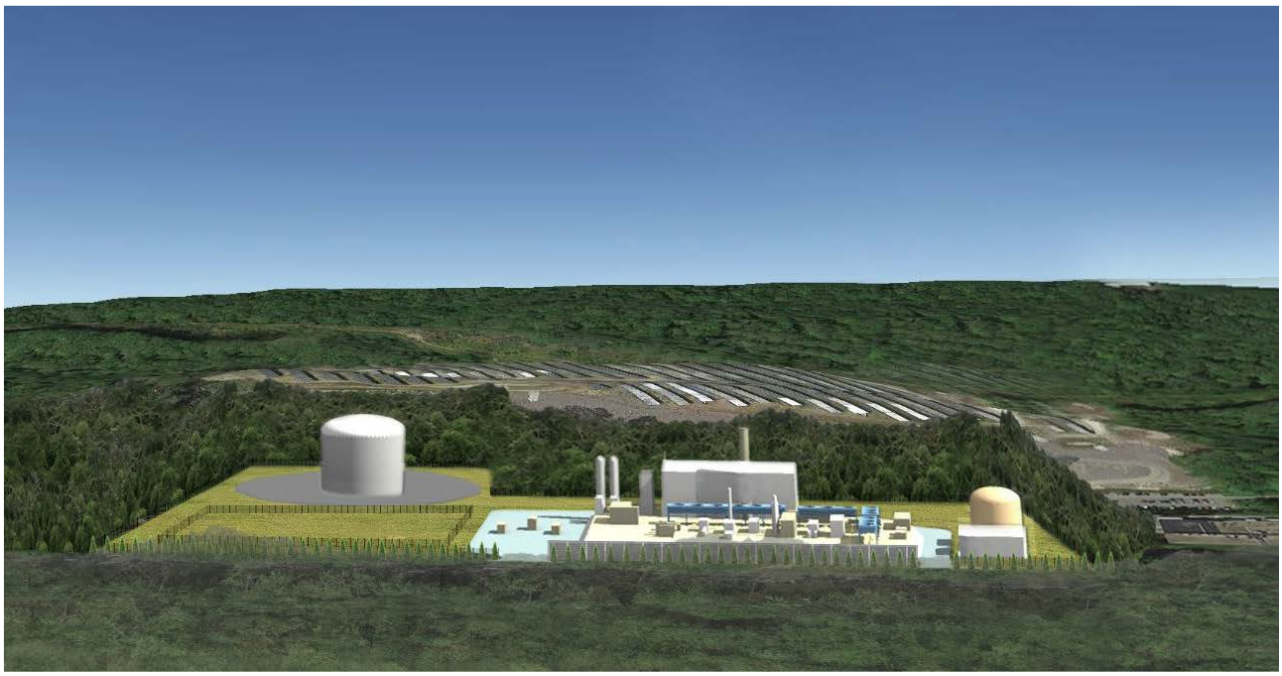
Amended and Restated Petitions before the Massachusetts Energy Facilities Siting Board for

Approval to Construct a Natural Gas Liquefaction, Storage, and Truck-loading Facility in Charlton, Massachusetts



Submitted by:
Northeast Energy Center LLC

Prepared by:
Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250,
Maynard, MA 01754

In Association with:
Liberty Energy Trust, LLC
Weston & Sampson Engineers, Inc.
Northstar Industries, LLC
Nitsch Engineering, Inc.
Public Archaeology Laboratory, Inc.
Pierce Atwood LLP

February 2019

Appendix E

Traffic Trip Generation & Site Distance Memo

Weston & Sampson

100 Foxborough Blvd, Foxborough, MA
Tel: 860.513.1473

TECHNICAL MEMORANDUM

TO: Northeast Energy Center, LLC

FROM: Jeffrey Santacruce, PE, PTOE

DATE: January 31, 2019

SUBJECT: Trip Generation & Sight Distance Memorandum
Northeast Energy Center, LLC
(Liquefied Natural Gas Facility)
Route 169 (Southbridge Road)
Charlton, MA

cc: Jay Gamble, Johanna Hall

As requested, Weston & Sampson has performed a trip generation and sight distance evaluation for the proposed Northeast Energy Center, LLC Liquefied Natural Gas (LNG) Facility on Route 169 (Southbridge Road) in Charlton, Massachusetts. The project involves the construction of a new facility that will consist of a gas pretreatment system, a liquefication system, one field erected LNG storage tank, four LNG truck loading stations, a SCADA control system, a fire protection system, and a hazard detection system and security system. The buildings on site will consist of a control building, MCC building, and a LNG truck loading station shelter.

This memorandum summarizes the trip generation and distribution of the proposed site. In addition, this memorandum provides a qualitative evaluation of the intersection and stopping sight distance at the proposed site egress driveway located on Route 169 (Southbridge Road).

The proposed site location in relation to the surrounding area is shown on Figure 1 – Site Location Map.

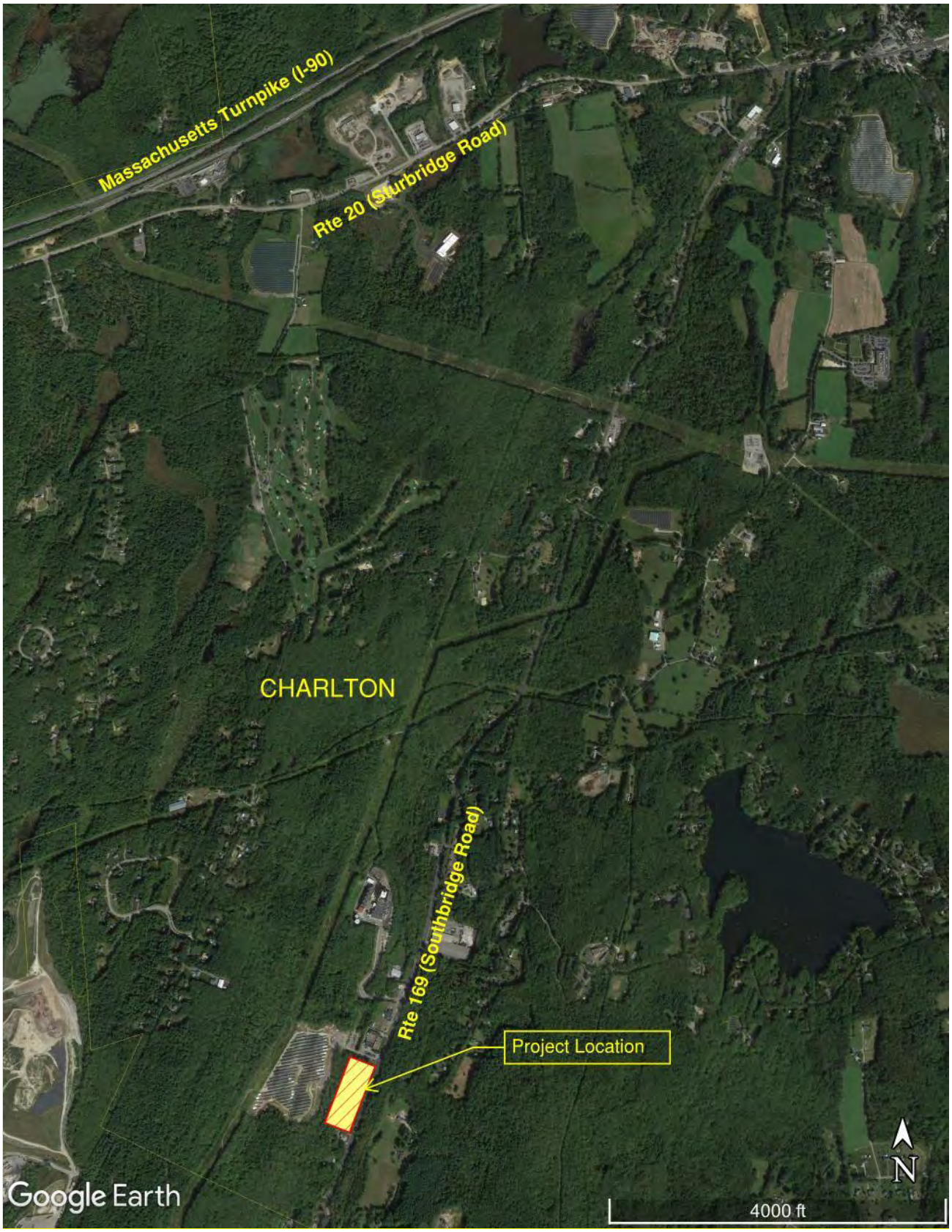


Figure 1 - Site Location Map

Existing Roadway

Route 169 (Southbridge Road) is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Principal Arterial and runs north-south from the Connecticut state line in the south to its intersection with Route 20 (Sturbridge Road) in Charlton to the north. The posted speed limit adjacent to the site is 50 mph. The uses along Route 169 are a mix of residential and commercial uses. The roadway is under the jurisdiction of MassDOT.

Vehicle Speeds

Vehicle speeds measurements were conducted along Route 169 (Southbridge Road) at the proposed site driveway by Nitsch Engineering on Tuesday December 11, 2018 and are shown in Table 1. The results of the speed measurements are attached.

Table 1
MEASURED VEHICLE SPEEDS (IN MILES PER HOUR)

Location/Direction	Posted Speed Limit	Average Speed
Route 169 (Southbridge Road)		
Northbound	50	55
Southbound	50	60

Sight Distance

A sight distance evaluation was performed by Nitsch Engineering on December 11, 2018 on Route 169 (Southbridge Road) at the proposed site egress driveway.

To identify potential safety concerns associated with site egress, sight distances have been evaluated at the site driveway location to determine if the available sight distances for vehicles exiting the site meet or exceed the minimum distances required for approaching vehicles to safely stop. The available sight distances were compared with minimum requirements, as established by the American Association of State Highway and Transportation Officials (AASHTO)1.

Stopping Sight Distance (SSD) is the minimum distance required for a vehicle traveling at a certain speed to safely stop before reaching a stationary object in the road. The values are based on a driver perception and reaction time of 2.5 seconds and a braking distance calculated for wet, level pavements. When the roadway is either on an upgrade or downgrade, grade correction factors are applied. Stopping sight distance is measured from a driver's eye height of 3.5 feet to an object height of 2 feet above street level.

Intersection sight distance (ISD) is the minimum distance required for a motorist exiting a minor street to turn onto the major street, without being overtaken by an approaching vehicle reducing its speed from the design speed to 70 percent of the design speed. Intersection sight distance is measured from a driver's eye height of 3.5 feet to an object height of 3.5 feet above street level.

[1] "*A Policy on the Geometric Design of Highways and Street*" American Association of State Highway Officials (AASHTO), Washington, DC 2018

Table 2
SIGHT DISTANCE

	Stopping Sight Distance (feet)			Intersection Sight Distance (feet)			
Location/Direction	Measured	Minimum Required[a]	Desirable[b]	Measured	Minimum Required[c]	Desirable (Posted)[a]	Desirable (Observed)[b]
Site Driveway							
North of intersection	500+	425	470	700+	425	555	665
South of intersection	500+	425	495	700+	425	555	610

[a] Values based on AASHTO requirements for posted speed limit of 50 mph on Route 169.
[b] Values based on AASHTO requirements for observed speeds of 55 and 60 mph as shown in Table 1.
[c] Values based on minimum SSD requirements.

SSD is generally more important as it represents the minimum distance required for safe stopping while ISD is based only upon acceptable speed reductions to the approaching traffic stream. However, the ISD must be equal to or greater than the minimum required SSD in order to provide safe operations at the intersection. The available SSD and ISD at the proposed site drive location was measured and compared to minimum requirements as established by AASHTO as shown in Table 1.

As indicated in Table 1, available sight distances at the proposed Route 169 site driveway will exceed both the minimum and the desirable SSD and ISD requirements for safe operation. Safe operation can accordingly be expected. It is recommended that any proposed landscaping or fencing in the vicinity of the driveway intersection be located sufficiently back from Route 169 or kept low to the ground so as not to impede the available sight distances. It is suggested that the sight distance be reevaluated after the grading of the driveways are performed to ensure results as anticipated.

Trip Generation

Trip generation is typically estimated for common land used based on information from the current edition of the Institute of Transportation Engineer Trip Generation Manual. However, for this development there is no existing Land Use Code that matches the proposed use. Therefore, we based the proposed trip generation rates on the number of total employees to be employed by the facility and the number of expected number of deliveries per day.

The Facility proposes to employ nine employees in three work shifts. The frequency is broken down such that 2 operators are present for each of 3 shifts and 3 employees will work a regular 8-hour daytime shift. To be conservative, it was assumed that five employees would be at the site during each shift, which translates into ten trips (5 trips in, and 5 trips out) during each shift change. The Facility operations will include twenty truck deliveries per eight-hour work day. To remain conservative, it was assumed there would be twenty four truck deliveries per day, and that the trips per day will happen uniformly over the eight busiest hours of the day. This translates to approximately three trips during the peak hour. For the purpose of this study and to be conservative all trips we rounded to the nearest whole number, therefore it was assumed that there would be four trips (2 trips in, and 2 trips out) at the site during each hour. Refer to Table 3

for the trips generated per peak hour for the Facility.

Table 3
TRIP GENERATION

Data		Trips Generated/Day	Trips Generated/Peak Hour	Trips Entering	Trips Exiting
Number of Employees	9	30	10	5	5
LNG Truck Deliveries	20	32	4	2	2
Total		62	14	7	7

Trip Distribution

The distribution of site traffic was developed based on surrounding roadway network, existing traffic patterns, and access to major highways for the truck deliveries. Northeast Energy Center, LLC has indicated that they will require all trucks exit the facility and head north along Route 169 (Southbridge Road) and head towards the Massachusetts Turnpike (I-90) and Interstate 84 (I-84). The employee generated traffic has been determined based on existing traffic patterns and access to major roadways. Trip distribution is shown in Table 4 below and on Figure 2.

