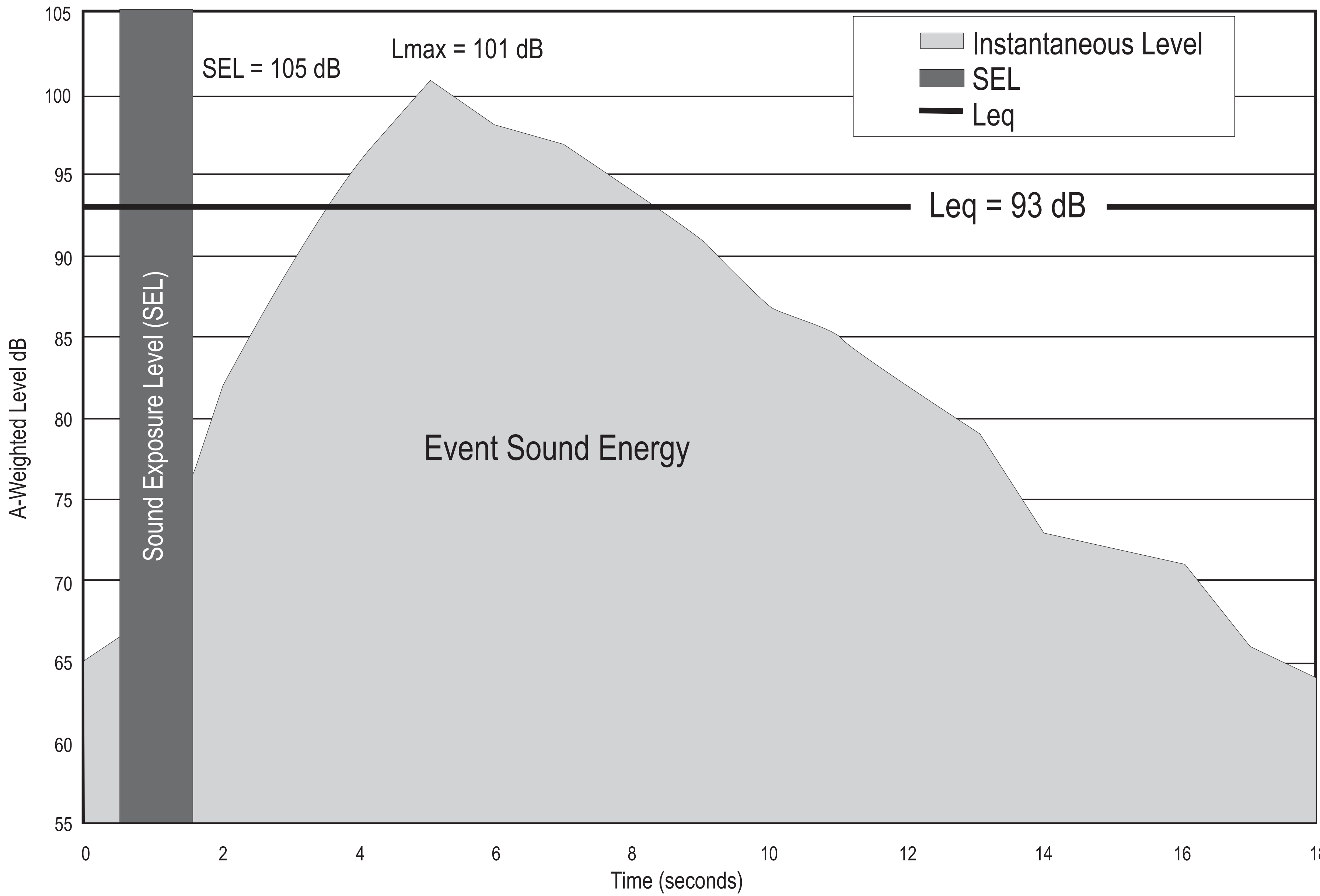

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Relationship Among Sound Metrics

Exhibit:
E-4

This example can be roughly equated to an airport noise environment. Recall that an SEL is the mathematical compression of a noise event into one second. Thus, 30 SELs of 100 dB during a 24-hour period would equal DNL 65 dB, or DNL 75 dB if they occurred at night. This situation could actually occur in places around a real airport. If the area experienced 30 overflights during the day, each of which produced an SEL of 100 dB, it would be exposed to DNL 65 dB. Recalling the relationship of SEL to the peak noise level (Lmax) of an aircraft overflight, the Lmax recorded for each of those overflights (the peak level a person would actually hear) would typically range from 90 to 95 dB.

E.2.6 COMMUNITY NOISE EQUIVALENT LEVEL (CNEL)

The CNEL metric is a single value of sound level for 24 hour period, which includes all of the time-varying sound energy within the period. To represent the greater annoyance caused by a noise event during the evening hours, the CNEL metric includes an added 5 dB weighting for evening noise events occurring between 7:00 P.M. and 10:00 P.M. This evening event weighting helps to account for the annoyance of noise during time periods after typical working-hours when people are at home. The weighting, in essence, equates one evening flight to approximately three daytime flights. Similarly, the CNEL metric also incorporates a 10 dB nighttime (10:00 P.M. and 7:00 A.M.) penalty to represent the greater annoyance caused by a noise event at night. This extra nighttime event weighting helps to account for the annoyance of noise during time periods when people are typically asleep and background noise levels are lower. The weighting, in essence, equates one nighttime flight to ten daytime flights.

In addition to requiring the use of the CNEL metric, the FAA also requires that aircraft noise be evaluated using one of several authorized computer noise prediction models. For this study, the most current version of the FAA's long standing Integrated Noise Model (INM) available at the time of analysis, version 7.0a, was used to develop the noise analysis..

E.2.7 FEDERAL REQUIREMENTS TO USE DNL IN ENVIRONMENTAL NOISE STUDIES

DNL is the standard metric used for environmental noise analysis in the U.S. This practice originated with the USEPA's effort to comply with the Noise Control Act of 1972. The USEPA designated a task group to "consider the characterization of the impact of airport community noise and develop a community noise exposure measure."[3] The task group recommended using the DNL metric. The USEPA accepted the recommendation in 1974, based on the following considerations:

1. The measure is applicable to the evaluation of pervasive, long-term noise in various defined areas and under various conditions over long periods of time.

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[3] *Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety.* U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, P. A-10.

2. The measure correlates well with known effects of the noise environment on individuals and the public.
3. The measure is simple, practical, and accurate.
4. Measurement equipment is commercially available.
5. The metric at a given location is predictable, within an acceptable tolerance, from knowledge of the physical events producing the noise.[4]

Soon thereafter, the Department of Housing and Urban Development (HUD), Department of Defense, and the Veterans Administration adopted the use of DNL.

At about the same time, the Acoustical Society of America developed a standard (ANSI S3.23-1980) which established DNL as the preferred metric for outdoor environments. This standard was reevaluated in 1990 and they reached the same conclusions regarding the use of DNL (ANSI S12.40-1990).

In 1980, the Federal Interagency Committee on Urban Noise (FICUN) met to consolidate Federal guidance on incorporating noise considerations in local land use planning. The committee selected DNL as the best noise metric for the purpose, thus endorsing the USEPA's earlier work and making it applicable to all Federal agencies.[5]

In response to the requirements of the Aviation Safety and Noise Abatement (ASNA) Act of 1979 and the recommendations of FICUN and USEPA, the FAA established DNL in 1981 as the single metric for use in airport noise and land use compatibility planning. This decision was incorporated into the final rule implementing ASNA, Federal Aviation Regulation 14 Code of Federal Regulations (CFR) Part 150, in 1985.

In the early 1990s, Congress authorized the creation of a new interagency committee to study airport noise issues. The Federal Interagency Committee on Noise (FICON) was formed with membership from the USEPA, the FAA, the U.S. Air Force, the U.S. Navy, HUD, the Department of Veterans Affairs (VA), and others. FICON concluded in its 1992 report that Federal agencies should "continue the use of the DNL metric as the principal means for describing long term noise exposure of civil and military aircraft operations."[6] FICON further concluded that there were no new sound descriptors of sufficient scientific standing to substitute for the DNL cumulative noise exposure metric.[7]

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[4] *Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety*. U.S. Environmental Protection Agency, Office of Noise Abatement and Control. 1974, Pp. A-1–A-23.

[5] *Guidelines for Considering Noise in Land Use Planning and Control*. Federal Interagency Committee on Urban Noise (FICUN). 1980.

[6] *Federal Agency Review of Selected Airport Noise Analysis Issues*. Federal Interagency Committee on Noise (FICON). August 1992, Pp. 3-1.

[7] *Federal Agency Review of Selected Airport Noise Analysis Issues*, Technical Report, Volume 2. Federal Interagency Committee on Noise (Technical). August 1992, Pp. 2-3.

In 1993, the FAA issued its *Report to Congress on Effects of Airport Noise*. Regarding DNL, the FAA stated, "Overall, the best measure of the social, economic, and health effects of airport noise on communities is the Day-Night Average Sound Level (DNL)."[8]

E.3 NOISE MEASUREMENTS

A sampling of field noise measurements was also included as part of this effort. Although the FAA guidelines require that the evaluation of aircraft noise be conducted based on approved computer noise model calculations, it can be helpful to consider the noise modeling results in the context of the local background noise environment. FAA's Order 1050.1E specifically addresses the use of noise measurement data as follows:

> "Noise monitoring data may be included in an EA or EIS at the discretion of the responsible FAA official. Noise monitoring is not required and should not be used to calibrate the noise model."

While it is clearly not appropriate to use noise measurement data for computer model calibration, field noise measurements do provide a background noise context for the consideration of modeled results. To that end, a field noise measurement program was conducted at select sites in the vicinity of Gnoss Field Airport (DVO or Airport) to provide a sample of ambient and aircraft event noise values for consideration.

E.3.1 PURPOSE

The primary focus of the noise measurement program was to collect and calculate a sample of aircraft event and background noise levels at each specific site. The noise measurements contain all noise recorded at a site including aircraft and non-aircraft events. The findings provide context to background and cumulative noise levels so that any changes in modeled noise exposure resulting from a project alternative can be considered. Thus, stake holders, decision makers, and the general public have a context to consider the relevant contributions of project-related noise exposure in relation to noise produced without project-related changes.

The noise measurement program included six long-term sites where measurements were taken for several days and twenty short-term sites where measurements were taken for one hour each. The noise measurement locations are shown in Exhibit E-5, *Noise Measurement Locations*. The effort was designed to collect cumulative CNEL noise levels and ambient levels at each of the long-term sites. With the exception of the 24-hour CNEL values, similar data was also collected for the short-term sites and also included aircraft single event levels. In addition to CNEL, the following supplemental information was computed from the measured data:

8 *Report to Congress on Effects of Airport Noise*. Federal Aviation Administration. 1993, P. 1.

- L_{50} – Sound level at which 50% of the measured 1-second samples are above and 50% are below. This is generally considered to be an estimation of background noise levels by FAA.
- Aircraft Leq(obs) – Sound level of the observed aircraft events averaged across the observation time period (obs).
- Non-Aircraft Leq (obs) – Average sound level of noise during observation time less the aircraft event noise.
- Total Leq(or CNEL) – Total average equivalent sound level during the measurement period.
- Aircraft Lmax – Range of maximum sound level associated with observed aircraft events

E.3.2 DATA COLLECTION

The noise measurement program focused on collecting a sample of data within strategic areas that were directly related to the areas of past noise concerns, the range of alternatives evaluated, and the local land uses within the study area.

The noise measurement program took place for a two-week period from Saturday, May 23, 2009 through Friday June 5, 2009. Long-term noise measurements were conducted at 6 locations. These locations included three residences south of Gnoss Field, Olompali State Historic Park, an access road north of Gnoss Field, and a walking trail south of Gnoss Field. In general, noise data for the long-term measurements were collected continuously 24 hours per day for a period of seven days, although for some of the long-term sites, the collection time was less than 7 days. Since it was not practical to staff each long-term site with an observer to log events, continuous digital audio recordings were taken for the duration of the measurements at each site.

The short-term noise measurements were taken at 20 locations, and consisted of collecting one hour's worth of noise measurement data at each location. A technician was present at each of these sites for the one hour period and logged any aircraft noise events that occurred. The locations were chosen from residential areas south of the Gnoss Field.

<u>Long-Term Measurement Set-up</u>

Sound meters at each of the six long-term noise measurement sites were set-up and checked periodically by a technician, but were typically unmanned during the noise measurement period. For the equipment's protection, all instruments, with the exception of the microphone, were housed in a weather resistant case. The sound meter's microphone was mounted on a tripod near the unit and fitted with a wind screen to eliminate any wind induced noise, and for the overall protection of the equipment.

The case containing the sound meter was secured to an immovable object to the greatest extent possible in order to prevent the unit from being moved, thereby ensuring the greatest accuracy of data received at that site. Measurement data were recorded at 1-second intervals. Prior to the start of any measurements, the technician ensured that the unit's internal clock was in-sync with the official local time. Thereafter, the technician made a daily check to ensure that the sound meter and battery power-source were functioning properly and to download the previous day's data. The daily data for each measurement site were then downloaded to a computer for further processing.

Two equipment configurations were used for the long-term measurements. The first included a B&K 2236 sound meter with detachable microphone, a large windscreen, an HP palmtop data logger, a Zoom digital audio recorder, a case, and miscellaneous supporting equipment. At 1-second intervals, data was transmitted via cable from the sound meter to the data logger where each data record was stored to a removable mass storage device inside the data logger. Simultaneous to the data logging activity, the audio output of the sound meter was input via a cable into the digital audio recorder to record the sounds responsible for the sound levels that were being logged. The audio recorder had its own mass storage device to record audio files. The second configuration included two B&K 2238 sound meters with detachable microphones, a large windscreen, a Zoom digital audio recorder, a case, and miscellaneous supporting equipment. At any given time, only one B&K 2238 sound meter was being used to collect data. The second was alternated each day with the other sound meter. All sound meter data was logged internally to the B&K 2238 instead of being sent to the data logger. Audio data was also recorded on the audio recorder. Calibration was performed on a daily basis during the technician's site check at the time that noise measurement and audio data were downloaded to the computer.

Short-Term Measurement Set-up

At each of the 20 short-term measurement sites, a tripod was set-up with a mounted sound level meter. The type of sound meter used was either a Brüel & Kjær Model 2236 or a Brüel & Kjær Model 2238. Prior to the start of each measurement, and again after the end of each measurement, a calibration check was performed on the sound meter using a Brüel & Kjær Model 4231 calibrator with certification traceable to the National Institute of Standards and Technology. Data was recorded internally within the sound meter at 1-second intervals. The sound meter's microphone was fitted with a large windscreen. Noise generating events that occurred during the measurement period were observed, and detailed notes were taken to document the noise sources that caused noise events at various times. When the noise source was an aircraft, the type of (i.e. propeller or jet) was noted by the technician, as was the time that the event occurred. Each short-term measurement lasted for one hour. The data for each measurement site was then downloaded to a computer for further processing.

E.3.3 MEASUREMENT SITES

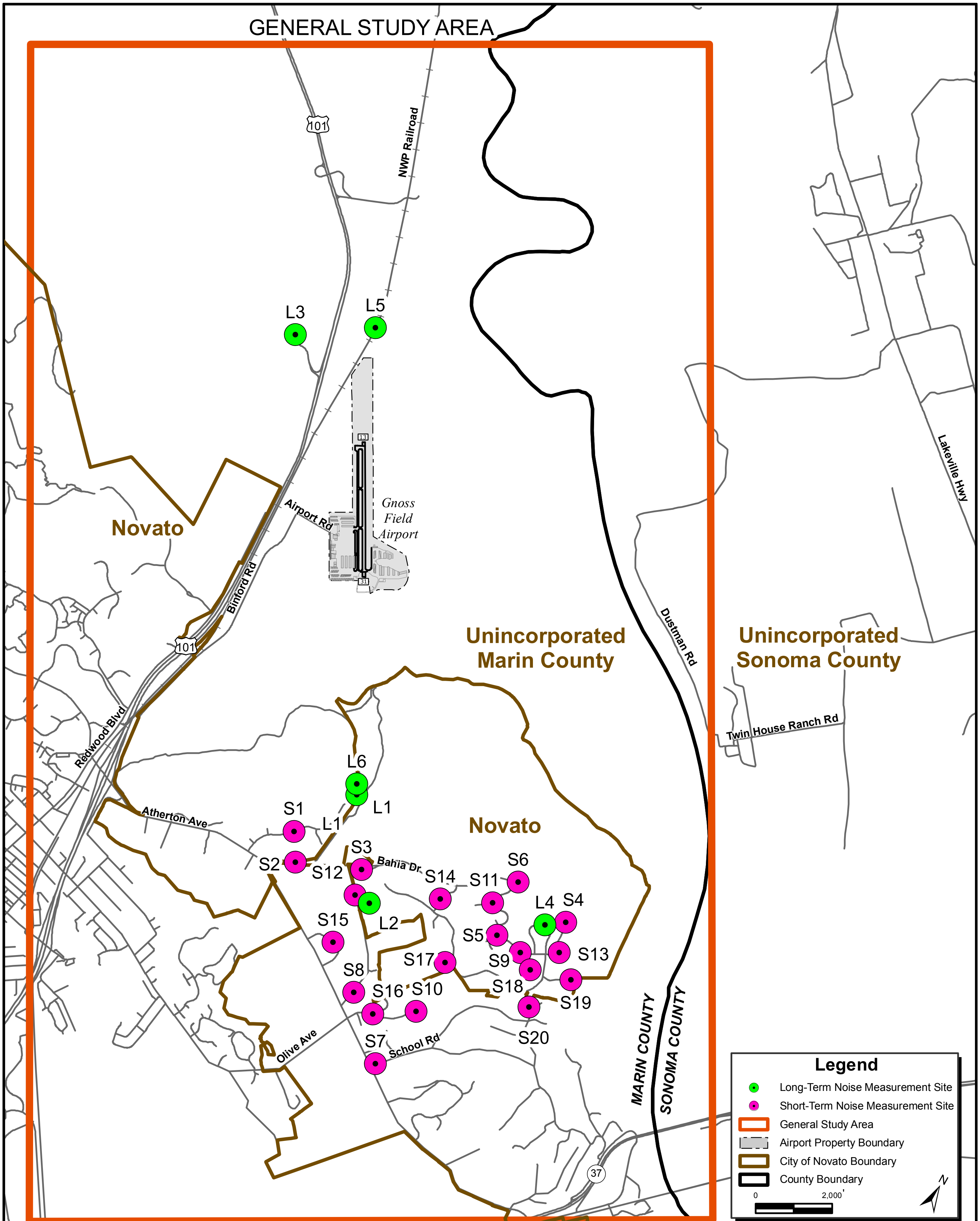
Table E-1 provides a listing of the 26 total measurement sites chosen for this program along with their location (6 long-term sites and 20 short-term sites). **Exhibit E-5, *Noise Measurement Locations*** illustrates the locations of all the sites on a map of the area. With both Exhibit E-5 and Table E-1, the sites with the "L" prefix identify the long-term sites and those with the "S" prefix indicate the short-term sites.

