EXHIBIT 3

Environmental Overview in Support of Petition for Changed Conditions

Killingly Energy Center

January 2019

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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
dB	decibels
dBA	broadband, or A-weighted decibels
DEEP	Connecticut Department of Energy and Environmental Protection
FCA-11	the 2017 Forward Capacity Auction
FCA-12	the 2018 Forward Capacity Auction
FCA-13	the 2019 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, an approximately 650-megawatt combined cycle electric generating facility on Lake Road in Killingly, Connecticut
km	kilometer
LAER	Lowest Achievable Emissions Rate

Acronyms/Abbreviations	Definition
lb/hr	pounds per hour
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[1] (MW) electric generating facility located on Lake Road in Killingly, Connecticut.

The Council issued a decision on May 16, 2017 (2017 Decision) that denied the 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 Connecticut's Environmental Justice requirements. The Council's charge is to balance the need for adequate and reliable electric power supply at the lowest reasonable cost to consumers with the need to protect the environment and ecology of the state. Although the characteristics of KEC enumerated 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.[2]

NTE is confident of the need for KEC (as further described in accompanying testimony), 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 2019 Forward Capacity Auction (FCA-13); 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 make progress, entering into a water supply and two construction agreements with the Connecticut Water Company (CWC); entering into an engineering agreement with Yankee Gas - Eversource under which design and permitting of the Yankee Gas lateral has commenced; coordinating with Eversource on the transfer of real estate to support Lake Road modifications; continuing review with ISO-NE on the System Impact Study (SIS); and executing a tax stabilization agreement and a community environmental benefits agreement (CEBA) with the Town of Killingly.

In addition, in the intervening period, NTE has had the opportunity to revisit options to improve upon KEC. Based upon NTE's positive experience utilizing Mitsubishi Hitachi Power Systems America (Mitsubishi) equipment on its two existing facilities (Middletown Energy Center in Ohio and Kings Mountain Energy Center in North Carolina), 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

[1] As discussed in this report, NTE is now proposing an increase in power output to approximately 650 MW, for which an air permit modification has been issued by the Connecticut Department of Energy and Environmental Protection.
[2] Note that KEC was not selected in the 2018 Forward Capacity Auction (FAC-12) in February 2018 and, therefore, did not proceed with a request for reconsideration at that time.

to this equipment, which is manufactured in Savannah, Georgia, results in a further benefit to KEC's emissions profile while retaining the existing development footprint and increasing output. 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 2.0 of this Environmental Overview provides a summary discussion regarding the need for KEC (further supported by pre-filed testimony of Tim Eves and Paul Hibbard); this demonstration is the backdrop against which other impacts will be considered by the Council. Section 3.0 of this Environmental Overview describes the proposed changes to KEC resulting from the replacement of the Siemens CTG with the Mitsubishi CTG. Section 4.0 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. The unique reliability challenges facing both Connecticut and the region have been recognized by ISO-NE, the North American Electric Reliability Corporation, the Federal Energy Regulatory Commission, and New England states. 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 2017 – 2018 cold snap);
- The ongoing attrition of aging and less-efficient generating capacity in the region; and
- An increasing penetration of variable wind and solar renewable resources 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, regulations establishing even more stringent CO_2 emission control requirements from power plants in New England states, and Connecticut- and Massachusetts-sponsored contracts for renewable projects – increase the likelihood of the retirement of older, less efficient, and higher-emitting power plants and the need for reliable, flexible generation such as KEC.

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 electric transmission 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 of existing power plants on interruptible natural gas supply, particularly during winter months. The experience of the 2017 – 2018 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 FCA-13 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 from Tim Eves and Paul Hibbard) are sufficient to demonstrate that KEC is necessary for the resilience and reliability of electric supply, and contributes to the competitiveness and efficiency of wholesale electricity markets. Nevertheless, KEC is also well positioned to succeed in the forward capacity auction and obtain CSOs in FCA 13 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 currently proposed KEC layout with the Mitsubishi CTG, and Figure 2 presents a more detailed plot plan. An updated rendering of KEC is provided on Figure 3. 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. 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 below, no changes are proposed to any on the Switchyard Site.

3.1 TECHNOLOGY UPDATE – MITSUBISHI CTG

With additional time available in the schedule for evaluating combustion turbine technology, NTE has selected the Mitsubishi 501JAC CTG to replace the previously proposed Siemens CTG turbine. An application for a minor modification to the existing air permit, specifically Permit Number 089-0107 (first issued on June 30, 2017), was submitted to DEEP on July 13, 2018. DEEP issued a Notice of Sufficiency letter on August 7, 2018, stating that the application was complete. DEEP issued the final modified permit to construct and operate the Mitsubishi 501JAC CTG (provided in Appendix A) on December 10, 2018.[3] The use of the Mitsubishi unit 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 incorporated in the latest permit (see Appendix A). There are no changes proposed 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 change in turbine technology to the Mitsubishi unit will allow for an increase in plant output to approximately 650 MW while achieving lower annual emissions of particulate matter (PM) and carbon monoxide (CO) with no increase in annual nitrogen oxide (NO_x) emissions.

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 emissions of all pollutants on a pounds emitted per megawatt-hour generated.

[3] Note that a prior permit modification had been issued on March 16, 2018 reflecting the change to Mitsubishi technology but not reflecting the additional output.

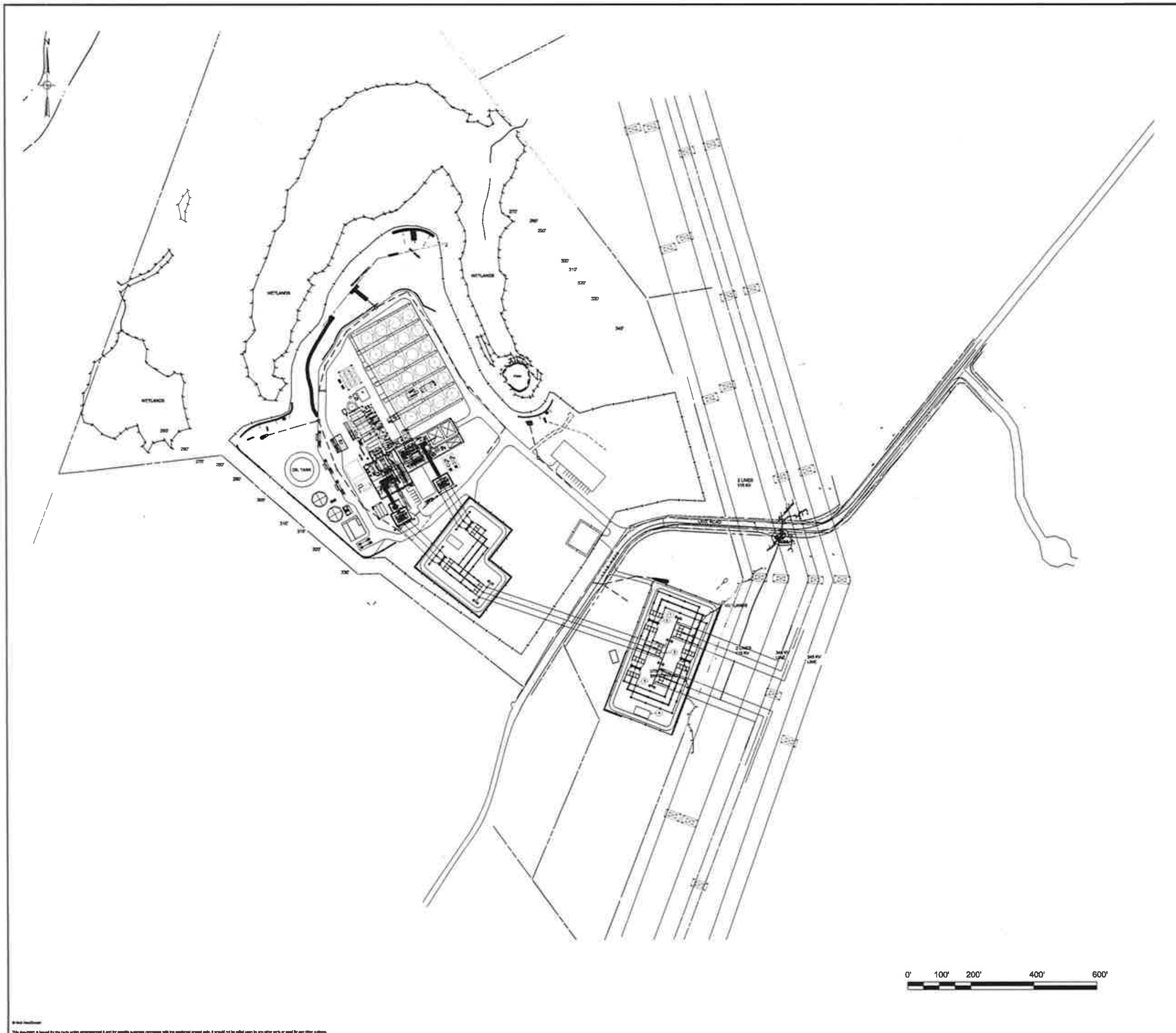

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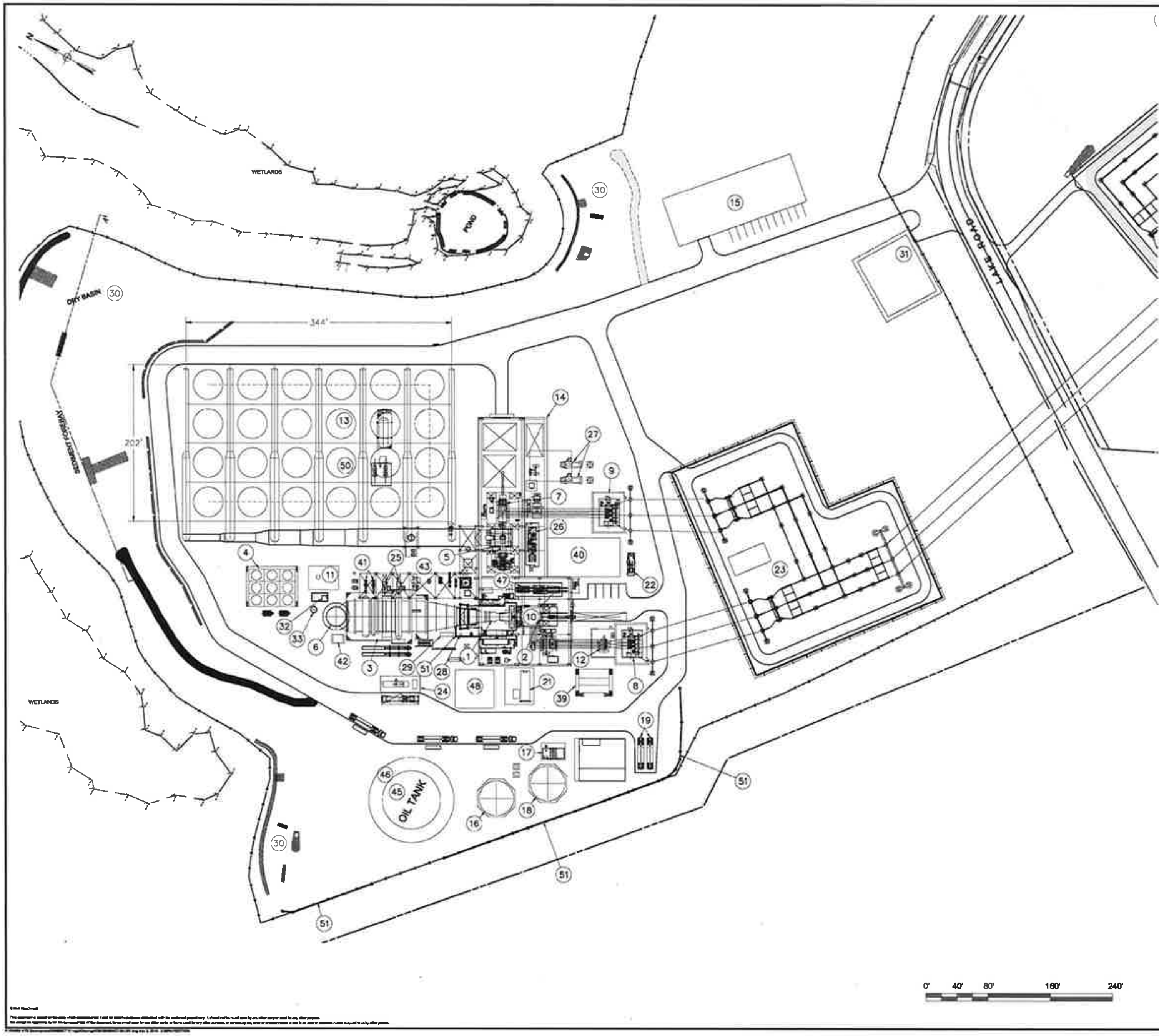
Figure 1. Proposed Killingly Energy Center Site Plan

Killingly Energy Center

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

Drawing Number 334954CT-SA-301

Rev A



Legend

1 COMBUSTION TURBINE (CT)
2 COMBUSTION TURBINE GENERATOR (CTG)
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
-	[illegible]	[illegible]	FOR INFORMATION	[illegible]	[illegible]
C	[illegible]	[illegible]	FOR CLIENT REVIEW	[illegible]	[illegible]
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A	[illegible]	[illegible]	FOR CLIENT REVIEW	[illegible]	[illegible]

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Figure 2.
Killingly Energy Center
Plot Plan

Killingly Energy Center

PRELIMINARY
NOT FOR
CONSTRUCTION
REPLACE WITH
[illegible]
AT CONSTRUCTION
[illegible]
FABRICATION

Drawing Number
334954CT-GA-301
Rev C

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Figure 3

Killingly Energy Center
Facility Rendering

As presented in Section 4.1, the air quality dispersion modeling analysis reflecting the changed technology 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.

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 KEC's efficiency, with a resulting reduction of fuel consumed (and, therefore, emissions) per MW-hour produced; and ii) benefits to electricity consumers by supporting 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: Siemens CTG 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	59	178	77	148
VOC	45	264	67	176	92	622	115	167
CO	477	2,306	212	429	385	11,004	139	171

lb/hr = pounds per hour; ULSD = ultra-low-sulfur distillate; VOC= volatile organic compounds.

SUSD times for the two technologies are the same, with both able to achieve emissions compliance in less than 35 minutes when firing natural gas, 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 generation facilities 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 instance 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 Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) standards. KEC's existing permit has the same LAER and BACT limits approved in the original 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 originally permitted Siemens CTG and the Mitsubishi CTG (from the current permit, provided in Appendix A).

Table 2: Comparison of Siemens CTG and Proposed CTG BACT 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	0.0046	0.0083
$PM_{10}/PM_{2.5}$	0.0044	0.0050	0.0168	0.0022	0.0046	0.0083

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.

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 on a lb/MMBtu basis. 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 will be slightly higher for most pollutants.

Table 3: Comparison of Siemens CTG and Mitsubishi 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	7.9	21.9	26.7
$PM_{10}/PM_{2.5}$	13.0	19.5	30.0	7.9	21.9	26.7
SO_2	4.5	5.9	4.0	6.0	7.6	4.9
NO_x	22.5	29.7	40.9	29.6	37.2	50.6
VOC	2.8	8.3	7.1	3.6	10.4	8.9
CO	6.2	15.4	11.2	8.1	19.2	14.1
Lead	1.44E-03	1.9E-03	3.0E-03	1.9E-03	2.3E-03	3.2E-03
H_2SO_4	1.6	2.0	1.5	2.1	2.7	1.8

SO_2 = sulfur dioxide; H_2SO_4 = sulfuric acid.

3.1.3 Reduction of Duct Firing

The Mitsubishi CTG has a greater output than the Siemens CTG and, therefore, has a higher design heat input rate (3,863 million British thermal units per hour [MMBtu/hr] firing natural gas and 3,256 MMBtu/hr firing ULSD under standard conditions[4]). With the increase in output from the Mitsubishi CTG, fewer hours of duct firing will be required and as a result there will be a reduction in fuel throughput to the duct burners (and associated decrease in emissions). With the Mitsubishi CTG configuration, KEC's operation will restrict duct firing to an annual heat input of no more than 2,850,000 million British thermal units per year, a reduction of over 65 percent from the duct burner fuel throughput approved in KEC's original air permit with the Siemens CTG.

As emissions of 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 even though the output has been increased. 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 when comparing the Siemens CTG to the currently permitted Mitsubishi CTG, as reflected in Table 4; these changes reflect the additional fuel consumption associated with the greater energy production now proposed.

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

Pollutant	Siemens CTG	Mitsubishi CTG
PM	88.7	54.9
PM_{10}/$PM_{2.5}$	88.7	54.9
SO_2	25.1	25.1
NO_x	130.1	130.1
VOC	41.7	45.5
CO	134.6	77.8
Lead	0.0018	0.009
H_2SO_4	8.76	9.62
CO_2e	1,989,650	2,207,451
Ammonia	49.8	54.6

CO_2e = carbon dioxide equivalents

[4] 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. In addition, because additional cooling capacity is needed for the additional energy generation, the air-cooled condenser (ACC) size increased. With an original length of 309 feet, it is now 343 feet (an increase of 34 feet); and with an original width of 189 feet, it is now 201 feet (an increase of 12 feet). In implementing these adjustments, two primary goals were utilized:

- No increase in the size or location of the development footprint (to avoid material changes to wetland, species, or stormwater issues); and
- Retain the height of the main CTG stack and keep the stack location as close to the original location as possible (to avoid material changes to visibility or air navigation – Federal Aviation Administration – issues).

To accomplish these objectives it was necessary to shift the stack by approximately 35 feet (12.3 meters); with an inner stack diameter of 22 feet, this represents a relatively modest shift. Using the shifted main CTG stack location as a pivot point, it was also 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 within the existing development footprint. This resulted in the ability to increase distance between the development footprint and 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
ACC	81	86
Closed cooling water fan array	22	No change

Structure	Siemens CTG Layout (feet)	Mitsubishi CTG Layout (feet)
Auxiliary boiler stack	90	No change
Auxiliary boiler	26	No change
Emergency generator stack	45	No change
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
Boundary sound walls	NA	16 – 28

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. Noise control barriers have also 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 to the north (north of the ACC), the distance between KEC grading and stormwater management features remains the same as with the prior configuration; however, the "development 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 (and associated stormwater details) have been undertaken, no material change results; updated site plans are provided in Appendix B, with an updated Stormwater Pollution Prevention Plan (SWPPP) provided in Appendix C. Based on coordination with DEEP, 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 the plans provided in Appendix B; this also does not reflect a material change.

3.3 CONSTRUCTION AND OPERATION SCHEDULE

The construction and operational schedule has been updated (Figure 4). This schedule shows obtaining all remaining approvals to support issuance of a Construction Notice to Proceed in mid-July 2019. Under this schedule tree clearing and other site preparation activities would commence in early August 2019. This schedule supports a commercial operation date in March of 2022.

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
an NTE Energy Project

Figure 4

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 project configuration in the Original Application. 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 to a Mitsubishi CTG results in some minor changes to the layout, as well as in emission-related benefits. NTE has evaluated the air quality implications of this change and submitted a formal application for minor modification to DEEP on July 13, 2018. DEEP issued KEC's final modified permit to construct and operate the Mitsubishi CTG on December 10, 2018. The information 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 will be necessary resulting in lower overall emissions. As annual NO_x emissions have not increased, no additional emission reduction credits are required, beyond those that have already been purchased in conjunction with the Siemens CTG air permit.

The minor modification application, and resulting final air permit (provided in Appendix A), 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 for the Siemens CTG, which had been 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 ($\mu g/m^3$)	Mitsubishi CTG Impact Concentration ($\mu g/m^3$)	SIL ($\mu g/m^3$)	Siemens CTG Extent of SIA (km)	Mitsubishi CTG Extent of SIA (km)	NAAQS ($\mu g/m^3$)
NO_2 (Normal Load)	1-hour	16.04	11.41	7.5	12.9	12.1	188
	Annual	0.87	0.78	1	NA	NA	100
NO_2 (SUSD)	1-hour	81.46	56.87	NA	NA	NA	188
	Annual	0.87	0.78	NA	NA	NA	100
CO	1-hour	1,418	374	2,000	NA	NA	40,000
	8-hour	133	49	500	NA	NA	10,000
PM_{10}	24-hour	4.04	2.42	5	NA	NA	150
	Annual	0.24	0.14	1	NA	NA	NA
$PM_{2.5}$ (NAAQS)	24-hour	2.39	1.65	1.2	8.1	0.5	35
	Annual	0.18	0.13	0.2	NA	NA	12
SO_2	1-hour	2.94	2.13	7.8	NA	NA	196
	3-hour	1.72	1.25	25	NA	NA	1300
	24-hour	0.75	0.72	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; $\mu g/m^3$ = 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	7.9	84.6	152.1	92.5	188
NO_2 (SUSD)	1-Hour	60.3	44.0	84.6	144.9	128.6	188
$PM_{2.5}$	24-hour	8.4	2.1	18	26.4	20.1	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	1.8	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[5]

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	62	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 5. 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 5 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.

[5] Note that Town of Killingly numerical standards are the same, but Daytime is defined as from 7:00 a.m. to 9:00 p.m. and Nighttime from 9:00 p.m. to 7:00 a.m., and their standards for Industrial emitters at Business (Commercial) property lines are more stringent (62 dBA instead of the Connecticut level of 66 dBA).

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	43
LT-1	50

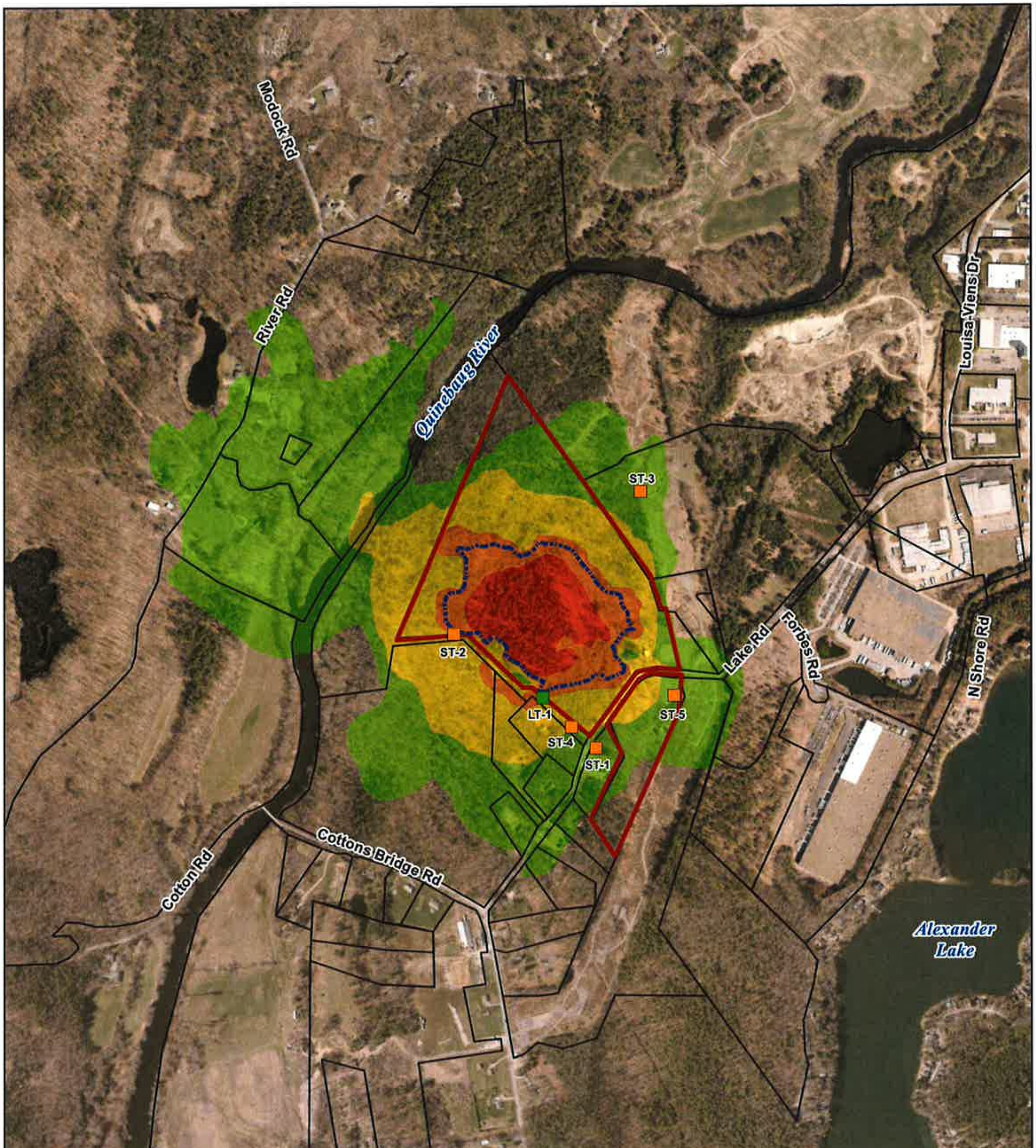
Detailed mitigation assumptions, including sound walls that may be necessary, are incorporated in the modeling effort to demonstrate the feasibility of achieving compliance with state and local noise regulations, as shown on Figure 2. The details of the specific mitigation measures incorporated in the 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 D.

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 B. There will be no change to stormwater management measures discussed in this section, and the implementation of the SWPPP, provided in Appendix C, 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 B, 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 original air permit, which provides a beneficial change. DEEP issued KEC's final modified permit to construct and operate the Mitsubishi CTG (provided in Appendix A) on December 10, 2018.
- **Section 6.0 Water Resources** – This section has not materially changed, as the water needs and wastewater discharge reflected for KEC remain essentially the same. While adjusted grading (as provided in Appendix B) has been integrated, no material change in SWPPP implementation measures (as reflected in the updated SWPPP provided in Appendix C) will result; the descriptive information in this section and consistency with applicable requirements remains the same.



Legend

Project Site

Parcel Boundaries

Short Term Monitoring Location

Long Term Monitoring Location

Noise Threshold Limit 51 dBA

Sound Level Contour Ranges (dBA):

40-45 dBA

45-50 dBA

50-55 dBA

>55 dBA

N

0 250 500 Feet

Figure 5

Sound Level Isopleths

Killingly Energy Center

- **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 local 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 is near its original location (it has been shifted approximately 35 feet to the south-southeast).
    - Section 7.3 Visual Resources and Aesthetics – The CTG stack remains 150 feet tall and near its current location (shifted approximately 35 feet to the south-southeast). Although certain layout elements have slightly shifted, some equipment profiles have changed, and potential 16 to 28-foot sound walls could be incorporated (as described in Section 3.2 and shown on Figure 2), none of these changes are sufficient to result in visual impacts materially different from those previously assessed (see Figure 3).
    - 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. According to information published by the Connecticut Department of Economic and Community Development, the Town of Killingly is not listed on the 2018 "Distressed Municipalities" list dated September 12, 2018.[6]

      A tax stabilization agreement has been executed between KEC and the Town of Killingly. This agreement affirms KEC's commitment and obligation under a mutually agreed upon non-abated taxation value for KEC. 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 structured 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 over $90 million paid over the course of a 20-year

[6] See https://www.ct.gov/ecd/cwp/view.asp?a=1105&q=251248.

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 taxes that will be paid by KEC to the Williamsville Fire District.

A CEBA has also been negotiated and executed with the Town of Killingly. The CEBA, approved by the Killingly Town Council on January 9, 2018, 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 educational activities. The CEBA specifies a staggered payment schedule, with just over $2 million due upon KEC's financial close, a second $2 million payment 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 to the Town, a 20-acre conservation easement will be established over a portion of the Property to the northwest of the KEC development area, the wetland mitigation area on the Switchyard parcel 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.

KEC will also pay for certain upgrades to the existing natural gas pipeline system owned and operated by Eversource (which will provide for twice the capacity for downstream users); improvements to 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 to make the roadway safer and more accommodating to truck traffic; and improvements to and fees associated with discharge of KEC's wastewater to the Killingly Pollution Control Facility.

NTE has also developed a Property Value Guarantee agreement that will be offered to those property owners within 2,500 feet of KEC to provide assurances that property values will not be negatively impacted by KEC.

Overall, KEC will bring considerable economic and other benefits to the Town and to the region and to the State of Connecticut 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 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 ultimately be required from the issuance of a DEEP wastewater discharge permit, the review of which is pending.

  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 to KEC from its existing wellfields. This includes the interconnection of its existing wellfield systems to KEC. This interconnection will not only benefit KEC but provide for greater reliability of water service to the Town of Killingly overall. It is NTE's understanding that an application for a diversion permit associated with the proposed interconnection was filed with DEEP by CWC and is currently under review.

  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 connection to KEC (as was described in Section 8.0 of the Original Application). An application to DEEP addressing wetland and other potential impacts related to the Section 401 Water Quality Certification program was submitted by Eversource to DEEP on September 22, 2017; NTE has made this application package 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.

Active and ongoing coordination continues regarding the electrical interconnection with both ISO-NE and Eversource. The SIS is nearing completion 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.
- Section 10.0 Required Permits and Approvals – No changes to this section results from the KEC refinements, other than the need for the minor permit modification to the air permit, which has been finalized and issued by DEEP for the Mitsubishi CTG.
- 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 – CURRENT AIR PERMITS

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

DEC 1 0 2018

Mr. Tim Eves
Vice President
NTE Connecticut, LLC
24 Cathedral Place Suite 300
Saint Augustine, FL 32084

Dear Mr. Eves:

Enclosed is a copy of your modified permit to construct and operate 647 MW combined cycle power plant consisting of a Mitsubishi M501JAC combustion turbine and duct burner at 180/189 Lake Road, Killingly, CT.

This letter does not relieve you of the responsibility to comply with the requirements of other appropriate Federal, State, and municipal agencies. This permit is not transferable from one permittee to another without prior written approval, from one location to another, or from one piece of equipment to another. The permit must be made available at the site of operation throughout the period that such permit is in effect.

Pursuant to Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA), NTE Connecticut, LLC must apply for a permit modification/revision in writing if it plans any physical change, change in method of operation, or addition to this source which constitutes a modification or revision pursuant to RCSA sections 22a-174-1 and 22a-174-2a, respectively. Any such changes should first be discussed with Mr. James Grillo of the Bureau of Air Management, by calling (860) 424-4152. Such changes shall not commence prior to the issuance of a permit modification.

Sincerely,

Jaimeson Sinclair
Assistant Director, Engineering
Bureau of Air Management

JS:JAG:jad
cc (via electronic mail): Keith Hill, Air Enforcement
S. Babcock, Tetra Tech, Inc.

Enclosure

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	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 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
Modification Issue Date	DEC 10 2018
Prior Permit Issue Dates	March 16, 2018 (Minor Modification) June 30, 2017 (Initial Permit)
Expiration Date	None

for [signature]
Robert E. Kaliszewski
Deputy Commissioner

12/10/18
Date

ORIGINAL

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 combustion turbine with dry low-NOx (DLN) combustors with a nominal gross electrical output of 647 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 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 3,863 MMBtu/hr while firing natural gas and 3,256 MMBtu/hr while firing ULSD. These heat inputs are based on an ambient temperature of 59^0F and result in firing rates of 3,757,455 scf of natural gas (HHV 1028 Btu/scf) and 23,594 gallons of ULSD (HHV 138,000 Btu/gal) per hour. Heat input will vary by approximately $\pm$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 1,106 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 1,075,875 scf/hr.

ORIGINAL

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): 1,721,122 (gas); 1,772,183 (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 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: 3.38×10^7 MMBtu (gas); 2.34×10^6 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: 2.85×10^6 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	7.9		0.0022
$PM_{10/2.5}$	7.9		0.0022
SO_2	6.0		0.0015
NOx	29.6	2.0	
VOC	3.6	0.7	
CO	8.1	0.9	
Lead	1.9E-03		4.9E-07
H_2SO_4	2.1		0.00053
Ammonia		2.0	

2. CTG Operating on Natural Gas with Duct Firing

Pollutant	lb/hr	ppmvd @ 15% O_2	lb/MMBtu
PM	21.9		0.0046
$PM_{10/2.5}$	21.9		0.0046
SO_2	7.6		0.0015
NOx	37.2	2.0	
VOC	10.4	1.6	
CO	19.2	1.7	
Lead	2.3E-03		4.9E-07
H_2SO_4	2.7		0.00052
Ammonia		2.0	

3. CTG Operating on ULSD

Pollutant	lb/hr	ppmvd @ 15% O_2	lb/MMBtu
PM	26.7		0.0083
$PM_{10/2.5}$	26.7		0.0083
SO_2	4.9		0.0015
NOx	50.6	4.0	
VOC	8.9	2.0	
CO	14.1	1.8	
Lead	3.2E-03		1.05E-06
H_2SO_4	1.8		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 on a 1-hour block hour average beginning with the first minute of each clock hour consistent with the CEMS monitoring in Part IV.A.1 of this permit. 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)	59	178	77	148
VOC (lb/hr)	92	622	115	167
CO (lb/hr)	385	1,004	139	171

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	54.9
$PM_{10/2.5}$	54.9
SO_2	25.1
NOx	130.1
VOC	45.5
CO	77.8
Pb	0.009
H_2SO_4	9.62
CO_2e	2,207,451
NH_3	54.6

D. Greenhouse Gas Emissions

The Permittee shall not exceed an annual CO_2e emissions limit of 2,232,604 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 12 month 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:

1. $PM/PM_{10}/PM_{2.5}$, VOC, Formaldehyde, H_2SO_4: Most recent Stack test data.

2. SO_2: Sulfur content in fuel.

3. NOx & CO (Steady-State): CEM data.

4. NOx, VOC, & CO (Transient): Manufacturer's uncontrolled emission factors.

5. 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.

6. GHG (CO_2e) Emissions:
   a. CO_2 emissions from the combustion CTG shall be determined by the methodology found in 40 CFR Part 75, Appendix G, Equation G-4.
   b. 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.
   c. 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.
   d. Estimated fugitive emissions of sulfur hexafluoride (SF_6) from the electrical circuit breakers shall be determined using mass balance.
   e. 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 date of 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 to determine the MHI between temperatures provided in Table 1

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

Where,

MHI_T = Turbine maximum heat input at ambient temperature (^0F)
T = Ambient Temperature

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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	3,617	3,256
0	3,862	3,256
20	4,016	3,256
30	3,961	3,256
50	3,885	3,256
59	3,863	3,256
65	3,878	3,236
90	3,828	3,106
100	3,794	3,022

C. The duct burner shall be required to meet a minimum heat input value of 885 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. Minimum Stack Height (ft): 90
   d. Maximum Allowable Fuel Use over any consecutive 12 month period: 375,875,500 ft^3
   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 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. Minimum Stack Height (ft): 20
   d. Maximum ULSD Sulfur Content (% by weight, dry basis): 0.0015
   e. Maximum Allowable Fuel Use over any consecutive 12 month period: 4,380 gallons
   f. 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. The Permittee shall not operate this emergency engine and the emergency engine operating under permit number 089-0108 individually for more than 300 hours per calendar year or more than 500 hours per calendar year in combination per calendar year.
   h. 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

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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: 7 MMBtu/hr Natural Gas Heater

1. Operational Conditions
   a. Make and Model: TERi or equivalent
   b. Allowable Fuel: Natural Gas
   c. Minimum Stack Height (ft): 20
   d. Maximum Allowable Fuel Use over any consecutive 12 month period: 24,237,354 ft^3
   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.

2. Allowable Emissions

Pollutant	lb/MMBtu	Tons/yr
$PM_{2.5}$	0.005	0.07
PM_{10}	0.005	0.07
NOx	0.012	0.17
SO_2	0.0015	0.021
VOC	0.0034	0.05
CO	0.037	0.52
H_2SO_4	1.1E-04	0.002
CO_2	116.9	1,637

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 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: 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.

Connecticut Department of
ENERGY &
ENVIRONMENTAL
PROTECTION

79 Elm Street • Hartford, CT 06106-5127 www.ct.gov/deep Affirmative Action/Equal Opportunity Employer

MAR 16 2018

Mr. Tim Eves
Vice President
NTE Connecticut, LLC
24 Cathedral Place, Suite 300
Suite 300
St. Augustine, FL 32084

Dear Mr. Eves:

Enclosed is a copy of your revised permit to construct and operate a Cummins Emergency Engine at 180/189 Lake Road, Killingly, CT.

This letter does not relieve you of the responsibility to comply with the requirements of other appropriate Federal, State, and municipal agencies. This permit is not transferable from one permittee to another without prior written approval, from one location to another, or from one piece of equipment to another. The permit must be made available at the site of operation throughout the period that such permit is in effect.

Pursuant to Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA), NTE Connecticut, LLC must apply for a permit modification/revision in writing if it plans any physical change, change in method of operation, or addition to this source which constitutes a modification or revision pursuant to RCSA sections 22a-174-1 and 22a-174-2a, respectively. Any such changes should first be discussed with Mr. James Grillo of the Bureau of Air Management, by calling (860) 424-4152. Such changes shall not commence prior to the issuance of a permit modification.

Sincerely,

Gary S. Rose

Gary S. Rose
Director
Engineering & Enforcement Division
Bureau of Air Management

GSR:JAG:jad
cc (via electronic mail): Robert Girard, Air Enforcement
L. Gresock, Tetra Tech, Inc.

Enclosure

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	Cummins 1250DQGAE 1,380 kW Emergency Engine
Collateral Conditions	Part II.A of this permit contains collateral conditions for one 305 bhp emergency fire pump engine identified in permit number 089-0107 as EU-4.
Town-Permit Numbers	089-0108
Premises Number	101
Stack Number	2
Revision Issue Date	MAR 16 2018
Prior Permit Issue Date	June 30, 2017
Expiration Date	None

Robert E. Kaliszewski
Deputy Commissioner

3/16/18
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 operates a Cummins 1250DQGAE 1,380 kW ULSD fired emergency engine, identified as EU-3, to provide emergency back-up power to the facility. The generator is not connected to the electrical grid and is only utilized as an emergency engine. The unit is also subject to 40 CFR Part 60 Subpart IIII.

B. Equipment Design Specifications

1. Allowable Fuel Type: Ultra Low Sulfur Distillate (ULSD)

2. Maximum Fuel Firing Rate (gal/hr): 90.9

3. Maximum Gross Heat Input (MMBTU/hr): 12.54

C. Stack Parameters

1. Minimum Stack Height (ft): 45

2. Minimum Exhaust Gas Flow Rate at maximum firing rate (acfm): 6,600

3. Minimum Stack Exit Temperature at maximum firing rate (°F): 840

4. Minimum Distance from Stack to Property Line (ft): 440

PART II. OPERATIONAL CONDITIONS

A. Equipment

1. This equipment shall fire only Ultra Low Sulfur Distillate (ULSD).

2. Maximum Fuel Consumption over any Consecutive 12 Month Period: 27,270 gallons

3. Maximum Fuel Sulfur Content: 0.0015% by weight

4. The Permittee may operate this source for up to 300 hours per calendar year, but not more than 500 hours per calendar year in combination with the emergency fire pump identified as EU-4 in permit number 089-0107.

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

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

B. For Emergency Use

1. This emission unit shall only operate in accordance with the definition of emergency engine as defined in RCSA Sections 22a-174-22 and 22a-174-22e.

2. The Permittee shall not operate the subject engine for routine scheduled testing or maintenance during days when ambient ozone is forecasted by the commissioner to be
   a. "moderate unhealthy for sensitive groups" to "very unhealthy", or
   b. "moderate to unhealthy for sensitive groups" or greater, after June 1, 2018, anywhere in Connecticut.
   c. Forecast Information
      Official ambient ozone information can be obtained by calling:
      i. (860) 424-4167 Department's Bureau of Air Management Monitoring Section (Recorded Message Updated daily at 3:00 p.m.)
      ii. (860) 424-3027 Department's Bureau of Air Management Monitoring Section (For additional air quality information)

PART III. ALLOWABLE EMISSION LIMITS

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

A. Short Term Emission Limits

1. Criteria Pollutants

Pollutant	lb/MMBtu	g/kW-hr
PM	0.05	0.20
$PM_{10/2.5}$	0.05	0.20
SO_2	0.0015	
NOx		6.4
VOC		0.32
CO		3.5
Pb	1.4E-05	
H_2SO_4	1.1E-04	
CO_2	163.1	

B. Annual Emission Limits

Pollutant	tons per 12 consecutive months
PM	0.09
$PM_{10/2.5}$	0.09
SO_2	0.003
NOx	2.92
VOC	0.15
CO	1.60
Pb	2.0E-05
H_2SO_4	2.0E-04
CO_2e	308

C. Hazardous Air Pollutants

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]

D. Opacity

Opacity resulting from operation of this engine shall not exceed 10% during any six-minute block average or 40% reduced to a one-minute block average; as measured by 40 CFR Part 60, Appendix A, Reference Method 9.

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

- *SO_2, H_2SO_4: Calculated from fuel sulfur content*
- *NOx, $PM_{10/2.5}$, VOC, CO: EPA Certified Vendor Emissions Factor*
- *Pb: AP-42 Sec. 3.1*
- *CO_2: 40 CFR Part 98 Subpart C, Table C-1*
- *CO_2e: 40 CFR Part 98 Subpart C, Table C-2*

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 continuously monitor fuel consumption by this unit using a non-resettable totalizing fuel meter.

2. The Permittee shall monitor all hours that this unit is in operation.

B. Record Keeping

1. 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.

2. 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.

3. 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.

4. The Permittee shall keep monthly and calendar year records of all hours of operation and fuel use for this unit.

   Such records shall contain the following information:
   a. reason for operating;
   b. date of event;
   c. duration of event (minutes);
   d. gallons of fuel combusted;
   e. for any testing or scheduled maintenance operation, the ozone level as forecasted for the day;
   f. total engine hours of operation and total combined engine hours of operation with the fire pump identified in permit 089-0107. (EU-4).

5. The Permittee shall keep records of the inspection and maintenance for this engine. The records shall include:
   a. the name of the person conducting the inspection or maintenance;
   b. the date of the inspection or maintenance;
   c. the results or actions taken.

6. The Permittee shall comply with the applicable record keeping requirements of RCSA Sections 22a-174-22(*l*) and 22a-174-22e(j).

7. The Permittee shall keep records of the manufacturer's specifications and written recommendations.

8. 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 comply with the applicable reporting requirements of RCSA Sections 22a-174-22(l) and 22a-174-22e(k).

2. The Permittee shall comply with the reporting requirements in 40 CFR §60.4214.

3. 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 V. SPECIAL REQUIREMENTS

A. 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.

B. The Permittee shall not cause or permit the emission of any substance or combination of substances which creates or contributes to an odor beyond the property boundary of the premises that constitutes a nuisance as set forth in RCSA Section 22a-174-23. [STATE ONLY REQUIREMENT]

PART VI. 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."

