APPENDIX L – SOUND SURVEY AND ANALYSIS REPORT

Sound Survey and Analysis Report

Killingly Energy Center

June 2016

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TETRA TECH

Killingly Energy Center
an NTE Energy Project

EXECUTIVE SUMMARY

NTE Connecticut, LLC (NTE) is proposing construction of the Killingly Energy Center (KEC) a 550-megawat (MW) combined cycle electric generating facility located at 180 and 189 Lake Road in Killingly, Connecticut. KEC is located in the westernmost portion of an area designated for future industrial development by the Town of Killingly.

This assessment examines the surroundings and presents information regarding acoustical metrics and the level of typical sources. Against that background, specific locations are described that have been selected to represent the ambient acoustic conditions in various directions around the KEC site. Sound levels measured during both daytime and nighttime periods are consistent with levels experienced in a quiet rural residential setting with light automobile traffic, with measured values higher in proximity to Lake Road and lower in locations further north. State of Connecticut and Town of Killingly regulations require that KEC meet stringent sound limits at its boundaries, with levels not to exceed 51 A-weighted decibels (dBA) required during nighttime hours, which is similar to a quiet office space or the sound generated from the water flow of a medium sized creek (Noise Navigator Sound Level Database 2015).

KEC has integrated low-noise features into its layout and design in order to meet the stringent state and local requirements. These features include: positioning louder equipment (such as the air-cooled condenser fans) towards the middle of the site; the use of enclosures around major equipment (for example, the combustion turbine and steam turbine); and incorporation of mitigation measures (such as acoustically treated equipment enclosures, acoustic silencers, sound walls or barriers, and specifying low-noise equipment). Although the specific noise control measures will be refined as KEC moves towards final design and construction, this analysis demonstrates that measures can be incorporated that will enable KEC to comply with all applicable noise requirements.

Given the existing levels of sound in the environment, the addition of KEC's normal operation will result in an increase of less than 10 dBA during the daytime period at the closest sensitive receptor (a residence approximately 260 feet from KEC), with sound continuing to attenuate significantly with distance. At locations near Alexander Lake, sound from KEC would be less than 30 dBA, which would not result in a perceptible difference in the overall sound level. Furthermore, during nighttime hours residents tend to be indoors; therefore, they would experience additional sound reduction from their home's walls. Typical residential construction provides approximately 15 to 20 decibels of additional noise reduction with windows closed and approximately 10 dB of additional noise reduction with windows in an open position (Harris 1998).

Nighttime sound associated with KEC will not only comply with the required 51 dBA at the property boundary but, due to noise attenuation of residential construction, will result in an interior noise level at the nearest residence ranging from 31 dBA to 36 dBA. This is well within the range of typical interior noise levels in bedrooms where people are sleeping, which is 30 dBA to 40 dBA (Harris 1998).

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
°F	degrees Fahrenheit
µPa	microPascal
ACC	air-cooled condenser
ANSI	American National Standards Institute
CTG	combustion turbine generator
dB	decibels
dBA	A-weighted decibels
dBL	linear decibel
DEEP	Connecticut Department of Energy and Environmental Protection
Generating Facility Site	63-acre property, located north of Lake Road, proposed for the generating equipment associated with the Killingly Energy Center
HRSG	heat recovery steam generator
Hz	Hertz
I-395	Interstate 395
ISO	International Organization for Standardization
KEC	Killingly Energy Center
kV	kilovolt
L_{eq}	equivalent sound level
L_p	sound pressure level (measured in dB referenced to 20 µPa)
LT	long-term monitoring location
L_W	sound power level
mph	miles per hour
MW	megawatts
NTE	NTE Connecticut, LLC
the Project Site	a 73-acre property on Lake Road in Killingly, Windham County, Connecticut
R.C.S.A.	Regulations of Connecticut State Agencies
ROW	right-of-way
ST	short-term monitoring location
STC	Sound Transmission Class
STG	steam turbine generator
Switchyard Site	10-acre property, located south of Lake Road, proposed for the utility switchyard associated with the Killingly Energy Center
Tetra Tech	Tetra Tech, Inc.

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this sound survey and analysis for the proposed Killingly Energy Center (KEC). NTE Connecticut, LLC (NTE) is proposing construction of KEC, a 550-megawatt (MW) combined cycle electric generating facility located on a 73-acre parcel located at 180 and 189 Lake Road in Killingly, Windham County, Connecticut (the Project Site), as shown on Figure 1.

As a combined cycle electric generating facility, the exhaust heat produced by KEC's combustion turbine generator (CTG) will be redirected and used in the heat recovery steam generator (HRSG) to produce steam to generate additional electricity in the steam turbine generator (STG). As shown on Figure 2, KEC is arranged in a 1x1 configuration. The CTG and the STG will be located in two separate acoustically treated enclosures, both of which will also be contained within a building. An air-cooled condenser (ACC) will be located north of the CTG and STG enclosures.

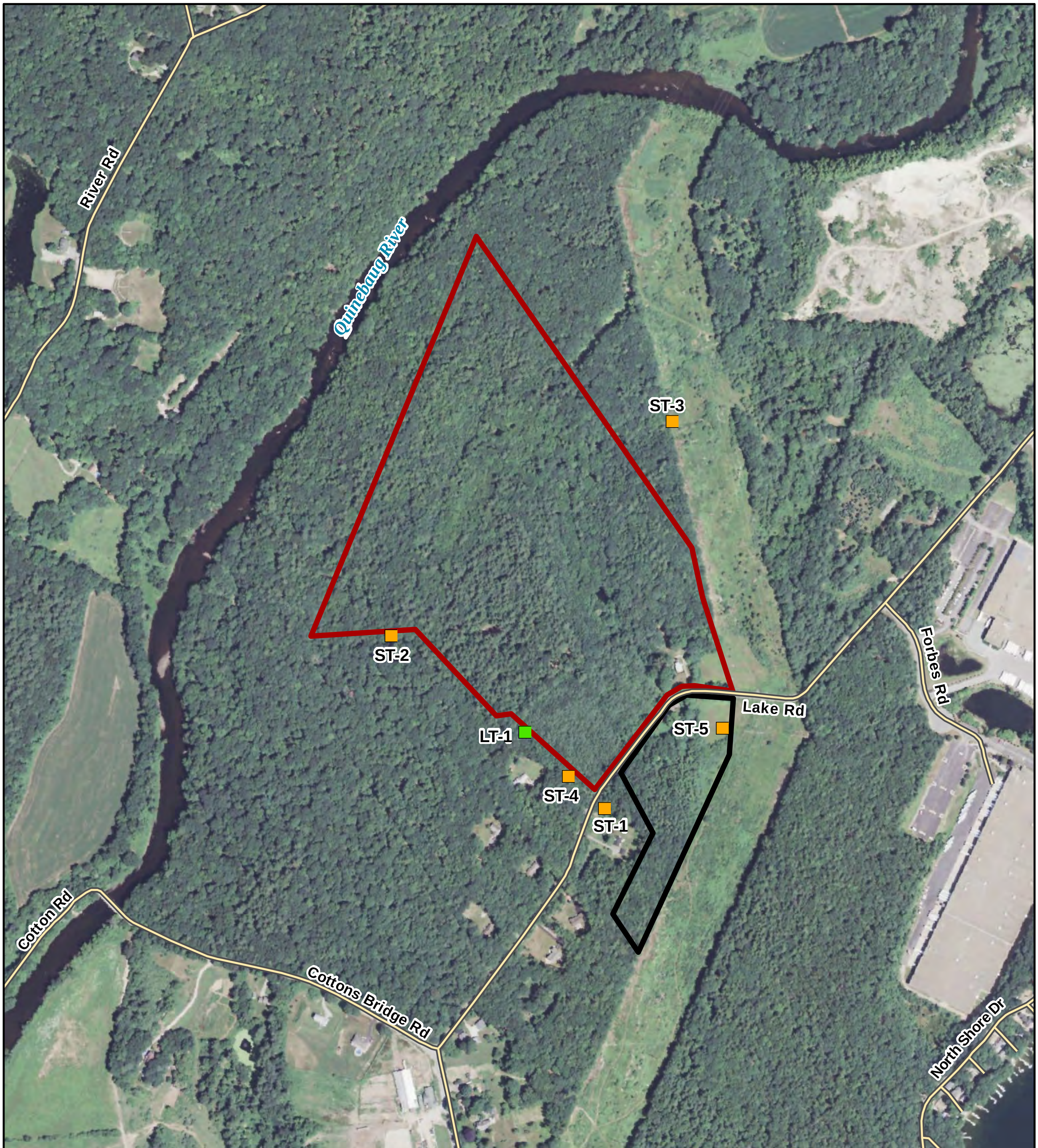
This report addresses the sound anticipated to be generated by KEC under normal full load operating conditions. This report provides background information on concepts related to environmental sound, including descriptions of the noise metrics used throughout the report. The following sections address: applicable noise standards and regulations in Section 2.0; the ambient sound measurement program taken in the KEC area in Section 3.0; anticipated construction sound levels in Section 4.0; predicted noise levels from full-load operation of KEC equipment in Section 5.0; conclusions in Section 6.0; and references in Section 7.0.

