Noise Charts/Maps for Proposed Warrenton AWS Data Center

By John W. Lyver, IV, Ph.D.
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File as of: 10/20/2022

Updates since last version

- All analyses updated
- Review of 9/9/22 AWS Submitted Noise Study
- Comparison to Fauquier and ToW Noise Ordinances
- Residential areas affected added

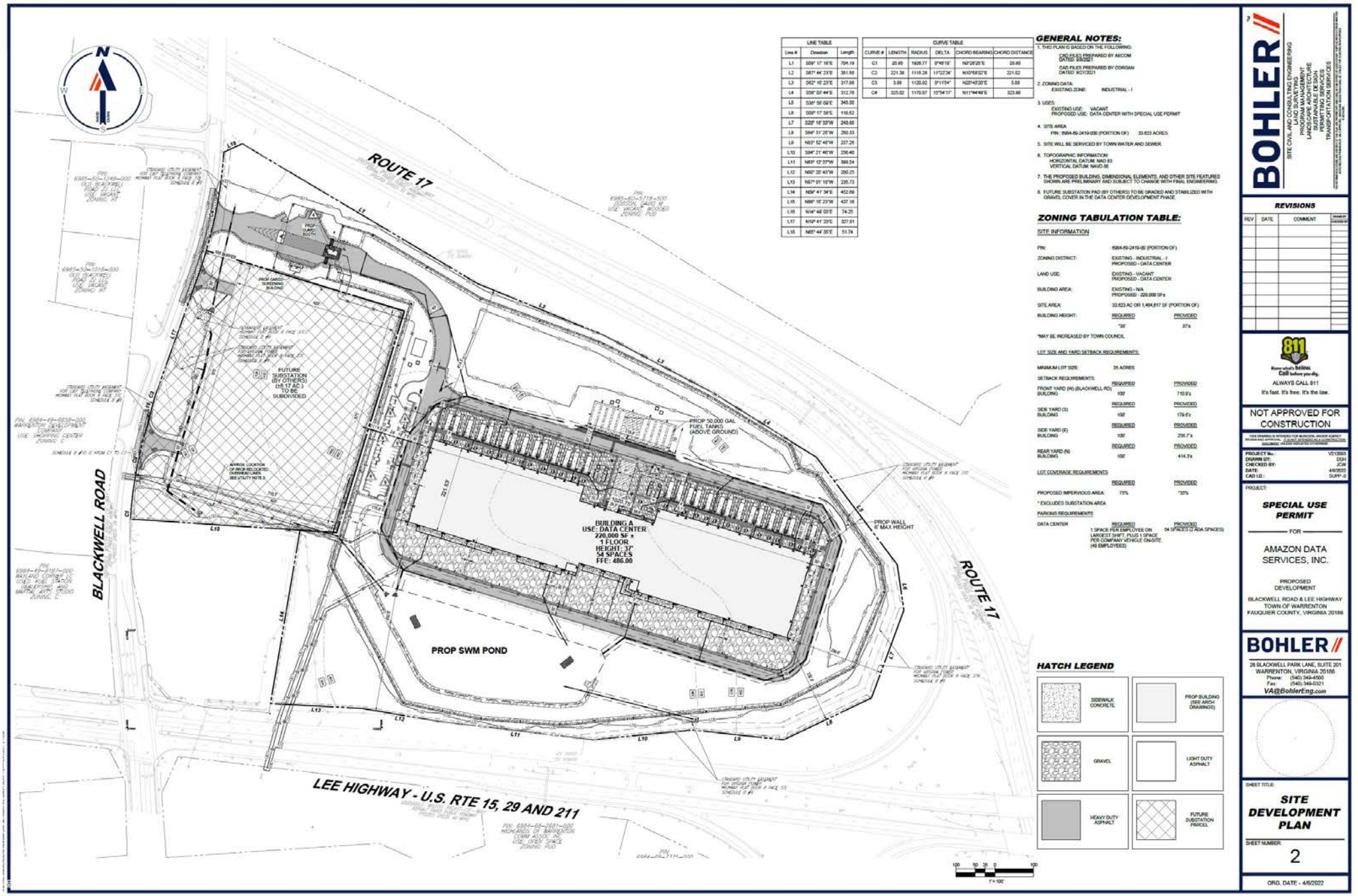
Contents

Contained in this file are for the Proposed Warrenton AWS Data Center:

- Town of Warrenton (ToW) Special Use Permit
- Residential Areas near site
- Excerpts from Fauquier County and ToW Noise Ordinances and Zoning
- Noise Analysis and Noise Mapping
- Review of Submitted AWS Noise Study
- Reference Material

Special Use Permit

- In Fauquier County, Virginia there are presently 2 data centers spanning over 180,000 square feet of operational space. Particularly, these facilities are operated by Amazon Web Services (AWS), at the Warrenton Training Center (WTC), and OVHcloud, a European-focused cloud service provider.
- Amazon Data Services, Inc. is the owner of property identified as Parcel ID 6984-69-2419-000, on the east side of Blackwell Road and north of Country Chevrolet. The parcel is approximately 41.793 acres in size, and this Special Use Permit (SUP) is for approximately 33.62 acres of the parcel.
- Amazon seeks to build one single story structure of approximately 220,000 square feet. The structure is shown conceptually on the Special Use Permit SUP Plan.
- At full buildout there will be approximately 52 employees at the Project, but only a maximum of 32 employees will be present on the Property at any given time, primarily during shift changes. *(Estimate from similar PW County data centers)*
- The design of the Applicant's data centers employs air cooling systems that produce significant noise. Generators are employed in emergency situations only to ensure power supplies in the event of a loss of public power are typically tested briefly every two weeks and produce sound in the range of 90 to 95 dB, effectively the sound of the human conversation.
- <u>Notes:</u>
  - Data in this section is from the SUP Application dated April 13, 2022.



