Environmental Overview in Support of Petition for Changed Conditions

Killingly Energy Center

January 2018

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Killingly Energy Center
an NTE Energy Project

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
2017 Decision	decision issued by the Connecticut Siting Council regarding Docket No. 470 on May 16, 2017
°F	degrees Fahrenheit
$\mu g/m^3$	micrograms per cubic meter
ACC	air-cooled condenser
ARM2	Ambient Ratio Method 2 model
BACT	Best Available Control Technology
CEBA	Community Environmental Benefits Agreement
Certificate	Certificate of Environmental Compatibility and Public Need
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
Council	Connecticut Siting Council
CSO	capacity supply obligation
CWC	Connecticut Water Company
dBA	broadband, or A-weighted decibels
DEEP	Connecticut Department of Energy and Environmental Protection
Eversource	Eversource Energy Service Company
FCA-11	the 2017 Forward Capacity Auction
FCA-12	the 2018 Forward Capacity Auction
H1H	highest first highest
H_2SO_4	sulfuric acid
HRSG	heat recovery steam generator
ISO	International Organization for Standardization
ISO-NE	Independent System Operator-New England, Inc.
KEC	Killingly Energy Center, a 550-megawatt combined cycle electric generating facility on Lake Road in Killingly, Connecticut
Km	Kilometer
LAER	Lowest Achievable Emissions Rate
lb/hr	pounds per hour

Acronyms/Abbreviations	Definition
lb/MMBtu	pounds per million British thermal units
Mitsubishi	Mitsubishi Hitachi Power Systems America
Mitsubishi CTG	Mitsubishi Model M501JAC combustion turbine generator
MMBtu/hr	million British thermal units per hour
MW	Megawatts
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NTE	NTE Connecticut, LLC
Original Application	the application for a Certificate of Environmental Compatibility and Public Need filed for the Killingly Energy Center under Docket No. 470
PM	particulate matter
PM_{10}	particulate matter with a diameter less than 10 microns
$PM_{2.5}$	particulate matter with a diameter less than 2.5 microns
PSD	Prevention of Significant Deterioration
R&R	Regulate and Restrict
SCR	selective catalytic reduction
SIA	Significant Impact Area
Siemens CTG	Siemens Model SGT6-8000H combustion turbine generator
SIL	Significant Impact Level
SIS	System Impact Study
SO_2	sulfur dioxide
SUSD	startup and shutdown
SWPPP	Stormwater Pollution Prevention Plan
ULSD	ultra-low sulfur distillate
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds
w/ DF	with duct firing
w/o DF	without duct firing

1.0 INTRODUCTION

NTE Connecticut, LLC (NTE) is submitting to the Connecticut Siting Council (Council) a Motion to Reopen the Docket No. 470 proceeding on a showing of changed conditions with respect to the proposed dual-fuel combined cycle electric generating facility, the Killingly Energy Center (KEC). KEC is the subject of Council Docket No. 470. An application for a Certificate of Environmental Compatibility and Public Need (Certificate) for KEC was submitted to the Council on August 17, 2016 (Original Application). The Original Application addressed the construction, maintenance, and operation of a proposed 550-megawatt (MW) electric generating facility located on Lake Road in Killingly, Connecticut.

The Council issued a decision on May 16, 2017 (2017 Decision) that denied KEC's Original Application, without prejudice, after full Council proceedings, including adjustments made by NTE to KEC to accommodate comments submitted by the Town of Killingly in its Regulate and Restrict (R&R) Orders submitted to the Council. In addition, extensive public outreach was conducted in accordance with the Connecticut's Environmental Justice requirements. The Council's charge is to balance the need for adequate and reliable public utility services at the lowest reasonable cost to consumers with the need to protect the environment and ecology of the state. Although the characteristics of KEC were enumerated that met various regulations and standards, the Council did not find the demonstration of need sufficiently compelling to provide for a public benefit in light of NTE's decision to withdraw from the Independent System Operator-New England, Inc. (ISO-NE) 2017 Forward Capacity Auction (FCA-11). As stated in the 2017 Decision, the Council determined that without "…a public benefit to balance with the environmental impacts…" the denial without prejudice allows for reconsideration at such time as the need for KEC can be demonstrated to the Council's satisfaction.

NTE is confident of the need for KEC, based on: i) the reliability that KEC will bring to the electrical system due to its firm gas supply and backup fuel capabilities; ii) its flexibility to support increased use of renewables; iii) its capacity to replace older, less efficient electric generating units; iv) its anticipated selection in the ISO-NE 2018 Forward Capacity Auction (FAC-12); and v) the economic and other benefits that will result to the local and regional communities. The range of these benefits respond to needs not only in Connecticut but also in New England.

During the intervening time, NTE has continued to work diligently with the Connecticut Water Company (CWC) on water supply and construction agreements; with Eversource Energy Service Company (Eversource) on engineering agreements for the design and permitting of the Yankee Gas lateral and transfer of real estate to support road modifications; with ISO-NE on the System Impact Study (SIS); and with the Town of Killingly on the tax stabilization agreement and a community environmental benefits agreement (CEBA). In addition, in the intervening period, NTE has had the opportunity to revisit options to improve KEC. Based upon NTE's positive experience utilizing Mitsubishi equipment on its two existing facilities, and on advancements in demonstrating Mitsubishi's latest "J" technology (with its economic and emissions benefits resulting from improved thermal efficiency), NTE has updated KEC to replace the Siemens Model SGT6-8000H combustion turbine generator (Siemens CTG) with the Mitsubishi Model M501JAC (Mitsubishi CTG). The change to this equipment, which is manufactured in the United States, results in a further benefit to KEC's emissions profile while retaining the existing development footprint. While the vast majority of details and topics remain as presented in the Original Application, this Environmental Overview provides information that updates the previously submitted information, as applicable.

Based on the above, a Motion to Reopen Docket No. 470 has been filed requesting that the Council reconsider its prior decision based on changed conditions and issue a Certificate approving KEC. Section 2 of this Environmental Overview provides a summary discussion regarding the need for KEC (further supported by testimony); this demonstration is the backdrop against which other impacts will be considered by the Council. Section 3 describes the proposed changes to KEC resulting from the replacement of the Siemens CTG with the Mitsubishi CTG. Section

4 discusses the manner in which impacts addressed in the Original Application are minimally affected for KEC's current proposed configuration.

KEC remains an important addition to energy generation in Connecticut that can provide a flexible, low cost and efficient resource with minimal environmental and community impacts.

2.0 DEMONSTRATION OF NEED

In New England, the need for a generating facility (its contributions to power system reliability and competitive market operations, as well as its economic and other public benefit impacts) occurs within the context of a fully interdependent relationship between state and regional power systems and market operations. Given the significant operational and market challenges faced by the State of Connecticut and the ISO-NE power system, KEC is vitally needed to support the reliability of electric supply, and contribute to the competitiveness and efficiency of electricity markets. Connecticut's and the region's unique reliability challenges have been recognized by ISO-NE, Connecticut (and other New England states), the North American Electric Reliability Corporation, and the Federal Energy Regulatory Commission. Particular challenges for Connecticut and New England include:

- Increasing dependence on natural gas, particularly during cold winter conditions (as evidenced by system operations during the recent cold snap);
- The ongoing attrition of aging and less-efficient generating capacity in the region; and
- An increasing penetration of variable renewable resources (primarily wind and solar plants) at both the regional power system and distribution system levels.

Recent developments, including suspension of the application for the Access Northeast natural gas pipeline, lower caps on carbon dioxide (CO_2) proposed by the Northeast states in the Regional Greenhouse Gas Initiative, and regulations establishing even more stringent CO_2 emission control requirements from power plants in New England states, increase the likelihood of the retirement of older, less efficient, and higher-emitting power plants.

KEC is precisely what is needed to meet the state's and the region's reliability needs now, and to help address the most pressing reliability, resilience, operating flexibility and environmental challenges that Connecticut and New England will face in the coming years. KEC is uniquely suited to these challenges because it will be a reliable, local, and efficient generating resource located close to load in the most densely populated portion of the New England region, and will provide an unmatched range of capabilities tailored to Connecticut and New England's specific circumstances. Specific reliability and market benefit attributes of KEC include those outlined below.

- KEC will represent an efficient and dispatchable generating resource connected to the high-voltage system, providing spinning mass/inertia close to load in Connecticut, and with the ability to provide Connecticut and the ISO-NE system with a full range of essential reliability services.
- KEC, with its firm gas contract and dual-fuel capability, will provide exactly the type of fuel security needed to address Connecticut's and New England's most pressing system resilience/reliability challenge – the dependence on natural gas, particularly during winter months. The recent cold snap amplifies the reliability value and price-hedging benefits of KEC's defense-in-depth approach to fuel management and security.
- KEC contains all of the fast-acting, flexible and dispatchable operating characteristics needed to fully support the expanded integration of variable renewable resources at the grid-connected and distributed levels.
- KEC's best-in-class production efficiency means that it will represent a low-emitting resource likely to displace emissions of CO_2 and other pollutants from higher-emitting resources in many hours throughout the year.

Obtaining a capacity supply obligation (CSO) in the ISO-NE forward capacity market is one – but not the only – indication of the reliability value of a resource to Connecticut and the ISO-NE region. Setting aside whether KEC obtains a CSO in the upcoming forward capacity auction, the reliability and competitive market attributes summarized above (and discussed in more detail in testimony filings) are sufficient to demonstrate that KEC is necessary for the reliability of electric supply, and contributes to the competitiveness and efficiency of wholesale electricity markets. Nevertheless, KEC is also well positioned to succeed in FCA 12 or succeeding capacity auctions, and obtain CSOs for FCA 12 and future capacity commitment periods.

3.0 PROJECT DESCRIPTION UPDATES

Section 2.0 of the Original Application provided details describing KEC that were subsequently updated in a filing on October 27, 2016 in order to respond to comments provided by the Town of Killingly through its R&R Orders. KEC continues to be proposed within the previously documented development footprint. In fact, the current update allows the distance from wetlands to be maintained, and in one area to be increased, allowing for removal of a previously proposed retaining wall; this responds to the desire expressed during previous hearings to allow for natural slopes and vegetation for stabilization wherever possible.

Figure 1 provides the proposed KEC layout with the Mitsubishi CTG; Figure 2 presents a more detailed plot plan. The following sections describe details regarding the performance and emissions associated with the Mitsubishi CTG as compared to the previously proposed Siemens CTG; the benefits derived from the resulting reduction in duct-fired hours; the associated minor adjustments to the layout (all of which remain within the previously proposed development footprint); and the updated KEC schedule. No changes are proposed to any activities on the Switchyard Site (other than a minor adjustment to the wetland mitigation area in response to a request by the Connecticut Department of Energy and Environmental Protection [DEEP], as discussed in Section 3.2).

3.1 TECHNOLOGY UPDATE – MITSUBISHI CTG

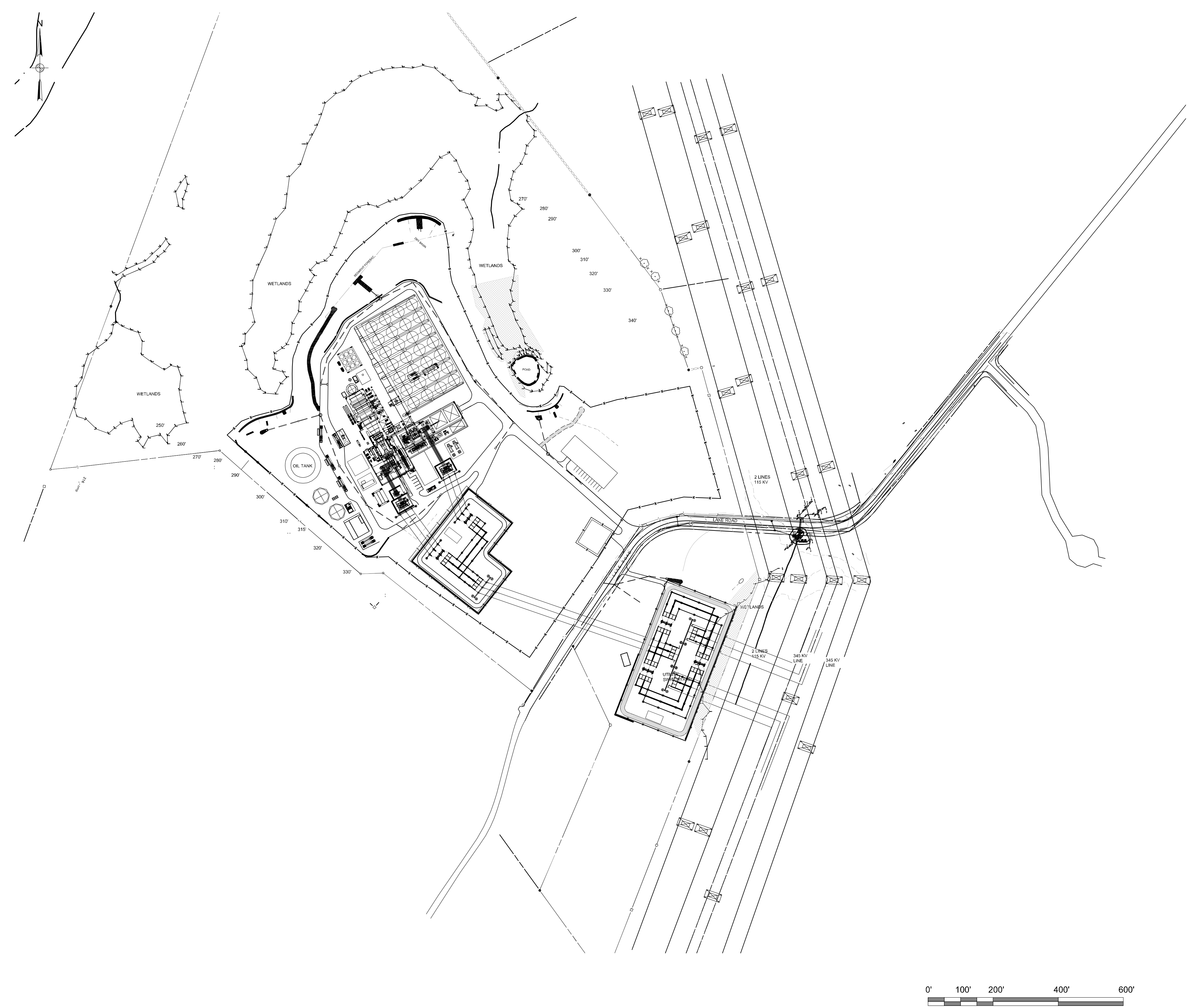
With additional time available in the schedule for evaluating combustion turbine technology, NTE has selected the use of the Mitsubishi CTG to replace the previously proposed Siemens CTG. An application for a minor modification to the existing air permit, specifically Permit Number 089-0107 (issued on June 30, 2017), was submitted to DEEP on November 22, 2017. DEEP issued a Notice of Sufficiency letter on December 12, 2017, stating that the application was complete. The proposed modification results in improvement in KEC's emissions profile and a reduction in ambient air impact concentrations. A slightly larger natural gas heater will be required for use with the Mitsubishi CTG, which is also addressed in the minor permit modification application. There will be no changes to the auxiliary boiler, the emergency fire pump engine (covered under existing Permit Number 089-0107), or the emergency generator engine (covered under existing Permit Number 089-0108), other than minor location adjustments (as described in Section 3.2 and addressed in the minor permit modification application). The shift in technology will allow for lower annual emissions and reduced particulate matter (PM) Best Available Control Technology (BACT) limits, while continuing to meet air quality standards.

Key benefits to the technology include:

- Continued high efficiency, rapid starts, and dual-fuel rapid switching ability;
- Reduced short-term PM emissions, while maintaining a similar emissions profile for the balance of parameters; and
- Higher design heat input rating and output, allowing for a reduction in fuel consumption by the duct burners to maintain KEC's nominal 550-MW rating.

As presented in Section 4.1, the air quality dispersion modeling analysis reflecting the changed technology and associated equipment adjustments continues to demonstrate compliance with National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments. In fact, the predicted ambient air quality impacts for KEC using the Mitsubishi CTG are less than those with the originally proposed Siemens CTG.

Further discussion of the technology benefits are provided in the following sections.



Notes

Legend

SOUND MITIGATION

Reference Drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
B	01/17/18	AF	FOR CLIENT REVIEW	KP	JW
A	01/12/18	AF	FOR CLIENT REVIEW	KP	JW

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Figure 1
Proposed Killingly Energy Center Site Plan

NTE ENERGY

KILLINGLY ENERGY CENTER
KILLINGLY CONNECTICUT

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

Designed	-	Eng check	JW
Drawn	AF	Approved	-
Dwg check	KP	Project Mngr	JW
Scale at ANSI E: 1" = 100'-0"		Date: 04/07/16	Rev: B

Drawing Number
334954CT-SA-213

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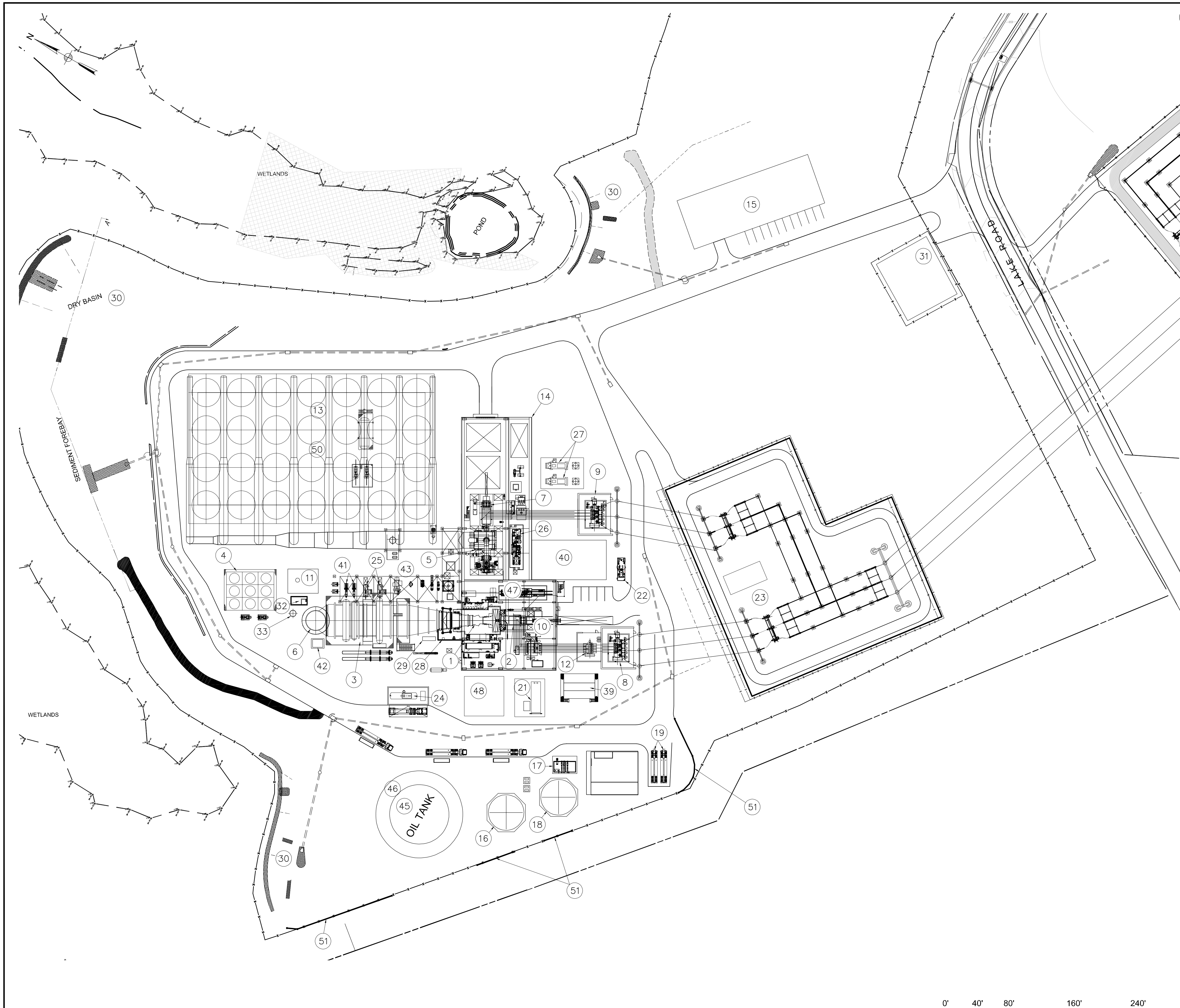

Notes

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
11. AUXILARY BOILER
12. UNIT AUXILARY TRANSFORMER
13. AIR COOLED CONDENSER (ACC) & CONDENSATE COLLECTION ENCLOSURE
14. TURBINE BUILDING
15. ADMIN/ WAREHOUSE BUILDING
16. RAW / FIRE WATER STORAGE TANK & RW PUMPS
17. FIRE PUMPS ENCLOSURE
18. DEMINERALIZED WATER STORAGE TANK
19. DEMINERALIZED WATER TRAILERS AREA
20. NOT USED
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. METER AND REGULATION YARD
32. HRSG BLOW OFF TANK & DRAINS PUMPS
33. HRSG BLOWDOWN SUMP
34. NOT USED
35. CIVIL OIL WATER SEPARATOR (NOT SHOWN)
36. NOT USED
37. PLANT GATE (NOT SHOWN)
38. NOT USED
39. CTG ELECTRICAL PACKAGE
40. CONTROL ROOM AND SWITCHGEAR (2-STORY BUILDING)
41. AMMONIA PUMPS
42. CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)
43. PIPE RACK
44. FUEL OIL UNLOADING
45. FUEL OIL TANK
46. STEEL CONTAINMENT
47. GT LUBE OIL SKID
48. FUEL GAS COMPRESSORS
49. WATER TREATMENT BUILDING
50. ACC MECHANICAL/ELECTRICAL EQUIPMENT ENCLOSURE
51. SOUND WALL

Reference Drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
E	01/17/18	AF	FOR CLIENT REVIEW	KP	JW
D	11/06/17	AF	FOR CLIENT REVIEW	KP	JW
C	10/20/17	AF	FOR CLIENT REVIEW	KP	JW
B	10/19/17	AF	FOR CLIENT REVIEW	KP	JW
A	10/13/17	AF	FOR CLIENT REVIEW	KP	JW

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Figure 2
Proposed Killingly Energy Center Plot Plan

NTE ENERGY

KILLINGLY ENERGY CENTER
KILLINGLY CONNECTICUT

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

Designed	-	Eng check	JW
Drawn	AF	Approved	-
Dwg check	KP	Project Mngr	JW
Scale at ANSI E 1" = 40'-0"		Date 04/07/16	Rev E
Drawing Number 334954CT-GA-213			

3.1.1 Next-Generation Technology

Just as was the case for the Siemens CTG, the Mitsubishi CTG reflects: i) ongoing technology enhancements intended to increase efficiency, with a resulting reduction of fuel consumed per MW-hour produced; and ii) benefits to electricity consumers in combination with the increase of renewable energy sources through its ability to rapidly start and adjust to various load configurations.

A comparison of the startup and shutdown (SUSD) emissions for the Siemens CTG and the Mitsubishi CTG is provided in Table 1.

Table 1: Permitted Versus Proposed CTG SUSD Emission Limits (lb/hr)

Pollutant	Siemens CTG				Mitsubishi CTG			
	Startup		Shutdown		Startup		Shutdown	
	Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	ULSD
NO_x	142	193	80	169	150	203	79	162
VOC	45	264	67	176	46	266	64	175
CO	477	2,306	212	429	404	2,309	213	428

lb/hr = pounds per hour; ULSD = ultra-low-sulfur distillate; NO_X = nitrogen oxides; VOC= volatile organic compounds; CO = carbon monoxide.

SUSD times for the two technologies are the same, with both able to achieve emissions compliance in less than 35 minutes, even from cold-start conditions. The use of the auxiliary boiler reduces start time by keeping the steam system components warm, minimizing the duration of cold starts. Shorter startup time provides significant benefits to the electric grid for meeting energy needs. A shorter startup time not only provides power to the grid more quickly, but also achieves compliance with the more stringent steady-state emission rates faster. The ability to come online quickly and change loads (ramping) efficiently has and will continue to become more and more important as intermittent renewable energy resources (wind and solar) become an increased component of New England's resource mix. Combined cycle projects such as KEC are an important companion to wind and solar due to their ability to "balance" generation on a rapid basis, as the output of renewable energy sources greatly varies throughout the day. The Mitsubishi CTG continues to demonstrate a superior ramping rate that makes it a valuable addition to the regional power generation fleet.

As was the case for the Siemens CTG, the Mitsubishi CTG also continues to allow for rapid switching between KEC's primary fuel, natural gas, and ULSD backup. This provides the critical ability to respond reliably to emergency situations in the rare occurrence when natural gas may not be available. Retaining this ability in switching to the Mitsubishi CTG was an important factor in its selection.

3.1.2 Best Available Control Technology and Lowest Achievable Emission Rates

KEC will continue to utilize the same emission control technologies that were affirmed to meet BACT and Lowest Achievable Emission Rate (LAER) standards. This will result in the same LAER and BACT limits approved in the existing KEC air permit, with the exception of a reduction to the BACT limit for PM. Table 2 provides a comparison of the PM emissions for the Siemens CTG (from the existing permit) and the Mitsubishi CTG (from the minor modification application).

Table 2: Comparison of Permitted and Proposed CTG PM Emission Rates (lb/MMBtu)

Pollutant	Permitted (Siemens CTG)			Proposed (Mitsubishi CTG)		
	Gas w/o DF	Gas w/ DF	ULSD	Gas w/o DF	Gas w/ DF	ULSD
PM	0.0044	0.0050	0.0168	0.0022	0.0033	0.0100
$PM_{10}/PM_{2.5}$	0.0044	0.0050	0.0168	0.0022	0.0033	0.0100

lb/MMBtu = pounds per million British thermal units; w/o DF = without duct firing; w/ DF = with duct firing; PM_{10} = particulate matter with a diameter less than 10 microns; $PM_{2.5}$ = particulate matter with a diameter less than 2.5 microns.

On a lb/hr basis, the maximum emission rates of the Mitsubishi CTG during duct firing will be comparable to the limits in KEC's existing air permit for all pollutants, except for the lower $PM/PM_{10}/PM_{2.5}$. As noted above, the proposed BACT $PM/PM_{10}/PM_{2.5}$ limit has been lowered, and therefore, emissions of $PM/PM_{10}/PM_{2.5}$ will be lower for all operating conditions. Table 3 provides a comparison of the permitted and proposed maximum lb/hr emission rates for all pollutants covered under Permit No. 089-0107. Because the output of the Mitsubishi CTG is greater than the Siemens CTG, its lb/hr emissions rates when running at full output without duct firing will be slightly higher for most pollutants. However, as discussed in Section 3.1.3, this allows the use of a smaller duct burner for fewer hours to achieve 550 MW, significantly reducing the annual emissions.

Table 3: Comparison of Permitted and Proposed Maximum CTG Emission Rates (lb/hr)

Pollutant	Siemens CTG			Mitsubishi CTG		
	Gas w/o DF	Gas w/ DF	ULSD	Gas w/o DF	Gas w/ DF	ULSD
PM	13.0	19.5	30.0	7.6	12.7	28.6
$PM_{10}/PM_{2.5}$	13.0	19.5	30.0	7.6	12.7	28.6
SO_2	4.5	5.9	4.0	5.6	6.1	4.6
NO_x	22.5	29.7	40.9	27.6	29.9	47.2
VOC	2.8	8.3	7.1	3.4	8.3	9.2
CO	6.2	15.4	11.2	7.6	15.5	14.4
Lead	1.44E-03	1.9E-03	3.0E-03	1.84E-03	2.0E-03	3.2E-03
H_2SO_4	1.6	2.0	1.5	1.9	2.1	1.9

SO_2 = sulfur dioxide; H_2SO_4 = sulfuric acid.

3.1.3 Reduction of Duct Firing

The Mitsubishi combustion turbine is larger than the Siemens combustion turbine and, therefore, has a higher design heat input rate (3,686 million British thermal units per hour [MMBtu/hr] firing natural gas and 3,033 MMBtu/hr firing ULSD under standard conditions[1]). As a result, to achieve an output of 550 MW, the duct burner peak firing rate for the Mitsubishi CTG will be reduced by more than 50 percent from the Siemens CTG to 408 MMBtu/hr (compared to 946 MMBtu/hr), with fewer hours of duct firing required per year (as duct firing will no longer be required at cooler ambient temperatures). Therefore, under the proposed configuration, KEC's operation will restrict duct firing to an annual heat input of no more than 1,030,400 million British thermal units per year, a reduction of over 85 percent from the duct burner fuel throughput approved in KEC's existing air permit.

As emissions of VOC, CO, PM, PM_{10}, and $PM_{2.5}$ are higher from the duct burners, the decreased need for duct firing allows for significantly lower annual emission limits for these pollutants to generate 550 MW with the Mitsubishi CTG. Annual emission limits for NO_x with the Mitsubishi CTG will be the same as currently permitted levels. Therefore, no change in the number of emission reduction credits will be required beyond those already purchased and retired in association with KEC's existing air permit. Only minor differences are associated with the remaining pollutants as compared to those reflected KEC's existing air permit, as reflected in Table 4.

Table 4: Comparison of Permitted and Proposed CTG Annual Emission Rates (tons per consecutive 12 months)

Pollutant	Siemens CTG	Mitsubishi CTG
PM	88.7	47.7
$PM_{10}/PM_{2.5}$	88.7	47.7
SO_2	25.1	24.6
NO_x	130.1	130.1
VOC	41.7	32.1
CO	134.6	117.7
Lead	0.0018	0.008
H_2SO_4	8.76	8.60
CO_2e	1,989,650	2,001,753
Ammonia	49.8	50.3

CO_2e = carbon dioxide equivalents

[1] International Organization for Standardization (ISO) conditions of 59 degrees Fahrenheit (°F), 60 percent relative humidity, and an atmospheric pressure of 14.7 pounds per square inch absolute. The Siemens CTG had a design heat input rate of 2,969 MMBtu/hr firing natural gas and 2,639 MMBtu/hr firing ULSD.

3.2 LAYOUT AND STRUCTURE ADJUSTMENTS

Replacement of the Siemens CTG with the Mitsubishi CTG required minor reconfiguration of KEC within the existing development footprint, and allowed for other reconfiguration opportunities. The revised layout is shown in Figures 1 and 2. All of the same structures and equipment that were required for the Siemens CTG are still required for the Mitsubishi CTG. However, minor dimensional differences exist between vendors that needed to be accounted for in the layout. Two primary goals were utilized in implementing the adjustments:

- No increase in the size or location of the development footprint (to avoid material changes to wetland, species, or stormwater issues); and
- Retain the existing location and height of the main CTG stack (to avoid material changes to visibility or air navigation issue potential).

Using the main CTG stack location as a pivot point, it was necessary to rotate KEC's power block structures approximately 19 degrees in a clockwise direction in order to accommodate the size of the Mitsubishi CTG and related structures. This resulted in the ability to increase distance from Wetland X, to KEC's northeast, as discussed further below. Once that move was accomplished, ancillary equipment and site layout was examined to determine whether repositioning would be beneficial to KEC's operations and/or whether dimensional changes were necessary to accommodate the Mitsubishi CTG. Only minor changes resulted to the various structure heights, as detailed in Table 5.

Table 5: Structure Height Comparison

Structure	Siemens CTG Layout (feet)	Mitsubishi CTG Layout (feet)
Heat Recovery Steam Generator (HRSG) stack	150	No change
HRSG	96	95
HRSG drum #1	106	No change
HRSG drum #2	103	106
HRSG drum #3	105	106
Turbine exhaust diffuser (9 tiers)	33 – 96	28.6 – 83.9
Turbine building high bay	91.5	78.6
Turbine building low bay	40.5	39.1
Air inlet filter housing duct	64	69.8
Air inlet filter housing	86	92.4
Air-cooled condenser (ACC)	81	80
Closed cooling water fan array	22	No change
Auxiliary boiler stack	90	No change
Auxiliary boiler	26	No change
Emergency generator stack	45	No change

Structure	Siemens CTG Layout (feet)	Mitsubishi CTG Layout (feet)
Emergency generator	16	No change
Fire pump stack	20	No change
Fire pump enclosure	16	No change
Gas heater stack	20	No change
Gas heater enclosure	18	No change
Fuel gas compressor	21	No change
Control/maintenance building	26	No change
Administration building	26	No change
Water treatment building	25.5	No change
Demineralized water storage tank	38	No change
Service water storage tank	43	No change
ULSD tank	45	No change
ULSD tank outer wall	21	No change

Other structural changes included slight increases in the dimensions of the closed cooling water fan array and the auxiliary boiler structure. The turbine building low bay is also slightly larger, and the shape changed from rectangular to L-shaped. The control/maintenance building has been slightly reduced in size. Although the height of the ACC was slightly reduced, more detailed coordination with potential vendors resulted in an increase in size (approximately 64 feet longer and 22 feet wider than previously reflected). Four noise control barriers have been added to the design (as further discussed in Section 4.2).

Smaller equipment that had its location slightly adjusted include:

- Fuel gas compressor and gas heater – The fuel gas compressor and gas heater remained on the southwestern side of the layout, but were moved from the prior location southeast of the ULSD tank to just west of the turbine building. This reflects an operational efficiency associated with the functional use of this equipment.
- Emergency generator – The emergency generator was repositioned to a different side of the electrical / control building for better functionality (from the northeast side to the southeast side).
- Storage tanks – Repositioning of tanks has occurred to support functionality and maintain appropriate site buffers.
- Emergency fire pump – Adjusted location in the same general vicinity, associated with tank repositioning.

As noted above, realigning the power block allowed the opportunity to pull the perimeter access road farther away from the wetlands. This, in turn, facilitated the ability to eliminate the previously proposed use of a retaining wall along the northeasterly segment of the development footprint (between KEC and Wetland X). KEC's design has been adjusted to allow for a natural graded, vegetated slope in this location, just as is the case for the balance of the KEC perimeter. The fence line has been adjusted to be placed at the toe of the slope. As can be seen in

Figures 1 and 2, the distance between KEC-related grading and the nearest wetlands has been maintained, with some locations allowing for a slightly greater separation distance:

- The distance from KEC to Wetland X was previously 28 feet to the south and 26 feet to the north; the distance with the adjusted layout is 38 feet to the south and 40 feet to the north.
- Just to the north of that same general area, the distance between KEC and Wetland A2 has also increased, from 34 feet to 70 feet.
- Further north, just north of the ACC, the distance between KEC grading features (including for stormwater management) remains the same as with the prior configuration; however, the “footprint” (the area that is graded flat for placement of the KEC structures) was previously 214 feet from Wetland A3, and is now 234 feet from Wetland A3.

Although updates to the grading design have been undertaken and are presented in Appendix A, no material change results. Based on coordination with DEEP, adjustments requested in the location of the proposed Lepidoptera habitat (previously located in the wetland mitigation area on the Switchyard Site) has been relocated to the southeastern corner of the Generating Facility Site as also shown in Appendix A; this also does not reflect a material change.

3.3 CONSTRUCTION AND OPERATION SCHEDULE

The construction and operational schedule has been updated, see Figure 3. This schedule shows obtaining all remaining approvals to support issuance of a Construction Notice to Proceed in mid-July 2018. Under this schedule tree clearing and other site preparation activities would commence in early August 2018. This schedule supports a commercial operation date in March of 2021.

3.4 CONCLUSION

KEC, as currently proposed, continues to reflect an important addition to the portfolio of generating assets in Connecticut in order to provide reliable, efficient and cost-effective electricity. As addressed in Section 4, KEC’s environmental and community impacts will continue to meet all applicable regulatory requirements, and KEC will continue to provide substantial benefits to Killingly, the State of Connecticut and the region, while minimally affecting its host community and the broader environment.

Killingly Energy Center

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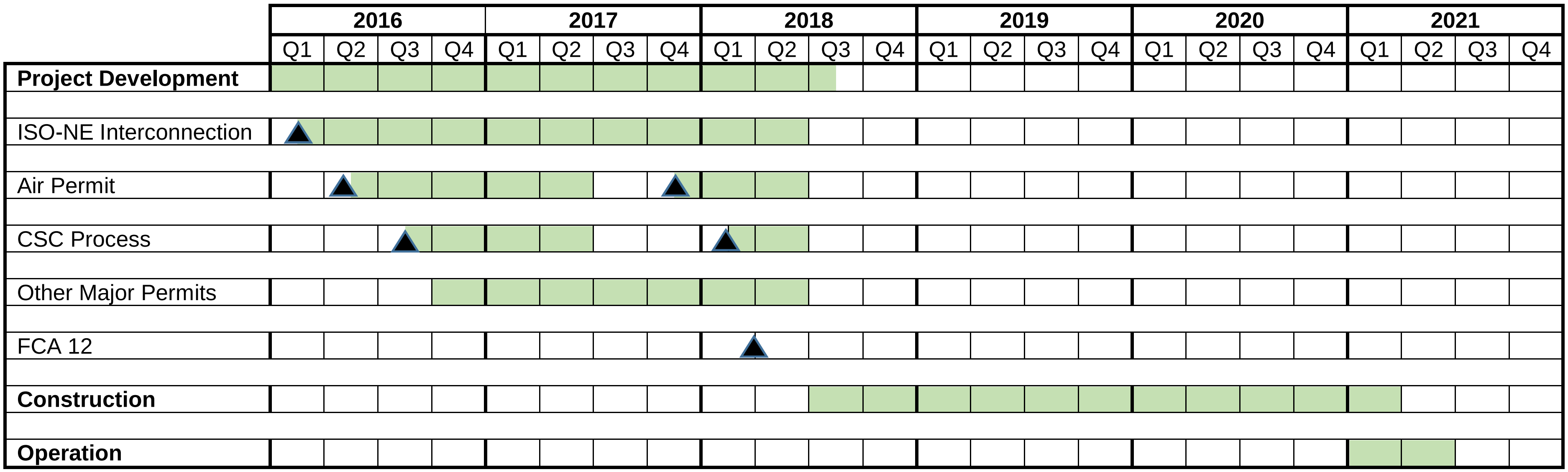


Figure 3

Updated KEC Schedule

4.0 ENVIRONMENTAL ANALYSIS

The following sections provide a discussion of:

- Environmental analyses that have changed relative to KEC's updates (air quality and noise); and
- Environmental and community conditions that have been reviewed and confirmed to remain fundamentally unchanged.

In all cases, KEC continues to reflect minimal environmental and community impact, and in some cases, reflects greater environmental benefit than the original configuration. KEC also continues to comply with all applicable environmental regulations, policies, and standards.

4.1 AIR QUALITY

As described in Section 3.0, the change in CTG results in some minor changes to the layout, as well as in emission-related benefits. NTE has evaluated the air quality implications of the change in a formal application for minor modification that was submitted to DEEP on November 22, 2017; additional information reflecting some minor equipment and other adjustments was provided to DEEP in January 2018 (Appendix B). The information under review included, in addition to a review of BACT/LAER and updated calculations for potential to emit, a detailed air dispersion modeling analysis in order to demonstrate compliance with the NAAQS.

KEC continues to integrate BACT and, for NO_x emissions, LAER technology, using the same stringent controls. Dry low-NO_X combustion in conjunction with selective catalytic reduction (SCR) will control NO_X emissions when firing natural gas. Water injection with SCR will control NO_X emissions when firing ULSD. An oxidation catalyst will control emissions of CO and VOC. Emissions of SO_2, PM_{10}/$PM_{2.5}$, and H_2SO_4 will be controlled through good combustion practices and selection of the cleanest available fuels. Through the use of the Mitsubishi CTG, NTE is able to commit to a lower BACT level for PM/PM_{10}/$PM_{2.5}$ than with the Siemens CTG.

Due to the Mitsubishi CTG's higher design heat input rating and output, fewer duct-fired hours are necessary in order to achieve KEC's nominal 550-MW output. This has considerably reduced the annual potential to emit. Because NO_X emissions have not increased, no additional emission reduction credits are required, beyond those that have already been purchased in conjunction with KEC's existing air permit.

The minor modification application reflects and assesses the above emission levels, including a detailed analysis of the range of potential operating conditions (at various loads and temperatures) through a dispersion modeling analysis. The dispersion modeling, in addition to normal combustion turbine and duct firing operation, incorporates SUSD conditions as well as ancillary equipment. Table 6 presents a comparison of KEC's modeled impact concentrations – both for the Siemens CTG and the Mitsubishi CTG – to the United States Environmental Protection Agency's (USEPA) Significant Impact Levels (SILs) and NAAQS. A comparison of the Siemens CTG and Mitsubishi CTG results for the cumulative modeling analysis and PSD increment compliance analysis are provided in Tables 7 and 8, respectively. As can be seen, modeled impacts with the Mitsubishi CTG are reduced to even less than those previously approved by DEEP in KEC's existing air permit, confirmed to appropriately protect public health and the environment.

Table 6: Comparison of Siemens CTG and Mitsubishi CTG Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Siemens CTG Impact Concentration (µg/m³)	Mitsubishi CTG Impact Concentration (µg/m³)	SIL (µg/m³)	Siemens CTG Extent of SIA (km)	Mitsubishi CTG Extent of SIA (km)	NAAQS (µg/m³)
NO_2 (Normal Load)	1-hour	16.04	10.78	7.5	12.9	12.1	188
	Annual	0.87	0.87	1	NA	NA	100
NO_2 (SUSD)	1-hour	81.46	65.05	NA	NA	NA	188
	Annual	0.87	0.88	NA	NA	NA	100
CO	1-hour	1,418	860.91	2,000	NA	NA	40,000
	8-hour	133	103.48	500	NA	NA	10,000
PM_{10}	24-hour	4.04	2.34	5	NA	NA	150
	Annual	0.24	0.15	1	NA	NA	NA
$PM_{2.5}$ (NAAQS)	24-hour	2.39	1.57	1.2	8.1	0.5	35
	Annual	0.18	0.14	0.2	NA	NA	12
SO_2	1-hour	2.94	1.79	7.8	NA	NA	196
	3-hour	1.72	1.26	25	NA	NA	1300
	24-hour	0.75	0.70	5	NA	NA	365
	Annual	0.05	0.04	1	NA	NA	80

Notes:

Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum 5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion in accordance with the Ambient Ratio Method 2 model (ARM2) NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentration prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

NO_2 = nitrogen dioxide; µg/m³ = micrograms per cubic meter; SIA = Significant Impact Area (the area for which cumulative sources is required to be considered); km = kilometers.

Table 7: Comparison of Siemens CTG and Mitsubishi CTG Cumulative NAAQS Compliance

Pollutant	Averaging Period	Siemens CTG Cumulative Impact (μg/m³)	Mitsubishi CTG Cumulative Impact (μg/m³)	Ambient Background (μg/m³)[a]	Siemens Total Impact Plus Background (μg/m³)[a]	Mitsubishi Total Impact Plus Background (μg/m³)	NAAQS (μg/m³)
NO_2 (Normal Load)	1-Hour	67.5	8.3	84.6	152.1	92.9	188
NO_2 (SUSD)	1-Hour	60.3	50.2	84.6	144.9	134.8	188
$PM_{2.5}$	24-hour	8.4	1.6	18	26.4	19.6	35

[a]Utilizing most recent ambient data.

Table 8: Comparison of Siemens CTG and Mitsubishi CTG Cumulative PSD Increment Consumption

Pollutant	Averaging Period	Siemens CTG Total Increment Consumption (μg/m³)	Mitsubishi CTG Total Increment Consumption (μg/m³)	Maximum Allowable PSD Increment (μg/m³)
$PM_{2.5}$	24-hour	3.1	1.7	9

4.2 NOISE

4.2.1 Construction Sound Levels

KEC's construction noise using the Mitsubishi CTG will not differ from the construction impacts reflected for the original configuration. NTE has committed to scheduling louder construction activities during daytime hours to the greatest extent possible, and to coordinating with the local community during the construction process. Construction occurs in phases, and will not be expected to generate long-term noise levels, even during the 3-year construction process.

4.2.2 Operational Sound Levels

An updated analysis has been completed for the Mitsubishi CTG and associated adjustments in equipment location. KEC will continue to meet Connecticut DEEP and Town of Killingly noise standards, regulated by land use category, with the more stringent of either outlined in Table 9.

Table 9: DEEP and Town of Killingly Noise Limits

Emitter	Receptor (dBA [a])			
	Class C	Class B	Class A Daytime (7:00 am – 10:00 pm)	Class A Nighttime (10:00 pm – 7:00 am)
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

[a]A-weighted decibel.

As a Class C Industrial sound source, KEC incorporated mitigation to meet nighttime sound levels of 51 dBA at the nearest residentially zoned area. No new standards have been developed that would apply to KEC, and neither zoning nor land uses have changed.

The new configuration has been evaluated using the CadnaA® acoustic model. Reference sound power levels (expressed in decibels, or dB) used as input to CadnaA® were provided by equipment manufacturers (including Mitsubishi) and KEC design engineers, based on information contained in reference documents, or developed using empirical methods.

Operational broadband (dBA) sound pressure levels were calculated during normal operation assuming that all identified components are operating continuously and concurrently at the representative manufacturer-rated sound levels. Sound contour plots displaying broadband (dBA) sound levels presented as color-coded isopleths are provided on Figure 4. The noise contours are graphical representations of the cumulative noise associated with full operation of the equipment and show how operational noise would be distributed over the surrounding area. The contour lines shown in the figure 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.

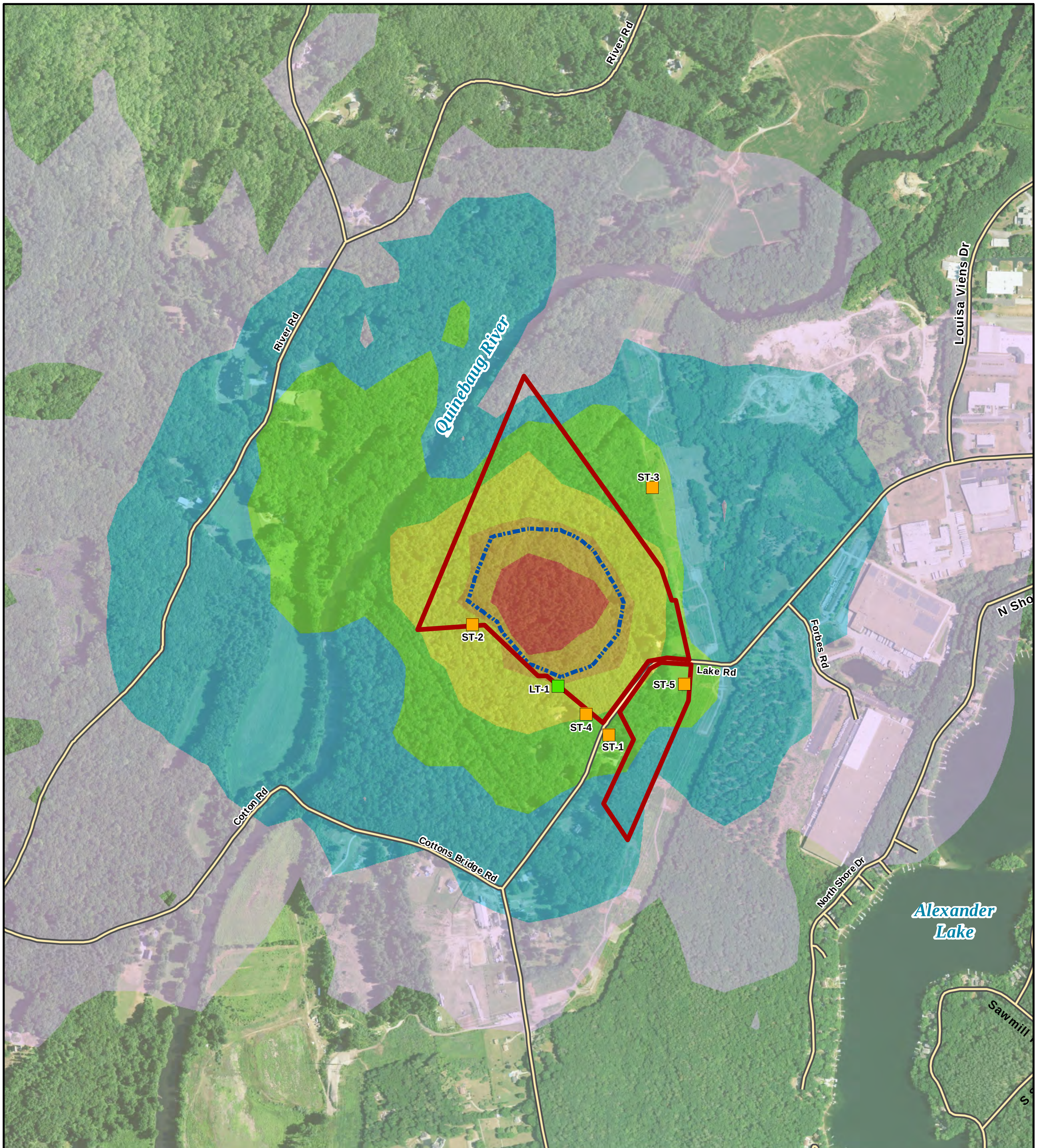
As can be seen from Figure 4 and Table 10, sound levels at the nearest residentially zoned areas are projected to meet the 51 dBA nighttime limit. Since sound levels decrease with distance, compliance with the applicable zoning limits at the closest borders ensures compliance at more distant receptors, i.e., structures found within a given zoning district.

Table 10: Acoustic Modeling Results Summary – Mitigated Design

Location	Project Sound Level, dBA
ST-1	43
ST-2	50
ST-3	42
ST-4	45
ST-5	42
LT-1	50

Detailed mitigation assumptions are incorporated in the modeling effort to demonstrate the feasibility of achieving compliance with state and local noise regulations. The details of the specific mitigation measures incorporated in the modeling effort may be refined in KEC's final design, while continuing to maintain compliance.

As demonstrated by the acoustic model, the updated KEC design will continue to meet state and local noise standards. Details are provided in Appendix C.



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 4
Acoustic Modeling Results-Mitigated Design

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4.3 NON-MATERIAL UPDATES

The majority of the topics addressed in KEC's Original Application have not changed or have only minimally (not materially) changed with the updated equipment selection. The following narrative provides a summary of the technical sections of the Original Application, providing information regarding the extent to which change has occurred to information already a part of the record in Docket No. 470.

- **Section 3.0 Earth Resources** – This section remains unchanged. The updated grading plan is provided in Appendix A. There will be not change to stormwater management measures discussed in this section, and the implementation of the Stormwater Pollution Prevention Plan (SWPPP) will continue to respond to site conditions and DEEP standards and requirements.
- **Section 4.0 Natural Resources** – This section remains unchanged. No additional wetland or species impact is proposed. The grading adjustment that allows for the use of slopes instead of a retaining wall near Wetland X provides a small beneficial change while maintaining (and in certain locations increasing) the distance between KEC's development footprint and nearby wetlands. No change to tree clearing results from the KEC refinements. The relocated Lepidoptera mitigation area requested by DEEP is reflected in Appendix A, and does not reflect a change in impacts.
- **Section 5.0 Air Resources** – This section has not materially changed. As discussed in Section 4.1, KEC's impacts on air quality have generally been reduced from its existing air permit, which provides a beneficial change.
- **Section 6.0 Water Resources** – This section has not materially changed, as the water needs and wastewater discharge reflected for KEC remain the same. While adjusted grading (as provided in Appendix A) has been integrated, no change in SWPPP implementation measures will result; the descriptive information in this section and consistency with applicable requirements remains the same.
- **Section 7.0 Community Resources** – This section reviews a number of community-related topics, none of which have materially changed, as outlined below:
    - Section 7.1 Land Use, Zoning, and Planning – No change has occurred that would affect KEC's consistency with land use, zoning or planning and policy objectives.
    - Section 7.2 Traffic and Transportation – No change in levels of anticipated traffic or anticipated impact will occur in association with the KEC refinements. However, NTE's experience on other projects indicates that peak construction traffic could increase from 350 to 450 workers. The analysis presented in Appendix D confirms that, even if worker levels were to increase to this level, the surrounding roadway network will continue to function at the same Levels of Service. As was previously the case, NTE will restrict construction traffic from use of Lake Road west of the KEC site and is working closely with the Town of Killingly to improve roadway geometry to serve existing and KEC-related truck traffic. The Town Engineer approved the conceptual design for Lake Road on October 6, 2016, and the culvert adjustments associated with the approved design have been reflected in KEC's wetland permitting. Air traffic will continue to be protected, as the CTG stack remains at 150 feet and in its original location.
    - Section 7.3 Visual Resources and Aesthetics – The CTG stack remains 150 feet tall and in its current location. Although certain layout elements have slightly shifted and some equipment profiles have changed (as described in Section 3.2), none of these changes are sufficient to result in visual impacts materially different from those previously assessed.

- Section 7.4 Noise – This section has not materially changed, as discussed in Section 4.2.
- Section 7.5 Electric and Magnetic Fields – No change has occurred that would affect KEC's compliance with applicable electric and magnetic field standards.
- Section 7.6 Cultural Resources – No change has occurred that would affect cultural resources.
- Section 7.7 Socioeconomics – No change in the expected construction or operational impact to the community is expected as a result of KEC's refinement, other than the adjusted schedule changing the timeline for realizing those benefits by approximately one year.

  Over the past 14 months, a tax stabilization agreement has been negotiated between KEC and the Town of Killingly that affirms KEC's obligation under a mutually agreed non-abated taxation value; the tax agreement was approved by the Killingly Town Council on January 9, 2018. The established value (reflecting current and future projections of tax rates) was levelized into a series of cash payments to be paid by KEC to the Town of Killingly. The agreement provides a payment of $1 million during the 3-year construction period, with an additional $90 million paid over the course of a 20-year operating period. This tax agreement is separate from other payments and/or benefits to be provided to the Town of Killingly under the CEBA and separate from the tax that will be paid by KEC to the Williamsville Fire District.

  Over the past 14 months, the CEBA has also been negotiated with the Town of Killingly; the CEBA was also approved by the Killingly Town Council on January 9, 2018. The CEBA identifies an additional $5 million in payments that will be utilized by the Town for such beneficial uses as scholarships, asthma research, tree planting, Earth Day activities, water level testing at Alexander Lake, and other school-related activities. The CEBA specifies a staggered payment schedule, with just over $2 million due upon KEC's financial close, a second $2 million due on the first anniversary of KEC's financial close, and the remaining funds paid in annual installments throughout the 20-year operating life. In addition to the $5 million in payments, a 20-acre conservation easement will be created to the northwest of the KEC development area, and conservation easements will be associated with the wetland mitigation area and Lepidoptera habitat area. The CEBA also includes a commitment that KEC will maintain a decommissioning bond in favor of the Town of Killingly for the operating life of KEC.

  Certain improvements will also be paid for by KEC that will benefit KEC as well as other system users and the Town of Killingly. These include: the upgraded natural gas pipeline in process by Eversource (which will provide for twice the capacity for downstream users); the CWC water system interconnection (which will create a more robust, reliable water system serving the Killingly area); improvements to Lake Road in the vicinity of KEC; and improvements to and fees associated with discharge of KEC's wastewater to the Killingly Pollution Control Facility.

  NTE has also established an agreement that will be offered to those located within 2,500 feet of KEC to provide assurances that property values will not be negatively influenced by KEC's operation.

  Therefore, KEC will continue to bring considerable economic and other benefits to the Town and to the region through taxes, employment, lower electric rates, secondary economic benefits from goods and services, and a source of reliable, efficient, and economical energy.

- Section 8.0 Project-Related Interconnections – No material changes result to this section from the proposed KEC refinements.

  KEC continues to actively coordinate with the Town of Killingly with regard to sewer line and lift station improvements, which will be the financial responsibility of KEC. Approval of the design details will be pending DEEP's issuance of KEC's wastewater discharge permit, review of which is ongoing.

  KEC executed a water service agreement and two construction agreements with CWC on October 31, 2017 under which CWC is proceeding with the design and permitting associated with providing water from its existing wellfields. This includes the interconnection of its existing wellfield systems, which will not only benefit KEC but provide for greater reliability of water service to the Town of Killingly. It is NTE's understanding that an application for a diversion permit associated with the interconnection and filed by CWC is under review by DEEP.

  KEC executed an amendment to the agreement for engineering services for the design and permitting of the new natural gas lateral with Eversource on October 17, 2017. Under this agreement, Eversource has been progressing with the design and permitting for the upgraded lateral (as was described in Section 8.0 of the Original Application). An application to DEEP addressing wetland and other issues related to the Section 401 Water Quality Certification program was submitted by Eversource to DEEP on September 22, 2017; NTE has made this available on its website and at the Killingly Town Hall and Library. In addition, KEC and Eversource are finalizing negotiations of a Special Contract for the delivery of natural gas to KEC. Execution of this contract is expected in the first quarter of 2018.

  Active and ongoing coordination continues regarding the electrical interconnection with both ISO-NE and Eversource. The SIS has been completed and is anticipated to be provided to NTE in the near future. Following issuance and review of the SIS, NTE will begin negotiating and finalizing the Large Generator Interconnection Agreement for KEC.

- Section 9.0 Alternatives – No change to this section results from the KEC refinements, although the adjustments associated with incorporation of the Mitsubishi CTG represent a further iteration of the Layout Alternatives discussed in Section 9.3.4. As was reflected in the Original Application, the potential use of graywater has not been selected for KEC.

- Section 10.0 Required Permits and Approvals – No changes to this section results from the KEC refinements, other than the need for a minor permit modification to the air permit currently received from DEEP for the combustion turbine generator.

- Section 11.0 References – No changes to this section results from the KEC refinements.

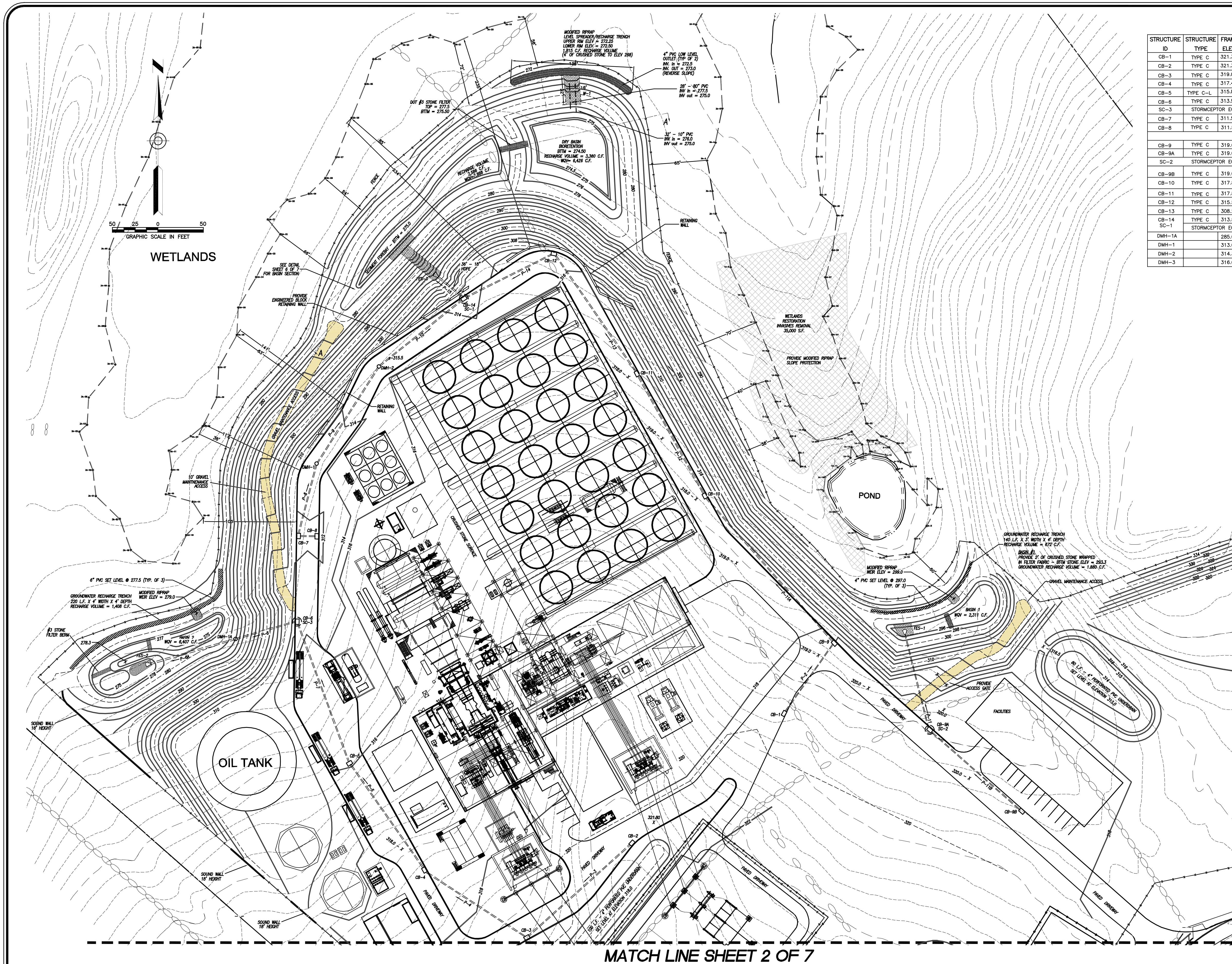
5.0 SUMMARY AND CONCLUSIONS

The additional information provided clearly demonstrates that KEC is needed, both within Connecticut and to support the broader regional electric grid. This demonstration of need provides a framework for understanding the other benefits and impacts associated with the construction and operation of KEC. Considerable benefit will be derived by the Town of Killingly, the State of Connecticut, and ISO-NE as a result.

Minimization of environmental and community impacts has been an important goal to NTE throughout the development of KEC, as illustrated by the integration of design adjustments reflecting comments from the Town of Killingly's R&R Orders during the review of the Original Application. With the refinements reflected, no greater impact will be experienced by the community or the environment. In fact, in the case of emissions, the selection of the Mitsubishi CTG will result in lower modeled air quality impacts.

As addressed in the Original Application and its supporting materials, as well as in this document, KEC will provide additional and highly efficient generating capacity to meet current and expected additional shortfalls in the ISO-NE markets, while complying with all applicable regulations and policies and resulting in low levels of environmental and community impact.

APPENDIX A – UPDATED SITE PLANS



STORM DRAINAGE STRUCTURE SCHEDULE

STRUCTURE ID	STRUCTURE TYPE	FRAME ELEV.	PIPE INVERT ELEVATION N	S	E	W	SUMP
CB-1	TYPE C	321.30	IN: 311.71 (NW)		OUT: 311.61 (NE)		307.61
CB-2	TYPE C	321.30		OUT: 316.65 (SW)			312.65
CB-3	TYPE C	319.00	OUT: 312.80 (NW)		IN: 312.90		318.80
CB-4	TYPE C	317.40	OUT: 309.50	IN: 309.60			305.50
CB-5	TYPE C-L	315.80	OUT: 306.60	IN: 306.70			302.70
CB-6	TYPE C	313.50		IN: 303.40		OUT: 303.20	301.30
SC-3	STORMCEPTOR EOS 15-1000 OIL-GRIT SEPARATOR						
CB-7	TYPE C	311.50	OUT: 307.30		IN: 307.40		303.30
CB-8	TYPE C	311.50				OUT: 307.60	303.60
CB-9	TYPE C	319.00	OUT: 313.27	IN: 313.37		OUT: 310.59 (NW)	304.59
CB-9A	TYPE C	319.00		IN: 313.59 (SE)		OUT: 313.49 (NW)	307.49
SC-2	STORMCEPTOR EOS 15-1000 OIL-GRIT SEPARATOR						
CB-9B	TYPE C	319.00				OUT: 314.79 (NW)	308.79
CB-10	TYPE C	317.80	OUT: 310.00	IN: 310.10			306.00
CB-11	TYPE C	317.80	OUT: 306.90	IN: 307.00			303.00
CB-12	TYPE C	315.50		IN: 303.80		OUT: 303.70	299.70
CB-13	TYPE C	308.20	OUT: 303.50 (NW)	IN: 303.60			297.50
CB-14	TYPE C	313.50		IN: 300.60 (SW)	IN: 300.60 (NE)	OUT: 300.50 (NW)	294.90
SC-1	STORMCEPTOR EOS 18-1000 OIL-GRIT SEPARATOR						
DMH-1A		285.00	NOTE: DROP OUTLET		IN: 280.00	OUT: 276.90	
DMH-1		313.00	OUT: 306.40 (NE)	IN: 306.50 (SW)			
DMH-2		314.30	OUT: 303.20 (NE)	IN: 303.30 (SW)			
DMH-3		316.00			OUT: 313.50 (SE)	IN: 313.60	

PIPE SCHEDULE

PIPE ID	OUTLET DIA. (IN.)	MATERIAL	LENGTH (FT.)	SLOPE (%)
P-2	15	HDPE	90	1.0%
P-3	15	HDPE	150	1.0%
P-4	15	HDPE	132	2.5%
P-5	15	HDPE	140	2.0%
P-6	15	HDPE	68	35.7%
P-6A	15	HDPE	90	1.0%
P-7	15	HDPE	167	1.52%
P-8	15	HDPE	80	1.0%
P-9	15	HDPE	124	2.5%
P-10	12	HDPE	115	2.5%
P-11	15	HDPE	115	16.5%
P-11A	15	HDPE	211	1.5%
P-11B	12	HDPE	135	2.0%
P-12	15	HDPE	185	2.0%
P-13	12	HDPE	190	2.0%
P-14	15	HDPE	110	2.0%
P-15	18	HDPE	36	7.0%
P-16	15	RCP	110	TBD
P-17	15	RCP	50	2.0%

STRUCTURE ID	TYPE	INVERT ELEVATION
FES-1	FLARED END	296.00
W-1	OVERFLOW WEIR	277.00
FES-2	FLARED END	278.00
FES-3	FLARED END	298.00
FES-4	FLARED END	312.50

DATE	DESCRIPTION
01/15/2018	SOUND WALLS
01/15/2018	LAYOUT & GRADING REVISIONS
11/21/2016	ACCESS TO BASINS ADDED
10/25/2016	PER R&R

REVISIONS

PROPOSED GRADING & DRAINAGE

PREPARED FOR

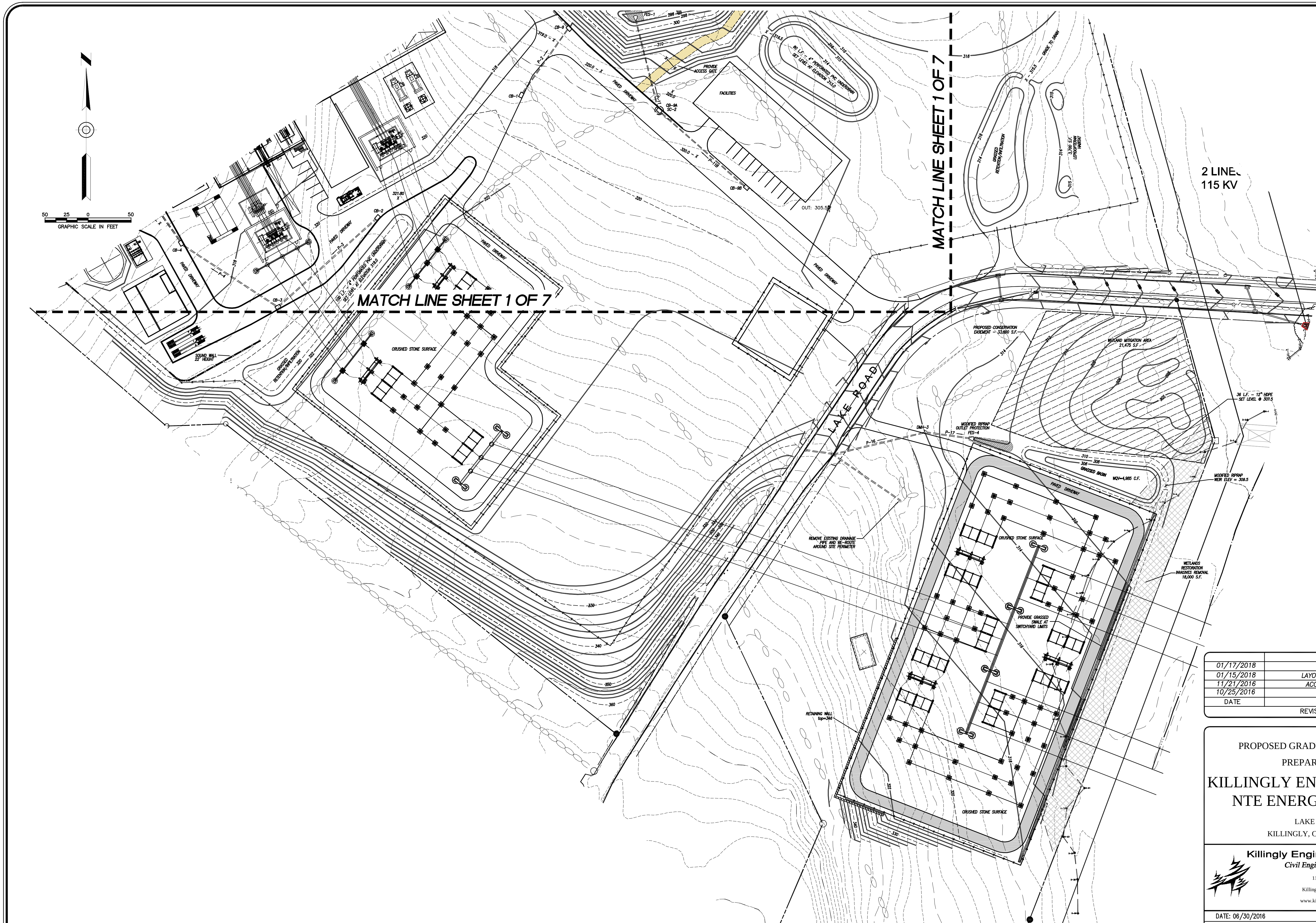
KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

LAKE ROAD

KILLINGLY, CONNECTICUT

Killingly Engineering Associates
Civil Engineering & Surveying
114 Westcott Road
P.O. Box 421
Killingly, Connecticut 06241
(860) 779-7299
www.killinglyengineering.com

DATE: 06/30/2016	DRAWN: NET
SCALE: 1"=50'	DESIGN: NET
SHEET: 1 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042



01/17/2018	SOUND WALLS
01/15/2018	LAYOUT & GRADING REVISIONS
11/21/2016	ACCESS TO BASINS ADDED
10/25/2016	PER R&R
DATE	DESCRIPTION

REVISIONS

PROPOSED GRADING & DRAINAGE

PREPARED FOR

KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

LAKE ROAD

KILLINGLY, CONNECTICUT

Killingly Engineering Associates

Civil Engineering & Surveying

114 Westcott Road
P.O. Box 421
Killingly, Connecticut 06241
(860) 779-7299
www.killinglyengineering.com

DATE: 06/30/2016	DRAWN: NET
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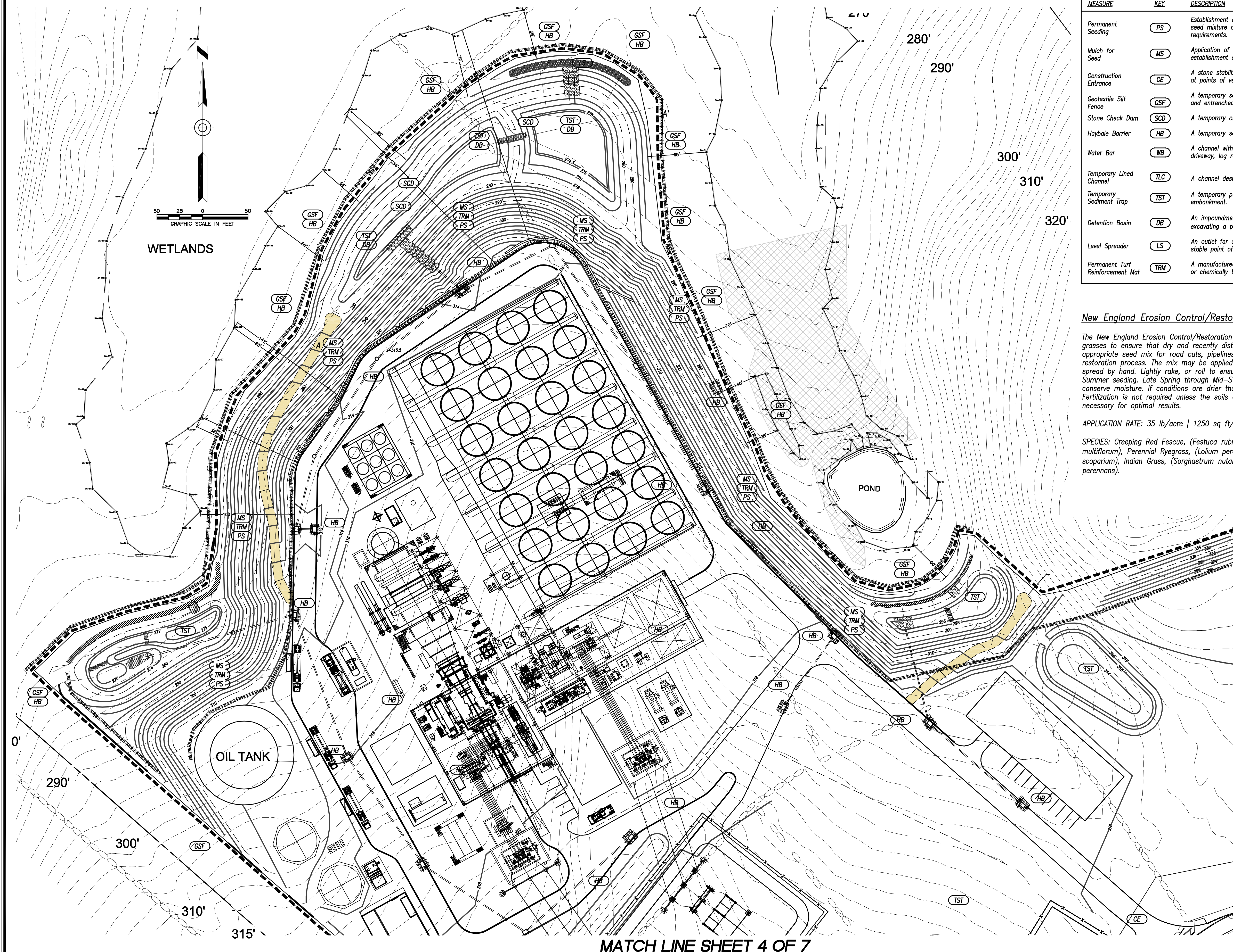

MEASURE	KEY	DESCRIPTION
Permanent Seeding	PS	Establishment of permanent stand of grass and/or legumes by seeding and mulching exposed soils with a seed mixture appropriate for long term stabilization. See Erosion Control Narrative for seed mix requirements.
Mulch for Seed	MS	Application of a mulch that will protect the soil surface on a temporary basis and promote the establishment of temporary or permanent seedings.
Construction Entrance	CE	A stone stabilized pad sometimes associated with a mud rack, automotive spray, or other measures located at points of vehicular ingress and egress on a construction site.
Geotextile Silt Fence	GSF	A temporary sediment barrier consisting of a geotextile fabric pulled taut and attached to supporting posts and entrenched.
Stone Check Dam	SCD	A temporary or permanent stone dam placed across a drainageway.
Haybale Barrier	HB	A temporary sediment barrier consisting of a row of entrenched and anchored bales of hay or straw.
Water Bar	WB	A channel with a supporting berm on the down slope side constructed across a construction access road, driveway, log road or other access way.
Temporary Lined Channel	TLC	A channel designed to convey flows on a short term basis and lined with an erosion resistant covering.
Temporary Sediment Trap	TST	A temporary ponding area with a stone outlet formed by excavation and/or constructing an earthen embankment.
Detention Basin	DB	An impoundment made by constructing a dam or an embankment (embankment detention basin) or by excavating a pit or dugout (excavated detention basin).
Level Spreader	LS	An outlet for diversions and other water conveyences consisting of an escavated depression with a broad stable point of discharge constrcuted at zero grade across a slope
Permanent Turf Reinforcement Mat	TRM	A manufactured mat composed of non-biodegradable polymer or synthetic fibers mechanically, structurally, or chemically bound to form a continuous matrix.

New England Erosion Control/Restoration Mix (temporary seeding)

The New England Erosion Control/Restoration Mix For Dry Sites provides an appropriate selection of native and naturalized grasses to ensure that dry and recently disturbed sites will be quickly revegetated and the soil surface stabilized. It is an appropriate seed mix for road cuts, pipelines, steeper slopes, and areas requiring quick cover during the ecological restoration process. The mix may be applied by hydro-seeding, by mechanical spreader, or on small sites it can be spread by hand. Lightly rake, or roll to ensure proper soil-seed contact. Best results are obtained with a Spring or late Summer seeding. Late Spring through Mid-Summer seeding will benefit from a light mulching of weed-free straw to conserve moisture. If conditions are drier than usual, watering will be required.
Fertilization is not required unless the soils are particularly infertile. Preparation of a clean weed free seed bed is necessary for optimal results.

APPLICATION RATE: 35 lb/acre | 1250 sq ft/lb

SPECIES: Creeping Red Fescue, (Festuca rubra), Canada Wild Rye, (Elymus canadensis), Annual Ryegrass, (Lolium multiflorum), Perennial Ryegrass, (Lolium perenne), Blue Grama, (Bouteloua gracilis), Little Bluestem, (Schizachyrium scoparium), Indian Grass, (Sorghastrum nutans), Rough Bentgrass, (Agrostis scabra), Upland Bentgrass, (Agrostis perennans).

NOTES:

1. CONTRUCTION LAYDOWN AND STAGING AREAS SHALL BE RE-ESTABLISHED AS GREEN AREAS AT THE TERMINATION OF CONSTRUCTION. PORTIONS MAY BE ESTABLISHED AS OVERFLOW OR EMERGENCY PARKING WITH GRASS PAVE OR AN ENGINEER APPROVED TURF REINFORCEMENT OPTION.
2. TURF REINFORCEMENT MAT ON FILL AND CUT SLOPES SHALL BE ERONET C-125 LONG-TERM PHOTODEGRADABLE DOUBLE-NET BLANKET OR APPROVED EQUAL.
3. SEED MIX ON SLOPES SHALL BE NEW ENGLAND ROADSIDE MATRIX MIX DISTRIBUTED BY NEW ENGLAND WETLANDS PLANTS, INC. APPLY AT A RATE OF 35 POUNDS PER ACRE AND SUPPLEMENT WITH 5% ANNUAL RYE GRASS (BY WEIGHT) AT TIME OF APPLICATION.

DATE	DESCRIPTION
01/17/2018	SOUND WALLS
01/15/2018	LAYOUT & GRADING REVISIONS
11/21/2016	ACCESS TO BASINS ADDED
10/25/2016	PER R&R

REVISIONS

EROSION AND SEDIMENTATION CONTROL PLAN

PREPARED FOR

KILLINGLY ENERGY CENTER NTE ENERGY PROJECT

LAKE ROAD
KILLINGLY, CONNECTICUT

Killingly Engineering Associates
Civil Engineering & Surveying
114 Westcott Road
P.O. Box 421
Killingly, Connecticut 06241
(860) 779-7299
www.killinglyengineering.com

DATE: 06/30/2016	DRAWN: NET
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SHEET: 3 OF 7	CHK BY: ---
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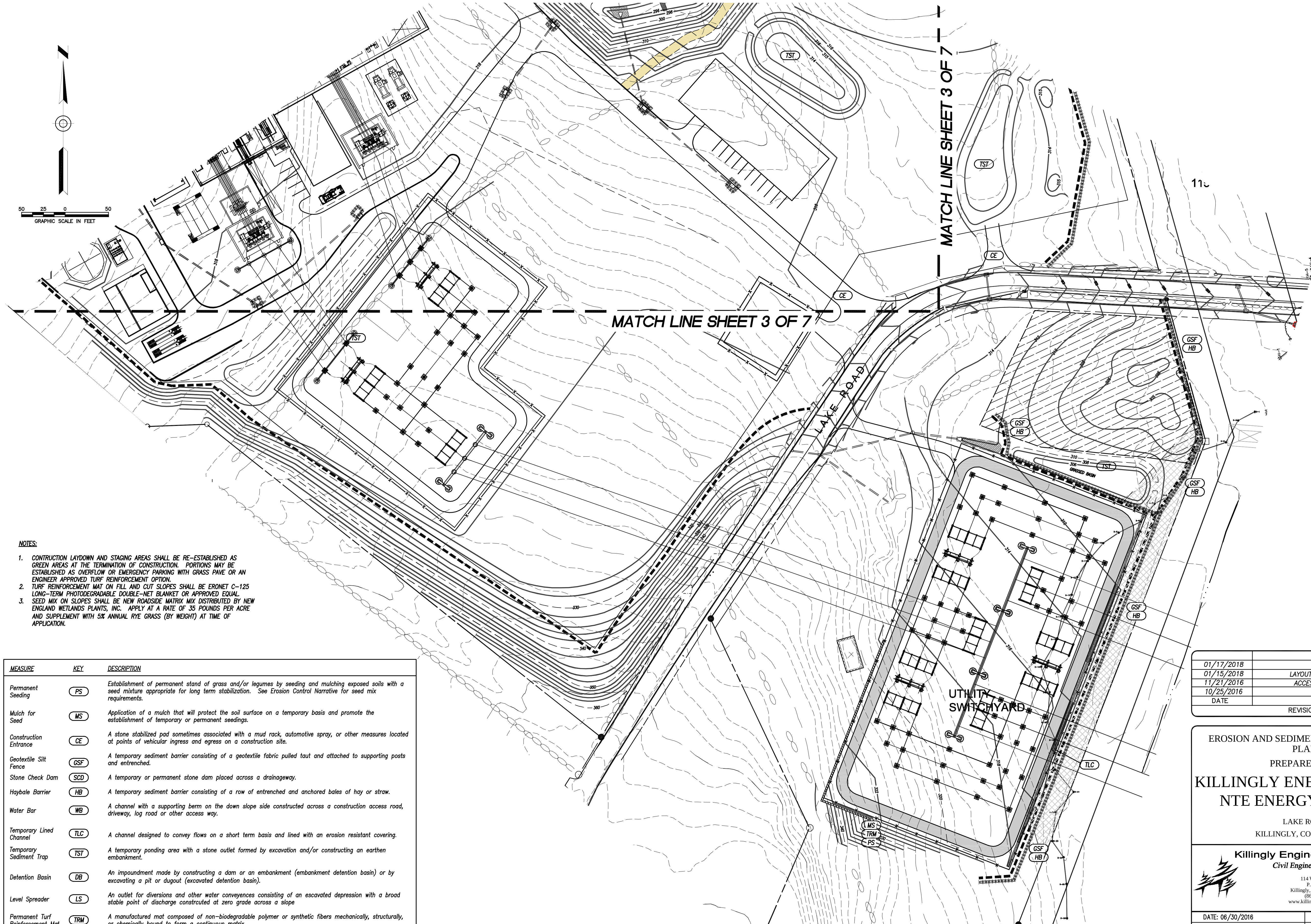

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REVISIONS

EROSION AND SEDIMENTATION CONTROL PLAN

PREPARED FOR

KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

LAKE ROAD

KILLINGLY, CONNECTICUT

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EROSION AND SEDIMENT CONTROL PLAN:

REFERENCE IS MADE TO:

1. Connecticut Guidelines for Soil Erosion and Sediment Control 2002 (2002 Guidelines).
2. NRCS WSS (Web Soil Survey)

DEVELOPMENT CONTROL PLAN:

1. Development of the site will be performed by the Contractor, who will be responsible for the installation and maintenance of erosion and sediment control measures required throughout construction.
2. The sedimentation control mechanisms shall remain in place from start of PutnamKillingly will be notified when sediment and erosion control structures are initially in place. Any additional soil & erosion control measures requested by the Town or its agent, shall be installed immediately. Once the proposed development, seeding and planting have been completed, the representative shall again be notified to inspect the site. The control measures will not be removed until this inspection is complete.
3. All stripping is to be confined to the immediate construction area. Topsoil shall be stockpiled so that slopes do not exceed 2 to 1. A hay bale sediment barrier is to surround each stockpile and a temporary vegetative cover shall be provided.
4. Dust control will be accomplished by spraying with water. The application of calcium chloride is not permitted adjacent to wetland resource areas or within 100' of these areas.
5. The proposed planting schedule is to be adhered to during the planting of disturbed areas throughout the proposed construction site.
6. Final stabilization of the site is to follow the procedures outlined in "Permanent Vegetative Cover". If necessary a temporary vegetative cover is to be provided until a permanent cover can be applied.

SILT FENCE INSTALLATION AND MAINTENANCE:

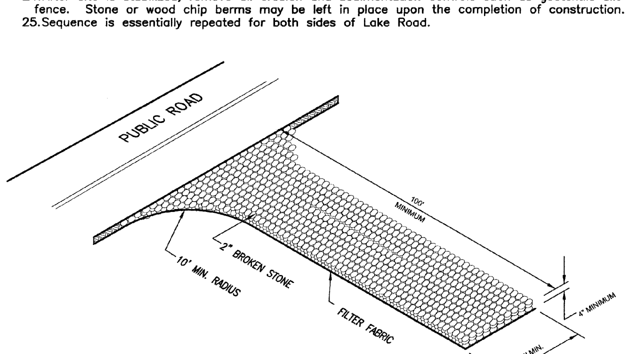
1. Dig a 6" deep trench on the uphill side of the barrier location.
2. Position the posts on the downhill side of the barrier and drive the posts 1.5 feet into the ground.
3. Lay the bottom 6" of the fabric in the trench to prevent undermining and backfill.
4. Inspect and repair barrier after heavy rainfall.
5. Inspections will be made at least once per week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inch or greater to determine maintenance needs.
6. Sediment deposits are to be removed when they reach a height of 1 foot behind the barrier or half the height of the barrier and are to be deposited in an area which is not regulated by the inland wetlands commission.
7. Replace or repair the fence within 24 hours of observed failure. Failure of the fence has occurred when sediment fails to be retained by the fence because:
- the fence has been overtopped, undercut or bypassed by runoff water,
- the fence has been moved out of position (knocked over), or
- the geotextile has decomposed or been damaged.

HAY BALE INSTALLATION AND MAINTENANCE:

1. Bales shall be placed as shown on the plans with the ends of the bales tightly abutting each other.
2. Each bale shall be securely anchored with at least 2 stakes and gaps between bales shall be wedged with straw to prevent water from passing between the bales.
3. Inspect bales at least once per week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inches or greater to determine maintenance needs.
4. Remove sediment behind the bales when it reaches half the height of the bale and deposit in an area which is not regulated by the Inland Wetlands Commission.
5. Replace or repair the barrier within 24 hours of observed failure. Failure of the barrier has occurred when sediment fails to be retained by the barrier because:
- the barrier has been overtopped, undercut or bypassed by runoff water,
- the barrier has been moved out of position, or
- the hay bales have deteriorated or been damaged.