As Exhibit E-5 illustrates, the measurement program generally focused on the residential areas south of the Airport, where residents have voiced noise concerns. In addition, two of the long-term sites were located north of the Airport.

Table E-1
MEASUREMENT PROGRAM MONITORING SITES
Gnoss Field Airport

Site	Location	Measurement Date(s) (Times)
L1	265 Saddle Wood	5/23 – 5/30
L2	160 H Lane	5/23 – 5/30
L3	Olompali State Park	5/27 – 5/29
L4	600 Santana Road	5/30 – 6/5
L5	U.S. Highway 101 Access Road	5/30 – 6/5
L6	Walking Trail south of DVO	5/30 – 6/5
S1	Saddle Wood Drive	05/25 (13:41-14:41)
S2	Bugeia Lane	05/26 (13:05-14:05)
S3	Bahia Drive Open Space	05/26 (16:39-17:39)
S4	End of Bolero Court	05/27 (12:27-13:28)
S5	Park on Topaz Drive	05/27 (13:37-14:38)
S6	Bahia Drive and Topaz Drive	05/27 (14:51-15:51)
S7	School Road and Atherton Avenue	05/27 (17:36-18:36)
S8	H Lane Driveway	05/28 (12:32-13:33)
S9	Topaz Drive Sidewalk	05/28 (14:23-15:23)
S10	End of William Road	05/28 (15:37-16:38)
S11	Malobar Drive and Topaz Drive	05/29 (15:49-16:49)
S12	End of Topaz Drive	05/29 (18:13-19:15)
S13	H Lane at Kenilworth Court	05/30 (08:41-09:42)
S14	Cerro Crest Drive	05/30 (15:34-16:35)
S15	Archibald Lane	05/31 (09:09-10:10)
S16	Alpine Road and William Road	05/31 (11:16-12:16)
S17	Lindsey Court	06/01 (10:46-11:46)
S18	Baruna Court	06/02 (10:20-11:21)
S19	River Vista Court	06/03 (10:27-11:33)
S20	Crest Road and Guisela Court	06/04 (09:53-10:59)

Source: Landrum & Brown, 2009.



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Noise Measurement Locations

Exhibit:
E-5

The following paragraphs provide a description of each of the measurement locations used during the effort. The long-term sites are presented first followed by the short-term sites

Long-Term Measurement Sites (L1-L6)

Site L1: 265 Saddlewood Drive - This site is a private residence located approximately 1 mile southeast of the Airport. Through on-site discussions with the property owner, it was decided to place the sound meter in the patio area on the opposite side of the house from the backyard because the owners believed this site would not be disturbed by their dogs when barking. The sound meter was initially set-up on May 23, 2009 at 10:30 AM. At approximately 2:00 PM that day, the property owners relocated the sound meter to a small shrubbery area at portion of the backyard where their dogs would not frequent; which is where the technician found the equipment when returning on May 24, 2009 for the daily equipment check. The sound meter stayed at this second location on the property for the duration of the measurement period. This new location is where the sound meter resided for the remaining portion of the measurement period, which ended on May 30, 2009. The CNEL noise level for the measurement period was 51.8 dBA. The highest aircraft event Lmax, which was caused by a jet, was 70.7 dBA.

Site L2: 160 H Lane - This site is a private residence located approximately 1 ½ miles southeast of the Airport. The sound meter was placed in the backyard, next to a tree on the hill, away from areas frequented by the residents. The sound meter was set-up at 12:00 PM on May 23, 2009. The equipment functioned normally until the early morning of May 29, 2009 when one of the fuses inside a piece of equipment burned-out, which halted equipment operation for several hours. When the technician performed the daily equipment check on the afternoon of May 29, the faulty fuse was replaced and the equipment continued to function normally until the measurement period ended on May 30, 2009. .The CNEL noise level for the measurement period was 47.7 dBA. The highest aircraft event Lmax, which was caused by a propeller aircraft, was 72.5 dBA.

Site L3: Olompali State Historic Park Visitors' Center - This site is located approximately ½ mile northwest of the Airport, in a publicly accessible area. Through on-site coordination with the Park Ranger, the sound meter was placed near the visitor parking lot, to the side of the ranger access road. The sound meter was set-up at 9:00 AM on May 27, 2009. Due to technical difficulties with the sound meter itself, only three days of data were collected at this site (May 27-30, 2009). The CNEL noise level for the measurement period was 54.9 dBA. The highest aircraft event Lmax, which was caused by a propeller aircraft, was 80.5 dBA.

Site L4: 600 Santana Road - This site is a private residence located approximately 2 miles southeast of the Airport. The sound meter was placed in the backyard on a wooden deck. The sound meter was set-up at 1:30 PM on May 30, 2009. Due to what was determined to be a faulty battery, there are gaps in the data collection. The data collected however, is valid and has been used in this noise analysis. The measurement period ended on June 6, 2009. The CNEL noise level for the measurement period was 48.0 dBA. The highest aircraft event Lmax, which was caused by a jet, was 72.4 dBA.

Site L5: U.S. Highway 101 Access Road - This site is along an east-west access road located approximately ½ mile northwest of the Airport, accessible from U.S. Highway 101. The sound meter was placed under the flight path of arrivals to Runway 13 and departures from Runway 31. The sound meter was set-up at 2:00 PM on May 30, 2009. The measurement period ended on June 5, 2009. Due to the close proximity of this site to the flight path of aircraft depart from Runway 31 at DVO, this site experienced the highest noise levels of the six long-term measurement sites. The CNEL noise level for the measurement period was 57.8 dBA. The Lmax, which was caused by an aircraft departure from Runway 31, was 92 dBA.

Site L6: Walking Trail South of Gnoss Field Airport - This site is located along a public walking trail south of the Airport, approximately 300 feet northwest of site L1. The sound meter was set-up at 3:00 PM on May 30, 2009. The measurement period ended on June 5, 2009. The sound meter was placed under the flight path of arrivals to Runway 31 and departures from Runway 13. The CNEL noise level for the measurement period was 55.5 dBA. The highest aircraft event Lmax, which was caused by a propeller aircraft, was 76.1 dBA.

Short-Term Measurement Sites (S1 – S20)

Site S1: Saddle Wood Drive – The measurement period was 1:41 PM – 2:41 PM on May 25, 2009. The sound meter was placed on a sidewalk about midway between Atherton Road and site L1 along Saddle Wood Drive. Although the vehicle traffic volume that traveled past this location was not heavy, it was a large contributor of noise to this site. Eleven aircraft overflew the site during the measurement period. The Leq was 47.6 dBA. The Lmax, which was caused by a passing pickup truck, was 71.9 dBA.

Site S2: Bugeia Lane - The measurement period was 1:05 PM – 2:05 PM on May 26, 2009. The sound meter was placed on a dirt sidewalk adjacent to a grass field inside the turnout of a driveway along Bugeia Lane close to the Atherton Road intersection. Bugeia Lane is the main thoroughfare for traffic traveling to and from residential areas to the east of Atherton Avenue. As a result, the location was exposed to a heavier than normal vehicle traffic volume as compared to other short-term sites. Four aircraft overflew the site during the measurement period. The Leq was 56.4 dBA and the Lmax was 82.8 dBA.

Site S3: Bahia Drive Open Space - The measurement period was 4:39 PM – 5:39 PM on May 26, 2009. East of H Lane along Bahia Drive is a grassy, open space, island area that divides eastbound traffic from westbound traffic. This area contains a large sign that is marked with the word “Bahia”. The sound meter was placed approximately 140 feet west of the sign along the paved area where vehicles make u-turns along Bahia Drive. Vehicle traffic was the greatest contributor of noise at this site. Nine aircraft overflew the site during the measurement period.

The Leq was 54.4 dBA. The Lmax, which was caused by a passing vehicle, was 76.6 dBA.

Site S4: End of Bolero Court - The measurement period was 12:27 PM – 1:28 PM on May 27, 2009. The sound meter was placed at the cul-de-sac at the end of Bolero Court. There was no vehicle traffic past the sound meter during the measurement period. Twelve aircraft overflew the site during the measurement period. The Leq was 43.2 dBA. The Lmax, which was caused by an aircraft overflight, was 69.4 dBA.

Site S5: Park on Topaz Drive – The measurement period was 1:37 PM – 2:38 PM on May 27, 2009. The sound meter was placed in a small park along Topaz Drive. Due to its close proximity to Topaz Drive, vehicle traffic was the greatest contributor of noise at this site. Six aircraft overflew the site during the measurement period. The Leq was 49.8 dBA and the Lmax was 67.0 dBA.

Site S6: Bahia Drive and Topaz Drive - The measurement period was 2:51 PM – 3:51 PM on May 27, 2009. The sound meter was placed on the sidewalk near the corner of Bahia Drive and Topaz Drive. Motor vehicle traffic was the greatest contributor of noise at this site. Six aircraft overflew the site during the measurement period. The Leq was 50.7 dBA. The Lmax, which was caused by a passing vehicle, was 70.9 dBA.

Site S7: School Road and Atherton Avenue – The measurement period was 5:36 PM – 6:36 PM on May 27, 2009. The sound meter was placed along the northwest side of School Road approximately 120 feet northeast of Atherton Avenue. Vehicle traffic was the greatest contributor of noise at this site. Five aircraft overflew the site during the measurement period. The Leq was 54.8 dBA and the Lmax was 78.8 dBA.

Site S8: H Lane Driveway - The measurement period was 12:32 PM – 1:33 PM on May 28, 2009. The sound meter was placed on H Lane near a gated driveway that separates H Lane from a vacant field. Vehicle traffic was the greatest contributor of noise at this site. Nine aircraft overflew the site during the measurement period. The Leq was 49.1 dBA and the Lmax was 72.8 dBA.

Site S9: Topaz Drive Sidewalk – The measurement period was 2:23 PM – 3:23 PM on May 28, 2009. The sound meter was placed approximately 760 feet east of Site S5, on the sidewalk adjacent to Topaz Drive. Vehicle traffic was the greatest contributor of noise at this site. Eight aircraft overflew the site during the measurement period. The Leq was 53.8 dBA and the Lmax was 76.3 dBA.

Site S10: End of William Road – The measurement period was 3:37 PM – 4:38 PM on May 29, 2009. The sound meter was placed in a cul-de-sac at the end of William Road, atop a hill adjacent to a new housing development that had not yet gone into the construction phase. No construction activity was taking place at the housing development site during the measurement period. There was no vehicle traffic past the site during the measurement period. Eleven aircraft overflew the site during the measurement period. The Leq was 44.8 dBA and the Lmax was 61.7 dBA.

Site S11: Malobar Drive and Topaz Drive – The measurement period was 3:49 PM – 4:49 PM on May 29, 2009. The sound meter was placed adjacent to the intersection of Malobar Drive and Topaz Drive. Vehicle traffic was the greatest contributor of noise at this site. Twelve aircraft overflew the site during the measurement period. The Leq was 49.9 dBA and the Lmax was 71.2 dBA.

Site S12: End of Topaz Drive – The measurement period was 6:13 PM – 7:15 PM on May 25, 2009. The sound meter was placed adjacent to the Bahia Wildlife Habitat, near the corner of Topaz Drive and Bolero Court. The greatest contributors to noise at this site were activities at the nearby recreational area swimming pool and vehicle traffic. Eight aircraft overflew the site during the measurement period. The Leq as 48.0 dBA and the Lmax was 70.0 dBA.

Site S13: H Lane at Kenilworth Court – The measurement period was 8:41 AM – 9:42 AM on May 30, 2009. The sound meter was places on H Lane approximately 760 feet southeast of Bahia Drive. Vehicle traffic, birds, and other wildlife were the greatest contributors of noise at this site. Sixteen aircraft overflew the site during the measurement period. The Leq was 50.5 dBA. The Lmax, which was caused by a passing vehicle, was 76.0 dBA.

Site S14: Cerro Crest Drive - The measurement period was 3:34 PM – 4:35 PM on May 30, 2009. The sound meter was placed on Cerro Crest Drive roughly midway between Laguna Vista Drive and Bahia Drive. Vehicle traffic was the greatest contributor of noise at this site. Twenty aircraft overflew the site during the measurement period. The Leq was 58.0 dBA and the Lmax was 82.3 dBA.

Site S15: Archibald Lane - The measurement period was 9:09 AM – 10:10 AM on May 31, 2009. Archibald Lane is a curved street that circles around and crosses Atherton Avenue at two distinct intersections. The sound meter was placed midway between the two intersections along Archibald Lane near where Archibald Lane's achieves it highest elevation along a hill. Very little vehicle traffic passed the site during the measurement period. Thirteen aircraft overflew the site during the measurement period. The Leq was 43.9 dBA and the Lmax was 64.5 dBA.

Site S16: Alpine Road and William Road - The measurement period was 11:16 AM – 12:16 PM on May 31, 2009. The sound meter was placed on a grassy lawn near the corner of Alpine Road and William Road about a block from Atherton Avenue. Very little vehicle traffic passed the site during the measurement period. Twenty-one aircraft overflew the site during the measurement period. The Leq was 43.2 dBA and the Lmax was 58.4 dBA. .

Site S17: Lindsey Court – The measurement period was 10:46 AM – 11:46 AM on June 1, 2009. The sound meter was placed the dead end of Lindsey Court along a walking path a short distance away from Laguna Vista Drive. Very little vehicle traffic passed the site during the measurement period. Twenty-one aircraft overflew the site during the measurement period. The Leq was 46.0 dBA. The Lmax, which was caused by a barking dog, was 64.4 dBA.

Site S18: Baruna Court – The measurement period was 10:20 AM – 11:21 AM on June 2, 2009. The sound meter was placed on a side-street near the cul-de-sac at the end of Baruna Court. While not heavy, local vehicle traffic was the greatest contributor of noise at this site. Fourteen aircraft overflew the site during the measurement period. The Leq was 47.5 dB. The Lmax, which was caused by a passing car, was 68.5 dBA.

Site S19: River Vista Court – The measurement period was 10:27 AM – 11:33 AM on June 3, 2009. The sound meter was placed at the end of River Vista Court. Very little vehicle traffic passed the site during the measurement period. Birds were the greatest contributors of noise at this site. Eighteen aircraft overflew the site during the measurement period. The Leq was 48.2 dBA. The Lmax, which was caused by a passing vehicle, was 71.0 dBA.

Site S20: Crest Road and Guisela Court – The measurement period was 9:53 AM – 10:59 AM on June 4, 2009. The sound meter was placed on a grassy area next to a street sign at the intersection of Crest Road and Guisela Court. Very little vehicle traffic passed the site during the measurement period. Birds were the greatest contributors of noise at this site. Ten aircraft overflew the site during the measurement period. The Leq was 42.7 dBA. The Lmax, which was caused by a jet aircraft overflight, was 66.7 dBA.