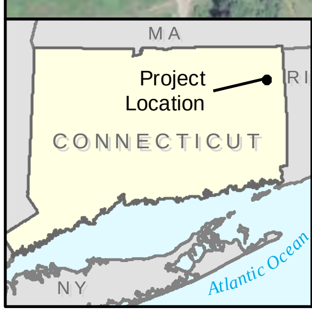
1.1 SITE DESCRIPTION

KEC is proposed to be located within the Town of Killingly in Windham County, south and east of the eastern bank of the Quinebaug River, and west of Alexander Lake and Interstate 395 (I-395). The Project Site is divided by Lake Road into two parcels; an approximately 63-acre northern parcel is proposed for the electric generating equipment (the Generating Facility Site), and an approximately 10-acre southern parcel is proposed for the utility switchyard (the Switchyard Site). Although this report will reference the Switchyard Site, this study focuses on the electric generating equipment located on the Generating Facility Site.

The Generating Facility Site is located near a large, industrially zoned district, known as the Killingly Industrial Park. Due to the proximity to Killingly Industrial Park, the Generating Facility Site is identified in the Town of Killingly's 2010-2020 Plan of Conservation and Development, as an area for future industrial use. Current occupants of the Killingly Industrial Park include Frito-Lay, Ryder Integrated Logistics, Unfi Dayville Warehouse, Automatic Rolls of New England, Putnam Plastics, U.S. Cosmetics, Web Industries, Superwinch, Killingly Asphalt, Nutmeg International Trucks, and a Rite Aid Distribution Center. These occupants are located within the Killingly Industrial Park, along Lake Road or other areas proximate to the Generating Facility Site. Lake Road Generating, an approximately 812-MW electric generating facility in the Killingly Industrial Park, is approximately 1 mile northeast of the Generating Facility Site.

An existing electric transmission line right-of-way (ROW) lies between the Killingly Industrial Park and the Generating Facility Site, and generally bounds the Project Site to the east. The existing ROW consists of two 115-kilovolt (kV) transmission lines and two 345-kV transmission lines. A narrow, triangular parcel of densely forested vegetation provides a buffer between the Generating Facility Site and the existing ROW along the northeastern boundary of the Generating Facility Site. Additional adjacent properties include a residence located approximately 260 feet to the west of KEC on the north side of Lake Road, and the Dunn Preserve, a 32-acre property owned by the Wyndham Land Trust. The Dunn Preserve is located north of the Generating Facility Site, between KEC and the Quinebaug River; a public access trail extends along the Generating Facility Site's western boundary.





Legend

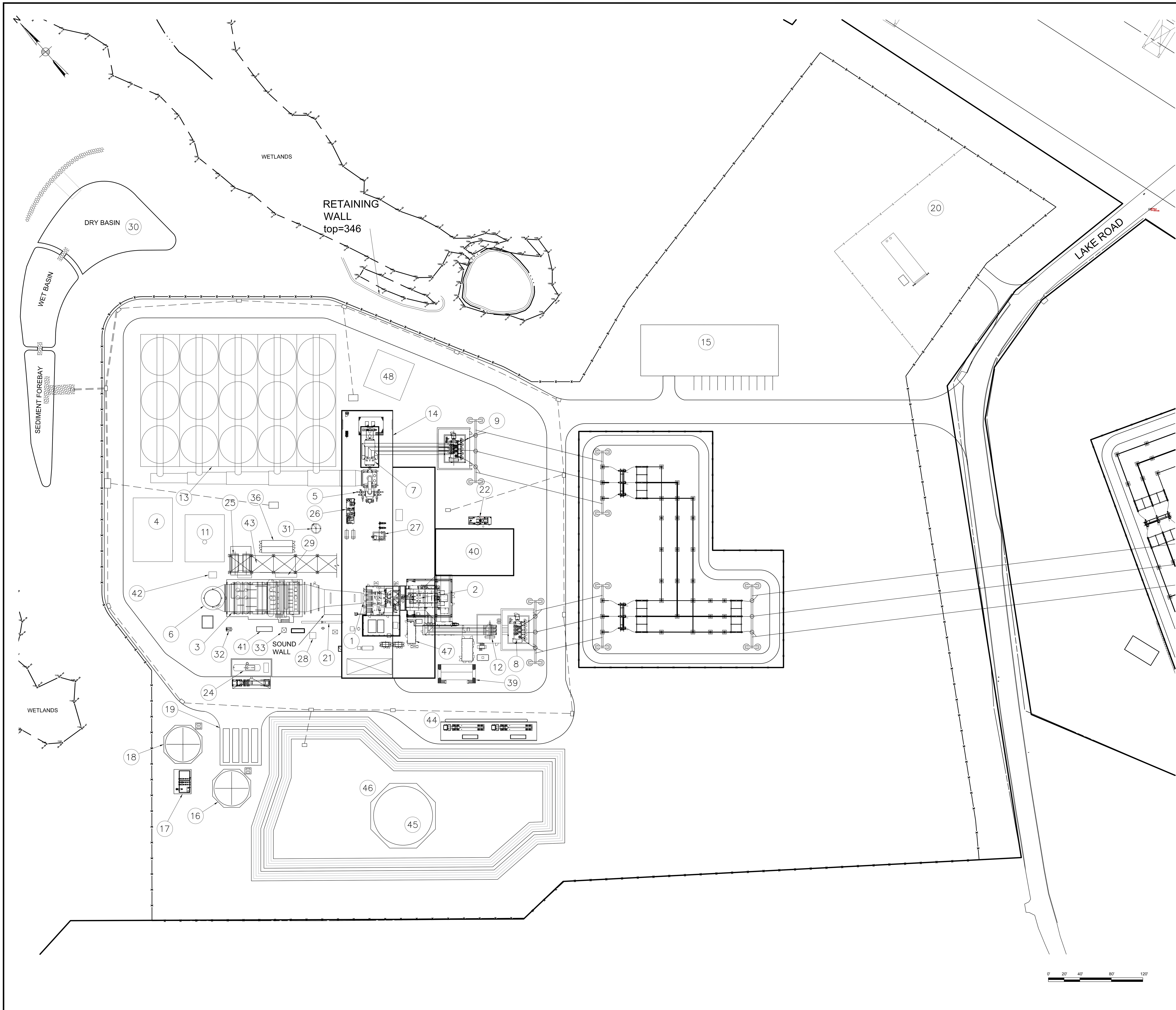
- Generating Facility Site
- Switchyard Site
- Short Term Monitoring Location
- Long Term Monitoring Location