SEQUENCE OF CONSTRUCTION

1. Flag the limits of construction disturbance necessary to facilitate the pre-construction meeting.
2. Contact Call Before You Dig at 1-800-922-4455 to mark out existing utilities.
3. Hold the pre-construction meeting.
4. Install the anti-tracking construction entrance.
5. Cut trees within the defined clearing limits and remove cut wood. Chip brush, branches and small trees and stockpile chips for use on site for erosion and sedimentation control.
6. Install perimeter erosion and sedimentation controls.
7. Remove stumps and transport off site. No stumps shall be buried on site.
8. Remove topsoil and grade construction staging and laydown area. Install crushed stone or rolled gravel surface and grade to provide positive drainage to perimeter of laydown area. Construct temporary sediment basin and install perimeter erosion controls in accordance with plans.
9. Strip and stockpile topsoil within the footprint of the construction phase area. Install perimeter erosion and sedimentation controls around stockpiles.
10. Make required cuts and fills and construct proposed retaining wall as fills are being placed adjacent to wetlands area.
11. Establish the subgrade for topsoil areas, buildings, perimeter roadway and parking areas. Bench buildings to a subgrade and allow for sufficient area around building footprints for construction activities.
12. Begin building and equipment construction.
13. Install surface water controls such as temporary sedimentation basins, diversions, and stone or wood chip dikes and insure that discharge locations are stable. Engineer shall evaluate unstable conditions for recommended alternatives prior to installing surface controls.
14. Construct Stormwater basin, outlet and outlet protection and utilize basin as a temporary sedimentation basin during construction. Plug low level outlet until all areas on site have been stabilized and basin vegetation is established.
15. Install all utilities and drainage systems to within 5' of the buildings and facilities or as modified by the site engineer for specific site conditions.
16. Prepare sub-base, slopes, parking areas, shoulder areas, access roads and any additional areas of disturbance for final grading.
17. Install topsoil on fill and cut slopes, seed disturbed areas and install erosion control fabric to protect against runoff erosion or raindrop impact.
18. Install and compact processed aggregate for pavement areas.
19. Install crushed stone surfaces where call for on the design plans.
20. Place remaining topsoil where required and complete perimeter landscaping. Fine grade, rake, seed and mulch to within 2' of curbs or paved areas.
21. Upon substantial completion of the building(s) and plant equipment areas, complete the balance of the site work and stabilization of remaining disturbed areas. Install first course of paving.
22. When all other work has been completed, repair and sweep all paved areas for final course of paving. Inspect drainage system and stormwater basin and remove accumulated sediment.
23. Install final course of pavement and unplug low level outlet from stormwater basin.
24. After site is stabilized, remove all erosion and sedimentation controls such as geotextile silt fence. Stone or wood chip berms may be left in place upon the completion of construction.
25. Sequence is essentially repeated for both sides of Lake Road.



ANTI-TRACKING PAD

NOT TO SCALE

EROSION AND SEDIMENT CONTROL NARRATIVE:

PRINCIPLES OF EROSION AND SEDIMENT CONTROL

The primary function of erosion and sediment controls is to absorb erosional energies and reduce runoff velocities that force the detachment and transport of soil and/or encourage the deposition of eroded soil particles before they reach any sensitive area.

KEEP LAND DISTURBANCE TO A MINIMUM

The more land that is in vegetative cover, the more surface water will infiltrate into the soil, thus minimizing stormwater runoff and potential erosion. Keeping land disturbance to a minimum not only involves minimizing the extent of exposure at any one time, but also the duration of exposure. Phasing, sequencing and construction scheduling are interrelated. Phasing divides a large project into distinct sections where construction work over a specific area occurs over distinct periods of time and each phase is not dependent upon a subsequent phase in order to be functional. A sequence is the order in which construction activities are to occur during any particular phase. A sequence should be developed on the premise of "first things first" and "last things last" with proper attention given to the inclusion of adequate erosion and sediment control measures. A construction schedule is a sequence with time lines applied to it and should address the potential overlap of actions in a sequence which may be in conflict with each other.

- Limit areas of clearing and grading. Protect natural vegetation from construction equipment with fencing, tree armoring, and retaining walls or tree wells.
- Route traffic patterns within the site to avoid existing or newly planted vegetation.
- Phase construction so that areas which are actively being developed at any one time are minimized and only that area under construction is exposed. Clear only those areas essential for construction.
- Sequence the construction of storm drainage systems so that they are operational as soon as possible during construction. Ensure all outlets are stable before outletting storm drainage flow into them.
- Schedule construction so that final grading and stabilization is completed as soon as possible.

SLOW THE FLOW

Detachment and transport of eroded soil must be kept to a minimum by absorbing and reducing the erosive energy of water. The erosive energy of water increases as the volume and velocity of runoff increases. The volume and velocity of runoff increases during development as a result of reduced infiltration rates caused by the removal of existing vegetation, removal of topsoil, compaction of soil and the construction of impervious surfaces.

- Use diversions, stone dikes, silt fences and similar measures to break flow lines and dissipate storm water energy.
- Avoid diverting one drainage system into another without calculating the potential for downstream flooding or erosion.

KEEP CLEAN RUNOFF SEPARATED

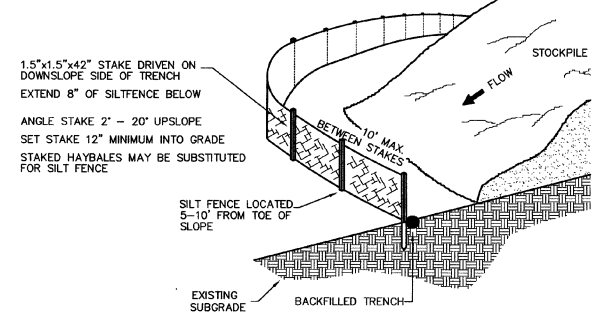
Clean runoff should be kept separated from sediment laden water and should not be directed over disturbed areas without additional controls. Additionally, prevent the mixing of clean off-site generated runoff with sediment laden runoff generated on-site until after adequate filtration of on-site waters has occurred.

- Segregate construction waters from clean water.
- Divert site runoff to keep it isolated from wetlands, watercourses and drainage ways that flow through or near the development until the sediment in that runoff is trapped or detained.

REDUCE ON SITE POTENTIAL INTERNALLY AND INSTALL PERIMETER CONTROLS

While it may seem less complicated to collect all waters to one point of discharge for treatment and just install a perimeter control, it can be more effective to apply internal controls to many small sub-drainage basins within the site. By reducing sediment loading from within the site, the chance of perimeter control failure and the potential off-site damage that it can cause is reduced. It is generally more expensive to correct off-site damage than it is to install proper internal controls.

- Control erosion and sedimentation in the smallest drainage area possible. It is easier to control erosion than to contend with sediment after it has been carried downstream and deposited in unwanted areas.
- Direct runoff from small disturbed areas to adjoining undisturbed vegetated areas to reduce the potential for concentrated flows and increase settlement and filtering of sediments.
- Concentrated runoff from development should be safely conveyed to stable outlets using rip rapped channels, waterways, diversions, storm drains or similar measures.
- Determine the need for sediment basins. Sediment basins are required on larger developments where major grading is planned and where it is impossible or impractical to control erosion at the source. Sediment basins are needed on large and small sites when sensitive areas such as wetlands, watercourses, and streets would be impacted by off-site sediment deposition. Do not locate sediment basins in wetlands or permanent or intermittent watercourses. Sediment basins should be located to intercept runoff prior to its entry into the wetland or watercourse.
- Grade and landscape around buildings and septic systems to divert water away from them.



SILT FENCE @ TOE OF SLOPE APPLICATION

NOT TO SCALE

TEMPORARY VEGETATIVE COVER:

SEED SELECTION

Grass species shall be appropriate for the season and site conditions. Appropriate species are outlined in Figure TS-2 in the 2002 Guidelines.

TIMING CONSIDERATIONS

Seed with a temporary seed mixture within 7 days after the suspension of grading work in disturbed areas where the suspension of work is expected to be more than 30 days but less than 1 year.

SITE PREPARATION

Install needed erosion control measures such as diversions, grade stabilization structures, sediment basins and grassed waterways.

Grade according to plans and allow for the use of appropriate equipment for seedbed preparation, seeding, mulch application, and mulch anchoring.

SEEDBED PREPARATION

Loosen the soil to a depth of 3-4 inches with a slightly roughened surface. If the area has been recently loosened or disturbed, no further roughening is required. Soil preparation can be accomplished by tracking with a bulldozer, discing, harrowing, raking or dragging with a section of chain link fence. Avoid excessive compaction of the surface by equipment traveling back and forth over the surface. If the slope is tracked, the cleat marks shall be perpendicular to the anticipated direction of the flow of surface water.

If soil testing is not practical or feasible on small or variable sites, or where timing is critical, fertilizer may be applied at the rate of 300 pounds per acre or 7.5 pounds per 1,000 square feet of 10-10-10 or equivalent. Additionally, lime may be applied using rates given in Figure TS-1 in the 2002 Guidelines.

SEEDING

Apply seed uniformly by hand cyclone seeder, drill, cultipacker type seeder or hydroseeder at a minimum rate for the selected species. Increase seeding rates by 10% when hydroseeding.

MULCHING

Temporary seedings made during optimum seeding dates shall be mulched according to the recommendations in the 2002 Guidelines. When seeding outside of the recommended dates, increase the application of mulch to provide 95%-100% coverage.

MAINTENANCE

Inspect seeded area at least once a week and within 24 hours of the end of a storm with a rainfall amount of 0.5 inch or greater for seed and mulch movement and rill erosion.

Where seed has moved or where soil erosion has occurred, determine the cause of the failure. Repair eroded areas and install additional controls if required to prevent reoccurrence of erosion.

Continue inspections until the grasses are firmly established. Grasses shall not be considered established until a ground cover is achieved which is mature enough to control soil erosion and to survive severe weather conditions (approximately 80% vegetative cover).

Figure TS-2 Temporary Seeding Rates and Dates

Species[4]	Seeding Rates (pounds) /Acre	Seeding Rates (pounds) /1000 sq. ft.	Optimum Seed Depth[2] (inches)	Plant Characteristics
Annual ryegrass Lolium multiflorum	40	1.0	0.5	May be added in mixes. Will mow out of most stands
Perennial ryegrass Lolium perenne	40	1.0	0.5	Use for winter cover. Tolerates cold and low moisture.
Winter Rye Secale cereale	120	3.0	1.0	Quick germination and heavy spring growth. Dies back in June with little regrowth.
Oats Avena sativa	86	2.0	1.0	In northern CT. will winter kill with the first killing frost and may throughout the state in severe winters.
Winter Wheat Triticum aestivum	120	3.0	1.0	Quick germination with moderate growth. Dies back in June with no regrowth.
Millet Echinochloa crusgalli	20	0.5	1.0	Warm season small grain. Dies with frost in September.
Sudangrass Sorghum sudanense	30	0.7	1.0	Tolerates warm temperatures and droughty conditions.
Buckwheat Fagopyrum esculentum	15	0.4	1.0	Hardy plant that will reseed itself and is good as a green manure crop.
Weeping lovegrass Eragostis curbula	5	0.2	0.25	Warm-season perennial. May bunch. Tolerates hot, dry slopes, acid infertile soils. Excellent nurse crop. Usually winter kills.
DOT All Purpose Mix[3]	150	3.4	0.5	Suitable for all conditions.

Optimum Seeding Dates[1]: 3/1, 3/15, 4/1, 4/15, 5/1, 5/15, 6/1, 6/15, 7/1, 7/15, 8/1, 8/15, 9/1, 9/15, 10/1, 10/15

[1] May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns.
[2] Seed at twice the indicated depth for sandy soils.
[3] See Permanent Seeding **Figure PS-3** for seeding mixture requirements.
[4] Listed species may be used in combinations to obtain a broader time spectrum. If used in combinations, reduce each species planting rate by 20% of that listed.

Figure PS-2 Selecting Seed Mix to Match Need

Area To Be Seeded	Mixture Number[1] Mowing Desired	Mixture Number[1] Mowing Not Required
BORROW AREAS, ROADSIDES, DIKES, LEVEES, POND BANKS AND OTHER SLOPES AND BANKS		
A) Well or excessively drained soil[2]	1,2,3,4,5 or 8	5, 6, 7, 8, 9, 10, 11, 12, 16, ***22***
B) Somewhat poorly drained soils[2]	2	5, 6
C) Variable drainage soils[2]	2	5, 6, 11
DRAINAGE DITCH AND CHANNEL BANKS		
A) Well or excessively drained soils[2]	1, 2, 3, or 4	9, 10, 11, 12
B) Somewhat poorly drained soils[2]	2	
C) Variable drainage soils[2]	2	
DIVERSIONS		
A) Well or excessively drained soils[2]	2, 3 or 4	9, 10, 11
B) Somewhat poorly drained soils[2]	2	
C) Variable drainage soils[2]	2	
EFFLUENT DISPOSAL		5 or 6
GRAVEL PITS[3]		26, 27, 28
GULLIED AND ERODED AREAS		3, 4, 5, 8, 10, 11, 12
MINESPOIL & WASTE, AND OTHER SPOIL BANKS (If toxic substances & physical properties not limiting)[3]		15, 16, 17, 18, 26, 27, 28
SHORELINES (Fluctuating water levels)		5 or 6
SKI SLOPES		4, 10
SOD WATERWAYS AND SPILLWAYS	1, 2, 3, 4, 6, 7, or 8	1, 2, 3, 4, 6, 7. or 8
SUNNY RECREATION AREAS (Picnic areas and playgrounds or driving and archery ranges, nature trails)	1, 2 or ***23***	
CAMPING AND PARKING, NATURE TRAILS (Shaded)	19, ***21*** or ***23***	
SAND DUNES (Blowing sand)	25	
WOODLAND ACCESS ROADS, SKID TRAILS AND LOG YARDING AREAS		9, 10, 16, ***22***, 26
LAWNS AND HIGH MAINTENANCE AREAS	1, 19, ***21*** or ***29***	

[1] The numbers following in these columns refer to seed mixtures in **Figure PS-3**. Mixes for shady areas are in ***bold-italics*** print (including mixes 20 through 24).
[2] See county soil survey for drainage class. Soil surveys are available from the County Soil and Water Conservation District Office.
[3] Use mix 26 when soil passing a 200 mesh sieve is less than 15% of total weight. Use mix 26 & 27 when soil passing a 200 mesh sieve is between 15 and 20% of total weight. Use mix 26, 27 & 28 when soil passing a 200 mesh sieve is above 20% of total weight.

PERMANENT VEGETATIVE COVER:

Refer to Figure PS-2, Permanent Seeding Measure in the 2002 Guidelines for specific applications and details related to the installation and maintenance of a permanent vegetative cover. In general, the following sequence of operations shall apply:

1. Topsoil will be replaced once the excavation and grading has been completed. Topsoil will be spread at a minimum compacted depth of 4".
2. Once the topsoil has been spread, all stones 2" or larger in any dimension will be removed as well as debris.
3. Apply agricultural ground limestone at a rate of 2 tons per acre or 100 lbs. per 1000 s.f. Apply 10-10-10 fertilizer or equivalent at a rate of 300 lbs. per acre or 7.5 lbs. per 1000 s.f. Work lime and fertilizer into the soil to a depth of 4".
4. Inspect seedbed before seeding. If traffic has compacted the soil, retill compacted areas.
5. Apply the chosen grass seed mix. The recommended seeding dates are: April 1 to June 15 & August 15 - October 1.
6. Following seeding, firm seedbed with a roller. Mulch immediately following seeding. If a permanent vegetative stand cannot be established by September 30, apply a temporary cover on the topsoil such as netting, mat or organic mulch.

Figure PS-3 Seed Mixtures for Permanent Seeding

No.	Seed Mixture (Variety)[4]	Lbs/Acre	Lbs/1,000 Sq. Ft.
1[5]	Kentucky Bluegrass Creeping Red Fescue (Pennlawn, Wintergreen) Perennial Ryegrass (Norlea, Manhatten)	20 20 5 Total 45	.45 .45 .10 1.00
2[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Redtop (Streeker, Common) Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln	20 2 20 Total 42	.45 .05 .45 .95
3[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Bird's-foot Trefoil (Empire, Viking) with inoculant[1] Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln)	20 8 20 Total 48	.45 .20 .45 1.10
4[5]	Creeping Red Fescue (Pennlawn, Wintergreen) or Tall Fescue (Kentucky 31) Redtop (Streeker, Common) Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	20 2 8 Total 30	.45 .05 .20 .70
5[5]	White Clover Perennial Rye Grass	10 2 Total 12	.25 .05 .30
6[5]	Creeping Red Fescue Redtop (Streeker, Common) Perennial Rye Grass	20 2 20 Total 42	.50 .05 .50 1.05
7[5]	Smooth Bromegrass (Saratoga, Lincoln) Perennial Ryegrass (Norlea, Manhatten) Bird's-foot Trefoil (Empire, Viking) with inoculant[1]	15 5 10 Total 30	.35 .10 .25 .79
8[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock) Weeping lovegrass Little Bluestem (Blaze, Aldous, Camper)	10[1] 3 10[1] Total 23	.25 .07 .25 .57
9[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Crown Vetch (Chemung, Penngift) with inoculant[1] (or Flatpea (Lathco) with inoculant[1]) Tall Fescue (Kentucky 31) or Smooth Bromegrass (Saratoga, Lincoln) Redtop (Streeker, Common)	10 15 (30) 15 2 Total 42 (or 57)	.25 .35 (.75) .35 .05 1.00 (or 1.40)
10[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Redtop (Streeker, Common) Crown Vetch (Chemung, Penngift) with inoculant[1] (or Flatpea (Lathco) with inoculant[1])	20 2 15 (30) Total 37 (or 52)	.45 .05 .35 (.75) .85 (or 1.25)
11[5]	Bird's-foot Trefoil (Empire, Viking) with inoculant[1] Crown Vetch (Chemung, Penngift) with inocuiant[1] Creeping Red Fescue (Pennlawn, Wintergreen) or Tall Fescue (Kentucky 31)	8 15	.20 .35

Figure PS-3 Seed Mixtures for Permanent Seeding (con't)

No.	Seed Mixture (Variety)[4]	Lbs/Acre	Lbs/1,000 Sq. Ft.
12[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock) Perennial Ryegrass (Norlea, Manhatten) Crown Vetch (Chemung, Penngift) with inoculant[1]	101 5 15 Total 45	.25 .10 .35 1.05
13[6]	Crown Vetch (Chemung, Penngift) with inoculant[1] (or (Flatpea (Lathco) with inoculant[1]) Switchgrass (Blackwell, Shelter, Cave-in-rock) Perennial Ryegrass (Norlea, Manhatten)	10 (30) 5[1] 5 Total 20 (or 40)	.25 (.75) .10 .10 .45 (or .95)
14[5]	Crown Vetch (Chemung, Penngift) with inoculant[1] (or (Flatpea (Lathco) with inoculant[1]) Perennial Ryegrass (Norlea, Manhatten)	15 (30) 10 Total 25 (or 40)	.35 (.75) .25 .60 (or 1.00)
15[6]	Switchgrass (Blackwell, Shelter, Cave in-rock) Big Bluestem (Niagra, Kaw) or Little Bluestem (Blaze, Aldous, Camper) Perennial Ryegrass (Norlea, Manhatten) Bird's foot Trefoil (Empire, Viking) with inoculant[1]	5[1] 5[1] 5 5 Total 20	.10 .10 .10 .10 .40
16[5]	Tall Fescue (Kentucky 31) Flatpea (Lathco) with inoculant[1]	20 30 Total 50	.45 .75 1.20
17[6]	Deer Tongue (Tioga) with inoculant[1] Bird's-foot Trefoil (Empire, Viking) with inoculant[1] Perennial Ryegrass (Norlea, Manhatten)	10[1] 8 3 Total 21	.25 .20 .07 .52
18[6]	Deer Tongue (Tioga) with inoculant[1] Crown Vetch (Chemung, Penngift) with inoculant[1] Perennial Ryegrass (Norlea, Manhatten)	10[1] 15 3 Total 28	.25 .35 .07 .67
19[5]	Chewings Fescue Hard Fescue Colonial Bentgrass Bird's-foot Trefoil (Empire, Viking) Perennial Ryegrass	35 30 5 10 20 Total 100	.80 .70 .10 .20 .50 2.30
20[5]	Deleted due to invasive species		
21[5]	Creeping Red Fescue (Pennlawn, Wintergreen)	Total 60	1.35
22[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Tall Fescue (Kentucky 31)	40 20 Total 60	.90 .45 1.35
23[5]	Creeping Red Fescue (Pennlawn, Wintergreen) Flatpea (Lathco) with inoculant[1]	15 30 Total 45	.35 .75 3.60
24[5]	Tall Fescue (Kentucky 31)	Total 150	3.60

Figure PS-3 Seed Mixtures for Permanent Seeding (con't)

No.	Seed Mixture (Variety)[4]	Lbs/Acre	Lbs/1,000 Sq. Ft.
25[5]	American Beachgrass (Cape)	58,500 culms/acre	1,345 culms/ 100 sq. ft.
26[6]	Switchgrass (Blackwell, Shelter, Cave-in-rock) Big Bluestem (Niagra, Kaw) Little Bluestem (Blaze, Aldous, Camper) Sand Lovegrass (NE-27, Bend) Bird's-foot Trefoil (Empire Viking)	4.0 4.0 2.0 1.5 2.0 Total 13.5	.10 .10 .05 .03 .05 .33
27[5]	Flatpea (Lathco) Perennial Pea (Lancer) Crown Vetch (Chemung, Penngift) Tall Fescue (Kentucky 31)	10 2 10 2 Total 24	.20 .05 .20 .20 .65
28[5]	Orchardgrass (Pennlate, Kay, Potomac) Tall Fescue (Kentucky 31) Redtop (Streeker, Common) Birds-foot Trefoil (Empire Viking)	5 10 2 5 Total 22	.10 .20 .05 .10 .45
29	Turf Type Tall Fescue (Bonanza, Mustang, Rebel II, Spartan, Jaguar) or Perennial Rye ("Future 2000" mix; Fiesta II. Blazer II, and Dasher II)	175 to 250	6 to 8

[1] Use proper inoculant for legume seeds, use four times recommended rate when hydroseeding.
[2] Use Pure Live Seed (PLS) = $\frac{\% \text{ Germination} \times \% \text{ Purity}}{100}$

EXAMPLE: Common Bermuda seed with 70% germination and 80% purity= $\frac{70 \times 80}{100}$ or $\frac{56}{100}$ or 56%

$\frac{10 \text{ lbs PLS/acre}}{56\%}$ = 17.9 lbs/acre of bagged seed

[3] DOT All purpose mix
[4] Wild flower mix containing New England Aster, Baby's Breath, Black Eye Susan, Catchfly, Dwarf Columbine, Purple Coneflower, Lance-leaved Coreopsis, Cornflower, Ox-eye Daisy, Dame;'s Rocket, Scarlet Flax, Foxglove, Gayfeather, Rocky Larkspur, Spanish Larkspur, Corn Poppy, Spurred Snapdragon, Wallflower and/or Yarrow may be added to any seed mix given. Most seed suppliers carry a wild flower mixture that is suitable for the Northeast and contains a variety of both annual and perennial flowers. Seeding rates for the specific mixtures should be followed.
[5] Considered to be a cool season mix.
[6] Considered to be a warm season mix.

DATE	DESCRIPTION

REVISIONS

EROSION AND SEIMENTATION CONTROL NARRATIVE AND DETAILS

PREPARED FOR

KILLINGLY ENERGY CENTER NTE ENERGY PROJECT

LAKE ROAD

KILLINGLY, CONNECTICUT

Killingly Engineering Associates

Civil Engineering & Surveying

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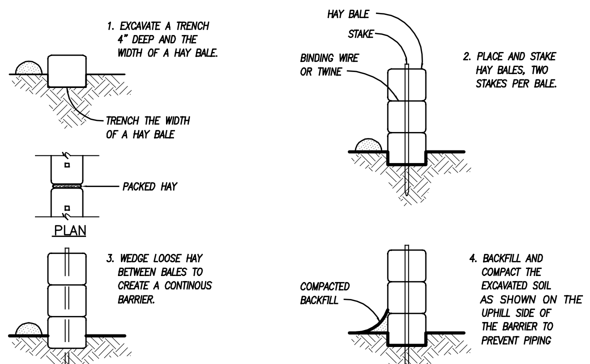
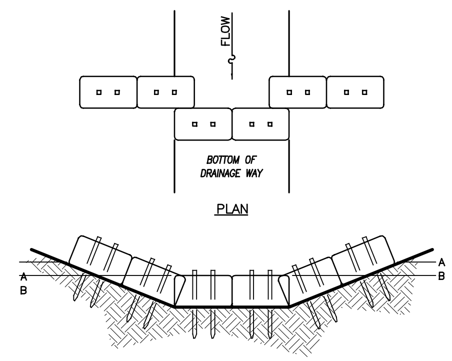
DATE: 06/30/2016	DRAWN: NET
SCALE: 1"=50'	DESIGN: NET
SHEET: 5 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042



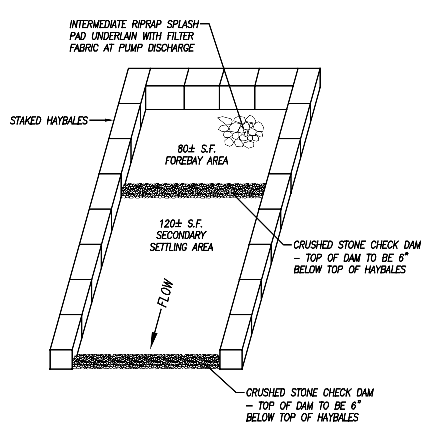
HAYBALE BARRIER

NOT TO SCALE



HAYBALE CHECK DAM

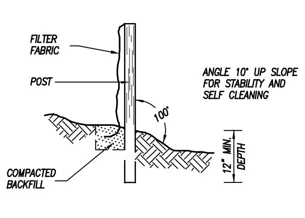
NOT TO SCALE



PUMPING OUTLET BASIN

NOT TO SCALE

NOTES:
1.) TO BE USED IN THE EVENT THAT CUTOFF TRENCH DEWATERING IS REQUIRED
2.) LOCATE BASINS OUTSIDE OF WETLANDS UPLAND REVIEW AREAS



SILT FENCE

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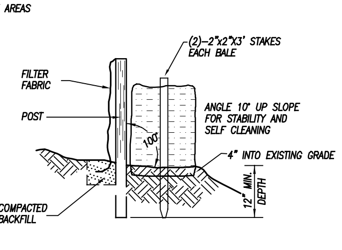
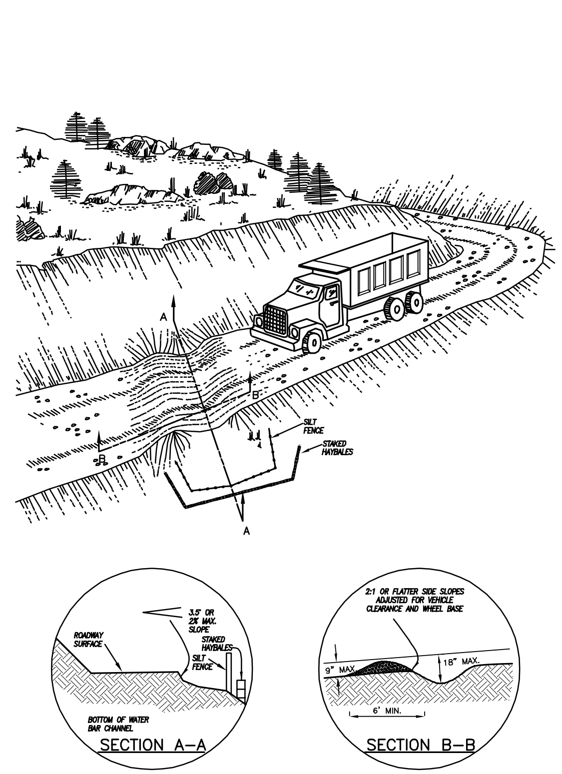


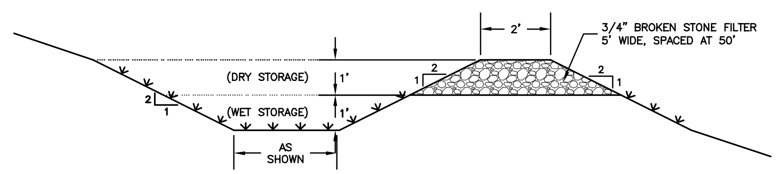
SILT FENCE – BACKED WITH HAYBALES

NOT TO SCALE



WATER BAR DETAIL

NOT TO SCALE

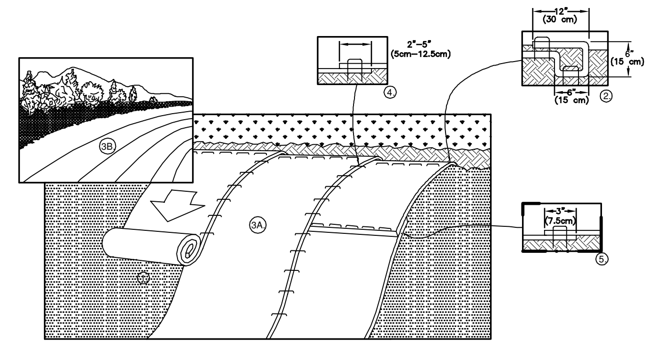


TEMPORARY SEDIMENTATION BASIN

NOT TO SCALE

NOTES:

1. Inspect the BASIN at least once a week (preferably twice) and after rainfall events of 0.5" or greater.
2. Remove sediment when deposits reach approximately 1/2 the height of the swale. Sediment shall be deposited in an area which is not regulated by the Inland Wetlands Commission.
3. Replace or repair within 24–hours of observed failure. Failure may include:
 –Overtopping, undercutting or bypassed by runoff water.
 –Stone filter has been moved or knocked over.



1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" (15cm) DEEP X 6" (15cm) WIDE TRENCH WITH APPROXIMATELY 12" (30cm) OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30cm) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30cm) PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30cm) APART ACROSS THE WIDTH OF THE BLANKET.
3. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING OPTIONAL DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH APPROXIMATELY 2"–5" (5cm–12.5cm) OVERLAP DEPENDING ON BLANKET TYPE. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE COLORED SEAM STITCH™ ON THE PREVIOUSLY INSTALLED BLANKET.
5. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" (7.5cm) OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" (30cm) APART ACROSS ENTIRE BLANKET WIDTH.

NOTES:

1. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15cm) MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.
2. TURF REINFORCEMENT MAT SHALL BE NORTH AMERICAN GREEN ERONET C–125 LONG TERM PHOTODEGRADEABLE BLANKET OR APPROVED EQUIVALENT.

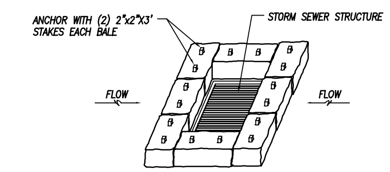
TURF REINFORCEMENT MAT INSTALLATION

NOT TO SCALE

New England Roadside Matrix Upland Seed Mix (Slope seed mix)

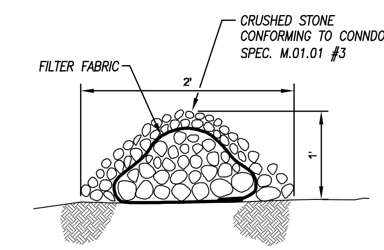
Botanical name	Common name Indicator
Elymus canadensis	Canada Wild Rye FACU+
Schizachyrium scoparium	Little Bluestem FACU
Festuca rubra	Creeping Red Fescue FACU
Andropogon gerardii	Big Bluestem FAC
Sorghastrum nutans	Indian Grass UPL
Chamaecrista fasciculata	Partridge Pea FACU
Panicum virgatum	Switch Grass FAC
Rhus typhina	Staghorn Sumac
Cornus amomum	Silky Dogwood FACW
Cornus racemosa	Grey Dogwood FAC
Asclepias syriaca	Common Milkweed FACUZizia
aurea	Golden Alexanders FAC
Desmodium canadense	Showy Tick Trefoil FAC
Lespedeza capitata	Bush Clover/Roundhead Lespedeza FACUHeliopsis
helianthoides	Ox Eye Sunflower UPL
Monarda fistulosa	Wild Bergamot UPL
Rudbeckia hirta	Black Eyed Susan FACUAster
laevis	Smooth Blue Aster UPL
Euthamia graminifolia	Grass Leaved Goldenrod FAC
Solidago juncea	Early Goldenrod

The New England Roadside Matrix Upland mix is designed for use along roads and highways. The mix is
unusual in that it contains native grasses, wildflowers, and shrubs that are blended together as a native matrix seed mix. In areas that receive frequent mowing, the grasses will dominate such as those closest to the roadway shoulder. In areas farther from the road, which may be mown only once each year, or in hard to mow areas, such as around sign posts, the wildflower component will become dominant. Along cuts and side slopes which may never be mown, the shrub component will add diversity, beauty and wildlife habitat to the roadside plantings. It is a particularly appropriate seed mix for roadsides, industrial sites, or cut and fill slopes. The mix may be applied by hydro–seeding, by
mechanical spreader, or on small sites it can be spread by hand. Lightly rake, or roll to ensure proper seed to soil contact. Best results are obtained with a Spring seeding. Late Spring and early
Summer seeding will benefit with a light mulching of weed–free straw to conserve moisture. If conditions are drier than usual, watering may be required. Preparation of a clean weed free seed bed is necessary for optimal results.



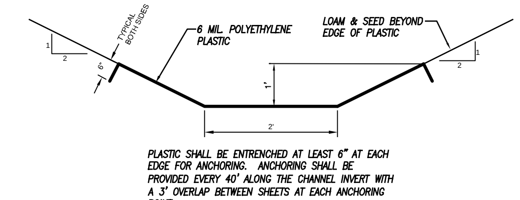
HAYBALE INSTALLATION AT CATCH BASIN

NOT TO SCALE



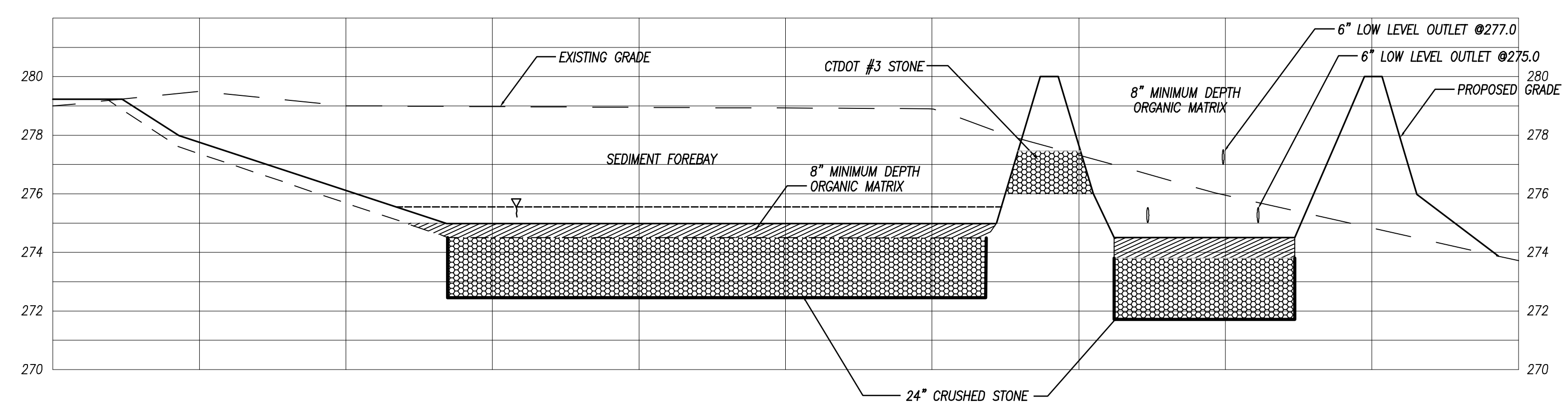
STONE CHECK DAM

NOT TO SCALE



TEMPORARY LINED CHANNEL

NOT TO SCALE



SECTION THROUGH DETENTION/WATER QUALITY BASIN

10/25/2016	PER R&R
DATE	DESCRIPTION

REVISIONS

EROSION AND SEDIMENTATION CONTROL DETAILS

PREPARED FOR

KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

LAKE ROAD

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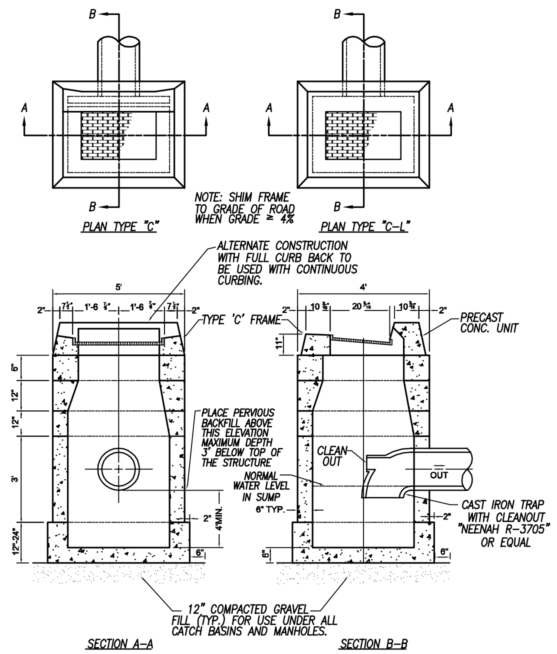
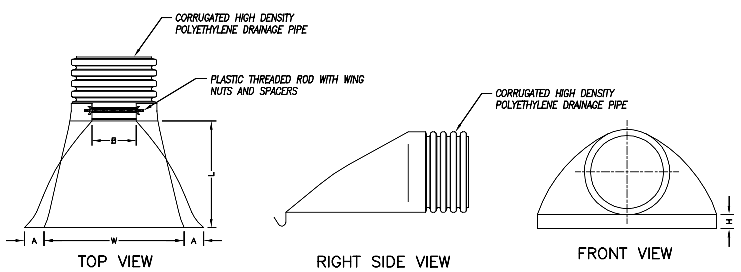


HOODED CATCH BASIN DETAIL

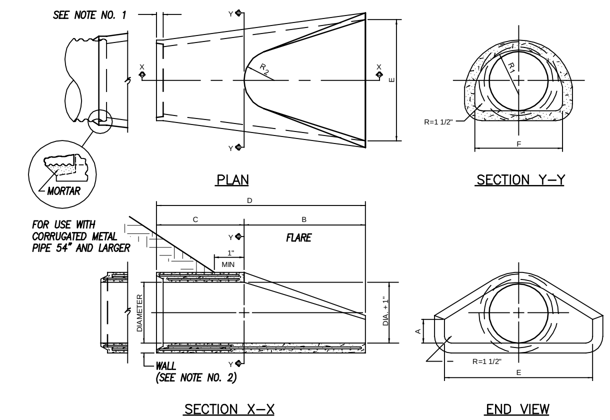
NOT TO SCALE



PIPE SIZE (IN)	A (IN)	B (IN, MAX)	H (IN)	L (IN)	W (IN)
12	6.50	10.00	6.50	25.00	29.00
15	6.50	10.00	6.50	25.00	29.00
18	7.50	15.00	6.50	32.00	35.00
24	7.50	18.00	6.50	36.00	45.00
30	7.50	12.00	8.60	58.00	63.00
36	7.50	25.00	8.60	58.00	63.00

FLARED END DETAIL

NOT TO SCALE

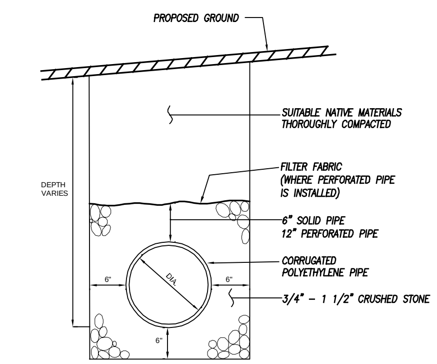


NOTE:
1. JOINTS SHALL BE TONGUE AND GROOVE OR BELL AND SPIGOT AS REQUIRED TO CONFORM TO PIPE INSTALLED
2. WALL THICKNESS SHALL CONFORM TO PIPE THICKNESS

DIMENSIONS FOR REINFORCED CONCRETE CULVERT END									FLARED REINFORCEMENT ONE LAYER ONLY IN CENTER OF WALL	
DIA.	A	B	C	D	E	F	R_1	R_2	MINIMUM AREA OF LONGITUDINALS SQ. IN. PER FT.	MINIMUM AREA OF TRANSVERSE STEEL SQ. IN. PER FT.
12"	4"	2'-0"	4'-0 3/8"	6'-0 3/8"	2'-0"	1'-7 15/16"	10 1/4"	9"	0.048	0.048
15"	6"	2'-3"	3'-10"	6'-1"	2'-6"	2'-0 5/16"	1'-0 1/2"	11"	0.054	0.054
18"	9"	2'-3"	3'-10"	6'-1"	3'-0"	2'-5"	1'-3 1/2"	1'-0"	0.060	0.060
21"	9"	2'-11"	3'-2"	6'-1"	3'-6"	2'-7 1/2"	1'-4"	1'-1"	0.066	0.066
24"	9 1/2"	3-7 1/2"	2'-6"	6'-1 1/2"	4'-0"	2'-9 3/16"	1'-4 13/16"	1'-2"	0.072	0.072
30"	1'-0"	4'-6"	1'-7 3/4"	6'-1 3/4"	5'-0"	3'-1"	1'-6 1/2"	1'-3"	0.084	0.084
36"	1'-3"	5'-3"	2'-10 3/4"	8'-1 3/4"	6'-0"	3'-11 13/16"	2'-0 5/16"	1'-8"	0.096	0.096
42"	1'-9"	5'-3"	2'-11"	8'-2"	6'-6"	4'-5 7/8"	2'-3 1/2"	1'-10"	0.108	0.108
48"	2'-0"	6'-0"	2'-2"	8'-2"	7'-0"	4'-8 1/2"	2'-4 1/2"	1'-10"	0.120	0.120
54"	2'-3"	5'-5"	2'-11"	8'-4"	7'-6"	5'-5 1/2"	2'-9 1/8"	2'-0"	0.132	0.132
60"	2'-6"	5'-0"	3'-3"	8'-3"	8'-0"	6'-0 1/2"	3'-0 11/16"	2'-0"	0.144	0.144

CULVERT END

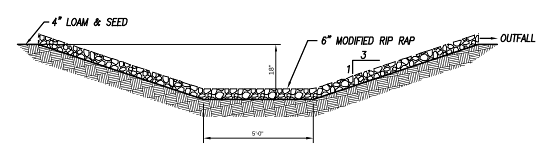
NOT TO SCALE



DRAINAGE PIPE INSTALLATION DETAIL

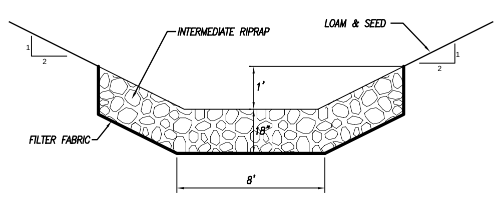
NOT TO SCALE

NOTE: PROVIDE WATER TIGHT GASKETED PIPE FOR INSTALLATIONS IN FILL SLOPES



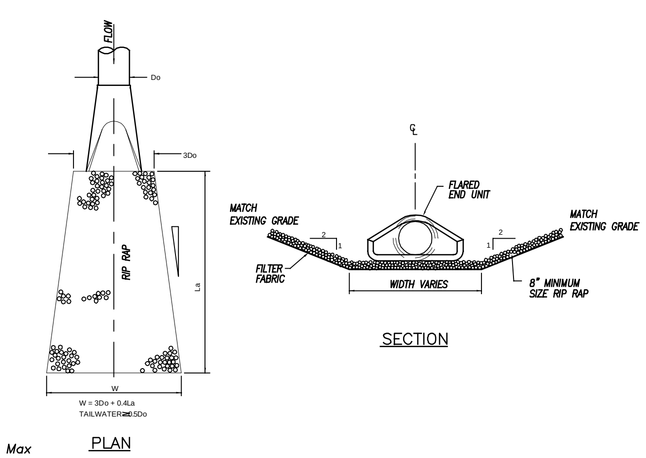
SECTION THROUGH LEVEL SPREADER

NOT TO SCALE



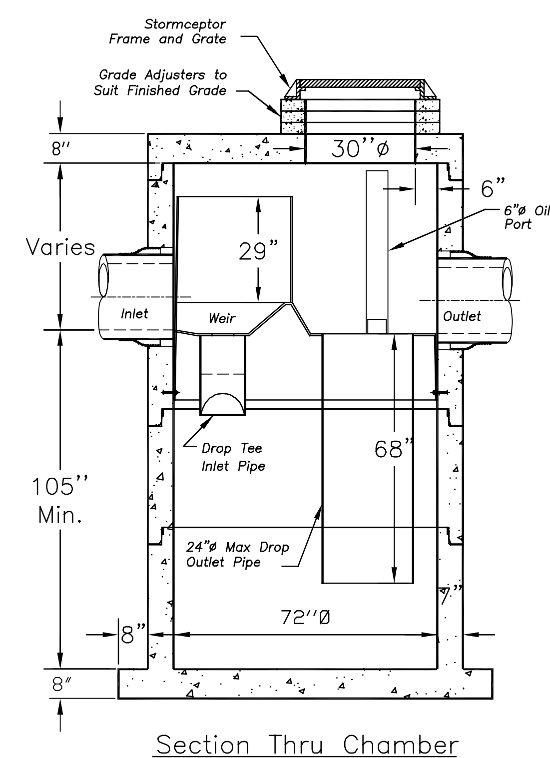
INTERMEDIATE RIPRAP SWALE

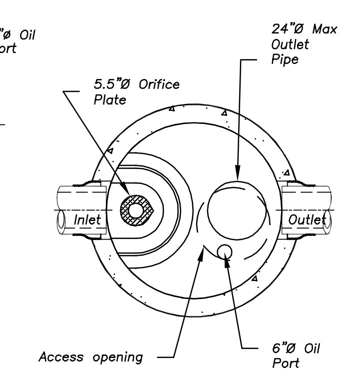
NOT TO SCALE



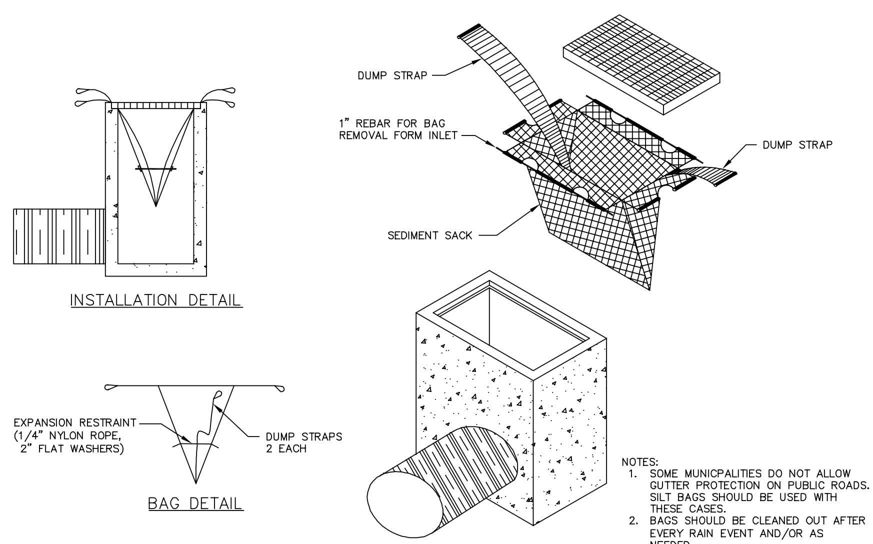
RIP RAP OUTFALL

NOT TO SCALE





EOS 18-1000 Precast Concrete Stormceptor
(1000 U.S. Gallon Oil Capacity)



NOTES:
1. SOME MUNICIPALITIES DO NOT ALLOW GUTTER PROTECTION ON PUBLIC ROADS. SILT BAGS SHOULD BE USED WITH THESE CASES.
2. BAGS SHOULD BE CLEANED OUT AFTER EVERY RAIN EVENT AND/OR AS NEEDED.

SILTBAG INLET SEDIMENT CONTROL DEVICE

NOT TO SCALE

MAY BE USED IN LIEU OF OR IN COMBINATION WITH STAKED HAYBALES

DATE	DESCRIPTION
10/25/2016	PER R&R

REVISIONS

STORMWATER CONSTRUCTION DETAILS

PREPARED FOR

KILLINGLY ENERGY CENTER NTE ENERGY PROJECT

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SHEET: 7 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042

NEW ENGLAND WETMIX (WETLAND SEED MIX)

The New England Wetmix (Wetland Seed Mix) contains a wide variety of native seeds that are suitable for most wetland restoration sites that are not permanently flooded. All species are best suited to moist ground as found in most wet meadows, scrub shrub, or forested wetland restoration areas. The mix is well suited for detention basin borders and the bottom of detention basins not generally under standing water. The seeds will not germinate under inundated conditions. If planted during the fall months, the seed mix will germinate the following spring. During the first season of growth, several species will produce seeds while other species will produce seeds after the second growing season. Not all species will grow in all wetland situations. This mix is comprised of the wetland species most likely to grow in created/restored wetlands and should produce more than 75% ground cover in two full growing seasons.

The wetland seeds in this mix can be sown by hand, with a hand–held spreader, or hydro–seeded on large or hard to reach sites. Lightly rake to insure good seed–to–soil contact. Seeding can take place on frozen soil, as the freezing and thawing weather of late fall and late winter will work the seed into the soil. If spring conditions are drier than usual watering may be required. If sowing during the summer months supplemental watering will likely be required until germination. A light mulch of clean, weed free straw is recommended.

APPLICATION RATE: 1 LB/2500 sq. ft

NEW ENGLAND CONSERVATION/WILDLIFE MIX

The New England Conservation/Wildlife Mix provides a permanent cover of grasses, wildflowers, and legumes. For both good erosion control and wildlife habitat value. The mix is designed to be a no maintenance seeding, and is appropriate for cut and fill slopes, detention basin side slopes, and disturbed areas adjacent to commercial and residential projects.

APPLICATION RATE: 25lbs/acre | 1750 sq ft/lb

NEW ENGLAND NATIVE WARM SEASON GRASS MIX

The New England Native Warm Season Grass Mix contains a broad spectrum of native warm season grasses to insure that a variety of the species will survive in the sandy, droughty conditions typically found along roadsides, gravel mine reclamation areas, and other low–fertility well drained soil conditions. This mix is somewhat slow to germinate and establish during the first year of planting, but it will produce good cover by the end of the second growing season to produce long–living native stands.

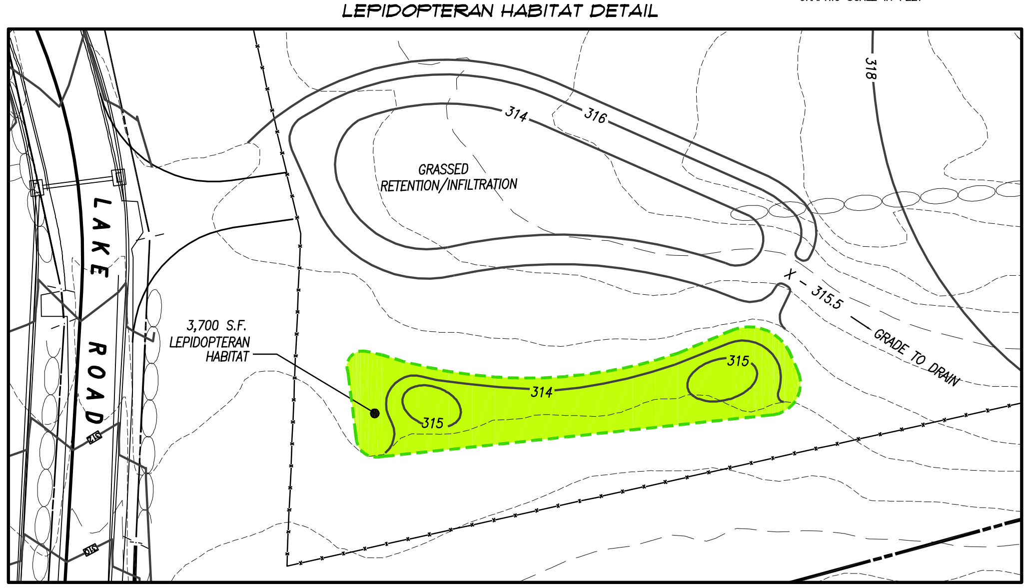
The cool season grasses have been added as a "starter" seed for erosion control. This mix has excellent heat and drought tolerance, and grows best in well drained soils. Warm season grasses provide excellent year round cover and food for wildlife, particulary as winter cover for small animals. This mix can be applied by hydroseeding, by mechanical spreader or by hand. Best results are obtained with a mid–late Spring seeding.

APPLICATION RATE: 23 lbs/acre | 1900 sq ft/lb

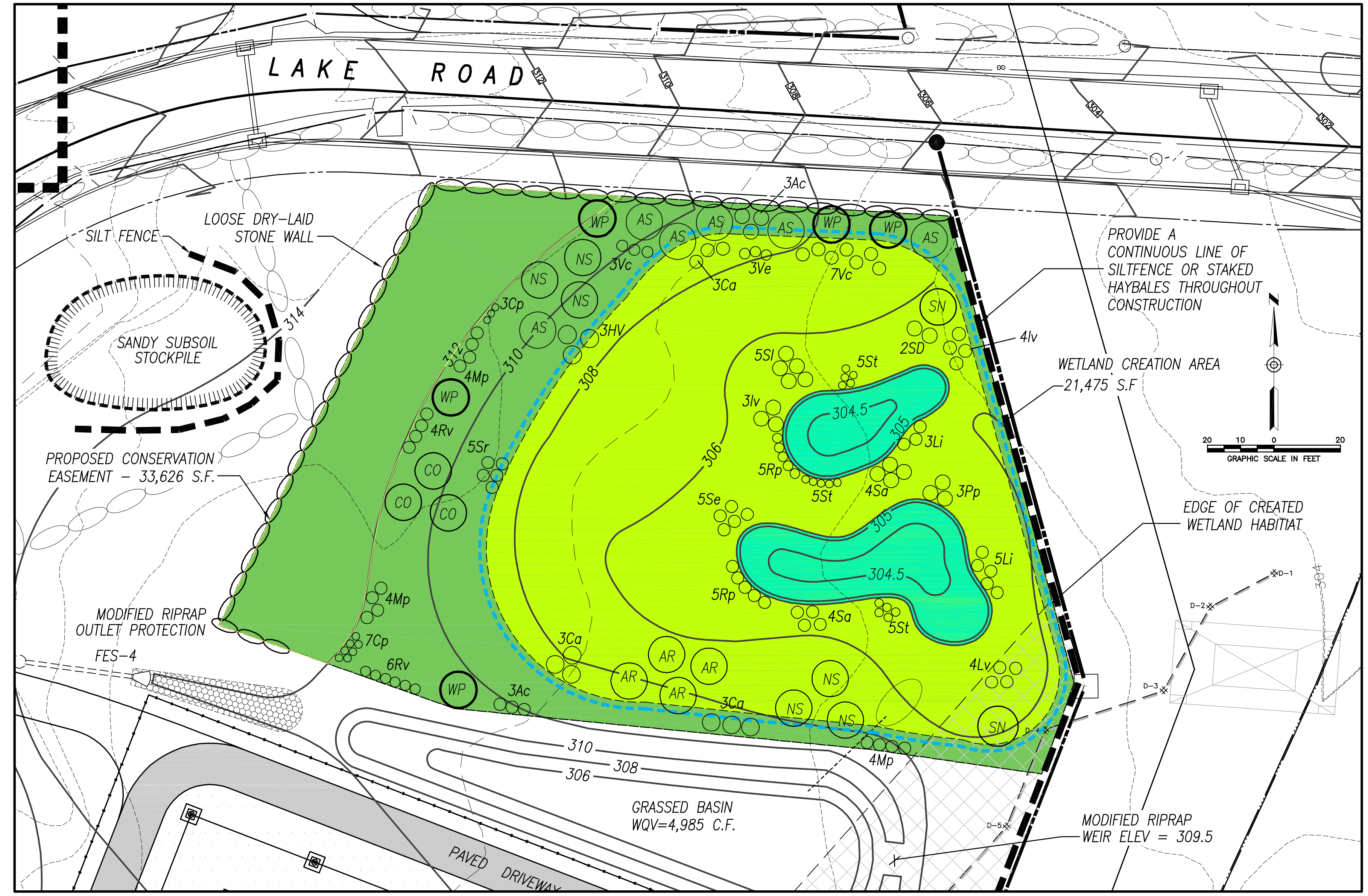
All mixes available from New England Wetlands Plants, 820 West Street, Amherst, MA 01002 WWW.NEWP.COM

30 15 0 30
GRAPHIC SCALE IN FEET

LEPIDOPTERAN HABITAT DETAIL



LEPIDOPTERAN HABITAT NORTH SIDE OF LAKE ROAD (SEE LOCUS, SHEET 2)



ZONE A: Marsh
ZONE B: Wet Meadow
ZONE C: Moist Meadow
ZONE D: Dry Meadow

TABLES OF PLANTING MATERIALS FOR WETLAND REPLICATION AREA & LEPIDOPTERAN HABITAT
Killingly Energy Center, Lake Road, Killingly, Connecticut

Table 1. Trees

Scientific Name	Code	Common Name	Size	Shade tolerant?	Form	Wetland Habitat	Upland Buffer	Lepidop. Habitat	Total
FULL SIZE TREES									
Acer rubrum	AR	Red maple	6-8'	N	potted	4			4
Acer saccharum	AS	Sugar maple	6-8'	Y	potted	2	3		5
Carya ovata	CO	Shagbark hickory	6-8'	Y	potted		3		3
Pinus strobus	PS	White pine	6-8'	N	potted	2	3		5
Nyssa sylvatica	NS	Black gum	6-8'	Y	potted	3	3		6
Salix nigra	SN	Black willow	6-8'	N	potted	2			2
Total:						*13*	*12*		***25***
SMALL TREES/LARGE SHRUBS									
Amelanchier canadensis	Ac	Shadblow	4'-6'	Y /N	potted		6		6
Hamamelis virginiana	Hv	Witch hazel	4'-6'	Y	potted	2	1		3
Salix discolor	Sd	Pussy willow	4'-6'	N	potted	2			2
Totals:						*4*	*4*		***11***

Table 2. Shrubs

Scientific Name		Common Name	Size	Shade tolerant?	Form	Wetland Habitat	Upland Habitat	Lepid. Habitat	Total
MEDIUM TO LOW SHRUBS									
Spiraea latifolia	Sl	Meadowsweet	3'-4'	N	potted	10			10
Spiraea tomentosa	St	Steeplebush	12" - 24"	N	potted	15			15
Lyonia ligustrina	Ll	Maleberry	3'-4'	Y	potted	8			8
Clethra alnifolia	Ca	Sweet pepperbush	3'-4'	Y	potted	6	3		9
Comptonia peregrina	Cp	Sweet fern	2'-3'	N	potted		10		10
Ilex verticillata	Iv	Winterberry	3'-4'	Y	potted	11			11
Morella pensylvanica	Mp	Bayberry	3'-4'	N	potted		12		12
Photinia pyrifolia	Pp	Red chokeberry	3'-4'	N	potted	3			3
Rosa palustris	Rp	Swamp rose	3'-4'	Y	potted	10			10
Rosa virginiana	Rv	Virginia rose	3'-4'	N	potted		10		10
Sambucus americana	Sa	Common elderberry	3'-4'	N	potted	8			8
Swida racemosa	Sr	Gray dogwood	3'-4'	Y	potted	3	2		5
Vaccinium corymbosum	Vc	Highbush blueberry	3'-4'	Y	potted	7	3		10
Viburnum lentago	Vl	Nannyberry	3'-4'	Y	potted	3			3
Totals:						*84*	*40*		***124***

Note:
Upland Habitat includes both Lepidopteran Habitat Area and upland areas around Wetland Replication Area, but no woody plants in Lepidopteran Area.

Table 3. Herbs

Scientific Name		Common Name	Size	Hyrdo Zone	NWI*	Spacing	Wetland Habitat	Upland Buffer Habitat	Upland Lepidop Habitat	Total
Asclepias incarnata	ai	Swamp milkweed	plug	B		1.5'OC	50			50
Asclepias tuberosa	at	Butterfly wilkweed	plug	C,D		1.5'OC		25	25	50
Alisma subcordatum	ac	Water plantain	plug	A	OBL	3'OC	50			50
Acorus americanus	aa	Sweet flag	plug	A	OBL	1'OC	50			50
Baptisia tinctoria	bt	Wild indigo	plug/port	D		1.5'OC		20	100	120
Calamogrostis canadensis	cc	Blue joint grass	plug	B	OBL	1.5'OC	100			100
Panicum virgatum	pv	Switchgrass	plug	C	FAC	1.5'OC	25	50	25	100
Glyceria canadensis	gc	Manna grass	plug	A	OBL	1.5'OC	50			50
Eutrochium maculatum	em	Spotted joy-pye-weed	plug	C		1.5'OC	25	25		50
Schoenoplectus tabernaemontani	st	Soft-stem bulrush	plug	A	OBL	2'OC	50			50
Thelypteris noveborecensis	tn	New York fern	quart pot	C	FAC	1.5'OC	20			20
Onoclea sensibilis	os	Sensitive fern	quart pot	B	FACW	1.5'OC	20			20
Sagittaria latifolia	sl	Arrowhead	plug	A	OBL	2'OC	50			50
Symphyotrichum novae-angliae	sn	New England aster	plug	C		1.5'OC	50			50
Symphyotrichum laeve	sla	Smooth aster	plug	B,C		1.5'OC	50	25	25	100
Chelone glabra	cg	Turtle head	plug	B		1.5'OC	50			50
Lupinus perennis	lp	Wild blue lupine	plug	D		1.5'OC		20	100	120
Mimulus ringens	mr	Monkey flower	plug	B	OBL	1.5'OC	50			50
Liatris spicata	ls	Marsh blazing star	plug	B,C		1.5'OC	25	25		50
Verbena hastata	vh	Blue vervain	plug	B	FACW	1.5'OC	50			50
Vernonia noveboracensis	vn	New York ironweed	plug	B,C		1.5'OC	30	20		50
Scirpus atrovirens	sa	Green bulrush	plug	B	OBL	1.5'OC	50			50
Carex crinita	cc	Fringed sedge	plug	B	OBL	1.5'OC	50			50
Carex stipata	cs	Stipate sedge	plug	B	OBL	1.5'OC	50			50
Carex scoparia	bs	Broom sedge	plug	B, C	FACW	1.5'OC	20	30		50
Zizia aurea	za	Golden Alexanders	plug	B, C		1.5'OC	25	25	25	75
Totals:							*990*	*265*	*300*	***1555***

** NWI Status (National Wetland Inventory; National Wetland Plant List: Northcentral & Northeast)*
NOTES:
Hydrologic Zones: A: seasonally flooded to semi-permanently flooded; B: sesonally saturated; C: moist; D: dry

2. Preferably plant woody and herbaceous plantings between April 15 and June 15 of a given year.
3. Coordinate plug order early in prior fall,so that flats of all species are planted (contract growing). Sources: Nasami Farms, Whately, MA & NEWP
4. Use topsoil from forested areas to be developed devoid of invasive species.
5. Use New England Wetmix from NEWP (New England Wetland Plants) , Amherst, MA (see Table 3) in areas between beds of herbaceous plugs.
6. No seeding or other plants in 3' diameter circle around each shrub, tree, and plug, mulched with bark mulch or shredded leaf litter.
7. Extra plugs will be ordered, because the minimum per flat is fifty. Plant extras nearby in restoration Area A; keep some in reserve as replacements.
8. Water frequently (several times a week) during first growing season; this is necessary for establishment of plugs and many of the seedlings.
9. Monitoring will take place for 5-years following establishment of plantings.
10. Annual reporting to the Town of Killingly will be provided for the 5-year monitoring period.

Table 4: Seed Mixes for Wetland Replication Area and Moist/Dry Uplands

Zone B: Saturated within 6", may be flooded at times (Wet Meadow)
Zone C: Transitional wetland/moist upland, occasionally saturated
Zone D: Moist to Dry upland

NEWP Seed Mixes (New England Wetland Plants)	**Comments**	**Zone**	Total Pounds Per Seed Mix: Wet Meadow/Shallow Marsh *(edge)*	Wet Meadow/Moist Meadow	Lepidopteran Habitat	Totals
NE Wetmix ***1 lb/2500 sf***	*Wet meadow and edge of shallow marsh - not in area of inundation*	**B**	5			5
NE Native Warm Season Grass Mix ***1 lb/1900 sf***	*Lepidopteran Habitat dry-site tolerant*	**D**			3	3
NE Conservation Wildlife Mix ***1 lb/1750 sf***	*Upper portion of wet meadow and moist uplands within CE, lepidopteran habitat area*	**C**		9		9
		Totals:	**5**	**9**	**3**	**17**

Notes:
1. Mix 1:1 with filler (coarse sand or kitty litter) to help correctly divide seed packages and for even spreading.
2. Mixes contain seeds with a range of hydrologic tolerances, so different species will thrive in different areas.
3. Only small areas will remain for seeding,needing <1 lb total of each mix; plan calls for mostly plugs & woody plants
4. Mulch (do not seed) areas under and around plug & shrub clusters, to exclude weeds and hold moisture. (Coverage specified assumes area occupied by mulched woody plantings has been subtracted.)
5. A late fall seeding will require 20% more seed, because some seed wil be lost to wash off and herbivory, but germination rates will actually be higher, due to the cold winter stratification of the seed.

Sources:
New England Wetland Plants, Inc., 820 West Street, Amherst, Massachusetts 01002; phone: 413-548-8000

DATE	DESCRIPTION
12/11/2017	REVISED LEPIDOPTERAN HABITAT LOCATION

REVISIONS

WETLAND MITIGATION AND RESTORATION PLAN

PREPARED FOR

KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

LAKE ROAD
KILLINGLY, CONNECTICUT

DATE: 01/13/2017	DRAWN: NET
SCALE: AS NOTED	DESIGN: GL
SHEET: 1 OF 2	CHK BY:
DWG. No:	JOB No: 16042

PLAN FOR UPLAND LEPIDOPTERAN HABITAT

IMPLEMENTATION NOTES

1.0 Introduction

THE CREATION OF A SPECIALIZED UPLAND HABITAT SUITABLE TO ATTRACT LIPEDOPTERAN SPECIES (I.E. BUTTERFLIES AND MOTHS), SHALL TAKE PLACE AT ONE LOCATION (I.E. LEPIDOPTERAN HABITAT AREA), IN THE NORTHERN PORTION OF THE "SWITCHYARD SITE." THIS HABITAT, WHICH ENCOMPASSES APPROXIMATELY 3,700 SQUARE FEET, SHALL BE LOCATED WITHIN THE FAR WESTERN SECTION OF THE CONSERVATION EASEMENT THAT WILL ALSO CONTAIN THE WETLAND CREATION AREA.

THE TARGET COVER TYPE FOR THE LEPIDOPTERAN HABITAT WILL BE A "DRY-SPECTRUM" MEADOW DOMINATED BY GRASSES AND FORBS KNOWN TO ATTRACT THE TARGET INVERTEBRATES. THE SOILS TO BE USED IN CREATING THIS HABITAT SHALL BE SANDY (I.E. SANDY LOAM, LOAMY SAND). APPROXIMATELY 10 TO 15 PERCENT OF THIS AREA'S SURFACE WILL BE COVERED WITH COARSE FRAGMENTS (I.E. STONE & ROCK). ONLY 4 TO 6 INCHES OF TOPSOIL WILL BE USED AND HAVE ROUGHLY 3 TO 4 PERCENT ORGANIC MATTER (BY WEIGHT). THE DRAINAGE CLASS OF THIS AREA WILL BE WELL DRAINED.

***NOTE:** ALL WETLAND MITIGATION WORK SHALL BE SUPERVISED BY AN ECOLOGIST, INCLUDING INITIAL GRADING, PLANTING, MARKING INVASIVES IN ADJACENT UPLAND AREAS, AND MARKING ANY NATIVE MATERIALS FOR SALVAGE. A PRE-IMPLEMENTATION MEETING SHALL TAKE PLACE AT LEAST ONE MONTH PRIOR TO PLAN IMPLEMENTATION, BETWEEN THE ECOLOGIST, THE SITE CONTRACTOR, AND THE LANDSCAPER.*

2.0 Site Preparation

1. THE LEPIDOPTERAN HABITAT AREA WILL BE INITIALLY USED FOR CONSTRUCTION-RELATED ACTIVITIES (E.G. PARKING, MATERIAL STORAGE). BEFORE SUCH ACTIVITIES TAKE PLACE TOPSOIL SHALL BE REMOVED. THIS TOPSOIL SHALL NOT BE USED FOR THIS HABITAT, BUT COULD BE USED IN AREAS TO BE MAINTAINED AS GRASS WITHIN THE FACILITY SITE.
2. AFTER THE LEPIDOPTERAN HABITAT AREA IS NO LONGER TO BE USED FOR CONSTRUCTION-RELATED ACTIVITIES, ALL IMPORTED MATERIALS (E.G. GRAVEL SURFACES) AND VEGETATION SHALL BE REMOVED.
3. INSTALL *PERIMETER EROSION CONTROLS* AROUND THE OVERALL MITIGATION AREA AS SHOWN ON PLAN: CORRECTLY TRENCHED AND STAKED SILT FENCE PER THE *2002 CONNECTICUT EROSION & SEDIMENTATION CONTROL GUIDELINES* (2002 GUIDELINES).
4. GRADING WILL TAKE PLACE UNDER THE DIRECTION OF AN ECOLOGIST IN THE DRIER PORTION OF THE YEAR (LATE SPRING THROUGH EARLY FALL). GRADING WILL FOLLOW THE PLAN, BUT THE ECOLOGIST MAY MAKE MINOR ADJUSTMENTS.
5. THE SUBSOIL TO BE USED IN THE LEPIDOPTERAN HABITAT AREA SHALL NOT BE FINER THAN A SANDY LOAM AND CAN BE AS COARSE AS LOAMY SAND, WITH NO MORE THAN 20% SILT CONTENT.
6. UPLAND TOPSOIL TO BE USED IN THE LEPIDOPTERAN HABITAT AREA SHOULD BE FROM NON-INVASIVE INFESTED AREAS WITHIN THE "GENERATING FACILITY SITE" OR FROM OFF-SITE SOURCES. A MINIMUM OF 4 INCHES (AFTER SETTLING), BUT NOT MORE THAN 6 INCHES SHALL BE USED TO BRING THE MITIGATION AREA TO THE DESIRED ELEVATIONS, AS SPECIFIED IN THE PLAN.
7. THE UPLAND TOPSOIL USED MUST HAVE A 3-4% ORGANIC MATTER (PERCENT LOSS ON IGNITION).
8. THE UPLAND TOPSOIL SHALL BE ANALYZED BEFORE USE FOR TEXTURAL CLASSIFICATION BASED ON THE USDA SOILS MANUAL WITH THE FOLLOWING CLASSES BEING ACCEPTABLE:
   a. SANDY LOAM TO LOAMY SAND, WITH NO MORE THAN 85% SAND CONTENT.
9. THE UPLAND TOPSOIL SHALL BE TESTED FOR pH (1:1, H_2O) AND BE WITHIN THE FOLLOWING RANGE: 6.5 - 7.5. LIME MAY BE ADDED TO RAISE THE pH TO AN ACCEPTABLE LEVEL.
10. 10 TO 15 PERCENT OF COARSE FRAGMENTS SHALL COVER THIS HABITAT AREA, AND CONSIST OF STONE AND ROCK SALVAGED FROM THE SITE, BUT DEVOID OF INVASIVE SPECIES (I.E. FRAGMENTS, SEEDS).
11. COARSE FRAGMENTS SHALL RANGE IN SIZE FROM 6 TO 18 INCHES ACROSS.
12. NO MACHINERY WILL BE ALLOWED WITHIN THE AREA AFTER THE FINAL 12 INCHES OF SANDY SUBSOIL AND THE TOPSOIL HAVE BEEN LAID DOWN.

3.0 Plantings - Upland Habitat Creation

1. PLANTING OF THE LEPIDOPTERAN HABITAT AREA SHALL BE INITIATED *IN SPRING* BETWEEN APRIL 15TH AND MAY 30TH. ONLY SEEDING MAY BE DONE IN LATE FALL OR EARLY WINTER AFTER HARD FROST (SEE TABLE 3).
2. DURING THE SUMMER BEFORE PLANT IMPLEMENTATION, COORDINATE WITH NASAMI FARMS, THE NURSERY THAT WILL CONTRACT-GROW THE BAPTISIA TINCTORIA AND LUPINUS PERENNIS PLANTS, AS WELL AS TWO LATE-SUMMER BLOOMING LEGUMES IN THE BUSH CLOVER AND TICK TREFOIL FAMILIES (**NOTE**: THE BUSH CLOVERS AND TICK TREFOILS ARE NOT INCLUDED IN TABLE 3). ORDER A TOTAL OF 320 PLANTS, TWO FLATS EACH OF LUPINE AND INDIGO, AND ONE FLAT EACH OF BUSH CLOVER AND TICK TREFOIL, PLUS 20 LARGER PLANTS OF EACH SPECIES. PLUGS WILL BE GROWN FROM FIELD-COLLECTED SEED, EITHER FROM A LOCAL SOURCE IN NORTHEASTERN CONNECTICUT, IF A SUFFICIENT QUANTITY IS AVAILABLE, OR NEARBY IN MASSACHUSETTS.
3. LEGUME SEED WILL BE SOWN WITH INOCULUM IN THE FALL IN A GREENHOUSE AT NASAMI FARM, TO PRODUCE FLATS OF FIFTY PLUGS EACH FOR SOWING AT THE SITE IN THE FOLLOWING SPRING. THE PRICE WILL BE APPROXIMATELY $1.25 PER PLUG.

3.2 SEEDING (SEED MIX)

1. SOW SEED IN FALL, AFTER FROST. MIX 1: 1 WITH SAND OR KITTLY LITTER FOR EVEN SOWING. PLANT THE QUANTITY SPECIFIED FOR 400 SQUARE FEET.
2. IN FALL, USE SPRAY PAINT TO DELINEATE LOCATIONS OF AREAS TO BE SEEDED. MARK OUT THE LOCATIONS AND SIZES OF THE SINGLE SPECIES PLANTING BEDS (SEED NEXT SECTION FOR SPACING & PLANT NUMBERS), FOR THE SPRING LEGUME PLANTING. SOW THE NEW ENGLAND NATIVE WARM SEASON GRASS MIX IN THE REMAINING AREAS OF THE SPECIALIZED LEPIDOPTERAN HABITAT (SEE TABLE 4).
3. LIGHTLY RAKE IN SEED (LESS THAN ½ INCH DEEP) AND ROLL. FOR FALL SEEDING, AFTER HARD FROST, SEED MAY SIMPLY BE SOWN. SNOW AND FROST WILL INCORPORATE INTO THE SOIL.
4. SPREAD A THIN LAYER OF *STRAW MULCH* OVER ALL SEEDED AREAS AND IN THE BEDS TO BE PLANTED WITH PLUGS IN THE FOLLOWING SPRING, ALLOWING SOME LIGHT PENETRATION. THIS WILL REDUCE MOLISTURE LOSSES, AND LOSSES TO BIRDS.

3.3 PLANTINGS INSTALLATION

1. STORAGE: KEEP PLANTS IN THE SHADE AND INSTALL WITHIN THREE DAYS OF DELIVERY. KEEP WATERED, AS NECESSARY.
2. A QUALIFIED ECOLOGIST SHALL SPECIFY PLANTING LOCATIONS AND DIRECT THE INSTALLATION, EITHER BY STAKING PLANTING LOCATIONS WITH A WIRE FLAG OR BAMBOO STAKE LABELED WITH THE SPECIES NAME OR CODE. POTTED STOCK MAY ALSO BE DIRECTLY PLACED AT PLANTING LOCATION.
3. PLANT SINGLE SPECIES PATCHES OF 20 TO 30 PLUGS, EIGHTEEN INCHES ON CENTER IN MAY OR JUNE OF YEAR 1 OF THE IMPLEMENTATION.
4. FOR THE WILD INDIGO (BAPTISIA TINCTORIA) AND THE LUPINE (LUPINUS PERENNIS), TEN PLANTS EACH OF LARGER, SECOND YEAR PLANTS WILL ALSO BE PLANTED AT THIS TIME, WITH THE SAME SPACING.
5. PATCHES SHALL BE OF VARIABLE SHAPES AND SIZES, FOR A NATURAL EFFECT, AND SPACED TWO TO TWENTY FEET APART.

3.4 PROTECTION FROM HERBIVORY

1. BAPTISIA TINCTORIA AND LUPINUS PERRENNIS ARE VERY ATTRACTIVE TO DEER. IF EXCESSIVE HERBIVORY IS OBSERVED, THE WETLAND ECOLOGIST MAY PROPOSE DEER FENCE TO REDUCE HERBIVORY.

3.5 FOLLOW-UP AND MAINTENANCE

1. PERIMETER SEDIMENT CONTROLS. MAINTAIN PER THE 2002 CT E&S GUIDELINES, CHECK AFTER EACH RAIN MORE THAN ONE INCH. REMOVE SILT FENCE AS SOON AS GROUND IS VEGETATED (>80% COVER) TO PREVENT IMPEDING ANIMAL MOVEMENT TO AND FROM ADJACENT SEASONALLY FLOODED AND SATURATED WETLANDS. SEDIMENT COLLECTED BY THESE DEVICES WILL BE REMOVED AND PLACED UPLAND IN A MANNER THAT PREVENTS ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.
2. IRRIGATION: WATER ALL SEEDED AND PLANTED AREAS AT LEAST TWO TO THREE TIMES A WEEK IN DROUGHTY PERIODS. MORE FREQUENT WATERING WILL INCREASE PLANTINGS SUCCESS.
3. MONITOR PLANTS SUCCESS IN CONJUNCTION WITH FREQUENT WATERING IN THE FIRST GROWING SERASON. BE ALERT FOR A NEED FOR DEER DETERRENBTS OR FENCING.

4.0 Invasive Plant Control and Monitoring

1. OVER THE NEXT FOUR YEARS (AFTER PLAN IMPLEMENTATION) FOLLOW THE PROCEDURES OUTLINED FOR THE MITIGATION AREAS IN THE: "*INVASIVE SPECIES CONTROL PLAN: KILLINGLY ENERGY CENTER, LAKE ROAD, KILLINGLY, CONNECTICUT*," DATED JANUARY 2017, AND PREPARED BY REMA ECOLOGICAL SERVICES, LLC.
2. OVER THE NEXT FOUR YEARS MONITOR THE LEPIDOPTERAN HABITAT ONCE OR TWICE A YEAR. PULL ANY UNDESIRABLE "WEEDY" SPECIES TO ALLOW THE DESIRED PLANTS TO SPREAD. MONITOR INVERTEBRATE ACTIVITY IN YEAR 2 AND 4 AND RECORD OBSERVATIONS.

MITIGATION PLAN FOR REPLICATION OF WETLAND HABITATS

IMPLEMENTATION NOTES

1.0 Introduction

WETLAND CREATION BY EXCAVATION AND PLANTING, WILL TAKE PLACE IN ONE LOCATION (I.E. WETLAND MITIGATION AREA), IN THE NORTHERN PORTION OF THE "SWITCHYARD SITE," ADJACENT TO LAKE ROAD AND THE EVERSOURCE ELECTRIC RIGHT OF WAY. WETLAND HABITATS WILL BE CREATED BY SHALLOW EXCAVATION IN A MOIST, UPLAND OPEN FIELD AREA, JUST NORTH OF THE WETLAND IMPACT AREA. ADJACENT UPLAND BUFFER HABITATS, WITH MODERATELY WELL DRAINED SOIL, WILL ALSO BE GRADED AND PLANTED. A SANDY, DRY LEPIDOPTERAN HABITAT WILL BE CREATED ALONG THE NORTHERN EDGE OF THE MITIGATION AREA (SEE SEPARATE IMPLEMENTATION NOTES).

THE TARGET COVER TYPE RATIO FOR THE WETLAND REPLICATION SHALL BE ROUGHLY 60% MEADOW/EMERGENT AND 40% WOODY COVER (I.E. SCRUB SHRUB), BY THE END OF THE FIVE YEAR MONITORING PERIOD. THE GOAL IS TO CREATE A MOSAIC OF HABITAT, WITH AT LEAST COMPARABLE FUNCTIONS TO THE WETLAND IMPACT AREA. THE RATIO OF WETLAND REPLICATION AREA TO WETLAND IMPACT AREA SHALL BE A MINIMUM OF 1.5:1. TREES WILL ALSO BE PLANTED IN THE NORTHERN EXTENT OF THE MITIGATION AREA, PARALLEL TO LAKE ROAD, REPLACING TREES THAT WOULD BE LOST DURING ROAD WIDENING AND ADJACENT TO THE WESTERN LEPIDOPTERAN HABITAT AREA, AS FOREST EDGES ARE AN IMPORTANT HABITAT COMPONENT FOR A THREATENED BUTTERFLY (I.E., FROSTED ELFIN).

THE CREATED AND RESTORED WETLAND HABITATS (SEE INVASIVE SPECIES CONTROL PLAN; ISCP) WILL MITIGATE FOR THE LIMITED DIRECT PRIMARY IMPACTS TO A PRIOR AGRICULTURAL WET MEADOW (I.E. OLD PASTURE) AND SCRUB SHRUB WETLAND, PARTIALLY INFESTED WITH INVASIVE PLANTS.

THIS PLAN FOLLOWS (IN PART) THE MOST RECENT REVISION OF THE U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT'S, COMPENSATORY MITIGATION GUIDANCE (9/132/16).

***NOTE:** ALL WETLAND MITIGATION WORK, SHALL BE SUPERVISED BY AN ECOLOGIST (OR WETLAND SCIENTIST), INCLUDING INITIAL GRADING, PLANTING, MARKING INVASIVES IN ADJACENT UPLAND BUFFER AREAS, AND MARKING ANY NATIVE MATERIALS FOR SALVAGE. A PRE-IMPLEMENTATION MEETING SHALL TAKE PLACE AT LEAST ONE MONTH PRIOR TO PLAN IMPLEMENTATION, BETWEEN THE WETLAND SCIENTIST, THE SITE CONTRACTOR, THE LANDSCAPER, AND ALSO THE TOWN KILLINGLY WETLANDS AGENT, AT THE TOWN'S DISCRETION.*

2.0 Site Preparation

1. THE WETLAND MITIGATION AREA WILL BE INITIALLY USED FOR CONSTRUCTION-RELATED ACTIVITIES (E.G. PARKING, MATERIAL STORAGE). BEFORE SUCH ACTIVITIES TAKE PLACE TOPSOIL SHALL BE REMOVED. THIS TOPSOIL SHALL NOT BE USED FOR WETLAND REPLICATION, BUT COULD BE USED IN AREAS TO BE MAINTAINED AS GRASS WITHIN THE FACILITY SITE.
2. AFTER THE WETLAND MITIGATION AREA IS NO LONGER TO BE USED FOR CONSTRUCTION-RELATED ACTIVITIES, ALL IMPORTED MATERIALS (E.G. GRAVEL SURFACES) AND VEGETATION WILL BE REMOVED, EXCEPT ANY SMALL INCLUSIONS WITH NATIVE VEGETATION, AT THE DISCRETION OF THE WETLAND SCIENTIST. MINIMIZE VEGETATION REMOVAL IN THE NORTHERN SECTION OF THE MITIGATION ADJACENT TO LAKE ROAD.
3. INSTALL *PERIMETER EROSION CONTROLS* AROUND THE MITIGATION AREA AS SHOWN ON PLAN: CORRECTLY TRENCHED AND STAKED SILT FENCE PER THE *2002 CONNECTICUT EROSION & SEDIMENTATION CONTROL GUIDELINES* (2002 GUIDELINES).
4. GRADING, INCLUDING SHALLOW EXCAVATION, WILL TAKE PLACE UNDER THE DIRECTION OF THE WETLAND SCIENTIST IN THE DRIER PORTION OF THE YEAR (MID SPRING THROUGH EARLY FALL). GRADING WILL FOLLOW THE PLAN, BUT IN THE EVENT OF UNEXPECTED SOIL AND HYDROLOGIC OCNDITIONS, THE WETLAND SCIENTIST MAY MAKE MINOR ADJUSTMENTS.
5. TOPSOIL TO BE USED IN THE WETLAND MITIGATION AREA SHOULD BE FROM NON-INVASIVE INFESTED AREAS WITHIN THE "GENERATING FACILITY SITE" OR FROM OFF-SITE SOURCES. A MINIMUM OF 8 INCHES (AFTER SETTLING) SHALL BE USED TO BRING THE MITIGATION AREA TO THE DESIRED ELEVATIONS.
6. THE WETLAND TOPSOIL USED MUST HAVE A MINIMUM OF 9% ORGANIC MATTER (PERCENT LOSS ON IGNITION). ORGANIC MATTER CAN BE INCREASED BY MIXING WITH HIGH-QUALITY LEAF COMPOST (2-YEAR MINIMUM AGE). ORGANIC MATTER CONTENT OF UPLAND TOPSOIL IN THE ADJACENT BUFFER MAY BE LOWER (3-4%).
7. THE TOPSOIL (FOR THE WETLAND REPLICATION AND FOR THE UPLAND BUFFER) SHALL BE ANALYZED BEFORE USE FOR TEXTURAL CLASSIFICATION BASED ON THE USDA SOILS MANUAL WITH THE FOLLOWING CLASSES BEING ACCEPTABLE:
   a. SANDY LOAM, WITH NO MORE THAN 80% SAND
   b. LOAM
   c. SILT LOAM, WITH NO MORE THAN 60% SILT
8. THE WETLAND TOPSOIL SHALL BE ANALYZED FOR NUTRIENTS USING THE MORGAN SOIL TEST OR APPROVED ALTERNATIVE. NUTRIENTS IN THE COMPOSITE SAMPLE TO BE TESTED SHALL BE WITHIN THE FOLLOWING RANGES:
   a. NITROGEN (N) - 15-35 PPM
   b. PHOSPHORUS (P) - 20-30 PPM
   c. POTASSIUM (K) - 100-160 PPM
9. IF THE WETLAND TOPSOIL DOES NOT MEET THE REQUIRED NUTRIENT LEVELS, AN ORGANIC METHOD FOR SOIL AMENDMENT SHALL BE USED.
10. THE WETLAND TOPSOIL SHALL BE TESTED FOR pH (1:1, H_2O) AND BE WITHIN THE FOLLOWING RANGE: 6.0 - 7.5. PELLETIZED LIME MAY BE USE TO RAISE THE pH.
11. THE WETLAND REPLICATION AREA, AND THE UPLAND BUFFER, WILL BE GRADED AS BROAD, LEVEL TO GENTLY SLOPING TERRACES. IN THE WETLAND THE TARGETED SPRING WATER TABLE SHALL BE WITHIN 16 INCHES OF THE SURFACE.
12. AS SHOWN ON PLANS THE CREATED WETLAND ALSO HAS TWO DEEPER "SUMPS," WHERE EMERGENT VEGETATION TYPICALLY FOUND IN SHALLOW MARSHES SHALL BE PLANTED.
13. ADDITIONAL MICROTOPOGRPHY, THAT IS, IRREGULAR SHALLOWER DEPRESSIONS, WILL BE CONSTRUCTED IN THE SUBSOIL IN A MANNER THAT MIMICS THE PIT AND MOUND MICROTOPOGRAPHY OF MOST NATURAL WETLAND SYSTEMS. THE PROPOSED MICROPOGRAPHIC VARIATIONS ARE NOT SHOWN ON THE PLANS AND SHALL BE DETERMINED AS 1 FOOT BELOW THE FINISHED WETLAND ELEVATION. MICROTOPOGRAPHY WILL BE CREATED BY VARYING THE CONTOURS OF THE SUBSOIL BY A MAXIMUM OF 1 FOOT ABOVE OR BELOW THE PROPOSED SUBSOIL ELEVATION. MICROTOPOGRAPHIC SURFACE VARIATIONS SHALL NOT RESULT IN VERTICAL OR NEAR VERTICAL SLOPES. MICROTOPOGRAPHY (THE SMALLER DEPRESSIONS) SHALL ALLOW LIMITED TEMPORARY PONDING, WITH LATERAL CAPILLARY ACTION INTO HIGHER ELEVATION AREAS.
14. NO MACHINERY WILL BE ALLOWED WITHIN THE AREAS WHERE MICROTOPOGRAPHY CONSTRUCTION HAS BEGUN.
15. PLACEMENT OF TOPSOIL SHALL OCCUR OVER THE SUBSOIL TO ACHIEVE THE FINAL GRADES SHOWN ON THE WETLAND MITIGATION PLAN. WETLAND TOPSOIL WILL HAVE BEEN TESTED AND APPROVED THIS BEFORE PLACEMENT. OPERATION MUST BE PERFORMED IN CONJUCTION WITH THE CONSTRUCTION OF MICROTOPOGRAPHY IN ORDER TO MINIMIZE COMPACTION BY MACHINERY. TWELVE TO EIGHTEEN (12 - 18) INCHES OF APPROVED WETLAND TOPSOIL AND SIX TO TEN (6-10) INCHES OF UPLAND TOPSOIL SHALL BE PLACED OVER THE SUBSOIL AND SHALL BE SPREAD USING HAND TOOLS TO AVOID COMPACTION. IT IS ANTICIPATED THAT UPON SETTLING, AT LEAST 8 INCHES OF TOPSOIL SHALL COVER THE SUBSOIL THROUGHOUT THE WETLAND PORTION OF THE MITIGATION AREA. ***NOTE*** THAT TOPSOIL SPECIFICATIONS FOR THE LEPIDOPTERAN HABITAT AREA DIFFER (SEE APPLICABLE NOTES).
16. ADDITIONAL WETLAND TOPSOIL SHALL BE STOCKPILED NEARBY TO BE USED DURING PLANTING OF SHRUBS AND TREES (SEE BELOW).
17. WOODY DEBRIS (E.G., FALLEN BRANCHES AND LOGS WITH MOSS AND FUNGUS) FROM ON-SITE NON-INVASIVE INFESTED FOREST AREAS OR FROM OTHER OFF-SITE SOURCES WILL BE PLACED IN THE MITIGATION AREAS, IN QUANTITY SUFFICIENT FOR APPROXMATELY 2% COVER, EXCLUDING WET MEADOWS, BUT INCLUDING MARSHY SUMPS.
18. "HARVESTING" OF WOODY DEBRIS FROM ON-SITE SOURCES (E.G., GENERATING FACILITY SITE) SHALL TAKE PLACE BEFORE GRADING FOR THE FACILITY (I.E. AFTER CLEARING AND GRUBBING). THIS MATERIAL SHALL BE STOCKPILED ALONG THE EASTERN EDGE OF THE WETLAND MITIGATION AREA AND BE PROTECTED (THIS WILL ALSO FACILITATE DECOMPOSITION PRIOR TO INSTALLATION).
   a. WOODY DEBRIS SHALL NOT CONTAIN ANY INVASIVE PLANT SPECIES.
   b. WOODY DEBRIS SHALL CONSIST OF SMALL TO MEDIUM STUMPS AND TRUNKS, AT LEAST 10 INCHES IN DIAMETER WITH ROOT CROWNS ATTACHED, AS WELL AS SMALLER BRANCHES/BRUSH. TRUNKS SHALL BE AT LEAST 3 FEET IN LENGTH. AS MUCH AS POSSIBLE, THESE MATERIALS SHALL BE IN VARIOUS STAGES OF DECOMPOSITION.