E.3.4 MEASUREMENT ANALYSIS AND RESULTS

The raw data files from each of the measurement sites were reformatted and updated to add additional fields to the data to identify the date and measurement day associated with each data record. Additionally, since all data records that are recorded on the B&K 2238 are devoid of individual time tags, all data coming from the B&K 2238 had to have a valid time tag identifier inserted for each data record. All of the data files then went through an extensive data cleaning process to distinguish useable data records from unusable. In some cases, it was discovered that occasionally data records collected by the HP palmtop data logger were corrupted. Each corrupted data record was identified within the data files and uncorrupted, if possible; otherwise that data record was flagged as containing an error. Data records that occurred within a 5 minutes window just prior to and just after the meter was set-up each day were considered to have been polluted with operational set-up noise and were consequently excluded from the analysis. Additionally, during the noise measurement period when the actual sound level became quieter than what the sound meter was capable of measuring, the sound meter output the data as “indeterminate.” All of these “indeterminate” data records were likewise excluded from analysis. The data files were then imported into Excel spreadsheets.

For each of short-term measurement sites, the one hour Leq and L50 were computed from the resulting data for the measurement period along with the Lmax values for each noise event noted in the site observation logs. For each of the long-term measurement sites, the daily and total CNEL values were computed along with the L50 levels. Since the long-term measurement sites did not have the benefit of continuous observations at each site, the data was evaluated to identify all times as referenced by the sound meter where the 1-second Leq exceeded

65 dBA. Since the times that these events occurred were widely distributed throughout the measurement period, the number of distinct 65+ dBA events was large. To aid in the identification of the noises that were responsible for these 65+ dBA events, the times of these events were grouped into a smaller, more manageable number of groups. The start and end times of each event group were assigned based upon the earliest and latest time of all events in the group, and a few seconds of buffer were added both before the earliest event and after the latest event to account for any uncertainty in the time of the event. The audio files corresponding to those event groups were then identified, correlated by time, and reviewed for the time periods corresponding to the event group time periods. This review process allowed the field technicians to interpret the sources of the sounds that achieved levels in excess of 65 dBA and identify those that were caused by aircraft events. Once the aircraft events were identified, the Lmax values for these events were flagged in the database.

Table E-2 presents the noise measurement results for each of the long-term measurement sites. The total site CNEL is presented along with the L_{50} level, which generally represents the background noise level during the measurement period. The table also provides single event information based on the events that exceeded 65 dBA, as previously discussed under the data analysis for the long-term sites. The single-event information is organized and presented in a similar fashion as was done for the short-term sites above.

Table E-2
MEASUREMENT RESULTS – LONG-TERM SITES
Gnoss Field Airport

			Jet			Propeller		
Site	**CNEL**	**L_{50}**	**# Events**	**L_{max} Range**	**L_{max} Average**	**# Events**	**L_{max} Range**	**L_{max} Average**
L1	51.8	42.9	4	65.3 – 70.7	68.0	25	65.3 – 79.7	68.6
L2	47.7	40.0	0	N/A	N/A	3	66.5 – 72.5	68.6
L3	54.9	47.6	7	65.1 – 76.3	70.3	23	65.2 – 80.5	69.0
L4	48.0	36.6	4	68.3 – 72.4	69.7	9	65.1 - 71	66.6
L5	55.5	49.7	10	66.9 - 92	76.9	148	65.2 – 84.9	75.2
L6	57.8	43.7	11	65.1 – 75.8	70.1	15	65.1 – 76.1	68.7

Source: Landrum & Brown, 2009.

As Table E-2 indicates, the average background level ranged from just below 37 dB to nearly 50 dB depending on measurement site. Similarly, the cumulative total CNEL levels at the sites ranged from 47.7 CNEL to 57.8 CNEL. As previously noted, these values include all noise at the site. The average maximum noise levels for jet aircraft events ranged from 68.0 dB to 76.9 dB at the site just north of the runway end. The range of the average maximum level for propeller aircraft events was from 66.6 dB to 75.2 dB depending on the measurement site. During the 33 site-days of measurements at the six long-term sites, 36 jet aircraft events above 65 dBA were identified from the audio tapes along with 223 propeller aircraft events above 65 dBA. The observed jet events ranged from 0 to 11 per site with an average of 6, while propeller events ranged from 3 to 148 per site with an average of 37 per site.

Table E-3 presents the noise measurement results for each of the short-term measurement sites. The one-hour average noise level $Leq_{(1\text{-hr})}$ is presented along with the L_{50} level which generally represents the background noise level during the measurement period. The table also provides single-event information related to the observed aircraft events at each site. The single-event information is separated for jet aircraft and propeller driven aircraft and includes the number of observed events, the range of maximum noise levels (L_{max}) associated with the events, and the average of the maximum levels for the events.

Table E-3
MEASUREMENT RESULTS – SHORT-TERM SITES
Gnoss Field Airport

			Jet			Propeller		
Site	$Leq_{(1\text{-hr})}$	L_{50}	# Events	L_{max} Range	L_{max} Average	# Events	L_{max} Range	L_{max} Average
S1	47.6	35.8	1	48.9 - 48.9	48.9	10	42.7 – 59.5	50.7
S2	56.4	46.8	2	52.2 – 56.3	54.3	2	58.9 – 60.5	59.7
S3	54.4	46.4	2	48.7 – 59.6	54.2	4	45.3 – 62.2	53.2
S4	43.2	37.4	1	41.3 - 41.3	41.3	11	41.1 – 65.1	47.4
S5	49.8	38.4	0	N/A	N/A	6	39.8 – 62.2	50.9
S6	50.7	44.0	0	N/A	N/A	6	47.7 – 60.6	52.9
S7	54.8	46.5	0	N/A	N/A	5	52.6 – 66.7	57.3
S8	49.1	38.1	2	43.9 – 54.8	49.4	6	40.6 – 60.7	48.2
S9	53.8	43.1	2	49.3 – 51.1	50.2	5	46.2 – 54.3	49.5
S10	44.8	41.5	2	51.4 – 61.7	56.6	9	44.6 – 58.5	50.8
S11	49.9	44.5	6	45.3 – 54.7	51.7	6	43.7 – 59.8	51.1
S12	48.0	43.5	1	50.4 - 50.4	50.4	7	45.9 – 56.7	49.4
S13	50.5	40.5	6	40.5 – 46.9	44.3	10	38.3 – 50.1	43.3
S14	58.0	47.7	2	47.6 – 67.7	57.7	17	43.8 – 67.3	51.7
S15	43.9	40.6	5	41.4 – 44.5	43.5	7	42 – 48.9	45.6
S16	43.2	41.5	5	40.6 – 58.1	48.3	13	42.1 – 56.9	46.1
S17	46.0	39.4	3	41.8 – 61.1	48.9	18	39.2 – 62.8	48.2
S18	47.5	38.7	1	47.7 - 47.7	47.7	13	41.6 – 65.9	49.0
S19	48.2	40.5	1	53.4 - 53.4	53.4	17	39.2 – 55.7	45.5
S20	42.7	34.2	7	41.1 – 60.6	48.3	4	34.1 – 48.1	42.0

Source: Landrum & Brown, 2009.

As Table E-3 indicates, the average background level ranged from just over 34 dB to nearly 48 dB for all measurement sites. The average maximum noise levels for jet aircraft events ranged from 41.3 dB to 57.7 dB while the range of the average maximum level for propeller aircraft events was from 42.0 dB to 59.7 dB. During the 20 hours of measurement time (1-hr per site spread throughout 11 days), 49 jet aircraft events were observed, along with 176 propeller aircraft events.

The observed jet events ranged from 0 to 7 per site with an average of 2.5 while propeller events ranged from 2 to 18 per site with an average of 8.8 per site.

E.4 NOISE MODELING AND ANALYSIS

In order to adequately inform concerned parties and decision makers, it is necessary to evaluate the expected noise levels for both the current and future conditions. Since future noise levels cannot be directly measured, it is necessary to simulate the expected future condition through noise modeling. Furthermore, noise modeling is the only way that various alternative designs can be compared to one another to identify the relative noise effects for each proposal.

The following sections describe the model to be used in the analysis, the data required for input into the model, noise model development procedures, and the output formats from the modeling process.

E.4.1 NOISE MODEL PROGRAM

A computer model is used to determine the noise exposure patterns related to aircraft operations (i.e. both arrivals and departures) in the airport environs. The use of a computerized overflight noise prediction model is necessary because noise impacts on humans are generally more closely correlated with prevailing long-term noise conditions than with occasional events and seasonal fluctuations. To attempt to measure prevailing noise levels directly would require months of measurement at numerous noise monitor sites -- an impractical, more expensive and potentially less accurate method of determination, particularly when estimating noise levels that will not occur for several years into the future.

The current version of the FAA's Integrated Noise Model (INM) Version 7.0a was used in this study. The INM is specified by the FAA for the prediction of aircraft noise at civilian airports. It is a computer model which, during an average 24-hour period at an airport, accounts for each aircraft flight along flight paths leading to or from the facility, or overflying it. Flight path definitions are coupled with separate tables in the program database relating to noise levels at varying distances and engine power settings for each distinct type of aircraft selected. The following paragraphs describe how the model computes noise contours.

At regular grid locations on ground level around the airport, the distance to each aircraft in flight is computed, and the associated noise exposure of each aircraft flying along each flight path within the vicinity of the grid location is determined. Additional corrections are applied for excess air-to-ground attenuation, acoustical shielding of aircraft engines by the aircraft body, speed variations, and atmospheric absorption. The logarithmic acoustical energy levels for each individual aircraft are then summed for each grid location. For the CNEL metric, a penalty for evening and nighttime operations is applied. The cumulative values of noise exposure at each grid location are then used to interpolate contours of equal noise exposure for reference CNEL levels (i.e., 65 CNEL, 70 CNEL, etc.). For this study, contour analysis will be used to describe CNEL dispersion patterns in excess of 65 CNEL.

For grid analyses, the model computes the acoustic data only at locations selected by the user (at grid points). Data on acoustic energy and peak noise levels requested by the user are computed for each aircraft overflight in the vicinity of the grid point. This data is reported for each desired metric. For this study, grid point noise level data include Time Above 65 dBA levels for the average annual day.

To activate the INM, a variety of user-supplied input data is required. These include a mathematical definition of the airport runways relative to a base reference point, the mathematical description of ground tracks above which aircraft fly, and the assignment of specific aircraft with specific engine types to individual flight paths from each runway end. Optionally, the user may adjust standard database information to reflect the vertical profiles used by aircraft as they fly to or from the airport(s) through the adjacent airspace or may modify the default noise-power-distance curves in the model. The following sections provide a discussion of the input data used to prepare the noise exposure contours and grid point data for the study.

E.4.2 NOISE MODEL INPUT

A variety of user-supplied information is required to accurately run the Integrated Noise Model (INM) to compute aircraft noise levels in the airport environs and along the routes of flight leading to and from the airport. The INM requires that airport runways and flight tracks be defined through a system of geographic coordinates, and that the volume of traffic using the airport be distributed among them. This distribution is divided among numerous aircraft types and the time of day at which they operate.

For this analysis, input data was developed from two primary sources.

1. Gnoss Field Airport Aviation Activity Forecast, September 2009 (Appendix C) 2008 and 2018 operations & fleet mix.
2. Radar Data provided by FAA's Air Traffic Organization (ATO) Aeronautical Information Management (AIM) Lab.

A sample of radar data for traffic at DVO was taken from FAA's AIM Labs archive covering the calendar year 2007. The data included some 3,300+ flight tracks that were used to develop modeled flight tracks and day-night distributions. Details of the input data to INM for this project are discussed below.

E.4.2.1 Local Environmental Variables

In order to calculate noise levels specific to the conditions in the area of investigation, the INM model utilizes several local environmental variables. These include temperature, atmospheric pressure, humidity, airport average headwind, airport elevation, and terrain. For this analysis, five years (2004-2008) of weather observations collected at the nearby Napa County Airport station were used to determine the long-term average weather conditions in the DVO area. Napa County Airport is the closest site to Gnoss Field that has long-term temperature and humidity data, which are necessary inputs to the INM model.[9] **Table E-4** summarizes the weather data used for the NIRS analysis.

Table E-4
ENVIRONMENTAL VARIABLES – WEATHER
Gnoss Field Airport

Variable	Annual Average
Temperature (degrees Fahrenheit)	56.9
Relative Humidity (percentage)	68.5
Headwind (knots)	8

Source: National Climatic Data Center (NCDC) Comparative Climatic data collected at Napa County Airport, 2004-2008. Napa County Airport is the closest site to Gnoss Field that has long-term temperature and humidity data, which are necessary inputs to the INM model.

The Airport elevation for DVO at two feet MSL was selected as the INM study elevation for the analysis. Detailed terrain data for the entire Study Area was incorporated from the United States Geological Survey (USGS) 1 degree Digital Elevation Model (DEM) database for the US. This database provides elevation data at ground points separated by 3 arc-seconds (approximately 240’ east-west and 303’ north-south in the DVO area). The elevation values for each point are provided at a 1-meter resolution.

E.4.2.2 Operations Levels

For this analysis, the number of daily operations (i.e. both arrivals and departures) for the year 2008 and forecast year 2018 were derived from the Gnoss Field Airport forecast evaluation developed as part of this EIS/EIR effort. The forecast information includes total average daily operations, distributed among general categories of user and detailed fleet mix.

The average number of daily operations was derived by dividing the annual operations, as reported in the forecasts, by 365. **Table E-5** provides a summary of the annual and annual average daily operations used in this assessment to project noise levels for each facility in the years 2008 and 2018.

The computations indicate that Gnoss Field Airport experienced an estimated average of 234 operations each day during 2008. By 2018 operations are expected to grow to 100,500 annual operations or approximately 275 on an annual average day.

[9] For the noise analysis, Napa Airport data was used because it was the closest site to Gnoss Field that had long-term temperature and humidity data. For the Air Quality analysis (see Appendix F), Oakland, California data was determined to be the location of the nearest station to Gnoss Field with mixing height data, which is in accordance with guidance provided by USEPA, Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the contiguous United States, AP-101, January 1972, Table B-1 *Mean Seasonal and Annual Morning and Afternoon Mixing Heights and Wind Speeds for NOP [no precipitation] and All Cases*.

Table E-5
CURRENT and FORECAST ANNUAL OPERATIONS
Gnoss Field Airport

Facility	Annual Operations		Operations Per Annual Average Day	
	2008	2018	2008	2018
Gnoss Field Airport	85,500	100,500	234.25	275.34

Note: Operation counts include arrivals, departures, and touch-and-go's.
Source: Landrum & Brown, September 2009.

E.4.2.3 Day/Night Distribution

The time of day that flight operations occur is also a key component of the INM input. It is important to the computation of the cumulative average noise level because a penalty of five decibels is assigned to each operation that occurs between the hours of 7 p.m. and 9:59 p.m. and a ten decibel penalty is assigned to each operation that occurs between the hours of 10 p.m. and 6:59 a.m. The distribution of traffic between day, evening and night periods was developed for the general categories of aircraft operations (GA Itinerant/Air Taxi and GA Local) by operation type (arrival, departures) from the DVO radar sample acquired for this analysis. On an average day in 2008, approximately 7% of aviation traffic operating at DVO takes place during the evening hours (7 p.m. to 9:59 p.m.) and 5% occurs during the nighttime hours (10 p.m. to 6:59 a.m.). The Day, Evening, and Night splits developed from the radar data sample were used for the future 2018 conditions as well as the current 2008 conditions. **Table E-6** presents the time of day percentages used for noise modeling. Since there are no anticipated changes in the characteristics of the future traffic or markets that would likely result in a change to this pattern of time of day usage, it is expected that the future forecast operations at DVO will generally follow this same pattern.

Table E-6
CURRENT and FUTURE TIME OF DAY PERCENTAGES BY OPERATION TYPE
Gnoss Field Airport

Operational Group	Arrivals (percent)			Departures (percent)		
	Day	Evening	Night	Day	Evening	Night
GA Itinerant/ Air Taxi	88.0%	9.0%	3.0%	89.0%	4.0%	7.0%
GA Local	90.0%	10.0%	0.0%	90.0%	10.0%	0.0%

Sources: FAA Radar Data 2007, Landrum & Brown Analysis, 2009.

E.4.2.4 Runway Use

The runway use percentages define which runways are to be used for arrivals and departures on an average annual basis. Generally, the primary factor determining runway use at an airport is the weather, aircraft type, and prevailing wind conditions at the time of a flight. Since DVO is a single runway air field, the runway choices are limited to two primary directions. The distribution of traffic among the runways at DVO was based on an analysis of the 2007 radar data sample. The use of individual runways, as drawn from analysis is presented in **Table E-7**. The runway use proportions information resulting from the analysis was assumed to be representative of the annualized condition for both the existing and future time frames. Similarly, the runway usage would not be changed due to the proposed alternatives for extending the runway. Therefore, the runway use percentages shown in the table are representative of all current and future scenarios investigated in this study.

Table E-7
MODELED RUNWAY USAGE – ALL SCENARIOS
Gnoss Field Airport

Runway	Departures	Arrivals	Touch & Go's
13	10.0%	90.0%	50.0%
31	90.0%	10.0%	50.0%
Total	**100.00%**	**100.00%**	**100.00%**

Sources: FAA Radar Data 2007, Landrum & Brown Analysis, 2009.

