Appendix C.

Aircraft Noise

1.1 ENVIRONMENTAL NOISE FUNDAMENTALS

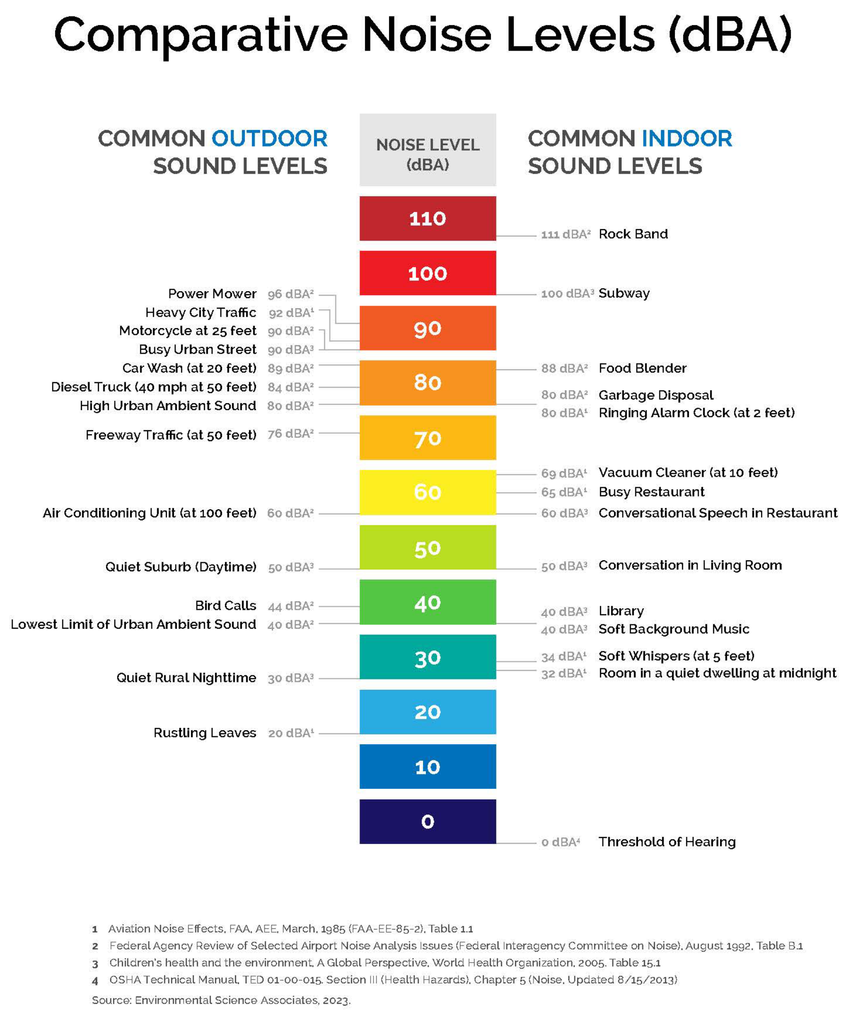
The measurement and human perception of sound involve two basic physical characteristics: intensity and frequency. Intensity is a measure of the acoustic energy of sound vibrations, expressed in terms of sound pressure. The higher the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is sound frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches.

Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level), which is measured in decibels (dB). On this scale, zero dB corresponds roughly to the threshold of human hearing, and 120 to 140 dB corresponds to the threshold of pain. Pressure waves traveling through air exert a force registered by the human ear as sound. Noise is commonly defined as unwanted sound.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequencies spanning 20 to 20,000 Hz. The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the sound frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts on humans, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear’s decreased sensitivity to extremely low and extremely high frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). A-weighting follows an international standard methodology of frequency weighting and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown on **Figure C-1**.

Figure C-1. Common Sounds on the A-Weighted Decibel Scale



1.2 GENERAL CHARACTERISTICS OF AIRCRAFT NOISE

Outdoor sound levels decrease as a function of distance from the source and as a result of wave divergence, atmospheric absorption, and ground attenuation. If sound is radiated from a source in a homogenous and undisturbed manner, the sound travels as spherical waves. As the sound wave travels away from the source, the sound energy is distributed over a greater area, dispersing the sound power of the wave. Spherical spreading of the sound wave reduces the noise level, for most sound sources, at a rate of 6 dB per doubling of the distance.

Atmospheric absorption also influences the levels that are received by the observer. The farther the sound travels, the greater the influence of atmospheric effects. Atmospheric absorption becomes important at distances greater than 1,000 feet. The degree of absorption is a function of the sound frequency, as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest at high humidity and higher temperatures. Turbulence and gradients of wind, temperature, and humidity also play a significant role in determining the degree of attenuation. Certain conditions, such as inversions, can also result in higher sound levels that would result from spherical spreading as a result of channeling or focusing the sound waves.

Absorption effects in the atmosphere vary with frequency. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated.

The effects of ground attenuation on aircraft noise propagation are a function of the height of the source and/or receiver and the characteristics of the terrain. The closer the source of the noise is to the ground, the greater the ground absorption. Terrain consisting of soft surfaces, such as vegetation, provide for more ground absorption than hard surfaces, such as a large parking lot.

Aircraft noise originates from both the engines and the airframe of an aircraft, but the engines are, by far, the more significant source of noise. Meteorological conditions affect the transmission of aircraft noise through the air. Wind speed and direction, and the temperature immediately above ground level, cause diffraction and displacement of sound waves. Humidity and temperature materially affect the transmission of air-to-ground sound through absorption associated with the instability and viscosity of the air.

1.3 AIRCRAFT NOISE DESCRIPTORS

The description, analysis, and reporting of aircraft noise levels is made difficult by the complexity of human response to sound and the myriad of sound-rating scales and metrics that have been developed for describing acoustic effects. Various rating scales have been devised to approximate the human response to the “loudness” or “noisiness” of a sound. Noise metrics have been developed to account for additional parameters, such as duration and cumulative effect of multiple events.

Noise metrics can be categorized as single-event metrics and cumulative metrics. Single-event metrics describe the noise from individual events, such as an aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure over a period of time.

1.3.1 A-Weighted Sound Pressure Level (dBA)

The decibel is a unit used to describe sound pressure level. When expressed in dBA, the sound has been filtered to reduce the effect of very low and very high frequency sounds, much as the human ear filters sound frequencies. Without this filtering, calculated and measured sound levels would include events that the human ear cannot hear (e.g., dog whistles and low frequency sounds, such as the groaning sounds emanating from large buildings with changes in temperature and wind). With A-weighting, calculations and sound monitoring equipment approximate the sensitivity of the human ear to sounds of different frequencies.

