



NCE REPORT 2026-023

Stafford County, VA – Data Center Noise Study

Revision 0

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0.0 EXECUTIVE SUMMARY

NCE was contracted by Protect Stafford to evaluate the potential noise impact of three (3) proposed data centers in Stafford County, VA. Through the process of ordinance review and long-term ambient background testing, NCE found that at the locations tested, data centers will likely create noise issues that are inadequately addressed by current regulations and ongoing development discussions.

NCE found that the property line limit of 55 dB(A), which is the minimum level allowed across all locations, is much greater than the current background levels at all locations tested. Because of the discrepancy found between the current background levels and the only county-wide enforceable limit, there is a great chance that these data centers produce intrusive and objectionable noise, even if staying within the current limits. Discussed in further detail later, the possible increase in sound pressure levels at the measurement locations could range from NYS DEC descriptors of “Objectionable” to “Very objectionable or intolerable” if the current criteria were just met.

With current interpretations of noise intrusion (NYS DEC) and consideration of other regulations that address noise through variable limits based on background level, zone, and tonal presence (MassDEP & CT DEEP), NCE recommends that a Virginia state-wide criteria be created that limits noise to 5-10 dB above an A-weighted ambient (L90) background level and addresses tones through penalties from ANSI S12.9 Part 4 or a similar variant.

1.0 INTRODUCTION

Noise Control Engineering LLC (NCE) has been retained by Protect Stafford to perform an ambient background noise study and ordinance evaluation concerning the influx of data center projects seeking developmental approval in Stafford County, VA. Results from this ambient background study evaluate parcels that are nearby or neighboring potential data centers. This report specifically concerns the Simms Farm Data Center, the GWV Data Centers, and the Forest Lane Data Center.

Comparisons between both the daytime and nighttime regularly occurring ambient background levels (L_{90}) and the current requirements for sound are provided to give insight into project feasibility, possible noise impacts, and whether the current ordinances are suitable for addressing the future noise emitted from data center project site developments.

2.0 NOISE REGULATIONS

The noise emissions from data center projects are not governed by federal or the State of Virginia regulations. Rules regarding noise, disturbance classification, and subsequent mitigation efforts are the result of local regulations and project specific proffers that petitioners agree to during the process of receiving development approval.

Because there are no state limits governing noise emissions or impact, individual projects are compared against current county criteria, ongoing data center specific county requirements, and site-specific proffers. As the accepted limits change over the time and location of each project, it is difficult to find a common noise assessment process or subsequent mitigation plan. According to the recently adopted local regulation in Stafford County, each data center is minimally required to:

- Not exceed boundary line limits for neighboring and nearby properties defined in the current Stafford County ordinance based on zone and time of day (the strictest limit possible is the is 55 dB(A) in a residential zone at night)
- Not exceed the Stafford County Data Center Ordinance property line limit of 55 dB(A) at a height of 1.5 meters above grade at the boundary of the data center project
- Specifically address expected noise emissions through pre-development impact studies and post-development monitoring

Note that as currently written, if a data center meets the Stafford County Data Center Ordinance, the requirements for the Stafford County General Ordinance will be met as well for all time periods and zones.

Specific datacenters may be required to additionally:

- Adjust current limits of overall sound pressure level through a penalty upon realization of a “pure tone” defined in ANSI S12.9 Part 4
- Not exceed L_{max} limits of 15 dB(A) above the boundary line limit (accounting for instantaneous or impulsive noise sources)
- Limit generator testing times
- Provide funding to the noise mitigation efforts

In summary, all new data center developments in Stafford County are limited to 55 dB(A) at their property line, regardless of source or receiver parcel zone. However, the limit of 55 dB(A)

may be too lenient to avoid noise disturbance issue/nuisance as further discussed in Section 4.0. The following subsections detail the noise limits from the federal, state, and local ordinances, as well as some of the historical and ongoing proffers that have been attached to data center projects.

2.1 Federal Regulations

There are no federal regulations that apply to noise emissions

2.2 State of Virginia Regulations

The State of Virginia specifies that the local ordinances have the authority to address noise; there are no state regulations that apply to noise emissions. The State of Virginia does clarify that no ordinance made can be applied to sound permitted by the Virginia Department of Energy or a subdivision. If any of these locations do fall under VDE permitting, the local noise regulations would not apply.

