BLACK & VEATCH
building a world of difference™

ENERGY • WATER • INFORMATION • GOVERNMENT

Facility Noise Assessment

Trumbull Substation Project
The United Illuminating Company
Trumbull, Connecticut

B&V Project 141417
July 13, 2005

Notice

This Facility Noise Assessment report is intended as a working document to support design and commmercial decisions related to the proposed project. It contains detailed technical information, design options, equipment specifications, and operational strategies related to the potential noise emissions from the facility. If an environmental impact or assessment report is needed for agency or public review, it is recommended that a supplemental report be developed that is an abbreviated version of this report.

Table of Contents

1.0 Introduction 1

2.0 Acoustical Terminology 2

2.1 Sound Energy 2
2.2 Sound Level Metrics 2
2.3 Typical Community Sound Levels 3
2.4 Human Response to Sound 3

3.0 Applicable Noise Regulations 5

3.1 City of Trumbull 5
3.2 Connecticut 5
3.3 Applicable Criteria 6

4.0 Existing Acoustical Environment 8

4.1 Procedure 8
4.2 Instrumentation 8
4.3 Survey Locations 9
4.4 Continuous Noise Monitoring 10
4.5 Short-Term Measurements 11

5.0 Environmental Noise Emissions 16

5.1 Noise Modeling Methodology 16
5.2 Equipment Noise Sources 16
5.3 Substation Noise Emissions 16

6.0 Conclusions 19

Appendix A 20

Appendix B 22

Appendix C 24

Executive Summary

The proposed site for the Trumbull Substation is located in the Town of Trumbull, Connecticut in Fairfield County, approximately 10 miles north of the City of Bridgeport. The facility will be an electrical substation with two 24/32/40 MVA transformers.

Prior to determining the potential noise emissions from the proposed substation facility, an environmental noise survey was conducted to assess the existing acoustical environment surrounding the proposed site. The existing acoustical environment is typical of urban residential areas. In general, the existing ambient sound levels in the areas surrounding the proposed site are influenced by noise sources such as local traffic, birds, insects, and nearby highway traffic. The ambient surveys indicate that the background sound levels (L_{90}) ranged from 36 dBA to 59 dBA. The existing background sound levels at the measurement locations are generally consistent with urban residential areas highly influenced by traffic noise.

The major noise sources associated with the proposed substation facility are anticipated to include the transformers and the control/switchgear building cooling equipment. Noise modeling has been conducted to predict the environmental noise emissions from the proposed substation facility. Based on the available information, there are noise regulations that apply to the proposed facility. As such, the facility noise emissions have been evaluated based on meeting these regulations and reducing the noise impact on nearby residences.

The environmental noise emissions associated with the proposed substation have been predicted in order to evaluate compliance with applicable local noise regulations and the potential future noise impacts on the neighboring noise sensitive receptors. Appropriate mitigation measures will be installed. The substation noise emissions are anticipated to comply with the regulations. Additionally, the substation noise emissions are anticipated to not increase the existing background sound levels at the nearest residences except only very slightly (less than 2 dB) during the occasional quietest nighttime periods.

1.0 Introduction

The proposed site for the Trumbull Substation is located in the Town of Trumbull, Connecticut in Fairfield County, approximately 10 miles north of the downtown City of Bridgeport. The site is situated on the east side of a cul-de-sac at the end of Wildflower Lane within the triangular area bounded by Nichols Avenue, Huntington Turnpike, and Route 8. The proposed site is largely wooded with a clearing at the center of the property for a 115 kV transmission line and a transmission line switching structure as well as a former distribution line training area. The 4.85 acre site and surrounding properties are zoned residential.

The facility will be an electrical substation with two 24/32/40 MVA transformers. The potential environmental noise emissions associated with the proposed substation have been evaluated. The major noise sources associated with the proposed substation facility are anticipated to include the transformers and the control/switchgear building cooling equipment. The facility noise emissions have been evaluated based on meeting these regulations and reducing the noise impact on nearby residences.

Prior to determining the potential noise emissions from the proposed substation facility, an environmental noise survey was conducted to assess the existing acoustical environment surrounding the proposed site.

2.0 Acoustical Terminology

A variety of terms are used in the field of acoustics. In order to familiarize the reader with the terminology included in this report, this section briefly introduces general acoustical terminology and describes basic acoustical parameters.

2.1 Sound Energy

Sound is generated by the propagation of energy in the form of pressure waves. Being a wave phenomenon, sound is characterized by amplitude (sound level) and frequency (pitch). Sound amplitude is measured in decibels, dB, and sound frequency is measured in hertz, Hz (cycles per second). The decibel is the logarithmic ratio of a sound pressure to a reference sound pressure. Typically, 0 dB corresponds to the threshold of human hearing. A 3 dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. Similarly, a 5 dB change is generally considered "clearly noticeable" and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness. For reference, the sound pressure levels and subjective loudness associated with common noise sources are shown in Table 2-1.

The normal human ear can hear frequencies ranging from 20 Hz to 20,000 Hz. At typical sound pressure levels, the human ear is more sensitive to sounds in the middle and high frequencies (1,000 to 8,000 Hz) than sounds in the low frequencies. Various weighting networks have been developed to simulate the frequency response of the human ear. The A-weighting network was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting network emphasizes sounds in the middle to high frequencies and de-emphasizes sounds in the low frequencies. Most sound level instruments can apply these weighting networks automatically. Any sound level to which the A-weighting network has been applied is expressed in A-weighted decibels, dBA.

2.2 Sound Level Metrics

Noise in the environment is constantly fluctuating, such as when a car drives by, a dog barks, or a plane passes overhead. Therefore, noise metrics have been developed to quantify fluctuating environmental noise levels. These metrics include the equivalent-continuous sound level and the exceedance sound levels.

The equivalent-continuous sound level, L_{eq}, is used to represent the equivalent sound pressure level over a specified time period. The L_{eq} metric is the sound level of a steady-state sound that has the same (equivalent) total energy as the time-varying sound of interest, taken over a specified time period and covering a specified set of conditions. Thus, L_{eq} is a single-value level that expresses the time-averaged total energy of a widely varying or fluctuating sound level.

The exceedance sound level, L_x, is the sound level exceeded "x" percent of the sampling period and is referred to as a statistical sound level. The most common L_x values are L_{90}, L_{50}, and L_{10}. L_{90} is the sound level exceeded 90 percent of the sampling period. The L_{90} sound level represents the sound level without the influence of loud, transient noise sources and is therefore often referred to as the *residual* or *background* sound level (ANSI S12.19 [2]). The L_{50} sound level is the sound level exceeded 50 percent of the sampling period or the median sound level. The L_{10} sound level is the sound level exceeded 10 percent of the sampling period. The L_{10} sound level represents the occasional louder noises and is often referred to as the *intrusive* sound level. As previously discussed, the L_{90} environmental sound level typically represents the background (residual) sound level.

The variation between the L_{90}, L_{50}, and L_{10} sound levels can provide an indication of the variability of the acoustical environment. If the acoustical environment is perfectly steady, all values are identical. A large variation between the values indicates the environment experiences highly fluctuating sound levels. For instance, measurements near a roadway with frequent passing vehicles may cause a large variation in the statistical sound levels.

2.3 Typical Community Sound Levels

Typical background (residual) sound levels in various types of communities are outlined in Table 2-2 for reference. However, it is important to remember that each community is unique with regard to the sources of noise that contribute to the background sound levels.

2.4 Human Response to Sound

Human response to sound is highly individualized. Annoyance is the most common issue regarding community noise. The percentage of people claiming to be annoyed by noise will generally increase as environmental sound levels increase. However, many other factors will also influence people's response to noise. These factors can include the character of the noise, the variability of the sound level, the presence of tones or impulses, and the time of day of the occurrence. Additionally, non-acoustical factors, such as the person's opinion of the noise source, the ability to adapt to the noise, the attitude towards the noise and those associated with it, and the predictability of the noise can also influence people's response. As such, response to noise varies widely from one person to another and with any particular noise, individual responses will range from "highly annoyed" to "not annoyed".

Table 2-1
Typical Sound Pressure Levels Associated with Common Noise Sources

Sound Pressure Level (dBA)	Subjective Evaluation	Common Noise Source and/or Environment	
		Outdoor	Indoor
140	Deafening	Jet aircraft at 75 ft	
130	Threshold of pain	Jet aircraft during takeoff at a distance of 300 ft	
120	Threshold of feeling	Elevated Train	Hard rock band
110	Extremely Loud	Jet flyover at 1000 ft	Inside propeller plane
100	Very Loud	Power mower, motorcycle at 25 ft, auto horn at 10 ft	
90	Very Loud	Propeller plane flyover at 1000 ft, noisy urban street	Full symphony or band, food blender, noisy factory
80	Moderately Loud	Diesel truck (40 mph) at 50 ft	Inside auto at high speed, garbage disposal, dishwasher
70	Loud	B-757 cabin during flight	Close conversation, vacuum cleaner, electric typewriter
60	Moderate	Air-conditioner condenser at 15 ft, near highway traffic	General office
50	Quiet		Private office
40	Quiet	Farm field with light breeze, birdcalls	Soft stereo music in residence
30	Very quiet	Quiet residential neighborhood	Bedroom, average residence (without t.v. and stereo)
20	Very quiet	Rustling leaves	Quiet theater, whisper
10	Just audible		Human breathing
0	Threshold of hearing		

Source: Adapted from Architectural Acoustics, M. David Egan, 1988 and Architectural Graphic Standards, Ramsey and Sleeper, 1994.

Table 2-2
Typical Daytime Residual (Background) Sound Levels in Various Types of Communities

Type of Community	Typical Daytime Residual (Background) Sound Pressure Level
Very Quiet Rural Areas	31 to 35 dBA
Quiet Suburban Residential	36 to 40 dBA
Normal Suburban Residential	41 to 45 dBA
Urban Residential	46 to 50 dBA
Noisy Urban Residential	51 to 55 dBA
Very Noisy Urban Residential	56 to 60 dBA
Adjacent Freeway or Major Airport	n/a

Source: Adapted from U.S. Environmental Protection Agency, Community Noise, December, 1971.

3.0 Applicable Noise Regulations

Based on the available information, there are local and state noise regulations that apply to the proposed facility. As such, the facility noise emissions have been evaluated based on meeting these regulations as well as reducing the noise impact on nearby residences.

3.1 Town of Trumbull

The proposed site is located within the Town of Trumbull in the state of Connecticut. Based on the available information, there are local noise ordinances that apply to the proposed facility. The regulations are specified in the town noise control ordinance. Section 13-50 states that *"no person ... shall emit noise beyond the boundaries of his premises exceeding the levels stated herein and applicable to adjacent residential, business/commercial and/or light industrial zones."* The project site is currently zoned as Residence-AA and therefore would be restricted to the regulations for noise sources emitting from a residential zone. The ordinance specifies limits of 55 dBA daytime and 45 dBA nighttime for residential to residential noise emissions. Daytime hours are those between 7:00 AM and 8:00 PM, Monday through Friday, and the hours of 9:00 AM through 8:00 PM on Saturday, Sunday and all federal and state holidays. Nighttime hours are those between 8:00 PM and 7:00 AM Sunday through Friday and the hours between 8:00 PM Saturday through 9:00 AM Sunday. During and state or federal holiday, the weekend schedule is in effect from the previous evening through the end of the holiday.

In Section 13-50 (c) of the ordinance, the regulations specify that in cases where the background noise level caused by other sources is greater than the limits specified, *"a source shall be considered to cause excessive noise if the noise emitted by such sources exceeds the background noise levels by five (5) dBA"* with a maximum noise limit of 80 dBA for a specific source.

Compliance for the specified limits is determined by measuring the A-weighed sound pressure level at one (1) foot beyond the emitter's boundary inside the receptor's noise zone. The emitter's zone includes contiguous rights of way for streets, highways, railroads, and waters of the state. For a continuously operating source in the presence of a variable background noise, the appropriate measurement metric is L_{90}.

3.2 Connecticut

The state ordinance governing noise is contained in the Connecticut General Statutes chapter 442. The statutes provide limits that are based on land use and time of day. Specifically, Section 22a-69-1.9 states that the limits for a noise source on a Class C type 4 land use (which covers utilities) when adjacent to a Class A land use (residential) are 61 dBA in the daytime and 51 dBA at nighttime. Daytime is defined as the hours between 7:00 AM and 10:00 PM and nighttime is defined as 10:00 PM to 7:00 AM. Because a substation is in continuous operation, the nighttime limits would make up the facility criteria design.