3.0 Plantings - Wetland Creation

1. PLANTING OF THE WOODY MATERIALS IN THE WETLAND REPLICATION AREA SHALL BE INITIATED *IN SPRING* BETWEEN APRIL 15TH AND MAY 30TH *OR IN EARLY FALL* BETWEEN SEPTEMBER 1ST AND SEPTEMBER 30TH. PLANTING OF HERBACEOUS PLUGS SHALL TAKE PLACE LARGELY IN THE SPRING WINDOW, WITH SOME FLEXIBILITY, DEPNDING ON MATURITY OF PLANTING STOCK. SEEDING MAY BE DONE EITHER IN SPRING OR IN LATE FALL OR EARLY WINTER AFTER HARD FROST.
2. *ORDER WOODY PLANTS AHEAD OF TIME* (AT LEAST ONE MONTH) TO IMPROVE LIKELIHOOD OF AVAILABILITY. REVIEW ORDER FOR HERBACEOUS PLUGS EARLY IN THE PREVIOUS FALL, TO MAKE SURE FLATS OF ALL THE SPECIES WILL BE GROWN AND AVAILABLE THE FOLLOWING SPRING. PLANT LISTS INCLUDE SOME NURSERY CONTACTS, BUT OTHERS MAY BE USED. TWO RECOMMENDED VENDORS ARE NEW ENGLAND WETLAND PLANTS (NEWP) IN AMHERST MASS., AND NASAMI FARM IN WHATELY, MASS. NURSERIES SHOULD BE IN SOUTHERN NEW ENGLAND OR THE MID-ATLANTIC STATES. OBTAIN APPROVAL FOR ANY PLANT SUBSTITUTIONS DUE TO LACK OF AVAILABILITY.

3.1 PLANTINGS INSTALLATION

1. STORAGE: KEEP PLANTS, SPECIFIED IN TABLES 1, 2 AND 3, IN THE SHADE AND INSTALL WITHIN THREE DAYS OF DELIVERY. KEEP WATERED, AS NECESSARY.
2. A QUALIFIED WETLAND PROFESSIONAL OR ECOLOGIST SHALL SPECIFY PLANTING LOCATIONS AND DIRECT THE INSTALLATION, EITHER BY STAKING PLANTING LOCATIONS WITH A WIRE FLAG OR BAMBOO STAKE LABELED WITH THE SPECIES NAME OR CODE. POTTED STOCK MAY ALSO BE DIRECTLY PLACED AT PLANTING LOCATION.
3. IN THE PERIMETER OF WETLAND MITIGATION AREA, THAT IS, UPLANDS WITHIN THE CONSERVATION EASEMENT AREA WOODY PLANTINGS SHALL BE INSTALLED AFTER INVASIVES HAVE BEEN REMOVED, AND SHALL BE POSITIONED BETWEEN AND AROUND ANY EXISTING NATIVE COLONIZERS..
4. PLANT IN SAME-SPECIES CLUSTERS, FOUR TO SIX FEET APART, FOR SHRUBS, TEN FEET APART FOR SMALL TREES. LARGER TREES SHOULD BE NO CLOSER THAN EIGHT FEET FROM A SHRUB OR SMALL TREE.
5. WOODY PLANTINGS: DIG HOLES *BY HAND* TO *MINIMIZE COMPACTION* OF SOIL (MECHANICAL AUGERS ARE PROHIBITED). WATER HOLES BEFORE PLANTING, UNLESS SOIL IS ALREADY MOIST. ADD *SLOW RELEASE FERTILIZER* (OSMACOTE, MILORGANITE OR EQUIVALENT) TO PLANTING HOLE. PLACE PLANTS INTO HOLES AND REPLACE SOIL, SO THAT THERE IS FULL COVERAGE OF ROOTS, WITH *NO AIR SPACES* AND LEVEL SOIL AROUND THE PLANT. HOLES SHALL BE OVERSIZED (2X THE POT DIAMETER) AND BACKFILLED WITH HIGH QUALITY TOPSOIL (NOT SUBSOIL REMOVED FROM BOTTOM PART OF HOLE). AN AMENDMENT WITH MYCORYZAL SPORES IS RECOMMENDED IF TOPSOIL HAS BEEN CONSTRUCTED OR STOCKPILED OVER SIX MONTHS. FFEDCO IN MAINE IS A GOOD SOURCE.
6. SPREAD A THREE-INCH THICK LAYER OF WELL-ROTTED HARDWOOD MULCH THROUGHOUT THE CLUSTER. LEAVE A GAP OF THREE INCHES AROUND EACH TRUNK. FORM *SAUCERS* AROUND ALL MULCHED TREE AND SHRUB PLANTINGS, TWO TO THREE INCHES HIGH, 36" ACROSS FOR NURSERY STOCK. WATER RIGHT AFTER PLANTING. FOR PLUGS IN THE WET MEADOW, WATERING SEVERAL TIMES A WEEK IS ESSENTIAL, IN DRY WEATHER. FOR IRRIGATION, SET UP A PUMP DRAWING ON LOCAL WATER, OR FROM A WATER TANK BROUGHT TO THE SITE.
7. PERENNIAL PLUGS. PLANT *AFTER* SHRUB INSTALLATION, IN MID TO LATE AFTERNOON, OR UNDER SHADY CONDITIONS. NOTE THE HYDROLOGIC ZONE PROVIDED FOR EACH SPECIES ON THE PLANTING TABLE, AND PLANT IN THE CORRESPONDING ZONE ON THE PLANTING PLAN. *WATER* IMMEDIATELY AFTER PLANTING. SPACE PLUGS 12 TO 36 INCHES APART, PER PLANTING TABLE (SEE TABLE 3).
8. FOR PLANTINGS IN SHALLOW WATER, SUCH IS THE "SUMPS," MAKE SURE PLANTS ARE WELL SECURED IN THE BOTTOM.
9. PLUGS COME IN FLATS OF FIFTY, SUCH THAT SOME WILL BE LEFT OVER, GIVEN THE DIVERSITY OF THE PROPOSED PLANTING PLAN. SORE LEFT-OVER PLANTS INA MOIST NEARBY AREA, CONVENIENT FOR WATERING, SUCH AS ADJACENT BIO;INFILTRATION AREA, JUST TO THE WEST. LEFT OVER PLUGS MAY BE PLANTED IN RESTORATION AREA A. NOTE THAT THE OPTION OF PURCHASING MANY FEWER, LARGER PLANTS IS NOT DEISRABLE, 1) BECAUSE ITR WOULD RESULT IN SPECIES POPULATIONS WITH LOWER GENETIC DIVERSITY, AND 2) BECAUSE THE COST OF ONE PLANT IN A QUART-SIZE POT IS APPROXIMATELY TEN TIMES THAT OF ONE PLUG.

3.2 SEEDING

1. IN WET AND MOIST MEADOW AREAS, BETWEEN BEDS OF MEADOW PLANTINGS AND BETWEEN SHRUB AND TREES, SEED AT SPECIFIED RATE, IN LOCATIONS SPECIFIED IN SEEDING TABLE 4, USE SPRAY PAINT TO DELINEATE LOCATIONS OF SEED PATCHES, AND/OR SOW SEED AS DIRECTED BY WETLAND ECOLOGIST. SEEDING MAY BE OMITTED IN AREAS WITH DESIRABLE, NATURALLY COLONIZED HERBACEOUS COVER (E.G. GOLDENRODS OR GRASSES).
2. FOR SPRING SEEDING, LIGHTLY RAKE IN SEED (LESS THAN ½ INCH DEEP), ROLL, AND LIGHTLY MULCH WITH STRAW (FREE OF SEEDS) TO HOLD MOISTURE FOR GERMINATION. FOR FALL SEEDING, AFTER HARD FROST, SEED MAY SIMPLY BE SOWN. SNOW AND FROST WILL INCORPORATE INTO THE SOIL.
3. IF SOIL IS SATURATED, BROADCAST SOIL ON SURFACE WITHOUT RAKING.
4. SPREAD A THIN LAYER OF *STRAW MULCH* OVER ALL SEEDED AREAS WITHOUT STANDING WATER, ALLOWING SOME LIGHT PENETRATION.

3.3 PROTECTION FROM HERBIVORY

1. WOODY PLANTINGS WILL BE MONITORED DURING THE FIRST AND SECOND GROWING SEASONS AFTER PLAN IMPLEMENTATION FOR EXCESSIVE HERBIVORY. IF OBSERVED, THE WETLAND ECOLOGIST MAY PROPOSE ADDITIONAL CONTROLS/METHODS TO REDUCE HERBIVORY.
2. AS AN INITIAL CONTROL, THE ORGANIC FERTILIZER MILORGRANITE SHALL BE USED AT EACH SHRUB/TREE PLANTING, AND ALONG THE PERIMETER OF THE ENTIRE MITIGATION AREA. THIS FERTILIZER IS MILD TO MODERATE DETERENT TO HERBIVORY BY DEER.

3.4 INITIAL FOLLOW-UP AND MAINTENANCE

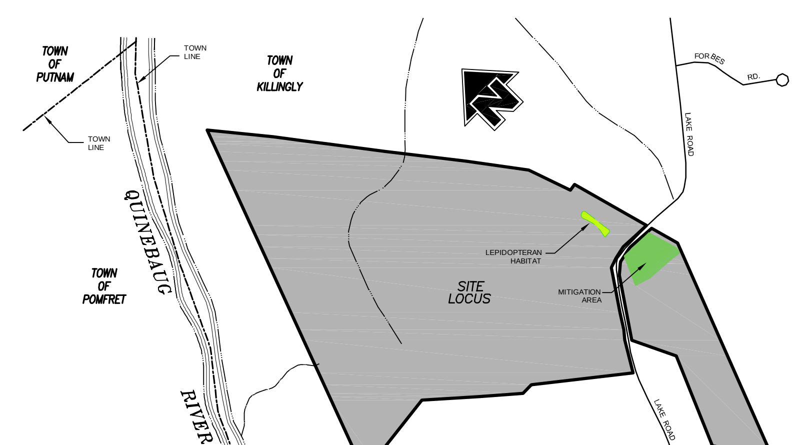
1. WOODY DEBRIS. AFTER INSTALLATION OF PLANTINGS AND SEEDING, SPREAD THE STOCKPILED LARGE LOGS AND MEDIUM-SIZED BRANCHES IN VARIOUS STAGES OF DECAY IN ALL MITIGATION AREAS, INCLUDING THE SUMPS. WOODY DEBRIS WILL HAVE BEEN STOCKPILED AS DESCRIBED ABOVE. WOODY DEBRIS PROVIDES SHELTER FOR WILDLIFE, SUBSTRATES FOR MOSSES AND FOREST FUNGI, AND ASSOCIATED INVERTEBRATES ARE A FOOD SOURCE FOR WILDLIFE.
2. PERIMETER SEDIMENT CONTROLS. MAINTAIN PER THE 2002 CT E&S GUIDELINES, CHECK AFTER EACH RAIN MORE THAN ONE INCH. REMOVE SILT FENCE AS SOON AS GROUND IS VEGETATED (>80% COVER) TO PREVENT IMPEDING ANIMAL MOVEMENT TO AND FROM ADJACENT SEASONALLY FLOODED AND SATURATED WETLANDS. SEDIMENT COLLECTED BY THESE DEVICES WILL BE REMOVED AND PLACED UPLAND IN A MANNER THAT PREVENTS ITS EROSION AND TRANSPORT TO A WATERWAY OR WETLAND.
3. IRRIGATION: WATER ALL SEEDED AREAS, PLANTINGS AND/OR TRANSPLANTS AT LEAST WEEKLY IN DROUGHTY PERIODS. MORE FREQUENT WATERING WILL INCREASE PLANTINGS SUCCESS. FOR PLUGS AND BARE ROOT STOCK, MORE FREQUENT WATERING COULD BE NEEDED.

4.0 Invasive Plant Control

1. THE ECOLOGIST WILL FLAG THE ADDITIONAL WOODY INVASIVES PATCHES TO BE REMOVED IN ALL UPLANDS WITHIN THE AREA OF PRESERVATION (I.E. CONSERVATION EASEMENT).
2. INVASIVE PLANT CONTROL WITHIN THE AREA OF PRESERVATION SHALL TAKE PLACE FOR FIVE (5) YEARS FOLLOWING THE YEAR OF PLAN IMPEMENTATION FOLLOWING THE PROCEDURES OUTLINED IN THE: "*INVASIVE SPECIES CONTROL PLAN: KILLINGLY ENERGY CENTER, LAKE ROAD, KILLINGLY, CONNECTICUT*," DATED JANUARY 2017, AND PREPARED BY REMA ECOLOGICAL SERVICES, LLC.

5.0 Monitoring

1. INSPECTIONS BY A QUALIFIED WETLAND PROFESSIONAL OR ECOLOGIST SHALL TAKE PLACE IN THE ***EARLY FALL*** AFTER INSTALLATION, AND IN THE FIVE (5) NEXT GROWING SEASONS, AT EACH OF THE WETLAND MITIGATION AREA.
2. DURING INSPECTIONS, CHECK MITIGATION AREA FOR SEEDLINGS OF THE FOLLOWING *INVASIVE SPECIES* AND MECHANICALLY REMOVE: COMMON REED, MORROW'S HONEYSUCKLE, AUTUMN OLIVE, MULTIFLORA ROSE, ASIATIC BITTERSWEET, JAPANESE BARBERRY, GLOSSY BUCKTHORN, BURNING BUSH, MUGWORT, AND GARLIC MUSTARD. INSPECTIONS SHALL BE DONE BY THE WETLANDS PROFESSIONAL, WHO COULD ALSO IDENTIFY OTHER INVASIVE PLANT SPECIES, BUT PERSONNEL TRAINED BY THE PROFESSIONAL IN IDENTIFICATION OF INVASIVE SEEDLINGS MAY ASSIST WITH MECHANICAL REMOVAL (WEEDING).
3. *COMPETING PLANTS:* IF THE WETLANDS PROFESSIONAL DETERMINES THAT EXCESSIVE NUMBERS OF SEEDLINGS OF A PARTICULAR NATIVE SPECIES HAVE GERMINATED ON SITE (E.G. CATTAIL), REMOVE THEM BY HOEING OR HAND PULLING. COLONIZATION BY A VARIETY OF NATIVE SPECIES IS EXPECTED AND IS DESIRABLE.
4. ANNUAL MONITORING REPORTS SHALL BE SUBMITTED TO THE TOWN OF KILLINGLY CONSERVATION COMMISSION (a.k.a. INLAND WETLANDS COMMISSION) NO LATER THAN DECEMBER 15TH OF THE YEAR BEING MONITORED, AND SHALL PROVIDE A SHORT *NARRATIVE* INCLUDING INFORMATION ON SURVIVAL AND PERFORMANCE OF PLANTINGS, EXTENT TO WHICH TARGET HYDROLOGY IS ACHIEVED, DEVELOPING WETLAND SOIL CHARACTERISTICS, COLONIZATION BY INVASIVE PLANTS & CONTROL MEASURES, COLONIZATION BY DESIRABLE NATIVE SPECIES, AND OBSERVED USAGE BY FAUNA (I.E. VERTEBRATES AND INVERTEBRATES).
5. REPORT SHALL ALSO INCLUDE PHOTO-DOCUMENTATION, WITH PHOTOS TAKEN EACH YEAR AT LEAST AT EACH OF FOUR (4) ESTABLISHED LOCATIONS AT THE MITIGATION AREA.
6. *REMEDIAL MEASURES* SUCH AS REPLACEMENT PLANTINGS, HYDROLOGIC ADJUSTMENTS, AND BROWSE PROTECTION, MAY BE RECOMMENDED AND IMPLEMENTED.



LOCATION MAP
SCALE: 1" = 500'

12/11/2017	REVISED LEPIDOPTERAN HABITAT LOCATION
DATE	DESCRIPTION
REVISIONS	

WETLAND MITIGATION AND RESTORATION PLAN
PREPARED FOR
KILLINGLY ENERGY CENTER NTE ENERGY PROJECT
LAKE ROAD
KILLINGLY, CONNECTICUT

DATE: 01/13/2017	DRAWN: NET
SCALE: AS NOTED	DESIGN: GL
SHEET: 2 OF 2	CHK BY:
DWG. No:	JOB No: 16042

APPENDIX B – AIR PERMIT MINOR MODIFICATION MATERIALS

AIR PERMIT MINOR MODIFICATION APPLICATION

Minor Modification Application for Stationary Sources of Air Pollution Permit No. 089-0107

Killingly Energy Center

November 22, 2017

Prepared for:

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For Submittal to:

Connecticut Department of Energy and Environmental Protection
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TETRA TECH

Killingly Energy Center
an NTE Energy Project

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ºF	degrees Fahrenheit
BACT	Best Available Control Technology
CO	carbon monoxide
CO_2e	carbon dioxide equivalents
CTG	combustion turbine generator
DEEP	Connecticut Department of Energy and Environmental Protection
the Facility	Killingly Energy Center
H_2SO_4	sulfuric acid
ISO	International Organization for Standardization
km	kilometer
LAER	Lowest Achievable Emission Rate
lb/hr	pounds per hour
lb/MMBtu	pounds per million British thermal units
lb/MW-hr	pounds per megawatt-hour
Mitsubishi CTG	Mitsubishi Model M501JAC combustion turbine generator
MMBtu	million British thermal units
MMBtu/hr	million British thermal units per hour
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NTE	NTE Connecticut, LLC
the Permit	Permit Number 089-0107
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 micrometers or less
PM_{10}	particulate matter with an aerodynamic diameter of 10 micrometers or less
PSD	Prevention of Significant Deterioration
RCSA	Regulations of Connecticut State Agencies
Siemens CTG	Siemens Model SGT6-8000H combustion turbine generator
SIL	Significant Impact Level
SO_2	sulfur dioxide
SUSD	startup and shutdown
tpy	tons per year (as applied on a consecutive 12-month basis)

Acronyms/Abbreviations	Definition
ULSD	ultra-low-sulfur distillate
VOC	volatile organic compound
w/DF	with duct firing
wo/DF	without duct firing

1.0 EXECUTIVE SUMMARY

NTE Connecticut, LLC (NTE) is submitting this minor modification application to revise Permit Number 089-0107 (the Permit) issued for the construction and operation of the Killingly Energy Center (the Facility). The Permit was issued by the Connecticut Department of Energy and Environmental Protection (DEEP) on June 30, 2017. The Facility is a nominal 550-megawatt (MW) combined cycle combustion turbine electric generating facility located in Killingly, Connecticut.

The Permit approved the installation and operation of a Siemens Model SGT6-8000H combustion turbine generator (Siemens CTG), duct burners, an auxiliary boiler, natural gas heater, and an emergency fire pump engine. NTE is proposing to modify the Permit to provide for the installation and operation of a Mitsubishi Model M501JAC CTG (Mitsubishi CTG) rather than the Siemens CTG, which will allow for lower annual emissions and reduced particulate matter (PM) Best Available Control Technology (BACT) limits while continuing to meet air quality standards.

Use of the Mitsubishi CTG, with a higher design heat input rating and output, will allow a reduction in fuel consumption by the duct burners while maintaining the nominal 550 MW rating of the combined cycle unit stated in the Permit. A slightly larger natural gas heater will be required for this configuration. There will be no changes to the auxiliary boiler, the emergency fire pump engine, or the emergency generator engine (covered under Permit Number 089-0108). The CTG stack will remain in the same location. Adjustments to the location of various structures are reflected in the dispersion modeling provided in Section 5 of this minor permit modification application.

This application proposes to significantly reduce annual emission limits of PM, PM with an aerodynamic diameter of 10 micrometers or less (PM_{10}), PM with an aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$), volatile organic compounds (VOC), and carbon monoxide (CO). Annual emission limits for NO_x with the Mitsubishi CTG will be the same as currently permitted levels. Only minor differences are associated with the remaining pollutants as compared to those reflected in the Permit, as further discussed in Section 2.

Further, this application is proposing a reduction in the approved BACT emission rates for PM, PM_{10}, and $PM_{2.5}$ from the combined cycle Mitsubishi CTG. No changes to the approved BACT and Lowest Achievable Emission Rate (LAER) limits are proposed for the other permitted pollutants.

Air quality dispersion modeling analyses were also conducted to reflect the change from the use of the Siemens CTG to the Mitsubishi CTG, as further described in Section 5. The Facility with the Mitsubishi CTG continues to demonstrate compliance with National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments. In fact, air quality impacts for the modified Facility using the Mitsubishi CTG are less than were predicted for the originally proposed use of the Siemens CTG.

This application includes the following information in accordance with the Regulations of Connecticut State Agencies (RCSA) Section 22a-174-2a(e) and DEEP instructions:

- Section 2.0 – A description of the proposed changes, including changes in emission rates, with a technical justification for these changes;
- Section 3.0 – Review of recent combined cycle CTG BACT and LAER determinations;
- Section 4.0 – A marked up copy of Permit Number 089-0107 to show the proposed changes;
- Section 5.0 – A revised air dispersion modeling analysis;
- Appendix A – DEEP application forms;
- Appendix B – Supporting emission calculations and vendor performance emissions data;
- Appendix C – BACT and LAER update tables; and
- Appendix D – Revised figures and supporting data for the air dispersion modeling analysis.

2.0 PROJECT DESCRIPTION

2.1 BACKGROUND

The Permit was issued for a Siemens CTG operating in combined cycle mode with a design heat input rate of 2,969 million British thermal units (MMBtu) per hour (MMBtu/hr) firing natural gas and 2,639 MMBtu/hr firing ultra-low-sulfur distillate (ULSD) under standard conditions.[1] In order to meet the Facility's approved dispatch output of 550 MW, duct firing was proposed during all natural gas firing conditions, with a design gross heat input to the duct burner of 946 MMBtu/hr.

The Mitsubishi CTG has a higher design heat input rate of 3,686 MMBtu/hr firing natural gas and 3,033 MMBtu/hr firing ULSD under standard conditions.[1] As a result, the duct burner firing rate for the Mitsubishi CTG will be reduced to 408 MMBtu/hr and fewer hours of duct firing will be required per year, as duct firing will no longer be required at cooler ambient temperatures. Therefore, this application proposes to modify the Permit to restrict duct firing to an annual heat input of no more than 1,030,400 MMBtu per year, a reduction of over 85 percent from the duct burner fuel throughput approved in the Permit. As emissions of VOC, CO, PM, PM_{10}, and $PM_{2.5}$ are higher from the duct burners, the decreased need for duct firing allows for significantly lower annual emission limits for these pollutants with the Mitsubishi CTG. Annual emission limits for NO_x with the Mitsubishi CTG will be the same as currently permitted levels. Only minor differences are associated with the remaining pollutants as compared to those reflected in the Permit, as discussed further below.

This application is also proposing a reduction in the approved BACT emission rates for PM, PM_{10}, and $PM_{2.5}$ from the Mitsubishi CTG. No changes to the approved BACT and LAER limits are proposed for the other permitted pollutants.

2.2 PROPOSED MODIFICATION

The Mitsubishi CTG's ability to achieve higher MW output without duct firing will result in lower emissions of VOC, CO, PM, PM_{10}, and $PM_{2.5}$ on a pound per megawatt-hour (lb/MW-hr) basis during most operating conditions and with minor exceptions, lower annual emissions of all pollutants because duct firing will be limited or not required at all to achieve an output of 550 MW. On a pound per hour (lb/hr) basis, the maximum emission rates of the Mitsubishi CTG during duct firing will be comparable to the limits in the Permit for all pollutants except $PM/PM_{10}/PM_{2.5}$, as the combined heat input of the Mitsubishi CTG and duct burners will be comparable to the permitted configuration to meet the Facility's dispatch output. Table 2-1 provides a comparison of the permitted and proposed maximum lb/hr emission rates for all pollutants covered under the Permit.

The Mitsubishi CTG has comparable emissions during startup and shutdown (SUSD) events to the Siemens CTG. Table 2-2 provides a comparison of the permitted and proposed SUSD pound per event emission rates for NO_x, CO and VOC (other pollutants are self-correcting).

[1] International Organization for Standardization (ISO) conditions of 59 degrees Fahrenheit (°F), 60 percent relative humidity, and an atmospheric pressure of 14.7 pounds per square inch absolute.

Table 2-1: Comparison of Permitted and Proposed Maximum CTG Emission Rates (lb/hr)

Pollutant	Siemens CTG			Mitsubishi CTG		
	Gas w/o DF	Gas w/ DF	ULSD	Gas w/o DF	Gas w/ DF	ULSD
PM	13.0	19.5	30.0	7.6	12.7	28.6
$PM_{10}/PM_{2.5}$	13.0	19.5	30.0	7.6	12.7	28.6
SO_2	4.5	5.9	4.0	5.6	6.1	4.6
NO_x	22.5	29.7	40.9	27.6	29.9	47.2
VOC	2.8	8.3	7.1	3.4	8.3	9.2
CO	6.2	15.4	11.2	7.6	15.5	14.4
Lead	1.44E-03	1.9E-03	3.0E-03	1.84E-03	2.0E-03	3.2E-03
H_2SO_4	1.6	2.0	1.5	1.9	2.1	1.9

w/o DF = without duct firing; w/ DF = with duct firing; SO_2 = sulfur dioxide; H_2SO_4 = sulfuric acid.

Table 2-2: Permitted Versus Proposed CTG SUSD Emission Limits (lb/hr)

Pollutant	Siemens CTG				Mitsubishi CTG			
	Startup		Shutdown		Startup		Shutdown	
	Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	ULSD
NO_x	142	193	80	169	150	203	79	162
VOC	45	264	67	176	46	266	64	175
CO	477	2,306	212	429	404	2,309	213	428

As noted above, the Siemens CTG incorporated duct firing at all ambient temperatures to meet the Facility's approved dispatch output, and the Permit as issued does not restrict operation of the duct burners, allowing for continuous operation of the duct burners for 8,760 hours per year. By contrast, the Mitsubishi CTG will not require unrestricted duct firing to meet the dispatch output. NTE is proposing that the Permit include a limit on duct firing to an annual heat input of no more than 1,030,400 MMBtu per year. Due this greater efficiency, annual emissions with the Mitsubishi CTG will be considerably reduced for VOC, CO, PM, PM_{10}, and $PM_{2.5}$, remain at the same as currently permitted levels for NO_x, and reflect only minor differences for the remaining pollutants. Table 2-3 provides a comparison of the permitted and proposed annual emission rates under fully permitted operating conditions from the CTG for all pollutants covered under the Permit.

Table 2-3: Comparison of Permitted and Proposed CTG Annual Emission Rates (tons per consecutive 12 months)

Pollutant	Siemens CTG	Mitsubishi CTG
PM	88.7	47.7
$PM_{10}/PM_{2.5}$	88.7	47.7
SO_2	25.1	24.6
NO_x	130.1	130.1
VOC	41.7	32.1
CO	134.6	117.7
Lead	0.0018	0.008
H_2SO_4	8.76	8.60
CO_2e	1,989,650	2,001,753
Ammonia	49.8	50.3

CO_2e = carbon dioxide equivalents

To accommodate the Mitsubishi CTG, a natural gas heater rated at 7 MMBtu per hour is proposed. This is marginally larger than the 5 MMBtu/hr heater approved in the Permit (as EU-5). The unit will continue to be restricted to 4,000 hours per year of operation consistent with the Permit, equivalent to a natural gas throughput of 27.2 million cubic feet per year. No changes to the BACT short-term emission rate limits for the heater are proposed in this application. Table 2-4 provides a comparison of the permitted and proposed annual emission rates from the gas heater.

Table 2-4: Comparison of Permitted Versus Proposed Gas Heater Annual Emission Rates (tpy)

Pollutant	Permitted	Proposed
PM	0.05	0.07
$PM_{10}/PM_{2.5}$	0.05	0.07
NO_x	0.12	0.17
SO_2	0.015	0.021
VOC	0.03	0.05
CO	0.37	0.52
H_2SO_4	0.001	0.002
CO_2e	1,170	1,638

tpy = tons per year

3.0 RECENT CTG BACT AND LAER DETERMINATIONS

A review was conducted to identify air permits issued for large combined cycle combustion turbine projects since submittal of the application for the Permit in April 2016. More than a dozen permits for new projects were identified. A review of these permits indicated that the approved BACT and LAER emission limits were equivalent to or higher than the emission limits in the Permit. Therefore, the approved BACT and LAER limits in the Permit remain valid for this proposed modification.

One proposed change from the Permit is for proposed BACT for $PM/PM_{10}/PM_{2.5}$ emissions. As noted in the application for the Permit, differences in $PM/PM_{10}/PM_{2.5}$ emission limits among various projects are mostly due to different emission guarantee philosophies of the various CTG vendors. The different emission guarantee philosophies are influenced by the overall uncertainties of the $PM/PM_{10}/PM_{2.5}$ test procedures, especially given reported difficulties in achieving test repeatability, and concerns with artifact emissions introduced by the inclusion of condensable particulate emissions in permit limits in the last decade. All of the $PM/PM_{10}/PM_{2.5}$ BACT precedents are based upon good combustion practices as the sole means of controlling emissions.

The $PM/PM_{10}/PM_{2.5}$ emission guarantees on a pound per MMBtu (lb/MMBtu) basis for the Mitsubishi CTG are lower than those for the Siemens CTG for all fuels and operating scenarios. This results in lower estimated short- and long-term $PM/PM_{10}/PM_{2.5}$ emissions from the Mitsubishi CTG as summarized in Tables 2-1 and 2-3. Table 3-1 provides a comparison of the permitted and proposed $PM/PM_{10}/PM_{2.5}$ emissions guarantee on a lb/MMBtu basis for the CTG.

Table 3-1: Comparison of Permitted and Proposed Combined Cycle CTG PM Emissions (lbs/MMBtu)

Pollutant	Permitted (Siemens CTG)			Proposed (Mitsubishi CTG)		
	Gas w/o DF	Gas w/ DF	ULSD	Gas w/o DF	Gas w/ DF	ULSD
PM	0.0044	0.0050	0.0168	0.0022	0.0033	0.0100
$PM_{10}/PM_{2.5}$	0.0044	0.0050	0.0168	0.0022	0.0033	0.0100

4.0 MARKED UP PERMIT

Provided on the following pages is a marked up copy of Permit Number 089-0107, reflecting the proposed modifications.

Connecticut Department of

ENERGY & ENVIRONMENTAL PROTECTION

BUREAU OF AIR MANAGEMENT
NEW SOURCE REVIEW PERMIT
TO CONSTRUCT AND OPERATE A STATIONARY SOURCE

Issued pursuant to Title 22a of the Connecticut General Statutes (CGS) and Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA).

Owner/Operator	NTE Connecticut, LLC
Address	24 Cathedral Place, Suite 300 Saint Augustine, FL 32084
Equipment Location	180/189 Lake Road, Killingly, CT 06241
Equipment Description	~~Siemens SGT6-8000H~~Mitsubishi M501JAC Combustion Turbine with DLN combustors, Duct Burners and Heat Recovery Steam Generator
Collateral Conditions	This permit contains collateral conditions for one 84 MMBtu/hr natural gas fired boiler, one 305 bhp emergency fire pump engine, one ~~5~~ 7 MMBtu/hr natural gas heater, and one 1,380 kW emergency generator engine (Permit No. 089-0108)
Town-Permit Numbers	089-0107
Premises Number	101
Stack Number	1
Permit Issue Date	June 30, 2017
Expiration Date	None

/s/ Robert Klee
Robert J. Klee
Commissioner

6/30/2017
Date

This permit specifies necessary terms and conditions for the operation of this equipment to comply with state and federal air quality standards. The Permittee shall at all times comply with the terms and conditions stated herein.

PART I. DESIGN SPECIFICATIONS

A. General Description

NTE Connecticut, LLC operates a power generation facility consisting of one Mitsubishi M501JAC ~~Siemens SGT6-8000H~~ combustion turbine with dry low-NOx (DLN) combustors with a nominal gross electrical output of 550 MW in Killingly, CT. The turbine is a dual fuel fired combined cycle unit, with a separate heat recovery steam generator (HRSG) that includes natural gas supplementary firing (duct burners) to power a single steam turbine generator. Oil firing for the turbine is limited to ultra-low sulfur distillate (ULSD) No. 2 fuel oil as allowed in Part II.A.1.d of this permit. Pollution control equipment will include selective catalytic reduction (SCR), oxidation catalyst, and water injection (ULSD firing only) to control NOx, CO and VOC emissions. The turbine, duct burner, and HRSG are considered the combustion turbine generator (CTG) and designated as Emissions Unit 1 (EU-1) for this permit.

There is one 1,380 kW ULSD fired emergency generator engine that operates under permit number 089-0108.

The ancillary equipment that do not require permits includes: one 84 MMBtu/hr natural gas fired auxiliary boiler with flue-gas-recirculation (FGR) to control NOx emissions; one 305 bhp emergency ULSD fired fire pump engine, and one ~~5~~7 MMBtu/hr natural gas heater. The boiler and gas heater will be able to operate for approximately 4,600 and 4,000, hours respectively, per year at maximum rated capacity with the allowable fuel limits. The emergency generator engine and emergency fire pump engine can only fire ULSD and are each limited to 300 hr/yr and not more than 500 hr/yr combined. Collateral conditions for this equipment are included in Part VI of this permit.

The CTG will also be fed by a ULSD oil tank with a capacity of one million gallons. The emergency engines will have self-contained oil tanks. There will be a 12,000 gallon storage tank for the 19% aqueous ammonia (NH_3) used in the NOx control system.

B. Equipment Design Specifications

1. Turbine
   The design gross heat input is ~~2,969~~3,686 MMBtu/hr while firing natural gas and ~~2,639~~3,033 MMBtu/hr while firing ULSD. These heat inputs are based on an ambient temperature of 59˚F and result in firing rates of ~~2,888,132~~3,585,603 scf of natural gas (HHV 1028 Btu/scf) and ~~19,058~~21,978 gallons of ULSD (HHV 138,000 Btu/gal) per hour. Heat input will vary by approximately ±10% over the typical range of expected ambient temperatures, with higher heat input occurring at lower ambient temperatures.

2. Duct Burner
   The design gross heat input to the duct burner is ~~946~~ 408 MMBtu/hr while firing natural gas. The heat input is based on an assumed HHV of 1028 Btu/scf and results in a firing rate of ~~920,233~~396,887 scf/hr.

C. Stack Parameters

1. Minimum Stack Height (ft): 150 (above base elevation)

2. Minimum Exhaust Gas Flow Rate at maximum operating load, CTG only (acfm): ~~1,282,886~~1,548,937 (gas); ~~1,349,732~~1,619,663 (ULSD)

3. Minimum Stack Exit Temperature at 100% load (°F): 175

4. Minimum Distance from Stack to Property Line (ft): 425

D. Definitions

1. "Steady-State" operation shall be defined as all periods other than transient operation.

2. "Transient" operation shall be all modes of operation at Loads less than ~~4~~50%, including periods of startup, shutdown, fuel switching and equipment cleaning.

3. "Load" shall be defined as the net electrical output of the CTG.

4. "Shakedown" shall be defined as CTG operations including, but not limited to, the first firing of the unit, proof of interlocks, steam blowing, chemical cleaning, initial turbine roll and ending after the equipment vendor service representative conducts operational and contractual testing and tuning of the turbine to meet warranted emission rates on site. The Shakedown period shall not extend beyond the required date for the initial performance test.

5. "Btu" shall be defined as British Thermal Units and "MMBtu" as one million Btu, both on a higher heating value (HHV) basis.

PART II. OPERATIONAL CONDITIONS and REQUIREMENTS

A. Equipment

1. CTG
   a. Allowable Fuel Types: Natural Gas (primary); Ultra-Low Sulfur Distillate (ULSD)
   b. Maximum Heat Input over any Consecutive 12 Month Period: ~~2.60~~ 3.23 x 10^7 MMBtu (gas); ~~1.89~~2.18 x 10^6 MMBtu (ULSD)
   c. Maximum ULSD Sulfur Content (% by weight, dry basis): 0.0015
   d. Firing of ULSD is allowed only in the following scenarios:
      i. ISO-NE declares an Energy Emergency as defined in ISO New England's Operating Procedure No. 21 and requests the firing of ULSD;
      ii. ISO-NE required audits of capacity;
      iii. The natural gas supply is curtailed by an entity through which gas supply and/or transportation is contracted;
      iv. Any equipment (whether on- or off-site) required to allow the CTG to operate on natural gas has failed, including a physical blockage of the supply pipeline. In the event of failure of onsite equipment, the Permittee shall document that this equipment has been maintained in accordance with manufacturer's recommendations and that the failed equipment was repaired or replaced and the CTG was returned to natural gas firing as soon as practicable;
      v. During the Shakedown period when the CTG is required to operate on ULSD pursuant to the manufacturer's written instructions;

vi. For emission testing purposes, as specified in the Part V of this permit or as required by DEEP, USEPA or other regulatory order requiring emissions testing during ULSD firing; or

vii. During routine maintenance and readiness testing, if any equipment requires ULSD operation.

e. The Permittee shall not operate the duct burner while firing ULSD in the CTG.

f. No period of Transient operation shall exceed 60 consecutive minutes.

2. Duct Burner

a. Allowable Fuel: Natural Gas

b. Maximum Heat Input over any Consecutive 12 Month Period: ~~8.29~~1.03 x 10^6 MMBtu

3. The Permittee shall comply with all applicable sections of the following New Source Performance Standards at all times.

Title 40 CFR Part 60 Subparts KKKK, TTTT and A

Copies of the Code of Federal Regulations (CFR) are available online at the U.S. Government Printing Office website.

B. The Permittee shall operate this equipment, including the SCR, oxidation catalyst, and water injection in a manner to comply with the emissions limits in Part III of this permit.

C. The Permittee shall operate and maintain this equipment, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup and shutdown.

D. The Permittee shall operate and maintain this equipment in accordance with the manufacturer's specifications and written recommendations.

E. The Permittee shall minimize emissions during periods of startup and shutdown to the extent practicable, and during startup shall start the ammonia injection as soon as the SCR vendor's recommended minimum catalyst temperature is reached. The Permittee shall incorporate the SCR vendor's recommended minimum catalyst temperature into this permit by modification pursuant to RCSA Section 22a-174-2a, and shall submit an application for such modification prior to or concurrently with submittal of the Permittee's application for an operating permit pursuant to RCSA Section 22a-174-33.

F. The Permittee shall not operate the auxiliary boiler (EU-2) simultaneously with the CTG for more than 500 hours in any calendar year.

G. The Permittee shall not exceed a maximum allowable heat rate at full operating load while firing natural gas, without duct firing, of 7,273 Btu/kW-hr, 12 month rolling average (HHV, net plant).

H. The Permittee shall immediately institute shutdown of the CTG in the event where emissions are in excess of a limit in Part III.A of this permit that cannot be corrected within three hours of when the emissions exceedance was identified.

I. The Permittee shall not operate CTG during startup and shutdown events for more than 500 hours per calendar year.

PART III. CTG ALLOWABLE EMISSION LIMITS

A. Steady State

Except during the Shakedown period, the Permittee shall not cause or allow this equipment to exceed these emission limits stated herein at any time during Steady-State operation.

1. CTG Operating on Natural Gas without Duct Firing

Pollutant	lb/hr	ppmvd @ 15% O_2	lb/MMBtu
PM	~~13.0~~7.6		0.00222~~44~~
$PM_{10/2.5}$	~~13.0~~7.6		0.00222~~44~~
SO_2	~~4.5~~5.6		0.0015
NOx	~~22.5~~27.6	2.0	
VOC	~~2.8~~3.4	0.7	
CO	~~6.2~~7.6	0.9	
Lead	1.~~44~~84E-03		4.9E-07
H_2SO_4	1.~~6~~9		0.00053
Ammonia		2.0	

2. CTG Operating on Natural Gas with Duct Firing

Pollutant	lb/hr	ppmvd @ 15% O_2	lb/MMBtu
PM	~~19.5~~12.7		0.00333~~50~~
$PM_{10/2.5}$	~~19.5~~12.7		0.00333~~50~~
SO_2	~~5.9~~6.1		0.0015
NOx	29.~~7~~9	2.0	
VOC	8.3	1.6	
CO	15.~~4~~5	1.7	
Lead	~~1.9~~2.0E-03		4.9E-07
H_2SO_4	2.1~~0~~		0.0005~~2~~3
Ammonia		2.0	

3. CTG Operating on ULSD

Pollutant	lb/hr	ppmvd @ 15% O_2	lb/MMBtu
PM	~~30.0~~28.6		0.~~0168~~0100
$PM_{10/2.5}$	~~30.0~~28.6		0.~~0168~~0100
SO_2	4.~~0~~6		0.0015
NOx	4~~0.9~~7.2	4.0	
VOC	~~7.1~~9.2	2.0	
CO	~~11.2~~14.4	1.8	
Lead	3.~~0~~2E-03		1.05E-06
H_2SO_4	1.~~5~~9		0.00054
Ammonia		5.0	

B. Transient Emissions

1. Except during the Shakedown period, the Permittee shall not cause or allow this equipment to exceed these emission limits during startup and shutdown events. No startup or shutdown event shall last longer than 60 consecutive minutes.

	Type of Event			
	Startup		Shutdown	
	Natural Gas	ULSD	Natural Gas	ULSD
NO_x (lb/hr)	~~142~~150	~~193~~203	~~80~~79	162~~9~~
VOC (lb/hr)	~~45~~46	26~~4~~6	~~67~~64	175~~6~~
CO (lb/hr)	~~477~~404	2,30~~6~~9	~~212~~213	428~~9~~

2. Ammonia (NH_3) emissions shall not exceed 5.0ppmvd @ 15% O_2 (both fuels) during Transient operation.

C. Total Allowable Annual Emission Limits

The Permittee shall not cause or allow this equipment to exceed these emission limits stated herein at any time.

Pollutant	tons per 12 consecutive months
PM	~~88.7~~47.7
$PM_{10/2.5}$	~~88.7~~47.7
SO_2	~~25.1~~24.6
NOx	130.1
VOC	~~41.7~~32.1
CO	~~134.6~~117.7
Pb	0.00~~1~~8
H_2SO_4	8.60~~76~~
CO_2e	~~1,989,650~~2,001,753
NH_3	~~49.8~~50.3

D. Greenhouse Gas Emissions

The Permittee shall not exceed an annual CO_2e emissions limit of 2,026,906~~14,335~~ tons/yr for combustion sources identified as EU-1, EU-2, EU-4, and EU-5 in this permit, along with permit number 089-0108, including SF_6 containing insulated electrical equipment. Compliance with this limitation shall be determined on a consecutive 12month rolling basis.

E. Hazardous Air Pollutants (HAP)

This equipment shall not cause an exceedance of the Maximum Allowable Stack Concentration (MASC) for any hazardous air pollutant (HAP) emitted and listed in RCSA Section 22a-174-29. [STATE ONLY REQUIREMENT]

F. Opacity

This equipment shall not exceed 10% opacity during any six minute block average as measured by 40 CFR Part 60, Appendix A, Reference Method 9.

G. Demonstration of compliance with the above emission limits may be met by calculating emissions based on emission factors from the following sources:

- *$PM/PM_{10}/PM_{2.5}$, VOC, Formaldehyde, H_2SO_4:Most recent Stack test data*
- *SO_2: Sulfur content in fuel*
- *NOx & CO (Steady-State): CEM data*
- NOx, VOC, & CO (Transient): Manufacturer's uncontrolled emission factors
- HAP: AP-42, Fifth Edition, Volume I Chapter 3.1, April 2000, except for those HAP with required stack test found in Part V of this permit.
- GHG (CO_2e) Emissions:
    1. CO_2 emissions from the combustion CTG shall be determined by the methodology found in 40 CFR Part 75, Appendix G, Equation G-4.
    2. CO_2 emissions from the auxiliary boiler (EU-2), the emergency fire pump engine (EU-4), and the natural gas heater (EU-5) shall be determined using the default emissions factors found in 40 CFR Part 98, Subpart C, Table C-1.
    3. Methane (CH_4) and nitrous oxide (N_2O) for all combustion sources shall be determined using the default emissions factors found in 40 CFR Part 98 Subpart C, Table C-2.
    4. Estimated fugitive emissions of sulfur hexafluoride (SF_6) from the electrical circuit breakers shall be determined using mass balance.
    5. Estimated fugitive emissions of CH_4 from the natural gas pipeline and associated components shall be determined using default emissions factors found in 40 CFR Part 98 Subpart W, Table W-7.

H. Emissions prior to the completion of the Shakedown period shall be counted towards the annual emission limits stated herein.

I. The commissioner may require other means (e.g. stack testing) to demonstrate compliance with the above emission limits, as allowed by state or federal statute, law or regulation.

PART IV. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS

A. Monitoring

1. The Permittee shall comply with the CEM requirements as set forth in RCSA Section 22a-174-4, the applicable sections of RCSA Sections 22a-174-22, 22a-174-22e and 22a-174-31; 40 CFR Part 60 Subparts KKKK and TTTT, *and* 40 CFR Parts 72-78, as applicable. Continuous Emissions Monitoring (CEM) is required for the following and enforced on the following basis:

Pollutant	Averaging Times	Emission Limit (ppmvd @15% O_2)
Opacity (ULSD only)	six minute block	10%
NOx	1 hour block	See Part III.A
CO	1 hour block	See Part III.A
NH_3	1 hour block	See Part III.A

2. The Permittee shall continuously monitor the following parameters:

Operational Parameter	Averaging Times
O_2	1 hour block
Fuel Flow	1 hour block
Net Electrical Output	Continuous

3. At least 60 days prior to the initial stack test specified in Part V.B, the Permittee shall submit a CEM monitoring plan to the commissioner in accordance with RCSA Section 22a-174-4(c)(3).

4. The Permittee shall use fuel flow meters, certified in accordance with 40 CFR Part 75, Appendix D to measure and record the flow rate of fuels to the CTG.

5. The Permittee shall perform inspections and maintenance of the SCR and oxidation catalysts as recommended by the manufacturer.

6. Prior to operation, the Permittee shall develop a written plan for the operation, inspection, maintenance, preventive and corrective measures for minimizing fugitive GHG emissions (CH_4 emissions from the natural gas pipeline components and SF_6 emissions from the insulated electrical equipment). At a minimum the plan shall provide for:
   a. Implementation of daily auditory/visual/olfactory inspections of the natural gas piping components supplying natural gas to the CTG;
   b. An installed leak detection system to include audible alarms to identify SF_6 leakage from the circuit breakers; and
   c. Inspection for SF_6 emissions from the insulated electrical equipment on at least a monthly basis.

B. Record Keeping

1. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption for the CTG (for each fuel). The consecutive 12 month fuel consumption shall be determined by adding (for each fuel) the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.

2. The Permittee shall keep records of the monthly and consecutive 12 month heat input for the CTG (for each fuel). The consecutive 12 month heat input shall be determined by adding (for each fuel) the current month's heat input to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month. The records shall include sample calculations.

3. The Permittee shall keep records of the fuel certification for each delivery of ULSD from a bulk petroleum provider or a copy of the current contract with the fuel supplier supplying the ULSD used by the equipment that includes the applicable sulfur content of the ULSD as a condition of each shipment. The shipping receipt or contract shall include the date of delivery, the name of the ULSD supplier, type of fuel delivered, the percentage of sulfur in the ULSD, by weight, dry basis, and the method used to determine the sulfur content of such fuel.

4. The Permittee shall calculate and record the monthly and consecutive 12 month PM, PM_{10}, $PM_{2.5}$, SO_2, NOx, VOC, CO,H_2SO_4, NH_3, and CO_2e emissions in units of tons for the CTG.

   The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.

   Emissions during startup and shutdown shall be included in the monthly and consecutive 12 month calculations.

5. The Permittee shall keep records of the emissions of this CTG during the Shakedown period. Emissions during Shakedown shall be calculated using good engineering judgment and the best data and methodology available for estimating such emissions. Emissions during Shakedown shall be counted towards the annual emission limitation in Part III.C of this permit.

6. The Permittee shall keep records of the occurrence and duration of all Transient operation of the unit; any malfunction of the air pollution control equipment that causes an exceedance of any emission limitation found in Part III of this permit; or any periods during which a continuous monitoring system or monitoring device is inoperative.

   Such records shall contain the following information:
   a. type of event and percent Load;
   b. equipment affected;
   c. date of event;
   d. duration of event (minutes);
   e. fuel being used during event; and
   f. total NO_x, CO and VOC emissions emitted (lb) during the event.

7. The Permittee shall keep records of each delivery of aqueous ammonia. The records shall include:
   a. the date of delivery;
   b. the name of the supplier;
   c. the quantity of aqueous ammonia delivered; and
   d. the percentage of ammonia in solution, by weight.

8. The Permittee shall keep records of the inspection and maintenance of the SCR and oxidation catalysts. The records shall include:
   a. the name of the person conducting the inspection/maintenance;
   b. the dateof the inspection/maintenance;
   c. the results or actions taken; and
   d. the date the catalyst is replaced.

9. The Permittee shall keep records of all repairs/replacement of parts and other maintenance activities for the equipment.

10. The Permittee shall keep records of the electrical output to the ISO-NE transmissions system and the heat rate for the turbine while firing natural gas (HHV, net) without duct firing, on a 12month rolling average for the plant.

11. The Permittee shall keep records of the inspection, maintenance, preventive and corrective measures for minimizing GHG emissions from the natural gas pipeline components and the SF_6containing insulated electrical equipment. The records shall include:
   a. the name of the person conducting the inspection/maintenance;
   b. the date the inspection/maintenance;
   c. the results or actions taken;
   d. the leak detection methods used;
   e. the amount of SF_6 added (if any) to the electrical equipment;
   f. the monthly records of the audible alarms from the SF_6 leak detection system; and
   g. All monitoring, record keeping and reporting pursuant to the relevant provisions of 40 CFR Part 98 Subpart DD, as applicable.

12. The Permittee shall make and keep records of all occurrences of firing ULSD in the CTG. At a minimum these records shall contain the following information:
    a. the duration of ULSD firing,
    b. the reason for ULSD firing, and
    c. the heat input to the CTG while firing ULSD.

13. The Permittee shall keep a signed copy of this permit on the premises at all times, and shall make this copy available upon request of the commissioner for the duration of this permit. This copy shall also be available for public inspection during regular business hours.

14. The Permittee shall keep a copy of all notifications submitted as required by Part IV.C of this permit.

15. The Permittee shall keep records of the manufacturer written recommendations for operation and maintenance of the equipment found in this permit.

16. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

C. Reporting

1. The Permittee shall notify the commissioner in writing of all exceedances of an emissions limitation, and shall identify the cause or likely cause of such exceedance, all corrective actions and preventive measures taken with respect thereto, and the dates of such actions and measures as follows:
    a. For any hazardous air pollutant, no later than 24 hours after such exceedance was identified; and
    b. For any other regulated air pollutant, no later than ten days after such exceedance commenced.

2. The Permittee shall notify the commissioner, in writing, of the dates of commencement of construction, completion of construction, and initial startup, and the date of completion of initial shakedown period of this equipment. Such written notifications shall be submitted no later than 30 days after the subject event.

PART V. STACK EMISSION TEST REQUIREMENTS

A. Stack emission testing shall be performed in accordance with the RCSA Section 22a-174-5 and the Emission Test Guidelines available on the DEEP website.

B. For the purposes of determining maximum heat input of the turbine during stack testing, the following equation may be used:

$$\mathbf{MHI_T = Q_1 - [(T - T_1)/(T_2 - T_1)] \times (Q_1 - Q_2)}$$

Where,

MHI_T = Turbine maximum heat input at ambient temperature (^{0}F)
T = Ambient Temperature
T_1 = Temperature Value from Table 1 that is immediately below the ambient temperature
T_2 = Temperature Value from Table 1 that is immediately above the ambient temperature
Q_1 = Heat Input at corresponding T_1 for corresponding fuel type
Q_2 = Heat Input at corresponding $T_2$for corresponding fuel type

Table 1

Ambient Temperature (T)^{0}F	Gas Firing Heat Input (Q)	ULSD Heat Input (Q)
-10	~~3,123~~3,745	~~2,756~~3,033
0	~~3,122~~3,762	~~2,771~~3,033
20	~~3,129~~3,827	~~2,748~~3,033
30	~~3,110~~3,794	~~2,745~~3,033
50	~~3,018~~3,701	~~2,754~~3,033
59	~~2,969~~3,686	~~2,762~~3,033
65	~~2,926~~3,654	~~2,759~~2,987
90	~~2,733~~3,490	~~2,730~~2,807
100	~~2,615~~3,438	~~2,689~~2,692

C. The duct burner shall be required to meet a minimum heat input value of ~~740~~ 324 MMBtu/hr for all ambient temperatures during initial and recurring stack testing.

D. The Permittee shall perform one set of tests on this CTG when burning natural gas with the duct burner and one set without duct firing. The Permittee shall perform one set of tests with the CTG burning ULSD.

E. Initial Performance Testing

1. Initial stack emission testing for the CTG is required for the following pollutant(s):

   ☒ $PM_{10/2.5}$ (includes filterable and condensable) ☒ SO_2 ☒ NOx ☒ CO
   ☒ CO_2 ☒ VOC ☒ Opacity
   ☒ Other (HAPs): Sulfuric Acid, Formaldehyde (gas firing only)

2. Compliance with the VOC emission limits shall be determined by correlating the VOC emissions with a monitored parameter or pollutant during the initial stack testing for this unit. The Permittee shall submit a modification to this permit within 60 days of such testing to incorporate the monitoring methodology to be used for VOC emission compliance.

3. Stack emissions testing for the CTG firing natural gas, without duct firing, for CO_2 shall be required to show compliance with an emissions limit of 816 lb/MW-hr (net), corrected to ISO conditions, as defined in the approved stack test protocol.

4. Performance testing shall be required to show compliance with the heat rate found in Part II.G of this permit.

5. Initial stack testing for the auxiliary boiler in Part VI.A of this permit is required for the following pollutants:

   ☒ NOx ☒ CO ☒ VOC

6. The Permittee shall conduct initial stack testing no later than 180 days after initial startup. The Permittee shall submit test results within 60 days after completion of testing.

F. Recurrent Performance Testing

1. Recurrent stack testing for the CTG shall be performed within five years from the date of the previous stack test for the following pollutants:

   ☒ $PM_{10/2.5}$(includes filterable and condensable) ☒SO_2 ☒ NOx ☒ CO
   ☒ VOC ☒ Opacity ☒ Other (HAPs): Sulfuric Acid, Formaldehyde (gas firing only)

   After the initial stack test, stack testing may not be required for pollutants using CEM. The commissioner retains the right to require stack testing of any pollutant at any time.

2. Recurrent performance testing shall be required within five years from the date of the previous test to show compliance with the heat rate found in Part II.G of this permit.

3. Recurrent stack testing for the auxiliary boiler in Part VI.A of this permit shall be performed within five years from the date of the previous stack test for the following pollutants:

   ☒ NOx ☒ CO ☒ VOC

4. Recurrent testing shall be required at least once every five years from the date of the last test, unless otherwise noted, but no less than 9 calendar months or no more than 15 calendar months from the required test date.

G. Stack emission test results shall be reported in the applicable units for each pollutant found in Part III.A of this permit.

PART VI. COLLATERAL CONDITIONS FOR AUXILIARY COMBUSTION SOURCES (EU-2 through EU-5)

A. EU-2: 84 MMBtu/hr Natural Gas Fired Boiler with FGR

1. Operational Conditions
   a. Make and Model: TBD
   b. Allowable Fuel: Natural Gas
   c. Maximum Allowable Fuel Use over any consecutive 12 month period: 375,875,500 ft^3
   d. This equipment shall not exceed 10% opacity during any six minute block average as measured by 40 CFR Part 60, Appendix A, Reference Method 9.
   e. The Permittee shall comply with all applicable sections of the following New Source Performance Standards.

      Title 40 CFR Part 60 Subparts Dc and A;

      Copies of the Code of Federal Regulations (CFR) are available online at the U.S. Government Printing Office website.

2. Allowable Emissions

Pollutant	lb/MMBtu	ppmvd @ 3% O_2	tons per 12 consecutive months
$PM_{2.5}$	0.005		0.97
PM_{10}	0.005		0.97
NOx	0.0085	7.0	1.64
SO_2	0.0015		0.29
VOC	0.0041		0.78
CO	0.037	50	7.14
Lead	4.9E-07		9.5E-05
H_2SO_4	1.1E-04		0.02
CO_2e	116.98		22,610

Demonstration of compliance with the above emission limits may be met by using emission factors from the following sources:

- SO_2 and H_2SO_4: Calculated from fuel sulfur content
- NOx, VOC, CO, Opacity: Most Recent Stack Test Data
- $PM_{10/2.5}$: Vendor Emissions Guarantee
- CO_2e: 40 CFR Part 98Subpart C, Tables C-1 and C-2
- Lead: AP-42, Fifth Edition, Volume I Chapter 1.4, July 1998

3. Monitoring
   a. The Permittee shall continuously monitor fuel consumption by this unit using a non-resettable totalizing fuel meter or a billing meter.
   b. The Permittee shall perform inspections of the burners and flue gas recirculation (FGR) system as recommended by the manufacturer.

4. Record Keeping
   a. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption. The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
   b. The Permittee shall calculate and record the monthly and consecutive 12 month PM, PM_{10}, $PM_{2.5}$, SO_2, NOx, VOC, CO, and CO_2e emissions in units of tons. The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.
   c. The Permittee shall make and keep records of all maintenance and tune-up activities for this unit.
   d. The Permittee shall make and keep records of all inspections of the burners and FGR system.
   e. The Permittee shall make and keep records of all hours of simultaneous operation of this unit with the CTG. The Permittee shall total these hours for each month and for the calendar year. The Permittee shall make these calculations within 30 days of the end of the previous month.
   f. The Permittee shall make and keep records of manufacturer written specifications and recommendations for operation and maintenance.
   g. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

5. Reporting
    a. The Permittee shall comply with the record keeping and reporting requirements in 40 CFR §60.49b.
    b. The Permittee shall notify the commissioner, in writing, of the date of commencement of construction and the date of initial startup of this equipment. Such written notifications shall be submitted no later than 30 days after the subject event.

6. Stack emission test requirements:
   Stack emission testing shall be conducted as required in Part V of this perm

B. EU-4: 305 bhp Emergency Fire Pump

1. Operational Conditions
    a. Make and Model: Clarke JU6H-UFADX8
    b. Allowable Fuel: ULSD
    c. Maximum ULSD Sulfur Content (% by weight, dry basis): 0.0015
    d. Maximum Allowable Fuel Use over any consecutive 12 month period: 4,380 gallons
    e. This equipment shall not exceed 10% opacity during any six minute block average as measured by 40 CFR Part 60, Appendix A, Reference Method 9.
    f. The Permittee shall not operate this emergency engine and the emergency engine operating under permit number 089-0108individually for more than 300 hours per calendar year or more than 500 hours per calendar year in combination per calendar year.
    g. The Permittee shall comply with all applicable sections of the following New Source Performance Standards at all times.

       Title 40 CFR Part 60 Subparts: IIII and A

       Copies of the Code of Federal Regulations (CFR) are available online at the U.S. Government Printing Office website.

2. Allowable Emissions

Pollutant	lb/MMBtu	g/bhp-hr	Tons per 12 consecutive months
$PM_{2.5}$	0.05	0.15	0.015
PM_{10}	0.05	0.15	0.015
NOx		3.0	0.30
SO_2	0.0015		5E-04
VOC		0.15	0.02
CO		2.6	0.26
H_2SO_4	1.1E-04		3.0E-05
CO_2e	163.1		49

Demonstration of compliance with the above emission limits may be met by calculating the using emission factors from the following sources:

- SO_2 and H_2SO_4: Calculated from fuel sulfur content
- NOx, $PM_{10/2.5}$, VOC, CO: Vendor Emissions Guarantee
- CO_2e: 40 CFR Part 98 Subpart C, Tables C-1 and C-2

3. Monitoring
   a. The Permittee shall continuously monitor fuel consumption by this unit using a non-resettable totalizing fuel meter.
   b. The Permittee shall monitor all hours that this unit is in operation.

4. Record Keeping
   a. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption. The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
   b. The Permittee shall keep records of the fuel certification for each delivery of fuel oil from a bulk petroleum provider or a copy of the current contract with the fuel supplier supplying the fuel used by the equipment that includes the applicable sulfur content of the fuel as a condition of each shipment. The shipping receipt or contract shall include the date of delivery, the name of the fuel supplier, type of fuel delivered, the percentage of sulfur in such fuel, by weight, dry basis, and the method used to determine the sulfur content of such fuel.
   c. The Permittee shall calculate and record the monthly and consecutive 12 month PM_{10},$PM_{2.5}$, SO_2, NOx, VOC, CO H_2SO_4, and CO_2e emissions in units of tons. The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.
   d. The Permittee shall keep records of the monthly and calendar year hours of operation for this unit.

      Such records shall contain the following information:
      i. reason for operating;
      ii. date of event;
      iii. duration of event (minutes);
      iv. gallons of fuel combusted;
      v. for any testing or scheduled maintenance operation, the ozone level as forecasted for the day;
      vi. total engine hours of operation and total combined engine hours of operation with the emergency generator engine (EU-3, Permit Number 089-0108).
   e. The Permittee shall keep records of the inspection and maintenance for this engine. The records shall include:
      i. the name of the person conducting the inspection or maintenance;
      ii. the date of the inspection or maintenance;
      iii. the results or actions taken.
   f. The Permittee shall keep records of the manufacturer's specifications and written recommendations.
   g. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

5. Reporting
   a. The Permittee shall comply with the reporting requirements in 40 CFR §60.4214.
   b. The Permittee shall notify the commissioner, in writing, of the date of commencement of construction and the date of initial startup of this equipment. Such written notifications shall be submitted no later than 30 days after the subject event.

C. EU-5: ~~5~~7 MMBtu/hr Natural Gas Heater

1. Operational Conditions
   a. Make and Model: TERi or equivalent
   b. Allowable Fuel: Natural Gas
   c. Maximum Allowable Fuel Use over any consecutive 12 month period: ~~19,455,253~~24,237,354 ft^3
   d. This equipment shall not exceed 10% opacity during any six minute block average as measured by 40 CFR Part 60, Appendix A, Reference Method 9.

2. Allowable Emissions

Pollutant	lb/MMBtu	Tons/yr
$PM_{2.5}$	0.005	0.07~~5~~
PM_{10}	0.005	0.07~~5~~
NOx	0.012	0.17~~2~~
SO_2	0.0015	0.0221~~15~~
VOC	0.0034	0.05~~3~~
CO	0.037	0.52~~37~~
H_2SO_4	1.1E-04	0.0022~~1~~
CO_2	116.98	1,638~~170~~

Demonstration of compliance with the above emission limits may be met by using emission factors from the following sources:

- SO_2 and H_2SO_4: Calculated from fuel sulfur content
- NOx, $PM_{10/2.5}$, VOC, CO: Vendor Emissions Guarantee
- CO_2e: 40 CFR Part 98 Subpart C, Tables C-1 and C-2

3. Monitoring
   The Permittee shall continuously monitor fuel consumption by this unit using a non-resettable totalizing fuel meter.

4. Record Keeping
   a. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption. The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
   b. The Permittee shall calculate and record the monthly and consecutive 12 month PM, PM_{10}, $PM_{2.5}$, SO_2, NOx, VOC, CO, and CO_2e emissions in units of tons. The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.
   c. The Permittee shall make and keep records of all maintenance and tune-up activities for this unit.
   d. The Permittee shall make and keep records of all inspections of the burner system.
   e. The Permittee shall make and keep records of manufacturer written specifications and recommendations for operation and maintenance.
   f. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

5. Reporting

The Permittee shall notify the commissioner, in writing, of the date of commencement of construction and the date of initial startup of this equipment. Such written notifications shall be submitted no later than 30 days after the subject event.

PART VII. SPECIAL REQUIREMENTS

A. The Permittee shall possess, at least, 163 tons of external emissions reductions to offset the quantity of NO_x emitted from the following sources to comply with RCSA Section 22a-174-3a(l):

- EU-1: Mitsubishi M501JAC ~~Siemens SGT6-8000HCTG~~ Combustion Turbine, Permit Number 089-0107
- EU-2: 84 MMBtu/hr natural gas fired auxiliary boiler, Permit Number 089-0107
- EU-3: 1,380 kW emergency generator engine, Permit Number 089-0108
- EU-4: 305 bhp emergency fire pump engine, Permit Number 089-0107
- EU-5: ~~5~~7 MMBtu/hr natural gas fired heater, Permit Number 089-107

Such a quantity is sufficient to offset the emissions from the sources listed above at a ratio of 1.2 to 1 for every ton of NOx emissions allowed under this permit. Specifically, the reductions are real, quantifiable, surplus, permanent, and enforceable as defined in RCSA Section 22a-174-3a(l)(5). The Permittee shall maintain sole ownership and possession of these emissions reductions for the duration of this permit and any subsequent changes to the permit.

Such offsets have been obtained from the following sources:

- 112.64 tons from Glenwood Combustion Turbine Facility: (NY-DEC-1-2822-00481-112.64)
- 50.36 tons from National Grid Far Rockaway Power Station: (NY-DEC-2-6308-00040-50.36)

The offsets were approved by the Department on June 14, 2017. The Permittee shall maintain sole ownership and possession of these emissions reductions for the duration of this permit and any subsequent changes to the permit.

The Permittee may be required to obtain additional NOx offsets and complete additional ambient air quality analysis to show that the NAAQS and PSD increments have not been violated, if observed Steady-State or Transient emissions exceed limits specified in Parts III.A, III.B or III.C of this permit.

The commissioner may require other methods for determining NOx emissions from these sources as allowed by state or federal statute, law or regulation.

B. Upon completion of construction of the CTG and control equipment, the Permittee shall prepare and submit a written standby plan in accordance with the RCSA Sections 22a-174-6(d)(2) through (d)(5).

C. The Permittee shall operate this facility at all times in a manner so as not to violate or contribute significantly to the violation of any applicable state noise control regulations, as set forth in RCSA Sections 22a-69-1 through 22a-69-7.4. [STATE ONLY REQUIREMENT]

D. The Permittee shall resubmit for review and approval a Best Available Control Technology (BACT) analysis if such construction or phased construction has not commenced within the 18 months following the commissioner's approval of the current BACT determination (i.e., the issue date of this permit) for such construction or phase of construction. [RCSA Section 22a-174-3a(j)(4)]

PART VIII. ADDITIONAL TERMS AND CONDITIONS

A. This permit does not relieve the Permittee of the responsibility to conduct, maintain and operate the regulated activity in compliance with all applicable requirements of any federal, municipal or other state agency. Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.

B. Any representative of the DEEP may enter the Permittee's site in accordance with constitutional limitations at all reasonable times without prior notice, for the purposes of inspecting, monitoring and enforcing the terms and conditions of this permit and applicable state law.

C. This permit may be revoked, suspended, modified or transferred in accordance with applicable law.

D. This permit is subject to and in no way derogates from any present or future property rights or other rights or powers of the State of Connecticut and conveys no property rights in real estate or material, nor any exclusive privileges, and is further subject to any and all public and private rights and to any federal, state or local laws or regulations pertinent to the facility or regulated activity affected thereby. This permit shall neither create nor affect any rights of persons or municipalities who are not parties to this permit.

E. Any document, including any notice, which is required to be submitted to the commissioner under this permit shall be signed by a duly authorized representative of the Permittee and by the person who is responsible for actually preparing such document, each of whom shall certify in writing as follows: "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under section 22a-175 of the Connecticut General Statutes, under section 53a-157b of the Connecticut General Statutes, and in accordance with any applicable statute."

F. Nothing in this permit shall affect the commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for violations of law, including but not limited to violations of this or any other permit issued to the Permittee by the commissioner.

G. Within 15 days of the date the Permittee becomes aware of a change in any information submitted to the commissioner under this permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the commissioner.

H. The date of submission to the commissioner of any document required by this permit shall be the date such document is received by the commissioner. The date of any notice by the commissioner under this permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" means calendar day. Any document or action which is required by this permit to be submitted or performed by a date which falls on a Saturday, Sunday or legal holiday shall be submitted or performed by the next business day thereafter.

I. Any document required to be submitted to the commissioner under this permit shall, unless otherwise specified in writing by the commissioner, be directed to: Office of Director; Engineering & Enforcement Division; Bureau of Air Management; Department of Energy and Environmental Protection; 79 Elm Street, 5th Floor; Hartford, Connecticut 06106-5127.

5.0 DISPERSION MODELING ANALYSIS

Air quality dispersion modeling analyses were conducted to reflect the change from the use of the Siemens CTG to the Mitsubishi CTG. The modeling analyses were conducted in accordance with the methodologies used for the modeling analysis of the Siemens CTG to support issuance of Permit Number 089-017, with updated methodology used as determined through consultation with DEEP. Each step of the dispersion modeling process has been revisited and updated to reflect the most current information with which to evaluate the Mitsubishi CTG.

As was the case for the Siemens CTG, Facility-related impacts are below Significant Impact Levels (SILs) for all pollutants and averaging periods except 1-hour nitrogen dioxide (NO_2) and 24-hour $PM_{2.5}$. Therefore, compliance with NAAQS and PSD increments is demonstrated for all other parameters without the need for additional analysis. Even for 1-hour NO_2 and 24-hour $PM_{2.5}$, the area over which impacts exceeded the SILs was modeled to be smaller than for the Siemens CTG, reducing from 12.9 kilometers (km) to 12.1 km for 1-hour NO_2 and from 8.1 km to 0.7 km for 24-hour $PM_{2.5}$.

Although modeling methodologies would allow reducing the radius for considering cumulative sources based on these modeling results, the same cumulative sources modeled for the Siemens CTG were considered in this analysis for conservatism. As was the case for the Siemens CTG, the cumulative modeling for the Facility continues to demonstrate compliance with NAAQS and PSD increments with the Mitsubishi CTG. In fact, air quality impacts for the modified Facility using the Mitsubishi CTG are less than were predicted for the originally proposed use of the Siemens CTG.

The dispersion modeling analysis also evaluates the additional impacts involving air quality modeling that must be addressed for projects subject to PSD review. As was the case for the Siemens CTG, the Mitsubishi CTG continues to demonstrate compliance and reflect no meaningful impact in association with the additional impacts assessed.

Appendix D provides the full air quality dispersion modeling report. Modeling files have been provided directly to DEEP.

APPENDIX A – DEEP APPLICATION FORMS

The following application forms for the Mitsubishi Model M501JAC CTG and associated duct burner are provided with this modification application.

- Minor Modification Form for an Existing New Source Review Permit (DEEP-NSR-APP-200MM);
- Fuel Burning Equipment Form (DEEP-NSR-APP-202);
- Unit Emissions Form (DEEP-NSR-APP-212); and
- Ambient Air Quality Impact Form (DEEP-NSR-APP-218).

Connecticut Department of
Energy & Environmental Protection
Bureau of Air Management
Engineering & Enforcement Division

Minor Modification Application for an Existing New Source Review Permit

CPPU USE ONLY
App #:______________________
Doc #:______________________
Check #:____________________
Program/EI/App Type: Air Engineering/NSR/Minor Modification

This form is to be used for a New Source Review permit minor modification as described in RCSA section 22a-174-2a(e). Submit one application form for each permit to be modified.

Complete this form in accordance with CGS section 22a-174, RCSA sections 22a-174-1, 2a and 3a and the instructions (DEEP-NSR-INST-200MM) to ensure the proper handling of your application. Print or type unless otherwise noted. You must submit the fee along with this form.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Applicant Name	NTE Connecticut, LLC		
Town Where Site is Located	Killingly, CT	**Existing Permit No.**	089-0107

Part I: Fee Information

There are two options available for payment. **Option 1:** Submit the full permit minor modification fee of $1,750.00 or $3,250.00, which includes the $940.00 application fee, with this application form. This option will shorten the permit process. For less than major emitting equipment, the full fee is $1,750.00. For major emitting equipment, the full fee is $3,250.00. **Option 2:** Submit only an application fee of $940.00 with this application form and be billed the balance of the permit minor modification fee at a later date.

The fee for municipalities is 50% of the above listed rate. The application will not be processed until DEEP receives the application fee. The fee shall be paid by check or money order to the Department of Energy and Environmental Protection.

Fee Type (Check One Only)	**Option 1**	☐ Permit Minor Modification fee = $1,750 [#195 + #207] (**< major emitting equipment**) ☒ Permit Minor Modification fee = $3,250 [#195 + #206] (**major emitting equipment)**
	Option 2	☐ Application fee only = $940 [#195] (Permit fee balance will be billed later.)
Municipality (Any Town, City or Borough)	☒ No ☐ Yes, 50% discount	

Part II: Applicant Information

- *If an applicant is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of State. If applicable, the applicant's name shall be stated **exactly** as it is registered with the Secretary of State. Please note, for those entities registered with the Secretary of State, the registered name will be the name used by DEEP. This information can be accessed at the Secretary of State's database (CONCORD).* **(www.concord-sots.ct.gov/CONCORD/index.jsp)**

- *If an applicant is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).*

- *If there are any changes or corrections to your company/facility or individual mailing or billing address or contact information, please complete and submit the Request to Change Company/Individual Information to the address indicated on the form. If there is a change in name of the entity holding a DEEP license or a change in ownership, contact the Office of Planning and Program Development (OPPD) at 860-424-3003. For any other changes you must contact the specific program from which you hold a current DEEP license.*

1. APPLICANT INFORMATION					
Applicant Name	NTE Connecticut, LLC Check at least one: ☒ equipment owner ☒ equipment operator *The applicant must be either the owner or operator of the equipment.*				
Mailing Address	24 Cathedral Place, Suite 300				
City/Town	St. Augustine	**State**	FL	**Zip Code**	32084
Business Phone No.	(813) 349-4943	**Extension No.**			
Contact Person	Tim Eves				
Title	Vice President				
Email	teves@nteenergy.com By providing this e-mail address you are agreeing to receive official correspondence from DEEP, at this electronic address, concerning the subject application. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify DEEP if your e-mail address changes.				
Applicant Type	☒ business entity ☐ municipality ☐ individual ☐ federal agency ☐ state agency ☐ tribal				
If a business entity:	**Business Type**	☐ corporation ☒ limited liability company ☐ limited partnership ☐ limited liability partnership ☐ statutory trust ☐ Other:			
	Secretary of the State Business ID No.	Pending ☐ Check here if your business is **NOT** registered with the Secretary of State's office.			
	This information can be accessed at the Secretary of State's database (CONCORD). **(www.concord-sots.ct.gov/CONCORD/index.jsp)**				
Applicant's Interest in Property at which the Proposed Activity is to be Located	☐ site owner ☒ option holder ☐ lessee ☐ easement holder ☐ Other:				
Are there co-applicants?	☐ Yes ☒ No If "Yes", attach additional sheet(s) with the required information as above.				

Part II: Applicant Information (continued)

2. PRIMARY CONTACT FOR DEPARTMENTAL CORRESPONDENCE AND INQUIRIES (if different than the applicant)					
Name					
Title					
Company/Individual Name					
Mailing Address					
City/Town		**State**		**Zip Code**	
Business Phone No.		**Extension No.**			
Email					
By providing this e-mail address you are agreeing to receive official correspondence from DEEP, at this electronic address, concerning the subject application. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify DEEP if your e-mail address changes.					
3. EQUIPMENT OWNER OR EQUIPMENT OPERATOR (only complete if applicant is not both equipment owner and operator)					
Name	Check one: ☐ equipment owner ☐ equipment operator				
Title					
Company/Individual Name					
Mailing Address					
City/Town		**State**		**Zip Code**	
Business Phone No.		**Extension No.**			
Email					
4. ENGINEER(s) OR CONSULTANT(s) EMPLOYED OR RETAINED TO ASSIST IN PREPARING THIS APPLICATION (if different than the applicant)					
Name	Lynn Gresock				
Title	Vice President – Energy Program				
Company/Individual Name	Tetra Tech, Inc.				
Mailing Address	2 Lan Drive, Suite 210				
City/Town	Westford	**State**	MA	**Zip Code**	01886
Business Phone No.	(978) 203-5352	**Extension No.**			
Email	lynn.gresock@tetratech.com				
Service Provided	Preparation of permit modification application				

☐ **Check here if additional sheets are necessary. Label and attach them to this sheet.**

Part III: Permit Modification Information

1. SITE NAME AND LOCATION					
Name of Site	Killingly Energy Center				
Street Address or Location Description	180/189 Lake Road				
City/Town	Killingly	State	CT	Zip Code	06241
2. EXISTING PERMIT NO.	089-0107				

3. DESCRIPTION OF MODIFICATION
Include a description of the proposed modification, the basis for such modification, any proposed monitoring procedures, any increase in potential emissions resulting from the proposed modification, and an identification of all regulatory, statutory, or otherwise applicable requirements that would become applicable as a result of such modification.
Change of combustion turbine model and lower heat input rating of the associxtaed duct burner

Note: Pursuant to RCSA section 22a-174-2a(e)(3)(C), a permittee may implement the modifications proposed in the minor permit modification application no less than 21 days after filing a complete application with the commissioner. The permittee shall comply with the terms and conditions of the proposed modified permit and the terms and conditions of the existing permit that are not being modified, until the commissioner issues or denies the proposed modified permit.

Part IV: Attachments

Check the applicable box below for each attachment being submitted with this application form. All referenced forms may be accessed electronically, in WORD and PDF versions, on the Air Emissions Permits webpage. Check all that apply.

If any of the following are true…	Attach…	Required?	Attached
Permit is being modified	Marked up copy of the current NSR permit noting proposed changes Use redline to delete language and uppercase font to add proposed new language.	**Required**	☒
Source is being moved to another location on the premises	Site Plan showing the exact location of the stack(s), the latitude and longitude of the stack(s), all boundary lines of the property and measurements, and the horizontal distance from the stack base to the nearest property line; and	If Applicable	☐
	A completed CTMASC spreadsheet, or equivalent, to demonstrate compliance with RCSA section 22a-174-29, Hazardous Air Pollutants.		☐
Burner is being replaced	*Fuel Burning Equipment Form* (DEEP-NSR-APP-202)	If Applicable	☒
Control equipment is being added	*Air Pollution Control Equipment Form* (DEEP-NSR-APP-210)	If Applicable	☐
Stack parameters are being changed	*Stack Parameters Form* (DEEP-NSR-APP-211)	If Applicable	☐

Part IV: Attachments (continued)

If any of the following are true…	Attach…	Required?	Attached
A change is made to the operation of the source (e.g., production or fuel usage increase/decrease, etc.), resulting in changed emissions	*Unit Emissions Form* (DEEP-NSR-APP-212)	If Applicable	☒
Allowable emissions in the current permit are based on older versions of AP-42 emission factors	*Unit Emissions Form* (DEEP-NSR-APP-212) Recalculate the emissions using the most current AP-42 emission factors.	If Applicable	☐
If the source was issued a permit to operate before March 1, 1986, compliance with RCSA section 22a-174-29 Tables 2 and 3 of the Hazardous Air Pollutants regulations shall be demonstrated	A completed CTMASC spreadsheet, or equivalent, to demonstrate compliance with Tables 2 and 3 of the RCSA section 22a-174-29, Hazardous Air Pollutants .	If Applicable	☒
Allowable emissions for a pollutant, previously limited by a BACT/LAER determination are increased	*Analysis of Best Available Control Technology (BACT) Form* (DEEP-NSR-APP-214a)	If Applicable	☒
Emissions for any pollutant are increased.	*Ambient Air Quality Analysis Form* (DEEP-NSR-APP-218)	If Applicable	☐
If any parameter (e.g., hourly emissions, stack height, exhaust gas flow rate, property line distance), previously modeled, is changed	Ambient Air Quality Analysis Form (DEEP-NSR-APP-218)	If Applicable	☒
If the source is located at a Major Stationary Source and emissions from the premises will **increase** due to the minor modification	Premises Information Form (DEEP-NSR-APP-217)	If Applicable	☐
	Major Modification Determination Form (DEEP-NSR-APP-213)		☐

Part V: Applicant Certification

The authorized representative **and** the individual(s) responsible for actually preparing the application must sign this part. An application will be considered insufficient unless all required signatures are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under section 22a-175 of the Connecticut General Statutes, under section 53a-157b of the Connecticut General Statutes, and in accordance with any applicable statute.

I certify that this application is on complete and accurate forms as prescribed by the commissioner without alteration of the text."

"I certify, in accordance with RCSA section 22a-174-2a(e)(3)(B)(ii), that the proposed minor permit modification meets all regulatory, statutory, or applicable requirements identified in the subject application."

APPLICANT:			
Signature of Applicant		**Date**	11/21/17
Name of Applicant (print or type)	Tim Eves		
Title (if applicable)	Vice President		
PREPARER:			
Signature of Preparer		**Date**	11/22/17
Name of Preparer (print or type)	Lynn Gresock		
Title (if applicable)	Vice President		

Note: Please submit the completed Application Form, Fee, and all Attachments to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

A notice of permit application is **not** required for a permit minor modification application.

Attachment E202: Fuel Burning Equipment Supplemental Application Form

Applicant Name: **NTE Connecticut, LLC**
Unit No.: **CT**

DEEP USE ONLY
App. No.: ______________

Complete this form in accordance with the instructions (DEEP-NSR-INST-202) to ensure the proper handling of your application. Print or type unless otherwise noted.

Note: Certain external combustion units may be operated pursuant to RCSA section 22a-174-3b or -3c in lieu of a permit to construct and operate pursuant to RCSA section 22a-174-3a.

Complete a separate form for *each* fuel burning source.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: General

Type of Unit *(check one)*	☐ Boiler ☐ IC Engine ☐ Duct Burner ☐ Heater/Furnace ☒ Turbine ☐ Other (specify):	
Manufacturer and Model Number	Mitsubishi Model M501JAC	
Construction Date	Sept. 2018	
Manufacture Date	TBD	
Is this unit subject to Title 40 CFR Part 60, NSPS?	☐ No ☒ Yes, Subpart(s) **KKKK & TTTT**	
Is this unit subject to Title 40 CFR Part 63, MACT?	☒ No ☐ Yes, Subpart(s)	
Maximum Design Heat Input	3,745 @ -10F MMBtu/hr	
Typical Heat Input	3,686 @ ISO MMBtu/hr	
Maximum Operating Schedule	**24** hours/day	**8,760** hours/year
Percentage of Annual Use in Each Category	Space Heat:	%
	Process Heat:	%
	Power:	**100**%

Part II: Fuel Information

Fuel Type	% Sulfur by weight	Higher Heating Value (BTU)	Maximum Hourly Firing Rate	Maximum Annual Fuel Usage	Units (gal or ft^3)
Natural Gas	0.0016	1,028	3.643E06	3.141E10	ft3
ULSD	0.0015	138,000	21,978	1.582E7	gal

Note: Parts III and IV are unit specific. Complete only that section which applies to the subject unit.

Part III: External Combustion Unit Information (Boiler or Heater/Furnace)

Burner Manufacturer and Model Number	
Number of Burners	
Burner Maximum Rated Capacity (per burner)	MMBtu/hr
Firing Type and Method Information *(Choose all that apply)*	
Oil/Gas Fired Unit	☐ Tangentially Fired ☐ Horizontally Opposed (normal) Fired ☐ Other (specify):
Pulverized Coal Fired Unit	☐ Dry Bottom ☐ Wet Bottom ☐ Wall Fired ☐ Tangentially Fired ☐ Horizontally Fired ☐ Vertically Fired ☐ Other (specify):
Coal/Wood Fired Stoker Unit	☐ Overfeed ☐ Underfeed ☐ Spreader ☐ Hand Fed ☐ IGCC (Integrated Gasification Combined Cycle) ☐ Other (specify):
Coal/Wood Fired Fluidized Bed Combustor	☐ Circulating Bed ☐ Bubbling Bed ☐ Cyclone Furnace ☐ Other (specify):
Other Coal/Wood Fired Unit	☐ Suspension Firing ☐ Dutch Oven/Fuel Cell Oven ☐ Over Fire Air ☐ Other (specify):

Part IV: Internal Combustion (IC) Unit Information (IC Engine or Turbine)

IC Engine Information	
IC Engine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
IC Engine Ignition *(check one)*	☐ Compression ☐ Spark
IC Engine Type *(check one)*	☐ 4-Stroke Rich Burn (4SRB) ☐ 4-Stroke Lean Burn (4SLB) ☐ 2-Stroke Lean Burn (2SLB)
IC Engine Brake Horsepower	HP
IC Engine Power Output	MW
Turbine Information	
Turbine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
Turbine Type *(check one)*	☐ Simple Cycle ☒ Combined Cycle
Turbine Power Output	374 @ ISO firing natural gas, gross MW

Part V: Combustion Controls Information (Check all that apply)

Type of Combustion Control(s) or Modifications(s)	☒ Low NOx Burners ☐ Flue Gas Recirculation ☒ Selective Catalytic Reduction ☐ Coal Reburn ☐ Gas Reburn ☐ Lean Burn ☐ Rich Burn ☐ Low Excess Air ☐ Other (specify):	☐ Fly Ash Reinjection ☐ Reburn ☐ Selective Non-Catalytic Reduction ☒ Oxidation Catalyst ☐ 3-way Catalyst ☐ Over Fire Air ☐ Biased Burner Firing ☐ Burners Out of Service ☐ None

Part VI: Attachments

Please check the attachments being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E202-A, etc.) and be sure to include the applicant's name.