2.3 Local Ordinances

The following regulations summarize the local rules that currently apply to datacenters in Stafford County.

2.3.1 Stafford County General Ordinance [1]

Noise disturbances are defined through daytime (7AM – 10PM weekdays, 9AM-10PM weekends & holidays) and nighttime (10PM – 7AM weekdays, 10PM – 9AM weekends & holidays) A-weighted sound pressure level limits, see Table 1.

Table 1: Stafford County – Maximum Permissible Sound Pressure Levels

Zoning District Classification	SPL, dB(A) re 20μPa	
	Daytime	Nighttime
Residential	60	55
Commercial	65	60
Office	65	60
Industrial	79	72

In addition to the quantitative limits provided by the county, qualitative regulations limiting noise recommend the use of noise mitigation on operational noise equipment (HVAC, equipment cooling, backup generation systems, etc.), studies to demonstrate noise attenuation effectiveness, and ongoing on-site noise monitoring. Low frequency noise is specifically highlighted as a concern.

2.3.2 Stafford County, Virginia Comprehensive Plan – “The Land Use Plan” Regarding Data Centers – December 2, 2025 [2]

“The Land Use Plan” rules (referred to as Stafford County Data Center Ordinance) are the result of ongoing efforts to regulate the data centers and have seen multiple revisions and approval efforts during the duration of this study. Their current quantitative restrictions stipulate:

- Noise emanating from a datacenter will be limited to a maximum level of 55 dB(A) at 1.5 meters above ground with a 3 dB reduction for the limit when conditions for pure tones defined by ANSI S12.9 Part 4 [3] are met

2.4 Project Specific Proffers

Historically, noise limits for data centers were dealt with on a “per project” basis in proffers where limits could be set higher than local regulations. Some of these proffers are subject to additional editing as discussion continues, note the date in each of the subsection headers. Some proffers include specific language requiring that the Stafford County General Ordinance limits be met; although NCE understands that this applies to all proffers.

2.4.1 Market at Austin Ridge – February 20, 2026 [4]

- No quantitative limits on property lines or other sensitive receptors
- Generator operational testing is limited to the hours of 9AM – 5PM on non-holiday weekends
- Generators may not be used as the primary source of power
- Loading/unloading activities will only be allowed within the access drive or parking lot
- Annual sound testing will occur for a minimum of 10 years after the issuance of final occupancy for the data center

2.4.2 Cranes Corner Data Center – October 21, 2025 [5]

- Noise cannot exceed 70 dB(C) or 55 dB(A) at the property boundaries, with a 3 dB reduction for both limits when conditions for pure tones defined by ANSI S12.9 Part 4 are met
- Generator operational testing is limited to the hours of 9AM-5PM on non-holiday weekends
- Mechanical equipment needs to be enclosed or shielded with a noise barrier
- Applicant pays \$10,000 for a period of 5 years to be utilized for noise mitigation
- Rezones parcels from A-1 Agriculture to M-1 Light Industrial

2.4.3 Stafford Technology Campus Data Center – September 13, 2024 [6]

- Noise must meet Stafford County General Ordinance (daytime and nighttime limits on different zones stated above)
- L_{eq} measurements are specified for recording the comparison against the limit
- L_{max} cannot exceed the sound limits by 15 dB(A)
- Rezones parcels from A-1 Agriculture to M-2 Heavy Industrial

2.4.4 Potomac Church Tech Data Center – November 14, 2023 [7]

- Noise cannot exceed 55 dB(A) at the property boundaries, with a 3 dB reduction for both limits when conditions for pure tones defined by ANSI S12.9 Part 4 are met
- Applicant pays \$25,000 to be utilized for noise monitoring and mitigation

With the codification of the Stafford County, Virginia Comprehensive Plan – “*The Land Use Plan*” Regarding Data Centers regulation, all new data center developments in Stafford County are limited to 55 dB(A) at their property line, regardless of source or receiver parcel zone. At a minimum this is a uniform approach to regulating noise limits and eliminates the implementation of site-specific proffers.