E.4.2.5 Aircraft Fleet Mix

The distribution of the operations (i.e. both arrivals and departures) among the many types of aircraft available within the INM is another important component of the INM input data. The distribution among types for this analysis was based on the general distribution of operations into operational categories prepared in the forecast evaluation and detailed aircraft types from the 2007 radar data sample. The average daily operations by aircraft type for DVO is presented in **Table E-8** for the current conditions, as well as the future forecast years of analysis. Generally, the proportional fleet mix is not expected to vary significantly in the future years. While the forecast evaluation noted some minor shifts between the general operational categories (Air Taxi, Itinerant, and Local operations) the detailed fleet mix in each of these categories is not expected to change. While the proposed runway extension alternatives provide an additional margin of safety and improve some operational margins for aircraft that already frequent DVO, they are not sufficient to cause significantly different aircraft to operate at DVO in the future.

Table E-8
CURRENT AND FUTURE FLEET MIX – ALL SCENARIOS
Gnoss Field Airport

Operational Group	Aircraft Category	INM Aircraft	Representative Aircraft	Average Day Operations 2008	Average Day Operations 2018
GA Itinerant / Air Taxi	Single Engine Piston	GASEPV	Cessna 182, Piper Cherokee PA28	27.03	42.29
		GASEPF	TBM TB-700, Cirrus SR-22	13.13	20.60
		CNA172	Cessna 172	4.36	7.33
	Multi Engine Piston	BEC58P	Cessna 310, Cessna 340	10.68	12.39
	Turbine	CNA500	Citation 525, Citation I	7.73	8.91
		CNA441	Beech King Air / Super King Air	4.70	5.38
		MU3001	Cessna 560 Citation Excel, Citation 550	4.10	4.72
		DHC6	Beech Super king Air 350	1.45	1.68
		LEAR35	Learjet 31	0.70	0.81
	Rotorcraft	S76	Sikorsky S-76 Spirit	1.19	1.37
GA Local	Single Engine Piston	CNA172	Cessna 172	19.12	20.40
		CNA206	Cessna 206	4.78	5.10
		GASEPF	TBM TB-700, Cirrus SR-22	44.55	47.54
		GASEPV	Cessna 182, Piper Cherokee PA28	90.73	96.82
			Total	**234.25**	**275.34**

Source: Landrum & Brown Analysis, 2009.

E.4.2.6 Flight Track Definitions

To determine projected noise levels on the ground, it is necessary to determine not only how many aircraft are present, but also where they fly. Therefore, flight route information is a key element of the INM input data. In order to ensure that the noise modeling accurately reflects local conditions in the DVO area it is helpful to develop noise modeling tracks from a sample of detailed radar data.

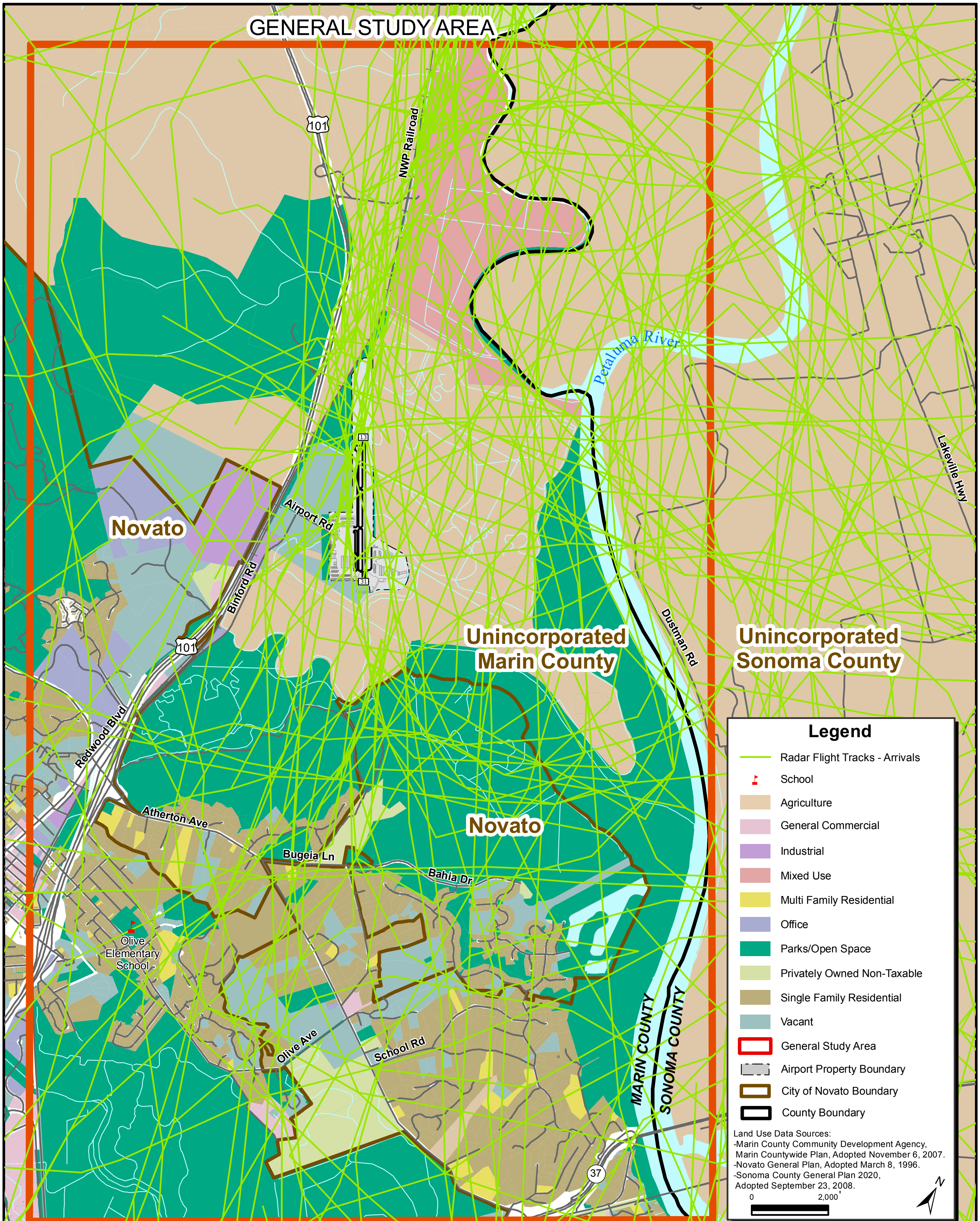
For this evaluation, flight paths for the Existing Conditions and future alternatives were developed from an analysis of the 2007 radar data sample acquired for this study. The sample yielded some 3,300+ individual radar tracks for analysis. **Exhibit E-6, *Radar Flight Tracks - Arrivals*** illustrates the radar data sample for arrival operations at DVO. The departure operations radar tracks are mapped in **Exhibit E-7, *Radar Flight Tracks – Departures***. As the exhibits illustrate, the radar data resolution around the DVO area is somewhat limited, which is due to the fact that DVO does not have on-site radar and the data is based on radar facilities some distance from the airfield. Consequently, terrain and obstacles between the DVO area and the radar sites limit the resolution of the data. The issue is further confounded by the fact that many of the operations at DVO are VFR operations, which are not reliably archived in the radar system. Accordingly, the radar data was evaluated and considered in conjunction with the published noise abatement routes and discussions with local Airport staff and users to develop the final flight track sets for the noise modeling.

The FAA's Terminal Area Route Generation, Evaluation, and Traffic Simulation (TARGETS) software was utilized for the detailed analysis of the radar data for the project. The data was first separated by operation type (arrival, departure). TARGETS was then used to develop bundles of radar tacks based on runway and route similarity. Once the radar track bundles were complete, the development of noise modeling input tracks was initiated.

The TARGETS program allows for the development of primary, or backbone, flight tracks for each radar track bundle. The system also allows for the simultaneous computation of sub-tracks that are located adjacent to the backbone track. These sub-tracks account for the dispersion of actual flights about the primary flight corridor based on the distribution of radar tracks within each bundle. The system uses the statistical distribution of the radar track locations along the backbone track determine the spacing between the sub-tracks at that point. The number of sub-tracks developed is determined by the user dependent on the number of radar tracks in the bundle and their general spread thought the route.

The system also computes a weighting factor for each sub-track that allows aircraft operations to be assigned to the backbone tracks and then automatically distributed to each of the corresponding sub-tracks. This weighting factor is computed based on the average lateral distribution of the radar tracks throughout the bundle with respect to the backbone track position. The resulting distribution generally approximates a "normal", or bell curve, distribution with the highest percentage on the backbone track and progressively lower percentages on the adjacent sub-tracks.

Exhibit E-8, *INM Flight Tracks - Arrivals* presents an overview of the INM arrival tracks used in the modeling of the 2008 existing condition as well as the future No Action condition. Similarly, **Exhibit E-9, *INM Flight Tracks - Departures & Training*** presents the resulting INM departure tracks used in the modeling of the 2008 existing and future conditions. The local training or touch and go tracks are also included on this exhibit.



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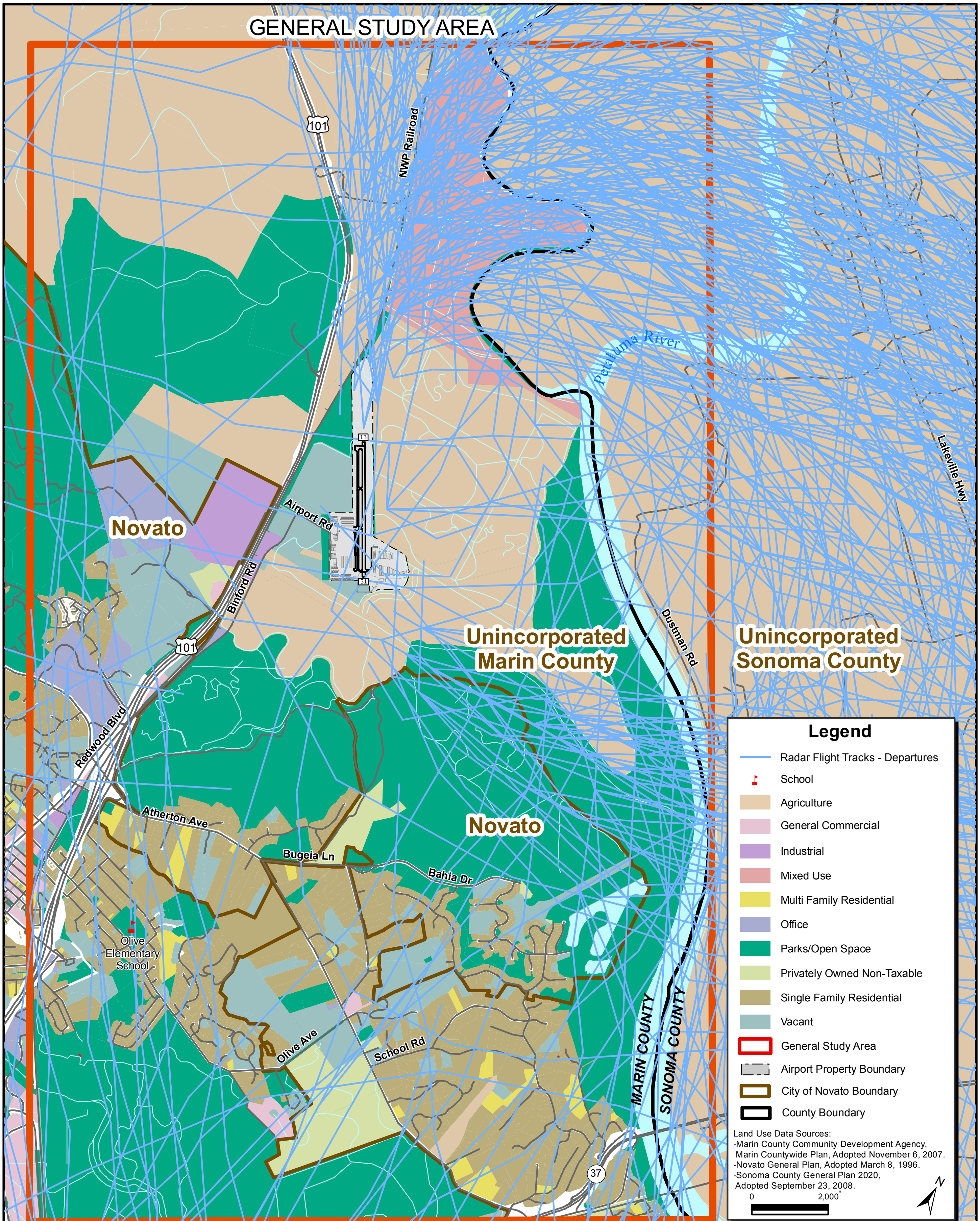
Radar Flight Tracks - Arrivals

Exhibit:
E-6



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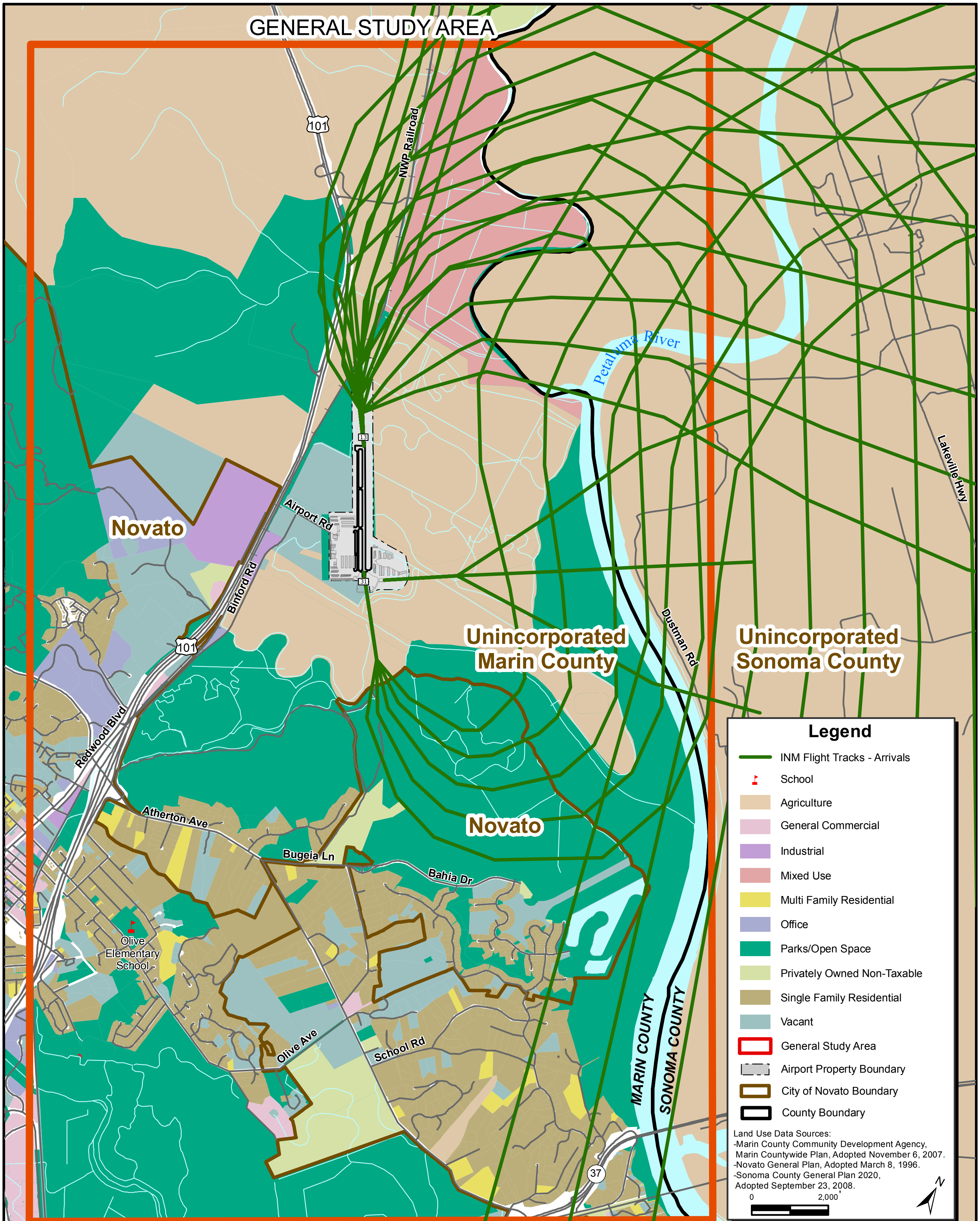
E-7_Radar Flight Tracks - Departures.mxd