N

0 200 400 Feet

Figure 1
Project Site and Monitoring Locations

Killingly Energy Center
an NTE Energy Project



Notes

Legend

1. COMBUSTION TURBINE (GT)
2. COMBUSTION TURBINE GENERATOR (GTG)
3. HEAT RECOVERY STEAM GENERATOR (HRSG)
4. CLOSED COOLING WATER
5. STEAM TURBINE (ST)
6. EXHAUST STACK
7. STEAM TURBINE GENERATOR (STG)
8. GENERATOR STEP-UP TRANSFORMER (GSU)
9. STG STEP-UP TRANSFORMER
10. AIR INLET FILTER HOUSE (NOT SHOWN)
11. AUXILARY BOILER
12. UNIT AUXILARY TRANSFORMER
13. AIR COOLED CONDENSER (ACC) & CONDENSATE COLLECTION ENCLOSURE
14. TURBINE BUILDING
15. ADMIN/ WAREHOUSE/ WATER TREATMENT BUILDING
16. RAW / FIRE WATER STORAGE TANK & RW PUMPS
17. FIRE PUMPS ENCLOSURE
18. DEMINERALIZED WATER STORAGE TANK & PUMPS
19. DEMINERALIZED WATER TRAILERS AREA
20. FUEL GAS METERING
21. FUEL GAS HEATER
22. DIESEL GENERATOR
23. PLANT SWITCHYARD
24. AMMONIA STORAGE TANK, PUMPS, & UNLOADING AREA
25. BOILER FEED PUMPS
26. STG LUBE OIL SKID
27. AIR COMPRESSORS, RECEIVERS & DRYERS SKID
28. FUEL GAS FINAL FILTER
29. DUCT BURNER SKID
30. DETENTION POND
31. STG DRAINS TANK & SUMP
32. HRSG BLOW OFF TANK & DRAINS PUMPS
33. HRSG BLOWDOWN SUMP
34. STORM WATER RETENTION POND
35. CIVIL OIL WATER SEPARATOR (NOT SHOWN)
36. BOP MOTOR CONTROL CENTER (MCC)
37. PLANT GATE (NOT SHOWN)
38. NOT USED
39. CTG ELECTRICAL PACKAGE
40. CENTRAL CONTROL ROOM / ELECTRICAL
41. AMMONIA INJECTION SKID
42. CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)
43. PIPE RACK
44. FUEL OIL UNLOADING
45. FUEL OIL TANK
46. FUEL OIL BERM
47. GT LUBE OIL SKID
48. FUEL GAS COMPRESSORS

Reference Drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
G	06/28/16	AF	FOR CLIENT REVIEW	KP	JW
F	05/24/16	AF	FOR CLIENT REVIEW	KP	JW
E	05/20/16	AF	FOR CLIENT REVIEW	KP	JW
D	05/04/16	AF	FOR CLIENT REVIEW	KP	JW
C	04/12/16	AF	FOR CLIENT REVIEW	KP	JW
B	04/11/16	AF	FOR CLIENT REVIEW	KP	JW
A	04/07/16	AF	FOR CLIENT REVIEW	KP	JW

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Figure 2
KEC Layout

Killingly Energy Center
an NTE Energy Project

PRELIMINARY
NOT FOR
CONSTRUCTION
REPLACE WITH
ENGINEERS STAMP
AT CONSTRUCTION
AND/OR
FABRICATION

Designed	-	Eng check	JW
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Dwg check	KP	Project Mngr	JW
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The Generating Facility Site largely consists of undeveloped woodland and wetlands, with a residence and associated outbuildings occupying less than 1 acre in the southeastern corner of the Generating Facility Site. The Generating Facility Site is characterized by undulating topography with relatively higher elevations along the boundaries and lower elevations proximate to wetlands that are located near the center of the Generating Facility Site (and will not be disturbed by KEC).

To the north of the Generating Facility Site, on the opposite side of the Quinebaug River, lies an agricultural land and an ash landfill in the Town of Putnam. To the west of the Generating Facility Site, also on the other side of the Quinebaug River, lies a rural residential district in the Town of Pomfret. In addition to the expanding industrial park, proximate land use within the Town of Killingly consists of rural development and a mix of seasonal and year-round residential dwellings surrounding Alexander Lake, approximately 0.5 mile west of the Generating Facility Site. Figure 1 illustrates the Generating Facility Site and the surrounding area. While some low-density residential uses are located west of the Generating Facility Site, and more densely settled seasonal and year-round residences surround Alexander Lake, the Generating Facility Site is generally located in an area separated from Killingly's higher density residential areas to the east by I-395.

1.2 ACOUSTIC METRICS AND TERMINOLOGY

All sounds originate from a source, whether it is a human voice, jet skis on a lake, motor vehicles on a roadway or a combustion turbine. Energy is required to produce sound and this sound energy is transmitted through the air in the form of sound waves – tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear. A sound source is defined by a sound power level (abbreviated "L_W"), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts.

A source's sound power level cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source outside the acoustic and geometric near-field. A sound pressure level (abbreviated "L_P") is a measure of the sound wave fluctuation at a given receiver location, and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. The sound pressure level in decibels (dB) is the logarithm of the ratio of the sound pressure of the source to the reference sound pressure of 20 microPascals (μPa), multiplied by 20.[1] The range of sound pressures that can be detected by a person with normal hearing is very wide, ranging from about 20 μPa for very faint sounds at the threshold of hearing to nearly 10 million μPa for extremely loud sounds.

Broadband sound includes sound energy summed across the entire audible frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum can be completed to determine tonal characteristics. The unit of frequency is Hertz (Hz), measuring the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave bands ranging from 16 Hz (low) to 16,000 Hz (high). Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system, and is represented in A-weighted decibels (dBA).

Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level (L_{eq}). The equivalent sound level has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments, including in the State

[1] The sound pressure level (Lp) in decibels (dB) corresponding to a sound pressure (p) is given by the following equation:

$$L_p = 20 \log_{10} (p / p_{ref});$$

Where:

p = the sound pressure in μPa; and
pref = the reference sound pressure of 20 μPa.

of Connecticut. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness are presented in Table 1.

Table 1: Typical Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Lawnmower (at operator)	85 - 90	Significant
Jet Ski (50 feet)	80	
Vacuum cleaner (10 feet)	70	Moderate
Passenger car at 65 mph (25 feet)	65	
Large store air-conditioning unit (20 feet)	60	
Light auto traffic (100 feet) Medium size creek (50 feet) Quiet Office Space	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room; Bird calls	40	Faint
Typical wilderness area	35	
Quiet library, soft whisper (15 feet)	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing
Adapted from: Kurze and Beranek (1988),United States Environmental Protection Agency (1971), and Noise Navigator Sound Level Database (2015).		

2.0 NOISE LEVEL REQUIREMENTS

Potential noise impacts associated with KEC were evaluated with respect to the Connecticut regulations for the Control of Noise established by the Connecticut Department of Energy and Environmental Protection (DEEP) at Regulations of Connecticut State Agencies (R.C.S.A.) Section 22a-69. In addition, Chapter 12.5, Article VI (Sections 120-131) of the Town of Killingly Code of Ordinances contains regulations pertaining to noise, which are generally consistent with DEEP noise regulations. Each are addressed further below.

2.1 CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION NOISE CONTROL REGULATIONS

DEEP noise control regulations (R.C.S.A. Section 22a-69-3.1) prescribe noise limits along property boundaries, according to the land use category, reflected by state zoning, as shown in Table 2.

Table 2: DEEP Noise Limits (dBA)

Emitter	Receptor			
	Class C	Class B	Class A Daytime (7:00 a.m. – 10:00 p.m.)	Class A Nighttime (10:00 p.m. – 7:00 a.m.)
Class C – Industrial	70	66	61	51
Class B – Commercial and Retail Trade	62	62	55	45
Class A – Residential Areas and Other Sensitive Areas	62	55	55	45

KEC is considered a Class C emitter, with its immediate surroundings treated as Class A. Therefore, KEC is required to demonstrate that it will meet the 51 dBA level at its property boundaries. Other land uses within the Killingly Industrial Park area would be considered Class C receptors, requiring KEC to meet a more relaxed standard at those property boundaries.

While Section R.C.S.A. 22a-69-3.1 will apply to operational noise from KEC, construction noise is exempt from DEEP noise regulations.

The regulations also prescribe provisions for impulse noise, prohibiting impulse noise in excess of 80 dB (peak) during nighttime hours in any Class A zone, and prohibiting impulse noise in excess 100 dB (peak) at any time in any zone.

Audible discrete tones also require special consideration under R.C.S.A. Section 22a-69-3.1. Noise of one or more audible discrete tones is considered excessive noise if a level of 5 dBA below the levels specified in Table 3 is exceeded. A limit of 100 dB also pertains to infrasonic and ultrasonic noise.

2.2 TOWN OF KILLINGLY NOISE ORDINANCE

The Town of Killingly provides noise level standards applicable to KEC under Chapter 12.5, Article VI (Sections 120-131) of the Code of Ordinances. Table 3 presents Town of Killingly Noise Level Standards, which are consistent with those prescribed by the DEEP, although the definition of “daytime” and “nighttime” differs slightly from that established by DEEP. Guidance pertaining to impulse sound and elevated background sound levels is consistent with what is provided by the DEEP. Construction during daytime hours is exempt from the Killingly noise level standards.