In addition to these limits, there is an additional 5 dB penalty for prominent discrete tones. Per the statute, a prominent discrete tone is "the presence of acoustic energy concentrated in a narrow frequency range". The determination of the tone is relative to the sound level in the adjacent frequency bands. The relative sound level for each one-third octave band is specified in Section 22a-69-1.2 (r) and are listed in Table 3-1. Because transformers are capable of emitting tones in multiples of 120 Hz, this requirement must be met in addition to the overall noise requirement. For the discrete tone case, the daytime and nighttime limits would be 56 dBA and 46 dBA, respectively.

Section 22a-69-3.6 contains provisions for sources that are located in areas that already have a background noise higher than the limit. In these instances, the source noise will be considered excessive if it is greater than 5 dBA above the background.

Although these limits are objective and straightforward, the statute also contains language that can be used to file a complaint. For example, Section 22a-69-1.5 states that *"compliance of a source with these Regulations is not a bar to a claim of nuisance by any person. A violation of any portion of these regulations shall not be deemed to create a nuisance per se."* This would seem to permit some leeway in determining whether a source is a nuisance or not regardless of whether it meets the objective requirements.

Compliance for the specified limits is determined by measuring the A-weighted sound pressure level at one (1) foot beyond the emitter's boundary inside the receptor's noise zone. The emitter's zone includes contiguous rights of way for streets, highways, railroads, and waters of the state. The proposed facility has street rights of way along Wildflower Lane.

Table 3-1
Relative Sound Pressure Levels for Prominent Discrete Tones

1/3 Octave Band Center Frequency (Hz)	Relative Sound Pressure Level (dB)
100	16
125	14
160	12
200	11
250	9
315	8
400	7

3.3 Applicable Criteria

Based on the regulations reviewed, the local regulations are more stringent and should be used as the design basis for the facility. Thus the nighttime limits for a residential emitter to a residential receptor are the applicable criteria. The limits are 55 dBA daytime and 45 dBA nighttime. The regulations also specify a 5 dBA limit on the increase to the existing background sound level for areas with ambient levels that already exceed the residential limits. However, after conducting the ambient noise survey, it was determined that while at times the existing ambient sound levels do exceed 45 dBA at the nearby receptor locations, there were also times during which the existing ambient sound levels were below 45 dBA.

As such, the most restrictive applicable limit is the 45-dBA nighttime limit. This limit applies at the nearest adjacent residential property boundaries which are detailed in Figure 3-1.

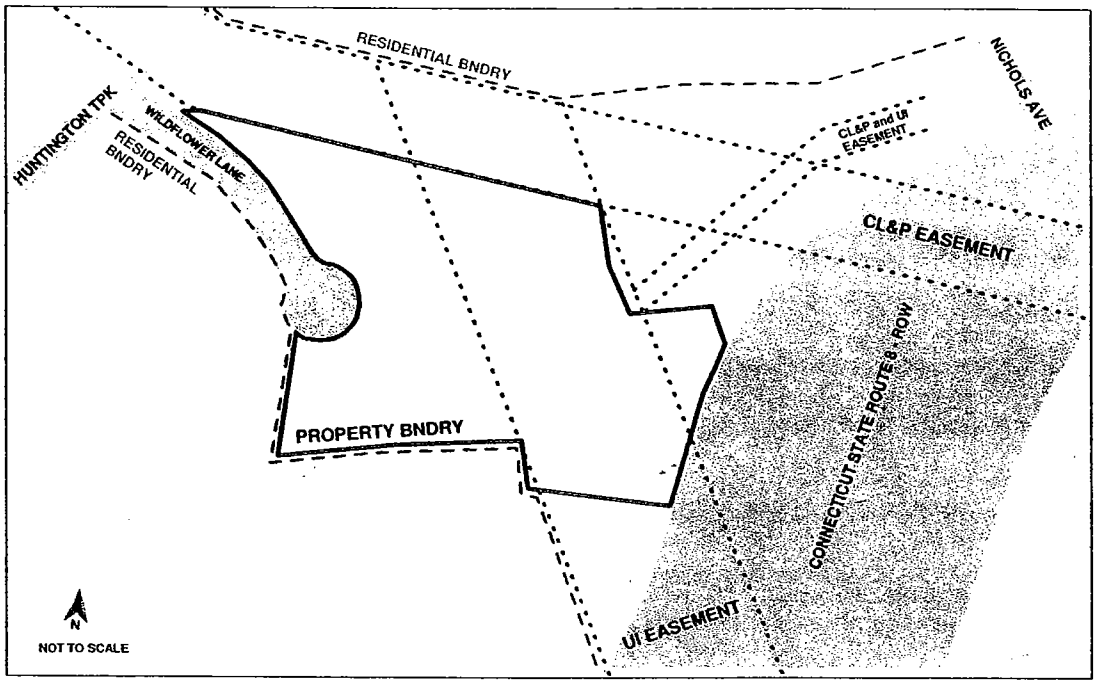


Figure 3-1. Location of the nearest adjacent residential property boundaries that represent the noise emissions compliance boundaries.

4.0 Existing Acoustical Environment

The proposed site and surrounding properties are zoned residential. The proposed site is largely wooded with a clearing at the center of the property for a 115 kV transmission line and a transmission line switching structure as well as a former distribution line training area. Nearby residences are located along the city roads surrounding the site. Traffic along the nearby roadways includes moderately heavy local traffic along Huntington Turnpike and heavy traffic along Route 8 and Nichols Avenue. An ambient noise survey was conducted on May 4 and 5, 2005, to characterize the existing acoustical environment within the vicinity of the proposed site.

4.1 Procedure

The ambient sound level survey procedure was based on general industry standards including ANSI S1.13, ANSI S12.9, ANSI S12.18, and ASTM E1014. In order to effectively quantify and qualify the existing daily sound levels within the area, the ambient survey included both continuous monitoring and short-term (manned) sound level measurements at three locations around the site. The continuous monitors collected sound level data at the monitoring locations throughout the survey period.

Short-term measurements were conducted periodically at the monitoring locations in order to qualify the existing overall conditions and quantify the existing spectral conditions during various daytime and nighttime hours.

Weather conditions during the measurement period were favorable for sound level measurements. Weather conditions generally included clear skies with little to no wind, temperatures from 45 to 57 °F, and relative humidity between 28 and 57 %.

4.2 Instrumentation

Sound level measurements were conducted using a sound level monitor that met the requirements of ANSI S1.4 and ANSI S1.43. The sound level monitor had integrating capabilities to determine the average and statistical sound levels on an hourly basis over the survey period. The sound level monitor continuously recorded the ambient sound levels and stored the hourly results for retrieval at the completion of the survey. The monitor was securely stored in an equipment case. The microphone was mounted to the top of a telescopic microphone pole and equipped with a windscreen provided by the manufacturer. The monitoring equipment was checked periodically throughout the survey period. The monitoring equipment is listed in Table 4-1.

A precision grade sound level meter, meeting the requirements of ANSI S1.4, was employed during the ambient survey. The sound level meter included integrating capabilities to determine the average and statistical 1/3-octave band sound pressure levels over the measurement duration. The sound level meter was mounted to a tripod and manned at all times. The microphone was equipped with a windscreen provided by the manufacturer. The sound level meter equipment is listed in Table 4-1.

All survey and measurement equipment had been laboratory calibrated within the previous 12 months and all calibrations are traceable to the National Institute of Standards and Technology (NIST). Calibration certificates are included in Appendix A.

Table 4-1
Ambient Survey Test Equipment

Model	Serial Number	Last Calibration Date
Rion Model NA-27	01191119	10/21/2004
Rion Type UC-53 Microphone	99858	10/21/2004
Norsonic Type 1251 Acoustic Calibrator	25762	10/21/2004
Rion Model NL-22	01110135	10/20/2004
Rion Model NL-22	01110133	10/20/2004
Rion Model NL-22	01110122	10/20/2004
Rion Model NC-73 Acoustic Calibrator	10527795	10/20/2004

4.3 Survey Locations

Noise monitoring was conducted at three locations surrounding the site. These locations were selected to capture an acoustical environment representative of the nearby residences. The nearest residences are located along Wildflower Lane approximately 100 feet west of the facility property line, along Huntington Turnpike approximately 100 feet north of the facility property line, and approximately 200 feet south of the facility property line. A description of each measurement location is listed in Table 4-2 and is based on the information and drawings provided. Additionally, the locations of the nearby residences and noise monitoring locations are shown in Figure 4-1.

Table 4-2
Descriptions of the Noise Monitoring Locations

Noise Monitoring Location (NML)	Description
1	On the east side of cul-de-sac on Wildflower Lane. This location was selected to represent the ambient noise at the residence in the cul-de-sac.
2	Near the CL&P transmission line tower near Huntington Turnpike. This location was selected due to the inaccessibility adjacent to the residential property at 1500 Huntington. It was at approximately the same distance from the proposed station as the residential southeastern boundary.
3	At the facility gate along Nichols Avenue near intersection with Route 8; adjacent to the residential property at 2911 Nichols Avenue.

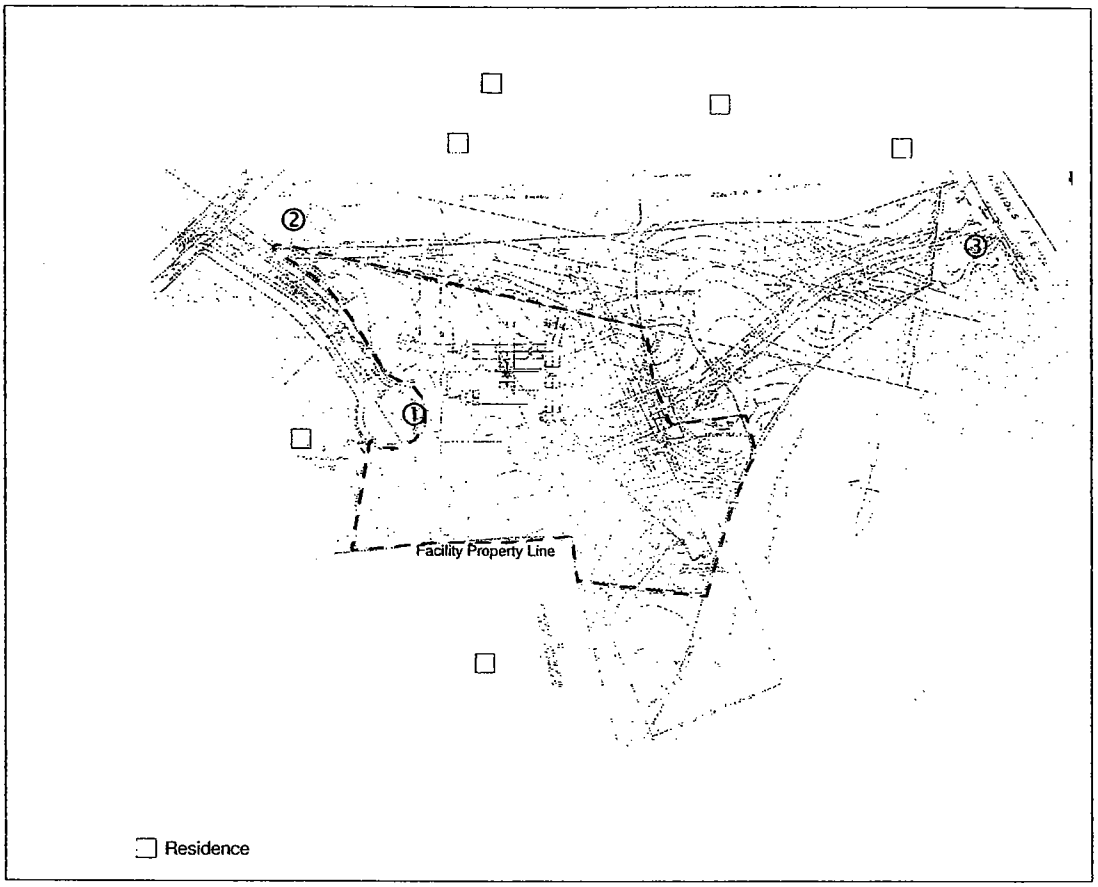


Figure 4-1. Nearby Residences and Ambient Noise Monitoring Locations.