Some common sound levels on the dBA scale are listed in **Table C-1**. As shown, the relative perceived loudness of a sound doubles for each increase of 10 dBA, although a 10-dBA change in the sound level corresponds to a factor of 10 changes in relative sound energy. Generally, single-event sound levels with differences of 2 dBA or less are not perceived to be noticeably different by most listeners.

Table C-1. Common Sounds on the A-Weighted Decibel Scale

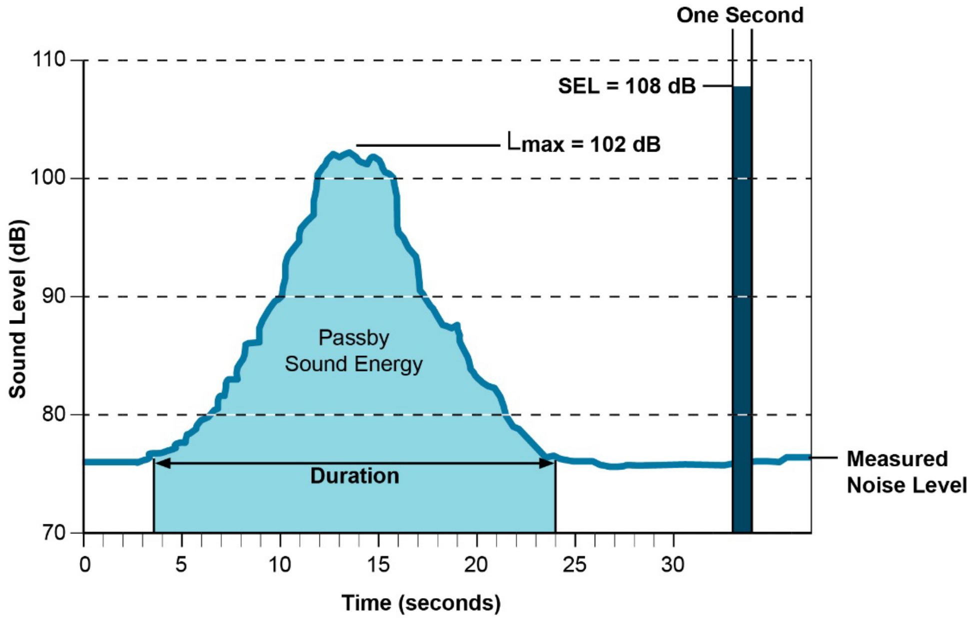
Sounds	Sound Level (dBA)	Relative Loudness (approximate)	Relative Sound Energy
Rock music, with amplifier	120	64	1,000,000
Thunder, snowmobile (operator)	110	32	100,000
Boiler shop, power mower	100	16	10,000
Orchestral crescendo at 25 feet, noisy kitchen	90	8	1,000
Busy street	80	4	100
Interior of department store	70	2	10
Ordinary conversation, 3 feet away	60	1	1
Quiet automobiles at low speed	50	1/2	.1
Average office	40	1/4	.01
City residence	30	1/8	.001
Quiet country residence	20	1/16	.0001
Rustle of leaves	10	1/32	.00001
Threshold of hearing	0	1/64	.000001

SOURCE: U.S. Department of Housing and Urban Development, Aircraft Noise Impact—Planning Guidelines for Local Agencies, 1972.

1.3.2 Maximum A-Weighted Sound Level (Lmax)

Lmax is the maximum, or peak, sound level during a noise event. The metric only accounts for the highest A-weighted sound level measured during a noise event, not for the duration of the event. For example, as an aircraft approaches, the sound of the aircraft begins to rise above ambient levels. The closer the aircraft gets, the louder the sound until the aircraft is at its closest point. As the aircraft passes, the sound level decreases until the sound returns to ambient levels. Some sound level meters measure and record the maximum sound level (Lmax). The Lmax for an aircraft flyover is illustrated on **Figure C-2**.

Figure C-2. Sound Exposure Level and Maximum Sound Level



SOURCE: ESA, 2025.

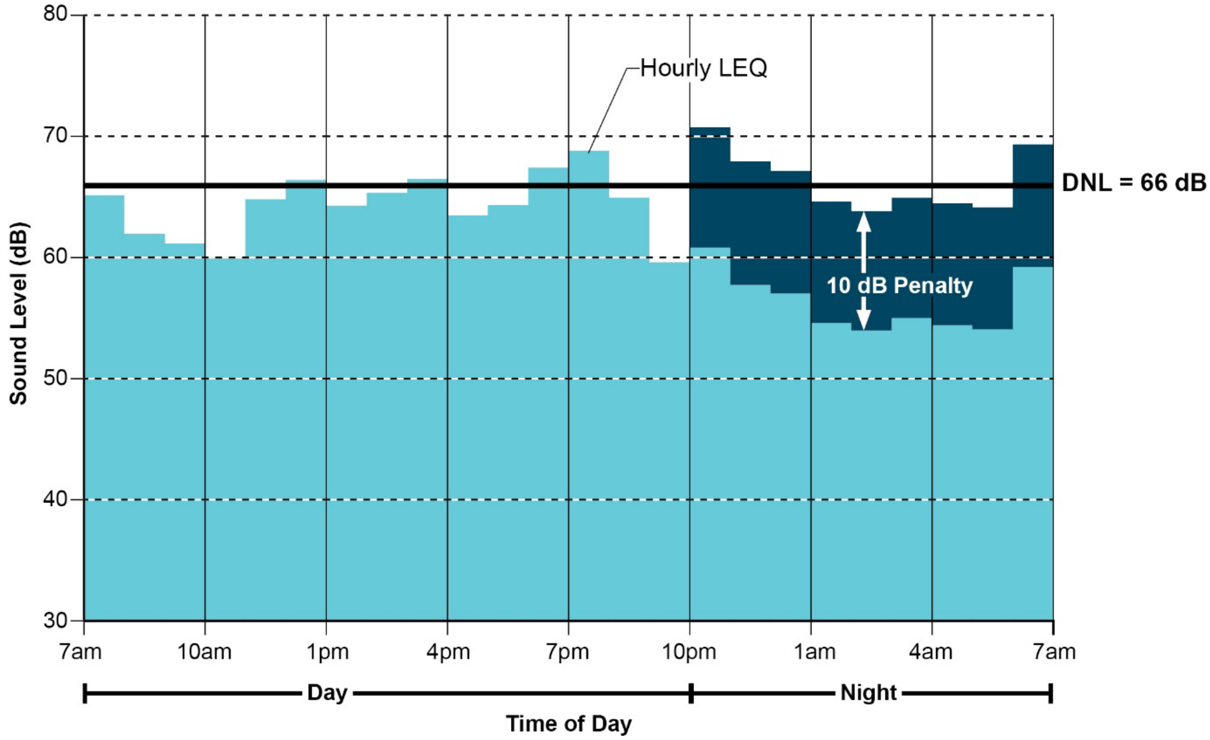
1.3.3 Sound Exposure Level (SEL)

Sound Exposure Level (SEL), is a time integrated measure, expressed in decibels, of the sound energy of a single noise event at a reference duration of one second. The sound level is integrated over the period that the level exceeds a threshold. Therefore, SEL accounts for both the maximum sound level and the duration of the sound. The standardization of discrete noise events into a one second duration allows calculation of the cumulative noise exposure of a series of noise events that occur over a period of time. The SEL of an aircraft noise event is typically 7 to 12 dBA greater than the Lmax of the event. SELs for aircraft noise events depend on the location of the aircraft relative to the noise receptor, the type of operation (landing, takeoff, or overflight), and the type of aircraft. The SEL for an aircraft flyover is also illustrated in **Figure C-2**.