Table 3: Town of Killingly Noise Level Standards (dBA)

Emitter	Receptor			
	Industrial	Business (Commercial)	Residential Daytime (7:00 a.m. – 9:00 p.m.)	Residential Nighttime (9:00 p.m. – 7:00 a.m.)
Industrial	70	62	61	51
Business (Commercial)	62	62	55	45
Residential	62	55	55	45

3.0 EXISTING SOUND ENVIRONMENT

Tetra Tech conducted a series of ambient sound level measurements to characterize the existing acoustic environment in the vicinity of KEC. This section summarizes the methodologies used by Tetra Tech to conduct the sound survey, describes the measurement locations, and presents the results of the ambient sound measurements. Although both the DEEP and Town of Killingly noise standards are based on specific property boundary decibel levels, existing ambient levels are provided for context and characterization of the setting.

3.1 FIELD METHODOLOGY

Ambient sound measurements were performed on March 21 and 22, 2016. Measurements included both short-term measurements, recorded in the presence of an acoustics expert for a minimum duration of 30 minutes, and long-term, unattended measurements that extended over a 24-hour period. The 30-minute short-term measurements occurred during both the daytime (10:00 a.m. to 1:00 p.m.) and nighttime periods (9:00 p.m. to 12:00 a.m.).

All of the measurements were conducted using three Larson Davis Model 831 precision integrating sound-level meters that meet the American National Standards Institute (ANSI) Standards for Type 1 precision instrumentation. This model has an operating range of 5 to 140 dB, and an overall frequency range of 8 to 20,000 Hz. During the measurement program, microphones were fitted with windscreens, and set upon a tripod at a height of approximately 5 feet above the ground for the short-term measurements and at a height of approximately 8 feet above ground for long-term measurements, and located out of the influence of any vertical reflecting surfaces. The sound analyzer was calibrated at the beginning and end of the measurement period using a Larson Davis Model CAL200 acoustic calibrator following procedures that are traceable to the National Institute of Standards and Technology. Table 4 lists the measurement equipment employed during the survey. The sound level meters were programmed to sample and store A-weighted (dBA) and octave band-specific sound level data, including L_{eq} and the percentile sound levels.

Table 4: Measurement Equipment

Description	Manufacturer	Type	Serial Number
Signal Analyzer	Larson Davis	831	3847
Signal Analyzer	Larson Davis	831	1350
Signal Analyzer	Larson Davis	831	4001
Preamplifier	Larson Davis	PRM831	036754
Preamplifier	Larson Davis	PRM831	010875
Preamplifier	Larson Davis	PRM831	036849
Microphone	PCB	377B02	150728
Microphone	PCB	377B02	109271
Microphone	PCB	377B02	156091
Windscreen	ACO Pacific	7-inch	NA
Calibrator	Larson Davis	CAL200	9540

There was no substantial precipitation during the survey. Temperatures ranged from 40 to 45 degrees Fahrenheit (°F) during the daytime, and 32 to 35°F during the nighttime. Wind speeds were variable, averaging from 2 to 4 miles per hour (mph) during the daytime, and 6 to 8 mph during the nighttime. Atmospheric conditions during the survey period were acceptable for the collection of accurate sound measurements.

3.2 MONITORING LOCATIONS

Five short-term, attended sound measurements were performed at adjoining, residentially zoned areas proximate to the Generating Facility Site. The short-term monitoring locations (ST-1 through ST-5) were selected to represent the closest noise-sensitive land uses in the vicinity of the Generating Facility Site. Thirty-minute measurements were made at each short-term monitoring location during the daytime (10:00 a.m. to 1:00 p.m.) and nighttime (9:00 p.m. to 12:00 a.m.) periods during a typical weekday.

One long-term, unattended sound-level meter was deployed west of the Generating Facility Site, along the public access path to the Dunn Preserve (LT-1). The long-term measurement data provide insight into variability of ambient sound levels over time, and validate the accuracy of the short-term measurements.

The monitoring locations are described in Table 5 and mapped on Figure 1. Additional descriptions of the monitoring locations and field observations are provided in the following sections.

Table 5: Sound Level Monitoring Locations

Monitoring Location	Coordinates (Universal Transverse Mercator Zone 19N)		Distance and Direction from the KEC Turbine Building
	Easting (m)	Northing (m)	
ST-1	258034	4638368	860 feet southeast across Lake Road
ST-2	257710	4638630	550 feet west
ST-3	258136	4638956	1,020 feet northeast
ST-4	257979	4638417	650 feet southeast
ST-5	258213	4638490	On the Switchyard Site
LT-1	257913	4638484	380 feet south

3.2.1 Short-Term Monitoring Location 1

ST-1 is located 100 feet south of the Generating Facility Site and 860 feet southeast of the KEC turbine building, just off the southern shoulder of Lake Road. This location was selected to represent the low-density, scattered residences along Lake Road, southwest of the Generating Facility Site. Figures 3 and 4 present views of ST-1.

Most of the scattered residences on Lake Road are set back from the road at distances ranging from 120 to 360 feet and surrounded by trees. Daytime sound measurements at ST-1 were collected from 11:06 a.m. to 11:38 a.m. on March 22, 2016. During the daytime measurement period, the wind speed was low, ranging from 2 to 4 mph. Field observations identified the dominant source of sound as motor vehicle traffic on Lake Road, with 46 vehicles passing by during the 30-minute measurement period. Other observed sounds included natural sounds, such as distant dogs barking from a neighboring residence and birds chirping, and vehicle back-up alarms from the Rite Aid Distribution Center located southeast of the Generating Facility Site. No other industrial noise sources were audible during this measurement.

Nighttime sound measurements were collected from 9:51 p.m. to 10:21 p.m. on March 22, 2016. During the nighttime measurement period, the wind speeds were near calm, ranging from 1 to 2 mph. The nighttime measurements were consistent with the daytime measurement results, with motor traffic vehicles continuing to be the dominant source of sound. Although there was a significant decrease in vehicle traffic along Lake Road during the nighttime hours, 16 vehicles passed during the 30-minute measurement period. Back-up alarms from the Rite Aid Distribution Center were also clearly audible during this period. No other industrial noise sources were audible during this measurement.

Figure 3: View South toward a Neighboring Property

Figure 4: View Northwest toward Lake Road

3.2.2 Short-Term Monitoring Location 2

ST-2 is located south of the Generating Facility Site, approximately 550 feet west of the KEC turbine building, 900 feet southeast of the Quinebaug River, and 1,200 feet northwest of Lake Road. ST-2 is situated amidst dense, tall vegetation along the access trail for the Dunn Preserve. Figures 5 and 6 present views of ST-2.

Daytime sound measurements at ST-2 were collected from 10:52 a.m. to 11:22 a.m. on March 22, 2016. Field observations identified natural sounds, such as bird calls and periodic, distant but recognizable, aircraft overflights.

During the daytime measurement, the wind speed was low, ranging from 2 to 4 mph. No industrial noise sources were audible during this measurement.

Nighttime sound measurements at ST-2 were collected from 10:08 p.m. to 10:38 p.m. on March 21, 2016. During the nighttime measurement, the wind speed increased to 6 to 8 mph. Distant aircraft overflights were also periodically audible during the nighttime measurements. No industrial noise sources were audible during this measurement.

Figure 5: View Southeast toward Lake Road

Figure 6: View East toward KEC

3.2.3 Short-Term Monitoring Location 3

ST-3 is located east of the Generating Facility Site, 1,020 feet northeast of the KEC turbine building, and adjacent to the west of the existing electric transmission ROW. ST-3 is approximately 1,300 feet from Lake Road, situated amidst the dense, forested buffer that lies between the Generating Facility Site and the existing ROW. Figures 7 and 8 present views of ST-3.

Daytime sound measurements at ST-3 were collected from 12:15 p.m. to 12:45 p.m. on March 22, 2016. Field observations identified natural sounds, such as bird calls, and periodic, distant aircraft overflights at this monitoring location. During the daytime measurement, the wind speed was low, ranging from 2 to 4 mph.

Nighttime sound measurements at ST-3 were collected from 11:24 p.m. to 11:54 p.m. on March 22, 2016. During the nighttime measurements, the wind speeds were near calm, ranging from 1 to 2 mph. Distant vehicle traffic from Lake Road, back-up alarms from the Rite Aid Distribution Center, and periodic, distant aircraft overflights were also audible during the nighttime measurements. No other industrial noise sources were audible during this measurement.