4.4 Continuous Noise Monitoring

Continuous noise monitoring was conducted at each location for a 24-hour period to capture typical ambient daytime and nighttime sound levels. The measurements included the equivalent-continuous sound level, L_{eq}; the 90-percentile exceedance sound level, L_{90}; the 50-percentile exceedance sound level, L_{50}; and the 10-percentile exceedance sound level, L_{10}, during each one-hour period.

The 24-hour noise monitoring results are detailed in Table 4-3 and Figure 4-2. The corresponding measurement data is included in Appendix B. Figure 4-2 depicts the L_{10}, L_{50}, and L_{90} hourly sound levels during the 24-hour period at each location and shows the variation in the hourly sound levels during a typical day. As previously discussed, the L_{90} sound level is typically considered the residual or background sound level, the L_{50} sound level is generally considered the median sound level, and the L_{10} sound level is generally considered the intrusive sound level. The quietest background sound levels (L_{90}) at the monitoring locations were generally consistent and ranged from 36 to 39 dBA during the 2:00 AM to 4:00 AM time periods when the volume of

local traffic diminished. During daytime hours when the traffic volumes increased substantially, the hourly background sound levels (L_{90}) at the monitoring locations were higher and ranged from 54 to 59 dBA. As such, the daytime ambient sound levels were generally 20 dB higher than the quietest nighttime hours.

Table 4-3
Continuous (24-hour) Ambient Sound Level Measurement Results

Location		Hourly Exceedance Sound Levels, dBA		
		L90	L50	L10
1	Min	37	41	46
	Median	47	49	52
	Max	54	55	57
2	Min	36	39	43
	Median	46	49	56
	Max	50	52	57
3	Min	39	45	52
	Median	54	57	61
	Max	59	61	64

4.5 Short-Term Measurements

Short-term octave band noise measurements were conducted at each location in order to evaluate the spectral content of the existing acoustical environment. The short-term measurement results for the quietest time period are detailed in Figures 4-3 through 4-5. The measurement data for all short-term measurements are included in Appendix C. Figures 4-3 through 4-5 show the background octave band sound levels (L_{90}) recorded during the short-term measurement period at each location. The measurement period was 20 minutes in duration to capture representative sound levels. It should be noted that the sound pressure levels between approximately 500 and 2500 Hz were significantly influenced by road noise, which consequently affected the overall A-weighted sound pressure levels. The influence of the traffic noise was most prevalent at locations NML-2 and NML-3, which were both located near roadways. Location NML-1 was more remote from roadways but was still influenced by distant traffic noise.

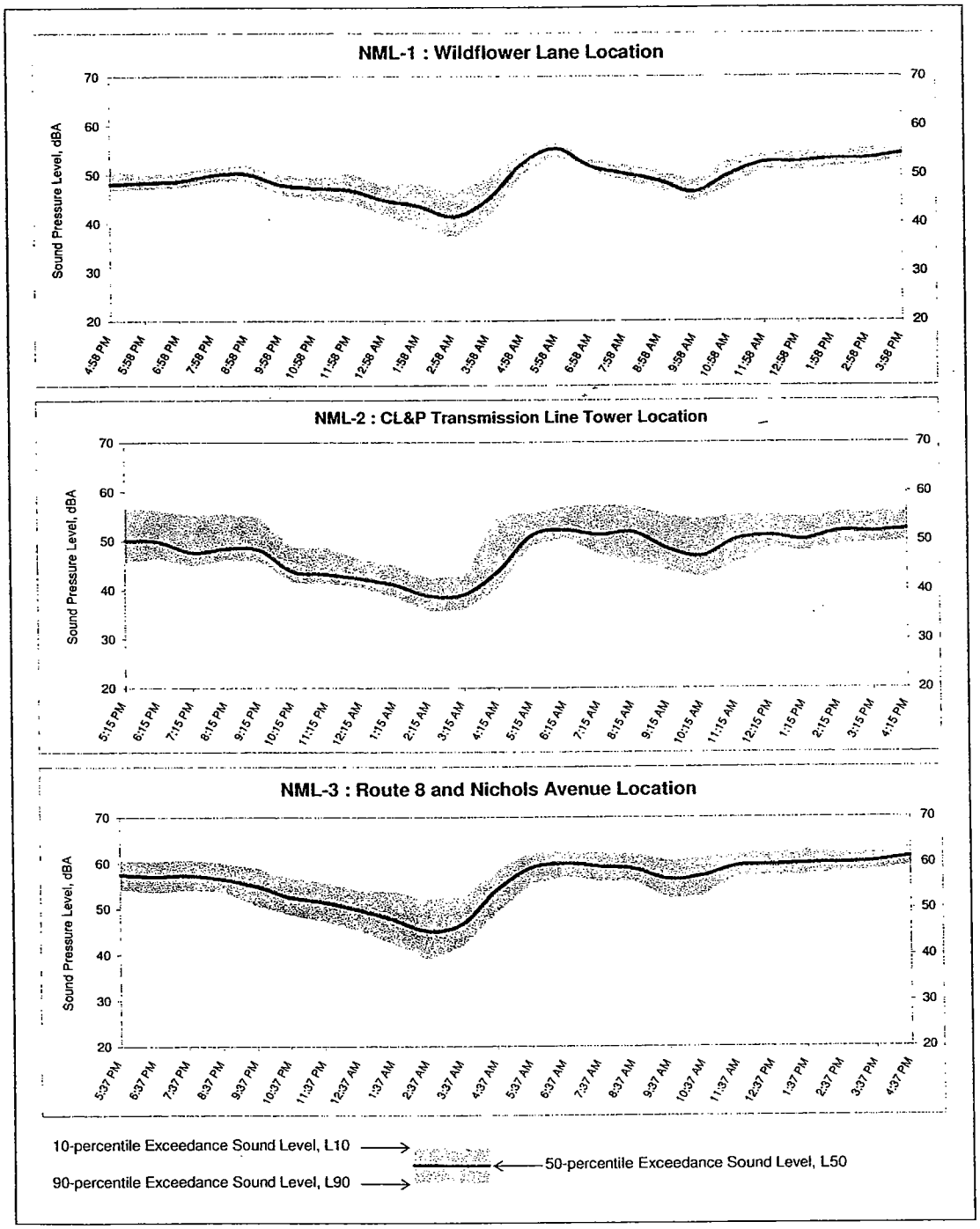


Figure 4-2. Continuous (24-hour) Ambient Noise Level Measurements.

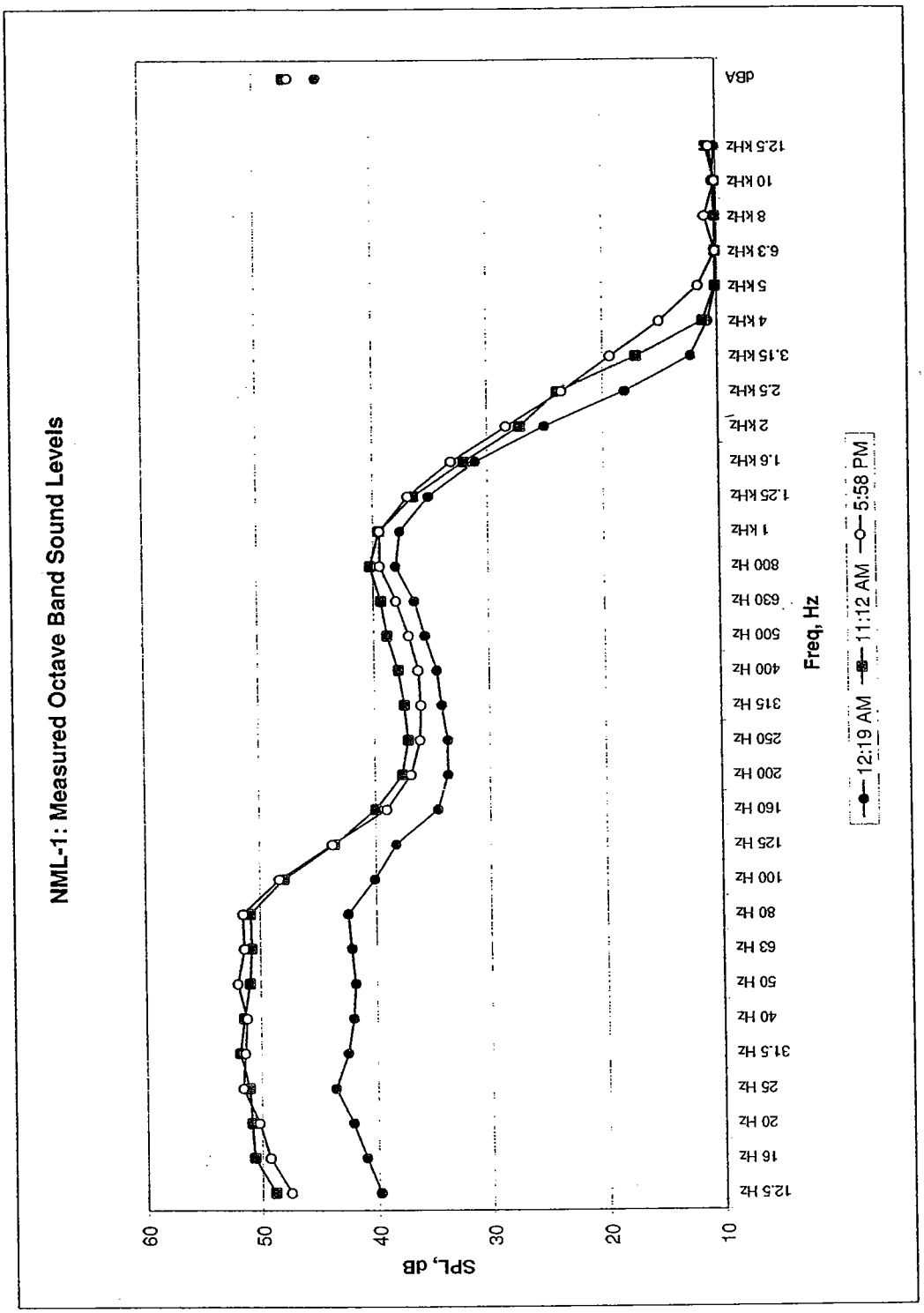


Figure 4-3. Octave Band (Short-Term) Ambient Noise Level Measurements at NML-1.

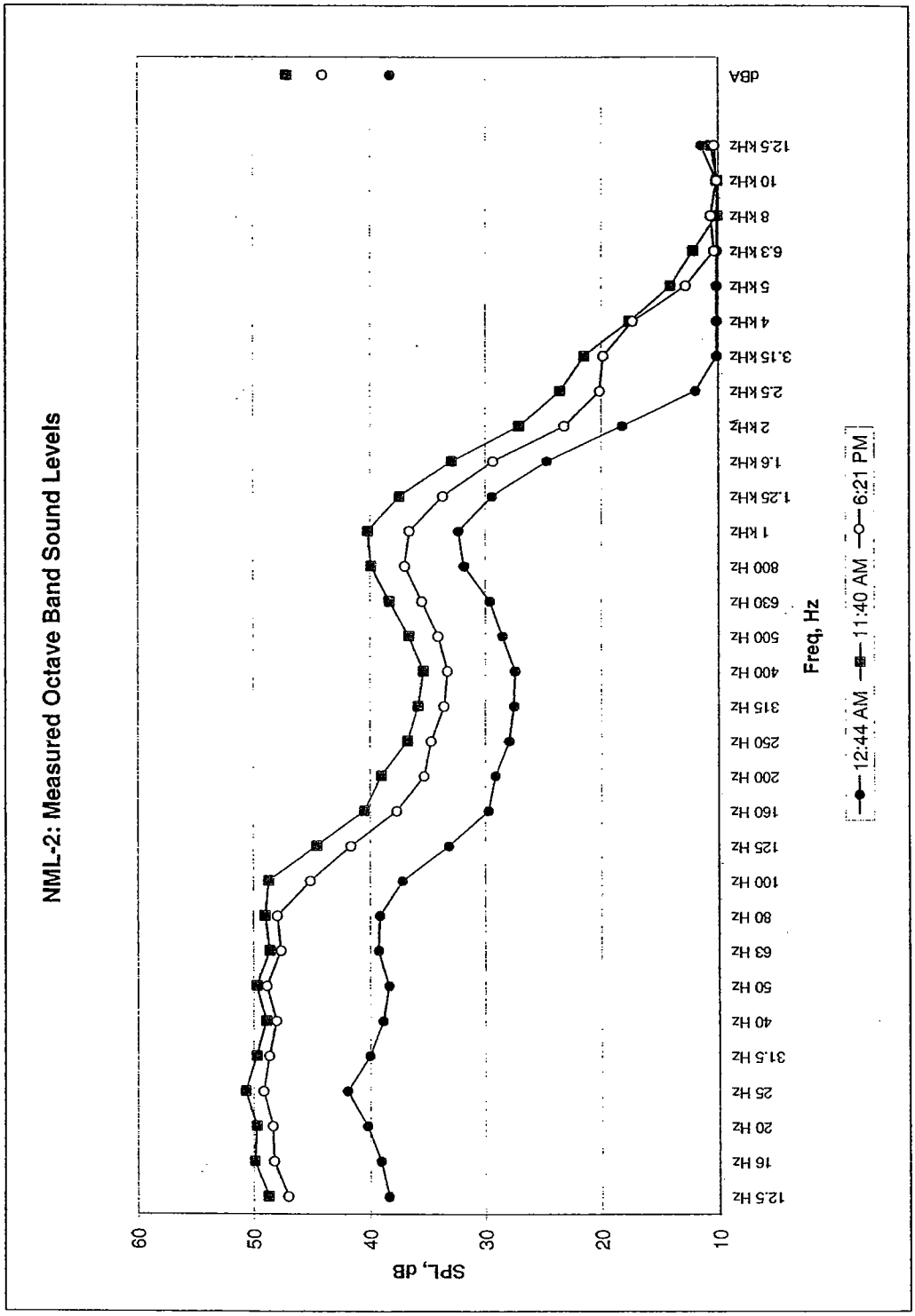


Figure 4-4. Octave Band (Short-Term) Ambient Noise Level Measurements at NML-2.