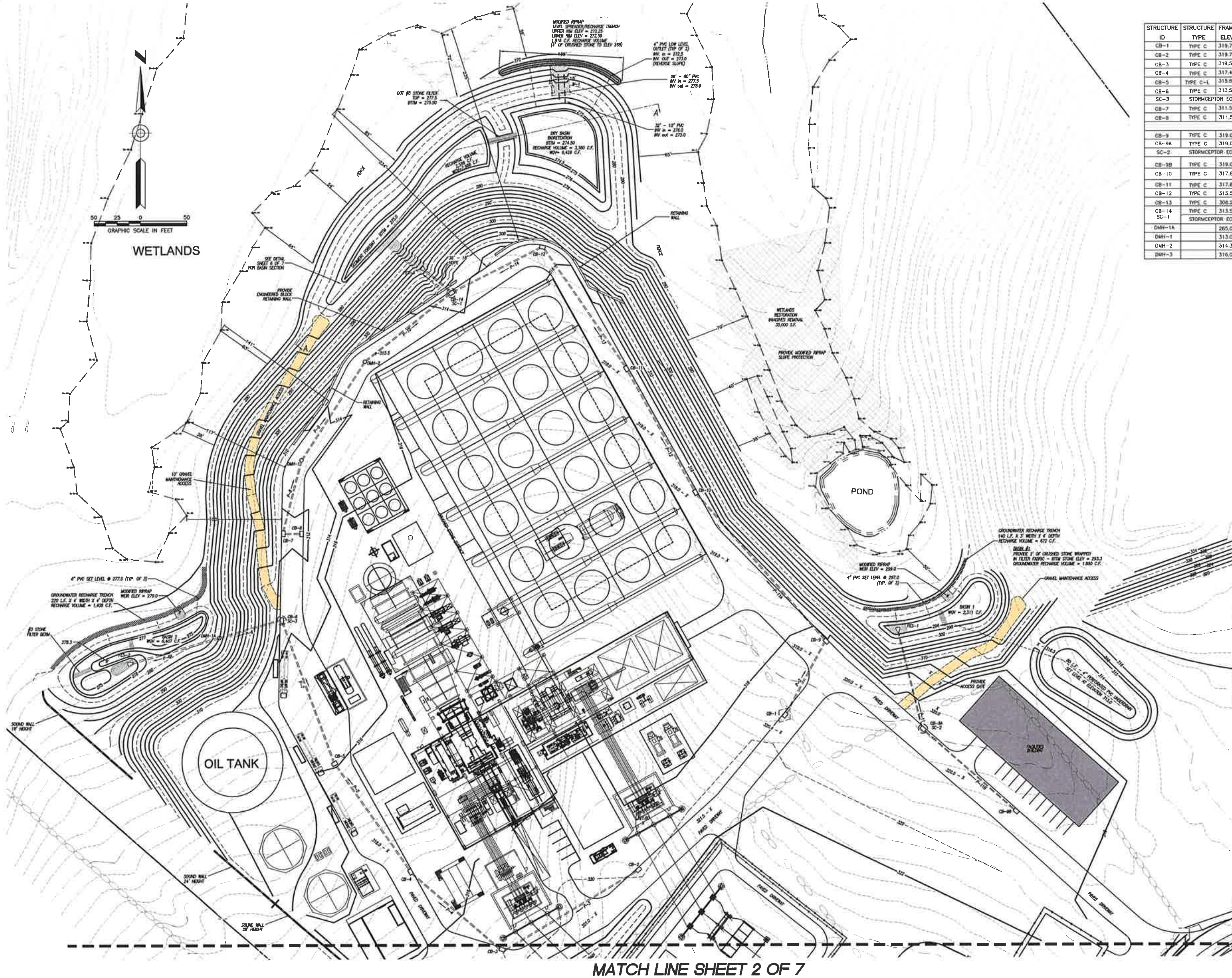
F. Nothing in this permit shall affect the commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for violations of law, including but not limited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

APPENDIX B – 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	319.75	OUT: 311.61				307.61
CB-2	TYPE C	319.70		OUT: 315.65 (SW)			312.65
CB-3	TYPE C	319.50	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	168	1.6%
P-4	15	HDPE	126	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
01/17/2019	LAYOUT REVISIONS
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

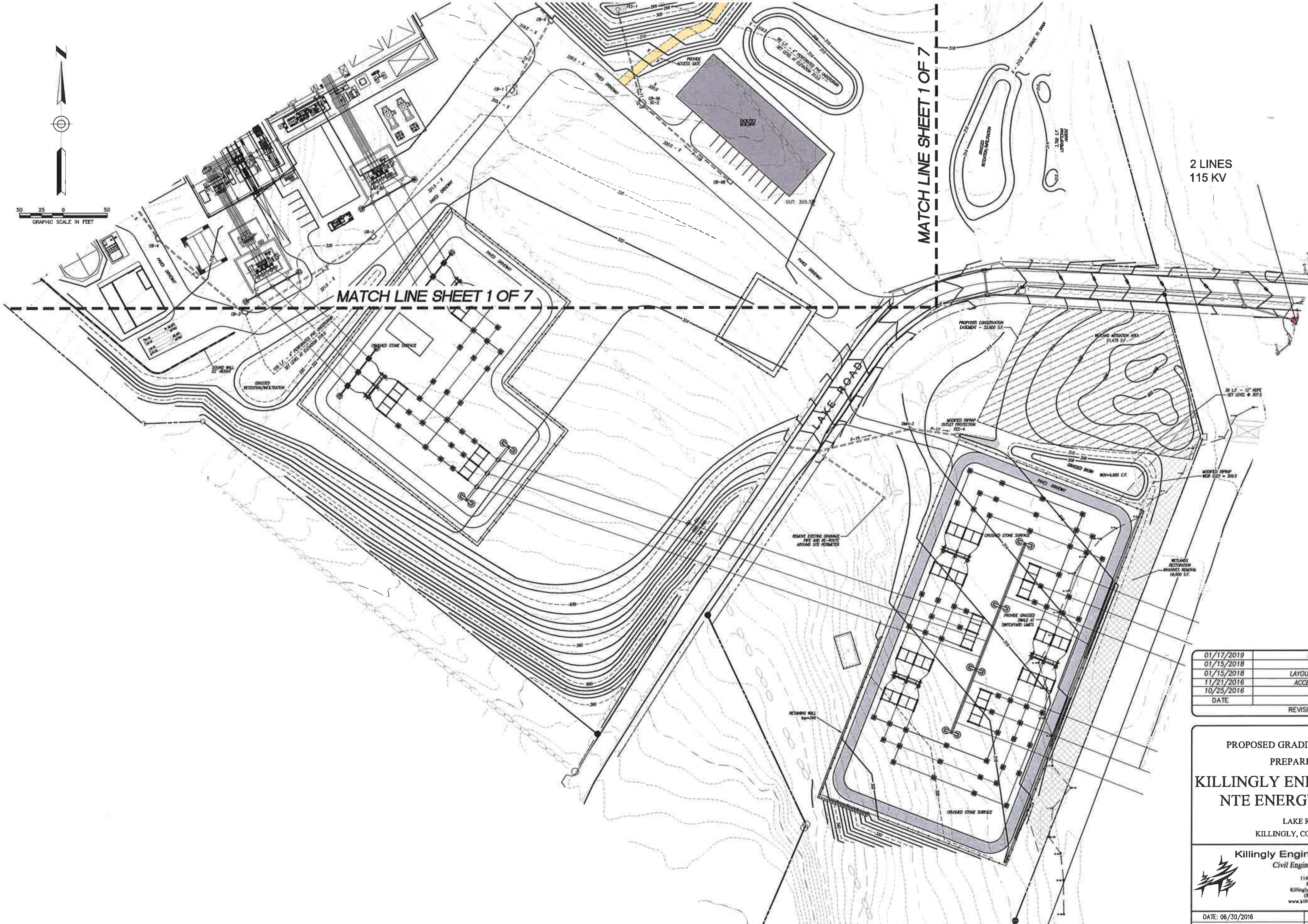
PREPARED FOR

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



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REVISIONS

PROPOSED GRADING & DRAINAGE

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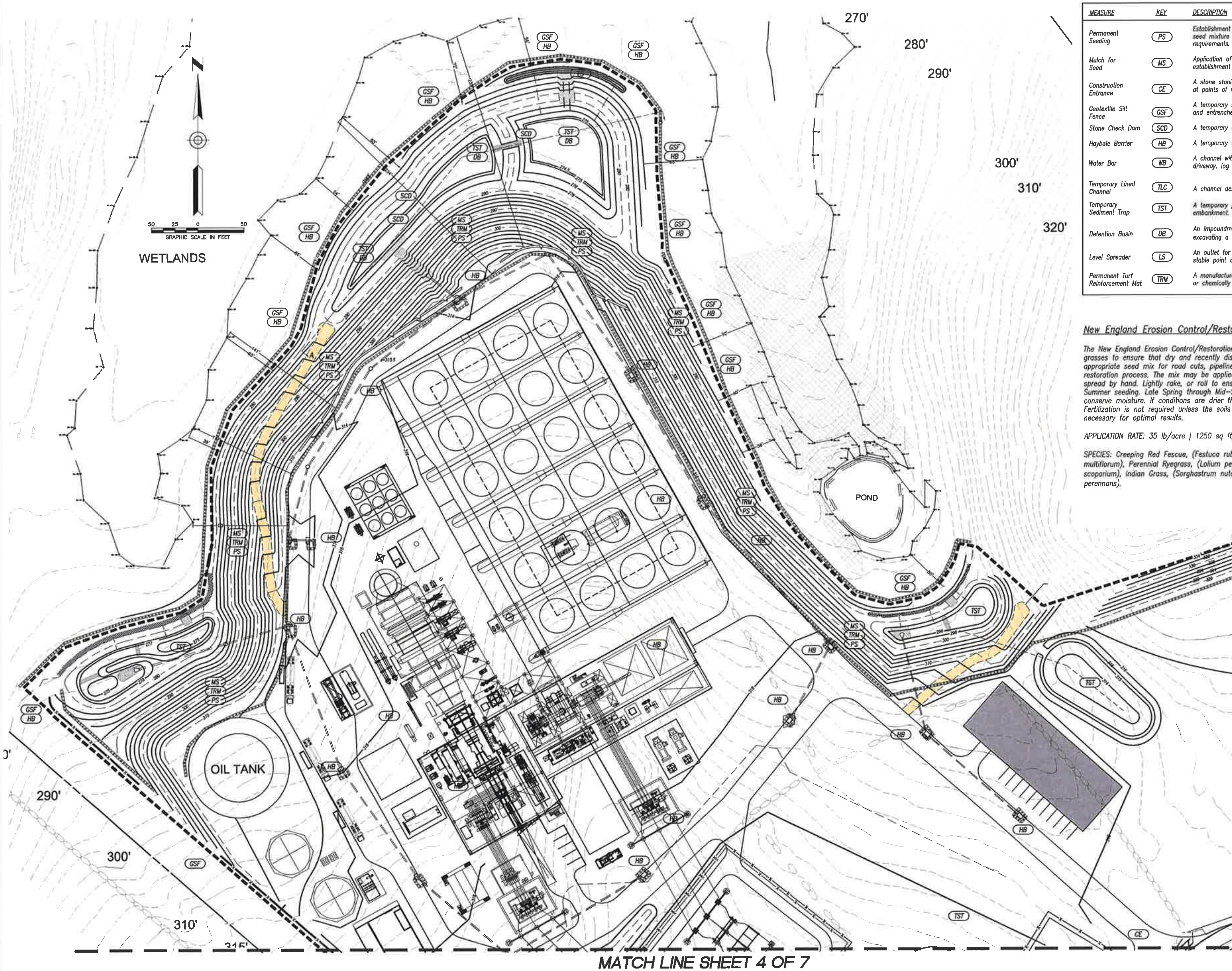


MEASURE	KEY	DESCRIPTION
Permanent Seeding	PS	Establishment of permanent stand of grass and/or legumes by seeding and mulching exposed soils with a seed mixture appropriate for long term stabilization. See Erosion Control Narrative for seed mix requirements.
Mulch for Seed	MS	Application of a mulch that 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
01/17/2019	LAYOUT REVISIONS
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

EROSION AND SEDIMENTATION CONTROL PLAN

PREPARED FOR

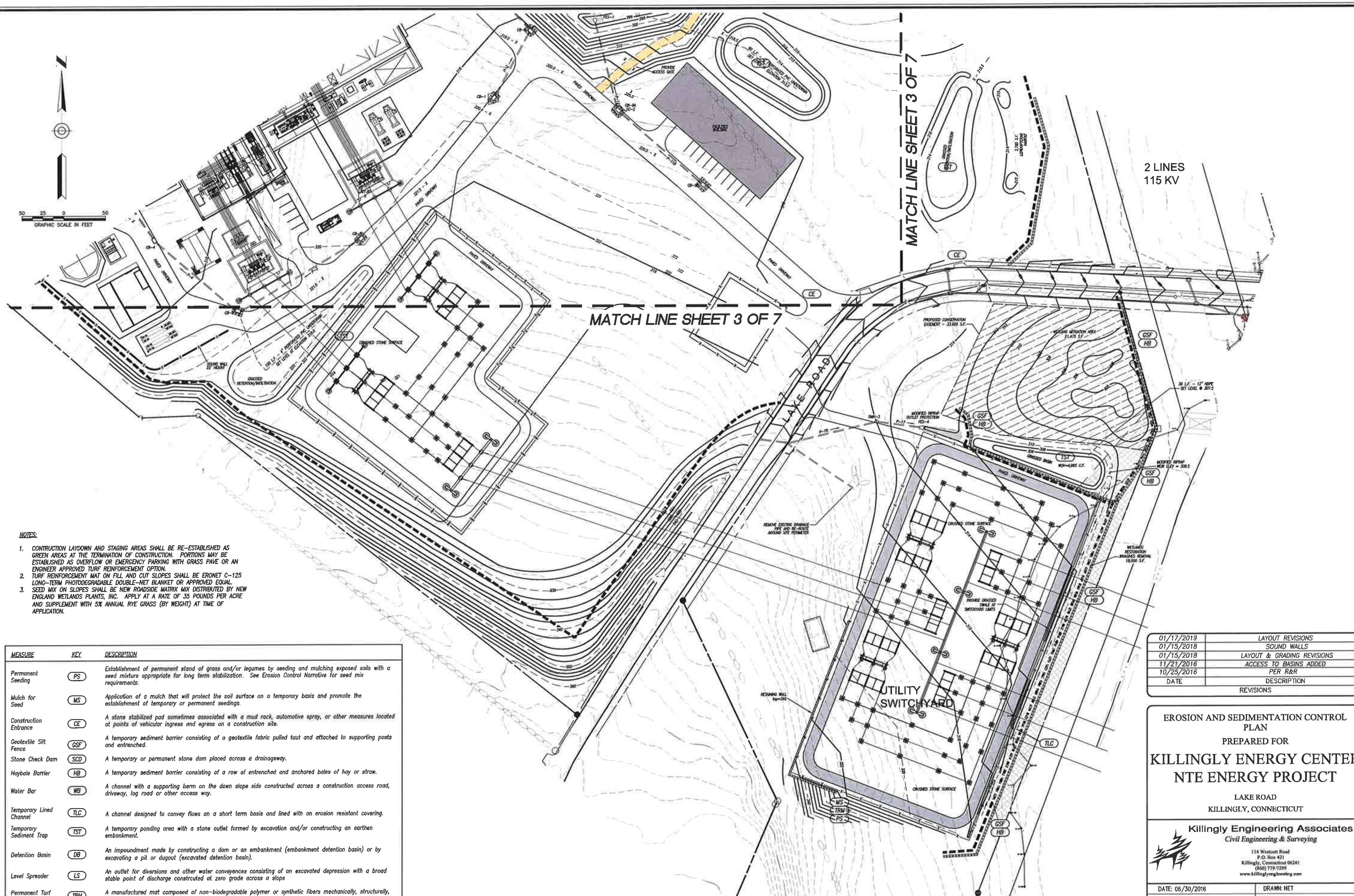
KILLINGLY ENERGY CENTER
NTE ENERGY PROJECT

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
SCALE: 1"=50'	DESIGN: NET
SHEET: 3 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042



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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.

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DATE: 06/30/2016	DRAWN: NET
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SHEET: 4 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042

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:

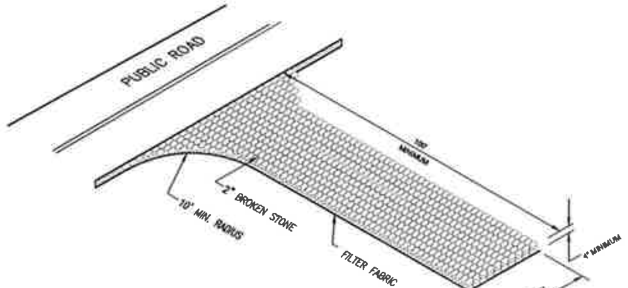
1. Dig a 6" deep trench on the uphill side of the barrier location.
2. Position the posts on the downhill side of the barrier and drive the posts 1.5 feet into the ground.
3. Lay the bottom 6" of the fabric in the trench to prevent undermining and backfill.
4. Inspect and repair barrier after heavy rainfall.
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

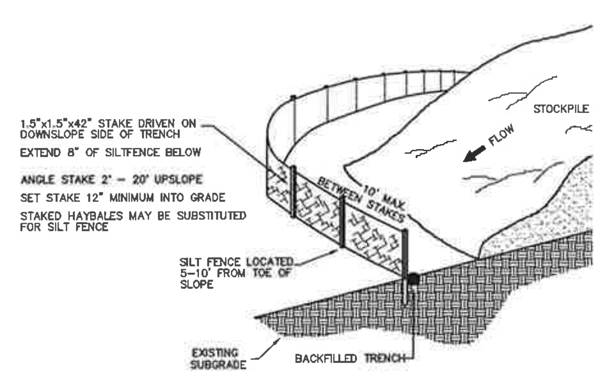
Clean runoff should be kept separated from sediment laden water and should not be directed over disturbed areas without additional controls. Additionally, prevent the mixing of clean off-site generated runoff with sediment laden runoff generated on-site until after adequate filtration of on-site waters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

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.

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REVISIONS

EROSION AND SEIMENTATION CONTROL NARRATIVE AND DETAILS

PREPARED FOR

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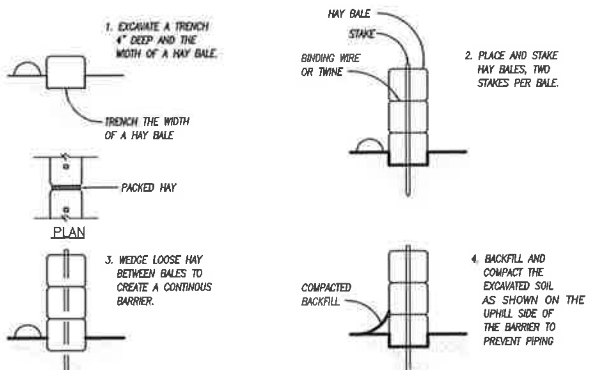

HAYBALE BARRIER

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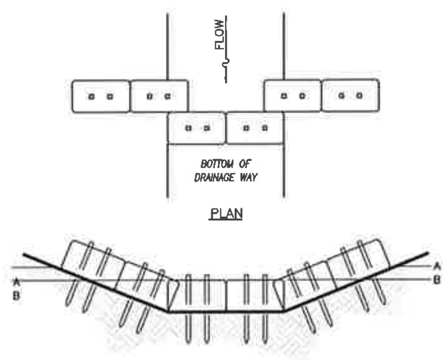

HAYBALE CHECK DAM

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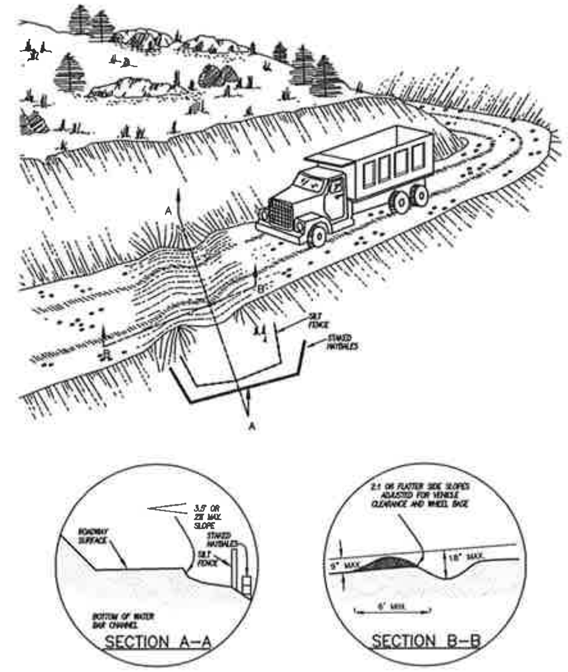

WATER BAR DETAIL

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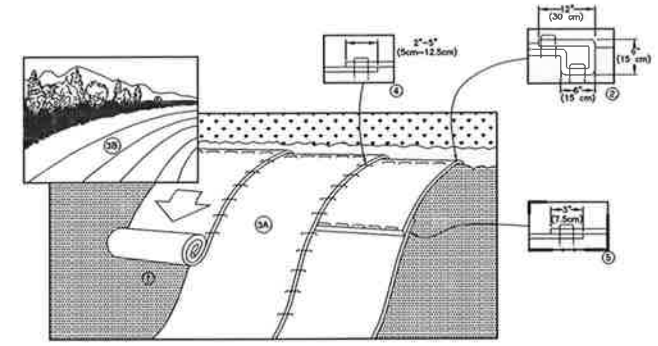


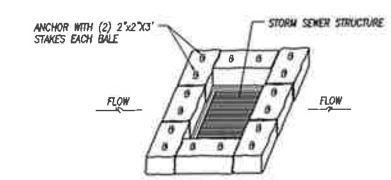
1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL-O-SEED DO NOT SEED PREPARED AREA. CELL-O-SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" (15cm) DEEP X 6" (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.

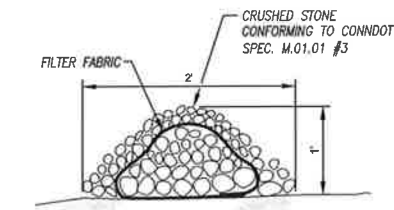
TURF REINFORCEMENT MAT INSTALLATION

NOT TO SCALE



HAYBALE INSTALLATION AT CATCH BASIN

NOT TO SCALE



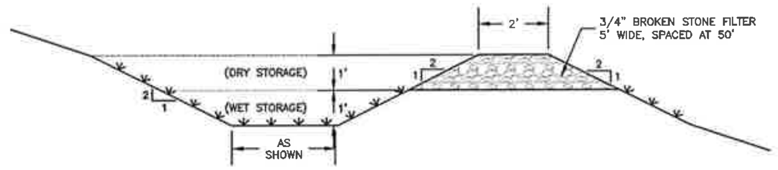
STONE CHECK DAM

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.

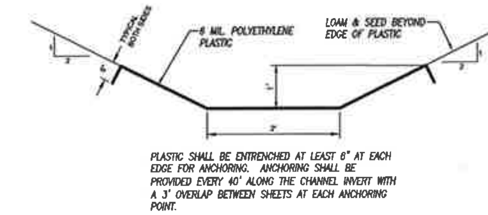


TEMPORARY SEDIMENTATION BASIN

NOT TO SCALE

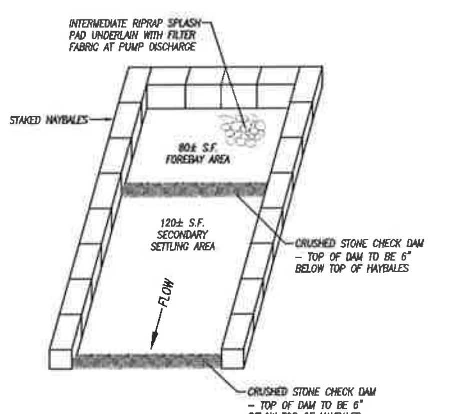
NOTES:

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.



TEMPORARY LINED CHANNEL

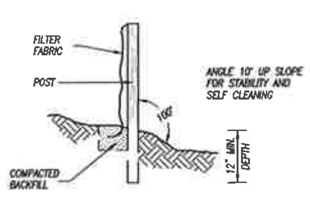
NOT TO SCALE



PUMPING OUTLET BASIN

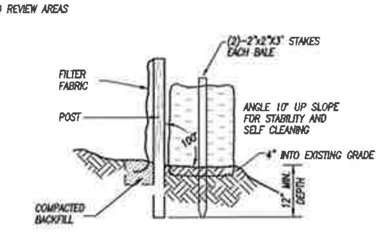
NOT TO SCALE

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



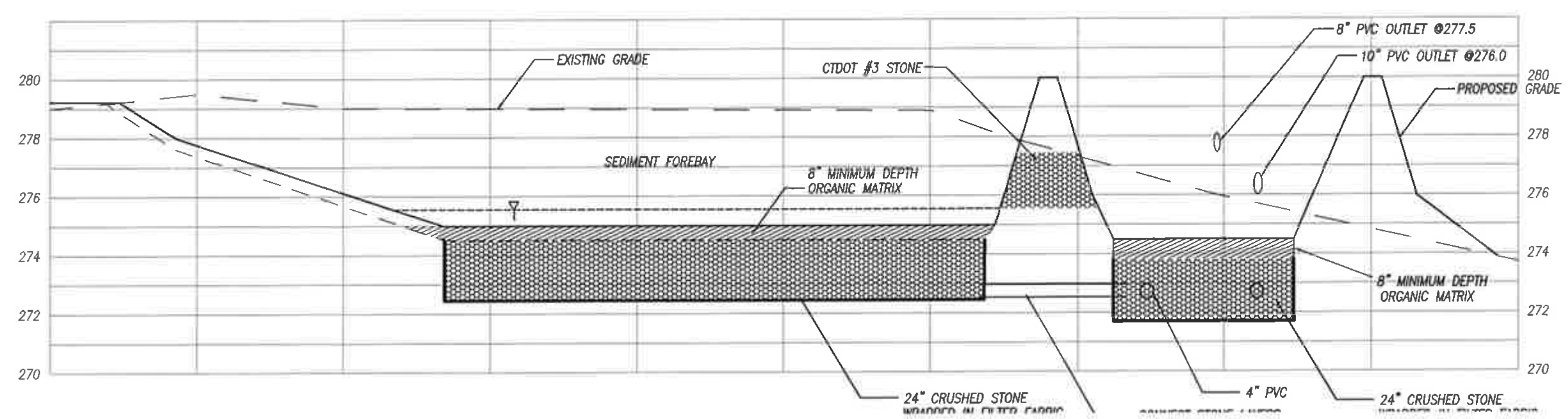
SILT FENCE

NOT TO SCALE



SILT FENCE – BACKED WITH HAYBALES

NOT TO SCALE



SECTION THROUGH DETENTION/WATER QUALITY BASIN

DATE	DESCRIPTION
01/17/2019	LAYOUT REVISIONS
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	

EROSION AND SEDIMENTATION CONTROL DETAILS

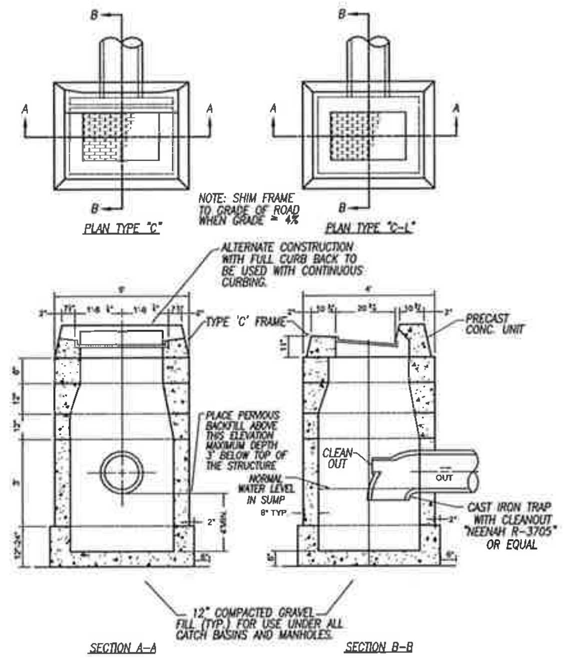
PREPARED FOR

KILLINGLY ENERGY CENTER NTE ENERGY PROJECT

LAKE ROAD
KILLINGLY, CONNECTICUT

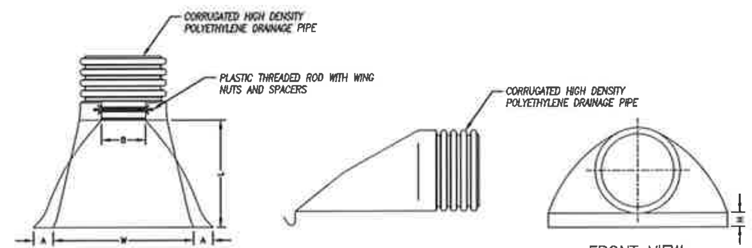
Killingly Engineering Associates
Civil Engineering & Surveying
114 Westcott Road
P.O. Box 421
Killingly, Connecticut 06241
(860) 779-7299
www.killinglyengineering.com

DATE: 08/30/2016	DRAWN: NET
SCALE: 1"=50'	DESIGN: NET
SHEET: 6 OF 7	CHK BY: ---
DWG. No: CLIENT FILE	JOB No: 16042



HOODED CATCH BASIN DETAIL

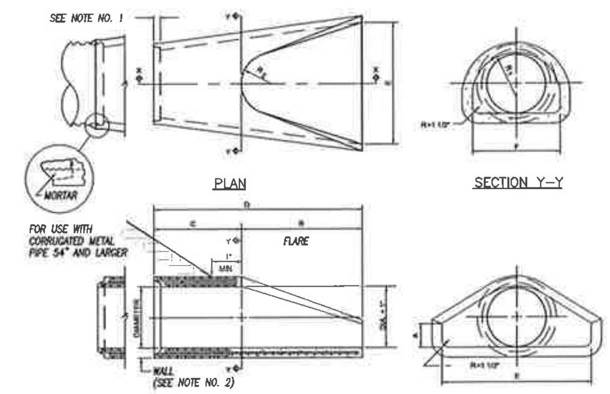
NOT TO SCALE



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

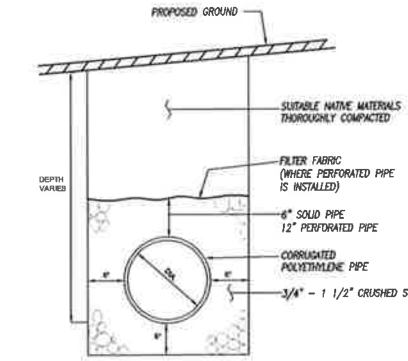


NOTE:
1. JOINTS SHALL BE TONGUE AND GROOVE OR BELL AND SPIGOT AS REQUIRED TO CONFORM TO PIPE INSTALLED
2. WALL THICKNESS SHALL CONFORM TO PIPE THICKNESS

DIMENSIONS FOR REINFORCED CONCRETE CULVERT END									FLARED REINFORCEMENT	
DIA.	A	B	C	D	E	F	R_1	R_2	[illegible]	[illegible]
12"	4"	2'-0"	4'-0 3/8"	6'-0 3/8"	2'-0"	[illegible]	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'-6"	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"	[illegible] 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"	[illegible]	1'-6 1/2"	1'-3"	0.084	0.084
36"	1'-3"	5'-3"	2'-10 3/4"	6'-1 3/4"	6'-0"	[illegible]	2'-0 5/16"	1'-6"	0.096	0.096
42"	1'-9"	5'-3"	2'-11"	6'-2"	6'-6"	4'-5 7/8"	2'-3 1/2"	1'-10"	0.108	0.108
48"	2'-0"	6'-0"	2'-2"	6'-2"	7'-0"	4'-8 1/2"	2'-4 1/2"	1'-10"	0.120	0.120
54"	2'-3"	6'-5"	2'-11"	6'-4"	7'-6"	5'-5 1/2"	2'-8 1/8"	2'-0"	0.132	0.132
60"	2'-6"	5'-0"	3'-3"	6'-3"	8'-0"	6'-0 1/2"	[illegible]	2'-0"	0.144	0.144

CULVERT END

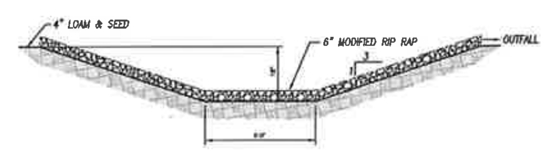
NOT TO SCALE



DRAINAGE PIPE INSTALLATION DETAIL

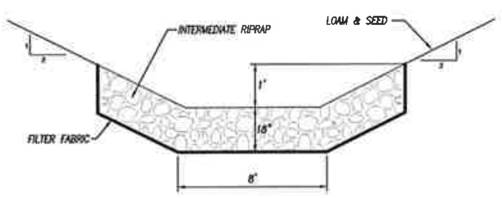
NOT TO SCALE

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



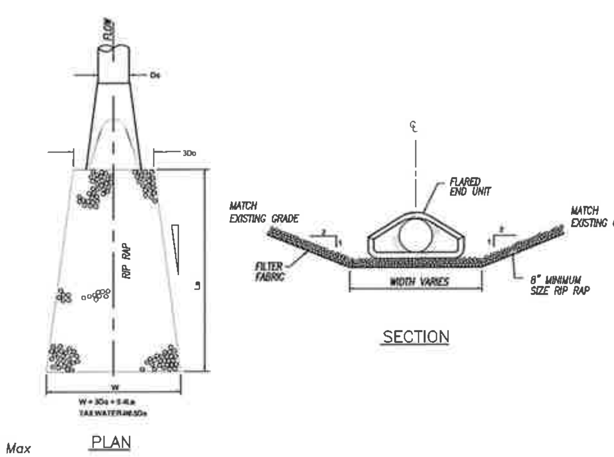
SECTION THROUGH LEVEL SPREADER

NOT TO SCALE



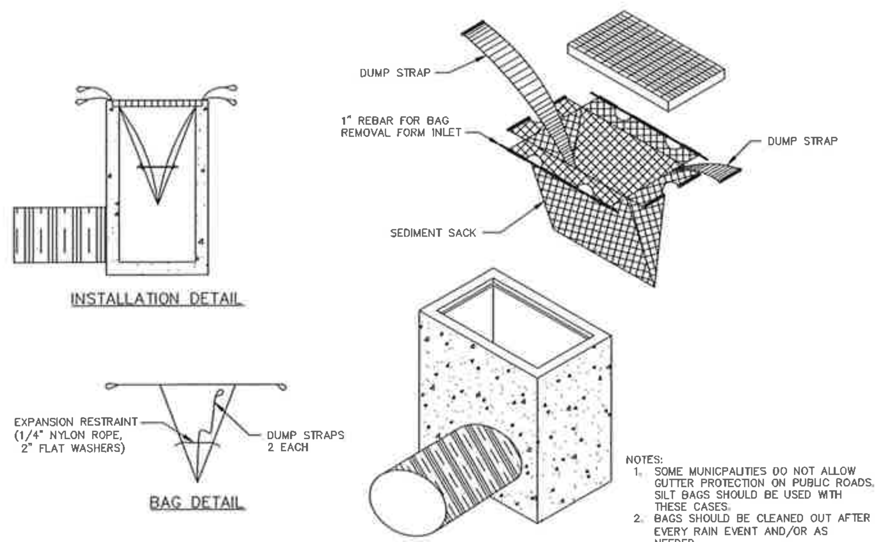
INTERMEDIATE RIPRAP SWALE

NOT TO SCALE



RIP RAP OUTFALL

NOT TO SCALE

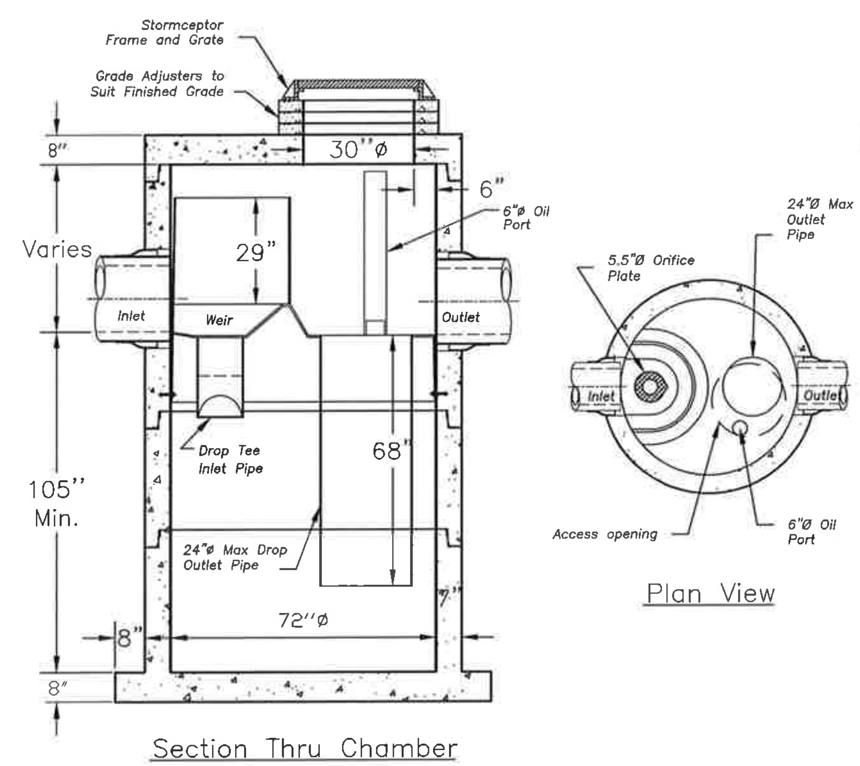


NOTES:
1. SOME MUNICIPALITIES DO NOT ALLOW GUTTER PROTECTION ON PUBLIC ROADS. SILT BAGS SHOULD BE USED WITH THESE CASES.
2. BAGS SHOULD BE CLEANED OUT AFTER EVERY RAIN EVENT AND/OR AS NEEDED.

SILTBAG INLET SEDIMENT CONTROL DEVICE

NOT TO SCALE

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



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

DATE	DESCRIPTION
01/17/2019	LAYOUT REVISIONS
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

STORMWATER CONSTRUCTION DETAILS

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: 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.

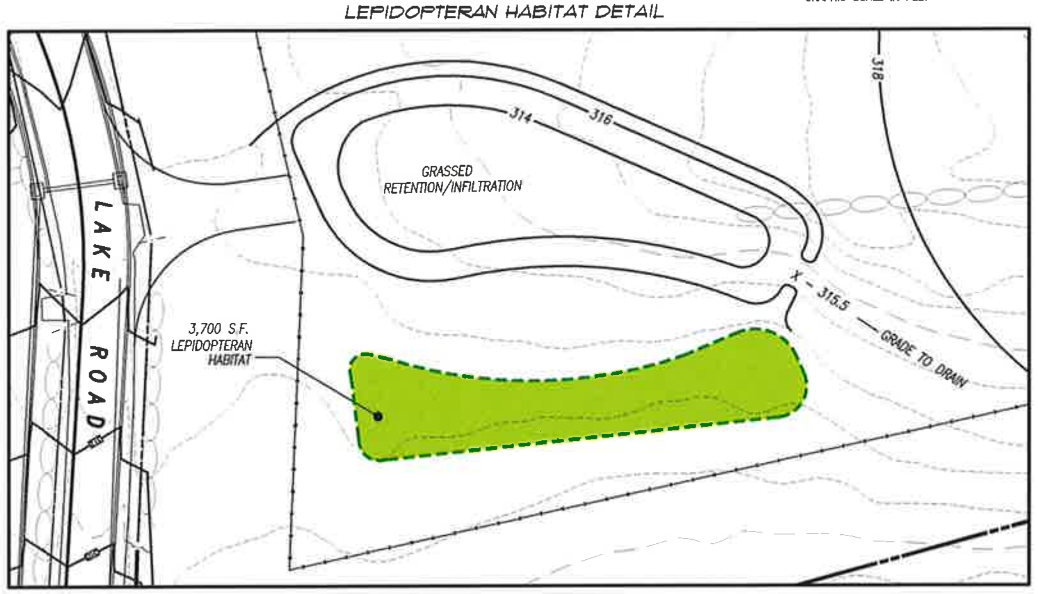
The cool season grasses have been added as a "starter" seed for erosion control. This mix has excellent heat and drought tolerance, and grows best in well drained soils. Warm season grasses provide excellent year round cover and food for wildlife, particulary as winter cover for small animals. This mix 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 C: Moist Meadow
ZONE B: Wet Meadow	ZONE D: Dry Meadow

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

Table 1. Trees

Scientific Name	Code	Common Name	Size	Shade tolerant?	Form	Wetland Habitat	Upland Buffer	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	7	11

Table 2. Shrubs

Scientific Name		Common Name	Size	Shade tolerant?	Form	Wetland Habitat	Upland 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

Table 3. Herbs

Scientific Name		Common Name	Size	Hyrdo Zone	NWI*	Spacing	Wetland Habitat	Upland Buffer Habitat	Total
Asclepias incarnata	ai	Swamp milkweed	plug	B	OBL	1.5'OC	50		50
Asclepias tuberosa	at	Butterfly wilkweed	plug	C,D	FACU	1.5'OC		25	25
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	UPL	1.5'OC		20	20
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	75
Glyceria canadensis	gc	Manna grass	plug	A	OBL	1.5'OC	50		50
Eutrochium maculatum	em	Spotted joy-pye-weed	plug	C	FACW	1.5'OC	25	25	50
Schoenoplectus tabernaemontani	st	Soft-stem bulrush	plug	A	OBL	2'OC	50		50
Thelypteris noveboracensis	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	FACW	1.5'OC	50		50
Symphyotrichum laeve	sla	Smooth aster	plug	B,C	UPL	1.5'OC	50	25	75
Chelone glabra	cg	Turtle head	plug	B	OBL	1.5'OC	50		50
Lupinus perennis	lp	Wild blue lupine	plug	D	UPL	1.5'OC		20	20
Mimulus ringens	mr	Monkey flower	plug	B	OBL	1.5'OC	50		50
Liatris spicata	ls	Marsh blazing star	plug	B,C	FAC	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	FACW	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	FAC	1.5'OC	25	25	50
Totals:							990	265	1255

** NWI Status (National Wetland Inventory; National Wetland Plant List: Northcentral & Northeast)*

NOTES:

Hydrologic Zones: A: seasonally flooded to semi-permanently flooded; B: seasonally saturated; C: moist; D: dry

1. Preferably plant woody and herbaceous plantings between April 15 and June 15 of a given year.
2. Coordinate plug order early in prior fall,so that flats of all species are planted (contract growing). Sources: Nasami Farms, Whately, MA & NEWP
3. Use topsoil from forested areas to be developed devoid of invasive species.
4. Use New England Wetmix from NEWP (New England Wetland Plants), Amherst, MA (see Table 3) in areas between beds of herbaceous plugs.
5. No seeding or other plants in 3' diameter circle around each shrub, tree, and plug, mulched with bark mulch or shredded leaf litter.
6. 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.
7. Water frequently (several times a week) during first growing season; this is necessary for establishment of plugs and many of the seedlings.
8. Monitoring will take place for 5 years following establishment of plantings.
9. 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/Shallo w 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

REVISIONS

DATE	DESCRIPTION
1/16/2019	REVISED LEPIDOPTERAN DETAILS
12/11/2017	REVISED LEPIDOPTERAN HABITAT LOCATION

WETLAND MITIGATION AND RESTORATION PLAN
PREPARED FOR

KILLINGLY ENERGY CENTER

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

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PLAN FOR
UPLAND LEPIDOPTERAN HABITAT

IMPLEMENTATION NOTES

1.0 Introduction

THE CREATION OF A SPECIALIZED UPLAND HABITAT SUITABLE TO ATTRACT LEPIDOPTERAN SPECIES (I.E. BUTTERFLIES AND MOTHS), SHALL TAKE PLACE AT ONE LOCATION (I.E. LEPIDOPTERAN HABITAT AREA), WHICH ENCOMPASSES APPROXIMATELY 3,700 SQUARE FEET, AS SHOWN ON THE LOCATION MAP.