Figure 7: View Southwest toward KEC

Figure 8: View Southeast toward Existing Transmission ROW

3.2.4 Short-Term Monitoring Location 4

ST-4 is located south of the Generating Facility Site, 650 feet southeast of the KEC turbine building, and along the public access path for the Dunn Preserve. Unlike ST-2, which is similarly located along the public access path for Dunn Preserve, ST-4 is located approximately 160 feet north of Lake Road. ST-4 was selected to represent the scattered residences located along Lake Road. The nearest residence is set back from Lake Road and located approximately 200 feet west of ST-4. Figures 9 and 10 present views of ST-4.

Daytime sound measurements at ST-4 were collected from 10:30 a.m. to 11:00 a.m. on March 22, 2016. Field observations identified natural sounds, such as dogs barking and bird noise. Traffic on Lake Road was the dominant source of sound in the vicinity of ST-4, with a total of 27 vehicles passing by during the 30-minute measurement period. Walkers along the public access path for the Dunn Preserve also briefly passed during the measurement period. Wind speed during the daytime measurements ranged from 2 to 4 mph.

Nighttime sound measurements at ST-4 were collected from 10:06 p.m. to 10:36 p.m. on March 21, 2016. The nighttime measurement did not show a significant decrease in vehicle traffic along Lake Road. However, wind speeds during the nighttime measurements were more variable, increasing to 6 to 8 mph, which resulted in noise from rustling trees.

Figure 9: View West toward a Neighboring Property

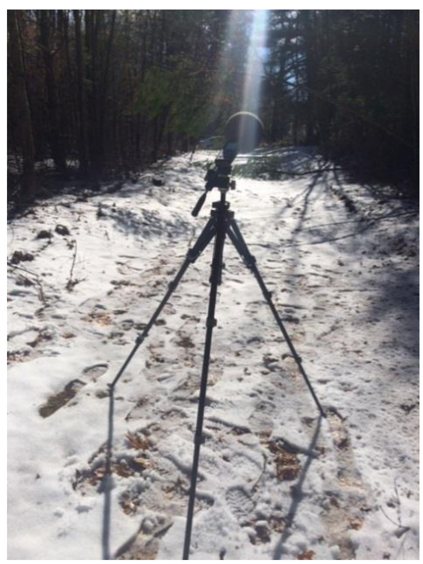


Figure 10: View Southeast toward Lake Road

3.2.5 Short-Term Monitoring Location 5

ST-5 is located south of the Generating Facility Site, in the northern portion of the Switchyard Site, approximately 160 feet south of Lake Road, and near the existing transmission ROW. Figures 11 and 12 present views of ST-5.

Daytime sound measurements at ST-5 were collected from 12:03 p.m. to 12:34 p.m. on March 22, 2016. Field observations identified natural sounds, such as bird calls, and also backup alarms from the Rite Aid Distribution Center located to the southeast. Vehicle traffic on Lake Road was the dominant source of sound in the vicinity of ST-5, with a total of 67 vehicles passing by during the 30-minute measurement period.

Nighttime sound measurements at ST-5 were collected from 10:07 p.m. to 10:38 p.m. on March 22, 2016. During the nighttime measurements, vehicle traffic along Lake Road remained consistent with what was observed during the daytime. Backup alarms from the Rite Aid Distribution Center located to the southeast remained clearly audible during the nighttime measurement period. No other industrial noise sources were audible during this measurement.

Figure 11: View Northeast toward the Existing Transmission ROW

Figure 12: View Northwest toward the Residence on the Generating Facility Site

3.2.6 Long-Term Monitoring Location 1

LT-1 is located west of the Generating Facility Site, approximately 380 feet south of the proposed turbine building. It is located along the public access path for the Dunn Preserve, approximately 450 feet north of Lake Road. The long-term measurements provide insight into variability of ambient sound levels over time, within the vicinity of the Generating Facility Site. The resulting long-term measurements validate the accuracy of the short-term measurements, and confirm the measurements are consistent with ambient noise levels typically expected in this type of acoustical environment.

Sound level measurements at LT-1 were collected from 7:00 p.m. on March 21, 2016 through 8:00 a.m. on March 23, 2016. Figures 13 and 14 present views of the LT-1.

Figure 13: View South toward a Neighboring Property on Lake Road

Figure 14: View North toward KEC

3.3 MEASUREMENT RESULTS

Table 6 provides a summary of the measured ambient sound levels observed at each of the monitoring locations. For each monitoring location, Table 6 provides the daytime and nighttime L_{eq}.

Table 6: Sound Measurement Results

Monitoring Location	Time Period	L_{eq} (dBA)
ST-1	Day	47
	Night	47
ST-2	Day	39
	Night	42
ST-3	Day	38
	Night	32
ST-4	Day	39
	Night	41
ST-5	Day	42
	Night	47
LT-1	Day	42
	Night	38

Results of the ambient sound survey indicate that sound levels surrounding the proposed Generating Facility Site are at relatively low levels. As expected, measurement locations closer to Lake Road (ST-1, ST-4, and ST-5) generally experienced louder ambient noise levels associated with vehicle traffic, particularly during the daytime.

Ambient sound levels did not exhibit typical diurnal patterns. Daytime L_{eq} sound levels at the measurement locations ranged from a low of 38 dBA at ST-3 to a high of 47 dBA at ST-1. Nighttime sound levels ranged from a low of 32 dBA at ST-3 to 47dBA at ST-1 and ST-5. The noise levels at ST-1 did not vary much from day to night due to the constant vehicle traffic along Lake Road. The nighttime noise levels at ST-2 and ST-4 were higher than daytime levels due in part to elevated wind speeds in these heavily forested areas, which resulted in elevated masking noise from rustling trees. The nighttime noise level at ST-5 is greater than the daytime period due to vehicle traffic along Lake Road and the increased number of occurences of backup alarm noise from the Rite Aid Distribution Center located southeast of the Generating Facility Site.

Table 7 presents the hourly sound level data collected during the 24-hour long-term sound monitoring study on March 22, 2016.

Table 7: Hourly Long-Term Measurement Results

Military Time	L_{eq} (dBA)
00:00:00	40
01:00:00	35
02:00:00	32
03:00:00	30
04:00:00	30
05:00:00	32
06:00:00	37
07:00:00	38
08:00:00	40
09:00:00	40
10:00:00	42
11:00:00	41
12:00:00	44
13:00:00	42
14:00:00	42
15:00:00	43
16:00:00	42
17:00:00	40
18:00:00	44

Military Time	L_{eq} (dBA)
19:00:00	41
20:00:00	40
21:00:00	41
22:00:00	44
23:00:00	39

The hourly data collected during the 24-hour sound monitoring study show consistency with the the short-term measurements. The daytime noise levels ranged from 38 dBA to 42 dBA, which is similar to the daytime range collected at the short-term noise measurement locations, which was 38 to 47 dBA. ST-1 daytime noise levels were higher because it was located in the vicinity of Lake Road.

The nighttime noise levels ranged from 30 dBA to 40 dBA, which is similarly documented with the short-term measurement locations that showed a nighttime range from 32 dBA to 42 dBA. ST-1 nighttime noise levels were higher because that measurement station was located in the vicinity of Lake Road. As expected, the sound levels during the early morning hours (1:00 a.m. to 5:00 a.m.) ranged from 30 dBA to 35 dBA. This is due to decrease in wind speed during the early morning hours. Overall, the long-term monitor validated both the daytime and nighttime sound level range documented by the short-term measurements.

4.0 ANTICIPATED CONSTRUCTION IMPACTS

NTE anticipates that construction of KEC will commence during the second quarter of 2017, and will require approximately three years to complete, with power to the electrical grid provided in 2020. Construction of KEC is expected to be typical of other power generating facilities in terms of schedule, equipment, and activity. Nighttime construction will be limited, but activities may occur 7 days per week, 10 hours per day. The last 4 to 6 months of construction would include commissioning and start-up, which would involve steam blows, among other activities, which may occur 24 hours per day, 7 days a week.

KEC construction will be conducted in phases, generally reflecting the following five broad work activities:

- Site clearing and preparation;
- Excavation and foundation installation;
- Steel erection;
- Mechanical and electrical installation; and
- Equipment installation, commissioning, and testing.