1.3.4 Equivalent Noise Level (Leq)

Equivalent Noise Level (Leq) is the sound level corresponding to a steady state, A-weighted sound level containing the same total energy as a time-varying signal over a given sample period. Leq is the “energy” average noise level during the time period of the sample. It is based on the observation that the potential for a noise to impact people is dependent on the total acoustical energy content of the noise. It is the energy sum of all the sound that occurs during that time period. This is graphically illustrated in the middle graph on **Figure C-3**. Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour, or 24 hours.

Figure C-3. Day-Night Average Sound Level



SOURCE: ESA, 2025.

1.3.5 Day-Night Average Sound Level (DNL)

Day-Night Average Sound Level (DNL), formerly referred to as Ldn, is expressed in dBA and represents the noise level over a 24-hour period. DNL includes the cumulative effects of a number of sound events rather than a single event. It also accounts for increased sensitivity to noise during relaxation and sleeping hours. DNL is used to estimate the effects of specific noise levels on land uses. The U.S. Environmental Protection Agency (EPA) introduced the DNL metric in 1976 as a single number. In the calculation of DNL, for each hour during the nighttime period (10:00 p.m. to 7:00 a.m.), the sound levels are increased by a 10 decibel-weighting penalty (equivalent to a 10-fold increase in aircraft operations) before the 24-hour value is computed. The weighting penalty accounts for the more intrusive nature of noise during the nighttime hours. The weighting penalty is illustrated on **Figure C-3**.

DNL is expressed as an average noise level on the basis of annual average aircraft operations for a 24-hour period during a calendar year. To calculate the DNL at a specific location, the SELs at that location associated with each individual aircraft operation (landing or takeoff) are determined. Using SEL for each noise event and applying the 10-dB penalty for nighttime operations as appropriate, a partial DNL is then calculated for each aircraft operation. The partial DNLs for each aircraft operation are added logarithmically to determine the total DNL.

DNL is used to describe existing and predicted noise exposure in communities in airport environs based on the average daily operations over the year and the average annual operational conditions at an airport. Therefore, at a specific location near an airport, the DNL noise exposure on a particular day is likely to be higher or lower than the annual average DNL noise exposure, depending on the specific operations at an airport on that day. DNL is widely accepted as the best available method to describe aircraft noise exposure and is the noise descriptor required for aircraft noise exposure analyses and land use compatibility planning under 14 CFR Part 150 and for federal environmental reviews of airport improvement projects (FAA Order 1050.1G).[1]

The DNL metric used for this aircraft noise analysis is based on an average annual day of aircraft operations, generally derived from data for a calendar year. An annual-average day (AAD) activity profile is computed by adding all aircraft operations occurring during the course of a year and dividing the result by 365. As such, AAD does not reflect activities on any one specific day but represents average conditions as they occur during the course of a calendar year.

1.4 NOISE EXPOSURE AND COMMUNITY NOISE

An individual's noise exposure is a measure of noise over a period of time; a noise level is a measure of noise at a given instant in time. However, noise levels rarely persist at that level over a long period of time. Rather, community noise varies continuously over a period of time with respect to the sound sources contributing to the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with many of the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources, such as changes in traffic volume. What makes community noise variable throughout a day, besides the slowly changing background noise, is the addition of short-duration, single-event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual. These successive additions of sound to the community noise environment change the community noise level from instant to instant, requiring the noise exposure to be measured over periods of time to characterize an existing community noise environment.

With regard to the subjective effects, the responses of individuals to similar noise events are diverse and influenced by many factors, including the type of noise, the perceived importance of the noise, the appropriateness of the noise to the setting, the duration of the noise, the time of day and the type of activity during which the noise occurs, and individual noise sensitivity. Overall, there is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance

[1] U.S. Department of Transportation. Federal Aviation Administration. Order 1050.1G, *Environmental Impacts: Policies and Procedures*. June 30, 2025.

and dissatisfaction on people. A wide variation in individual thresholds of annoyance exists, and different tolerances to noise tend to develop based on an individual's past experiences with noise. Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing environment to which one has adapted. In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships generally occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA in ambient noise levels cannot be perceived;
- Outside of the laboratory, a 3 dBA change in ambient noise levels is considered to be a barely perceivable difference;
- A change in ambient noise levels of 5 dBA is considered to be a readily perceivable difference; and
- A change in ambient noise levels of 10 dBA is subjectively heard as a doubling of the perceived loudness.

These relationships occur in part because of the logarithmic nature of sound and the decibel scale. The human ear perceives sound in a non-linear fashion; therefore, the dBA scale was developed. Because the dBA scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. Under the dBA scale, when two sources are each producing sound of the same loudness, the resulting sound level at a given distance would be approximately 3 dBA higher than one of the sources under the same conditions. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. Under the dB scale, three sources of equal loudness together produce a sound level of approximately 5 dBA louder than one source, and ten sources of equal loudness together produce a sound level of approximately 10 dBA louder than the single source.

To supplement the discussion of community noise characteristics and individual noise exposure, **Attachment A** presents the Noise Monitoring Technical Report, which documents temporary noise measurements conducted at six (6) locations in the vicinity of Seattle-Tacoma International Airport (SEA or the Airport). These measurements were collected from November 6 through November 21, 2024, and again from March 25 through April 10, 2025, with additional monitoring at one site from April 11 through May 2, 2025. The purpose of this monitoring effort was to provide a snapshot of the existing noise environment and to illustrate the variability of community noise over time and location. The data are provided for informational purposes only and were not used in the development of noise exposure contours, consistent with the requirements of 14 CFR Part 150, which prohibits the use of monitoring data to calibrate the noise model used in contour development.

1.5 AVIATION ENVIRONMENTAL DESIGN TOOL (AEDT)

The noise analyses were conducted using the FAA's Aviation Environmental Design Tool (AEDT). The AEDT is the FAA's standard model for evaluating aircraft noise, fuel burn/consumption, and emissions at airports. For this analysis, AEDT, Version 3f, was used to model aircraft noise exposure at SEA for the 2022 Existing Conditions and the 2032 Future Conditions.