Table 4
TRIP DISTRIBUTION

Data	Total Trips/Peak Hour	Trips Entering from the North	Trips Entering from the South	Trips Exiting to the North	Trips Exiting to the South
Employees	10	4	1	4	1
LNG Truck Deliveries	4	2	0	2	0
Total	14	6	1	6	1

Site access will be provided by two proposed site driveways along Route 169. The northern site driveway will function as an entrance only access point and the southern site driveway will function as an exit only egress point (see Figure 2).

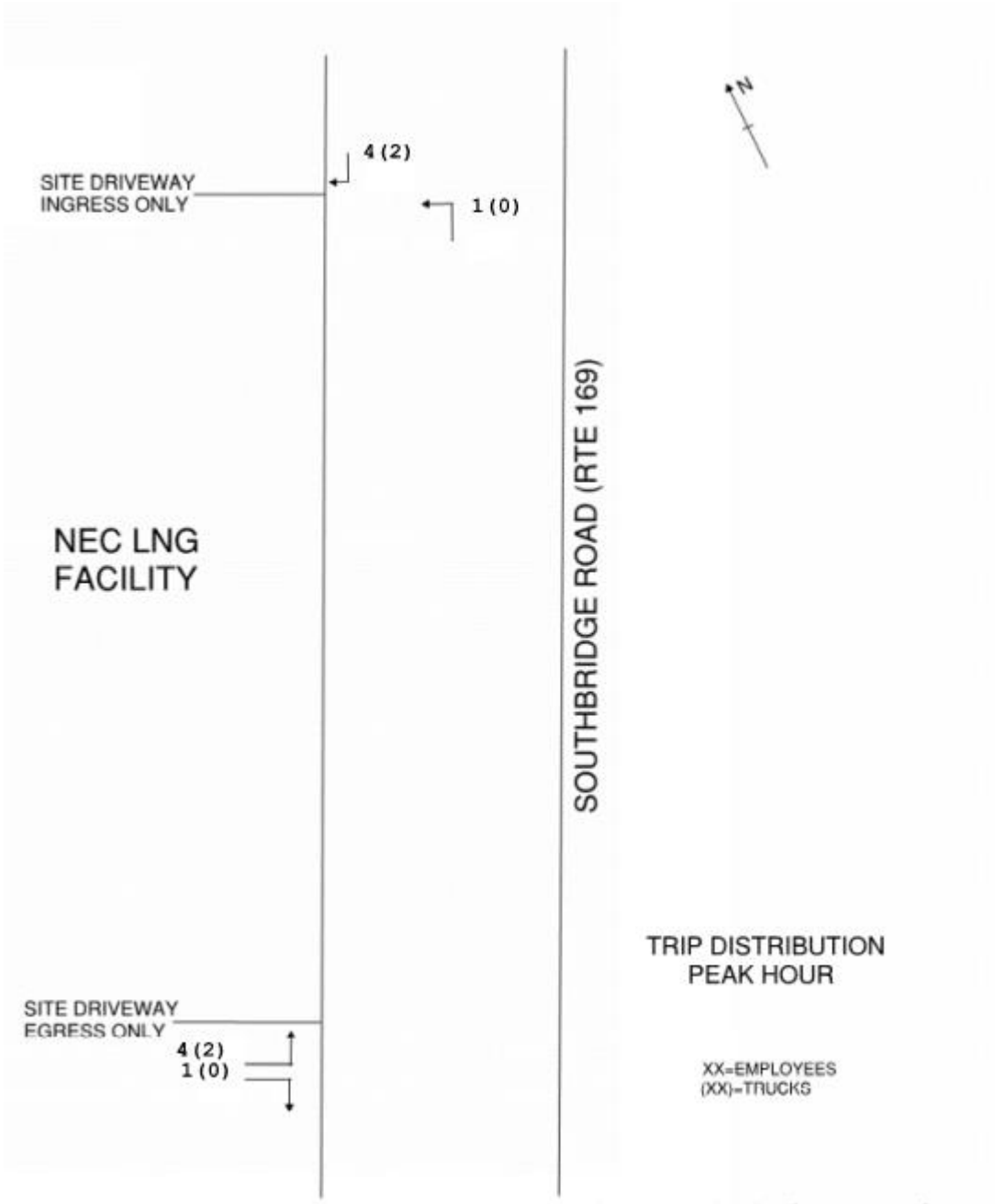


Figure 2 – Trip Distribution – Peak Hour

100 Foxborough Blvd, Foxborough, MA
Tel: 860.513.1473

ATTACHMENTS

Nitsch Engineering

Northeast Energy Center, LLC (Liquefied Natural Gas Facility) Charlton, MA

Sight Distance Study

December 19, 2018

Prepared for:

Northeast Energy Center, LLC
100 Front Street, Suite 940
West Conshohocken, PA 19428

Submitted by:

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

Nitsch Project #13260.

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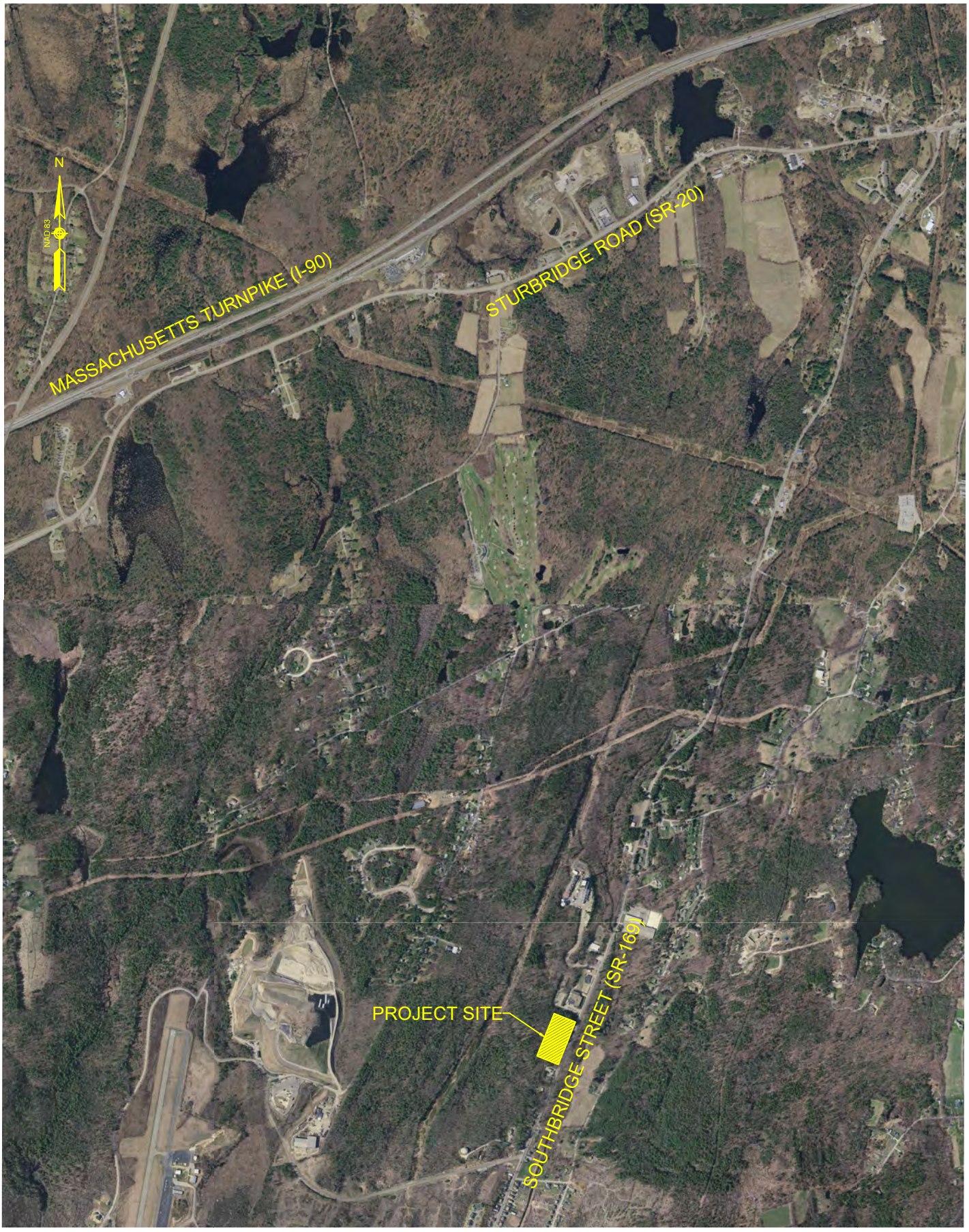
INTRODUCTION

Nitsch Engineering has previously prepared a qualitative assessment of safety, and traffic access/egress, associated with the proposed Liquefied Natural Gas (LNG) Facility located on Route 20 in Charlton, Massachusetts—the Northeast Energy Center, LLC (NEC). In expansion of this study, Nitsch Engineering has been retained to prepare a qualitative assessment of sight distance associated with an alternative site for the proposed (LNG) Facility at 304 Southbridge Road (Route 169) in Charlton, Massachusetts. The Project involves construction of a new facility that will consist of a gas pretreatment system, a liquefaction system, ten (10) shop fabricated LNG storage tanks, two LNG truck loading stations with the ability to add a third station, a SCADA and control system, a fire protection system, a hazard detection system and a security system. The buildings on site will consist of a control building, MCC building and LNG truck loading station shelter.

This report will assess the intersection and stopping sight distances for the proposed facility's driveway.

The Locus Plan of the Project is shown in Figure 1.



CHARLTON, MA
NEC LNG STORAGE ALTERNATE SITE
FIGURE 1 - LOCUS PLAN

0 1000 2000 3000 4000

SCALE: 1" = 1000'

EXISTING CONDITIONS

Roadways

To examine the existing conditions, we studied the following roadways:

Southbridge road (State Route 169)

Southbridge road (State Route 169) is classified by the Massachusetts Department of Transportation (MassDOT) as an Urban Principal Arterial and runs in the north-south from the southern border of the state in the Town of Southbridge to its northern terminus intersecting US Route 20 in the Town of Charlton. The posted speed limit along the roadway is 50 miles per hour (MPH). The land use is a mix of residential and commercial within the study area. The roadway is within the jurisdiction of the MassDOT.

Vehicle Travel Speeds

Nitsch Engineering conducted a site walk on Tuesday, December 11, 2018 to manually measure the average vehicle travel speeds at the proposed driveway location. The posted speed limit for the roadway is 50 MPH. The speed data (the posted speed limit and the average speed) is shown in Table 1.

Table 1 - Vehicle Travel Speeds

LOCATION	POSTED SPEED (MPH[a])	AVERAGE SPEED (MPH[a])
U.S. Route 169 at the Site Drive		
Southbound	50	60
Northbound	50	55

[a]Miles per hour

Sight Distance

Stopping Sight Distance (SSD) is the length of the roadway ahead that is visible to the driver and should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path. Stopping sight distance is the sum of the distance traversed by the vehicle from the instant the driver sights an object necessitating a stop to the instant the brakes are applied and the distance needed to stop the vehicle from the instant brake application begins.

Intersection Sight Distance (ISD) is the length of the leg of the departure sight triangle along the major road in both directions for a vehicle stopped on the minor road waiting to depart. The critical departure sight triangles for the new driveway are for traffic approaching from either the left or right for left turns from the new driveway at 304 Southbridge Road onto Southbridge Road (Route 169). The methods for determining the sight distances needed by drivers approaching intersections are based on the same principles as stopping sight distance, but incorporate modified assumptions based on observed driver behavior at intersections.

The SSD and ISD values associated with a given design speed are shown in Table 2. The site distance evaluations for the intersection are shown in Table 3.

Table 2 - Sight Distance Criteria

DESIGN SPEED	DESIGN STOPPING SIGHT DISTANCE VALUE[1] (SSD)	RECOMMENDED INTERSECTION SIGHT DISTANCE VALUE[2] (ISD)
(MPH)	(FT)	(FT)
15	80	170
20	115	225
25	155	280
30	200	335
35	250	390
40	305	445
45	360	500
50	425	555
55	495	610
60	570	665
65	645	720
70	730	775
75	820	830
80	910	885

Source: *A Policy on Geometric Design of Highways and Streets, AASHTO, Washington DC (2011)*

[1]Design value based on a grade of less than 3%, a brake reaction distance predicted on a time of 2.5 seconds and a deceleration rate of 11.2 ft/s^2

[2]Recommended value based on Case B1 - a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less

The posted speed limit for Southbridge Road (Route 169) is 50 MPH. However, during our site visit measuring vehicle travel speed, the average vehicle travel speeds measured for Southbridge northbound and southbound were 55 and 60 MPH respectively.

During the site walk on Tuesday, December 11, 2018, Nitsch Engineering also measured the actual line of sight distances at the intersection of Southbridge Road (Route 169) at the proposed driveway. The measurements were based on where the driver in the car would be sitting.

Table 3 - Proposed Sight Distance Evaluation

INTERSECTION	AVERAGE SPEED (MPH)	MINIMUM (FEET)[1,2]	MEASURED (FEET)	OBSTRUCTION
Stouthbridge Rd. (Route 169) at the Proposed Driveway				
Stopping Sight Distance:	55			
Southbridge Road (Route 169) Northbound		495	>1,200	
Southbridge Road (Route 169) Southbound	60	470	>1,200	
Intersection Sight Distance:	55			
Looking to the right from Driveway		610	>1,200	Vegetation
Looking to the left from Driveway	60	665	>1,200	,

Source: A Policy on Geometric Design of Highways and Streets, AASHTO, Washington DC (2011)

[1] Table 3-1. Stopping Sight Distance on Level Roadways

[2] Table 9-6. Design Intersection Sight Distance - Case B1, Left Turn from Stop

The measured SSD for vehicles approaching the proposed driveway traveling northbound on Southbridge Road (Route 169) exceed the minimum SSD of 495 feet required for a travel speed of 55 MPH (Table 2). Similarly, the measured SSD for vehicles approaching the proposed driveway traveling southbound on Southbridge Road (Route 169) exceed the minimum SSD of 570 feet required for a travel speed of 60 MPH (Table 2).