☐ Attachment E202-A:	*Process Information and Flow Diagram* – Submit a process flow diagram indicating all related equipment, air pollution control equipment and stacks, as applicable. Identify all materials entering and leaving each such device indicating quantities and parameters relevant to the proper operation of the device. Indicate all monitoring devices and controls. **REQUIRED**
☒ Attachment E202-B:	*Manufacturer Information* - Submit copies of the manufacturer specification sheets for the unit, the air pollution control equipment and the monitoring systems. **REQUIRED**
☒ Attachment E202-C:	*Turbine Emissions Profiles* - Submit copies of manufacturer's emissions profile data for steady state and transient operation of the turbine. **IF APPLICABLE**

Attachment E202: Fuel Burning Equipment Supplemental Application Form

Applicant Name: **NTE Connecticut, LLC**
Unit No.: **DB**

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-202) to ensure the proper handling of your application. Print or type unless otherwise noted.

Note: Certain external combustion units may be operated pursuant to RCSA section 22a-174-3b or -3c in lieu of a permit to construct and operate pursuant to RCSA section 22a-174-3a.

Complete a separate form for *each* fuel burning source.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: General

Type of Unit *(check one)*	☐ Boiler ☐ Heater/Furnace ☐ IC Engine ☐ Turbine ☒ Duct Burner ☐ Other (specify):	
Manufacturer and Model Number	TBD	
Construction Date	Sept. 2018	
Manufacture Date		
Is this unit subject to Title 40 CFR Part 60, NSPS?	☐ No ☒ Yes, Subpart(s) **KKKK & TTTT**	
Is this unit subject to Title 40 CFR Part 63, MACT?	☒ No ☐ Yes, Subpart(s)	
Maximum Design Heat Input	408 MMBtu/hr	
Typical Heat Input	368 MMBtu/hr	
Maximum Operating Schedule	**24** hours/day	**8,760** hours/year
Percentage of Annual Use in Each Category	Space Heat:	%
	Process Heat:	%
	Power:	**100**%

Part II: Fuel Information

Fuel Type	% Sulfur by weight	Higher Heating Value (BTU)	Maximum Hourly Firing Rate	Maximum Annual Fuel Usage	Units (gal or ft^3)
Natural Gas	0.0016	1028	396,887	7.45E08	ft3

Note: Parts III and IV are unit specific. Complete only that section which applies to the subject unit.

Part III: External Combustion Unit Information (Boiler or Heater/Furnace)

Burner Manufacturer and Model Number	
Number of Burners	
Burner Maximum Rated Capacity (per burner)	MMBtu/hr
Firing Type and Method Information *(Choose all that apply)*	
Oil/Gas Fired Unit	☐ Tangentially Fired ☐ Horizontally Opposed (normal) Fired ☐ Other (specify):
Pulverized Coal Fired Unit	☐ Dry Bottom ☐ Wet Bottom ☐ Wall Fired ☐ Tangentially Fired ☐ Horizontally Fired ☐ Vertically Fired ☐ Other (specify):
Coal/Wood Fired Stoker Unit	☐ Overfeed ☐ Underfeed ☐ Spreader ☐ Hand Fed ☐ IGCC (Integrated Gasification Combined Cycle) ☐ Other (specify):
Coal/Wood Fired Fluidized Bed Combustor	☐ Circulating Bed ☐ Bubbling Bed ☐ Cyclone Furnace ☐ Other (specify):
Other Coal/Wood Fired Unit	☐ Suspension Firing ☐ Dutch Oven/Fuel Cell Oven ☐ Over Fire Air ☐ Other (specify):

Part IV: Internal Combustion (IC) Unit Information (IC Engine or Turbine)

IC Engine Information	
IC Engine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
IC Engine Ignition *(check one)*	☐ Compression ☐ Spark
IC Engine Type *(check one)*	☐ 4-Stroke Rich Burn (4SRB) ☐ 4-Stroke Lean Burn (4SLB) ☐ 2-Stroke Lean Burn (2SLB)
IC Engine Brake Horsepower	HP
IC Engine Power Output	MW
Turbine Information	
Turbine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
Turbine Type *(check one)*	☐ Simple Cycle ☐ Combined Cycle
Turbine Power Output	MW

Part V: Combustion Controls Information (Check all that apply)

Type of Combustion Control(s) or Modifications(s)	☒ Low NOx Burners ☐ Flue Gas Recirculation ☒ Selective Catalytic Reduction ☐ Coal Reburn ☐ Gas Reburn ☐ Lean Burn ☐ Rich Burn ☐ Low Excess Air ☐ Other (specify):	☐ Fly Ash Reinjection ☐ Reburn ☐ Selective Non-Catalytic Reduction ☒ Oxidation Catalyst ☐ 3-way Catalyst ☐ Over Fire Air ☐ Biased Burner Firing ☐ Burners Out of Service ☐ None

Part VI: Attachments

Please check the attachments being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E202-A, etc.) and be sure to include the applicant's name.

☐ Attachment E202-A:	*Process Information and Flow Diagram* – Submit a process flow diagram indicating all related equipment, air pollution control equipment and stacks, as applicable. Identify all materials entering and leaving each such device indicating quantities and parameters relevant to the proper operation of the device. Indicate all monitoring devices and controls. **REQUIRED**
☒ Attachment E202-B:	*Manufacturer Information* - Submit copies of the manufacturer specification sheets for the unit, the air pollution control equipment and the monitoring systems. **REQUIRED**
☐ Attachment E202-C:	*Turbine Emissions Profiles* - Submit copies of manufacturer's emissions profile data for steady state and transient operation of the turbine. **IF APPLICABLE**

Attachment E202: Fuel Burning Equipment Supplemental Application Form

Applicant Name: **NTE Connecticut, LLC**
Unit No.: **GH**

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-202) to ensure the proper handling of your application. Print or type unless otherwise noted.

Note: Certain external combustion units may be operated pursuant to RCSA section 22a-174-3b or -3c in lieu of a permit to construct and operate pursuant to RCSA section 22a-174-3a.

Complete a separate form for *each* fuel burning source.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: General

Type of Unit *(check one)*	☐ Boiler ☒ Heater/Furnace ☐ IC Engine ☐ Turbine ☐ Duct Burner ☐ Other (specify):	
Manufacturer and Model Number	TERI (or equivalent)	
Construction Date	Sept. 2018	
Manufacture Date	N/A	
Is this unit subject to Title 40 CFR Part 60, NSPS?	☐ No ☒ Yes, Subpart(s) **Dc**	
Is this unit subject to Title 40 CFR Part 63, MACT?	☒ No ☐ Yes, Subpart(s)	
Maximum Design Heat Input	7 MMBtu/hr	
Typical Heat Input	7 MMBtu/hr	
Maximum Operating Schedule	**24** hours/day	**4,000** hours/year
Percentage of Annual Use in Each Category	Space Heat:	%
	Process Heat:	**100**%
	Power:	%

Part II: Fuel Information

Fuel Type	% Sulfur by weight	Higher Heating Value (BTU)	Maximum Hourly Firing Rate	Maximum Annual Fuel Usage	Units (gal or ft^3)
Natural Gas	0.0016	1,028	6,809	27,237,000	ft3

Note: Parts III and IV are unit specific. Complete only that section which applies to the subject unit.

Part III: External Combustion Unit Information (Boiler or Heater/Furnace)

Burner Manufacturer and Model Number	**TERI (or equivalent)**
Number of Burners	**1**
Burner Maximum Rated Capacity (per burner)	7 MMBtu/hr
Firing Type and Method Information *(Choose all that apply)*	
Oil/Gas Fired Unit	☐ Tangentially Fired ☒ Horizontally Opposed (normal) Fired ☐ Other (specify):
Pulverized Coal Fired Unit	☐ Dry Bottom ☐ Wet Bottom ☐ Wall Fired ☐ Tangentially Fired ☐ Horizontally Fired ☐ Vertically Fired ☐ Other (specify):
Coal/Wood Fired Stoker Unit	☐ Overfeed ☐ Underfeed ☐ Spreader ☐ Hand Fed ☐ IGCC (Integrated Gasification Combined Cycle) ☐ Other (specify):
Coal/Wood Fired Fluidized Bed Combustor	☐ Circulating Bed ☐ Bubbling Bed ☐ Cyclone Furnace ☐ Other (specify):
Other Coal/Wood Fired Unit	☐ Suspension Firing ☐ Dutch Oven/Fuel Cell Oven ☐ Over Fire Air ☐ Other (specify):

Part IV: Internal Combustion (IC) Unit Information (IC Engine or Turbine)

IC Engine Information	
IC Engine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
IC Engine Ignition *(check one)*	☐ Compression ☐ Spark
IC Engine Type *(check one)*	☐ 4-Stroke Rich Burn (4SRB) ☐ 4-Stroke Lean Burn (4SLB) ☐ 2-Stroke Lean Burn (2SLB)
IC Engine Brake Horsepower	HP
IC Engine Power Output	MW
Turbine Information	
Turbine Operation *(check one)*	☐ Emergency Only ☐ Emergency/Non-Emergency
Turbine Type *(check one)*	☐ Simple Cycle ☐ Combined Cycle
Turbine Power Output	MW

Part V: Combustion Controls Information (Check all that apply)

Type of Combustion Control(s) or Modifications(s)	☒ Low NOx Burners ☐ Flue Gas Recirculation ☐ Selective Catalytic Reduction ☐ Coal Reburn ☐ Gas Reburn ☐ Lean Burn ☐ Rich Burn ☐ Low Excess Air ☐ Other (specify):	☐ Fly Ash Reinjection ☐ Reburn ☐ Selective Non-Catalytic Reduction ☐ Oxidation Catalyst ☐ 3-way Catalyst ☐ Over Fire Air ☐ Biased Burner Firing ☐ Burners Out of Service ☐ None

Part VI: Attachments

Please check the attachments being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E202-A, etc.) and be sure to include the applicant's name.

☒ Attachment E202-A:	*Process Information and Flow Diagram* – Submit a process flow diagram indicating all related equipment, air pollution control equipment and stacks, as applicable. Identify all materials entering and leaving each such device indicating quantities and parameters relevant to the proper operation of the device. Indicate all monitoring devices and controls. **REQUIRED**
☒ Attachment E202-B:	*Manufacturer Information* - Submit copies of the manufacturer specification sheets for the unit, the air pollution control equipment and the monitoring systems. **REQUIRED**
☐ Attachment E202-C:	*Turbine Emissions Profiles* - Submit copies of manufacturer's emissions profile data for steady state and transient operation of the turbine. **IF APPLICABLE**

Attachment E212: Unit Emissions Supplemental Application Form

Applicant Name: NTE Connecticut, LLC
Unit No.: CT & DB

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-212) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete a separate form for *each* unit.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: Unit Emission Information

Pollutant	Potential Emissions at Maximum Capacity		Proposed Allowable Emissions		
	lb/hr	tpy	lb/hr	Other Units *(specify)*	tpy
Criteria Air Pollutants					
PM	28.6	125.3	28.6	See Attached	47.7
PM_{10}	28.6	125.3	28.6	Text and Tables	47.7
$PM_{2.5}$ Total (filterable + condensable)	28.6	125.3	28.6		47.7
SO_x	6.1	26.7	6.1		24.6
NO_x	47.2	179.1	44.0		130.1
CO	15.5	67.5	15.2		134.6
VOC	8.3	36.4	8.3		41.7
Pb	3.2E-03	1.4E-02	3.2E-03		8.0E-03
GHG	492,213	2.16E06	492,213		2,001,753
Hazardous or Other Air Pollutants					
See Appendix A					

Potential Emissions Calculation Basis: Vendor Data

Proposed Allowable Emissions Calculation Basis: Vendor Data/operating restrictions in attached text

Part II: Regulatory Standards

Enter the regulatory standard(s) and the proposed allowable emissions for each pollutant emitted by the unit using the same units (e.g., ppmvd, lb/MMBTU, lb/hour, lb/day, etc.). More than one regulatory standard will often apply to a unit for a particular pollutant, list all that apply. Enter the regulatory citation(s) for the standard(s).

NOTE: The applicant should be aware of any existing regulatory standard applicable to the unit and should not propose allowable emissions in excess of the regulatory standard(s).

Pollutant	Regulatory Standard(s) *(specify units)*	Proposed Allowable Emissions *(specify units)*	Regulatory Citation(s)
Criteria Air Pollutants			
PM			
PM_{10}			
$PM_{2.5}$ Total (filterable + condensable)			
SO_x	0.06 lb/MMBtu	0.0015 lb/MMBtu	40 CFR 60.4320(a)
NO_x	15 ppmvd @15% O2	2.0 ppmvdc (gas) 4.0 ppmvdc (ULSD)	40 CFR 60.4330(a)(2)
CO			
VOC			
Pb			
GHG			
Hazardous or Other Air Pollutants *(Standards other than RCSA §22a-174-29)*			

Part III: Attachments

Please check the attachment being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E212-A, etc.) and be sure to include the applicant's name.

☒	Attachment E212-A:	*Sample Calculations*- Submit sample calculations used to determine all emissions rates, excluding GHG. See Attachment E212-C for GHG emissions. **REQUIRED**
☒	Attachment E212-B:	*RCSA section 22a-174-29 Hazardous Air Pollutants Compliance* – Submit a completed CTMASC spreadsheet**,** or equivalent, to demonstrate compliance with RCSA section 22a-174-29. **REQUIRED**
☒	Attachment E212-C:	*Greenhouse Gas Emissions* – Submit a completed CO_2 Equivalents Calculator Spreadsheet, or equivalent, used to quantify Greenhouse Gas emissions, **REQUIRED**

Attachment E212: Unit Emissions Supplemental Application Form

Applicant Name: NTE Connecticut, LLC
Unit No.: GH

DEEP USE ONLY
App. No.: ____________

Complete this form in accordance with the instructions (DEEP-NSR-INST-212) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete a separate form for *each* unit.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: Unit Emission Information

Pollutant	Potential Emissions at Maximum Capacity		Proposed Allowable Emissions		
	lb/hr	**tpy**	**lb/hr**	**Other Units** *(specify)*	**tpy**
Criteria Air Pollutants					
PM	0.04	0.15	0.04	0.005 lb/MMBtu	0.07
PM_{10}	0.04	0.15	0.04	0.005 lb/MMBtu	0.07
$PM_{2.5}$ Total (filterable + condensable)	0.04	0.15	0.04	0.005 lb/MMBtu	0.07
SO_x	0.01	0.05	0.01	0.0015 lb/MMBtu	0.02
NO_x	0.08	0.37	0.08	0.012 lb/MMBtu	0.17
CO	0.26	1.13	0.26	0.037 lb/MMBtu	0.52
VOC	0.02	0.10	0.02	0.0034 lb/MMBtu	0.05
Pb	3.4E-06	1.5E-05	3.4E-06	4.9E-07 lb/MMBtu	6.9E-06
GHG	819	3,587	819	119 lb/MMBtu	1,638
Hazardous or Other Air Pollutants					
See Appendix A					

Part II: Regulatory Standards

Enter the regulatory standard(s) and the proposed allowable emissions for each pollutant emitted by the unit using the same units (e.g., ppmvd, lb/MMBTU, lb/hour, lb/day, etc.). More than one regulatory standard will often apply to a unit for a particular pollutant, list all that apply. Enter the regulatory citation(s) for the standard(s).

NOTE: The applicant should be aware of any existing regulatory standard applicable to the unit and should not propose allowable emissions in excess of the regulatory standard(s).

Pollutant	**Regulatory Standard(s)** *(specify units)*	**Proposed Allowable Emissions** *(specify units)*	**Regulatory Citation(s)**
Criteria Air Pollutants			
PM			
PM_{10}			
$PM_{2.5}$ Total (filterable + condensable)			
SO_x			
NO_x			
CO			
VOC			
Pb			
GHG			
Hazardous or Other Air Pollutants *(Standards other than RCSA §22a-174-29)*			

Part III: Attachments

Please check the attachment being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E212-A, etc.) and be sure to include the applicant's name.

☒	Attachment E212-A:	*Sample Calculations*- Submit sample calculations used to determine all emissions rates, excluding GHG. See Attachment E212-C for GHG emissions. **REQUIRED**
☒	Attachment E212-B:	*RCSA section 22a-174-29 Hazardous Air Pollutants Compliance* – Submit a completed CTMASC spreadsheet**,** or equivalent, to demonstrate compliance with RCSA section 22a-174-29. **REQUIRED**
☒	Attachment E212-C:	*Greenhouse Gas Emissions* – Submit a completed CO_2 Equivalents Calculator Spreadsheet, or equivalent, used to quantify Greenhouse Gas emissions, **REQUIRED**

APPENDIX B – SUPPORTING EMISSION CALCULATIONS

NTE Connecticut, LLC - Killingly Energy Center

Facility-Wide Potential Annual Emissions (TPY)

Pollutant	CTG & Duct Burners	Auxiliary Boiler	Natural Gas Heater	Emergency Generator	Fire Pump	Fugitive Emissions	Facility Total
NO_x	130.1	1.64	0.17	2.92	0.30	N/A	135.1
CO	117.7	7.14	0.52	1.60	0.26	N/A	127.2
VOC	32.1	0.78	0.05	0.15	0.02	N/A	33.1
SO_2	24.6	0.29	0.02	0.003	0.0005	N/A	24.9
PM	47.7	0.97	0.07	0.09	0.02	N/A	48.8
PM_{10}	47.7	0.97	0.07	0.09	0.02	N/A	48.8
$PM_{2.5}$	47.7	0.97	0.07	0.09	0.02	N/A	48.8
CO_2e	2,001,753	22,610	1,638	308	49	547	2,026,906
H_2SO_4	8.60	0.02	0.0016	0.0002	0.00003	N/A	8.6
Lead (Pb)	8.0E-03	9.5E-05	6.9E-06	1.4E-06	2.3E-07	N/A	8.1E-03
NH_3	50.3	N/A	N/A	N/A	N/A	N/A	50.3
Total HAPS	11.69	0.36	0.03	0.01	0.003	N/A	12.1

Potential To Emit Operating Scenario

The CTG will operate at full rated load for 8,760 hours per year.

Higher emission rates occur during gas firing with duct firing and ULSD firing without duct firing

ULSD firing will be limited to 720 hours per year per turbine without duct firing

Over the course of 8,760 operating hours, the average annual temperature will be 59°F

ULSD firing expected to occur during cold winter months

ULSD emission rate for 720 hrs/yr applied when the lb/hr rate is greater than the duct firing lb/hr rate

The potential to emit is the sum of the steady state potential to emit plus the net increase due to startup/shutdown operation

Operating Condition	Operating Load	Fuel	Ambient Temp. (°F)	Duct Firing	Maximum Annual Hours
Case #36	100%	Nat. Gas	59	On	2,800
Case #37	100%	Nat. Gas	59	Off	5,240
Case #25	100%	ULSD	-10	Off	720
Total					**8,760**

Pollutant	Case #36	Case #37	Case #25	8760 PTE	SU/SD	PTE
	lb/hr	lb/hr	lb/hr	tpy	tpy	tpy
NO_x	29.9	27.2	47.2	130.0	0.1	130.1
CO	15.2	7.4	14.4	46.0	71.8	117.7
VOC	8.2	3.3	9.2	23.5	8.6	32.1
$PM_{10}/PM_{2.5}$	12.7	7.6	27.7	47.7	0	47.7
SO_2	6.1	5.5	4.5	24.6	0	24.6
H_2SO_4	2.1	1.9	1.9	8.60	0	8.60
CO_2e	482,099	438,553	493,907	2,001,753	0	2,001,753
NH_3	10.9	10.0	24.3	50.3	0	50.3

NTE Connecticut, LLC - Killingly Energy Center
Mitsubishi Model M501JAC Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):	**100**				**59**				**-10**		
Case #:	**1**	**2**	**4**	**5**	**36**	**37**	**39**	**40**	**33**	**34**	**35**
Fuel	**Natural Gas**										
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)											
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	3,436	3,438	2,638	2,181	3,684	3,686	2,881	2,246	3,745	3,362	2,558
DB Heat Input (MMBtu/hr/unit, HHV)	408				368						
Net Power (kW)						527,475					
Gross Power (kW)						541,000					
Heat Rate (Btu/kW-hr, net, HHV)						6,988					
HRSG Stack Exhaust Gas											
Exhaust Flow, lb/hr	5,567,461	5,549,000	4,471,000	3,907,000	5,969,000	5,952,000	4,850,000	3,953,000	5,932,000	5,620,000	4,761,000
Stack Temperature, °F	175.0	185.0	175.0	175.0	175.0	175.0	175.0	175.0	175.0	175.0	176.0
Exhaust Flow, acfm	1,548,937	1,570,107	1,241,596	1,083,894	1,647,235	1,644,326	1,337,600	1,089,000	1,632,500	1,544,859	1,307,606
O_2, Vol. %	9.19	10.30	10.91	11.46	9.73	10.67	11.17	11.62	10.68	11.27	12.53
CO_2, Vol. %	5.23	4.70	4.47	4.21	5.18	4.74	4.53	4.31	4.85	4.58	3.98
H_2O, Vol. %	13.17	12.20	11.21	10.74	10.93	10.10	9.49	9.09	9.20	8.67	7.54
N_2, Vol. %	71.54	71.91	72.52	72.70	73.24	73.57	73.88	74.05	74.36	74.57	75.03
Ar, Vol. %	0.90	0.90	0.91	0.91	0.92	0.92	0.93	0.93	0.94	0.94	0.95
MW, lb/lb-mole	28.01	28.06	28.15	28.18	28.25	28.30	28.35	28.37	28.41	28.44	28.51
HRSG Stack Exhaust Gas Emissions											
NOx, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOx, lb/MMBtu as NO2 (Mitsubishi)	0.0073	0.0072	0.0072	0.0072	0.0074	0.0074	0.0074	0.0074	0.0072	0.0072	0.0069
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
NOx, lb/hr as NO2 (Mitsubishi)	27.90	24.90	19.00	15.60	29.90	27.20	21.20	16.60	27.10	24.20	17.70
NOx, lb/hr as NO2 (Method 19)	28.33	25.33	19.44	16.07	29.86	27.16	21.23	16.55	27.60	24.77	18.85
VOC ppm (Mitsubishi)	1.6	0.7	0.7	0.7	1.6	0.7	0.7	0.7	0.7	0.7	0.7
VOC ppm (Method 19)	1.6	0.7	0.7	0.7	1.6	0.7	0.7	0.7	0.7	0.7	0.7
VOC, lb/MMBtu (Mitsubishi)	0.0020	0.0009	0.0009	0.0009	0.0020	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0021	0.0009	0.0009	0.0009	0.0021	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
VOC, lb/hr as CH4 (Mitsubishi)	7.80	3.00	2.30	1.90	8.20	3.30	2.50	2.00	3.30	3.00	2.20
VOC, lb/hr as CH4 (Method 19)	7.90	3.09	2.37	1.96	8.32	3.31	2.59	2.02	3.37	3.02	2.30
CO, ppmvd @ 15% O2	1.7	0.9	0.9	0.9	1.7	0.9	0.9	0.9	0.9	0.9	0.9
CO, lb/MMBtu (Mitsubishi)	0.0037	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0022	0.0020	0.0020	0.0019
CO, lb/MMBtu (EPA Method 19)	0.0038	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020
CO, lb/hr (Mitsubishi)	14.40	6.80	5.20	4.30	15.20	7.30	5.70	4.90	7.40	6.60	4.90
CO, lb/hr (Method 19)	14.66	6.94	5.32	4.40	15.45	7.44	5.82	4.53	7.56	6.79	5.16
SO2, lb/hr (calculated)	5.77	5.16	3.96	3.27	6.08	5.53	4.32	3.37	5.62	5.04	3.84
SO2, lb/MMBtu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	2.00	1.80	1.30	1.10	2.10	1.90	1.40	1.10	1.90	1.70	1.30
H2SO4, lb/MMBtu	0.00052	0.00052	0.00049	0.00050	0.00052	0.00052	0.00049	0.00049	0.00051	0.00051	0.00051
$PM/PM_{10}/PM_{2.5}$, lb/hr	12.70	7.00	5.50	4.70	12.70	7.60	6.00	4.80	7.70	7.00	5.60
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0033	0.0020	0.0021	0.0022	0.0031	0.0021	0.0021	0.0021	0.0021	0.0021	0.0022
NH_3, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NH_3, lb/MMBtu (EPA Method 19)	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
NH3, lb/hr (Mitsubishi)	10.30	9.20	7.00	5.80	10.90	9.90	7.70	5.90	10.00	9.00	6.60
NH_3, lb/hr (Method 19)	10.47	9.36	7.18	5.94	11.03	10.04	7.84	6.12	10.20	9.15	6.96
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	456,948	408,638	313,507	259,208	481,609	438,107	342,427	266,953	445,172	399,555	304,007
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	8.48	7.58	5.82	4.81	8.93	8.13	6.35	4.95	8.26	7.41	5.64
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	0.85	0.76	0.58	0.48	0.89	0.81	0.64	0.50	0.83	0.74	0.56
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	457,413	409,053	313,826	259,471	482,099	438,553	342,776	267,225	445,624	399,961	304,316
CO_2e, lb/MMBtu	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0
HCOH (lb/hr)	0.841	0.752	0.577	0.477	0.887	0.807	0.630	0.491	0.820	0.736	0.560

NTE Connecticut, LLC - Killingly Energy Cer
Mitsubishi Model M501JAC Combined Cycle

Ambient Temperature (°F):	**100**			**59**			**-10**		
Case #:	**2**	**3**	**4**	**28**	**14**	**15**	**25**	**29**	**30**
Fuel	**ULSD**								
GT Operating Load	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)									
Ambient Relative Humidity, %	45	45	45	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,692	2,226	1,948	3,033	2,453	2,177	3,033	2,773	2,374
DB Heat Input (MMBtu/hr/unit, HHV)									
Net Power (kW)									
Gross Power (kW)									
Heat Rate (Btu/kW-hr, net, HHV)									
HRSG Stack Exhaust Gas									
Exhaust Flow, lb/hr	5,543,000	4,523,000	3,870,000	6,201,000	4,942,000	4,391,000	5,984,000	5,955,000	5,100,000
Stack Temperature, °F	207.0	196.0	186.0	199.0	187.0	180.0	197.0	198.0	191.0
Exhaust Flow, acfm	1,619,663	1,300,020	1,095,727	1,778,354	1,391,783	1,223,096	1,706,521	1,681,908	1,425,064
O_2, Vol. %	10.59	10.52	10.34	10.82	10.73	10.78	10.61	11.94	11.96
CO_2, Vol. %	5.53	5.57	5.67	5.60	5.65	5.62	5.82	5.38	5.36
H_2O, Vol. %	13.22	13.29	13.48	11.57	11.68	11.62	11.12	7.77	7.76
N_2, Vol. %	69.81	69.77	69.66	71.11	71.05	71.10	71.57	74.01	74.01
Ar, Vol. %	0.88	0.88	0.88	0.89	0.89	0.89	0.91	0.93	0.93
MW, lb/lb-mole	28.10	28.10	28.09	28.29	28.28	28.29	28.36	28.68	28.68
HRSG Stack Exhaust Gas Emissions									
NOx, ppmvd @ 15% O2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
NOx, lb/MMBtu as NO2 (Mitsubishi)	0.0173	0.0172	0.0171	0.0156	0.0156	0.0155	0.0156	0.0156	0.0156
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0155	0.0155	0.0155	0.0155	0.0155	0.0155	0.0155	0.0155	0.0155
NOx, lb/hr as NO2 (Mitsubishi)	46.6	38.3	33.4	47.2	38.2	33.8	47.2	43.1	37.0
NOx, lb/hr as NO2 (Method 19)	41.9	34.6	30.3	47.2	38.1	33.8	47.2	43.1	36.9
VOC ppm (Mitsubishi)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC ppm (Method 19)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC, lb/MMBtu (Mitsubishi)	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030	0.0030
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
VOC, lb/hr as CH4 (Mitsubishi)	8.10	6.70	5.80	9.20	7.40	6.50	9.20	8.30	7.10
VOC, lb/hr as CH4 (Method 19)	7.29	6.03	5.28	8.21	6.64	5.90	8.21	7.51	6.43
CO, ppmvd @ 15% O2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
CO, lb/MMBtu (Mitsubishi)	0.0048	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
CO, lb/MMBtu (EPA Method 19)	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043
CO, lb/hr (Mitsubishi)	12.80	10.50	9.20	14.40	11.60	10.20	14.40	13.10	11.20
CO, lb/hr (Method 19)	11.47	9.48	8.30	12.92	10.45	9.27	12.92	11.81	10.11
SO2, lb/hr (calculated)	4.04	3.34	2.92	4.55	3.68	3.27	4.55	4.16	3.56
SO2, lb/MMBtu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	1.70	1.40	1.20	1.90	1.50	1.30	1.90	1.70	1.40
H2SO4, lb/MMBtu	0.00063	0.00063	0.00062	0.00063	0.00061	0.00060	0.00063	0.00061	0.00059
$PM/PM_{10}/PM_{2.5}$, lb/hr	25.3	20.3	17.2	28.6	22.4	19.7	27.7	27.6	23.4
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0094	0.0091	0.0088	0.0094	0.0091	0.0090	0.0091	0.0100	0.0099
NH_3, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3, lb/MMBtu (EPA Method 19)	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072
NH3, lb/hr (Mitsubishi)	21.60	17.70	15.50	24.30	19.50	17.30	24.30	22.10	18.80
NH_3, lb/hr (Method 19)	19.34	15.99	13.99	21.78	17.62	15.64	21.78	19.92	17.05
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	436,920	361,209	316,103	492,213	398,087	353,296	492,210	449,973	385,331
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	17.81	14.72	12.88	20.06	16.23	14.40	20.06	18.34	15.71
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	3.56	2.94	2.58	4.01	3.25	2.88	4.01	3.67	3.14
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	438,426	362,454	317,193	493,910	399,460	354,514	493,907	451,524	386,659
CO_2e, lb/MMBtu	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8
HCOH (lb/hr)	0.622	0.514	0.450	0.700	0.566	0.503	0.700	0.640	0.548

NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Mitsubishi Model M501JAC

Startup/Shutdown Operating Data

hot starts/unit/gas	208	number/yr	0.50	hrs/event	6	Avg. hrs downtime	6.50	hrs/event
warm starts/unit/gas	42	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/gas	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/gas	250	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event
hot starts/unit/ULSD	0	number/yr	0.53	hrs/event	6	Avg. hrs downtime	6.53	hrs/event
warm starts/unit/ULSD	10	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/ULSD	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/ULSD	10	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event

Startup/Shutdown Emissions Self-Correcting Analysis

		Natural Gas Start				ULSD Start			
		NOx	CO	VOC	PM	NOx	CO	VOC	PM
Emissions per hot start	lbs	133	355	40	6.0	175	2301	261	22.4
Emissions per warm start	lbs	138	356	44	6.0	183	2303	262	22.4
Emissions per cold start	lbs	138	400	44	6.0	183	2303	262	22.4
Emissions per shutdown	lbs	59	206	60	4.8	129	418	169	19.7
Shutdown/Hot start - duration (w/ downtime)	hrs	6.80	6.80	6.80	6.80	6.83	6.83	6.83	6.83
Shutdown/Warm start - duration (w/ downtime)	hrs	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88
Shutdown/Cold start - duration (w/ downtime)	hrs	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88
Shutdown/Hot start - avg hourly emissions[1]	lb/hr	28.24	82.50	14.71	1.59	44.49	397.90	62.93	6.16
Shutdown/Warm start - avg hourly emissions[1]	lb/hr	11.67	33.29	6.16	0.64	18.48	161.16	25.53	2.49
Shutdown/Cold start - avg hourly emissions[1]	lb/hr	3.04	9.34	1.60	0.17	4.81	41.94	6.64	0.65
Steady state average hourly (annual)[2]	lb/hr	28.12	10.14	5.01	12.70	47.16	14.40	9.20	27.70
Hot Start Net increase	lb/event	0.8	492.0	65.9	0.0	0.0	2620.6	367.1	0.0
Warm Start Net increase	lb/event	0.0	390.8	19.3	0.0	0.0	2477.9	275.7	0.0
Cold Start Net increase	lb/event	0.0	0.0	0.0	0.0	0.0	1786.7	0.0	0.0
Hot start - self correcting?	lb/hr	no	no	no	yes	yes	no	no	yes
Warm start - self correcting?	lb/hr	yes	no	no	yes	yes	no	no	yes
Cold start - self correcting?	lb/hr	yes	yes	yes	yes	yes	no	yes	yes

[1] Includes balance of the hour at the steady state annual average hourly rate
[2] Based upon average annual hourly emissions with 4,250 hr/yr gas with duct firing, 720 hr/yr oil firing and gas without duct firing balance of the year.

Startup/Shutdown Potential Emissions Increase (tpy/unit)

SUSD Type	Gas NOx	Gas CO	Gas VOC	Oil NOx	Oil CO	Oil VOC
Shutdown/Cold Start	-	-	-	-	0.00	-
Shutdown/Warm Start	-	8.21	0.41	-	12.39	1.38
Shutdown/Hot Start	0.08	51.17	6.85	-	0.00	0.00
TOTAL	**0.08**	**59.38**	**7.26**	**0.00**	**12.39**	**1.38**

Note: Maximum of hot start/warm start/transition used for worst case hot start

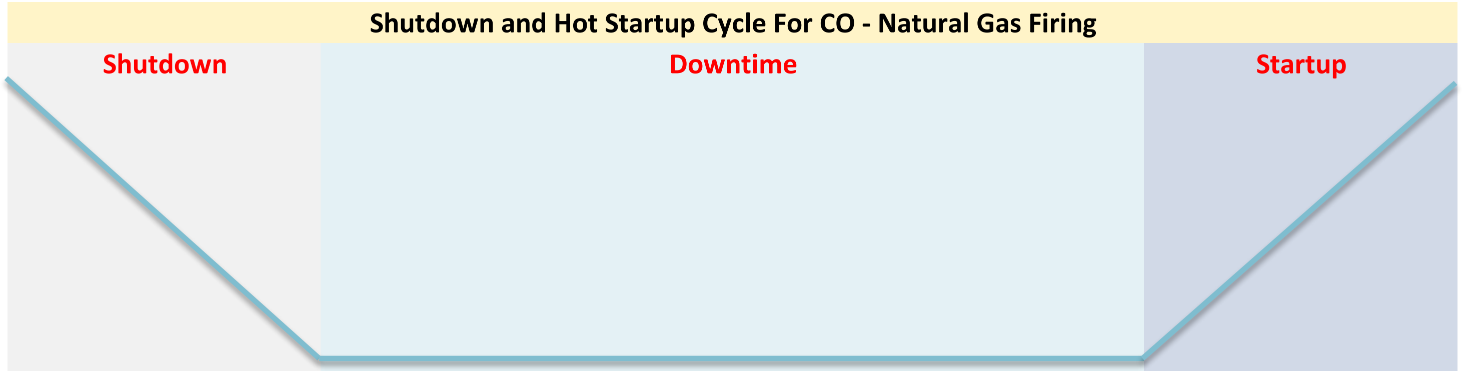
NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Mitsubishi Model M501JAC

Startup/Shutdown Hourly Parameters

Type	Operating Condition	Exhaust Flow (ACFM)	Temp (°F)	Temp (°K)	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	PM (lb/hr)	SO2 (lb/hr)	Stack Diameter (ft)	Exit Velocity (m/s)
Hot Start - gas	Startup	1,072,786	185.7	358.4	146.6	358.7	41.7	9.0	3.4	22	14.34
Warm Start - gas	Startup	1,014,013	184.7	357.8	149.3	359.1	45.4	8.5	3.4	22	13.55
Cold Start - gas	Startup	1,012,438	183.0	356.9	149.3	403.1	45.4	8.5	3.4	22	13.53
Shutdown - gas	Shutdown	1,259,590	182.3	356.5	78.0	211.2	62.3	9.0	3.4	22	16.83
Hot Start - ULSD	Startup	1,100,774	196.3	364.3	197.0	2307.7	265.3	32.9	3.3	22	14.71
Warm Start - ULSD	Startup	1,065,259	193.6	362.8	202.6	2309.0	265.8	31.7	3.3	22	14.24
Cold Start - ULSD	Startup	1,063,918	191.8	361.8	202.6	2309.0	265.8	31.7	3.3	22	14.22
Shutdown - ULSD	Shutdown	1,296,591	194.9	363.5	162.0	428.1	175.4	35.4	3.3	22	17.33

Notes
1.) Cold startup (SU) data are based on CTG shutdown (SD) >60 hours
2.) Warm SU data CTG SD between 12 and 60 hours
3.) Hot SU data CTG SD <12 hours, 6 hour average presumed based upon daily cycling of CTG
4.) PM SU lb/event equal to lb/hr rate at 75% load at ISO for each fuel.
5.) PM SD lb/event equal to lb/hr rate at 50% load at ISO for each fuel.
6.) SUSD lb/hr emissions, except for SO2, equal to lb/event emissions plus baseload lb/hr rate at ISO for the remainder of the hour
7.) SO2 SUSD lb/hr emissions equal to lb/hr rate at 50% load at ISO for each fuel

Example Calculation of Net Increase in Emissions Due To Shutdown and Startup Operation



	Shutdown	Downtime	Startup	SUSD Totals	
Duration (hrs)	0.30	6.00	0.50	**6.80**	**A**
Emissions (lbs)	206	0	355	**561.0**	**B**

Shutdown and Startup Cycle Emission Rate (lb/hr) =	82.50	**C** = B / A
Full Load Steady State Emission Rate (lb/hr) =	15.20	**D** (Case #36, full load on gas with duct firing at 59°F)
Net Increase in Emissions Due To Shutdown/Startup (lb/hr) =	67.30	**E** = C - D (avg over the shutdown/downtime/startup cycle)

If "E" is less than or equal to zero then there is no net increase in emissions over steady state from shutdown and startup operation.
If "E" is greater than zero, then there is a net increase in emissions over steady state from shutdown and startup operation.
If there is a net increase in emissions, then the impact on potential annual emissions from shutdown and startup must be quantifed.

Calculation of Impact on Potential Annual Emissions Due to a Net Increase in Emissions From Shutdown and Startup Operation

Net Increase in Emissions Due To Shutdown/Startup (lb/event) =	457.64	**F** = E x A
Number of Shutdown and Startup Cycles Per Year =	208	**G**
Net Increase in Annual Emissions (tpy) =	47.59	**H** = F x G / 2000

The net increase in emissions resulting from shutdown and startup operation is added to the steady state potential annual emissions to determine the total potential to emit from the CTG.

NTE Connecticut, LLC - Killingly Energy Center
Emissions From Ancillary Equipment

Pollutant	Auxiliary Boiler 84.0 MMBtu/hr		Natural Gas Heater 7.0 MMBtu/hr		Emergency Generator kW 1,380 (mechanical)		Fire Pump kW 227.5 (mechanical)	
NO_x	7	ppmvd @ 3% O_2	9	ppmvd @ 3% O_2	6.40	g/kW-hr	4.0	g/kW-hr
	0.0085	lb/MMBtu	0.012	lb/MMBtu	1.55	lb/MMBtu	1.00	lb/MMBtu
	0.71	lb/hr	0.084	lb/hr	19.46	lb/hr	2.01	lb/hr
	1.64	TPY	0.17	TPY	2.92	TPY	0.30	TPY
CO	50	ppmvd @ 3% O_2	50	ppmvd @ 3% O_2	3.5	g/kW-hr	3.5	g/kW-hr
	0.037	lb/MMBtu	0.037	lb/MMBtu	0.85	lb/MMBtu	0.87	lb/MMBtu
	3.11	lb/hr	0.259	lb/hr	10.64	lb/hr	1.76	lb/hr
	7.14	TPY	0.52	TPY	1.60	TPY	0.263	TPY
VOC	9.6	ppmvd @ 3% O_2	8	ppmvd @ 3% O_2	0.32	g/kW-hr	0.20	g/kW-hr
	0.0041	lb/MMBtu	0.0034	lb/MMBtu	0.078	lb/MMBtu	0.050	lb/MMBtu
	0.34	lb/hr	0.02	lb/hr	0.97	lb/hr	0.100	lb/hr
	0.78	TPY	0.05	TPY	0.15	TPY	0.015	TPY
$PM_{10}/PM_{2.5}$	N/A	ppmvd @ 3% O_2	N/A	ppmvd @ 3% O_2	0.20	g/kW-hr	0.20	g/kW-hr
	0.005	lb/MMBtu	0.005	lb/MMBtu	0.048	lb/MMBtu	0.050	lb/MMBtu
	0.42	lb/hr	0.04	lb/hr	0.61	lb/hr	0.10	lb/hr
	0.97	TPY	0.07	TPY	0.091	TPY	0.015	TPY
SO_2	0.0015	lb/MMBtu	0.0015	lb/MMBtu	0.0015	lb/MMBtu	0.0015	lb/MMBtu
	0.13	lb/hr	0.0105	lb/hr	0.02	lb/hr	0.0030	lb/hr
	0.29	TPY	0.021	TPY	0.003	TPY	0.0005	TPY
H_2SO_4	0.00011	lb/MMBtu	0.00011	lb/MMBtu	0.00011	lb/MMBtu	0.00011	lb/MMBtu
	0.010	lb/hr	0.00080	lb/hr	0.0014	lb/hr	0.00023	lb/hr
	0.02	TPY	0.002	TPY	0.0002	TPY	0.00003	TPY
Pb	4.9E-07	lb/MMBtu	4.9E-07	lb/MMBtu	1.1E-06	lb/MMBtu	1.1E-06	lb/MMBtu
	4.1E-05	lb/hr	3.4E-06	lb/hr	1.3E-05	lb/hr	2.1E-06	lb/hr
	9.5E-05	TPY	6.86E-06	TPY	2.0E-06	TPY	3.2E-07	TPY
CO_2	116.9	lb/MMBtu	116.9	lb/MMBtu	163.1	lb/MMBtu	163.1	lb/MMBtu
	9,820	lb/hr	818	lb/hr	2,046	lb/hr	329	lb/hr
	22,587	TPY	1,637	TPY	307	TPY	49	TPY
CH_4	0.0022	lb/MMBtu	0.0022	lb/MMBtu	0.0066	lb/MMBtu	0.0066	lb/MMBtu
	0.1852	lb/hr	0.0154	lb/hr	0.083	lb/hr	0.013	lb/hr
	0.43	TPY	0.03	TPY	0.0124	TPY	0.0020	TPY
N_2O	0.00022	lb/MMBtu	0.0	lb/MMBtu	0.0013	lb/MMBtu	0.0013	lb/MMBtu
	0.0185	lb/hr	0.0015	lb/hr	1.7E-02	lb/hr	0.0027	lb/hr
	0.043	TPY	0.003	TPY	2.5E-03	TPY	4.0E-04	TPY
CO_2e	9,831	lb/hr	819	lb/hr	2,053	lb/hr	330	lb/hr
	22,610	TPY	1,638	TPY	308	TPY	49	TPY

NOTES:

Natural Gas SO2 emissions based upon a sulfur content of 0.5 gr/100 dscf

ULSD SO_2 emissions based upon a sulfur content of 15 ppmw

Aux Boiler and Gas Heater criteria pollutant emission factors from BACT analysis

Emergency Generator criteria pollutant emission factors based on Tier 2 emission standards in 40 CFR 89.

Fire Pump criteria pollutant emission factors based on post -2009 emission standards in 40 CFR 60 Subpart IIII.

H_2SO_4 emissions assume a 5% conversion of SO2 --> SO3 (on a molar basis)

Fuel specific CO_2, CH_4 and N_2O emission factors from 40 CFR 98, Subpart C

Pb emission factor for ULSD from "Survey of Ultra-Trace Metals in Gas Turbine Fuels"

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Organic Compounds						
Acetaldehyde	6.46E-01			4.74E-05	2.32E-04	6.46E-01
Acrolein	1.03E-01			1.48E-05	2.80E-05	1.03E-01
Benzene	1.81E-01	4.06E-04	2.94E-05	1.46E-03	2.82E-04	1.83E-01
1,3-Butadiene	6.37E-03				1.18E-05	6.38E-03
Dichlorobenzene	1.93E-03	2.32E-04	1.68E-05			2.18E-03
Ethylbenzene	5.17E-01					5.17E-01
Formaldehyde	3.65E+00	1.43E-02	1.04E-03	1.48E-04	3.57E-04	3.67E+00
Hexane	2.90E+00	3.48E-01	2.52E-02			3.27E+00
Propylene oxide	4.68E-01			7.24E-03	1.08E-03	4.77E-01
Toluene	2.10E+00	6.38E-04	4.62E-05	5.29E-04	1.24E-04	2.11E+00
Xylene	1.03E+00			3.63E-04	3.66E-04	1.03E+00
PAHs						
Acenaphthene	2.90E-06	3.48E-07	2.52E-08	8.81E-06	4.29E-07	1.25E-05
Acenaphthylene	2.90E-06	4.64E-07	3.36E-08	1.74E-05	1.53E-05	3.61E-05
Anthracene	3.87E-06	3.48E-07	2.52E-08	2.31E-06	5.65E-07	7.12E-06
Benzo(a)anthracene	2.90E-06	3.48E-07	2.52E-08	1.17E-06	5.08E-07	4.95E-06
Benzo(a)pyrene	1.93E-06	2.32E-07	1.68E-08	4.84E-07	5.68E-08	2.72E-06
Benzo(b)fluoranthene	2.90E-06	3.48E-07	2.52E-08	4.10E-07	3.00E-08	3.71E-06
Benzo(g,h,i)perylene	1.93E-06	2.32E-07	1.68E-08	1.05E-06	1.48E-07	3.38E-06
Benzo(k)fluoranthene	2.90E-06	3.48E-07	2.52E-08	2.09E-06	4.68E-08	5.41E-06
Chrysene	2.90E-06	3.48E-07	2.52E-08	2.88E-06	1.07E-07	6.26E-06
Dibenz(a,h)anthracene	1.93E-06	2.32E-07	1.68E-08	6.51E-07	1.76E-07	3.01E-06
7,12-Dimethylbenz(a) an	2.58E-05	3.09E-06	2.24E-07			2.91E-05
Fluoranthene	4.84E-06	5.60E-07	4.06E-08	7.58E-06	2.30E-06	1.53E-05
Fluorene	4.51E-06	5.22E-07	3.78E-08	2.41E-05	8.82E-06	3.80E-05
Indeno(1,2,3-cd)pyrene	2.90E-06	3.48E-07	2.52E-08	7.79E-07	1.13E-07	4.17E-06
3-Methylchloranthrene	2.90E-06	3.48E-07	2.52E-08			3.27E-06
2-Methylnaphthalene	3.87E-05	4.64E-06	3.36E-07			4.37E-05
Naphthalene	2.02E-02	1.20E-04	8.68E-06	2.45E-04	2.56E-05	2.06E-02
Phenanthrene	2.74E-05	3.28E-06	2.38E-07		8.89E-06	3.98E-05
Pyrene	8.06E-06	9.47E-07	6.86E-08	6.98E-06	1.44E-06	1.75E-05
TOTAL PAH	3.36E-02	1.31E-04	9.52E-06	3.99E-04	5.08E-05	3.42E-02
Metals						
Arsenic	3.00E-04	3.86E-05	2.80E-06	8.69E-08	1.40E-08	3.41E-04
Beryllium	1.79E-05	2.32E-06	1.68E-07			2.04E-05
Cadmium	1.77E-03	2.13E-04	1.54E-05	9.65E-09	1.55E-09	2.00E-03
Chromium	2.08E-03	2.70E-04	1.96E-05	2.33E-05	3.75E-06	2.39E-03
Chromium VI	3.74E-04	4.83E-05	3.50E-06	4.21E-06	6.77E-07	4.30E-04
Cobalt	1.32E-04	1.58E-05	1.15E-06			1.49E-04

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Lead	7.99E-03	9.47E-05	6.86E-06	1.45E-06	2.32E-07	8.09E-03
Manganese	8.32E-04	7.15E-05	5.18E-06	5.31E-07	8.52E-08	9.09E-04
Mercury	4.03E-04	4.83E-05	3.50E-06	1.94E-08	3.11E-09	4.55E-04
Nickel	3.11E-03	4.06E-04	2.94E-05	2.78E-06	4.47E-07	3.55E-03
Selenium	4.45E-05	4.64E-06	3.36E-07	4.82E-07	7.74E-08	5.00E-05
Max. Single HAP						**3.67**
Total All HAPs	**1.17E+01**	**3.65E-01**	**2.64E-02**	**1.06E-02**	**2.60E-03**	**12.09**

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Organic Compounds							
Acetaldehyde	4.00E-05	1.47E-01					6.46E-01
Acrolein	6.40E-06	2.36E-02					1.03E-01
Benzene	1.20E-05	4.42E-02	5.50E-05	1.67E-01	2.10E-06	7.73E-04	1.81E-01
1,3-Butadiene	4.30E-07	1.58E-03	1.60E-05	4.85E-02			6.37E-03
Dichlorobenzene					1.20E-06	4.42E-04	1.93E-03
Ethylbenzene	3.20E-05	1.18E-01					5.17E-01
Formaldehyde	2.19E-04	8.07E-01	2.31E-04	7.00E-01	7.50E-05	2.76E-02	3.65E+00
Hexane					1.80E-03	6.62E-01	2.90E+00
Propylene oxide	2.90E-05	1.07E-01					4.68E-01
Toluene	1.30E-04	4.79E-01			3.40E-06	1.25E-03	2.10E+00
Xylene	6.40E-05	2.36E-01					1.03E+00
PAHs							
Acenaphthene					1.80E-09	6.62E-07	2.90E-06
Acenaphthylene					1.80E-09	6.62E-07	2.90E-06
Anthracene					2.40E-09	8.83E-07	3.87E-06
Benzo(a)anthracene					1.80E-09	6.62E-07	2.90E-06
Benzo(a)pyrene					1.20E-09	4.42E-07	1.93E-06
Benzo(b)fluoranthene					1.80E-09	6.62E-07	2.90E-06
Benzo(g,h,i)perylene					1.20E-09	4.42E-07	1.93E-06
Benzo(k)fluoranthene					1.80E-09	6.62E-07	2.90E-06
Chrysene					1.80E-09	6.62E-07	2.90E-06
Dibenz(a,h)anthracene					1.20E-09	4.42E-07	1.93E-06
7,12-Dimethylbenz(a) anthracene					1.60E-08	5.89E-06	2.58E-05
Fluoranthene					3.00E-09	1.10E-06	4.84E-06
Fluorene					2.80E-09	1.03E-06	4.51E-06
Indeno(1,2,3-cd)pyrene					1.80E-09	6.62E-07	2.90E-06
3-Methylchloranthrene					1.80E-09	6.62E-07	2.90E-06
2-Methylnaphthalene					2.40E-08	8.83E-06	3.87E-05
Naphthalene	1.30E-06	4.79E-03	3.50E-05	1.06E-01	6.10E-07	2.24E-04	2.02E-02
Phenanthrene					1.70E-08	6.26E-06	2.74E-05
Pyrene					5.00E-09	1.84E-06	8.06E-06
TOTAL PAH	2.20E-06	8.11E-03	4.00E-05	1.21E-01	6.98E-07	2.57E-04	3.36E-02
Metals							
Arsenic			4.60E-08	1.39E-04	2.00E-07	7.36E-05	3.00E-04
Beryllium			3.10E-07	9.40E-04	1.20E-08	4.42E-06	1.79E-05
Cadmium			5.11E-09	1.55E-05	1.10E-06	4.05E-04	1.77E-03
Chromium			1.24E-05	3.76E-02	1.40E-06	5.15E-04	2.08E-03
Chromium VI			2.23E-06	6.76E-03	2.52E-07	9.27E-05	3.74E-04
Cobalt					8.20E-08	3.02E-05	1.32E-04

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Lead	4.90E-07	1.81E-03	1.05E-06	3.19E-03	4.90E-07	1.80E-04	7.99E-03
Manganese			1.80E-07	5.47E-04	3.70E-07	1.36E-04	8.32E-04
Mercury			1.02E-08	3.10E-05	2.50E-07	9.20E-05	4.03E-04
Nickel			1.48E-06	4.48E-03	2.10E-06	7.73E-04	3.11E-03
Selenium			2.55E-07	7.75E-04	2.40E-08	8.83E-06	4.45E-05
Max. Single HAP							
Total All HAPs	**5.37E-04**		**3.95E-04**		**1.89E-03**		**1.17E+01**

Notes:

1. Blank entry indicates no emission factor reported in the reference cited.
2. Organic HAP emission factors for CTGs are from Tables 3.1-3 and 3.1.4 of AP-42 except gas-firing for formaldehyde which is based on the NESHAP Subpart YYYY MACT floor limit of 91 ppb at 15% O2.
3. Emission factors for the HRSG and auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics from the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4, for the fire pump from AP-42 Table 3.3-2.
5. Metal emission factors for ULSD firing are based on the paper "Survey of Ultra-Trace Metals in Gas Turbine Fuels", 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. No reduction by oxidation catalysts presumed for organic HAPs.
8. lb/hr values are at 59°F and do not represent maximum values at higher firing rates at colder temperatures.

NTE Connecticut, LLC - Killingly Energy Center
Ancillary Source Potential HAP Emissions (lb/hr)

HAP	Auxiliary Boiler		Natural Gas Heater		Em. Generator		Fire Pump	
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr
Organic Compounds								
Acetaldehyde					2.52E-05	3.16E-04	7.67E-04	1.55E-03
Acrolein					7.88E-06	9.88E-05	9.25E-05	1.86E-04
Benzene	2.10E-06	1.76E-04	2.10E-06	1.47E-05	7.76E-04	9.73E-03	9.33E-04	1.88E-03
1,3-Butadiene							3.91E-05	7.88E-05
Dichlorobenzene	1.20E-06	1.01E-04	1.20E-06	8.40E-06				
Ethylbenzene								
Formaldehyde	7.40E-05	6.22E-03	7.40E-05	5.18E-04	7.89E-05	9.90E-04	1.18E-03	2.38E-03
Hexane	1.80E-03	1.51E-01	1.80E-03	1.26E-02				
Propylene oxide					3.85E-03	4.83E-02	3.56E-03	7.17E-03
Toluene	3.30E-06	2.77E-04	3.30E-06	2.31E-05	2.81E-04	3.52E-03	4.09E-04	8.24E-04
Xylene					1.93E-04	2.42E-03	2.85E-04	2.44E-03
PAHs								
Acenaphthene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	4.68E-06	5.87E-05	1.42E-06	2.86E-06
Acenaphthylene	2.40E-09	2.02E-07	2.40E-09	1.68E-08	9.23E-06	1.16E-04	5.06E-05	1.02E-04
Anthracene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	1.23E-06	1.54E-05	1.87E-06	3.77E-06
Benzo(a)anthracene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	6.22E-07	7.80E-06	1.68E-06	3.38E-06
Benzo(a)pyrene	1.20E-09	1.01E-07	1.20E-09	8.40E-09	2.57E-07	3.22E-06	1.88E-07	3.79E-07
Benzo(b)fluoranthene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	2.18E-07	2.73E-06	9.91E-08	2.00E-07
Benzo(g,h,i)perylene	1.20E-09	1.01E-07	1.20E-09	8.40E-09	5.56E-07	6.97E-06	4.89E-07	9.85E-07
Benzo(k)fluoranthene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	1.11E-06	1.39E-05	1.55E-07	3.12E-07
Chrysene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	1.53E-06	1.92E-05	3.53E-07	7.11E-07
Dibenz(a,h)anthracene	1.20E-09	1.01E-07	1.20E-09	8.40E-09	3.46E-07	4.34E-06	5.83E-07	1.17E-06
7,12-Dimethylbenz(a) anthracene	1.60E-08	1.34E-06	1.60E-08	1.12E-07				
Fluoranthene	2.90E-09	2.44E-07	2.90E-09	2.03E-08	4.03E-06	5.06E-05	7.61E-06	1.53E-05
Fluorene	2.70E-09	2.27E-07	2.70E-09	1.89E-08	1.28E-05	1.61E-04	2.92E-05	5.88E-05
Indeno(1,2,3-cd)pyrene	1.80E-09	1.51E-07	1.80E-09	1.26E-08	4.14E-07	5.19E-06	3.75E-07	7.56E-07
3-Methylchloranthrene	1.80E-09	1.51E-07	1.80E-09	1.26E-08				
2-Methylnaphthalene	2.40E-08	2.02E-06	2.40E-08	1.68E-07				
Naphthalene	6.20E-07	5.21E-05	6.20E-07	4.34E-06	1.30E-04	1.63E-03	8.48E-05	1.71E-04
Phenanthrene	1.70E-08	1.43E-06	1.70E-08	1.19E-07			2.94E-05	5.92E-05
Pyrene	4.90E-09	4.12E-07	4.90E-09	3.43E-08	3.71E-06	4.65E-05	4.78E-06	9.63E-06
TOTAL PAH	6.80E-07	5.71E-05	6.80E-07	4.76E-06	2.12E-04	2.66E-03	1.68E-04	3.38E-04
Metals								
Arsenic	2.00E-07	1.68E-05	2.00E-07	1.40E-06	4.62E-08	5.80E-07	4.62E-08	9.31E-08
Beryllium	1.20E-08	1.01E-06	1.20E-08	8.40E-08				
Cadmium	1.10E-06	9.24E-05	1.10E-06	7.70E-06	5.13E-09	6.44E-08	5.13E-09	1.03E-08
Chromium	1.40E-06	1.18E-04	1.40E-06	9.80E-06	1.24E-05	1.56E-04	1.24E-05	2.50E-05
Chromium VI	2.50E-07	2.10E-05	2.50E-07	1.75E-06	2.24E-06	2.81E-05	2.24E-06	4.51E-06
Cobalt	8.20E-08	6.89E-06	8.20E-08	5.74E-07				
Lead	4.90E-07	4.12E-05	4.90E-07	3.43E-06	7.69E-07	9.65E-06	7.69E-07	1.55E-06
Manganese	3.70E-07	3.11E-05	3.70E-07	2.59E-06	2.82E-07	3.54E-06	2.82E-07	5.68E-07
Mercury	2.50E-07	2.10E-05	2.50E-07	1.75E-06	1.03E-08	1.29E-07	1.03E-08	2.08E-08
Nickel	2.10E-06	1.76E-04	2.10E-06	1.47E-05	1.48E-06	1.86E-05	1.48E-06	2.98E-06
Selenium	2.40E-08	2.02E-06	2.40E-08	1.68E-07	2.56E-07	3.21E-06	2.56E-07	5.16E-07
Max. Single HAP								
Total All HAPs	**1.89E-03**	**1.59E-01**	**1.89E-03**	**1.32E-02**	**5.61E-03**	**7.04E-02**	**7.66E-03**	**1.73E-02**

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Gas Firing

Instructions

Stack Parameter Units:	English	
Stack Height =	150	ft
Minimum Distance from Stack to Property Line =	425	ft
Exhaust Stack Flow Rate =	1,647,235	acfm
Hazard Limiting Values (HLV) Averaging Times =	30-Minute	
	No	

Notes:
Maximum gas firing rate and duct firing rate at 59F. Stack height is an estimate pending completion of ambient air quality impact analysis.

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Acetaldehyde	75-07-0	18000	1.47E-01	4.03E+05	2.39E+01	yes
Acrolein	107-02-8	25	2.36E-02	5.60E+02	3.82E+00	yes
Benzene	71-43-2	750	4.50E-02	1.68E+04	7.29E+00	yes
Butadiene (1,3-butadiene)	106-46-7	45000	1.58E-03	1.01E+06	2.57E-01	yes
Ethyl benzene	100-41-4	43500	1.18E-01	9.75E+05	1.91E+01	yes
Formaldehyde	50-00-0	60	8.34E-01	1.34E+03	1.35E+02	yes
Hexane, other isomers	110-54-3	180000	6.62E-01	4.03E+06	1.07E+02	yes
Toluene	108-88-3	37500	4.80E-01	8.40E+05	7.78E+01	yes
o-Xylene	1330-20-7	43400	2.36E-01	9.72E+05	3.82E+01	yes
Naphthalene	91-20-3	5000	5.01E-04	1.12E+05	8.12E-02	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.5	8.36E-04	1.12E+01	1.35E-01	yes
Sulfuric acid	7664-93-9	100	2.10E+00	2.24E+03	3.40E+02	yes
Arsenic & compounds (as As)	7440-38-2	0.25	7.36E-05	5.60E+00	1.19E-02	yes
Beryllium	7440-41-7	0.05	4.42E-06	1.12E+00	7.15E-04	yes
Cadmium	7440-43-9	2	4.05E-04	4.48E+01	6.56E-02	yes
Chromium, metal	7440-47-3	12.5	5.15E-04	2.80E+02	8.35E-02	yes
Cobalt metal, dust & fume (as Co)	7440-48-4	10	3.02E-05	2.24E+02	4.89E-03	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	15	1.80E-04	3.36E+02	2.92E-02	yes
Manganese fume (as Mn)	7439-96-5	100	1.36E-04	2.24E+03	2.21E-02	yes

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Gas Firing

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Mercury vapor	--	5	9.20E-05	1.12E+02	1.49E-02	yes
Nickel (metal)	7440-02-0	25	7.73E-04	5.60E+02	1.25E-01	yes
Ammonia	7664-41-7	1800	1.10E+01	4.03E+04	1.78E+03	yes
Selenium compounds (as Se)	--	20	9.40E-05	4.48E+02	1.52E-02	yes

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Gas Firing

Instructions

Stack Parameter Units:	English	
Stack Height =	150	ft
Minimum Distance from Stack to Property Line =	425	ft
Exhaust Stack Flow Rate =	1,647,235	acfm
Hazard Limiting Values (HLV) Averaging Times =	8-Hour	
Adjustments to the MASC for Time Periods < 8 hrs =	No	

Notes:
Maximum gas firing rate and duct firing rate at 59F. Stack height is an estimate pending completion of ambient air quality impact analysis.

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Acetaldehyde	75-07-0	3600	1.47E-01	8.07E+04	2.39E+01	yes
Acrolein	107-02-8	5	2.36E-02	1.12E+02	3.82E+00	yes
Benzene	71-43-2	150	4.50E-02	3.36E+03	7.29E+00	yes
Butadiene (1,3-butadiene)	106-46-7	9000	1.58E-03	2.02E+05	2.57E-01	yes
Ethyl benzene	100-41-4	8700	1.18E-01	1.95E+05	1.91E+01	yes
Formaldehyde	50-00-0	12	8.34E-01	2.69E+02	1.35E+02	yes
Hexane, other isomers	110-54-3	36000	6.62E-01	8.07E+05	1.07E+02	yes
Toluene	108-88-3	7500	4.80E-01	1.68E+05	7.78E+01	yes
o-Xylene	1330-20-7	8680	2.36E-01	1.94E+05	3.82E+01	yes
Naphthalene	91-20-3	1000	5.01E-04	2.24E+04	8.12E-02	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.1	8.36E-04	2.24E+00	1.35E-01	yes
Sulfuric acid	7664-93-9	20	2.10E+00	4.48E+02	3.40E+02	yes
Arsenic & compounds (as As)	7440-38-2	0.05	7.36E-05	1.12E+00	1.19E-02	yes
Beryllium	7440-41-7	0.01	4.42E-06	2.24E-01	7.15E-04	yes
Cadmium	7440-43-9	0.4	4.05E-04	8.96E+00	6.56E-02	yes
Chromium, metal	7440-47-3	2.5	5.15E-04	5.60E+01	8.35E-02	yes
Cobalt metal, dust & fume (as Co)	7440-48-4	2	3.02E-05	4.48E+01	4.89E-03	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	3	1.80E-04	6.72E+01	2.92E-02	yes
Manganese fume (as Mn)	7439-96-5	20	1.36E-04	4.48E+02	2.21E-02	yes

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Gas Firing

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Mercury vapor	--	1	9.20E-05	2.24E+01	1.49E-02	yes
Nickel (metal)	7440-02-0	5	7.73E-04	1.12E+02	1.25E-01	yes
Ammonia	7664-41-7	360	1.10E+01	8.07E+03	1.78E+03	yes
Selenium compounds (as Se)	--	4	9.40E-05	8.96E+01	1.52E-02	yes

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Oil Firing

Instructions

Stack Parameter Units:	English	
Stack Height =	150	ft
Minimum Distance from Stack to Property Line =	425	ft
Exhaust Stack Flow Rate =	1,706,521	acfm
Hazard Limiting Values (HLV) Averaging Times =	30-Minute	
	No	

Notes:
Maximum oil firing rate at -10 F. Stack height is an estimate pending completion of ambient air quality impact analysis.

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (μg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (μg/m^3)	ASC (μg/m^3)	Complies?
Ammonia	7664-41-7	1800	2.43E+01	3.90E+04	3.80E+03	yes
Benzene	71-43-2	750	1.67E-01	1.63E+04	2.61E+01	yes
Formaldehyde	50-00-0	60	7.00E-01	1.30E+03	1.10E+02	yes
Sulfuric acid	7664-93-9	100	1.90E+00	2.17E+03	2.97E+02	yes
Naphthalene	91-20-3	5000	1.06E-02	1.08E+05	1.66E+00	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.5	1.21E-02	1.08E+01	1.90E+00	yes
Arsenic & compounds (as As)	7440-38-2	0.25	1.39E-04	5.42E+00	2.18E-02	yes
Cadmium	7440-43-9	2	1.55E-05	4.34E+01	2.42E-03	yes
Chromium, metal	7440-47-3	12.5	3.76E-02	2.71E+02	5.87E+00	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	15	3.19E-03	3.25E+02	4.99E-01	yes
Manganese fume (as Mn)	7439-96-5	100	5.47E-04	2.17E+03	8.55E-02	yes
Mercury vapor	--	5	3.10E-05	1.08E+02	4.85E-03	yes
Nickel (metal)	7440-02-0	25	4.48E-03	5.42E+02	7.00E-01	yes
Selenium compounds (as Se)	--	20	7.75E-04	4.34E+02	1.21E-01	yes
Beryllium	7440-41-7	0.05	9.40E-04	1.08E+00	1.47E-01	yes

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Combined Cycle Combustion Turbine Facility - Oil Firing

Instructions

Stack Parameter Units:	English	
Stack Height =	150	ft
Minimum Distance from Stack to Property Line =	425	ft
Exhaust Stack Flow Rate =	1,706,521	acfm
Hazard Limiting Values (HLV) Averaging Times =	8-Hour	
Adjustments to the MASC for Time Periods < 8 hrs =	No	

Notes:
Maximum oil firing rate at -10 F. Stack height is an estimate pending completion of ambient air quality impact analysis.

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (μg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (μg/m^3)	ASC (μg/m^3)	Complies?
Ammonia	7664-41-7	360	2.43E+01	7.80E+03	3.80E+03	yes
Benzene	71-43-2	150	1.67E-01	3.25E+03	2.61E+01	yes
Formaldehyde	50-00-0	12	7.00E-01	2.60E+02	1.10E+02	yes
Sulfuric acid	7664-93-9	20	1.90E+00	4.34E+02	2.97E+02	yes
Naphthalene	91-20-3	1000	1.06E-02	2.17E+04	1.66E+00	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.1	1.21E-02	2.17E+00	1.90E+00	yes
Arsenic & compounds (as As)	7440-38-2	0.05	1.39E-04	1.08E+00	2.18E-02	yes
Cadmium	7440-43-9	0.4	1.55E-05	8.67E+00	2.42E-03	yes
Chromium, metal	7440-47-3	2.5	3.76E-02	5.42E+01	5.87E+00	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	3	3.19E-03	6.50E+01	4.99E-01	yes
Manganese fume (as Mn)	7439-96-5	20	5.47E-04	4.34E+02	8.55E-02	yes
Mercury vapor	--	1	3.10E-05	2.17E+01	4.85E-03	yes
Nickel (metal)	7440-02-0	5	4.48E-03	1.08E+02	7.00E-01	yes
Selenium compounds (as Se)	--	4	7.75E-04	8.67E+01	1.21E-01	yes
Beryllium	7440-41-7	0.01	9.40E-04	2.17E-01	1.47E-01	yes

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Natural Gas Heater

Instructions

Stack Parameter Units:	English	
Stack Height =	10	ft
Minimum Distance from Stack to Property Line =	345	ft
Exhaust Stack Flow Rate =	1,595	acfm
Hazard Limiting Values (HLV) Averaging Times =	30-Minute	
	No	

Notes:
Maximum gas firing rate

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (μg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (μg/m^3)	ASC (μg/m^3)	Complies?
Mercury vapor	107-02-8	25	1.75E-06	4.25E+04	2.93E-01	yes
Benzene	71-43-2	750	1.47E-05	1.27E+06	2.46E+00	yes
o-Dichlorobenzene	106-46-7	45000	8.40E-06	7.64E+07	1.41E+00	yes
Hexan (n-hexane)	110-54-3	18000	1.26E-02	3.06E+07	2.11E+03	yes
Formaldehyde	50-00-0	60	5.18E-04	1.02E+05	8.67E+01	yes
Toluene	108-88-3	37500	2.31E-05	6.37E+07	3.86E+00	yes
Nickel (metal)	7440-02-0	25	1.47E-05	4.25E+04	2.46E+00	yes
Naphthalene	91-20-3	5000	4.34E-06	8.49E+06	7.26E-01	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.5	4.76E-06	8.49E+02	7.96E-01	yes
Sulfuric acid	7664-93-9	100	8.04E-04	1.70E+05	1.34E+02	yes
Arsenic & compounds (as As)	7440-38-2	0.25	1.40E-06	4.25E+02	2.34E-01	yes
Beryllium	7440-41-7	0.05	8.40E-08	8.49E+01	1.41E-02	yes
Cadmium	7440-43-9	2	7.70E-06	3.40E+03	1.29E+00	yes
Chromium, metal	7440-47-3	12.5	9.80E-06	2.12E+04	1.64E+00	yes
Cobalt metal, dust & fume (as Co)	7440-48-4	10	5.74E-07	1.70E+04	9.60E-02	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	15	3.43E-06	2.55E+04	5.74E-01	yes
Manganese fume (as Mn)	7439-96-5	100	2.59E-06	1.70E+05	4.33E-01	yes

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Natural Gas Heater

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Mercury vapor	--	5	2.10E-05	8.49E+03	3.51E+00	yes
Nickel (metal)	7440-02-0	25	1.76E-04	4.25E+04	2.95E+01	yes
			1.09E+01		1.82E+06	

Footnotes

CT DEEP Maximum Allowable Stack Concentration (MASC) Calculator

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Natural Gas Heater

Instructions

Stack Parameter Units:	English	
Stack Height =	10	ft
Minimum Distance from Stack to Property Line =	345	ft
Exhaust Stack Flow Rate =	1,595	acfm
Hazard Limiting Values (HLV) Averaging Times =	8-Hour	
Adjustments to the MASC for Time Periods < 8 hrs =	No	

Notes:
Maximum gas firing rate

Additional HAPs | Clear All | Print | Footnotes

Hazardous Air Pollutant(s)	CAS No.	HLV (µg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (µg/m^3)	ASC (µg/m^3)	Complies?
Mercury vapor	107-02-8	5	1.75E-06	8.49E+03	2.93E-01	yes
Benzene	71-43-2	150	1.47E-05	2.55E+05	2.46E+00	yes
o-Dichlorobenzene	106-46-7	9000	8.40E-06	1.53E+07	1.41E+00	yes
Hexan (n-hexane)	110-54-3	3600	1.26E-02	6.11E+06	2.11E+03	yes
Formaldehyde	50-00-0	12	5.18E-04	2.04E+04	8.67E+01	yes
Toluene	108-88-3	7500	2.31E-05	1.27E+07	3.86E+00	yes
Nickel (metal)	7440-02-0	5	1.47E-05	8.49E+03	2.46E+00	yes
Naphthalene	91-20-3	1000	4.34E-06	1.70E+06	7.26E-01	yes
Polynuclear aromatic hydrocarbons (PAH) *	50-32-8	0.1	4.76E-06	1.70E+02	7.96E-01	yes
Sulfuric acid	7664-93-9	20	8.04E-04	3.40E+04	1.34E+02	yes
Arsenic & compounds (as As)	7440-38-2	0.05	1.40E-06	8.49E+01	2.34E-01	yes
Beryllium	7440-41-7	0.01	8.40E-08	1.70E+01	1.41E-02	yes
Cadmium	7440-43-9	0.4	7.70E-06	6.79E+02	1.29E+00	yes
Chromium, metal	7440-47-3	2.5	9.80E-06	4.25E+03	1.64E+00	yes
Cobalt metal, dust & fume (as Co)	7440-48-4	2	5.74E-07	3.40E+03	9.60E-02	yes
Lead, inorg., fumes & dusts (as Pb)	7439-92-1	3	3.43E-06	5.09E+03	5.74E-01	yes
Manganese fume (as Mn)	7439-96-5	20	2.59E-06	3.40E+04	4.33E-01	yes

Company Name:	NTE Killingly Energy Center, LLC
Source Description:	Natural Gas Heater

Hazardous Air Pollutant(s)	CAS No.	HLV (μg/m^3)	Proposed Allowable Emission Rate (lb/hr)	MASC (μg/m^3)	ASC (μg/m^3)	Complies?
Mercury vapor	--	1	2.10E-05	1.70E+03	3.51E+00	yes
Nickel (metal)	7440-02-0	5	1.76E-04	8.49E+03	2.95E+01	yes
			1.09E+01		1.82E+06	

Footnotes

APPENDIX C – BACT AND LAER UPDATE TABLES

Table C-1: Summary Of Recent NO_x BACT and LAER Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limit(s)
Guernsey Power Station	Guernsey County, OH	10/23/2017	GE 7HA.02	2.0 ppmvdc
Oregon Energy Center	Oregon County, OH	09/27/2017	Siemens SCC6-8000H	2.0 ppmvdc
Trumbull Energy Center	Trumbull County, OH	09/07/2017	Siemens SCC6-8000H	2.0 ppmvdc
Gaines County Power Plant	Gaines County, TX	04/28/2017	Siemens 5000f	2.0 ppmvdc (3-hour avg.)
Archibald Energy Partners	Lackawanna, PA	04/28/2017	GE 7HA.02	2.0 ppmvdc (3-hour avg.)
PSEG Power Connecticut	Bridgeport, CT	04/11/2017	GE 7HA.02	2.0 ppmvdc
Indeck Niles	Cass County, MI	01/04/2017	"H" or "J" class	3.0 ppmvdc (24-hour avg.)
CPV Fairview LLC	Cambria County, PA	9/2/2016	GE 7HA.02	2.0 ppmvdc
Entergy St. Charles Power Station	St. Charles County, LA	08/31/2016	Mitsubishi M501GAC	2.0 ppmvdc
Middlesex Energy Center - Stonegate Power	Sayreville, NJ	7/19/2016	GE 7HA.02	2.0 ppmvdc
Greensville Power Station	Emporia, VA	6/17/2016	Mitsubishi M501J	2.0 ppmvdc
PSE&G Sewaren Generating Station	Sewaren, NJ	4/26/2016	GE 7HA.02	2.0 ppmvdc
Apex Texas Power LLC – Neches Station	Cherokee County TX	3/24/2016	Siemens 5000F or GE 7FA	2.0 ppmvdc

ppmvdc = parts per million by volume, dry basis, corrected to 15% O_2

Table C-2: Summary Of Recent VOC BACT and LAER Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limit(s)
Guernsey Power Station	Guernsey County, OH	10/23/2017	GE 7HA.02	1.0 ppmvdc without DF 2.0 ppmvdc with DF
Oregon Energy Center	Oregon County, OH	09/27/2017	Siemens SCC6-8000H	1.0 ppmvdc without DF 2.0 ppmvdc with DF
Trumbull Energy Center	Trumbull County, OH	09/07/2017	Siemens SCC6-8000H	1.0 ppmvdc without DF 2.0 ppmvdc with DF
Gaines County Power Plant	Gaines County, TX	04/28/2017	Siemens 5000f	3.5 ppmvdc
Archibald Energy Partners	Lackawanna, PA	04/28/2017	GE 7HA.02	2.0 ppmvdc
PSEG Power Connecticut	Bridgeport, CT	04/11/2017	GE 7HA.02	0.7 ppmvdc without DF 1.6 ppmvdc with DF
Indeck Niles	Cass County, MI	01/04/2017	"H" or "J" class	4.0 ppmvdc
CPV Fairview LLC	Cambria County, PA	9/2/2016	GE 7HA.02	1.0 ppmvdc without DF 1.9 ppmvdc with DF
Entergy St. Charles Power Station	St. Charles County, LA	08/31/2016	Mitsubishi M501GAC	2.0 ppmvdc
Middlesex Energy Center - Stonegate Power	Sayreville, NJ	7/19/2016	GE 7HA.02	1.0 ppmvdc without DF 2.0 ppmvdc with DF
Greensville Power Station	Emporia, VA	6/17/2016	Mitsubishi M501J	0.7 ppmvdc without DF 1.4 ppmvdc with DF
PSE&G Sewaren Generating Station	Sewaren, NJ	4/26/2016	GE 7HA.02	1.0 ppmvdc without DF 2.0 ppmvdc with DF
Apex Texas Power LLC – Neches Station	Cherokee County TX	3/24/2016	Siemens 5000F or GE 7FA	2.0 ppmvdc

ppmvdc = parts per million by volume, dry basis, corrected to 15% O_2

Table C-3: Summary Of Recent CO BACT Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limit(s)
Guernsey Power Station	Guernsey County, OH	10/23/2017	GE 7HA.02	2.0 ppmvdc
Oregon Energy Center	Oregon County, OH	09/27/2017	Siemens SCC6-8000H	2.0 ppmvdc
Trumbull Energy Center	Trumbull County, OH	09/07/2017	Siemens SCC6-8000H	2.0 ppmvdc
Gaines County Power Plant	Gaines County, TX	04/28/2017	Siemens 5000f	2.0 ppmvdc
Archibald Energy Partners	Lackawanna, PA	04/28/2017	GE 7HA.02	2.0 ppmvdc
PSEG Power Connecticut	Bridgeport, CT	04/11/2017	GE 7HA.02	0.9 ppmvdc without DF 1.7 ppmvdc with DF
Indeck Niles	Cass County, MI	01/04/2017	"H" or "J" class	4.0 ppmvdc
CPV Fairview LLC	Cambria County, PA	9/2/2016	GE 7HA.02	2.0 ppmvdc
Entergy St. Charles Power Station	St. Charles County, LA	08/31/2016	Mitsubishi M501GAC	2.0 ppmvdc
Middlesex Energy Center - Stonegate Power	Sayreville, NJ	7/19/2016	GE 7HA.02	2.0 ppmvdc
Greensville Power Station	Emporia, VA	6/17/2016	Mitsubishi M501J	1.0 ppmvdc without DF 1.6 ppmvdc with DF
PSE&G Sewaren Generating Station	Sewaren, NJ	4/26/2016	GE 7HA.02	2.0 ppmvdc
Apex Texas Power LLC – Neches Station	Cherokee County TX	3/24/2016	Siemens 5000F or GE 7FA	4.0 ppmvdc

ppmvdc = parts per million by volume, dry basis, corrected to 15% O_2

Table C-4: Summary Of Recent PM/PM_{10}/$PM_{2.5}$ BACT Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limits
Guernsey Power Station	Guernsey County, OH	10/23/2017	GE 7HA.02	0.0073 lb/MMBtuF
Oregon Energy Center	Oregon County, OH	09/27/2017	Siemens SCC6-8000H	0.0060 lb/MMBtu without DF 0.0046 lb/MMBtu with DF
Trumbull Energy Center	Trumbull County, OH	09/07/2017	Siemens SCC6-8000H	0.0060 lb/MMBtu without DF 0.0046 lb/MMBtu with DF
Gaines County Power Plant	Gaines County, TX	04/28/2017	Siemens 5000f	Good combustion practices
Archibald Energy Partners	Lackawanna, PA	04/28/2017	GE 7HA.02	0.0038 lb/MMBtu
PSEG Power Connecticut	Bridgeport, CT	04/11/2017	GE 7HA.02	0.007 lb/MMBtu without DF 0.005 lb/MMBtu with DF
Indeck Niles	Cass County, MI	01/04/2017	"H" or "J" class	19.8 lb/hr
CPV Fairview LLC	Cambria County, PA	9/2/2016	GE 7HA.02	0.0068 lb/MMBtu without DF 0.0050 lb/MMBtu with DF
Entergy St. Charles Power Station	St. Charles County, LA	08/31/2016	Mitsubishi M501GAC	17.52 lb/hr
Middlesex Energy Center - Stonegate Power	Sayreville, NJ	7/19/2016	GE 7HA.02	11.7 lb/hr/unit without DF 18.3 lb/hr/unit with DF
Greensville Power Station	Emporia, VA	6/17/2016	Mitsubishi M501J	9.2 lb/hr/unit and 0.0030 lb/MMBtu without DF 14.1 lb/hr and 0.0039 lb/MMBtu with DF
PSE&G Sewaren Generating Station	Sewaren, NJ	4/26/2016	GE 7HA.02	14.4 lb/hr/unit without DF 22.6 lb/hr/unit with DF
Apex Texas Power LLC – Neches Station	Cherokee County TX	3/24/2016	Siemens 5000F or GE 7FA	19.35 lb/hr/unit

APPENDIX D – DISPERSION MODELING SUPPORTING DOCUMENTATION

Ambient Air Quality Analysis

Killingly Energy Center: Mitsubishi CTG

November 2017

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
°F	degrees Fahrenheit
µg/m³	micrograms per cubic meter
AERMOD	USEPA-approved steady-state air quality dispersion model
the Agencies	United States Forest Service, National Park Service, and United States Fish and Wildlife Service
AQRV	Air Quality Related Value
ARM2	Tier 2 Ambient Ratio Method
BPIP	Building Profile Input Program
Btu/lb	British thermal units per pound
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CTG	combustion turbine generator
DEEP	Connecticut Department of Energy and Environmental Protection
the Facility	Killingly Energy Center, a nominal 550-MW natural gas-fired, combined cycle generating facility located in Killingly, Connecticut
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLM	Federal Land Manager
g/s	grams per second
GEP	good engineering practice
GHG	greenhouse gases
H1H	highest first highest
H2H	highest second highest
H8H	98^{th} percentile
H_2SO_4	sulfuric acid mist
HHV	higher heating value
HRSG	heat recovery steam generator
K	Kelvin
km	kilometers
MADEP	Massachusetts Department of Environmental Protection
m/s	meters per second
Mitsubishi CTG	Mitsubishi Model M501JAC
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAD83	North American Datum of 1983

Acronyms/Abbreviations	Definition
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service
NTE	NTE Connecticut, LLC
O_3	ozone
Pb	lead
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 micrometers or less
ppm	parts per million
PSD	Prevention of Significant Deterioration
RIDEM	Rhode Island Department of Environmental Management
SER	Significant Emission Rate
SIA	Significant Impact Area
Siemens CTG	Siemens Model SGT6-8000H
SILs	Significant Impact Levels
SO_2	sulfur dioxide
STG	steam turbine generator
SUSD	startup and shutdown
tpy	tons per year
ULSD	ultra-low sulfur distillate
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VISCREEN	USEPA-approved plume visibility model
VOC	volatile organic compounds
WCSS	worst-case steady-state

1.0 INTRODUCTION

NTE Connecticut, LLC (NTE) proposes to construct and operate the Killingly Energy Center (the Facility), a nominal 550-megawatt (MW) combined cycle electric generating facility at a site located off Lake Road in the Town of Killingly, Windham County, Connecticut. The proposed Facility will include one combustion turbine generator (CTG), with a supplementary-fired heat recovery steam generator (HRSG), a steam turbine generator (STG), an auxiliary boiler, a natural gas-fired dew point heater, an emergency diesel generator, and an emergency fire pump diesel engine. The Facility will be fired primarily with natural gas, the use of ultra-low sulfur distillate (ULSD) will be incorporated for up to 720 hours per year as the backup fuel, although actual use is expected to be considerably less.

The purpose of this report is to present the air quality dispersion modeling analyses reflecting the change from the use of a Siemens Model SGT6-8000H CTG (Siemens CTG), as authorized under Permit Number 089-0107, to a Mitsubishi Model M501JAC CTG (Mitsubishi CTG). The modeling demonstrates that the Facility will continue to meet Prevention of Significant Deterioration (PSD) requirements for criteria pollutants in association with a minor modification to the existing permit issued by the Connecticut Department of Energy and Environmental Protection (DEEP). The modeling analyses were conducted in accordance with the methodologies used for the modeling analysis of the original Siemens CTG to support issuance of Permit Number 089-017, with updated methodology based on consultation with DEEP.

In addition to this introduction, this report includes:

- A detailed description of the modeling analyses undertaken to evaluate the air quality impacts of the proposed Facility, including: model selection criteria; good engineering practice (GEP) stack height determination and building dimensions for model input; and meteorological data. The methodology remains generally the same as was used for the analysis of the Siemens CTG. The primary stack is in the same location and is 150 feet tall, as was previously the case; other adjustments in layout associated with use of the Mitsubishi CTG are reflected in the modeling inputs presented.
- Description and results of the refined modeling analyses and the ambient air quality compliance assessment. As was the case for the Siemens CTG, the Mitsubishi CTG continues to comply with all National Ambient Air Quality Standards (NAAQS) and PSD increments. In fact, modeling for the Mitsubishi CTG demonstrates generally lower concentrations and smaller associated significant impact areas (SIAs) than the modeling for the Siemens CTG.
- Results of additional PSD analyses such as Class I Area Air Quality Related Values (AQRVs), visibility, growth, and impacts to vegetation and soils. As was the case for the Siemens CTG, the Mitsubishi CTG will not have a significant impact on PSD Class I Area AQRVs or visibility, and will not significantly influence secondary growth in the area.
- References to source documents used in preparing this report and detailed appendices that provide source parameter data; a description of the Facility's building layout and Building Profile Input Program (BPIP) analysis results; detailed AERMOD results data; background inventory source data; VISCREEN results; and detailed soils and vegetation analysis data.

The detailed modeling analysis for the Mitsubishi CTG shows that associated impacts will continue to be protective of public health and the environment, demonstrating compliance with all applicable standards. In fact, air quality impacts for the modified Facility are less than were predicted for use of the Siemens CTG.

2.0 AIR QUALITY IMPACT ASSESSMENT

This section of the modeling report provides details regarding the various inputs to the model. As previously noted, the revised modeling utilizes the same approach as was used for the Siemens CTG, updated to reflect guidance changes that the United States Environmental Protection Agency (USEPA) has implemented since review of the prior application (USEPA 2017). The most current DEEP methodology (DEEP 2009) continues to be used as well, with the modeling approach affirmed through discussions and emails (November 17, 2017 email from Ted Guertin of Tetra Tech to Sam Sampieri of DEEP describing the modeling methodology updates, along with a November 20, 2017 reply email from DEEP confirming approval of the methodology). Each step of the process has been revisited and updated to reflect the most current information with which to evaluate the Mitsubishi CTG.