The AEDT produces noise exposure contours that are used for land use compatibility maps. The program includes a built-in Geographic Information System (GIS) platform and tools for comparing contours and utilities that facilitate easy export to other GIS software suites. The model can also calculate predicted noise at specific sites such as hospitals, schools, or other noise-sensitive locations. For these discrete locations, the AEDT has the capability to report noise exposure levels at the specific location.

During an average 24-hour period, the AEDT accounts for each aircraft flight along flight tracks to or from an airport, or aircraft overflying an airport. Flight track definitions are coupled with information in the model's databases relating to noise levels at varying distances and flight performance data for each distinct type of aircraft selected. In general, the model computes noise levels at regularly spaced grid receptors at ground level around an airport. The distance to each aircraft in flight is computed (slant distance), and the associated noise exposure of each aircraft flying along each flight track within the vicinity of the grid receptor is determined. The logarithmic acoustical energy levels for each individual aircraft single-event are then summed for each grid receptor. The AEDT can create contours of specific noise levels based on the acoustical energy summed at each of the grid receptors for the selected metric. The cumulative values of noise exposure at each grid receptor are used to interpolate contours of equal noise exposure. The AEDT can also compute noise levels at user-defined points on the ground.

Information required to run the AEDT includes:

- A physical description of an airport layout, including location, length and orientation of all runways, and airport elevation.
- The aircraft fleet mix for the average day.
- The number of daytime flights and run-up operations (7:00 a.m. to 9:59 p.m.).
- The number of nighttime flights and run-up operations (10:00 p.m. to 6:59 a.m.).
- Runway utilization rates.
- Primary departure and arrival flight tracks.
- Flight track utilization rates.

1.6 DNL AND NOISE EXPOSURE RANGES

Noise exposure values of DNL 65, 70, and 75 were used as the criterion levels for the noise analysis. Three specific ranges of noise exposure were modeled: (1) DNL 65 to 70, (2) DNL 70 to 75, and (3) DNL 75 and higher. Although the FAA considers aircraft noise exposure lower than DNL 65 to be compatible with residential land uses, persons residing outside the area exposed to DNL 65 and higher may still be annoyed by aircraft noise. The frequently cited "Schultz Curve"[2] shows that, at an aircraft noise exposure of DNL 65, approximately 15 percent of the population would be expected to be "highly annoyed." At DNL 60, approximately nine percent of the population would be expected to be highly annoyed by aircraft noise. At DNL 55, approximately five percent of the population would be expected to be highly annoyed by aircraft noise. The FAA conducted the Neighborhood Environmental Survey (NES)[3] which provides updated information on public responses to aircraft noise and is one of several inputs the FAA is evaluating as part of its ongoing review of federal aircraft noise policy. While the FAA has not yet issued any changes to its noise metrics or thresholds, the survey and related research efforts are informing that policy review process.

DNL mapping was developed as a tool to assist in land use planning around airports. The mapping is best used for comparative purposes rather than for providing absolute values. DNL calculations provide valid comparisons between different projected conditions, as long as consistent assumptions and data are used for all calculations.

Sets of DNL calculations can show anticipated changes in aircraft noise exposure over time, or can indicate which series of simulated situations is better, and generally how much better, from the standpoint of noise exposure. However, a line drawn on a map does not imply that a particular noise condition exists on one side of the line and not on the other. DNL calculations are for comparing noise effects, not for precisely defining them relative to specific parcels of land.

DNL contours can be used to: (1) highlight an existing or potential aircraft noise problem that requires attention; (2) assist in the preparation of noise compatibility programs; (3) provide guidance in developing land use controls, such as zoning ordinances, subdivision regulations, and building codes; and (4) determine mitigation eligibility for residential sound insulation programs. DNL is considered to be the best methodology available for depicting aircraft noise exposure by the FAA.

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[2] Schultz, T.J. "Synthesis of Social Surveys on Noise Annoyance." *Journal of the Acoustical Society of America*. V. 64 (2). 1978.

[3] Federal Aviation Administration, Neighborhood Environmental Survey, accessed at: https://www.faa.gov/regulations_policies/policy_guidance/noise/survey.

1.6.1 Graphic Representation of Aircraft Noise Exposure

Noise exposure contours are lines on a map that connect points of equal DNL values, much like topographic contours are drawn to indicate area of equal ground elevation. For example, a contour may be drawn to connect all points of DNL 70; another may be drawn to connect all points of DNL 65; and so forth. Generally, noise contours are plotted at 5-dB intervals. Noise contours were developed for the Airport in conformance with FAA guidelines included in 14 CFR Part 150.

For this analysis, the AEDT was used to produce contours to delineate areas exposed to DNL 65, 70, and 75. These contours were integrated with U.S. Census data, the American Community Survey (ACS), the Port of Seattle datasets, and land use data provided by Washington State and King County. These data were also used to determine land uses and estimate the number of dwelling units, residents, and noise-sensitive facilities located within the areas exposed to aircraft noise levels of 1) DNL 65 to 70, 2) between DNL 70 and 75, 3) DNL 75 and higher, and 4) the sum of the previous, totaling the impacts within DNL 65 and higher.

Attachment A

Noise Monitoring Technical Report

SEATTLE-TACOMA INTERNATIONAL AIRPORT

Noise Monitoring Technical Report

August 2025

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1 Introduction

ESA is assisting the Port of Seattle (the Port) with noise monitoring of the communities and environs surrounding the Seattle-Tacoma International Airport (SEA or the Airport). This effort is part of SEA's Title 14 Code of Federal Regulations (CFR) Part 150 Study. The purpose of this report is to document, evaluate, and characterize the existing noise environment using field measurements and data analysis. These findings may help inform future noise abatement strategies, land use planning recommendations, and public engagement initiatives aimed at mitigating aircraft noise impacts and enhancing community compatibility. However, under 14 CFR Part 150, airports are required to use FAA-approved noise modeling to develop the 65 DNL noise exposure contour, which forms the basis for evaluating noise impacts and identifying areas of potential noncompatible land uses.

2 Noise Monitoring

The following section outlines the noise monitoring methodology and results. This includes an overview of the noise monitoring locations, description of the noise monitoring equipment utilized and its setup, and existing noise (ambient) results.

2.1 Methodology

ESA contracted Barry Technologies, Inc. (BTI) to conduct two separate periods of short-term noise monitoring at six (6) locations in the vicinity of SEA from November 6, 2024 through November 21, 2024 and then from March 25, 2025 through April 10, 2025 (with additional measurements at one site from April 11, 2025 through May 2, 2025) to document and analyze the existing noise environment. The noise monitoring locations were selected based on proximity to established flight paths and noise sensitive land uses within the vicinity of SEA. They were also positioned in areas away from permanent noise monitoring sites. Of the original five noise monitoring locations, four of them were repeated between measurement periods, with one site having to be moved due to noise contamination in the area surrounding a local fire station. Noise monitoring locations are presented in **Figure 1** and photos of each location are found in **Section 2.2**.