PER GUIDANCE FROM CT DEEP NDDB PROGRAM, EXISTING SOILS IN THE AREA PROPOSED AS LEPIDOPTERAN HABITAT ARE SUITABLE AS-IS AND WILL BE MINIMALLY DISRUPTED. NO PLANTINGS WILL BE INCLUDED IN THIS AREA OTHER THAN SEEDING WITH LOCAL BAPTISIA TINCTORIA AND LUPINUS PERENNIS SEEDS.

2.0 Site Preparation

1. 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).
2. NO MACHINERY WILL BE ALLOWED WITHIN THE AREA TO AVOID COMPACTION.

3.0 Seeding

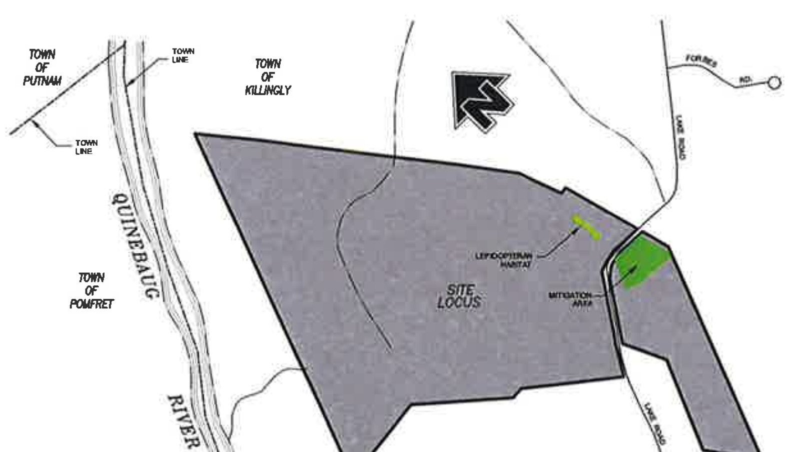
1. SOW LOCAL BAPTISIA TINCTORIA AND LUPINUS PERENNIS SEED IN FALL, AFTER FROST. MIX 1: 1 WITH SAND OR KITTY LITTER FOR EVEN SOWING. LIGHTLY RAKE IN SEED (LESS THAN ½ INCH DEEP) AND ROLL. FOR FALL SEEDING, AFTER HARD FROST, SEED MAY SIMPLY BE SOWN. SNOW AND FROST WILL INCORPORATE INTO THE SOIL.
2. SPREAD 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. BAPTISIA TINCTORIA AND LUPINUS PERRENNIS ARE VERY ATTRACTIVE TO DEER. IF EXCESSIVE HERBIVORY IS OBSERVED, A DEER FENCE MAY BE PROPOSED TO REDUCE HERBIVORY.

4.0 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.

5.0 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.



LOCATION MAP
SCALE: 1" = 500'

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.

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.

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) 9/13/2016 REVISION OF THE U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT'S, COMPENSATORY MITIGATION GUIDANCE.

***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 OF 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 MITIGATON 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 CONDITIONS, 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, H2O) 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 6 INCHES OF TOPSOIL SHALL COVER THE SUBSOIL THROUGHOUT THE WETLAND PORTION OF THE MITIGATION AREA.
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. STORE LEFT-OVER PLANTS IN A 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 DESIRABLE, 1) BECAUSE IT 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 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.

1/16/2019	*REVISED LEPIDOPTERAN DETAILS*
12/11/2017	*REVISED LEPIDOPTERAN HABITAT LOCATION*
DATE	DESCRIPTION
REVISIONS	

WETLAND MITIGATION AND
RESTORATION PLAN
PREPARED FOR

KILLINGLY ENERGY CENTER

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

K:\16042\Drawings\To REMA\Mitigation - REVISED 2019.dwg Jan 16, 2019 - 2:47 PM

STORMWATER POLLUTION PREVENTION PLAN

Prepared for

NTE CONNECTICUT, LLC
LAKE ROAD
KILLINGLY CONNECTICUT

August 2016
Revised to January 2019

Prepared for

Proposed Natural Gas Power Plant

Prepared by

Normand Thibeault Jr., P.E.
CT License #22834

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SECTION 1: SITE EVALUATION, ASSESSMENT & PLANNING

SECTION 2: EROSION AND SEDIMENT CONTROL BMP'S

SECTION 3: GOOD HOUSEKEEPING BMP'S

SECTION 4: POST CONSTRUCTION BMP'S

SECTION 5: DRAINAGE SUMMARY

1. Site Evaluation, Assessment & Planning

1.1 Project/Site Description

NTE Connecticut, LLC is seeking local and state approvals to develop the Killingly Energy Center (KEC), an approximately 550-MW air-cooled electric generating facility and related electrical interconnection switchyard to be located on an approximately 73-acre site off Lake Road in the Town of Killingly, Connecticut; a natural gas lateral will provide fuel to the Generating Facility. Approximately 63-acre parcel north of Lake Road is the proposed location of the Generating Facility and a 10-acre portion of the property located south of Lake Road is the proposed location of the Switchyard. KEC will be located in an area designated in the Townôs Plan of Conservation and Development for future industrial development in the northern portion of Killingly.

Structural stormwater collection systems have been designed to collect stormwater from paved and crushed stone surfaces for conveyance to stormwater detention/treatment basins. The basins have been positioned to discharge to the headwaters of existing wetlands systems to preserve the recharge and functionality of these systems. The basins incorporate water quality volume treatment into the design, a low level outlets and high level weir overflows, and below grade crushed stone levels to assist in groundwater recharge. The main basin will discharge to a level spreader positioned on flat terrain (3% slope) approximately 60ô from the nearest wetland which also incorporates below grade storage. The stormwater outlet will be reinforced with riprap outlet protection and the level spreaders outfall will sheet flow overland through natural vegetation.

Conveyance of stormwater from the switchyard (southern portion of the site) will be via sheet flow over a crushed stone surface, to a grassed swale, and to a stormwater basin with a low level outlet and overflow weir. This basin will also serve as a recharge mechanism to the existing wetlands as well as to a proposed 18,400 square foot wetland mitigation area adjacent to the switchyard.

Where ever possible, sheet flow and overland discharge from pervious surfaces is incorporated into the design with limited storm drain installation and the construction of shallow depressions within the landscape to encourage infiltration and the preservation of natural terrain and ground cover adjacent to wetland resource areas Also, in accordance with the State of Connecticut 2004 Water Quality Guideline recommendations, stormwater runoff from impervious areas will be treated for water quality prior to discharge to the wetland resource areas.

1.2 Contact Information – Responsible Parties

Operator(s):

NTE Connecticut, LLC
24 Cathedral Place, Suite 300
St. Augustine, Florida

SWPPP Contact(s):

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24 Cathedral Place, Suite 300
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Mark Mirabito
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Killingly Engineering Associates
114 Westcott Road
P.O. Box 421, Dayville, CT
Normand Thibeault, Jr, P.E.
SWPPP Preparation
(860) 779-7299

SWPPP Preparation Date:

October 2016
Updated to January 2019
Estimated Project Dates:

Project Start Date: Summer 2019
Project Completion Date: Spring/Summer 2022

Site Center Location:

Lake Road, Killingly, CT

N 875,990 E 1,227,084

1.3 Soils

According to the USDA-NRCS Web Soil Survey, the site consists of the following soils:

- Ridgebury, Leicester and Whitman soils - map unit 3;
- Walpole sandy loam ï map unit 13;
- Ninigret and Tisbury soils ï map unit 21;
- Hinckley loamy sand ï map unit 38;
- Sutton fine sandy loam ï map unit 52;
- Gloucester gravelly sandy loam ï map unit 58;
- Canton & Charlton soils ï map units 31 & 62;
- Charlton-Chatfield complex ï map unit 73;
- Hollis-Chatfield-rock outcrop ï map unit 75;

The presence of these soil series and soil mapping units were verified in the field by the project soil scientist in the course of delineating regulated wetlands and watercourses.

The bulk of the land disturbance and development will be conducted in areas shown as Canton and Charlton soils. These soils are well drained and stony but suitable for land development projects. For specific soil descriptions, please refer to the NRCS Web Soil Survey mapping provided as Attachment 1.

Borings were performed throughout the site and in the area of the main stormwater basin as part of a geotechnical analysis, performed by Haley and Aldrich (H&A). The results of the borings showed consistent soil characteristics throughout the site. The soils more than a few feet below grade predominantly consist of very dense glacial till type soils, and therefore the stormwater basins have been designed entirely above grade with a crushed stone base to encourage infiltration and recharge to the adjacent wetlands. As a conservative measure, the design calculations do not assume infiltration from the lower glacial till layer, though there will be some.

1.4 Existing Conditions

The site consists of approximately 73-acres and is located on the northern and southern sides of Lake Road. The site is divided by Lake Road that runs essentially in a northeast-southwest direction. The eastern 10.099-acre property where the switchyard will be constructed is wooded at the higher elevation on the southwestern end, and drains down gradient to the north and east toward an existing agricultural field and ultimately to a wetland system adjacent to the Connecticut Light and Power right of way. The larger northern portion of the property drains predominantly to the north to a large centrally located wetland system. This system flows off site to the northwest to a small depression shown on FEMA mapping as flood zone ñAò (flood elevation undetermined). This area is more than 40ô lower in elevation than the proposed development.

The existing drainage area to these wetlands is approximately 45 acres. The Quinebaug River is located further to the north and west from the proposed development; the project will not result in any direct stormwater discharge to the Quinnebaug River. A small western and northwestern section of the site separated from the bulk of the site by a prominent ridgeline, drains directly to the Quinebuag River via a seasonal watercourse.

The bulk of the area slated for development has been historically utilized for activities associated with agricultural purposes. Numerous on-site fam dump areas were identified adjacent to wetland resource areas. These on-site disposal areas are not uncommon to the area or with agricultural activities and contain household wastes (bottles & cans), paper and cardboard, appliances, and automobile and farm equipment parts.
The following statements can be made regarding the project:

- The project is not located within the Coastal Boundary and therefore a coastal site plan approval in accordance with Sections 22a-92 and 22a-93(15) of the Connecticut General Statutes is not required.
- The project is not located within an aquifer protection area. Statewide aquifer protection mapping available from the CTDEEP website http://cteco.uconn.edu/map_catalog/maps/state/stateAPA.pdf shows no aquifer protection areas in the area of the development.
- There will not be any direct stormwater discharge to the Quinebaug River. The nearest point of disturbance will be greater than 1000ô from the river and is protected by conservation land and higher terrain.
- Plan review certification will be provided by a qualified professional engineer.
- No direct wetland impacts are proposed on the northern portion of the project.

1.5 Proposed Conditions

Development on the northern side of Lake Road for the generating facility will result in the disturbance of approximately 24 acres of land (including construction laydown) and will require some significant grading to create a usable surface. Slopes throughout the site of the generating facility will be approximately 2% and surfaces will be comprised predominantly of pervious materials. Of the 24-acre disturbance on the north side of Lake Road, only 2.1 acres of paved surfaces are proposed and additional 4.0 acres of building for a total of 6.0 acres.

The site does not and will not discharge directly to a perennial surface water body (the Quinebaug River). The discharges from proposed detention basins have been designed to drain adjacent to on-site wetlands. The discharges have been designed with the appropriate outlet protection and/or treatment in accordance with the state stormwater quality guidelines. After the discharge point, overland sheet flow is incorporated into the design prior to final discharge to existing on-site wetlands.

Development on the south side of Lake Road for the switchyard will result in the disturbance of approximately 5 acres of land with a direct wetland impact of approximately 12,500 square feet. Total area of disturbance includes the construction laydown area. Grading at the south-southwest portion of the site will be minimized with the construction of a retaining wall and grades across the switchyard will be less than 3%.

Total impervious surface around the perimeter of the switchyard will be 15,600 square feet. The remainder of the switchyard surface will be comprised of a crushed stone surface.

In order to offset for the loss of wetlands, the eastern agricultural field adjacent to the switchyard will be mitigated in return at the completion of construction. Wetland replication shall take place within a portion of the agricultural field, adjacent to existing wetland areas. This shall take place at the completion of construction and staging activities and includes creation of 18,400 square feet of additional wetlands, the removal of an additional 18,000 square feet of wetlands enhancement by removal of invasive vegetation, and the designation of a 33,550 s.f. (0.77 acres) of land to conservation.

The drainage design and water quality mechanisms have been designed in accordance with the State of Connecticut 2004 Stormwater Quality Manual. Construction erosion and sedimentation control mechanisms follow the recommendations of the 2002 Connecticut Guidelines for soil erosion and sediment control.

1.6 Potential Sources of Pollution

Sources of water pollution on construction sites include: diesel and oil; paint, solvents, cleaners and other chemicals; and construction debris and dirt. When land is cleared it creates the potential for soil erosion which may lead to silt-bearing run-off, wind-blown soils and sediment, and sediment erosion into resource areas. Silt and soil that runs into natural waterways may turn them turbid, which ultimately restricts sunlight filtration and may affect aquatic life. The erosion and sedimentation controls during construction and water quality treatments designed for post construction assure that resource areas will not be detrimentally impacted by this project.

1.7 Endangered, Protected or Species of Concern

Reference to the June 2016 Natural Diversity Database Mapping shows the property may be subject to known listed species. The construction activity will not threaten the continued existence of any species listed pursuant to section 26-306 of the Connecticut General Statutes as endangered or threatened and will not result in the destruction or adverse modification of habitat designated as essential to such species (see Appendix A).

1.8 Historic Preservation

Phase I and Phase II Archeological investigations were conducted on site. Any areas of archeological sensitivity or concern as identified by the SHPO will be preserved.

2. Erosion & Sedimentation Control BMP’s

Detailed Erosion and Sedimentation control measures have been outlined on the plans and are in accordance with the 2002 Guidelines.

2.1 Minimize Disturbed Areas and Protect Natural Features

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.

2.1.1 Keep Land Disturbance Minimized

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 outlets are stable before conveying storm drainage flow into them.
- Schedule construction so that final grading and stabilization is completed as soon as possible.

2.2 Phase Construction Activities

The project will disturb a total of approximately 29 acres over the duration of the construction (generation facility and switchyard). This disturbance consists of grading to create minimally sloped areas for site facilities and buildings, access roadway, facilities building, support buildings and parking. The clearing and grading activities will commence prior to any buildings or infrastructure with all required tree removal conducted as a single phase. Site work will be done per the sequence outlined on the design plans and as listed below. All construction will be conducted in accordance with the 2002 CTDEEP Guidelines for Soil Erosion and Sediment Control (the Guidelinesò). The construction will generally proceed as follows:

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 walls as fills are being placed adjacent to wetlands area and as cuts are made for the switchyard. Required rock blasting shall be conducted in accordance with Section 3.6 of this Plan and with applicable state and local regulations.
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 5ô 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 2ô 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. With the exception of blasting, sequence is essentially repeated for both sides of Lake Road.

2.3 Control Stormwater Flowing onto and Through the Project

2.3 .1 Slow the Flow

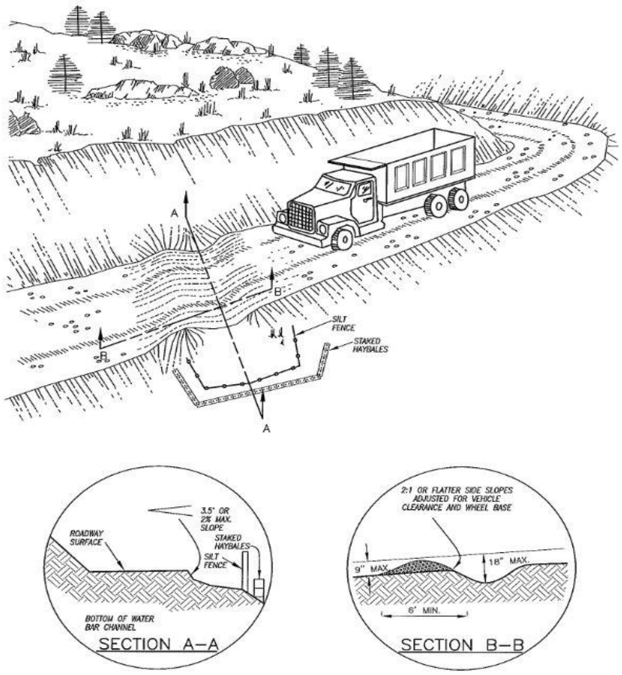
Detachment and transport of eroded soil must be kept to a minimum by absorbing and reducing the erosive energy of water. The erosive energy of water increases as the volume and velocity of runoff increases. The volume and velocity of runoff increases during development as a result of reduced infiltration 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 evaluating the potential for downstream flooding or erosion.

2.3.2 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.



WATER BAR DETAIL
NOT TO SCALE

2.4 Preserve & Stabilize Soils

The preserved areas of existing vegetation, as identified on the site plans, will be flagged in the field prior to clearing. Vehicles and equipment will be kept away from these areas. Topsoil stripped from the immediate construction area will be stockpiled as identified on the site plans. The stockpiles will be in areas that will not interfere with construction phases and at least 15 feet away from areas of concentrated flows or pavement. The slopes of the stockpiles will not exceed 2:1 to prevent erosion. A silt fence or wood chip berm will be installed around the perimeter of each stockpile immediately upon formation. Stockpiles that will stand for more than 30 days will be stabilized with temporary seeding PER Figure TS-2.

- <u>Topsoiling</u> including the stripping and reapplication of topsoil to promote the growth of vegetation following establishment of final grades. Distribute topsoil evenly to a minimum depth of 4ò.
- <u>Land Grading Restrictions</u> such as minimizing slope lengths, reverse benches for slopes exceeding 15ô in height, and compacting cuts and fills to reduce erosion for establishment of a stable slope.
- Provide <u>Surface Roughening</u> with tracked machinery up and down slopes to create horizontal depressions in the soil.

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

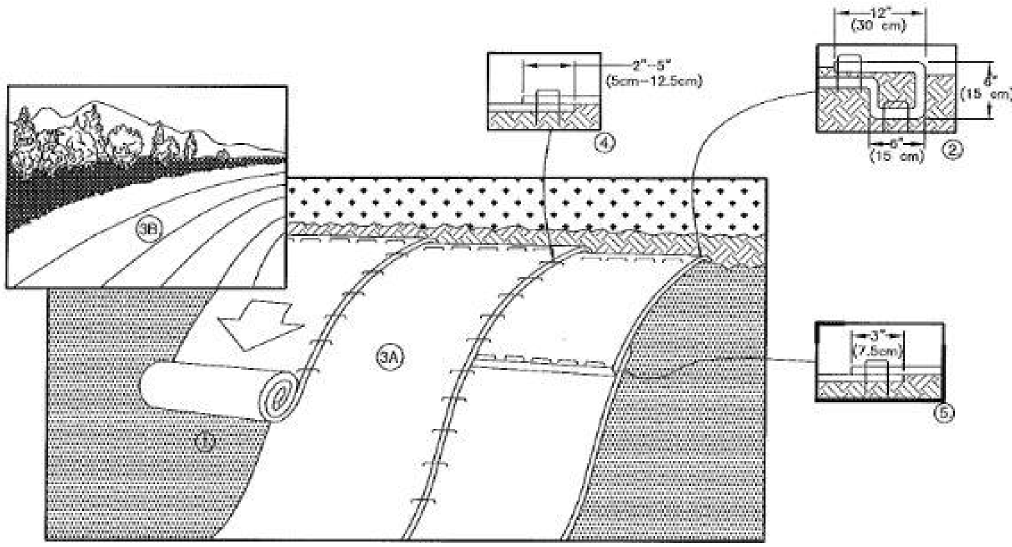
[1] May be planted throughout summer if soil moisture is adequate or can be irrigated. Fall seeding may be extended 15 days in the coastal towns.
[2] Seed at twice the indicated depth for sandy soils.
[3] See Permanent Seeding **Figure PS-3** for seeding mixture requirements.
[4] Listed species may be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

Source: USDA, NRCS

2.5 Protect Slopes

Provide erosion control blanketing/turf reinforcement Mats on slopes greater than 3:1.

Geotextile erosion control blankets or jute netting will be used to provide stabilization for slopes. The blanket will cover the entire area of the graded slopes which will be seeded and mulched before the blanket is applied. The blanket will be installed by digging a small trench on the upside of the slope, 12 inches wide by 6 inches deep, and stapling the leading edge of the blanket in the trench. The blanket will be rolled down the slope slowly to maintain soil contact and stapled in 12-inch intervals. If the blanket cannot cover the entire slope, the blankets will be overlapped (minimum of 2 inches) and stapled at the overlapped edge. The erosion control blanket will always be installed according to the manufacturer's instructions and specifications.



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:

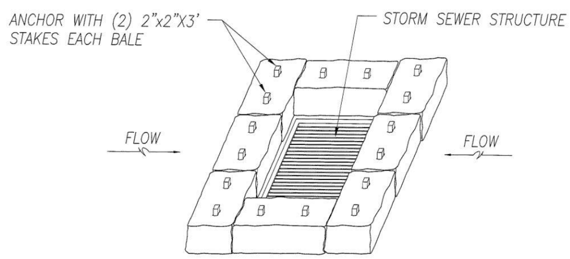
1. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15cm) MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.
2. TURF REINFORCEMENT MAT SHALL BE NORTH AMERICAN GREEN P-300® OR APPROVED EQUIVALENT.

TURF REINFORCEMENT MAT INSTALLATION

NOT TO SCALE

2.6 Protect Storm Drain Inlets

Storm drains may be protected from sediment by installation of staked haybales prior to paving. After the first course of pavement has been installed, silt socks or sacks, crushed stone berms or stone filled geotextile may be used.

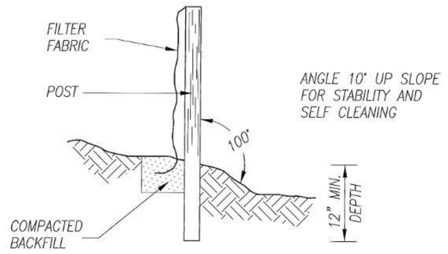


HAYBALE INSTALLATION
AT CATCH BASIN

2.7 *Establish Perimeter Controls & Sediment Barriers*

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 costly 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.

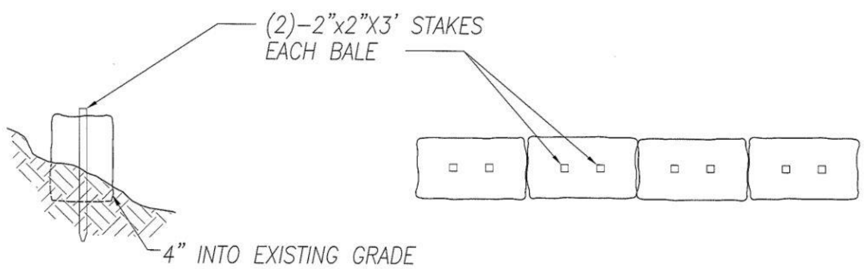


SILT FENCE

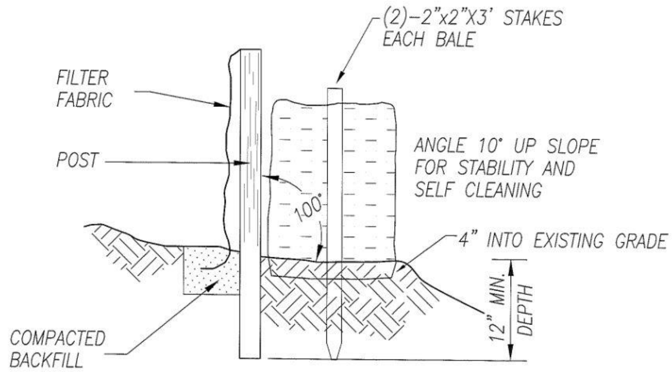
NOT TO SCALE

The silt fence barrier will be installed by excavating a 6-inch-deep trench. Wooden posts supporting the silt fence will be spaced 2 to 3 feet apart and driven securely into the ground; a minimum of 18 to 20 inches deep. The bottom edge of the silt fence will extend across the bottom of the trench and the trench will be backfilled and compacted to prevent stormwater and sediment from discharging underneath the silt fence.

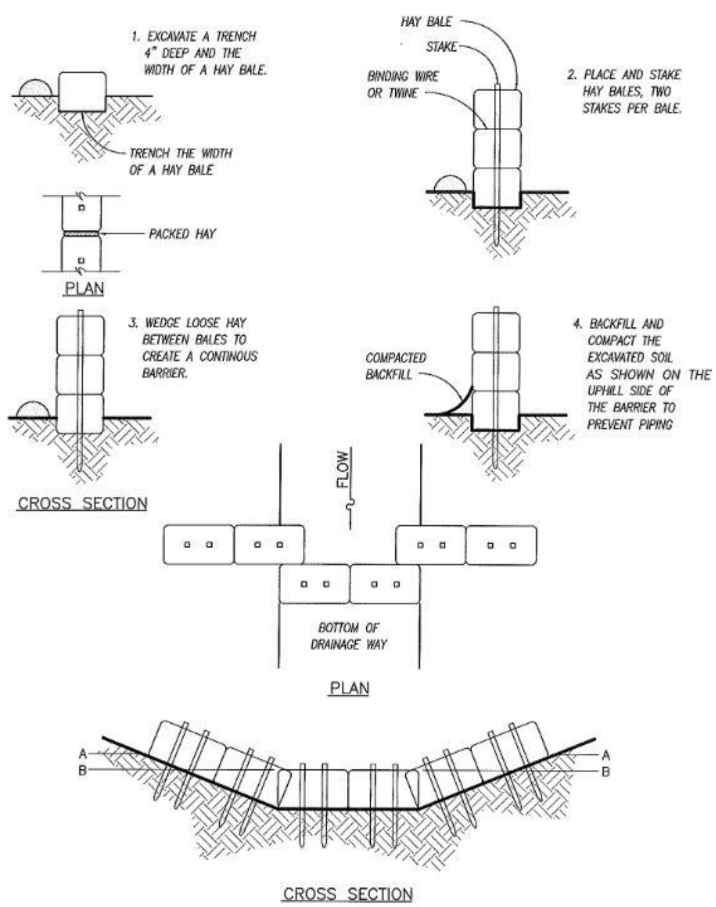
Hay bales may be utilized in lieu of silt fencing or as backing for silt fence in areas of excessive or problematic erosion. Bales may also be utilized as check dams in temporary swales or as protection around catch basins prior to paving.



HAYBALE BARRIER



SILT FENCE – BACKED WITH HAYBALES



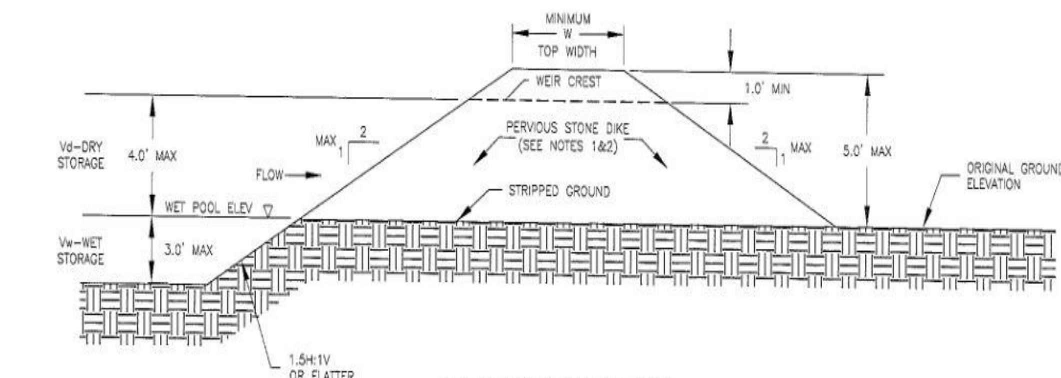
HAYBALE CHECK DAM

NOT TO SCALE

2.8 Construct Temporary Sediment Basins & Diversion Channels

Temporary Sediment Basins are designed and installed to intercept and retain sediment during construction. They prevent erosion and sediment near the source and reduce and/or abate water body impacts, prevent deposition of sediment into undeveloped or undisturbed areas. Basins should be constructed with controlled outlets and designed to have wet and dry storage capacities. Basins may be created by constructing a dam to trap and impound surface water (an embankment basin) or by excavation (an excavated sediment basin), or a combination of both. Method of construction shall be as shown in the detail below and in the locations shown on the design plans.

Diversion channels are constructed with a berm of tamped or compacted soil placed in a manner to divert runoff flows. They are typically constructed to divert sediment laden soils from disturbed areas to temporary sediment basins or to divert clean runoff away from disturbed areas of 25 acres or less. Refer to Figure TD-1 from the 2002 Guidelines. For diversions with slopes of greater than 2%, the necessity for stabilization of the channel should be evaluated (e.g. temporary seeding, riprap, erosion control blankets). For these channels, stone or wood chip check dams should be installed at every 2ô of grade change to slow and filter sediment laden stormwater.



TEMPORARY SEDIMENT TRAP
EMBANKMENT CROSS SECTION
NOT TO SCALE

TOP WIDTH VS. HEIGHT

H = HEIGHT OF EMBANKMENT
W= TOP WIDTH OF EMBANKMENT

H(ft)	W(ft)
1.5	2.0
2.0	2.0
2.5	2.5
3.0	2.5
3.5	3.0
4.0	3.0
4.5	4.0
5.0	4.5

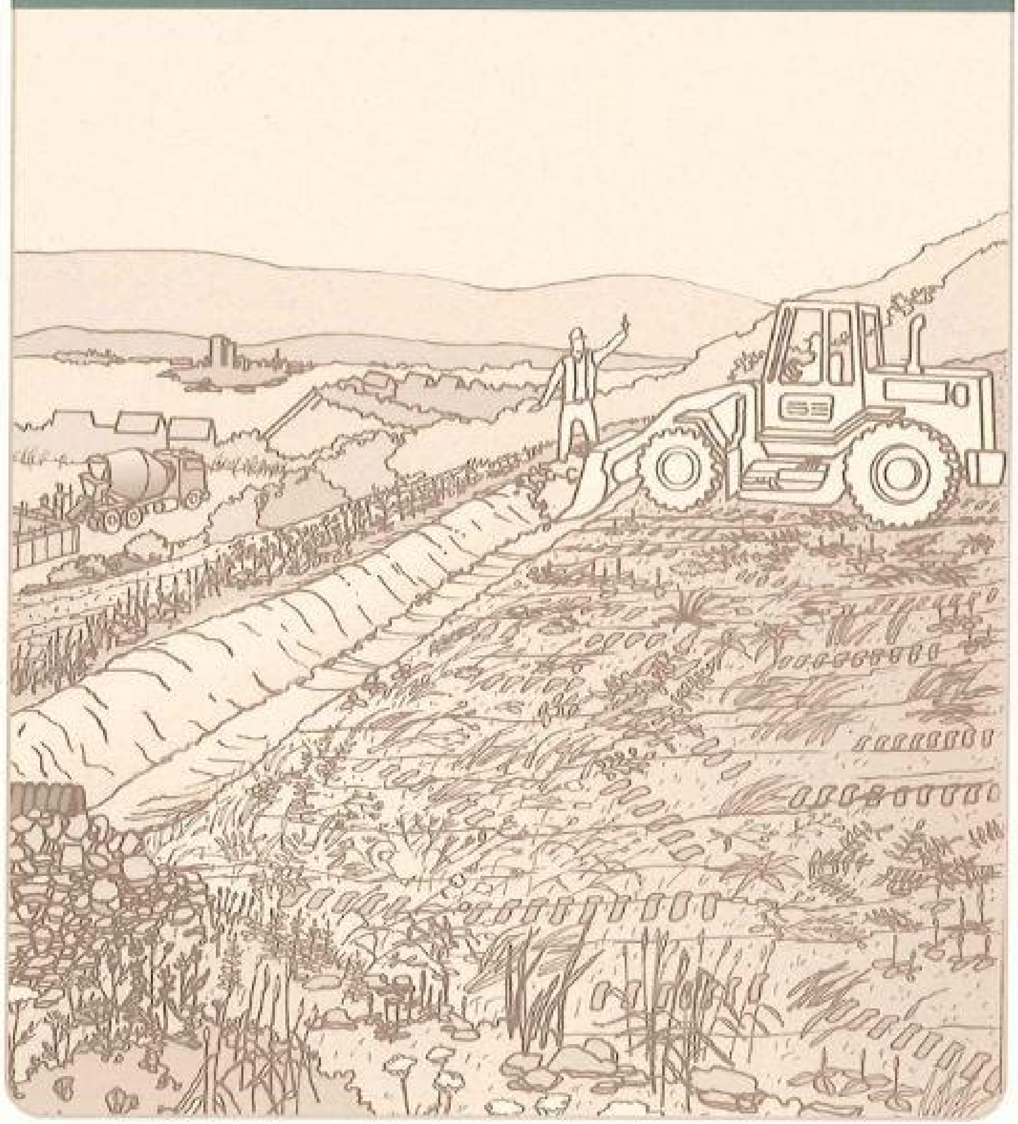
NOTES:

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE 2002 CONNECTICUT GUIDELINES FOR SOIL AND EROSION CONTROL, SECTIONS 5-11-25 THRU 5-11-29.
2. PERVIOUS STONE DIKE SHALL BE CONSTRUCTED OF MODIFIED RIPRAP (CTDOT M.12.02) WITH #3 STONE ON FACE (CTDOT M.01.01).
3. NON-OVERFLOW PORTIONS AND ABUTMENTS OF TEMPORARY SEDIMENT TRAPS MAY BE CONSTRUCTED OF ENGINEER APPROVED BACKFILL COMPACTED IN 9" LAYERS. USE ONLY MATERIAL FOR THE EMBANKMENT THAT IS FREE FROM EXCESSIVE ORGANICS, DEBRIS, ROCKS OVER 6" IN DIAMETER OR OTHER UNSUITABLE MATERIALS.
4. IF, IN THE JUDGEMENT OF THE ENGINEER, MATERIALS FROM ON-SITE EXCAVATION ACTIVITIES ARE NOT SUITABLE FOR CONSTRUCTION OF SEDIMENT TRAP EMBANKMENTS, MATERIALS SHALL BE IMPORTED TO THE SITE.
5. EARTHEN EMBANKMENTS SHALL BE STABILIZED WITH TEMPORARY SEEDING, PERMENANT SEEDING OR STONE SLOPE PROTECTION IMMEDIATELY AFTER INSTALLATION.
6. TEMPORARY SEDIMENT TRAP(S) SHALL BE INSPECTED AT LEAST ONCE PER WEEK AND WITHIN 24 HOURS OF THE END OF A STORM OF 0.5 INCHES OF RAINFALL OR GREATER. REMOVE ACCUMULATED SEDIMENT WHEN ONE HALF OF THE MINIMUM WET STORAGE VOLUME HAS BEEN FILLED. DISPOSE OF REMOVED SEDIMENT IN A SUITABLE AREA AND IN SUCH A MANNER THAT IT WILL NOT ERODE.

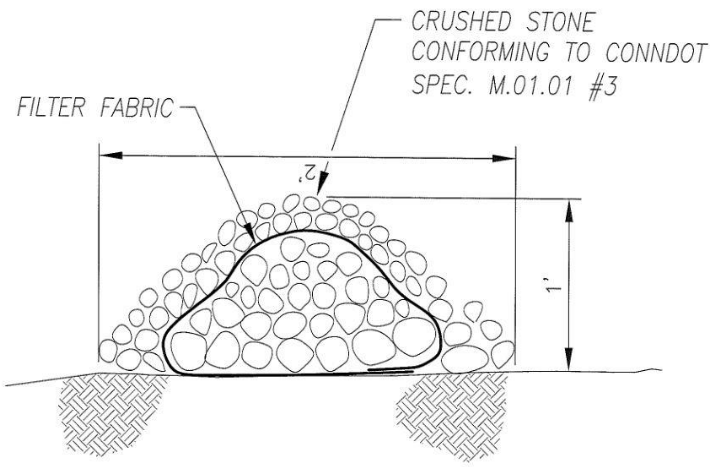
The erosion and sedimentation control design calls for temporary diversion channels during construction per figure TD-1 above to convey overland runoff from and around disturbed areas to temporary sediment basins. Temporary diversions are typically constructed with a berm of tamped or compacted soil placed in a manner to divert flows. Their purpose is to:

- Divert sediment-laden runoff from a disturbed area to a sediment-trapping facility such as a temporary sediment trap, sediment basin r vegetative filter.
- Divert water originating from undisturbed areas away from where construction activities are taking place.
- Fragment disturbed areas which thereby reduce the velocity and concentration of runoff.

Figure TD-1 Requirements for Non-Engineered Temporary Diversions



Stone check dams placed at 50ô intervals within the temporary diversions will assist in reducing velocities and providing a filtering mechanism for removal of sediment.

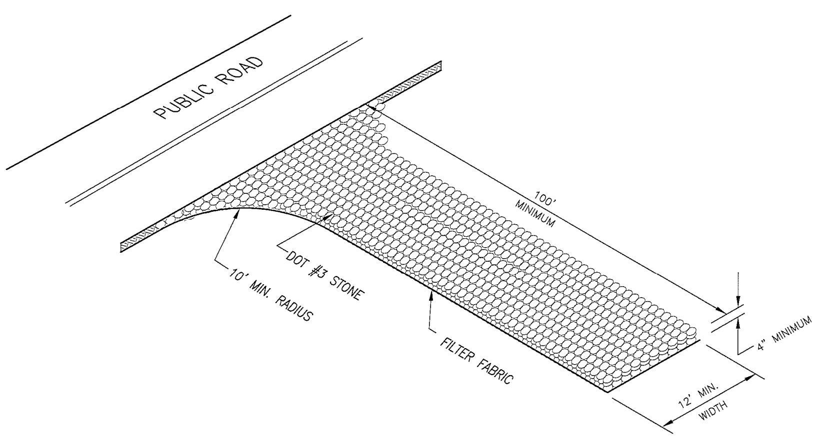


STONE CHECK DAM

NOT TO SCALE

2.9 Establish Stabilized Construction Entrances

Install stabilized construction entrances/anti tracking pads at any and all access/egress points to the site to prevent tire tracked soils and sediment onto paved surfaces.



CONSTRUCTION ENTRANCE

NOT TO SCALE

Construction shall be in accordance with 5-12-2 of the 2002 guidelines. These pads shall be maintained by the addition of stone or lengthening of the entrances as necessary to alleviate sediment transport.

2.10 Additional BMP's

2.10.1 Dust Control

Dust control measures should be taken when it has been determined that other measures for stabilization cannot be practically applied.

- Mechanical Sweeping shall be used on paved areas where dust and fine materials accumulate as a result of truck traffic or wind and water deposits from adjacent areas. Sweep daily in heavily trafficked areas.
- Apply water to exposed soil surfaces and unpaved travel ways.
- Non-asphaltic soil tackifiers may be use consisting of an emulsified liquid soil stabilizer of organic, inorganic or mineral origin. The solutions shall be non-toxic to human, animal or plant life, non-corrosive and nonflammable. Materials shall meet local, state nd federal guidelines for intended use and shall be applied per the manufacturerǿs recommendations.

2.10.2 Wood Chips

Clearing of brush and woody vegetation for the purposes of construction will generate wood chips when unmarketable wood is chipped and slashed on site. These chips may be utilized as berms around the perimeter of site disturbances, check dams in swales where slopes are 3% or less, reinforcement behind silt fencing in areas of persistent problematic erosion. They may also be utilized as mulch and spread over exposed surfaces to prevent erosion from rain drop impact; an approved per EPA National Pollutant Discharge Elimination System (NPDES). http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=41

Chips may also be combined with compost to create filter berms to prevent sediment transport. In a combined effort, the Connecticut Department of Transportation and the CTDEEP collaborated on a 2-year research project to demonstrate the effectiveness of this application.
http://www.ct.gov/deep/cwp/view.asp?A=2718&Q=325354

3 Good Housekeeping BMP's

3.1 Material Handling & Housekeeping

This section sets forth the requirements for handling, storage, and disposal of material. It specifically addresses the requirements for storing material in open areas; stacking bagged material; storing material in bulk; storing lumber; storing bricks and masonry blocks; handling and storing cement and lime; handling and storing reinforcing sheet and structural steel; handling and storing pipe, conduit, and cylindrical material; storing sand, gravel, and crushed stone; handling and storing flammable and combustible liquids; handling asphalt and tar products; handling liquefied petroleum gas & diesel; and housekeeping.

Materials shall be stored in a manner that does not endanger worker safety. Hazardous materials shall be stored in accordance with the individual requirements. Store all materials on pallets and immediately clean up spills and leaks that could create environmental issues.