2.1 GENERAL APPROACH

The Facility is subject to PSD regulations for: carbon monoxide (CO); nitrogen oxides (NO_X); particulate matter (PM); PM with diameters of 10 micrometers or less (PM_{10}); PM with diameters of 2.5 micrometers or less ($PM_{2.5}$); volatile organic compounds (VOC); greenhouse gases (GHG); and sulfuric acid mist (H_2SO_4). Dispersion modeling has been conducted for: CO; nitrogen dioxide (NO_2); PM; PM_{10}; and $PM_{2.5}$ to demonstrate compliance with the NAAQS and PSD increments; for completeness, sulfur dioxide (SO_2) has also been modeled. Since potential emissions of lead (Pb) are less than 0.5% of its Significant Emission Rate (SER), ambient impacts were not evaluated. There are no ambient air quality standards for VOC, GHG, or H_2SO_4.

Consistent with USEPA (2017) and DEEP (2009) guidance, the dispersion modeling for this Facility has been conducted with the USEPA- and DEEP-recommended AERMOD dispersion model (USEPA 2004), in a manner that evaluates worst-case operating conditions in an effort to predict the highest impact for each pollutant and averaging period. Maximum predicted impacts from the worst-case scenarios are compared to the USEPA-established Significant Impact Levels (SILs). If maximum predicted impacts are below the corresponding SILs, then compliance is demonstrated and no additional analysis is necessary. However, if predicted impacts are greater than the SIL for one or more pollutants, a cumulative impact analysis must be conducted with other major emission sources of the pollutant(s) above its SIL in the area, as identified by the DEEP (with DEEP's Radius Search Tool and subsequent correspondence with DEEP) and the agencies for the two neighboring states, the Massachusetts Department of Environmental Protection (MADEP) and the Rhode Island Department of Environmental Management (RIDEM). The results of the cumulative modeling are compared to the NAAQS and to PSD increments. Table 1 provides the SILs, NAAQS and PSD increments along with the modeling rank basis used for assessment of the various thresholds.

Table 1: SILs, NAAQS, and PSD Increments

Pollutant	Averaging Period	Rank for SIL Assessment	SIL ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)	Rank for NAAQS/PSD Assessment
NO_2	1-hour	H1H[1] (5-year Average)	7.5	188	NA	H8H (5-year Average)
	Annual	H1H	1	100	25	H1H
CO	1-hour	H1H	2,000	40,000	NA	H2H
	8-hour	H1H	500	10,000	NA	H2H
PM_{10}	24-hour	H1H	5	150	30	H6H
	Annual	H1H	1	NA	17	H1H
$PM_{2.5}$ (NAAQS)	24-hour	H1H (5-year Average)	1.2	35	NA	H8H (5-year Average)
	Annual	H1H (5-year Average)	0.3	12	NA	H1H (5-year Average)

Pollutant	Averaging Period	Rank for SIL Assessment	SIL (µg/m³)	NAAQS (µg/m³)	PSD Class II Increment (µg/m³)	Rank for NAAQS/PSD Assessment
$PM_{2.5}$ (PSD)	24-hour	H1H	1.2	NA	9	H2H
	Annual	H1H	0.3	NA	4	H1H
SO_2	1-hour	H1H (5-year Average)	7.8	196	NA	H4H (5-year Average)
	3-hour	H1H	25	1,300	512	H2H
	24-hour	H1H	5	365	91	H2H
	Annual	H1H	1	80	20	H1H

[a] µg/m³ =micrograms per cubic meter
[b] H1H = highest first highest; H2H = highest second highest, etc.

The $PM_{2.5}$ SILs were vacated on January 22, 2013 by the United States Court of Appeals for the District of Columbia Circuit (*Sierra Club v. USEPA*). However, as will be discussed in Section 2.8, existing ambient monitoring data representative of ambient background for the Facility area indicate that there is sufficient margin between the ambient background levels and the NAAQS to allow use of the $PM_{2.5}$ SILs as a demonstration of compliance with the NAAQS. The SIL is only approximately 10% of this margin. Predicted Facility impacts below the SILs will ensure protection of the NAAQS and, therefore, the $PM_{2.5}$ SILs are proposed to be used for this analysis.

All electronic modeling files have been provided to DEEP.

2.2 SOURCE DATA AND OPERATING SCENARIOS

The modeling analyses for the Facility include: the CTG/duct burners; the gas dew point heater; the emergency diesel generator; the fire pump diesel engine; and the auxiliary boiler. Air quality dispersion modeling has been conducted for a range of operating scenarios to capture worst-case potential impact concentrations from the CTG. Table 2 summarizes stack characteristics for the HRSG stack and ancillary sources.

Table 2: Stack Characteristics

Source	UTM* E (m)	UTM N (m)	Base Elevation (feet)	Stack Height (feet)	Stack Diameter (feet)
HRSG Stack	257865.36	4638681.24	316	150	22.0
Auxiliary Boiler	257876.13	4638694.43	315	90	4.0
Emergency Generator	257933.57	4638588.99	316	45	1.17
Fire Pump	257825.01	4638585.81	316	20	1.0
Gas Dew Point Heater	257881.81	4638594.65	316	20	2.0

*UTM = Universal Transverse Mercator

The CTG was modeled for the range of expected operating loads (full, mid, and low loads) over the range of expected ambient temperatures (-10 degrees Fahrenheit [°F], 59°F, 100°F). The operating scenarios include inlet air cooling and supplemental firing of the HRSG. The worst-case loads by pollutant and averaging period have been used for Facility-only modeling and, if necessary, cumulative modeling. Turbine transient startup and shutdown (SUSD) conditions have also been considered for short-term averaging period standards of 24 hours and less, and annual averages. Since startup conditions for these turbines generally last for less than 1 hour, the contribution of SUSD to predicted impacts are calculated as a weighted average with worst-case steady-state (WCSS) load impacts according to the following assumptions:

- 1-hour: Full SUSD impacts, no weighting
- 3-hour: Full SUSD impacts, no weighting
- 8-hour: 2/8 SUSD, 6/8 WCSS (conservatively assumes 2 starts and shutdowns per period)
- 24-hour: 4/24 SUSD, 20/24 WCSS (conservatively assumes 4 starts and shutdowns per period)
- Annual: 500/8,760 SUSD, 8,260/8,760 WCSS (conservatively assumes a maximum of 500 hours of SUSD operation)

The natural gas dew point heater will operate simultaneously with the CTG and the modeling analysis assesses their combined operation. The auxiliary boiler will typically operate to provide sealing steam to the STG during startups and it will not operate simultaneously with the CTG except for brief periods of overlap. The diesel generator and fire pump engines will each be limited to 300 hours per year or 500 hours per year combined (both engines); however, they will typically only be operated for testing one time per week for 1 hour or less. The auxiliary boiler has been evaluated for all averaging periods. The emergency engines were considered for all averaging periods with the exception of the 1-hour NO_2 and 1-hour SO_2 statistical-based standards. Consistent with USEPA guidance (USEPA 2011), the engines were excluded from the modeling for the 1-hour NO_2 and 1-hour SO_2 statistical-based standards, since they are "intermittent" based on the guidance. Emissions for the engines were normalized for periods longer than 1 hour to reflect typical test operations. Engine emission rates for the 3-hour, 8-hour, and 24-hour averaging periods have been scaled by 1/3, 1/8, and 1/24 hours, respectively.

Tables 3 and 4 provide emission rates and stack parameters that bracket the full range of normal operating loads for natural gas-fired and ULSD-fired conditions, respectively.

Table 5 provides worst-case emission rates and stack parameters under startup conditions. The startup parameters are based on worst-case emissions and stack parameters considering the hot start, warm start, and cold startup conditions, as well as shutdown conditions.

Table 6 provides the stack parameters for the gas dew point heater, emergency diesel generator, fire pump engine, and the auxiliary boiler.

The CTG was first modeled alone to determine worst-case load conditions for each pollutant and averaging period. The CTG under worst-case load conditions was then modeled in combination with the ancillary units to determine total Facility impacts.

2.3 MODEL SELECTION

The USEPA-recommended AERMOD modeling system (USEPA 2004) has been used to conduct the dispersion modeling. The most current versions of the model have been used (AERMOD version 16216r, AERMAP version 11103).

2.4 METEOROLOGICAL DATA

The modeling has been conducted using five years (2012-2016) of meteorological data processed and provided by DEEP. The data was processed with the latest version of AERMET (version 16216) and includes use of the ADJ_U* option.[1] The surface data are from the Windham Airport in Windham, Connecticut and the corresponding upper air data are from Albany, New York. The surface station is located approximately 25.7 kilometers (km) (16 miles) southwest of the Facility site. It is representative of the Facility site area because of its relatively close proximity and similar distance from the coastline with no significant intervening terrain. A windrose plot describing the wind speed and wind direction frequency distribution for these data is provided in Figure 1.

[1] Adjustment to the surface frictional velocity to improve model performance during period of low-wind/stable meteorological conditions.

Table 3: Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing Natural Gas

Parameter	Units	Natural Gas										
		100 °F				59°F				-10°F		
		1	2	4	5	36	37	39	40	33	34	35
GT Operating Load		100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%
Fuel Higher Heating Value (HHV)	Btu/lb	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112
Evaporative Cooler Status	On or Off	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	On or Off	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Exhaust velocity	m/s	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47
Exhaust temperature	K	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15
NO_X	g/s	3.569	3.192	2.449	2.025	3.762	3.422	2.675	2.085	3.477	3.121	2.375
CO	g/s	1.847	0.874	0.671	0.555	1.947	0.937	0.733	0.571	0.953	0.855	0.650
PM	g/s	1.600	0.882	0.693	0.592	1.600	0.958	0.756	0.605	0.970	0.882	0.706
SO_2	g/s	0.727	0.650	0.499	0.412	0.766	0.697	0.545	0.424	0.708	0.635	0.483
Btu/lb = British thermal units per pound; g/s = grams per second; K = degrees Kelvin												

Table 4: Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing ULSD

Parameter	Units	ULSD								
		100 °F			59°F			-10°F		
		2	3	4	28	14	15	25	29	30
GT Operating Load		100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, HHV	Btu/lb	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status	On or Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	On or Off	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Exhaust velocity	m/s	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature	K	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
NO_X	g/s	5.872	4.826	4.208	5.947	4.813	4.259	5.947	5.437	4.656
CO	g/s	1.613	1.323	1.159	1.814	1.462	1.285	1.814	1.651	1.411
PM	g/s	3.188	2.558	2.167	3.604	2.822	2.482	3.490	3.478	2.948
SO_2	g/s	0.509	0.421	0.368	0.573	0.464	0.411	0.573	0.524	0.449

Table 5: Startup Condition Stack Parameters for Each Fuel

Parameter	Units	Startup / Shutdown							
		Natural Gas				ULSD			
		Hot Start	Warm Start	Cold Start	Shutdown	Hot Start	Warm Start	Cold Start	Shutdown
Exhaust velocity	m/s	14.34	13.55	13.53	16.83	14.71	14.24	14.22	17.33
Exhaust temperature	K	358.38	357.83	356.91	356.50	364.27	362.76	361.80	363.48
NO_X	g/s	18.47	18.82	18.82	9.83	24.82	25.53	25.53	20.41
CO	g/s	45.20	45.25	50.79	26.61	290.77	290.93	290.93	53.94
PM	g/s	1.13	1.07	1.07	1.13	4.14	4.00	4.00	4.46
SO_2	g/s	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41
m/s = meters per second									

Table 6: Stack Parameters for Ancillary Equipment

Parameter	Time	Auxiliary Boiler	Emergency Generator	Fire Pump	Natural Gas Heater
Exhaust velocity (m/s)		8.29	49.99	9.06	4.24
Exhaust temperature (K)		422.04	722.04	789.26	394.26
NO_X (g/s)	1-hour	9.00E-02	2.45	2.53E-01	1.06E-02
	Annual	4.72E-02	8.40E-02	8.66E-03	4.83E-03
CO (g/s)	1-hour	3.91E-01	1.34	2.21E-01	3.26E-02
	8-hour	3.91E-01	1.68E-01	2.76E-02	3.26E-02
PM (g/s)	1-hour	5.29E-02	7.66E-02	1.26E-02	4.41E-03
	24-hour	5.29E-02	3.19E-03	5.27E-04	4.41E-03
	Annual	2.78E-02	2.62E-03	4.33E-04	2.01E-03
SO_2 (g/s)	1-hour	1.59E-02	2.37E-03	3.81E-04	1.32E-03
	3-hour	1.59E-02	7.90E-04	1.27E-04	1.32E-03
	24-hour	1.59E-02	9.88E-05	1.59E-05	1.32E-03
	Annual	8.34E-03	8.12E-05	1.30E-05	6.04E-04

2.5 LAND USE

A land use determination has been made following the classification technique suggested by Auer (Auer 1978) in accordance with USEPA/DEEP modeling guidance. The classification technique was conducted to determine the predominant land use (urban versus rural) in the area for the dispersion characteristics, by assessing land use categories within a 3-km radius of the proposed site. Figure 2 provides an aerial view of the 3-km radius around the proposed Facility site. Inspection of this aerial photo, other maps, and on-site inspection, indicates that the large majority of the area is characterized as rural. Therefore, rural dispersion coefficients have been used for the air quality modeling.

2.6 GOOD ENGINEERING PRACTICE STACK HEIGHT ANALYSIS

A GEP stack height analysis has been performed based on the Facility structures to determine the potential for building-induced aerodynamic downwash for the proposed stack. The analysis procedures described in USEPA's Guidelines for Determination of Good Engineering Practice Stack Height (USEPA 1985) and DEEP guidance (DEEP 2009) have been used.

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground-level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamic downwash is avoided, and the maximum stack height[2] that can be used in modeling analyses. The GEP formula stack height, as defined in the 1985 guidelines, is calculated as follows:

$$H_{GEP} = H_{BLDG} + 1.5L$$

Where:

- H_{GEP} is the calculated GEP formula height;
- H_{BLDG} is the height of the nearby structure; and
- L is the lesser dimension (height or projected width) of the nearby structure.

Both the height and width of the structure are determined from the frontal area of the structure projected onto the plane perpendicular to the direction of the wind. The GEP stack height is based on the plane projected from any structure that results in the greatest calculated height. For the purpose of the GEP analysis, nearby refers to the “sphere of influence” defined as 5 times L (the lesser dimension [height or projected width] of the nearby structure), downwind from the trailing edge of the structure.

In order to minimize visual impact, the HRSG stack height for the Facility will be limited to 150 feet, which is less than the GEP height. Therefore, the USEPA’s BPIP (Dated: 04274) version that is appropriate for use with the PRIME algorithms in AERMOD was used. The building dimensions and coordinates for each potentially influencing structure were input into the BPIPPRM program to determine direction-specific building data for input to AERMOD. The PRIME algorithms calculate the entire configuration of the structure’s wake from the cavity immediately downwind of the structure to the far wake to evaluate downwash effects in the modeling. Schematic diagrams, which describe the Facility building configuration along with the BPIP input and output data, are provided in Appendix B.

2.7 RECEPTOR GRID AND AERMAP PROCESSING

Discrete receptors were placed at 25-meter intervals along the Facility fence line. In addition, a nested Cartesian grid was extended out from the fence line at the following receptor intervals and distances:

- At 50-meter intervals from the fence line to 300 meters;
- At 100-meter intervals from the 300 meters to 2,000 meters;
- At 500-meter intervals from 2,000 to 5,000 meters;
- At 1,000-meter intervals from 5,000 to 10,000 meters; and
- At 2,000-meter intervals from 10,000 to 20,000 meters.

Terrain elevations at receptors were determined using Lakes Environmental’s AERMOD View program and United States Geological Survey (USGS) digital terrain data. AERMOD View implements the AERMAP model, which includes processing routines that extract National Elevation Data at 10-meter spacing based on North American Datum of 1983 (NAD83). The four nearest data points surrounding each receptor have been used to determine receptor terrain elevations (by interpolation) for air quality model input.

For any cases where the maximum model concentrations were predicted beyond the dense (50-meter intervals) portion of the grid, supplemental receptors were placed around the initial maximum location (at a 50-meter grid spacing interval) to ensure higher concentrations were not overlooked.

[2] The maximum stack height a modeling analysis can take credit for is the greater of 65 meters or the GEP formula stack height.

2.8 AMBIENT BACKGROUND DATA

As previously stated, if AERMOD-predicted maximum-impact concentrations are greater than a SIL for any pollutant/averaging time, then multi-source modeling is required to be conducted for that pollutant/averaging time. In the multi-source modeling analysis, representative ambient air quality background concentrations are added to modeled concentrations from the cumulative modeling to compare against the NAAQS. Representative ambient air quality data and the selected background concentrations that were used in the compliance assessment are provided in Table 7.

Table 7: Ambient Air Quality Monitoring Data and Selected Background Concentrations*

Pollutant	Averaging Period	Rank	Background Concentration ($\mu g/m^3$)
CO	1-hour	2nd high	1600.0
	8-hour	2nd high	1259.5
NO_2	1-hour	98th percentile	84.6
	Annual	Mean	16.9
$PM_{2.5}$	24-hour	98th percentile	18
	Annual	Mean	7.1
PM_{10}	24-hour	2nd high	30
SO_2	1-hour	99th percentile	13.1
	3-hour	2nd high	21.0
	24-hour	2nd high	10.2
	Annual	Mean	1.9

*All monitoring data collected at McAuliffe Park, East Hartford, CT (ID# 09-009-1003).

DEEP monitoring data, as well as monitoring data from neighboring states, were reviewed to identify representative monitoring sites and determine ambient background concentrations for the Facility area. The monitoring site selections considered proximity to the Facility area, and similarity of the monitoring site environment to the relatively rural Facility site area.

As required by DEEP, the ambient data for all pollutants comes from the McAuliffe Park monitor located in East Hartford. This monitoring site is suburban/residential in character and is located just 120 meters east of Route 5; 2.0 km east of I-91; and 2.5 km south of I-291. Therefore, the data from the monitoring site are conservatively representative of ambient background concentrations for the relatively rural Facility area, with Interstate 395 located approximately 2.5 km east of the Facility site. Therefore, for the purposes of this analysis, the ambient monitoring data presented in Table 7 are considered conservatively representative of the Facility area ambient background.

2.9 POTENTIAL SECONDARY $PM_{2.5}$ FORMATION ASSESSMENT

The analysis of $PM_{2.5}$ impacts is consistent with recent USEPA guidance on $PM_{2.5}$ permit modeling (USEPA 2013). Since the Facility has an annual potential-to-emit of direct $PM_{2.5}$ and NO_x both greater than their respective SER thresholds, air quality impacts from both primary and secondary $PM_{2.5}$ emissions were assessed. Impacts of primary $PM_{2.5}$ emissions have been determined with dispersion modeling using AERMOD. The guidance indicates that the

Facility falls in the Case 3 Assessment category, where secondary $PM_{2.5}$ can be assessed by either a qualitative, hybrid qualitative/quantitative, or full quantitative approach.

The qualitative approach is appropriate for the Facility for the following reasons:

- Model-predicted impacts indicate maximum primary $PM_{2.5}$ impacts will be located very close to the Facility (either at the Facility fence line or within a few hundred meters of the fence line). Secondary $PM_{2.5}$ impacts are expected to be very low (negligible) in the vicinity of areas where model-predicted primary $PM_{2.5}$ impacts are highest, because there is not enough time for secondary chemical reactions to occur. Conversely, what limited secondary $PM_{2.5}$ emissions may form will occur several miles from the Facility site and where the primary $PM_{2.5}$ impacts will be lowest. This makes it highly unlikely that maximum $PM_{2.5}$ primary and secondary impacts will occur at the same time and place.
- There will be a relatively small amount of $PM_{2.5}$ precursor emissions from the Facility when compared to the existing source emissions in the region, especially for SO_2, where Facility emissions are less than the SER threshold.
- The ambient background $PM_{2.5}$ monitoring data are quality assured and account for secondary $PM_{2.5}$ from regional emission sources. There is no indication that secondary formation of $PM_{2.5}$ from existing regional sources is causing or contributing to a violation of the NAAQS.
- RIDEM's Francis School monitor (USEPA AIRS monitor 44-007-1010) located in Providence, RI is the closest $PM_{2.5}$ monitor that also has speciation data available. These speciated $PM_{2.5}$ data were reviewed and it was determined that, over the last three-year period (2014-2016), the fraction of total nitrate to total $PM_{2.5}$ is just 9.3% on an average annual basis. Given that the proposed NO_x emissions for the Facility are a small fraction of the NO_x emissions in the airshed, and that the ambient monitoring data show relatively small fractions of nitrates, secondary $PM_{2.5}$ formation from the proposed NO_x emissions would be expected to be considerably smaller than the monitored concentration of nitrates. The monitoring information supports the conclusion that the secondary $PM_{2.5}$ formation will be negligible and would not be expected to cause a NAAQS or PSD increment exceedance.

For the reasons stated above, emissions of $PM_{2.5}$ precursors from the Facility, together with emissions of primary $PM_{2.5}$, will not cause or contribute to violations of the $PM_{2.5}$ NAAQS. Given this result, detailed quantification of secondary $PM_{2.5}$ is not necessary.

3.0 FACILITY MODELING ANALYSIS

This section provides details regarding the modeling analysis for the Mitsubishi CTG. As was the case for the Siemens CTG, Facility-related impacts are below SILs for all pollutants and average periods except 1-hour NO_2 and 24-hour $PM_{2.5}$. Therefore, compliance with NAAQS and PSD increments is demonstrated for all other parameters without the need for additional analysis. Even for 1-hour NO_2 and 24-hour $PM_{2.5}$, the area over which impacts exceeded the SILs was modeled to be smaller than for the Siemens CTG, reducing from 12.9 km to 12.1 km for 1-hour NO_2 and from 8.1 km to 0.7 km for 24-hour $PM_{2.5}$.

Although modeling methodologies would allow reducing the radius for considering cumulative sources based on these modeling results, the same cumulative sources were considered in this analysis for conservatism even when the smaller SIA would not require their inclusion in accordance with modeling methodologies. As was the case for the Siemens CTG, the cumulative modeling for the Facility continues to demonstrate compliance with NAAQS and PSD increments with the Mitsubishi CTG. In fact, air quality impacts for the modified Facility are less than were predicted for use of the Siemens CTG.

3.1 FACILITY IMPACT ASSESSMENT

The modeling analysis has been conducted using AERMOD along with the set of representative meteorological data as described in Section 2.4. The analysis was conducted to demonstrate compliance with the NAAQS and PSD increments. If maximum impacts from the Facility's criteria pollutant emissions are predicted to exceed their associated SILs, shown in Table 1, a refined cumulative modeling analysis with additional major sources was conducted to determine compliance with the NAAQS and PSD increments. The full range of CTG operating conditions described in Table 3 through Table 5 was evaluated to determine worst-case loads (highest impact concentrations) for each pollutant and averaging period. Detailed results of this analysis are provided in Appendix C.

The CTG under worst-case load conditions was then modeled along with the other Facility emissions sources (natural gas dew point heater, emergency generator, fire pump engine, and auxiliary boiler) to determine total Facility impacts. Note that the auxiliary boiler will not operate simultaneously with the turbines, except for brief periods during startup. The case of a CTG in startup mode along with the auxiliary boiler operating has been assessed with modeling. Operation of the CTG simultaneously with the natural gas dew point heater, emergency generator, and fire pump engine has also been assessed. Normalized emission rates corresponding with short-term and annual operation, as shown in Table 6, were used for the assessment of standards.

The NO_2 impact analysis is consistent with the approach outlined in the USEPA guidance on 1-hour NO_2 dispersion modeling as described in the recently updated Guideline on Air Quality Models (USEPA 2017). The Tier 2 Ambient Ratio Method (ARM2) with default NO_2/NO_X ambient ratios (minimum ratio of 0.5 and maximum ratio of 0.9) have been applied. Also consistent with the USEPA guidance, the emergency generator engine and emergency fire pump engine have been excluded from the statistical-based 1-hour NO_2 and 1-hour SO_2 analyses as "intermittent" sources. These units will be permitted to operate up to 300 hours per year per engine or up to 500 hours per year for both engines combined; however, absent emergencies, actual operations are expected to be less than 52 hours per year each since they will typically only be operated for testing one time per week for less than 1 hour. In addition, the SUSD conditions for the turbine will be limited to 500 hours per year, but actual SUSD operation is expected to be much less. Therefore, assessment of the 1-hour NO_2 NAAQS for transient turbine SUSD conditions consists of adding ambient background to the maximum predicted Facility-only concentrations (98th percentile [H8H] of the daily maximum 1-hour concentration averaged over 5 years). No comparison with the SIL or cumulative modeling is conducted for 1-hour NO_2 for SUSD conditions, since these conditions are intermittent and do not occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations on which the 1-hour NO_2 standard is based.

Table 8: Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Rank Basis for SIL Assessment	Impact Concentration (µg/m³)	SIL (µg/m³)	Extent of SIA (km)	NAAQS (µg/m³)	PSD Class II Increment (µg/m³)
NO_2 (Normal Load)	1-hour	H1H (5-year Average)	11.28	7.5	12.06	188	NA
	Annual	H1H	0.90	1	NA	100	25
NO_2 (SUSD)	1-hour	H1H (5-year Average)	65.45	NA	NA	188	NA
	Annual	H1H	0.91	NA	NA	100	25
CO	1-hour	H1H	862.94	2,000	NA	40,000	NA
	8-hour	H1H	102.36	500	NA	10,000	NA
PM_{10}	24-hour	H1H	2.11	5	NA	150	30
	Annual	H1H	0.19	1	NA	NA	17
$PM_{2.5}$ (NAAQS)	24-hour	H1H (5-year Average)	1.80	1.2	0.5	35	NA
	Annual	H1H (5-year Average)	0.17	0.2	NA	12	NA
$PM_{2.5}$ (PSD)	24-hour	H1H	2.11	1.2	0.7	NA	9
	Annual	H1H	0.19	0.2	NA	NA	4
SO_2	1-hour	H1H (5-year Average)	1.80	7.8	NA	196	NA
	3-hour	H1H	1.29	25	NA	1300	512
	24-hour	H1H	0.63	5	NA	365	91
	Annual	H1H	0.05	1	NA	80	20

Notes:
Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum 5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentrations prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

SIA = Significant Impact Area, defined as a circle with a radius equal to the distance to the furthest receptor for which the maximum predicted impact exceeds the SIL.

The AERMOD results for the Facility are summarized in Table 8. Detailed results for the analyses are also provided in Appendix C. As shown in Table 8, maximum predicted impact concentrations are less than SILs for all pollutants except 1-hour NO_2 and 24-hour $PM_{2.5}$. Compliance with NAAQS and PSD increments is, therefore, demonstrated for pollutants with predicted impacts less than the SIL. Because of these results, no additional modeling for these pollutants is necessary.

Cumulative modeling has been conducted for pollutants with Facility impacts that exceed their respective SILs (1-hour NO_2 and 24-hour $PM_{2.5}$) to demonstrate compliance with the 1-hour NO_2 NAAQS[3] and 24-hour $PM_{2.5}$ NAAQS and PSD increments, as described in Section 3.2.

3.2 CUMULATIVE IMPACT MODELING

As described in Section 3.1, maximum predicted impact concentrations for 1-hour NO_2 and 24-hour $PM_{2.5}$ exceed their respective SILs. Therefore, a cumulative modeling analysis including other regional emissions sources and existing ambient background concentrations has been conducted for these pollutants and averaging periods. The source inventory was based on the DEEP Radius Search Tool for 2008 Air Emissions Inventory Data, provided by DEEP. The Radius Search Tool was used to develop an inventory of sources located within 50 km of the Facility site. DEEP guidance, based on distance and actual annual emissions levels, was used to select from the inventory the specific sources to be included in the cumulative modeling assessment. Consultation with MADEP and RIDEM also occurred to identify appropriate source information in those respective states.

Five background NO_X sources met the DEEP criteria for inclusion in the cumulative 1-hour NO_2 NAAQS analysis; two background sources of $PM_{2.5}$ met the criteria for inclusion in the cumulative 24-hour $PM_{2.5}$ NAAQS analysis; and one background source met the criteria for inclusion in the 24-hour $PM_{2.5}$ PSD increment assessment. As discussed in Section 3.1, there is no PSD increment for 1-hour NO_2.

The sources modeled cumulatively with the Facility are as follows:

<u>NO_2 NAAQS Interactive Modeling Sources</u>

- Lake Road Generating Co., LLC, Killingly Connecticut; distance from Facility = 2.0 km
  - Combustion Turbine #1 – Actual NO_x = 20.6 tons per year (tpy)
  - Combustion Turbine #2 – Actual NO_x = 30.0 tpy
  - Combustion Turbine #3 – Actual NO_x = 26.6 tpy
- Exeter Energy L.P., Sterling Connecticut; distance from Facility = 18.7 km
  - Standard Kessl Inc./Blr #1, Actual NO_x = 45.8 tpy
  - Standard Kessl Inc./Blr #2, Actual NO_x = 50.8 tpy
- Wheelabrator Millbury, Inc., Millbury Massachusetts; distance from Facility = 41.4 km
  - B&W Incinerator #1/#2 – Actual NO_x = 824 tpy

[3] Note that there is no PSD increment for 1-hour NO_2, so no increment assessment is necessary for this pollutant/averaging period.

- Algonquin Gas Compressor Station, Burrillville, Rhode Island; distance from Facility = 17.7 km - Existing and Proposed Expansion
  - Actual NO_x = 18.0 tpy
  - Proposed Emission Increases NO_x = 18.0 tpy
  - Three Clark TLA-8 Engines (existing)
  - Five Combustion Turbines (3 existing / 2 proposed)

Note that the Gas Compressor Station facility no longer technically meets the criteria for inclusion in the cumulative NO_2 analysis since it falls outside of the updated SIA. However, the facility is conservatively included in the analysis for consistency with the previous analysis.

- Invenergy Clean River Energy Center (proposed), Burrillville, Rhode Island; distance from Facility = 17.7 km
  - Potential NO_x = 286.6 tpy, Potential $PM_{2.5}$ = 196.8 tpy
  - Two Combined Cycle Combustion Turbines (proposed)

$PM_{2.5}$ Interactive Modeling Sources

- Lake Road Generating Co., LLC, Killingly Connecticut; distance from Facility = 2.0 km ($PM_{2.5}$ NAAQS only; constructed before PSD baseline date)
  - Combustion Turbine #1 – Actual $PM_{2.5}$ = 23.1 tpy
  - Combustion Turbine #2 – Actual $PM_{2.5}$ = 12.5 tpy
  - Combustion Turbine #3 – Actual $PM_{2.5}$ = 9 tpy

Note that the Lake Road Generating facility no longer technically meets the criteria for inclusion in the cumulative $PM_{2.5}$ analysis since it falls outside of the updated SIA. However, the facility is included in the analysis due to its relatively close proximity to the Facility and for consistency with the previous analysis.

- Invenergy Clean River Energy Center (proposed), Burrillville, Rhode Island (proposed project); distance from Facility = 17.7 km
  ($PM_{2.5}$ NAAQS and PSD)
  - Distance from Facility = 17.7 km
  - Potential $PM_{2.5}$ = 196.8 tpy
  - Two Combined Cycle Combustion Turbines (proposed)

Detailed emissions and stack parameter data for these sources are provided in Appendix D, along with details on the source inventory selection criteria.

Table 9 presents the results of the NAAQS compliance assessment. This assessment includes the predicted cumulative impacts of the Facility and background inventory sources plus representative ambient background concentrations for all receptors and time periods where the Facility has a significant impact. As shown in Table 9, the resulting total concentrations are less than the corresponding NAAQS concentrations for all pollutants. Detailed results of the modeling analysis are provided in Appendix C.

Table 9: Cumulative NAAQS Compliance Assessment

Pollutant	Averaging Period	Rank Basis for NAAQSL Assessment	Cumulative Impact Concentration (µg/m³)	Ambient Background (µg/m³)	Total Impact Plus Background (µg/m³)	NAAQS (µg/m³)
NO_2 (Normal Load)	1-Hour	H8H (5-year Average)	8.73	84.6	93.33	188
NO_2 (SUSD)	1-Hour	H8H (5-year Average)	50.32	84.6	134.92	188
$PM_{2.5}$	24-hour	H8H (5-year Average)	1.46	18	19.46	35

Notes:

- Total cumulative impact concentrations based on consideration of all receptors and time periods where the Facility has a predicted significant impact concentration (based on 5-year average maximum H1H for 1-hour NO_2 and 24-hour $PM_{2.5}$).
- NO_2 concentrations assume NO_X to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9).
- Assessment of the 1-hour NO_2 NAAQS for the transient turbine SUSD conditions consists of adding ambient background to Facility-only concentrations.

3.3 PSD INCREMENT CONSUMPTION ANALYSIS

The PSD program requires a demonstration that the proposed Facility, in combination with other PSD increment-consuming emission sources (as described in Section 3.2), will comply with the maximum allowable PSD increment. PSD increments prevent the air quality in areas that meet NAAQS from deteriorating to the level set by the NAAQS. The NAAQS is a maximum allowable concentration "ceiling." A PSD increment, on the other hand, is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time that the first complete PSD permit application affecting the area is submitted.

A PSD increment analysis was conducted for 24-hour $PM_{2.5}$, which is the only pollutant/averaging time for which a PSD increment has been set and for which Facility impacts exceed the respective SIL.

Table 10 presents the results of the PSD increment compliance assessment for 24-hour $PM_{2.5}$. As shown, the cumulative impacts of the Facility and the proposed Invenergy Clean River Energy Center (the only other PSD increment-consuming source in the area) are less than the available increment. Detailed results for the analysis are also provided in Appendix C.

Table 10: Cumulative PSD Increment Compliance Assessment

Pollutant	Averaging Period	Total Increment Consumption[1] (µg/m³)	Maximum Allowable PSD Increment (µg/m³)
$PM_{2.5}$	24-hour	1.98	9

[1] Impact concentrations are conservatively based on the maximum highest second highest (H2H) concentration predicted across the range of modeled years.

4.0 EVALUATION OF ADDITIONAL IMPACTS

This section, in accordance with PSD regulations, evaluates the additional impacts involving air quality modeling that must be addressed for projects subject to PSD review. As was the case for the Siemens CTG, the Mitsubishi CTG continues to demonstrate compliance and reflect no meaningful impact in association with the additional impacts assessed.

4.1 CLASS I AREA AIR QUALITY RELATED VALUES

The nearest PSD Class I Areas to the Facility are as follows:

- Lye Brook National Wilderness Area, Vermont – located approximately 160 km from the Facility.
- Presidential Range – Dry River National Wilderness Area, New Hampshire – located approximately 250 km from the Facility.

The Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) has implemented initial screening criteria to determine whether impacts to Class I Areas from sources greater than 50 km away would be considered negligible for all AQRVs, including visibility. The screening criteria are detailed in FLAG's October 2010 Phase I Report (United States Forest Service [USFS] et al. 2010). The FLAG Phase I Report was produced as a collaborative report by the FLMs in the USFS, National Park Service (NPS), and United States Fish and Wildlife Service (USFWS) (collectively "the Agencies"). The details of the screening criteria are given below.

> *…the Agencies will consider a source locating greater than 50 km from a Class I area to have negligible impacts with respect to Class I AQRVs if its total SO_2, NO_X, PM_{10}, and H_2SO_4 [sulfuric acid] annual emissions (in tons per year, based on 24-hour maximum allowable emissions), divided by the distance (in km) from the Class I area (Q/D) is 10 or less. The Agencies would not request any further Class I AQRV impact analyses from such sources* (USFS et al. 2010).

The combined annual potential-to-emit for SO_2, NO_x, PM_{10}, and H_2SO_4 for the Facility (based on 24-hour maximum emissions) is approximately 360.3 tpy. The approximate distance to the Lye Brook National Wilderness Area, the closer of the two PSD Class I Areas, is 160 km. The resulting Q/D value of 2.3 is well below the screening level of 10. Therefore, no additional analysis of Class I Area impacts is required for the Facility.

4.2 VISIBILITY

The Facility will comply with the particulate matter and visible emissions requirements specified in Section 22a-174-18 of the Regulations of Connecticut State Agencies. Compliance with these regulations will address the intent of the PSD plume blight visibility requirements.

The VISCREEN model was used to assess potential visibility impacts at the closest Class I Area, the Lye Brook National Wilderness Area (160 km away). The Facility's maximum potential emissions were used in the analysis. The results (provided in Appendix E) indicate that the visibility impairment related to the Facility's plume will not exceed threshold criteria.

4.3 SOILS AND VEGETATION

The USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980), established a screening methodology for comparing air quality modeling impacts to "vegetation sensitivity thresholds." These methods were used to evaluate potential impacts on vegetation and soils.

4.3.1 Vegetation Assessment

As an indication of whether emissions from the Facility will significantly impact the surrounding vegetation (i.e., cause acute or chronic exposure to each evaluated pollutant), the model predicted impact concentrations are compared against both a range of injury thresholds found in the guidance, as well as those established by the NAAQS secondary standards.

The dominant upland vegetative cover types for the portion of the Facility site located north of Lake Road (where the Facility is proposed) are maturing, second-growth deciduous-evergreen forest, evergreen (white pine dominated) forest, and pioneer, pole-sized evergreen dominated forest. The latter occurs in the areas closer to Lake Road, historically used for agriculture (e.g., pasture, fruit tree grove, hayfield, etc.). This portion of the Facility site includes wetland areas that are dominated by both deciduous and evergreen cover types (red maple dominates the interior and white pine-hemlock dominates the margins), along with a significant ground cover of sedges and sphagnum mosses

The small portion of the Facility site located south of Lake Road is mostly in post-agricultural deciduous woods and shrub tangles, on moderately to gently sloping land, with a mowed field on nearly level topography within its northernmost section. The majority of this portion of the site is upland, with limited wetland areas located along the parcel's eastern property boundary, mostly off-site and within the electric transmission line right-of-way. These wetlands are dominated by scrub-shrub and emergent (i.e., wet meadow) cover types.

The species prevalent in the area do not represent vegetation that would be expected to be more sensitive than those used by USEPA to establish the screening concentrations provided in Tables 11 through 13.

As an indication of whether emissions from the proposed Facility will significantly impact (i.e., cause acute or chronic exposure to each evaluated pollutant) any surrounding vegetation with commercial or recreational value, the modeled emission concentrations are compared against both a range of injury thresholds found in the guidance and appropriate literature, as well as those established by the NAAQS secondary standards. Since the NAAQS secondary standards were set to protect public welfare, including protection against damage to crops and vegetation, comparing modeled emissions to these standards will provide some indication if potential impacts are likely to be significant. Tables 11 through 13 list the Facility impact concentrations and compare them to the vegetation sensitivity thresholds and NAAQS secondary standards. All pollutant concentrations are well below the vegetation sensitivity thresholds.

Table 11: Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Maximum Facility Impacts (µg/m³)	Threshold for Impact to Vegetation (µg/m³)	Applicability
1-hour	65.45	66,000[a]	Leaf Injury to plant
2-hour	65.45	1,130[b]	Affects to alfalfa
Annual	0.91	100[c]	Protects all vegetation
		190[d]	Metabolic and growth impact to plants

[a] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976.

[b] "Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of SO_2 and NO_2" Environmental Science and Technology, vol. 8(6): p.574-576, 1975. The limit is based on a concentration in ambient air of 0.6 ppm NO_2 (1,130 µg/m³) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

[c] "Secondary National Ambient Air Quality Standard (µg/m³) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[d] "Air Quality Criteria for Oxides of Nitrogen," EPA/600/8-91/049aF-cF.3v, Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1993.

Table 12: Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Maximum Facility Impacts (µg/m³)	Threshold for Impact to Vegetation (µg/m³)	Applicability
1-hour	862.94	40,000[a]	Protects all vegetation
8-hour	102.36	10,000[a]	Protects all vegetation
Multiple day		10,000[b]	No known effects to vegetation
1-week		115,000[c]	Effects to some vegetation
Multiple week		115,000[d]	No effect on various plant species

[a] Secondary NAAQS (µg/m³) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[b] "Air Quality Criteria for Carbon Monoxide," EPA/600/8-90/045F (NTIS PB93-167492), Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1991. Various CO concentrations were examined the lowest of these was 10,000 µg/m³. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 µg/m³ caused no effects. The exception was legume seedlings which were found to experience abnormal leaf growth when exposed to CO concentrations of 27,000 µg/m³. Also related to this family of plants, CO concentrations in the soil of 113,000 µg/m³ were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 µg/m³ will not affect vegetation.

[c] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976. A CO concentration of 115,000 µg/m³ was found to affect certain plant species.

[d] "Polymorphic Regions in Plant Genomes Detected by an M13 Probe" Zimmerman, P.A., et al. 1989. Genome 32: 824-828. 115,000 µg/m³ was the lowest CO concentration included in this study. This concentration was not found to cause a reduction in growth rate to a variety of plant species.

Table 13: Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Averaging Period	Maximum Facility Impacts (µg/m³)	Threshold for Impact to Vegetation (µg/m³)	Applicability
SO_2			
1-hour SO_2	1.80	131[a]	Suggested worst-case limit
3-hour SO_2	1.29	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	0.63	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.05	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	2.11	150[c]	Protects all vegetation
Annual PM_{10}	0.19	50[c]	Protects all vegetation
Annual PM_{10}		579[e]	Damage to sensitive species (fir tree)

a. “Crop and Forest Losses due to Current and Projected Emissions from Coal-Fired Power Plants in the Ohio River Basin” Loucks, O.L., R.W. Miller, et al. 1980. The Institute of Ecology. In this publication, the authors propose 1-hour thresholds from 131 to 262 µg/m³.

b. “Impacts of Coal-fired Power Plants on Fish, Wildlife, and their Habitats” Dvorak, A.J., et al. Argonne National Laboratory. Argonne, Illinois. Fish and Wildlife Service Publication No. FWS/OBS-78/29. March 1978. This document indicates the lowest 3-hour SO_2 concentration expected to cause injury to sensitive plants growing under compromised conditions is approximately 390 µg/m³. Similarly, a threshold of 130 µg/m³ is suggested for chronic exposure.

c. Secondary National Ambient Air Quality Standard (µg/m³) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

d. “Concurrent Exposure to SO_2 and/or NO_2 Alters Growth and Yield Responses of Wheat and Barley to Low Concentrations of O_3” (New Phytologist, 118 (4). 1991. Pp. 581-592). This paper indicates exposure to 63 µg/m³ of SO_2 during the growing season had insignificant effects to wheat but did affect the weight of Barley seeds.

e. “Responses of Plants to Air Pollution” Lerman, S.L., and E.F. Darley. 1975. “Particulates,” pp. 141-158 (Chap. 7). In J.B. Mudd and T.T. Kozlowski (eds.). Academic Press. New York, NY. Results of studies conducted indicated concluded that particulate deposition rates of 365 g/m²/yr caused damage to fir trees, but rates of 274 g/m²/year and 400 to 600 g/m²/yr did not cause damage to vegetation. 365 g/m²/yr translates to W579 µg/m³, using a worst-case deposition velocity of 2 centimeters per second.

4.3.2 Soil Assessment

The USEPA Screening Procedure also provides a method for assessing impacts on soils. This assessment evaluates trace element contamination of soils. Since plant and animal communities can be affected before noticeable accumulation occurs in the soils, the approach used here evaluates the way soil acts as an intermediary in the transfer of deposited trace elements to plants. For trace elements, the concentration deposited in the soil is calculated from the maximum-predicted annual ground-level concentrations conservatively assuming that all deposited material is soluble and available for uptake by plants. The amount of trace elements potentially taken up by plants is calculated using average plant-to-soil concentration ratios. The calculated soil and plant concentrations were then compared to screening concentration threshold criteria designed to assess potential adverse effects to soils and plants.

According to the United States Department of Agriculture Natural Resources Conservation Service Connecticut Soil Survey and field-verification, the portion of the Facility site located north of Lake Road is dominated by glacial till-derived soils, with the exception of soils within and adjacent to an on-site forested swamp, where soils are derived from a glacial outwash deposit. Bedrock outcrops were observed within the Facility site, but mostly along the ridgeline that dominates its sloping western section, where bedrock mining had taken place through the early 20th century.

Table 14 presents the results of the potential soil and plant concentrations and compares them to the corresponding screening concentration criteria. Only pollutants that are potentially emitted from the Facility and which have a screening concentration are presented. A calculated concentration in excess of either of the screening concentration criteria is an indication that a more detailed evaluation may be required. However, as shown in Table 14, calculated concentrations as a result of operation of the Facility are all well below the screening criteria. Detailed calculations are provided in Appendix F.

Table 14: Soils Impact Screening Assessment

Pollutant	Maximum Facility Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Plant Tissue Concentration (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	1.16E-04	3	0.00%	1.62E-05	0.25	0.01%
Beryllium	7.82E-04	NA	NA	NA	NA	NA
Cadmium	4.30E-04	2.5	0.02%	4.60E-03	3	0.15%
Chromium	3.12E-02	8.4	0.37%	6.25E-04	1	0.06%
Cobalt	3.20E-05	NA	NA	3.52E-06	19	0.00%
Lead	2.65E-03	1000	0.00%	1.19E-03	126	0.00%
Manganese	4.55E-04	2.5	0.02%	3.00E-05	400	0.00%
Mercury	9.76E-05	455	0.00%	4.88E-05	NA	NA
Nickel	3.72E-03	500	0.00%	1.68E-04	60	0.00%
Selenium	6.44E-04	13	0.00%	6.44E-04	100	0.00%

Note: Based on screening procedures described in Chapter 5 of the USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980).

4.4 GROWTH

A growth analysis examines the potential emissions from secondary sources associated with the Facility. While these activities are not directly involved in Facility operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the Facility area due to the Facility itself. Secondary emissions do not include any emissions that come directly from mobile sources, such as emissions from the tailpipe of any on-road motor vehicle or the propulsion of a train. They also do not include sources that do not impact the same general area as the source under review.

The Facility is expected to have a construction workforce reflecting approximately 350 jobs over the approximately three-year construction period. A significant portion of the regional construction force in the area of the site is currently available to build the Facility. Although it is possible that a small percentage of the labor force will be from outside the commuting region, and may create a small new housing demand, it is expected that any new housing demand can be met with existing housing stock in the region. In addition, it is expected that no induced commercial or industrial construction in the area will be necessary to support the Facility. The operations staff will consist of approximately 20 to 25 workers, and will not significantly influence growth in the area. Therefore, an evaluation of secondary emission sources associated with the Facility is not warranted.

5.0 REFERENCES

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DEEP 2009. *A Guideline for Performing Stationary Source Air Quality Modeling in Connecticut*. July 2009, Revised December 2009.

USEPA 1980. A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals. EPA-450/2-81-078. U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. December 1980.

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USEPA 2004. User's Guide for the AMS/EPA Regulatory Model (AERMOD) and Addendums. EPA-454/B-03-001 Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. September 2004.

USEPA 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard.

USEPA 2013. *Draft Guidance for $PM_{2.5}$ Permit Modeling*, Steven D. Page, March 2013.

USEPA 2017. Guidance on Air Quality Models (Revised). Codified in the Appendix W to 40 CFR Part 51. Office of Air Quality Planning and Standards, Research Triangle Park, NC. January 2017.

USFS, NPS, and USFWS 2010. Federal Land Managers' Air Quality Related Values Work Group (FLAG): Phase 1 Report, Revised. Natural Resource Report NPS/NRPC/NRR – 2010/232. October 2010.

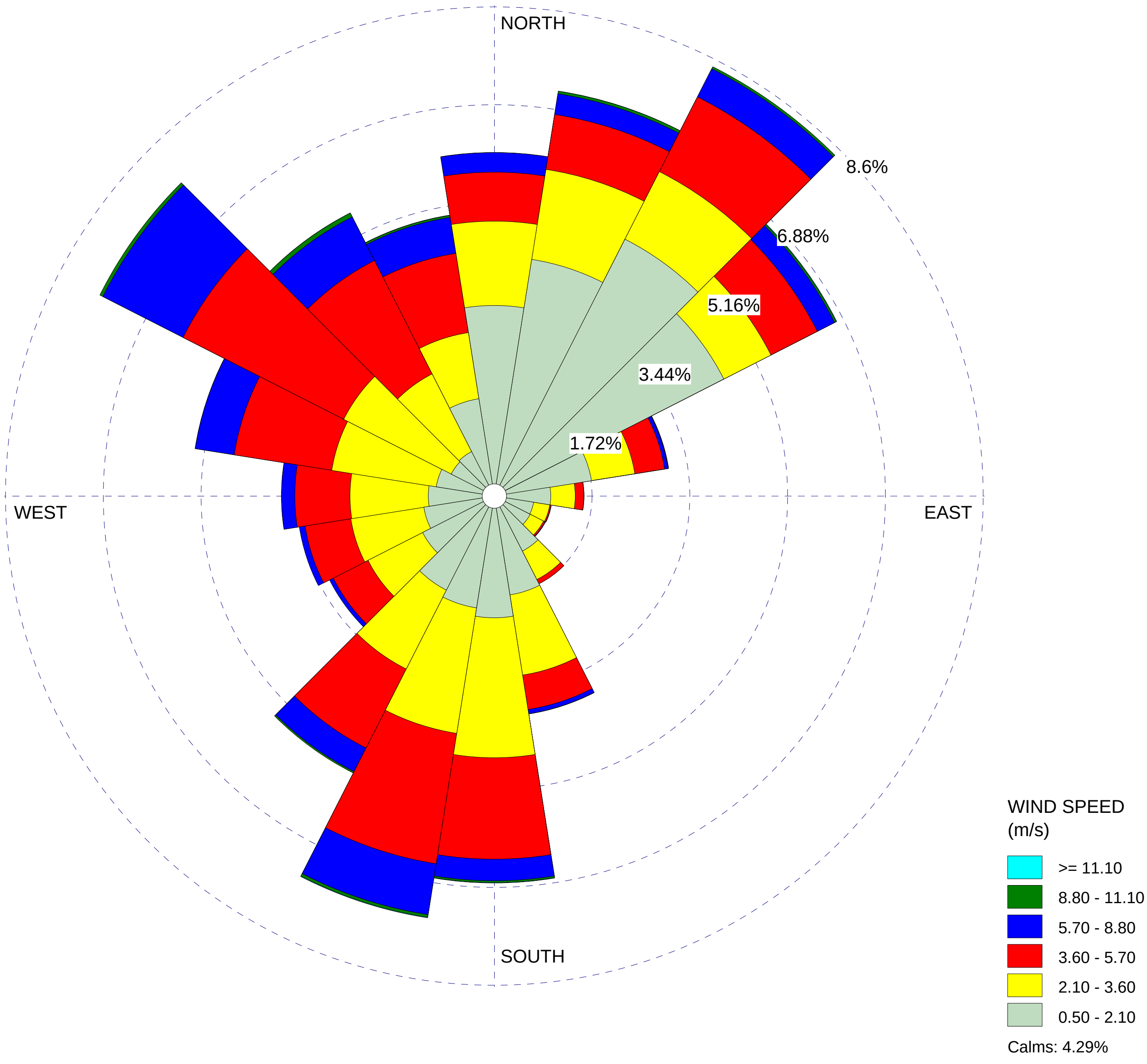
FIGURES

WIND ROSE PLOT:

Project: NTE Connecticut - Killingly Energy Center
Met: Windham CT Airport 2012-2016

DISPLAY:

Wind Speed
Direction (blowing from)



DATA PERIOD:

Start Date: 1/1/2012 - 00:00
End Date: 12/31/2016 - 23:59

TOTAL COUNT:

43341 hrs.

CALM WINDS:

4.29%

AVG. WIND SPEED:

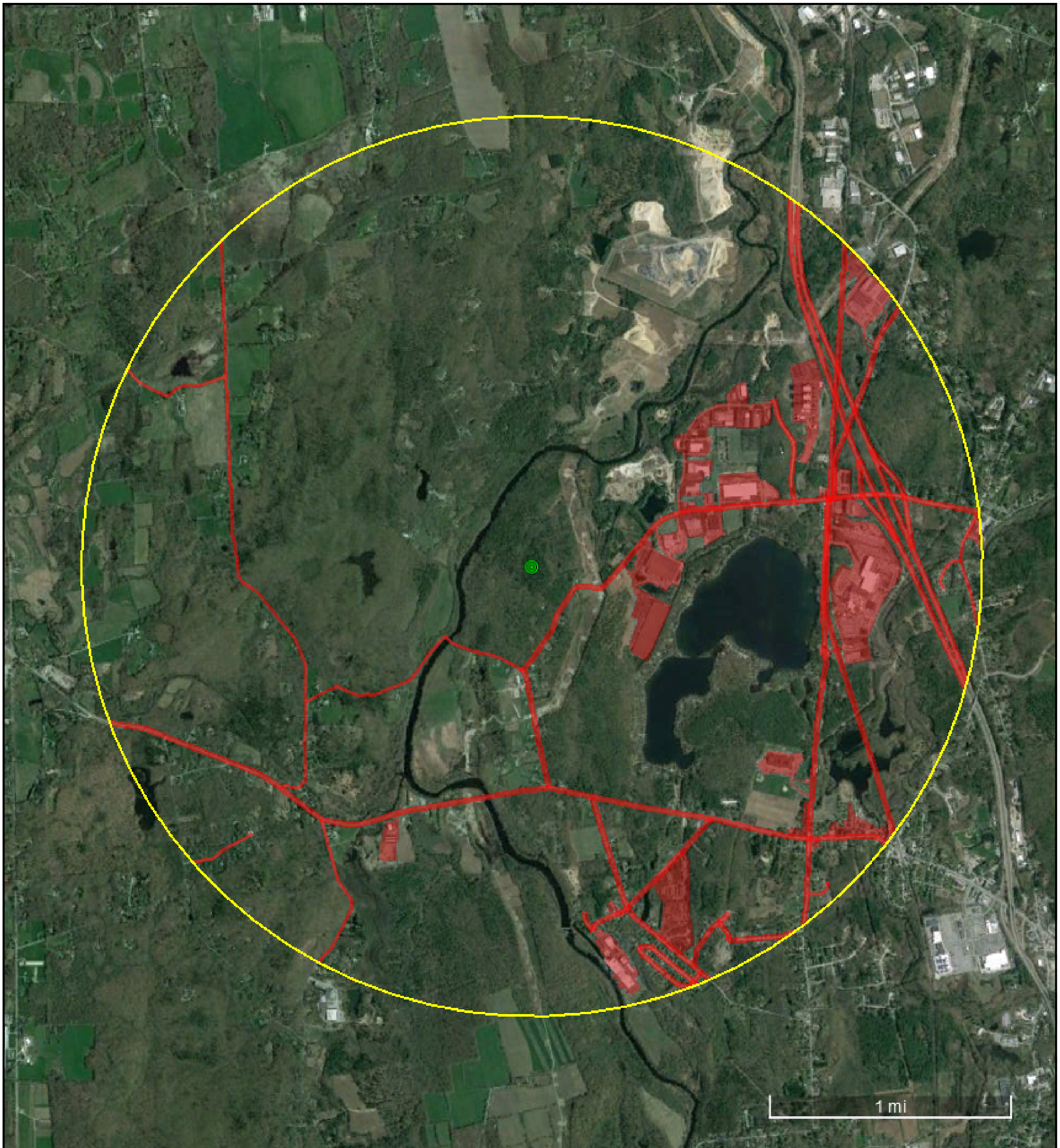
2.83 m/s

TETRA TECH

Figure 1
Wind Rose Plot

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

WRPLOT View - Lakes Environmental Software



Legend

Project site
3 km buffer
Urban areas

N

TETRA TECH

Figure 2
Urban / Rural Determination Map

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

APPENDIX A: DETAILED SOURCE PARAMETER DATA

NTE Connecticut, LLC - Killingly Energy Center

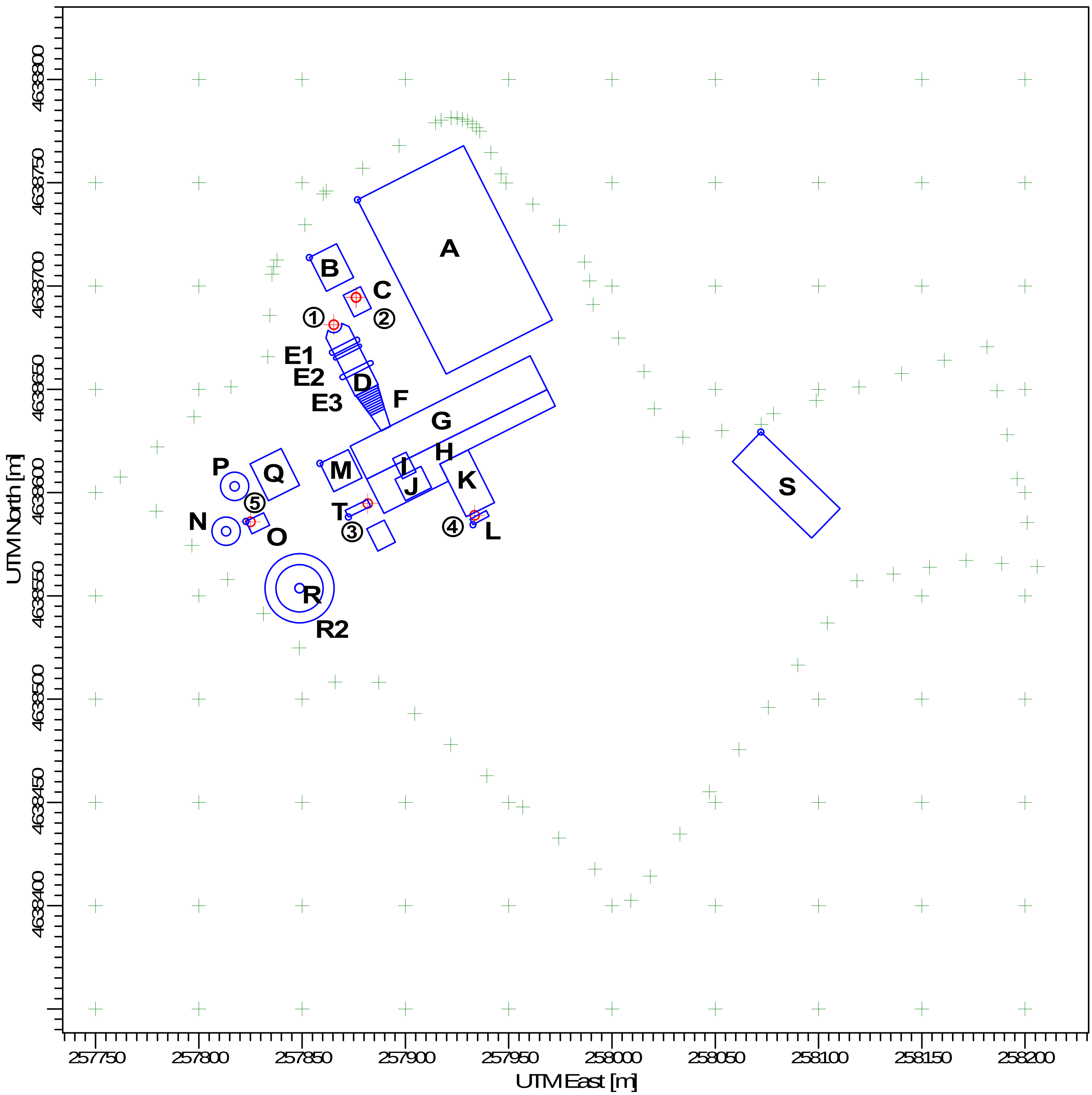
Mitsubishi Model M501JAC Combined Cycle Combustion Turbine and Ancillary Equipment Emissions Estimates

Combustion Turbine											
Ambient Temperature (°F):	100				59				-10		
Case #:	1	2	4	5	36	37	39	40	33	34	35
Fuel	Natural Gas										
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	3,436	3,438	2,638	2,181	3,684	3,686	2,881	2,246	3,745	3,362	2,558
DB Heat Input (MMBtu/hr/unit, HHV)	408	0	0	0	368	0	0	0	0	0	0
Net Power (kW)	0	0	0	0	0	527,475	0	0	0	0	0
Gross Power (kW)	0	0	0	0	0	541,000	0	0	0	0	0
Heat Rate (Btu/kW-hr, net, HHV)	0	0	0	0	0	6,988	0	0	0	0	0
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15
NOx (g/s)	3.57	3.19	2.45	2.02	3.76	3.42	2.67	2.09	3.48	3.12	2.37
CO (g/s)	1.85	0.87	0.67	0.55	1.95	0.94	0.73	0.57	0.95	0.85	0.65
PM (g/s)	1.60	0.88	0.69	0.59	1.60	0.96	0.76	0.60	0.97	0.88	0.71
SO2 (g/s)	0.73	0.65	0.50	0.41	0.77	0.70	0.54	0.42	0.71	0.64	0.48

Combustion Turbine									
Ambient Temperature (°F):	100			59			-10		
Case #:	2	3	4	28	14	15	25	29	30
Fuel	ULSD								
GT Operating Load	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,692	2,226	1,948	3,033	2,453	2,177	3,033	2,773	2,374
DB Heat Input (MMBtu/hr/unit, HHV)	0	0	0	0	0	0	0	0	0
Net Power (kW)	0	0	0	0	0	0	0	0	0
Gross Power (kW)	0	0	0	0	0	0	0	0	0
Heat Rate (Btu/kW-hr, net, HHV)	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
NOx (g/s)	5.87	4.83	4.21	5.95	4.81	4.26	5.95	5.44	4.66
CO (g/s)	1.61	1.32	1.16	1.81	1.46	1.29	1.81	1.65	1.41
PM (g/s)	3.19	2.56	2.17	3.60	2.82	2.48	3.49	3.48	2.95
SO2 (g/s)	0.51	0.42	0.37	0.57	0.46	0.41	0.57	0.52	0.45

	Combustion Turbine (Start-up / Shutdown)								Ancillary Equipment			
Case #:	HOT	WARM	COLD	SHUTDOWN	HOT	WARM	COLD	SHUTDOWN			Emergency	
Fuel	Natural Gas				ULSD				Auxiliary Boiler	Gas Heater	Generator	Fire Pump
Exhaust velocity (m/s)	14.34	13.55	13.53	16.83	14.71	14.24	14.22	17.33	8.29	4.24	49.99	9.06
Exhaust temperature (K)	358.38	357.83	356.91	356.50	364.27	362.76	361.80	363.48	422.04	394.26	722.04	789.26
NOx (g/s)	18.47	18.82	18.82	9.83	24.82	25.53	25.53	20.41	9.00E-02	1.06E-02	2.45	2.53E-01
CO (g/s)	45.20	45.25	50.79	26.61	290.77	290.93	290.93	53.94	3.91E-01	3.26E-02	1.34	2.21E-01
PM (g/s)	1.13	1.07	1.07	1.13	4.14	4.00	4.00	4.46	5.29E-02	4.41E-03	7.66E-02	1.26E-02
SO2 (g/s)	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41	1.59E-02	1.32E-03	2.37E-03	3.81E-04

APPENDIX B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA



Legend

	Building / Structure Name	Grade Elevation (ft)	Height above Grade (ft)
A	Air Cooled Condenser	316	80
B	Closed Cooling Water Fan Array	313	22
C	Auxiliary Boiler	315	26
D	Heat Recovery Steam Generator (HRSG)	316	95
E1	HRSG Drum 1	316	106
E2	HRSG Drum 2	316	106
E3	HRSG Drum 3	316	106
F	Turbine Exhaust Diffuser (10 tiers)	316	28.6-83.9
G	Turbine Building High Bay	316	78.6
H	Turbine Building Low Bay	316	39.1
I	Air Inlet Filter Housing Duct	316	69.8
J	Air Inlet Filter Housing	316	92.4
K	Control/Maintenance Building	316	26
L	Emergency Generator	316	16
M	Fuel Gas Compressor	316	21

		Grade Elevation (ft)	Height above Grade (ft)
N	Demineralized Water Storage Tank	316	38
O	Fire Pump Enclosure	316	16
P	Service Water Storage Tank	315	43
Q	Water Treatment Building	316	25.5
R	Fuel Oil Tank	320	45
R2	Fuel Oil Tank Outer Wall	320	21
S	Administration	318	26
T	Gas Heater Enclosure	316	18
	Sources		
1	HRSG	316	150
2	Auxiliary Boiler	315	90
3	Gas Heater	316	20
4	Emergency Generator	316	45
5	Fire Pump	316	20

TETRA TECH

Figure 1
Buildings, Structures, and Stacks Input to AERMOD

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

AERMOD View - Lakes Environmental Software

BPIP Input

```
'Killingly Energy Center 11/2017'
'P'
'METERS'  1.00000000
'UTMY'  0.0000
20
'FIREPUMP'  1           96.32
    4           4.88
            257822.84      4638586.05
            257831.34      4638590.20
            257834.29      4638584.15
            257825.79      4638580.00
'CONTROL'  1           96.32
    4           7.92
            257916.74      4638613.75
            257930.37      4638620.62
            257943.21      4638595.08
            257929.45      4638588.26
'EMGEN'  1           96.32
    4           4.88
            257932.74      4638584.44
            257931.33      4638587.09
            257939.15      4638591.24
            257940.55      4638588.59
'CTDIFF1'  1           96.32
    4           8.71
            257883.24      4638637.20
            257889.93      4638640.54
            257892.75      4638631.99
            257888.43      4638629.82
'ADMIN'  1           96.93
    4           7.92
            258072.11      4638629.26
            258110.47      4638592.21
            258096.70      4638577.96
            258058.34      4638615.00
'DEMINTNK'  1           96.32
    8          11.58
            257813.23      4638588.13
            257808.38      4638586.12
            257806.37      4638581.27
            257808.38      4638576.42
            257813.23      4638574.41
            257818.08      4638576.42
            257820.09      4638581.27
            257818.08      4638586.12
'SVCTANK'  1           96.01
    8          13.11
            257817.35      4638609.87
            257812.50      4638607.86
            257810.49      4638603.01
            257812.50      4638598.16
            257817.35      4638596.15
            257822.20      4638598.16
            257824.21      4638603.01
            257822.20      4638607.86
'GASCOMP'  1           96.32
    4           6.40
            257858.67      4638614.13
            257872.39      4638620.82
            257879.07      4638607.11
            257865.36      4638600.42
'OILTANKE'  2           97.54
    8           6.40
            257848.78      4638570.42
            257836.93      4638565.50
            257832.02      4638553.65
            257836.93      4638541.80
            257848.78      4638536.89
            257860.63      4638541.80
            257865.54      4638553.65
            257860.63      4638565.50
    8          13.72
            257848.77      4638565.08
            257840.69      4638561.73
            257837.34      4638553.65
            257840.69      4638545.57
```

```
            257848.77      4638542.22
            257856.85      4638545.57
            257860.20      4638553.65
            257856.85      4638561.73
'GASHTR'  1           96.32
    4           5.49
            257872.47      4638588.11
            257870.89      4638591.35
            257881.63      4638596.59
            257883.21      4638593.35
'ACC'  1           96.32
    4          24.38
            257876.77      4638741.74
            257928.17      4638767.93
            257971.14      4638683.60
            257919.74      4638657.41
'COOLFAN'  1           95.40
    4           6.71
            257853.50      4638713.73
            257866.65      4638720.43
            257874.96      4638704.13
            257861.81      4638697.43
'AUXBLR'  1           96.01
    5           7.92
            257869.94      4638695.57
            257878.28      4638699.70
            257883.51      4638689.19
            257875.19      4638685.02
            257875.19      4638685.02
'WWTRTMT'  1           96.32
    4           7.77
            257824.87      4638613.83
            257839.87      4638621.34
            257848.78      4638603.53
            257833.70      4638595.97
'TURBHIGH'  1           96.32
    4          23.96
            257873.33      4638622.49
            257960.44      4638666.14
            257968.63      4638649.80
            257881.29      4638606.48
'CONTROL3'  1           96.32  'Additional Control Building added 10/17/2017'
    4           7.92
            257889.82      4638586.64
            257895.17      4638575.96
            257886.71      4638571.67
            257881.30      4638582.40
'HRSG'  4           96.32
    11          28.96
            257862.55      4638678.56
            257863.71      4638677.71
            257865.26      4638677.33
            257867.09      4638677.75
            257868.45      4638678.84
            257869.16      4638680.46
            257869.19      4638681.91
            257872.74      4638680.37
            257886.89      4638652.23
            257875.71      4638646.66
            257861.58      4638674.85
    16          32.31
            257869.03      4638656.88
            257882.67      4638663.72
            257883.17      4638663.86
            257883.76      4638663.76
            257884.13      4638663.44
            257884.37      4638662.95
            257884.39      4638662.43
            257884.15      4638661.96
            257883.72      4638661.65
            257870.06      4638654.80
            257869.60      4638654.64
            257868.99      4638654.76
            257868.60      4638655.07
            257868.37      4638655.55
            257868.34      4638656.04
            257868.57      4638656.56
    12          32.31
            257865.39      4638665.58
```

```
            257877.88       4638671.84
            257878.24       4638671.76
            257878.50       4638671.57
            257878.75       4638671.06
            257878.74       4638670.73
            257878.60       4638670.42
            257866.11       4638664.16
            257865.75       4638664.25
            257865.49       4638664.44
            257865.26       4638664.91
            257865.23       4638665.28
    16           32.31
            257863.48       4638668.66
            257876.57       4638675.22
            257877.00       4638675.12
            257877.37       4638674.92
            257877.61       4638674.62
            257877.85       4638674.13
            257877.89       4638673.70
            257877.85       4638673.29
            257877.70       4638672.95
            257864.62       4638666.40
            257864.20       4638666.53
            257863.84       4638666.76
            257863.56       4638667.00
            257863.34       4638667.47
            257863.27       4638667.88
            257863.30       4638668.30
'AIRINLET'  2            96.32
    4           21.26
            257893.83       4638616.35
            257900.30       4638619.59
            257905.20       4638609.89
            257898.65       4638606.64
    4           28.16
            257895.05       4638606.44
            257907.56       4638612.70
            257912.64       4638602.38
            257900.13       4638596.08
'TURBLOW'  1            96.32
    6           11.93
            257881.29       4638606.48
            257889.67       4638589.85
            257920.86       4638605.48
            257916.74       4638613.75
            257972.59       4638641.88
            257968.63       4638649.80
'CTDIFF'  10            96.32
    4            8.71
            257876.04       4638646.84
            257886.53       4638652.05
            257889.94       4638640.54
            257883.24       4638637.20
    8           10.58
            257876.05       4638646.84
            257882.45       4638638.27
            257882.53       4638638.16
            257888.49       4638641.13
            257889.60       4638641.68
            257889.56       4638641.81
            257886.53       4638652.05
            257877.20       4638647.42
    8           12.46
            257876.06       4638646.84
            257881.66       4638639.34
            257881.82       4638639.12
            257887.04       4638641.72
            257889.26       4638642.83
            257889.18       4638643.09
            257886.53       4638652.04
            257878.37       4638647.99
    8           14.33
            257876.07       4638646.84
            257880.87       4638640.41
            257881.11       4638640.08
            257885.58       4638642.31
            257888.91       4638643.97
            257888.80       4638644.36
            257886.53       4638652.04
```