LINE TABLE		
Line #	Direction	Length
L1	S59° 17' 16"E	794.19
L2	S67° 44' 23"E	361.66
L3	S62° 10' 23"E	317.96
L4	S58° 03' 44"E	312.76
L5	S39° 56' 09"E	345.35
L6	S09° 17' 39"E	116.62
L7	S29° 16' 35"W	248.66
L8	S64° 31' 25"W	260.33
L9	N63° 52' 46"W	237.26
L10	S84° 21' 46"W	256.46
L11	N83° 12' 27"W	399.54
L12	N60° 29' 43"W	200.25
L13	N57° 01' 18"W	235.73
L14	N09° 41' 34"E	452.69
L15	N86° 16' 23"W	437.16
L16	N14° 49' 03"E	74.25
L17	N10° 41' 23"E	327.91
L18	N65° 44' 35"E	51.74

CURVE TABLE					
CURVE #	LENGTH	RADIUS	DELTA	CHORD BEARING	CHORD DISTANCE
C1	25.95	1926.77'	0°46'15"	N30°28'28"E	25.95
C2	221.38	1116.28	11°22'24"	N10°58'32"E	221.02
C3	3.99	1120.92	0°11'54"	N25°40'20"E	3.68
C4	325.02	1170.87	15°54'17"	N11°44'48"E	323.98

GENERAL NOTES:

1. THIS PLAN IS BASED ON THE FOLLOWING:
   CAD FILES PREPARED BY AECOM DATED: 8/6/2021
   CAD FILES PREPARED BY CORSAN DATED: 9/27/2021
2. ZONING DATA:
   EXISTING ZONE: INDUSTRIAL - I
3. USES:
   EXISTING USE: VACANT
   PROPOSED USE: DATA CENTER WITH SPECIAL USE PERMIT
4. SITE AREA
   PIN : 6984-59-2419-000 (PORTION OF) 33.623 ACRES
5. SITE WILL BE SERVICED BY TOWN WATER AND SEWER.
6. TOPOGRAPHIC INFORMATION
   HORIZONTAL DATUM: NAD 83
   VERTICAL DATUM: NAVD 88
7. THE PROPOSED BUILDING, DIMENSIONAL ELEMENTS, AND OTHER SITE FEATURES SHOWN ARE PRELIMINARY AND SUBJECT TO CHANGE WITH FINAL ENGINEERING.
8. FUTURE SUBSTATION PAD (BY OTHERS) TO BE GRADED AND STABILIZED WITH GRAVEL COVER IN THE DATA CENTER DEVELOPMENT PHASE.

ZONING TABULATION TABLE:

SITE INFORMATION

PIN:	6984-59-2419-00 (PORTION OF)	
ZONING DISTRICT:	EXISTING - INDUSTRIAL - I PROPOSED - DATA CENTER	
LAND USE:	EXISTING - VACANT PROPOSED - DATA CENTER	
BUILDING AREA:	EXISTING - N/A PROPOSED - 220,000 SF±	
SITE AREA:	33.623 AC OR 1,464,617 SF (PORTION OF)	
BUILDING HEIGHT:	REQUIRED *35'	PROVIDED 37'±

*MAY BE INCREASED BY TOWN COUNCIL

LOT SIZE AND YARD SETBACK REQUIREMENTS:

MINIMUM LOT SIZE:	35 ACRES	
SETBACK REQUIREMENTS:	REQUIRED	PROVIDED
FRONT YARD (W) (BLACKWELL RD) BUILDING	100'	710.9'±
SIDE YARD (S) BUILDING	REQUIRED 100'	PROVIDED 179.6'±
SIDE YARD (E) BUILDING	REQUIRED 100'	PROVIDED 256.7'±
REAR YARD (N) BUILDING	REQUIRED 100'	PROVIDED 414.3'±

LOT COVERAGE REQUIREMENTS

	REQUIRED	PROVIDED
PROPOSED IMPERVIOUS AREA:	75%	*35%

* EXCLUDES SUBSTATION AREA

PARKING REQUIREMENTS

DATA CENTER	REQUIRED 1 SPACE PER EMPLOYEE ON LARGEST SHIFT, PLUS 1 SPACE PER COMPANY VEHICLE ON-SITE. (48 EMPLOYEES)	PROVIDED 54 SPACES (2 ADA SPACES)

HATCH LEGEND

- SIDEWALK CONCRETE
- PROP BUILDING (SEE ARCH+ DRAWINGS)
- GRAVEL
- LIGHT DUTY ASPHALT
- HEAVY DUTY ASPHALT
- FUTURE SUBSTATION PARCEL

BOHLER

SITE CIVIL AND CONSULTING ENGINEERING
LAND DEVELOPMENT
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SURVEYING SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY

811 Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

NOT APPROVED FOR CONSTRUCTION

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DRAWING. UNLESS INDICATED OTHERWISE.

PROJECT No.: V21093
DRAWN BY: DSH
CHECKED BY: JCW
DATE: 4/6/2022
CAD I.D.: SUP7-0

PROJECT:

SPECIAL USE PERMIT

FOR

AMAZON DATA SERVICES, INC.

PROPOSED DEVELOPMENT

BLACKWELL ROAD & LEE HIGHWAY
TOWN OF WARRENTON
FAUQUIER COUNTY, VIRGINIA 20186

BOHLER
28 BLACKWELL PARK LANE, SUITE 201
WARRENTON, VIRGINIA 20186
Phone: (540) 349-4500
Fax: (540) 349-0321
VA@BohlerEng.com

SHEET TITLE:

SITE DEVELOPMENT PLAN

SHEET NUMBER:

2

ORIG. DATE - 4/6/2022

What is Noise?