- Stack lumber on level and solidly supported sills so that the stacks are stable. Do not pile lumber more than 16 feet high.
- Bagged concrete, mortar or lime shall be stacked on pallets and kept covered at all times. Broken or torn bags shall be removed and disposed of offsite.
- Make sure cylindrical materials are stable when storing or handling. Stacking. Place pipe, conduit bar stock, and other cylindrical materials in racks or stack and block them on a firm, level surface to prevent spreading, rolling, or falling. Use either a pyramided or battened stack. Step back battened stacks at least one unit per tier and securely chock them on both sides of the stack.
- Locate stockpiles to provide safe access for withdrawing material. Material or vertical faces must not overhang. Stockpiles shall be surrounded with silt fence, staked haybales or wood chip berms to prevent erosion from the stockpiles or flow of water into them. Topsoil stockpiles left for more than 30 days shall be over seeded in accordance with Table TS-2, Section 2.4.
- Most flammable and combustible liquids are highly toxic. Use them only after determining their toxic characteristics. In handling toxic liquids, follow the appropriate safety and health requirements in the ñOccupational Healthò section.
- Closed tanks and containers for combustibles shall not exceed the requirements as outlined in the following table:

	-Maximum allowable size of containers and portable tanks, combustible				
	Flammable liquids			Liquids	
Container type	Class IA	Class IB	Class IB	Class II	Class III
Glass	1 pint	1 quart	1 gallon	1 gallon	5 gallons
Metal	1 gallon	5 gallons	5 gallons	5 gallons	5 gallons
Safety cans	2 gallon	5 gallons	5 gallons	5 gallons	5 gallons
Metal drums	60 gallons	60 gallons	60 gallons	60 gallons	60 gallons
Approved portable tanks	660 gallons	660 gallons	660 gallons	660 gallons	660 gallons
Polyethylene	1 gallon	5 gallons	5 gallons	60 gallons	60 gallons

- **Outdoor Housekeeping -** Keep the areas adjacent to facilities free from rubbish, waste, and tall, dry vegetation. Place combustible waste materials stored outdoors to await subsequent disposal at least 20 feet away from facilities.
- **Tools and Equipment** - To prevent tripping or injury, keep areas clear of tools and portable equipment. Adequately secure tools, materials, and equipment where a tripping hazard exists.
- **Wind** - Store loose or light materials on roofs or unenclosed height only if they are safely tied down or secured.
- **Sacks and Bags** - Remove empty bags that contained cement, lime, or other dust-producing material from the work area at least daily.
- **Excavated Materials** - Keep drives and walkways clear of excavated materials wherever possible. Where this is not possible, adequately post or barricade these areas and provide alternative access.

3.2 Construction Staging Areas

Construction staging areas shall be located as shown on the plans or within locations approved by the site inspector or engineer. Designate where vehicles or construction trailers will turn around or park, where excavated soil or building materials will be stockpiled, where excavation equipment will be unloaded and loaded, where job-site waste will be stored for recycling, etc. Setting up and ensuring use of staging areas requires installation of a packed pervious surface, free of organics or erodible soils. In areas of soft soils, installation of a geogrid prior to placement of a packed pervious surface may be necessary to stabilize surfaces for support of construction equipment and materials. Staging areas will be evaluated prior to the start of construction to assess surface treatment needs.

3.3 Designate Vehicle Fueling and Maintenance Areas

Designated fueling areas shall be designed to prevent stormwater runoff and spills. It is recommended that fuel-dispensing areas be paved with cement, concrete, or an equivalent impervious surface, with a two to four percent slope to prevent ponding, and separated from the rest of the site by a grade break or berm that prevents run-on of stormwater.

Where practical, fuel dispensing areas should be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area. The cover should not drain onto the fuel dispensing area. Use a perimeter drain or slope the surface inward so that runoff drains to a blind sump. It might be necessary to install and maintain an oil control device in catch basins that might receive runoff from the fueling area.

For fueling with a mobile fuel truck, consider establishing a designated fueling area. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain). A form of secondary containment should be used when transferring fuel from the tank truck to the fuel tank. Storm drains in the vicinity should also be covered. Install vapor recovery nozzles to help control drips as well as reduce air pollution. Fueling areas should have a spill prevention plan and necessary spill kits located nearby.

General Fueling Requirements:

- When fueling must occur onsite, the contractor shall select and designate an area to be used, subject to approval of the Project Engineer or designee of the Town.
- Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on fueling trucks and shall be disposed of properly after use.
- Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.
- Dedicated fueling areas shall be protected from storm water run-on and runoff, and shall be located at least 100 feet from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.
- Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut-off to control drips. Fueling operations shall not be left unattended.
- Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills.
- Fuel tanks shall not be "topped-off."

- Vehicles and equipment shall be inspected on each day of use for leaks. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.
- Absorbent spill clean-up materials shall be available in fueling and maintenance areas and used on small spills instead of hosing down or burying techniques. The spent absorbent material shall be removed promptly and disposed of properly.
- Federal, state, and local requirements shall be observed for any stationary above ground storage tanks.
- Mobile fueling of construction equipment throughout the site shall be minimized. Whenever practical, equipment shall be transported to the designated fueling area.
- Fueling areas and storage tanks shall be inspected regularly.
- Keep an ample supply of spill cleanup material on the site.
- Immediately cleanup spills and properly dispose of contaminated soil and cleanup materials.

3.4 Vehicle Washing & Maintenance

The plans as presented do not consider on-site vehicle washing. Ideally, vehicle maintenance and washing occurs in garages and wash facilities, not on active construction sites. However, if these activities must occur onsite, operators should follow appropriate BMPs to prevent untreated nutrient-enriched wastewater or hazardous wastes from being discharged to surface or ground waters. Appropriate BMPs include the following:

- Provide a covered, paved area dedicated to vehicle maintenance and washing;
- Ensure that the areas are properly connected to a liquids collection system;
- Develop a spill prevention and cleanup plan;
- Prevent hazardous chemical leaks by properly maintaining vehicles and equipment;
- Properly cover and provide secondary containment for fuel drums and toxic materials;
- Properly handle and dispose of vehicle wastes and wash water;

Inspect construction vehicles daily, and repair any leaks immediately. Dispose of all used oil, antifreeze, solvents and other automotive-related chemicals according to manufacturer instructions. These wastes require special handling and disposal. Used oil, antifreeze, and some solvents can be recycled at designated facilities, but other chemicals must be disposed of at a hazardous waste disposal site.

Designate areas for vehicle repair. If cleaning is necessary, use blowers or vacuums instead of water to remove dry materials from vehicles if possible. Water alone can remove most dirt adequately, use high-pressure water spray without detergents at vehicle washing areas. If detergents must be used avoid phosphate- or organic-based cleansers to reduce nutrient enrichment and biological oxygen demand in wastewater. Use only biodegradable products that are free of halogenated solvents. Clearly mark all washing areas.

3.5 Spill Prevention & Control

Small spills (5 gallons or less) of fuels, oils, chemicals or solvents at the site can be cleaned up in accordance with the following procedure:

1. Have proper protective equipment available for personnel cleaning up the spill.
2. Contain the spill - Oil Absorbent Socks are a containment option for smaller spills. Often used for quick containment around vehicles, valves, small leaks and machines, these absorbents are flexible enough to be quickly molded and curved to fit around a spill area
3. If the spill is from an equipment leak, stop the leak while using the proper protective equipment and ventilation.
4. Clean up small spills and leaks immediately using mops, rags, cloth, sawdust or compatible chemical binders such as bentonite, vermiculite or sawdust. If leak occur on a soil surface, remove the contaminated soil completely as soon as practical.
5. Place solvent-laden materials and/or binders in a covered, solvent-resistant metal container.
6. Arrange for proper waste disposal

For larger spills, contact local and state authorities:

Dayville Fire Department: 911 or 860-774-5525

CTDEEP Emergency Response & Spill Prevention: 866-377-7745

3.6 Rock Blasting

A. Best Management Practices for Blasting.

All activities related to blasting shall follow Best Management Practices (BMPôs) to prevent contamination of ground and surface water including:

- Preparing, reviewing and following an approved blasting plan;
- Proper drilling, explosive handling and loading procedures;
- Evaluating blasting performance;
- Handling and storage of blasted rock.
- Groundwater well monitoring

(1) Loading practices

The following blast hole loading practices to minimize environmental effects shall be followed

(a) Drilling logs shall be maintained by the driller and communicated directly to the blaster. The logs shall indicate depths and lengths of voids, cavities, and fault zones or other weak zones encountered as well as groundwater conditions.

(b) Explosive products shall be managed on-site so that they are either used in the bore hole, returned to the the delivery vehicle, or placed in secure containers for off-site disposal.

(c) Spillage around the borehole shall either be placed in the borehole or cleaned up and returned to an appropriate vehicle for handling or placement in secured containers for off-site disposal.

(d) Loaded explosives shall be detonated as soon as possible and shall not be left in the blastholes overnight, unless weather or other safety concerns reasonably dictate that detonation should be postponed.

(e) Loading equipment shall be cleaned in an area where wastewater can be properly contained and handled in a manner that prevents release of contaminants to the environment.

(f) Explosives shall be loaded to maintain good continuity in the column load to promote complete detonation. Industry accepted loading practices for priming, stemming, decking and column rise shall be attended to.

(2) Explosive Selection.

The following BMPs shall be followed to reduce the potential for ground or surface water contamination when explosives are used:

(a) Explosive products shall be selected that are appropriate for site conditions and safe blast execution.

(b) Explosive products shall be selected that have the appropriate water resistance for the site conditions present to minimize the potential for effect of the product upon ground or surface water.

(3) Prevention of Misfires.

Appropriate practices shall be developed and implemented to prevent misfires.

(4) Muck Pile Management.

Muck piles (the blasted pieces of rock) and rock piles shall be managed in a manner to reduce the potential for contamination by implementing the following measures:

(a) Remove the muck pile from the blast area as soon as reasonably possible.
(b) Manage the interaction of blasted rock piles and stormwater to prevent contamination of surface water.

(5) Groundwater Well Monitoring

A pre-blast survey of existing conditions shall be performed to evaluate structures of concern and all structures located within 250ô of blasting locations, including groundwater wells. Well levels will be monitored throughout the entirety of the blasting process.

4. <u>Post Construction BMP's</u>

For the purposes of this report, post construction BMPôs for impervious surfaces are separated into 3 categories:

1. <u>Overland Flow Erosion Control</u> ï Minimizing the release and suspension of pollutants, particularly erosion of roadway or paved surfaces shoulders by drainage. Erosion control BMPs typically are installed in the form of pervious cover (vegetation, etc.) or energy dissipation devices.
2. <u>Roadway Drainage Conveyance</u> ï Effectively and safely removing water from the roadway or other critical areas of the infrastructure (i.e. steep roadway shoulders or banks). Conveyance BMPs operate as either open (spillway, channel, etc.) or closed (culvert, conduit pipe, etc.) systems.
3. <u>Water Quality and Treatment</u> ï Water quality and treatment BMPs focus on the treatment (pollutant displacement/removal) of stormwater before discharging to and/or beyond the storm drain. Treatment BMPs operate by means of sedimentation, infiltration, filtration, and biological degradation.

The plans, drainage computations and stormwater management methods will need to be reviewed and approved by the CTDEEP in conjunction with a 401 Water Quality Certification <u>and</u> for the General Permit for Discharge of Stormwater Associated with Construction Activities. All proposed discharges and pre-treatment prior to this discharge points were designed to be in accordance with the 2004 Water Quality Guidelines. Where ever possible, non-structural methods of stormwater treatment have been implemented.

- Post construction control measures include promotion of groundwater recharge through pervious surfaces, as well as the construction of stormwater depressions for roof drainage, overland flow and sheet flow from pavement. A large portion of the stormwater from paved surfaces will be collected and treated by a large stormwater basin and discharged to a riprap level spreader constructed on level ground.
- Suspended solid and floatable removal is provided with sumped catch basins with hoods or elbow inserts. The goal of 80% of the annual anticipated sediment load can be achieved with these mechanisms.

- Velocity dissipation is achieved by the design and installation of riprap outlet protection. Flows from these devices discharge to gently sloped vegetated surfaces prior to final discharge to resource areas.
- Runoff reduction is accomplished by encouraging infiltration where practical and extended overland flows.

At the completion of construction, all stormwater collection and treatment devices should be inspected and cleaned in accordance with the plans, including but not limited to the removal of sediment from catch basin sumps & treatment devices, removal of silt fencing adjacent to stabilized areas, inspection of outlets for evidence of erosion or accumulation of sediment, inspection of detention & retention basins and removal of debris and sediment, removal of construction entrances. In addition, paved areas should be thoroughly swept and vegetated surfaces should be inspected to determine whether replacement plantings are necessary.

5. Drainage Summary

The drainage calculations separate drainage into 3 discharge points with a final analysis at the property boundary. More than half of the watershed analyzed will remain in its existing wooded condition.

The calculations utilized HydroCAD® Stormwater Modeling System, a computer model, to analyze pre and post development drainage conditions, and to aid in the design of the stormwater detention/infiltration system. The model used the Soil Conservation Service TR-20 method with a Type III 24-hour rainfall to calculate the runoff. The 2, 10 and 100-year extreme precipitation storms were analyzed to evaluate peak runoff flow to 3 wetlands sections, the switchyard and site and perimeter for pre and post construction conditions. All HydroCAD summaries and drainage area maps are included for reference herein as Attachment 3.

5.1 Drainage to Wetlands

Table 1 summarizes the proposed peak runoff flows to the eastern wetland (Drainage Area 1S to 1R). This drainage area is defined on the enclosed drainage area mapping and has been rounded to the nearest 0.1 CFS

Table 1: Summary of Existing and Proposed Peak Flows to East Wetland (1R)*

Design Storm	Depth (in)	Existing Peak	Proposed Peak
2-Year	3.32	3.70 CFS	2.14 CFS
10-Year	5.16	17.86 CFS	8.28 CFS
100-Year	8.09	50.36 CFS	21.34 CFS

*All flows are in CFS (cubic feet per second)

Table 2: Summary of Existing and Proposed Peak Flows to West Wetland (2R)

Design Storm	Depth (in)	Existing Peak	Proposed Peak
2-Year	3.32	2.71 CFS	3.04 CFS
10-Year	5.16	12.17 CFS	12.81 CFS
100-Year	8.09	33.30 CFS	38.53 CFS

As shown in Table 2, the post-construction peak runoff rates at this point are higher than pre-construction for all design storms. However, these increases are contained on site and do not peak simultaneously with the other analyzed points. The net result are decreases in peak runoff rates at the point at which runoff discharges from the property as seen below in table 3.

Table 3: Summary of Existing and Proposed Peak Flows from Central Wetlands At Eastern Property Line

Design Storm	Depth (in)	Existing Peak	Proposed Peak
2-Year	3.32	6.95 CFS	6.51 CFS
10-Year	5.16	34.43 CFS	29.94 CFS
100-Year	8.09	99.04 CFS	98.52 CFS

As shown in Table 3, the post-construction peak runoff rates are equal to or less than pre-construction for all design storms with the exception of the 100-year storm which results in a negligible increase of 0.5%. This has been accomplished by re-routing drainage areas to proposed detention/water quality basins which include sediment forebays and/or bioretention and dry basins for groundwater recharge. Replacement of forested terrain with grassed, gravel and paved areas due to the construction of the proposed facility require these basins.

A small portion of the northern site (the Generating Facility site) discharges east via sheet flow; flow in this direction will continue in the same manner. Table 2 summarizes existing and proposed peak discharge rates at the eastern property boundary (Drainage Area 4S).

Table 2: Summary of Existing and Proposed Peak Flows East

Design Storm	Depth (in)	Existing Peak	Proposed Peak
2-Year	3.32	0.44 CFS	0.10 CFS
10-Year	5.16	2.74 CFS	1.81 CFS
100-Year	8.09	8.10 CFS	8.80 CFS

As the calculations demonstrate, there will be slight increases in peak runoff rates east for the 100-year frequency storm but these peaks will be metered by construction of a small depression in the landscape to act as a retention area. The increase will be negligible as it is not a direct (point) discharge from the property.

The switchyard on the southern side of Lake Road will be comprised substantially of a crushed stone surface that will sheet flow to wetlands located predominantly off site and within the CL&P right of way. The site drains in the same manner presently. Table 3 summarizes existing and proposed peak flows to this wetland area.

Table 5: Summary of Existing and Proposed Peak Flows from Switchyard

Design Storm	Depth (in)	Existing Peak	Proposed Peak
2-Year	3.32	1.83 CFS	0.53 CFS
10-Year	5.16	7.06 CFS	6.14 CFS
100-Year	8.09	18.2 CFS	16.08 CFS

Peak runoff rates from the Switchyard will sheet flow overland through the proposed crushed stone surface, to the proposed basin, and ultimately discharge to the wetlands system associated with the existing CL&P right of way. Peak runoff rates will be slightly reduced for all design storms.

5.2 Discharge Volume

Although the discharge rate to the central wetlands is significantly reduced for most design storms, it is important to preserve the hydrology of this area. Increased volumes will not adversely affect the wetland or cause erosion of stream banks, on and off the subject site as discharge rates are controlled. The following table lists pre and post construction discharge volumes to the wetlands for each design storm:

Table 4: Summary of Existing and Proposed Discharge Volume To Central Wetlands in acre-feet

Design Storm	Depth (in)	Existing Volume	Proposed Volume
2-Year	3.32	1.598	2.149
10-Year	5.16	4.999	6.106
100-Year	8.09	12.326	13.933

The central portion wetland on site will continue to discharge off site to the northeast as it does presently. As shown in the computations, this wetland acts as a natural attenuator for existing and proposed flow discharges.

The calculations demonstrate that with construction of the tiered stormwater basin, overland flow and the creation of shallow depressions within the terrain, peak discharge rates to the wetlands will be reduced while the total volume of water to the wetlands will not be. Drainage from impervious areas will be collected, treated and discharged to the basins which ultimately will continue to recharge the wetland areas.

Some of the drainage from building rooftops and overland will be discharged to the ground or to shallow points in the terrain where ever possible to encourage sheet flow, infiltration, and to slow the rate of water movement throughout the site. Roof coverings will be comprised of painted standing seam surfaces which are not prone to corrosion or the release of contaminants with rain events.

5.3 Infiltration/Groundwater Recharge

Groundwater recharge volume (GRV) is calculated using the hydrologic soil group approach per the State of CT 2004 Stormwater Quality Manual. For hydrologic soil group ñBò, average annual recharge is 12ò per year and the recharge depth (D) is 0.25ò. The net increase in impervious surface for the runoff to the proposed stormwater basin is 39.3%. Utilizing this information, the required GRV is (D)(A)(I)/12 = (0.25)(16.3)(.39)/12 = 0.132 acre-feet (5,770 cubic feet).

Due to the presence of a till layer for most of the soils throughout the property, it is generally presumed that any water that percolates through the topsoil and subsoil layers will follow the till layer generally toward the wetlands. This condition was evidenced in the spring of this year as discharge of groundwater was noted adjacent to wetlands areas. Much of the site will be stripped deeply into the till layer and final grades will be met by amending the till with subsoil that will be stripped from the site prior to replacement of topsoil; thereby encouraging the same movement of groundwater through the site.

Although some infiltration will be achieved when the site is complete, the drainage design incorporates ñstorageò of water in stone layers within the stormwater basins and recharge trenches that will slowly infiltrate after the termination of storm events. Following is a summary of the proposed storage of water to be utilized for recharge:

Table 5: Summary of Groundwater Recharge Volume

Basin	Volume (c.f.)	Volume (ac-ft)
Basin 1	2,642	0.06
Basin 2	1,152	0.026
Basin 3	7,761	0.178
TOTAL	11,555	0.264

The required GRV is nearly double the required amount. Additional groundwater recharge is accomplished by the construction of small depressions in the terrain throughout the site as well as within the proposed crushed stone surfaces; these volumes are not accounted for in the computations.

6. Inspections & Reporting

6.1 Inspection Procedure

Within the first 30 days following the commencement of construction activity, the permittee shall contact the Town of Killingly or the project inspecting engineer to review site conditions. The site shall be inspected at least monthly during the first 90 days to insure proper installation of erosion control measures.

The site shall be routinely inspected for compliance with the General Permit and the Plan for the site until a Notice of Termination has been submitted. At least once a week and within 24 hours of a storm that generates a discharge, the qualified inspector shall inspect (at a minimum) the following:

- Disturbed areas of construction activity that have not been stabilized;
- All erosion and sedimentation control measures;
- All structural control measures; soil stockpile areas;
- Washout areas and site entrances;

These areas shall be inspected for evidence of or the potential for off-site impacts and sediment tracking. For storms that fall on a weekend, holiday or after a point where regular working hours will not commence for greater than 24-hours, inspections are required only for storms that equal or exceed 0.5ò.

The qualified inspector shall evaluate the effectiveness of E&S controls, structural controls, stabilization practices, and any other controls implemented to prevent pollution and determine if it is necessary to install, maintain or repair such controls and/or practices to improve the quality of stormwater discharges.

6.2 Reporting

Reports shall be prepared and retained as part of the SWPPP and shall contain the following information:

- Scope of the inspection;
- Name & qualifications of the qualified inspector generating the report;
- Date & weather conditions at the time of the inspection;
- Major observations regarding E&S controls;
- Descriptions of Stormwater Discharges;
- Any stormwater monitoring conducted during the inspection.

A sample report form is enclosed herein as Attachment 7; completed reports may be added to this section as record of inspections. The report should state whether the site is in compliance or out of compliance with the terms of the plans and permit. If the site is out of compliance, the report shall state the remedial actions required to bring the site back into compliance. Non-engineered corrective actions (i.e. silt fence repair, sediment removal, addition of E&S measures) shall be corrected within 24 hours of reporting. Engineered corrective actions (re-design of engineered controls) shall be implemented within 7 days of reporting and shall be incorporated into revised plans within 10 days of reporting.

Inspectors from the DEEP and Town may inspect the site ate any time for compliance with the anticipated General Permit or in terms of approval conditions from state and local authorities. These inspections may take place at any time while construction activities are being conducted or to review post-construction stormwater management measures.

6.3 Keeping Plans Current

The Permittee is responsible for keeping their Plan in compliance with the General Permit at all times, including the following:

A. The Plan shall be amended by the Permittee if the actions required by the plan fail to prevent pollution or fail to otherwise comply with any provisions of the General Permit. The plan shall be immediately amended upon a change in contractor, change in design or construction, operation or maintenance at the site which has the potential for discharge of pollutants to the waters of the state which has not been otherwise addressed in the Plan.

B. The Commissioner of the CTDEEP (the ñDepartmentò) may notify the Permittee at any time that the Plan and/or the site do not meet one or more of the one or more of the minimum requirements of the General Permit. The Permittee shall make any required changes within 7 days upon receipt of such notification and then shall submit certification to the Commissioner within 15 days that the requested changes have been made and implemented.

7. Turbidity Monitoring Requirements

Turbidity monitoring shall be conducted monthly at least monthly with sampling procedure consistent with 40 CFR Part 136.

7.1 Monitoring Frequency

a. Sampling shall be conducted when there is a discharge from the site while construction activity is ongoing, until final stabilization of the drainage areas associated with each outfall is achieved.

b. The Permittee is only required to take samples during regular work hours. If sampling is discontinued at the end of regular working hours, sampling shall resume the next working day as long as the discharge continues.
c. Sampling may be suspended if at any time conditions exist that may reasonably pose a threat to the safety of the person sampling. Such conditions may include high winds, lighting, intense rainfall or other hazardous condition. When the unsafe condition is no longer present, sampling may resume.

7.2 Sample Collection

a. All samples shall be collected from discharges resulting from a storm event that occurs at least 24 hours after any previous storm event that generates a stormwater discharge. Sampling of snow or ice melt without a storm event is not a valid sample.
b. Samples shall be grab samples taken at least three (3) separate times during a storm event and shall be representative of the flow and characteristics of the discharge. Samples may be taken manually or with an in-situ turbidity probe or other automatic sampling device equipped to take turbidity readings. The first sample shall be taken within the first hour of stormwater discharge from the site. If samples are collected manually and the discharge begins outside of normal working hours, the first sample shall be taken at the start of normal working hours and shall be noted.

7.3 Sampling Locations

Sampling is required from point discharges of stormwater from disturbed areas. Sampling points shall be at proposed stormwater outfalls as they are installed throughout the project.

7.4 Monitoring Reports

A. Within thirty (30) days following the end of each month, permittees shall enter the stormwater sampling result(s) on the Stormwater Monitoring Report (SMR) form (available at www.ct.gov/deep/stormwater) and submit it in accordance with the NetDMR provisions as described below, or, if the permittee has opted out of NetDMR, to the following address:

Bureau of Materials Management and Compliance Assurance
Water Permitting and Enforcement Division (Attn: DMR Processing)
Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

If there was no discharge during any given monitoring period, the permittee shall submit the form as required with the words ñno dischargeò entered in place of the monitoring results.

If the permittee monitors any discharge more frequently than required by this general permit, the results of this monitoring shall be included in additional SMRs for the month in which the samples were collected.
If sampling protocols are modified due to the limitations of normal working hours or unsafe conditions in accordance with Section 5(c)(1)(A)(ii) or (iii) above, a description of and reason for the modifications shall be included with the SMR.

If the permittee samples a discharge that is representative of two or more substantially identical discharge points, the permittee shall include the names or locations of the other discharge points.

NetDMR Reporting Requirements

Prior to one-hundred and eighty (180) days after the issuance of a permit, the
Permittee may either submit monitoring data and other reports to the Department in hard copy form or electronically using NetDMR, a web-based tool that allows Permittees to electronically submit stormwater monitoring reports through a secure internet connection. Unless otherwise approved in writing by the commissioner, no later than one-hundred and eighty (180) days after the issuance of the permit the Permittee shall begin reporting electronically using NetDMR. Specific requirements regarding subscription to NetDMR and submittal of data and reports in hard copy form and for submittal using NetDMR are described below:

Submittal of NetDMR Subscriber Agreement

On or before fifteen (15) days after the issuance of a permit, the Permittee and/or the person authorized to sign the Permittee's discharge monitoring reports (ñSignatory Authorityò) as described in RCSA Section 22a-430-3(b)(2) shall contact the Department at deep.netdmr@ct.gov and initiate the NetDMR subscription process for electronic submission of Stormwater Monitoring Report information. Information on NetDMR is available on the Department's website at www.ct.gov/deep/netdmr on or before ninety (90) days after issuance of this permit the Permittee shall submit a signed and notarized copy of the Connecticut DEEP NetDMR Subscriber Agreement to the Department

Submittal of Reports Using NetDMR

Unless otherwise approved by the commissioner, on or before one-hundred and eighty (180) days after issuance of this permit, the Permittee and/or the Signatory Authority shall electronically submit SMRs required under the permit to the Department using NetDMR in satisfaction of the SMR submission requirements of Sections 5(c)(2)(A) of this permit.

SMRs shall be submitted electronically to the Department no later than the 30th day of the month following the completed reporting period. Any additional monitoring conducted in accordance with 40 CFR 136 shall be submitted to the Department as an electronic attachment to the SMR in NetDMR. Once a Permittee begins submitting reports using NetDMR, it will no longer be required to submit hard copies of SMRs to the Department. NetDMR is accessed from: http://www.epa.gov/netdmr

Submittal of NetDMR Opt-Out Requests

If the Permittee is able to demonstrate a reasonable basis, such as technical or administrative infeasibility, that precludes the use of NetDMR for electronically submitting SMRs, the commissioner may approve the submission of SMRs in hard copyform (ñopt-out requestò). Opt-out requests must be submitted in writing to the Department for written approval on or before fifteen (15) days prior to the date a Permittee would be required under this permit to begin filing SMRs using NetDMR. This demonstration shall be valid for twelve (12) months from the date of the Departmentôs approval and shall thereupon expire. At such time, SMRs shall be submitted electronically to the Department using NetDMR unless the Permittee submits a renewed opt-out request and such request is approved by the Department.

All opt-out requests and requests for the NetDMR subscriber form should be sent to the following address or by email at deep.netdmr@ct.gov:

Attn: NetDMR Coordinator
Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

7.5 Reporting and Record Keeping Requirements

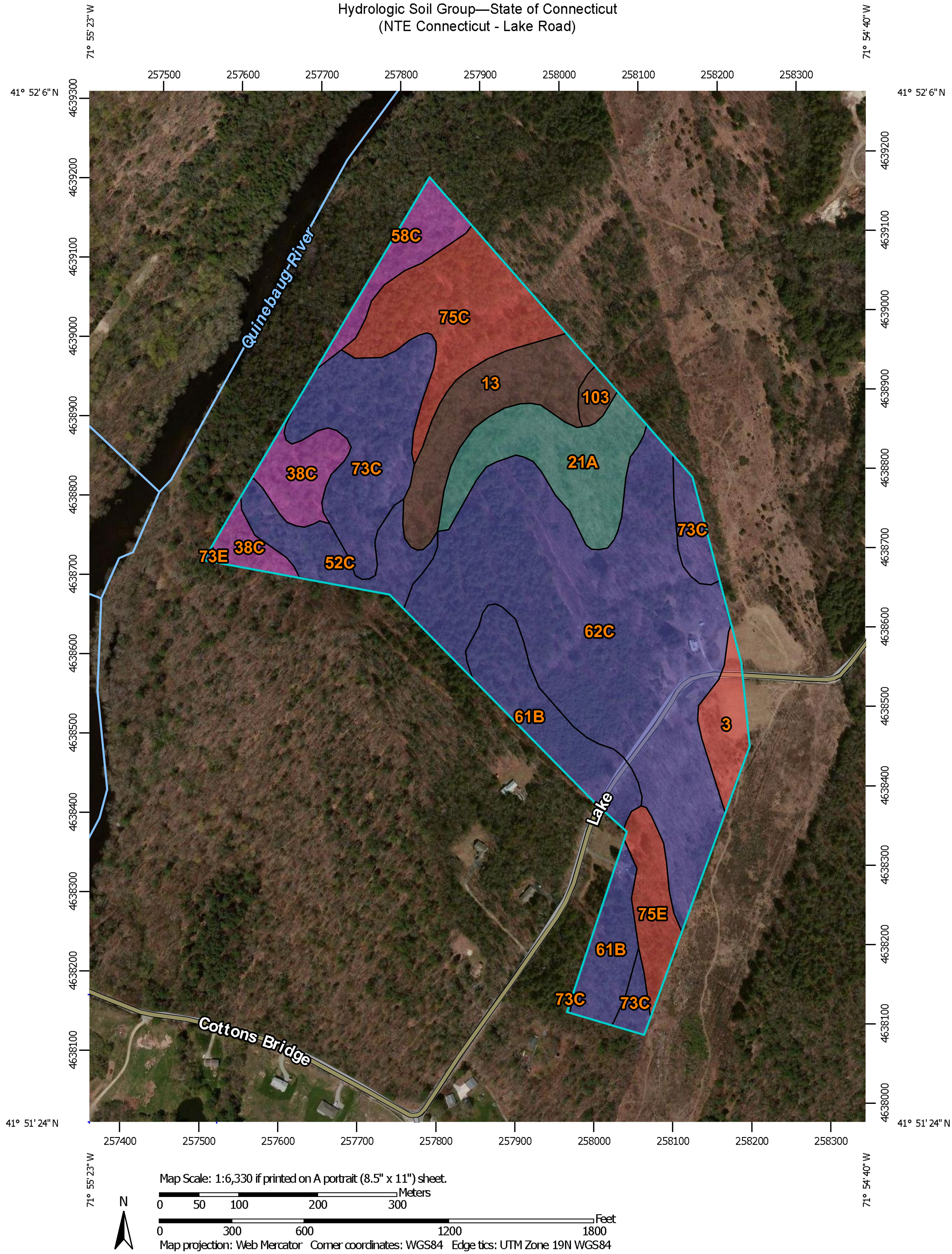
A. For a period of at least five years from the date that construction is complete, the permittee shall retain copies of the Plan and all reports required by the General Permit, and records of all data used to complete the registration for the General Permit, unless the commissioner specifies another time period in writing. Inspection records must be retained as part of the Plan for a period of five (5) years after the date of inspection.

B. The permittee shall retain an updated copy of the Plan required by this general permit at the construction site from the date construction is initiated at the site until the date construction at the site is completed.

ATTACHMENT 1

USDA-NRCS WEB SOIL SURVEY MAPPING

Hydrologic Soil Group—State of Connecticut
(NTE Connecticut - Lake Road)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 14, Sep 22, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — State of Connecticut (CT600)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	D	2.0	2.6%
13	Walpole sandy loam, 0 to 3 percent slopes	B/D	5.3	7.0%
21A	Ninigret and Tisbury soils, 0 to 5 percent slopes	C	6.0	7.9%
38C	Hinckley loamy sand, 3 to 15 percent slopes	A	3.5	4.6%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	B	3.5	4.6%
58C	Gloucester gravelly sandy loam, 8 to 15 percent slopes, very stony	A	2.3	3.1%
61B	Canton and Charlton soils, 3 to 8 percent slopes, very stony	B	7.2	9.5%
62C	Canton and Charlton soils, 3 to 15 percent slopes, extremely stony	B	26.6	35.1%
73C	Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky	B	9.2	12.1%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	B	0.1	0.1%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	D	7.2	9.5%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	D	2.5	3.2%
103	Rippowam fine sandy loam	B/D	0.6	0.8%
Totals for Area of Interest			**75.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

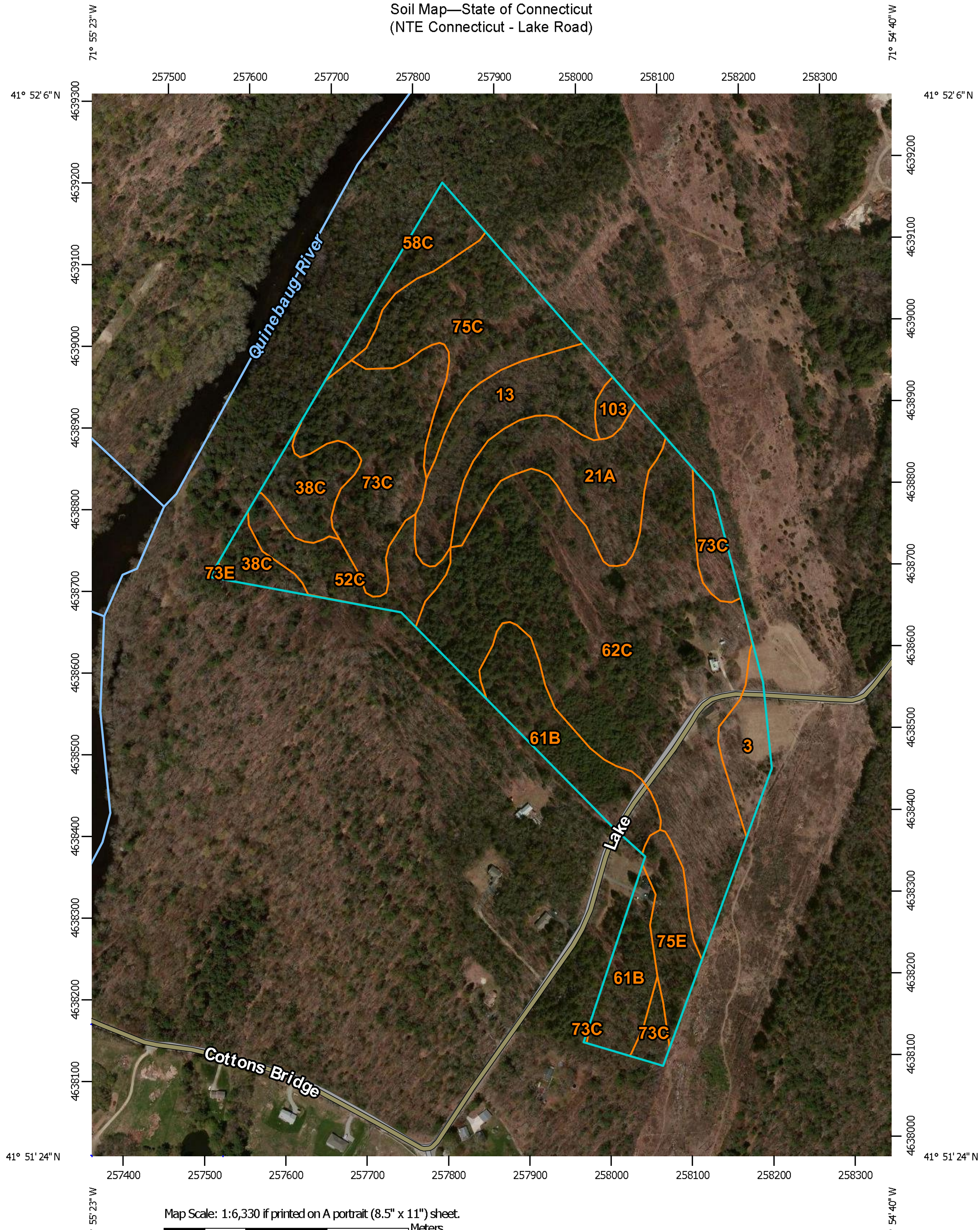
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



Map Scale: 1:6,330 if printed on A portrait (8.5" x 11") sheet.

Meters: 0 50 100 200 300

Feet: 0 300 600 1200 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 14, Sep 22, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

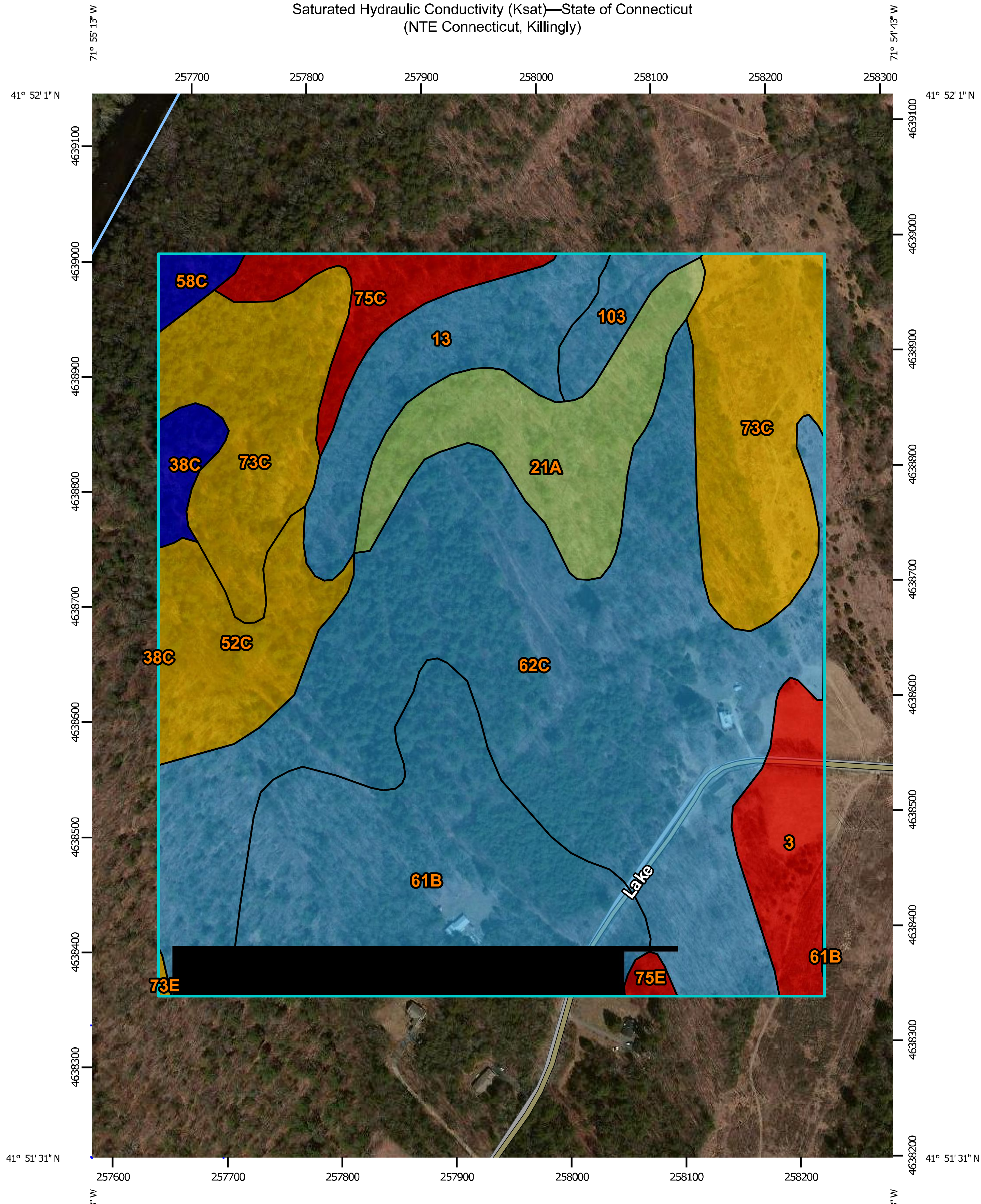
Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

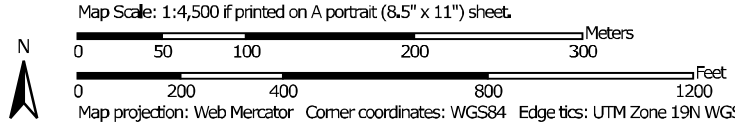
Map Unit Legend

State of Connecticut (CT600)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	2.0	2.6%
13	Walpole sandy loam, 0 to 3 percent slopes	5.3	7.0%
21A	Ninigret and Tisbury soils, 0 to 5 percent slopes	6.0	7.9%
38C	Hinckley loamy sand, 3 to 15 percent slopes	3.5	4.6%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	3.5	4.6%
58C	Gloucester gravelly sandy loam, 8 to 15 percent slopes, very stony	2.3	3.1%
61B	Canton and Charlton soils, 3 to 8 percent slopes, very stony	7.2	9.5%
62C	Canton and Charlton soils, 3 to 15 percent slopes, extremely stony	26.6	35.1%
73C	Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky	9.2	12.1%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	0.1	0.1%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	7.2	9.5%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	2.5	3.2%
103	Rippowam fine sandy loam	0.6	0.8%
Totals for Area of Interest		**75.8**	**100.0%**

Saturated Hydraulic Conductivity (Ksat)—State of Connecticut
(NTE Connecticut, Killingly)



Map Scale: 1:4,500 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- <= 10.0139
- > 10.0139 and <= 24.9231
- > 24.9231 and <= 34.7253
- > 34.7253 and <= 44.6703
- > 44.6703 and <= 100.0000
- Not rated or not available

Soil Rating Lines

- <= 10.0139
- > 10.0139 and <= 24.9231
- > 24.9231 and <= 34.7253
- > 34.7253 and <= 44.6703
- > 44.6703 and <= 100.0000
- Not rated or not available

Soil Rating Points

- <= 10.0139
- > 10.0139 and <= 24.9231
- > 24.9231 and <= 34.7253
- > 34.7253 and <= 44.6703
- > 44.6703 and <= 100.0000
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: State of Connecticut
Survey Area Data: Version 14, Sep 22, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Saturated Hydraulic Conductivity (Ksat)

Saturated Hydraulic Conductivity (Ksat)— Summary by Map Unit — State of Connecticut (CT600)				
Map unit symbol	**Map unit name**	**Rating (micrometers per second)**	**Acres in AOI**	**Percent of AOI**
3	Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony	5.1044	3.9	4.2%
13	Walpole sandy loam, 0 to 3 percent slopes	40.6593	5.7	6.1%
21A	Ninigret and Tisbury soils, 0 to 5 percent slopes	34.7253	7.0	7.6%
38C	Hinckley loamy sand, 3 to 15 percent slopes	100.0000	1.1	1.2%
52C	Sutton fine sandy loam, 2 to 15 percent slopes, extremely stony	24.9231	5.2	5.5%
58C	Gloucester gravelly sandy loam, 8 to 15 percent slopes, very stony	93.0769	0.7	0.8%
61B	Canton and Charlton soils, 3 to 8 percent slopes, very stony	39.6703	16.1	17.3%
62C	Canton and Charlton soils, 3 to 15 percent slopes, extremely stony	39.6703	33.2	35.7%
73C	Charlton-Chatfield complex, 3 to 15 percent slopes, very rocky	21.5714	15.2	16.3%
73E	Charlton-Chatfield complex, 15 to 45 percent slopes, very rocky	21.5714	0.1	0.1%
75C	Hollis-Chatfield-Rock outcrop complex, 3 to 15 percent slopes	10.0139	3.0	3.2%
75E	Hollis-Chatfield-Rock outcrop complex, 15 to 45 percent slopes	10.0139	0.3	0.3%
103	Rippowam fine sandy loam	44.6703	1.5	1.6%
Totals for Area of Interest			**92.9**	**100.0%**

Description

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Rating Options

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: *None Specified*

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 0

Bottom Depth: 36

Units of Measure: Inches

ATTACHMENT 2

DECEMBER 2018

NATURAL DIVERSITY DATABASE MAP

Natural Diversity Data Base Areas

KILLINGLY, CT

December 2018

State and Federal Listed Species & Significant Natural Communities

Town Boundary

NOTE: This map shows general locations of State and Federal Listed Species and Significant Natural Communities. Information on listed species is collected and compiled by the Natural Diversity Data Base (NDDB) from a number of data sources. Exact locations of species have been buffered to produce the general locations. Exact locations of species and communities occur somewhere in the shaded areas, not necessarily in the center. A new mapping format is being employed that more accurately models important riparian and aquatic areas and eliminates the need for the upstream/downstream searches required in previous versions.