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          257879.53      4638648.57
    8         16.21
          257876.08      4638646.84
          257880.08      4638641.48
          257880.41      4638641.05
          257884.13      4638642.90
          257888.57      4638645.12
          257888.42      4638645.64
          257886.52      4638652.03
          257880.70      4638649.14
    8         18.08
          257876.09      4638646.84
          257879.29      4638642.55
          257879.70      4638642.01
          257882.68      4638643.49
          257888.23      4638646.26
          257888.04      4638646.91
          257886.52      4638652.03
          257881.86      4638649.71
    8         19.96
          257876.10      4638646.84
          257878.50      4638643.62
          257878.99      4638642.97
          257881.23      4638644.08
          257887.89      4638647.41
          257887.66      4638648.19
          257886.52      4638652.03
          257883.03      4638650.29
    8         21.83
          257876.11      4638646.83
          257877.70      4638644.69
          257878.28      4638643.93
          257879.77      4638644.67
          257887.55      4638648.55
          257887.28      4638649.46
          257886.52      4638652.02
          257884.19      4638650.86
    8         23.71
          257876.11      4638646.83
          257876.91      4638645.76
          257877.58      4638644.89
          257878.32      4638645.26
          257887.20      4638649.70
          257886.90      4638650.74
          257886.52      4638652.02
          257885.35      4638651.44
    4         25.58
          257876.12      4638646.83
          257886.52      4638652.01
          257886.86      4638650.84
          257876.87      4638645.85
5
'GAS_SUC'            96.32        45.72       257865.36      4638681.24  'Nat. Gas, Cold Start'
'AUXBLR'             96.01        27.43       257876.13      4638694.43  'Auxiliary Boiler - 84.0 MMBtu/hr'
'GASHEATR'           96.32         6.10       257881.81      4638594.65  'Natural Gas Heater - 7.0 MMBtu/hr'
'EGEN'               96.32        13.72       257933.57      4638588.97  'Emergency Diesel Generator - 1,380 kW -
Scaled by 1/3'
'FIREPUMP'           96.32         6.10       257825.01      4638585.81  'Emergecy Fire Pump - 227.5 kW - Scaled
by 1/3'
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BPIP Output

```
                             BPIP (Dated: 04274)
 DATE : 11/19/2017
 TIME : 23:47:32


 Killingly Energy Center 11/2017

  BPIP output is in meters

     SO BUILDHGT GAS_36     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT GAS_36     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT GAS_36     28.96   23.96   23.96   23.96   28.96   28.96
     SO BUILDHGT GAS_36     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT GAS_36     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT GAS_36     28.96   23.96   23.96   23.96   28.96   28.96
     SO BUILDWID GAS_36     28.85   31.88   34.24   35.57   35.82   34.97
     SO BUILDWID GAS_36     35.35   35.85   35.25   33.58   30.89   27.71
     SO BUILDWID GAS_36     23.91   98.98   98.38   98.89   21.00   25.31
     SO BUILDWID GAS_36     28.85   31.88   34.24   35.57   35.82   34.97
     SO BUILDWID GAS_36     35.35   35.85   35.25   33.58   30.89   27.71
     SO BUILDWID GAS_36     23.91   98.98   98.38   98.89   21.00   25.31
     SO BUILDLEN GAS_36     33.58   30.89   27.71   23.91   19.39   14.28
     SO BUILDLEN GAS_36     16.05   21.00   25.31   28.85   31.88   34.24
     SO BUILDLEN GAS_36     35.57   90.22   77.95   28.99   35.85   35.25
     SO BUILDLEN GAS_36     33.58   30.89   27.71   23.91   19.39   14.28
     SO BUILDLEN GAS_36     16.05   21.00   25.31   28.85   31.88   34.24
     SO BUILDLEN GAS_36     35.57   40.34   24.00   28.99   35.85   35.25
     SO XBADJ    GAS_36    -32.26  -28.95  -24.77  -19.84  -14.30   -8.33
     SO XBADJ    GAS_36     -5.74   -4.83   -3.78   -2.61   -1.72   -1.09
     SO XBADJ    GAS_36     -0.43    0.25    0.92   46.71    0.01   -0.67
     SO XBADJ    GAS_36     -1.32   -1.94   -2.94   -4.08   -5.09   -5.96
     SO XBADJ    GAS_36    -10.31  -16.17  -21.53  -26.24  -30.15  -33.15
     SO XBADJ    GAS_36    -35.14  -90.47  -78.86  -75.70  -35.85  -34.58
     SO YBADJ    GAS_36    -11.81  -14.21  -16.03  -17.36  -18.15  -18.40
     SO YBADJ    GAS_36    -18.36  -17.93  -16.96  -15.47  -13.51  -10.92
     SO YBADJ    GAS_36     -7.88   13.64   25.60   36.84    5.67    8.88
     SO YBADJ    GAS_36     11.81   14.21   16.03   17.36   18.15   18.40
     SO YBADJ    GAS_36     18.36   17.93   16.95   15.47   13.51   10.92
     SO YBADJ    GAS_36      7.88  -13.64  -25.60  -36.84   -5.67   -8.88


     SO BUILDHGT AUXBLR     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT AUXBLR     28.96   28.96   28.96   28.96   28.96   24.38
     SO BUILDHGT AUXBLR     24.38   24.38   23.96   23.96   24.38   28.96
     SO BUILDHGT AUXBLR     28.96   28.96   28.96   28.96   28.96   28.96
     SO BUILDHGT AUXBLR     28.96   28.96   28.96   28.96   28.96   24.38
     SO BUILDHGT AUXBLR     24.38   24.38   23.96   23.96   24.38   28.96
     SO BUILDWID AUXBLR     28.85   31.88   34.24   35.57   35.82   34.97
     SO BUILDWID AUXBLR     35.35   35.85   35.25   33.58   30.89   99.93
     SO BUILDWID AUXBLR     90.08   77.50   98.38   98.89   82.84   25.31
     SO BUILDWID AUXBLR     28.85   31.88   34.24   35.57   35.82   34.97
     SO BUILDWID AUXBLR     35.35   35.85   35.25   33.58   30.89   99.93
     SO BUILDWID AUXBLR     90.08   77.50   98.38   98.89   82.84   25.31
     SO BUILDLEN AUXBLR     33.58   30.89   27.71   23.91   19.39   14.28
     SO BUILDLEN AUXBLR     16.05   21.00   25.31   28.85   31.88  110.80
     SO BUILDLEN AUXBLR    109.66  105.20   77.95   75.02  107.38   35.25
     SO BUILDLEN AUXBLR     33.58   30.89   27.71   23.91   19.39   14.28
     SO BUILDLEN AUXBLR     16.05   21.00   25.31   28.85   31.88  110.80
     SO BUILDLEN AUXBLR    109.66  105.20   24.00   28.99  107.38   35.25
     SO XBADJ    AUXBLR    -47.12  -45.03  -41.58  -36.86  -31.03  -24.25
     SO XBADJ    AUXBLR    -20.37  -17.73  -14.55  -10.93   -7.33  -23.10
     SO XBADJ    AUXBLR    -29.92  -35.83    6.95    9.39  -63.35   12.52
     SO XBADJ    AUXBLR     13.53   14.14   13.87   12.95   11.63    9.97
     SO XBADJ    AUXBLR      4.32   -3.27  -10.76  -17.92  -24.54  -87.70
     SO XBADJ    AUXBLR    -79.74  -69.37  -84.90  -84.41  -44.03  -47.77
     SO YBADJ    AUXBLR     -3.50   -8.61  -13.30  -17.58  -21.34  -24.44
     SO YBADJ    AUXBLR    -27.07  -29.05  -30.14  -30.33  -29.59   39.71
     SO YBADJ    AUXBLR     44.71   48.36    9.68   22.21   50.27   -1.89
     SO YBADJ    AUXBLR      3.50    8.61   13.30   17.58   21.34   24.44
     SO YBADJ    AUXBLR     27.07   29.05   30.14   30.33   29.59  -39.71
     SO YBADJ    AUXBLR    -44.71  -48.36   -9.68  -22.21  -50.27    1.89


     SO BUILDHGT GASHEATR   28.96   23.96   23.96   23.96   23.96   23.96
     SO BUILDHGT GASHEATR   23.96   23.96   23.96   23.96   23.96   23.96
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SO BUILDHGT GASHEATR   23.96   23.96   23.96   23.96   28.96   28.96
SO BUILDHGT GASHEATR   28.96   24.38   24.38   24.38   24.38   23.96
SO BUILDHGT GASHEATR   23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GASHEATR   23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDWID GASHEATR   27.19   80.21   68.88   55.45   40.34   24.00
SO BUILDWID GASHEATR   28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GASHEATR   96.58   98.98   98.38   98.89   21.00   25.31
SO BUILDWID GASHEATR   27.19  108.56  110.80  109.66  105.20   24.00
SO BUILDWID GASHEATR   28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GASHEATR   96.58   98.98   98.38   98.89   98.59   95.30
SO BUILDLEN GASHEATR   33.58   83.13   91.24   96.58   98.98   98.38
SO BUILDLEN GASHEATR   98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GASHEATR   55.45   40.34   24.00   28.99   35.85   35.25
SO BUILDLEN GASHEATR   33.58  106.74   99.93   90.08   77.50   98.38
SO BUILDLEN GASHEATR   98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GASHEATR   55.45   40.34   24.00   28.99   45.01   59.66
SO XBADJ    GASHEATR   50.16   10.94    9.99    8.73    7.21    5.46
SO XBADJ    GASHEATR    1.55   -3.52   -8.48  -13.19  -17.49  -21.26
SO XBADJ    GASHEATR  -24.39  -26.78  -28.35  -40.29  -88.13  -87.26
SO XBADJ    GASHEATR  -83.74 -178.69 -173.24 -162.54 -146.90 -103.84
SO XBADJ    GASHEATR -100.45  -95.08  -86.82  -75.92  -62.72  -47.61
SO XBADJ    GASHEATR  -31.06  -13.56    4.35   11.29   11.74   11.83
SO YBADJ    GASHEATR   19.42  -22.62  -13.17   -3.33    6.61   16.35
SO YBADJ    GASHEATR   25.79   34.25   41.66   47.81   52.51   55.61
SO YBADJ    GASHEATR   57.02   56.70   54.65   51.00    4.50   -7.58
SO YBADJ    GASHEATR  -19.42   -0.76  -22.51  -43.58  -63.32  -16.35
SO YBADJ    GASHEATR  -25.79  -34.25  -41.66  -47.81  -52.51  -55.61
SO YBADJ    GASHEATR  -57.02  -56.70  -54.65  -51.00  -45.78  -39.17
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APPENDIX C: DETAILED AERMOD RESULTS SUMMARY

NTE Connecticut, LLC - Killingly Energy Center
Mitsubishi Model M501JAC Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):		100				59				-10			100			59			-10	
Case #:	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel	Natural Gas											ULSD								
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45	45	45	45	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	3,436	3,438	2,638	2,181	3,684	3,686	2,881	2,246	3,745	3,362	2,558	2,692	2,226	1,948	3,033	2,453	2,177	3,033	2,773	2,374
DB Heat Input (MMBtu/hr/unit, HHV)	408	0	0	0	368	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Power (kW)	0	0	0	0	0	527,475	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Power (kW)	0	0	0	0	0	541,000	0	0	0	0	0	0	0	0	0	0	0.0000	0	0	0
Heat Rate (Btu/kW-hr, net, HHV)	0	0	0	0	0	6,988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
NOx (g/s)	3.569	3.192	2.449	2.025	3.762	3.422	2.675	2.085	3.477	3.121	2.375	5.872	4.826	4.208	5.947	4.813	4.259	5.947	5.437	4.656
CO (g/s)	1.847	0.874	0.671	0.555	1.947	0.937	0.733	0.571	0.953	0.855	0.650	1.613	1.323	1.159	1.814	1.462	1.285	1.814	1.651	1.411
PM (g/s)	1.600	0.882	0.693	0.592	1.600	0.958	0.756	0.605	0.970	0.882	0.706	3.188	2.558	2.167	3.604	2.822	2.482	3.490	3.478	2.948
SO2 (g/s)	0.727	0.650	0.499	0.412	0.766	0.697	0.545	0.424	0.708	0.635	0.483	0.509	0.421	0.368	0.573	0.464	0.411	0.573	0.524	0.449

AERMOD SU/SD Impacts - Turbine only (µg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.34	2.23	2.54	2.74	2.27	2.28	2.48	2.73	2.28	2.35	2.49	1.96	2.35	2.62	1.89	2.35	2.51	1.98	2.00	2.29
3-HR	1ST	1.09	1.02	1.58	2.12	1.02	1.02	1.37	2.10	1.02	1.09	1.42	0.95	1.34	1.98	0.92	1.23	1.61	0.94	0.95	1.17
8-HR	1ST	0.71	0.67	1.05	1.36	0.65	0.65	0.91	1.35	0.65	0.72	0.97	0.59	0.88	1.27	0.54	0.80	1.06	0.58	0.58	0.76
24-HR	1ST	0.32	0.30	0.50	0.67	0.29	0.29	0.42	0.66	0.29	0.32	0.44	0.26	0.41	0.62	0.22	0.37	0.51	0.24	0.25	0.35
1-HR	2ND	2.23	2.09	2.51	2.74	2.13	2.14	2.42	2.73	2.15	2.23	2.44	1.83	2.27	2.60	1.78	2.25	2.49	1.83	1.84	2.18
3-HR	2ND	0.99	0.91	1.57	2.06	0.89	0.89	1.33	2.05	0.90	0.99	1.39	0.85	1.30	1.93	0.83	1.15	1.59	0.85	0.85	1.07
8-HR	2ND	0.66	0.63	1.01	1.27	0.60	0.60	0.88	1.27	0.61	0.66	0.91	0.54	0.86	1.20	0.51	0.78	1.02	0.53	0.54	0.73
24-HR	2ND	0.25	0.23	0.38	0.51	0.23	0.23	0.33	0.51	0.23	0.25	0.34	0.20	0.31	0.47	0.18	0.28	0.38	0.20	0.20	0.26
1-HR	4TH	2.13	2.00	2.49	2.68	2.05	2.05	2.38	2.67	2.06	2.14	2.40	1.82	2.23	2.55	1.76	2.18	2.46	1.82	1.83	2.10
24-HR	6TH	0.20	0.19	0.30	0.35	0.19	0.19	0.25	0.34	0.19	0.20	0.27	0.17	0.24	0.32	0.16	0.23	0.30	0.17	0.17	0.21
1-HR	8TH	2.06	1.95	2.40	2.60	1.98	1.99	2.27	2.60	2.00	2.06	2.31	1.72	2.14	2.47	1.65	2.10	2.37	1.72	1.73	2.03
24-HR	8TH	0.20	0.19	0.27	0.33	0.19	0.19	0.24	0.32	0.19	0.20	0.25	0.17	0.23	0.31	0.15	0.21	0.27	0.16	0.16	0.21
ANNUAL AVG		0.020	0.019	0.025	0.029	0.019	0.019	0.023	0.028	0.019	0.020	0.024	0.016	0.022	0.027	0.015	0.021	0.025	0.016	0.016	0.020
ANNUAL Y1		0.026	0.025	0.032	0.037	0.025	0.025	0.030	0.037	0.025	0.027	0.031	0.022	0.028	0.035	0.021	0.028	0.032	0.022	0.022	0.026
ANNUAL Y2		0.014	0.013	0.019	0.022	0.013	0.013	0.017	0.022	0.013	0.014	0.017	0.011	0.016	0.020	0.010	0.015	0.018	0.011	0.011	0.014
ANNUAL Y3		0.017	0.016	0.022	0.027	0.016	0.016	0.020	0.026	0.016	0.017	0.021	0.014	0.019	0.025	0.013	0.018	0.022	0.013	0.014	0.017
ANNUAL Y4		0.022	0.021	0.027	0.031	0.021	0.021	0.025	0.031	0.021	0.022	0.026	0.018	0.023	0.029	0.017	0.023	0.027	0.018	0.018	0.022
ANNUAL Y5		0.023	0.021	0.028	0.032	0.021	0.021	0.026	0.032	0.022	0.023	0.027	0.019	0.024	0.030	0.018	0.024	0.028	0.019	0.019	0.023
ANNUAL MAX		0.026	0.025	0.032	0.037	0.025	0.025	0.030	0.037	0.025	0.027	0.031	0.022	0.028	0.035	0.021	0.028	0.032	0.022	0.022	0.026

AERMOD SU/SD Scaled Impacts - Turbine only (µg/m³) - 150 ft. turbine stack

Case #:	Averaging	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel	Period	Natural Gas											ULSD								
NO2																					
1-HR	1ST	7.54	6.38	5.98	5.43	7.61	6.93	6.18	5.60	7.09	4.38	4.24	10.55	10.51	10.70	10.33	10.36	10.26	10.74	9.87	9.73
1-HR	8TH	5.05	4.32	4.08	3.81	5.17	4.70	4.20	3.92	4.80	2.93	2.87	7.00	7.07	7.30	6.78	6.93	6.92	7.09	6.55	6.53
1-HR (ARM)	1ST	6.03	5.11	4.79	4.35	6.09	5.55	4.94	4.48	5.67	3.50	3.39	8.44	8.41	8.56	8.27	8.29	8.21	8.59	7.90	7.78
1-HR (ARM)	8TH	4.04	3.45	3.26	3.05	4.13	3.76	3.36	3.14	3.84	2.34	2.30	5.60	5.65	5.84	5.43	5.54	5.54	5.67	5.24	5.22
ANNUAL		0.09	0.08	0.08	0.07	0.09	0.09	0.08	0.08	0.09	0.08	0.07	0.13	0.14	0.15	0.12	0.13	0.14	0.13	0.12	0.12
CO																					
1-HR	1ST	4.33	1.95	1.70	1.52	4.43	2.13	1.82	1.56	2.18	2.01	1.62	3.16	3.11	3.03	3.43	3.44	3.22	3.60	3.29	3.23
1-HR	2ND	4.12	1.83	1.68	1.52	4.15	2.00	1.77	1.56	2.05	1.91	1.59	2.95	3.00	3.01	3.23	3.30	3.19	3.33	3.04	3.07
8-HR	1ST	1.32	0.59	0.71	0.75	1.26	0.61	0.67	0.77	0.62	0.61	0.63	0.96	1.16	1.47	0.98	1.17	1.37	1.05	0.96	1.08
8-HR	2ND	1.22	0.55	0.68	0.71	1.17	0.57	0.64	0.72	0.58	0.57	0.59	0.87	1.13	1.39	0.93	1.13	1.31	0.97	0.89	1.03
PM10 / PM2.5 (PSD)																					
24-HR	1ST	0.51	0.26	0.35	0.40	0.46	0.27	0.32	0.40	0.28	0.28	0.31	0.82	1.06	1.35	0.80	1.04	1.26	0.85	0.87	1.02
24-HR	2ND	0.39	0.21	0.26	0.30	0.36	0.22	0.25	0.31	0.22	0.22	0.24	0.64	0.80	1.02	0.66	0.80	0.95	0.69	0.70	0.78
24-HR	6TH	0.32	0.17	0.21	0.21	0.31	0.18	0.19	0.21	0.19	0.18	0.19	0.54	0.60	0.70	0.58	0.64	0.74	0.59	0.59	0.62
ANNUAL		0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
PM2.5																					
24-HR	1ST	0.36	0.19	0.24	0.27	0.33	0.20	0.23	0.27	0.20	0.20	0.22	0.58	0.72	0.89	0.60	0.72	0.86	0.61	0.62	0.71
24-HR	8TH	0.22	0.11	0.12	0.12	0.21	0.12	0.12	0.12	0.13	0.12	0.12	0.36	0.39	0.40	0.38	0.42	0.43	0.39	0.39	0.41
ANNUAL		0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SO2																					
1-HR	1ST	1.54	1.30	1.22	1.10	1.56	1.42	1.25	1.13	1.45	0.89	0.87	0.92	0.91	0.94	0.99	0.99	0.99	1.03	0.94	0.94
1-HR	4TH	1.30	1.09	1.02	0.92	1.31	1.19	1.06	0.94	1.22	0.75	0.73	0.76	0.77	0.79	0.81	0.84	0.83	0.85	0.78	0.79
3-HR	1ST	0.79	0.67	0.79	0.88	0.78	0.71	0.75	0.89	0.72	0.69	0.69	0.48	0.56	0.73	0.52	0.57	0.66	0.54	0.50	0.52
3-HR	2ND	0.72	0.59	0.78	0.85	0.68	0.62	0.72	0.87	0.63	0.63	0.67	0.43	0.55	0.71	0.48	0.53	0.65	0.49	0.45	0.48
24-HR	1ST	0.23	0.19	0.25	0.28	0.22	0.20	0.23	0.28	0.20	0.20	0.21	0.13	0.17	0.23	0.13	0.17	0.21	0.14	0.13	0.16
24-HR	2ND	0.18	0.15	0.19	0.21	0.17	0.16	0.18	0.21	0.16	0.16	0.17	0.10	0.13	0.17	0.11	0.13	0.16	0.11	0.11	0.12
ANNUAL		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

NTE Connecticut, LLC - Killingly Energy Center

Mitsubishi Model M501JAC Combined Cycle Combustion Turbine - Start-up/Shutdown (SU/SD) Emissions Estimates

Case #:	HOT	WARM	COLD	SHUTDOWN	HOT	WARM	COLD	SHUTDOWN
Fuel	Natural Gas				ULSD			
Exhaust velocity (m/s)	14.34	13.55	13.53	16.83	14.71	14.24	14.22	17.33
Exhaust temperature (K)	358.38	357.83	356.91	356.50	364.27	362.76	361.80	363.48
NOx (g/s)	18.47	18.82	18.82	9.83	24.82	25.53	25.53	20.41
CO (g/s)	45.20	45.25	50.79	26.61	290.77	290.93	290.93	53.94
PM (g/s)	1.13	1.07	1.07	1.13	4.14	4.00	4.00	4.46
SO2 (g/s)	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41

AERMOD SU/SD Impacts - Turbine only (µg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.65	2.77	2.83	2.48	2.52	2.60	2.62	2.36
3-HR	1ST	2.07	2.34	2.36	1.49	1.89	2.04	2.07	1.35
8-HR	1ST	1.32	1.47	1.48	0.99	1.21	1.30	1.31	0.89
24-HR	1ST	0.65	0.73	0.74	0.47	0.59	0.64	0.65	0.42
1-HR	2ND	2.64	2.75	2.77	2.43	2.50	2.57	2.59	2.28
3-HR	2ND	2.02	2.24	2.26	1.48	1.84	2.00	2.01	1.31
8-HR	2ND	1.25	1.37	1.38	0.96	1.15	1.23	1.24	0.86
24-HR	2ND	0.49	0.56	0.56	0.36	0.45	0.48	0.49	0.32
1-HR	4TH	2.60	2.68	2.70	2.40	2.47	2.53	2.54	2.24
24-HR	6TH	0.34	0.36	0.38	0.28	0.31	0.32	0.32	0.24
1-HR	8TH	2.51	2.63	2.64	2.29	2.39	2.46	2.47	2.16
24-HR	8TH	0.32	0.35	0.35	0.26	0.29	0.31	0.31	0.24
ANNUAL AVG		0.027	0.029	0.029	0.024	0.025	0.027	0.027	0.022
ANNUAL Y1		0.035	0.037	0.038	0.031	0.033	0.034	0.035	0.028
ANNUAL Y2		0.021	0.023	0.023	0.018	0.019	0.020	0.020	0.016
ANNUAL Y3		0.025	0.027	0.028	0.021	0.023	0.024	0.025	0.019
ANNUAL Y4		0.029	0.031	0.032	0.026	0.027	0.028	0.029	0.024
ANNUAL Y5		0.030	0.032	0.033	0.027	0.028	0.030	0.030	0.025
ANNUAL MAX		0.035	0.037	0.038	0.031	0.033	0.034	0.035	0.028

AERMOD SU/SD Scaled Impacts - Turbine only (µg/m³) - 150 ft. turbine stack

Case #:	Averaging	HOT	WARM	COLD	SHUTDOWN	HOT	WARM	COLD	SHUTDOWN
Fuel	Period	Natural Gas				ULSD			
NO2									
1-HR	1ST	47.82	50.90	51.29	22.98	60.27	64.25	64.78	44.70
1-HR	8TH	32.82	35.52	36.00	15.64	40.60	43.41	43.95	30.12
ANNUAL		0.65	0.70	0.71	0.30	0.81	0.88	0.88	0.58
CO									
1-HR	1ST	119.99	125.35	143.60	65.93	733.61	756.55	761.30	127.55
1-HR	2ND	119.38	124.40	140.56	64.61	726.64	747.97	753.89	123.19
8-HR	1ST	59.82	66.56	75.39	26.30	350.87	377.53	380.85	47.83
8-HR	2ND	56.48	61.89	70.16	25.48	334.58	358.01	360.47	46.55
PM10 / PM2.5 (PSD)									
24-HR	1ST	0.74	0.78	0.79	0.53	2.46	2.57	2.60	1.85
24-HR	2ND	0.56	0.60	0.60	0.41	1.84	1.93	1.95	1.42
24-HR	6TH	0.38	0.39	0.41	0.32	1.29	1.29	1.30	1.06
ANNUAL		0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.13
PM2.5									
24-HR	1ST	0.48	0.51	0.52	0.37	1.59	1.65	1.70	1.25
24-HR	8TH	0.21	0.22	0.22	0.19	0.74	0.74	0.74	0.68
ANNUAL		0.03	0.03	0.03	0.03	0.10	0.11	0.11	0.10
SO2									
1-HR	1ST	1.09	1.14	1.14	0.98	1.00	1.03	1.04	0.90
1-HR	2ND	0.91	0.94	0.94	0.83	0.84	0.87	0.88	0.76
3-HR	1ST	0.88	0.99	1.00	0.63	0.78	0.84	0.85	0.55
3-HR	2ND	0.86	0.95	0.96	0.63	0.76	0.82	0.83	0.54
24-HR	1ST	0.28	0.31	0.31	0.20	0.24	0.26	0.27	0.17
24-HR	2ND	0.21	0.24	0.24	0.15	0.18	0.20	0.20	0.13
ANNUAL		0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01

NTE Killingly Energy Center - Detailed Results Table

Pollutant	Averaging Period	Rank for SIL	Project Maximum Impact (SIL) (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YYMMDDHH)	Worst Case Turbine Load Scenario	SIL (µg/m³)	NAAQS (µg/m³)	PSD (µg/m³)
				UTM-E (m)	UTM-N (m)						
NO2 (SS)	1-HR	H1H (5YA)	11.28	266700.00	4634850.00	244.25	5-YR AVG	ULSD Case 25	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.90	257990.89	4638691.04	92.70	2012	ULSD Case 4 / GAS Cas 1	**1**	**100**	**25**
NO2 (SUSD)	1-HR	H1H (5YA)	65.45	266600.00	4634750.00	228.16	5-YR AVG	ULSD Cold Start	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.91	257990.89	4638691.04	92.70	2012	ULSD Cold Start / ULSD Case 4 / GAS Cas 1	**1**	**100**	**25**
CO	1-HR	H1H	862.94	266600.00	4634800.00	231.76	15081901	ULSD Cold Start	**2000**	**40000**	**NA**
	8-HR	H1H	102.36	258100.00	4638300.00	113.64	15021516	ULSD Cold Start / ULSD Case 4	**500**	**10000**	**NA**
PM10	24-HR	H1H	2.11	257865.96	4638508.24	102.25	14120724	ULSD Hot start / ULSD Case 15	**5**	**150**	**30**
	ANNUAL	H1H	0.19	258015.58	4638658.55	94.50	2013	ULSD Cold Start / ULSD Case 15, GAS Case 1	**1**	**NA**	**17**
PM2.5	24-HR	H1H (5YA)	1.80	258015.58	4638658.55	94.50	5-YR AVG	ULSD Cold Start / ULSD Case 15	**1.2**	**35**	**NA**
	ANNUAL	H1H (5YA)	0.17	257990.89	4638691.04	92.70	5-YR AVG	ULSD Cold Start / ULSD Case 15 / GAS Case 1	**0.2**	**12**	**NA**
PM2.5 (PSD)	24-HR	H1H	2.11	257865.96	4638508.24	102.25	14120724	ULSD Hot start / ULSD Case 15	**1.2**	**NA**	**9**
	ANNUAL	H1H	0.19	258015.58	4638658.55	94.50	2013	ULSD Cold Start / ULSD Case 15, GAS Case 1	**0.2**	**NA**	**4**
SO2	1-HR	H1H (5YA)	1.80	266650.00	4634850.00	239.43	5-YR AVG	GAS Case 36	**7.8**	**196**	**NA**
	3-HR	H1H	1.29	257900.00	4638400.00	108.96	14061703	GAS Cold Start	**25**	**1300**	**512**
	24-HR	H1H	0.63	257865.96	4638508.24	102.25	14120724	GAS Cold Start / GAS Case 40	**5**	**365**	**91**
	ANNUAL	H1H	0.05	258015.58	4638658.55	94.50	2013	GAS Cold Start / GAS Case 1	**1**	**80**	**20**

NTE Killingly Energy Center - Cumulative Impacts

Pollutant	Averaging Period	Rank	Cumulative Maximum Impact (NAAQS) (µg/m³)	Ambient Background (µg/m³)	Cumulative Impact + Ambient Background (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YYMMDDHH)	NAAQS (µg/m³)	PSD (µg/m³)
						UTM-E (m)	UTM-N (m)				
NO2 (SS)	1-HR	H8H (5YA)	8.73	84.6	93.3	257900.00	4638400.00	108.96	5-YR AVG	**188**	**NA**
NO2 (SU/SD)	1-HR	H8H (5YA)	50.32	84.6	134.9	265950.00	4638500.00	226.01	5-YR AVG	**188**	**NA**
PM2.5 (NAAQS)	24-HR	H8H (5YA)	1.46	18.0	19.5	258015.58	4638658.55	94.50	5-YR AVG	**35**	**NA**
PM2.5 (PSD)	24-HR	H2H	1.98	NA	NA	257887.09	4638508.10	103.33	13110324	**NA**	**9**

Note: Cumulative Impacts reported for all pollutants, receptors, and time periods for which the Project has a significant impact

APPENDIX D: BACKGROUND INVENTORY SOURCE DATA

Killingly Energy Center – Background Source Inventory for Cumulative Modeling Assessment

As described Section 3.11, the proposed Project has significant predicted impact concentrations for 1-hour NO_2 and 24-hour $PM_{2.5}$. The predicted significant impact area (SIA) is 12.06 kilometers (km) for NO_2, 0.54 km for $PM_{2.5}$, and 0.73 km for $PM_{2.5}$ PSD Increment. Therefore, cumulative modeling with other regional sources has been conducted. CTDEEP guidance, based on distance and actual annual emissions levels, was used to determine the final set of inventory sources for the cumulative modeling assessment. The CTDEEP guidance criteria for background source selection is summarized below:

- For NAAQS modeling:
  - All stacks with actual emissions of >15 tons per year (tpy) of a given pollutant that fall within the radius of significance of the subject source for the pollutant;
  - All stacks with actual emissions of ≥ 50 tpy that fall within 20 km of the subject source; and
  - All stacks with actual emissions of ≥ 500 tpy that fall within 50 km of the subject source.

  All sources retrieved above should be modeled at their allowable emission rate for all short term averaging times. Source can be modeled at their actual emission rates for annual average modeling.

- For PSD increment tracking:
  - All sources affecting the PSD increment (defined in RCSA sections 22a-174-3a(k)(5) and 22a-174-3a(k)-174-2a(k)(6)) that fall within the radius of significance of the subject source for the applicable pollutant;
  - All sources affecting PSD increment with actual stack emissions of ≥ 50 tpy that fall within 20 km of the subject source; and
  - All sources affecting PSD increment with actual stack emissions of ≥ 500 tpy that fall within 50 km of the subject source.

For Connecticut, the source inventory was based on the CTDEEP Radius Search Tool for 2008 Air Emissions Inventory Data, provided by CTDEEP. The Radius Search Tool was used to determine the potential inventory of sources located within 50 km of the Project. For the neighboring states of Massachusetts and Rhode Island, emissions inventory data provided by MADEP and RIDEM.

Five background NO_X sources met the CTDEEP criteria for inclusion in the cumulative NO_2 NAAQS analysis, and two background sources of $PM_{2.5}$ met the criteria for inclusion in the cumulative modeling assessment for NAAQS. The PSD baseline trigger date for $PM_{2.5}$ is October 20, 2010. Therefore, sources that commence construction after that date could potentially consume increment. In addition to the proposed project, two new sources proposed nearby in Rhode Island were considered (the Algonquin Gas Compressor Station Expansion project and the Clean River Energy Center project, both in Burrillville, RI). As shown below, only the proposed Invenergy facility meets the CTDEEP criteria to be included in the $PM_{2.5}$ PSD Increment analysis (the Algonquin PM emissions are less than 50 tpy). Note that there is no PSD increment for 1-hour NO_2.

The sources modeled cumulatively with the Project are as follows:

NO2 NAAQS Modeling

- Lake Road Generating Co., LLC, Killingly Connecticut - Distance from Project = 2.0 km
  - Combustion Turbine #1, Actual NO_x = 20.6 tpy
  - Combustion Turbine #2, Actual NO_x = 30.0 tpy
  - Combustion Turbine #3, Actual NO_x = 26.6 tpy
- Exeter Energy L.P., Sterling Connecticut - Distance from Project = 18.7 km
  - Standard Kessl Inc./Blr #1, Actual NO_x = 45.8 tpy
  - Standard Kessl Inc./Blr #2, Actual NO_x = 50.8 tpy
- Wheelabrator Millbury, Inc., Millbury Massachusetts - Distance from Project = 41.4 km
  - B&W Incinerator #1 / #2, Actual NO_x = 824 tpy
- Algonquin Gas Compressor Station, Burrillville, Rhode Island - Distance from Project = 17.7 km - Existing and Proposed Expansion
  - Actual NO_x = 18.0 tpy
  - Proposed Emission Increases NO_x = 18.0 tpy
  - Three Clark TLA-8 Engines (existing)
  - Five Combustion Turbines (3 existing / 1 proposed)

  Note that the Gas Compressor Station facility no longer technically meets the criteria for inclusion in the cumulative NO_2 analysis since it falls outside of the updated significant impact area (SIA). However, the facility is conservatively included in the analysis for consistency with the previous analysis.
- Invenergy Clean River Energy Center, Burrillville, Rhode Island – (Proposed Project) Distance from Project = 17.7 km
  - Potential NO_x = 286.6 tpy, Potential $PM_{2.5}$ = 196.8 tpy
  - Two Combined Cycle Combustion Turbines

PM2.5 Modeling

- Lake Road Generating Co., LLC, Killingly Connecticut - Distance from Project = 2.0 km ($PM_{2.5}$ NAAQS only, constructed before PSD baseline date)
  - Combustion Turbine #1, Actual $PM_{2.5}$ = 23.1 tpy
  - Combustion Turbine #2, Actual $PM_{2.5}$ = 12.5 tpy
  - Combustion Turbine #3, Actual $PM_{2.5}$ = 9 tpy

  Note that the Lake Road Generating facility no longer technically meets the criteria for inclusion in the cumulative $PM_{2.5}$ analysis since it falls outside of the updated significant impact area (SIA). However, the facility is included in the analysis due to its relatively close proximity to the Project and for consistency with the previous analysis.
- Invenergy Clean River Energy Center, Burrillville, Rhode Island (Proposed Project)-Distance from Project = 17.7 km Proposed
  ($PM_{2.5}$ NAAQS and PSD)
  - Distance from Project = 17.7 km,
  - Potential PM2.5 = 196.8 tpy
  - Two Combined Cycle Combustion Turbines

One additional source, the Griswold Rubber Co., located 16.9 km from the Project, was identified by the DEEP Radius Search Tool as potentially needing to be included in the cumulative NO_2 NAAQS analysis with actual NO_X emissions listed as 30.5 tpy. However, potential NO_X emissions for this source were listed as only 4.4. tpy. Follow up with the CTDEEP (Jared Millay) confirmed that the facility currently operates under a General Permit to Limit Potential to Emit (GPLPE) permit that limits potential NO_X emissions to 4.4 tpy. Therefore, this source was excluded from the analysis

Detailed emissions and stack parameter data for these sources are provided in the table below.

Killingly Energy Center - Modeled Source Parameters for the Background Inventory Sources

Facility	Source ID	UTM Easting	UTM Northing	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter	Emission Rate (g/s)	
		m	m	ft	ft	K	m/s	ft	1-HR NO2	24-HR PM2.5
Lake Road Generating Co., LLC	Turbine 1	259783.06	4639806.86	315	165	364.26	15.86	18.00	6.590	10.823
	Turbine 2	259780.09	4639748.48	315	165	364.26	15.86	18.00	6.590	10.823
	Turbine 3	259776.91	4639690.27	315	165	364.26	15.86	18.00	6.590	10.823
Exeter Energy L.P.	Boiler 1, 2	265300.91	4621670.51	565	196	355.37	8.12	8.00	5.541	NA
Wheelabrator Millbury, Inc.	Incinerator 1, 2	271605.14	4677996.46	496	365	429.10	23.08	10.00	26.770	NA
Algonquin/Spectra Gas Compressor Station	RICE 1	271650.08	4649864.07	572.51	54.46	725.00	25.00	2.49	3.830	NA
	RICE 2	271658.76	4649868.72	572.51	54.46	725.00	25.00	2.49	3.830	NA
	RICE 3	271667.48	4649873.47	572.51	54.46	725.00	25.00	2.49	3.830	NA
	Turbine 1 (existing)	271675.10	4649877.80	572.51	54.46	723.00	59.50	3.28	0.730	NA
	Turbine 2 (existing)	271683.30	4649882.60	572.51	54.46	723.00	59.50	3.28	0.730	NA
	Turbine 3 (existing)	271613.80	4649863.10	572.51	55.12	755.00	15.78	9.02	0.590	NA
	Turbine 4 (proposed)	271577.60	4649843.00	572.51	55.12	755.00	15.78	9.02	0.590	NA
	Turbine 5 (proposed)	271669.29	4649858.42	572.51	60.37	763.00	70.72	6.89	0.380	NA
Invenergy Clean River Energy Center	Turbine 1 (NO2)	271725.83	4649606.72	570.01	200.00	366.50	17.71	22.01	6.170	NA
	Turbine 2 (NO2)	271818.60	4649661.23	570.01	200.00	366.50	17.71	22.01	6.170	NA
	Turbine 1 (PM2.5)	271725.83	4649606.72	570.01	200.00	395.90	15.43	22.01	NA	8.520
	Turbine 2 (PM2.5)	271818.60	4649661.23	570.01	200.00	395.90	15.43	22.01	NA	8.520

APPENDIX E: VISCREEN ANALYSIS

Visual Effects Screening Analysis for
Source: Killingly Energy Center
Class I Area: Lye Brook NWA

*** Level-1 Screening ***

Input Emissions for

Particulates	28.60	LB /HR
NOx (as NO2)	47.20	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	40.00 km
Source-Observer Distance:	160.00 km
Min. Source-Class I Distance:	160.00 km
Max. Source-Class I Distance:	170.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	160.0	84.	2.00	0.016	0.05	0.000
SKY	140.	84.	160.0	84.	2.00	0.003	0.05	0.000
TERRAIN	10.	84.	160.0	84.	2.00	0.001	0.05	0.000
TERRAIN	140.	84.	160.0	84.	2.00	0.000	0.05	0.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	70.	152.1	99.	2.00	0.017	0.05	0.000
SKY	140.	70.	152.1	99.	2.00	0.003	0.05	0.000
TERRAIN	10.	65.	149.3	104.	2.00	0.002	0.05	0.000
TERRAIN	140.	65.	149.3	104.	2.00	0.000	0.05	0.000

APPENDIX F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS

NTE Killingly Energy Center
Soils Screening Assessment - Updated 11/2017

Ambient Temperature (°F):	100				59				-10			100			59			-10		
Case #:	**1**	**2**	**4**	**5**	**36**	**37**	**39**	**40**	**33**	**34**	**35**	**2**	**3**	**4**	**28**	**14**	**15**	**25**	**29**	**30**
Fuel	**Natural Gas**											**ULSD**								
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45	45	45	45	60	60	60	100	100	100
MODELING INPUTS																				
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
EMISSION RATES (g/s)																				
Arsenic	1.03E-05	0	0	0	9.27E-06	0	0	0	0	0	0	0	1.29E-05	0	1.76E-05	1.42E-05	1.26E-05	1.76E-05	1.61E-05	1.38E-05
Beryllium	6.17E-07	0	0	0	5.56E-07	0	0	0	0	0	0	0	8.69E-05	0	1.18E-04	9.58E-05	8.50E-05	1.18E-04	1.08E-04	9.27E-05
Cadmium	5.66E-05	0	0	0	5.10E-05	0	0	0	0	0	0	0	1.43E-06	0	1.95E-06	1.58E-06	1.40E-06	1.95E-06	1.78E-06	1.53E-06
Chromium	7.20E-05	0	0	0	6.49E-05	0	0	0	0	0	0	0	3.47E-03	0	4.73E-03	3.83E-03	3.40E-03	4.73E-03	4.33E-03	3.70E-03
Cobalt	4.22E-06	0	0	0	3.80E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	2.37E-04	2.12E-04	1.63E-04	1.35E-04	2.50E-04	2.28E-04	1.78E-04	1.39E-04	2.31E-04	2.08E-04	1.58E-04	2.12E-04	2.95E-04	1.63E-04	4.02E-04	3.25E-04	2.88E-04	4.02E-04	3.67E-04	3.15E-04
Manganese	1.90E-05	0	0	0	1.72E-05	0	0	0	0	0	0	0	5.06E-05	0	6.89E-05	5.57E-05	4.95E-05	6.89E-05	6.30E-05	5.39E-05
Mercury	1.29E-05	0	0	0	1.16E-05	0	0	0	0	0	0	0	2.86E-06	0	3.90E-06	3.16E-06	2.80E-06	3.90E-06	3.57E-06	3.06E-06
Nickel	1.08E-04	0	0	0	9.74E-05	0	0	0	0	0	0	0	4.14E-04	0	5.64E-04	4.56E-04	4.05E-04	5.64E-04	5.16E-04	4.42E-04
Selenium	1.23E-06	0	0	0	1.11E-06	0	0	0	0	0	0	0	7.16E-05	0	9.76E-05	7.89E-05	7.01E-05	9.76E-05	8.92E-05	7.64E-05
MODELING RESULTS																				
AERMOD Unit Impacts (ug/m3 per g/s)																				
Annual	0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03
Scaled Impacts (ug/m3)																				
Arsenic	2.72E-07	0	0	0	2.31E-07	0	0	0	0	0	0	0	3.63E-07	0.00E+00	3.62E-07	3.91E-07	4.05E-07	3.80E-07	3.51E-07	3.64E-07
Beryllium	1.63E-08	0	0	0	1.39E-08	0	0	0	0	0	0	0	2.44E-06	0.00E+00	2.44E-06	2.64E-06	2.73E-06	2.56E-06	2.37E-06	2.45E-06
Cadmium	1.50E-06	0	0	0	1.27E-06	0	0	0	0	0	0	0	4.03E-08	0.00E+00	4.02E-08	4.35E-08	4.50E-08	4.23E-08	3.90E-08	4.04E-08
Chromium	1.91E-06	0	0	0	1.62E-06	0	0	0	0	0	0	0	9.76E-05	0.00E+00	9.75E-05	1.05E-04	1.09E-04	1.02E-04	9.46E-05	9.80E-05
Cobalt	1.12E-07	0	0	0	9.48E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	6.29E-06	5.26E-06	5.28E-06	4.97E-06	6.24E-06	5.68E-06	5.39E-06	5.09E-06	5.82E-06	5.51E-06	4.86E-06	4.63E-06	8.29E-06	5.63E-06	8.28E-06	8.95E-06	9.26E-06	8.70E-06	8.03E-06	8.33E-06
Manganese	5.04E-07	0	0	0	4.28E-07	0	0	0	0	0	0	0	1.42E-06	0.00E+00	1.42E-06	1.53E-06	1.59E-06	1.49E-06	1.38E-06	1.43E-06
Mercury	3.41E-07	0	0	0	2.89E-07	0	0	0	0	0	0	0	8.06E-08	0.00E+00	8.05E-08	8.70E-08	8.99E-08	8.45E-08	7.80E-08	8.09E-08
Nickel	2.86E-06	0	0	0	2.43E-06	0	0	0	0	0	0	0	1.16E-05	0.00E+00	1.16E-05	1.26E-05	1.30E-05	1.22E-05	1.13E-05	1.17E-05
Selenium	3.27E-08	0	0	0	2.78E-08	0	0	0	0	0	0	0	2.01E-06	0.00E+00	2.01E-06	2.17E-06	2.25E-06	2.11E-06	1.95E-06	2.02E-06

Killingly Energy Center - Soils Impact Screening Assessment

Trace Element	Annual Concentration (ug/m3)	Maximum Project Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Average Soil Concentration (ppmw)	Percent Increase	Soil Concentration Ratio	Plant Tissue Concentration Criteria (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	4.05E-07	1.16E-04	3	0.00%	6	0.00%	0.14	1.62E-05	0.25	0.01%
Beryllium	2.73E-06	7.82E-04	NA	NA	6	0.01%	NA	NA	NA	NA
Cadmium	1.50E-06	4.30E-04	2.5	0.02%	0.06	0.72%	10.7	4.60E-03	3	0.15%
Chromium	1.09E-04	3.12E-02	8.4	0.37%	100	0.03%	0.02	6.25E-04	1	0.06%
Cobalt	1.12E-07	3.20E-05	NA	NA	8	0.00%	0.11	3.52E-06	19	0.00%
Lead	9.26E-06	2.65E-03	1000	0.00%	10	0.03%	0.45	1.19E-03	126	0.00%
Manganese	1.59E-06	4.55E-04	2.5	0.02%	850	0.00%	0.066	3.00E-05	400	0.00%
Mercury	3.41E-07	9.76E-05	455	0.00%	0.1	0.10%	0.5	4.88E-05	NA	NA
Nickel	1.30E-05	3.72E-03	500	0.00%	40	0.01%	0.045	1.68E-04	60	0.00%
Selenium	2.25E-06	6.44E-04	13	0.00%	0.5	0.13%	1	6.44E-04	100	0.00%

STACK PARAMETERS FORM

From:	Babcock, Steven
Sent:	Monday, December 04, 2017 10:37 AM
To:	Grillo, James
Cc:	Gresock, Lynn
Subject:	RE: NTE Minor Modification
Attachments:	NTE KEC Attachment E211 - Stack Parameters 12042017.pdf

Jim,

Attached is the Stack Parameter form (DEEP-NSR-APP-211) for the minor modification application submitted for the Killing Energy Center to change the combustion turbine model to a Mitsubishi Model M501JAC combustion turbine generator (CTG).

Let me know if you have any questions.

Steve

Steven J. Babcock, P.E. | **Consulting Engineer**
Direct: 617.443.7533 | Cell: 617.758.9311 | Fax: 617.737.3480
Steven.J.Babcock@tetratech.com

Tetra Tech
160 Federal St., 3rd Floor | Boston, MA 02110 | www.tetratech.com

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From: Gresock, Lynn
Sent: Friday, December 01, 2017 3:59 PM
To: Babcock, Steven <Steven.Babcock2@tetratech.com>; Guertin, Ted <Ted.Guertin@tetratech.com>
Subject: Fwd: NTE Minor Modification

Sent from my iPhone

Begin forwarded message:

> **From:** "Grillo, James" <James.Grillo@ct.gov>
> **Date:** December 1, 2017 at 3:58:33 PM EST
> **To:** "'Gresock, Lynn'" <Lynn.Gresock@tetratech.com>
> **Subject: NTE Minor Modification**
>
> Lynn,
>
> I need the Stack Parameter form DEEP-NSR-APP-211.
>
> Thanks,
>
> Jim

Attachment E211: Stack and Building Parameters Supplemental Application Form

Applicant Name: **NTE Connecticut, LLC (Mitsubishi CTG)**

Complete this form in accordance with the instructions (DEEP-NSR-INST-211) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete this supplemental application form to provide the stack and building parameter information for all units that are part of this application package.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I. Stack Parameters Summary

Stack No.	Unit No.(s)	Control Equipment No.(s)	Stack Height (feet)	Stack Diameter (feet)	Stack Exit Temp (°F)		Stack Exhaust Flow Rate (ACFM)		Stack Exit Direction (H or V)	Rain Hat (Y or N)	Stack Lining Material	Stack Distance to Nearest Property Line (feet)
					Max	Min	Max	Min				
1	CT/DB	SCR/O	150	22.0	207	175	1.8E6	1.1E6	V	N	Metal	425
2	AB	N/A	90	4.0	300	N/A	20500	N/A	V	N	Metal	430
3	EG	N/A	25	1.17	840	N/A	6,600	N/A	V	N	Metal	440
4	FP	N/A	20	1.0	961	N/A	1,100	N/A	V	N	Metal	130
5	GH	N/A	20	1.0	250	N/A	2,700	N/A	V	N	Metal	345

☐ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part II. Building Parameters Summary

Complete this Part if a Stack Height Review or Screening Ambient Air Quality Analysis is required. This Part is not required for sources performing a Refined Modeling Analysis.

Building No.	Building Description	Building Height (H) (feet)	Building Length (L) (feet)	Building Width (W) (feet)	Building Distance to				Building Distance to Nearest Property Line (feet)
					Stack No.	Stack No.	Stack No.	Stack No.	

☐ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part III. Attachment

Please check the attachments being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E211-A, etc.) and be sure to include the applicant's name.

☒ Attachment E211-A: *Plot Plan* – Submit a detailed plot plan of the facility with all structures, stack locations, and property lines clearly delineated. In addition you may submit sketches, aerial photos, or other site plans to aid in the identification of buildings listed in Part II and their locations with respect to the stacks listed in Part I. **REQUIRED**

DISPERSION MODELING UPDATE

MEMO

To:	James Grillo, Connecticut Department of Energy and Environmental Protection
From:	Steven Babcock, Lynn Gresock
Date:	January 12, 2018
Subject:	Killingly Energy Center: Minor Adjustments to Dispersion Modeling

A Minor Modification Application for Stationary Sources of Air Pollution Permit No.089-0107 to construct and operate for the proposed Killingly Energy Center (KEC) located in Killingly, Connecticut – submitted by NTE Connecticut, LLC (NTE) on November 22, 2017 – has been found complete and is under technical review by the Connecticut Department of Energy and Environmental Protection (DEEP).

As the final internal grading plan was completed, NTE identified the need to shift certain storage tanks, resulting in some additional minor adjustments to the layout in that area. This includes relocation of the emergency fire pump engine (an emission source) as well as: the ultra-low sulfur distillate storage tank; the raw/fire water tank; the demineralized water storage tank; and the water treatment building. Although these changes are minor in nature, the dispersion modeling has been updated to confirm that no material change in KEC-related impacts will result. There are no changes to the emission source parameters proposed.

The revised site configuration results in minimal change to the modification application. Attachment A includes the single affected form (E211) revised to reflect the distance to property line for the emergency fire pump engine stack.

The same modeling procedures documented in the modeling report dated November 22, 2017 were used. Therefore, the revised air dispersion modeling analysis presents only the revised inputs and results, as applicable, to account for the changes described above. The revised modeling results confirm that no material change in KEC-related impacts will result from the updated site configuration. The revised pages of the Ambient Air Quality Analysis report are provided in Attachment B and include the following:

- Table 2: Stack Characteristics
- Table 8: Maximum Predicted Impact Concentrations
- Table 9: Cumulative NAAQS Compliance Assessment
- Table 10: Cumulative PSD Increment Compliance Assessment
- Table 11: Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds
- Table 12: Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds
- Table 13: Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds
- Table 14: Soils Impact Screening Assessment
- Updated Appendix B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA
    - Figure L-B: Buildings, Structures, and Stacks Input to AERMOD
    - BPIP Input
    - BPIP Output
- Updated Appendix C: DETAILED AERMOD RESULTS SUMMARY
    - Killingly Energy Center – Detailed Results Table
    - Killingly Energy Center – Cumulative Impacts
- Updated Appendix F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS
    - Killingly Energy Center – Soils Screening Assessment

ATTACHMENT A: UPDATED PERMIT APPLICATION FORM

Attachment E211: Stack and Building Parameters Supplemental Application Form

Applicant Name: **NTE Connecticut, LLC (Mitsubishi CTG)**

Complete this form in accordance with the instructions (DEEP-NSR-INST-211) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete this supplemental application form to provide the stack and building parameter information for all units that are part of this application package.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I. Stack Parameters Summary

Stack No.	Unit No.(s)	Control Equipment No.(s)	Stack Height (feet)	Stack Diameter (feet)	Stack Exit Temp (°F)		Stack Exhaust Flow Rate (ACFM)		Stack Exit Direction (H or V)	Rain Hat (Y or N)	Stack Lining Material	Stack Distance to Nearest Property Line (feet)
					Max	Min	Max	Min				
1	**CT/DB**	**SCR/O**	**150**	**22.0**	**207**	**175**	**1.8E6**	**1.1E6**	**V**	**N**	**Metal**	**425**
2	**AB**	**N/A**	**90**	**4.0**	**300**	**N/A**	**20500**	**N/A**	**V**	**N**	**Metal**	**430**
3	**EG**	**N/A**	**45**	**1.17**	**840**	**N/A**	**6,600**	**N/A**	**V**	**N**	**Metal**	**440**
4	**FP**	**N/A**	**20**	**1.0**	**961**	**N/A**	**1,100**	**N/A**	**V**	**N**	**Metal**	**140**
5	**GH**	**N/A**	**20**	**2.0**	**250**	**N/A**	**2,700**	**N/A**	**V**	**N**	**Metal**	**345**

☐ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part II. Building Parameters Summary

Complete this Part if a Stack Height Review or Screening Ambient Air Quality Analysis is required. This Part is not required for sources performing a Refined Modeling Analysis.

Building No.	Building Description	Building Height (H) (feet)	Building Length (L) (feet)	Building Width (W) (feet)	Building Distance to				Building Distance to Nearest Property Line (feet)
					Stack No.	Stack No.	Stack No.	Stack No.	

☐ Check here if additional sheets are necessary, and label and attach them to this sheet.

Part III. Attachment

Please check the attachments being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E211-A, etc.) and be sure to include the applicant's name.

☒	Attachment E211-A:	*Plot Plan* – Submit a detailed plot plan of the facility with all structures, stack locations, and property lines clearly delineated. In addition you may submit sketches, aerial photos, or other site plans to aid in the identification of buildings listed in Part II and their locations with respect to the stacks listed in Part I. **REQUIRED**

ATTACHMENT B: REVISED AMBIENT AIR QUALITY ANALYSIS REPORT PAGES

Table 2. Stack Characteristics

Source	UTM* E (m)	UTM N (m)	Base Elevation (feet)	Stack Height (feet)	Stack Diameter (feet)
HRSG Stack	257865.36	4638681.24	318	150	22.0
Auxiliary Boiler	257876.13	4638694.43	318	90	4.0
Emergency Generator	257933.57	4638588.97	318	45	1.17
Fire Pump	257859.3	4638574.17	318	20	1.0
Gas Dew Point Heater	257881.81	4638594.65	318	20	2.0

*UTM = Universal Transverse Mercator

Table 8. Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Rank Basis for SIL Assessment	Impact Concentration (µg/m^3)	SIL (µg/m^3)	Extent of SIA (km)	NAAQS (µg/m^3)	PSD Class II Increment (µg/m^3)
NO_2 (Normal Load)	1-hour	H1H (5-year Average)	11.23	7.5	12.1	188	NA
	Annual	H1H	0.97	1	NA	100	25
NO_2 (SUSD)	1-hour	H1H (5-year Average)	65.45	NA	NA	188	NA
	Annual	H1H	0.98	NA	NA	100	25
CO	1-hour	H1H	860.91	2,000	NA	40,000	NA
	8-hour	H1H	101.45	500	NA	10,000	NA
PM_{10}	24-hour	H1H	2.19	5	NA	150	30
	Annual	H1H	0.18	1	NA	NA	17
$PM_{2.5}$ (NAAQS)	24-hour	H1H (5-year Average)	1.73	1.2	0.5	35	NA
	Annual	H1H (5-year Average)	0.17	0.2	NA	12	NA
$PM_{2.5}$ (PSD)	24-hour	H1H	2.19	1.2	0.7	NA	9
	Annual	H1H	0.18	0.2	NA	NA	4
SO_2	1-hour	H1H (5-year Average)	1.79	7.8	NA	196	NA
	3-hour	H1H	1.32	25	NA	1300	512
	24-hour	H1H	0.63	5	NA	365	91
	Annual	H1H	0.05	1	NA	80	20

Notes:
Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum
5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentrations prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

SIA = Significant Impact Area, defined as a circle with a radius equal to the distance to the furthest receptor for which the maximum predicted impact exceeds the SIL.

Table 9. Cumulative NAAQS Compliance Assessment

Pollutant	Averaging Period	Rank Basis for NAAQSL Assessment	Cumulative Impact Concentration (µg/m³)	Ambient Background (µg/m³)	Total Impact Plus Background (µg/m³)	NAAQS (µg/m³)
NO_2 (Normal Load)	1-Hour	H8H (5-year Average)	8.3	84.6	92.9	188
NO_2 (SUSD)	1-Hour	H8H (5-year Average)	50.3	84.6	134.9	188
$PM_{2.5}$	24-hour	H8H (5-year Average)	1.4	18	19.4	35

Notes:

- Total cumulative impact concentrations based on consideration of all receptors and time periods where the Facility has a predicted significant impact concentration (based on 5-year average maximum H1H for 1-hour NO_2 and 24-hour $PM_{2.5}$).
- NO_2 concentrations assume NO_X to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9).
- Assessment of the 1-hour NO_2 NAAQS for the transient turbine SUSD conditions consists of adding ambient background to Facility-only concentrations.

Table 10. Cumulative PSD Increment Compliance Assessment

Pollutant	Averaging Period	Total Increment Consumption[1] (µg/m³)	Maximum Allowable PSD Increment (µg/m³)
$PM_{2.5}$	24-hour	2.0	9

[1] Impact concentrations are conservatively based on the maximum highest second highest (H2H) concentration predicted across the range of modeled years.

Table 11. Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	65.45	66,000[a]	Leaf Injury to plant
2-hour	65.45	1,130[b]	Affects to alfalfa
Annual	0.98	100[c]	Protects all vegetation
		190[d]	Metabolic and growth impact to plants

[a] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976.

[b] "Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of SO_2 and NO_2" Environmental Science and Technology, vol. 8(6): p.574-576, 1975. The limit is based on a concentration in ambient air of 0.6 ppm NO_2
(U 1,130 $\mu g/m^3$) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

[c] "Secondary National Ambient Air Quality Standard ($\mu g/m^3$) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[d] "Air Quality Criteria for Oxides of Nitrogen," EPA/600/8-91/049aF-cF.3v, Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1993.

Table 12. Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	860.91	40,000[a]	Protects all vegetation
8-hour	101.45	10,000[a]	Protects all vegetation
Multiple day		10,000[b]	No known effects to vegetation
1-week		115,000[c]	Effects to some vegetation
Multiple week		115,000[d]	No effect on various plant species

[a] Secondary NAAQS ($\mu g/m^3$) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[b] "Air Quality Criteria for Carbon Monoxide," EPA/600/8-90/045F (NTIS PB93-167492), Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1991. Various CO concentrations were examined the lowest of these was 10,000 $\mu g/m^3$. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 $\mu g/m^3$ caused no effects. The exception was legume seedlings which were found to experience abnormal leaf growth when exposed to CO concentrations of only 27,000 $\mu g/m^3$. Also related to this family of plants, CO concentrations in the soil of 113,000 $\mu g/m^3$ were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 $\mu g/m^3$ will not affect vegetation.

[c] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976. A CO concentration of 115,000 $\mu g/m^3$ was found to affect certain plant species.

[d] "Polymorphic Regions in Plant Genomes Detected by an M13 Probe" Zimmerman, P.A., et al. 1989. Genome 32: 824-828. 115,000 $\mu g/m^3$ was the lowest CO concentration included in this study. This concentration was not found to cause a reduction in growth rate to a variety of plant species.

Table 13. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (µg/m^3)	Threshold for Impact to Vegetation (µg/m^3)	Applicability
SO_2			
1-hour SO_2	1.79	131[a]	Suggested worst-case limit
3-hour SO_2	1.32	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	0.63	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.05	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	2.19	150[c]	Protects all vegetation
Annual PM_{10}	0.18	50[c]	Protects all vegetation
Annual PM_{10}		579[e]	Damage to sensitive species (fir tree)

a. "Crop and Forest Losses due to Current and Projected Emissions from Coal-Fired Power Plants in the Ohio River Basin" Loucks, O.L., R.W. Miller, et al. 1980. The Institute of Ecology. In this publication, the authors propose 1-hour thresholds from 131 to 262 µg/m^3.

b. "Impacts of Coal-fired Power Plants on Fish, Wildlife, and their Habitats" Dvorak, A.J., et al. Argonne National Laboratory. Argonne, Illinois. Fish and Wildlife Service Publication No. FWS/OBS-78/29. March 1978. This document indicates the lowest 3-hour SO_2 concentration expected to cause injury to sensitive plants growing under compromised conditions is approximately 390 µg/m^3. Similarly, a threshold of 130 µg/m^3 is suggested for chronic exposure.

c. Secondary National Ambient Air Quality Standard (µg/m^3) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

d. "Concurrent Exposure to SO_2 and/or NO_2 Alters Growth and Yield Responses of Wheat and Barley to Low Concentrations of O_3" (New Phytologist, 118 (4). 1991. pp. 581-592). This paper indicates exposure to 63 µg/m^3 of SO_2 during the growing season had insignificant effects to wheat but did affect the weight of Barley seeds.

e. "Responses of Plants to Air Pollution" Lerman, S.L., and E.F. Darley. 1975. "Particulates," pp. 141-158 (Chap. 7). In J.B. Mudd and T.T. Kozlowski (eds.). Academic Press. New York, NY. Results of studies conducted indicated concluded that particulate deposition rates of 365 g/m^2/yr caused damage to fir trees, but rates of 274 g/m^2/year and 400 to 600 g/m^2/yr did not cause damage to vegetation. 365 g/m^2/yr translates to W579 µg/m^3, using a worst-case deposition velocity of 2 centimeters per second.

Table 14. Soils Impact Screening Assessment

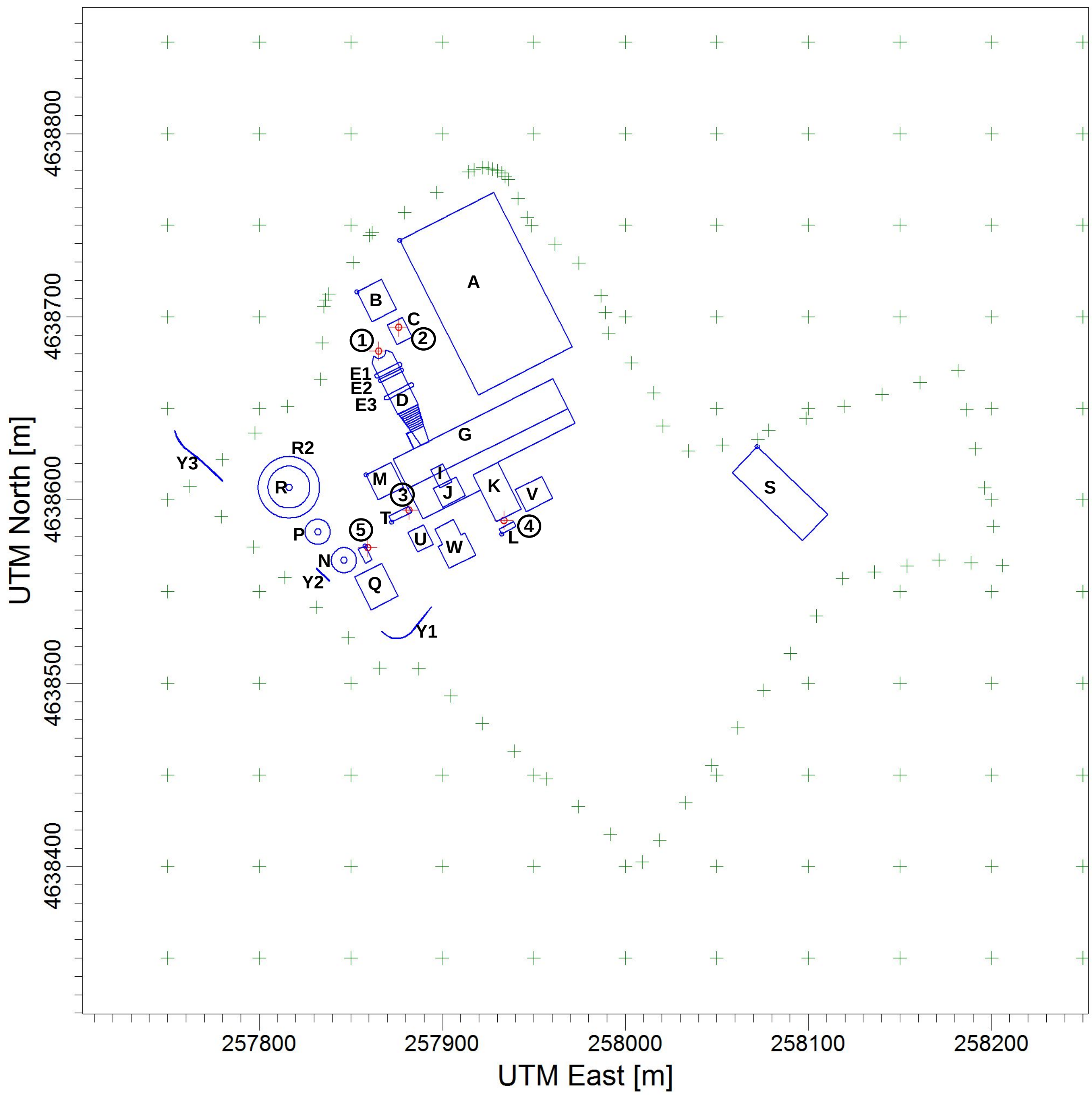
Pollutant	Maximum Facility Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Plant Tissue Concentration (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	1.16E-04	3	0.00%	1.62E-05	0.25	0.01%
Beryllium	7.81E-04	NA	NA	NA	NA	NA
Cadmium	4.29E-04	2.5	0.02%	4.59E-03	3	0.15%
Chromium	3.12E-02	8.4	0.37%	6.24E-04	1	0.06%
Cobalt	3.20E-05	NA	NA	3.52E-06	19	0.00%
Lead	2.65E-03	1000	0.00%	1.19E-03	126	0.00%
Manganese	4.54E-04	2.5	0.02%	3.00E-05	400	0.00%
Mercury	9.75E-05	455	0.00%	4.88E-05	NA	NA
Nickel	3.72E-03	500	0.00%	1.67E-04	60	0.00%
Selenium	6.44E-04	13	0.00%	6.44E-04	100	0.00%

Note: Based on screening procedures described in Chapter 5 of the USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980).

UPDATED APPENDIX B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA

PROJECT TITLE:

Killingly Energy Center 01/2018
Mitsubishi Model M501JAC



LEGEND

	Building / Structure Name	Grade Elevation (ft)	Height above Grade (ft)			Grade Elevation (ft)	Height above Grade (ft)
A	Air Cooled Condenser	318	80	Q	Water Treatment Building	318	25.5
B	Closed Cooling Water Fan Array	318	22	R	Fuel Oil Tank	318	45
C	Auxiliary Boiler	318	26	R2	Fuel Oil Tank Outer Wall	318	21
D	Heat Recovery Steam Generator (HRSG)	318	95	S	Administration	318	26
E1	HRSG Drum 1	318	106	T	Gas Heater Enclosure	318	18
E2	HRSG Drum 2	318	106	U	Control Building	318	26
E3	HRSG Drum 3	318	106	V	Transformer Sound Wall 1	318	10
F	Turbine Exhaust Diffuser (10 tiers)	318	28.6-83.9	W	Transformer Sound Wall 2	318	10
G	Turbine Building High Bay	318	78.6	X	Diffuser Sound Wall	318	40
H	Turbine Building Low Bay	318	39.1	Y1	Boundary Sound Wall 1	318	22
I	Air Inlet Filter Housing Duct	318	69.8	Y2	Boundary Sound Wall 2	318	18
J	Air Inlet Filter Housing	318	92.4	Y3	Boundary Sound Wall 3	318	16
K	Control/Maintenance Building	318	26				
L	Emergency Generator	318	16	1	HRSG	318	150
M	Fuel Gas Compressor	318	21	2	Auxiliary Boiler	318	90
N	Demineralized Water Storage Tank	318	38	3	Gas Heater	318	20
O	Fire Pump Enclosure	318	16	4	Emergency Generator	318	45
P	Service Water Storage Tank	318	43	5	Fire Pump	318	20

TETRA TECH

Figure 1

Buildings, Structures, and Stacks Input to AERMOD

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

AERMOD View - Lakes Environmental Software

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'Killingly Energy Center 01/2018'
'P'
'METERS'  1.00000000
'UTMY'  0.0000
26
'FIREPUMP'  1           96.93
    4           4.88
            257857.93      4638575.10
            257861.80      4638567.50
            257858.00      4638565.56
            257854.13      4638573.16
'CONTROL'  1           96.93
    4           7.92
            257916.74      4638613.75
            257930.37      4638620.62
            257943.21      4638595.08
            257929.45      4638588.26
'EMGEN'  1           96.93
    4           4.88
            257932.48      4638581.55
            257931.12      4638584.22
            257939.00      4638588.24
            257940.36      4638585.57
'CTDIFF1'  1           96.93
    4           8.71
            257883.24      4638637.20
            257889.93      4638640.54
            257892.75      4638631.99
            257888.43      4638629.82
'ADMIN'  1           96.93
    4           7.92
            258072.11      4638629.26
            258110.47      4638592.22
            258096.70      4638577.96
            258058.34      4638615.00
'DEMINTNK'  1           96.93
    8          11.58
            257846.38      4638573.99
            257841.53      4638571.98
            257839.52      4638567.13
            257841.53      4638562.28
            257846.38      4638560.27
            257851.23      4638562.28
            257853.24      4638567.13
            257851.23      4638571.98
'SVCTANK'  1           96.93
    8          13.11
            257831.99      4638589.51
            257827.14      4638587.50
            257825.13      4638582.65
            257827.14      4638577.80
            257831.99      4638575.79
            257836.84      4638577.80
            257838.85      4638582.65
            257836.84      4638587.50
'GASCOMP'  1           96.93
    4           6.40
            257858.39      4638613.92
            257872.10      4638620.61
            257878.79      4638606.90
            257865.08      4638600.21
'OILTANKE'  2           96.93
    8           6.40
            257816.30      4638623.73
            257804.45      4638618.82
            257799.54      4638606.97
            257804.45      4638595.12
            257816.30      4638590.21
            257828.15      4638595.12
            257833.06      4638606.97
            257828.15      4638618.82
    8          13.72
            257816.32      4638618.47
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            257808.24      4638615.12
            257804.89      4638607.04
            257808.24      4638598.96
            257816.32      4638595.61
            257824.40      4638598.96
            257827.75      4638607.04
            257824.40      4638615.12
'GASHTR'  1           96.93
    4          5.49
            257872.47      4638588.11
            257870.89      4638591.35
            257881.63      4638596.59
            257883.21      4638593.35
'ACC'  1           96.93
    4         24.38
            257876.77      4638741.74
            257928.17      4638767.93
            257971.14      4638683.60
            257919.74      4638657.41
'COOLFAN'  1           96.93
    4          6.71
            257853.50      4638713.73
            257866.65      4638720.43
            257874.96      4638704.13
            257861.81      4638697.42
'AUXBLR'  1           96.93
    5          7.92
            257869.94      4638695.57
            257878.28      4638699.70
            257883.51      4638689.19
            257875.19      4638685.02
            257875.19      4638685.02
'WWTRTMT'  1           96.93
    4          7.77
            257852.14      4638557.96
            257867.13      4638565.46
            257876.05      4638547.66
            257860.96      4638540.10
'TURBHIGH'  1           96.93
    4         23.96
            257873.33      4638622.49
            257960.44      4638666.14
            257968.63      4638649.80
            257881.29      4638606.48
'CONTROL3'  1           96.93  'Additional Control Building added 10/17/2017'
    4          7.92
            257889.82      4638586.64
            257895.17      4638575.96
            257886.71      4638571.67
            257881.30      4638582.40
'HRSG'  4           96.93
    11         28.96
            257862.55      4638678.56
            257863.71      4638677.71
            257865.26      4638677.33
            257867.09      4638677.75
            257868.45      4638678.84
            257869.16      4638680.46
            257869.19      4638681.91
            257872.74      4638680.37
            257886.89      4638652.23
            257875.71      4638646.66
            257861.58      4638674.85
    16         32.31
            257869.03      4638656.88
            257882.67      4638663.72
            257883.17      4638663.86
            257883.76      4638663.76
            257884.13      4638663.44
            257884.37      4638662.95
            257884.39      4638662.43
            257884.15      4638661.96
            257883.72      4638661.65
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           257870.06      4638654.80
           257869.60      4638654.64
           257868.99      4638654.76
           257868.60      4638655.07
           257868.37      4638655.55
           257868.34      4638656.04
           257868.57      4638656.56
   12           32.31
           257865.39      4638665.58
           257877.88      4638671.84
           257878.24      4638671.76
           257878.50      4638671.57
           257878.75      4638671.06
           257878.74      4638670.73
           257878.60      4638670.42
           257866.11      4638664.16
           257865.75      4638664.25
           257865.49      4638664.44
           257865.26      4638664.91
           257865.23      4638665.28
   16           32.31
           257863.48      4638668.66
           257876.57      4638675.22
           257877.00      4638675.12
           257877.37      4638674.92
           257877.61      4638674.62
           257877.85      4638674.13
           257877.89      4638673.70
           257877.85      4638673.29
           257877.70      4638672.95
           257864.62      4638666.40
           257864.20      4638666.53
           257863.84      4638666.76
           257863.56      4638667.00
           257863.34      4638667.47
           257863.27      4638667.88
           257863.30      4638668.30
'AIRINLET'  2           96.93
   4           21.26
           257893.83      4638616.35
           257900.30      4638619.59
           257905.20      4638609.89
           257898.65      4638606.64
   4           28.16
           257895.05      4638606.44
           257907.56      4638612.70
           257912.64      4638602.38
           257900.13      4638596.08
'TURBLOW'  1           96.93
   6           11.93
           257881.29      4638606.48
           257889.67      4638589.85
           257920.86      4638605.48
           257916.74      4638613.75
           257972.59      4638641.88
           257968.63      4638649.80
'CTDIFF'  10           96.93
   4            8.71
           257876.04      4638646.84
           257886.53      4638652.05
           257889.94      4638640.54
           257883.24      4638637.20
   8           10.58
           257876.05      4638646.84
           257882.45      4638638.27
           257882.53      4638638.16
           257888.49      4638641.13
           257889.60      4638641.68
           257889.56      4638641.81
           257886.53      4638652.05
           257877.20      4638647.42
   8           12.46
           257876.06      4638646.84
```

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             257881.66      4638639.34
             257881.82      4638639.12
             257887.04      4638641.72
             257889.26      4638642.83
             257889.18      4638643.09
             257886.53      4638652.04
             257878.37      4638647.99
     8           14.33
             257876.07      4638646.84
             257880.87      4638640.41
             257881.11      4638640.08
             257885.58      4638642.31
             257888.91      4638643.97
             257888.80      4638644.36
             257886.53      4638652.04
             257879.53      4638648.57
     8           16.21
             257876.08      4638646.84
             257880.08      4638641.48
             257880.41      4638641.05
             257884.13      4638642.90
             257888.57      4638645.12
             257888.42      4638645.64
             257886.52      4638652.03
             257880.70      4638649.14
     8           18.08
             257876.09      4638646.84
             257879.29      4638642.55
             257879.70      4638642.01
             257882.68      4638643.49
             257888.23      4638646.26
             257888.04      4638646.91
             257886.52      4638652.03
             257881.86      4638649.71
     8           19.96
             257876.10      4638646.84
             257878.50      4638643.62
             257878.99      4638642.97
             257881.23      4638644.08
             257887.89      4638647.41
             257887.66      4638648.19
             257886.52      4638652.03
             257883.03      4638650.29
     8           21.83
             257876.11      4638646.83
             257877.70      4638644.69
             257878.28      4638643.93
             257879.77      4638644.67
             257887.55      4638648.55
             257887.28      4638649.46
             257886.52      4638652.02
             257884.19      4638650.86
     8           23.71
             257876.11      4638646.83
             257876.91      4638645.76
             257877.58      4638644.89
             257878.32      4638645.26
             257887.20      4638649.70
             257886.90      4638650.74
             257886.52      4638652.02
             257885.35      4638651.44
     4           25.58
             257876.12      4638646.83
             257886.52      4638652.01
             257886.86      4638650.84
             257876.87      4638645.85
 'DIFFWALL'  1           96.93  'Diffuser sound wall'
     6           12.19
             257883.00      4638637.43
             257880.43      4638636.26
             257884.20      4638627.99
             257884.37      4638628.01
             257880.61      4638636.20
```

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           257883.09      4638637.33
'WALL1'  1          96.93  'Sound wall south of water treatment building'
    25           6.71
           257894.41      4638541.78
           257893.51      4638540.83
           257890.33      4638536.70
           257886.19      4638531.45
           257882.82      4638527.29
           257880.10      4638525.33
           257878.39      4638524.74
           257876.38      4638524.33
           257874.68      4638524.32
           257872.27      4638524.65
           257869.72      4638525.93
           257866.99      4638528.24
           257867.13      4638528.38
           257869.83      4638526.12
           257872.37      4638525.02
           257874.89      4638524.64
           257876.85      4638524.70
           257878.81      4638525.21
           257879.94      4638525.70
           257880.87      4638526.29
           257882.71      4638527.65
           257886.37      4638532.26
           257890.67      4638537.72
           257892.16      4638539.52
           257893.89      4638541.60
'WALL2'  1          96.93  'Sound wall between water tanks'
    4           5.49
           257831.18      4638562.50
           257838.24      4638555.80
           257838.48      4638555.99
           257831.44      4638562.76
'WALL3'  1          96.93  'Sound wall north of oil tank'
    22           4.88
           257753.89      4638637.84
           257754.69      4638634.87
           257756.30      4638631.82
           257757.70      4638630.01
           257758.99      4638628.60
           257760.85      4638627.18
           257765.30      4638623.65
           257768.36      4638621.20
           257773.19      4638616.88
           257779.97      4638610.28
           257780.15      4638610.54
           257777.01      4638613.65
           257773.14      4638617.37
           257769.77      4638620.44
           257766.58      4638623.12
           257763.22      4638625.73
           257760.64      4638627.80
           257759.15      4638629.02
           257757.32      4638631.24
           257756.18      4638632.90
           257755.13      4638634.84
           257754.24      4638637.86
'TRNSWAL1'  1          96.93  'Transformer sound wall 1'
    8           3.05
           257906.27      4638589.39
           257896.08      4638584.27
           257900.28      4638575.97
           257897.90      4638574.75
           257903.89      4638562.66
           257918.36      4638569.98
           257912.37      4638582.03
           257910.34      4638580.98
'TRNSWAL2'  1          96.93  'Transformer sound wall 2'
    4           3.05
           257954.34      4638612.94
           257939.81      4638605.64
           257945.83      4638593.64
```

```
            257960.42      4638600.94
5
'CTG'                    96.93       45.72       257865.36      4638681.24
'Combustion Turbine and HRSG'
'AUX'                    96.93       27.43       257876.13      4638694.43  'Auxiliary
Boiler'
'GH'                     96.93        6.10       257881.81      4638594.65  'Natural
Gas Heater'
'EDG'                    96.93       13.72       257933.57      4638588.97  'Emergency
Diesel Generator'
'FP'                     96.93        6.10       257859.30      4638574.17  'Emergecy
Fire Pump Engine'
```

Killingly Energy Center 01/2018

BPIP (Dated: 04274)

DATE : 1/11/2018
TIME : 17:11: 2
Killingly Energy Center 01/2018

============================
BPIP PROCESSING INFORMATION:
============================

The P flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in METERS will be converted to meters using a conversion factor of 1.0000. Output will be in meters.

The UTMP variable is set to UTMY. The input is assumed to be in UTM coordinates. BPIP will move the UTM origin to the first pair of UTM coordinates read. The UTM coordinates of the new origin will be subtracted from all the other UTM coordinates entered to form this new local coordinate system.

Plant north is set to 0.00 degrees with respect to True North.

Killingly Energy Center 01/2018

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
CTG	45.72	0.00	72.40	72.40
AUX	27.43	0.00	72.40	72.40
GH	6.10	0.00	69.74	69.74
EDG	13.72	0.00	61.56	65.00
FP	6.10	0.00	72.40	72.40

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 1/11/2018
TIME : 17:11: 2

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BPIP output is in meters

SO	BUILDHGT	CTG	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	CTG	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	CTG	28.96	23.96	23.96	23.96	28.96	28.96
SO	BUILDHGT	CTG	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	CTG	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	CTG	28.96	23.96	23.96	23.96	28.96	28.96
SO	BUILDWID	CTG	28.85	31.88	34.24	35.57	35.82	34.97
SO	BUILDWID	CTG	35.35	35.85	35.25	33.58	30.89	27.71
SO	BUILDWID	CTG	23.91	98.98	98.38	98.89	21.00	25.31
SO	BUILDWID	CTG	28.85	31.88	34.24	35.57	35.82	34.97
SO	BUILDWID	CTG	35.35	35.85	35.25	33.58	30.89	27.71
SO	BUILDWID	CTG	23.91	98.98	98.38	98.89	21.00	25.31
SO	BUILDLEN	CTG	33.58	30.89	27.71	23.91	19.39	14.28
SO	BUILDLEN	CTG	16.05	21.00	25.31	28.85	31.88	34.24
SO	BUILDLEN	CTG	35.57	90.22	77.95	28.99	35.85	35.25
SO	BUILDLEN	CTG	33.58	30.89	27.71	23.91	19.39	14.28
SO	BUILDLEN	CTG	16.05	21.00	25.31	28.85	31.88	34.24
SO	BUILDLEN	CTG	35.57	40.34	24.00	28.99	35.85	35.25
SO	XBADJ	CTG	-32.26	-28.95	-24.77	-19.84	-14.30	-8.33
SO	XBADJ	CTG	-5.74	-4.83	-3.78	-2.61	-1.72	-1.09
SO	XBADJ	CTG	-0.43	0.25	0.92	46.71	0.01	-0.67
SO	XBADJ	CTG	-1.32	-1.94	-2.94	-4.08	-5.09	-5.96
SO	XBADJ	CTG	-10.31	-16.17	-21.53	-26.24	-30.15	-33.15
SO	XBADJ	CTG	-35.14	-90.47	-78.86	-75.70	-35.85	-34.58
SO	YBADJ	CTG	-11.81	-14.21	-16.03	-17.36	-18.15	-18.40
SO	YBADJ	CTG	-18.36	-17.93	-16.96	-15.47	-13.51	-10.92
SO	YBADJ	CTG	-7.88	13.64	25.60	36.84	5.67	8.88
SO	YBADJ	CTG	11.81	14.21	16.03	17.36	18.15	18.40
SO	YBADJ	CTG	18.36	17.93	16.95	15.47	13.51	10.92
SO	YBADJ	CTG	7.88	-13.64	-25.60	-36.84	-5.67	-8.88

SO	BUILDHGT	AUX	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	AUX	28.96	28.96	28.96	28.96	28.96	24.38
SO	BUILDHGT	AUX	24.38	24.38	23.96	23.96	24.38	28.96
SO	BUILDHGT	AUX	28.96	28.96	28.96	28.96	28.96	28.96
SO	BUILDHGT	AUX	28.96	28.96	28.96	28.96	28.96	24.38
SO	BUILDHGT	AUX	24.38	24.38	23.96	23.96	24.38	28.96
SO	BUILDWID	AUX	28.85	31.88	34.24	35.57	35.82	34.97
SO	BUILDWID	AUX	35.35	35.85	35.25	33.58	30.89	99.93
SO	BUILDWID	AUX	90.08	77.50	98.38	98.89	82.84	25.31
SO	BUILDWID	AUX	28.85	31.88	34.24	35.57	35.82	34.97
SO	BUILDWID	AUX	35.35	35.85	35.25	33.58	30.89	99.93
SO	BUILDWID	AUX	90.08	77.50	98.38	98.89	82.84	25.31
SO	BUILDLEN	AUX	33.58	30.89	27.71	23.91	19.39	14.28
SO	BUILDLEN	AUX	16.05	21.00	25.31	28.85	31.88	110.80
SO	BUILDLEN	AUX	109.66	105.20	77.95	75.02	107.38	35.25
SO	BUILDLEN	AUX	33.58	30.89	27.71	23.91	19.39	14.28
SO	BUILDLEN	AUX	16.05	21.00	25.31	28.85	31.88	110.80
SO	BUILDLEN	AUX	109.66	105.20	24.00	28.99	107.38	35.25
SO	XBADJ	AUX	-47.12	-45.03	-41.58	-36.86	-31.03	-24.25
SO	XBADJ	AUX	-20.37	-17.73	-14.55	-10.93	-7.33	-23.10
SO	XBADJ	AUX	-29.92	-35.83	6.95	9.39	-63.35	12.52
SO	XBADJ	AUX	13.53	14.14	13.87	12.95	11.63	9.97
SO	XBADJ	AUX	4.32	-3.27	-10.76	-17.92	-24.54	-87.70
SO	XBADJ	AUX	-79.74	-69.37	-84.90	-84.41	-44.03	-47.77
SO	YBADJ	AUX	-3.50	-8.61	-13.30	-17.58	-21.34	-24.44
SO	YBADJ	AUX	-27.07	-29.05	-30.15	-30.33	-29.59	39.71
SO	YBADJ	AUX	44.71	48.36	9.68	22.21	50.27	-1.89
SO	YBADJ	AUX	3.50	8.61	13.30	17.58	21.34	24.44

```
SO YBADJ    AUX        27.07   29.05   30.15   30.33   29.59  -39.71
SO YBADJ    AUX       -44.71  -48.36   -9.68  -22.21  -50.27    1.89


SO BUILDHGT GH         28.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   28.96   28.96
SO BUILDHGT GH         28.96   24.38   24.38   24.38   24.38   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDWID GH         27.19   80.21   68.88   55.45   40.34   24.00
SO BUILDWID GH         28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GH         96.58   98.98   98.38   98.89   21.00   25.31
SO BUILDWID GH         27.19  108.56  110.80  109.66  105.20   24.00
SO BUILDWID GH         28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GH         96.58   98.98   98.38   98.89   98.59   95.30
SO BUILDLEN GH         33.58   83.13   91.24   96.58   98.98   98.38
SO BUILDLEN GH         98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GH         55.45   40.34   24.00   28.99   35.85   35.25
SO BUILDLEN GH         33.58  106.74   99.93   90.08   77.50   98.38
SO BUILDLEN GH         98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GH         55.45   40.34   24.00   28.99   45.01   59.66
SO XBADJ    GH         50.16   10.94    9.99    8.73    7.21    5.46
SO XBADJ    GH          1.55   -3.52   -8.48  -13.19  -17.49  -21.26
SO XBADJ    GH        -24.39  -26.78  -28.35  -40.29  -88.13  -87.26
SO XBADJ    GH        -83.74 -178.69 -173.24 -162.54 -146.90 -103.84
SO XBADJ    GH       -100.45  -95.08  -86.82  -75.92  -62.72  -47.61
SO XBADJ    GH        -31.06  -13.56    4.35   11.29   11.74   11.83
SO YBADJ    GH         19.42  -22.62  -13.17   -3.33    6.61   16.35
SO YBADJ    GH         25.79   34.25   41.66   47.81   52.51   55.61
SO YBADJ    GH         57.02   56.70   54.65   51.00    4.50   -7.58
SO YBADJ    GH        -19.42   -0.76  -22.51  -43.58  -63.32  -16.35
SO YBADJ    GH        -25.79  -34.25  -41.66  -47.81  -52.51  -55.61
SO YBADJ    GH        -57.02  -56.70  -54.65  -51.00  -45.78  -39.17


SO BUILDHGT EDG        23.96   23.96   23.96   11.93    7.92    7.92
SO BUILDHGT EDG         7.92    7.92   23.96   23.96   23.96   23.96
SO BUILDHGT EDG        28.96   23.96   23.96   24.38   24.38   24.38
SO BUILDHGT EDG        24.38   24.38   23.96   11.93    7.92    7.92
SO BUILDHGT EDG         7.92    7.92   23.96   23.96   23.96   23.96
SO BUILDHGT EDG        23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDWID EDG        89.11   80.21   68.88   47.19   31.32   29.40
SO BUILDWID EDG        30.09   31.71   70.06   72.50   83.13   91.24
SO BUILDWID EDG        21.74   98.98   98.38   68.79   82.84   94.37
SO BUILDWID EDG       103.03  108.56   68.88   47.19   31.32   29.40
SO BUILDWID EDG        30.09   31.71   70.06   72.50   83.13   91.24
SO BUILDWID EDG        96.58   98.98   98.38   98.89   98.59   95.30
SO BUILDLEN EDG        72.50   83.13   91.24   96.68   21.51   16.98
SO BUILDLEN EDG        18.49   22.83   95.30   89.11   80.21   68.88
SO BUILDLEN EDG        35.57   40.34   24.00  100.97  107.38  110.52
SO BUILDLEN EDG       110.30  106.74   91.24   96.68   21.51   16.98
SO BUILDLEN EDG        18.49   22.83   95.30   89.11   80.21   68.88
SO BUILDLEN EDG        55.45   40.34   24.00   28.99   45.01   59.66
SO XBADJ    EDG         8.17   -1.43  -10.98  -27.54   -3.61   -3.92
SO XBADJ    EDG        -7.34  -12.27  -60.24  -65.15  -68.07  -68.93
SO XBADJ    EDG      -111.99  -64.40  -59.15 -170.01 -177.18 -178.96
SO XBADJ    EDG      -175.30 -166.32  -80.27  -69.13  -17.89  -13.05
SO XBADJ    EDG       -11.15  -10.55  -35.06  -23.96  -12.14    0.05
SO XBADJ    EDG        12.24   24.06   35.15   34.33   26.32   17.51
SO YBADJ    EDG        20.59   27.97   34.49   27.71   14.14   15.17
SO YBADJ    EDG        15.79   15.87   42.14   44.41   40.14   34.65
SO YBADJ    EDG        18.96   20.70   12.67   33.27   12.01   -9.62
SO YBADJ    EDG       -30.95  -51.34  -34.49  -27.71  -14.14  -15.17
SO YBADJ    EDG       -15.79  -15.87  -42.14  -44.41  -40.14  -34.65
```

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SO YBADJ    EDG       -28.10  -20.70  -12.67   -4.30    4.21   12.59