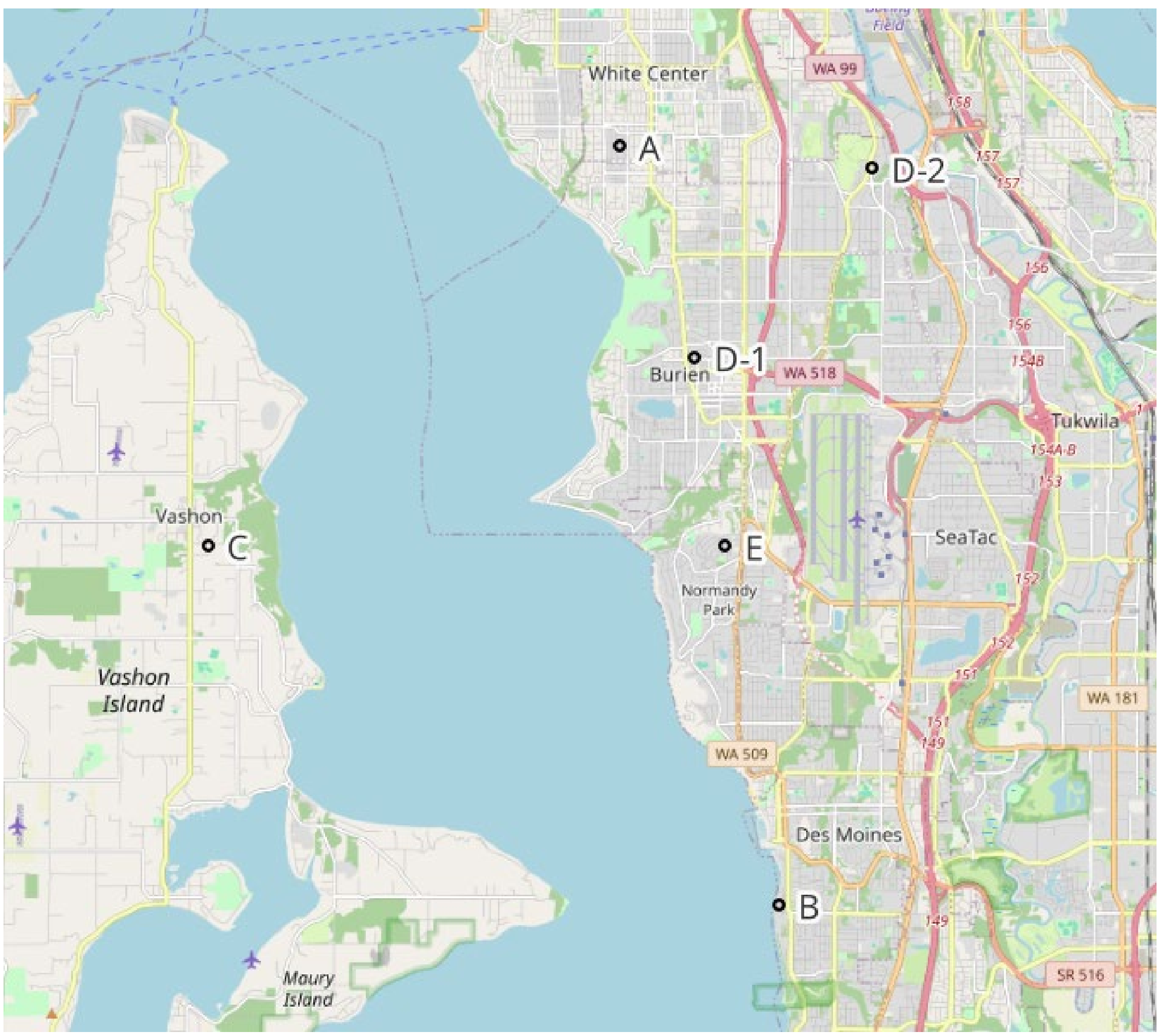
BTI deployed Larson Davis Model 831 Sound Level Meter (SLM) and conducted noise monitoring in accordance with appropriate professional standards. All instrumentation conformed to American National Standard Institute (ANSI) Standard S1.4 for Type 1 precision, the highest level of precision, with current calibrations traceable to the U.S. National Institute of Standards and Technology (NIST). Type 1 precision instrumentation requires constant calibration to meet ANSI standards; calibrations were carried out in the field before and after the measurement period using NIST-certified calibration devices.

All noise measurement data collected by BTI were uploaded to the Port's EnvironmentalVue Noise and Operations Monitoring System (NOMS) maintained by PASSUR Aerospace, Inc. (PASSUR). This system provides a platform for correlating noise events with actual aircraft operations. By integrating the continuous one-second equivalent sound level (Leq) data from each monitoring location with real-time flight tracking information, PASSUR identified and matched specific noise events to corresponding aircraft movements, including events associated with takeoffs, landings, and overflights. This correlation process allowed for better understanding of the contribution of aircraft operations to the overall noise environment in the vicinity of SEA by identifying the specific aircraft associated with each noise event.

Continuous one-second Leq measurement data was obtained at each noise monitoring location. BTI personnel monitored each site on a short-term basis and noted any prominent ambient noise events (e.g. vehicles, high altitude aircraft overflights, wildlife, etc.).

It is important to note that the noise monitoring results presented in this report should not be compared to noise measurements made using less precise instrumentation, such as cell phone applications. Cellphone microphones do not conform to ANSI or NIST standard for several reasons: (1) the built-in microphones found in cellphones have limitations due to their miniature size and circuit board placement, which affect their dynamic range and signal-to-noise ratio, (2) the lack of access and inability to perform periodic or pre-measurements and (3) the placement of the microphone can affect measured sound levels.

Figure 1. Noise Monitoring Locations



SOURCE: ESA, 2025

2.2 Noise Monitoring Results

2.2.1 Site A – 10927 24th Ave SW, Seattle

Site A is located approximately three nautical miles northwest of SEA at a private residence in the Arbor Heights neighborhood of Seattle. The noise monitor was placed on a second-floor balcony on the west side of the building, with the microphone positioned above the roofline. **Table 1** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the maximum A-weighted sound level (Lmax) noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated sound exposure level (SEL) aircraft event. The loudest aircraft event at Site A during the first measurement period occurred on November 6, 2024, at 7:19 PM from a Bell 407 helicopter. During the second measurement period, the loudest recorded aircraft event occurred on March 26, 2025, at 7:35 PM from an Embraer 175L regional jet.