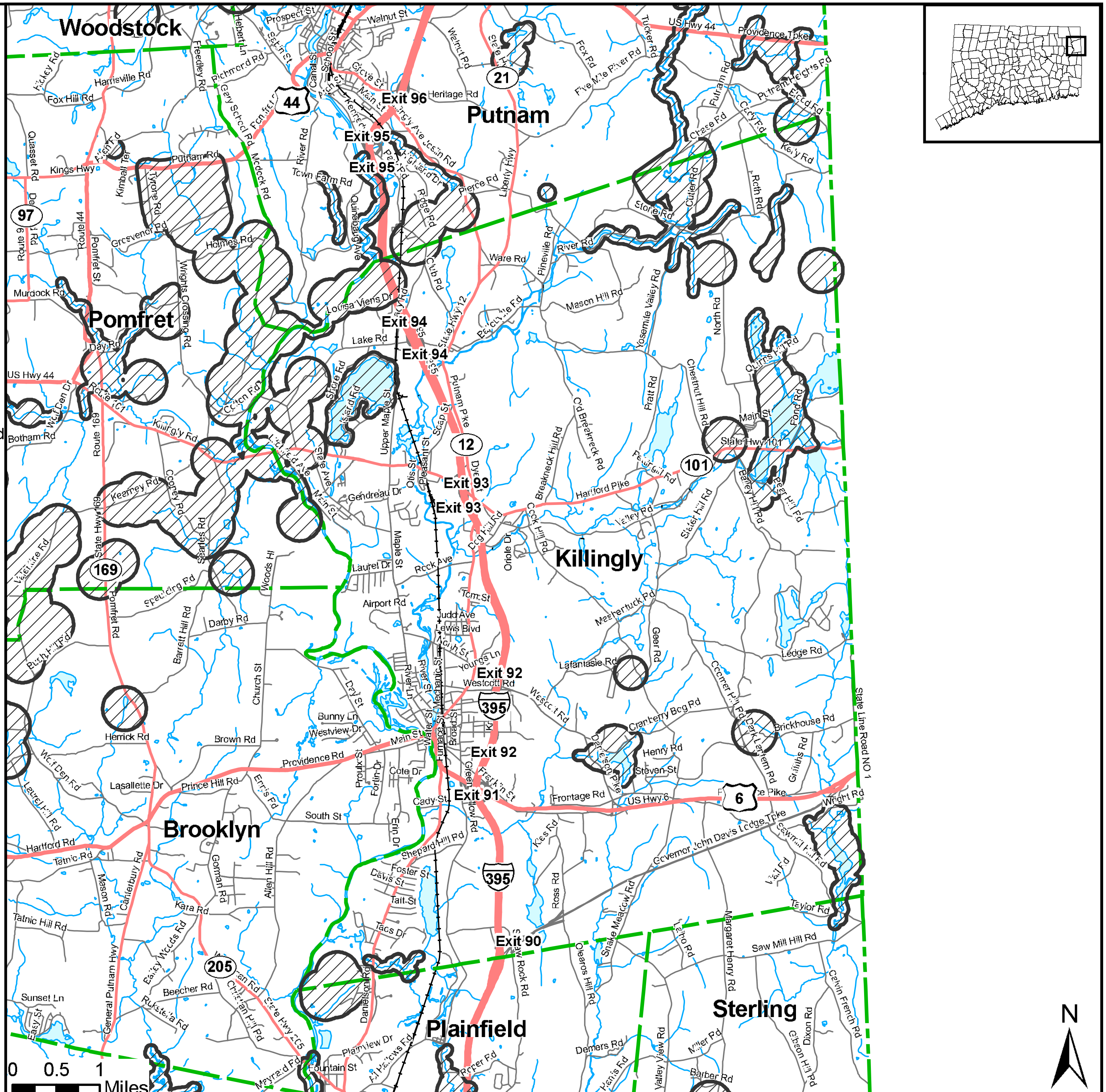
This map is intended for use as a preliminary screening tool for conducting a Natural Diversity Data Base Review Request. To use the map, locate the project boundaries and any additional affected areas. If the project is within a shaded area there may be a potential conflict with a listed species. For more information, complete a Request for Natural Diversity Data Base State Listed Species Review form (DEP-APP-007), and submit it to the NDDB along with the required maps and information. More detailed instructions are provided with the request form on our website.

www.ct.gov/deep/nddbrequest

Use the CTECO Interactive Map Viewers at www.cteco.uconn.edu to more precisely search for and locate a site and to view aerial imagery with NDDB Areas.

QUESTIONS: Department of Energy and Environmental Protection (DEEP)
79 Elm St., Hartford CT 06106
Phone (860) 424-3011

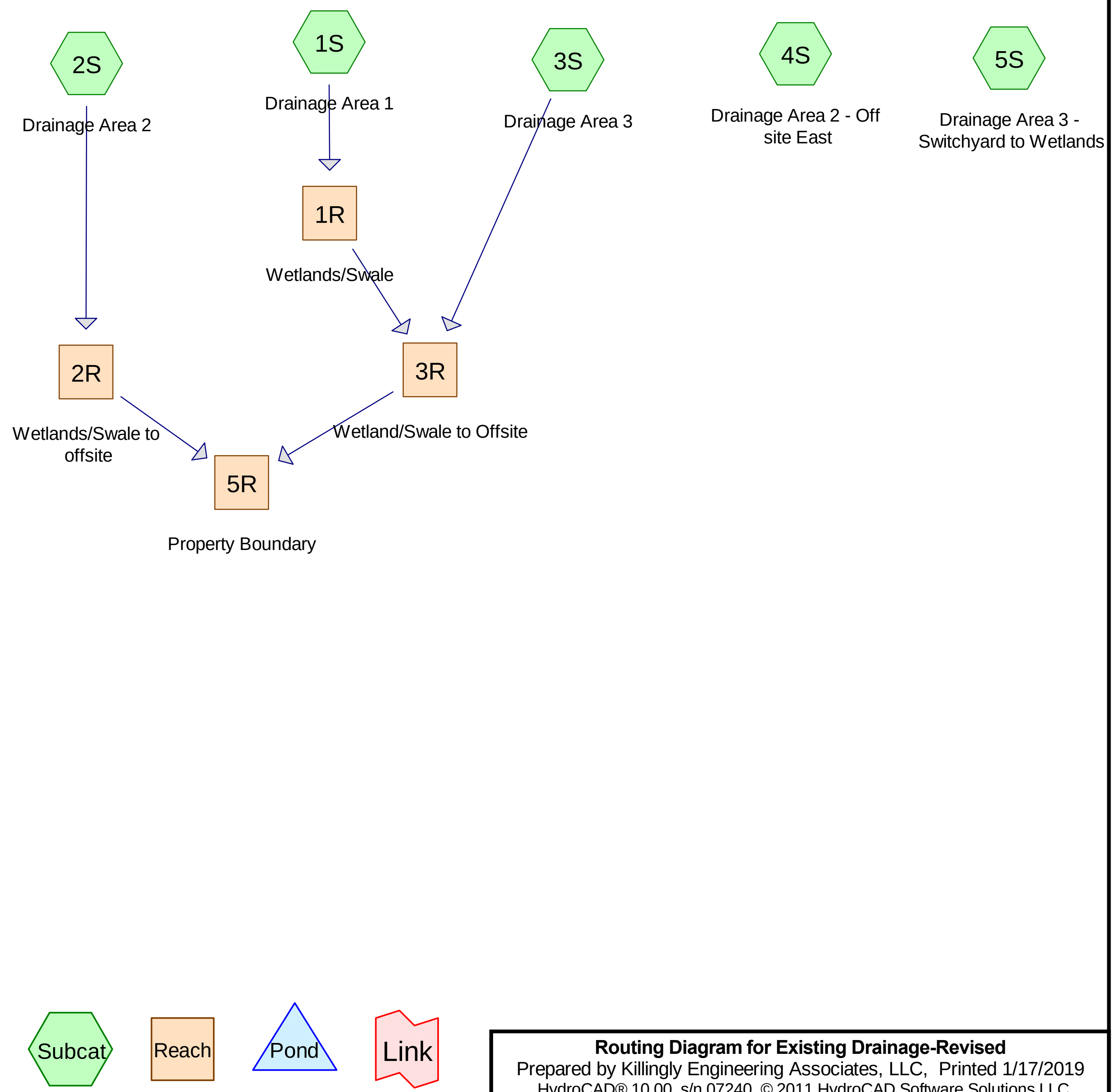
Connecticut Department of Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division



ATTACHMENT 3

HydroCAD DRAINAGE CALCULATION SUMMARIES

(With drainage area maps)



Routing Diagram for Existing Drainage-Revised
Prepared by Killingly Engineering Associates, LLC, Printed 1/17/2019
HydroCAD® 10.00 s/n 07240 © 2011 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: Drainage Area 1

Runoff = 3.70 cfs @ 12.48 hrs, Volume= 0.680 af, Depth> 0.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (Wetlands)
	18.740	55	Woods, Good, HSG B
	0.550	70	1/2 acre lots, 25% imp, HSG B
	21.400	58	Weighted Average
	21.262		99.36% Pervious Area
	0.137		0.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,038	0.0750	0.79		**Lag/CN Method, Tc-2**

Summary for Subcatchment 2S: Drainage Area 2

Runoff = 2.71 cfs @ 12.45 hrs, Volume= 0.469 af, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (Wetlands)
	11.130	55	Woods, Good, HSG B
	13.530	59	Weighted Average
	13.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	1,078	0.0780	0.84		**Lag/CN Method, Tc-2s**

Summary for Subcatchment 3S: Drainage Area 3

Runoff = 3.45 cfs @ 12.42 hrs, Volume= 0.499 af, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (Wetlands)
	5.870	55	Woods, Good, HSG B
	9.790	64	Weighted Average
	9.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	300	0.1460	0.22		**Sheet Flow, Tc-3a**
					Woods: Light underbrush n= 0.400 P2= 3.32"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc-3b**
					Woodland Kv= 5.0 fps
24.1	415	Total			

Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 0.44 cfs @ 12.20 hrs, Volume= 0.073 af, Depth> 0.35"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

Area (ac)	CN	Description
1.650	55	Woods, Good, HSG B
0.700	58	Meadow, non-grazed, HSG B
0.150	70	1/2 acre lots, 25% imp, HSG B
2.500	57	Weighted Average
2.462		98.50% Pervious Area
0.037		1.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	350	0.1080	0.75		**Lag/CN Method, Tc-2**

Summary for Subcatchment 5S: Drainage Area 3 - Switchyard to Wetlands

Runoff = 1.83 cfs @ 12.50 hrs, Volume= 0.306 af, Depth> 0.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	0.900	98	Roof & Pavement
	1.000	58	Meadow, non-grazed, HSG B
	5.600	55	Woods, Good, HSG B
	7.500	61	Weighted Average
	6.600		88.00% Pervious Area
	0.900		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	850	0.0770	0.83		**Lag/CN Method, Tc-3**
6.3	567	0.0900	1.50		**Shallow Concentrated Flow, 597** Woodland Kv= 5.0 fps
3.1	225	0.0300	1.21		**Shallow Concentrated Flow, Tc-4c** Short Grass Pasture Kv= 7.0 fps
26.4	1,642	Total			

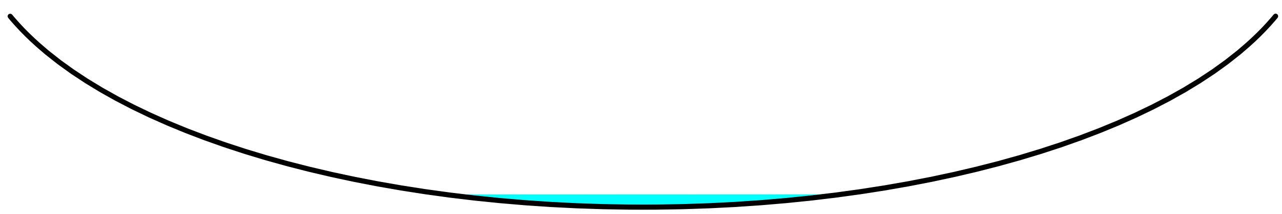
Summary for Reach 1R: Wetlands/Swale

Inflow Area = 21.400 ac, 0.64% Impervious, Inflow Depth > 0.38" for 2-Year event
Inflow = 3.70 cfs @ 12.48 hrs, Volume= 0.680 af
Outflow = 3.45 cfs @ 12.72 hrs, Volume= 0.671 af, Atten= 7%, Lag= 14.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.40 fps, Min. Travel Time= 7.7 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 13.4 min

Peak Storage= 1,592 cf @ 12.59 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'



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Summary for Reach 2R: Wetlands/Swale to offsite

Inflow Area = 13.530 ac, 0.00% Impervious, Inflow Depth > 0.42" for 2-Year event
Inflow = 2.71 cfs @ 12.45 hrs, Volume= 0.469 af
Outflow = 2.09 cfs @ 12.97 hrs, Volume= 0.457 af, Atten= 23%, Lag= 30.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.68 fps, Min. Travel Time= 17.1 min
Avg. Velocity = 0.40 fps, Avg. Travel Time= 28.9 min

Peak Storage= 2,155 cf @ 12.68 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'

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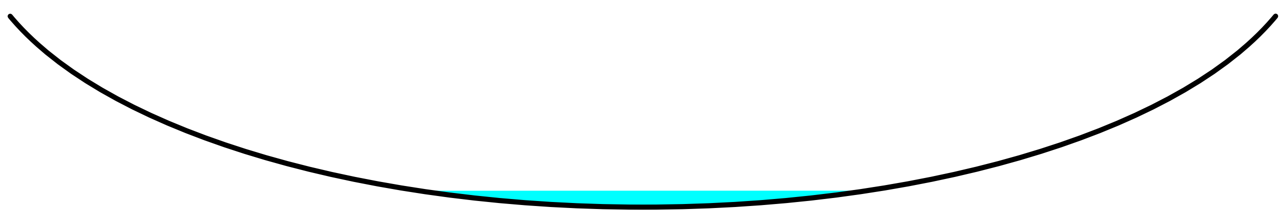


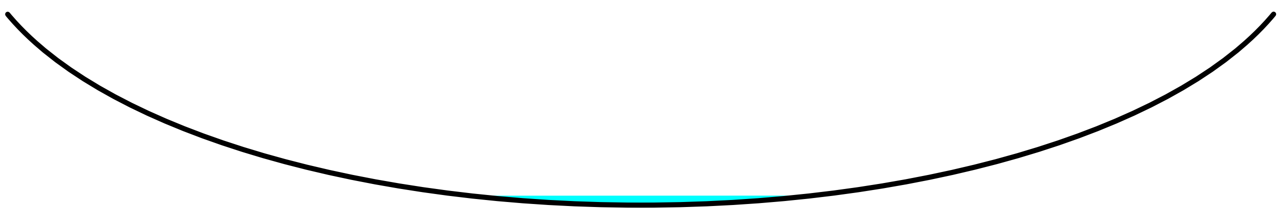
Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 31.190 ac, 0.44% Impervious, Inflow Depth > 0.45" for 2-Year event
Inflow = 6.03 cfs @ 12.63 hrs, Volume= 1.170 af
Outflow = 5.00 cfs @ 13.12 hrs, Volume= 1.141 af, Atten= 17%, Lag= 29.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.63 fps, Min. Travel Time= 16.9 min
Avg. Velocity = 0.38 fps, Avg. Travel Time= 28.0 min

Peak Storage= 5,080 cf @ 12.84 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 3.00' Flow Area= 700.0 sf, Capacity= 3,229.60 cfs

350.00' x 3.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'



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Summary for Reach 5R: Property Boundary

Inflow Area = 44.720 ac, 0.31% Impervious, Inflow Depth > 0.43" for 2-Year event
Inflow = 6.95 cfs @ 13.08 hrs, Volume= 1.598 af
Outflow = 6.95 cfs @ 13.08 hrs, Volume= 1.598 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Drainage Area 1

Runoff = 17.86 cfs @ 12.35 hrs, Volume= 2.229 af, Depth> 1.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (Wetlands)
	18.740	55	Woods, Good, HSG B
	0.550	70	1/2 acre lots, 25% imp, HSG B
	21.400	58	Weighted Average
	21.262		99.36% Pervious Area
	0.137		0.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,038	0.0750	0.79		**Lag/CN Method, Tc-2**

Summary for Subcatchment 2S: Drainage Area 2

Runoff = 12.17 cfs @ 12.34 hrs, Volume= 1.486 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (Wetlands)
	11.130	55	Woods, Good, HSG B
	13.530	59	Weighted Average
	13.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	1,078	0.0780	0.84		**Lag/CN Method, Tc-2s**

Summary for Subcatchment 3S: Drainage Area 3

Runoff = 11.36 cfs @ 12.36 hrs, Volume= 1.367 af, Depth> 1.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (Wetlands)
	5.870	55	Woods, Good, HSG B
	9.790	64	Weighted Average
	9.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	300	0.1460	0.22		**Sheet Flow, Tc-3a** Woods: Light underbrush n= 0.400 P2= 3.32"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc-3b** Woodland Kv= 5.0 fps
24.1	415	Total			

Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 2.74 cfs @ 12.13 hrs, Volume= 0.248 af, Depth> 1.19"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

Area (ac)	CN	Description
1.650	55	Woods, Good, HSG B
0.700	58	Meadow, non-grazed, HSG B
0.150	70	1/2 acre lots, 25% imp, HSG B
2.500	57	Weighted Average
2.462		98.50% Pervious Area
0.037		1.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	350	0.1080	0.75		**Lag/CN Method, Tc-2**

Summary for Subcatchment 5S: Drainage Area 3 - Switchyard to Wetlands

Runoff = 7.06 cfs @ 12.41 hrs, Volume= 0.910 af, Depth> 1.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	0.900	98	Roof & Pavement
	1.000	58	Meadow, non-grazed, HSG B
	5.600	55	Woods, Good, HSG B
	7.500	61	Weighted Average
	6.600		88.00% Pervious Area
	0.900		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	850	0.0770	0.83		**Lag/CN Method, Tc-3**
6.3	567	0.0900	1.50		**Shallow Concentrated Flow, 597** Woodland Kv= 5.0 fps
3.1	225	0.0300	1.21		**Shallow Concentrated Flow, Tc-4c** Short Grass Pasture Kv= 7.0 fps
26.4	1,642	Total			

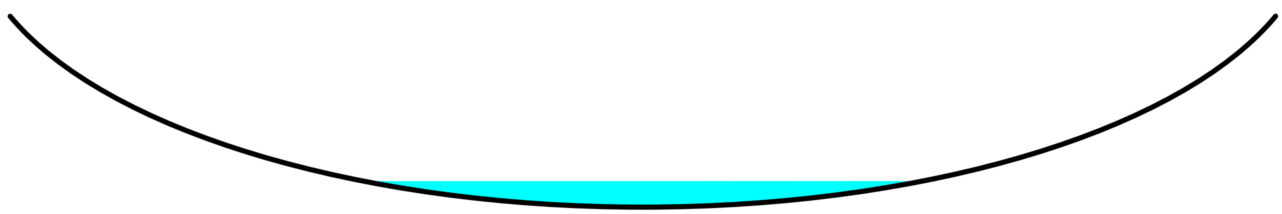
Summary for Reach 1R: Wetlands/Swale

Inflow Area = 21.400 ac, 0.64% Impervious, Inflow Depth > 1.25" for 10-Year event
Inflow = 17.86 cfs @ 12.35 hrs, Volume= 2.229 af
Outflow = 17.17 cfs @ 12.50 hrs, Volume= 2.215 af, Atten= 4%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.29 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 10.0 min

Peak Storage= 4,853 cf @ 12.42 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'



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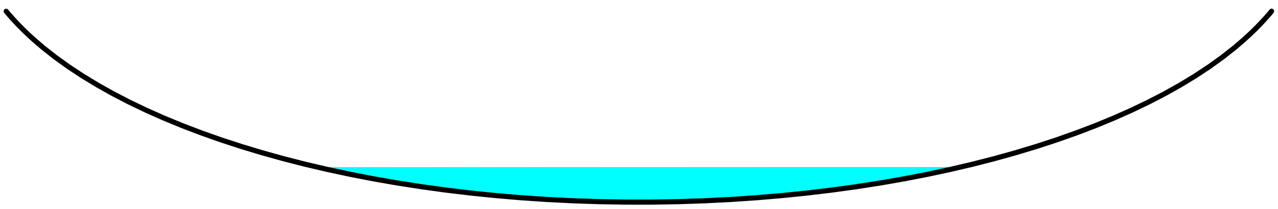
Summary for Reach 2R: Wetlands/Swale to offsite

Inflow Area = 13.530 ac, 0.00% Impervious, Inflow Depth > 1.32" for 10-Year event
Inflow = 12.17 cfs @ 12.34 hrs, Volume= 1.486 af
Outflow = 10.51 cfs @ 12.66 hrs, Volume= 1.466 af, Atten= 14%, Lag= 19.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.12 fps, Min. Travel Time= 10.4 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 21.8 min

Peak Storage= 6,598 cf @ 12.49 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'



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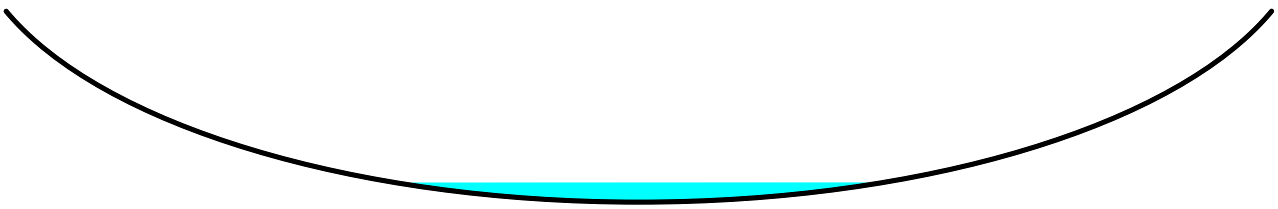
Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 31.190 ac, 0.44% Impervious, Inflow Depth > 1.38" for 10-Year event
Inflow = 27.58 cfs @ 12.46 hrs, Volume= 3.582 af
Outflow = 24.43 cfs @ 12.77 hrs, Volume= 3.534 af, Atten= 11%, Lag= 18.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.03 fps, Min. Travel Time= 10.4 min
Avg. Velocity = 0.49 fps, Avg. Travel Time= 21.8 min

Peak Storage= 15,246 cf @ 12.60 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 3.00' Flow Area= 700.0 sf, Capacity= 3,229.60 cfs

350.00' x 3.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'



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Summary for Reach 5R: Property Boundary

Inflow Area =	44.720 ac,	0.31% Impervious,	Inflow Depth > 1.34"	for 10-Year event	
Inflow =	34.43 cfs @	12.75 hrs,	Volume=	4.999 af	
Outflow =	34.43 cfs @	12.75 hrs,	Volume=	4.999 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Summary for Subcatchment 1S: Drainage Area 1

Runoff = 50.36 cfs @ 12.32 hrs, Volume= 5.638 af, Depth> 3.16"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (Wetlands)
	18.740	55	Woods, Good, HSG B
	0.550	70	1/2 acre lots, 25% imp, HSG B
	21.400	58	Weighted Average
	21.262		99.36% Pervious Area
	0.137		0.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.8	1,038	0.0750	0.79		**Lag/CN Method, Tc-2**

Summary for Subcatchment 2S: Drainage Area 2

Runoff = 33.30 cfs @ 12.31 hrs, Volume= 3.690 af, Depth> 3.27"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (Wetlands)
	11.130	55	Woods, Good, HSG B
	13.530	59	Weighted Average
	13.530		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	1,078	0.0780	0.84		**Lag/CN Method, Tc-2s**

Summary for Subcatchment 3S: Drainage Area 3

Runoff = 27.31 cfs @ 12.34 hrs, Volume= 3.127 af, Depth> 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (Wetlands)
	5.870	55	Woods, Good, HSG B
	9.790	64	Weighted Average
	9.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	300	0.1460	0.22		**Sheet Flow, Tc-3a**
					Woods: Light underbrush n= 0.400 P2= 3.32"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc-3b**
					Woodland Kv= 5.0 fps
24.1	415	Total			

Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 8.10 cfs @ 12.12 hrs, Volume= 0.638 af, Depth> 3.06"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

Area (ac)	CN	Description
1.650	55	Woods, Good, HSG B
0.700	58	Meadow, non-grazed, HSG B
0.150	70	1/2 acre lots, 25% imp, HSG B
2.500	57	Weighted Average
2.462		98.50% Pervious Area
0.037		1.50% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.8	350	0.1080	0.75		**Lag/CN Method, Tc-2**

Summary for Subcatchment 5S: Drainage Area 3 - Switchyard to Wetlands

Runoff = 18.20 cfs @ 12.38 hrs, Volume= 2.183 af, Depth> 3.49"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	0.900	98	Roof & Pavement
	1.000	58	Meadow, non-grazed, HSG B
	5.600	55	Woods, Good, HSG B
	7.500	61	Weighted Average
	6.600		88.00% Pervious Area
	0.900		12.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	850	0.0770	0.83		**Lag/CN Method, Tc-3**
6.3	567	0.0900	1.50		**Shallow Concentrated Flow, 597** Woodland Kv= 5.0 fps
3.1	225	0.0300	1.21		**Shallow Concentrated Flow, Tc-4c** Short Grass Pasture Kv= 7.0 fps
26.4	1,642	Total			

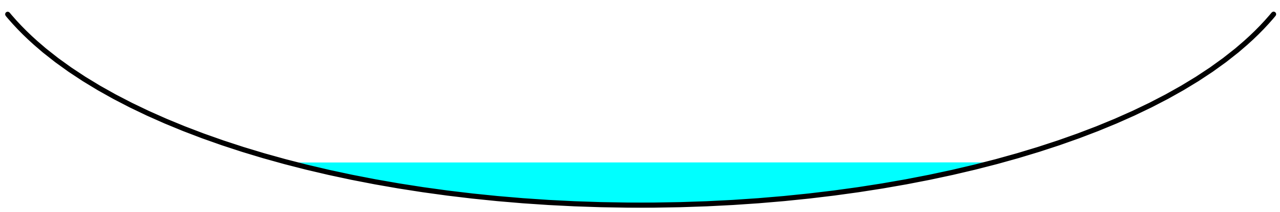
Summary for Reach 1R: Wetlands/Swale

Inflow Area = 21.400 ac, 0.64% Impervious, Inflow Depth > 3.16" for 100-Year event
Inflow = 50.36 cfs @ 12.32 hrs, Volume= 5.638 af
Outflow = 49.28 cfs @ 12.42 hrs, Volume= 5.616 af, Atten= 2%, Lag= 6.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.17 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.33 fps, Avg. Travel Time= 8.1 min

Peak Storage= 10,050 cf @ 12.36 hrs
Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'



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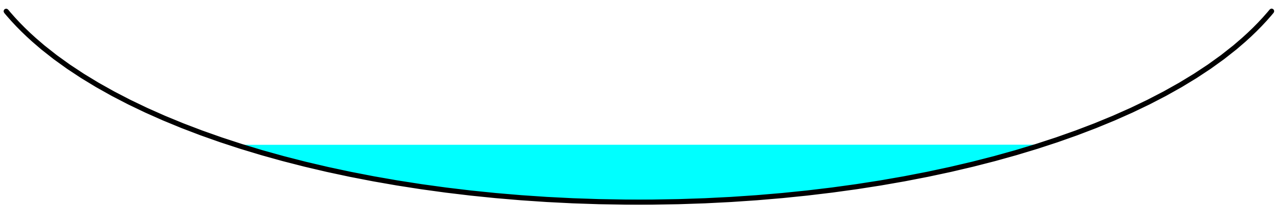
Summary for Reach 2R: Wetlands/Swale to offsite

Inflow Area = 13.530 ac, 0.00% Impervious, Inflow Depth > 3.27" for 100-Year event
Inflow = 33.30 cfs @ 12.31 hrs, Volume= 3.690 af
Outflow = 30.39 cfs @ 12.54 hrs, Volume= 3.658 af, Atten= 9%, Lag= 13.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.55 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.66 fps, Avg. Travel Time= 17.7 min

Peak Storage= 13,796 cf @ 12.41 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'



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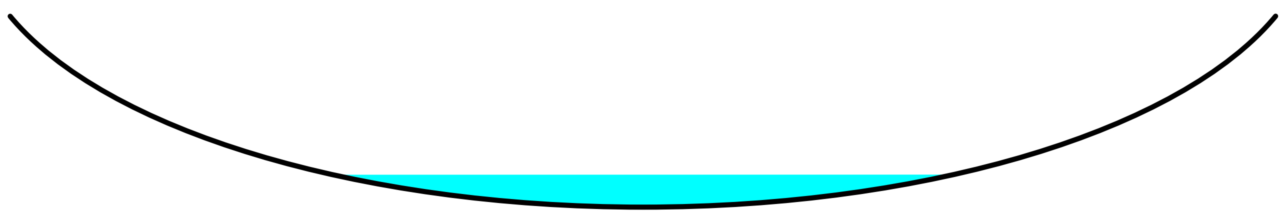
Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 31.190 ac, 0.44% Impervious, Inflow Depth > 3.36" for 100-Year event
Inflow = 75.58 cfs @ 12.40 hrs, Volume= 8.743 af
Outflow = 69.83 cfs @ 12.62 hrs, Volume= 8.668 af, Atten= 8%, Lag= 13.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.42 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 0.59 fps, Avg. Travel Time= 18.0 min

Peak Storage= 31,601 cf @ 12.50 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 3.00' Flow Area= 700.0 sf, Capacity= 3,229.60 cfs

350.00' x 3.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'



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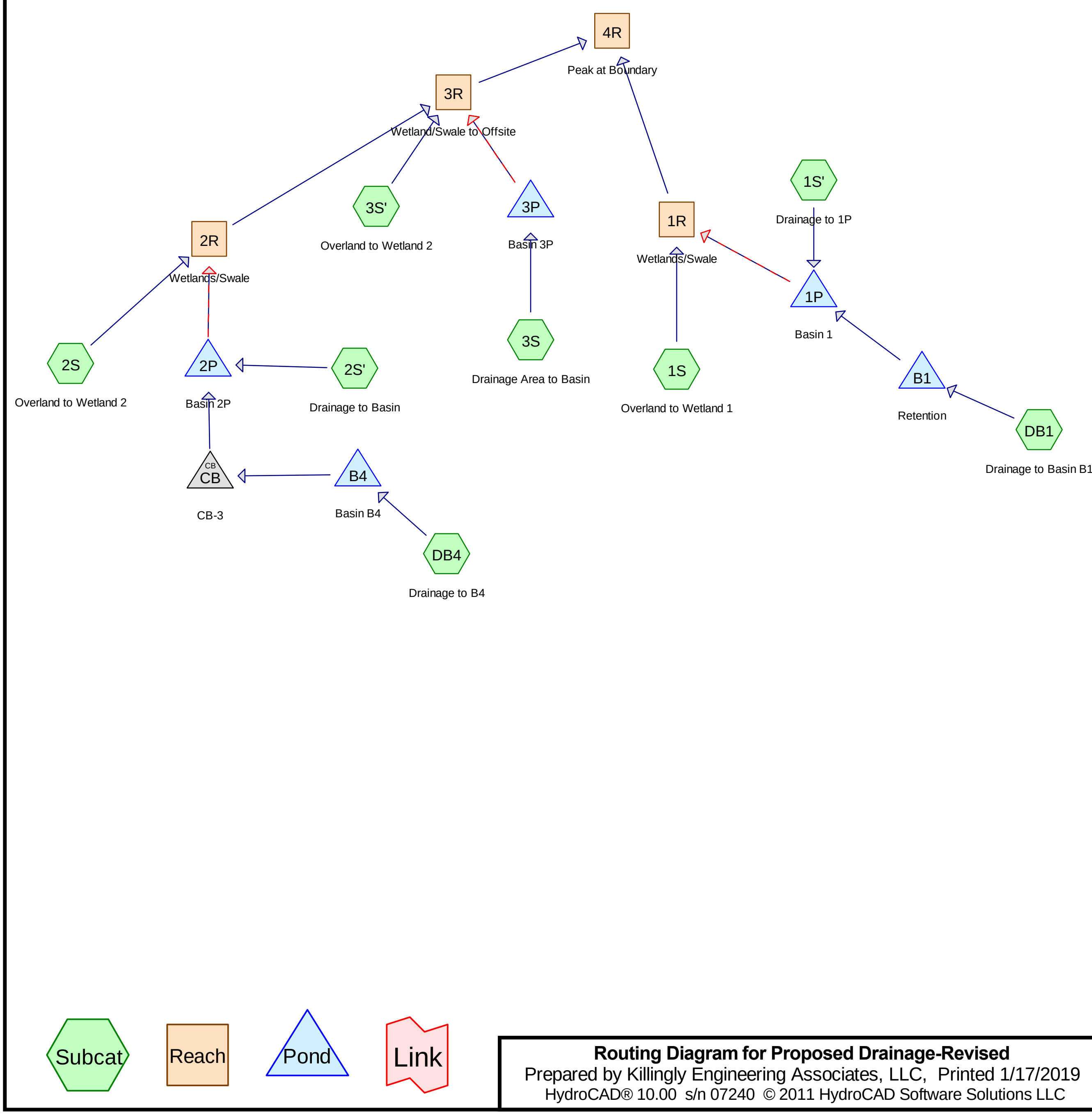
Summary for Reach 5R: Property Boundary

Inflow Area =	44.720 ac,	0.31% Impervious,	Inflow Depth > 3.31"	for 100-Year event	
Inflow =	99.04 cfs @	12.60 hrs,	Volume=	12.326 af	
Outflow =	99.04 cfs @	12.60 hrs,	Volume=	12.326 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

PROPOSED CONDITIONS DRAINAGE COMPUTATIONS
2, 10 & 100-YEAR STORMS



Routing Diagram for Proposed Drainage-Revised
Prepared by Killingly Engineering Associates, LLC, Printed 1/17/2019
HydroCAD® 10.00 s/n 07240 © 2011 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: Overland to Wetland 1

Runoff = 2.14 cfs @ 12.49 hrs, Volume= 0.312 af, Depth> 0.43"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (wetlands)
	6.120	55	Woods, Good, HSG B
	0.510	61	>75% Grass cover, Good, HSG B
	8.740	61	Weighted Average
	8.740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	250	0.0960	0.17		**Sheet Flow, Tc-1S-1** Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	270	0.1920	2.19		**Shallow Concentrated Flow, Tc-1S-2** Woodland Kv= 5.0 fps
26.0	520	Total			

Summary for Subcatchment 1S': Drainage to 1P

Runoff = 2.69 cfs @ 12.31 hrs, Volume= 0.272 af, Depth> 1.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (sf)	CN	Description
	89,580	74	>75% Grass cover, Good, HSG C
*	9,550	87	Crushed stone, HSG C
	15,070	98	Paved parking, HSG C
	114,200	78	Weighted Average
	99,130		86.80% Pervious Area
	15,070		13.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-1a** Grass: Dense n= 0.240 P2= 3.20"
6.5	480	0.0310	1.23		**Shallow Concentrated Flow, Tc-1a-2** Short Grass Pasture Kv= 7.0 fps
0.1	106	0.1200	19.75	24.24	**Pipe Channel, HDPE from CB-9** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
21.1	836	Total			

Summary for Subcatchment 2S: Overland to Wetland 2

Runoff = 3.02 cfs @ 12.19 hrs, Volume= 0.288 af, Depth> 0.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (wetlands)
	0.590	61	>75% Grass cover, Good, HSG B
	2.900	55	Woods, Good, HSG B
	5.890	65	Weighted Average
	5.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	75	0.0600	0.11		**Sheet Flow, Tc-2s** Woods: Light underbrush n= 0.400 P2= 3.20"

Summary for Subcatchment 2S': Drainage to Basin

Runoff = 6.51 cfs @ 12.24 hrs, Volume= 0.601 af, Depth> 1.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	1.900	61	>75% Grass cover, Good, HSG B (fill slopes)
*	2.110	87	Crushed Stone, HSG C
	1.230	98	Paved parking, HSG C
	5.240	80	Weighted Average
	4.010		76.53% Pervious Area
	1.230		23.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	589	0.0150	0.58		**Lag/CN Method, Tc-2S'**

Summary for Subcatchment 3S: Drainage Area to Basin

Runoff = 11.08 cfs @ 12.20 hrs, Volume= 0.953 af, Depth> 1.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	3.010	98	Impervious roof & pavement
*	3.900	72	Crushed Stone surface, HSG B
	1.390	61	>75% Grass cover, Good, HSG B
	8.300	80	Weighted Average
	5.290		63.73% Pervious Area
	3.010		36.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	560	0.0200	0.66		**Lag/CN Method, Tc-1**

Summary for Subcatchment 3S': Overland to Wetland 2

Runoff = 3.42 cfs @ 12.44 hrs, Volume= 0.454 af, Depth> 0.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (wetlands)
*	0.270	61	>75% Grass cover, Good, HSG B (fill slopes)
	6.650	55	Woods, Good, HSG B
	10.840	63	Weighted Average
	10.840		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	300	0.1460	0.21		**Sheet Flow, Tc 3S-1** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc 3S-2** Woodland Kv= 5.0 fps
24.5	415	Total			

Summary for Subcatchment DB1: Drainage to Basin B1

Runoff = 1.10 cfs @ 12.19 hrs, Volume= 0.094 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

Area (sf)	CN	Description
48,285	74	>75% Grass cover, Good, HSG C
48,285		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	225	0.1350	0.29		**Sheet Flow, Tc-B1** Grass: Dense n= 0.240 P2= 3.20"

Summary for Subcatchment DB4: Drainage to B4

Runoff = 1.80 cfs @ 12.24 hrs, Volume= 0.168 af, Depth> 1.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

Area (sf)	CN	Description
86,400	74	>75% Grass cover, Good, HSG C
86,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-DB4** Grass: Dense n= 0.240 P2= 3.20"
1.5	110	0.0300	1.21		**Shallow Concentrated Flow, Tc-DB4-2** Short Grass Pasture Kv= 7.0 fps
16.0	360	Total			

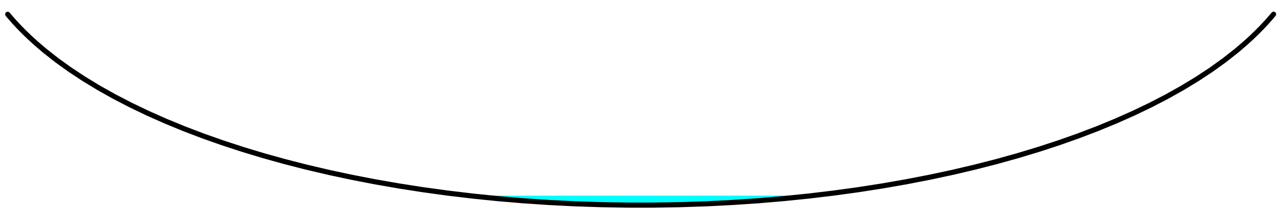
Summary for Reach 1R: Wetlands/Swale

Inflow Area = 12.470 ac, 2.77% Impervious, Inflow Depth > 0.49" for 2-Year event
Inflow = 2.14 cfs @ 12.49 hrs, Volume= 0.512 af
Outflow = 1.97 cfs @ 12.80 hrs, Volume= 0.501 af, Atten= 8%, Lag= 18.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.18 fps, Min. Travel Time= 9.1 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 12.7 min

Peak Storage= 1,078 cf @ 12.65 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'



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Summary for Reach 2R: Wetlands/Swale

Inflow Area = 13.113 ac, 9.38% Impervious, Inflow Depth > 0.76" for 2-Year event
Inflow = 3.47 cfs @ 12.45 hrs, Volume= 0.836 af
Outflow = 3.04 cfs @ 12.89 hrs, Volume= 0.806 af, Atten= 12%, Lag= 26.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.76 fps, Min. Travel Time= 15.3 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 21.5 min

Peak Storage= 2,791 cf @ 12.63 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'

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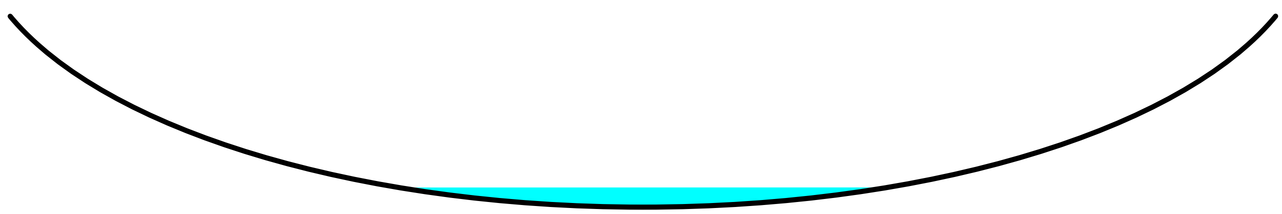

Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 32.253 ac, 13.15% Impervious, Inflow Depth > 0.65" for 2-Year event
Inflow = 5.70 cfs @ 12.70 hrs, Volume= 1.736 af
Outflow = 5.05 cfs @ 13.37 hrs, Volume= 1.648 af, Atten= 11%, Lag= 40.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.53 fps, Min. Travel Time= 20.0 min
Avg. Velocity = 0.41 fps, Avg. Travel Time= 25.9 min