- From Merriam-Webster Dictionary:
  - ✓ “loud, confused, and usually inharmonious sound”
  - ✓ “any sound that is undesired or interferes with one's hearing of something”
- The human auditory system does NOT “sleep” during sleep like other bodily functions. From evolution, humans are most attuned to hear a few frequencies:
  - ✓ ~1,000 Hz: A baby’s cry
  - ✓ ~ 600 Hz: Sound from a predator
  - ✓ ~ lower frequencies are felt and cannot be filtered out.

Data Center Noise

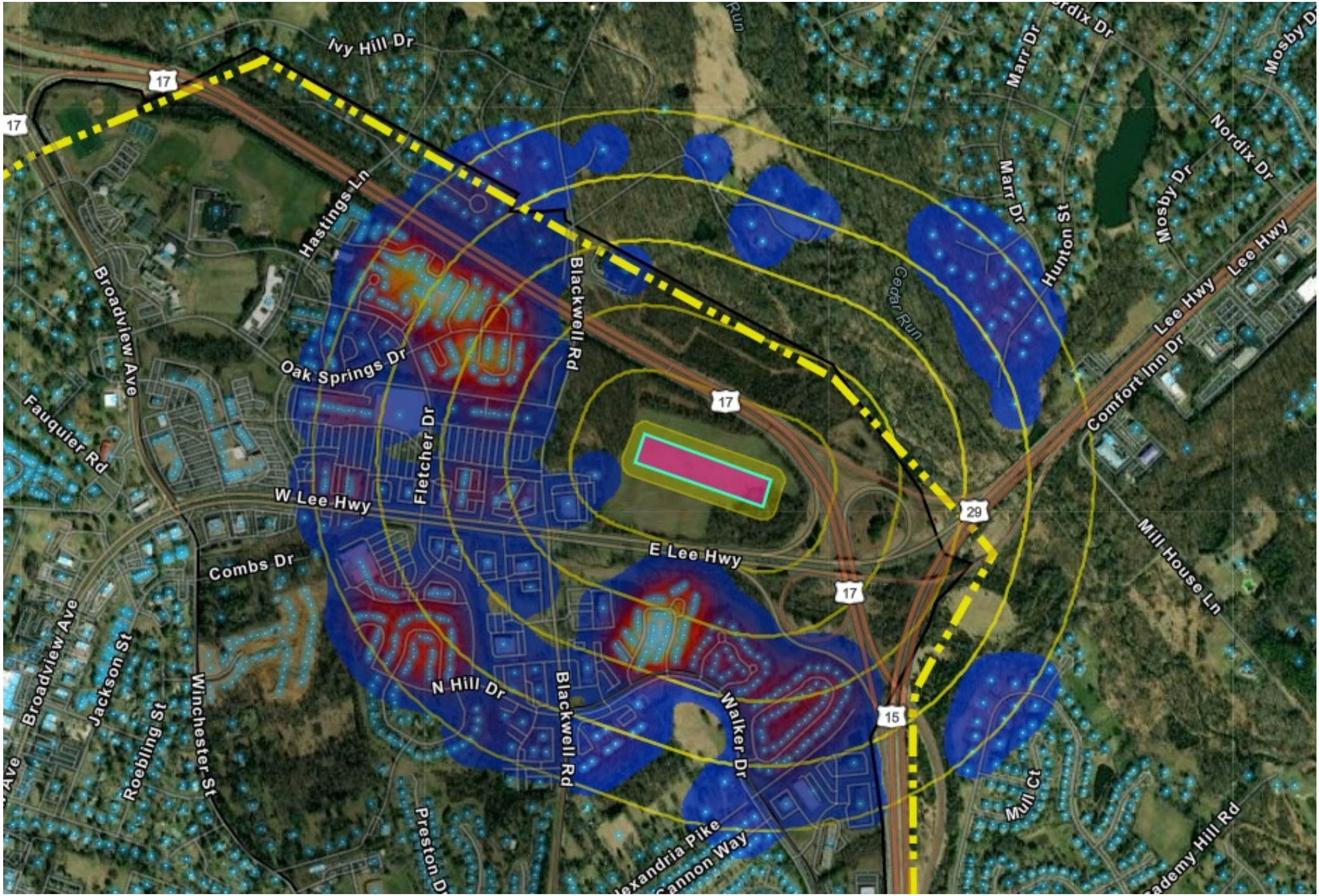
- Persistent noise causes a human stress response which leads to:
  - ✓ Chronic Sleep Deprivation
  - ✓ Anxiety and Depression due to combination of noise and lack of control
  - ✓ Difficulty with Concentration
  - ✓ Increases stress-related conditions such as: gastrointestinal problems, autoimmune diseases, hypertension and cardiovascular disease
  - ✓ Increased health risk as residents avoid outdoor exercise

Residential Areas near site

- Fauquier County: Approximately 40 homes are within the 2,500 foot line inside the "earshed" (north of the ToW Boundary shown as a dashed yellow line)
- The chart on the next page shows the large number of residences within the TOW that will be affected.
- Since this facility will produce excessive noise within the TOW and within the Fauquier County, it is assumed that SUP proffers will need to be placed on the developer to ensure that both Noise ordinances are complied with.

Notes:

- The Town of Warrenton overlay is available at: https://services9.arcgis.com/qoIL2Yd5pjdAD2CP/arcgis/rest/services/Town_Warrenton/FeatureServer
- Fauquier County Code of Ordinances: Chapter 13.5 – NOISE *https://library.municode.com/va/fauquier_county/codes/code_of_ordinances?nodeId=COOR_CH13.5NO#*
- An excerpt from the Fauquier County Noise ordinance is on the next page, the decibel limits in the ToW noise ordinance is included 3 pages later



9/11/2022 Image provided courtesy of Dave Gibson (davegibson3@gmail.com) from ARCGIS.com

Excerpts from Fauquier County Noise Ordinance

Sec. 13.5-3. - Prohibitions.