Radar Flight Tracks - Departures

Exhibit:
E-7



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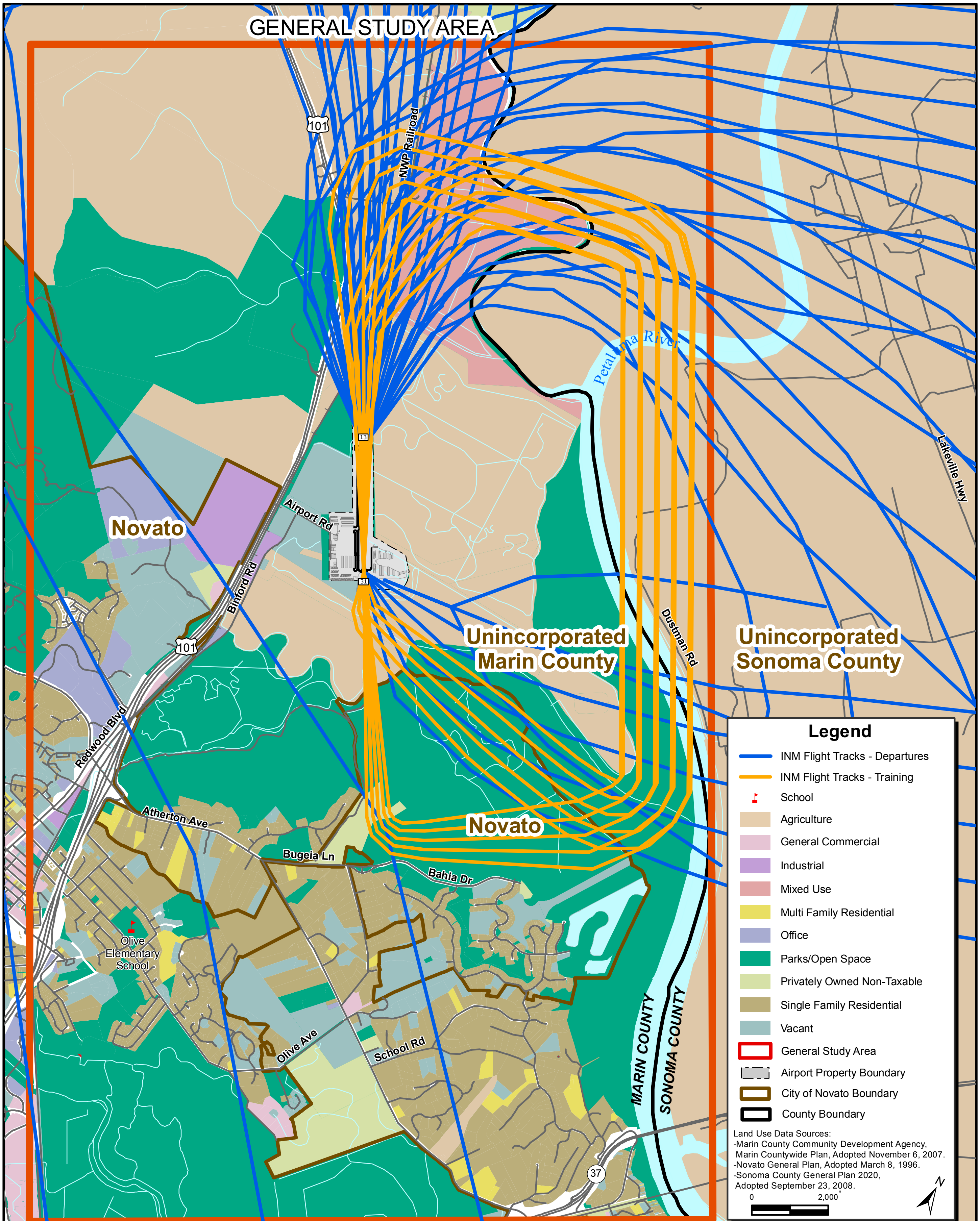
INM Flight Tracks - Arrivals

Exhibit:
E-8



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INM Flight Tracks - Departures & Training

Exhibit: **E-9**

E.4.2.7 Flight Track Assignment

The final step in developing the flight track input data for the INM is the assignment of aircraft to specific flight tracks. The radar data sample acquired for the flight track analysis was used as a basis for this analysis. The flight data associated with the bundle of radar data used to make the INM backbone track was retained as an attribute of each backbone track. This data included operation type, operational group, and flight origin or destination.

The distribution of traffic among the modeled flight tracks developed from the radar data analysis was based on the distribution of flights in the radar data for the current conditions. It is expected that the current distribution will continue into the future years.

E.4.3 ASSESSING THE IMPACT OF NOISE

The FAA has considered the matter of threshold levels above which aircraft noise causes an adverse impact on people and has established 65 CNEL as the threshold above which aircraft noise is considered incompatible with residential areas. In addition, the FAA has determined that a significant impact occurs if a proposed action would result in an increase of 1.5 CNEL or more on any noise-sensitive area within the 65 DNL exposure level.[10,11,12]

In 1992, the Federal Interagency Committee on Noise (FICON) recommended that noise increases of 3 dB or more between CNEL 60 and 65 dB be evaluated in environmental studies when increases of 1.5 CNEL or more occur at noise-sensitive locations at or above 65 CNEL. Increases of this magnitude below 65 CNEL are not to be considered as *significant impacts*, but they are to receive consideration. The FAA adopted FICON's recommendation into FAA Order 1050.1E.

Noise exposure contours and areas of increased noise exposure were prepared in accordance with the above criterion in order to determine if potential noise impacts would occur as a result of the Proposed Action.

E.4.3.1 Compatible Land Use Planning

Compatible or non-compatible land use is determined by comparing the predicted or measured yearly DNL (YDNL) levels (or YCNEL in California) at a site with the values given. Compatibility designations generally refer to the major use of the site (see **Table E-9**, recreated from original table located in Federal Aviation Regulation Part 150, Airport Noise Compatibility Planning, Appendix A, Table 1.). If other uses with greater sensitivity to noise are permitted by local government at a site, a determination of compatibility must be based on that use which is most adversely affected by noise. Table E-9 describes compatible land use information for several land uses as a function of YDNL (YCNEL) values. The ranges of YDNL values in Table E-9 reflect the statistical variability for the responses of large groups of

[10] FAA Order 1050.1E, Appendix A, Section 14, Noise.
[11] FAR Part 150 Section 150.21(a)(2)(d).
[12] FICON 1992, Pp. 3-5.

people to noise. Any particular level might not, therefore, accurately assess an individual's perception of an actual noise environment.[13]

Table E-9
LAND USE COMPATIBILITY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS

Type of Land Use	Yearly Day-Night Average Level (Ldn) in Decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N[1]	N[1]	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N[1]	N[1]	N[1]	N	N
Public Use						
Schools, hospitals, nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y[2]	Y[3]	Y[4]	N[4]
Parking	Y	Y	Y[2]	Y[3]	Y[4]	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail building materials, hardware, and farm equipment	Y	Y	Y[2]	Y[3]	Y[4]	N
Retail trade, general	Y	Y	25	30	N	N
Utilities	Y	Y	Y[2]	Y[3]	Y[4]	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y[2]	Y[3]	Y[4]	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y[6]	Y[7]	Y[8]	Y[8]	Y[8]
Livestock farming and breeding	Y	Y[6]	Y[7]	N	N	N
Production, and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y	Y[5]	N[5]	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Source: Federal Aviation Regulation (FAR) Part 150, *Airport Noise Compatibility Planning*, Appendix A, Table 1.

13 Federal Aviation Regulation (FAR) Part 150, *Airport Noise Compatibility Planning*, Appendix A.

Table E-9, Continued
LAND USE COMPATIBILITY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS

Note: The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable under federal, State of California, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Key:

Y (Yes) Land Use and related structures compatible without restrictions.

N (No) Land Use and related structures are not compatible and should be prohibited.

NLR Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure

25, 30, 35 Land Use and related structures generally compatible; measures to achieve or NLR of 25, 30, or 35dB must be incorporated into design and construction of structure.

[1] Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR or 20dB, thus, the reduction requirements are often stated as 5, 10, or 15dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

[2] Measures to achieve Noise Level Reduction (NLR) of 25dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[3] Measures to achieve Noise Level Reduction (NLR) of 30dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[4] Measures to achieve Noise Level Reduction (NLR) of 35dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.

[5] Land use compatible provided special sound reinforcement systems are installed.

[6] Residential buildings require a Noise Level Reduction (NLR) of 25.

[7] Residential buildings require a Noise Level Reduction (NLR) of 30.

[8] Residential buildings not permitted.

E.4.3.2 Existing Conditions 2008 Noise Impacts

This section presents the aircraft noise exposure to surrounding communities resulting from the current conditions at DVO The impact of airport-related noise levels upon the surrounding area is presented in terms of CNEL noise contours and areas, housing units, population, and noise-sensitive land uses within the noise contours. The existing land use and zoning surrounding Gnoss Field Airport (DVO or Airport) was based on Marin County Community Development Agency; Marin Countywide Plan, Adopted November 6, 2007; Novato General Plan, Adopted March 8, 1996; Sonoma County General Plan 2020, Adopted September 23, 2008.

Based on the data and methodology described in the preceding sections, the Community Noise Equivalent Level (CNEL) noise contours were developed for the Existing 2008 condition using the Integrated Noise Model (INM), Version 7.0a. **Exhibit E-10, *Existing Conditions (2008) Community Equivalent Noise Level,*** reflects the average-annual noise exposure pattern present at the Airport during the Existing Condition period. The noise pattern is shown over a map of the local Airport area that includes the specific land uses in the area.

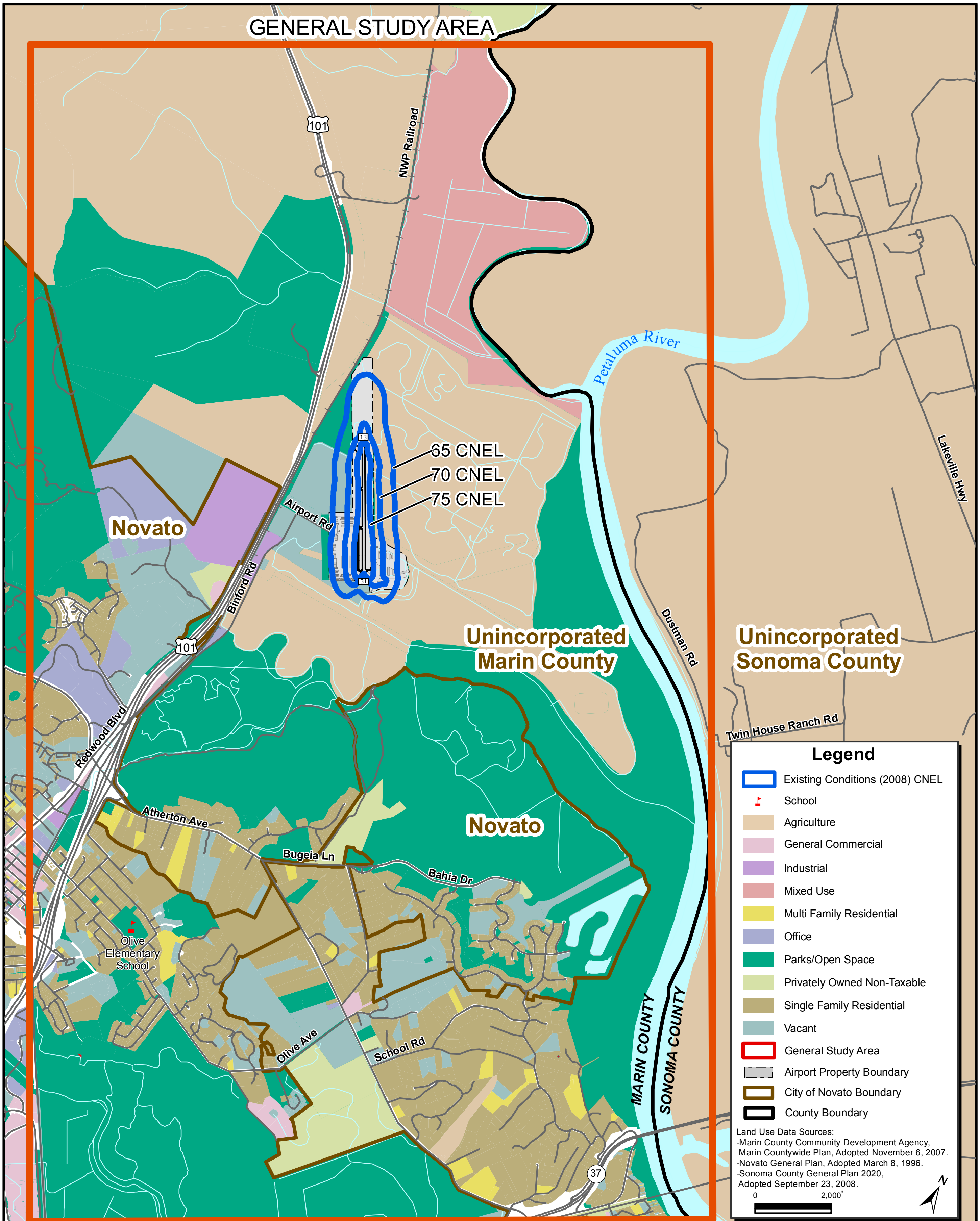
Table E-10 summarizes the area within each noise contour level. Noise contours are presented for the 65, 70, and 75 CNEL. The Federal Aviation Administration (FAA) uses the 65 CNEL as the noise level in which noise-sensitive land uses (residences, churches, schools, libraries, and nursing homes) become significantly impacted. Below the 65 CNEL, all land uses are determined to be compatible.

Table E-10
AREAS WITHIN EXISTING NOISE EXPOSURE CONTOUR
Gnoss Field Airport

CONTOUR RANGE	EXISTING CONDITIONS (2008)	
	Square Miles	Acres
65-70 CNEL	0.17	111.6
70-75 CNEL	0.07	45.4
75 + CNEL	0.05	29.9
65 + CNEL	0.29	186.9

Source: Landrum & Brown, 2009.

A CNEL noise contour does not represent the noise levels present on any specific day, but represents the energy-average of all 365 days of operation during the year. Noise contour patterns extend from an airport along each extended runway centerline, reflective of the flight tracks used by all aircraft. The relative distance of a contour from the airport along each route is a function of the frequency of use of each runway end for total arrivals and departures, as well as its use at night, and the type of aircraft assigned to it.



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Filename: P:\DVO-Gnoss Field\GIS\ MXD\EIS APPENDICES\ E-10_Existing (2008) Community CNEL.mxd
Contour: DVOBaseNoise-Contours_Rev1

Existing Conditions (2008)
Community Noise Equivalent Level

Exhibit: **E-10**

The size and shape of the noise contours for DVO are a function of the combination of flight tracks and runway use. The 2007 radar data indicated that traffic largely followed the requested noise abatement runway use with departures on Runway 31 and arrivals on Runway 13. Approximately 90 percent of the departures occurred on Runway 31 with 10 percent on Runway 13. Conversely, about 90 percent of the arrivals used Runway 13 with only about 10 percent on Runway 31. As a result, the Existing (2008) Existing Condition noise contour is longer and wider to the north of the Airport than it is to the south.

To the north of the Airport, the noise contour extends approximately 1/3 of a mile north of the north end of the runway to a point just east of the railroad tracks. The shape of the pattern is generally aligned with the runway and reflects the combination of takeoffs to the north and arrivals from the north which is some 90 percent of the activity at the Airport. The contour covers an area that comprises of Airport property and exempt land use. The higher noise levels of 70 and 75 CNEL cover a progressively smaller area of similar land uses to the north.

The noise pattern runs adjacent to the Airport runway with the contour lines generally parallel to the runway alignment. To the south, the 65 CNEL noise contour only extends some 500 feet south of Airport property over both commercial and agricultural land uses. The higher noise levels of 70 and 75 CNEL contours remain largely over Airport property and their shape is associated with the start of takeoff roll noise associated within a high percentage of departures.

As Exhibit E-10 illustrates there are no residential or noise sensitive land uses within any of the noise contour levels evaluated. Consequently, there are no identifiable significant noise impacts associated with the existing condition for aircraft operations at the Airport.

E.4.3.3 Future 2018 and 2023 Noise Impacts

This section presents the aircraft noise exposure to surrounding communities resulting from each of the alternatives identified to be carried forward for detailed analysis. The noise effects of each of the runway extension alternatives are identified and compared to the No Action Alternative. In addition, the noise associated with each of the alternatives is compared to the existing noise condition as was developed in the previous section.

The impact of airport-related noise levels upon the surrounding area is presented in terms of CNEL noise contours and areas, housing units, population, and noise-sensitive land uses within the noise contours. Based on Federal Aviation Administration (FAA) standards, aircraft noise impacts are analyzed for areas located within the 65+ CNEL noise contour compared to Alternative A the No Action Alternative. Similarly, in accordance with California CEQA regulations and policies, the alternatives are also compared to the 2008 existing condition. Within the 65+ CNEL noise contour, the analysis identifies noise-sensitive land uses such as churches, schools, libraries, hospitals, and nursing homes. An increase in the noise level of CNEL 1.5 decibels (dB) or more for a noise-sensitive land use located within the 65+ CNEL noise contour is the threshold FAA uses for determining significant noise impacts.

The following alternatives are analyzed for potential noise impacts for 2018 conditions:

Alternative A: No Action;

Alternative B: Extend Runway 13/31 to the northwest by 1,100 feet (Sponsor's Proposed Project);

Alternative D: Extend Runway 13/31 to the southeast by 240 feet and to the northwest by 860 feet.