The measured ISD for vehicles looking to the left from the proposed driveway for turning left or right on Southbridge Road (Route 169) was above 1,200 feet and exceeding the minimum ISD of 665 feet required for a travel speed of 60 MPH (Table 2). Similarly, the measured ISD for vehicles looking to the right from the proposed driveway for turning left on Southbridge Road (Route 169) was above 1,200 feet and exceeding the minimum ISD of 610 feet required for a travel speed of 55 MPH (Table 2).

Figure 2 graphically demonstrates the sight distance measurements.

CHARLTON, MA
NEC LNG STORAGE ALTERNATE SITE
FIGURE 2 - SIGHT DISTANCE PLAN

0 100 200 300 400
SCALE: 1" = 100'

CONCLUSIONS

Nitsch Engineering has been retained by NEC to prepare a qualitative assessment of sight distance associated with the proposed Liquefied Natural Gas (LNG) Facility at 304 Southbridge Road (Route 169) in Charlton, Massachusetts—the Northeast Energy Center, LLC (NEC).

Nitsch Engineering conducted a site walk on Tuesday, December 11, 2018 to manually measure the average vehicle travel speeds, and physically measure the actual line of sight distances at the proposed site driveway.

Based on our field measurements, both SSD and ISD for the proposed site driveway exceed the minimum values required for the average travel speeds of 55 and 60 MPH, and the site will be able to accommodate the LNG transporting trucks for turning onto Southbridge Road (Route 169).

Nitsch Engineering also offers the following recommendations:

- Improve the intersection sight distance (ISD) by trimming back the vegetation along the easterly edge of Southbridge Road (Route 169) south of the proposed driveway to the Facility.
- Consider installing advance driveway warning signs at Southbridge Road (Route 169) approaching the proposed driveway to the Facility.

Appendix F

Onsite Construction Activities

APPENDIX F ONSITE CONSTRUCTION ACTIVITIES

F-1.0 Facility Construction Overview

The Applicant is negotiating a contract with a turnkey engineering, procurement and construction ("EPC") contractor. The EPC Contractor will fulfill the role of engineer and general contractor. Activities undertaken by the EPC Contractor include final Project design prior to construction, providing Project site access for equipment suppliers and vendors and coordination among subcontractors. Ultimately, the EPC Contractor will be responsible to ensure the engineering and construction is executed timely and in accordance with the EPC contract documents. The Applicant's representative will oversee the EPC Contractor to ensure the Contractor's performance is in compliance with all Project permits and the EPC contract documents.

The Applicant anticipates construction of the Facility will take approximately 12 months, including testing and commissioning. Prior to the start of the construction the required equipment and systems will be ordered and prefabricated off-site. The longest lead items such as the gas turbine, refrigerant compressor, and cold box take approximately 18 months from time of order to delivery for on-site construction. After completion of Hazardous Operation Analysis (Haz-Op) and final engineering & design, the major construction activities include:

- **Mobilization** – transporting and preparing equipment, tools, supplies, construction offices, storage facilities, etc. necessary to support construction;
- **Site preparation** – clearing of the site, installation of erosion & sediment control devices, stormwater management facilities, grading (including cut and fill to prepare a level project site), construction of retaining walls, preparation of some subgrade utilities such as piping and electrical conduits;
- **Foundations** – installation of concrete foundations to support equipment, buildings, tanks, etc.;
- **LNG tank erection** – the erection of the LNG tank including the delivery of prefabricated inner tank panels & other components, installation of the tank floor system, assembly & welding of the inner tank panels, assembly of the outer tank panels (pre-casting of the outer tank panels may occur on or off site), assembly & installation of the dome roof, installation of perlite insulation, installation of additional components, painting of the outer tank & roof;
- **Major equipment deliveries** – delivery of the combustion turbines and compressor, cold box, process equipment & skids, electrical transformer, and other significant pieces of equipment;

- **Major equipment installation** – installation of the foregoing equipment on their respective foundations;

- **Structures** – construction of the various structures on the Project site is completed at various stages of the construction schedule depending on purpose. For example, some buildings may be completed early in the process while those housing major equipment are typically completed after installation of such equipment to optimize construction efficiency;

- **Electrical scope** – installation of electrical service components such as auxiliary equipment power supply cables, communications wires, connecting facility control panels and equipment and the buses and conductors connecting the generators to the electrical grid; and

- **Commissioning, Testing, Training, and Documentation** – a series of progressive steps to energize the facility; test equipment; train operations staff on the Project's specific facilities; create written procedures, and verify compliance with operational permit conditions.

Typical work hours will be during daytime hours (7:00 AM to 5:00 PM). It is the Applicant's expectation that construction activities will be scheduled during the week from Monday through Saturday. Some work, particularly during the startup & commissioning of the Facility, may need to be scheduled at night or throughout the weekend. After installation of the interconnection pipeline, the work to perform pressure testing and purging and packing of the pipeline may require an extended work schedule.

In order to maximize construction efficiency, the Applicant expects overlap of certain activities. For example, it may be optimal to begin installing equipment on completed foundations while others are still being prepared or poured. Prior to the start of the construction activities all the equipment and buildings will be ordered and pre-fabricated over a twelve-month process.

The Project will require delivery of oversized equipment, including the LNG storage tank pre-fabricated inner tank panels, gas turbine and compressor, cold box and other process equipment and skids. Working with MassDOT and Town officials, the Project team will minimize the traffic impacts of these deliveries. To minimize traffic impacts, deliveries may be scheduled outside of normal construction hours.

F-2.0 Interconnection Pipeline Construction Overview

Construction of the eight-inch interconnection pipeline will likely be performed primarily via open-cut trenching, but horizontal directional drilling (HDD) may be performed based upon the final route selection and in order to cross major roadways and/or minimize the impact to environmentally sensitive areas.

The construction sequence will likely proceed as follows:

- **Survey stake out -** the survey team will stake out pipeline right-of-way and temporary construction workspace.

- **Clearing, establishment of erosion & sediment controls and grading -** the next step is to clear the pipeline corridor, install erosion & sediment control measures, and grade the corridor, stockpiling topsoil along the way.

- **Excavation/trenching -** the trench will be excavated, the pipeline trench will be approximately five to eight feet wide and approximately five feet deep. Suitable bedding materials (typically, six inches of sand) will be placed in the trench.

- **Welding -** The pipe spools will be strung out along the corridor, pipe joints welded, and then visually and non-destructively inspected in accordance with applicable federal and state regulations.

- **Cathodic protection -** the pipeline will be constructed using factory coated steel pipe. The weld joints and any imperfections found in the coating will be repaired in the field. A cathodic protection system, such as a Magnesium Anode bed system[1] or induced current system will be installed to minimize corrosion during the life of the pipeline. The type of system installed during construction will be based on the results and recommendations of a Cathodic Protection Study to be completed during the engineering and design phase of the Project.

- **Backfill and compaction –** after welding of the pipe joints and application of field coating, the pipe sections will be lowered into the trench. The area around the pipe to eight inches above the pipe will be backfilled with fine materials or sand padding, and then suitable backfill will be placed above the pipe and compacted. The segregated native topsoil will then be placed above the backfill prior to final restoration and seeding.

- **Cleaning and testing -** following pipeline installation, pressure testing is required by code to verify that the line is leak-tight and capable of safely withstanding its rated pressure. The pipe will be cleaned using a cleaning or scarifying "pig", removing most welding slag and any incidental soil that may have been inadvertently introduced during placement of the pipe sections. Additional pigs will be run through the new pipeline to dry the pipe after it is de-watered.

[1] A Magnesium Anode bed system imparts a slight current on the main, thus inhibiting corrosive forces in the surrounding soil.

- **Purging and packing –** after the pressure testing and cleaning of the pipeline, air will be purged from the pipeline segment using natural gas. This gas will be vented to atmosphere or flared. After the percentage of natural gas in the pipeline reaches acceptable levels, the venting or flaring will cease, and the pipeline will be slowly packed with natural gas up to the proposed operating pressure.

- **Restoration -** once construction ends, the clean-up and restoration of the pipeline right of way begins. The land will be restored as closed to preconstruction conditions as possible.

- **Final inspection and alignment marking -** the alignment will be checked to ensure the area is properly restored, swept, and tidy. Pipeline markers will be installed at intervals to indicate the presence of the newly-installed gas line.

Appendix G

Photos and Wireframes

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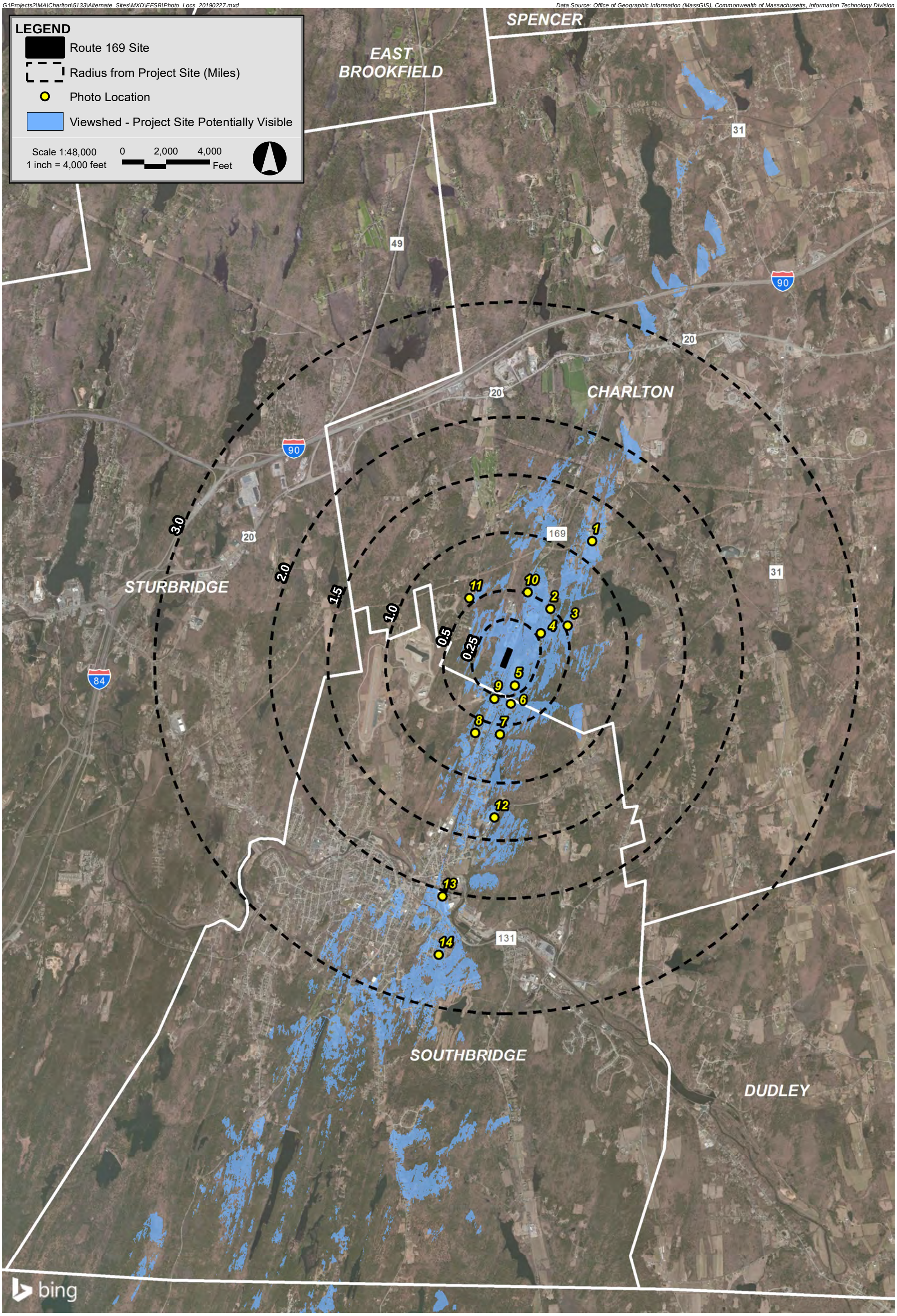
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



Northeast Energy Center **Charlton, Massachusetts**

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 1

View from Tennessee Gas – 196 Carpenter Hill Rd, Charlton
(Approximately 6,400 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 2