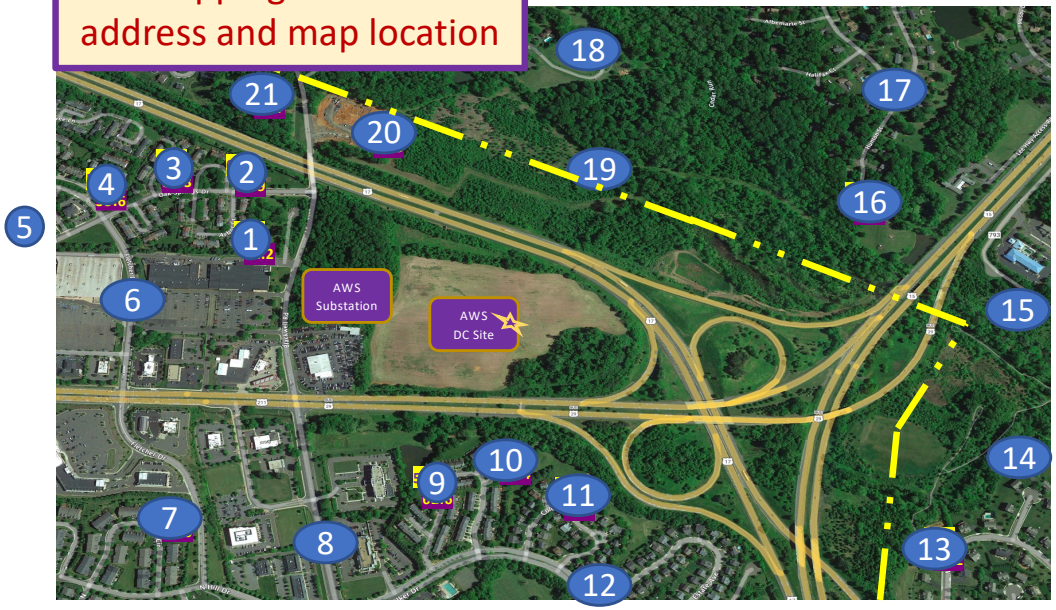
(a) No person shall permit, operate, or cause any source of sound or sound generation to create a sound that is plainly audible in any other person's residential dwelling or place of business with the doors and windows of that residential dwelling or place of business closed. In addition, the source of sound or sound generation must be discernible regardless of whether such doors and windows are closed. Plainly audible means the sound can be heard by the human ear with or without a medically approved hearing aid or device. Discernible means that the sound is sufficiently distinct such that its source can be clearly identified.

(b) No person shall permit, operate, or cause any source of sound or sound generation to create a sound that is in excess of sixty-five (65) A-weighted decibels (dBA) measured at the emitter's property line or at any point within any other affected property.

Sec. 13.5-5. - Severability; private nuisance actions preserved; enforceability.

(g) A-weighted sound level or decibels (dBA) is the sound pressure level in decibels as measured on a sound level meter (SLM) using the A-weighting network. L equivalent (Leq) is the constant sound level that, in a given situation and time period, conveys the same sound energy as the actual time-varying, A-weighted sound level.

Mapping between address and map location



Town of Warrenton
Zoning Ordinance, Chapter 9

Table 9-1
Maximum Permissible Sound Pressure Levels Measured

Freq Band (Hz)	dB(Z) Limit	Watts/m2	% total energy
63	64	2.51E-06	65.2%
125	60	1.00E-06	26.0%
250	54	2.51E-07	6.5%
500	48	6.31E-08	1.6%
1,000	42	1.58E-08	0.4%
2,000	38	6.31E-09	0.2%
4,000	34	2.51E-09	0.1%
8,000	30	1.00E-09	0.03%
IF maximum in each frequency band (dBA)		3.85E-06	65.9

Table 9-2 Correction Factors

Condition	Correction in dB(Z) to Limit
At contiguous or across the street boundary from any R-district	Minus 5
Operation between the hours of 10:00pm and 7:00am	Minus 5

'Fraction' of energy in each frequency Octave

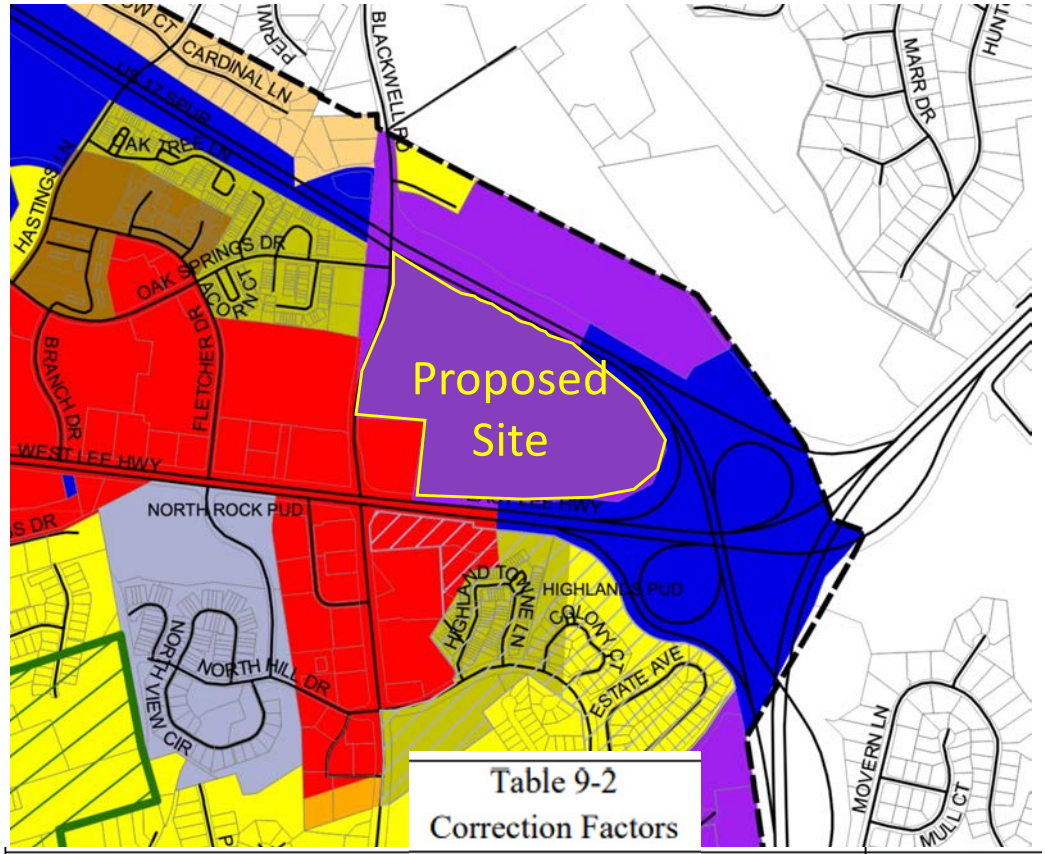
DC	Road	
35.17%	0.53%	63
31.95%	2.19%	125
12.55%	3.27%	250
7.65%	16.92%	500
8.93%	52.02%	1000
3.01%	21.81%	2000
0.72%	2.86%	4000
0.02%	0.40%	8000