SO BUILDHGT FP         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT FP         23.96   13.11   13.11   13.11   13.72   13.72
SO BUILDHGT FP         13.72   13.72    7.77    7.77    7.77   28.96
SO BUILDHGT FP         28.96   28.96   24.38   24.38   24.38   23.96
SO BUILDHGT FP         23.96   13.11   13.11   13.11   13.11   13.11
SO BUILDHGT FP         13.11   13.11    7.77    7.77    7.77   23.96
SO BUILDWID FP         89.11   80.21   68.88   55.45   40.34   24.00
SO BUILDWID FP         45.21   13.51   13.72   13.51   21.48   22.07
SO BUILDWID FP         22.77   22.77   18.02   18.95   21.76   25.31
SO BUILDWID FP         28.85   31.88  110.80  109.66  105.20   24.00
SO BUILDWID FP         45.21   13.51   13.72   13.51   34.75   13.25
SO BUILDWID FP         13.67   22.77   18.02   18.95   21.76  107.05
SO BUILDLEN FP         72.50   83.13   91.24   96.58   98.98   98.38
SO BUILDLEN FP         98.89   13.51   13.72   13.51   21.48   22.07
SO BUILDLEN FP         22.77   22.77   20.88   21.72   23.90   35.25
SO BUILDLEN FP         33.58   30.89   99.93   90.08   77.50   98.38
SO BUILDLEN FP         98.89   13.51   13.72   13.51   40.25   13.25
SO BUILDLEN FP         13.67   46.97   20.88   21.72   23.90   75.43
SO XBADJ    FP         35.64   37.88   38.98   38.89   37.61   35.20
SO XBADJ    FP         29.71  -32.18  -34.17  -35.12  -62.37  -64.69
SO XBADJ    FP        -65.44  -64.19   10.46   10.86    9.94 -107.74
SO XBADJ    FP       -107.82 -104.63 -202.24 -192.70 -177.30 -133.57
SO XBADJ    FP       -128.60   18.67   20.45   21.61   22.12   21.27
SO XBADJ    FP         19.54   17.22  -31.33  -32.58  -33.84   32.31
SO YBADJ    FP        -49.98  -36.76  -22.43   -7.41    7.83   22.83
SO YBADJ    FP         29.23   13.09    8.48    3.61   16.19    6.98
SO YBADJ    FP         -2.45  -11.80   -6.59   -2.80    1.01   14.93
SO YBADJ    FP         -0.81  -16.71  -13.26  -39.50  -64.54  -22.83
SO YBADJ    FP        -29.23  -13.09   -8.48   -3.61   -9.56    6.31
SO YBADJ    FP         11.06   11.80    6.59    2.80   -1.01  -55.80
```

UPDATED APPENDIX C: DETAILED AERMOD RESULTS SUMMARY

NTE Connecticut, LLC - Killingly Energy Center
Mitsubishi Model M501JAC Combined Cycle Combustion Turbine Emissions Estimates

Case #:	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel	Natural Gas											ULSD								
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
NOx (g/s)	3.569	3.192	2.449	2.025	3.762	3.422	2.675	2.085	3.477	2.066	1.808	5.872	4.826	4.208	5.947	4.813	4.259	5.947	5.437	4.656
CO (g/s)	1.847	0.874	0.671	0.555	1.947	0.937	0.733	0.571	0.953	0.566	0.495	1.613	1.323	1.159	1.814	1.462	1.285	1.814	1.651	1.411
PM (g/s)	1.600	0.882	0.693	0.592	1.600	0.958	0.756	0.605	0.970	0.882	0.706	3.188	2.558	2.167	3.604	2.822	2.482	3.490	3.478	2.948
SO2 (g/s)	0.727	0.650	0.499	0.412	0.766	0.697	0.545	0.424	0.708	0.421	0.368	0.509	0.421	0.368	0.573	0.464	0.411	0.573	0.524	0.449

AERMOD SU/SD Impacts - Turbine only (µg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.34	2.22	2.53	2.72	2.27	2.27	2.48	2.71	2.28	2.34	2.49	1.95	2.35	2.60	1.88	2.35	2.51	1.97	1.98	2.28
3-HR	1ST	1.09	1.02	1.57	2.11	1.02	1.02	1.37	2.09	1.02	1.09	1.42	0.95	1.33	1.96	0.91	1.23	1.59	0.94	0.95	1.17
8-HR	1ST	0.71	0.67	1.04	1.34	0.64	0.64	0.90	1.34	0.65	0.71	0.97	0.59	0.87	1.25	0.54	0.80	1.06	0.58	0.57	0.76
24-HR	1ST	0.32	0.30	0.50	0.66	0.28	0.29	0.42	0.66	0.29	0.32	0.44	0.26	0.41	0.62	0.22	0.37	0.50	0.24	0.25	0.35
1-HR	2ND	2.21	2.07	2.51	2.72	2.12	2.12	2.41	2.71	2.13	2.22	2.43	1.82	2.25	2.58	1.77	2.24	2.48	1.83	1.84	2.16
3-HR	2ND	0.98	0.91	1.56	2.05	0.89	0.90	1.32	2.04	0.90	0.99	1.39	0.85	1.29	1.91	0.83	1.14	1.57	0.85	0.85	1.07
8-HR	2ND	0.66	0.63	1.00	1.26	0.60	0.60	0.87	1.26	0.61	0.66	0.90	0.54	0.85	1.19	0.51	0.77	1.01	0.53	0.54	0.72
24-HR	2ND	0.25	0.23	0.38	0.50	0.23	0.23	0.32	0.50	0.23	0.25	0.34	0.20	0.31	0.47	0.18	0.28	0.38	0.20	0.20	0.26
1-HR	4TH	2.12	1.99	2.47	2.68	2.03	2.04	2.36	2.67	2.05	2.12	2.39	1.81	2.21	2.55	1.75	2.16	2.43	1.81	1.82	2.08
24-HR	6TH	0.20	0.19	0.29	0.35	0.19	0.19	0.25	0.34	0.19	0.20	0.27	0.17	0.23	0.32	0.16	0.22	0.29	0.17	0.17	0.21
1-HR	8TH	2.03	1.95	2.39	2.59	1.97	1.97	2.25	2.58	1.98	2.04	2.28	1.70	2.12	2.48	1.63	2.09	2.36	1.70	1.72	2.01
24-HR	8TH	0.20	0.19	0.27	0.32	0.19	0.19	0.24	0.32	0.19	0.20	0.25	0.17	0.23	0.30	0.15	0.21	0.27	0.16	0.16	0.20
ANNUAL AVG		0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
ANNUAL Y1		0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03
ANNUAL Y2		0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.01
ANNUAL Y3		0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.02
ANNUAL Y4		0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.02
ANNUAL Y5		0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.02
ANNUAL MAX		0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03

AERMOD SU/SD Scaled Impacts - Turbine only (µg/m³) - 150 ft. turbine stack

Case #:	Averaging Period	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel		Natural Gas											ULSD								
NO2																					
1-HR	1ST	7.49	6.34	5.94	5.40	7.58	6.90	6.15	5.57	7.05	4.35	4.21	10.48	10.45	10.62	10.27	10.30	10.18	10.68	9.82	9.66
1-HR	8TH	5.03	4.29	4.01	3.74	5.14	4.68	4.18	3.86	4.78	2.92	2.86	6.92	7.00	7.18	6.74	6.89	6.89	7.02	6.47	6.51
ANNUAL		0.09	0.08	0.08	0.07	0.09	0.09	0.08	0.08	0.09	0.05	0.06	0.13	0.14	0.15	0.12	0.13	0.14	0.13	0.12	0.12
CO																					
1-HR	1ST	4.32	1.94	1.70	1.51	4.41	2.13	1.82	1.55	2.17	1.33	1.23	3.14	3.10	3.02	3.41	3.43	3.23	3.58	3.27	3.22
1-HR	2ND	4.09	1.81	1.68	1.51	4.12	1.99	1.77	1.55	2.03	1.26	1.21	2.93	2.98	2.99	3.21	3.27	3.18	3.32	3.03	3.05
8-HR	1ST	1.31	0.59	0.70	0.75	1.25	0.60	0.66	0.76	0.62	0.40	0.48	0.95	1.15	1.45	0.97	1.17	1.36	1.04	0.95	1.07
8-HR	2ND	1.22	0.55	0.67	0.70	1.17	0.56	0.64	0.72	0.58	0.38	0.45	0.87	1.12	1.38	0.92	1.12	1.30	0.97	0.89	1.02
PM10 / PM2.5 (PSD)																					
24-HR	1ST	0.51	0.26	0.34	0.39	0.46	0.27	0.32	0.40	0.28	0.28	0.31	0.82	1.04	1.34	0.80	1.04	1.25	0.85	0.87	1.02
24-HR	2ND	0.39	0.21	0.26	0.30	0.36	0.22	0.24	0.30	0.22	0.22	0.24	0.64	0.79	1.01	0.66	0.79	0.94	0.69	0.70	0.77
24-HR	6TH	0.32	0.17	0.20	0.21	0.30	0.18	0.19	0.21	0.19	0.18	0.19	0.54	0.60	0.70	0.58	0.63	0.73	0.59	0.59	0.61
ANNUAL		0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
PM2.5																					
24-HR	1ST	0.36	0.19	0.24	0.26	0.33	0.20	0.23	0.26	0.20	0.20	0.22	0.58	0.71	0.88	0.60	0.71	0.85	0.61	0.62	0.70
24-HR	8TH	0.22	0.11	0.12	0.12	0.20	0.12	0.12	0.12	0.13	0.12	0.12	0.36	0.39	0.40	0.38	0.42	0.43	0.39	0.39	0.41
ANNUAL		0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SO2																					
1-HR	1ST	1.53	1.29	1.21	1.10	1.55	1.41	1.24	1.12	1.44	0.88	0.86	0.91	0.91	0.93	0.98	0.98	0.98	1.02	0.94	0.93
1-HR	2ND	1.29	1.08	1.02	0.91	1.30	1.18	1.05	0.93	1.21	0.75	0.73	0.76	0.77	0.79	0.81	0.84	0.83	0.85	0.78	0.79
3-HR	1ST	0.79	0.67	0.78	0.87	0.78	0.71	0.75	0.89	0.72	0.46	0.52	0.48	0.56	0.72	0.52	0.57	0.65	0.54	0.50	0.52
3-HR	2ND	0.72	0.59	0.78	0.84	0.69	0.62	0.72	0.86	0.63	0.42	0.51	0.43	0.54	0.70	0.47	0.53	0.65	0.49	0.45	0.48
24-HR	1ST	0.23	0.19	0.25	0.27	0.22	0.20	0.23	0.28	0.20	0.13	0.16	0.13	0.17	0.23	0.13	0.17	0.21	0.14	0.13	0.16
24-HR	2ND	0.18	0.15	0.19	0.21	0.17	0.16	0.18	0.21	0.16	0.10	0.12	0.10	0.13	0.17	0.11	0.13	0.16	0.11	0.11	0.12
ANNUAL		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

NTE Connecticut, LLC - Killingly Energy Center

Mitsubishi Model M501JAC Combined Cycle Combustion Turbine - Start-up/Shutdown (SU/SD) Emissions Estimates

Case #:	HOT	WARM	COLD	HUTDOW	HOT	WARM	COLD	HUTDOW
Fuel	Natural Gas				ULSD			
Exhaust velocity (m/s)	14.34	13.55	13.53	16.83	14.71	14.24	14.22	17.33
Exhaust temperature (K)	358.38	357.83	356.91	356.50	364.27	362.76	361.80	363.48
NOx (g/s)	18.47	18.82	18.82	9.83	24.82	25.53	25.53	20.41
CO (g/s)	45.20	45.25	50.79	26.61	290.77	290.93	290.93	53.94
PM (g/s)	1.13	1.07	1.07	1.13	4.14	4.00	4.00	4.46
SO2 (g/s)	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41

AERMOD SU/SD Impacts - Turbine only (μg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.64	2.76	2.82	2.48	2.51	2.59	2.60	2.36
3-HR	1ST	2.05	2.32	2.35	1.48	1.87	2.02	2.05	1.34
8-HR	1ST	1.31	1.46	1.47	0.98	1.19	1.28	1.29	0.88
24-HR	1ST	0.65	0.73	0.73	0.47	0.59	0.64	0.64	0.41
1-HR	2ND	2.62	2.74	2.75	2.42	2.49	2.55	2.57	2.27
3-HR	2ND	2.01	2.23	2.25	1.47	1.83	1.98	1.99	1.29
8-HR	2ND	1.24	1.36	1.37	0.95	1.14	1.22	1.23	0.85
24-HR	2ND	0.49	0.55	0.56	0.35	0.44	0.48	0.48	0.31
1-HR	4TH	2.58	2.67	2.69	2.40	2.46	2.53	2.54	2.22
24-HR	6TH	0.33	0.36	0.38	0.28	0.31	0.32	0.32	0.24
1-HR	8TH	2.49	2.62	2.63	2.28	2.37	2.47	2.47	2.14
24-HR	8TH	0.31	0.34	0.35	0.26	0.29	0.31	0.31	0.23
ANNUAL AVG		0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02
ANNUAL Y1		0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
ANNUAL Y2		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
ANNUAL Y3		0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
ANNUAL Y4		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
ANNUAL Y5		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
ANNUAL MAX		0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03

AERMOD SU/SD Scaled Impacts - Turbine only (μg/m³) - 150 ft. turbine stack

Case #:	Averaging Period	HOT	WARM	COLD	HUTDOW	HOT	WARM	COLD	HUTDOW
Fuel		Natural Gas				ULSD			
NO2									
1-HR	1ST	47.82	50.57	50.97	22.82	59.81	63.75	64.27	44.46
1-HR	8TH	32.30	34.94	35.39	15.57	40.51	42.75	43.26	29.86
ANNUAL		0.65	0.70	0.71	0.30	0.81	0.87	0.88	0.58
CO									
1-HR	1ST	119.38	124.83	143.03	66.00	728.78	752.21	757.08	127.34
1-HR	2ND	118.56	123.84	139.90	64.40	724.42	743.30	748.38	122.44
8-HR	1ST	59.14	65.86	74.60	25.99	346.68	373.22	376.52	47.31
8-HR	2ND	56.06	61.47	69.69	25.24	331.86	355.30	357.76	46.06
PM10 / PM2.5 (PSD)									
24-HR	1ST	0.74	0.78	0.79	0.53	2.44	2.55	2.58	1.83
24-HR	2ND	0.55	0.59	0.60	0.40	1.82	1.91	1.93	1.39
24-HR	6TH	0.38	0.39	0.40	0.32	1.29	1.29	1.30	1.05
ANNUAL		0.04	0.04	0.04	0.03	0.14	0.14	0.14	0.13
PM2.5									
24-HR	1ST	0.48	0.51	0.51	0.36	1.57	1.64	1.69	1.24
24-HR	8TH	0.21	0.22	0.22	0.19	0.73	0.74	0.74	0.68
ANNUAL		0.03	0.03	0.03	0.03	0.10	0.11	0.11	0.10
SO2									
1-HR	1ST	1.08	1.13	1.14	0.97	0.99	1.02	1.03	0.89
1-HR	2ND	0.91	0.94	0.95	0.83	0.84	0.86	0.87	0.76
3-HR	1ST	0.87	0.99	1.00	0.63	0.77	0.83	0.84	0.55
3-HR	2ND	0.85	0.94	0.95	0.62	0.75	0.82	0.82	0.53
24-HR	1ST	0.28	0.31	0.31	0.20	0.24	0.26	0.27	0.17
24-HR	2ND	0.21	0.23	0.24	0.15	0.18	0.20	0.20	0.13
ANNUAL		0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01

NTE Killingly Energy Center - Detailed Results Table

Pollutant	Averaging Period	Rank for SIL	Project Maximum Impact (SIL) (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YYMMDDHH)	Worst Case Turbine Load Scenario	SIL (µg/m³)	NAAQS (µg/m³)	PSD (µg/m³)
				UTM-E (m)	UTM-N (m)						
NO2 (SS)	1-HR	H1H (5YA)	11.23	257900.00	4638450.00	106.79	5-YR AVG	ULSD Case 25	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.97	257990.89	4638691.04	92.70	2012	ULSD Case 4 / GAS Cas 1	**1**	**100**	**25**
NO2 (SUSD)	1-HR	H1H (5YA)	65.45	265950.00	4638500.00	226.01	5-YR AVG	ULSD Cold Start	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.98	257990.89	4638691.04	92.70	2012	ULSD Cold Start / ULSD Case 4 / GAS Cas 1	**1**	**100**	**25**
CO	1-HR	H1H	860.91	266600.00	4634800.00	231.76	16052803	ULSD Cold Start	**2000**	**40000**	**NA**
	8-HR	H1H	101.45	258100.00	4638300.00	113.64	14032616	ULSD Cold Start / ULSD Case 4	**500**	**10000**	**NA**
PM10	24-HR	H1H	2.19	258015.58	4638658.55	94.50	15032224	ULSD Cold Start / ULSD Case 15	**5**	**150**	**30**
	ANNUAL	H1H	0.18	257990.89	4638691.04	92.70	2013	ULSD Cold Start / ULSD Case 15, GAS Case	**1**	**NA**	**17**
PM2.5	24-HR	H1H (5YA)	1.73	258015.58	4638658.55	94.50	5-YR AVG	ULSD Cold Start / ULSD Case 15	**1.2**	**35**	**NA**
	ANNUAL	H1H (5YA)	0.17	257990.89	4638691.04	92.70	5-YR AVG	ULSD Cold Start / ULSD Case 15 / GAS Case	**0.2**	**12**	**NA**
PM2.5 (PSD)	24-HR	H1H	2.19	257887.09	4638508.10	103.33	13110324	ULSD Cold Start / ULSD Case 4	**1.2**	**NA**	**9**
	ANNUAL	H1H	0.18	257990.89	4638691.04	92.70	2013	ULSD Cold Start / ULSD Case 15, GAS Case	**0.2**	**NA**	**4**
SO2	1-HR	H1H (5YA)	1.79	266700.00	4634900.00	241.85	5-YR AVG	GAS Case 36	**7.9**	**196**	**NA**
	3-HR	H1H	1.32	258100.00	4638350.00	110.15	14032615	GAS Cold Start	**25**	**1300**	**512**
	24-HR	H1H	0.63	257887.09	4638508.10	103.33	13110324	GAS Cold Start / GAS Case 40	**5**	**365**	**91**
	ANNUAL	H1H	0.05	258015.58	4638658.55	94.50	2013	GAS Cold Start / GAS Case 1	**1**	**80**	**20**

NTE Killingly Energy Center - Cumulative Impacts

Pollutant	Averaging Period	Rank	Cumulative Maximum Impact (NAAQS) (µg/m³)	Ambient Background (µg/m³)	Cumulative Impact + Ambient Background (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YYMMDDHH)	NAAQS (µg/m³)	PSD (µg/m³)
						UTM-E (m)	UTM-N (m)				
NO2 (SS)	1-HR	H8H (5YA)	8.3	84.6	92.9	257900.00	4638400.00	108.96	5-year avg	188.00	NA
NO2 (SUSD)	1-HR	H8H (5YA)	50.3	84.6	134.9	265950.00	4638500.00	226.01	5-year avg	188.00	NA
PM2.5 (NAAQS)	24-HR	H8H (5YA)	1.4	18.0	19.4	258015.58	4638658.55	94.50	5-year avg	35.00	NA
PM2.5 (PSD)	24-HR	H2H	2.0	NA	2.0	257887.09	4638508.10	103.33	13110324	NA	9.00

Note: Cumulative Impacts reported for all pollutants and averaging periods for which the Project has a significant impact

UPDATED APPENDIX F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS

NTE Killingly Energy Center
Soils Screening Assessment - Updated 1/10/2017

Ambient Temperature (°F):	100				59				-10			100			59			-10		
Case #:	**1**	**2**	**4**	**5**	**36**	**37**	**39**	**40**	**33**	**34**	**35**	**2**	**3**	**4**	**28**	**14**	**15**	**25**	**29**	**30**
Fuel	**Natural Gas**											**ULSD**								
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45	45	45	45	60	60	60	100	100	100
MODELING INPUTS																				
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
EMISSION RATES (g/s)																				
Arsenic	1.03E-05	0	0	0	9.27E-06	0	0	0	0	0	0	0	1.29E-05	0	1.76E-05	1.42E-05	1.26E-05	1.76E-05	1.61E-05	1.38E-05
Beryllium	6.17E-07	0	0	0	5.56E-07	0	0	0	0	0	0	0	8.69E-05	0	1.18E-04	9.58E-05	8.50E-05	1.18E-04	1.08E-04	9.27E-05
Cadmium	5.66E-05	0	0	0	5.10E-05	0	0	0	0	0	0	0	1.43E-06	0	1.95E-06	1.58E-06	1.40E-06	1.95E-06	1.78E-06	1.53E-06
Chromium	7.20E-05	0	0	0	6.49E-05	0	0	0	0	0	0	0	3.47E-03	0	4.73E-03	3.83E-03	3.40E-03	4.73E-03	4.33E-03	3.70E-03
Cobalt	4.22E-06	0	0	0	3.80E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	2.37E-04	2.12E-04	1.63E-04	1.35E-04	2.50E-04	2.28E-04	1.78E-04	1.39E-04	2.31E-04	1.37E-04	1.20E-04	2.12E-04	2.95E-04	1.63E-04	4.02E-04	3.25E-04	2.88E-04	4.02E-04	3.67E-04	3.15E-04
Manganese	1.90E-05	0	0	0	1.72E-05	0	0	0	0	0	0	0	5.06E-05	0	6.89E-05	5.57E-05	4.95E-05	6.89E-05	6.30E-05	5.39E-05
Mercury	1.29E-05	0	0	0	1.16E-05	0	0	0	0	0	0	0	2.86E-06	0	3.90E-06	3.16E-06	2.80E-06	3.90E-06	3.57E-06	3.06E-06
Nickel	1.08E-04	0	0	0	9.74E-05	0	0	0	0	0	0	0	4.14E-04	0	5.64E-04	4.56E-04	4.05E-04	5.64E-04	5.16E-04	4.42E-04
Selenium	1.23E-06	0	0	0	1.11E-06	0	0	0	0	0	0	0	7.16E-05	0	9.76E-05	7.89E-05	7.01E-05	9.76E-05	8.92E-05	7.64E-05
MODELING RESULTS																				
AERMOD Unit Impacts (ug/m3 per g/s)																				
Annual	0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03
Scaled Impacts (ug/m3)																				
Arsenic	2.72E-07	0	0	0	2.31E-07	0	0	0	0	0	0	0	3.62E-07	0.00E+00	3.62E-07	3.91E-07	4.04E-07	3.80E-07	3.51E-07	3.64E-07
Beryllium	1.63E-08	0	0	0	1.39E-08	0	0	0	0	0	0	0	2.44E-06	0.00E+00	2.44E-06	2.64E-06	2.73E-06	2.56E-06	2.36E-06	2.45E-06
Cadmium	1.50E-06	0	0	0	1.27E-06	0	0	0	0	0	0	0	4.02E-08	0.00E+00	4.02E-08	4.34E-08	4.49E-08	4.22E-08	3.90E-08	4.04E-08
Chromium	1.91E-06	0	0	0	1.62E-06	0	0	0	0	0	0	0	9.75E-05	0.00E+00	9.74E-05	1.05E-04	1.09E-04	1.02E-04	9.44E-05	9.79E-05
Cobalt	1.12E-07	0	0	0	9.47E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	6.28E-06	5.26E-06	5.28E-06	4.96E-06	6.23E-06	5.68E-06	5.38E-06	5.08E-06	5.81E-06	3.65E-06	3.69E-06	4.62E-06	8.29E-06	5.62E-06	8.27E-06	8.94E-06	9.25E-06	8.69E-06	8.02E-06	8.32E-06
Manganese	5.04E-07	0	0	0	4.27E-07	0	0	0	0	0	0	0	1.42E-06	0.00E+00	1.42E-06	1.53E-06	1.59E-06	1.49E-06	1.38E-06	1.43E-06
Mercury	3.40E-07	0	0	0	2.89E-07	0	0	0	0	0	0	0	8.05E-08	0.00E+00	8.03E-08	8.69E-08	8.98E-08	8.44E-08	7.79E-08	8.08E-08
Nickel	2.86E-06	0	0	0	2.43E-06	0	0	0	0	0	0	0	1.16E-05	0.00E+00	1.16E-05	1.26E-05	1.30E-05	1.22E-05	1.13E-05	1.17E-05
Selenium	3.27E-08	0	0	0	2.77E-08	0	0	0	0	0	0	0	2.01E-06	0.00E+00	2.01E-06	2.17E-06	2.25E-06	2.11E-06	1.95E-06	2.02E-06

Killingly Energy Center - Soils Impact Screening Assessment

Trace Element	Annual Concentra-tion (ug/m3)	Maximum Project Deposited Soil Concentra-tion (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Average Soil Concentra-tion (ppmw)	Percent Increase	Soil Concentra-tion Ratio	Plant Tissue Concentra-tion Criteria (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	4.04E-07	1.16E-04	3	0.00%	6	0.00%	0.14	1.62E-05	0.25	0.01%
Beryllium	2.73E-06	7.81E-04	NA	NA	6	0.01%	NA	NA	NA	NA
Cadmium	1.50E-06	4.29E-04	2.5	0.02%	0.06	0.72%	10.7	4.59E-03	3	0.15%
Chromium	1.09E-04	3.12E-02	8.4	0.37%	100	0.03%	0.02	6.24E-04	1	0.06%
Cobalt	1.12E-07	3.20E-05	NA	NA	8	0.00%	0.11	3.52E-06	19	0.00%
Lead	9.25E-06	2.65E-03	1000	0.00%	10	0.03%	0.45	1.19E-03	126	0.00%
Manganese	1.59E-06	4.54E-04	2.5	0.02%	850	0.00%	0.066	3.00E-05	400	0.00%
Mercury	3.40E-07	9.75E-05	455	0.00%	0.1	0.10%	0.5	4.88E-05	NA	NA
Nickel	1.30E-05	3.72E-03	500	0.00%	40	0.01%	0.045	1.67E-04	60	0.00%
Selenium	2.25E-06	6.44E-04	13	0.00%	0.5	0.13%	1	6.44E-04	100	0.00%

TETRA TECH

MEMO

To:	James Grillo, Connecticut Department of Energy and Environmental Protection
From:	Steven Babcock, Lynn Gresock
Date:	January 19, 2018
Subject:	Killingly Energy Center: Additional Minor Adjustments to Dispersion Modeling

A Minor Modification Application for Stationary Sources of Air Pollution Permit No.089-0107 to construct and operate for the proposed Killingly Energy Center (KEC) located in Killingly, Connecticut – submitted by NTE Connecticut, LLC (NTE) on November 22, 2017 – has been found complete and is under technical review by the Connecticut Department of Energy and Environmental Protection (DEEP).

This memorandum reflects some additional adjustments associated with maintaining adequate grading and buffer, as well as an adjusted facility fence line. Although these changes are, again, minor in nature, the dispersion modeling has been updated to confirm that no material change in KEC-related impacts will result. There are no changes to the emission source parameters proposed.

The same modeling procedures documented in the modeling report dated November 22, 2017 were used. Therefore, the revised air dispersion modeling analysis presents only the revised inputs and results, as applicable, to account for the changes described above. The revised modeling results confirm that no material change in KEC-related impacts will result from the updated site configuration. The revised pages of the Ambient Air Quality Analysis report are provided in Attachment A and include the following:

- Table 8: Maximum Predicted Impact Concentrations
- Table 9: Cumulative NAAQS Compliance Assessment
- Table 10: Cumulative PSD Increment Compliance Assessment
- Table 11: Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds
- Table 12: Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds
- Table 13: Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds
- Table 14: Soils Impact Screening Assessment
- Updated Appendix B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA
    - Figure L-B: Buildings, Structures, and Stacks Input to AERMOD
    - BPIP Input
    - BPIP Output
- Updated Appendix C: DETAILED AERMOD RESULTS SUMMARY
    - Killingly Energy Center – Detailed Results Table
    - Killingly Energy Center – Cumulative Impacts
- Updated Appendix F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS
    - Killingly Energy Center – Soils Screening Assessment

ATTACHMENT A: REVISED AMBIENT AIR QUALITY ANALYSIS REPORT PAGES

Table 8. Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Rank Basis for SIL Assessment	Impact Concentration (µg/m³)	SIL (µg/m³)	Extent of SIA (km)	NAAQS (µg/m³)	PSD Class II Increment (µg/m³)
NO_2 (Normal Load)	1-hour	H1H (5-year Average)	10.78	7.5	12.1	188	NA
	Annual	H1H	0.87	1	NA	100	25
NO_2 (SUSD)	1-hour	H1H (5-year Average)	65.04	NA	NA	188	NA
	Annual	H1H	0.88	NA	NA	100	25
CO	1-hour	H1H	860.91	2,000	NA	40,000	NA
	8-hour	H1H	103.48	500	NA	10,000	NA
PM_{10}	24-hour	H1H	2.34	5	NA	150	30
	Annual	H1H	0.15	1	NA	NA	17
$PM_{2.5}$ (NAAQS)	24-hour	H1H (5-year Average)	1.57	1.2	0.5	35	NA
	Annual	H1H (5-year Average)	0.14	0.2	NA	12	NA
$PM_{2.5}$ (PSD)	24-hour	H1H	2.34	1.2	0.7	NA	9
	Annual	H1H	0.15	0.2	NA	NA	4
SO_2	1-hour	H1H (5-year Average)	1.79	7.8	NA	196	NA
	3-hour	H1H	1.26	25	NA	1300	512
	24-hour	H1H	0.70	5	NA	365	91
	Annual	H1H	0.14	1	NA	80	20

Notes:
Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum
5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentrations prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

SIA = Significant Impact Area, defined as a circle with a radius equal to the distance to the furthest receptor for which the maximum predicted impact exceeds the SIL.

Table 9. Cumulative NAAQS Compliance Assessment

Pollutant	Averaging Period	Rank Basis for NAAQSL Assessment	Cumulative Impact Concentration (µg/m^3)	Ambient Background (µg/m^3)	Total Impact Plus Background (µg/m^3)	NAAQS (µg/m^3)
NO_2 (Normal Load)	1-Hour	H8H (5-year Average)	8.3	84.6	92.9	188
NO_2 (SUSD)	1-Hour	H8H (5-year Average)	50.2	84.6	134.8	188
$PM_{2.5}$	24-hour	H8H (5-year Average)	1.6	18	19.6	35

Notes:

- Total cumulative impact concentrations based on consideration of all receptors and time periods where the Facility has a predicted significant impact concentration (based on 5-year average maximum H1H for 1-hour NO_2 and 24-hour $PM_{2.5}$).
- NO_2 concentrations assume NO_X to NO_2 conversion in accordance with the ARM2 NO_2/NO_2 ratio curve (with a minimum ratio of 0.5 and a maximum ratio of 0.9).
- Assessment of the 1-hour NO_2 NAAQS for the transient turbine SUSD conditions consists of adding ambient background to Facility-only concentrations.

Table 10. Cumulative PSD Increment Compliance Assessment

Pollutant	Averaging Period	Total Increment Consumption[1] (µg/m^3)	Maximum Allowable PSD Increment (µg/m^3)
$PM_{2.5}$	24-hour	1.7	9

[1] Impact concentrations are conservatively based on the maximum highest second highest (H2H) concentration predicted across the range of modeled years.

Table 11. Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (µg/m³)	Threshold for Impact to Vegetation (µg/m³)	Applicability
1-hour	65.05	66,000[a]	Leaf Injury to plant
2-hour	65.05	1,130[b]	Affects to alfalfa
Annual	0.80	100[c]	Protects all vegetation
		190[d]	Metabolic and growth impact to plants

[a] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976.

[b] "Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of SO_2 and NO_2" Environmental Science and Technology, vol. 8(6): p.574-576, 1975. The limit is based on a concentration in ambient air of 0.6 ppm NO_2
(U 1,130 µg/m³) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

[c] "Secondary National Ambient Air Quality Standard (µg/m³) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[d] "Air Quality Criteria for Oxides of Nitrogen," EPA/600/8-91/049aF-cF.3v, Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1993.

Table 12. Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (µg/m³)	Threshold for Impact to Vegetation (µg/m³)	Applicability
1-hour	860.91	40,000[a]	Protects all vegetation
8-hour	103.48	10,000[a]	Protects all vegetation
Multiple day		10,000[b]	No known effects to vegetation
1-week		115,000[c]	Effects to some vegetation
Multiple week		115,000[d]	No effect on various plant species

[a] Secondary NAAQS (µg/m³) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

[b] "Air Quality Criteria for Carbon Monoxide," EPA/600/8-90/045F (NTIS PB93-167492), Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1991. Various CO concentrations were examined the lowest of these was 10,000 µg/m³. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 µg/m³ caused no effects. The exception was legume seedlings which were found to experience abnormal leaf growth when exposed to CO concentrations of only 27,000 µg/m³. Also related to this family of plants, CO concentrations in the soil of 113,000 µg/m³ were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 µg/m³ will not affect vegetation.

[c] "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976. A CO concentration of 115,000 µg/m³ was found to affect certain plant species.

[d] "Polymorphic Regions in Plant Genomes Detected by an M13 Probe" Zimmerman, P.A., et al. 1989. Genome 32: 824-828. 115,000 µg/m³ was the lowest CO concentration included in this study. This concentration was not found to cause a reduction in growth rate to a variety of plant species.

Table 13. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (µg/m^3)	Threshold for Impact to Vegetation (µg/m^3)	Applicability
SO_2			
1-hour SO_2	1.79	131[a]	Suggested worst-case limit
3-hour SO_2	1.26	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	0.70	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.04	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	2.34	150[c]	Protects all vegetation
Annual PM_{10}	0.15	50[c]	Protects all vegetation
Annual PM_{10}		579[e]	Damage to sensitive species (fir tree)

a. "Crop and Forest Losses due to Current and Projected Emissions from Coal-Fired Power Plants in the Ohio River Basin" Loucks, O.L., R.W. Miller, et al. 1980. The Institute of Ecology. In this publication, the authors propose 1-hour thresholds from 131 to 262 µg/m^3.

b. "Impacts of Coal-fired Power Plants on Fish, Wildlife, and their Habitats" Dvorak, A.J., et al. Argonne National Laboratory. Argonne, Illinois. Fish and Wildlife Service Publication No. FWS/OBS-78/29. March 1978. This document indicates the lowest 3-hour SO_2 concentration expected to cause injury to sensitive plants growing under compromised conditions is approximately 390 µg/m^3. Similarly, a threshold of 130 µg/m^3 is suggested for chronic exposure.

c. Secondary National Ambient Air Quality Standard (µg/m^3) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

d. "Concurrent Exposure to SO_2 and/or NO_2 Alters Growth and Yield Responses of Wheat and Barley to Low Concentrations of O_3" (New Phytologist, 118 (4). 1991. pp. 581-592). This paper indicates exposure to 63 µg/m^3 of SO_2 during the growing season had insignificant effects to wheat but did affect the weight of Barley seeds.

e. "Responses of Plants to Air Pollution" Lerman, S.L., and E.F. Darley. 1975. "Particulates," pp. 141-158 (Chap. 7). In J.B. Mudd and T.T. Kozlowski (eds.). Academic Press. New York, NY. Results of studies conducted indicated concluded that particulate deposition rates of 365 g/m^2/yr caused damage to fir trees, but rates of 274 g/m^2/year and 400 to 600 g/m^2/yr did not cause damage to vegetation. 365 g/m^2/yr translates to W579 µg/m^3, using a worst-case deposition velocity of 2 centimeters per second.

Table 14. Soils Impact Screening Assessment

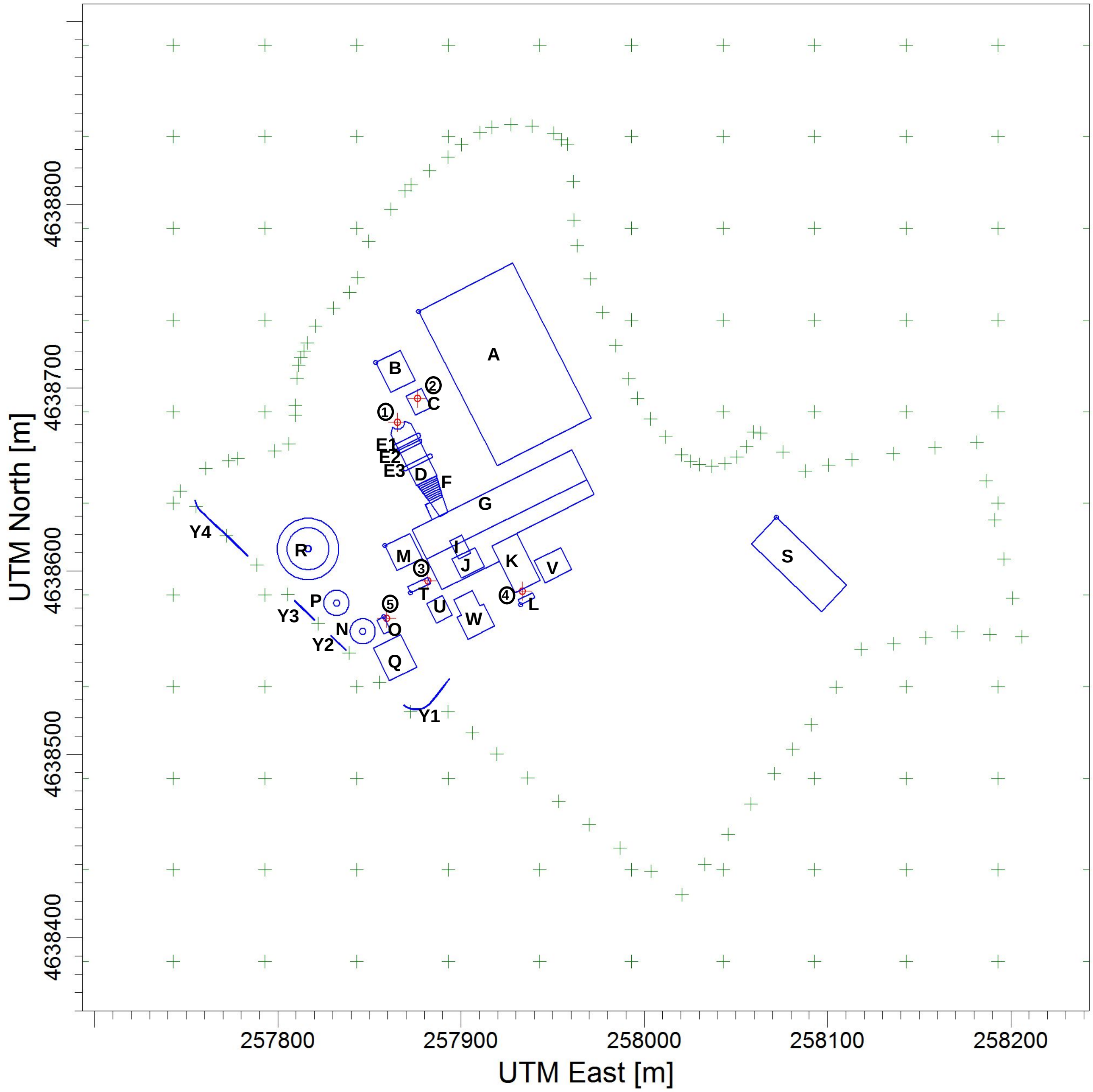
Pollutant	Maximum Facility Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Plant Tissue Concentration (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	1.16E-04	3	0.00%	1.62E-05	0.25	0.01%
Beryllium	7.82E-04	NA	NA	NA	NA	NA
Cadmium	4.29E-04	2.5	0.02%	4.59E-03	3	0.15%
Chromium	3.12E-02	8.4	0.37%	6.25E-04	1	0.06%
Cobalt	3.20E-05	NA	NA	3.52E-06	19	0.00%
Lead	2.65E-03	1000	0.00%	1.19E-03	126	0.00%
Manganese	4.55E-04	2.5	0.02%	3.00E-05	400	0.00%
Mercury	9.75E-05	455	0.00%	4.88E-05	NA	NA
Nickel	3.72E-03	500	0.00%	1.68E-04	60	0.00%
Selenium	6.44E-04	13	0.00%	6.44E-04	100	0.00%

Note: Based on screening procedures described in Chapter 5 of the USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980).

APPENDIX B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA

PROJECT TITLE:

Killingly Energy Center 01/2018
Mitsubishi Model M501JAC



LEGEND

	Building / Structure Name	Grade Elevation (ft)	Height above Grade (ft)			Grade Elevation (ft)	Height above Grade (ft)
A	Air Cooled Condenser	318	80	Q	Water Treatment Building	318	25.5
B	Closed Cooling Water Fan Array	318	22	R	Fuel Oil Tank	318	45
C	Auxiliary Boiler	318	26	R2	Fuel Oil Tank Outer Wall	318	21
D	Heat Recovery Steam Generator (HRSG)	318	95	S	Administration	318	26
E1	HRSG Drum 1	318	106	T	Gas Heater Enclosure	318	18
E2	HRSG Drum 2	318	106	U	Control Building	318	26
E3	HRSG Drum 3	318	106	V	Transformer Sound Wall 1	318	10
F	Turbine Exhaust Diffuser (10 tiers)	318	28.6-83.9	W	Transformer Sound Wall 2	318	10
G	Turbine Building High Bay	318	78.6	X	Diffuser Sound Wall	318	40
H	Turbine Building Low Bay	318	39.1	Y1	Boundary Sound Wall 1	320	22
I	Air Inlet Filter Housing Duct	318	69.8	Y2	Boundary Sound Wall 2	316	18
J	Air Inlet Filter Housing	318	92.4	Y3	Boundary Sound Wall 3	311	16
K	Control/Maintenance Building	318	26	Y4	Boundary Sound Wall 4	296	16
L	Emergency Generator	318	16	1	HRSG	318	150
M	Fuel Gas Compressor	318	21	2	Auxiliary Boiler	318	90
N	Demineralized Water Storage Tank	318	38	3	Gas Heater	318	20
O	Fire Pump Enclosure	318	16	4	Emergency Generator	318	45
P	Service Water Storage Tank	318	43	5	Fire Pump	318	20

TETRA TECH

Figure 1
Buildings, Structures, and Stacks Input to AERMOD

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

```
'Killingly Energy Center 01/2018'
'P'
'METERS'  1.00000000
'UTMY'  0.0000
27
'FIREPUMP'  1           96.93
    4           4.88
            257857.93      4638575.10
            257861.80      4638567.50
            257858.00      4638565.56
            257854.13      4638573.16
'CONTROL'  1           96.93
    4           7.92
            257916.74      4638613.75
            257930.37      4638620.62
            257943.21      4638595.08
            257929.45      4638588.26
'EMGEN'  1           96.93
    4           4.88
            257932.48      4638581.55
            257931.12      4638584.22
            257939.00      4638588.24
            257940.36      4638585.57
'CTDIFF1'  1           96.93
    4           8.71
            257883.24      4638637.20
            257889.93      4638640.54
            257892.75      4638631.99
            257888.43      4638629.82
'ADMIN'  1           96.93
    4           7.92
            258072.11      4638629.26
            258110.47      4638592.22
            258096.70      4638577.96
            258058.34      4638615.00
'DEMINTNK'  1           96.32
    8          11.58
            257846.38      4638573.99
            257841.53      4638571.98
            257839.52      4638567.13
            257841.53      4638562.28
            257846.38      4638560.27
            257851.23      4638562.28
            257853.24      4638567.13
            257851.23      4638571.98
'SVCTANK'  1           95.21
    8          13.11
            257832.03      4638589.47
            257827.18      4638587.46
            257825.17      4638582.61
            257827.18      4638577.76
            257832.03      4638575.75
            257836.88      4638577.76
            257838.89      4638582.61
            257836.88      4638587.46
'GASCOMP'  1           96.93
    4           6.40
            257858.39      4638613.92
            257872.10      4638620.61
            257878.79      4638606.90
            257865.08      4638600.21
'OILTANKE'  2           95.10
    8           6.40
            257816.51      4638628.84
            257804.66      4638623.93
            257799.75      4638612.08
            257804.66      4638600.23
            257816.51      4638595.32
            257828.36      4638600.23
            257833.27      4638612.08
            257828.36      4638623.93
    8          13.72
            257816.53      4638623.58
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            257808.45      4638620.23
            257805.10      4638612.15
            257808.45      4638604.07
            257816.53      4638600.72
            257824.62      4638604.07
            257827.96      4638612.15
            257824.62      4638620.23
'GASHTR'  1          96.93
    4          5.49
            257872.47      4638588.11
            257870.89      4638591.35
            257881.63      4638596.59
            257883.21      4638593.35
'ACC'  1          96.93
    4         24.38
            257876.77      4638741.74
            257928.17      4638767.93
            257971.14      4638683.60
            257919.74      4638657.41
'COOLFAN'  1          96.93
    4          6.71
            257853.50      4638713.73
            257866.65      4638720.43
            257874.96      4638704.13
            257861.81      4638697.42
'AUXBLR'  1          96.93
    5          7.92
            257869.94      4638695.57
            257878.28      4638699.70
            257883.51      4638689.19
            257875.19      4638685.02
            257875.19      4638685.02
'WWTRTMT'  1          96.93
    4          7.77
            257852.14      4638557.96
            257867.13      4638565.46
            257876.05      4638547.66
            257860.96      4638540.10
'TURBHIGH'  1          96.93
    4         23.96
            257873.33      4638622.49
            257960.44      4638666.14
            257968.63      4638649.80
            257881.29      4638606.48
'CONTROL3'  1          96.93  'Additional Control Building added 10/17/2017'
    4          7.92
            257889.82      4638586.64
            257895.17      4638575.96
            257886.71      4638571.67
            257881.30      4638582.40
'HRSG'  4          96.93
    11          28.96
            257862.55      4638678.56
            257863.71      4638677.71
            257865.26      4638677.33
            257867.09      4638677.75
            257868.45      4638678.84
            257869.16      4638680.46
            257869.19      4638681.91
            257872.74      4638680.37
            257886.89      4638652.23
            257875.71      4638646.66
            257861.58      4638674.85
    16          32.31
            257869.03      4638656.88
            257882.67      4638663.72
            257883.17      4638663.86
            257883.76      4638663.76
            257884.13      4638663.44
            257884.37      4638662.95
            257884.39      4638662.43
            257884.15      4638661.96
            257883.72      4638661.65
```

```
            257870.06      4638654.80
            257869.60      4638654.64
            257868.99      4638654.76
            257868.60      4638655.07
            257868.37      4638655.55
            257868.34      4638656.04
            257868.57      4638656.56
    12           32.31
            257865.39      4638665.58
            257877.88      4638671.84
            257878.24      4638671.76
            257878.50      4638671.57
            257878.75      4638671.06
            257878.74      4638670.73
            257878.60      4638670.42
            257866.11      4638664.16
            257865.75      4638664.25
            257865.49      4638664.44
            257865.26      4638664.91
            257865.23      4638665.28
    16           32.31
            257863.48      4638668.66
            257876.57      4638675.22
            257877.00      4638675.12
            257877.37      4638674.92
            257877.61      4638674.62
            257877.85      4638674.13
            257877.89      4638673.70
            257877.85      4638673.29
            257877.70      4638672.95
            257864.62      4638666.40
            257864.20      4638666.53
            257863.84      4638666.76
            257863.56      4638667.00
            257863.34      4638667.47
            257863.27      4638667.88
            257863.30      4638668.30
'AIRINLET'  2           96.93
    4           21.26
            257893.83      4638616.35
            257900.30      4638619.59
            257905.20      4638609.89
            257898.65      4638606.64
    4           28.16
            257895.05      4638606.44
            257907.56      4638612.70
            257912.64      4638602.38
            257900.13      4638596.08
'TURBLOW'  1           96.93
    6           11.93
            257881.29      4638606.48
            257889.67      4638589.85
            257920.86      4638605.48
            257916.74      4638613.75
            257972.59      4638641.88
            257968.63      4638649.80
'CTDIFF'  10           96.93
    4            8.71
            257876.04      4638646.84
            257886.53      4638652.05
            257889.94      4638640.54
            257883.24      4638637.20
    8           10.58
            257876.05      4638646.84
            257882.45      4638638.27
            257882.53      4638638.16
            257888.49      4638641.13
            257889.60      4638641.68
            257889.56      4638641.81
            257886.53      4638652.05
            257877.20      4638647.42
    8           12.46
            257876.06      4638646.84
```

	257881.66	4638639.34	
	257881.82	4638639.12	
	257887.04	4638641.72	
	257889.26	4638642.83	
	257889.18	4638643.09	
	257886.53	4638652.04	
	257878.37	4638647.99	
8	14.33		
	257876.07	4638646.84	
	257880.87	4638640.41	
	257881.11	4638640.08	
	257885.58	4638642.31	
	257888.91	4638643.97	
	257888.80	4638644.36	
	257886.53	4638652.04	
	257879.53	4638648.57	
8	16.21		
	257876.08	4638646.84	
	257880.08	4638641.48	
	257880.41	4638641.05	
	257884.13	4638642.90	
	257888.57	4638645.12	
	257888.42	4638645.64	
	257886.52	4638652.03	
	257880.70	4638649.14	
8	18.08		
	257876.09	4638646.84	
	257879.29	4638642.55	
	257879.70	4638642.01	
	257882.68	4638643.49	
	257888.23	4638646.26	
	257888.04	4638646.91	
	257886.52	4638652.03	
	257881.86	4638649.71	
8	19.96		
	257876.10	4638646.84	
	257878.50	4638643.62	
	257878.99	4638642.97	
	257881.23	4638644.08	
	257887.89	4638647.41	
	257887.66	4638648.19	
	257886.52	4638652.03	
	257883.03	4638650.29	
8	21.83		
	257876.11	4638646.83	
	257877.70	4638644.69	
	257878.28	4638643.93	
	257879.77	4638644.67	
	257887.55	4638648.55	
	257887.28	4638649.46	
	257886.52	4638652.02	
	257884.19	4638650.86	
8	23.71		
	257876.11	4638646.83	
	257876.91	4638645.76	
	257877.58	4638644.89	
	257878.32	4638645.26	
	257887.20	4638649.70	
	257886.90	4638650.74	
	257886.52	4638652.02	
	257885.35	4638651.44	
4	25.58		
	257876.12	4638646.83	
	257886.52	4638652.01	
	257886.86	4638650.84	
	257876.87	4638645.85	
'DIFFWALL'	1	96.93	'Diffuser sound wall'
6	12.19		
	257883.00	4638637.43	
	257880.43	4638636.26	
	257884.20	4638627.99	
	257884.37	4638628.01	
	257880.61	4638636.20	

```
            257883.09      4638637.33
'SWALL1'  1         102.27  'Sound wall south of water treatment building'
    25           6.71
            257893.69      4638540.99
            257892.98      4638540.19
            257890.33      4638536.70
            257886.19      4638531.45
            257882.82      4638527.29
            257880.10      4638525.33
            257878.39      4638524.74
            257876.38      4638524.33
            257874.68      4638524.32
            257872.27      4638524.65
            257869.72      4638525.93
            257868.59      4638526.83
            257869.03      4638526.98
            257869.83      4638526.12
            257872.37      4638525.02
            257874.89      4638524.64
            257876.85      4638524.70
            257878.81      4638525.21
            257879.94      4638525.70
            257880.87      4638526.29
            257882.71      4638527.65
            257886.37      4638532.26
            257890.67      4638537.72
            257892.16      4638539.52
            257893.40      4638541.07
'SWALL2'  1          96.67  'Sound wall between water tanks'
    5           5.49
            257828.87      4638564.77
            257830.58      4638563.13
            257837.22      4638556.75
            257837.42      4638556.90
            257829.16      4638564.88
'SWALL4'  1          95.71  'Sound wall north of oil tank'
    23           4.88
            257754.74      4638638.52
            257755.58      4638635.62
            257756.51      4638634.17
            257757.83      4638632.69
            257759.45      4638631.09
            257760.96      4638629.60
            257762.71      4638628.04
            257766.41      4638624.44
            257769.17      4638621.88
            257773.93      4638617.32
            257783.56      4638607.98
            257783.77      4638608.35
            257777.76      4638614.29
            257773.89      4638618.02
            257770.62      4638621.12
            257767.51      4638624.02
            257764.36      4638626.98
            257762.00      4638629.20
            257760.22      4638630.85
            257758.56      4638632.50
            257757.25      4638633.91
            257756.05      4638635.52
            257755.10      4638638.54
'TRNSWAL1'  1          96.93  'Transformer sound wall 1'
    8           3.05
            257906.27      4638589.39
            257896.08      4638584.27
            257900.28      4638575.97
            257897.90      4638574.75
            257903.89      4638562.66
            257918.36      4638569.98
            257912.37      4638582.03
            257910.34      4638580.98
'TRNSWAL2'  1          96.93  'Transformer sound wall 2'
    4           3.05
            257954.34      4638612.94
```

```
            257939.81      4638605.64
            257945.83      4638593.64
            257960.42      4638600.94
'SWALL3'  1           94.79  'Sound Wall 3'
    4           5.49
            257820.01      4638573.17
            257809.05      4638583.68
            257809.28      4638583.94
            257820.23      4638573.44
5
'CTG'                96.93       45.72       257865.36      4638681.24
'Combustion Turbine and HRSG'
'AUX'                96.93       27.43       257876.13      4638694.43  'Auxiliary
Boiler'
'GH'                 96.93        6.10       257881.81      4638594.65  'Natural
Gas Heater'
'EDG'                96.93       13.72       257933.57      4638588.97  'Emergency
Diesel Generator'
'FP'                 96.93        6.10       257859.30      4638574.17  'Emergecy
Fire Pump Engine'
```

Killingly Energy Center 01/2018

BPIP (Dated: 04274)

DATE : 1/17/2018
TIME : 19:42:40
Killingly Energy Center 01/2018

============================
BPIP PROCESSING INFORMATION:
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The P flag has been set for preparing downwash related data for a model run utilizing the PRIME algorithm.

Inputs entered in METERS will be converted to meters using a conversion factor of 1.0000. Output will be in meters.

The UTMP variable is set to UTMY. The input is assumed to be in UTM coordinates. BPIP will move the UTM origin to the first pair of UTM coordinates read. The UTM coordinates of the new origin will be subtracted from all the other UTM coordinates entered to form this new local coordinate system.

Plant north is set to 0.00 degrees with respect to True North.

Killingly Energy Center 01/2018

PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
(Output Units: meters)

Stack Name	Stack Height	Stack-Building Base Elevation Differences	GEP** EQN1	Preliminary* GEP Stack Height Value
CTG	45.72	0.00	72.40	72.40
AUX	27.43	0.00	72.40	72.40
GH	6.10	0.00	69.74	69.74
EDG	13.72	0.00	61.56	65.00
FP	6.10	0.00	72.40	72.40

* Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP Technical Support Document. Determinant 3 may be investigated for additional stack height credit. Final values result after Determinant 3 has been taken into consideration.

** Results were derived from Equation 1 on page 6 of GEP Technical Support Document. Values have been adjusted for any stack-building base elevation differences.

Note: Criteria for determining stack heights for modeling emission limitations for a source can be found in Table 3.1 of the GEP Technical Support Document.

BPIP (Dated: 04274)

DATE : 1/17/2018
TIME : 19:42:40

Killingly Energy Center 01/2018

BPIP output is in meters

```
SO BUILDHGT CTG        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT CTG        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT CTG        28.96   23.96   23.96   23.96   28.96   28.96
```

```
SO BUILDHGT CTG        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT CTG        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT CTG        28.96   23.96   23.96   23.96   28.96   28.96
SO BUILDWID CTG        28.85   31.88   34.24   35.57   35.82   34.97
SO BUILDWID CTG        35.35   35.85   35.25   33.58   30.89   27.71
SO BUILDWID CTG        23.91   98.98   98.38   98.89   21.00   25.31
SO BUILDWID CTG        28.85   31.88   34.24   35.57   35.82   34.97
SO BUILDWID CTG        35.35   35.85   35.25   33.58   30.89   27.71
SO BUILDWID CTG        23.91   98.98   98.38   98.89   21.00   25.31
SO BUILDLEN CTG        33.58   30.89   27.71   23.91   19.39   14.28
SO BUILDLEN CTG        16.05   21.00   25.31   28.85   31.88   34.24
SO BUILDLEN CTG        35.57   90.22   77.95   28.99   35.85   35.25
SO BUILDLEN CTG        33.58   30.89   27.71   23.91   19.39   14.28
SO BUILDLEN CTG        16.05   21.00   25.31   28.85   31.88   34.24
SO BUILDLEN CTG        35.57   40.34   24.00   28.99   35.85   35.25
SO XBADJ    CTG       -32.26  -28.95  -24.77  -19.84  -14.30   -8.33
SO XBADJ    CTG        -5.74   -4.83   -3.78   -2.61   -1.72   -1.09
SO XBADJ    CTG        -0.43    0.25    0.92   46.71    0.01   -0.67
SO XBADJ    CTG        -1.32   -1.94   -2.94   -4.08   -5.09   -5.96
SO XBADJ    CTG       -10.31  -16.17  -21.53  -26.24  -30.15  -33.15
SO XBADJ    CTG       -35.14  -90.47  -78.86  -75.70  -35.85  -34.58
SO YBADJ    CTG       -11.81  -14.21  -16.03  -17.36  -18.15  -18.40
SO YBADJ    CTG       -18.36  -17.93  -16.96  -15.47  -13.51  -10.92
SO YBADJ    CTG        -7.88   13.64   25.60   36.84    5.67    8.88
SO YBADJ    CTG        11.81   14.21   16.03   17.36   18.15   18.40
SO YBADJ    CTG        18.36   17.93   16.95   15.47   13.51   10.92
SO YBADJ    CTG         7.88  -13.64  -25.60  -36.84   -5.67   -8.88


SO BUILDHGT AUX        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT AUX        28.96   28.96   28.96   28.96   28.96   24.38
SO BUILDHGT AUX        24.38   24.38   23.96   23.96   24.38   28.96
SO BUILDHGT AUX        28.96   28.96   28.96   28.96   28.96   28.96
SO BUILDHGT AUX        28.96   28.96   28.96   28.96   28.96   24.38
SO BUILDHGT AUX        24.38   24.38   23.96   23.96   24.38   28.96
SO BUILDWID AUX        28.85   31.88   34.24   35.57   35.82   34.97
SO BUILDWID AUX        35.35   35.85   35.25   33.58   30.89   99.93
SO BUILDWID AUX        90.08   77.50   98.38   98.89   82.84   25.31
SO BUILDWID AUX        28.85   31.88   34.24   35.57   35.82   34.97
SO BUILDWID AUX        35.35   35.85   35.25   33.58   30.89   99.93
SO BUILDWID AUX        90.08   77.50   98.38   98.89   82.84   25.31
SO BUILDLEN AUX        33.58   30.89   27.71   23.91   19.39   14.28
SO BUILDLEN AUX        16.05   21.00   25.31   28.85   31.88  110.80
SO BUILDLEN AUX       109.66  105.20   77.95   75.02  107.38   35.25
SO BUILDLEN AUX        33.58   30.89   27.71   23.91   19.39   14.28
SO BUILDLEN AUX        16.05   21.00   25.31   28.85   31.88  110.80
SO BUILDLEN AUX       109.66  105.20   24.00   28.99  107.38   35.25
SO XBADJ    AUX       -47.12  -45.03  -41.58  -36.86  -31.03  -24.25
SO XBADJ    AUX       -20.37  -17.73  -14.55  -10.93   -7.33  -23.10
SO XBADJ    AUX       -29.92  -35.83    6.95    9.39  -63.35   12.52
SO XBADJ    AUX        13.53   14.14   13.87   12.95   11.63    9.97
SO XBADJ    AUX         4.32   -3.27  -10.76  -17.92  -24.54  -87.70
SO XBADJ    AUX       -79.74  -69.37  -84.90  -84.41  -44.03  -47.77
SO YBADJ    AUX        -3.50   -8.61  -13.30  -17.58  -21.34  -24.44
SO YBADJ    AUX       -27.07  -29.05  -30.15  -30.33  -29.59   39.71
SO YBADJ    AUX        44.71   48.36    9.68   22.21   50.27   -1.89
SO YBADJ    AUX         3.50    8.61   13.30   17.58   21.34   24.44
SO YBADJ    AUX        27.07   29.05   30.15   30.33   29.59  -39.71
SO YBADJ    AUX       -44.71  -48.36   -9.68  -22.21  -50.27    1.89


SO BUILDHGT GH         28.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   28.96   28.96
SO BUILDHGT GH         28.96   24.38   24.38   24.38   24.38   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT GH         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDWID GH         27.19   80.21   68.88   55.45   40.34   24.00
SO BUILDWID GH         28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GH         96.58   98.98   98.38   98.89   21.00   25.31
SO BUILDWID GH         27.19  108.56  110.80  109.66  105.20   24.00
SO BUILDWID GH         28.99   45.01   59.66   72.50   83.13   91.24
SO BUILDWID GH         96.58   98.98   98.38   98.89   98.59   95.30
```

```
SO BUILDLEN GH         33.58   83.13   91.24   96.58   98.98   98.38
SO BUILDLEN GH         98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GH         55.45   40.34   24.00   28.99   35.85   35.25
SO BUILDLEN GH         33.58  106.74   99.93   90.08   77.50   98.38
SO BUILDLEN GH         98.89   98.59   95.30   89.11   80.21   68.88
SO BUILDLEN GH         55.45   40.34   24.00   28.99   45.01   59.66
SO XBADJ    GH         50.16   10.94    9.99    8.73    7.21    5.46
SO XBADJ    GH          1.55   -3.52   -8.48  -13.19  -17.49  -21.26
SO XBADJ    GH        -24.39  -26.78  -28.35  -40.29  -88.13  -87.26
SO XBADJ    GH        -83.74 -178.69 -173.24 -162.54 -146.90 -103.84
SO XBADJ    GH       -100.45  -95.08  -86.82  -75.92  -62.72  -47.61
SO XBADJ    GH        -31.06  -13.56    4.35   11.29   11.74   11.83
SO YBADJ    GH         19.42  -22.62  -13.17   -3.33    6.61   16.35
SO YBADJ    GH         25.79   34.25   41.66   47.81   52.51   55.61
SO YBADJ    GH         57.02   56.70   54.65   51.00    4.50   -7.58
SO YBADJ    GH        -19.42   -0.76  -22.51  -43.58  -63.32  -16.35
SO YBADJ    GH        -25.79  -34.25  -41.66  -47.81  -52.51  -55.61
SO YBADJ    GH        -57.02  -56.70  -54.65  -51.00  -45.78  -39.17


SO BUILDHGT EDG        23.96   23.96   23.96   11.93    7.92    7.92
SO BUILDHGT EDG         7.92    7.92   23.96   23.96   23.96   23.96
SO BUILDHGT EDG        28.96   23.96   23.96   24.38   24.38   24.38
SO BUILDHGT EDG        24.38   24.38   23.96   11.93    7.92    7.92
SO BUILDHGT EDG         7.92    7.92   23.96   23.96   23.96   23.96
SO BUILDHGT EDG        23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDWID EDG        89.11   80.21   68.88   47.19   31.32   29.40
SO BUILDWID EDG        30.09   31.71   70.06   72.50   83.13   91.24
SO BUILDWID EDG        21.74   98.98   98.38   68.79   82.84   94.37
SO BUILDWID EDG       103.03  108.56   68.88   47.19   31.32   29.40
SO BUILDWID EDG        30.09   31.71   70.06   72.50   83.13   91.24
SO BUILDWID EDG        96.58   98.98   98.38   98.89   98.59   95.30
SO BUILDLEN EDG        72.50   83.13   91.24   96.68   21.51   16.98
SO BUILDLEN EDG        18.49   22.83   95.30   89.11   80.21   68.88
SO BUILDLEN EDG        35.57   40.34   24.00  100.97  107.38  110.52
SO BUILDLEN EDG       110.30  106.74   91.24   96.68   21.51   16.98
SO BUILDLEN EDG        18.49   22.83   95.30   89.11   80.21   68.88
SO BUILDLEN EDG        55.45   40.34   24.00   28.99   45.01   59.66
SO XBADJ    EDG         8.17   -1.43  -10.98  -27.54   -3.61   -3.92
SO XBADJ    EDG        -7.34  -12.27  -60.24  -65.15  -68.07  -68.93
SO XBADJ    EDG      -111.99  -64.40  -59.15 -170.01 -177.18 -178.96
SO XBADJ    EDG      -175.30 -166.32  -80.27  -69.13  -17.89  -13.05
SO XBADJ    EDG       -11.15  -10.55  -35.06  -23.96  -12.14    0.05
SO XBADJ    EDG        12.24   24.06   35.15   34.33   26.32   17.51
SO YBADJ    EDG        20.59   27.97   34.49   27.71   14.14   15.17
SO YBADJ    EDG        15.79   15.87   42.14   44.41   40.14   34.65
SO YBADJ    EDG        18.96   20.70   12.67   33.27   12.01   -9.62
SO YBADJ    EDG       -30.95  -51.34  -34.49  -27.71  -14.14  -15.17
SO YBADJ    EDG       -15.79  -15.87  -42.14  -44.41  -40.14  -34.65
SO YBADJ    EDG       -28.10  -20.70  -12.67   -4.30    4.21   12.59