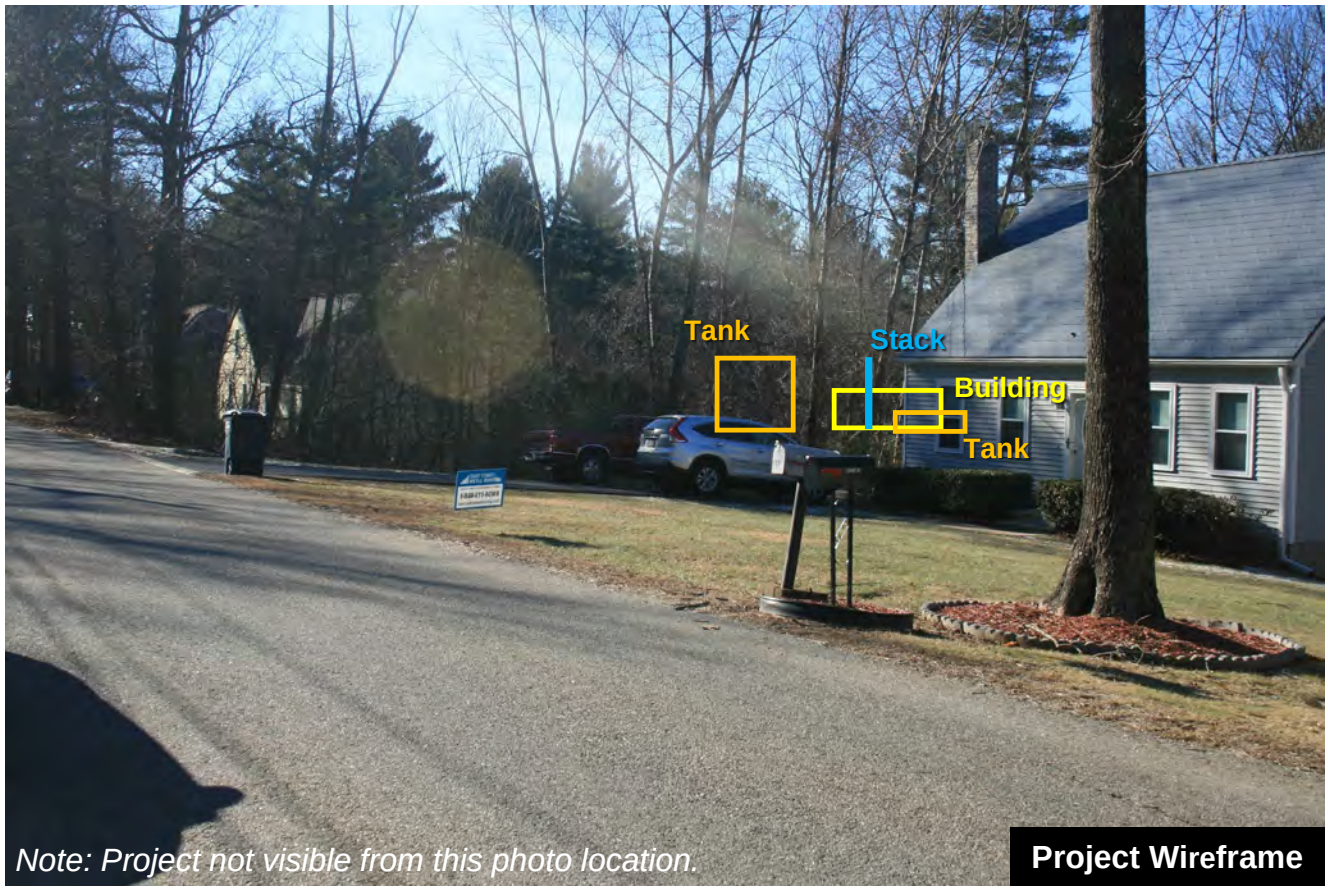
View from Woodland Walk Condo Complex – 24 Harrington Rd, Charlton
(Approximately 2,800 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 3

View from Nature's Classroom/Prindle Pond Conference Center – 19 Harrington Rd, Charlton
(Approximately 3,000 feet from Project Site)

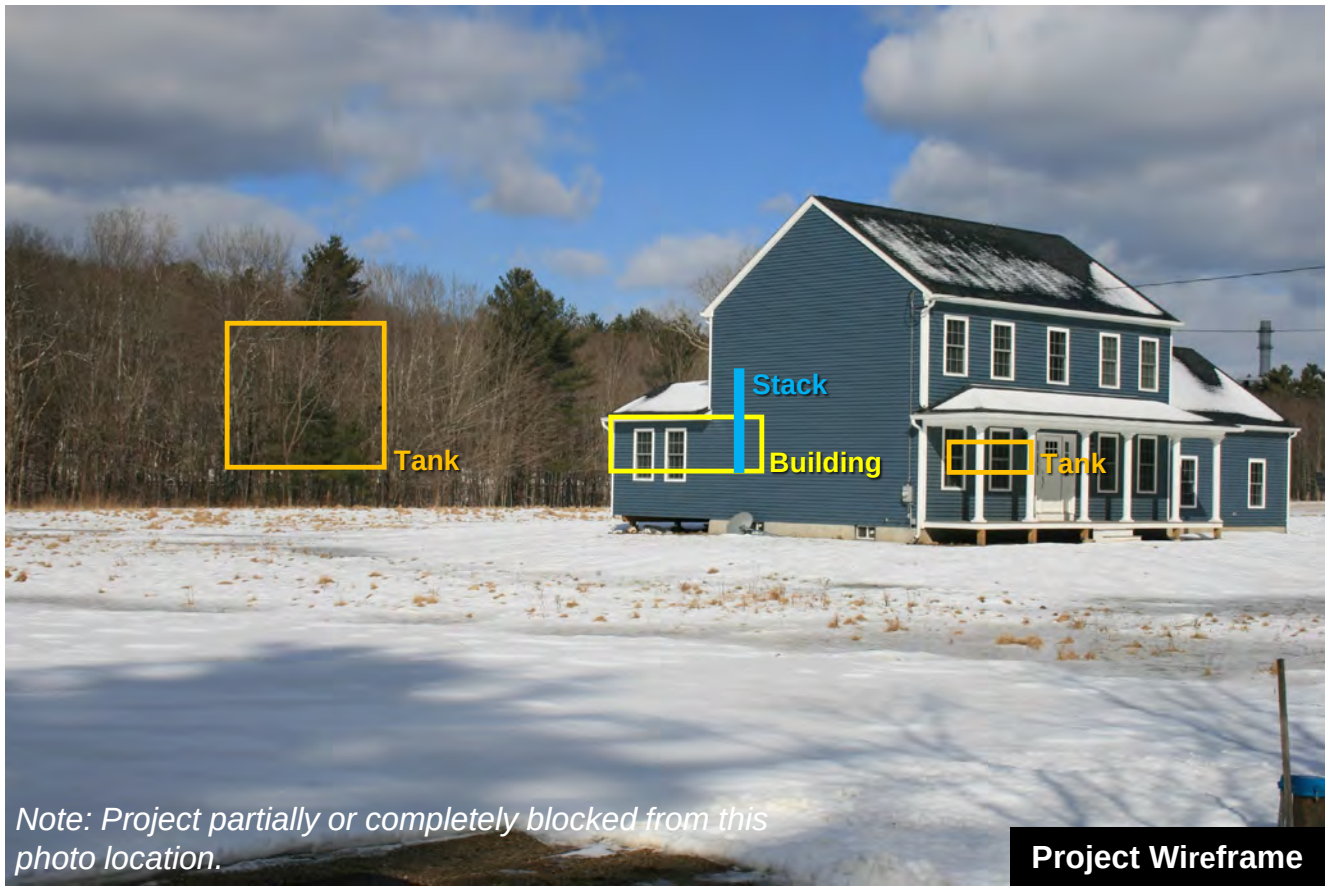


Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 4

View from Residence – 52 Harrington Rd, Charlton
(Approximately 1,800 feet from Project Site)

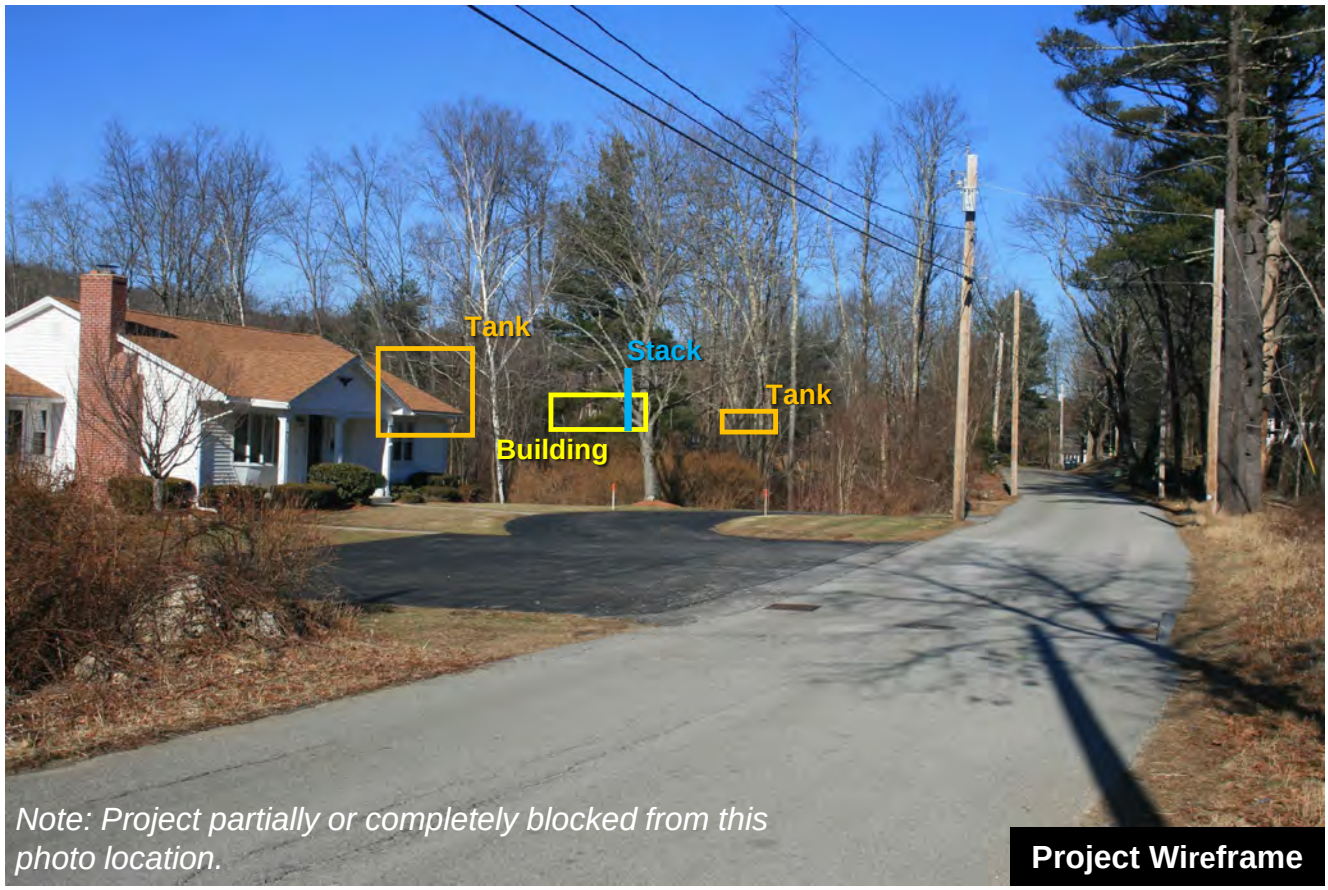


Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 5

View from Residence – 106 Harrington Rd, Charlton
(Approximately 1,500 feet from Project Site)



Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 6

View from Residence – 926 Charlton St, Southbridge
(Approximately 2,400 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 7

View from Residence – 786 Charlton St, Southbridge
(Approximately 3,800 feet from Project Site)

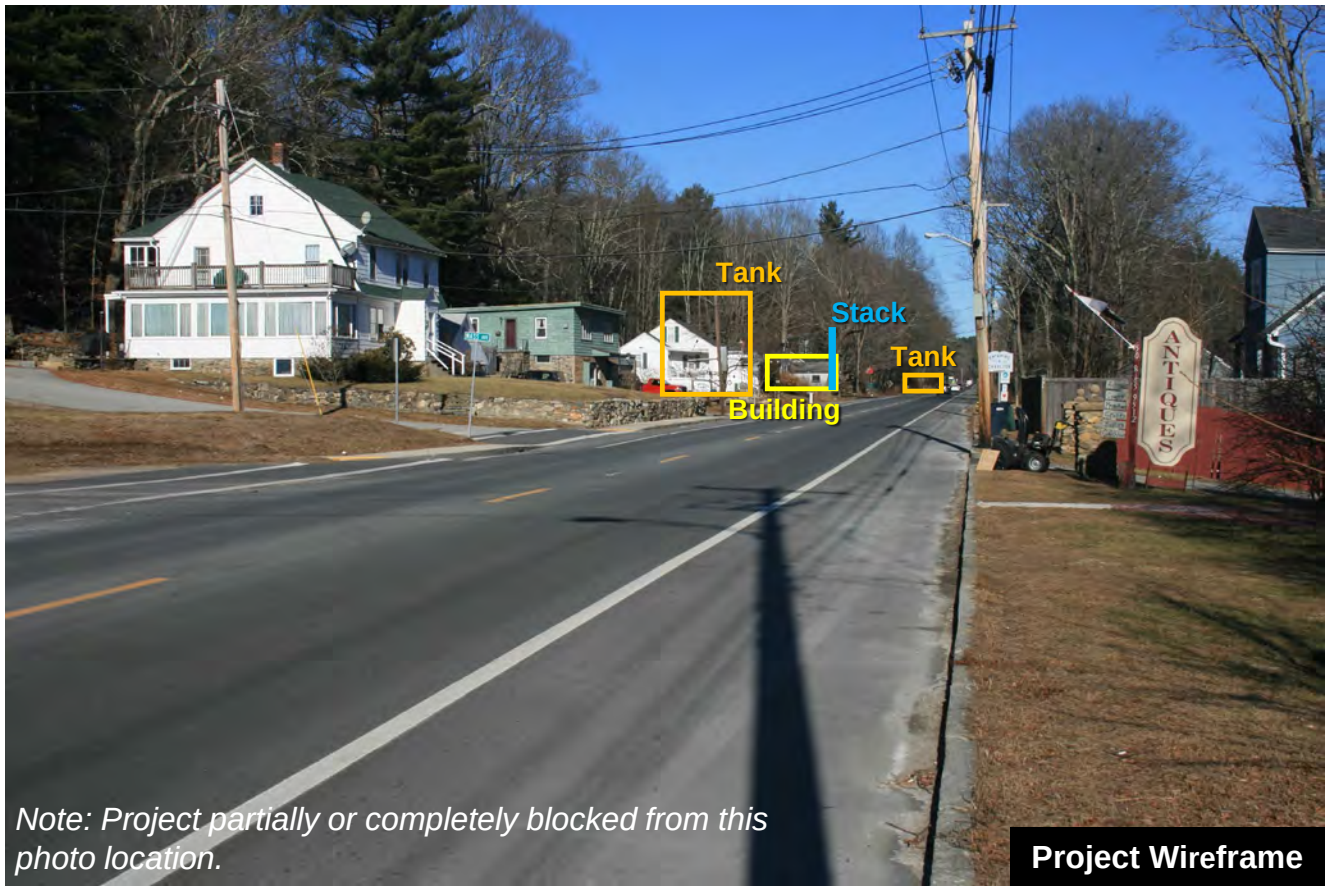
Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 8

View from Rosemeade Condo Complex – 657 Worcester St, Southbridge
(Approximately 4,000 feet from Project Site)

Existing Conditions



Note: Project partially or completely blocked from this photo location.