Although the limit of 55 dB(A) is a step in the right direction to protect the citizens of Virginia, it does not consider the ambient background levels, and may be too lenient to avoid noise disturbance issue/nuisance. Massachusetts Department of Environmental Protection (MassDEP) defines excessive noise as 10 dB(A) over the ambient background level and similarly New York State Department of Environmental Conservation (NY DEC) also has a state-wide interpretation on noise impacts and limits a rise of no more than 5 dB(A) to be unnoticed to tolerable.

To properly evaluate the effectiveness of Stafford County’s current regulations, NCE conducted an ambient background noise survey at several project sensitive locations.

3.0 MEASUREMENT OVERVIEW

To determine the existing noise conditions in the communities near the proposed data centers, NCE performed ambient background noise monitoring. These background levels, collected over multiple weeks, establish regularly occurring sound level minimums that could be compared against the county’s criteria. These long-term measurements, later discussed in more detail, are reported in A-weighted L_{90S} , which scale unweighted sound pressure based on human hearing sensitivity and remove residual noise as defined in ISO 1996-2 [13] (e.g. traffic noise, irregular noise occurrences).

NOTE: L_{eq} is the equivalent continuous noise level for a given time interval and reflects all noise that was present during the interval; it averages all sound levels for a given period of time, it does not filter impulses or peaks. L_{90} is defined as the level exceeded 90% of the time over a given time interval; it does filter impulses and peaks.

3.1 Ambient Noise Measurement Methodology

Unattended noise monitoring was performed at six (6) locations with expected impact from three (3) separate data centers. The monitoring occurred over two recording periods, the first lasting around 14 days (January 30 to February 13, 2026), and the second lasting around 12 days (February 14 to February 26, 2026). The recordings over each period were continuous. The monitors used consisted of four meters, two (2) Larson Davis 831s, one Larson Davis LxT, and a Zoom F3 Wav Recorder using a PCB 377B20 microphone. All meters were situated within weatherproof cases and installed on grade. Locations were chosen that represented neighboring or nearby properties to the respective data centers [10]. Each prospective data center boundary was recorded with two meters, see Table 2. Table 2 provides additional details such as address and datacenter project being assessed.

Table 2: Meter Information

Meter Name	Associated Datacenter Project	Address	Meter Type	Recording Period
LT1	Simms Farm	1423 Kings Highway	Larson Davis LxT	1/30 – 2/13
LT2	Simms Farm	214 Old Landing Court	Larson Davis 831	2/14 – 2/26
LT3	GWV Data Centers	157 Kelsey Road	Larson Davis 831	1/30 – 2/13
LT4	GWV Data Centers	142 Powhatan Trail	Larson Davis 831	2/14 – 2/26
LT5	Forest Lane Data Center	455 Forest Lane Road	Zoom	1/30 – 2/13
LT6	Forest Lane Data Center	249 Forest Lane Road	Larson Davis 831	1/30 – 2/13