Over the course of the construction period, sound levels will vary. Both state and local noise regulations exempt daytime construction noise from the need to comply with specific requirements. To the extent that construction activities must occur past 9:00 p.m. (defined by Killingly ordinance as the start of the nighttime period), additional measures will be incorporated to control noise levels. Such activities would include concrete pours, which are required to occur continuously until completed and preparation activities for the next work day.

Since construction machines operate intermittently, and the types of machines in use will change with each given phase of construction, noise emitted during construction will be mobile and highly variable. The construction management protocols will include the following noise mitigation measures to minimize noise impacts using the following measures:

- Maintain all construction tools and equipment in good operating order according to manufacturers' specifications.
- Limit use of major excavating and earth moving machinery to daytime hours.
- To the extent practicable, schedule construction activity during normal working hours on weekdays when higher sound levels are typically present, and are found acceptable. Some limited activities, such as concrete pours, will be required to occur continuously until completion.
- Equip any internal combustion engine used for any purpose on the job or related to the job with a properly operating muffler that is free from rust, holes, and leaks.
- For construction devices that utilize internal combustion engines, ensure the engine's housing doors are kept closed, and install noise-insulating material mounted on the engine housing consistent with manufacturers' guidelines, if possible.
- Limit evening shift work to the extent possible to low noise activities such as welding, wire pulling and other similar activities, together with appropriate material handling equipment.
- Prior to the start of construction, establish a procedure for addressing any noise complaints received from residents.
- Before conducting specific loud noise activities, such as steam blows, communicate with the community to plan ahead for such events.

Because of the temporary nature of the construction noise, no adverse or long-term effects are expected.

5.0 OPERATIONAL NOISE IMPACT ANALYSIS

This section describes the methods and input assumptions used to calculate noise levels due to normal KEC operation, and the results of the noise impact analysis.

5.1 NOISE PREDICTION MODEL

The Cadna-A® computer noise model was used to calculate sound pressure levels from the operation of KEC equipment in the vicinity of the Project Site. An industry standard, Cadna-A® was developed by DataKustik GmbH to provide an estimate of sound levels at distances from sources of known sound emission. It is used by acousticians and acoustic engineers due to the capability to accurately describe noise emission and propagation from complex facilities and in most cases yields conservative results of operational noise levels in the surrounding community.

The current International Organization for Standardization (ISO) standard for outdoor sound propagation, ISO 9613 Part 2 – "Attenuation of sound during propagation outdoors," was used within Cadna-A.® The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as for downwind propagation or moderate atmospheric inversion. The calculation of sound propagation from source to receiver locations consists of full octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption at 10 degrees Celsius and 70 percent relative humidity;
- Screening by topography and obstacles;
- The effects of terrain features including relative elevations of noise sources;
- Sound power levels from stationary and mobile sources;
- The locations of noise-sensitive land use types;
- Intervening objects including buildings and barrier walls;
- Ground effects due to areas of pavement and unpaved ground;
- Sound power at multiple frequencies;
- Source directivity factors;
- Multiple noise sources and source type (point, area, and/or line); and
- Averaging predicted sound levels over a given time period.

Cadna-A® allows for three basic types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Point sources were programmed for concentrated small dimension sources such as building ventilation fans that radiate sound hemispherically. Line sources are used for linear-shaped sources such as ducts and pipelines. Larger dimensional sources, such as the HRSGs and building walls, were modeled as area sources. Noise walls, equipment enclosures, stacks, and KEC equipment were modeled as solid structures since diffracted paths around and over structures will tend to reduce computed noise levels. The interaction between sound sources and structures was taken into account with reflection loss. The storage tanks were modeled as obstacles impeding noise propagation. The reflective characteristic of the structure is quantified by its reflection loss, which is typically defined as smooth façade from which the reflected sound energy is 2 dB less than the incident sound energy. Transformer fire walls and sound barriers were modeled as reflective or absorptive barriers.

Off-site topography was obtained using the publically available United States Geological Survey digital elevation data. A default ground attenuation factor of 0.5 was assumed for off-site sound propagation over acoustically "mixed" ground. A ground attenuation factor of 0.0 for a reflective surface was assumed for paved on-site areas.

The output from Cadna-A® includes tabular sound level results at selected receiver locations and colored noise contour maps (isopleths) that show areas of equal sound levels.

5.2 INPUT TO THE NOISE PREDICTION MODEL

KEC's general arrangement was reviewed and directly imported into the acoustic model so that on-site equipment could be easily identified, buildings and structures could be added, and sound power data could be assigned to sources as appropriate. Figure 2 shows the KEC equipment layout utilized.

The primary noise sources during base load operation are the ACC, STG, and CTG, main step-up transformers, air inlet face and filter housing, the exhaust stack, and HRSG. Reference sound power levels input to Cadna-A® were provided by equipment manufacturers, based on information contained in reference documents, or developed using empirical methods. The source levels used in the predictive modeling are based on estimated sound power levels that are generally deemed to be conservative. The projected operational noise levels are based on vendor-supplied guaranteed sound power level data for the major sources of equipment including the power generation package. The sound power level (abbreviated "L_W") is defined as ten times the logarithm (to the base 10) of the ratio of a given sound power to the reference sound power of 1 picowatt. Sound power is defined as the rate per unit time at which sound energy is radiated from a source and is expressed in terms of watts. Table 8 summarizes the equipment sound power level data used as inputs to the modeling analysis.

Table 8: Modeled Octave Band Sound Power Levels for Major Pieces of KEC Equipment

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Air Cooled Condenser	108	109	106	102	96	95	95	97	95	103
Closed Cooling Water Fan Array	91	94	92	91	91	89	88	86	84	95
Fuel Gas Piping	104	100	89	81	80	86	88	91	89	96
HRSG Stack - Lower Portion	103	104	88	79	76	79	56	46	20	83
HRSG Stack - Upper Portion – with 10ft Silencer	100	97	84	68	64	46	50	42	21	73
HRSG Stack Exit - w/o directivity - with 10ft Silencer	113	110	108	99	101	87	80	81	83	100
HRSG Transition Duct - Upstream with Increased Casing Thickness	111	110	102	95	95	96	93	92	71	100
HRSG Transition Duct - Downstream with Increased Casing Thickness	111	110	102	95	95	96	93	92	71	100
HRSG Body - Upstream Portion	114	118	102	97	92	89	86	82	61	97
HRSG Body - Downstream Portion	108	113	96	91	85	80	73	67	46	90
Lagged HRSG Duct Burner Gas Piping	104	108	106	93	80	76	75	71	71	92
Hydraulic Supply Skid	110	103	95	100	99	98	94	93	89	103
Fuel Oil Pumping Skid	98	114	101	104	107	107	109	105	98	113
Water Injection Pump	99	115	100	106	105	105	105	101	98	111
GT Enclosure Walls	98	101	86	81	77	82	83	86	82	91
Gas Turbine Enclosure Air Inlet Vents with Silencer	89	95	84	80	73	71	76	77	83	85

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Gas Turbine Enclosure Air Discharge Vents with Silencer	91	96	88	84	75	74	74	73	78	83
Turbine Exhaust Diffuser	129	126	111	109	106	104	102	96	73	110
Generator S-Gen 1000A	102	114	107	96	89	88	86	82	65	96
ST-Total K+N Turbine (w/o Generator)		115	116	111	110	105	106	106	100	113
Unlagged Hot Box during base load	101	98	91	86	82	79	95	76	65	96
Lube Oil Unit		110	105	105	105	101	98	98	94	106
Hydraulic Supply Unit		109	103	105	104	105	100	99	96	109
Condensate Pump	92	106	101	99	99	98	98	93	91	104
Gas Turbine Generator	117	123	120	112	113	109	113	111	108	118
Enclosed Lube Oil Skid	94	94	100	95	97	98	89	85	80	98
Boiler Feed Water Pumps	89	95	93	87	88	97	95	91	81	100
Air Inlet Filter Housing	116	106	97	82	72	88	69	75	90	92
Air Inlet Filter Housing Duct	109	104	103	92	86	100	85	86	91	101
Fuel Gas Compressor	90	86	91	90	88	91	91	89	84	97
Generator Step-up Transformer	88	88	92	89	95	87	77	72	66	93
Unit Auxiliary Transformer	70	70	74	71	77	69	59	54	48	75
STG Step-up Transformer	87	87	91	88	94	86	76	71	65	92
Ammonia Injection Skid	89	96	92	89	90	90	88	85	80	101
Demineralized Water Pump	77	71	71	74	81	84	85	81	73	90

The design of KEC design has incorporated silencers for the HRSG exhaust stack as well as for the GT enclosure are inlet and discharge vents. The design also includes increased casing thickness for the HRSG transition duct and lagging for the HRSG duct burner gas piping to reduce the noise levels. KEC has also been designed such that several large components, including the hydraulic supply unit, fuel oil pumping skid, combustion turbine enclosure, water injection pump skid, gas turbine generator, steam turbine generator, hot box, lube oil unit, and condensate pumps, are enclosed in the Turbine High Bay and Low Bay Buildings. A transmission loss rating was incorporated into the wall and roof assemblies of the Turbine High Bay and Low Bay Buildings based on recommended Sound Transmission Class (STC) ratings to reduce noise propagation. The recommended ratings for the Turbine High Bay and Low Bay Buildings are summarized in Table 9. Note that the selected mitigation reflected by these values is intended to reflect the feasibility of achieving the resulting level of impact; final design may incorporate different mitigation in order to achieve the same objective.