Interpolated from AWS Noise Study

"9-14 Performance Standards for All Non-Residential Uses
9-14.2 The sound pressure level of sound radiated from an establishment, measured at the lot line of the site thereof that is the nearest thereto, **shall not exceed the values in any octave band of frequency** that are specified in Table 9-1 below, or in Table 9-1 as modified by the correction factors set forth in Table 9-2."

Zoning

- SUP requesting use within purple "I" (Industrial) zone.
- Site directly adjacent to red "C" Commercial and yellow "R-10" and "R-15" (Residential) zones.
- Other adjoining is blue "PSP" as a residential supporting zone



Warrenton Town Ordinance:

- Section 9-14.2 (previous page) cites Table 9-2 for correction factors.
- ***"Across the street"*** to the south and west and northwest are R-10 and R-15 zoned areas ***SO*** -5 dBZ applies

Table 9-2
Correction Factors

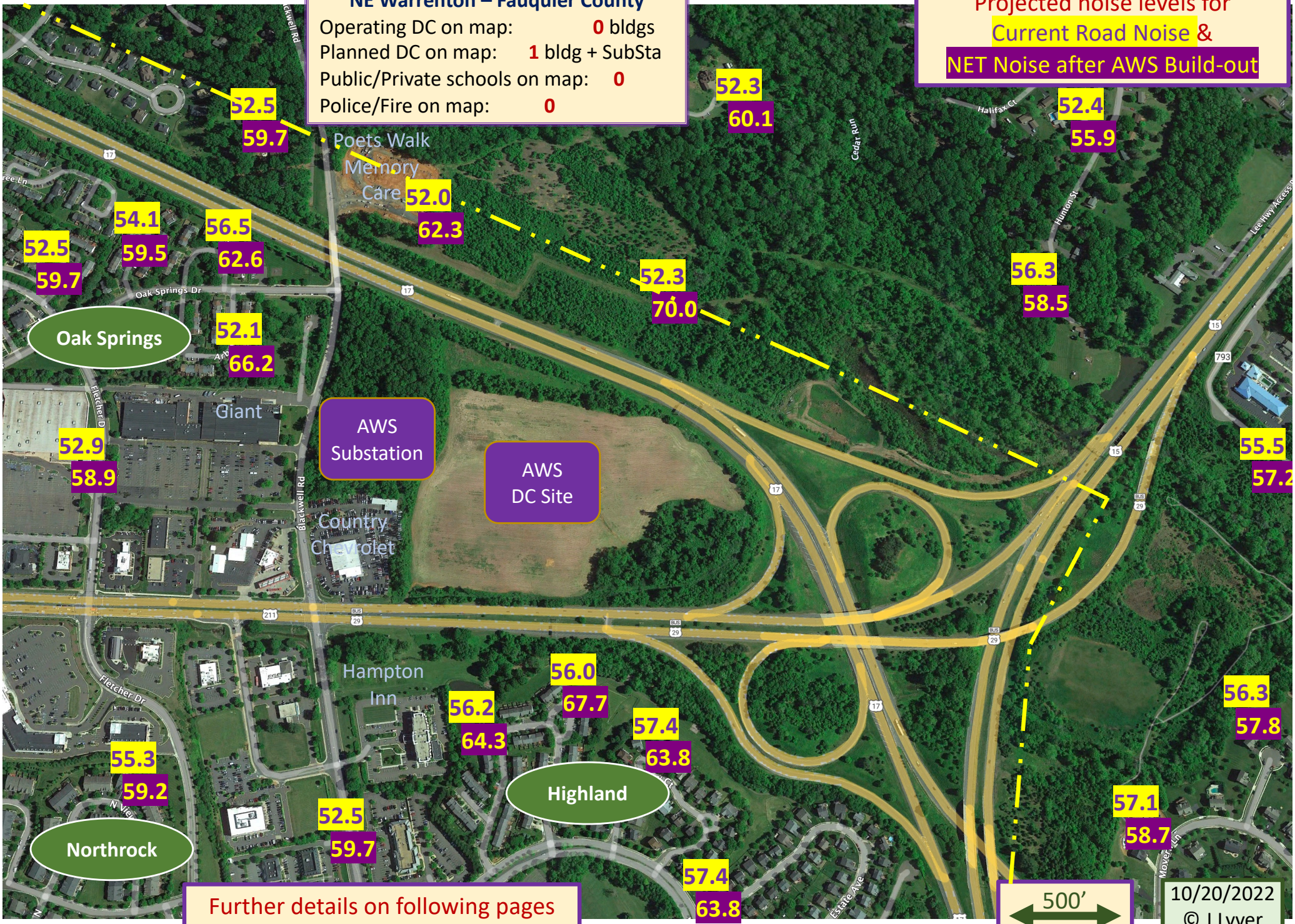
Condition	Correction in Decibels
On a site contiguous to or across a street from the boundary of any R-district established by this chapter.	Minus 5
Operation between the hours of 10:00 p.m. and 7:00 a.m.	Minus 5