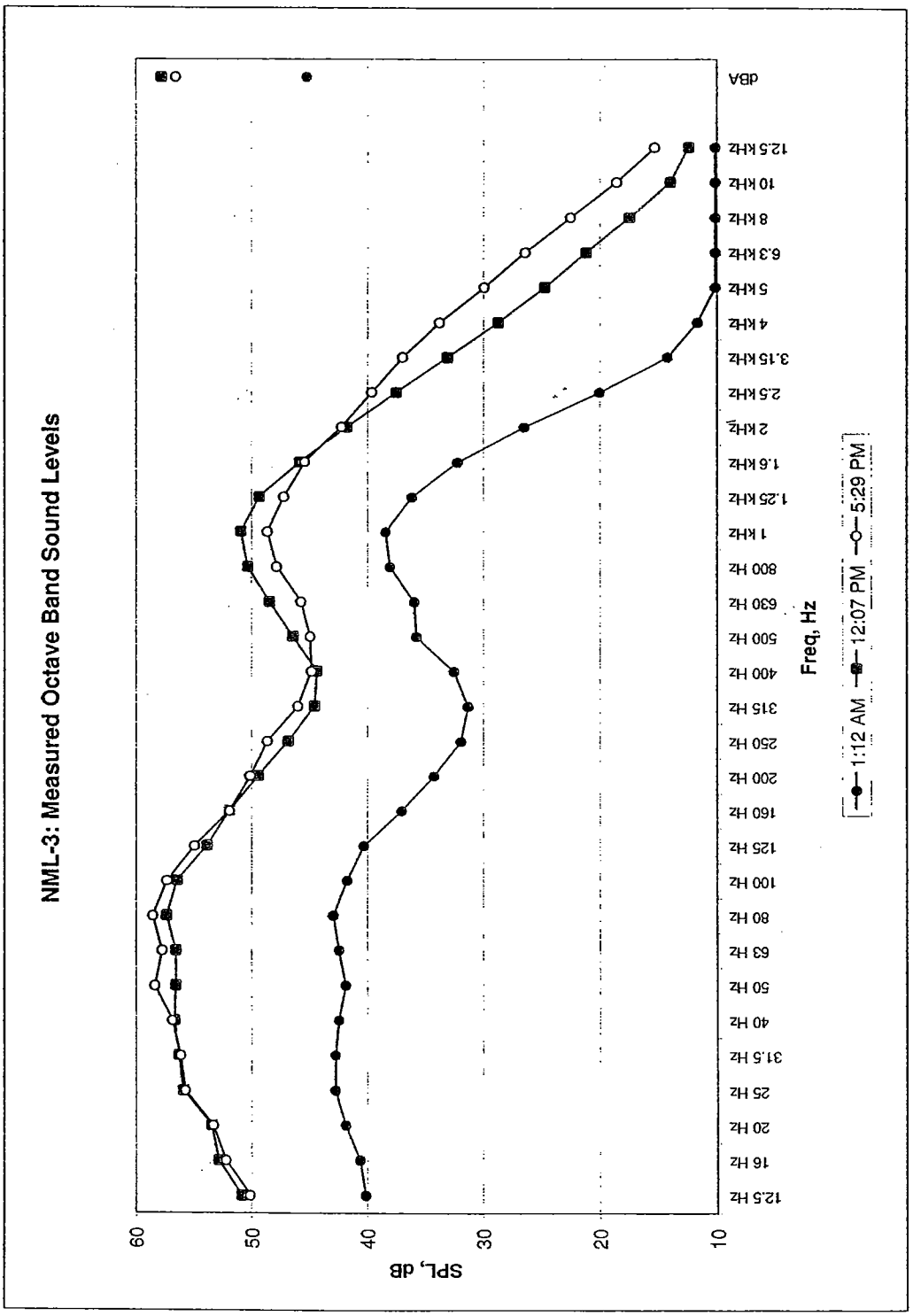


Figure 4-5. Octave Band (Short-Term) Ambient Noise Level Measurements at NML-3.

5.0 Environmental Noise Emissions

The environmental noise emissions include the noise emitted by the proposed substation facility to the areas surrounding the proposed facility site.

5.1 Noise Modeling Methodology

The environmental noise emissions were modeled using noise prediction software (CadnaA version 3.3.107). The model simulated the outdoor propagation of sound from each noise source and accounted for sound wave divergence, atmospheric and ground sound absorption, sound directivity, and sound attenuation due to interceding barriers and topography. A database was developed which specified the location, octave band sound levels, and sound directivity of each noise source. A receptor grid was specified which covered the entire area of interest. The model calculated the overall A-weighted sound pressure levels within the receptor grid based on the octave band sound level contribution of each noise source. Finally, a noise contour plot was produced based on the overall sound pressure levels within the receptor grid, including specific receptor locations. Noise modeling was conducted to predict the environmental noise emissions during normal facility operation, which excludes any abnormal or upset operating conditions.

5.2 Equipment Noise Sources

Based on the available substation design information and drawings, the proposed substation will include two new transformers and a control/switchgear building. The primary sources of noise are anticipated to be the two 40 MVA transformers and the cooling units associated with the control/switchgear building ventilation system.

All equipment sound levels were based on available in-house manufacturer data or data provided by the Edison Electric Institute (EEI) in the *Electric Power Plant Environmental Noise Guide* (1984). The equipment sound level specification considered for each equipment noise source is listed in Table 5-1. These equipment sound level specifications are anticipated to be available with packaged equipment. However, the available performance guarantees for each equipment component must be confirmed with the appropriate equipment suppliers.

Table 5-1
Anticipated Equipment Sound Level Specifications for Proposed Facility Equipment

Noise Source Component	Qty	Sound Level Specification
Transformer (fans at maximum cooling)	2	71 dBA per IEEE C57.12.90
5-ton Residential Cooling Unit	2	75 dBA @ 3 ft [1]

NOTES
1. *Average sound pressure level along the equipment envelope.*

5.3 Substation Noise Emissions

As previously discussed, the substation noise emissions must not exceed an A-weighted sound pressure level of 45 dBA at the nearest adjacent residential property boundaries. Initial modeling results indicated that the noise emissions associated with the substation would exceed the

prescribed limit without proper consideration of mitigation strategies. Therefore, noise mitigation measures were considered for the major equipment noise sources. These strategies were adequate to reduce the noise emissions to sound pressure levels that comply with the prescribed limit.

5.3.1 Regulatory Compliance

The predicted substation noise emissions with mitigation are detailed in Figure 5-2. Figure 5-2 shows the predicted sound levels as noise contours plotted at 5 dB intervals. The 45-dBA noise contour is highlighted as a dotted line. As shown, the levels at the nearest residential boundaries, which correspond to the compliance boundaries, are below 45 dBA and thus comply with the prescribed limit.

As previously discussed, the Connecticut regulations require that the facility noise emissions not include prominent discrete tones. If such tones were to exist the Connecticut sound level limit would be reduced to 46 dBA. While the noise modeling results indicate no prominent discrete tones as defined by the regulations, the overall levels are below 46 dBA and compliant with the more restrictive tonal limit as is. During detailed design of the substation, proper consideration will be given to the transformer specifications and performance to ensure the tonal impacts are controlled.

5.3.2 Impact to Existing Ambient Sound Levels

The predicted substation sound levels are compared to the measured median background sound levels in Table 5-4. The future background sound levels include the measured background sound levels combined with the predicted substation sound levels. As listed in Table 5-4, the increases in the existing background sound level with the operation of the proposed substation range from 0 to 2 dB. As previously discussed, a 3 dB change is "just barely perceptible" to the average listener. Therefore, the increase due to the substation would be considered insignificant. It should be noted that this is based on the measured median background sound level and at certain times of the day the existing background sound level is higher than the median and therefore the increase due to the substation would be less than indicated in Table 5-4.

Table 5-4
Predicted Background Sound Level Increase due to the Facility with Mitigation

Nearby Residences	Direction from Facility Equipment	Representative Measurement Location	Measured Background Sound Level (median L_{90}), dBA	Predicted Facility Sound Level, dBA	Future Background Sound Level with Facility, dBA	Increase in Background Sound Level, dB
Wildflower Ln	SW	NML-1	47	45	49	2
1500 Huntington	N	NML-2	46	44	48	2
2911 Nichols Avenue	NE	NML-3	54	32	54	0