Peak Storage= 6,055 cf @ 13.04 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 1.00' Flow Area= 233.3 sf, Capacity= 517.60 cfs

350.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'

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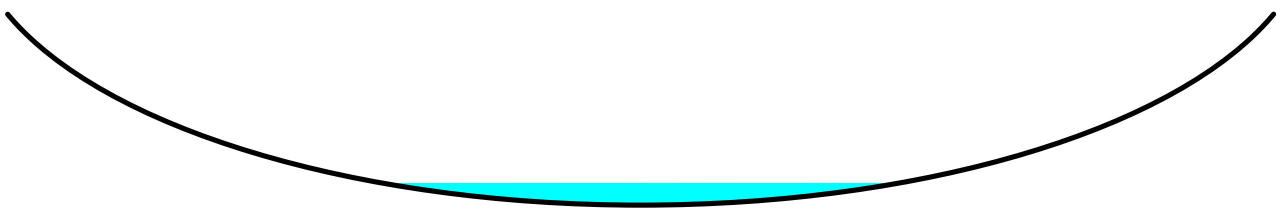

Summary for Reach 4R: Peak at Boundary

Inflow Area =	44.724 ac,	10.25% Impervious,	Inflow Depth > 0.58"	for 2-Year event
Inflow =	6.51 cfs @	13.32 hrs, Volume=	2.149 af	
Outflow =	6.51 cfs @	13.32 hrs, Volume=	2.149 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Basin 1

Inflow Area = 3.730 ac, 9.27% Impervious, Inflow Depth > 1.16" for 2-Year event
Inflow = 3.16 cfs @ 12.31 hrs, Volume= 0.361 af
Outflow = 0.64 cfs @ 13.44 hrs, Volume= 0.200 af, Atten= 80%, Lag= 67.8 min
Primary = 0.64 cfs @ 13.44 hrs, Volume= 0.200 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 274.60' @ 13.44 hrs Surf.Area= 5,002 sf Storage= 8,552 cf
Flood Elev= 278.00' Surf.Area= 7,415 sf Storage= 29,355 cf

Plug-Flow detention time= 184.5 min calculated for 0.199 af (55% of inflow)
Center-of-Mass det. time= 103.9 min (927.9 - 824.0)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	29,355 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	1,000	0	0
274.00	4,650	5,650	5,650
276.00	5,820	10,470	16,120
278.00	7,415	13,235	29,355

Device	Routing	Invert	Outlet Devices
#1	Primary	274.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 274.00' / 274.00' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	277.00'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=0.64 cfs @ 13.44 hrs HW=274.60' (Free Discharge)
└—**1=Culvert** (Barrel Controls 0.64 cfs @ 1.87 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=272.00' (Free Discharge)
└—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Basin 2P

Inflow Area = 7.223 ac, 17.03% Impervious, Inflow Depth > 1.21" for 2-Year event
Inflow = 6.69 cfs @ 12.24 hrs, Volume= 0.730 af
Outflow = 2.01 cfs @ 12.77 hrs, Volume= 0.548 af, Atten= 70%, Lag= 31.4 min
Primary = 2.01 cfs @ 12.77 hrs, Volume= 0.548 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 278.55' @ 12.77 hrs Surf.Area= 6,559 sf Storage= 12,400 cf

Plug-Flow detention time= 132.3 min calculated for 0.548 af (75% of inflow)
Center-of-Mass det. time= 63.4 min (898.5 - 835.2)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	22,943 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	1,090	0	0
277.00	3,440	4,530	4,530
277.50	4,066	1,877	6,407
278.00	6,000	2,517	8,923
280.00	8,020	14,020	22,943

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.50'	**24.0' long x 7.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.42 2.53 2.70 2.69 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.67 2.69 2.71 2.76
#2	Primary	277.50'	**6.0" Round Culvert X 3.00** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 277.50' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=2.01 cfs @ 12.77 hrs HW=278.55' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 2.01 cfs @ 3.41 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=275.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Basin 3P

Inflow Area = 8.300 ac, 36.27% Impervious, Inflow Depth > 1.38" for 2-Year event
Inflow = 11.08 cfs @ 12.20 hrs, Volume= 0.953 af
Outflow = 0.98 cfs @ 14.24 hrs, Volume= 0.476 af, Atten= 91%, Lag= 122.2 min
Primary = 0.98 cfs @ 14.24 hrs, Volume= 0.476 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 276.44' @ 14.24 hrs Surf.Area= 21,435 sf Storage= 25,119 cf

Plug-Flow detention time= 221.5 min calculated for 0.474 af (50% of inflow)
Center-of-Mass det. time= 138.6 min (947.1 - 808.5)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	6,413 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 16,032 cf Overall x 40.0% Voids
#2	274.50'	77,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		84,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	8,016	0	0
274.00	8,016	16,032	16,032

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.50	4,205	0	0
275.00	7,438	2,911	2,911
276.00	12,723	10,081	12,991
278.00	15,906	28,629	41,620
280.00	20,311	36,217	77,837

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.00'	**16.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	277.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 275.00' S= 0.1250 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#3	Primary	276.00'	**10.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 276.00' / 275.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#4	Primary	273.00'	**4.0" Round Culvert** L= 52.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.50' / 273.00' S= -0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=0.98 cfs @ 14.24 hrs HW=276.44' (Free Discharge)
2=Culvert (Controls 0.00 cfs)
3=Culvert (Inlet Controls 0.52 cfs @ 1.78 fps)
4=Culvert (Outlet Controls 0.46 cfs @ 5.29 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=272.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B1: Retention

Inflow Area = 1.108 ac, 0.00% Impervious, Inflow Depth > 1.02" for 2-Year event
Inflow = 1.10 cfs @ 12.19 hrs, Volume= 0.094 af
Outflow = 0.47 cfs @ 12.55 hrs, Volume= 0.089 af, Atten= 58%, Lag= 21.8 min
Primary = 0.47 cfs @ 12.55 hrs, Volume= 0.089 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.14' @ 12.55 hrs Surf.Area= 5,089 sf Storage= 975 cf

Plug-Flow detention time= 36.7 min calculated for 0.089 af (95% of inflow)
Center-of-Mass det. time= 18.5 min (840.2 - 821.7)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	19,555 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	312.00'	384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 960 cf Overall x 40.0% Voids
		19,939 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	3,590	0	0
316.00	10,660	7,125	7,125
317.00	14,200	12,430	19,555

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	480	0	0
314.00	480	960	960

Device	Routing	Invert	Outlet Devices
#1	Primary	316.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	313.00'	**4.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 313.00' / 300.00' S= 0.1130 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=0.47 cfs @ 12.55 hrs HW=315.14' (Free Discharge)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**2=Culvert** (Inlet Controls 0.47 cfs @ 5.35 fps)

Summary for Pond B4: Basin B4

Inflow Area = 1.983 ac, 0.00% Impervious, Inflow Depth > 1.02" for 2-Year event
Inflow = 1.80 cfs @ 12.24 hrs, Volume= 0.168 af
Outflow = 0.19 cfs @ 14.40 hrs, Volume= 0.129 af, Atten= 90%, Lag= 129.8 min
Primary = 0.19 cfs @ 14.40 hrs, Volume= 0.129 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 321.56' @ 14.40 hrs Surf.Area= 6,451 sf Storage= 3,437 cf

Plug-Flow detention time= 184.2 min calculated for 0.128 af (76% of inflow)
Center-of-Mass det. time= 125.0 min (949.2 - 824.2)

Volume	Invert	Avail.Storage	Storage Description
#1	318.00'	360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 900 cf Overall x 40.0% Voids
#2	321.00'	27,168 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		27,528 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
318.00	300	0	0
321.00	300	900	900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
321.00	4,850	0	0
322.00	7,175	6,013	6,013
324.00	13,980	21,155	27,168

Device	Routing	Invert	Outlet Devices
#1	Primary	318.00'	**3.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 318.00' / 315.12' S= 0.0192 '/' Cc= 0.900 n= 0.012, Flow Area= 0.05 sf
#2	Primary	323.00'	**30.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.19 cfs @ 14.40 hrs HW=321.56' (Free Discharge)
↑**1=Culvert** (Barrel Controls 0.19 cfs @ 3.82 fps)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond CB: CB-3

Inflow Area = 1.983 ac, 0.00% Impervious, Inflow Depth > 0.78" for 2-Year event
Inflow = 0.19 cfs @ 14.40 hrs, Volume= 0.129 af
Outflow = 0.19 cfs @ 14.40 hrs, Volume= 0.129 af, Atten= 0%, Lag= 0.0 min
Primary = 0.19 cfs @ 14.40 hrs, Volume= 0.129 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.32' @ 14.40 hrs
Flood Elev= 321.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	315.12'	**15.0" Round Culvert** L= 650.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 315.12' / 277.00' S= 0.0586 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=0.18 cfs @ 14.40 hrs HW=315.32' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.18 cfs @ 1.50 fps)

Summary for Subcatchment 1S: Overland to Wetland 1

Runoff = 8.28 cfs @ 12.40 hrs, Volume= 0.959 af, Depth> 1.32"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (wetlands)
	6.120	55	Woods, Good, HSG B
	0.510	61	>75% Grass cover, Good, HSG B
	8.740	61	Weighted Average
	8.740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	250	0.0960	0.17		**Sheet Flow, Tc-1S-1**
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	270	0.1920	2.19		**Shallow Concentrated Flow, Tc-1S-2**
					Woodland Kv= 5.0 fps
26.0	520	Total			

Summary for Subcatchment 1S': Drainage to 1P

Runoff = 5.75 cfs @ 12.29 hrs, Volume= 0.577 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (sf)	CN	Description
	89,580	74	>75% Grass cover, Good, HSG C
*	9,550	87	Crushed stone, HSG C
	15,070	98	Paved parking, HSG C
	114,200	78	Weighted Average
	99,130		86.80% Pervious Area
	15,070		13.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-1a** Grass: Dense n= 0.240 P2= 3.20"
6.5	480	0.0310	1.23		**Shallow Concentrated Flow, Tc-1a-2** Short Grass Pasture Kv= 7.0 fps
0.1	106	0.1200	19.75	24.24	**Pipe Channel, HDPE from CB-9** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
21.1	836	Total			

Summary for Subcatchment 2S: Overland to Wetland 2

Runoff = 9.74 cfs @ 12.17 hrs, Volume= 0.788 af, Depth> 1.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (wetlands)
	0.590	61	>75% Grass cover, Good, HSG B
	2.900	55	Woods, Good, HSG B
	5.890	65	Weighted Average
	5.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	75	0.0600	0.11		**Sheet Flow, Tc-2s** Woods: Light underbrush n= 0.400 P2= 3.20"

Summary for Subcatchment 2S': Drainage to Basin

Runoff = 13.35 cfs @ 12.24 hrs, Volume= 1.234 af, Depth> 2.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	1.900	61	>75% Grass cover, Good, HSG B (fill slopes)
*	2.110	87	Crushed Stone, HSG C
	1.230	98	Paved parking, HSG C
	5.240	80	Weighted Average
	4.010		76.53% Pervious Area
	1.230		23.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	589	0.0150	0.58		**Lag/CN Method, Tc-2S'**

Summary for Subcatchment 3S: Drainage Area to Basin

Runoff = 22.72 cfs @ 12.20 hrs, Volume= 1.956 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	3.010	98	Impervious roof & pavement
*	3.900	72	Crushed Stone surface, HSG B
	1.390	61	>75% Grass cover, Good, HSG B
	8.300	80	Weighted Average
	5.290		63.73% Pervious Area
	3.010		36.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	560	0.0200	0.66		**Lag/CN Method, Tc-1**

Summary for Subcatchment 3S': Overland to Wetland 2

Runoff = 11.84 cfs @ 12.37 hrs, Volume= 1.314 af, Depth> 1.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (wetlands)
*	0.270	61	>75% Grass cover, Good, HSG B (fill slopes)
	6.650	55	Woods, Good, HSG B
	10.840	63	Weighted Average
	10.840		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	300	0.1460	0.21		**Sheet Flow, Tc 3S-1** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc 3S-2** Woodland Kv= 5.0 fps
24.5	415	Total			

Summary for Subcatchment DB1: Drainage to Basin B1

Runoff = 2.56 cfs @ 12.18 hrs, Volume= 0.213 af, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

Area (sf)	CN	Description
48,285	74	>75% Grass cover, Good, HSG C
48,285		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	225	0.1350	0.29		**Sheet Flow, Tc-B1** Grass: Dense n= 0.240 P2= 3.20"

Summary for Subcatchment DB4: Drainage to B4

Runoff = 4.24 cfs @ 12.22 hrs, Volume= 0.381 af, Depth> 2.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

Area (sf)	CN	Description
86,400	74	>75% Grass cover, Good, HSG C
86,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-DB4** Grass: Dense n= 0.240 P2= 3.20"
1.5	110	0.0300	1.21		**Shallow Concentrated Flow, Tc-DB4-2** Short Grass Pasture Kv= 7.0 fps
16.0	360	Total			

Summary for Reach 1R: Wetlands/Swale

Inflow Area =	12.470 ac,	2.77% Impervious,	Inflow Depth > 1.51"		for 10-Year event	
Inflow =	10.07 cfs @	12.45 hrs,	Volume=	1.573 af		
Outflow =	9.74 cfs @	12.62 hrs,	Volume=	1.557 af,	Atten= 3%,	Lag= 10.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.93 fps, Min. Travel Time= 5.6 min
Avg. Velocity = 1.10 fps, Avg. Travel Time= 9.8 min

Peak Storage= 3,265 cf @ 12.52 hrs
Average Depth at Peak Storage= 0.21'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'

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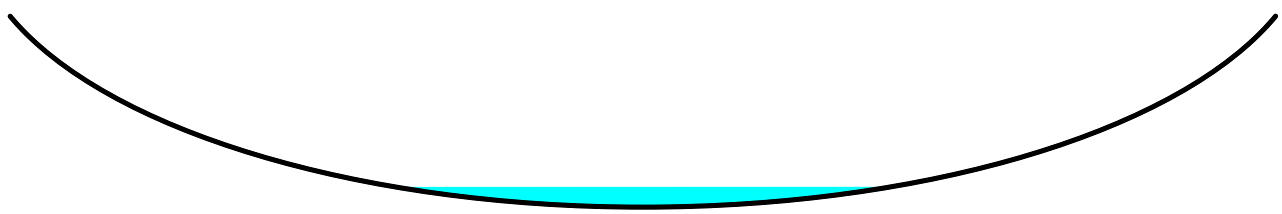


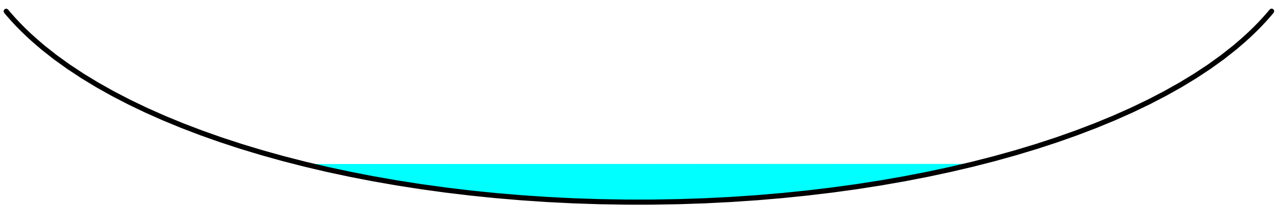
Summary for Reach 2R: Wetlands/Swale

Inflow Area = 13.113 ac, 9.38% Impervious, Inflow Depth > 1.82" for 10-Year event
Inflow = 14.76 cfs @ 12.42 hrs, Volume= 1.985 af
Outflow = 12.81 cfs @ 12.67 hrs, Volume= 1.948 af, Atten= 13%, Lag= 15.2 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.19 fps, Min. Travel Time= 9.8 min
Avg. Velocity = 0.64 fps, Avg. Travel Time= 18.3 min

Peak Storage= 7,576 cf @ 12.51 hrs
Average Depth at Peak Storage= 0.20'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'



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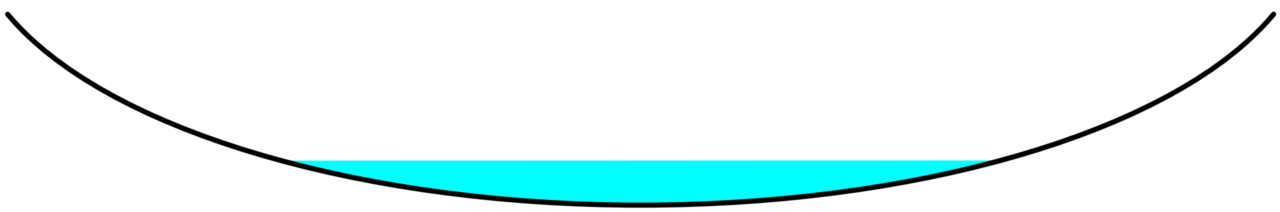
Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 32.253 ac, 13.15% Impervious, Inflow Depth > 1.74" for 10-Year event
Inflow = 24.16 cfs @ 12.61 hrs, Volume= 4.667 af
Outflow = 22.44 cfs @ 12.94 hrs, Volume= 4.549 af, Atten= 7%, Lag= 19.6 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 0.84 fps, Min. Travel Time= 12.6 min
Avg. Velocity = 0.50 fps, Avg. Travel Time= 21.2 min

Peak Storage= 17,021 cf @ 12.73 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.00' Flow Area= 233.3 sf, Capacity= 517.60 cfs

350.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'



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Summary for Reach 4R: Peak at Boundary

Inflow Area =	44.724 ac, 10.25% Impervious, Inflow Depth > 1.64"	for 10-Year event	
Inflow =	29.94 cfs @ 12.88 hrs, Volume=	6.106 af	
Outflow =	29.94 cfs @ 12.88 hrs, Volume=	6.106 af, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Basin 1

Inflow Area = 3.730 ac, 9.27% Impervious, Inflow Depth > 2.53" for 10-Year event
Inflow = 6.25 cfs @ 12.30 hrs, Volume= 0.785 af
Outflow = 2.55 cfs @ 12.77 hrs, Volume= 0.614 af, Atten= 59%, Lag= 28.4 min
Primary = 2.55 cfs @ 12.77 hrs, Volume= 0.614 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 275.44' @ 12.77 hrs Surf.Area= 5,494 sf Storage= 12,970 cf
Flood Elev= 278.00' Surf.Area= 7,415 sf Storage= 29,355 cf

Plug-Flow detention time= 116.4 min calculated for 0.614 af (78% of inflow)
Center-of-Mass det. time= 63.2 min (880.1 - 816.8)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	29,355 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	1,000	0	0
274.00	4,650	5,650	5,650
276.00	5,820	10,470	16,120
278.00	7,415	13,235	29,355

Device	Routing	Invert	Outlet Devices
#1	Primary	274.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 274.00' / 274.00' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	277.00'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=2.55 cfs @ 12.77 hrs HW=275.44' (Free Discharge)
└─**1=Culvert** (Barrel Controls 2.55 cfs @ 3.25 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=272.00' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Basin 2P

Inflow Area = 7.223 ac, 17.03% Impervious, Inflow Depth > 2.31" for 10-Year event
Inflow = 13.53 cfs @ 12.24 hrs, Volume= 1.388 af
Outflow = 9.37 cfs @ 12.44 hrs, Volume= 1.197 af, Atten= 31%, Lag= 12.4 min
Primary = 3.15 cfs @ 12.44 hrs, Volume= 1.034 af
Secondary = 6.23 cfs @ 12.44 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 279.72' @ 12.44 hrs Surf.Area= 7,741 sf Storage= 20,768 cf

Plug-Flow detention time= 99.9 min calculated for 1.193 af (86% of inflow)
Center-of-Mass det. time= 57.2 min (865.8 - 808.6)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	22,943 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	1,090	0	0
277.00	3,440	4,530	4,530
277.50	4,066	1,877	6,407
278.00	6,000	2,517	8,923
280.00	8,020	14,020	22,943

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.50'	**24.0' long x 7.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.42 2.53 2.70 2.69 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.67 2.69 2.71 2.76
#2	Primary	277.50'	**6.0" Round Culvert X 3.00** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 277.50' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=3.14 cfs @ 12.44 hrs HW=279.72' (Free Discharge)
↑**2=Culvert** (Inlet Controls 3.14 cfs @ 5.34 fps)

Secondary OutFlow Max=6.13 cfs @ 12.44 hrs HW=279.72' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 6.13 cfs @ 1.15 fps)

Summary for Pond 3P: Basin 3P

Inflow Area = 8.300 ac, 36.27% Impervious, Inflow Depth > 2.83" for 10-Year event
Inflow = 22.72 cfs @ 12.20 hrs, Volume= 1.956 af
Outflow = 3.39 cfs @ 12.98 hrs, Volume= 1.405 af, Atten= 85%, Lag= 46.9 min
Primary = 3.39 cfs @ 12.98 hrs, Volume= 1.405 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 277.88' @ 12.98 hrs Surf.Area= 23,727 sf Storage= 46,100 cf

Plug-Flow detention time= 183.7 min calculated for 1.405 af (72% of inflow)
Center-of-Mass det. time= 120.0 min (912.3 - 792.3)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	6,413 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 16,032 cf Overall x 40.0% Voids
#2	274.50'	77,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		84,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	8,016	0	0
274.00	8,016	16,032	16,032

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.50	4,205	0	0
275.00	7,438	2,911	2,911
276.00	12,723	10,081	12,991
278.00	15,906	28,629	41,620
280.00	20,311	36,217	77,837

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.00'	**16.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	277.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 275.00' S= 0.1250 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#3	Primary	276.00'	**10.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 276.00' / 275.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#4	Primary	273.00'	**4.0" Round Culvert** L= 52.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.50' / 273.00' S= -0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=3.39 cfs @ 12.98 hrs HW=277.88' (Free Discharge)
—2=Culvert (Inlet Controls 0.34 cfs @ 1.65 fps)
—3=Culvert (Inlet Controls 2.51 cfs @ 4.59 fps)
—4=Culvert (Outlet Controls 0.55 cfs @ 6.30 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=272.00' (Free Discharge)
—1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B1: Retention

Inflow Area = 1.108 ac, 0.00% Impervious, Inflow Depth > 2.31" for 10-Year event
Inflow = 2.56 cfs @ 12.18 hrs, Volume= 0.213 af
Outflow = 0.51 cfs @ 12.77 hrs, Volume= 0.208 af, Atten= 80%, Lag= 35.1 min
Primary = 0.51 cfs @ 12.77 hrs, Volume= 0.208 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.53' @ 12.77 hrs Surf.Area= 7,844 sf Storage= 3,307 cf

Plug-Flow detention time= 63.3 min calculated for 0.208 af (98% of inflow)
Center-of-Mass det. time= 54.2 min (857.7 - 803.6)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	19,555 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	312.00'	384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 960 cf Overall x 40.0% Voids
		19,939 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	3,590	0	0
316.00	10,660	7,125	7,125
317.00	14,200	12,430	19,555

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	480	0	0
314.00	480	960	960

Device	Routing	Invert	Outlet Devices
#1	Primary	316.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	313.00'	**4.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 313.00' / 300.00' S= 0.1130 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=0.51 cfs @ 12.77 hrs HW=315.53' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Culvert (Inlet Controls 0.51 cfs @ 5.85 fps)

Summary for Pond B4: Basin B4

Inflow Area = 1.983 ac, 0.00% Impervious, Inflow Depth > 2.30" for 10-Year event
Inflow = 4.24 cfs @ 12.22 hrs, Volume= 0.381 af
Outflow = 0.20 cfs @ 16.42 hrs, Volume= 0.154 af, Atten= 95%, Lag= 251.8 min
Primary = 0.20 cfs @ 16.42 hrs, Volume= 0.154 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 322.53' @ 16.42 hrs Surf.Area= 9,264 sf Storage= 10,616 cf

Plug-Flow detention time= 202.7 min calculated for 0.154 af (41% of inflow)
Center-of-Mass det. time= 114.2 min (920.3 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1	318.00'	360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 900 cf Overall x 40.0% Voids
#2	321.00'	27,168 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		27,528 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
318.00	300	0	0
321.00	300	900	900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
321.00	4,850	0	0
322.00	7,175	6,013	6,013
324.00	13,980	21,155	27,168

Device	Routing	Invert	Outlet Devices
#1	Primary	318.00'	**3.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 318.00' / 315.12' S= 0.0192 '/' Cc= 0.900 n= 0.012, Flow Area= 0.05 sf
#2	Primary	323.00'	**30.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.20 cfs @ 16.42 hrs HW=322.53' (Free Discharge)
1=Culvert (Barrel Controls 0.20 cfs @ 4.10 fps)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond CB: CB-3

Inflow Area = 1.983 ac, 0.00% Impervious, Inflow Depth > 0.93" for 10-Year event
Inflow = 0.20 cfs @ 16.42 hrs, Volume= 0.154 af
Outflow = 0.20 cfs @ 16.42 hrs, Volume= 0.154 af, Atten= 0%, Lag= 0.0 min
Primary = 0.20 cfs @ 16.42 hrs, Volume= 0.154 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.32' @ 16.42 hrs
Flood Elev= 321.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	315.12'	**15.0" Round Culvert** L= 650.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 315.12' / 277.00' S= 0.0586 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=0.20 cfs @ 16.42 hrs HW=315.32' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.20 cfs @ 1.53 fps)

Summary for Subcatchment 1S: Overland to Wetland 1

Runoff = 21.34 cfs @ 12.38 hrs, Volume= 2.344 af, Depth> 3.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	2.110	77	Woods, Good, HSG D (wetlands)
	6.120	55	Woods, Good, HSG B
	0.510	61	>75% Grass cover, Good, HSG B
	8.740	61	Weighted Average
	8.740		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	250	0.0960	0.17		**Sheet Flow, Tc-1S-1**
					Woods: Light underbrush n= 0.400 P2= 3.20"
2.1	270	0.1920	2.19		**Shallow Concentrated Flow, Tc-1S-2**
					Woodland Kv= 5.0 fps
26.0	520	Total			

Summary for Subcatchment 1S': Drainage to 1P

Runoff = 10.98 cfs @ 12.29 hrs, Volume= 1.119 af, Depth> 5.12"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (sf)	CN	Description
	89,580	74	>75% Grass cover, Good, HSG C
*	9,550	87	Crushed stone, HSG C
	15,070	98	Paved parking, HSG C
	114,200	78	Weighted Average
	99,130		86.80% Pervious Area
	15,070		13.20% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-1a** Grass: Dense n= 0.240 P2= 3.20"
6.5	480	0.0310	1.23		**Shallow Concentrated Flow, Tc-1a-2** Short Grass Pasture Kv= 7.0 fps
0.1	106	0.1200	19.75	24.24	**Pipe Channel, HDPE from CB-9** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.012
21.1	836	Total			

Summary for Subcatchment 2S: Overland to Wetland 2

Runoff = 22.94 cfs @ 12.16 hrs, Volume= 1.804 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	2.400	77	Woods, Good, HSG D (wetlands)
	0.590	61	>75% Grass cover, Good, HSG B
	2.900	55	Woods, Good, HSG B
	5.890	65	Weighted Average
	5.890		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	75	0.0600	0.11		**Sheet Flow, Tc-2s** Woods: Light underbrush n= 0.400 P2= 3.20"

Summary for Subcatchment 2S': Drainage to Basin

Runoff = 24.81 cfs @ 12.23 hrs, Volume= 2.340 af, Depth> 5.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	1.900	61	>75% Grass cover, Good, HSG B (fill slopes)
*	2.110	87	Crushed Stone, HSG C
	1.230	98	Paved parking, HSG C
	5.240	80	Weighted Average
	4.010		76.53% Pervious Area
	1.230		23.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0	589	0.0150	0.58		**Lag/CN Method, Tc-2S'**

Summary for Subcatchment 3S: Drainage Area to Basin

Runoff = 42.19 cfs @ 12.19 hrs, Volume= 3.710 af, Depth> 5.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	3.010	98	Impervious roof & pavement
*	3.900	72	Crushed Stone surface, HSG B
	1.390	61	>75% Grass cover, Good, HSG B
	8.300	80	Weighted Average
	5.290		63.73% Pervious Area
	3.010		36.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	560	0.0200	0.66		**Lag/CN Method, Tc-1**

Summary for Subcatchment 3S': Overland to Wetland 2

Runoff = 29.09 cfs @ 12.35 hrs, Volume= 3.105 af, Depth> 3.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	3.920	77	Woods, Good, HSG D (wetlands)
*	0.270	61	>75% Grass cover, Good, HSG B (fill slopes)
	6.650	55	Woods, Good, HSG B
	10.840	63	Weighted Average
	10.840		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.3	300	0.1460	0.21		**Sheet Flow, Tc 3S-1** Woods: Light underbrush n= 0.400 P2= 3.20"
1.2	115	0.0950	1.54		**Shallow Concentrated Flow, Tc 3S-2** Woodland Kv= 5.0 fps
24.5	415	Total			

Summary for Subcatchment DB1: Drainage to Basin B1

Runoff = 5.20 cfs @ 12.17 hrs, Volume= 0.432 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

Area (sf)	CN	Description
48,285	74	>75% Grass cover, Good, HSG C
48,285		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.7	225	0.1350	0.29		**Sheet Flow, Tc-B1** Grass: Dense n= 0.240 P2= 3.20"

Summary for Subcatchment DB4: Drainage to B4

Runoff = 8.55 cfs @ 12.22 hrs, Volume= 0.773 af, Depth> 4.67"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

Area (sf)	CN	Description
86,400	74	>75% Grass cover, Good, HSG C
86,400		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.5	250	0.1200	0.29		**Sheet Flow, Tc-DB4** Grass: Dense n= 0.240 P2= 3.20"
1.5	110	0.0300	1.21		**Shallow Concentrated Flow, Tc-DB4-2** Short Grass Pasture Kv= 7.0 fps
16.0	360	Total			

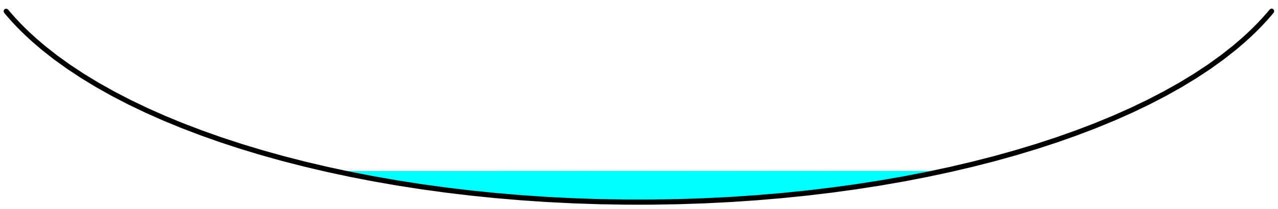
Summary for Reach 1R: Wetlands/Swale

Inflow Area = 12.470 ac, 2.77% Impervious, Inflow Depth > 3.53" for 100-Year event
Inflow = 25.52 cfs @ 12.39 hrs, Volume= 3.668 af
Outflow = 24.98 cfs @ 12.51 hrs, Volume= 3.639 af, Atten= 2%, Lag= 7.5 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.57 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 1.30 fps, Avg. Travel Time= 8.3 min

Peak Storage= 6,280 cf @ 12.44 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 2.00' Flow Area= 146.7 sf, Capacity= 1,259.44 cfs

110.00' x 2.00' deep Parabolic Channel, n= 0.035
Length= 645.0' Slope= 0.0279 '/'
Inlet Invert= 284.00', Outlet Invert= 266.00'



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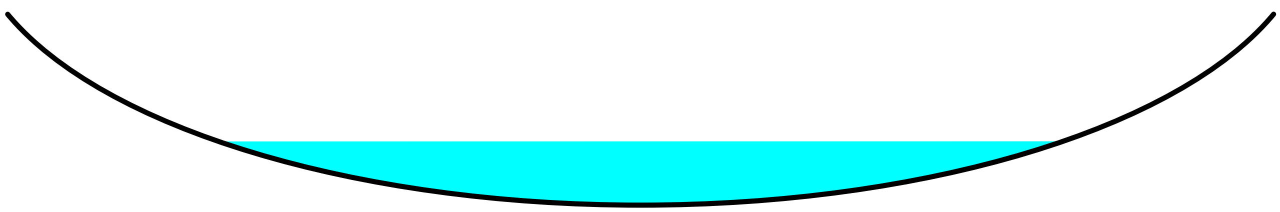
Summary for Reach 2R: Wetlands/Swale

Inflow Area = 13.113 ac, 9.38% Impervious, Inflow Depth > 3.99" for 100-Year event
Inflow = 44.01 cfs @ 12.22 hrs, Volume= 4.363 af
Outflow = 38.53 cfs @ 12.43 hrs, Volume= 4.313 af, Atten= 12%, Lag= 13.1 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.67 fps, Min. Travel Time= 7.0 min
Avg. Velocity = 0.74 fps, Avg. Travel Time= 15.8 min

Peak Storage= 16,296 cf @ 12.31 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 120.0 sf, Capacity= 415.63 cfs

180.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 700.0' Slope= 0.0114 '/'
Inlet Invert= 274.00', Outlet Invert= 266.00'



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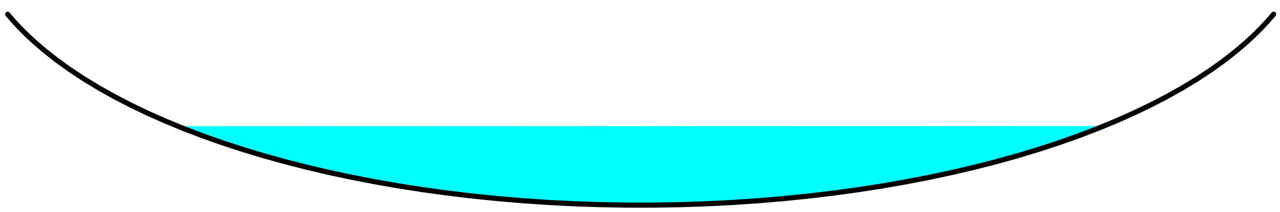
Summary for Reach 3R: Wetland/Swale to Offsite

Inflow Area = 32.253 ac, 13.15% Impervious, Inflow Depth > 3.89" for 100-Year event
Inflow = 85.13 cfs @ 12.44 hrs, Volume= 10.464 af
Outflow = 76.59 cfs @ 12.69 hrs, Volume= 10.294 af, Atten= 10%, Lag= 15.4 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.23 fps, Min. Travel Time= 8.7 min
Avg. Velocity = 0.58 fps, Avg. Travel Time= 18.3 min

Peak Storage= 39,835 cf @ 12.55 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00' Flow Area= 233.3 sf, Capacity= 517.60 cfs

350.00' x 1.00' deep Parabolic Channel, n= 0.035
Length= 640.0' Slope= 0.0047 '/'
Inlet Invert= 266.00', Outlet Invert= 263.00'



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Summary for Reach 4R: Peak at Boundary

Inflow Area = 44.724 ac, 10.25% Impervious, Inflow Depth > 3.74" for 100-Year event
Inflow = 98.52 cfs @ 12.67 hrs, Volume= 13.933 af
Outflow = 98.52 cfs @ 12.67 hrs, Volume= 13.933 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 1P: Basin 1

Inflow Area = 3.730 ac, 9.27% Impervious, Inflow Depth > 4.91" for 100-Year event
Inflow = 11.51 cfs @ 12.29 hrs, Volume= 1.527 af
Outflow = 4.84 cfs @ 12.72 hrs, Volume= 1.324 af, Atten= 58%, Lag= 25.9 min
Primary = 4.74 cfs @ 12.72 hrs, Volume= 1.323 af
Secondary = 0.11 cfs @ 12.72 hrs, Volume= 0.001 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 277.02' @ 12.72 hrs Surf.Area= 6,631 sf Storage= 22,454 cf
Flood Elev= 278.00' Surf.Area= 7,415 sf Storage= 29,355 cf

Plug-Flow detention time= 98.8 min calculated for 1.324 af (87% of inflow)
Center-of-Mass det. time= 55.2 min (876.7 - 821.5)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	29,355 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	1,000	0	0
274.00	4,650	5,650	5,650
276.00	5,820	10,470	16,120
278.00	7,415	13,235	29,355

Device	Routing	Invert	Outlet Devices
#1	Primary	274.00'	**12.0" Round Culvert** L= 30.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 274.00' / 274.00' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	277.00'	**12.0' long x 12.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=4.73 cfs @ 12.72 hrs HW=277.02' (Free Discharge)
└─**1=Culvert** (Inlet Controls 4.73 cfs @ 6.03 fps)

Secondary OutFlow Max=0.06 cfs @ 12.72 hrs HW=277.02' (Free Discharge)
└─**2=Broad-Crested Rectangular Weir** (Weir Controls 0.06 cfs @ 0.32 fps)

Summary for Pond 2P: Basin 2P

Inflow Area = 7.223 ac, 17.03% Impervious, Inflow Depth > 4.59" for 100-Year event
Inflow = 25.01 cfs @ 12.23 hrs, Volume= 2.764 af
Outflow = 24.63 cfs @ 12.27 hrs, Volume= 2.559 af, Atten= 1%, Lag= 2.2 min
Primary = 3.35 cfs @ 12.27 hrs, Volume= 1.619 af
Secondary = 21.28 cfs @ 12.27 hrs, Volume= 0.941 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 279.99' @ 12.27 hrs Surf.Area= 8,007 sf Storage= 22,841 cf

Plug-Flow detention time= 69.9 min calculated for 2.551 af (92% of inflow)
Center-of-Mass det. time= 45.0 min (835.8 - 790.8)

Volume	Invert	Avail.Storage	Storage Description
#1	275.00'	22,943 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
275.00	1,090	0	0
277.00	3,440	4,530	4,530
277.50	4,066	1,877	6,407
278.00	6,000	2,517	8,923
280.00	8,020	14,020	22,943

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.50'	**24.0' long x 7.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.42 2.53 2.70 2.69 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.67 2.69 2.71 2.76
#2	Primary	277.50'	**6.0" Round Culvert X 3.00** L= 15.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 277.50' S= 0.0000 '/' Cc= 0.900 n= 0.012, Flow Area= 0.20 sf

Primary OutFlow Max=3.35 cfs @ 12.27 hrs HW=279.98' (Free Discharge)
↑**2=Culvert** (Inlet Controls 3.35 cfs @ 5.68 fps)

Secondary OutFlow Max=20.96 cfs @ 12.27 hrs HW=279.98' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 20.96 cfs @ 1.81 fps)

Summary for Pond 3P: Basin 3P

Inflow Area = 8.300 ac, 36.27% Impervious, Inflow Depth > 5.36" for 100-Year event
Inflow = 42.19 cfs @ 12.19 hrs, Volume= 3.710 af
Outflow = 20.06 cfs @ 12.49 hrs, Volume= 3.046 af, Atten= 52%, Lag= 17.9 min
Primary = 5.96 cfs @ 12.49 hrs, Volume= 2.531 af
Secondary = 14.11 cfs @ 12.49 hrs, Volume= 0.515 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 279.47' @ 12.49 hrs Surf.Area= 27,167 sf Storage= 73,859 cf

Plug-Flow detention time= 148.7 min calculated for 3.036 af (82% of inflow)
Center-of-Mass det. time= 100.7 min (878.0 - 777.3)

Volume	Invert	Avail.Storage	Storage Description
#1	272.00'	6,413 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 16,032 cf Overall x 40.0% Voids
#2	274.50'	77,837 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		84,250 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
272.00	8,016	0	0
274.00	8,016	16,032	16,032

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
274.50	4,205	0	0
275.00	7,438	2,911	2,911
276.00	12,723	10,081	12,991
278.00	15,906	28,629	41,620
280.00	20,311	36,217	77,837

Device	Routing	Invert	Outlet Devices
#1	Secondary	279.00'	**16.0' long x 16.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	277.50'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 277.50' / 275.00' S= 0.1250 '/' Cc= 0.900 n= 0.012, Flow Area= 0.35 sf
#3	Primary	276.00'	**10.0" Round Culvert** L= 32.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 276.00' / 275.00' S= 0.0313 '/' Cc= 0.900 n= 0.012, Flow Area= 0.55 sf
#4	Primary	273.00'	**4.0" Round Culvert** L= 52.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 272.50' / 273.00' S= -0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=5.96 cfs @ 12.49 hrs HW=279.47' (Free Discharge)
├─**2=Culvert** (Inlet Controls 1.70 cfs @ 4.87 fps)
├─**3=Culvert** (Inlet Controls 3.62 cfs @ 6.64 fps)
└─**4=Culvert** (Outlet Controls 0.63 cfs @ 7.26 fps)

Secondary OutFlow Max=13.98 cfs @ 12.49 hrs HW=279.47' (Free Discharge)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 13.98 cfs @ 1.85 fps)

Summary for Pond B1: Retention

Inflow Area = 1.108 ac, 0.00% Impervious, Inflow Depth > 4.68" for 100-Year event
Inflow = 5.20 cfs @ 12.17 hrs, Volume= 0.432 af
Outflow = 0.57 cfs @ 13.22 hrs, Volume= 0.408 af, Atten= 89%, Lag= 62.9 min
Primary = 0.57 cfs @ 13.22 hrs, Volume= 0.408 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 316.08' @ 13.22 hrs Surf.Area= 11,418 sf Storage= 8,356 cf

Plug-Flow detention time= 149.2 min calculated for 0.408 af (94% of inflow)
Center-of-Mass det. time= 129.3 min (916.7 - 787.4)

Volume	Invert	Avail.Storage	Storage Description
#1	315.00'	19,555 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	312.00'	384 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 960 cf Overall x 40.0% Voids
		19,939 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
315.00	3,590	0	0
316.00	10,660	7,125	7,125
317.00	14,200	12,430	19,555

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	480	0	0
314.00	480	960	960

Device	Routing	Invert	Outlet Devices
#1	Primary	316.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63
#2	Primary	313.00'	**4.0" Round Culvert** L= 115.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 313.00' / 300.00' S= 0.1130 '/' Cc= 0.900 n= 0.012, Flow Area= 0.09 sf

Primary OutFlow Max=0.57 cfs @ 13.22 hrs HW=316.08' (Free Discharge)
├─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**2=Culvert** (Inlet Controls 0.57 cfs @ 6.49 fps)

Summary for Pond B4: Basin B4

Inflow Area = 1.983 ac, 0.00% Impervious, Inflow Depth > 4.67" for 100-Year event
Inflow = 8.55 cfs @ 12.22 hrs, Volume= 0.773 af
Outflow = 2.90 cfs @ 12.65 hrs, Volume= 0.423 af, Atten= 66%, Lag= 26.1 min
Primary = 2.90 cfs @ 12.65 hrs, Volume= 0.423 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 323.10' @ 12.65 hrs Surf.Area= 11,229 sf Storage= 16,360 cf

Plug-Flow detention time= 141.0 min calculated for 0.423 af (55% of inflow)
Center-of-Mass det. time= 62.8 min (852.8 - 790.1)