Table 9: Noise Level Reductions for the Turbine Buildings

Type of Construction or Acoustical Treatment	Modeled Noise Level Reductions (dB re: 20 μPa) by Octave Band Center Frequency dBL								
	31.5	63	125	250	500	1k	2k	4k	8k
Wall Panel STC 44	13	19	25	35	39	45	52	58	59

5.3 NOISE CONTROL MEASURES

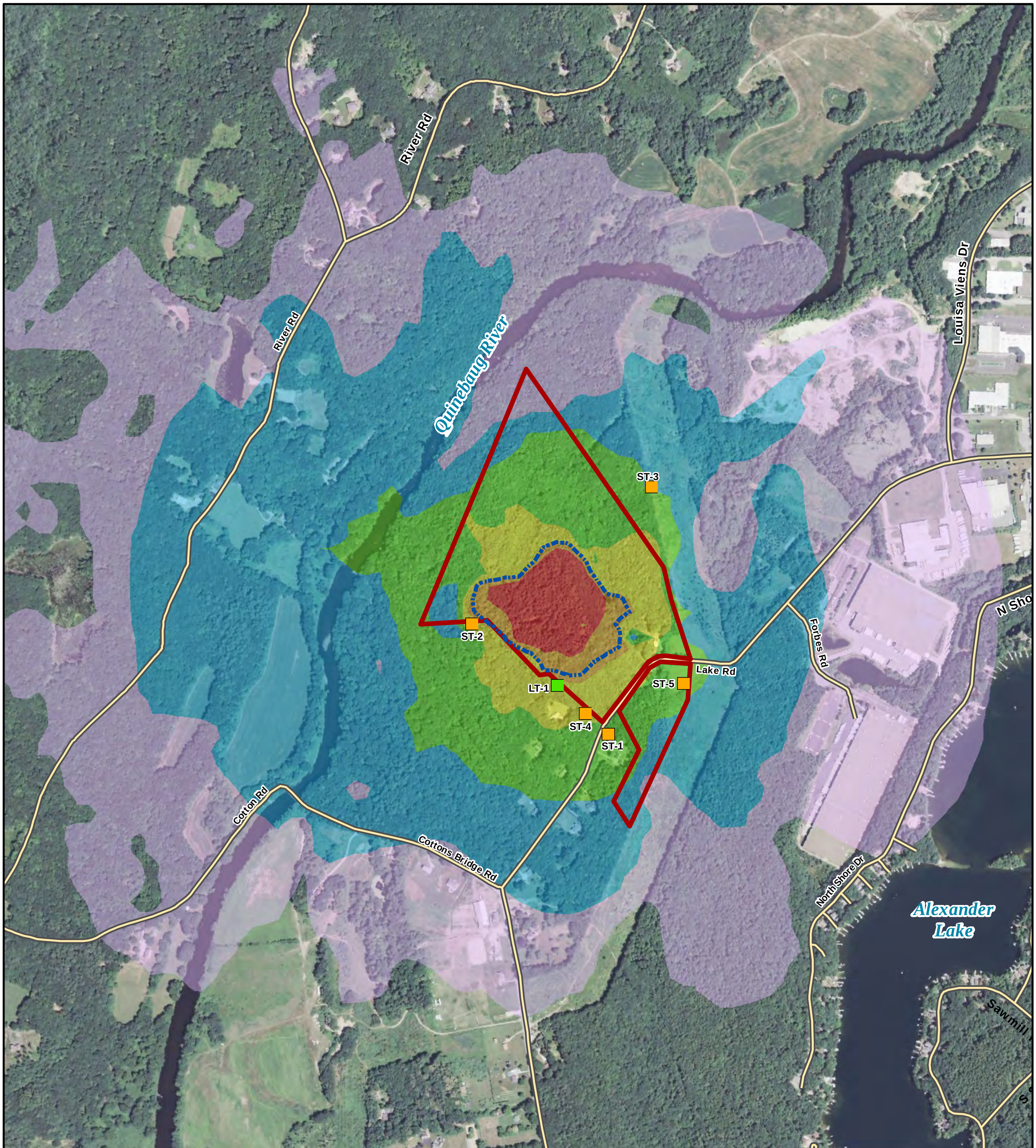
The following mitigation measures, in addition to assumptions reflected in Tables 8 and 9, were included in this analysis to demonstrate that compliant sound levels can be readily achieved by KEC:

- HRSG Exhaust Stack: The HRSG exhaust stack will incorporate a 10 foot silencer system that will reduce the noise from the upper stack portion and the exhaust stack exit (see Table 8).
- Turbine Exhaust Diffuser: The turbine exhaust diffuser will incorporate 40-foot high sound barrier wall located on the west side of the diffuser. Alternatively, lagging or increased casing could be incorporated into the design to reduce the sound power level of the turbine diffuser to 98 dBA, equivalent to a sound pressure level of 88 dBA at 3 feet.
- HRSG Transition Duct: The HRSG transition duct will incorporate an acoustical shroud to reduce the overall sound power level to 91 dBA, equivalent to a sound pressure level of 81 dBA at 3 feet.
- HRSG Duct Burner Gas Piping: The HRSG duct burner gas piping will incorporate acoustical lagging to reduce the overall sound power level to 92 dBA, equivalent to a sound pressure level of 82 dBA at 3 feet.
- Fuel Gas Piping: The fuel gas piping will incorporate acoustical lagging to reduce the overall sound power level to 85 dBA, equivalent to a sound pressure level of 75 dBA at 3 feet.
- Fuel Gas Heater Stack: The fuel gas heater stack will incorporate a silencer to reduce the overall sound power leve to 83 dBA, equivalent to a sound pressure level of 73 dBA at 3 feet.
- ACC: The ACC will be a low noise design incorporating noise reduction measures to achieve a far-field sound pressure level of 46 dBA at 650 feet, equivalent to a net sound power level of 103 dBA.
- Closed Cooling Water System: The closed cooling water fin-fan tower will be a low noise design incorporating noise reduction measures to achieve net sound power level of 95 dBA, equivalent to a sound pressure level of 85 dBA at 3 feet.
- Gas Turbine Enclosure Air Inlet Vents: The air inlet vents for the gas turbine enclosure will incorporate a silencer system to the reduce the overall sound power level to 85 dBA, equivalent to a sound pressure level of 75 dBA at 3 feet.
- Gas Turbine Enclosure Air Discharge Vents: The air discharge vents for the gas turbine enclosure will incorporate a silencer system to reduce the overall sound power level to 83 dBA, equivalent to a sound pressure level of 73 dBA at 3 feet.

The treatments with the acoustic performance as outlined above relate to the dominant noise sources. These mitigation measures were incorporated into the noise assessment to demonstrate the feasibility of KEC to meet applicable noise requirements. Final design may incorporate different mitigation measures in order to achieve the same objective as demonstrated in this assessment.

5.4 NOISE PREDICTION MODEL RESULTS

Broadband (dBA) sound pressure levels were calculated at an elevation of 1.5 meters (5 feet) above the ground, the height of the ears of a standing person, for expected normal KEC operation assuming that all components identified previously are operating continuously and concurrently at the representative manufacturer-rated sound levels. The sound energy was then summed to determine the equivalent A-weighted sound pressure level at a point of reception during normal operation. Sound contour plots displaying broadband (dBA) sound levels presented as color-coded noise isopleths in 5-dBA intervals are provided in Figure 15. In addition, an isopleth is shown that corresponds to the DEEP and Town of Killingly noise limit required for a Class C industrial land use (such as KEC) to a Class A residential land use receiver during the most stringent nighttime period (51 dBA).