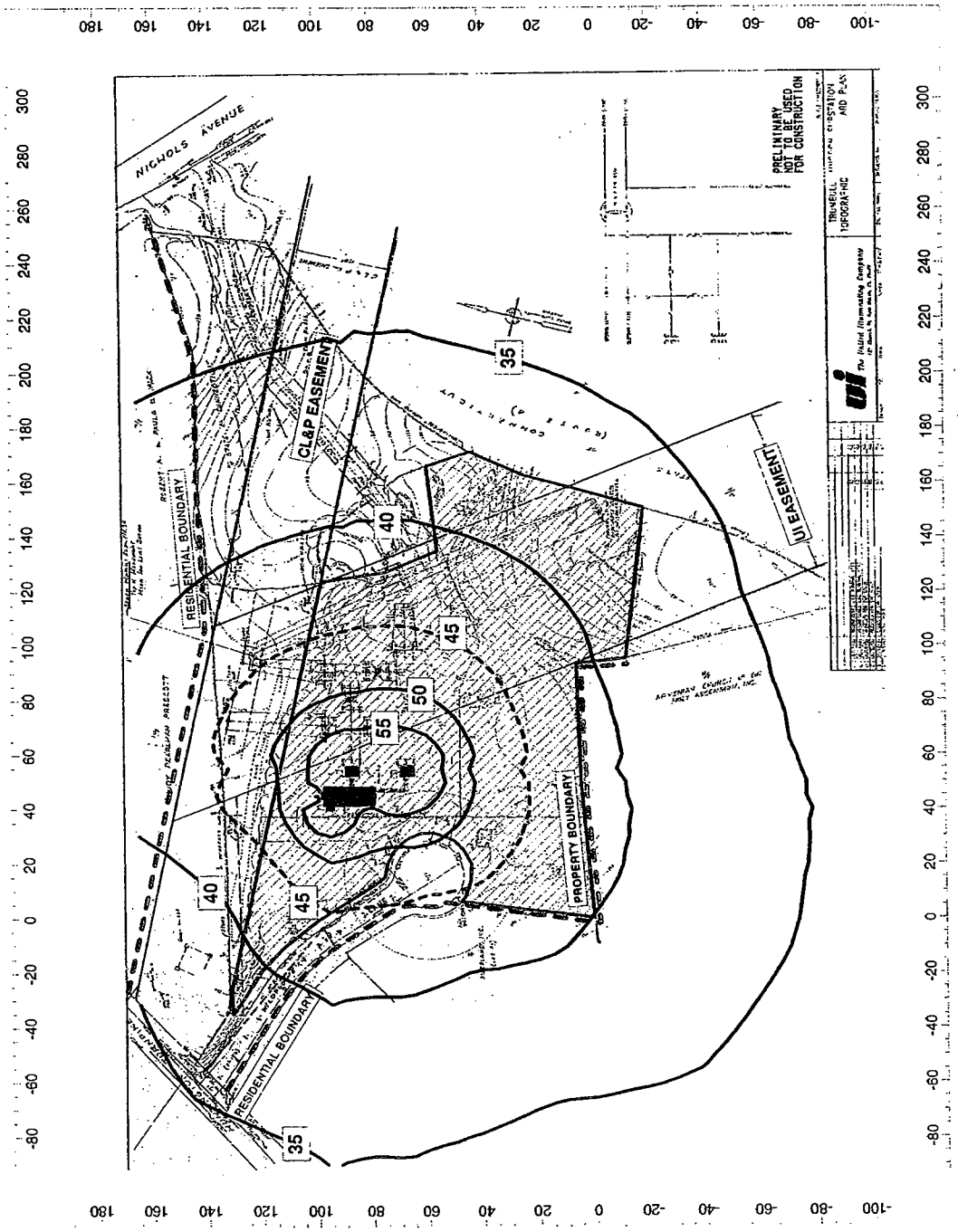


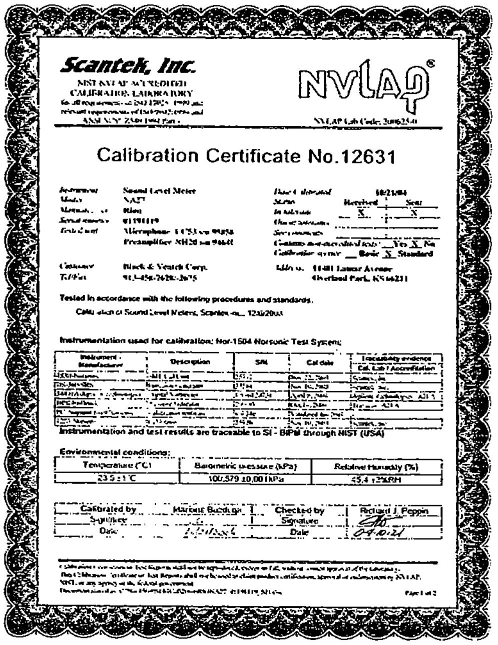
Figure 5-2. Predicted A-weighted sound pressure levels (re: 20e-6 Pa) during normal operation of the proposed substation.

6.0 Conclusions

In general, the existing ambient sound levels in the areas surrounding the proposed site are characteristic of urban areas and are influenced by noise sources such as local traffic, birds, insects, and nearby highway traffic. The ambient survey indicated that the hourly background sound levels (L_{90}) range from 36 dBA to 59 dBA. The existing background sound levels at the measurement locations are generally consistent with noisy urban residential areas.

The environmental noise emissions associated with the proposed substation have been predicted in order to evaluate compliance with applicable local noise regulations and the potential future noise impacts on the neighboring noise sensitive receptors. Appropriate mitigation measures will be installed. The substation noise emissions are anticipated to comply with the regulations. Additionally, the substation noise emissions are anticipated to not increase the existing background sound levels at the nearest residences except only very slightly (less than 2 dB) during the occasional quietest nighttime periods.

Appendix A



Scantek, Inc.
NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP

Calibration Certificate No.12631

Instrument: Sound Level Meter
Manufacturer: Rion
Customer: Black & Veatch Corp.
Date Calibrated: 10/21/04
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:

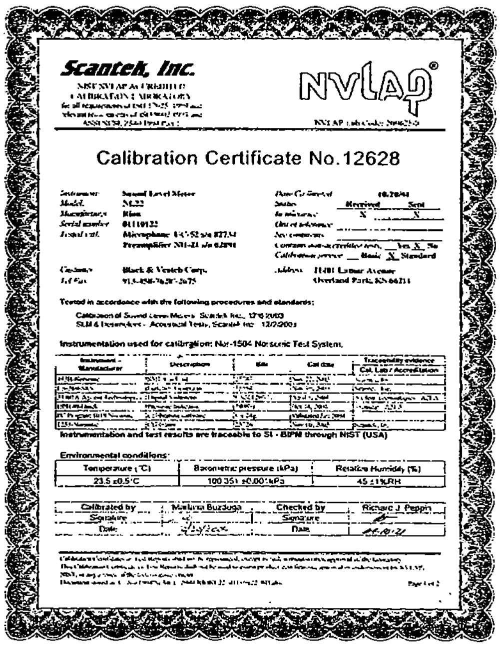
Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.5 ±1°C	100.579 ±0.001kPa	45.4 ±2%RH

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin



Scantek, Inc.
NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP

Calibration Certificate No.12628

Instrument: Sound Level Meter
Model: NL-22
Manufacturer: Rion
Customer: Black & Veatch Corp.
Date Calibrated: 10/20/04
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:

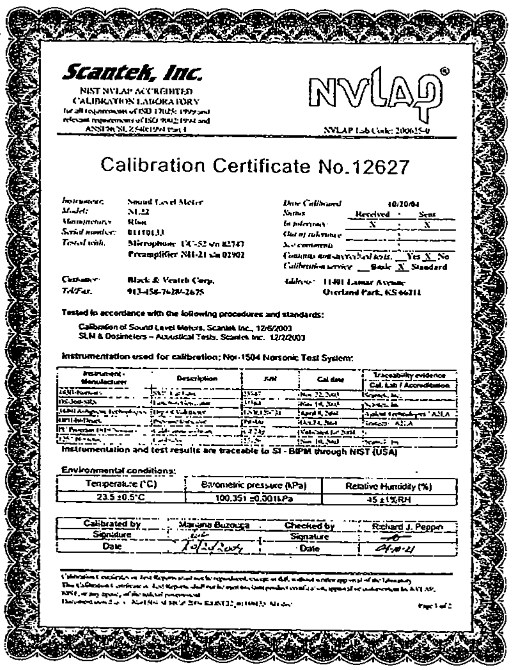
Instrumentation used for calibration: Nor-1504 Norsonic Test System.

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.5 ±0.5°C	100.351 ±0.001kPa	45 ±1%RH

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin



Scantek, Inc.
NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP Lab Code: 200625-0

Calibration Certificate No.12627

Instrument: Sound Level Meter
Model: NL-22
Manufacturer: Rion
Serial number: 01110133
Tested with: Microphone UC-52 s/n [illegible]; Preamplifier NH-21 s/n [illegible]
Date Calibrated: 10/20/04
Status: Received X, Sent X (In tolerance)
Contains non-accredited tests: ___ Yes X No
Calibration service: ___ Basic X Standard
Customer: Black & Veatch Corp.
Tel/Fax: 913-458-7628/-2675
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 12/6/2003
SLM & Dosimeters – Acoustical Tests, Scantek Inc. 12/2/2003

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrument - Manufacturer	Description	S/N	Cal date	Traceability evidence Cal. Lab / Accreditation
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

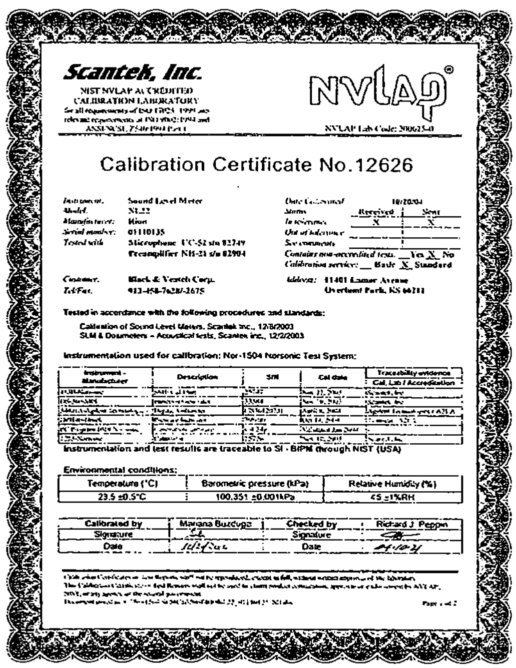
Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.5 ±0.5°C	100.351 ±0.001kPa	45 ±1%RH

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin
Signature		Signature	
Date		Date	

Page 1 of 2



Scantek, Inc.
NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP Lab Code: 200625-0

Calibration Certificate No.12626

Instrument: Sound Level Meter
Model: NL-22
Manufacturer: Rion
Serial number: 01110135
Date Calibrated: 10/20/04
Contains non-accredited tests: ___ Yes X No
Calibration service: ___ Basic X Standard
Customer: Black & Veatch Corp.
Tel/Fax: 913-458-7628/-2675
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:
Calibration of Sound Level Meters, Scantek Inc., 12/6/2003
SLM & Dosimeters – Acoustical Tests, Scantek Inc., 12/2/2003

Instrumentation used for calibration: Nor-1504 Norsonic Test System:

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Environmental conditions:

Temperature (°C)	Barometric pressure (kPa)	Relative Humidity (%)
23.5 ±0.5°C	100.351 ±0.001kPa	45 ±1%RH

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin
Signature		Signature	
Date		Date	

Scantek, Inc.

NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP

NVLAP Lab Code: 200625-0

Calibration Certificate No.12633

Instrument	Acoustical Calibrator	Date Calibrated	10/21/04
Model	1251	Status	Received: X / Sent: X (In tolerance)
Manufacturer	Norsonic	Out of tolerance	
Serial number	25762	See comments	
Class (IEC 60942)	1	Contains non-accredited tests	__ Yes X No
Barometer type			
Barometer s/n			

Customer: Black & Veatch Corp.
Tel/Fax: 913-458-7620/-2675
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc. 11/19/2003

Instrumentation used for calibration: Nor-1504 Norsonic Test System

Instrument - Manufacturer	Description	S/N	Cal. date	Traceability evidence Cal. Lab / Accreditation
4659-Norsonic	SME Cal Unit	25747	Nov 22, 2003	Scantek, Inc.
DS-360-SRS	Function Generator	33584	Nov 10, 2003	Scantek, Inc.
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Apr 8, 2004	Agilent Technologies / A2LA
DPI140-Druck	Pressure Indicator	790/03	Oct 14, 2004	Transcat / A2LA
840-Norsonic	Real Time Analyzer	18892	7/29/2004	Scantek, Inc.
PC Program 1018 Norsonic	Calibrator software	v.4.24g	Validated Jan 2004	-
1253-Norsonic	Calibrator	22909	Nov 16, 2003	Scantek, Inc.
1203-Norsonic	Preamplifier	14051	Aug 1, 2003	Scantek, Inc.
4134-Bruel&Kjaer	Microphone	173368	Nov 11, 2003	Scantek, Inc.

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin
Signature	[illegible]	Signature	[illegible]
Date	[illegible]	Date	04-11-31

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Report shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government. [illegible]

Page 1 of 2

Scantek, Inc.

NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP

NVLAP Lab Code: 200625-0

Calibration Certificate No.12632

Instrument	Microphone	Date Calibrated	10/21/04
Model	UC53A	Status	Received: X / Sent: X (In tolerance)
Manufacturer	Rion	Out of tolerance	
Serial number	96920	See comments	
		Contains non-accredited tests	__ Yes X No

Customer: Black & Veatch Corp.
Tel/Fax: 913-458-7628
Address: 11401 Lamar Avenue, Overland Park, KS 66211-1598

Tested in accordance with the following procedures and standards:
Procedure for Calibration of Measurement Microphones, Scantek Inc., 12/6/2003

Instrumentation used for calibration: N-1504B Norsonic Test System.