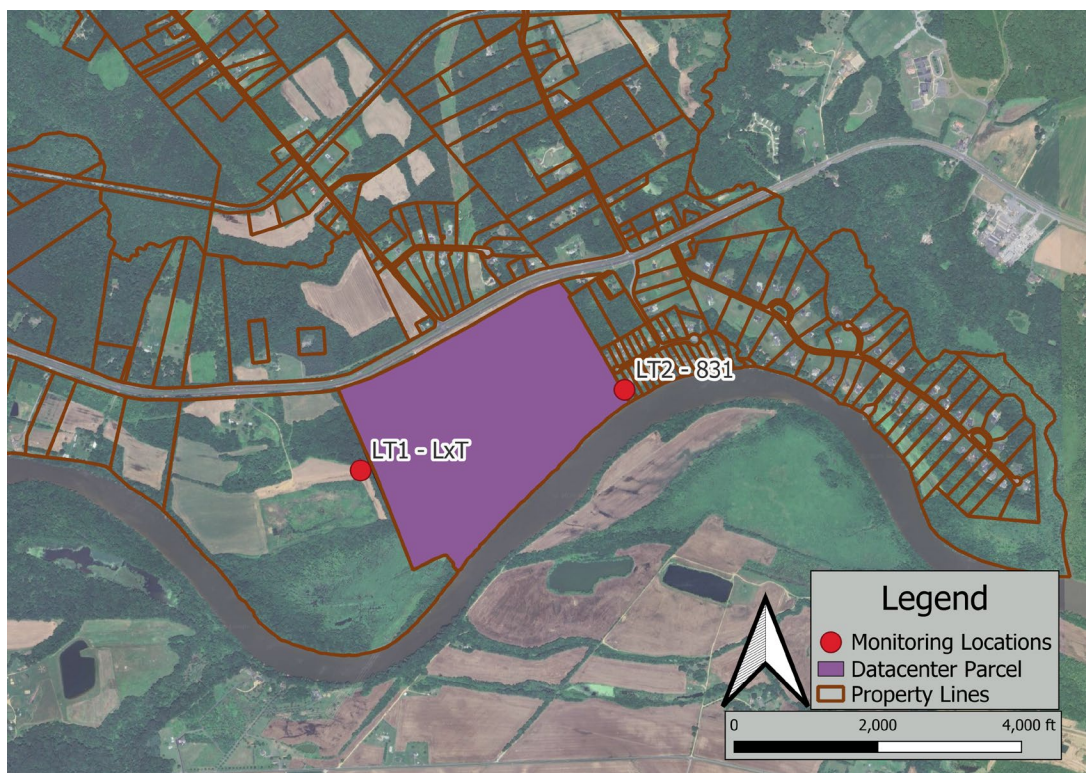


Figure 1: Simms Farm Data Center Parcels and Monitor Locations

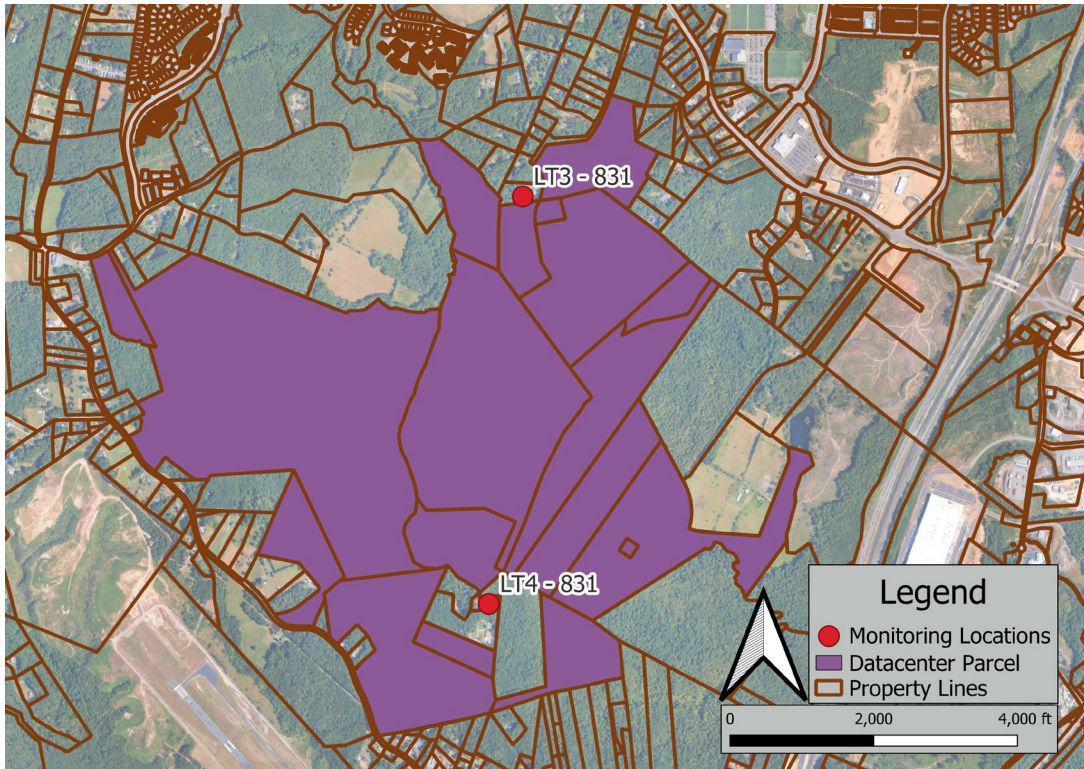


Figure 2 :GWV Data Centers Parcels and Monitor Locations

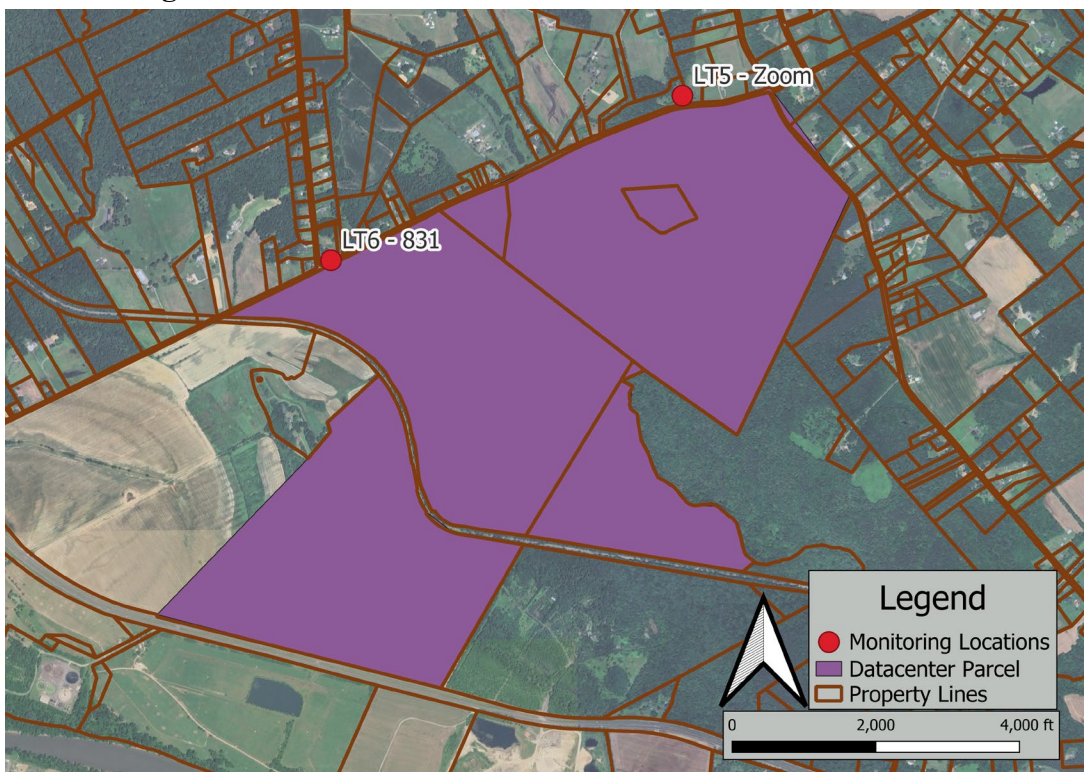


Figure 3: Forest Lane Data Center Parcels and Monitor Locations

Microphones for each meter were protected with waterproof windscreens to minimize noise from wind gusts and were mounted 5 feet above the ground. All Larson Davis meters were configured to average sound pressure levels continuously in both 1-second and 5-minute intervals for the duration of the monitoring period. Data was collected at these intervals in A-weighted and unweighted overall dB(Z)/dB(A), L_{90} , L_{eq} , and one-third octave-band formats. The Zoom Wav Recorder collected data in 32 bit wav files at a sampling rate of 48 kHz, and the same metrics as the LDs were found through postprocessing. All noise monitors were field-calibrated using a Larson Davis CAL200 both prior to installation and drift checked during their retrieval. All instrumentation is laboratory calibrated traceable to NIST standards within the previous 12 months, see Appendix A: for the associated calibration certificates.

3.2 Weather Conditions

Temperature and humidity were measured throughout the duration period using three Kestrel D3 meters. Additional historical weather data during the monitoring period, including precipitation, was retrieved from World Weather Online [11] for nearby locations. For any period that had high winds and/or appreciable precipitation, the acoustic data was excluded from the dataset. Due to the inclement weather, the first and second dataset required the exclusion of about 85 hours and 73 hours of data respectively (~25% of each dataset).

3.3 Ambient Noise Measurement Results

From the measured 1-second time history sound levels (unweighted overall and third octave band) and .wav recordings, hourly A-weighted L_{90} values were calculated for the full monitoring period for each meter. L_{90} is defined as the level exceeded 90% of the time over a given time interval and is commonly considered to be the equivalent to the ambient sound level, as it omits inconsistent controlling noise (e.g. inconsistent traffic, dogs barking, plane flybys). As the goal is to compare continuous noise, this would be the metric to compare against the 55 dB(A) criteria from the Stafford County Data Center Plan.