- Data centers operate 24/7, ***SO*** at night another -5 dBZ reduction applies
- Corrected Table 9-1 limits at the closest R-10/R-15 zone boundary:

63 Hz – 59 dBZ day/54 dBZ night,
125 Hz – 55 dBZ day/50 dBZ night,
250 Hz – 49 dBZ day/44 dBZ night,
500 Hz – 43 dBZ day/38 dBZ night,
1,000 Hz – 37 dBZ day/32 dBZ night,
2,000 Hz – 33 dBZ day/28 dBZ night,
4,000 Hz – 29 dBZ day/24 dBZ night,
8,000 Hz – 25 dBZ day/20 dBZ night

Noise Analysis Methodology

- Noise analysis developed by J.Lyver.
- Projected Road noise:
  - Traffic Volumes: https://www.virginiadot.org/info/2021_traffic_data_by_jurisdiction.asp
  - Modeling developed from various internet sources and validated from readings taken along I-66.
  - Noise attenuation for roads not included in model, however, geography of the area would not have attenuation from road noises for US-15/29, US-211 and Blackwell Road. Some attenuation would be experienced for portions of US-17 bypass.
- Projected Data Center noise:
  - Normalized data applied as the average from 4 data center sites: AWS Tanner Way, QTS University Drive, facility south of Manassas Airport, and randomly selected data center along Loudoun County Parkway near US-50. First 3 sites are in Manassas, VA.
  - SUP states the proposed Warrenton AWS data center would be air cooled. This is similar to the 4 reference data centers. (Expected noise from DC only: 62.8 dBA @ 500').
- Notes on the following Charts:
  - All data presented is calculated from the above parameters.
  - Data provided for 21 separate sites at the locations used in the analysis.
  - Upper (yellow box) is predicted noise only from the traffic.
  - Lower (purple box) is predicted noise from traffic, the proposed data center, and the proposed substation.
  - Green ovals are neighborhood names.
  - Choropleth charts show noise levels across areas and interpolated between data points for the two noise ranges indicated.


NE Warrenton – Fauquier County
Operating DC on map: 0 bldgs
Planned DC on map: 1 bldg + SubSta
Public/Private schools on map: 0
Police/Fire on map: 0
Projected noise levels for
Current Road Noise &
NET Noise after AWS Build-out
52.5
59.7
Poets Walk
Memory
Care
52.0
62.3
52.3
60.1
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70.0
56.3
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Oak Springs
52.1
66.2
Giant
AWS
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AWS
DC Site
52.9
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58.7
Northrock
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63.8
Further details on following pages
500’
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Results of analysis

Resulting Noise Levels in
dBA and dBZ by Frequency Octave

Locations of sites to analyse		Road dBA	DC dBA	Total dBA		Total 63 dBZ	Total 125 dBZ	Total 250 dBZ	Total 500 dBZ	Total 1,000 dBZ	Total 2,000 dBZ	Total 4,000 dBZ	Total 8,000 dBZ
1	725 Arbor Ct	52.1	54.5	66.2		61.5	61.1	57.1	55.3	56.5	52.0	45.3	31.9
2	21 Pepper Tree Ct	56.5	59.3	62.6		56.8	56.5	52.7	52.5	55.5	51.4	43.5	33.2
3	751 Cherry Tree Ln	54.1	56.7	59.5		53.5	53.2	49.5	49.7	52.8	48.8	40.8	30.7
4	721 Acron Ct	52.5	55.0	59.7		54.3	53.9	50.1	49.5	52.1	47.9	40.3	29.5
5	761 Gen Wallace Ct	52.5	55.3	58.0		52.1	51.8	48.0	48.2	51.3	47.2	39.2	29.1
6	141 W. Lee Hwy	52.9	55.7	58.9		53.2	52.9	49.1	48.9	51.8	47.8	39.9	29.5
7	222 North View Circle	55.3	54.4	59.2		52.4	52.2	48.6	49.8	53.4	49.5	41.2	31.6
8	492 Blackwell Rd	52.6	55.4	61.0		55.8	55.4	51.5	50.5	52.8	48.6	41.1	29.8
9	530 Highland Towne Ln	56.2	56.3	64.3		59.1	58.7	54.8	53.9	56.2	52.0	44.5	33.3
10	102 Dorsett Ln	56.0	59.0	67.7		62.9	62.5	58.5	56.9	58.4	54.0	47.1	34.5
11	514 Camden Cir	57.4	57.5	63.8		58.1	57.8	53.9	53.7	56.6	52.5	44.6	34.2
12	534 Estate Ave	53.8	56.2	58.5		52.3	52.0	48.3	48.8	52.2	48.2	40.1	30.2
13	7648 Moven Dr	57.1	57.4	58.7		49.4	49.4	46.7	50.2	54.6	50.7	42.1	33.2
14	7482 Argyll Ct	56.3	55.4	57.8		48.1	48.2	45.6	49.3	53.7	49.9	41.3	32.3
15	7379 Comfort Inn Dr	55.5	53.5	57.2		48.0	48.0	45.2	48.7	53.0	49.2	40.6	31.6
16	7350 Hunton St	56.3	56.1	58.5		50.1	50.0	46.9	49.7	53.9	50.1	41.5	32.4
17	7320 Marr Dr	52.4	54.9	55.9		48.7	48.5	45.1	46.6	50.4	46.5	38.1	28.7
18	6539 Hidden Hollow Ln	52.3	55.0	60.1		54.8	54.4	50.5	49.7	52.2	48.0	40.4	29.4
19	Parcel 6985-60-5718-500	52.3	54.9	70.0		65.3	64.9	60.9	58.9	59.8	55.2	48.7	34.6
20	33 Woodlands Way	52.0	54.7	62.3		57.3	56.9	52.9	51.6	53.4	49.1	41.9	29.9
21	800 Blackwell Rd	52.5	55.0	59.7		54.3	53.9	50.0	49.5	52.1	47.9	40.2	29.5