Volume	Invert	Avail.Storage	Storage Description
#1	318.00'	360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 900 cf Overall x 40.0% Voids
#2	321.00'	27,168 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
		27,528 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
318.00	300	0	0
321.00	300	900	900

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
321.00	4,850	0	0
322.00	7,175	6,013	6,013
324.00	13,980	21,155	27,168

Device	Routing	Invert	Outlet Devices
#1	Primary	318.00'	**3.0" Round Culvert** L= 150.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 318.00' / 315.12' S= 0.0192 '/' Cc= 0.900 n= 0.012, Flow Area= 0.05 sf
#2	Primary	323.00'	**30.0' long x 40.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=2.87 cfs @ 12.65 hrs HW=323.10' (Free Discharge)
↑—**1=Culvert** (Barrel Controls 0.21 cfs @ 4.27 fps)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 2.66 cfs @ 0.86 fps)

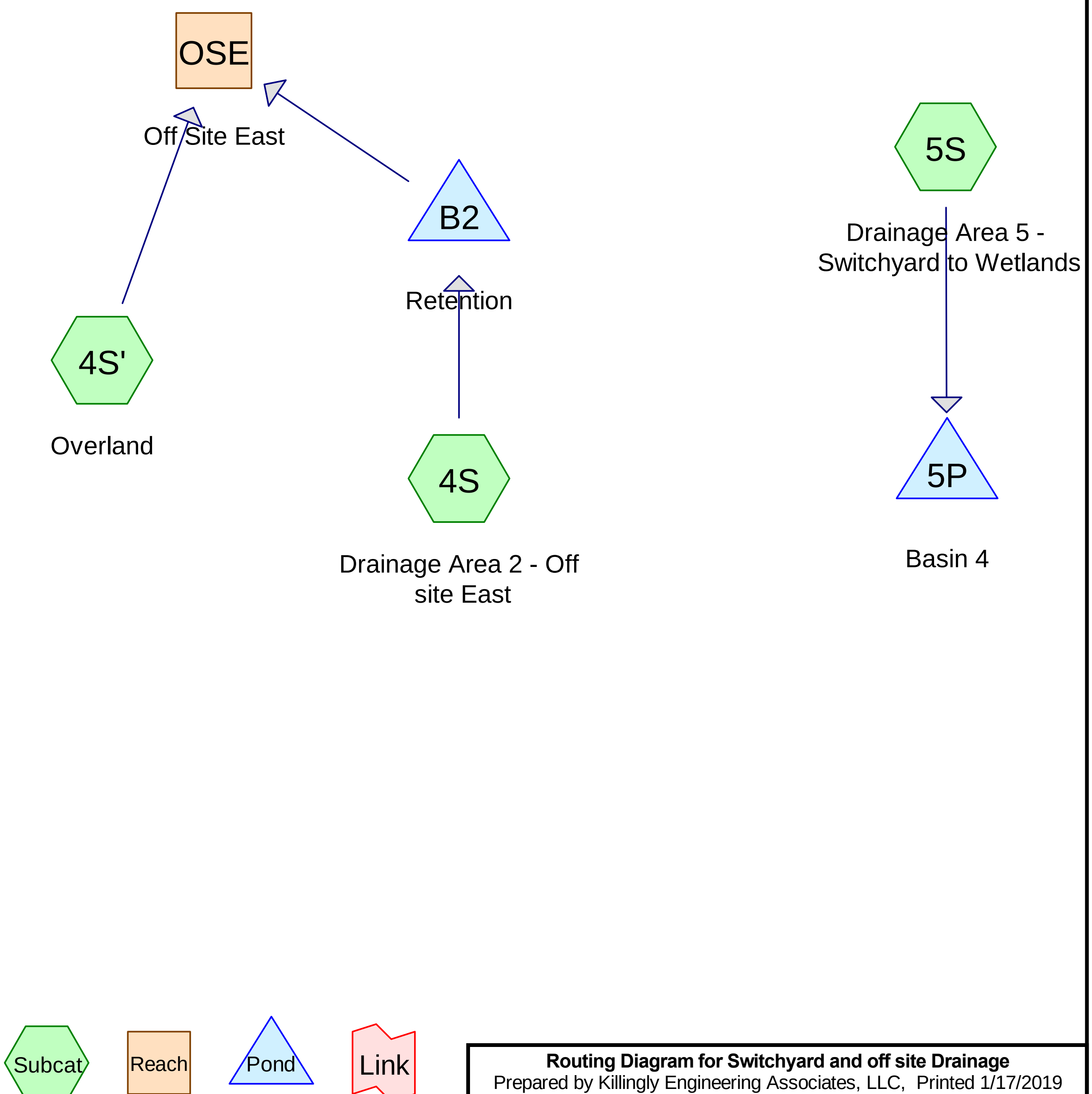
Summary for Pond CB: CB-3

Inflow Area =	1.983 ac,	0.00% Impervious, Inflow Depth > 2.56"	for 100-Year event
Inflow =	2.90 cfs @	12.65 hrs, Volume=	0.423 af
Outflow =	2.90 cfs @	12.65 hrs, Volume=	0.423 af, Atten= 0%, Lag= 0.0 min
Primary =	2.90 cfs @	12.65 hrs, Volume=	0.423 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 315.99' @ 12.65 hrs
Flood Elev= 321.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	315.12'	**15.0" Round Culvert** L= 650.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 315.12' / 277.00' S= 0.0586 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf

Primary OutFlow Max=2.89 cfs @ 12.65 hrs HW=315.99' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.89 cfs @ 3.17 fps)



Routing Diagram for Switchyard and off site Drainage
Prepared by Killingly Engineering Associates, LLC, Printed 1/17/2019
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Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 1.13 cfs @ 12.20 hrs, Volume= 0.102 af, Depth> 0.72"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

Area (sf)	CN	Description
22,565	55	Woods, Good, HSG B
52,200	74	>75% Grass cover, Good, HSG C
74,765	68	Weighted Average
74,765		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	250	0.0880	0.38		**Sheet Flow, Tc 4S-1** Grass: Short n= 0.150 P2= 3.32"
1.0	112	0.0710	1.87		**Shallow Concentrated Flow, Tc 4s-2** Short Grass Pasture Kv= 7.0 fps
12.1	362	Total			

Summary for Subcatchment 4S': Overland

Runoff = 0.10 cfs @ 12.48 hrs, Volume= 0.018 af, Depth> 0.24"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

Area (sf)	CN	Description
39,244	55	Woods, Good, HSG B
39,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	205	0.1460	0.20		**Sheet Flow, Tc-4S'** Woods: Light underbrush n= 0.400 P2= 3.32"

Summary for Subcatchment 5S: Drainage Area 5 - Switchyard to Wetlands

Runoff = 2.51 cfs @ 12.92 hrs, Volume= 0.459 af, Depth> 0.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.32"

	Area (ac)	CN	Description
*	0.810	98	Roof & Pavement
	0.730	71	Meadow, non-grazed, HSG C
	4.760	55	Woods, Good, HSG B
*	1.600	89	Crushed stone surface, HSG C
	7.900	68	Weighted Average
	7.090		89.75% Pervious Area
	0.810		10.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
54.3	200	0.0300	0.06		**Sheet Flow, Tc-4a** Woods: Dense underbrush n= 0.800 P2= 3.32"
6.2	567	0.0920	1.52		**Shallow Concentrated Flow, Tc-4B** Woodland Kv= 5.0 fps
60.5	767	Total			

Summary for Reach OSE: Off Site East

Inflow Area = 2.617 ac, 0.00% Impervious, Inflow Depth > 0.08" for 2-Year event
Inflow = 0.10 cfs @ 12.48 hrs, Volume= 0.018 af
Outflow = 0.10 cfs @ 12.48 hrs, Volume= 0.018 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 5P: Basin 4

Inflow Area = 7.900 ac, 10.25% Impervious, Inflow Depth > 0.70" for 2-Year event
Inflow = 2.51 cfs @ 12.92 hrs, Volume= 0.459 af
Outflow = 0.53 cfs @ 15.66 hrs, Volume= 0.175 af, Atten= 79%, Lag= 164.4 min
Primary = 0.53 cfs @ 15.66 hrs, Volume= 0.175 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 309.41' @ 15.66 hrs Surf.Area= 5,120 sf Storage= 13,126 cf

Plug-Flow detention time= 242.0 min calculated for 0.175 af (38% of inflow)
Center-of-Mass det. time= 142.7 min (1,014.4 - 871.7)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	16,268 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	2,580	0	0
308.00	4,064	6,644	6,644
310.00	5,560	9,624	16,268

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 309.00' / 307.00' S= 0.0222 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	309.50'	**8.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=0.53 cfs @ 15.66 hrs HW=309.41' (Free Discharge)
↑**1=Culvert** (Inlet Controls 0.53 cfs @ 1.72 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=306.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B2: Retention

Inflow Area = 1.716 ac, 0.00% Impervious, Inflow Depth > 0.72" for 2-Year event
Inflow = 1.13 cfs @ 12.20 hrs, Volume= 0.102 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 313.46' @ 20.00 hrs Surf.Area= 3,114 sf Storage= 4,460 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	312.00'	6,150 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	2,990	0	0
314.00	3,160	6,150	6,150

Device	Routing	Invert	Outlet Devices
#1	Primary	313.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=312.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 3.15 cfs @ 12.18 hrs, Volume= 0.261 af, Depth> 1.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

Area (sf)	CN	Description
22,565	55	Woods, Good, HSG B
52,200	74	>75% Grass cover, Good, HSG C
74,765	68	Weighted Average
74,765		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	250	0.0880	0.38		**Sheet Flow, Tc 4S-1** Grass: Short n= 0.150 P2= 3.32"
1.0	112	0.0710	1.87		**Shallow Concentrated Flow, Tc 4s-2** Short Grass Pasture Kv= 7.0 fps
12.1	362	Total			

Summary for Subcatchment 4S': Overland

Runoff = 0.65 cfs @ 12.28 hrs, Volume= 0.071 af, Depth> 0.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

Area (sf)	CN	Description
39,244	55	Woods, Good, HSG B
39,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	205	0.1460	0.20		**Sheet Flow, Tc-4S'** Woods: Light underbrush n= 0.400 P2= 3.32"

Summary for Subcatchment 5S: Drainage Area 5 - Switchyard to Wetlands

Runoff = 7.01 cfs @ 12.86 hrs, Volume= 1.178 af, Depth> 1.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=5.16"

	Area (ac)	CN	Description
*	0.810	98	Roof & Pavement
	0.730	71	Meadow, non-grazed, HSG C
	4.760	55	Woods, Good, HSG B
*	1.600	89	Crushed stone surface, HSG C
	7.900	68	Weighted Average
	7.090		89.75% Pervious Area
	0.810		10.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
54.3	200	0.0300	0.06		**Sheet Flow, Tc-4a** Woods: Dense underbrush n= 0.800 P2= 3.32"
6.2	567	0.0920	1.52		**Shallow Concentrated Flow, Tc-4B** Woodland Kv= 5.0 fps
60.5	767	Total			

Summary for Reach OSE: Off Site East

Inflow Area =	2.617 ac,	0.00% Impervious, Inflow Depth > 1.03"	for 10-Year event
Inflow =	1.81 cfs @	12.52 hrs, Volume=	0.225 af
Outflow =	1.81 cfs @	12.52 hrs, Volume=	0.225 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 5P: Basin 4

Inflow Area = 7.900 ac, 10.25% Impervious, Inflow Depth > 1.79" for 10-Year event
Inflow = 7.01 cfs @ 12.86 hrs, Volume= 1.178 af
Outflow = 6.14 cfs @ 13.12 hrs, Volume= 0.881 af, Atten= 12%, Lag= 15.6 min
Primary = 1.78 cfs @ 13.12 hrs, Volume= 0.524 af
Secondary = 4.36 cfs @ 13.12 hrs, Volume= 0.357 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 309.86' @ 13.12 hrs Surf.Area= 5,453 sf Storage= 15,483 cf

Plug-Flow detention time= 101.2 min calculated for 0.878 af (74% of inflow)
Center-of-Mass det. time= 44.4 min (896.1 - 851.7)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	16,268 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	2,580	0	0
308.00	4,064	6,644	6,644
310.00	5,560	9,624	16,268

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 309.00' / 307.00' S= 0.0222 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	309.50'	**8.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=1.78 cfs @ 13.12 hrs HW=309.86' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 1.78 cfs @ 2.49 fps)

Secondary OutFlow Max=4.32 cfs @ 13.12 hrs HW=309.86' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.32 cfs @ 1.52 fps)

Summary for Pond B2: Retention

Inflow Area = 1.716 ac, 0.00% Impervious, Inflow Depth > 1.83" for 10-Year event
Inflow = 3.15 cfs @ 12.18 hrs, Volume= 0.261 af
Outflow = 1.32 cfs @ 12.54 hrs, Volume= 0.155 af, Atten= 58%, Lag= 21.8 min
Primary = 1.32 cfs @ 12.54 hrs, Volume= 0.155 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 313.63' @ 12.54 hrs Surf.Area= 3,129 sf Storage= 5,000 cf

Plug-Flow detention time= 147.1 min calculated for 0.155 af (59% of inflow)
Center-of-Mass det. time= 66.9 min (881.6 - 814.7)

Volume	Invert	Avail.Storage	Storage Description
#1	312.00'	6,150 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	2,990	0	0
314.00	3,160	6,150	6,150

Device	Routing	Invert	Outlet Devices
#1	Primary	313.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=1.31 cfs @ 12.54 hrs HW=313.63' (Free Discharge)
└—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.31 cfs @ 0.98 fps)

Summary for Subcatchment 4S: Drainage Area 2 - Off site East

Runoff = 7.06 cfs @ 12.17 hrs, Volume= 0.573 af, Depth> 4.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

Area (sf)	CN	Description
22,565	55	Woods, Good, HSG B
52,200	74	>75% Grass cover, Good, HSG C
74,765	68	Weighted Average
74,765		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	250	0.0880	0.38		**Sheet Flow, Tc 4S-1** Grass: Short n= 0.150 P2= 3.32"
1.0	112	0.0710	1.87		**Shallow Concentrated Flow, Tc 4s-2** Short Grass Pasture Kv= 7.0 fps
12.1	362	Total			

Summary for Subcatchment 4S': Overland

Runoff = 2.07 cfs @ 12.25 hrs, Volume= 0.195 af, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

Area (sf)	CN	Description
39,244	55	Woods, Good, HSG B
39,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.9	205	0.1460	0.20		**Sheet Flow, Tc-4S'** Woods: Light underbrush n= 0.400 P2= 3.32"

Summary for Subcatchment 5S: Drainage Area 5 - Switchyard to Wetlands

Runoff = 15.62 cfs @ 12.83 hrs, Volume= 2.590 af, Depth> 3.93"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=8.09"

	Area (ac)	CN	Description
*	0.810	98	Roof & Pavement
	0.730	71	Meadow, non-grazed, HSG C
	4.760	55	Woods, Good, HSG B
*	1.600	89	Crushed stone surface, HSG C
	7.900	68	Weighted Average
	7.090		89.75% Pervious Area
	0.810		10.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
54.3	200	0.0300	0.06		**Sheet Flow, Tc-4a**
					Woods: Dense underbrush n= 0.800 P2= 3.32"
6.2	567	0.0920	1.52		**Shallow Concentrated Flow, Tc-4B**
					Woodland Kv= 5.0 fps
60.5	767	Total			

Summary for Reach OSE: Off Site East

Inflow Area =	2.617 ac,	0.00% Impervious, Inflow Depth >	3.03"	for 100-Year event
Inflow =	8.80 cfs @	12.22 hrs, Volume=	0.660 af	
Outflow =	8.80 cfs @	12.22 hrs, Volume=	0.660 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Summary for Pond 5P: Basin 4

Inflow Area = 7.900 ac, 10.25% Impervious, Inflow Depth > 3.93" for 100-Year event
Inflow = 15.62 cfs @ 12.83 hrs, Volume= 2.590 af
Outflow = 16.08 cfs @ 12.80 hrs, Volume= 2.278 af, Atten= 0%, Lag= 0.0 min
Primary = 2.56 cfs @ 12.80 hrs, Volume= 0.799 af
Secondary = 13.53 cfs @ 12.80 hrs, Volume= 1.479 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 310.23' @ 12.80 hrs Surf.Area= 5,560 sf Storage= 16,268 cf

Plug-Flow detention time= 55.5 min calculated for 2.270 af (88% of inflow)
Center-of-Mass det. time= 22.3 min (857.5 - 835.2)

Volume	Invert	Avail.Storage	Storage Description
#1	306.00'	16,268 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
306.00	2,580	0	0
308.00	4,064	6,644	6,644
310.00	5,560	9,624	16,268

Device	Routing	Invert	Outlet Devices
#1	Primary	309.00'	**12.0" Round Culvert** L= 90.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 309.00' / 307.00' S= 0.0222 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#2	Secondary	309.50'	**8.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=2.55 cfs @ 12.80 hrs HW=310.23' (Free Discharge)
1=Culvert (Inlet Controls 2.55 cfs @ 3.25 fps)

Secondary OutFlow Max=13.47 cfs @ 12.80 hrs HW=310.23' (Free Discharge)
2=Broad-Crested Rectangular Weir (Weir Controls 13.47 cfs @ 2.30 fps)

Summary for Pond B2: Retention

Inflow Area = 1.716 ac, 0.00% Impervious, Inflow Depth > 4.01" for 100-Year event
Inflow = 7.06 cfs @ 12.17 hrs, Volume= 0.573 af
Outflow = 6.77 cfs @ 12.21 hrs, Volume= 0.465 af, Atten= 4%, Lag= 2.6 min
Primary = 6.77 cfs @ 12.21 hrs, Volume= 0.465 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 313.90' @ 12.21 hrs Surf.Area= 3,151 sf Storage= 5,827 cf

Plug-Flow detention time= 78.9 min calculated for 0.464 af (81% of inflow)
Center-of-Mass det. time= 29.4 min (826.6 - 797.2)

Volume	Invert	Avail.Storage	Storage Description
#1	312.00'	6,150 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
312.00	2,990	0	0
314.00	3,160	6,150	6,150

Device	Routing	Invert	Outlet Devices
#1	Primary	313.50'	**10.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=6.65 cfs @ 12.21 hrs HW=313.89' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 6.65 cfs @ 1.69 fps)

ATTACHMENT 4

WATER QUALITY BASIN CALCULATIONS

Water Quality Volume Requirements

Basin

Drainage Area to Basin 1 = 3.73 Acres

Impervious Area = 0.346 Acres

% Impervious = 9.27%

WQV = 1ò (R) (A) / 12

R = 0.05 + 0.009 (I) = 0.05 + 0.009 (9.27) = 0.1334

WQV = 1ò (0.1334) (3.73) /12 = 0.0414 Acre feet = 1,806 Cubic Feet

Total Provided

Total = 2,311 C.F.

Basin 2

Drainage Area to Basin 2 = 7.223 Acres

Impervious Area = 1.23 Acres

% Impervious = 17.03%

WQV = 1ò (R) (A) / 12

R = 0.05 + 0.009 (I) = 0.05 + 0.009 (17.3) = 0.2057

WQV = 1ò (0.2057) (7.223) /12 = 0.1238 Acre feet = 5,393 Cubic Feet

Total Provided

Total = 6,407 C.F.

Basin 3

Drainage Area to Basin 3 = 8.3 Acres

Impervious Area = 3.01 Acres

% Impervious = 36.27%

WQV = 1ò (R) (A) / 12

R = 0.05 + 0.009 (I) = 0.05 + 0.009 (36.27) = 0.3764

WQV = 1ò (0.3764) (8.3) /12 = 0.26 Acre feet = 11,341 Cubic Feet

Total Provided

Total = 14,314 C.F.

Basin 5 (Switchyard)

Drainage Area to Basin 5 = 7.9 Acres

Impervious Area = 0.81 Acres

% Impervious = 10.25%

WQV = 1ò (R) (A) / 12

R = 0.05 + 0.009 (I) = 0.05 + 0.009 (10.25) = 0.1423

WQV = 1ò (0.1423) (7.9) /12 = 0.0936 Acre feet = 4,077 Cubic Feet

Total Provided

Total = 4,985 C.F.

ATTACHMENT 5

TEMPORARY SEDIMENTATION BASIN REQUIREMENTS

Temporary Sediment Trap Requirements

Per 5-11-5 / 5-11-25 of the 2002 CT guidelines for Soil & Erosion Control

Area	***DA (acres)***	***A (ton/acre/yr)***	***Tons per year***	***Density***	***Required Storage Volume (c.f.)***	***Provided***
Basin 1	3.73	134	499.8	85	**11,760.5**	**16,120**
Basin 2	7.22	134	967.5	85	**22,764.2**	**22,943**
Basin 3	8.3	134	1112.2	85	**26,169.4**	**41,620**
Basin 4	2.8	134	375.2	85	**8,828.2**	**16,628**

Note: additional sediment traps may be field located after land clearing and prior to grading activities

*Per 5-11-25 OF THE 2002 Guidelines
**Per Figure SB-2 of the 2002 Guidelines, Section 5-11-8

ATTACHMENT 6

SAMPLE CONSTRUCTION STORMWATER INSPECTION REPORT

General Information (see reverse for instructions)					
Name of Project	NTE	**CGP Tracking No.**	**IR #35-36**	**Inspection Date**	
Inspector Name, Title & Contact Information	Normand Thibeault, Jr., P.E.				
Present Phase of Construction					
Inspection Location (if multiple inspections are required, specify location where this inspection is being conducted)					

Inspection Frequency *(Note: you may be subject to different inspection frequencies in different areas of the site. Check all that apply.)*

Standard Frequency: ☐ Weekly ☒ within 24 hours of a 0.25" rain

Increased Frequency: ☐ Every 7 days and within 24 hours of a 0.25" rain (for areas of sites discharging to sediment or nutrient-impaired waters or to waters designated as Tier 2, Tier 2.5, or Tier 3)

Reduced Frequency:
- ☒ Once per month (for stabilized areas)
- ☐ Once per month and within 24 hours of a 0.25" rain (for arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought)
- ☐ Once per month (for frozen conditions where earth-disturbing activities are being conducted)

Was this inspection triggered by a 0.25" storm event? ☒ Yes ☐ No

If yes, how did you determined whether a 0.25" storm event has occurred?

☐ Rain gauge on site ☒ Weather station representative of site. Specify weather station source: **Weather Underground**

Total rainfall amount that triggered the inspection (in inches):

Unsafe Conditions for Inspection

Did you determine that any portion of your site was unsafe for inspection per CGP Part 4.1.5? ☐ Yes ☒ No

If "yes", complete the following:
- Describe the conditions that prevented you from conducting the inspection in this location:
- Location(s) where conditions were found:

Condition and Effectiveness of Erosion and Sediment (E&S) Controls				
Type/Location of E&S Control **[Add an additional sheet if necessary]**	**Repairs or Other Maintenance Needed?***	**Corrective Action Required?***	**Date on Which Maintenance or Corrective Action First Identified?**	**Notes**
1. xxxxxxx	☐Yes ☐No	☐Yes ☐No		
2. xxxxxx	☐Yes ☐No	☐Yes ☐No		
3. xxxxxx	☐Yes ☐No	☐Yes ☐No		
4. xxxxxx	☐Yes ☐No	☐Yes ☐No		
5. xxxxxx	☐Yes ☐No	☐Yes ☐No		

* **Note:** The permit differentiates between conditions requiring repairs and maintenance, and those requiring corrective action. The permit requires maintenance in order to keep controls in effective operating condition and requires repairs if controls are not operating as intended. Corrective actions are triggered only for specific, more serious conditions, which include: 1) A required stormwater control was never installed, was installed incorrectly, or not in accordance with the requirements in Part 2 and/or 3; 2) You become aware that the stormwater controls you have installed and are maintaining are not effective enough for the discharge to meet applicable water quality standards or applicable requirements in Part 3.1; 3) One of the prohibited discharges in Part 2.3.1 is occurring or has occurred; or 4) EPA requires corrective actions as a result of a permit violation found during an inspection carried out under Part 4.2. If a condition on your site requires a corrective action, you must also fill out a corrective action form found at www.epa.gov/npdes/stormwater/swppp. See Part 5 of the permit for more information.

Condition and Effectiveness of Pollution Prevention				
Type/Location of P2 Practices [Add an additional sheet if necessary]	**Repairs or Other Maintenance Needed?***	**Corrective Action Required?***	**Date on Which Maintenance or Corrective Action First Identified?**	**Notes**
1.	☐Yes ☐No	☐Yes ☐No		
2.	☐Yes ☐No	☐Yes ☐No		
3.	☐Yes ☐No	☐Yes ☐No		
4.	☐Yes ☐No	☐Yes ☐No		
5.	☐Yes ☐No	☐Yes ☐No		
6.	☐Yes ☐No	☐Yes ☐No		
7.	☐Yes ☐No	☐Yes ☐No		
8.	☐Yes ☐No	☐Yes ☐No		

* **Note:**

Stabilization of Exposed Soil			
Stabilization Area	**Stabilization Method**	**Have You Initiated Stabilization?**	**Notes**
		☐ YES ☐ NO If yes, provide date: ☐ YES ☐ NO If yes, provide date: ☐ YES ☐ NO If yes, provide date:	

Description of Discharges	
Was a stormwater discharge or other discharge occurring from any part of your site at the time of the inspection(s)? ☐ Yes ☒ No **If "yes", provide the following information for each point of discharge:**	
Discharge Location	**Observations**
1	
2.	

Certification and Signature by Permittee

(see reverse for instructions)

"I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature of Permittee or "Duly Authorized Representative": ______________________ **Date:**

Printed Name and Affiliation: ______________________

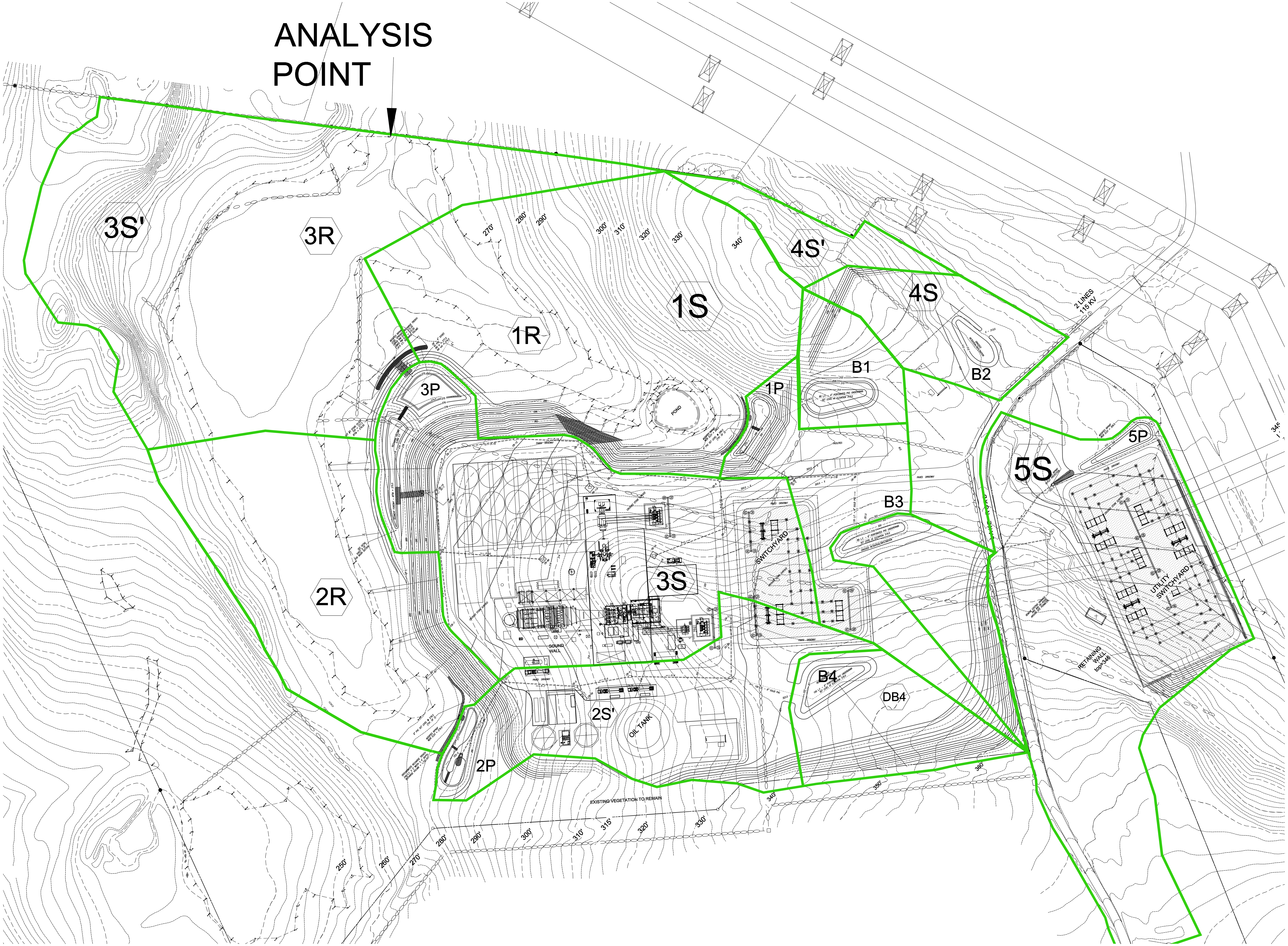
ATTACHMENT 7

DRAINAGE AREA PLANS

GRADING PLANS, EROSION AND SEDIMENTATION CONTROL PLANS & DETAILS

SEPARATE ENCLOSURE


ANALYSIS POINT
3S
9.79 ACRES
3R
1S
21.4 ACRES
1R
4S
2.5 ACRES
2S
13.53 ACRES
2R
5S
7.5 ACRES
RIVER
EXISTING CONDITIONS
200 100 0 200
GRAPHIC SCALE IN FEET



ANALYSIS POINT
3S'
3R
1R
1S
4S'
4S
3P
1P
B1
B2
5P
5S
B3
3S
SWITCHYARD
UTILITY SWITCHYARD
2R
B4
DB4
2S'
OIL TANK
2P
SOUND WALL
POND
RETAINING WALL
2 LINES 115 KV
EXISTING VEGETATION TO REMAIN

APPENDIX D – UPDATED SOUND ANALYSIS

Sound Survey and Analysis Report

Killingly Energy Center

January 2019

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Killingly Energy Center
an NTE Energy Project

EXECUTIVE SUMMARY

NTE Connecticut, LLC is proposing construction of the Killingly Energy Center (KEC) an approximately 650-megawatt combined cycle electric generating facility located at 180 and 189 Lake Road in Killingly, Connecticut. KEC is located in the westernmost portion of an area designated for future industrial development in the Town of Killingly's Plan of Conservation and Development.

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

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

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

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ACRONYMS/ABBREVIATIONS

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

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) has prepared this sound survey and analysis for the proposed Killingly Energy Center (KEC). NTE Connecticut, LLC (NTE) is proposing construction of KEC, an approximately 650-megawatt (MW) combined cycle electric generating facility located on a 73-acre parcel located at 180 and 189 Lake Road in Killingly, Windham County, Connecticut (the Project Site), as shown on Figure 1.

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

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

1.1 SITE DESCRIPTION

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

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

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

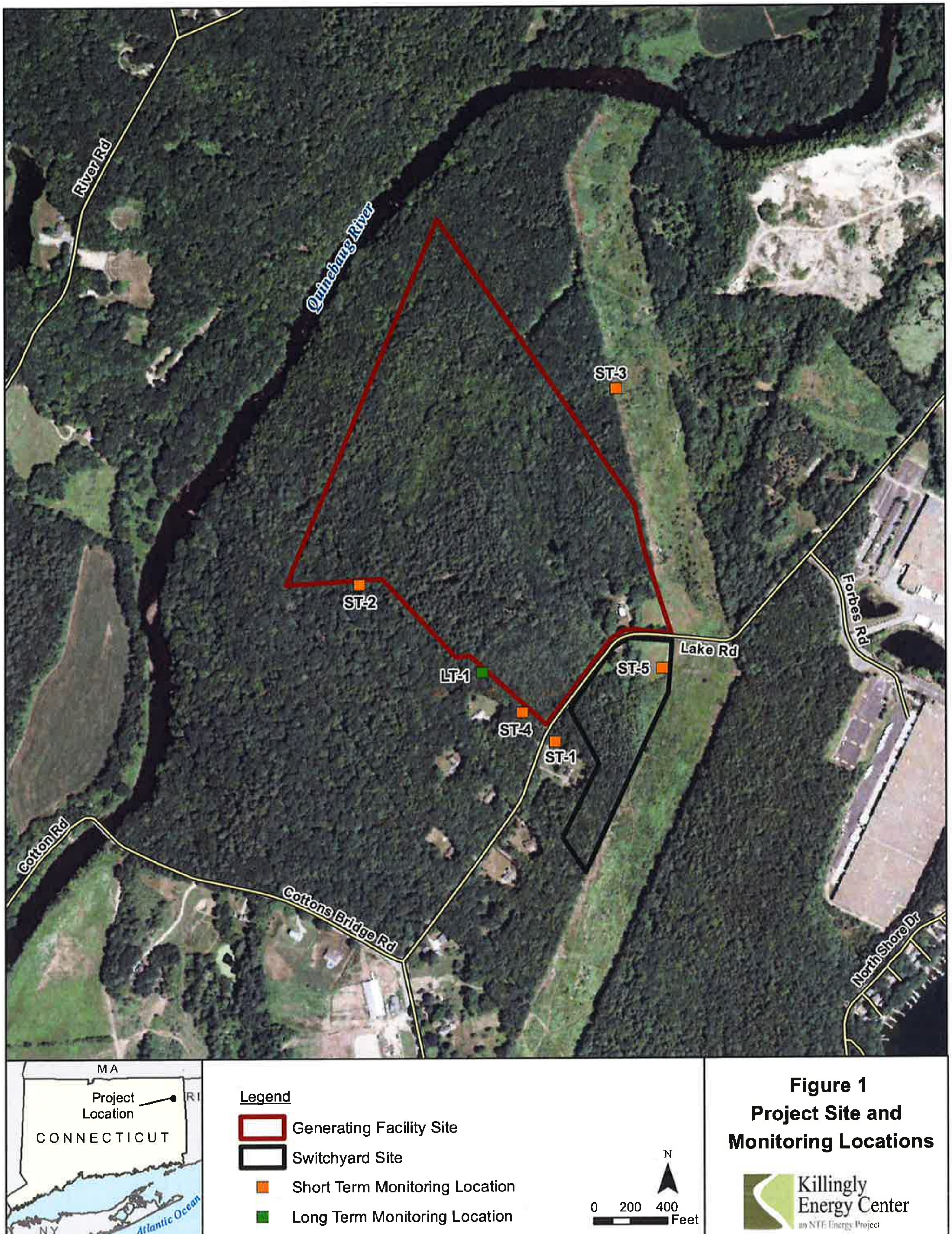
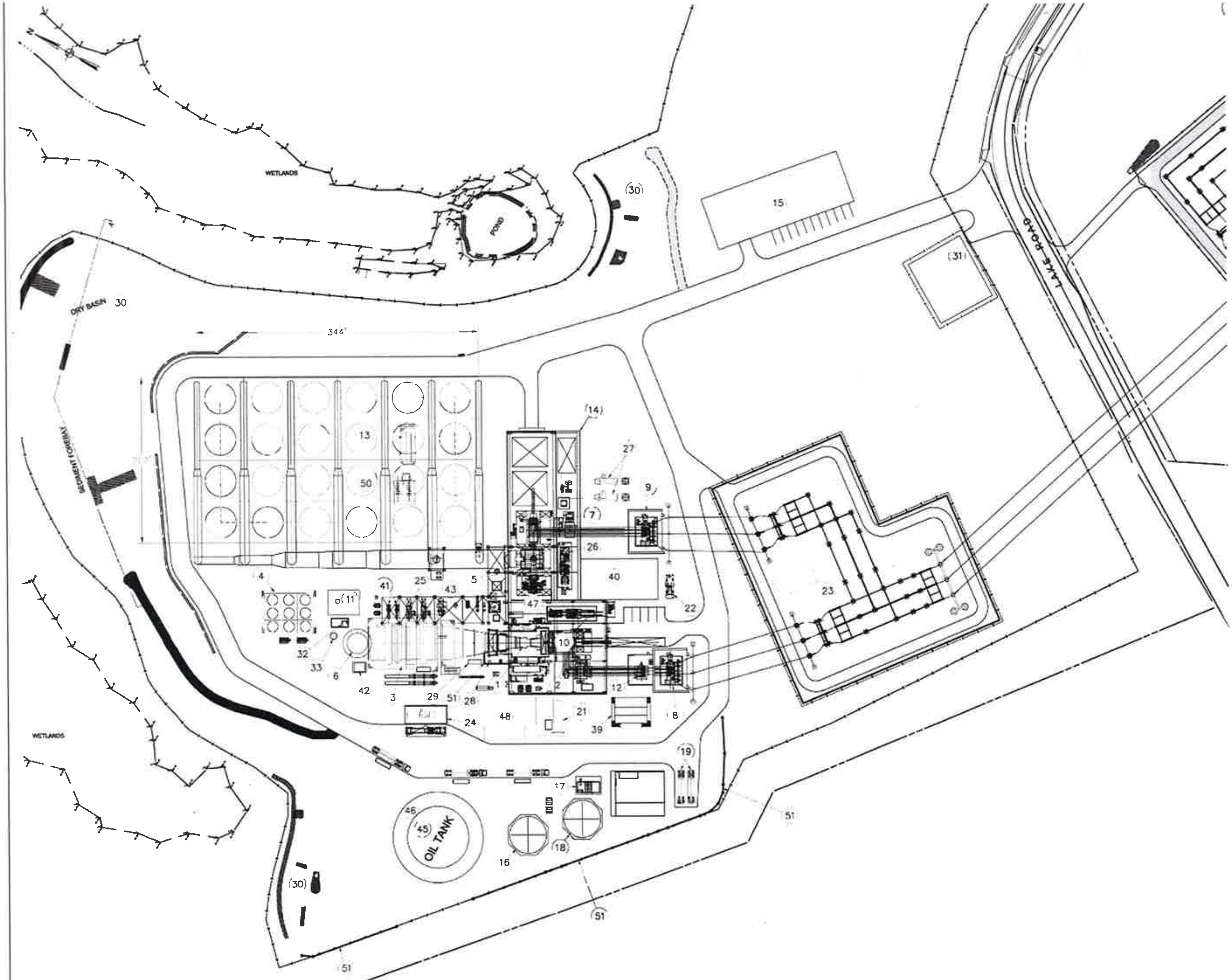


Figure 1
Project Site and Monitoring Locations



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. AUXILIARY 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 ARE/
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 BUILDIN
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 ENCLOSUI
51. SOUND WALL

Reference Drawings

Rev	Date	Drawn	Description	Ch'k'd	App
-	11/02/18	AF	FOR INFORMATION	KP	JM
C	10/11/18	AF	FOR CLIENT REVIEW	KP	JM
B	[illegible]	AF	FOR CLIENT REVIEW	KP	JM
A	[illegible]	AF	FOR CLIENT REVIEW	KP	JM

Mott MacDonald

Client

NTE ENERGY

KILLINGLY ENERGY CENTER
KILLINGLY CONNECTICUT

Title

FIGURE 2
KEC LAYOUT

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

Designed	-	Eng check	JM
Drawn	AF	Approved	
Dwg check	KP	Project Mngr	JM
Scale at ANSI E	1" = 40'0"	Date	Rev
		[illegible]	C

Drawing Number
334954CT-GA-301

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

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

1.2 ACOUSTIC METRICS AND TERMINOLOGY

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

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

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

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

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

$L_P = 20 \log10 (p / pref)$;

Where:

p = the sound pressure in µPa; and

pref = the reference sound pressure of 20 µPa.

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

Table 1: Typical Noise Sources and Acoustic Environments

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

2.0 NOISE LEVEL REQUIREMENTS

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

2.1 CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION NOISE CONTROL REGULATIONS

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

Table 2: DEEP Noise Limits (dBA)

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

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

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

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

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

2.2 TOWN OF KILLINGLY NOISE ORDINANCE

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

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

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

3.0 EXISTING SOUND ENVIRONMENT

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

3.1 FIELD METHODOLOGY

Ambient sound measurements were performed on March 21 and 22, 2016.[2] Measurements included both short-term measurements, recorded in the presence of an acoustics expert for a minimum duration of 30 minutes, and long-term, unattended measurements that extended over a 24-hour period. The 30-minute short-term measurements occurred during both the daytime (10:00 a.m. to 1:00 p.m.) and nighttime periods (9:00 p.m. to 12:00 a.m.).

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

Table 4: Measurement Equipment

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

[2] No substantial changes in land use have occurred; therefore, this data continues to reflect the context of ambient conditions in the vicinity of KEC.

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

3.2 MONITORING LOCATIONS

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

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

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

Table 5: Sound Level Monitoring Locations

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

3.2.1 Short-Term Monitoring Location 1

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

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

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

Figure 3: View South toward a Neighboring Property

Figure 4: View Northwest toward Lake Road

3.2.2 Short-Term Monitoring Location 2

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

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

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

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

Figure 5: View Southeast toward Lake Road

Figure 6: View East toward KEC

3.2.3 Short-Term Monitoring Location 3

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

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

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

Figure 7: View Southwest toward KEC

Figure 8: View Southeast toward Existing Transmission ROW

3.2.4 Short-Term Monitoring Location 4

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

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

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

Figure 9: View West toward a Neighboring Property

Figure 10: View Southeast toward Lake Road

3.2.5 Short-Term Monitoring Location 5

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

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

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

Figure 11: View Northeast toward the Existing Transmission ROW

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

3.2.6 Long-Term Monitoring Location 1

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

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

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

Figure 14: View North toward KEC

3.3 MEASUREMENT RESULTS

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

Table 6: Sound Measurement Results

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

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

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

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

Table 7: Hourly Long-Term Measurement Results

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

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

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

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

4.0 ANTICIPATED CONSTRUCTION IMPACTS

NTE anticipates that construction of KEC will commence during the third quarter of 2019, and will require approximately three years to complete, with power to the electrical grid provided in 2020. Construction of KEC is expected to be typical of other power generating facilities in terms of schedule, equipment, and activity. Nighttime construction will be limited, but activities may occur 7 days per week, 10 hours per day. The last 4 to 6 months of construction would include commissioning and start-up, which would involve steam blows, among other activities, which may occur 24 hours per day, 7 days a week.