From the L_{90} data, the 10th percentile¹ hourly A-weighted L_{90} sound levels were then determined for each of the 24 hours of the day, representing minimum hourly ambient levels throughout each 24-hour day. The result is shown in Figure 4 for all 6 monitoring locations, with each point on the graph accounting for the full hour beginning at the indicated time.

All sound level minimums occur between the hours of 1AM and 2AM, generally reflecting a diurnal cycle. It is worth noting that for the monitors concerning the GWV Data Centers (LT3 and LT4) there is an uptick of noise that regularly occurs between 5PM and 7PM before quieting down again. With that in mind, the noise at each site generally reflects quietest hours during the night, and loudest hours during the day (correlating with commuting hours).

¹ NCE uses the 10th percentile of the hourly A-weighted L_{90} to determine a minimum hourly ambient level that is likely to occur on a regular basis and could therefore be reasonably expected to be present during compliance measurements. Generally, this method produces very similar results to a minimum LA_{90} over all measured hours, but prevents extended monitoring periods from producing lower results than shorter periods.

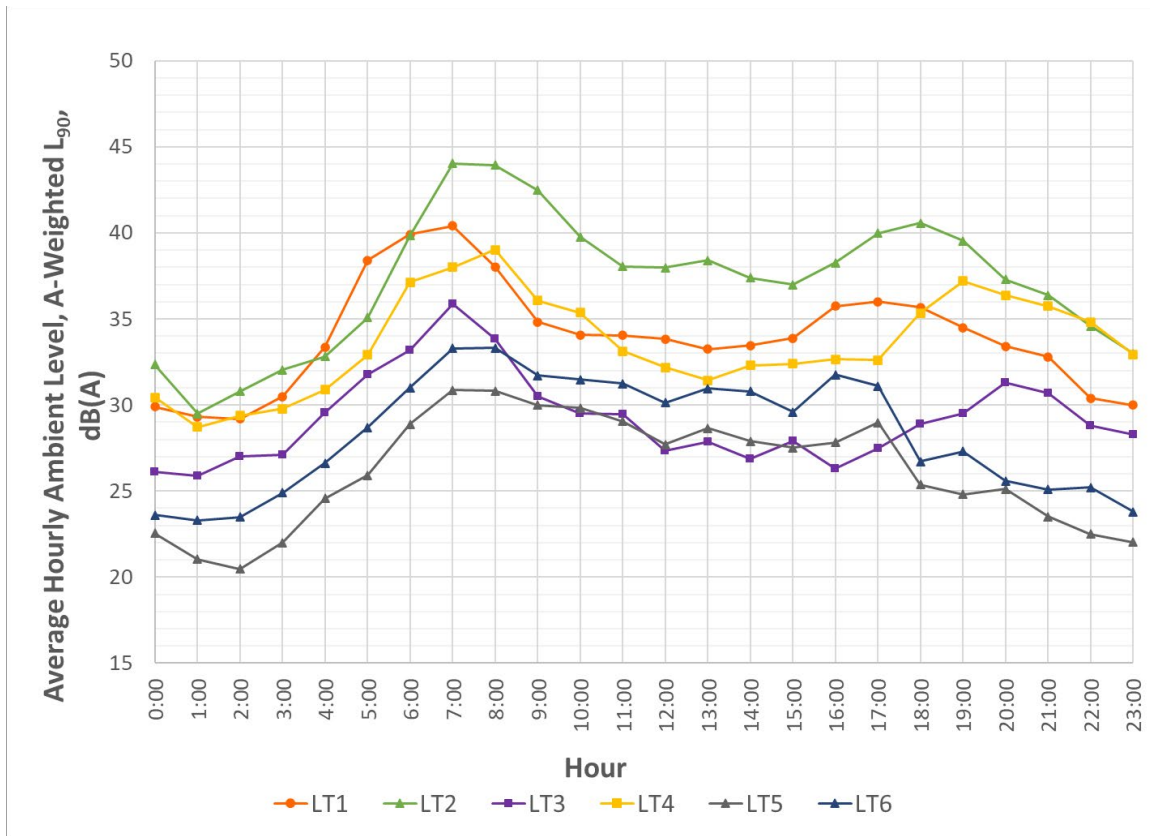


Figure 4: 10th Percentile Hourly Ambient Levels Derived from Noise Monitoring Data (A-Weighted L₉₀)

3.4 Ambient Noise Measurement Conclusion

Given the requirements from some of the ordinances to compare levels across different time periods, daytime (7AM-10PM) and nighttime (10PM-7AM) minimum background levels were determined at each location, see Table 3. These are minimum levels expected to regularly occur at each of these locations representing a neighboring or nearby border, and as a result offer insight into potentially disturbing noise from data centers even if the current noise regulations are met.