Instrument - Manufacturer	Description	S/N	Cal. date	Traceability evidence Cal. Lab / Accreditation
4658-Norsonic	SME Cal Unit	25747	Nov 22, 2003	Scantek, Inc.
DS-360-SRS	Function Generator	33584	Nov 10, 2003	Scantek, Inc.
34401A-Agilent Technologies	Digital Voltmeter	US36120731	Apr 8, 2004	Agilent Technologies / A2LA
DPI 140-Druck	Pressure Indicator	790/03	Oct 14, 2004	Transcat / A2LA
PC Program 1017 Norsonic	Calibration software	v.4.24c	Validated Jan 2004	-
1253-Norsonic	Calibrator	22909	Nov 16, 2003	Scantek, Inc.
1203-Norsonic	Preamplifier	14051	Aug 1, 2003	Scantek, Inc.
4134-Bruel&Kjaer	Microphone	173368	Nov 11, 2003	Scantek, Inc.
840-2 Norsonic	Real Time Analyzer	18892	July 29, 2004	Scantek, Inc.

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin
Signature	[illegible]	Signature	[illegible]
Date	[illegible]	Date	04-10-21

Calibration Certificates or Test Reports shall not be reproduced, except in full, without written approval of the laboratory. This Calibration Certificate or Test Report shall not be used to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the federal government. [illegible]

Page 1 of 2

Scantek, Inc.

NIST NVLAP ACCREDITED CALIBRATION LABORATORY

NVLAP

NVLAP Lab Code: 200625-0

Calibration Certificate No.12634

Instrument	Acoustical Calibrator	Date Calibrated	10/21/04
Model	NC-73	Status	Received: X / Sent: X (In tolerance)
Manufacturer	Rion	Out of tolerance	
Serial number	10527715	See comments	
Class (IEC 60942)	1	Contains non-accredited tests	__ Yes X No
Barometer type			
Barometer s/n			

Customer: Black & Veatch Corp.
Tel/Fax: 913-458-7620/-2675
Address: 11401 Lamar Avenue, Overland Park, KS 66211

Tested in accordance with the following procedures and standards:
Calibration of Acoustical Calibrators, Scantek Inc., 11/19/2003

Instrumentation used for calibration: Nor-1504 Norsonic Test System

Instrument - Manufacturer	Description	S/N	Cal. date	Traceability evidence Cal. Lab / Accreditation
4033-Norsonic	[illegible]	[illegible]	[illegible]	Scantek, Inc.
DS-360-SRS	Function Generator	[illegible]	[illegible]	Scantek, Inc.
34401A-Agilent Technologies	Digital Voltmeter	[illegible]	[illegible]	Agilent Technologies / A2LA
DPI140-Druck	Pressure Indicator	[illegible]	[illegible]	Transcat / A2LA
840-Norsonic	Real Time Analyzer	[illegible]	[illegible]	Scantek, Inc.
PC Program 1018 Norsonic	Calibrator software	v.4.24g	Validated Jan 2004	
1253-Norsonic	Calibrator	[illegible]	[illegible]	Scantek, Inc.
1203-Norsonic	Preamplifier	[illegible]	[illegible]	Scantek, Inc.
4134-Bruel&Kjaer	Microphone	[illegible]	[illegible]	Scantek, Inc.

Instrumentation and test results are traceable to SI - BIPM through NIST (USA)

Calibrated by	Mariana Buzduga	Checked by	Richard J. Peppin
Signature	[illegible]	Signature	[illegible]
Date	[illegible]	Date	[illegible]

[illegible]

Page 1 of 2

Appendix B

TRUMBULL SUBSTATION - Environmental Noise Assessment 2005
United Illuminating
B&V 141417

Ambient Sound Level Survey : NML-1

Address	Date	Time	Measurment Time	LAeq	LAE	LAmax	LAmin	LA01	LA10	LA50	LA90	LA95
1	5/4/2005	4:58 PM	1:00:00	50.6	86.2	76.5	45.0	59.4	51.7	48.0	46.6	46.3
2	5/4/2005	5:58 PM	1:00:00	49.5	85.1	71.2	44.0	56.3	50.2	48.3	46.9	46.5
3	5/4/2005	6:58 PM	1:00:00	49.1	84.7	61.1	45.2	53.7	50.5	48.6	47.2	46.8
4	5/4/2005	7:58 PM	1:00:00	50.4	86.0	64.2	46.0	55.3	51.7	49.9	48.5	48.1
5	5/4/2005	8:58 PM	1:00:00	50.7	86.3	63.1	46.8	55.2	52.3	50.1	48.5	48.0
6	5/4/2005	9:58 PM	1:00:00	48.7	84.3	60.9	41.0	55.5	50.2	47.9	45.7	44.8
7	5/4/2005	10:58 PM	1:00:00	47.8	83.4	59.2	41.9	52.6	49.8	47.2	44.7	44.0
8	5/4/2005	11:58 PM	1:00:00	49.3	84.9	75.3	40.9	56.4	50.7	46.8	44.3	43.7
9	5/5/2005	12:58 AM	1:00:00	45.4	81.0	52.7	38.4	50.2	47.9	44.7	41.5	40.7
10	5/5/2005	1:58 AM	1:00:00	45.1	80.7	56.2	32.8	51.6	48.5	43.5	39.1	37.9
11	5/5/2005	2:58 AM	1:00:00	43.1	78.7	53.3	31.4	50.4	46.3	41.3	36.9	35.7
12	5/5/2005	3:58 AM	1:00:00	46.7	82.3	62.2	33.0	54.2	49.5	44.8	40.3	39.1
13	5/5/2005	4:58 AM	1:00:00	52.4	88.0	62.0	45.0	56.5	54.3	52.1	49.6	48.7
14	5/5/2005	5:58 AM	1:00:00	55.4	91.0	60.5	51.4	58.2	56.9	55.2	53.5	53.0
15	5/5/2005	6:58 AM	1:00:00	51.9	87.5	60.3	48.9	55.1	53.1	51.6	50.4	50.1
16	5/5/2005	7:58 AM	1:00:00	51.5	87.1	65.4	46.3	60.7	52.1	50.1	48.6	48.1
17	5/5/2005	8:58 AM	1:00:00	50.7	86.3	67.7	43.1	60.9	51.1	48.6	46.7	46.1
18	5/5/2005	9:58 AM	1:00:00	47.2	82.8	62.8	41.6	53.9	48.9	46.3	44.1	43.5
19	5/5/2005	10:58 AM	1:00:00	51.3	86.9	74.0	43.2	56.8	53.1	49.8	46.9	46.3
20	5/5/2005	11:58 AM	1:00:00	52.9	88.5	62.6	48.7	57.2	54.4	52.4	50.7	50.3
21	5/5/2005	12:58 PM	1:00:00	52.9	88.5	62.3	47.2	57.0	54.6	52.5	50.5	50.0
22	5/5/2005	1:58 PM	1:00:00	53.6	89.2	67.9	48.3	58.9	55.1	53.1	51.2	50.8
23	5/5/2005	2:58 PM	1:00:00	55.4	91.0	82.5	48.4	63.9	55.5	53.2	51.5	50.9
24	5/5/2005	3:58 PM	1:00:00	54.5	90.1	60.9	51.0	58.1	55.9	54.2	52.8	52.5
							Minimum		46.3	41.3	36.9	
							Median		51.7	49.2	47.1	
							Maximum		56.9	55.2	53.5	

TRUMBULL SUBSTATION - Environmental Noise Assessment 2005
United Illuminating
B&V 141417

Ambient Sound Level Survey : NML-2

Address	Time	Time	Measurment Time	LAeq	LAE	LAmax	LAmin	LA01	LA10	LA50	LA90	LA95
1	5/4/2005	5:15 PM	1:00:00	53.1	88.7	73.2	41.5	60.2	56.8	50.1	45.6	44.9
2	5/4/2005	6:15 PM	1:00:00	52.6	88.2	65.0	44.4	59.8	56.3	49.8	46.4	45.8
3	5/4/2005	7:15 PM	1:00:00	52.0	87.6	70.9	42.7	60.3	55.4	47.6	44.7	44.2
4	5/4/2005	8:15 PM	1:00:00	51.6	87.2	62.7	44.4	59.3	55.7	48.4	46.0	45.6
5	5/4/2005	9:15 PM	1:00:00	51.3	86.9	65.3	44.1	59.8	55.0	48.1	45.7	45.2
6	5/4/2005	10:15 PM	1:00:00	46.5	82.1	61.6	39.5	56.4	48.7	43.7	41.3	40.9
7	5/4/2005	11:15 PM	1:00:00	46.4	82.0	60.9	38.9	56.8	48.7	43.1	41.3	40.8
8	5/5/2005	12:15 AM	1:00:00	45.4	81.0	63.0	38.0	56.6	46.4	42.2	40.3	39.9
9	5/5/2005	1:15 AM	1:00:00	43.9	79.5	63.4	35.0	54.5	45.1	40.9	38.3	37.8
10	5/5/2005	2:15 AM	1:00:00	41.2	76.8	60.2	30.2	51.3	42.5	38.7	35.5	34.6
11	5/5/2005	3:15 AM	1:00:00	42.3	77.9	60.8	31.7	53.4	43.0	39.0	35.7	34.6
12	5/5/2005	4:15 AM	1:00:00	50.4	86.0	63.1	35.0	59.7	55.6	43.7	40.0	39.0
13	5/5/2005	5:15 AM	1:00:00	52.6	88.2	61.6	46.9	59.4	55.6	51.0	48.9	48.4
14	5/5/2005	6:15 AM	1:00:00	54.0	89.6	64.9	47.9	61.1	57.1	52.1	50.4	49.8
15	5/5/2005	7:15 AM	1:00:00	53.6	89.2	63.8	42.7	60.0	57.4	51.1	46.9	46.0
16	5/5/2005	8:15 AM	1:00:00	54.3	89.9	68.3	41.7	63.8	57.3	51.7	45.4	44.3
17	5/5/2005	9:15 AM	1:00:00	52.5	88.1	75.8	40.2	60.1	55.3	48.3	43.7	42.9
18	5/5/2005	10:15 AM	1:00:00	50.4	86.0	63.8	38.7	58.6	54.5	46.8	42.2	41.5
19	5/5/2005	11:15 AM	1:00:00	52.3	87.9	73.3	42.1	58.9	55.4	50.2	45.2	44.3
20	5/5/2005	12:15 PM	1:00:00	52.5	88.1	63.0	44.9	58.3	55.5	51.0	48.4	47.7
21	5/5/2005	1:15 PM	1:00:00	51.9	87.5	65.7	44.8	58.0	54.8	50.2	47.6	47.0
22	5/5/2005	2:15 PM	1:00:00	53.6	89.2	71.3	45.0	60.2	56.0	51.9	48.8	48.1
23	5/5/2005	3:15 PM	1:00:00	53.2	88.8	66.9	46.0	59.5	55.8	51.8	49.4	48.7
24	5/5/2005	4:15 PM	1:00:00	53.5	89.1	60.9	47.1	59.1	56.4	52.3	49.7	49.1
							Minimum		42.5	38.7	35.5	
							Median		55.5	49.1	45.5	
							Maximum		57.4	52.3	50.4	

TRUMBULL SUBSTATION - Environmental Noise Assessment 2005
United Illuminating
B&V 141417