Project Wireframe

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 9

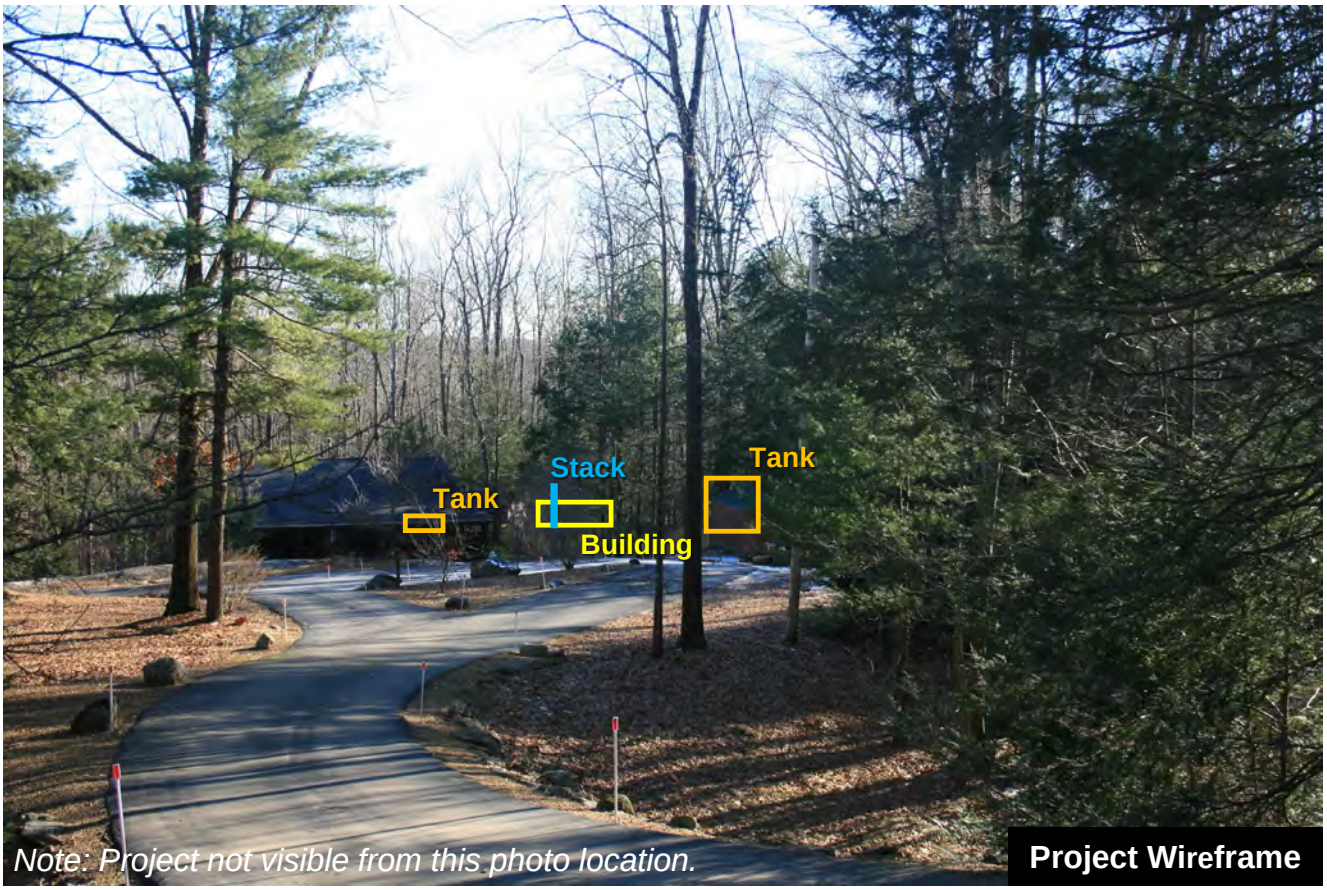
View from Residence – 884 Worcester St, Southbridge
(Approximately 2,200 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon Associates Inc.

Photo Location 10

View from Charlton Family Practice – 246 Southbridge Rd, Charlton
(Approximately 2,900 feet from Project Site)

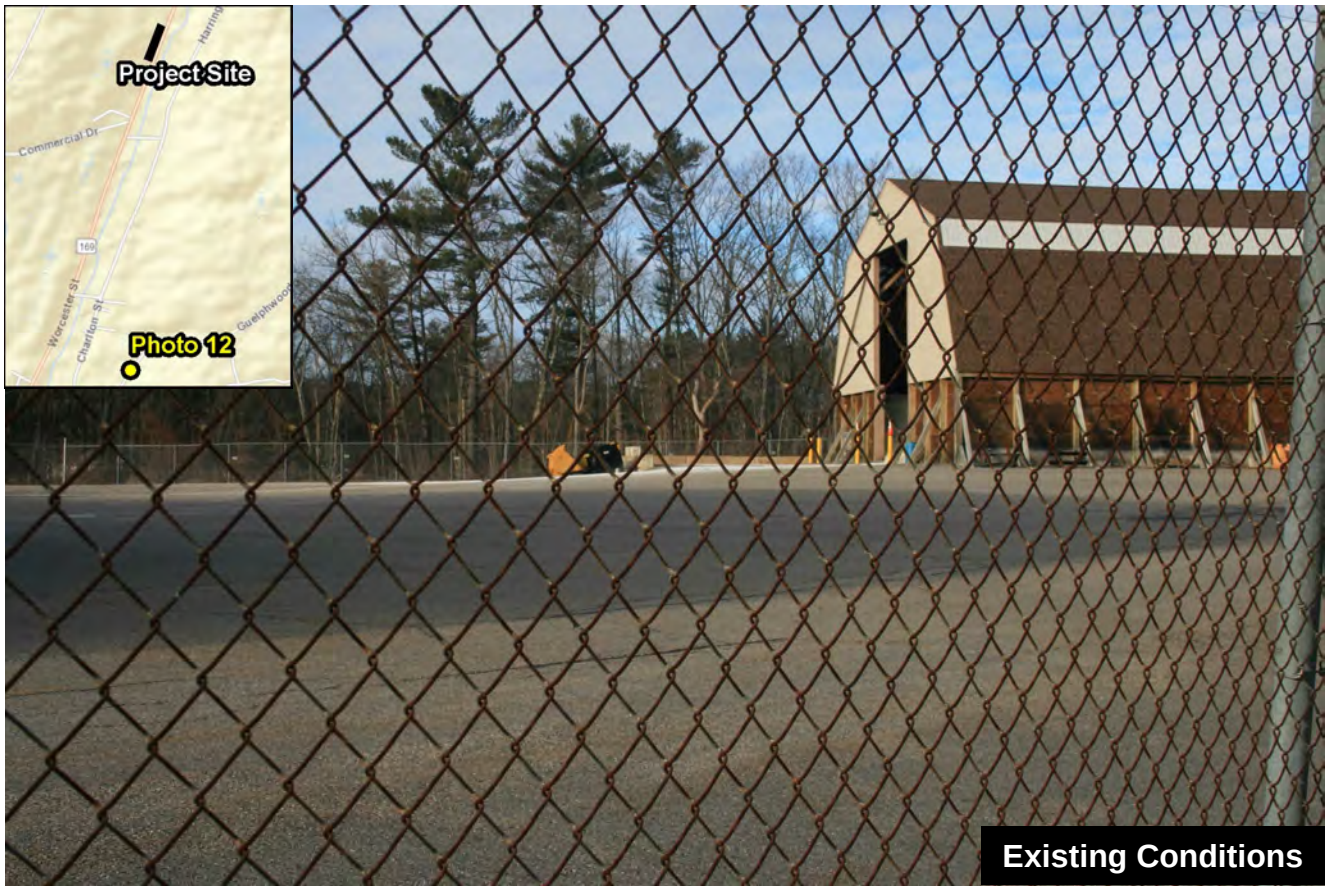


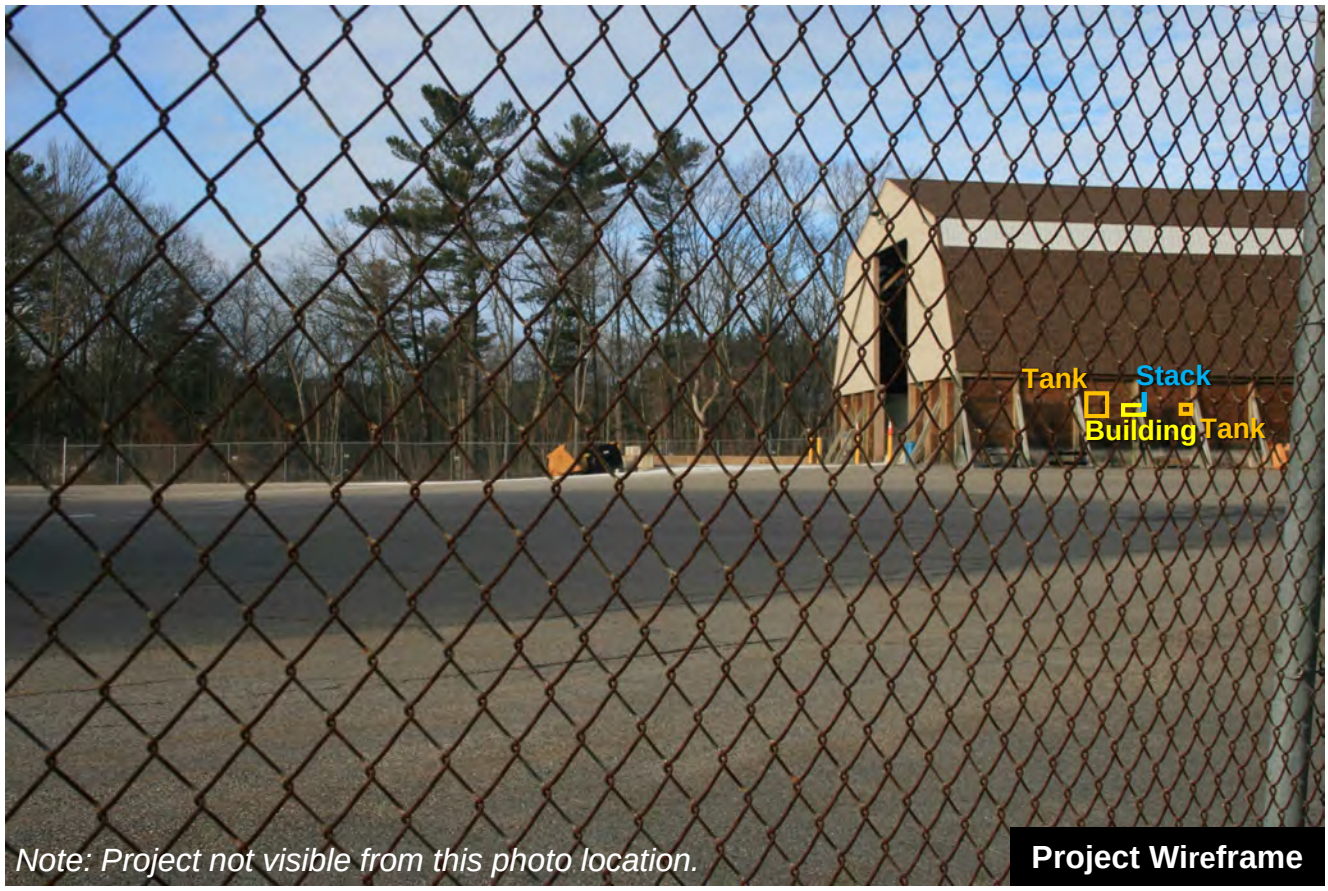
Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 11

View from Residence – 65 H Foote Rd, Charlton
(Approximately 3,000 feet from Project Site)





Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 12

View from Southbridge Dept of Public Works – 165 Guelphwood Rd, Southbridge
(Approximately 7,600 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 13

View from Southbridge Hotel and Conference Center – 14 Mechanic St, Southbridge
(Approximately 11,600 feet from Project Site)

Northeast Energy Center **Charlton, Massachusetts**

Epsilon ASSOCIATES INC.

Photo Location 14

View from Morris Street Park – 168 Morris St, Southbridge
(Approximately 14,200 feet from Project Site)

Appendix H

Precedent Agreement
(redacted)

PRECEDENT AGREEMENT

THIS PRECEDENT AGREEMENT ("Agreement") is entered into this 25th day of ~~March~~ MAY, 2015 (the "Effective Date") by and between Northeast Energy Center, LLC, a Delaware limited liability company herein referred to as "Supplier," and Boston Gas Company d/b/a National Grid, a Massachusetts company, herein referred to as "Customer." In this Agreement, Supplier and Customer may be referred to individually as "Party" and collectively as "Parties."