Table 3: Background Sound Pressure Level L_{A90S} per Measurement Location, dB(A) re: 20 μ Pa

	Simms Farm Data Center		GWV Data Centers		Forest Lane Data Center	
	LT1	LT2	LT3	LT4	LT5	LT6
Daytime	33	36	26	31	24	25
Nighttime	29	29	26	29	20	23

The results of our analysis indicate that variations in ambient level between the three (3) proposed development areas are significant, with differences up to 12 dB during the day and 9 dB at night. This difference is likely due to road noise proximity and currently neighboring development. Additionally, the maximum overall levels for all time periods are 36 dB(A) by the Simms Farm border during the day and 29 dB(A) at both the Simms Farm and GWV borders, respectively at night. Even at these maximum background levels, the sites NCE tested are currently representative of very quiet rural areas.

4.0 DISCUSSION

With the minimum requirement from Stafford County being a 55 dB(A) limit at the property boundaries, there could be a possible difference from 19 dB(A) up to 35 dB(A) at the locations which have the loudest background levels, while still technically meeting the current requirements.

As a rule of thumb, a 10 dB difference between two sources renders the lower one negligible, meaning that between two sources, if one is 10 dB louder, an observer would only hear the louder one despite them both being present. In lay terms, the higher sound source becomes the dominant sound source and redefines what a resident hears as their normal noise level. In this case, a potential data center measuring at 55 dB(A) at the property lines would drown out the background levels currently measured at 36 dB(A) or 29 dB(A). As a result, the possible 19 to 35 dB(A) difference at these locations would certainly stand out as a disturbance. This disturbance is supported by other regulatory conclusions, such as the criteria from the Massachusetts Department of Environmental Protection (MassDEP), which defines excessive noise as 10 dB over the ambient background level [8].

An additional state-wide interpretation on noise impact is provided by the New York State Department of Environmental Conservation (NYS DEC) [12] which quantifies thresholds for significant sound pressure level increases in Table 4.

Table 4: NYS DEC – Human Reaction to Increases in Sound Pressure Level (dB re:20 µPa)

Increase in Sound Pressure Level	Human Reaction
Under 5	Unnoticed to tolerable
5-10	Intrusive
10-15	Very noticeable
15-20	Objectionable
Over 20	Very objectionable to intolerable

Comparing these values to the 19 – 35 dB expected if the 55 dB(A) criteria were just met from either the current Stafford County General Ordinance or current Stafford County Data Center would result in these increases be quantified by NY DEC as “Objectionable” to “Very objectionable or intolerable;” a status reflecting the poor protection that the Stafford County limits currently provide.

NCE believes that in order to adequately and effectively address the possible noise nuisance issues at these sites, a comprehensive noise plan at the state level (unimpacted by local

guidelines calling for the use of project specific proffers) that bases criteria on limits defined by the pre-development ambient background level should be implemented. This plan should consider the current background at sensitive locations from which to determine a limit. Tonal and impulsive noise should cause penalty to the determined limit. Zones at receivers should also be considered in determining appropriate levels, limiting those at residential areas and allowing for more lenient restrictions at industrial/commercial locations. This is important to clarify, as the changing of the zone for source parcels has been a standard procedure for these data centers, and the change does not account for the surrounding area in terms of noise.

For reference into statewide regulations that already address some of the points discussed earlier, please note the regulations for Massachusetts and Connecticut in Appendix B, which provide limits based on current background level, zone, and account for continuous presence of a pure tone. Similarly, the NYS DEC is a guideline policy, but has similar findings MassDEP. These are generally stricter limits and can adapt to different land uses and background levels. These should be referenced for more appropriate limits and noise assessment methodologies during ongoing regulatory edits and proffer negotiations.