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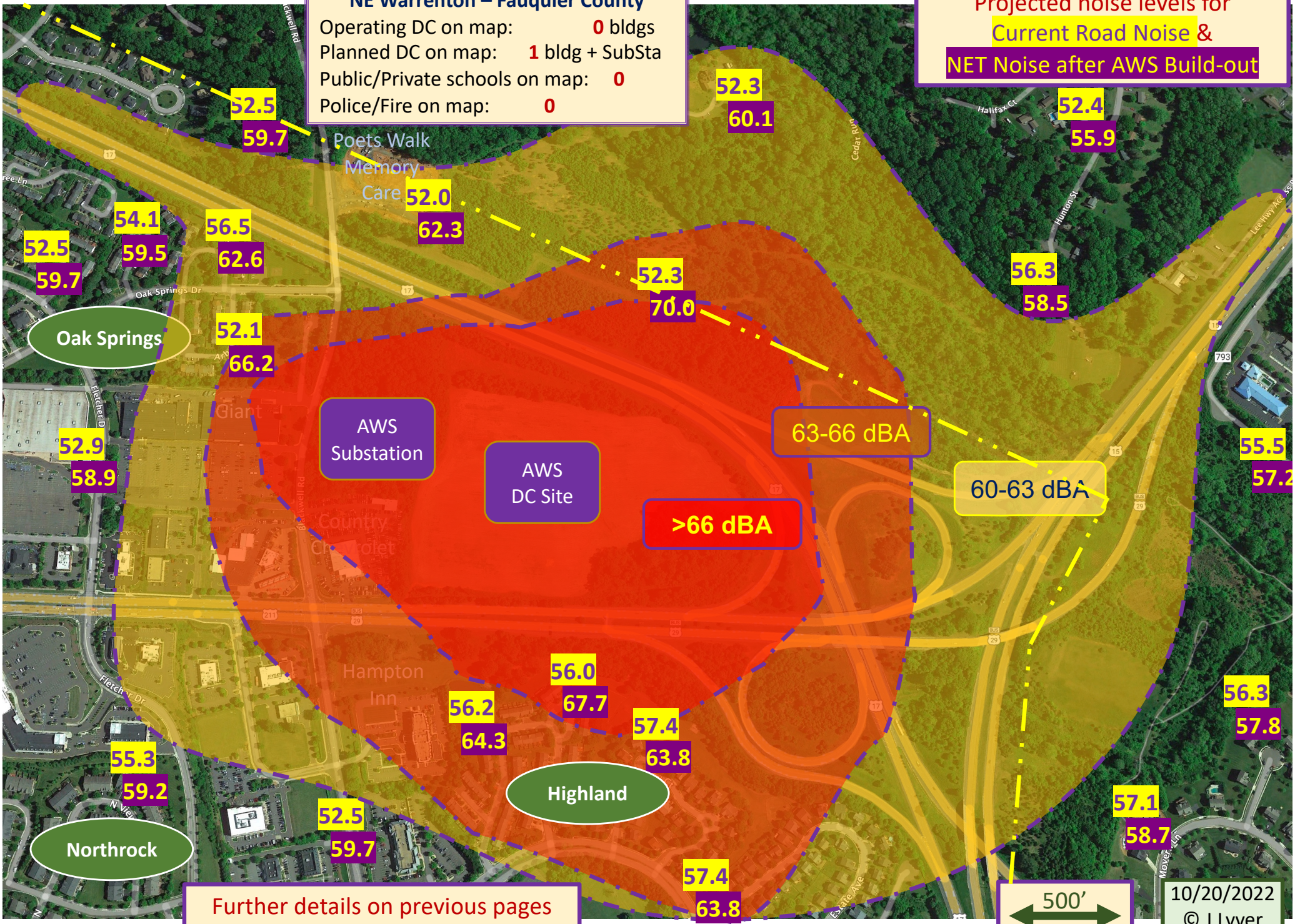
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List of Noise Ordinance Violations for mapped locations after DC is built

	Daytime Violations							
Location	63 Hz	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz	8,000 Hz
1		V	V	V	V	V	V	V
2				V	V	V	V	V
3				V	V	V	V	V
4				V	V	V	V	
5				V	V	V	V	
6				V	V	V	V	
7				V	V	V	V	V
8				V	V	V	V	
9			V	V	V	V	V	V
10		V	V	V	V	V	V	V
11				V	V	V	V	V
12				V	V	V	V	V
13				V	V	V	V	V
14				V	V	V	V	V
15				V	V	V	V	V
16				V	V	V	V	V
17				V	V	V	V	
18				V	V	V	V	
19	V	V	V	V	V	V	V	V
20				V	V	V	V	
21				V	V	V	V	