Table 1. Site A - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event: Aircraft Type	Loudest Aircraft Event: Time of Event	Loudest Aircraft Event: SEL
Measurement 1 (November 6 – November 21, 2024)								
6-Nov	78.1	36.2	78.1	North	2	B407	7:19 PM	82.9
7-Nov	48.0	29.0	48.0	South	6	B738	9:44 AM	74.7
8-Nov	46.4	31.8	46.6	South	11	E75L	6:36 AM	76.8
9-Nov	45.7	-	45.7	South	-	-	-	-
10-Nov	46.8	29.2	46.8	South	8	C172	11:41 AM	75.5
11-Nov	49.6	27.1	49.6	South	6	DH8D	7:36 PM	71.8
12-Nov	48.5	24.0	48.5	South	4	C25B	12:57 AM	68.7
13-Nov	48.6	24.5	48.6	South	6	C208	3:46 PM	69.1
14-Nov	48.6	34.9	48.8	South	4	B39M	5:15 PM	82.4
15-Nov	46.5	-	46.5	South	-	-	-	-
16-Nov	46.2	25.2	46.3	South	2	CL35	11:49 AM	73.7
17-Nov	51.3	24.5	51.3	South	4	C208	10:20 AM	71.2
18-Nov	47.6	23.4	47.6	South	4	C208	3:33 PM	69.3
19-Nov	52.5	35.2	52.6	South	10	B739	8:33 PM	80.1
20-Nov	48.0	29.2	48.1	South	5	MD11	5:45 PM	75.7
21-Nov	45.7	-	45.7	South	-	-	-	-
Measurement 2 (March 25 – April 10, 2025)								
25-Mar	47.0	26.6	47.1	North	2	B763	7:26 PM	70.2
26-Mar	49.2	52.5	54.2	South	72	E75L	7:34 PM	84.4
27-Mar	46.8	38.3	47.4	South	41	B739	10:07 AM	81.9
28-Mar	47.6	31.1	47.7	South	22	C172	2:29 PM	72.7
29-Mar	45.2	35.2	45.6	South	14	EC35	9:46 PM	83.2
30-Mar	47.4	36.0	47.7	South	70	E75L	2:42 PM	72.8
31-Mar	45.9	31.9	46.1	South	25	DH8D	3:25 PM	74.1
1-Apr	44.9	26.9	45.0	South	11	E75L	4:56 PM	69.5
2-Apr	45.1	30.1	45.2	South	9	LJ45	12:51 AM	75.5
3-Apr	46.1	36.2	46.5	South	14	GLST	11:37 AM	81.5
4-Apr	47.6	29.7	47.7	North	10	PC12	4:04 PM	73.2
5-Apr	45.4	35.9	45.9	South	32	E75L	4:52 PM	79.5
6-Apr	46.2	40.5	47.2	South	91	F2TH	10:35 AM	78.6
7-Apr	47.1	33.5	47.2	South	31	E75L	1:15 PM	76.8
8-Apr	49.2	41.6	49.9	South	113	E75L	1:06 PM	81.0
9-Apr	44.4	29.4	44.5	South	5	C208	7:17 AM	75.4
10-Apr	48.6	44.9	50.1	South	121	CL60	5:14 PM	83.1

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.

NOTES: Missing aircraft Leq is due to infrequent overflights.

2.2.2 Site B – 560 S 239th Street, Des Moines

Site B is located approximately three nautical miles south-southwest of SEA at a private residence near the waterfront of the Puget Sound in Des Moines, WA. The noise monitor was placed next to a low fence on the south side of the property adjacent to the public street. **Table 2** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the Lmax noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated SEL aircraft event. The loudest aircraft event at Site B during the first measurement period occurred on November 20, 2024, at 10:15 AM from a Boeing 737-800 jetliner. During the second measurement period, the loudest recorded aircraft event occurred on April 9, 2025, at 10:24 AM from a Boeing 767-200 jetliner.

Table 2. Site B - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event: Aircraft Type	Loudest Aircraft Event: Time of Event	Loudest Aircraft Event: SEL
Measurement 1 (November 6 – November 21, 2024)								
6-Nov	46.3	59.0	59.3	North	426	B739	10:37 AM	97.4
7-Nov	45.8	58.2	58.4	South	562	B763	10:14 AM	95.2
8-Nov	48.3	57.7	58.1	South	559	B744	1:44 AM	88.1
9-Nov	43.8	57.2	57.4	South	481	B77W	4:15 PM	87.0
10-Nov	46.6	58.3	58.6	South	572	B77W	11:09 PM	89.4
11-Nov	47.9	58.8	59.1	South	623	A343	2:44 PM	91.1
12-Nov	47.6	57.8	58.2	South	563	B738	2:26 PM	89.4
13-Nov	54.8	59.2	60.5	South	561	E75L	12:58 PM	98.1
14-Nov	48.6	59.2	59.5	South	676	B77W	4:29 PM	89.2
15-Nov	45.4	59.0	59.2	South	604	B744	9:49 AM	87.6
16-Nov	45.5	57.4	57.7	South	501	B744	1:02 PM	89.5
17-Nov	49.3	58.5	59.0	South	641	B738	4:38 PM	88.0
18-Nov	47.0	58.2	58.5	South	624	E75L	8:51 AM	90.9
19-Nov	48.9	57.9	58.4	South	535	MD11	6:39 AM	87.5
20-Nov	46.8	58.5	58.8	South	579	B738	10:15 AM	100.2
21-Nov	45.2	57.7	57.9	South	281	B744	12:23 PM	87.4
Measurement 2 (March 25 – April 10, 2025)								
25-Mar	48.1	58.4	58.8	North	595	B738	5:23 PM	92.7
26-Mar	56.8	59.5	61.3	South	621	B739	2:15 PM	96.6
27-Mar	47.6	58.9	59.2	South	633	E75L	9:59 AM	96.1
28-Mar	58.5	59.2	61.9	South	599	B744	10:38 PM	89.4
29-Mar	45.5	58.1	58.3	South	518	B748	6:11 AM	86.0
30-Mar	49.3	58.4	58.9	South	602	E75L	12:41 PM	93.8
31-Mar	52.0	59.2	60.0	South	598	E75L	9:13 AM	96.6
1-Apr	46.0	59.0	59.2	South	580	B744	8:36 PM	88.5
2-Apr	48.6	59.7	60.0	South	599	B739	11:29 AM	98.1
3-Apr	65.1	59.6	66.2	South	556	B39M	1:00 PM	102.7
4-Apr	48.4	57.5	58.0	North	611	B738	9:39 AM	90.7
5-Apr	47.4	56.8	57.2	South	529	A343	2:08 PM	85.6
6-Apr	47.2	58.9	59.2	South	593	B744	2:39 PM	89.1
7-Apr	49.9	58.9	59.4	South	611	B772	2:37 PM	90.7
8-Apr	52.3	58.9	59.7	South	610	B772	3:09 PM	89.3
9-Apr	48.4	60.2	60.5	South	573	B762	10:24 AM	104.0
10-Apr	39.4	47.5	48.1	South	4	B739	12:20 AM	80.3

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.