5.0 CONCLUSION

Historically, data center projects in Virginia have been addressed on a case-by-case basis using proffers, a form of regulation that is subject to change throughout the development process, and lacks consistency across projects of similar scope. NCE finds that unfortunately the current Stafford County data center ordinance is insufficient in adequately protecting the citizens of Virginia from noise disturbances resulting from data centers.

NCE measured the ambient background levels of three (3) of the currently proposed data centers and found that the background levels were vastly below the property line limit of 55 dB(A) that all of these data center projects would be subject to. To properly address noise disturbances that may occur even if the current limit is met, NCE proposes that state-wide limits be created and enforced that require limits for all data centers that at a minimum consider property line limits based on pre-development ambient background noise and address tonality of the proposed equipment.

NCE recommends that possible regulations could be based on other codified regulations such as those from MassDEP and NYS DEC that regulate noise emissions based on ambient background levels. The regulation should account for current background noise at each receiving site to properly address the specific impacts expected from each data center. Limits at each receiving site should be determined by land use zone and should be based on the measured pre-construction ambient level. Based on the field testing results, if the NYS DEC policy was used as an example, the data center projects would generate noise levels that would be considered “Objectionable” to “Very objectionable or intolerable to the nearby residences. In addition, pure tones should also be limited using adjustments/penalties from ANSI S12.9 Part 4 or a similar variant such as the limit defined by the Connecticut Department of Energy and Environmental Protection (DEEP) [9].

6.0 REFERENCES

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APPENDIX A:

INSTRUMENTATION CALIBRATION CERTIFICATES

APPENDIX B:

ALTERNATIVE STATE-WIDE ORDINANCES

This appendix provides established noise ordinances that exist in other states that NCE believes could be useful to consider. These ordinances address noise based on current background levels and/or receiver zone, resulting in limits that allow lower variability from current levels and do not change based on source zone. Additionally, these limits consider both overall (broadband) and tonal noise when identifying disturbances.

1. State of Massachusetts – Massachusetts Department of Environmental Protection (MassDEP) [8]

[This is an excerpt from the full documentation]

310 CMR 7.10 of the Code of Massachusetts Regulations provides a general noise regulation for the Commonwealth of Massachusetts, with criteria specified in the Massachusetts Department of Environmental Protection (MassDEP) Noise Policy, which is codified in the Division of Air Quality Control (DAQC) Policy 90-00. This policy considers a noise source to be in violation if, when measured in a neighboring parcel, the source increases the broadband sound level more than 10 dB above ambient or if a ‘pure tone’ condition is produced.

For the purposes of the regulation, ambient is defined as the background A-weighted sound level that is exceeded 90% of the time and measured during equipment operating hours.

A pure tone is defined as a sound pressure level in an octave band that exceeds the two adjacent octave band levels by 3 dB or more.

2. State of Connecticut – Connecticut Department of Energy and Environmental Protection (DEEP) [9]

[This is an excerpt from the full documentation]

§ 22a-69 of Connecticut’s “Administrative Code” has a very robust noise ordinance that accounts for background noise, overall (broadband) noise limits for specific source and receiver zone combinations, limit adjustments for tonality and acceptable error/deviance in follow-up compliance testing.

In quick summary, Table B.1 lists the quantitative limits for specific emission/receiver zones, where A, B, and C zones correspond to different land use areas (generally residential, commercial, and industrial).

Table B.1: Noise Zone Limits, dB(A) re: 20 μ Pa

	C	B	A/Day	A/Night
Class C Emitter	70	66	61	51
Class B Emitter	62	62	55	45
Class A Emitter	62	55	55	45

Limits are then further lowered by 5 dB in the presence of a prominent discrete tone, defined by Table B.2, where an audible tone produces a one-third octave sound pressure level greater than

that of either adjacent one-third octave which exceeds the arithmetic average of the two adjacent one-third octave band levels by an amount greater than the value in the table.

Table B.2: Prominent Discrete Tone Definition

One-Third Octave Band Center Frequency (Hz)	dB
100	16
125	14
160	12
200	11
250	9
315	8
400	7
500	6
630	6
800	5
1000	4
1250	4
1600	4
2000	3
2500	3
3150	3
4000	3
5000	4
6300	4
8000	5
10000	6