SO BUILDHGT FP         23.96   23.96   23.96   23.96   23.96   23.96
SO BUILDHGT FP         23.96   13.11   13.11   13.11   13.11   13.72
SO BUILDHGT FP         13.72   13.72    7.77    7.77    7.77   28.96
SO BUILDHGT FP         28.96   28.96   24.38   24.38   24.38   23.96
SO BUILDHGT FP         23.96   13.11   13.11   13.11   13.11   13.11
SO BUILDHGT FP         13.11    7.77    7.77    7.77    7.77   23.96
SO BUILDWID FP         89.11   80.21   68.88   55.45   40.34   24.00
SO BUILDWID FP         45.21   13.51   13.72   13.51   12.89   22.08
SO BUILDWID FP         22.77   22.77   18.02   18.95   21.76   25.31
SO BUILDWID FP         28.85   31.88  110.80  109.66  105.20   24.00
SO BUILDWID FP         45.21   13.51   13.72   13.51   12.89   13.25
SO BUILDWID FP         13.67   21.03   18.02   18.95   21.76  107.05
SO BUILDLEN FP         72.50   83.13   91.24   96.58   98.98   98.38
SO BUILDLEN FP         98.89   13.51   13.72   13.51   12.89   22.08
SO BUILDLEN FP         22.77   22.77   20.88   21.72   23.90   35.25
SO BUILDLEN FP         33.58   30.89   99.93   90.08   77.50   98.38
SO BUILDLEN FP         98.89   13.51   13.72   13.51   12.89   13.25
SO BUILDLEN FP         13.67   23.26   20.88   21.72   23.90   75.43
SO XBADJ    FP         35.64   37.88   38.98   38.89   37.61   35.20
SO XBADJ    FP         29.71  -32.15  -34.13  -35.08  -34.96  -67.07
SO XBADJ    FP        -68.56  -67.97   10.46   10.86    9.94 -107.74
```

SO	XBADJ	FP	-107.82	-104.63	-202.24	-192.70	-177.30	-133.57
SO	XBADJ	FP	-128.60	18.63	20.41	21.57	22.07	21.21
SO	XBADJ	FP	19.48	-31.07	-31.33	-32.58	-33.84	32.31
SO	YBADJ	FP	-49.98	-36.76	-22.43	-7.41	7.83	22.83
SO	YBADJ	FP	29.23	13.05	8.44	3.58	-1.40	11.51
SO	YBADJ	FP	1.61	-8.35	-6.59	-2.80	1.01	14.93
SO	YBADJ	FP	-0.81	-16.71	-13.26	-39.50	-64.54	-22.83
SO	YBADJ	FP	-29.23	-13.05	-8.44	-3.58	1.40	6.33
SO	YBADJ	FP	11.06	10.11	6.59	2.80	-1.01	-55.80

APPENDIX C: DETAILED AERMOD RESULTS SUMMARY

NTE Connecticut, LLC - Killingly Energy Center
Mitsubishi Model M501JAC Combined Cycle Combustion Turbine Emissions Estimates

Case #:	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel	Natural Gas											ULSD								
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45	45	45	45	60	60	60	100	100	100
Barometric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	3,436	3,438	2,638	2,181	3,684	3,686	2,881	2,246	3,745	2,226	1,948	2,692	2,226	1,948	3,033	2,453	2,177	3,033	2,773	2,374
DB Heat Input (MMBtu/hr/unit, HHV)	408	0	0	0	368	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Power (kW)	0	0	0	0	0	527,475	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gross Power (kW)	0	0	0	0	0	541,000	0	0	0	0	0	0	0	0	0	0	0.0000	0	0	0
Heat Rate (Btu/kW-hr, net, HHV)	0	0	0	0	0	6,988	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
NOx (g/s)	3.569	3.192	2.449	2.025	3.762	3.422	2.675	2.085	3.477	2.066	1.808	5.872	4.826	4.208	5.947	4.813	4.259	5.947	5.437	4.656
CO (g/s)	1.847	0.874	0.671	0.555	1.947	0.937	0.733	0.571	0.953	0.566	0.495	1.613	1.323	1.159	1.814	1.462	1.285	1.814	1.651	1.411
PM (g/s)	1.600	0.882	0.693	0.592	1.600	0.958	0.756	0.605	0.970	0.882	0.706	3.188	2.558	2.167	3.604	2.822	2.482	3.490	3.478	2.948
SO2 (g/s)	0.727	0.650	0.499	0.412	0.766	0.697	0.545	0.424	0.708	0.421	0.368	0.509	0.421	0.368	0.573	0.464	0.411	0.573	0.524	0.449

AERMOD SU/SD Impacts - Turbine only (µg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.26	2.13	2.79	3.16	2.14	2.14	2.59	3.14	2.16	2.27	2.63	1.86	2.41	2.89	1.76	2.36	2.72	1.85	1.86	2.27
3-HR	1ST	1.48	1.40	1.76	2.10	1.40	1.41	1.67	2.09	1.42	1.49	1.69	1.23	1.57	1.96	1.16	1.54	1.75	1.22	1.23	1.48
8-HR	1ST	0.70	0.66	1.07	1.38	0.63	0.63	0.93	1.37	0.64	0.70	0.98	0.58	0.89	1.29	0.53	0.81	1.07	0.57	0.57	0.75
24-HR	1ST	0.32	0.30	0.49	0.65	0.28	0.28	0.42	0.65	0.29	0.32	0.44	0.26	0.41	0.61	0.22	0.37	0.50	0.24	0.25	0.35
1-HR	2ND	2.26	2.09	2.77	3.07	2.12	2.13	2.59	3.06	2.14	2.26	2.63	1.85	2.37	2.89	1.75	2.33	2.72	1.84	1.86	2.22
3-HR	2ND	1.00	0.92	1.53	1.90	0.94	0.94	1.35	1.88	0.95	1.00	1.40	0.79	1.30	1.79	0.74	1.17	1.54	0.79	0.79	1.10
8-HR	2ND	0.66	0.62	1.00	1.26	0.60	0.60	0.87	1.25	0.61	0.66	0.91	0.54	0.84	1.18	0.51	0.74	1.00	0.53	0.54	0.71
24-HR	2ND	0.25	0.23	0.40	0.53	0.23	0.23	0.34	0.53	0.23	0.25	0.36	0.20	0.33	0.49	0.19	0.29	0.40	0.20	0.20	0.27
1-HR	4TH	2.21	2.08	2.68	2.98	2.10	2.11	2.49	2.97	2.12	2.22	2.53	1.81	2.30	2.81	1.72	2.26	2.63	1.81	1.82	2.18
24-HR	6TH	0.20	0.19	0.30	0.34	0.19	0.19	0.25	0.34	0.19	0.20	0.27	0.17	0.23	0.32	0.16	0.23	0.30	0.17	0.17	0.21
1-HR	8TH	2.14	1.97	2.56	2.82	2.00	2.01	2.43	2.81	2.02	2.15	2.45	1.73	2.24	2.66	1.63	2.20	2.54	1.73	1.74	2.09
24-HR	8TH	0.20	0.19	0.27	0.33	0.19	0.19	0.24	0.33	0.19	0.20	0.25	0.16	0.23	0.31	0.15	0.21	0.27	0.16	0.16	0.20
ANNUAL AVG		0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
ANNUAL Y1		0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03
ANNUAL Y2		0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01
ANNUAL Y3		0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.02	0.02	0.01	0.01	0.02
ANNUAL Y4		0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.02
ANNUAL Y5		0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.03	0.02	0.02	0.02
ANNUAL MAX		0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03

AERMOD SU/SD Scaled Impacts - Turbine only (µg/m³) - 150 ft. turbine stack

Case #:	Averaging Period	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel		Natural Gas											ULSD								
NO2																					
1-HR	1ST	7.65	6.43	6.22	5.67	7.68	7.00	6.39	5.85	7.16	4.44	4.39	10.34	10.79	11.14	9.97	10.58	10.65	10.50	9.68	9.89
1-HR	8TH	6.06	5.03	4.85	4.39	6.03	5.49	5.04	4.53	5.63	3.52	3.45	7.92	8.56	8.68	7.59	8.41	8.33	8.01	7.39	7.79
ANNUAL		0.09	0.08	0.08	0.07	0.09	0.09	0.08	0.08	0.09	0.05	0.06	0.13	0.14	0.15	0.12	0.13	0.14	0.13	0.12	0.12
CO																					
1-HR	1ST	4.18	1.86	1.87	1.75	4.16	2.01	1.90	1.80	2.05	1.29	1.30	3.00	3.19	3.35	3.19	3.44	3.50	3.35	3.08	3.20
1-HR	2ND	4.17	1.82	1.86	1.70	4.13	1.99	1.90	1.75	2.04	1.28	1.30	2.98	3.13	3.35	3.17	3.40	3.50	3.35	3.07	3.14
8-HR	1ST	1.29	0.58	0.72	0.76	1.23	0.59	0.68	0.78	0.61	0.40	0.48	0.94	1.18	1.49	0.96	1.18	1.38	1.03	0.93	1.06
8-HR	2ND	1.22	0.54	0.67	0.70	1.17	0.56	0.64	0.71	0.58	0.38	0.45	0.87	1.12	1.37	0.92	1.08	1.29	0.97	0.89	1.00
PM10 / PM2.5 (PSD)																					
24-HR	1ST	0.51	0.26	0.34	0.39	0.45	0.27	0.32	0.39	0.28	0.28	0.31	0.82	1.05	1.32	0.80	1.05	1.24	0.84	0.87	1.03
24-HR	2ND	0.40	0.20	0.28	0.31	0.36	0.22	0.26	0.32	0.22	0.22	0.25	0.65	0.84	1.07	0.69	0.83	0.99	0.70	0.70	0.81
24-HR	6TH	0.32	0.17	0.21	0.20	0.30	0.18	0.19	0.21	0.19	0.18	0.19	0.54	0.60	0.70	0.58	0.64	0.74	0.59	0.59	0.62
ANNUAL		0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02	0.02	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08
PM2.5																					
24-HR	1ST	0.36	0.19	0.24	0.27	0.33	0.20	0.23	0.27	0.20	0.20	0.22	0.58	0.71	0.90	0.59	0.71	0.86	0.61	0.62	0.70
24-HR	8TH	0.22	0.11	0.12	0.12	0.20	0.12	0.12	0.12	0.13	0.12	0.12	0.36	0.38	0.40	0.38	0.41	0.43	0.38	0.39	0.41
ANNUAL		0.03	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06
SO2																					
1-HR	1ST	1.56	1.31	1.27	1.15	1.57	1.43	1.29	1.18	1.46	0.90	0.90	0.90	0.94	0.98	0.96	1.01	1.03	1.01	0.93	0.96
1-HR	4TH	1.39	1.16	1.12	1.00	1.39	1.26	1.15	1.02	1.29	0.80	0.79	0.80	0.83	0.86	0.84	0.90	0.91	0.89	0.82	0.85
3-HR	1ST	1.08	0.91	0.88	0.87	1.07	0.98	0.91	0.89	1.00	0.63	0.62	0.62	0.66	0.72	0.66	0.71	0.72	0.70	0.64	0.67
3-HR	2ND	0.73	0.60	0.76	0.78	0.72	0.66	0.73	0.80	0.67	0.42	0.51	0.40	0.55	0.66	0.43	0.54	0.63	0.45	0.42	0.49
24-HR	1ST	0.23	0.19	0.25	0.27	0.22	0.20	0.23	0.27	0.20	0.13	0.16	0.13	0.17	0.22	0.13	0.17	0.21	0.14	0.13	0.16
24-HR	2ND	0.18	0.15	0.20	0.22	0.17	0.16	0.19	0.22	0.16	0.10	0.13	0.10	0.14	0.18	0.11	0.14	0.16	0.11	0.11	0.12
ANNUAL		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

NTE Connecticut, LLC - Killingly Energy Center

Mitsubishi Model M501JAC Combined Cycle Combustion Turbine - Start-up/Shutdown (SU/SD) Emissions Estimates

Case #:	HOT	WARM	COLD	HUTDOW	HOT	WARM	COLD	HUTDOW
Fuel	Natural Gas				ULSD			
Exhaust velocity (m/s)	14.34	13.55	13.53	16.83	14.71	14.24	14.22	17.33
Exhaust temperature (K)	358.38	357.83	356.91	356.50	364.27	362.76	361.80	363.48
NOx (g/s)	18.47	18.82	18.82	9.83	24.82	25.53	25.53	20.41
CO (g/s)	45.20	45.25	50.79	26.61	290.77	290.93	290.93	53.94
PM (g/s)	1.13	1.07	1.07	1.13	4.14	4.00	4.00	4.46
SO2 (g/s)	0.42	0.42	0.42	0.42	0.41	0.41	0.41	0.41

AERMOD SU/SD Impacts - Turbine only (µg/m³ per g/s) - 150 ft. turbine stack height

1-HR	1ST	2.96	3.13	3.17	2.63	2.75	2.86	2.89	2.43
3-HR	1ST	2.06	2.31	2.33	1.70	1.87	2.04	2.05	1.58
8-HR	1ST	1.34	1.49	1.50	1.01	1.22	1.32	1.33	0.90
24-HR	1ST	0.64	0.71	0.72	0.46	0.58	0.63	0.63	0.41
1-HR	2ND	2.95	3.09	3.11	2.61	2.75	2.84	2.86	2.39
3-HR	2ND	1.86	2.13	2.15	1.45	1.72	1.83	1.85	1.31
8-HR	2ND	1.22	1.33	1.33	0.94	1.13	1.19	1.21	0.83
24-HR	2ND	0.52	0.58	0.58	0.37	0.46	0.50	0.51	0.33
1-HR	4TH	2.87	3.01	3.03	2.52	2.66	2.77	2.80	2.31
24-HR	6TH	0.33	0.37	0.38	0.28	0.31	0.32	0.33	0.24
1-HR	8TH	2.72	2.86	2.89	2.45	2.55	2.65	2.67	2.26
24-HR	8TH	0.32	0.35	0.35	0.26	0.30	0.31	0.32	0.24
ANNUAL AVG		0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.02
ANNUAL Y1		0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
ANNUAL Y2		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
ANNUAL Y3		0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
ANNUAL Y4		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
ANNUAL Y5		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
ANNUAL MAX		0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03

AERMOD SU/SD Scaled Impacts - Turbine only (µg/m³) - 150 ft. turbine stack

Case #:	Averaging Period	HOT	WARM	COLD	HUTDOW	HOT	WARM	COLD	HUTDOW
Fuel		Natural Gas				ULSD			
NO2									
1-HR	1ST	49.79	53.00	53.42	23.78	62.90	66.91	67.41	45.94
1-HR	8TH	38.55	40.73	41.06	18.72	48.68	51.92	52.53	36.45
ANNUAL		0.65	0.70	0.71	0.30	0.81	0.87	0.88	0.58
CO									
1-HR	1ST	133.76	141.73	161.05	69.91	799.46	832.00	839.40	130.91
1-HR	2ND	133.27	139.70	158.12	69.58	799.07	825.52	832.17	128.89
8-HR	1ST	60.61	67.26	76.18	26.78	356.14	382.64	385.92	48.53
8-HR	2ND	55.32	60.40	67.61	25.06	327.27	344.87	352.25	44.87
PM10 / PM2.5 (PSD)									
24-HR	1ST	0.72	0.76	0.77	0.53	2.40	2.51	2.54	1.84
24-HR	2ND	0.58	0.62	0.63	0.42	1.92	2.02	2.04	1.48
24-HR	6TH	0.37	0.39	0.41	0.32	1.29	1.29	1.30	1.06
ANNUAL		0.04	0.04	0.04	0.04	0.14	0.14	0.14	0.13
PM2.5									
24-HR	1ST	0.49	0.52	0.52	0.37	1.60	1.67	1.72	1.25
24-HR	8TH	0.21	0.22	0.22	0.19	0.74	0.74	0.74	0.67
ANNUAL		0.03	0.03	0.03	0.03	0.10	0.11	0.11	0.10
SO2									
1-HR	1ST	1.13	1.18	1.19	1.02	1.04	1.07	1.08	0.92
1-HR	4TH	1.00	1.03	1.04	0.90	0.92	0.95	0.96	0.82
3-HR	1ST	0.88	0.98	0.99	0.72	0.77	0.84	0.84	0.65
3-HR	2ND	0.79	0.90	0.91	0.62	0.71	0.75	0.76	0.54
24-HR	1ST	0.27	0.30	0.31	0.20	0.24	0.26	0.26	0.17
24-HR	2ND	0.22	0.25	0.25	0.16	0.19	0.21	0.21	0.14
ANNUAL		0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01

NTE Killingly Energy Center - Detailed Results Table

Pollutant	Averaging Period	Rank for SIL	Project Maximum Impact (SIL) (µg/m^3)	Maximum Impact Receptor Location UTM-E (m)	Maximum Impact Receptor Location UTM-N (m)	Elevation (m)	Maximum Impact Date (YYMMDDHH)	Worst Case Turbine Load Scenario	SIL (µg/m^3)	NAAQS (µg/m^3)	PSD (µg/m^3)
NO2 (SS)	1-HR	H1H (5YA)	10.78	265950.00	4638500.00	226.01	5-YR AVG	ULSD Case 4	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.87	257991.51	4638704.89	88.40	2012	ULSD Case 4 / GAS Cas 1	**1.0**	**100**	**25**
NO2 (SUSD)	1-HR	H1H (5YA)	65.05	265950.00	4638500.00	226.01	5-YR AVG	ULSD Cold Start	**7.5**	**188**	**NA**
	ANNUAL	H1H	0.88	257991.51	4638704.89	88.40	2012	ULSD Cold Start / ULSD Case 4 / GAS Cas 1	**1.0**	**100**	**25**
CO	1-HR	H1H	860.91	266600.00	4634800.00	231.76	16052803	ULSD Cold Start	**2000.0**	**40000**	**NA**
	8-HR	H1H	103.48	258093.00	4638237.00	113.68	15021516	ULSD Cold Start / ULSD Case 4	**500.0**	**10000**	**NA**
PM10	24-HR	H1H	2.34	257843.00	4638537.00	99.13	14110124	ULSD Cold Start / ULSD Case 15	**5.0**	**150**	**30**
	ANNUAL	H1H	0.15	258020.18	4638663.47	92.76	2013	ULSD Cold Start / ULSD Case 15, GAS Case 1	**1.0**	**NA**	**17**
PM2.5	24-HR	H1H (5YA)	1.57	258020.18	4638663.47	92.76	5-YR AVG	ULSD Cold Start / ULSD Case 15	**1.2**	**35**	**NA**
	ANNUAL	H1H (5YA)	0.14	258011.71	4638673.30	92.52	5-YR AVG	ULSD Cold Start / ULSD Case 15 / GAS Case 1	**0.2**	**12**	**NA**
PM2.5 (PSD)	24-HR	H1H	2.34	257872.25	4638523.36	97.50	14102324	ULSD Cold Start / ULSD Case 15	**1.2**	**NA**	**9**
	ANNUAL	H1H	0.15	258020.18	4638663.47	92.76	2013	ULSD Cold Start / ULSD Case 15, GAS Case 1	**0.2**	**NA**	**4**
SO2	1-HR	H1H (5YA)	1.79	266700.00	4634900.00	241.85	5-YR AVG	GAS Case 36	**7.9**	**196**	**NA**
	3-HR	H1H	1.26	257893.00	4638437.00	107.35	14061703	GAS Cold Start	**25.0**	**1300**	**512**
	24-HR	H1H	0.70	257872.25	4638523.36	97.50	13030824	GAS Cold Start / GAS Case 40	**5.0**	**365**	**91**
	ANNUAL	H1H	0.04	258020.18	4638663.47	92.76	2013	GAS Cold Start / GAS Case 1	**1.0**	**80**	**20**

NTE Killingly Energy Center - Cumulative Impacts

Pollutant	Averaging Period	Rank	Cumulative Maximum Impact (NAAQS) (µg/m^3)	Ambient Background (µg/m^3)	Cumulative Impact + Ambient Background (µg/m^3)	Maximum Impact Receptor Location UTM-E (m)	Maximum Impact Receptor Location UTM-N (m)	Elevation (m)	Maximum Impact Date (YYMMDDHH)	NAAQS (µg/m^3)	PSD (µg/m^3)
NO2 (SS)	1-HR	H8H (5YA)	8.3	84.6	92.9	265950.00	4638500.00	226.01	5-year avg	**188.00**	**NA**
NO2 (SUSD)	1-HR	H8H (5YA)	50.2	84.6	134.8	265950.00	4638500.00	226.01	5-year avg	**188.00**	**NA**
PM2.5 (NAAQS)	24-HR	H8H (5YA)	1.6	18.0	19.6	257872.25	4638523.36	94.50	5-year avg	**35.00**	**NA**
PM2.5 (PSD)	24-HR	H2H	1.7	NA	1.7	257887.09	4638508.10	103.33	13110324	**NA**	**9**

Note: Cumulative Impacts reported for all pollutants and averaging periods for which the Project has a significant impact

APPENDIX F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS

NTE Killingly Energy Center
Soils Screening Assessment - Updated 1/2018

Ambient Temperature (°F):	100				59				-10			100			59			-10		
Case #:	1	2	4	5	36	37	39	40	33	34	35	2	3	4	28	14	15	25	29	30
Fuel	Natural Gas											ULSD								
GT Operating Load	100%	100%	75%	55%	100%	100%	75%	50%	100%	75%	60%	100%	75%	60%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	22,112	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594	19,594
Evaporative Cooler Status (On or Off	ON	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	Off	Off	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Inlet Fogger State (On or Off)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	45	45	45	45	45	60	60	60	100	100	100
MODELING INPUTS																				
Exhaust velocity (m/s)	20.70	20.98	16.59	14.48	22.01	21.97	17.88	14.55	21.82	20.65	17.47	21.64	17.37	14.64	23.77	18.60	16.35	22.81	22.48	19.04
Exhaust temperature (K)	352.59	358.15	352.59	352.59	352.59	352.59	352.59	352.59	352.59	352.59	353.15	370.37	364.26	358.71	365.93	359.26	355.37	364.82	365.37	361.48
EMISSION RATES (g/s)																				
Arsenic	1.03E-05	0	0	0	9.27E-06	0	0	0	0	0	0	0	1.29E-05	0	1.76E-05	1.42E-05	1.26E-05	1.76E-05	1.61E-05	1.38E-05
Beryllium	6.17E-07	0	0	0	5.56E-07	0	0	0	0	0	0	0	8.69E-05	0	1.18E-04	9.58E-05	8.50E-05	1.18E-04	1.08E-04	9.27E-05
Cadmium	5.66E-05	0	0	0	5.10E-05	0	0	0	0	0	0	0	1.43E-06	0	1.95E-06	1.58E-06	1.40E-06	1.95E-06	1.78E-06	1.53E-06
Chromium	7.20E-05	0	0	0	6.49E-05	0	0	0	0	0	0	0	3.47E-03	0	4.73E-03	3.83E-03	3.40E-03	4.73E-03	4.33E-03	3.70E-03
Cobalt	4.22E-06	0	0	0	3.80E-06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	2.37E-04	2.12E-04	1.63E-04	1.35E-04	2.50E-04	2.28E-04	1.78E-04	1.39E-04	2.31E-04	1.37E-04	1.20E-04	2.12E-04	2.95E-04	1.63E-04	4.02E-04	3.25E-04	2.88E-04	4.02E-04	3.67E-04	3.15E-04
Manganese	1.90E-05	0	0	0	1.72E-05	0	0	0	0	0	0	0	5.06E-05	0	6.89E-05	5.57E-05	4.95E-05	6.89E-05	6.30E-05	5.39E-05
Mercury	1.29E-05	0	0	0	1.16E-05	0	0	0	0	0	0	0	2.86E-06	0	3.90E-06	3.16E-06	2.80E-06	3.90E-06	3.57E-06	3.06E-06
Nickel	1.08E-04	0	0	0	9.74E-05	0	0	0	0	0	0	0	4.14E-04	0	5.64E-04	4.56E-04	4.05E-04	5.64E-04	5.16E-04	4.42E-04
Selenium	1.23E-06	0	0	0	1.11E-06	0	0	0	0	0	0	0	7.16E-05	0	9.76E-05	7.89E-05	7.01E-05	9.76E-05	8.92E-05	7.64E-05
MODELING RESULTS																				
AERMOD Unit Impacts (ug/m3 per g/s)																				
Annual	0.03	0.02	0.03	0.04	0.02	0.02	0.03	0.04	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.03	0.02	0.02	0.03
Scaled Impacts (ug/m3)																				
Arsenic	2.72E-07	0	0	0	2.31E-07	0	0	0	0	0	0	0	3.62E-07	0.00E+00	3.62E-07	3.91E-07	4.05E-07	3.80E-07	3.51E-07	3.64E-07
Beryllium	1.63E-08	0	0	0	1.39E-08	0	0	0	0	0	0	0	2.44E-06	0.00E+00	2.44E-06	2.64E-06	2.73E-06	2.56E-06	2.36E-06	2.45E-06
Cadmium	1.50E-06	0	0	0	1.27E-06	0	0	0	0	0	0	0	4.03E-08	0.00E+00	4.02E-08	4.34E-08	4.50E-08	4.22E-08	3.90E-08	4.04E-08
Chromium	1.91E-06	0	0	0	1.62E-06	0	0	0	0	0	0	0	9.76E-05	0.00E+00	9.74E-05	1.05E-04	1.09E-04	1.02E-04	9.44E-05	9.79E-05
Cobalt	1.12E-07	0	0	0	9.47E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lead	6.28E-06	5.26E-06	5.28E-06	4.96E-06	6.23E-06	5.68E-06	5.38E-06	5.08E-06	5.81E-06	3.65E-06	3.70E-06	4.62E-06	8.29E-06	5.62E-06	8.27E-06	8.94E-06	9.26E-06	8.69E-06	8.02E-06	8.32E-06
Manganese	5.04E-07	0	0	0	4.27E-07	0	0	0	0	0	0	0	1.42E-06	0.00E+00	1.42E-06	1.53E-06	1.59E-06	1.49E-06	1.38E-06	1.43E-06
Mercury	3.40E-07	0	0	0	2.89E-07	0	0	0	0	0	0	0	8.05E-08	0.00E+00	8.03E-08	8.69E-08	8.99E-08	8.44E-08	7.79E-08	8.08E-08
Nickel	2.86E-06	0	0	0	2.42E-06	0	0	0	0	0	0	0	1.16E-05	0.00E+00	1.16E-05	1.26E-05	1.30E-05	1.22E-05	1.13E-05	1.17E-05
Selenium	3.27E-08	0	0	0	2.77E-08	0	0	0	0	0	0	0	2.01E-06	0.00E+00	2.01E-06	2.17E-06	2.25E-06	2.11E-06	1.95E-06	2.02E-06

Killingly Energy Center - Soils Impact Screening Assessment

Trace Element	Annual Concentration (ug/m3)	Maximum Project Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Average Soil Concentration (ppmw)	Percent Increase	Soil Concentration Ratio	Plant Tissue Concentration Criteria (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	4.05E-07	1.16E-04	3	0.00%	6	0.00%	0.14	1.62E-05	0.25	0.01%
Beryllium	2.73E-06	7.82E-04	NA	NA	6	0.01%	NA	NA	NA	NA
Cadmium	1.50E-06	4.29E-04	2.5	0.02%	0.06	0.72%	10.7	4.59E-03	3	0.15%
Chromium	1.09E-04	3.12E-02	8.4	0.37%	100	0.03%	0.02	6.25E-04	1	0.06%
Cobalt	1.12E-07	3.20E-05	NA	NA	8	0.00%	0.11	3.52E-06	19	0.00%
Lead	9.26E-06	2.65E-03	1000	0.00%	10	0.03%	0.45	1.19E-03	126	0.00%
Manganese	1.59E-06	4.55E-04	2.5	0.02%	850	0.00%	0.066	3.00E-05	400	0.00%
Mercury	3.40E-07	9.75E-05	455	0.00%	0.1	0.10%	0.5	4.88E-05	NA	NA
Nickel	1.30E-05	3.72E-03	500	0.00%	40	0.01%	0.045	1.68E-04	60	0.00%
Selenium	2.25E-06	6.44E-04	13	0.00%	0.5	0.13%	1	6.44E-04	100	0.00%

APPENDIX C – UPDATED SOUND ANALYSIS

TETRA TECH

To:	NTE Connecticut, LLC
From:	Kevin Fowler, Lynn Gresock
Subject:	Killingly Energy Center – Acoustic Modeling Analysis
Date:	January 17, 2018

Tetra Tech previously prepared an acoustic modeling analysis for the Killingly Energy Center (KEC) dated June 2016 and submitted to the Connecticut Siting Council (CSC) as Appendix L of KEC's CSC Application, and later revised the analysis to reflect minor adjustments associated with the local review process in October 2016. Additional minor changes, largely associated with the selection of the Mitsubishi combustion turbine generator (CTG) to replace the previously proposed Siemens CTG, are now reflected in KEC's design. This memo describes the results of the updated acoustical modeling to reflect the most recent changes, and demonstrates that compliance with Connecticut and Killingly noise requirements continues to be achieved.

Noise Level Requirements and Guidelines

Potential noise impacts resulting from the operation of 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 Section 22a-69. In addition, Chapter 12.5, Article VI (Sections 120-131) of the Town of Killingly Code of Ordinances contains guidance pertaining to noise, which is generally consistent with the DEEP noise regulations.

Connecticut Department of Energy and Environmental Protection

The DEEP noise control regulations in Section 22a-69-3.1, which prescribe noise limits according to land use category, as reflected by zoning, are shown in Table 1.

Table 1. DEEP Noise Limits

Emitter	**Receptor (dBA)**			
	Class C	**Class B**	**Class A Daytime (7:00 am – 10:00 pm)**	**Class A Nighttime (10:00 pm – 7:00 am)**
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

The regulations also prescribe provisions for impulse noise, not allowing impulse noise in excess of 80 decibels (dB) (peak) during nighttime hours in any Class A zone and not allowing impulse noise in excess 100 dB (peak) at any time to any zone. Audible discrete tones also require special consideration. A limit of 100 dB pertains to infrasonic and ultrasonic noise. Construction noise is exempt from the DEEP noise regulations.

Town of Killingly Code of 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. The Town noise-level standards are consistent with those prescribed by the DEEP, although the definition of daytime varies. The Town of Killingly considers daytime Monday through Saturday to be 7:00 am to 9:00 pm, and on Sundays it is 9:00 am to 9:00 pm.

Acoustic Modeling Methodology and Inputs

Acoustic modeling was conducted using the DataKustic GmbH CadnaA computer-aided noise abatement program (v 4.5.153), which conforms to algorithms contained within the International Organization for Standardization (ISO) standard 9613-2, "Attenuation of Sound during Propagation Outdoors." The engineering methods specified in this standard consist of full (1/1) octave band algorithms that incorporate geometric spreading due to wave divergence, reflection from surfaces, atmospheric absorption, screening by topography and obstacles, ground effects, source directivity, heights of both sources and receptors, seasonal foliage effects, and meteorological conditions. The CadnaA acoustic modeling analysis incorporated site-specific topographic and terrain data and a mixed (semi-reflective) ground factor of G=0.5 applied for the surrounding community. The ground absorption factor applied for KEC was G=0.

KEC's general arrangement (Figure 1) 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. The primary noise sources during base load operation are the air-cooled condenser (ACC), steam turbine generator (STG), CTG, main step-up transformers, air inlet face and filter housing, the exhaust stack, and heat recovery steam generator (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 2 summarizes the equipment sound power level data used as inputs to the modeling analysis.

Table 2. Modeled Octave Band Sound Power Levels for Major Pieces of Project Equipment

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Gas Turbine Inlet Air Filter with Silencer	117	107	97	95	94	105	101	100	93	108
Gas Turbine Inlet Air Duct	119	112	105	98	90	97	99	99	99	106
Gas Turbine Enclosure[1]	140	129	111	99	98	108	109	103	90	114
Gas Turbine Generator and Slip Ring Housing[1]	120	115	123	94	88	90	84	78	70	107
Gas Turbine Exhaust Diffuser Duct	125	123	114	104	92	78	73	69	63	102
Gas Turbine Enclosure Ventilation Fan	89	77	87	91	93	95	94	87	77	99
Gas Turbine Lube Oil Unit[1]	111	103	108	108	104	103	97	87	75	107
Gas Turbine Enhanced Cooling Air Compressor[1]	---	78	80	84	87	91	92	97	86	100
Gas Turbine Main Fuel Oil Pump (MFOP) Unit[1]	---	80	96	92	94	99	94	93	84	102
Gas Turbine Water Injection Skid[1]	---	88	88	90	93	95	96	93	90	101
HRSG at Inlet Duct	121	121	114	106	98	99	105	103	95	110
HRSG Upstream SCR	129	123	115	106	97	98	102	102	100	109
HRSG Downstream SCR	128	122	114	104	94	95	98	98	96	106
At Stack Inlet	124	118	110	99	88	79	70	66	62	98
HRSG Stack Exit with 90 degree directivity	123	117	108	101	95	92	85	83	81	99

Table 2. Modeled Octave Band Sound Power Levels for Major Pieces of Project Equipment

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Steam Turbine (High Pressure Portion) [1]	---	118	117	111	109	106	105	100	91	112
Steam Turbine (Low Pressure Portion) [1]	---	107	109	111	106	102	96	88	78	108
STG and Slip Ring Housing[1]	114	116	123	102	97	96	83	80	73	107
STG Lube Oil Unit[1]	---	110	109	98	90	98	95	91	91	102
STG Control Oil Unit[1]	---	97	101	97	100	96	98	89	82	103
Gland Condenser Fan[1]	---	91	93	91	90	87	85	81	84	93
Fuel Gas Piping	94	90	79	71	70	76	78	81	79	86
STG Step-up Transformer	87	87	91	88	94	86	76	71	65	92
Unit Auxiliary Transformer	70	70	74	71	77	69	59	54	48	75
CTG Step-up Transformer	88	88	92	89	95	87	77	72	66	93
Closed Cooling Water Fan Array	91	94	92	91	91	89	88	86	84	95
ACC	110	111	108	104	98	97	97	99	97	103
Fuel Gas Compressor	83	79	84	83	81	84	84	82	77	90
Fuel Gas Heater	102	98	100	90	84	82	82	79	75	90
Boiler Feed Pump	89	95	93	87	88	97	95	91	81	100
Lagged HRSG Duct Burner Gas Piping	102	106	104	91	78	74	73	69	69	90
Ammonia Injection Skid	96	103	99	96	97	97	95	92	87	102
Demineralized Water Pump[2]	88	82	82	85	92	95	96	92	84	101

[1]Located within turbine building.
[2]Located within the water treatment building.

The KEC design has incorporated silencers for the HRSG exhaust stack. 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. Several large components, including the following are enclosed in the Turbine High Bay and Low Bay Buildings:

- CTG enclosure;
- CTG and slip ring housing;
- CTG lube oil skid;
- CTG enhanced cooling air compressor;
- CTG MFOP Unit;
- CTG water injection skid;
- STG (High Pressure and Low Pressure Portions);
- STG and slip ring housing;
- STG lube oil unit;
- STG control oil unit; and
- Gland condenser fan.

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 3. 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 3: Noise Level Reductions for the Turbine Buildings

Type of Construction or Acoustical	Modeled Noise Level Reductions (dB re: 20 microPascals) by Octave Band Center Frequency dBL								
	31.5	63	125	250	500	1k	2k	4k	8k
Wall Panel STC 50	15	19	28	42	48	59	65	71	73

The following mitigation measures, in addition to assumptions reflected in Tables 2 and 3, 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 silencer system that will reduce the noise from the upper stack portion and the exhaust stack exit (see Table 2).
- CTG Exhaust Diffuser: The turbine exhaust diffuser will incorporate 40-foot high sound barrier wall located on the west side of the diffuser.
- HRSG Inlet Duct: The HRSG Inlet duct will incorporate an acoustical shroud to reduce the overall sound power level to 96 dBA, equivalent to a sound pressure level of 85 dBA at 3 feet.
- HRSG Upstream SCR: The HRSG upstream SCR will incorporate an acoustical mitigation measures to reduce the overall sound power level to 105 dBA, equivalent to a sound pressure level of 94 dBA at 3 feet.
- HRSG Downstream SCR: The HRSG downstream SCR will incorporate an acoustical mitigation measures to reduce the overall sound power level to 97 dBA, equivalent to a sound pressure level of 86 dBA at 3 feet.
- HRSG Stack Inlet: The HRSG stack inlet will incorporate an acoustical mitigation measures to reduce the overall sound power level to 85 dBA, equivalent to a sound pressure level of 74 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.
- CTG Enclosure Ventilation Fans: The gas turbine enclosure ventilation fans will incorporate a 5-foot high sound barrier located on the south, west, and north sides of the fans.
- Generator Step-up Transformer: The 10-foot high fire wall associated with the generator step-up transformer will be oriented so that the opening faces to the east.
- Property Line Noise Barriers: Four noise barriers have been positioned along the southwestern property line (one 22 feet high and 107 feet long; one 18 feet high and 37 feet long; one 18 feet high and 50 feet long; and one 16 feet high and 139 feet long; as final design progresses, it may be determined that barriers can be eliminated or reduced in size). The locations of the noise barriers are illustrated in the latest site layout (Figure 1).

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

Noise Prediction Model Results

Broadband (dBA) sound pressure levels were calculated at an elevation of 1.5 meters (5 feet) above the ground, the presumed 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 (A-weighted decibels, or dBA) sound levels presented as color-coded noise isopleths in 5-dBA intervals are provided in Figure 2. 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).

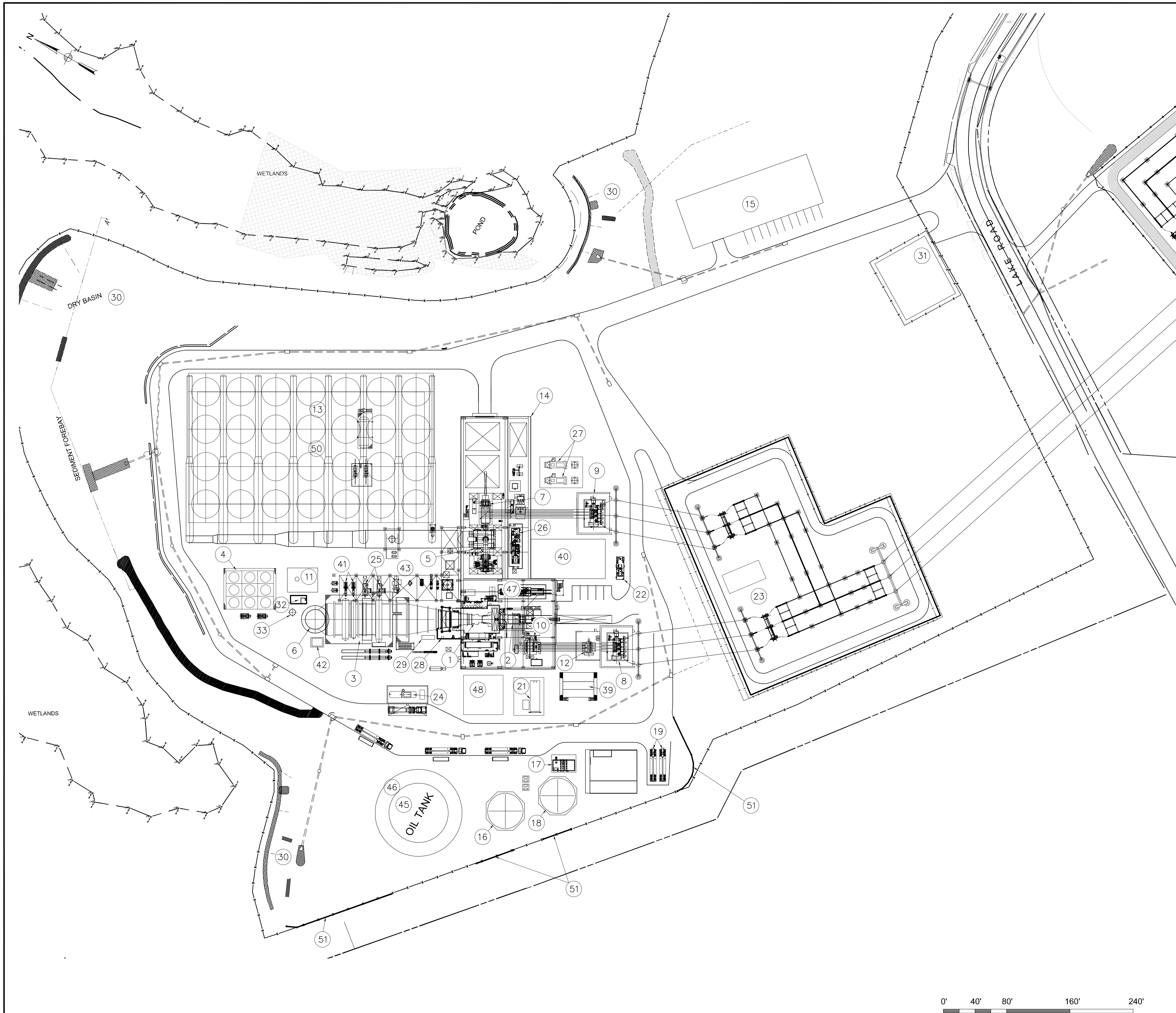
The noise contours are graphical representations of the cumulative noise associated during normal operation of the individual equipment components and show how operational noise would be distributed over the surrounding area. The contour lines shown are analogous to elevation contours on a topographic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

Table 4 shows the projected exterior sound levels resulting at all the representative monitoring locations for the October 2016 layout and the proposed Mitsubishi layout. 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 4. Acoustic Modeling Results Summary – Mitigated Design

Location	October 2016 Project Sound Level, dBA	Updated Layout Projected Sound Level, dBA
ST-1	44	43
ST-2	47	50
ST-3	39	42
ST-4	46	45
ST-5	42	42
LT-1	50	50

Figures



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
11. AUXILARY BOILER
12. UNIT AUXILIARY TRANSFORMER
13. AIR COOLED CONDENSER (ACC) & CONDENSATE COLLECTION ENCLOSURE
14. TURBINE BUILDING
15. ADMIN/ WAREHOUSE BUILDING
16. RAW / FIRE WATER STORAGE TANK & RW PUMPS
17. FIRE PUMPS ENCLOSURE
18. DEMINERALIZED WATER STORAGE TANK
19. DEMINERALIZED WATER TRAILERS AREA
20. NOT USED
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. METER AND REGULATION YARD
32. HRSG BLOW OFF TANK & DRAINS PUMPS
33. HRSG BLOWDOWN SUMP
34. NOT USED
35. CIVIL OIL WATER SEPARATOR (NOT SHOWN)
36. NOT USED
37. PLANT GATE (NOT SHOWN)
38. NOT USED
39. CTG ELECTRICAL PACKAGE
40. CONTROL ROOM AND SWITCHGEAR (2-STORY BUILDING)
41. AMMONIA PUMPS
42. CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)
43. PIPE RACK
44. FUEL OIL UNLOADING
45. FUEL OIL TANK
46. STEEL CONTAINMENT
47. GT LUBE OIL SKID
48. FUEL GAS COMPRESSORS
49. WATER TREATMENT BUILDING
50. ACC MECHANICAL/ELECTRICAL EQUIPMENT ENCLOSURE
51. SOUND WALL

Reference Drawings

Rev	Date	Drawn	Description	Ch'k'd	App'd
E	01/17/18	AF	FOR CLIENT REVIEW	KP	JW
D	11/06/17	AF	FOR CLIENT REVIEW	KP	JW
C	10/20/17	AF	FOR CLIENT REVIEW	KP	JW
B	10/19/17	AF	FOR CLIENT REVIEW	KP	JW
A	10/13/17	AF	FOR CLIENT REVIEW	KP	JW

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Westwood, MA 02090
United States
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F +1 (781) 915-0001
W www.mottmac.com

Figure 1

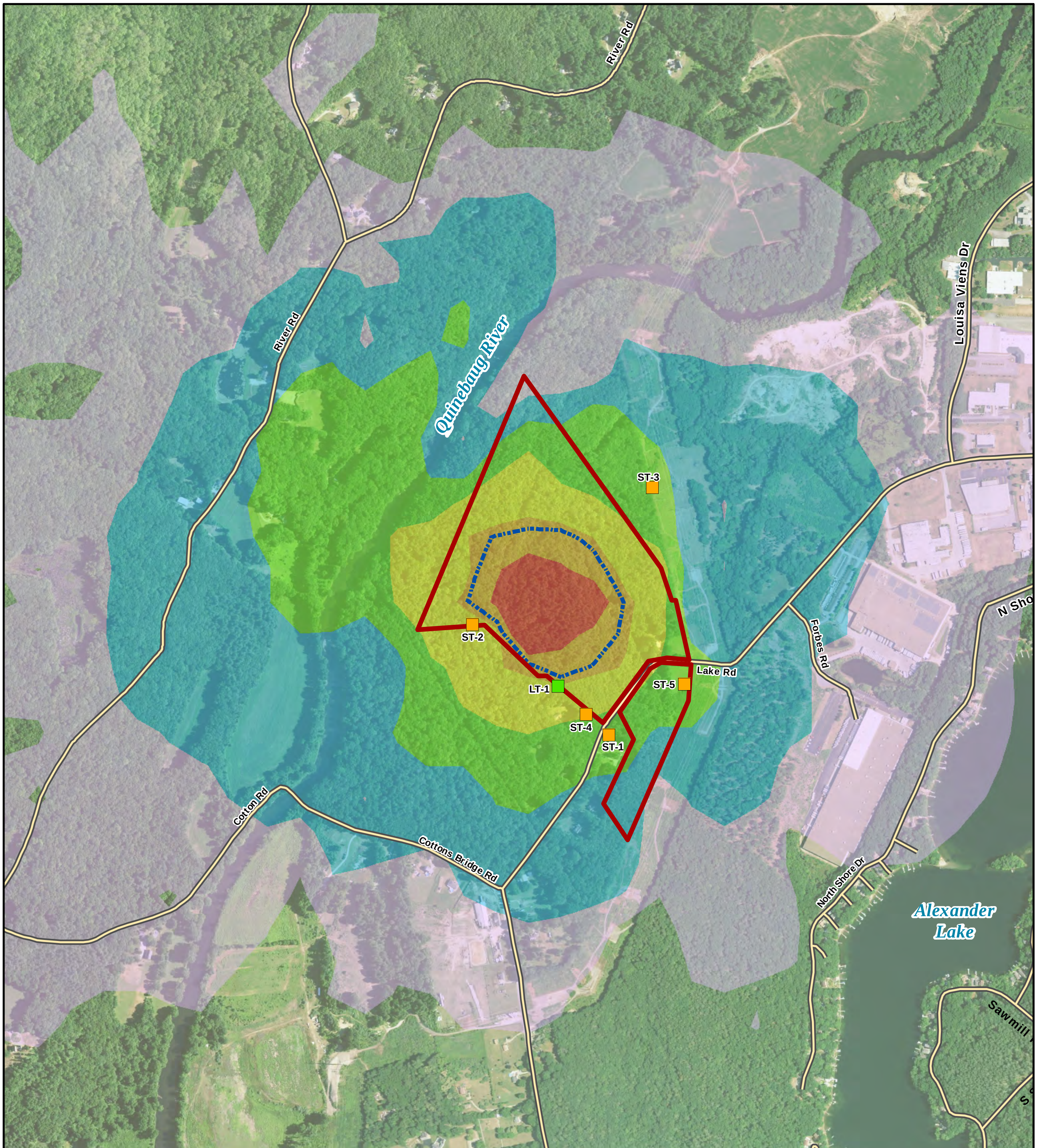
Site Plan

NTE ENERGY

KILLINGLY ENERGY CENTER
KILLINGLY CONNECTICUT

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

Designed	-	Eng check	JW
Drawn	AF	Approved	-
Dwg check	KP	Project Mngr	JW
Scale at ANSI E: 1" = 40'-0"		Date: 04/07/16	Rev: E
Drawing Number: 334954CT-GA-213			



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 2
Acoustic Modeling Results-Mitigated Design

Killingly Energy Center
an NTE Energy Project

R:\PROJECTS\KILLINGLY_5545\NOISE\MAPS\Figure_2_Noise_Levels_Mitigated.mxd

APPENDIX D – UPDATED TRAFFIC ANALYSIS

January 11, 2018

Mr. Chris Rega
NTE Energy
24 Cathedral Place, Suite 300
St. Augustine, FL 32084

RE: Traffic Statement
450 Construction Employees
NTE Energy, Killingly
Our File: 16126

Dear Mr. Rega:

Pursuant to your request our office has prepared this letter to outline the potential impact of construction related traffic, related to the proposed NTE Energy Plant, on the local roadway network. This letter is written to summarize our preliminary findings.

Our office had previously prepared and submitted a traffic impact report, dated June 28, 2016, based on a peak construction employment of 350. A copy of the level of service summary table, Table 7, from that report is presented here.

You have requested that we prepare a new analysis to determine the potential impact of a peak construction employment of 450. Attached are revised movement diagrams and tables that present that data and summarizing the results. The revised analysis was conducted in a similar manner as the original report. The projected trip generation and directional distribution of traffic utilized in this revised analysis is consistent with the methodologies use in the original report.

Table 6R-1 presents the trip generation for the project. Based on a peak construction employment level of 450, we project a peak hour traffic volume of 495 trips. We assume a vehicle occupancy of one person per vehicle, that all workers arrive or depart the site in one hour, and that the contrary traffic volume is 10% or the primary volume, i.e. during the morning peak hour when 450 vehicles are arriving, 45 vehicle will depart the site and vice versa during the afternoon peak hour. Based on this methodology the increase in trip generation of 450 employees versed 350 employees is a total of 110 trips.

These volumes were distributed to the roadway network with 75% of the traffic oriented to and from the east along Attawaugan Crossing Road towards I-395 and 25% to and from the south along Attawaugan Crossing Road towards the Hartford Turnpike. This is the same distribution used in the original report. Revised capacity analyses were conducted for the revised combined traffic volumes. The results are presented in Table 7R-1. The results are similar to those previously presented. There are two locations where there is a notable increase in delay.

During the morning peak hour the I-395 southbound off ramp to Attawaugan Crossing Road will see an increase in delay of 18 seconds and the 95% queue will extend an additional 70 feet.

During the afternoon peak hour the eastbound through movement of Attawaugan Crossing Road at Tracy Road will experience an additional 23 seconds of delay and the queue will extend an additional 103 feet.

There are no other notable impacts. It is important to note that these impacts will occur during the construction of the facility and not during normal operations of the facility. This level of impact will occur only during the peak level of construction activity, a period of perhaps two or three months.

Based on our analysis it is my professional opinion that the existing roadway network has sufficient excess capacity in order to accommodate the increased traffic related to the construction activities related to the proposed development. The two locations that will experience impacts will still operate at acceptable levels of service and the impacts will be temporary and of short duration. Therefore no mitigation measures are proposed, or in my opinion required.

If you require any additional information regarding this project, please do not hesitate to contact our office.

Sincerely,
F.A. Hesketh & Associates, Inc.

Scott F. Hesketh, P.E.
Manager of Transportation Engineering

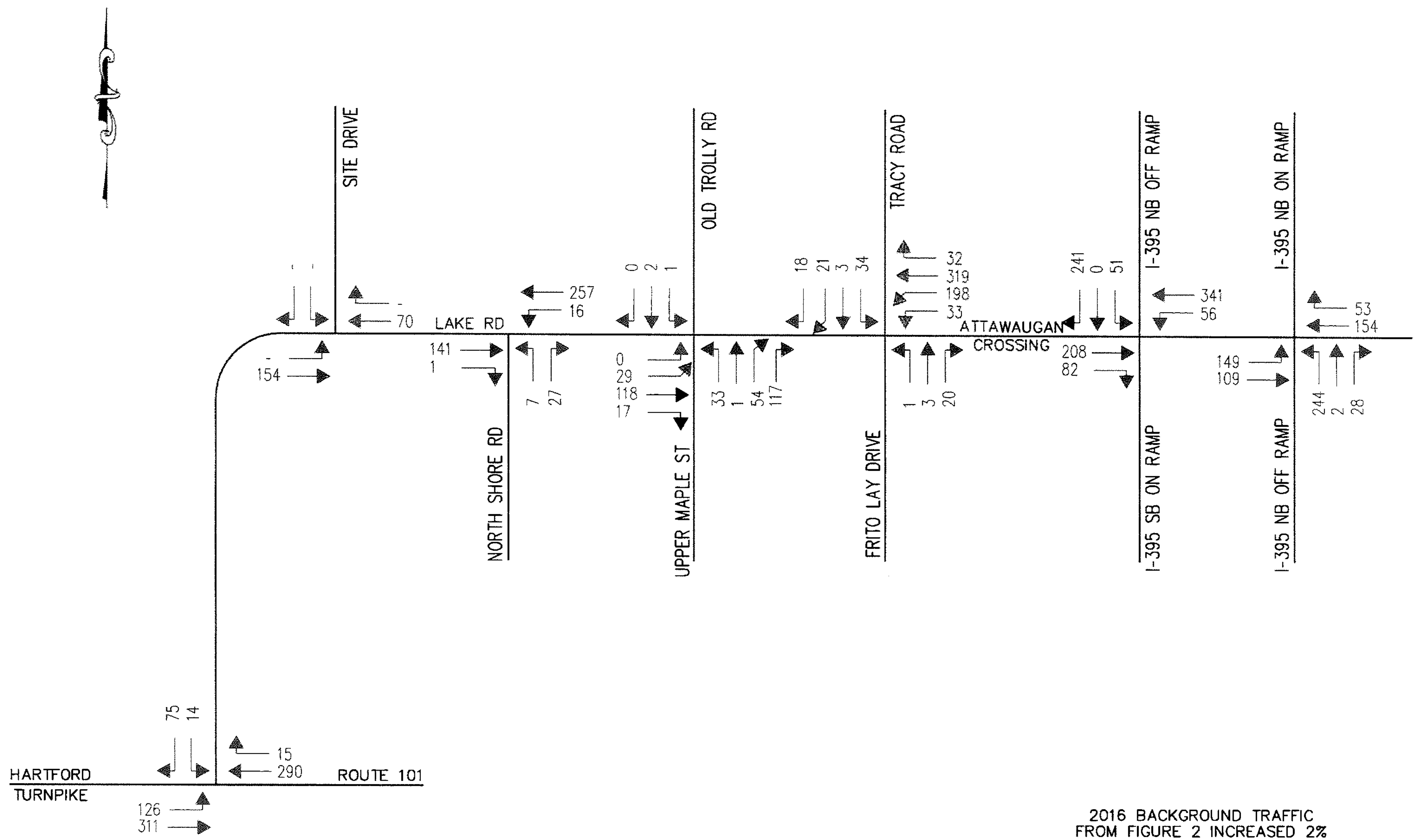
cc: Tin Eves, NTE Energy
Kenneth Baldwin, Robinson & Cole

T:\pf\16126\Rega.01.11.18.docx

Table 7
Level of Service Summary
NTE Connecticut - Lake Road - Killingly, CT

	A. M. PEAK HOUR								P. M. PEAK HOUR							
	Background Traffic				Combined Traffic				Background Traffic				Combined Traffic			
Time Period	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue
Attawaugan Crossing Road at I-395 NB Ramps																
NB	B	16.8	0.50	127	B	19.7	0.62	201	B	14.5	0.42	86	B	15.4	0.46	91
EB Left	A	7.3	0.26	49	A	9.6	0.30	68	A	7.0	0.36	57	A	8.4	0.48	84
Through	A	6.4	0.13	37	A	8.3	0.13	50	A	5.5	0.17	40	A	5.8	0.20	50
WB	B	17.1	0.45	100	C	21.0	0.51	144	B	15.7	0.36	69	B	16.0	0.37	72
Overall	B	13.4	0.50		B	16.8	0.62		B	10.6	0.42		B	11.0	0.48	
Attawaugan Crossing Road at I-395 SB Ramps																
SB	C	18.4	0.54	79	E	38.8	0.83	201	B	14.3	0.36	41	C	17.9	0.45	58
EB	A	0.0	0.18	0	A	0.0	0.19	0	A	0.0	0.36	0	A	0.0	0.52	0
WB	A	1.5	0.05	4	A	1.3	0.05	4	A	2.5	0.07	5	A	3.2	0.09	8
Attawaugan Crossing Road / Lake Road at Tracy Road / Frito Lay Driveway																
NB	B	14.4	0.10	13	B	13.6	0.10	21	B	12.8	0.13	25	B	12.5	0.13	24
SB	C	20.1	0.35	55	B	17.4	0.38	58	C	23.3	0.55	89	C	23.5	0.56	89
EB Left	A	4.8	0.24	9	A	8.3	0.36	26	A	3.6	0.24	12	A	4.1	0.28	m9
Through	A	3.0	0.24	20	A	3.2	0.26	24	A	5.4	0.52	51	B	18.2	0.76	#213
WB	C	20.6	0.59	194	C	26.6	0.75	#308	B	19.9	0.41	117	C	20.0	0.40	130
Overall	B	15.0	0.59		B	19.7	0.75		B	12.4	0.55		B	17.9	0.76	
Attawaugan Crossing Road / Lake Road at Upper Maple Street																
NB Left	C	28.5	0.13	41	C	31.4	0.22	65	C	30.0	0.12	44	C	31.4	0.12	45
Through	A	9.2	0.46	54	A	9.4	0.46	56	A	9.0	0.54	58	A	9.7	0.56	58
EB	B	14.9	0.18	52	B	16.2	0.19	63	C	21.0	0.47	126	C	27.3	0.71	245
WB Left	A	1.7	0.31	13	A	1.4	0.31	m1	A	5.1	0.39	56	B	14.1	0.58	105
Through	A	0.9	0.30	2	A	4.0	0.51	95	A	1.1	0.18	4	A	1.1	0.20	5
Overall	A	6.1	0.59		A	7.4	0.75		B	11.8	0.55		B	18.0	0.76	
Lake Road at North Shore Road																
NB	B	10.1	0.06	4	B	11.2	0.07	5	B	10.7	0.04	3	B	14.1	0.07	6
EB	A	0.0	0.10	0	A	0.0	0.12	0	A	0.0	0.19	0	A	0.0	0.38	0
WB	A	0.6	0.01	1	A	0.4	0.01	1	A	1.5	0.03	2	A	1.6	0.04	3
Route 101 at Lake Road																
SB	B	13.4	0.19	18	C	15.4	0.25	24	C	15.2	0.28	29	C	19.9	0.50	68
EB	A	3.3	0.12	10	A	4.7	0.19	18	A	2.0	0.07	6	A	2.1	0.08	6
WB	A	0.0	0.21	0	A	0.0	0.22	0	A	0.0	0.27	0	A	0.0	0.27	0
Lake Road at Site Driveway																
NB					A	3.6	0.09	7					A	0.8	0.01	1
SB					A	0.0	0.23	0					A	0.0	0.12	0
EB					B	13.4	0.09	7					C	16.8	0.58	94

6/20/2016



2016 BACKGROUND TRAFFIC FROM FIGURE 2 INCREASED 2% PER YEAR OR 6% TOTAL TO A DESIGN YEAR OF 2019

FIGURE 4 5/27/16

2019 BACKGROUND TRAFFIC
A.M. PEAK HOUR

NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026
FAH
TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE

2016 BACKGROUND TRAFFIC FROM FIGURE 3 INCREASED 2% PER YEAR OR 6% TOTAL TO A DESIGN YEAR OF 2019

FIGURE 5 | 5/27/16

2019 BACKGROUND TRAFFIC
P.M. PEAK HOUR

NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026
FAH
TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE

Table 6R-1
Trip Generation Summary

			Weekday Volumes					
			AM Peak			PM Peak		
Source	**Size**	**ADT**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**
Proposed Development								
Utility	30 Employees		21	2	23	4	19	23
	40,000 s.f.		16	16	32	14	16	30
Construction Traff	450 Workers		450	45	495	45	450	495

* - Assumes a vehicle occupancy rate of 1 person per vehicle, that 100% of workers arrive in one hour, and 10% depart during the same hour.

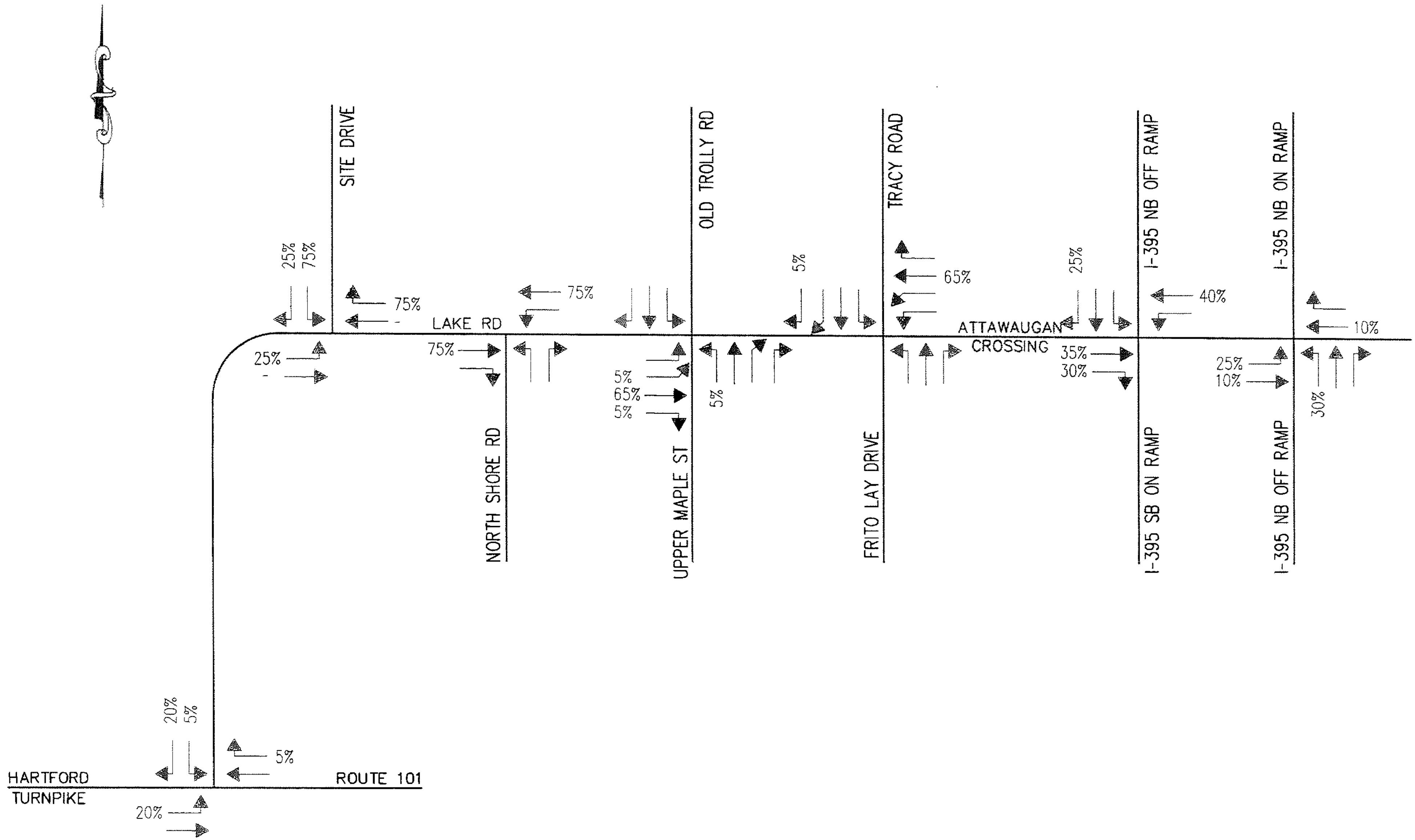


FIGURE 6

5/27/16

DIRECTIONAL DISTRIBUTION OF SITE GENERATED TRAFFIC

NTE CONNECTICUT

180 & 189 LAKE ROAD

KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

FAH

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DESIGN

NOT TO SCALE

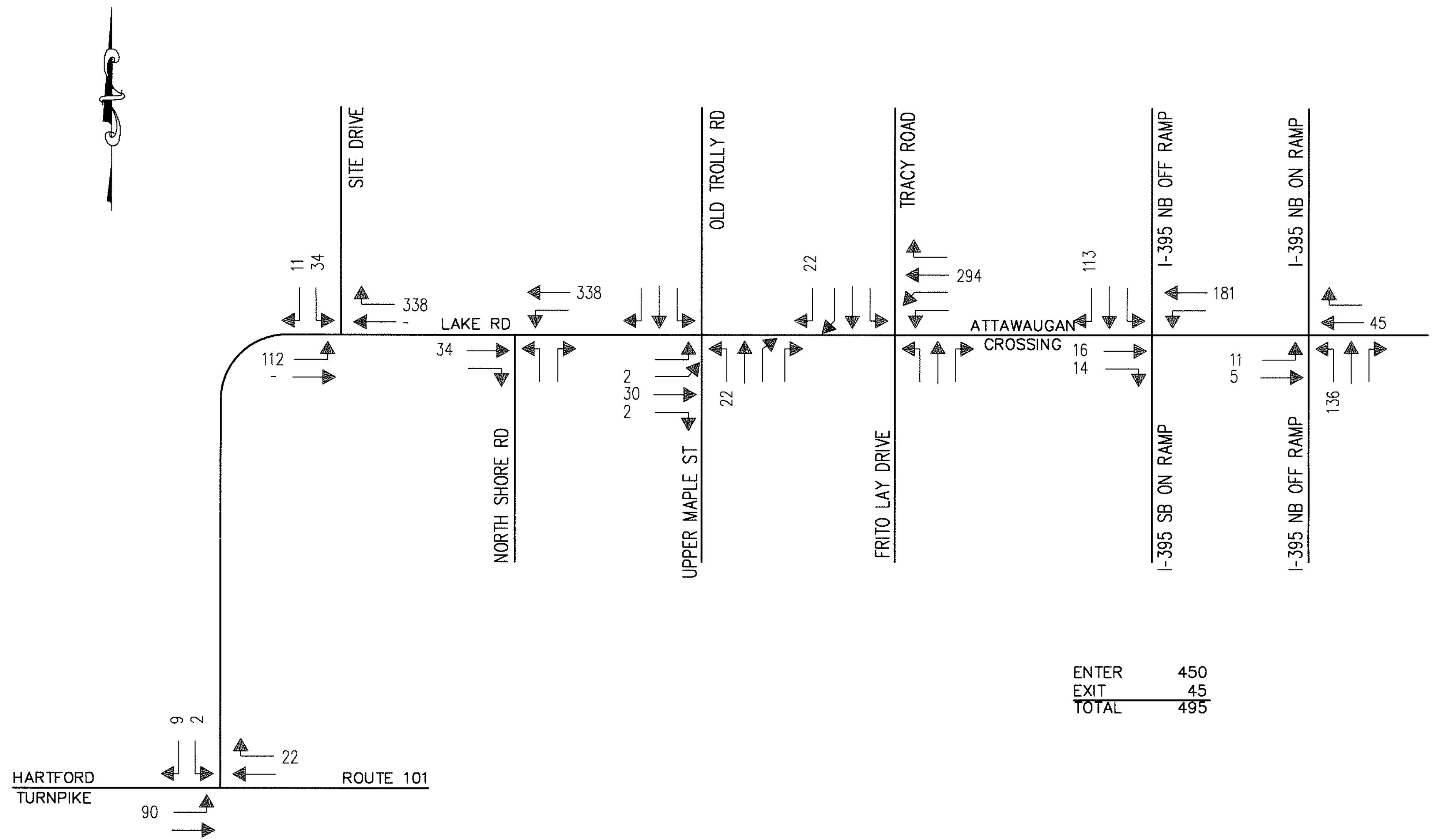

FIGURE 7R–1

01/11/18

SITE GENERATED TRAFFIC
A.M. PEAK HOUR

NTE CONNECTICUT

180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

FAH

TRAFFIC
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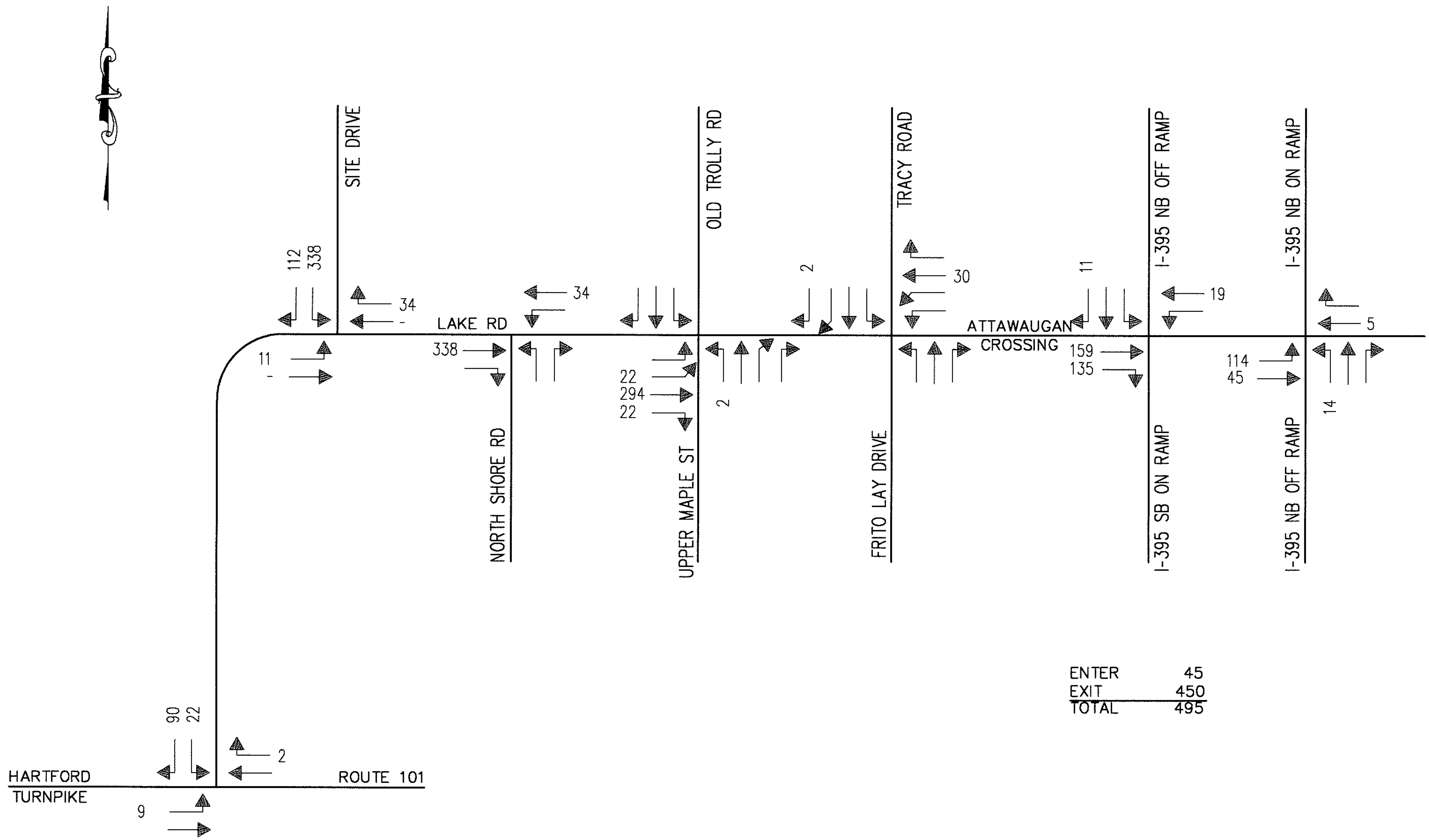
ENGINEERING
DESIGN

NOT TO SCALE

A.M. PEAK HOUR CONSTRUCTION TRAFFIC FROM TABLE 6 DISTRIBUTED BASED ON THE TRIP DISTRIBUTION IN FIGURE 6



ENTER 45
EXIT 450
TOTAL 495

P.M. PEAK HOUR CONSTRUCTION TRAFFIC FROM TABLE 6 DISTRIBUTED BASED ON THE TRIP DISTRIBUTION IN FIGURE 6

FIGURE 8R-1 1/11/18

SITE GENERATED TRAFFIC
P.M. PEAK HOUR

NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026
FAH
TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE

2019 BACKGROUND TRAFFIC
FROM FIGURE 4 PLUS THE
SITE GENERATED TRAFFIC
FROM FIGURE 7R-1

FIGURE 9R-1 1/11/18

2019 COMBINED TRAFFIC
A.M. PEAK HOUR

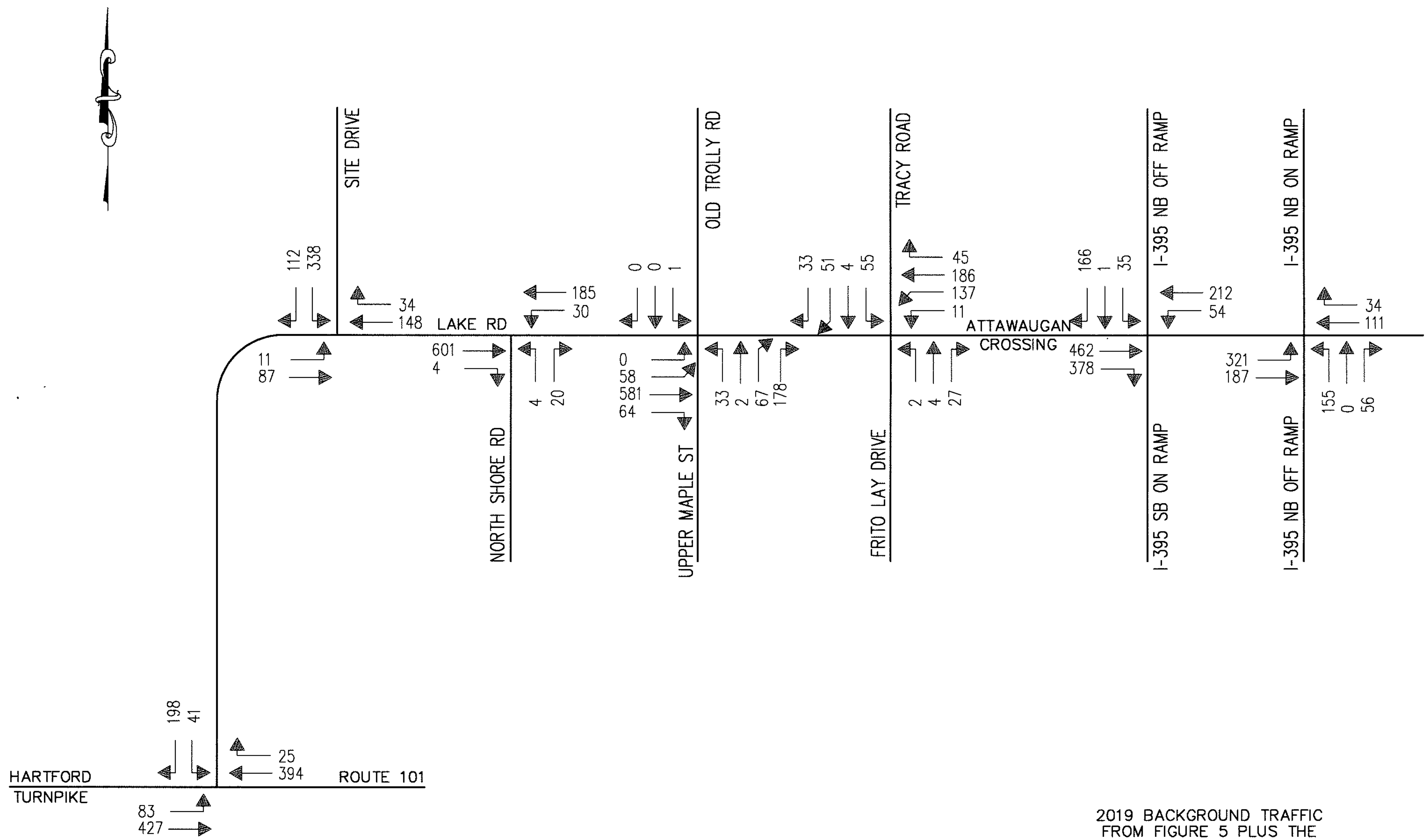
NTE CONNECTICUT

180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE



2019 BACKGROUND TRAFFIC
FROM FIGURE 5 PLUS THE
SITE GENERATED TRAFFIC
FROM FIGURE 8R-1

FIGURE 10R-1 1/11/18

2019 COMBINED TRAFFIC
P.M. PEAK HOUR

NTE CONNECTICUT

180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

FAH

TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE

Table 7R-1
Level of Service Summary
NTE Connecticut - Lake Road - Killingly, CT

	A. M. PEAK HOUR								P. M. PEAK HOUR							
	Background Traffic				Combined Traffic				Background Traffic				Combined Traffic			
Time Period	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue	LOS	delay	v/c	Queue
Attawaugan Crossing Road at I-395 NB Ramps																
NB	B	16.8	0.50	127	C	20.4	0.65	228	B	14.5	0.42	86	B	13.9	0.47	84
EB Left	A	7.3	0.26	49	B	10.6	0.31	74	A	7.0	0.36	57	A	8.5	0.52	89
Through	A	6.4	0.13	37	A	9.1	0.14	55	A	5.5	0.17	40	A	5.6	0.21	50
WB	B	17.1	0.45	100	C	22.2	0.53	158	B	15.7	0.36	69	B	15.7	0.37	71
Overall	B	13.4	0.50		B	17.8	0.65		B	10.6	0.42		B	10.4	0.52	
Attawaugan Crossing Road at I-395 SB Ramps																
SB	C	18.4	0.54	79	F	56.9	0.93	271	B	14.3	0.36	41	C	20.1	0.50	67
EB	A	0.0	0.18	0	A	0.0	0.20	0	A	0.0	0.36	0	A	0.0	0.56	0
WB	A	1.5	0.05	4	A	1.3	0.05	4	A	2.5	0.07	5	A	3.6	0.11	9
Attawaugan Crossing Road / Lake Road at Tracy Road / Frito Lay Driveway																
NB	B	14.4	0.10	13	B	13.5	0.09	21	B	12.8	0.13	25	B	12.5	0.13	24
SB	C	20.1	0.35	55	B	16.5	0.37	59	C	23.3	0.55	89	C	23.6	0.57	89
EB Left	A	4.8	0.24	9	B	11.0	0.41	35	A	3.6	0.24	12	A	4.6	0.29	m8
Through	A	3.0	0.24	20	A	3.4	0.28	25	A	5.4	0.52	51	D	40.7	0.83	#316
WB	C	20.6	0.59	194	C	31.3	0.81	#382	B	19.9	0.41	117	C	20.6	0.42	136
Overall	B	15.0	0.59		C	23.1	0.81		B	12.4	0.55		C	29.9	0.83	
Attawaugan Crossing Road / Lake Road at Upper Maple Street																
NB Left	C	28.5	0.13	41	C	31.8	0.23	66	C	30.0	0.12	44	C	31.4	0.13	45
Through	A	9.2	0.46	54	A	9.5	0.47	56	A	9.0	0.54	58	A	9.9	0.57	58
EB	B	14.9	0.18	52	B	16.7	0.20	68	C	21.0	0.47	126	C	32.9	0.78	#306
WB Left	A	1.7	0.31	13	A	1.6	0.31	m1	A	5.1	0.39	56	C	20.0	0.65	117
Through	A	0.9	0.30	2	A	5.7	0.56	m139	A	1.1	0.18	4	A	1.1	0.20	5
Overall	A	6.1	0.59		A	8.3	0.81		B	11.8	0.55		C	22.0	0.83	
Lake Road at North Shore Road																
NB	B	10.1	0.06	4	B	11.8	0.07	6	B	10.7	0.04	3	C	15.4	0.08	6
EB	A	0.0	0.10	0	A	0.0	0.13	0	A	0.0	0.19	0	A	0.0	0.43	0
WB	A	0.6	0.01	1	A	0.4	0.01	1	A	1.5	0.03	2	A	1.7	0.04	3
Route 101 at Lake Road																
SB	B	13.4	0.19	18	C	16.1	0.26	26	C	15.2	0.28	29	C	21.8	0.55	83
EB	A	3.3	0.12	10	A	5.1	0.21	20	A	2.0	0.07	6	A	2.2	0.08	7
WB	A	0.0	0.21	0	A	0.0	0.22	0	A	0.0	0.27	0	A	0.0	0.27	0
Lake Road at Site Driveway																
NB					A	4.4	0.12	10					A	0.9	0.01	1
SB					A	0.0	0.28	0					A	0.0	0.13	0
EB					C	15.5	0.13	11					C	24.1	0.75	174

1/11/2018

SYNCHRO CAPACITY ANALYSIS WORKSHEETS

2019 COMBINED TRAFFIC

A.M. PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			✥				
Traffic Volume (vph)	160	114	0	0	199	53	380	2	28	0	0	0
Future Volume (vph)	160	114	0	0	199	53	380	2	28	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.971			0.991				
Flt Protected	0.950							0.956				
Satd. Flow (prot)	1770	1863	0	0	1809	0	0	1765	0	0	0	0
Flt Permitted	0.382							0.956				
Satd. Flow (perm)	712	1863	0	0	1809	0	0	1765	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					15			5				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		906			1473			940			892	
Travel Time (s)		20.6			33.5			21.4			20.3	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	165	118	0	0	205	55	392	2	29	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	165	118	0	0	260	0	0	423	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2		1	2				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	6			6		20	6				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	5	2			6			8				
Permitted Phases	2						8					

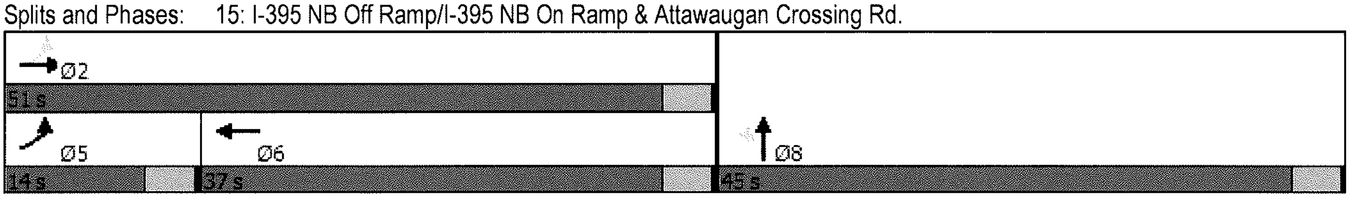
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2			6		8	8				
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0		4.0	4.0				
Minimum Split (s)	8.0	20.0			20.0		20.0	20.0				
Total Split (s)	14.0	51.0			37.0		45.0	45.0				
Total Split (%)	14.6%	53.1%			38.5%		46.9%	46.9%				
Maximum Green (s)	10.0	47.0			33.0		41.0	41.0				
Yellow Time (s)	3.5	3.5			3.5		3.5	3.5				
All-Red Time (s)	0.5	0.5			0.5		0.5	0.5				
Lost Time Adjust (s)	0.0	0.0			0.0			0.0				
Total Lost Time (s)	4.0	4.0			4.0			4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		Min	Min				
Walk Time (s)		5.0			5.0		5.0	5.0				
Flash Dont Walk (s)		11.0			11.0		11.0	11.0				
Pedestrian Calls (#/hr)		0			0		0	0				
Act Effct Green (s)	23.8	23.8			13.8			19.1				
Actuated g/C Ratio	0.46	0.46			0.27			0.37				
v/c Ratio	0.31	0.14			0.53			0.65				
Control Delay	10.6	9.1			22.2			20.4				
Queue Delay	0.0	0.0			0.0			0.0				
Total Delay	10.6	9.1			22.2			20.4				
LOS	B	A			C			C				
Approach Delay		10.0			22.2			20.4				
Approach LOS		A			C			C				
90th %ile Green (s)	10.0	34.9			20.9		29.5	29.5				
90th %ile Term Code	Max	Hold			Gap		Gap	Gap				
70th %ile Green (s)	10.0	29.9			15.9		22.7	22.7				
70th %ile Term Code	Max	Hold			Gap		Gap	Gap				
50th %ile Green (s)	10.0	27.0			13.0		18.0	18.0				
50th %ile Term Code	Max	Hold			Gap		Gap	Gap				
30th %ile Green (s)	9.0	23.7			10.7		14.7	14.7				
30th %ile Term Code	Gap	Hold			Gap		Gap	Gap				
10th %ile Green (s)	0.0	8.1			8.1		10.9	10.9				
10th %ile Term Code	Skip	Hold			Gap		Gap	Gap				
Stops (vph)	80	54			186			307				
Fuel Used(gal)	2	1			5			6				
CO Emissions (g/hr)	134	92			354			447				
NOx Emissions (g/hr)	26	18			69			87				
VOC Emissions (g/hr)	31	21			82			104				
Dilemma Vehicles (#)	0	0			0			0				
Queue Length 50th (ft)	25	18			67			111				
Queue Length 95th (ft)	74	55			156			228				
Internal Link Dist (ft)		826			1393			860			812	
Turn Bay Length (ft)	150											
Base Capacity (vph)	564	1606			1211			1377				
Starvation Cap Reductn	0	0			0			0				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.29	0.07			0.21			0.31				

Intersection Summary

Area Type: Other
Cycle Length: 96
Actuated Cycle Length: 51.9
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 17.8 Intersection LOS: B
Intersection Capacity Utilization 55.4% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 72.4
70th %ile Actuated Cycle: 60.6
50th %ile Actuated Cycle: 53
30th %ile Actuated Cycle: 46.4
10th %ile Actuated Cycle: 27

Splits and Phases: 15: I-395 NB Off Ramp/I-395 NB On Ramp & Attawaugan Crossing Rd.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	224	96	56	522	0	0	0	0	51	0	354
Future Volume (Veh/h)	0	224	96	56	522	0	0	0	0	51	0	354
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	236	101	59	549	0	0	0	0	54	0	373
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		668			906							
pX, platoon unblocked				0.99			0.99	0.99	0.99	0.99	0.99	
vC, conflicting volume	549			337			1326	954	286	954	1004	549
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	549			324			1325	947	273	947	998	549
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			100	100	100	76	100	30
cM capacity (veh/h)	1021			1222			38	246	757	229	229	535

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	337	608	427
Volume Left	0	59	54
Volume Right	101	0	373
cSH	1700	1222	458
Volume to Capacity	0.20	0.05	0.93
Queue Length 95th (ft)	0	4	271
Control Delay (s)	0.0	1.3	56.9
Lane LOS		A	F
Approach Delay (s)	0.0	1.3	56.9
Approach LOS			F

Intersection Summary			
Average Delay	18.3		
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			↑↱			↰↑↱			↰↑↱	
Traffic Volume (vph)	85	265	1	33	811	32	1	3	20	34	3	61
Future Volume (vph)	85	265	1	33	811	32	1	3	20	34	3	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	11	12	12	12	12	12	11	12
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.995			0.886			0.915	
Flt Protected	0.950				0.998			0.998			0.983	
Satd. Flow (prot)	1407	1481	0	0	3269	0	0	1461	0	0	1437	0
Flt Permitted	0.213				0.933			0.991			0.892	
Satd. Flow (perm)	315	1481	0	0	3056	0	0	1451	0	0	1304	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					4			22			67	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		109			291			272			1012	
Travel Time (s)		2.5			6.6			6.2			23.0	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	24%	24%	2%	6%	6%	6%	15%	15%	15%	15%	15%	15%
Adj. Flow (vph)	93	291	1	36	891	35	1	3	22	37	3	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	93	292	0	0	962	0	0	26	0	0	107	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		11			11			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.00	1.00	1.04	1.00	1.00	1.00	1.00	1.00	1.04	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	1		1	1	
Detector Template												
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	50	50		50	50		50	50		50	50	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2 4 6			2			3			3	
Permitted Phases	2 4 6			2			3			3		
Detector Phase	2 4 6	2 4 6		2	2		3	3		3	3	
Switch Phase												
Minimum Initial (s)				4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)				20.6	20.6		9.6	9.6		9.6	9.6	
Total Split (s)				34.0	34.0		29.0	29.0		29.0	29.0	
Total Split (%)				37.8%	37.8%		32.2%	32.2%		32.2%	32.2%	

Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	4.0	4.0
Minimum Split (s)	9.4	20.0
Total Split (s)	18.0	9.0
Total Split (%)	20%	10%

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)				29.4	29.4		23.4	23.4		23.4	23.4	
Yellow Time (s)				3.6	3.6		3.2	3.2		3.2	3.2	
All-Red Time (s)				1.0	1.0		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)					-0.6			-1.6			-1.6	
Total Lost Time (s)					4.0			4.0			4.0	
Lead/Lag							Lead	Lead		Lead	Lead	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)				3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode				None	None		None	None		None	None	
Walk Time (s)				5.0	5.0							
Flash Dont Walk (s)				11.0	11.0							
Pedestrian Calls (#/hr)				0	0							
Act Effct Green (s)	55.7	55.7			30.1			14.0			14.0	
Actuated g/C Ratio	0.72	0.72			0.39			0.18			0.18	
v/c Ratio	0.41	0.28			0.81			0.09			0.37	
Control Delay	9.4	2.6			29.4			13.5			16.5	
Queue Delay	1.5	0.8			1.9			0.0			0.0	
Total Delay	11.0	3.4			31.3			13.5			16.5	
LOS	B	A			C			B			B	
Approach Delay		5.2			31.3			13.5			16.5	
Approach LOS		A			C			B			B	
90th %ile Green (s)				29.4	29.4		20.0	20.0		20.0	20.0	
90th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
70th %ile Green (s)				29.4	29.4		13.8	13.8		13.8	13.8	
70th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
50th %ile Green (s)				29.4	29.4		11.3	11.3		11.3	11.3	
50th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
30th %ile Green (s)				29.4	29.4		9.7	9.7		9.7	9.7	
30th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
10th %ile Green (s)				28.9	28.9		8.1	8.1		8.1	8.1	
10th %ile Term Code				Gap	Gap		Gap	Gap		Gap	Gap	
Stops (vph)	38	47			710			10			37	
Fuel Used(gal)	0	1			14			0			1	
CO Emissions (g/hr)	31	44			959			12			91	
NOx Emissions (g/hr)	6	8			187			2			18	
VOC Emissions (g/hr)	7	10			222			3			21	
Dilemma Vehicles (#)	0	0			0			0			0	
Queue Length 50th (ft)	6	17			214			2			17	
Queue Length 95th (ft)	35	25			#382			21			59	
Internal Link Dist (ft)		29			211			192			932	
Turn Bay Length (ft)												
Base Capacity (vph)	220	1037			1188			484			467	
Starvation Cap Reductn	43	472			0			0			0	
Spillback Cap Reductn	0	0			109			0			2	
Storage Cap Reductn	0	0			0			0			0	
Reduced v/c Ratio	0.53	0.52			0.89			0.05			0.23	

Intersection Summary

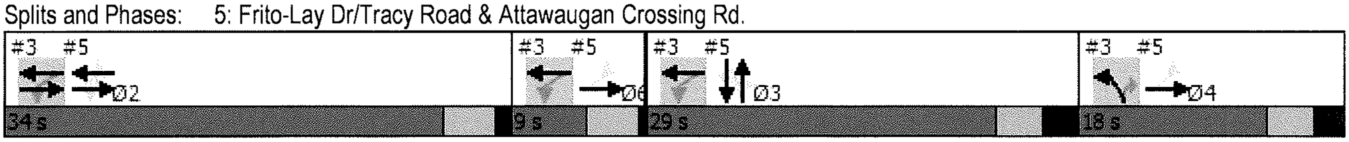
Area Type: Other

Lane Group	Ø4	Ø6
Maximum Green (s)	12.6	5.0
Yellow Time (s)	3.2	3.5
All-Red Time (s)	2.2	0.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lag	
Lead-Lag Optimize?	Yes	
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)		5.0
Flash Dont Walk (s)		11.0
Pedestrian Calls (#/hr)		0
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
90th %ile Green (s)	12.6	5.0
90th %ile Term Code	Max	Max
70th %ile Green (s)	12.6	5.0
70th %ile Term Code	Max	Max
50th %ile Green (s)	12.6	5.0
50th %ile Term Code	Max	Max
30th %ile Green (s)	10.9	5.0
30th %ile Term Code	Gap	Max
10th %ile Green (s)	7.5	5.0
10th %ile Term Code	Gap	Max
Stops (vph)		
Fuel Used(gal)		
CO Emissions (g/hr)		
NOx Emissions (g/hr)		
VOC Emissions (g/hr)		
Dilemma Vehicles (#)		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 77.7
Natural Cycle: 70
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 23.1 Intersection LOS: C
Intersection Capacity Utilization 60.9% ICU Level of Service B
Analysis Period (min) 15
90th %ile Actuated Cycle: 86.6
70th %ile Actuated Cycle: 80.4
50th %ile Actuated Cycle: 77.9
30th %ile Actuated Cycle: 74.6
10th %ile Actuated Cycle: 69.1
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Frito-Lay Dr/Tracy Road & Attawaugan Crossing Rd.

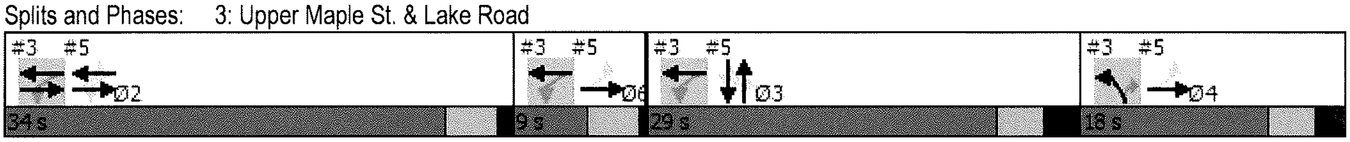


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Lane Configurations	↑↱		↰	↑	↰	↱		
Traffic Volume (vph)	179	19	219	653	56	171		
Future Volume (vph)	179	19	219	653	56	171		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	11	11	11	11	12	12		
Storage Length (ft)		0	0		125	0		
Storage Lanes		0	1		1	1		
Taper Length (ft)			25		25			
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00		
Frt	0.986					0.850		
Flt Protected			0.950		0.950			
Satd. Flow (prot)	2775	0	1646	1733	1703	1524		
Flt Permitted			0.615		0.950			
Satd. Flow (perm)	2775	0	1066	1733	1703	1524		
Right Turn on Red		Yes				Yes		
Satd. Flow (RTOR)	13					188		
Link Speed (mph)	30			30	30			
Link Distance (ft)	330			109	473			
Travel Time (s)	7.5			2.5	10.8			
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91		
Heavy Vehicles (%)	24%	24%	6%	6%	6%	6%		
Adj. Flow (vph)	197	21	241	718	62	188		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	218	0	241	718	62	188		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	11			11	12			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.04	1.04	1.04	1.04	1.00	1.00		
Turning Speed (mph)		9	15		15	9		
Number of Detectors	1		1	1	1	1		
Detector Template								
Leading Detector (ft)	50		50	50	50	50		
Trailing Detector (ft)	0		0	0	0	0		
Detector 1 Position(ft)	0		0	0	0	0		
Detector 1 Size(ft)	50		50	50	50	50		
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0		
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0		
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0		
Turn Type	NA		Perm	NA	Prot	Perm		
Protected Phases	2			2 3 6	4		3	6
Permitted Phases			2 3 6			4		
Detector Phase	2		2 3 6	2 3 6	4	4		
Switch Phase								
Minimum Initial (s)	4.0				4.0	4.0	4.0	4.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Minimum Split (s)	20.6				9.4	9.4	9.6	20.0
Total Split (s)	34.0				18.0	18.0	29.0	9.0
Total Split (%)	37.8%				20.0%	20.0%	32%	10%
Maximum Green (s)	29.4				12.6	12.6	23.4	5.0
Yellow Time (s)	3.6				3.2	3.2	3.2	3.5
All-Red Time (s)	1.0				2.2	2.2	2.4	0.5
Lost Time Adjust (s)	-0.6				-1.4	-1.4		
Total Lost Time (s)	4.0				4.0	4.0		
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
Vehicle Extension (s)	3.0				3.0	3.0	3.0	3.0
Recall Mode	None				None	None	None	None
Walk Time (s)	5.0							5.0
Flash Dont Walk (s)	11.0							11.0
Pedestrian Calls (#/hr)	0							0
Act Effct Green (s)	30.1		57.1	57.1	12.6	12.6		
Actuated g/C Ratio	0.39		0.73	0.73	0.16	0.16		
v/c Ratio	0.20		0.31	0.56	0.23	0.47		
Control Delay	16.7		0.8	4.7	31.8	9.4		
Queue Delay	0.0		0.8	1.0	0.0	0.1		
Total Delay	16.7		1.6	5.7	31.8	9.5		
LOS	B		A	A	C	A		
Approach Delay	16.7			4.7	15.0			
Approach LOS	B			A	B			
90th %ile Green (s)	29.4				12.6	12.6	20.0	5.0
90th %ile Term Code	Max				Max	Max	Gap	Max
70th %ile Green (s)	29.4				12.6	12.6	13.8	5.0
70th %ile Term Code	Max				Max	Max	Gap	Max
50th %ile Green (s)	29.4				12.6	12.6	11.3	5.0
50th %ile Term Code	Max				Max	Max	Gap	Max
30th %ile Green (s)	29.4				10.9	10.9	9.7	5.0
30th %ile Term Code	Max				Gap	Gap	Gap	Max
10th %ile Green (s)	28.9				7.5	7.5	8.1	5.0
10th %ile Term Code	Gap				Gap	Gap	Gap	Max
Stops (vph)	119		4	148	47	26		
Fuel Used(gal)	5		0	2	1	1		
CO Emissions (g/hr)	324		17	139	58	77		
NOx Emissions (g/hr)	63		3	27	11	15		
VOC Emissions (g/hr)	75		4	32	13	18		
Dilemma Vehicles (#)	0		0	0	0	0		
Queue Length 50th (ft)	33		1	62	26	0		
Queue Length 95th (ft)	68		m1	m139	66	56		
Internal Link Dist (ft)	250			29	393			
Turn Bay Length (ft)					125			
Base Capacity (vph)	1085		925	1504	308	429		
Starvation Cap Reductn	0		431	503	0	0		
Spillback Cap Reductn	57		0	0	0	17		
Storage Cap Reductn	0		0	0	0	0		
Reduced v/c Ratio	0.21		0.49	0.72	0.20	0.46		

Intersection Summary	
Area Type: Other	
Cycle Length: 90	
Actuated Cycle Length: 77.7	
Natural Cycle: 70	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 8.3	Intersection LOS: A
Intersection Capacity Utilization 44.4%	ICU Level of Service A
Analysis Period (min) 15	
90th %ile Actuated Cycle: 86.6	
70th %ile Actuated Cycle: 80.4	
50th %ile Actuated Cycle: 77.9	
30th %ile Actuated Cycle: 74.6	
10th %ile Actuated Cycle: 69.1	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 3: Upper Maple St. & Lake Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↱			↰	Y	
Traffic Volume (veh/h)	175	1	16	595	7	27
Future Volume (Veh/h)	175	1	16	595	7	27
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	216	1	20	735	9	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			217		992	216
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			217		992	216
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	96
cM capacity (veh/h)			1353		269	823

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	217	755	42
Volume Left	0	20	9
Volume Right	1	0	33
cSH	1700	1353	571
Volume to Capacity	0.13	0.01	0.07
Queue Length 95th (ft)	0	1	6
Control Delay (s)	0.0	0.4	11.8
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	11.8
Approach LOS			B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		Y	
Traffic Volume (veh/h)	216	311	290	37	16	84
Future Volume (Veh/h)	216	311	290	37	16	84
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	251	362	337	43	19	98
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	380				1222	358
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	380				1222	358
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	79				88	86
cM capacity (veh/h)	1178				156	686

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	613	380	117
Volume Left	251	0	19
Volume Right	0	43	98
cSH	1178	1700	442
Volume to Capacity	0.21	0.22	0.26
Queue Length 95th (ft)	20	0	26
Control Delay (s)	5.1	0.0	16.1
Lane LOS	A		C
Approach Delay (s)	5.1	0.0	16.1
Approach LOS			C

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	34	11	112	154	70	338
Future Volume (Veh/h)	34	11	112	154	70	338
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	40	13	132	181	82	398
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	726	281	480			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	726	281	480			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	98	88			
cM capacity (veh/h)	344	758	1082			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	53	313	480
Volume Left	40	132	0
Volume Right	13	0	398
cSH	397	1082	1700
Volume to Capacity	0.13	0.12	0.28
Queue Length 95th (ft)	11	10	0
Control Delay (s)	15.5	4.4	0.0
Lane LOS	C	A	
Approach Delay (s)	15.5	4.4	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

SYNCHRO CAPACITY ANALYSIS WORKSHEETS

2019 COMBINED TRAFFIC

P.M. PEAK HOUR

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↱			✥				
Traffic Volume (vph)	321	187	0	0	111	34	155	0	56	0	0	0
Future Volume (vph)	321	187	0	0	111	34	155	0	56	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	0		0	0		0	0		0
Storage Lanes	1		0	0		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.968			0.964				
Flt Protected	0.950							0.965				
Satd. Flow (prot)	1770	1863	0	0	1803	0	0	1733	0	0	0	0
Flt Permitted	0.416							0.965				
Satd. Flow (perm)	775	1863	0	0	1803	0	0	1733	0	0	0	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					17			57				
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		906			1473			940			892	
Travel Time (s)		20.6			33.5			21.4			20.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	349	203	0	0	121	37	168	0	61	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	349	203	0	0	158	0	0	229	0	0	0	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2			2		1	2				
Detector Template	Left	Thru			Thru		Left	Thru				
Leading Detector (ft)	20	100			100		20	100				
Trailing Detector (ft)	0	0			0		0	0				
Detector 1 Position(ft)	0	0			0		0	0				
Detector 1 Size(ft)	20	6			6		20	6				
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex				
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0				
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0				
Detector 2 Position(ft)		94			94			94				
Detector 2 Size(ft)		6			6			6				
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				
Turn Type	pm+pt	NA			NA		Perm	NA				
Protected Phases	5	2			6			8				
Permitted Phases	2						8					

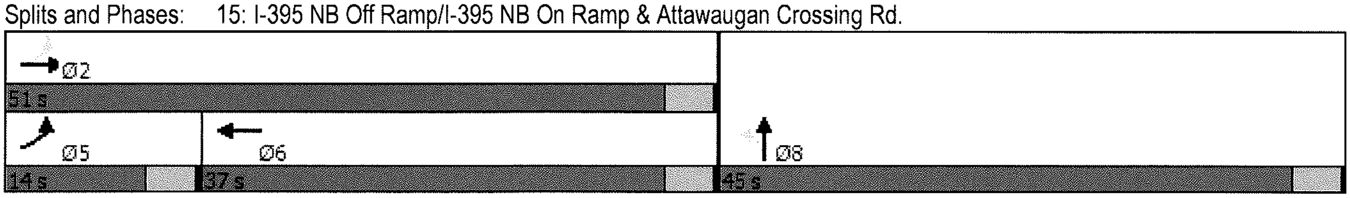
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2			6		8	8				
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0		4.0	4.0				
Minimum Split (s)	8.0	20.0			20.0		20.0	20.0				
Total Split (s)	14.0	51.0			37.0		45.0	45.0				
Total Split (%)	14.6%	53.1%			38.5%		46.9%	46.9%				
Maximum Green (s)	10.0	47.0			33.0		41.0	41.0				
Yellow Time (s)	3.5	3.5			3.5		3.5	3.5				
All-Red Time (s)	0.5	0.5			0.5		0.5	0.5				
Lost Time Adjust (s)	0.0	0.0			0.0			0.0				
Total Lost Time (s)	4.0	4.0			4.0			4.0				
Lead/Lag	Lead				Lag							
Lead-Lag Optimize?	Yes				Yes							
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Recall Mode	None	None			None		Min	Min				
Walk Time (s)		5.0			5.0		5.0	5.0				
Flash Dont Walk (s)		11.0			11.0		11.0	11.0				
Pedestrian Calls (#/hr)		0			0		0	0				
Act Effct Green (s)	20.1	20.1			8.9			9.8				
Actuated g/C Ratio	0.52	0.52			0.23			0.26				
v/c Ratio	0.52	0.21			0.37			0.47				
Control Delay	8.5	5.6			15.7			13.9				
Queue Delay	0.0	0.0			0.0			0.0				
Total Delay	8.5	5.6			15.7			13.9				
LOS	A	A			B			B				
Approach Delay		7.4			15.7			13.9				
Approach LOS		A			B			B				
90th %ile Green (s)	10.0	26.0			12.0		13.9	13.9				
90th %ile Term Code	Max	Hold			Gap		Gap	Gap				
70th %ile Green (s)	10.0	23.8			9.8		11.1	11.1				
70th %ile Term Code	Max	Hold			Gap		Gap	Gap				
50th %ile Green (s)	10.0	22.6			8.6		9.5	9.5				
50th %ile Term Code	Max	Hold			Gap		Gap	Gap				
30th %ile Green (s)	10.0	21.5			7.5		8.1	8.1				
30th %ile Term Code	Max	Hold			Gap		Gap	Gap				
10th %ile Green (s)	9.2	9.2			0.0		6.5	6.5				
10th %ile Term Code	Gap	Hold			Skip		Gap	Gap				
Stops (vph)	158	81			103			127				
Fuel Used(gal)	4	2			3			3				
CO Emissions (g/hr)	258	138			189			199				
NOx Emissions (g/hr)	50	27			37			39				
VOC Emissions (g/hr)	60	32			44			46				
Dilemma Vehicles (#)	0	0			0			0				
Queue Length 50th (ft)	35	18			27			33				
Queue Length 95th (ft)	89	50			71			84				
Internal Link Dist (ft)		826			1393			860			812	
Turn Bay Length (ft)	150											
Base Capacity (vph)	685	1856			1502			1670				
Starvation Cap Reductn	0	0			0			0				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Spillback Cap Reductn	0	0			0			0				
Storage Cap Reductn	0	0			0			0				
Reduced v/c Ratio	0.51	0.11			0.11			0.14				

Intersection Summary

Area Type: Other
Cycle Length: 96
Actuated Cycle Length: 38.4
Natural Cycle: 50
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 10.4 Intersection LOS: B
Intersection Capacity Utilization 47.7% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 47.9
70th %ile Actuated Cycle: 42.9
50th %ile Actuated Cycle: 40.1
30th %ile Actuated Cycle: 37.6
10th %ile Actuated Cycle: 23.7

Splits and Phases: 15: I-395 NB Off Ramp/I-395 NB On Ramp & Attawaugan Crossing Rd.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↱			↰						✥	
Traffic Volume (veh/h)	0	462	378	54	212	0	0	0	0	35	1	166
Future Volume (Veh/h)	0	462	378	54	212	0	0	0	0	35	1	166
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	0	525	430	61	241	0	0	0	0	40	1	189
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		668			906							
pX, platoon unblocked				0.49			0.49	0.49	0.49	0.49	0.49	
vC, conflicting volume	241			955			1292	1103	740	1103	1318	241
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	241			383			1075	686	0	686	1127	241
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			89			100	100	100	75	99	76
cM capacity (veh/h)	1326			574			67	161	529	162	89	798

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	955	302	230
Volume Left	0	61	40
Volume Right	430	0	189
cSH	1700	574	465
Volume to Capacity	0.56	0.11	0.50
Queue Length 95th (ft)	0	9	67
Control Delay (s)	0.0	3.6	20.1
Lane LOS		A	C
Approach Delay (s)	0.0	3.6	20.1
Approach LOS			C

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			↑↱			✥			✥	
Traffic Volume (vph)	125	759	1	11	323	45	2	4	27	55	4	84
Future Volume (vph)	125	759	1	11	323	45	2	4	27	55	4	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	11	12	12	12	12	12	11	12
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.982			0.890			0.921	
Flt Protected	0.950				0.999			0.997			0.981	
Satd. Flow (prot)	1407	1481	0	0	3230	0	0	1466	0	0	1443	0
Flt Permitted	0.465				0.849			0.984			0.862	
Satd. Flow (perm)	689	1481	0	0	2745	0	0	1447	0	0	1268	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					17			31			79	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		109			291			272			1012	
Travel Time (s)		2.5			6.6			6.2			23.0	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	24%	24%	2%	6%	6%	6%	15%	15%	15%	15%	15%	15%
Adj. Flow (vph)	145	883	1	13	376	52	2	5	31	64	5	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	145	884	0	0	441	0	0	38	0	0	167	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		11			11			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.04	1.04	1.00	1.00	1.04	1.00	1.00	1.00	1.00	1.00	1.04	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	1		1	1	
Detector Template												
Leading Detector (ft)	50	50		50	50		50	50		50	50	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	50	50		50	50		50	50		50	50	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2 4 6			2			3			3	
Permitted Phases	2 4 6			2			3			3		
Detector Phase	2 4 6	2 4 6		2	2		3	3		3	3	
Switch Phase												
Minimum Initial (s)				4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)				20.6	20.6		9.6	9.6		9.6	9.6	
Total Split (s)				34.0	34.0		29.0	29.0		29.0	29.0	
Total Split (%)				37.8%	37.8%		32.2%	32.2%		32.2%	32.2%	

Lane Group	Ø4	Ø6
Lane Configurations		
Traffic Volume (vph)		
Future Volume (vph)		
Ideal Flow (vphpl)		
Lane Width (ft)		
Lane Util. Factor		
Frt		
Flt Protected		
Satd. Flow (prot)		
Flt Permitted		
Satd. Flow (perm)		
Right Turn on Red		
Satd. Flow (RTOR)		
Link Speed (mph)		
Link Distance (ft)		
Travel Time (s)		
Peak Hour Factor		
Heavy Vehicles (%)		
Adj. Flow (vph)		
Shared Lane Traffic (%)		
Lane Group Flow (vph)		
Enter Blocked Intersection		
Lane Alignment		
Median Width(ft)		
Link Offset(ft)		
Crosswalk Width(ft)		
Two way Left Turn Lane		
Headway Factor		
Turning Speed (mph)		
Number of Detectors		
Detector Template		
Leading Detector (ft)		
Trailing Detector (ft)		
Detector 1 Position(ft)		
Detector 1 Size(ft)		
Detector 1 Type		
Detector 1 Channel		
Detector 1 Extend (s)		
Detector 1 Queue (s)		
Detector 1 Delay (s)		
Turn Type		
Protected Phases	4	6
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	4.0	4.0
Minimum Split (s)	9.4	20.0
Total Split (s)	18.0	9.0
Total Split (%)	20%	10%

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Maximum Green (s)				29.4	29.4		23.4	23.4		23.4	23.4	
Yellow Time (s)				3.6	3.6		3.2	3.2		3.2	3.2	
All-Red Time (s)				1.0	1.0		2.4	2.4		2.4	2.4	
Lost Time Adjust (s)					-0.6			-1.6			-1.6	
Total Lost Time (s)					4.0			4.0			4.0	
Lead/Lag							Lead	Lead		Lead	Lead	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)				3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode				None	None		None	None		None	None	
Walk Time (s)				5.0	5.0							
Flash Dont Walk (s)				11.0	11.0							
Pedestrian Calls (#/hr)				0	0							
Act Effct Green (s)	57.1	57.1			29.9			14.4			14.4	
Actuated g/C Ratio	0.72	0.72			0.38			0.18			0.18	
v/c Ratio	0.29	0.83			0.42			0.13			0.57	
Control Delay	2.0	16.9			20.3			12.5			23.6	
Queue Delay	2.6	23.8			0.3			0.0			0.0	
Total Delay	4.6	40.7			20.6			12.5			23.6	
LOS	A	D			C			B			C	
Approach Delay		35.6			20.6			12.5			23.6	
Approach LOS		D			C			B			C	
90th %ile Green (s)				29.4	29.4		23.4	23.4		23.4	23.4	
90th %ile Term Code				Max	Max		Max	Max		Max	Max	
70th %ile Green (s)				29.4	29.4		15.8	15.8		15.8	15.8	
70th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
50th %ile Green (s)				29.4	29.4		11.9	11.9		11.9	11.9	
50th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
30th %ile Green (s)				29.4	29.4		8.1	8.1		8.1	8.1	
30th %ile Term Code				Max	Max		Gap	Gap		Gap	Gap	
10th %ile Green (s)				27.9	27.9		6.6	6.6		6.6	6.6	
10th %ile Term Code				Gap	Gap		Gap	Gap		Gap	Gap	
Stops (vph)	8	410			260			11			68	
Fuel Used(gal)	0	6			5			0			2	
CO Emissions (g/hr)	14	386			348			15			154	
NOx Emissions (g/hr)	3	75			68			3			30	
VOC Emissions (g/hr)	3	89			81			3			36	
Dilemma Vehicles (#)	0	0			0			0			0	
Queue Length 50th (ft)	5	196			78			3			39	
Queue Length 95th (ft)	m8	#316			136			24			89	
Internal Link Dist (ft)		29			211			192			932	
Turn Bay Length (ft)												
Base Capacity (vph)	489	1052			1053			479			455	
Starvation Cap Reductn	241	197			0			0			0	
Spillback Cap Reductn	0	0			187			0			4	
Storage Cap Reductn	0	0			0			0			0	
Reduced v/c Ratio	0.58	1.03			0.51			0.08			0.37	

Intersection Summary

Area Type: Other

Lane Group	Ø4	Ø6
Maximum Green (s)	12.6	5.0
Yellow Time (s)	3.2	3.5
All-Red Time (s)	2.2	0.5
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lag	
Lead-Lag Optimize?	Yes	
Vehicle Extension (s)	3.0	3.0
Recall Mode	None	None
Walk Time (s)		5.0
Flash Dont Walk (s)		11.0
Pedestrian Calls (#/hr)		0
Act Effct Green (s)		
Actuated g/C Ratio		
v/c Ratio		
Control Delay		
Queue Delay		
Total Delay		
LOS		
Approach Delay		
Approach LOS		
90th %ile Green (s)	12.6	5.0
90th %ile Term Code	Max	Max
70th %ile Green (s)	12.6	5.0
70th %ile Term Code	Max	Max
50th %ile Green (s)	12.6	5.0
50th %ile Term Code	Max	Max
30th %ile Green (s)	12.6	5.0
30th %ile Term Code	Max	Max
10th %ile Green (s)	12.6	5.0
10th %ile Term Code	Max	Max
Stops (vph)		
Fuel Used(gal)		
CO Emissions (g/hr)		
NOx Emissions (g/hr)		
VOC Emissions (g/hr)		
Dilemma Vehicles (#)		
Queue Length 50th (ft)		
Queue Length 95th (ft)		
Internal Link Dist (ft)		
Turn Bay Length (ft)		
Base Capacity (vph)		
Starvation Cap Reductn		
Spillback Cap Reductn		
Storage Cap Reductn		
Reduced v/c Ratio		

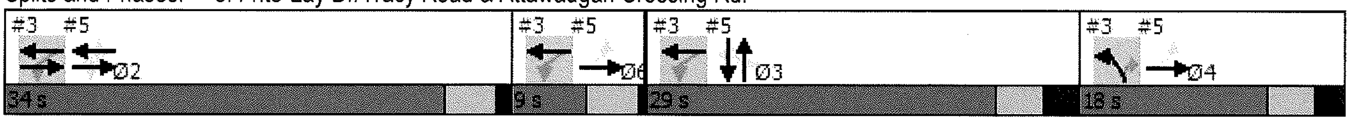
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 79.5
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 75.8% ICU Level of Service D
Analysis Period (min) 15
90th %ile Actuated Cycle: 90
70th %ile Actuated Cycle: 82.4
50th %ile Actuated Cycle: 78.5
30th %ile Actuated Cycle: 74.7
10th %ile Actuated Cycle: 71.7

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Frito-Lay Dr/Tracy Road & Attawaugan Crossing Rd.



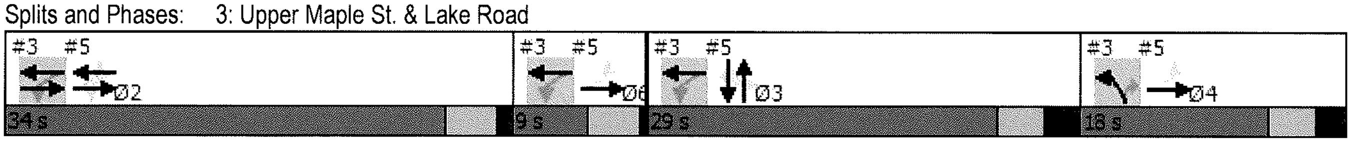
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Lane Configurations	↑↱		↰	↑	↰	↱		
Traffic Volume (vph)	639	64	188	219	33	247		
Future Volume (vph)	639	64	188	219	33	247		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	11	11	11	11	12	12		
Storage Length (ft)		0	0		125	0		
Storage Lanes		0	1		1	1		
Taper Length (ft)			25		25			
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00		
Frt	0.986					0.850		
Flt Protected			0.950		0.950			
Satd. Flow (prot)	2775	0	1646	1733	1703	1524		
Flt Permitted			0.269		0.950			
Satd. Flow (perm)	2775	0	466	1733	1703	1524		
Right Turn on Red		Yes				Yes		
Satd. Flow (RTOR)	12					287		
Link Speed (mph)	30			30	30			
Link Distance (ft)	330			109	473			
Travel Time (s)	7.5			2.5	10.8			
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86		
Heavy Vehicles (%)	24%	24%	6%	6%	6%	6%		
Adj. Flow (vph)	743	74	219	255	38	287		
Shared Lane Traffic (%)								
Lane Group Flow (vph)	817	0	219	255	38	287		
Enter Blocked Intersection	No	No	No	No	No	No		
Lane Alignment	Left	Right	Left	Left	Left	Right		
Median Width(ft)	11			11	12			
Link Offset(ft)	0			0	0			
Crosswalk Width(ft)	16			16	16			
Two way Left Turn Lane								
Headway Factor	1.04	1.04	1.04	1.04	1.00	1.00		
Turning Speed (mph)		9	15		15	9		
Number of Detectors	1		1	1	1	1		
Detector Template								
Leading Detector (ft)	50		50	50	50	50		
Trailing Detector (ft)	0		0	0	0	0		
Detector 1 Position(ft)	0		0	0	0	0		
Detector 1 Size(ft)	50		50	50	50	50		
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		
Detector 1 Channel								
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0		
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0		
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0		
Turn Type	NA		Perm	NA	Prot	Perm		
Protected Phases	2			2 3 6	4		3	6
Permitted Phases			2 3 6			4		
Detector Phase	2		2 3 6	2 3 6	4	4		
Switch Phase								
Minimum Initial (s)	4.0				4.0	4.0	4.0	4.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Minimum Split (s)	20.6				9.4	9.4	9.6	20.0
Total Split (s)	34.0				18.0	18.0	29.0	9.0
Total Split (%)	37.8%				20.0%	20.0%	32%	10%
Maximum Green (s)	29.4				12.6	12.6	23.4	5.0
Yellow Time (s)	3.6				3.2	3.2	3.2	3.5
All-Red Time (s)	1.0				2.2	2.2	2.4	0.5
Lost Time Adjust (s)	-0.6				-1.4	-1.4		
Total Lost Time (s)	4.0				4.0	4.0		
Lead/Lag					Lag	Lag	Lead	
Lead-Lag Optimize?					Yes	Yes	Yes	
Vehicle Extension (s)	3.0				3.0	3.0	3.0	3.0
Recall Mode	None				None	None	None	None
Walk Time (s)	5.0							5.0
Flash Dont Walk (s)	11.0							11.0
Pedestrian Calls (#/hr)	0							0
Act Effct Green (s)	29.9		57.4	57.4	14.1	14.1		
Actuated g/C Ratio	0.38		0.72	0.72	0.18	0.18		
v/c Ratio	0.78		0.65	0.20	0.13	0.57		
Control Delay	29.2		17.0	0.8	31.4	9.3		
Queue Delay	3.7		3.0	0.3	0.0	0.6		
Total Delay	32.9		20.0	1.1	31.4	9.9		
LOS	C		C	A	C	A		
Approach Delay	32.9			9.9	12.5			
Approach LOS	C			A	B			
90th %ile Green (s)	29.4				12.6	12.6	23.4	5.0
90th %ile Term Code	Max				Max	Max	Max	Max
70th %ile Green (s)	29.4				12.6	12.6	15.8	5.0
70th %ile Term Code	Max				Max	Max	Gap	Max
50th %ile Green (s)	29.4				12.6	12.6	11.9	5.0
50th %ile Term Code	Max				Max	Max	Gap	Max
30th %ile Green (s)	29.4				12.6	12.6	8.1	5.0
30th %ile Term Code	Max				Max	Max	Gap	Max
10th %ile Green (s)	27.9				12.6	12.6	6.6	5.0
10th %ile Term Code	Gap				Max	Max	Gap	Max
Stops (vph)	564		106	9	29	34		
Fuel Used(gal)	19		1	0	0	2		
CO Emissions (g/hr)	1330		98	19	34	109		
NOx Emissions (g/hr)	259		19	4	7	21		
VOC Emissions (g/hr)	308		23	4	8	25		
Dilemma Vehicles (#)	0		0	0	0	0		
Queue Length 50th (ft)	176		54	4	16	0		
Queue Length 95th (ft)	#306		117	5	45	58		
Internal Link Dist (ft)	250			29	393			
Turn Bay Length (ft)					125			
Base Capacity (vph)	1061		396	1473	301	506		
Starvation Cap Reductn	0		96	735	0	0		
Spillback Cap Reductn	163		0	0	0	53		
Storage Cap Reductn	0		0	0	0	0		
Reduced v/c Ratio	0.91		0.73	0.35	0.13	0.63		

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 79.5
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 22.0 Intersection LOS: C
Intersection Capacity Utilization 43.5% ICU Level of Service A
Analysis Period (min) 15
90th %ile Actuated Cycle: 90
70th %ile Actuated Cycle: 82.4
50th %ile Actuated Cycle: 78.5
30th %ile Actuated Cycle: 74.7
10th %ile Actuated Cycle: 71.7
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Upper Maple St. & Lake Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	601	4	30	185	4	20
Future Volume (Veh/h)	601	4	30	185	4	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	733	5	37	226	5	24
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			738		1036	736
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			738		1036	736
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		98	94
cM capacity (veh/h)			868		246	419

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	738	263	29
Volume Left	0	37	5
Volume Right	5	0	24
cSH	1700	868	374
Volume to Capacity	0.43	0.04	0.08
Queue Length 95th (ft)	0	3	6
Control Delay (s)	0.0	1.7	15.4
Lane LOS		A	C
Approach Delay (s)	0.0	1.7	15.4
Approach LOS			C

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	427	394	25	41	198
Future Volume (Veh/h)	83	427	394	25	41	198
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	90	464	428	27	45	215
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	455				1086	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	455				1086	442
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				80	65
cM capacity (veh/h)	1106				220	616

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	554	455	260
Volume Left	90	0	45
Volume Right	0	27	215
cSH	1106	1700	470
Volume to Capacity	0.08	0.27	0.55
Queue Length 95th (ft)	7	0	83
Control Delay (s)	2.2	0.0	21.8
Lane LOS	A		C
Approach Delay (s)	2.2	0.0	21.8
Approach LOS			C

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	338	112	11	87	148	34
Future Volume (Veh/h)	338	112	11	87	148	34
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	398	132	13	102	174	40
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	322	194	214			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322	194	214			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	40	84	99			
cM capacity (veh/h)	665	847	1356			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	530	115	214
Volume Left	398	13	0
Volume Right	132	0	40
cSH	703	1356	1700
Volume to Capacity	0.75	0.01	0.13
Queue Length 95th (ft)	174	1	0
Control Delay (s)	24.1	0.9	0.0
Lane LOS	C	A	
Approach Delay (s)	24.1	0.9	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	15.0		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		