2.2.3 Site C – 9527 SW 180th Street, Vashon Island

Site C is located approximately 5.5 nautical miles west of SEA at a private residence on the eastern side of Vashon Island. Complete measurement data was obtained for the first measurement period in November 2024. During the second measurement period the monitor lost power on March 29, 2025. Additional measurements at this site were conducted from April 11, 2025, through May 2, 2025. **Table 3** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the Lmax noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated SEL aircraft event. The loudest aircraft event at Site C during the first measurement period occurred on November 15, 2024, at 1:35 PM from a Boeing 737-900 jetliner. During the second measurement period, the loudest recorded aircraft event occurred on April 20, 2025, at 4:35 PM from an Embraer 175L regional jet.

Table 3. Site C - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event: Aircraft Type	Loudest Aircraft Event: Time of Event	Loudest Aircraft Event: SEL
Measurement 1 (November 6 – November 21, 2024)								
6-Nov	41.2	36.3	42.4	North	44	C210	2:47 PM	79.5
7-Nov	42.7	40.2	44.6	South	119	EC35	9:38 AM	80.8
8-Nov	42.7	40.2	44.6	South	119	B429	3:01 PM	82.4
9-Nov	42.0	38.7	43.7	South	87	B789	10:02 AM	75.9
10-Nov	44.1	41.5	46.0	South	155	B737	10:06 PM	76.7
11-Nov	48.8	42.6	49.8	South	207	B737	5:13 PM	76.9
12-Nov	46.4	41.3	47.6	South	158	A21N	6:26 AM	76.3
13-Nov	47.4	42.2	48.6	South	146	C17	2:57 PM	82.7
14-Nov	46.0	40.2	47.0	South	134	A21N	6:12 AM	78.0
15-Nov	51.8	44.7	52.5	South	144	B739	1:35 PM	88.4
16-Nov	44.1	41.5	46.0	South	120	B429	2:48 PM	84.6
17-Nov	48.4	42.5	49.4	South	182	B39M	12:29 AM	77.4
18-Nov	45.3	42.1	47.0	South	162	B763	12:54 AM	77.7
19-Nov	46.2	43.1	47.9	South	159	MD11	4:12 PM	78.2
20-Nov	44.7	41.6	46.4	South	157	CL35	10:03 PM	77.9
21-Nov	40.4	41.0	43.7	South	42	B763	1:49 AM	76.5
Measurement 2 (April 11 – May 2, 2025)								
11-Apr	46.0	34.3	46.3	North	28	B738	5:40 PM	74.7
12-Apr	45.4	40.1	46.6	South	43	B429	12:45 PM	83.5
13-Apr	43.8	30.6	44.0	North	10	C182	9:57 AM	73.8
14-Apr	46.2	33.2	46.4	North	18	COL3	1:16 PM	76.8
15-Apr	61.9	35.8	61.9	North	20	B77L	5:58 AM	77.3
16-Apr	69.9	58.5	70.2	North	28	B429	4:23 PM	83.9
17-Apr	72.4	60.7	72.7	North	20	B738	10:31 AM	97.5
18-Apr	44.1	33.4	44.5	South	21	C208	8:18 AM	76.7
19-Apr	64.4	39.2	64.5	South	48	B748	9:35 PM	81.5
20-Apr	69.0	52.3	69.1	South	42	E75L	4:35 PM	98.7
21-Apr	66.2	38.5	66.2	South	78	B38M	10:19 PM	77.9
22-Apr	70.4	33.7	70.4	North	21	C208	5:20 PM	74.6
23-Apr	63.5	31.4	63.5	North	12	EC35	2:59 PM	75.5
24-Apr	72.6	49.1	72.6	North	21	E75L	10:20 AM	98.0
25-Apr	71.5	59.2	71.7	North	24	EC35	1:50 PM	76.2
26-Apr	44.7	37.8	45.5	South	51	C172	12:40 PM	80.4
27-Apr	47.9	36.6	48.2	South	47	B39M	7:04 PM	77.5
28-Apr	48.9	38.3	49.3	South	78	EC35	6:47 PM	77.4
29-Apr	48.1	38.0	48.5	South	33	B190	6:12 PM	81.7
30-Apr	43.4	33.8	43.8	North	18	C172	9:49 PM	76.0
1-May	43.3	33.0	43.7	North	16	C180	4:07 PM	74.8
2-May	43.3	37.8	44.4	South	19	A332	8:12 AM	76.0

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.

2.2.4 Site D-1 – 900 SW 146th, Burien

Site D-1 is located approximately 1.2 nautical miles northwest of SEA at King County Fire District #2 Fire Station 28 in Burien, WA. This site was only utilized during the first measurement period in November 2024 and was relocated to site D-2 for the March-April 2025 measurements due to the level of community noise contamination. The noise monitor was placed on the roof of the fire station on the southeast side of the building. **Table 4** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the Lmax noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated SEL aircraft event. The loudest aircraft event at Site D-1 occurred on November 20, 2024, at 6:14 PM from an Embraer 175L regional jet.

Table 4. Site D-1 - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event		
						Aircraft Type	Time of Event	SEL
Measurement 1 (November 6 – November 21, 2024)								
6-Nov	55.7	53.6	57.8	North	597	B407	7:19 PM	85.1
7-Nov	55.7	54.1	58.0	South	912	B738	8:58 AM	88.2
8-Nov	52.7	54.2	56.5	South	1191	B737	4:21 PM	86.1
9-Nov	52.4	52.6	55.5	South	1000	A321	2:32 PM	88.4
10-Nov	59.3	57.2	61.4	South	906	B737	9:51 PM	90.8
11-Nov	58.0	54.3	59.5	South	992	E75L	6:17 AM	95.3
12-Nov	57.0	52.6	58.3	South	642	B739	9:07 PM	91.5
13-Nov	54.7	56.7	58.9	South	892	B39M	8:46 PM	89.9
14-Nov	57.0	55.0	59.1	South	757	E75L	4:37 PM	94.5
15-Nov	43.8	43.8	46.8	South	186	BCS3	9:51 AM	83.3
16-Nov	47.5	42.0	48.5	South	102	B739	12:12 PM	78.7
17-Nov	55.1	54.9	58.0	South	1045	B739	2:30 PM	93.8
18-Nov	53.3	54.2	56.7	South	934	B738	11:54 AM	90.1
19-Nov	60.5	50.4	60.9	South	215	E75L	6:00 AM	88.5
20-Nov	55.6	56.5	59.1	South	866	E75L	6:14 PM	99.9
21-Nov	57.3	49.3	57.9	South	105	A21N	6:41 AM	84.3

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.