Legend

- Project Site
- Short Term Monitoring Location
- Long Term Monitoring Location
- Noise Threshold Limit 51 dBA

Sound Level Contour Ranges (dBA):

- 30-35 dBA
- 35-40 dBA
- 40-45 dBA
- 45-50 dBA
- 50-55 dBA
- >55 dBA

N

0 250 500 Feet

Figure 15
Acoustic Modeling Results - Mitigated Design

Killingly Energy Center
an NTE Energy Project

The noise contours are graphical representations of the cumulative noise associated during normal operation of the individual equipment components and show how operational noise would be distributed over the surrounding area. The contour lines shown are analogous to elevation contours on a topographic map, i.e., the noise contours are continuous lines of equal noise level around some source, or sources, of noise.

Table 10 shows the projected exterior sound levels resulting at all the representative monitoring locations under the mitigated design. Note that ST-2 and LT-1 are essentially along the KEC property boundary and reflect compliance with the 51 dBA standard. For all locations beyond the property boundary, sound levels continue to drop off rapidly.

Table 10. Acoustic Modeling Results Summary – Mitigated Design

Location	Project Sound Level, dBA
ST-1	44
ST-2	49
ST-3	40
ST-4	46
ST-5	41
LT-1	49

6.0 CONCLUSIONS

The operation of KEC equipment will fully comply with all of the applicable noise standards and limits pursuant to the state standards and local regulations. With the recommended noise control features described in Section 4, operational noise levels have been demonstrated to meet the limits established by the DEEP and the Town of Killingly. Careful equipment specification will ensure that no pure tone violations will occur as a result of KEC.

State of Connecticut and Town of Killingly regulations require that KEC meet stringent sound limits at its boundaries, with levels not to exceed 51 dBA required during nighttime hours, which is similar to a quiet office space or the sound generated from the water flow of a medium sized creek (Noise Navigator Sound Level Database 2015). Figure 15 and Table 10 confirm that the maximum KEC sound in all nearby residentially zoned areas will meet the most stringent 51 dBA nighttime limit during normal, full operation.

KEC has integrated low-noise features into its layout and design in order to meet the stringent state and local requirements. These features include: positioning louder equipment (such as the ACC fans) towards the middle of the site; the use of enclosures around major equipment (for example, the combustion turbine and steam turbine); and incorporation of mitigation measures (such as acoustically treated equipment enclosures, acoustic silencers, sound walls or barriers, and specifying low-noise equipment). Although the specific noise control measures will be refined as KEC moves towards final design and construction, this analysis demonstrates that measures can be incorporated that will enable KEC to comply with all applicable noise requirements.

Given the existing levels of sound in the environment, the addition of KEC's normal operation will result in an increase of less than 10 dBA during the daytime period at the closest sensitive receptor (a residence approximately 260 feet from KEC), with sound continuing to attenuate significantly with distance. At locations near Alexander Lake, sound generated from KEC would be less than 30 dBA, which would not result in a perceptible difference in the overall sound level. Furthermore, during nighttime hours residents tend to be indoors; therefore, they would experience additional sound reduction from their home's walls. Typical residential construction provides approximately 15 to 20 decibels of additional noise reduction with windows closed and approximately 10 dB of additional noise reduction with windows in an open position (Harris 1998).

Nighttime sound associated with KEC will not only comply with the required 51 dBA at the property boundary but, due to noise attenuation of residential construction, will result in an interior noise level at the nearest residence ranging from 31 dBA to 36 dBA. This is well within the range of typical interior noise levels in bedrooms where people are sleeping, which is 30 dBA to 40 dBA (Harris 1998).

Although the specific mitigation assumptions incorporated in this modeling effort may be further refined in final design, the results of this acoustic modeling analysis demonstrate that the criteria limits can be readily achieved by KEC. Agreements with major equipment vendors and the construction contractor awarded for the KEC project will incorporate guarantees that will reflect compliance with the 51 dBA requirement before conveying KEC to NTE for formal operational control. Furthermore, it is fully expected that the Connecticut Siting Council will require, as a part of its Development and Management Plan process, detailed information about final noise mitigation measures and plans to demonstrate compliance with DEEP noise standards. Unlike many industrial facilities, considerable regulatory oversight is focused on energy facilities that requires confirmation that the required standards are met.

7.0 REFERENCES

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APPENDIX A: CALIBRATION CERTIFICATION DOCUMENTATION

Calibration Certificate

Certificate Number 2015001437

Customer:

Hilton Garden Inn Covington/Mandeville
350 Holiday Square Boulevard
Covington, LA 70433, United States

Model Number	831
Serial Number	0003847
Test Results	**Pass**
Initial Condition	As Manufactured
Description	Larson Davis Model 831

Procedure Number	D0001.8384		
Technician	Ron Harris		
Calibration Date	16 Feb 2015		
Calibration Due			
Temperature	23.11	°C	± 0.01 °C
Humidity	50.1	%RH	± 0.5 %RH
Static Pressure	86.43	kPa	± 0.03 kPa

Evaluation Method ***Tested with:***
PRM831, S/N 036754
377B02, S/N 150589

Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

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Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	07/08/2014	07/08/2015	006311
Hart Scientific 2626-S Humidity/Temperature Sensor	05/16/2014	05/16/2015	006943
Larson Davis CAL200 Acoustic Calibrator	08/06/2014	08/06/2015	007027
Larson Davis Model 831	03/05/2014	03/05/2015	007182
1/2 inch Microphone - P - 0V	03/11/2014	03/11/2015	007185
Larson Davis CAL291 Residual Intensity Calibrator	09/26/2014	09/26/2015	007287

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ilac-MRA
ACCREDITED
Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.00	113.80	114.20	0.14	Pass

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using S-time-weighted sound level

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.21	-0.20	-1.20	0.80	0.21	Pass
1000	0.14	0.00	-0.70	0.70	0.21	Pass
8000	-2.03	-3.00	-5.50	-1.50	0.21	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
Low Range, 20 dB gain	63.89

-- End of measurement results--

-- End of Report--

Signatory: *Ron Harris*

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2015006618

Customer:

Tetra Tech EC Inc
3rd Floor
160 Federal Street
Boston, MA 02110, United States

Model Number	831	***Procedure Number***	D0001.8384		
Serial Number	0004001	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	13 Jul 2015		
Initial Condition	As Manufactured	***Calibration Due***			
		Temperature	23.07	°C	± 0.01 °C
Description	Larson Davis Model 831	***Humidity***	49.5	%RH	± 0.5 %RH
		Static Pressure	86.43	kPa	± 0.03 kPa

Evaluation Method — ***Tested with:***
PRM831, S/N 036849
377B02, S/N 156091

Data reported in dB re 20 μPa.

Compliance Standards — Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	06/24/2015	06/24/2016	006311
Hart Scientific 2626-H Temperature Probe	06/17/2015	06/17/2016	006798
Larson Davis CAL200 Acoustic Calibrator	08/06/2014	08/06/2015	007027
Larson Davis Model 831	03/05/2015	03/05/2016	007182
1/2 inch Microphone - P - 0V	03/11/2015	03/11/2016	007185
Larson Davis CAL291 Residual Intensity Calibrator	09/26/2014	09/26/2015	007287

Calibration Certificate

Certificate Number 2015011769

Customer:
Tetra Tech Inc
3rd Floor
160 Federal Street
Boston, MA 02110, United States

Model Number	831	***Procedure Number***	D0001.8384		
Serial Number	0001350	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	9 Dec 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	9 Dec 2017		
		Temperature	23.31	°C	± 0.01 °C
Description	Larson Davis Model 831	***Humidity***	49.5	%RH	± 0.5 %RH
		Static Pressure	86.29	kPa	± 0.03 kPa

Evaluation Method ***Tested with:***
PRM831. S/N 010875
377B02. S/N 109271

Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

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Hart Scientific 2626-H Temperature Probe	06/17/2015	06/17/2016	006798
Larson Davis CAL200 Acoustic Calibrator	08/12/2015	08/12/2016	007027
Larson Davis Model 831	03/05/2015	03/05/2016	007182
1/2 inch Microphone - P - 0V	03/11/2015	03/11/2016	007185
Larson Davis CAL291 Residual Intensity Calibrator	09/24/2015	09/24/2016	007287