2018 CONDITIONS

This section provides a summary of the noise analysis of the 2018 conditions for each alternative. An analysis of the 2018 conditions provides potential impacts five years after the first full year of operation of the runway extension alternatives. The 2008 Existing Condition is compared to the 2018 Alternative A, as well as each of the two 2018 runway extension alternatives, including the Sponsor's Proposed Project (Alternative B). Similarly, the 2018 Alternative A is also compared to each of the runway extensions alternatives. General descriptions of the operational characteristics of each alternative are provided later in this section.

2018 Alternative A: No Action

This section provides a summary of the INM input data, the resulting noise exposure pattern, and the disclosure of the potential noise impacts resulting from the operation of the Airport under Alternative A in 2018. The noise exposure and impact assessment prepared for the 2018 Alternative A is the no action existing condition against which all other 2018 alternatives are evaluated.

Runway Definition: Gnoss Field consists of a single 3,300 foot long and 75 feet wide runway (designated 13/31) that is oriented in northwest to southeast direction. This runway definition was used for the modeling of the future Alternative A noise pattern and is the same as that used for the Existing 2008 Existing Condition noise analysis.

Activity Levels and Fleet Mix: The forecast analysis presented indicates that the operational levels at DVO are expected to grow 17.5 percent from the 2008 level of 85,500 to the forecast 2018 level of 100,500. The proportional mix of aircraft types forecast to operate at DVO in 2018 is generally projected to remain constant over the forecast period and will be similar to the proportions currently experienced at the Airport. Thus, the future fleet mix proportions remained the same for the 2018 condition with only the growth in total operations changing.

Runway End Utilization: The average-annual runway end utilization for the 2018 Alternative A is expected to remain the same as the existing condition. Traffic is expected to continue to follow the requested noise abatement runway use with departures on Runway 31 and arrivals on Runway 13. Approximately 90 percent of the departures will occur on Runway 31 with 10 percent on Runway 13. Conversely, about 90 percent of the arrivals are expected to use Runway 13 with only about 10 percent on Runway 31.

Flight Tracks: The flight tracks and proportional traffic distribution modeled for the 2018 future condition are expected to remain the same as those identified in Exhibits E-8 and E-9 for the current conditions.

Noise Exposure Contour: The 2018 Alternative A noise exposure contour for 65, 70, and 75 CNEL levels are graphically depicted on **Exhibit E-11**, ***Noise Contour Comparison: 2018 Alternative A (No Action) vs. 2008 Existing Conditions.*** For comparative purposes, the existing 2008 noise contours are mapped in red.

The size and shape of the noise contours for DVO are a function of the combination of flight tracks and runway use. As noted above, it is expected that traffic will continue to follow the requested noise abatement runway use with departures on Runway 31 and arrivals on Runway 13. As a result, the future 2018 Alternative A noise contour is longer and wider to the north of the Airport than it is to the south.

To the north of the Airport, the noise contour extends approximately one-third of a mile north beyond the north end of the existing runway to a point just east of the railroad tracks. The shape of the pattern is generally aligned with the runway and reflects the combination of takeoffs to the north and arrivals from the north, which is 90 percent of the activity at the Airport. The contour covers an area that includes Airport property and compatible land use. The higher noise levels of 70 and 75 CNEL cover a progressively smaller area of similar land uses to the north. The noise pattern runs adjacent to the existing runway with the contour lines generally parallel to the runway alignment.

To the south, the 65 CNEL noise contour extends 500 feet south of the existing Airport property line over currently vacant agricultural land uses. The higher noise levels of 70 and 75 CNEL contours remain largely over Airport property and their shape is associated with the start of takeoff roll noise associated within a high percentage of departures.

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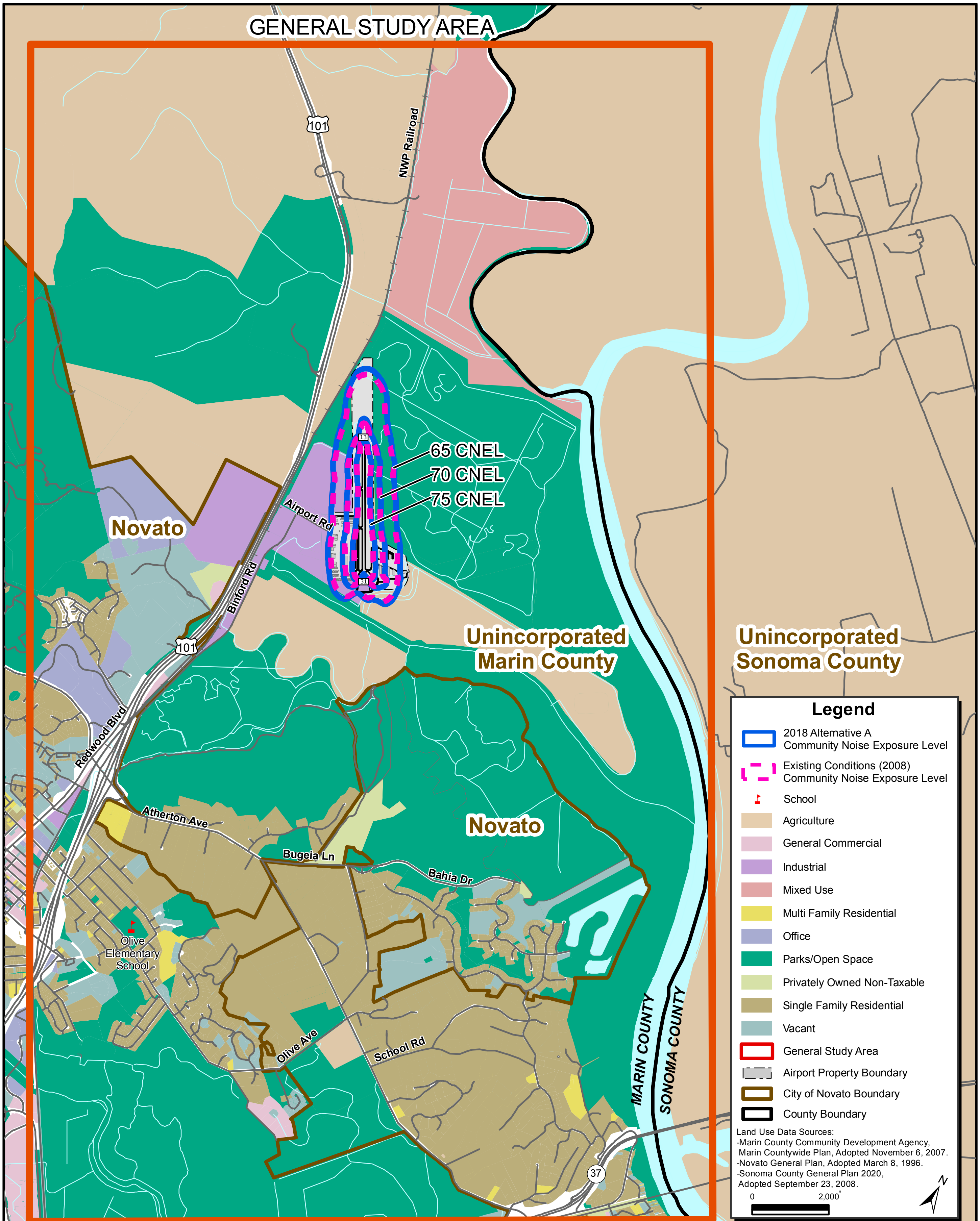

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12/20/2013 Prepared by Landrum & Brown
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(No Action) vs 2008.mxd Contour: DVOBase
Noise-Contours_Rev1; Alt-A_18Noise-Contours

Noise Contour Comparison:
2018 Alternative A (No Action) vs
2008 Existing Conditions

Exhibit:
E-11

Overall, the noise pattern is identical in shape and very similar in size to the 2008 existing condition noise pattern. As expected, the only difference is a very slight increase in the size of the Alternative A noise pattern resulting from the thirteen percent growth in total annual operations at DVO forecast to occur between now and 2018, regardless of whether the proposed runway extension is approved and implemented. **Table E-11** provides the total area within the 2018 Alternative A noise contours in comparison to that of the 2008 Existing Condition noise contours.

Table E-11
COMPARISON OF AREAS WITHIN THE 2018 ALTERNATIVE A NOISE EXPOSURE CONTOUR (IN ACRES)
Gnoss Field Airport

CONTOUR RANGE	2008 Existing Condition	2018 ALTERNATIVE A
65-70 CNEL	111.6	121.8
70-75 CNEL	45.4	49.5
75 + CNEL	29.9	34.7
65 + CNEL	186.9	206.0

Source: Landrum & Brown, 2009.

Land Use Impact Assessment: The 65+ CNEL noise contour for the 2018 Alternative A, encompasses 206 Acres, or 0.32 square miles of land. There are no residential or noise sensitive land uses within any of the noise contour levels evaluated. Consequently, there are no significant noise impacts associated with the expected future 2018 Alternative A condition at the Airport.

2018 Alternative B: Extend Runway 13/31 to the Northwest by 1,100 Feet (Sponsor's Proposed Project)

This section provides a summary of the INM input data, the resulting noise exposure pattern, and the disclosure of the potential noise impacts resulting from the operation of the Airport under Alternative B in 2018.

Runway Definition: Alternative B includes a northwesterly extension of Runway 13-31 by 1,100 feet, resulting in a runway length of 4,400 feet. This is the Airport Sponsor's Proposed Project.

Activity Levels and Fleet Mix: The proportional mix of aircraft types expected to operate at DVO in 2018 is projected to remain similar to that of the existing condition. Thus, the future fleet mix proportions remained the same for the 2018 condition with only the growth in total operations changing.

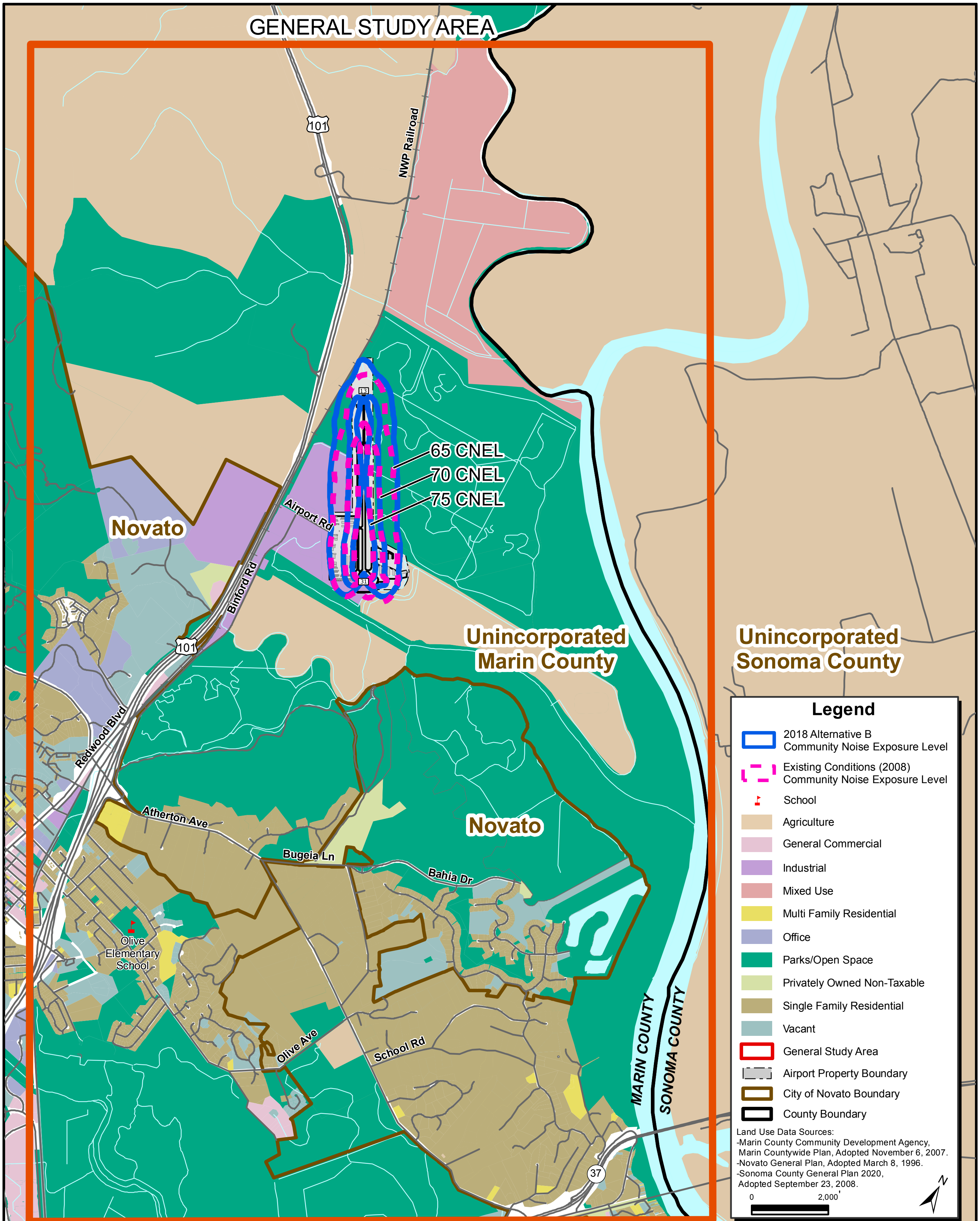
Runway End Utilization: The proposed extension of Runway 13/31 is not expected to affect runway use percentages from what was modeled for the Existing (2008) Existing condition. Consequently, the runway use for this alternative will be identical to the 2018 Alternative A runway use.

Flight Tracks: The proposed runway extension under Alternative B would have modest effects on the flight tracks as related to takeoffs and landings to and from Runway 13. These changes are anticipated to be exclusively tied to the new location of the runway end as it relates to the proposed 1,100 foot northwesterly runway extension. Aircraft taking off to the south on Runway 13 would start their takeoff roll approximately 1,000 feet farther to the northwest than is the current practice with the existing runway and thus, would be somewhat higher south of the Airport as they ascend. Further, it is expected that the preferred noise abatement turns to the east would occur farther to the northwest than with the current practice. Arrival tracks to Runway 13 would also be affected as the landing threshold would be moved 1,100 feet to the northwest. It is expected that this would generally result in aircraft turning onto their final approach slightly farther to the northwest than is the current practice and the aircraft would tend to be slightly lower at any given point while on final approach north of the airfield. Flight tracks for departures on Runway 31 to the north and arrivals to Runway 31 from the south are not anticipated to change as a result of this alternative. Finally, the alternative would not affect the flight track utilization percentages identified for the existing conditions and the 2018 Alternative A scenarios.

Noise Exposure Contour: The 2018 Alternative B noise exposure contour for 65, 70, and 75 CNEL levels are graphically depicted on **Exhibit E-12**, ***Noise Contour Comparison: 2018 Alternative B vs. 2008 Existing Conditions.*** For comparative purposes, the 2008 Existing Condition noise contours are mapped in red. **Exhibit E-13**, ***Noise Contour Comparison: 2018 Alternative B vs. 2018 Alternative A.*** presents a comparison of the alternative against the 2018 no action. For comparative purposes, the 2018 Alternative A noise contours are mapped in red.

As the exhibits illustrate, the overall size and shape of the Alternative B noise contours for DVO are similar to those of the Alternative A noise pattern, as well as the 2008 Existing Condition. To the north of the Airport, the Alternative B 65 CNEL noise contour is slightly larger and extends a bit farther north than the Alternative A no action and 2008 Existing Condition noise contours. This is due to the runway extension and the corresponding shift in the landing threshold for Runway 13 and the start of takeoff roll for Runway 13. More dramatic evidence of this effect can be seen in the comparison of the higher noise level contours of 70 and 75 CNEL. As the exhibit shows, most of this change is located on, or immediately adjacent to Airport property.

To the south, the Alternative B 65 CNEL noise contour would shift to the northwest slightly as a result of the reduced influence in departure noise from Runway 13 departures. This reduction is due to the slightly higher altitudes for departures and the slight northwestward shift in the Runaway 13 departure turn to the east. The higher noise level contours of 70 and 75 CNEL are nearly the same as the Alternative A and 2008 Existing Condition noise contours as these contours are more influenced by noise from the start of takeoff roll from the high percentage of takeoffs on Runway 31. These takeoffs do not change in Alternative B and thus the noise pattern very close to the runway doesn’t shift here.