WHEREAS, Supplier intends to develop, permit, construct, own and operate a natural gas liquefaction and storage facility in [redacted] Massachusetts (the "Facility") that will be connected to the Tennessee Gas Pipeline, which will be certificated and operated pursuant to the regulations of the Federal Energy Regulatory Commission ("FERC");

WHEREAS, Customer desires that Supplier provide Customer liquefaction and related service at Supplier's Facility for the reservation quantities set forth in Attachment A;

WHEREAS, Supplier plans to initiate a binding open season ("Open Season") to offer firm liquefaction and related service from the Facility to evaluate the commitments that prospective customers are willing to make and thus determine both the feasibility and the engineering design and size of the Facility;

WHEREAS, the Open Season will establish the opportunity for bidders to qualify as Anchor Customers or Supporting Customers based upon conforming bid criteria as set forth in Attachment D; and

WHEREAS, the Parties agree that this Agreement shall be deemed a binding bid by Customer in the Open Season for Anchor Customer status pursuant to the terms of this Agreement and Customer's terms of service set forth in Attachments A and D hereto;

NOW, THEREFORE, in consideration of the understandings and mutual covenants set forth herein, and intending to be legally bound, Supplier and Customer agree as follows:

1. **Request for Service.** Customer has completed and submitted to Supplier a Request for Service for Firm Liquefaction and Delivery Service ("FLS") under Rate Schedule FLS, attached hereto as Attachment A, and agrees to be bound by the quantity, term, rates and charges and any supplemental terms set forth in Attachment A, which shall be incorporated in Customer's FLS Service Agreement ("Service Agreement").

2. **Customer Conditions Precedent.** Customer shall execute and deliver Customer's Service Agreement within ten (10) business days after the last of the Customer Conditions Precedent set forth in (a) and (b) below are completed or waived

   a. Customer receipt of all necessary approvals from its executive management and/or board of directors to execute the Service Agreement pursuant to the terms of this Agreement ("Customer Approvals") by April 1, 2015; and

   b. Customer receipt of all necessary regulatory authorizations, including any input, guidance and/or informal or formal approvals and orders or other authorizations or consents as determined to be acceptable by Customer in its sole discretion from the Massachusetts Department of Public Utilities ("Regulator"), and any other federal, state or local authorities having jurisdiction (collectively, "Customer Regulatory Authorizations"), to proceed under this Agreement, the Service Agreement and any related agreements by January 1, 2016.

3. **Customer Termination Rights**.

   a. If Customer is unable to satisfy the conditions precedent specified in Section 2.a and does not waive the conditions by April 1, 2015, then Customer shall have the right, to be exercised by written notice no later than April 15, 2015 to terminate

this Agreement. If such notice is given by Customer, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Customer Approvals, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Customer withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

b. If Customer is unable to satisfy the conditions precedent specified in Section 2.b and does not waive the conditions by January 1, 2016, then Customer shall have the right, to be exercised by written notice no later than January 15, 2016 to terminate this Agreement. If such notice is given by Customer, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Customer Regulatory Authorizations, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) Customer decides to accept the Customer Regulatory Authorizations as issued, (b) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (c) the

Parties agree in writing to extend the 30-day period, or (d) Customer withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

c. If Supplier has not received and accepted its FERC Certificate of public convenience and necessity ("FERC Certificate") and started construction of the Facility by April 1, 2019, then Customer shall have the right, upon written notice to Supplier no later than April 1, 2019, to elect to terminate ("Customer Notice of Termination") this Agreement and, if executed, the Service Agreement; provided, however, that the Customer Notice of Termination shall be null and void if Supplier has started construction of the Facility on or before April 15, 2019. If such notice is given by Customer, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment of this Agreement and any related agreements to accomplish the objectives of the Parties and to address any delay in receipt of regulatory approvals and/or start of construction, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Customer withdraws its previously submitted Customer Notice of Termination, this Agreement shall terminate. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

REDACTED

d. If the Facility is not in service by July 1, 2022, then Customer shall have the right, upon written notice to Supplier no later than July 30, 2022, to terminate this Agreement and, if executed, the Service Agreement. Such termination shall be without liability to Customer or Supplier.

4. **Supplier Conditions Precedent**. Supplier shall execute and deliver Customer's Service Agreement within ten (10) business days after the last of the Supplier Conditions Precedent set forth in (a) through (e) below are completed or waived

a. Supplier receipt of all necessary and final authorizations, consents, and approvals, including all necessary and final authorizations from federal, state, and local authorities having jurisdiction, including but not limited to those of the FERC, including the FERC Certificate, and of any state or federal court in which Supplier seeks to exercise eminent domain or otherwise obtain rights or access to land (collectively "Supplier Regulatory Authorizations") on terms and conditions acceptable to Supplier in its sole discretion to construct and operate the Facility;

b. Supplier receipt of all necessary internal approvals to execute this Agreement and all other agreements contemplated herein ("Supplier Approvals");

c. [redacted]

d. Supplier's receipt of commitments for all financing necessary to construct the Facility in a form satisfactory to Supplier in its sole discretion: and

e. Customer meets the Creditworthiness and Credit Support Requirements set forth in Section 10 at the time Supplier executes the Customer Service Agreement and at the time Customer is obligated to execute the Service Agreement.

5. **Supplier Termination Rights**.

a. If Supplier is unable to satisfy the conditions precedent specified in Section 4.b and does not waive the conditions by July 31, 2015, then Supplier shall have the right, to be exercised by written notice no later than August 15, 2015 to terminate this Agreement. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Supplier Approvals, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

b. If Customer is unable to satisfy the conditions precedent specified in Section 2.a and Supplier does not waive the conditions by April 15, 2015, then Supplier shall have the right, to be exercised by written notice no later than April 30, 2015 to

terminate this Agreement. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Customer Approvals, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

c. If Customer does not provide notice to Supplier by January 15, 2016, that Customer has satisfied the conditions precedent specified in Section 2.b and Supplier does not waive the conditions, then Supplier shall have the right, to be exercised by written notice by January 31, 2016, to terminate this Agreement. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Customer Regulatory Authorizations, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) Customer elects to accept the Customer Regulatory Authorizations as then issued, (b) the Parties otherwise mutually agree in writing

to an amendment to this Agreement, (c) the Parties agree in writing to extend the 30-day period, or (d) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

d. If Supplier is unable to satisfy the conditions precedent specified in Section 4.a and Supplier does not waive the conditions, then Supplier shall have the right to terminate this Agreement and, if executed, the Service Agreement upon thirty (30) days' prior written notice to Customer; provided that any such notice must be provided within thirty (30) days of the event giving rise to the termination right. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of satisfactory Supplier Regulatory Authorizations, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) Supplier elects to accept the Supplier Regulatory Authorizations as then issued, (b) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (c) the Parties agree in writing to extend the 30-day period, or (d) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion.

Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

e. If the conditions precedent specified in Section 4.c are not satisfied and Supplier does not waive the conditions, then Supplier shall have the right to be exercised by written notice no later than March 1, 2016, to terminate this Agreement. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with insufficient commitments under rate schedule FLS, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

f. If the Customer fails to satisfy the creditworthiness and credit support requirements set forth in Section 10, then Supplier shall have the right to terminate this Agreement and, if executed, the Service Agreement. In such event, Customer shall be liable for its pro-rata share of the Development Costs in

accordance with Section 9 and Supplier shall be afforded all rights and remedies in accordance with Section 11.

g. If the conditions precedent specified in Section 4.d are not satisfied and Supplier does not waive the conditions, then Supplier shall have the right to be exercised by written notice no later than sixty (60) days following the issuance of the FERC Certificate for the Facility, to terminate this Agreement. If such notice is given by Supplier, then the Parties shall negotiate in good faith for a period not to exceed thirty (30) days toward an amendment to this Agreement and any related agreements to accomplish the objectives of the Parties and to address any issues associated with the lack of commitments for all financing necessary to construct the Facility, provided, however, that neither Party shall be required to consent to modifications of this Agreement or any related agreements. Unless within such period (a) the Parties otherwise mutually agree in writing to an amendment to this Agreement, (b) the Parties agree in writing to extend the 30-day period, or (c) Supplier withdraws its previously submitted notice to terminate, this Agreement shall terminate. Any such agreement between Supplier and Customer to amend any agreement shall include as a condition the receipt by Customer of all necessary regulatory authorizations and approvals acceptable to Customer in its sole discretion. Supplier shall use commercially reasonable efforts to cooperate with Customer in its efforts to obtain any necessary approval or regulatory authorization. Any termination pursuant to this provision shall be without liability to Customer or Supplier.

h. [redacted]

6. **Term.**

   a. This Agreement shall become effective as of the Effective Date and shall continue in effect, notwithstanding the intervening execution of the Service Agreement, until such time as the commencement of service, unless terminated pursuant to Sections 3, 5, 10, or 11.

   b. Notwithstanding Section 6(a), Sections 9, 10, and 12 shall survive the expiration or early termination of this Agreement until fulfillment or satisfaction of their terms.

7. **Supplier Regulatory Authorizations.** Supplier shall proceed with due diligence to obtain all Supplier Regulatory Authorizations. All decisions relating to the process of obtaining the Supplier Regulatory Authorizations shall be made by Supplier in its sole discretion,

including decisions to file, prosecute, amend, supplement, or withdraw any application for the Supplier Regulatory Authorizations, accept or reject any Supplier Regulatory Authorizations, or seek court review thereof. Customer shall support and cooperate with the efforts of Supplier to obtain the Supplier Regulatory Authorizations, including filing interventions in support and providing any information reasonably requested by Supplier related to obtaining such Supplier Regulatory Authorizations. Supplier agrees, subject to the terms and conditions of this Agreement, to seek FERC approval for and construct the Facility to render firm liquefaction, storage and liquid delivery service for Customer pursuant to the terms and conditions of the Service Agreement, which shall be substantially in the form attached hereto as Attachment B, and the Operational Terms and Conditions of Service, attached hereto as Attachment C respectively. It is understood by the Parties that Supplier shall file with FERC for approval a *pro forma* FERC Gas Tariff that shall (a) be materially consistent with the Operational Terms and Conditions of Service; (b) include customary terms and conditions applicable to a FERC Gas Tariff; and (c) be consistent with then-applicable FERC rules and regulations.

8. **Customer Regulatory Authorizations.** Customer shall proceed with due diligence to obtain all Customer Regulatory Authorizations required to proceed under this Agreement, the Service Agreement, and any related agreements. All decisions relating to the process of obtaining the Customer Regulatory Authorizations shall be made by Customer in its sole discretion, including decisions to file, prosecute, amend, supplement, or withdraw any application for the Customer Regulatory Authorizations, accept or reject any Customer Regulatory Authorization, or seek court review thereof. Supplier shall support and cooperate with the efforts of Customer to obtain the Customer Regulatory Authorizations, including filing interventions in support and providing any information reasonably requested by Customer related to obtaining such Customer Regulatory Authorizations.

9. **Development Costs.** Customer acknowledges that Supplier has made and will continue to make advance expenditures in connection with satisfying the conditions precedent, including, but not limited to, seeking Supplier Regulatory Approvals, site acquisition, obtaining long lead time materials and the services of engineering and environmental consultants. In consideration of these efforts to provide the liquefaction and related service requested by Customer, if Customer breaches this Precedent Agreement, Customer shall reimburse Supplier for its pro rata share of the total of such advance expenditures based on Customer's percentage of the total liquefaction capacity sought in the Regulatory Approvals; any such reimbursement payment will be due from Customer to Supplier within 10 days of delivery of Supplier's invoice to Customer.

10. **Creditworthiness & Credit Support.** Execution of this Agreement is contingent upon a satisfactory credit evaluation by Supplier of Customer. On a non-discriminatory basis, Supplier shall apply consistent financial standards to determine the acceptability of Customer's creditworthiness. Notwithstanding the foregoing, Customer shall be deemed creditworthy if: (i) Customer's Corporate Credit Rating is at least BBB- with a stable outlook or higher by Standard & Poor's Corporation and at least Baa3 with a stable outlook or higher by Moody's Investor Service; and (ii) the sum of reservation fees for the contract term is less than 15% of Customer's or its guarantor's, as applicable, tangible net worth.

If Customer has failed to satisfy the creditworthiness criteria above, Customer may nevertheless obtain credit approval from Supplier by providing one of the following in an amount, at all times, equal to (i) the total of the Reservation Charges charged to Customer pursuant to this Agreement under rate schedule FLS times (ii) the Maximum Contract Quantity(ies) times (iii) thirty-six (36) months; provided, however, that once the remaining term of the Customer's Service Agreement is less than thirty-six (36) months, such amount shall be reduced such that the credit support amount equals the total of the Reservation Charges times the Maximum Contract Quantity(ies) times the

remaining months of service under the Service Agreement, but at no time shall the amount be less than three (3) months of Reservation Charges:

a) an advance deposit;
b) a standby irrevocable letter of credit; or
c) a guaranty, in a form reasonably acceptable to Supplier, by another person or entity that Supplier has made a determination is sufficiently creditworthy.

Customer shall also promptly provide such additional Customer credit information as may be reasonably required by Supplier at any time during the term of service under a Service Agreement to enable Supplier to determine Customer's creditworthiness including, but not limited to:

a. Written confirmation that Customer is not operating under any chapter of the bankruptcy laws and is not subject to liquidation or debt reduction procedures, such as an assignment for the benefit of creditors, under any informal creditors' committee agreement or under state laws, provided that an exception may be made for a Customer who is a debtor in possession operating under Chapter 11 of the Federal Bankruptcy Act but only with adequate assurance that the service billing will be paid promptly as a cost of administration under the federal bankruptcy court's jurisdiction;
b. Written confirmation that no significant collection lawsuits or judgments are outstanding which would materially affect Customer's ability to remain solvent as an ongoing business entity; and
c. Written confirmation that Customer is not aware of any change in business conditions which would cause a substantial deterioration in its financial condition, a condition of insolvency, or the inability to exist as an ongoing business entity.