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

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

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

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

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

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

5.0 OPERATIONAL NOISE IMPACT ANALYSIS

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

5.1 NOISE PREDICTION MODEL

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

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

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

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

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

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

5.2 INPUT TO THE NOISE PREDICTION MODEL

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

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

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

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
Gas Turbine Inlet Air Filter with Silencer	63	66	66	72	76	90	87	86	77	93
Gas Turbine Inlet Air Duct with noise reduction	69	75	78	79	76	87	90	90	87	95
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 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
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 with acoustical lagging	94	90	79	71	70	76	78	81	79	86

Equipment Description	Octave Band Sound Power Level (dB)									Broadband
	31.5	63	125	250	500	1000	2000	4000	8000	dBA
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 design of KEC design has incorporated silencers for the turbine air inlet filter and 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. KEC has also been designed such that several large components, including the hydraulic supply unit, fuel oil pumping skid, combustion turbine enclosure, water injection pump skid, gas turbine generator, steam turbine generator, slip ring housing, lube oil unit, and demineralized water pumps, are enclosed in the Turbine High Bay and Low Bay Buildings. A transmission loss rating was incorporated into the wall and roof assemblies of the Turbine High Bay and Low Bay Buildings based on recommended Sound Transmission Class (STC) ratings to reduce noise propagation. The recommended ratings for the Turbine High Bay and Low Bay Buildings are summarized in Table 9. Note that the selected mitigation reflected by these values is intended to reflect the feasibility of achieving the resulting level of impact; final design may incorporate different mitigation in order to achieve the same objective.

Table 9: Noise Level Reductions for the Turbine Buildings

Type of Construction or Acoustical Treatment	Modeled Noise Level Reductions (dB re: 20 μPa) by Octave Band Center Frequency dBL								
	31.5	63	125	250	500	1k	2k	4k	8k
Wall Panel STC 50	15	19	28	42	48	59	65	71	73

5.3 NOISE CONTROL MEASURES

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

- HRSG Exhaust Stack: The HRSG exhaust stack will incorporate a silencer system that will reduce the noise from the upper stack portion and the exhaust stack exit (see Table 8).
- 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 75 dBA at 3 feet.
- 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 95 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 87 dBA at 3 feet.
- Fuel Gas Heater Stack: The fuel gas heater stack will incorporate a silencer to reduce the overall sound power leve to 83 dBA, equivalent to a sound pressure level of 73 dBA at 3 feet.
- ACC: The ACC will be a low noise design incorporating noise reduction measures to achieve a far-field sound pressure level of 46 dBA at 650 feet, equivalent to a net sound power level of 103 dBA (see Table 8).
- 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 (see Table 8).
- Property Line Noise Barriers: Two noise barriers have been positioned along the southwestern property line (one 430 feet long with a height of 28 feet for 314 feet transitioning to a height of 24 feet for 116 feet and one 16 feet high and 122 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 provided as Figure 2.

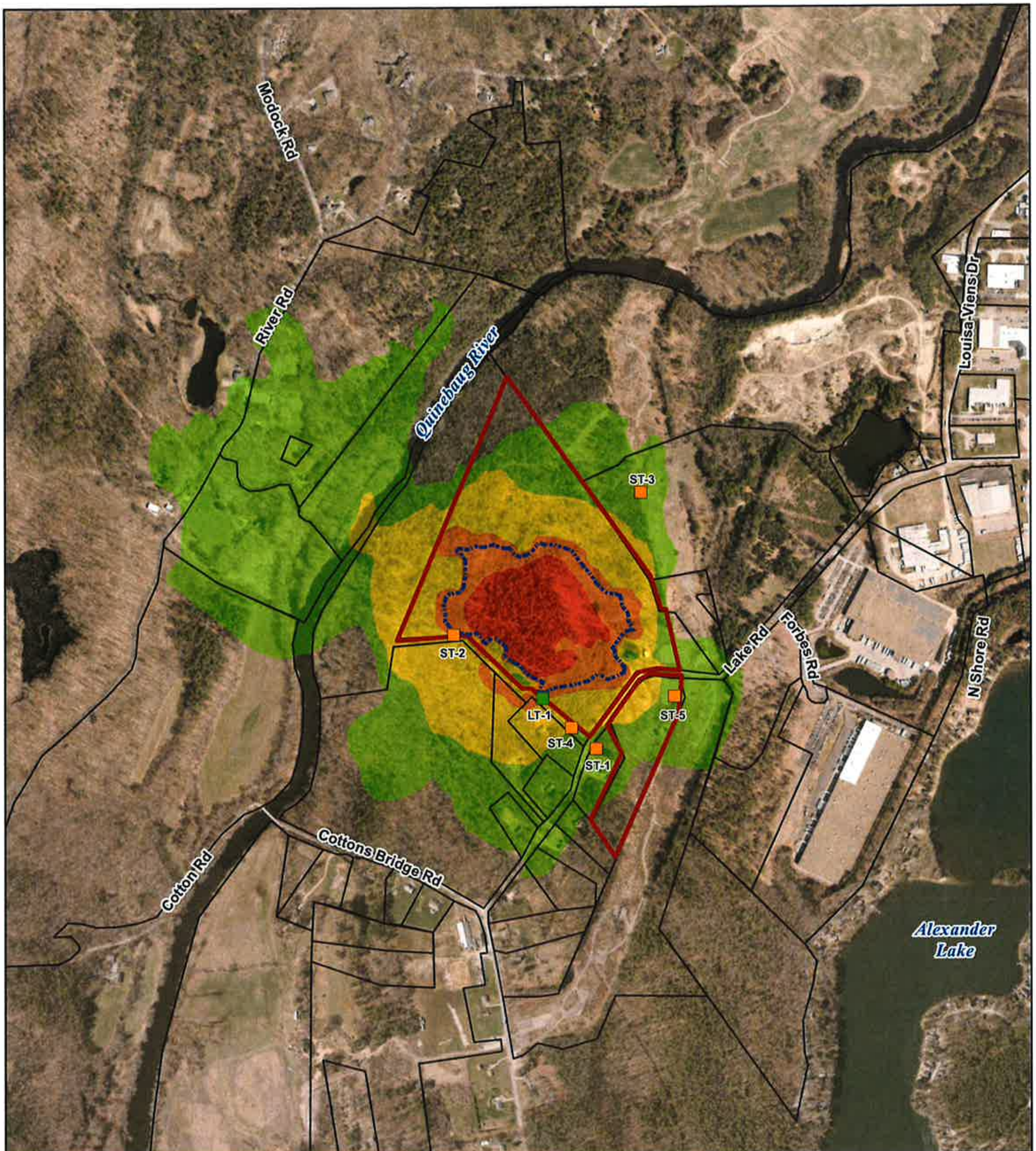
The treatments with the acoustic performance as outlined above relate to the dominant noise sources. These mitigation measures were incorporated into the noise assessment to demonstrate the feasibility of KEC to meet applicable noise requirements. Final design may incorporate different mitigation measures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

5.4 NOISE PREDICTION MODEL RESULTS

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

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

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



Legend

Project Site

Parcel Boundaries

Short Term Monitoring Location

Long Term Monitoring Location

Noise Threshold Limit 51 dBA

Sound Level Contour Ranges (dBA):

40-45 dBA

45-50 dBA

50-55 dBA

>55 dBA

N

0 250 500 Feet

Figure 15
Acoustical Modeling Results – Mitigation Design

Killingly Energy Center

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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	43
LT-1	50

6.0 CONCLUSIONS

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

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

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

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

7.0 REFERENCES

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Kurze, U. and L. Beranek. 1988. Noise and Vibration Control. Institute of Noise Control Engineering, Washington, DC.

NIST 2012. Calibration Uncertainty for the NIST PM/AM Noise Standards. National Institute of Standards and Technology Special Publication 250-90. July 2012.

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APPENDIX A: CALIBRATION CERTIFICATION DOCUMENTATION

Calibration Certificate

Certificate Number 2015001437

Customer:

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

Model Number	831	***Procedure Number***	D0001.8384		
Serial Number	0003847	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	16 Feb 2015		
Initial Condition	As Manufactured	***Calibration Due***			
		Temperature	23.11	°C	± 0.01 °C
Description	Larson Davis Model 831	***Humidity***	50.1	%RH	± 0.5 %RH
		Static Pressure	86.43	kPa	± 0.03 kPa

Evaluation Method

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

Data reported in dB re 20 μPa.

Compliance Standards

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

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

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

The quality system is registered to ISO 9001:2008.

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

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

Standards Used

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

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

ACCREDITED
Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Acoustic Calibration

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

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

Acoustic Signal Tests, C-weighting

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

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

-- End of measurement results--

Self-generated Noise

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

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

-- End of measurement results--

-- End of Report--

Signatory: *Ron Harris*

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

ACCREDITED
Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2015006618

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

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

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

Data reported in dB re 20 μPa.

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

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

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

The quality system is registered to ISO 9001:2008.

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

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

Standards Used

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

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

ACCREDITED Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2015011769

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

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

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

Data reported in dB re 20 μPa.

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

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

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

The quality system is registered to ISO 9001:2008.

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

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

Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	06/24/2015	06/24/2016	006311
Hart Scientific 2626-H Temperature Probe	06/17/2015	06/17/2016	006798
Larson Davis CAL200 Acoustic Calibrator	08/12/2015	08/12/2016	007027
Larson Davis Model 831	03/05/2015	03/05/2016	007182
1/2 inch Microphone - P - 0V	03/11/2015	03/11/2016	007185
Larson Davis CAL291 Residual Intensity Calibrator	09/24/2015	09/24/2016	007287

APPENDIX E – POTENTIAL PEAK TRAFFIC INCREASE ASSESSMENT

Hesketh

Civil & Traffic Engineers • Surveyors • Planners • Landscape Architects

F. A. Hesketh
& Associates, Inc.

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

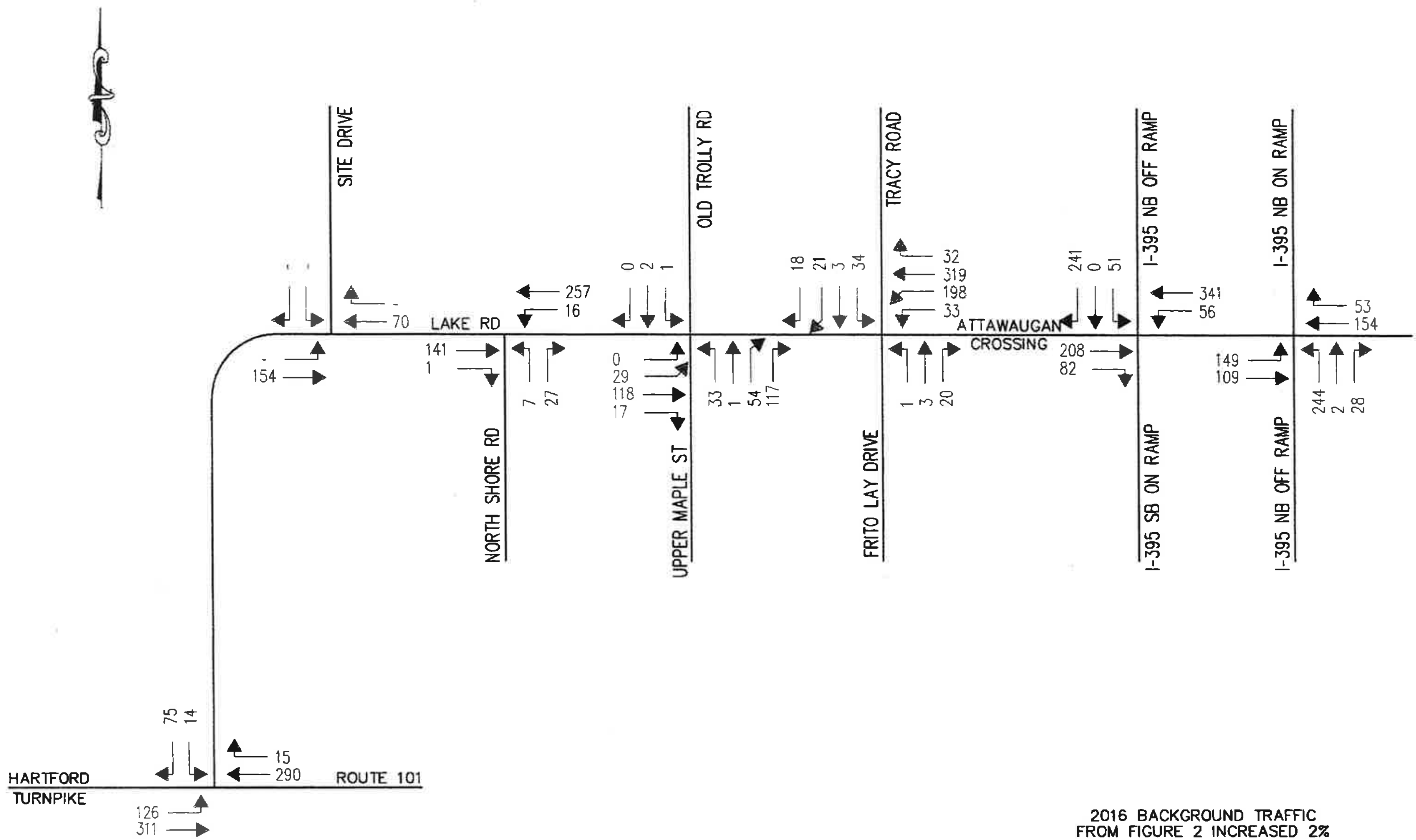
cc: Tin Eves, NTE Energy
Kenneth Baldwin, Robinson & Cole

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

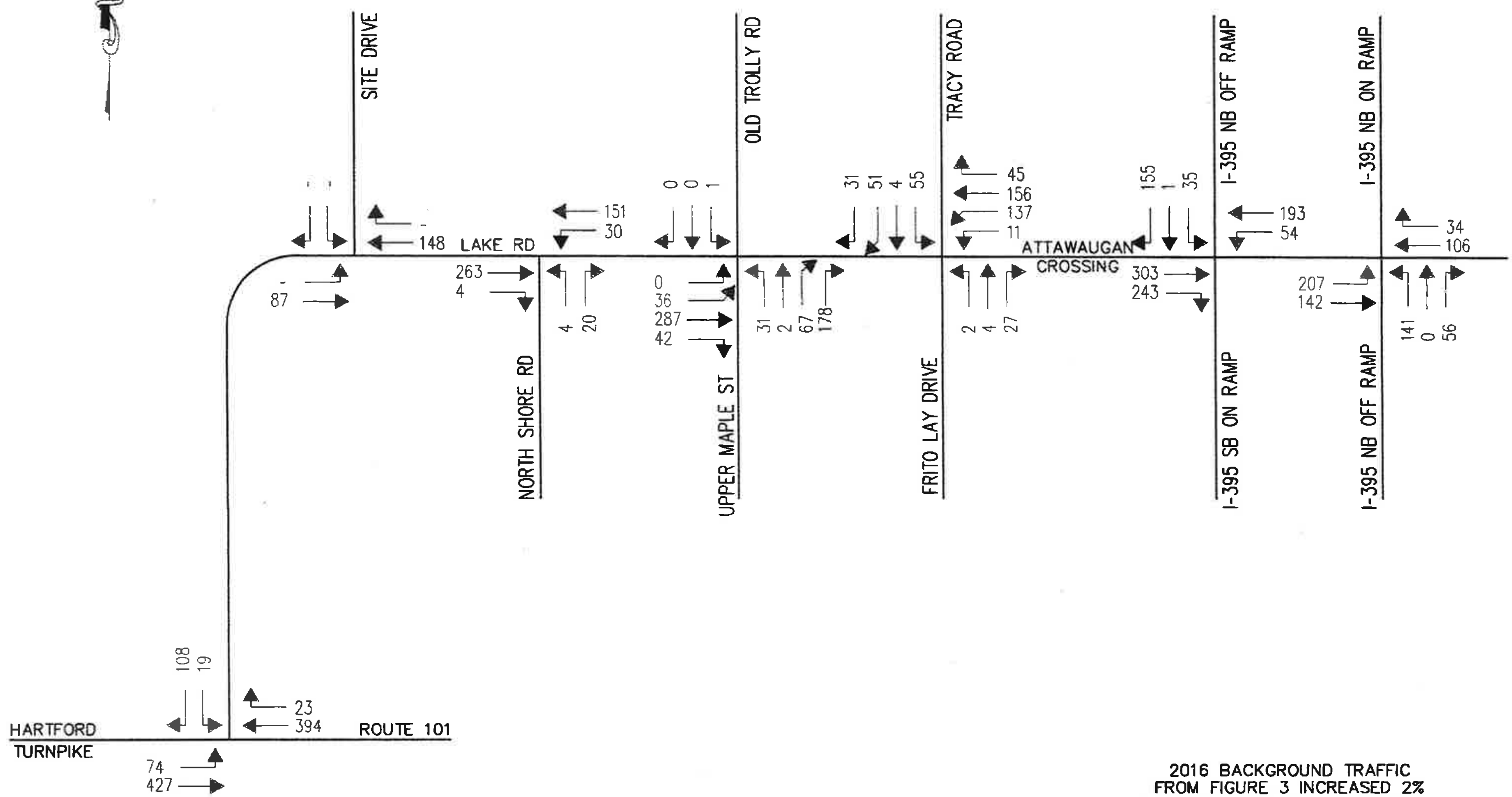
NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

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

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.

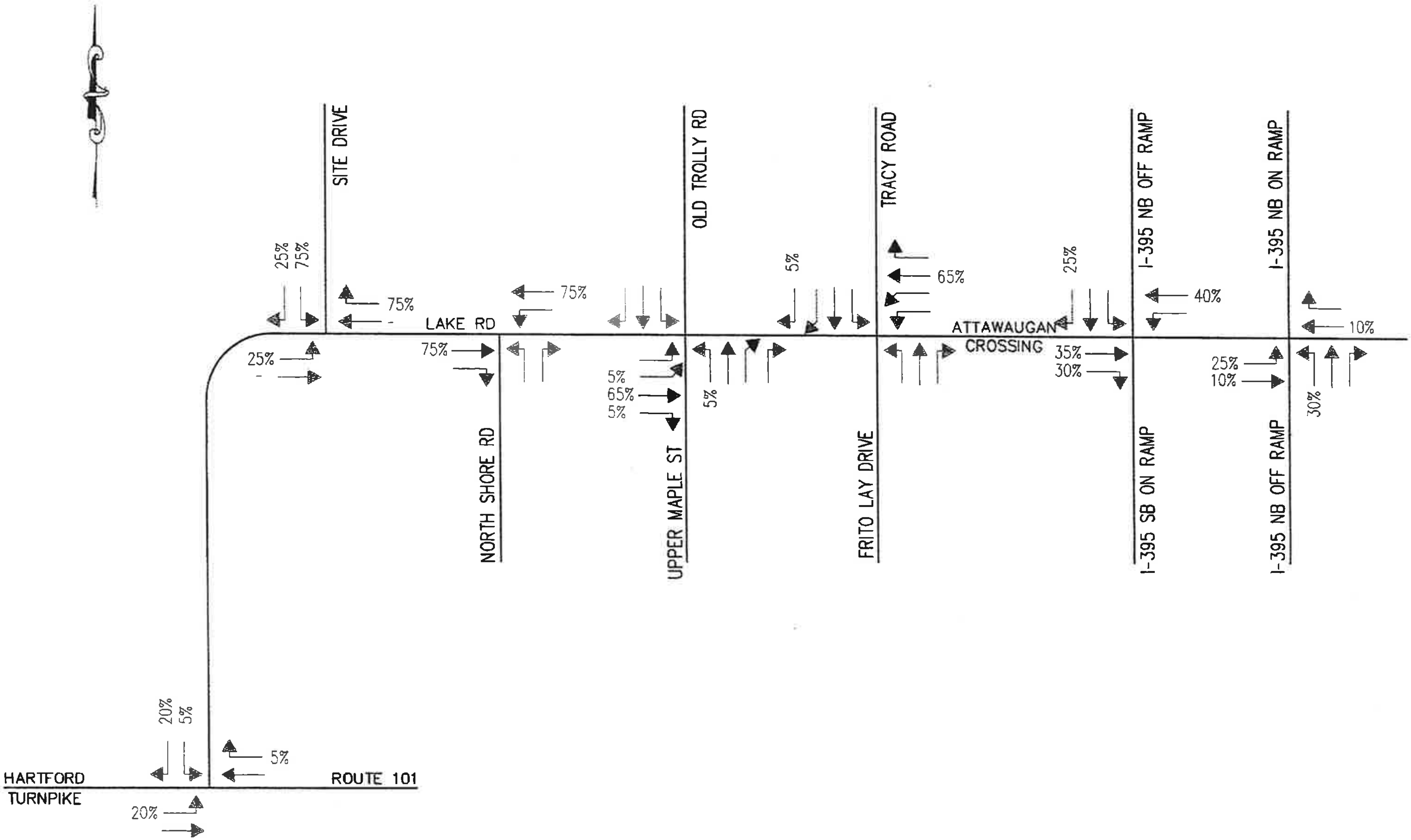


FIGURE 6 5/27/16

DIRECTIONAL DISTRIBUTION OF SITE GENERATED TRAFFIC

NTE CONNECTICUT

180 & 189 LAKE ROAD

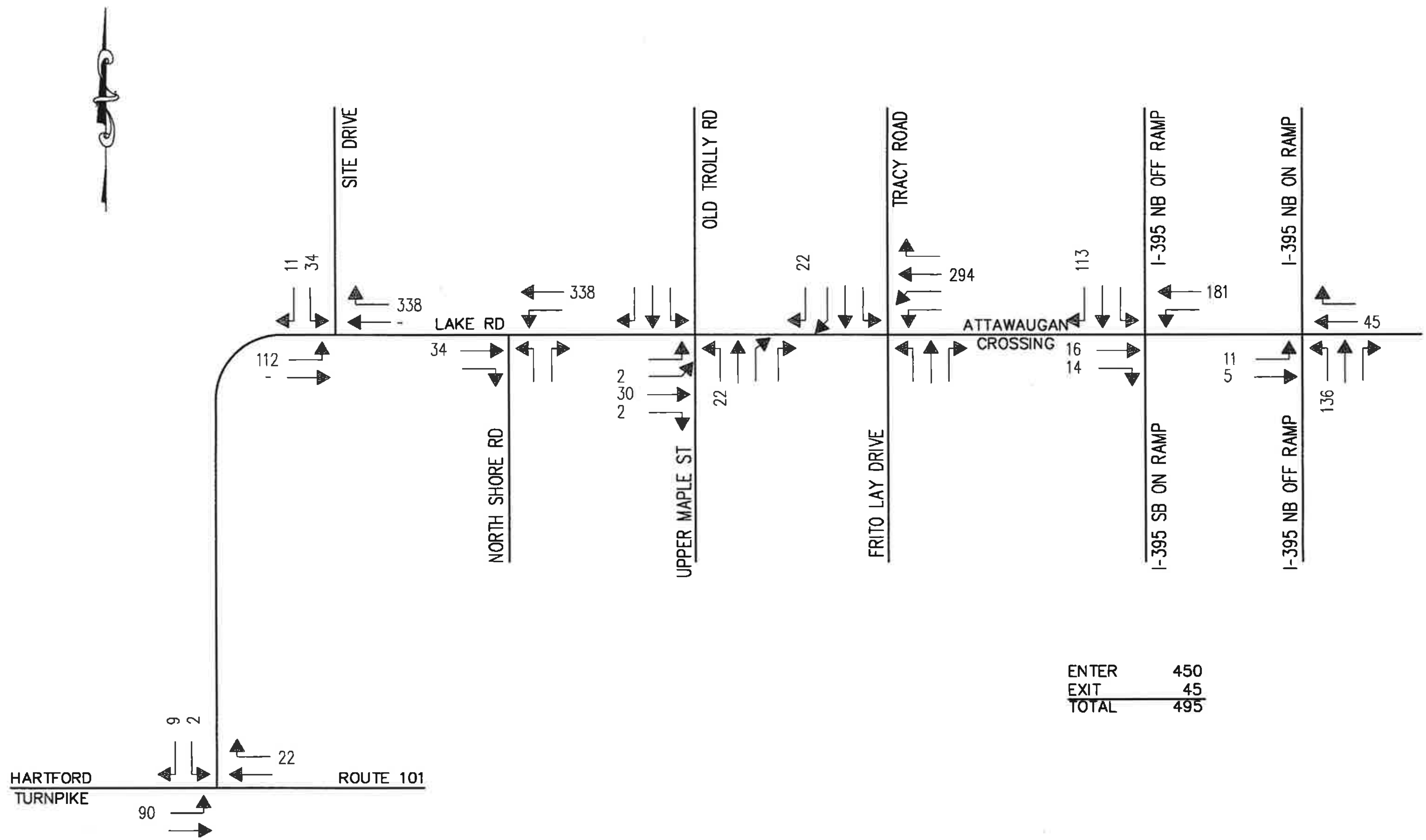
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

FAH

TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE



ENTER	450
EXIT	45
TOTAL	495

A.M. PEAK HOUR CONSTRUCTION TRAFFIC FROM TABLE 6 DISTRIBUTED BASED ON THE TRIP DISTRIBUTION IN FIGURE 6

FIGURE 7R-1

01/11/18

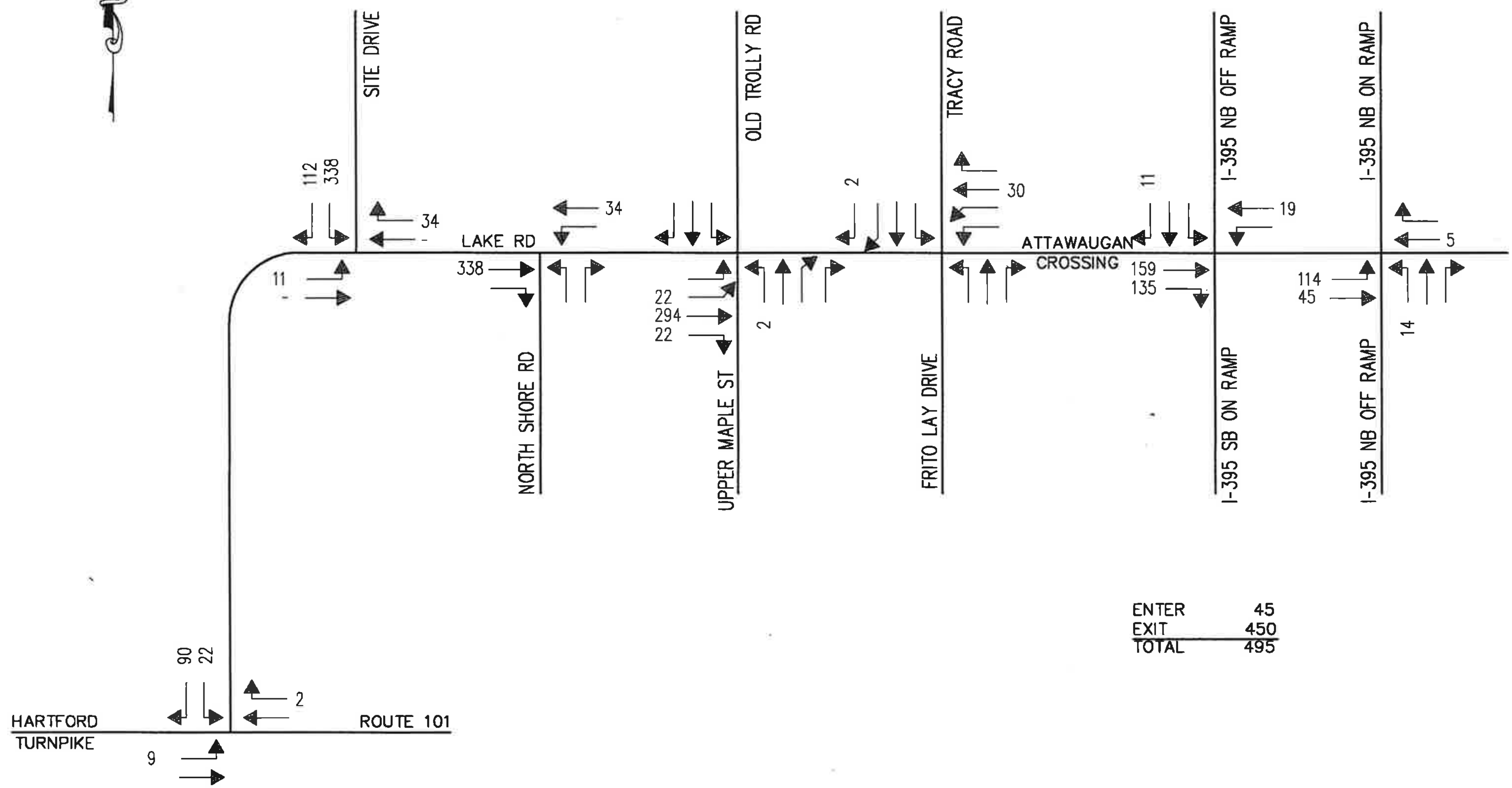
SITE GENERATED TRAFFIC
A.M. PEAK HOUR

NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE



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

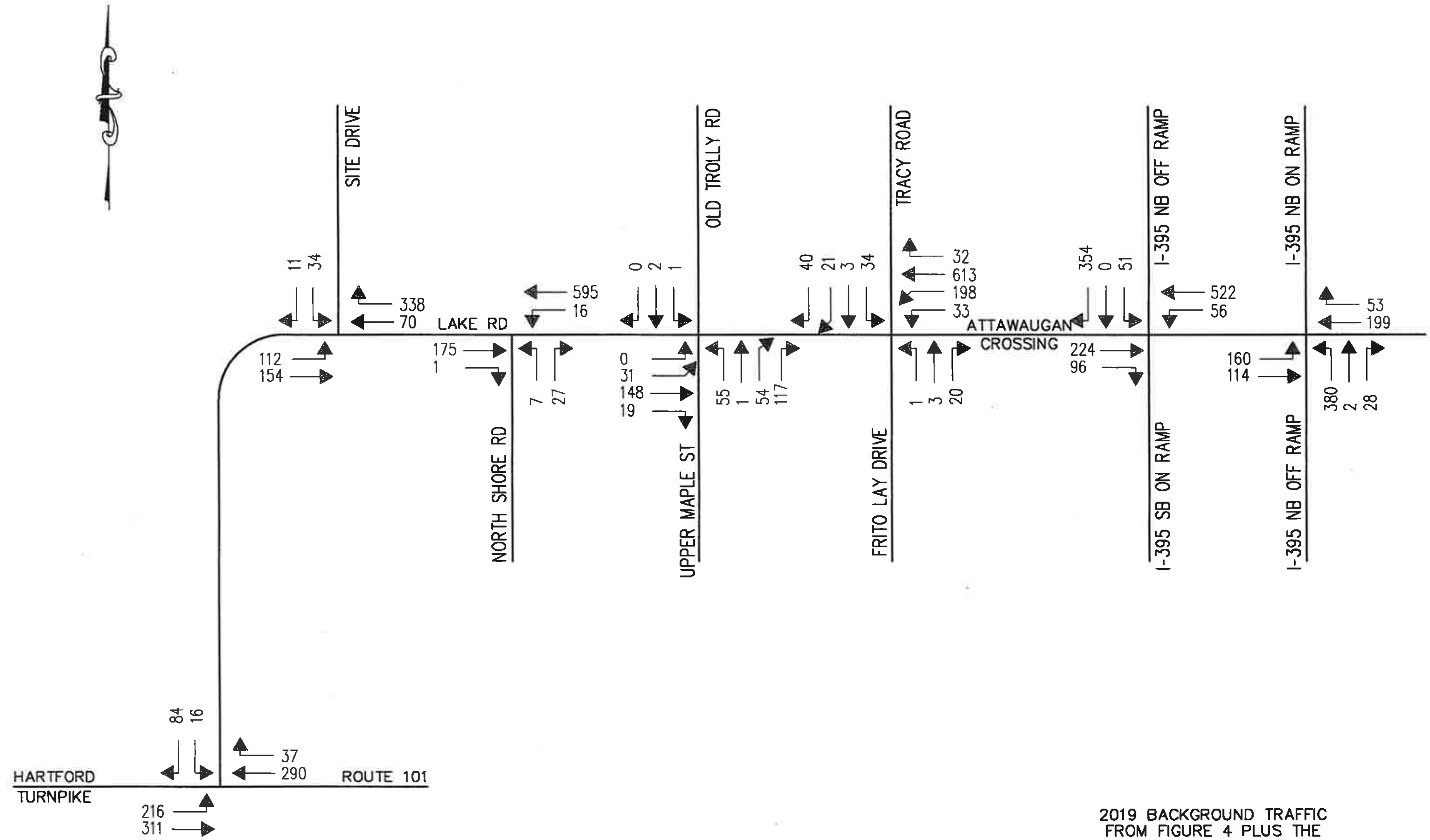
NTE CONNECTICUT
180 & 189 LAKE ROAD
KILLINGLY, CONNECTICUT

F. A. Hesketh & Associates, Inc.
6 CREAMERY BROOK, EAST GRANBY, CT 06026

FAH

TRAFFIC
PLANNING
ENGINEERING
DESIGN

NOT TO SCALE

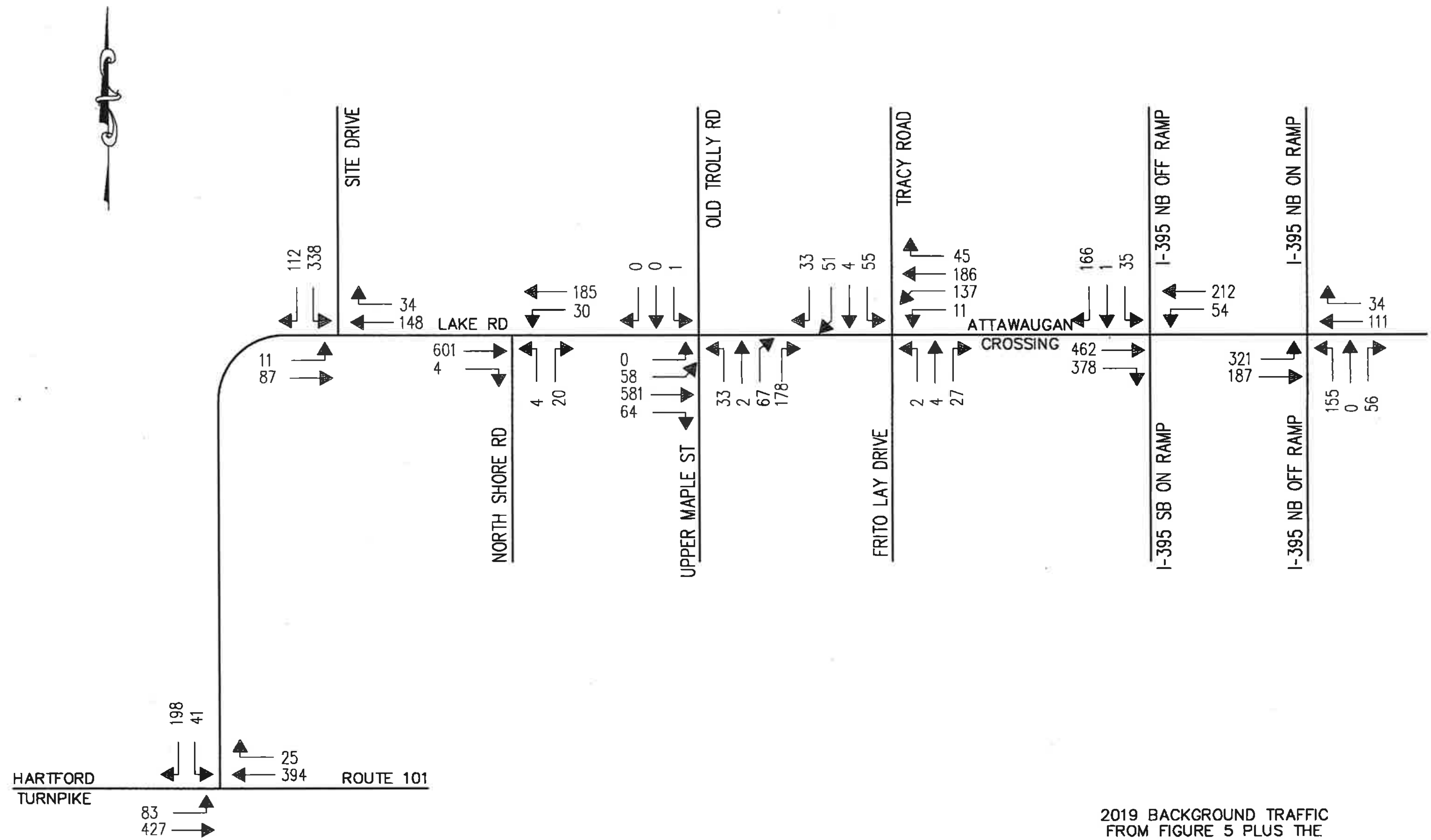


2019 BACKGROUND TRAFFIC
FROM FIGURE 4 PLUS THE
SITE GENERATED TRAFFIC
FROM FIGURE 7R-1

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 FAH 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					

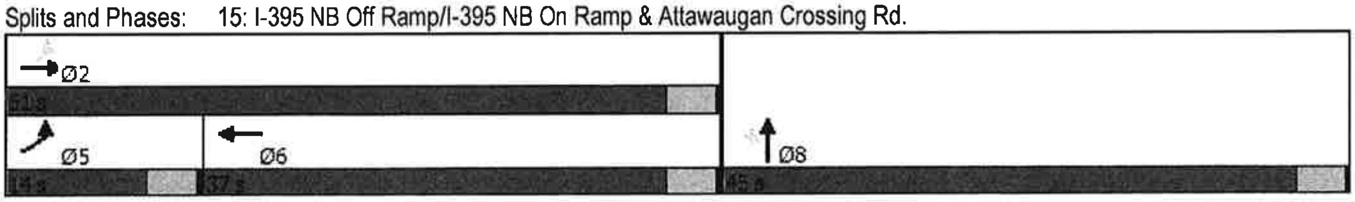
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2			6		8	8				
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0		4.0	4.0				
Minimum Split (s)	8.0	20.0			20.0		20.0	20.0				
Total Split (s)	14.0	51.0			37.0		45.0	45.0				
Total Split (%)	14.6%	53.1%			38.5%		46.9%	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

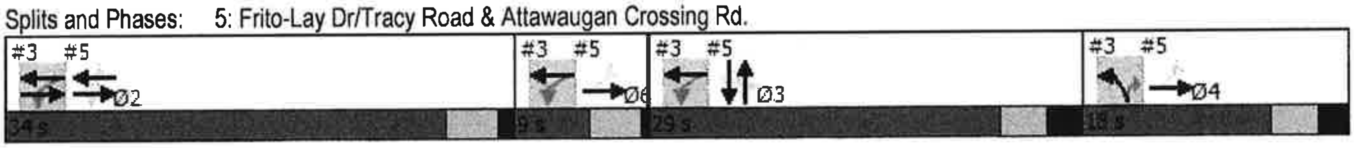
Area Type: Other

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.



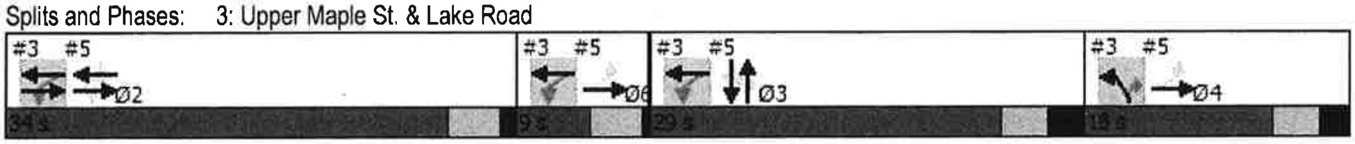
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Lane Configurations	↑↱		↰	↑	↰	↱		
Traffic Volume (vph)	179	19	219	653	56	171		
Future Volume (vph)	179	19	219	653	56	171		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	11	11	11	11	12	12		
Storage Length (ft)		0	0		125	0		
Storage Lanes		0	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						
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						
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					

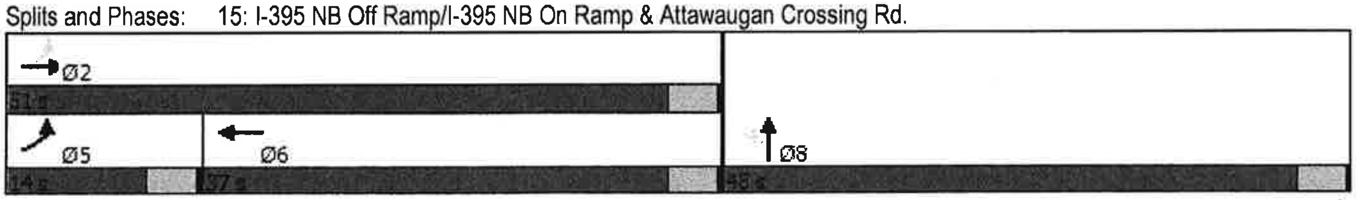
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	5	2			6		8	8				
Switch Phase												
Minimum Initial (s)	4.0	4.0			4.0		4.0	4.0				
Minimum Split (s)	8.0	20.0			20.0		20.0	20.0				
Total Split (s)	14.0	51.0			37.0		45.0	45.0				
Total Split (%)	14.6%	53.1%			38.5%		46.9%	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

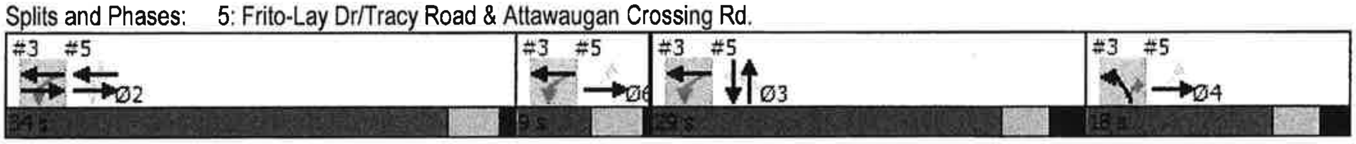
Area Type: Other

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.



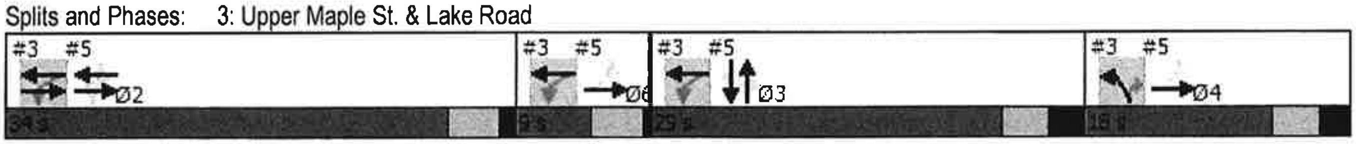
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø6
Lane Configurations	↑↱		↰	↑	↰	↱		
Traffic Volume (vph)	639	64	188	219	33	247		
Future Volume (vph)	639	64	188	219	33	247		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900		
Lane Width (ft)	11	11	11	11	12	12		
Storage Length (ft)		0	0		125	0		
Storage Lanes		0	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		