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Gnoss Field Airport

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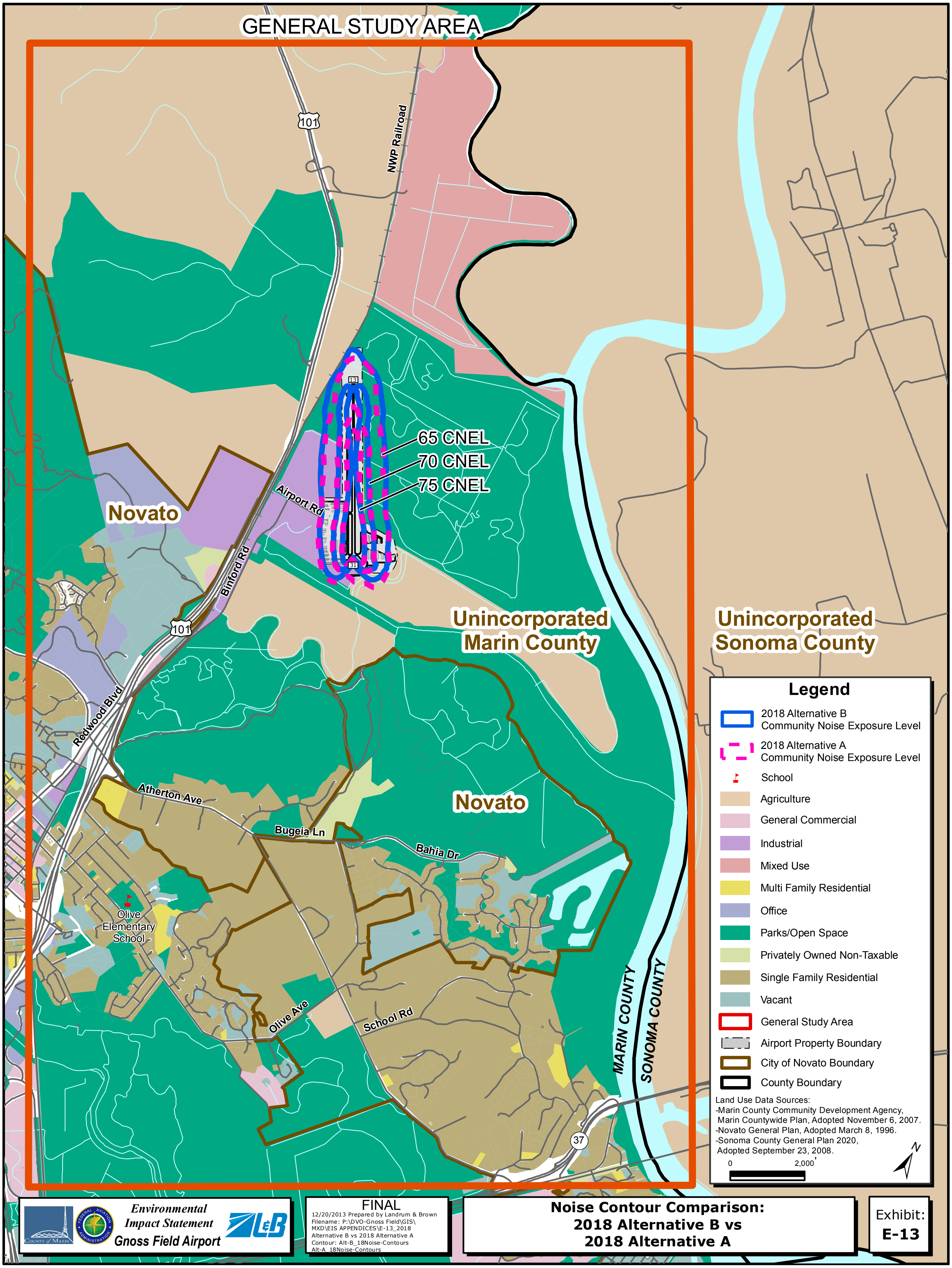
Filename: P:\DVO-Gnoss Field\GIS\MXD\EIS APPENDICES\E-12_2018 Alternative B vs 2008
Contour: DVOBaseNoise-Contours_Rev1 Alt-B_18Noise-Contours

Noise Contour Comparison: 2018 Alternative B vs 2008 Existing Conditions

Exhibit: **E-12**


GENERAL STUDY AREA
101
NWP Railroad
65 CNEL
70 CNEL
75 CNEL
13
31
Airport Rd
Novato
Binford Rd
101
Unincorporated
Marin County
Unincorporated
Sonoma County
Redwood Blvd
Atherton Ave
Bugeia Ln
Bahia Dr
Novato
Olive
Elementary
School
Olive Ave
School Rd
MARIN COUNTY
SONOMA COUNTY
37
Legend
2018 Alternative B
Community Noise Exposure Level
2018 Alternative A
Community Noise Exposure Level
School
Agriculture
General Commercial
Industrial
Mixed Use
Multi Family Residential
Office
Parks/Open Space
Privately Owned Non-Taxable
Single Family Residential
Vacant
General Study Area
Airport Property Boundary
City of Novato Boundary
County Boundary
Land Use Data Sources:
-Marin County Community Development Agency,
Marin Countywide Plan, Adopted November 6, 2007.
-Novato General Plan, Adopted March 8, 1996.
-Sonoma County General Plan 2020,
Adopted September 23, 2008.
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Filename: P:\DVO-Gnoss Field\GIS\
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Alternative B vs 2018 Alternative A
Contour: Alt-B_18Noise-Contours
Alt-A_18Noise-Contours
Noise Contour Comparison:
2018 Alternative B vs
2018 Alternative A
Exhibit:
E-13

Table E-12 provides the total area within the 2018 Alternative B noise contours in comparison to that of both the 2018 Alternative A and 2008 Existing Condition noise contours.

Table E-12
COMPARISON OF AREAS WITHIN THE 2018 ALTERNATIVE B NOISE EXPOSURE CONTOUR (IN ACRES)
Gnoss Field Airport

CONTOUR RANGE	2008 Existing Condition	2018 ALTERNATIVE A	2018 ALTERNATIVE B
65-70 CNEL	111.6	121.8	118.4
70-75 CNEL	45.4	49.5	60.3
75 + CNEL	29.9	34.7	35.0
65 + CNEL	186.9	206.0	213.7
Acreage of noise-sensitive land uses within 65+ CNEL	0	0	0

Source: Landrum & Brown, 2009.

Land Use Impact Assessment: The 65+ CNEL noise contour for the 2018 Alternative B, encompasses 214 Acres, or 0.33 square miles of land. There are no residential or noise sensitive land uses within any of the noise contour levels evaluated.

As previously noted, FAA standards require that aircraft noise impacts be analyzed for areas located within the 65+ CNEL noise contour compared to the No Action Alternative (Alternative A) for a given future year. Under the FAA guidelines, an increase in the noise level of CNEL 1.5 decibels (dB) or more for a noise-sensitive land use located within the 65+ CNEL noise contour is the threshold FAA uses for determining significant noise impacts. Since there are no noise sensitive land uses within the 65 CNEL noise contour for either Alternative A or Alternative B, the analysis confirms that there would be no significant noise changes associated with the expected future 2018 Alternative B condition at the Airport.

2018 Alternative D: Extend Runway 13/31 to the Southeast by 240 Feet and to the Northwest by 860 Feet.

This section provides a summary of the INM input data, the resulting noise exposure pattern, and the disclosure of the potential noise impacts resulting from the operation of the Airport under Alternative D in 2018.

Runway Definition: Alternative D includes a northwesterly extension of Runway 13/31 by 860 feet and a southeasterly extension of 240 feet. The resulting runway would be 4,400 feet in length.

Activity Levels and Fleet Mix: The proportional mix of aircraft types expected to operate at DVO in 2018 is projected to remain similar to that of the existing condition. Thus, the future fleet mix proportions remained the same for the 2018 condition with only the growth in total operations changing.

Runway End Utilization: The proposed extension of Runway 13/31 is not expected to affect runway use percentages from what was modeled for the Existing Condition (2008). Consequently, the runway use for this alternative will be identical to the 2018 Alternative A runway use.

Flight Tracks: The proposed runway extension under Alternative D would have modest effects on the flight tracks at DVO. Like Alternative B, the expected flight track changes would be related to the shifts in takeoff and landing points as they relate to the runway extensions included in the alternative.

Aircraft taking off to the south on Runway 13 would start their takeoff roll approximately 860 feet farther to the northwest than they currently do and thus be somewhat higher south of the Airport as they climb. Correspondingly, it is expected that the preferred noise abatement turns to the east would occur farther to the northwest than is the current practice with the existing runway. Arrival tracks to Runway 13 would also be affected as the landing threshold would be moved 860 feet to the northwest. It is expected that this would generally result in aircraft turning onto their final approach slightly farther to the northwest than is the current practice and the aircraft would tend to be slightly lower at a given point along the final approach north of the airfield.

Flight tracks for departures on Runway 31 to the north and arrivals to Runway 31 from the south would be expected to shift in a similar way but to a lesser degree as they relate to the 240 foot southeastward extension of the runway. Thus the start of takeoff roll and the landing threshold are expected to move 240 feet to the southeast.

Finally, the alternative would not affect the flight track utilization percentages shown in identified for the current conditions and the 2018 Alternative A scenarios.

Noise Exposure Contour: The 2018 Alternative D noise exposure contour for 65, 70, and 75 CNEL levels are graphically depicted on **Exhibit E-14**, ***Noise Contour Comparison: 2018 Alternative D vs. 2008 Existing Conditions.*** For comparative purposes, the 2008 Existing Condition noise contours are mapped in red. **Exhibit E-15**, ***Noise Contour Comparison: 2018 Alternative D vs. 2018 Alternative A.*** presents a comparison of the alternative against the 2018 no action. For comparative purposes, the 2018 Alternative A noise contours are mapped in red.

As the exhibits illustrate, the overall size and shape of the Alternative D noise contours for DVO are similar to those of the Alternative A noise pattern, as well as the 2008 Existing Condition pattern. To the north of the Airport the Alternative D 65 CNEL noise contour is slightly wider but extends about the same distance north as the Alternative A and 2008 Existing Condition noise contours. The increase in width is due to the northwesterly runway extension and the corresponding shift in the starting point of the takeoff roll for Runway 13 departures. Although the landing threshold is shifted to the north also, that increase in noise to the north is offset by the reduction in departure noise due to takeoffs on Runway 31 being shifted 240 feet further to the southeast. This combined effect keeps the northern extent of the 65 CNEL about the same as in Alternative A and the 2008 Existing Condition. Again, more dramatic evidence of the northwestward runway extension can be seen in the comparison of the higher noise level contours of 70 and 75 CNEL. As the map notes, the changes in these contours closely follow the runway extension with most of this change located on, or immediately adjacent to, the Airport property.

To the south, the Alternative D 65 CNEL noise contour exhibits multiple shifts related to the combined effects of the two runway extensions. On the east side, the contour is similar to the no action contour due to the offsetting effects of the Runway 13 departure noise reduction from the northwest runway extension and the arrival and departure noise increases due to the southeast runway extension. On the west side, the 65 CNEL noise contour shifts further to the south than Alternative A and 2008 Existing Condition due to the southeast runway extension and associated shifting of the start of takeoff roll for Runway 31 departures. Again, the higher noise level contours of 70 and 75 CNEL shift to the southeast and closely follow the 240 foot runway extension.

Table E-13 provides the total area within the 2018 Alternative D noise contours in comparison to that of the 2018 Alternative A, 2018 Alternative B, and the 2008 Existing Condition noise contours.

Table E-13
COMPARISON OF AREAS WITHIN THE 2018 ALTERNATIVE D NOISE EXPOSURE CONTOUR (IN ACRES)
Gnoss Field Airport

CONTOUR RANGE	2008 Existing Condition	2018 ALTERNATIVE A	2018 ALTERNATIVE B	2018 ALTERNATIVE D
65-70 CNEL	111.6	121.8	118.4	118.4
70-75 CNEL	45.4	49.5	60.3	60.1
75 + CNEL	29.9	34.7	35.0	35.1
65 + CNEL	186.9	206.0	213.7	213.6
Acreage of noise-sensitive land uses within 65 + CNEL	0	0	0	0

Source: Landrum & Brown, 2009.

Land Use Impact Assessment: The 65+ CNEL noise contour for the 2018 Alternative D, encompasses 213 Acres, or 0.33 square miles of land. There are no residential or noise sensitive land uses within any of the noise contour levels evaluated.

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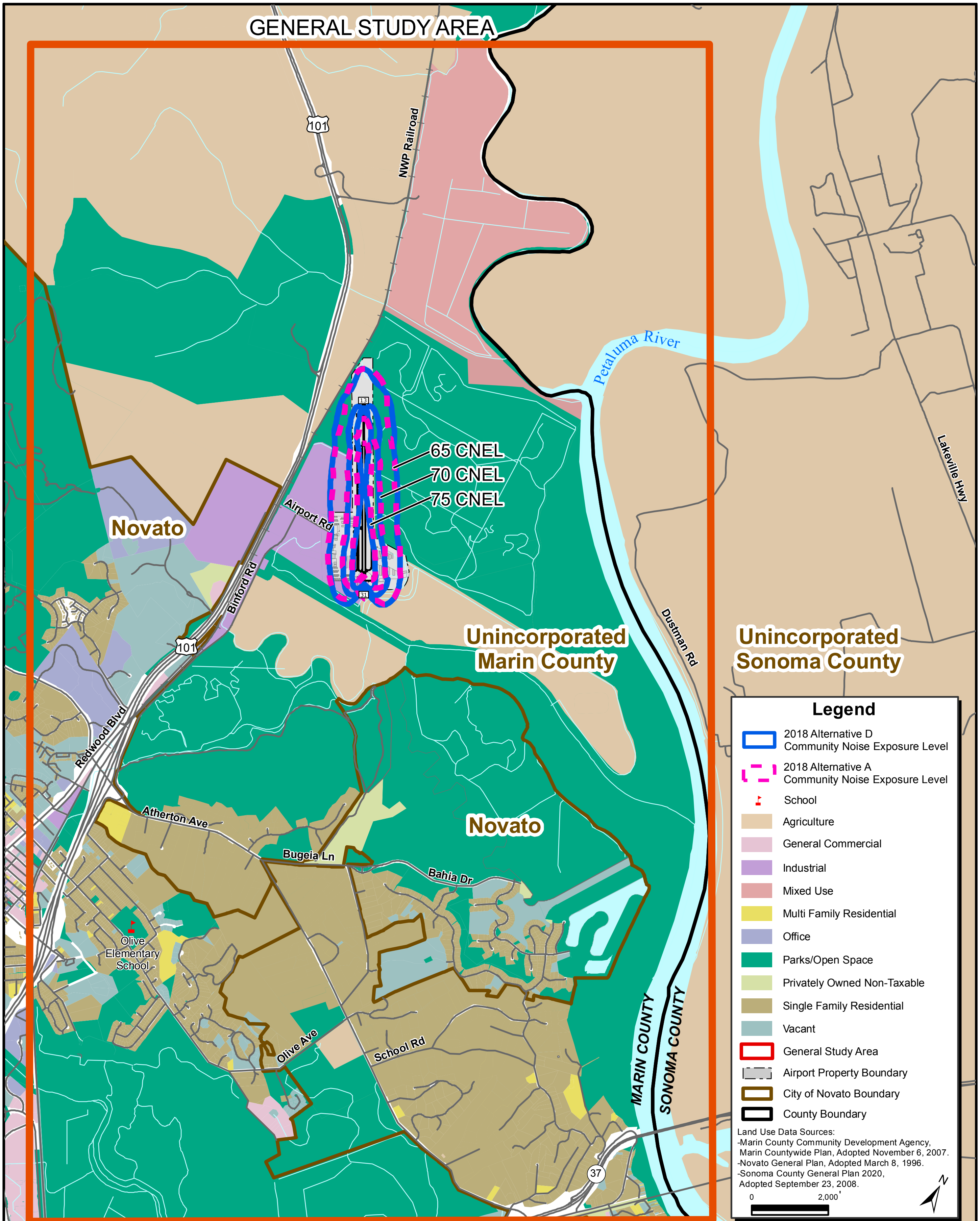