Ambient Sound Level Survey : NML-3

Address	Time	Time	Measurment Time	LAeq	LAE	LAmax	LAmin	LA01	LA10	LA50	LA90	LA95
1	5/4/2005	5:37 PM	1:00:00	58.4	94.0	72.4	49.6	64.6	60.8	57.5	54.0	53.2
2	5/4/2005	6:37 PM	1:00:00	58.0	93.6	70.2	49.7	65.0	60.4	57.0	53.4	52.6
3	5/4/2005	7:37 PM	1:00:00	59.5	95.1	86.7	49.0	66.4	60.9	57.3	53.9	53.2
4	5/4/2005	8:37 PM	1:00:00	57.8	93.4	71.9	48.2	64.7	60.1	56.4	53.5	52.8
5	5/4/2005	9:37 PM	1:00:00	59.1	94.7	83.9	46.4	68.5	59.1	54.9	50.5	49.3
6	5/4/2005	10:37 PM	1:00:00	54.5	90.1	72.5	41.9	62.8	56.9	52.5	48.5	47.0
7	5/4/2005	11:37 PM	1:00:00	54.1	89.7	75.4	42.7	62.2	56.0	51.4	47.1	46.1
8	5/5/2005	12:37 AM	1:00:00	51.6	87.2	72.7	41.0	59.6	54.1	49.7	45.0	44.1
9	5/5/2005	1:37 AM	1:00:00	50.9	86.5	65.8	35.6	60.9	53.9	47.6	42.1	40.9
10	5/5/2005	2:37 AM	1:00:00	48.5	84.1	62.2	33.0	57.6	52.2	45.1	38.6	37.2
11	5/5/2005	3:37 AM	1:00:00	49.6	85.2	62.7	35.8	59.2	52.9	46.6	41.5	39.9
12	5/5/2005	4:37 AM	1:00:00	55.4	91.0	65.5	41.8	61.9	58.6	54.1	48.8	47.1
13	5/5/2005	5:37 AM	1:00:00	60.0	95.6	77.1	51.3	66.3	62.3	58.9	55.3	54.5
14	5/5/2005	6:37 AM	1:00:00	60.5	96.1	69.3	53.2	65.9	62.7	59.8	56.8	56.1
15	5/5/2005	7:37 AM	1:00:00	60.1	95.7	72.1	52.1	65.9	62.3	59.2	55.8	55.1
16	5/5/2005	8:37 AM	1:00:00	60.4	96.0	80.2	52.4	68.6	62.2	58.7	55.8	55.0
17	5/5/2005	9:37 AM	1:00:00	58.2	93.8	75.2	45.7	66.5	60.6	56.4	52.0	50.8
18	5/5/2005	10:37 AM	1:00:00	58.7	94.3	72.8	47.2	66.5	61.3	57.2	52.7	51.5
19	5/5/2005	11:37 AM	1:00:00	60.3	95.9	75.0	53.1	67.0	62.3	59.3	56.8	56.1
20	5/5/2005	12:37 PM	1:00:00	60.1	95.7	70.9	53.8	65.4	62.2	59.5	56.9	56.2
21	5/5/2005	1:37 PM	1:00:00	62.8	98.4	86.8	54.0	69.8	63.0	59.8	57.1	56.3
22	5/5/2005	2:37 PM	1:00:00	60.6	96.2	74.3	54.9	65.8	62.2	59.9	57.8	57.3
23	5/5/2005	3:37 PM	1:00:00	61.1	96.7	77.8	54.3	66.7	62.6	60.3	58.1	57.4
24	5/5/2005	4:37 PM	1:00:00	62.0	97.6	75.9	56.6	68.0	63.5	61.3	59.1	58.6
							Minimum		52.2	45.1	38.6	
							Median		60.9	57.3	53.7	
							Maximum		63.5	61.3	59.1	

Appendix C

TRUMBULL SUBSTATION
EA Noise 2005
United Illuminating
B&V 141417

Ambient Sound Level Survey

Description of the Site:	NML-3					NML-1					NML-2					NML-1					NML-2					NML-3				
Address In Meter:	1					2					3					4					5					6				
Date:	Wednesday, May 04, 2005					Wednesday, May 04, 2005					Wednesday, May 04, 2005					Thursday, May 05, 2005					Thursday, May 05, 2005					Thursday, May 05, 2005				
Start Time:	5:29 PM					5:58 PM					6:21 PM					12:19 AM					12:44 AM					1:12 AM				
Duration:	1200 sec					1200 sec					1200 sec					1200 sec					1200 sec					1200 sec				
Time Constant:	Slow					Slow					Slow					Slow					Slow					Slow				
Weighting:	Flat					Flat					Flat					Flat					Flat					Flat				
Sub Time Constant:	Slow					Slow					Slow					Slow					Slow					Slow				
Sub Weighting:	A					A					A					A					A					A				
	Lmax	Leq	L10	L50	L90	Leq	L1	L10	L50	L90	Leq	L1	L10	L50	L90	Leq	L1	L10	L50	L90	Leq	L1	L10	L50	L90	Leq	L1	L10	L50	L90
Main	88.5	74.3	78.5	72	69.3	67.6	79.9	67.5	63.9	62.6	83.5	73.5	64.8	61.9	60.2	60.3	71	62.9	57.6	55.1	56.2	64.7	56.5	53.2	51.9	60.7	69.6	63.9	56.1	55.1
Sub	78.6	62.6	65.5	61.4	56.5	48.9	55	50	46.5	46.9	50.3	60.7	52.7	46.2	44	47.8	54.8	50.1	46.7	44.5	42.4	54	41.8	39.5	38.2	51.8	61.4	55.1	49.5	45.2
Calculated Octaves																														
16 Hz	56.6	62.7	62.9	59.3	56.8	59.2	71.5	59.8	56.1	53.9	56.0	62.0	58.2	55.1	52.6	53.9	67.7	53.9	48.6	45.8	49.9	55.6	49.3	46.3	44.0	51.3	58.9	53.3	48.4	45.7
31 Hz	60.1	66.3	68.2	64.0	61.0	58.7	66.8	60.3	57.9	56.2	56.5	62.5	58.7	55.8	53.4	52.9	63.5	54.6	50.4	47.5	49.3	57.0	51.0	47.4	45.2	52.8	61.2	55.9	50.4	47.4
63 Hz	66.9	70.0	72.0	66.6	63.0	59.8	68.0	61.8	58.5	56.4	56.5	63.2	59.1	55.3	52.9	54.7	66.7	56.0	50.1	46.9	49.6	61.1	50.7	46.1	43.7	54.8	64.8	56.0	51.1	47.2
125 Hz	69.5	68.4	70.3	64.4	60.0	54.5	65.2	56.6	52.2	50.0	57.1	70.4	55.5	50.2	47.2	51.6	63.3	54.0	47.4	42.9	48.3	58.0	47.1	41.4	39.1	55.1	65.2	57.1	49.3	44.8
250 Hz	67.8	60.1	62.9	58.1	53.3	47.2	58.2	47.8	43.2	41.0	50.5	60.7	49.4	42.5	39.3	45.7	55.5	47.4	41.8	38.5	39.5	48.5	37.6	34.7	33.0	47.2	58.9	50.5	41.8	37.4
500 Hz	59.9	58.0	59.8	55.6	49.9	45.1	51.9	46.7	44.5	41.8	45.5	55.5	47.6	41.6	39.1	45.0	54.2	47.3	42.8	40.3	37.5	47.8	37.0	34.7	33.4	45.9	55.1	48.8	43.4	39.7
1 kHz	61.5	58.5	61.6	57.6	52.7	45.9	48.7	47.4	45.9	43.5	46.6	56.8	49.5	42.7	40.7	44.9	51.1	47.2	44.2	41.8	39.8	50.1	39.7	37.5	36.1	49.3	57.9	52.8	47.3	42.4
2 kHz	59.7	55.2	58.5	54.1	47.8	37.6	43.8	39.7	38.8	34.7	40.7	51.5	44.2	34.2	30.7	36.1	43.1	38.5	35.0	32.1	33.0	45.3	31.3	27.7	25.8	43.5	54.3	46.8	40.1	33.4
4 kHz	53.3	47.7	51.1	46.8	39.1	28.6	38.9	31.8	25.3	21.2	35.3	44.9	39.4	30.6	22.2	23.5	34.5	25.1	18.0	15.9	22.5	36.1	18.0	14.9	14.9	33.4	46.3	35.9	23.0	17.1
8 kHz	44.5	37.8	41.1	36.7	28.4	22.3	32.2	24.9	17.4	15.2	25.7	38.2	28.4	17.6	15.1	18.6	30.3	19.2	15.3	14.9	16.6	27.9	15.3	14.9	14.9	21.6	34.3	23.4	14.9	14.9
Frequency																														
12.5 Hz	48.5	54.3	55.7	52.6	50.1	54.1	66.9	53.5	49.9	47.5	50.2	55.0	52.3	49.4	47.0	49.7	64.5	47.6	42.6	39.8	45.1	48.8	43.6	40.8	38.3	45.2	51.5	47.1	42.9	40.1
16 Hz	52.2	55.5	57.7	54.7	52.2	54.8	67.3	55.0	51.7	49.3	51.3	56.9	53.6	50.7	48.2	48.5	61.5	49.0	43.7	41.0	45.1	49.4	44.4	41.3	39.0	47.2	53.9	48.5	43.4	40.6
20 Hz	53.5	61.0	59.9	55.8	53.3	54.5	65.7	56.1	52.2	50.2	51.9	59.0	54.1	50.8	48.3	49.2	62.1	50.4	44.7	42.1	45.3	53.0	45.3	42.4	40.2	47.0	56.0	49.7	44.4	41.8
25 Hz	54.0	62.6	63.2	58.7	55.7	54.6	63.2	56.0	53.5	51.6	52.1	57.1	54.2	51.5	49.1	49.3	61.0	50.2	46.7	43.8	46.2	53.8	47.6	44.0	41.9	47.3	55.0	50.2	45.6	42.7
31.5 Hz	54.9	60.5	63.6	59.2	56.1	53.6	60.0	55.1	53.1	51.4	51.8	58.1	54.1	50.7	48.6	48.0	57.3	49.9	45.2	42.5	44.0	51.6	45.8	42.3	40.0	48.0	55.5	51.3	45.7	42.7
40 Hz	58.6	61.2	63.5	59.8	56.8	53.5	58.3	55.4	52.9	51.2	51.4	57.9	53.6	50.3	48.0	48.9	56.6	49.2	44.7	42.0	42.8	50.9	44.8	41.2	39.8	48.8	58.1	51.7	45.7	42.4
50 Hz	78.5	63.2	65.4	61.4	58.3	55.1	63.1	57.0	54.0	52.0	52.1	58.4	54.3	51.2	48.8	48.5	59.3	50.8	45.1	41.8	44.3	56.6	44.9	40.6	38.3	49.0	58.5	52.1	45.3	41.8
63 Hz	86.2	65.9	67.1	61.4	57.7	55.3	64.2	57.1	53.6	51.4	50.8	57.4	53.3	49.7	47.6	51.1	64.5	51.4	45.2	42.1	45.7	57.9	46.0	41.3	39.2	49.6	59.6	52.5	45.9	42.4
80 Hz	83.6	66.1	68.5	62.5	58.5	54.8	62.2	57.1	53.6	51.5	52.2	59.4	55.1	50.6	47.9	49.7	59.9	51.4	45.8	42.4	44.4	53.4	46.8	41.9	39.1	51.2	61.5	54.6	47.5	42.9
100 Hz	69.9	65.7	67.3	61.5	57.3	52.0	59.6	54.8	50.6	48.3	51.5	62.9	52.9	47.7	45.1	48.4	58.7	51.2	44.7	40.1	44.2	54.4	45.6	39.6	37.1	50.5	61.4	53.7	46.3	41.7
125 Hz	60.4	63.4	66.0	59.5	54.9	49.5	62.1	50.6	45.9	43.7	55.0	69.0	50.4	45.0	41.6	45.9	56.9	49.0	42.6	38.2	45.4	54.8	40.4	35.0	33.1	51.7	60.7	52.9	44.1	40.3
160 Hz	68.4	59.8	61.5	56.3	51.9	45.7	58.8	46.5	41.1	39.0	47.6	60.3	47.1	41.6	37.6	45.7	59.6	46.0	38.8	34.5	38.1	47.1	36.3	31.9	29.7	47.9	58.8	49.0	42.3	37.0
200 Hz	65.9	56.8	59.5	54.5	50.1	41.9	51.7	44.1	38.8	36.8	48.0	58.4	45.3	39.0	35.2	42.7	52.9	43.2	37.1	33.6	35.9	44.6	34.4	30.9	29.1	44.0	56.9	46.0	38.4	34.2
250 Hz	61.0	55.2	58.0	53.5	48.6	43.8	55.8	42.2	38.1	36.0	44.9	55.2	44.7	37.5	34.6	39.1	48.1	41.9	36.7	33.8	34.6	44.1	32.3	29.8	27.9	42.1	52.6	46.5	36.0	31.9
315 Hz	59.2	53.4	56.2	51.5	48.0	41.3	51.2	42.6	38.4	35.9	42.3	51.9	43.7	36.4	33.5	40.3	49.9	42.8	37.3	34.1	33.3	42.1	31.3	28.9	27.5	40.3	50.3	44.3	35.4	31.3
400 Hz	58.0	53.8	55.2	50.8	44.8	40.1	47.9	41.9	38.9	36.1	39.9	49.8	42.0	36.2	33.2	39.9	48.8	42.6	37.3	34.5	32.1	42.6	31.0	28.6	27.4	39.1	48.8	42.1	36.2	32.5
500 Hz	54.5	53.9	55.1	51.0	44.9	40.1	46.7	41.6	39.7	36.9	40.6	50.0	42.9	36.8	34.0	40.6	50.7	42.8	37.9	35.5	32.5	43.2	32.5	30.0	28.5	41.2	49.8	44.1	39.2	35.7
630 Hz	54.8	51.8	54.9	50.8	45.7	40.7	46.6	42.2	40.4	38.0	41.6	52.0	43.5	37.4	35.4	40.2	48.4	42.2	38.8	36.4	33.5	43.3	33.0	31.0	29.6	42.4	51.9	45.4	39.8	35.9
800 Hz	55.8	53.3	56.3	52.4	47.8	41.8	44.7	43.4	41.8	39.4	42.1	52.0	44.7	38.8	36.9	41.0	47.6	43.1	40.2	38.0	34.9	44.7	35.2	33.2	31.8	44.6	53.4	48.0	42.4	38.0
1 kHz	57.1	54.4	57.5	53.5	48.6	41.8	44.5	43.4	41.8	39.4	42.2	52.3	45.1	38.5	36.5	40.7	46.6	43.1	40.1	37.6	35.7	45.6	35.7	33.6	32.3	45.2	53.4	48.7	43.3	38.4
1.25 kHz	57.3	53.5	56.7	52.4	47.2	39.2	42.1	40.7	39.2	36.9	41.1	51.8	44.4	35.8	33.6	38.2	44.2	40.6	37.5	35.1	34.4	45.6	33.5	31.0	29.4	43.7	52.4	47.3	41.8	36.1
1.6 kHz	55.9	52.2	55.4	51.1	45.4	35.4	38.5	37.1	35.2	33.1	38.3	49.0	41.9	31.9	29.3	34.6	41.0	37.0	33.7	31.0	31.0	42.8	29.8	26.6	24.7	41.3	51.4	44.7	38.5	32.2
2 kHz	55.0	50.0	53.4	48.8	42.2	30.7	35.0	32.8	30.2	28.3	34.6	45.9	38.1	27.1	23.2	29.6	37.3	32.1	28.2	25.0	27.1	40.1	25.0	20.5	18.2	37.9	49.5	41.0	34.1	26.5
2.5 kHz	53.6	48.2	51.5	47.1	39.8	30.7	41.3	33.5	26.7	23.5	33.2	43.5	36.4	27.4	20.1	24.6	33.5	27.2	21.7	18.1	23.4	36.9	19.5	13.7	11.9	34.5	46.3	37.4	28.1	20.0
3.15 kHz	50.0	45.3	48.7	44.4	36.9	26.1	35.6	29.1	23.2	19.3	32.7	41.4	36.5	28.6	19.8	20.3	30.6	22.4	15.6	12.3	19.7	33.6	15.2	10.1	10.1	31.2	43.7	33.9	21.7	14.2
4 kHz	46.4	42.2	45.6	41.3	33.7	24.2	35.3	27.0	19.6	15.1	30.7	41.2	35.0	25.2	17.3	18.4	29.6	19.5	12.3	10.8	17.2	30.6	12.7	10.1	10.1	28.0	41.4	30.2	15.6	11.6
5 kHz	48.6	39.0	42.3	38.0	29.9	19.7	28.8	22.7	15.8	11.8	25.9	38.3	30.1	19.3	12.7	16.8	28.7	17.7	10.1	10.1	14.8	28.3	10.6	10.1	10.1	23.9	37.4	26.0	11.6	10.1
6.3 kHz	43.2	35.7	39.1	34.8	26.4	18.4	28.4	21.5	13.4	10.1	23.4	36.0	26.3	14.3	10.3	14.6	26.8	15.6	10.1	10.1	12.5	25.7	10.1	10.1	10.1	19.5	32.5	21.5	10.1	10.1
8 kHz	37.3	32.2	35.5	30.9	22.5	18.2	28.4	20.4	13.1	11.0	20.7	33.3	23.4	12.6	10.6	13.7	25.5	14.5	10.1	10.1	11.8	22.2	10.1	10.1	10.1	15.9	28.3	17.5	10.1	10.1
10 kHz	33.3	27.8	31.1	26.6	18.5	15.2	24.4	17.4	11.2	10.1	15.4	26.4	16.8	11.0	10.1	13.1	23.7	12.8	11.4	10.3	11.0	18.9	11.4	10.1	10.1	12.3	23.8	13.2	10.1	10.1
12.5 kHz	28.3	23.2	26.4	21.7	15.3	13.9	22.2	14.8	11.2	10.6	13.7	24.6	13.6	10.8	10.3	10.8	20.7	11.0	10.1	10.1	12.3	15.9	12.7	12.1	11.4	10.6	17.7	10.8	10.1	10.1