2.2.5 Site D-2 – 11240 Military Rd South, Burien

Site D-2 is located approximately 2 nautical miles north of SEA at a private residence in Burien, WA. This site was only utilized during the second measurement period in March-April 2025 after being relocated from site D-1 due to the level of community noise contamination from the local fire station. The noise monitor was placed on a wooden deck on the east side of the house. **Table 5** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the Lmax noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated SEL aircraft event. The loudest aircraft event at Site D-2 occurred on March 27, 2025, at 3:49 AM from a McDonnell Douglas MD-11 jetliner.

Note: Noise monitor was located on this deck but is not shown in this photo (photo source: Google.com).

Table 5. Site D-2 - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event		
						Aircraft Type	Time of Event	SEL
Measurement 2 (March 25 – April 10, 2025)								
25-Mar	57.1	63.6	64.5	North	159	B739	9:34 PM	90.5
26-Mar	53.8	60.6	61.4	South	891	B739	9:08 AM	95.3
27-Mar	55.7	55.5	58.6	South	607	MD11	3:49 AM	95.6
28-Mar	55.9	57.4	59.7	South	605	B763	3:52 AM	93.1
29-Mar	50.6	56.5	57.5	South	1026	B744	11:35 PM	91.7
30-Mar	60.4	57.8	62.3	South	436	B744	2:43 AM	94.8
31-Mar	56.7	57.7	60.2	South	1014	A333	11:58 AM	92.3
1-Apr	49.6	57.1	57.8	South	1033	B744	6:52 PM	94.2
2-Apr	51.8	59.4	60.1	South	975	MD11	7:05 PM	92.9
3-Apr	50.6	61.1	61.5	South	899	MD11	6:59 PM	92.6
4-Apr	58.7	63.1	64.4	North	635	A343	2:26 PM	94.8
5-Apr	52.1	56.1	57.5	South	841	B763	5:33 AM	91.5
6-Apr	48.8	57.0	57.6	South	1068	B744	12:35 PM	92.5
7-Apr	55.8	55.9	58.9	South	626	B748	8:46 PM	92.3
8-Apr	59.6	54.2	60.7	South	362	A332	7:56 PM	90.3
9-Apr	52.1	59.3	60.1	South	838	B739	6:02 PM	91.3
10-Apr	56.5	51.2	57.6	South	136	B78X	10:42 AM	87.8

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.

2.2.6 Site E – 17721 3rd Place SW, Normandy Park

Site E is located approximately 0.75 nautical miles west of SEA at a private residence in Normandy Park, WA. The noise monitor was placed near the corner of the house on the southeast side of the property adjacent to the local public road. **Table 6** presents the recorded daily Leq noise levels for aircraft, community, and total noise as well as the Lmax noise levels at this location for both measurement periods. The table also presents the primary operational flow at the airport during each day, as well as the loudest correlated SEL aircraft event. The loudest aircraft event at Site E during the first measurement program occurred on November 7, 2024, at 9:23 PM from a Boeing 737-900 jetliner. During the second measurement period, the loudest recorded aircraft event occurred on April 2, 2025, at 11:08 AM from an Embraer 175L regional jet.

Table 6. Site E - Measured Noise Levels

Date	Community Leq	Aircraft Leq	Total Leq	Primary Flow	Number of Correlated Events	Loudest Aircraft Event		
						Aircraft Type	Time of Event	SEL
Measurement 1 (November 6 – November 21, 2024)								
6-Nov	56.5	50.5	57.5	North	302	B738	8:49 AM	87.7
7-Nov	47.9	52.8	54.0	South	285	B739	9:23 PM	100.8
8-Nov	46.6	42.1	47.9	South	132	E75L	4:08 PM	80.9
9-Nov	46.2	40.3	47.2	South	133	E75L	9:37 PM	76.6
10-Nov	50.0	47.4	51.9	South	387	A321	10:15 PM	81.9
11-Nov	51.1	48.5	53.0	South	607	B39M	7:23 AM	82.2
12-Nov	68.2	48.4	68.2	South	475	B737	11:08 AM	87.7
13-Nov	57.8	50.1	58.4	South	547	B739	11:09 AM	94.0
14-Nov	50.8	49.1	53.0	South	565	B738	6:29 PM	83.1
15-Nov	48.1	44.5	49.7	South	199	E75L	1:27 PM	83.9
16-Nov	48.8	45.1	50.4	South	390	C208	7:37 AM	78.7
17-Nov	51.4	49.6	53.6	South	657	DH8D	4:00 PM	81.7
18-Nov	49.4	46.3	51.1	South	305	E75L	3:08 PM	90.5
19-Nov	56.6	54.9	58.9	South	670	E75L	12:58 PM	99.0
20-Nov	50.0	48.5	52.4	South	538	B39M	7:54 AM	86.3
21-Nov	48.1	50.5	52.5	South	302	E75L	10:56 AM	84.0
Measurement 2 (March 25 – April 10, 2025)								
25-Mar	49.7	51.8	53.9	North	116	B739	8:43 PM	88.8
26-Mar	43.8	37.5	44.7	South	3	B39M	12:32 AM	69.8
27-Mar	48.6	45.4	50.3	South	327	B738	8:34 AM	80.7
28-Mar	48.9	47.1	51.1	South	395	B39M	6:41 PM	84.9
29-Mar	46.6	41.2	47.7	South	125	A21N	9:40 PM	82.9
30-Mar	50.6	50.3	53.5	South	567	B39M	9:26 AM	83.9
31-Mar	46.7	43.0	48.3	South	152	B39M	8:29 AM	81.1
1-Apr	60.1	47.8	60.4	South	245	E75L	10:20 AM	86.1
2-Apr	48.6	51.7	53.4	South	177	E75L	11:08 AM	99.0
3-Apr	47.4	44.7	49.3	South	158	E75L	6:52 AM	85.5
4-Apr	47.9	44.4	49.5	North	206	E75S	2:32 PM	79.2
5-Apr	47.4	41.8	48.4	South	131	B39M	2:44 PM	80.2
6-Apr	46.7	42.0	48.0	South	183	B739	8:03 PM	75.1
7-Apr	48.3	44.8	49.9	South	292	B738	1:02 PM	80.0
8-Apr	49.5	51.2	53.4	South	579	E75L	12:58 PM	92.3
9-Apr	47.4	44.1	49.1	South	162	A21N	7:39 AM	82.2
10-Apr	50.6	49.9	53.3	South	186	E75L	10:10 AM	85.1

SOURCE: BTI, 2025; ESA, 2025; PASSUR, 2025.