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Gnoss Field Airport

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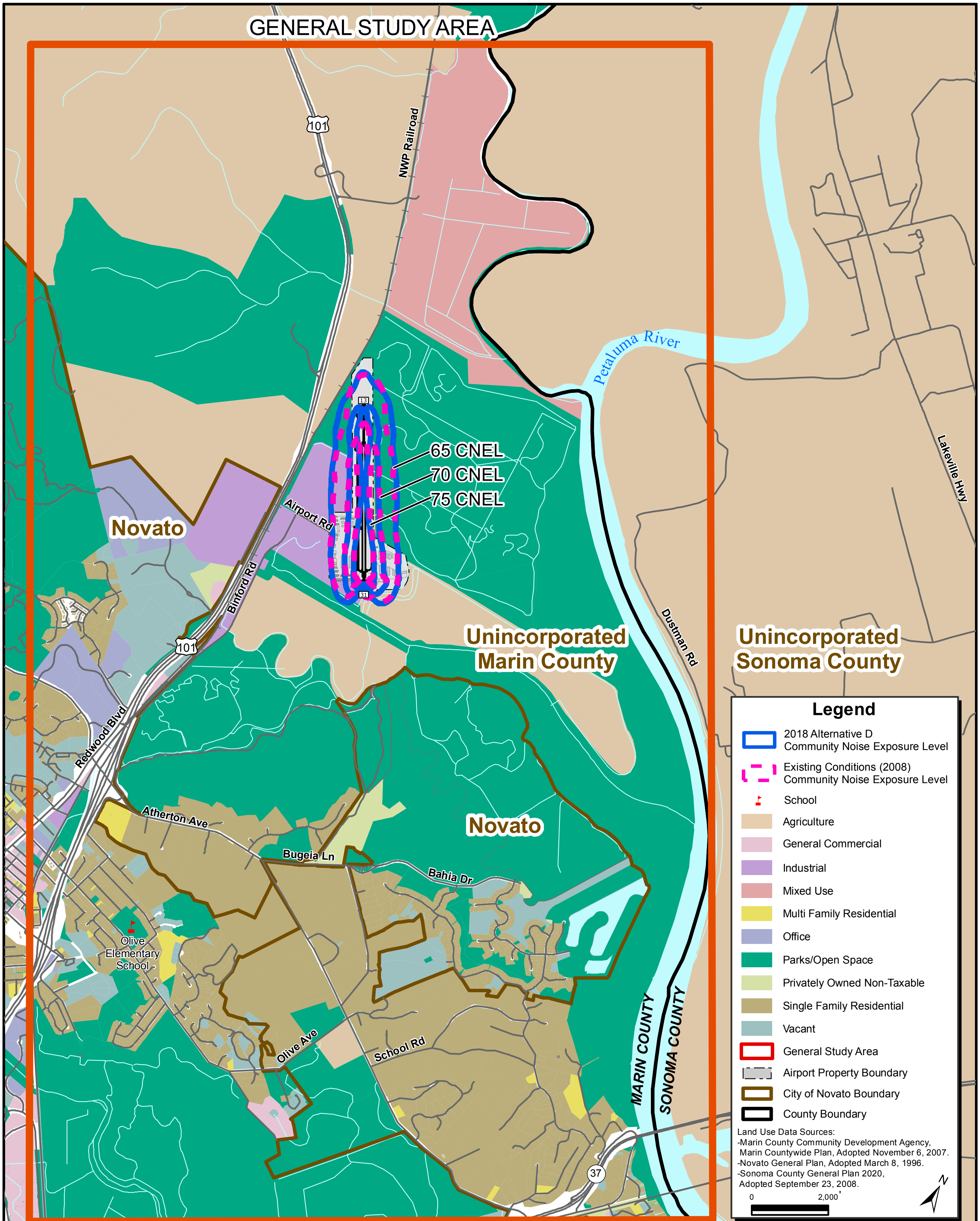
Filename: P:\DVO-Gnoss Field\GIS\MXD\EIS APPENDICES\E-15_2018 Alternative D vs 2018 Alternative A.mxd
Contour: Alt-A_18Noise-Contours
Alt-D_18Noise-Contours

Noise Contour Comparison: 2018 Alternative D vs 2018 Alternative A

Exhibit: **E-15**



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Gnoss Field Airport

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Filename: P:\DVO-Gnoss Field\GIS\MXD\EIS APPENDICES\E-14_2018 Alternative D vs 2008
Contour: DVOBaseNoise-Contours_Rev1 Alt-D_18Noise-Contours

Noise Contour Comparison: 2018 Alternative D vs 2008 Existing Conditions

Exhibit: **E-14**

As previously noted, FAA standards require that aircraft noise impacts be analyzed for areas located within the 65+ CNEL noise contour compared to the No Action Alternative (Alternative A) for a given future year. Under the FAA guidelines, an increase in the noise level of CNEL 1.5 decibels (dB) or more for a noise-sensitive land use located within the 65+ CNEL noise contour is the threshold FAA uses for determining significant noise impacts. Since there are no noise sensitive land uses within the 65 CNEL noise contour for either Alternative A or Alternative D, the analysis confirms that there would be no significant noise changes associated with the expected future 2018 Alternative D condition at the Airport.

2023 CONDITIONS

This section provides an evaluation of the potential increases in noise levels five years beyond the opening of the project (2023) for each alternative. The analysis focuses on the forecasted change in operating levels and fleet mix to determine the potential increase in noise for the community. FAA Order 1050.1E provides guidance for assessing conditions where there is a general overall increase in aircraft operations or changes in the type of aircraft occur. In cases where there are no changes in ground tracks or flight profiles, the analysis may be performed using the FAA's Area Equivalent Method (AEM) computer model. If the AEM calculations indicate that the proposed action would result in less than a 17 percent (approximately a DNL 1 dB) increase in the CNEL 65 dB contour area, it may be concluded that there would be no significant impact over noise sensitive areas and that no further noise analysis is required. For each of the alternatives, a comparison of the conditions between 2018 and 2023 finds that the only difference would be operating levels and fleet mix. Therefore, an evaluation of the difference between the operating levels and fleet mix from 2018 to 2023 will provide an indication of the relative increase in noise levels for any of the three alternatives.

The results from the AEM modeling, found that the CNEL 65 dB noise contour would increase in area by 5.9 percent (0.02 square miles), which is less than the 17 percent threshold increase identified in FAA Order 1050.1E. Therefore it can be concluded that there would be no significant impact as a result of the forecasted operating levels and fleet mix and no further noise analysis is required.

E.4.3.4 Supplemental Noise Analysis

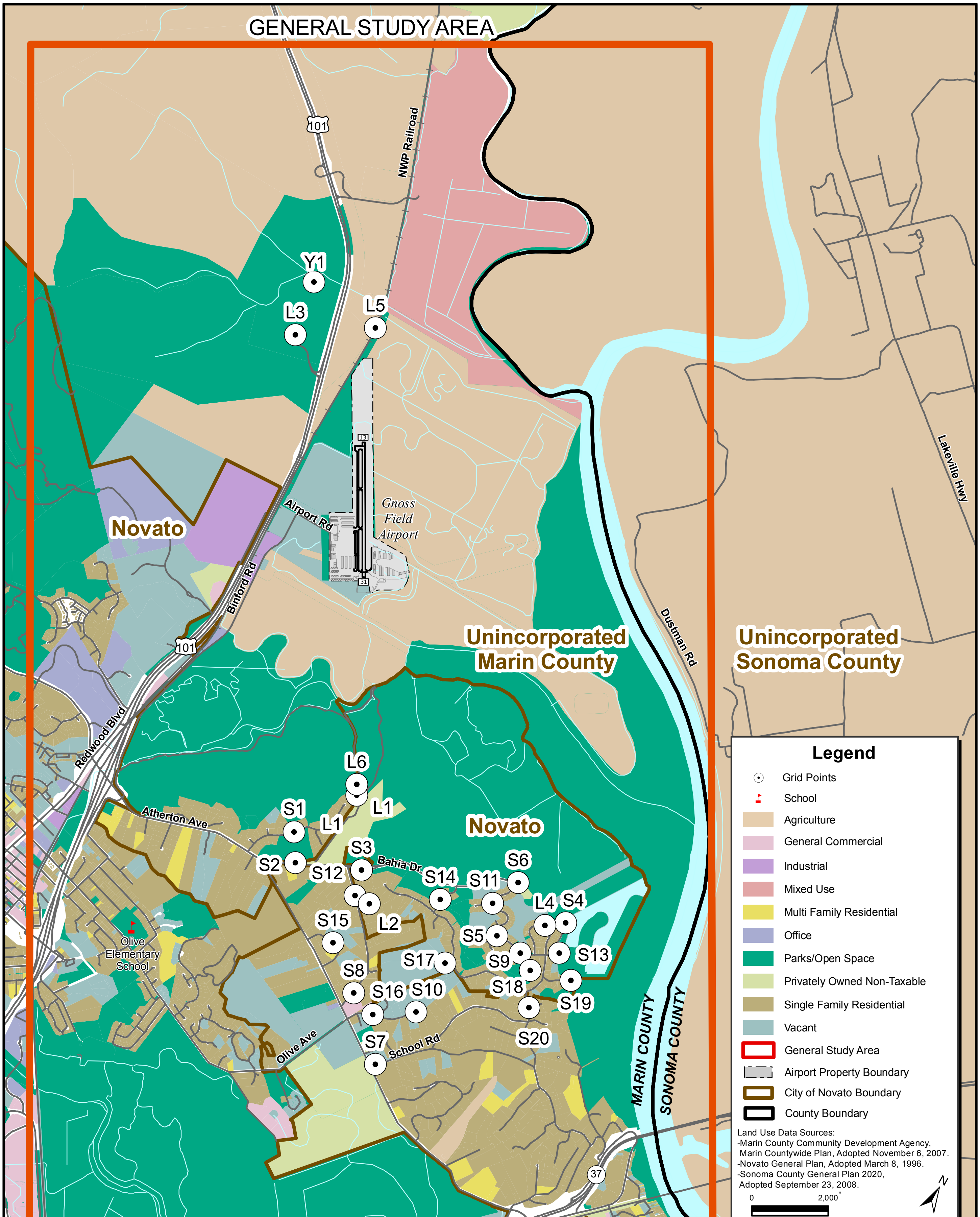
The preceding analysis focused on evaluating the anticipated noise effects of the proposed alternatives in terms of the cumulative CNEL noise levels as required by State and Federal policies and regulations. This analysis confirmed that there would be no noise impacts associated with the existing and future no action conditions, as well as no significant noise changes associated with either of the proposed alternatives. While these noise contour comparisons provide a general indication of the overall magnitude of the critical noise levels and the direction of change associated with the alternatives, they are limited in scope to areas near the airfield. Since the nearest residential areas are located more than a mile south of the airfield, supplemental noise information may provide added context to the noise evaluation. This can also enhance the understanding of the CNEL noise analysis that is required for the EIS.

The supplemental noise analysis was conducted using the INM and the input data described for the noise contour development in the preceding sections. The analysis focused on grid point locations defined based upon the noise measurement sites presented in previous sections. **Exhibit E-16, *Grid Point Locations*** illustrates the locations of these sites relative to the Airport on a land use base. As the exhibit indicates, most of the grid point locations are situated south of the airfield at or adjacent to residential areas that are closest to the Airport and typical flight paths. Two of the grid points are located north of the airfield and relatively close to the existing runway.

The Time Above (TA) metric was selected for this supplemental noise analysis as it provides a relatively simple metric that relates more directly to the noise experience on the ground than cumulative metrics, such as CNEL. The TA metric identifies the number of minutes per day that the outdoor noise from aircraft operations would exceed a specific value. For this analysis a threshold value of 65 dB (TA65) was selected as it is a level that provides a reasonable representation of where outdoor speech interference would occur. This level would generally translate to an interior (windows open) noise level of 45 dB to 50 dB depending on building construction. This would be well below the threshold of speech or television interference. By way of comparison, the typical dial tone in a telephone handset generates approximately 80 dB.

The TA65 levels were computed at each grid point for each of the scenarios identified in the preceding noise contour analysis. **Table E-14** presents a summary of the results for the 2008 Existing Condition and each of the future alternatives at each grid point. The grid points in the table are organized such that those on the north side of the airfield are listed first, followed by those on the south side. The table is also color coded so that key comparisons can be quickly noted. Specifically, entries in red text identify locations where there were increases in the TA65 as compared to the 2008 Existing Condition conditions. This coding only applies to the future No Action alternatives (Alternative A). The shaded cells in the table identify where the TA65 for a specific alternative increased (red) or decreased (green) as compared to the No Action alternative (A) for the same year of analysis.

As the comparisons in the table indicate, the future growth in operations that is expected at DVO regardless of the proposed alternatives only generates small increases (red text) in TA65 south of the Airport as compared to the current condition. The TA65 at most grid locations south of the Airport would remain the same (less than 0.1 minute increase) under the 2018 no action conditions. Only three grid points in 2018 would experience any increase and these would be limited to no more than 0.1 minutes (6 seconds) of increased time per day. The grid points north of the airfield exhibit larger changes (0.8 to 6.2 minutes) as they are closer to the airfield and more aligned with flight patterns. Generally, these results confirm what was evident to a lesser degree in the primary noise analysis using the CNEL noise contours.



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Gnoss Field Airport

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10/18/2013 Prepared by Landrum & Brown
Filename: P:\DVO-Gnoss Field\GIS\MXD\EIS APPENDICES\E-16_Grid Point Locations.mxd

Grid Point Locations

Exhibit: **E-16**

The comparisons of the proposed alternatives to the future No Action conditions reveal a similar confirmation of the CNEL noise contour results. As Table E-17 indicates, the TA65 for Alternative B at points south of the Airport either remains the same or is reduced (green shading) as compared to the no action condition for both future years.

Table E-14
SUPPLEMENTAL NOISE ANALYSIS SUMMARY
GNOSS FIELD AIRPORT

Grid Point	Outdoor Time Above 65 dB (minutes)			
	2008	2018		
	Existing Condition	Alt. A	Alt. B	Alt. D
North of Airport				
L3	11.7	13.7	15.2	13.6
L5	34.8	41.0	42.5	40.8
Y1	10.2	12.8	12.4	11.8
South of Airport				
L1	4.0	4.1	3.9	4.1
L2	0.0	0.0	0.0	0.1
L4	0.2	0.2	0.0	0.1
L6	4.4	4.5	4.1	4.2
S1	0.0	0.0	0.0	0.0
S2	0.0	0.0	0.0	0.0
S3	0.2	0.2	0.2	0.6
S4	0.2	0.2	0.1	0.1
S5	0.1	0.1	0.0	0.0
S6	1.5	1.5	1.3	2.0
S7	0.0	0.0	0.0	0.0
S8	0.0	0.0	0.0	0.0
S9	0.1	0.1	0.0	0.0
S10	0.0	0.0	0.0	0.0
S11	0.3	0.4	0.2	0.4
S12	0.0	0.0	0.0	0.0
S13	0.1	0.1	0.0	0.0
S14	0.2	0.2	0.1	0.3
S15	0.0	0.0	0.0	0.0
S16	0.0	0.0	0.0	0.0
S17	0.0	0.0	0.0	0.0
S18	0.0	0.0	0.0	0.0
S19	0.0	0.0	0.0	0.0
S20	0.0	0.0	0.0	0.0

Notes:
0.0 Red numbers indicate increases relative to the 2008 Existing Condition
Red shading indicate increases relative to Alt. A (no action) for the year indicated
Green shading indicate decreases relative to Alt. A (no action) for the year indicated

Source: Landrum & Brown, 2009.

As noted in the noise contour analysis, the grid points north of the airfield would experience modest increases in TA65 if Alternative B were implemented. It should also be noted that Alternative B in 2018 would result in TA65 levels south of the Airport that are either the same as or lower than the 2008 Existing Condition levels; thus, helping to offset the expected future growth in traffic at DVO.

A comparison of the TA65 results for Alternative D reveals that while there are very small reductions evident to the north of the airfield, the grid points to the south show a mixture of increases and decreases for the 2018 condition. These results again confirm what was evident to a lesser extent in the CNEL noise contour analysis. Unlike Alternative B, the TA65 results show that Alternative D cannot overcome the projected increase in traffic at DVO to maintain TA65 levels south of the Airport at or below that of the current condition.

E.4.4 SUMMARY

The noise analysis developed for both the EIS and EIR included both the required CNEL noise contour analysis and a supplemental noise evaluation at noise sensitive locations around the airport using the Time Above 65 dB metric. Both evaluations identified similar conclusions regarding the effect of the proposed alternatives for DVO.

In all cases, the analyses confirmed that there are no noise sensitive areas exposed to aircraft noise levels that are considered not to be compatible with those types of land use. Furthermore, neither of the proposed alternatives would result in a change in noise levels that would be considered to be a significant impact. Beyond the concern for significant impacts, both the CNEL noise contour analysis and the supplemental TA65 noise analysis indicate that there are subtle differences between the two proposed alternatives.

Generally, the results indicate that Alternative D provides a mixed effect to the south of the Airport where the residential development is located. Conversely, Alternative A (Sponsors Proposed Project) tends to minimize the noise effects south of the Airport This alternative also appears to have the added benefit of keeping the future noise exposure to the south of the Airport levels that are at or below those that are currently experienced despite forecasts of growth in air traffic activity. **Table E-15** presents a general summary of the noise analysis findings along with some qualitative notes regarding the effects of each of the proposed alternatives.

Table E-15
SUMMARY OF NOISE ANALYSIS RESULTS
Gnoss Field Airport

	Impacts within 65+ CNEL	Significant Noise Impacts (+1.5 dB in 65 CNEL)	Change in Flights South of DVO (no action)	Change in noise South of DVO (no action)
2008 Existing Condition	None	n/a	n/a	n/a
2018 Alternative A (No Action)	None	n/a	None	n/a
2018 Alternative B	None	None	Departures higher w/ turns farther north, Arrivals same as existing	Modest reductions in noise contours, departure single events slightly lower, TA65 lower
2018 Alternative D	None	None	Departures slightly higher w/turns slightly north, Arrivals slightly lower	Mixed minor shifts in noise contours, departure single events slightly lower, arrival events slightly higher, TA65 mixed
2023 Alternative A (No Action)	None	n/a	None	n/a
2023 Alternative B	None	None	Departures higher w/ turns farther north, Arrivals same as existing	Modest reductions in noise contours, departure single events slightly lower, TA65 lower
2023 Alternative D	None	None	Departures slightly higher w/turns slightly north, Arrivals slightly lower	Mixed minor shifts in noise contours, departure single events slightly lower, arrival events slightly higher, TA65 mixed

n/a not applicable

Source: Landrum & Brown, 2009.

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