Upon notification by Supplier that Customer during the term of the Service Agreement no longer satisfies the credit criteria, Supplier has the right to require security as specified herein and, if satisfactory security is not tendered within three (3) business days, then Supplier, in addition to any other remedy available to it, shall have the right upon two (2) business days advance notice to suspend service until such security is tendered. If Customer's failure to tender satisfactory security continues for 60 days after the original due date, then Supplier, in addition to any other remedy available to it, shall have the right upon five (5) days advance notice to terminate Customer's Service Agreement(s).

Customer shall satisfy the credit assurance provisions as of the Effective Date of this Agreement, and shall have a continuing obligation to satisfy the credit assurance provisions of this Agreement throughout the term of this Agreement, and such provisions of the Service Agreement and any other related agreements as may be in effect from time to time.

11. Breach and Remedies. Nothing in this Agreement shall be construed to preclude the Parties from pursuing any remedy at law or equity for the other Party's breach of this Agreement; provided however that neither Party shall be liable for consequential, incidental, punitive, exemplary, or indirect damages, by statute, in tort or contract or otherwise; provided further that the foregoing shall not preclude Supplier from pursuing any remedy to recover Reservation Charges under the Service Agreement.

12. Confidentiality. Each Party shall hold the substance and terms of this Agreement confidential, but may disclose the substance and terms of this Agreement to its or its affiliates' directors, officers, employees, representatives, agents, lenders, consultants, attorneys or auditors ("Representatives") who have a need to know the substance and terms of this Agreement and who are subject to a confidentiality obligation covering the disclosed information. Neither Party shall disclose or communicate, and will cause its

Representatives not to disclose or communicate, the substance or terms of this Agreement to any other person, entity, firm, or corporation without the prior written consent of the other Party; provided that Supplier may disclose the Agreement in any applications for Supplier Regulatory Authorizations and that Customer may disclose the terms of the Agreement, the Service Agreement and any related agreements in any efforts or proceedings relating to obtaining Customer Approvals and Customer Regulatory Authorizations. Either Party may disclose the substance or terms of this Agreement as requested or required by law, order, rule or regulation of any duly constituted governmental body or official authority having jurisdiction; provided however, the Party compelled to disclose the Agreement shall give prompt written notice of such requirement to the other Party so that either Party may seek a protective order or other appropriate remedy and/or waive the compliance with the terms hereof.

13. **Assignment.** Any company which shall succeed by purchase, merger, consolidation or otherwise to the properties substantially as an entirety, of Supplier or of Customer shall be entitled to the rights and shall be subject to the obligations of its predecessors in title under this Agreement. Supplier shall have the right to assign this Agreement and the rights and obligations hereunder to any affiliate that is creditworthy as of the effective date of the assignment; in the event of any such assignment, such assignee shall, in writing, assume, and be bound by, all the rights and obligations of Supplier hereunder and Supplier shall be released from all obligations and liabilities hereunder. Customer shall have the right to assign this Agreement and the rights and obligations hereunder to any affiliate that meets the Creditworthiness provisions of Section 10 as of the effective date of the assignment; in the event of any such assignment, such assignee affiliate shall, in writing, assume, and be bound by, all the rights and obligations of Customer hereunder and Customer shall be released from all obligations and liabilities hereunder. No other assignment of this Agreement, or of any of the rights or obligations hereunder, shall be made unless there first shall have been obtained the consent thereto of Supplier, in the event of any assignment by Customer, or the consent thereto of

Customer, in the event of an assignment by Supplier. These restrictions on assignment shall not in any way prevent any Party from pledging or mortgaging its rights under this Agreement as security for its indebtedness.

14. **Notice.** Notices to either Party shall be in writing, transmitted by personal delivery, by registered or certified United States mail, by overnight courier service, by facsimile, or by email to the Parties at the addresses shown below or such other address as either Party may designate by proper notice to the other Party. If transmitted by email or facsimile before 5:00 p.m. Eastern Clock Time on a business day and telephonically confirmed, notice shall be deemed to have been given or made on the business day on which so transmitted, or if not before such deadline, on the next business day, and if sent by overnight courier and delivery is confirmed, or, if mailed by registered or certified mail, return receipt requested, notice shall be deemed to have been given or made on the day on which delivered:

If to Supplier:

Northeast Energy Center, LLC
C/O Liberty Utilities
Attention: Chris Thompson, VP Project Development
354 Davis Road, Oakville, Ontario L6J 2X1
Telephone: 905-465-6111
Facsimile: 905-465-4514
E-mail: Chris.Thompson@libertyutilities.com
Michael.Petit@libertyutilities.com

With a copy to:

Northstar Industries
Attention: Tom Quine, President
126 Merrimack Street
Methuen, MA 01844
Telephone: 978-975-5500
Facsimile: 978-975-9975
Email: tquine@northstarind.com

If to Customer:

Boston Gas Company d/b/a National Grid
Attention: Samara Jaffe
100 E. Old Country Rd.
Hicksville, NY 11801
Telephone: 516-545-5408
Facsimile: 516-545-5468
E-mail: Samara.jaffe@nationalgrid.com

15. **Governing Law.** This Agreement shall be governed by the laws of the State of New York.

16. **Applicable Law.** This Agreement and the rights and obligations of the Parties hereunder are subject to all applicable laws, regulations, rules and orders of all governmental and regulatory bodies having jurisdiction.

17. **Waiver.** A waiver by a Party of any one or more defaults hereunder shall not operate as a waiver of any future default, whether of a like or a different character.

18. **Amendment.** No modification to the terms and provisions of this Agreement or any Service Agreement executed by Supplier and Customer pursuant hereto shall become effective except by an amendment executed in writing by both Supplier and Customer.

19. **Whole Agreement.** This Agreement sets forth all understandings and agreements of the Parties and supersedes all other prior agreements, whether oral or written, respecting the subject matter hereof. In the event of any conflict between the terms of this Agreement and the Service Agreement, the terms of the Service Agreement shall control.

20. **Counterparts.** This Agreement may be executed by the parties in any number of counterparts, each of which shall be deemed an original instrument, but all of which together shall constitute but one and the same agreement.

21. **Severability**. Any provision of this Agreement declared or rendered unlawful or unenforceable by any applicable court of law or regulatory agency or deemed unlawful because of a statutory change will not otherwise affect the remaining lawful obligations that arise under this Agreement or Customer's Service Agreement; provided that in such event, the Parties shall use commercially reasonable efforts to reform this Agreement in order to give effect to the original intention of the Parties.

22. **Representations and Warranties**. On the Effective Date and on the effective date of Customer's Service Agreement, each Party represents and warrants to the other Party that:

    a. such Party is duly organized, validly existing and in good standing under the laws of the jurisdiction of its formation and is in good standing in each other jurisdiction where the failure to so qualify would have a material adverse effect upon the business or financial condition of such Party or the ability to perform its obligations under this Agreement and Customer's Service Agreement;

    b. with the exception of the governmental authorizations described in Sections 2.b and 4.a, such Party has all governmental authorizations necessary for such Party to legally execute, deliver and perform its obligations under this Agreement and Customer's Service Agreement;

    c. the execution, delivery and performance of this Agreement and of Customer's Service Agreement are within such Party's corporate powers, have been duly authorized by all necessary corporate action and do not violate any of the terms and conditions in such Party's governing corporate documents, any contracts to which such Party is a party, or subject to receipt of the governmental authorizations described in Sections 2.b and 4.a, any law, rule, regulation, order or the like applicable to such Party;

d. subject to receipt of the governmental authorizations described in Sections 2.b and 4.a, this Agreement and Customer's Service Agreement constitute the legally valid and binding obligation of such Party enforceable against it in accordance with such agreement's terms; except as such enforceability may be limited by applicable bankruptcy, insolvency, moratorium, reorganization or other similar laws affecting the enforcement of creditors' rights and subject to general equitable principles;

e. such Party is not operating under any chapter of the bankruptcy laws and is not subject to liquidation or debt reduction procedures, such as an assignment for the benefit of creditors, under any informal creditors' committee agreement or under state laws, and there are no such proceedings pending or being contemplated by such Party or, to its knowledge, threatened against it which would result in it operating under any chapter of the bankruptcy laws or similar laws in other jurisdictions or subject to such liquidation or debt reduction procedures under state laws; and

f. there are not pending or, to such Party's knowledge, threatened against it or any of its affiliates any legal proceedings that could materially adversely affect such Party's ability to perform its obligations under this Agreement and Customer's Service Agreement or materially and adversely affect the financial condition or operations of such Party or that purports to affect the legality, validity or enforceability of this Agreement or Customer's Service Agreement or would otherwise hinder or prevent performance hereunder or thereunder.

Northeast Energy Center, LLC

By Michael Petit

Printed Name Michael PETIT

Title DEVELOPMENT MANAGER

MAY 15, 2015

Boston Gas Company d/b/a National Grid

By _____

Printed Name John V. Vaughn
Authorized Signatory

Title _____

Attachment A

REQUEST FOR SERVICE UNDER RATE SCHEDULE FLS / ILS

Northeast Energy Center, LLC
Service Request Form

Send to: Northeast Energy Center, LLC
C/O Liberty Utilities
Attention: VP Project Development
354 Davis Road, Oakville, Ontario L6J 2X1
Telephone: 905 465 6111
Facsimile: 905-465-4514
E-mail: Chris.Thompson@libertyutilities.com
Michael.Petit@libertyutilities.com

With a copy to:

Northstar Industries
Attention: Tom Quine, President
126 Merrimack Street
Methuen, MA 01844
Telephone: 978-975-5500
Facsimile: 978-975-9975
Email: tquine@northstarind.com

Date of Request: _____

1. **Customer Name and Address (Party which will execute the Service Agreement)**

Boston Gas Company d/b/a National Grid
100 E. Old Country Rd.
Hicksville, NY 11801

Attn:____ Samara Jaffe _____ Telephone:____516 545 5408 _____

Address for Statements & Invoices (if different)

_____

_____

Attn:_____ Telephone:_____

REDACTED

2. Is Customer affiliated with Supplier? Yes_____ No ___X__

   If yes, affiliation and percentage of ownership between Customer and Supplier_____

3. Customer is a(n): (Check One)

   __X__Local Distribution Company
   _____Intrastate Pipeline Company
   _____Interstate Pipeline Company
   _____Other (Please describe)_____
   _____Producer
   _____End-user
   _____Marketer/Broker

4. This request is for (Check One)

   ___X_Firm Liquefaction and Delivery Service Rate Schedule FLS
   _____Interruptible Liquefaction and Delivery Service Rate Schedule ILS

5. Liquefaction and Delivery Service

   Requested Maximum Liquefaction Quantity (MDLQ) ___12,240__ dekatherms per day

   Summer Season (April 1 – October 31):

   Requested Maximum Storage Quantity (MSQ) ____61,200_____ dekatherms

   Requested Maximum Truck Loading Quantity (MDTQ) _____[redacted]_____trucks per day

   Winter Season (November 1 – March 31):

   Requested Maximum Storage Quantity (MSQ) ____36,720_____ dekatherms

   Requested Maximum Truck Loading Quantity (MDTQ) _____[redacted]_____trucks per day

6. Term of Service: 15 years

   Requested Commencement Date _____

   Requested Termination Date_____

7. Rate Information (Customer will agree to pay rates below for service requested)

Firm Liquefaction and Delivery Service

Liquefaction Capacity Reservation Charge [redacted]

Truck Loading Charge*

Liquefaction Usage Charge*

Other Rate Terms

[redacted]

*Authorized Overruns – see Attachment D.

Fuel Retainage:

Fuel Retainage obligation will be assessed by Supplier for all amounts actually liquefied, stored or loaded onto trucks on behalf of Customer. Customer will deliver sufficient volumes of Gas to provide process fuel (natural gas) for the Facility's use (liquefaction, tail, flash and boil-off), currently estimated to [redacted]

After the start of commercial operation of the Facility, at the end of each calendar quarter Supplier shall provide Customer with a report providing actual Fuel usage at the

1/ Payment is the product of Customer's Liquefaction Capacity Reservation Charge and Customer's MDLQ specified in Appendix B to Customer's executed Service Agreement multiplied by the number of days in the respective month.

Facility, projecting estimated Fuel usage based on prior period volumes, and adjusting the Customer's Fuel Retainage obligation to correct for any actual Under- or Over-recoveries of Fuel by Supplier. Notwithstanding the foregoing, Supplier agrees to notify Customer prior to the end of the applicable quarter if the then-applicable Fuel Retainage percentage is resulting in a significant Under- or Over-recovery of Fuel; and, upon such notice, Customer agrees to use commercially reasonable efforts to promptly adjust quantities nominated for Fuel to more closely align with actual Fuel usage in that quarter.

Subject to adjustment for any increase or decrease in (i) surcharges prescribed by the FERC, (ii) any applicable approved tariff calculated lost and unaccounted for gas, (iii) any state or local taxes imposed on the operation or inventories of the Facility, and (iv) any material change in federal, state or local taxation, Customer shall not be liable for any rates or charges for firm service other than as shown above.

8. Customer Status

a. Anchor Customer	X
b. Supporting Customer	_
c. Other	_

Attachment B

SERVICE AGREEMENT
(Applicable to Service Under Rate Schedule FLS)

This Agreement, is made and entered into this ____ day of _____, ____, by and between Northeast Energy Center, LLC a Delaware limited liability company (hereinafter referred to as "Company") and Boston Gas Company d/b/a National Grid, a Massachusetts company (hereinafter referred to as "Customer").