TRUMBULL SUBSTATION
EA Noise 2005
United Illuminating
B&V 141417

Ambient Sound Level Survey

Description of the Site:	NML-1	NML-2	NML-3
Address in Meter:	7	8	9
Date:	Thursday, May 05, 2005	Thursday, May 05, 2005	Thursday, May 05, 2005
Start Time:	11:12 AM	11:40 AM	12:07 PM
Duration:	1200 sec	1200 sec	1200 sec
Time Constant:	Slow	Slow	Slow
Weighting:	Flat	Flat	Flat
Sub Time Constant:	Slow	Slow	Slow
Sub Weighting:	A	A	A

	NML-1 Leq	NML-1 L1	NML-1 L10	NML-1 L50	NML-1 L90	NML-2 Leq	NML-2 L1	NML-2 L10	NML-2 L50	NML-2 L90	NML-3 Leq	NML-3 L1	NML-3 L10	NML-3 L50	NML-3 L90
Main	65.8	71.1	68.2	65.2	62.8	66.3	74.8	68.6	64.7	62.3	73.2	81	76	71.6	68.7
Sub	50	55.6	51.9	49	47.2	52.1	60.5	55.2	49.9	47.1	61	65.3	63.4	60.5	57.7
Calculated Octaves															
16 Hz	58.8	65.6	61.4	57.7	54.9	58.8	67.2	61.4	57.1	54.2	62.6	71.0	65.3	60.8	57.2
31 Hz	60.6	68.5	62.5	59.1	56.2	58.4	65.0	60.6	57.3	54.6	64.9	70.9	67.7	63.8	61.0
63 Hz	60.5	70.2	62.9	58.2	55.6	58.8	68.3	60.8	56.7	53.9	68.4	78.2	71.4	65.3	61.6
125 Hz	53.9	61.8	56.4	52.3	49.7	58.4	70.2	60.0	53.9	50.6	67.1	77.8	69.9	63.2	59.2
250 Hz	47.7	57.8	50.6	44.5	42.0	48.8	57.4	50.6	45.5	42.2	57.8	66.6	60.3	56.2	52.1
500 Hz	47.4	55.6	49.8	45.5	43.4	47.0	55.1	49.7	44.7	41.7	55.9	61.8	58.4	54.9	51.5
1 kHz	46.6	52.1	48.9	45.8	43.7	49.1	57.3	52.4	46.9	44.1	58.2	62.4	60.5	57.7	55.0
2 kHz	39.6	47.0	43.4	37.2	33.7	42.6	52.7	46.3	38.3	34.3	51.9	57.9	54.5	51.2	47.7
4 kHz	24.4	32.7	27.6	22.4	18.7	35.1	44.7	38.5	31.6	23.5	42.2	49.7	45.1	41.1	34.8
8 kHz	18.0	25.3	16.8	15.0	14.9	27.9	37.4	32.1	23.6	15.6	33.4	42.3	34.8	29.9	23.2
Frequency															
12.5 Hz	52.3	57.9	54.8	51.6	48.8	53.4	62.0	55.7	51.7	48.7	56.9	66.7	59.3	54.2	50.8
16 Hz	54.1	60.0	56.6	53.2	50.6	54.5	63.5	56.9	52.7	49.9	58.2	66.9	60.9	56.2	52.8
20 Hz	55.2	63.0	58.0	53.6	50.8	54.1	61.4	57.2	52.5	49.7	58.3	64.6	61.2	57.1	53.4
25 Hz	54.8	60.9	57.2	54.1	51.0	54.3	61.1	56.7	53.3	50.7	59.6	65.4	62.6	58.6	55.8
31.5 Hz	56.8	66.0	57.9	54.8	51.8	53.2	59.5	55.2	52.3	49.7	59.8	65.7	62.4	58.8	56.2
40 Hz	55.5	62.6	57.9	54.0	51.4	53.2	59.8	55.5	51.8	48.9	60.6	67.0	63.8	59.7	56.6
50 Hz	55.4	64.5	57.4	53.7	50.9	53.5	60.9	55.8	52.3	49.7	62.2	71.4	64.8	59.8	56.5
63 Hz	55.7	65.7	58.2	53.3	50.7	54.5	65.8	55.9	51.3	48.6	63.2	72.9	66.3	60.3	56.6
80 Hz	56.1	65.9	58.6	53.4	50.8	53.9	62.4	56.4	52.2	49.0	64.9	75.2	68.1	61.4	57.3
100 Hz	51.6	58.5	53.9	50.6	47.9	53.6	61.4	55.7	51.8	48.7	64.9	76.0	67.7	60.4	56.4
125 Hz	47.6	55.2	50.4	45.9	43.5	56.1	69.3	57.3	48.1	44.6	60.9	71.1	63.7	57.9	53.8
160 Hz	46.1	56.8	48.9	42.5	39.9	47.9	58.1	50.1	44.7	40.5	58.8	68.8	61.7	55.5	51.9
200 Hz	44.1	55.4	46.6	40.0	37.5	45.7	54.2	47.3	42.3	39.0	55.1	64.5	57.4	53.1	49.4
250 Hz	42.6	52.1	46.2	39.3	37.0	43.9	52.5	45.2	40.1	36.7	52.5	60.7	55.3	51.1	46.8
315 Hz	41.8	49.7	44.4	39.9	37.3	41.6	50.5	44.5	39.1	35.8	50.2	57.4	52.9	49.1	44.5
400 Hz	41.8	50.3	44.3	39.8	37.8	40.8	48.7	43.6	38.4	35.3	49.6	56.3	52.2	48.7	44.3
500 Hz	43.1	50.8	45.5	41.0	36.8	42.0	49.9	44.8	39.8	36.6	51.1	57.3	53.6	50.0	46.4
630 Hz	42.9	51.3	45.2	41.2	39.3	43.4	51.9	46.1	41.1	38.3	52.2	57.4	54.8	51.4	48.4
800 Hz	43.0	49.3	45.3	42.0	40.2	44.8	53.0	47.7	42.7	39.9	53.7	58.2	56.1	53.2	50.3
1 kHz	42.3	47.2	44.6	41.6	39.4	45.0	53.0	48.4	42.9	40.2	54.0	58.1	56.3	53.6	50.9
1.25 kHz	39.4	43.9	41.9	38.7	36.4	43.0	51.5	46.6	40.3	37.4	52.3	56.4	54.6	51.9	49.3
1.6 kHz	35.1	39.4	37.8	34.3	32.0	39.8	48.9	43.7	36.2	32.9	49.6	54.4	52.1	49.0	45.8
2 kHz	29.8	34.0	32.1	29.4	27.1	36.3	45.6	40.3	31.2	27.1	46.3	52.8	49.0	45.6	41.7
2.5 kHz	36.9	45.9	41.6	32.3	23.8	36.5	48.7	39.3	31.2	23.6	43.5	51.9	46.1	42.3	37.4
3.15 kHz	22.9	30.2	26.2	21.3	17.1	31.9	40.5	35.4	28.8	21.5	40.0	47.5	42.8	39.0	33.0
4 kHz	17.6	27.4	20.8	13.9	11.2	30.9	41.7	33.9	26.4	17.6	36.5	43.5	39.4	35.4	28.7
5 kHz	14.1	24.3	15.6	11.2	10.1	26.9	35.6	30.5	23.8	14.1	33.4	41.8	36.4	32.0	24.7
6.3 kHz	15.9	23.1	13.4	10.6	10.1	28.9	35.8	31.3	22.6	12.1	29.9	38.4	32.8	28.1	21.1
8 kHz	11.0	19.5	11.4	10.1	10.1	19.6	30.8	22.7	14.9	10.1	28.0	38.0	29.1	24.0	17.4
10 kHz	10.5	16.3	11.0	10.1	10.1	16.0	27.1	18.4	11.9	10.1	27.6	35.7	25.0	19.6	13.9
12.5 kHz	11.2	14.1	11.8	11.0	10.8	16.6	26.4	16.3	11.8	10.6	17.8	27.4	20.0	15.4	12.3