	Nighttime Violations							
Location	63 Hz	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz	8,000 Hz
1	V	V	V	V	V	V	V	V
2		V	V	V	V	V	V	V
3			V	V	V	V	V	V
4	V		V	V	V	V	V	V
5				V	V	V	V	V
6			V	V	V	V	V	V
7				V	V	V	V	V
8		V	V	V	V	V	V	V
9		V	V	V	V	V	V	V
10	V	V	V	V	V	V	V	V
11				V	V	V	V	V
12	V			V	V	V	V	V
13				V	V	V	V	V
14	V			V	V	V	V	V
15				V	V	V	V	V
16	V			V	V	V	V	V
17				V	V	V	V	V
18	V		V	V	V	V	V	V
19	V	V	V	V	V	V	V	V
20	V	V	V	V	V	V	V	V
21	V		V	V	V	V	V	V

- Above results are compared to Warrenton Noise Ordinance limits for each noise frequency octave
- “V” indicates violation, blank is within limits
- “Day” indicates noise limitation violation during the daytime hours
- “Night” indicates noise limitation violation during the nighttime hours

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Review of AWS' Noise Study - Physics

- Data from "*Walsh, Collucci, Lubeley & Walsh letter dated 9/9/2002 Exhibits 4 & 5"*
- Isopleth Charts from Exhibits 4 & 5 were analyzed for: [pp 29-47 in reference .pdf]
  - ✓ The 'fraction' of the data center noise energy in each Frequency octave
  - ✓ The spreading of the energy wave as a function of distance for "point sources" (data center is considered a point source)
    - Basic Energy Physics: In a vacuum energy expands at R^{-2} *[R is ratio of a given distance to new distance]*
    - Generally accepted with ground & cloud reflection $R^{-1.5}$ *(used in Lyver model)*
    - AWS Sound study used: R^{-2} for 63Hz to 250Hz, $R^{-2.6}$ for 500-1,000Hz, and $R^{-4.9}$ for 2,000Hz to 8,000Hz *[No physical rational for this assumption]*
    - Result: AWS reported noise attenuated too rapidly
- Road Noise charts were analyzed for: [pp 57-84 in reference .pdf]
  - ✓ The 'fraction' of the data center noise energy in each Frequency octave
  - ✓ The spreading of the energy wave as a function of distance for "line sources" (roads are considered a point source)
    - Basic Energy Physics: In a vacuum energy expands at R^{-1}
    - Generally accepted with ground & cloud reflection R^{-1} *(used in Lyver model)*
    - AWS Sound study used: unknown.
    - Result: In Lyver model averaged the M1-M5 readings with the calculations of point sources

Review of AWS' Noise Study - Engineering

- Engineering review of Noise Analysis presented in:
  '*Walsh, Collucci, Lubeley & Walsh letter dated 9/9/2002 Exhibits 4 & 5*'
- Letter Page 4 item (6): False statement. The noise that is over the Town limit is from road noise. The data presented in the isopleth charts shows more violations of the noise ordinance.
- Town Noise limits:
  - ✓ Limits cited do not match the Warrenton Town Noise Ordinance.
- Isopleth Charts (Daytime, Nighttime, and Generator):
  - ✓ Charts show the center of the noise isopleth contours as being about 50' north of the building. On the Daytime 1,000Hz chart, the entire highest isopleth is north of the site. These charts are titled for "Rooftop Mechanical Noise". Should be centered on rooftop noise sources.
  - ✓ Noise reduces at various rates depending on the frequency. See "Results of Analysis page"
  - ✓ Violations and discussion missing for residential areas west-north-west, north-west, and south of the proposed site.
  - ✓ Summary page violations note does not match between two pages.
  - ✓ Isopleth contours do not match topography in several areas, such as to the east.
  - ✓ Unexplained major change in isopleths between 4,000Hz and 8,000Hz charts.
  - ✓ No explanation for differences between day/night in base noise generation.
  - ✓ Generator Noise charts are identical to day charts in shapes.
- Road noise charts:
  - ✓ Incorrect Town Noise limits cited on Measurement Summary page.
  - ✓ The measurements (blue lines) is incorrectly analyzed in the dashed line. Resulting in many missed violations of road noise.
- Page between 250Hz and 500Hz nighttime charts is for a site in Gainesville area.
- Fauquier County Noise Ordinance not cited or analyzed for.

Reference Noise Chart

Typical Noise Levels	
45-50 dBA	Quiet Suburb~ & Moderate Rainfall~
50-60 dBA	Modern Built in Dishwasher ~
55 dBA	Coffee percolator ~
59 dBA	Volvo @ idle @ 5′ *
60 dBA	Restaurant with regular conversation ~ Modern garbage disposal @ 5′ * Sewing Machine @ 5′ ~
65-70 dBA	Restaurant which is too loud for conversation ~ Average 2000's Dishwasher ~
72 dBA	I-66 @ 300' * (to median strip)
74 dBA	Dyson Vacuum Cleaner @ 5′ *, Hairdryer @ 1′ ~ Battery powered Leaf Blower @ 5′ * *(Hearing damage begins)*
80 dBA	Food Blender ~, 2000's garbage disposal ~, Typical alarm clock~, coffee grinder ~
81 dBA	Push Gasoline Lawn Mower @ 5′ *
85 dBA	Train whistle @ 500' ~, Passing diesel semi-Truck ~

Notes:

- ✓ On the above chart, *indicates measured noise and ~ indicates internet referenced noise level
- ✓ Distance indicated is between noise generator and measurement
- ✓ All readings in this analysis are in decibels [dB(A)], Town of Warrenton's noise ordinance limits are expressed in dB(Z) so additional analyses are needed to directly apply
- ✓ Decibels are a logarithmic representation of the noise energy expressed as $^{watts}/_{meter^2}$
- ✓ A 3 decibel change in readings is a doubling of the noise energy, a change of 10 decibels is an increase the noise energy by a factor of 10
- ✓ Noise energy is additive

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