WHEREAS, Company owns and operates a natural gas liquefaction and storage facility located in Massachusetts (the "Facility");

WHEREAS, Customer desires that Company provide Customer with natural gas liquefaction, storage and delivery service at Company's Facility;

NOW THEREFORE, in consideration of the premises and mutual covenants contained herein, Company and Customer agree as follows:

ARTICLE I
SERVICE TO BE PROVIDED

Subject to the terms and provisions of this Agreement, Rate Schedule FLS and the General Terms and Conditions of Company's FERC Gas Tariff, as each may be amended from time to time, Company shall, on a firm basis, receive, liquefy, store and deliver Gas for Customer for Customer's account as follows:

Customer agrees to deliver to Company and Company agrees to accept, liquefy and store for Customer, such quantities of Gas as may be requested by Customer up to the maximum daily liquefaction quantity (MDLQ) and maximum storage quantity (MSQ) set forth on Appendix B.

Company agrees to deliver to Customer and Customer agrees to receive from Company such quantities of Gas as may be requested by Customer up to the maximum daily truck quantity (MDTQ) set forth on Appendix B.

ARTICLE II
EFFECTIVE DATE AND TERM OF AGREEMENT

This Agreement shall become effective as of the date first written above and shall remain in effect for a term of fifteen (15) years, commencing on April 1, 2019 or such later date when Company shall notify Customer that those facilities required to provide service pursuant to Rate Schedule FLS are completed and in service ("Primary Term"), and, subject to any contract extension rights granted to Customer in Appendix B attached hereto, year-to-year

thereafter until terminated by either party by giving at least twelve (12) months prior written notice.

ARTICLE III
RATE

Customer shall pay Company for service rendered hereunder in accordance with Rate Schedule FLS and as specified in Appendix A to this Agreement.

ARTICLE IV
POINTS OF RECEIPT AND DELIVERY

The Points of Receipt and Delivery for all Gas Tendered and Delivered pursuant to this Agreement shall be as set forth on Appendix B.

ARTICLE V
NOTICE

Unless otherwise provided in the General Terms and Conditions of Company's FERC Gas Tariff, notices to either party shall be in writing and shall be considered as duly delivered when mailed by registered, certified, or first class mail to the address of the parties hereto, as follows:

If to Company:

Northeast Energy Center, LLC
C/O Liberty Utilities
Attention: VP Project Development
354 Davis Road, Oakville, Ontario L6J 2X1
Telephone: 905 465 6111
Facsimile: 905-465-4514
E-mail: Chris.Thompson@libertyutilities.com
Michael.Petit@libertyutilities.com

With a copy to:

Northstar Industries
Attention: Tom Quine, President
126 Merrimack Street
Methuen, MA 01844
Telephone: 978-975-5500
Facsimile: 978-975-9975
Email: tquine@northstarind.com

If to Customer: Boston Gas Company d/b/a National Grid
Attention: Samara Jaffe
100 E. Old Country Rd.
Hicksville, NY 11801
Telephone: 516 545 5408
Facsimile: 516 545 5468
E-mail: Samara.Jaffe@nationalgrid.com

or such other address as either party shall designate by written notice to the other party.

ARTICLE VI
RATE SCHEDULES AND GENERAL TERMS AND CONDITIONS

This Agreement is subject to the terms of Rate Schedule FLS and the General Terms and Conditions of Company's FERC Gas Tariff, including any amendments to the same as may be filed and made effective by Company from time to time, which Rate Schedules and General Terms and Conditions are by this reference made a part hereof.

ARTICLE VII
AGENCY ARRANGEMENTS

Customer shall have the right to designate an agent or person to provide nomination and scheduling information, to receive invoices and make payments, and to take actions necessary to release capacity for Customer on Customer's behalf subject to the General Terms and Conditions of Company's FERC Gas Tariff.

ARTICLE VIII
INTERPRETATION

The interpretation and performance of this Agreement shall be in accordance with the laws of New York, excluding conflicts of law principles that would require the application of the laws of a different jurisdiction.

ARTICLE IX
PRIOR CONTRACTS

When this Agreement becomes effective, it shall supersede (as of the date of commencement of service hereunder) the following agreements between Company and Customer: _____N/A_____

ARTICLE X
MISCELLANEOUS

10.1 No waiver by either party of any one or more defaults by the other in the

performance of any provisions of this Agreement shall operate or be construed as a waiver of any future default or defaults, whether of a like or different character.

10.2 No presumption shall operate in favor of or against either party hereto as a result of any responsibility either party may have had for drafting this Agreement.

10.3 Capitalized terms used herein, to the extent not otherwise defined, shall have the meanings attributed to them in Company's approved FERC Gas Tariff.

10.4 This Agreement may be executed in multiple counterparts, each of which shall be deemed an original, but all of which shall constitute one and the same agreement.

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be signed by their respective agents thereunto duly authorized, the day and year first above written.

Northeast Energy Center, LLC:

By: _____

Title: _____

Customer:

By: _____

Title: _____

APPENDIX A
To
Rate Schedule FLS Service Agreement between
Northeast Energy Center, LLC (Company)
and
Boston Gas Company d/b/a National Grid (Customer)

Rates (calculated in accordance with the Statement of Rates and Rate Schedule FLS in Company's FERC Gas Tariff)

Liquefaction and Delivery Service

Liquefaction Capacity Reservation Charge [redacted]

Truck Loading Charge*

Liquefaction Usage Charge*

Other Rate-Related Terms (if applicable):

*Base Truck Loading and Liquefaction Usage charges are calculated effective January 1, 2015 and are subject to a Consumer Price Index (CPI) escalation annually thereafter each January 1 pursuant to the following escalation formula: identify the CPI index published by the U.S. Bureau of Labor Statistics for All Urban Consumers (CPI-U), Northeast Region, All Items index, for the most recent 12 month period ending for the most recent October to obtain the index point change. The new Truck Loading and Liquefaction Usage rates shall each be increased by the percentage change rate effective January 1, using a calculation to four significant decimal places. (E.g., if the percentage change is 1.2%, the previously effective rate will be multiplied by 1.012 to obtain the new rate). If the CPI index is at or below 0, the rates will not adjust.

*Authorized Overrun Charge [redacted]

Fuel Retainage: A Fuel Retainage obligation will be assessed by Supplier for all amounts actually liquefied, stored or loaded onto trucks on behalf of Customer. Customer will deliver sufficient volumes of Gas to provide process fuel (natural gas) for the Facility's use (liquefaction, tail, flash and boil-off) [redacted]

After the start of commercial operation of the Facility, at the end of each calendar quarter Supplier shall provide Customer with a report providing actual Fuel usage at the Facility, projecting estimated Fuel usage based on prior period volumes, and adjusting the Customer's Fuel Retainage obligation to correct for any actual Under- or Over-recoveries of Fuel by Supplier. Notwithstanding the foregoing, Supplier agrees to notify Customer prior to the end of the applicable quarter if the then-applicable Fuel Retainage percentage is resulting in a significant Under- or Over-recovery of Fuel; and, upon such notice, Customer agrees to use commercially reasonable efforts to promptly adjust quantities nominated for Fuel to more closely align with actual Fuel usage in that quarter.

Subject to adjustment for any increase or decrease in (i) surcharges prescribed by the FERC, (ii) any applicable approved tariff calculated lost and unaccounted for gas, (iii) any state or local taxes imposed on the operation or inventories of the Facility, and (iv) any material change in federal, state or local taxation, Customer shall not be liable for any rates or charges for firm service other than as shown above.

Company:	Customer:
By: _____	By: _____
Title: _____	Title: _____
Date: _____	Date: _____

REDACTED

APPENDIX B
To
To Rate Schedule FLS Service Agreement between
Northeast Energy Center, LLC (Company)
and
Boston Gas Company d/b/a National Grid (Customer)

Quantity:

Maximum Daily Liquefaction Quantity (MDLQ) ___12,240_____ Dth/d

Summer Season (April 1 – October 31):

Requested Maximum Storage Quantity (MSQ) ____61,200_____ Dth

Maximum Daily Truck Quantity (MDTQ) _[redacted]_ trucks per day

Winter Season (November 1 – March 31):

Requested Maximum Storage Quantity (MSQ) ____36,720_____ Dth

Maximum Daily Truck Quantity (MDTQ) _[redacted]_ trucks per day

Point(s) of Receipt and Delivery:

Primary Point of Receipt:

Facility / Tennessee Gas Pipeline Company, L.L.C. Interconnection (equal to Customer's MDLQ)

Primary Point of Delivery:

Flange outlet of Facility
Truck Loading Dock (equal to Customer's MDTQ)

Other Terms and Conditions:

Customer _X_ does/__does not have a ROFR pursuant to the GT&C of Company's FERC Gas Tariff. Service pursuant to this Appendix B shall commence as of _____.

Company:

By: _____
Title: _____
Date: _____

Customer:

By: _____
Title: _____
Date: _____

Attachment C – Selected Operational Terms and Conditions of Service

[redacted]

April 1 - October 31:
Supplier would provide liquefaction services up to Customers MDLQ. Supplier would provide a negotiated maximum of [redacted] of on-site storage for the MDLQ ([redacted]) and [redacted] truck loading slots per day.

November 1 – March 31:
Supplier would provide liquefaction services up to Customers MDLQ. Supplier would provide a negotiated maximum of [redacted] of on-site storage for the MDLQ [redacted] and [redacted] truck loading slots per day.

Fuel Retainage shall be assessed to Customer by Supplier in accordance with the provisions of Appendix A.

Supplier reserves the right to reject trucks that are not compatible with the Facility or present unacceptable risks to the site or Facility.

Supplier will undertake commercially reasonable efforts to schedule routine maintenance during the period November 1 to March 31 of each year.

[redacted]

[redacted]

[redacted] Customer acknowledges that Supplier has no control over the pressures of TGP. Unless waived by Supplier, Customer gas tendered to Company at the Tennessee Gas Pipeline Company, L.L.C. interconnect must meet the gas quality specifications in the Tennessee Gas Pipeline Company, L.L.C. FERC Gas Tariff.

To the extent the Supplier is unable to provide Customer with its full MDLQ, Supplier shall pro-rate capacity among all firm customers pursuant to its FERC Gas Tariff.

Attachment D – Anchor and Supporting Customer Qualification and Rights

1. **Anchor Customer Qualification and Rights.**

   a. **Minimum Bid.** Bidders will be deemed Anchor Customers by submitting a conforming bid during the Open Season agreeing to a minimum quantity of 5,000 MDLQ (together with such commitments to the project that are made by such Customer's affiliates) for a minimum initial service term of fifteen (15) years. For purposes of determining Customer's status as an Anchor Customer, Supplier will consider the Customer and its affiliates as a single entity and will aggregate the Customer's commitments under it and its affiliates' Precedent Agreements.

   b. **Proration of Capacity.** The Parties agree that the Precedent Agreement shall be deemed to be a binding bid in the Supplier Open Season. The Open Season shall provide that, as an Anchor Customer, Customer's Capacity Reservation volumes may not be reduced by proration if the capacity offered in the Open Season is oversubscribed, unless such proration is ordered by FERC to accommodate the bids of other Anchor Customers.

   c. **Most Favored Nation Right.** The Parties Agree that the Service Agreement will be subject to a Most Favored Nations clause p[redacted]

   d. **Authorized Overrun Rights.** [redacted]

e. **Right of First Refusal ("ROFR").** The Parties agree that the Service Agreement shall include a ROFR pursuant to Supplier's FERC Gas Tariff and that the Service Agreement shall continue to have a ROFR through the initial term and any extensions thereof.

2. **Supporting Customer Status and Rights.**

a. **Minimum Bid.** Bidders will be deemed Supporting Customers by submitting a conforming bid during the Open Season agreeing to a minimum quantity of 1000 MDLQ (together with such commitments to the project that are made by such Customer's affiliates) for a minimum initial service term of fifteen (15) years. [redacted]

b. **Proration of Capacity.** The Parties agree that the Precedent Agreement shall be deemed to be a binding bid in the Supplier Open Season. The Open Season shall provide that, as a Supporting Customer, Customer's Capacity Reservation volumes may not be reduced by proration if the capacity offered in the Open Season is oversubscribed, unless such proration is necessary to accommodate the bids of Anchor Customers or unless such proration is ordered by FERC to accommodate the bids of other Supporting Customers.

c. **Most Favored Nation Right.** The Parties Agree that the Service Agreement will be subject to a Most Favored Nations clause [redacted]

d. **Authorized Overrun Rights.** [redacted]

e. **Right of First Refusal ("ROFR").** The Parties agree that the Service Agreement shall include a ROFR pursuant to Supplier's FERC Gas Tariff and that the Service Agreement shall continue to have a ROFR through the initial term and any extensions thereof.

AMENDMENT TO

PRECEDENT AGREEMENT

This amendment ("Amendment"), dated as of July 29th, 2015, is made to that certain Precedent Agreement entered into by and between Northeast Energy Center, LLC ("Supplier") and Boston Gas Company d/b/a National Grid ("Customer"), dated May 15, 2015 (the "Agreement"). Supplier and Customer are collectively referred to herein as the "Parties."

WHEREAS, Supplier and Customer now wish to amend the Agreement as set forth herein.

NOW, THEREFORE, in consideration of the mutual covenants and agreements contained herein, Supplier and Customer agree to amend the Agreement as follows:

1. Effective as of the date hereof, the Agreement is hereby changed and amended by deleting the date "**January 1, 2016**" in Section 2(b) and replacing it with "**March 1, 2016**".

2. Effective as of the date hereof, the Agreement is hereby changed and amended by deleting the dates "**January 1, 2016**" and "**January 15, 2016**" as they appear in Section 3(b), and replacing the dates with "**March 1, 2016**" and "**March 15, 2016**", respectively.

3. Effective as of the date hereof, the Agreement is hereby changed and amended by deleting the dates "**April 1, 2019**" and "**April 15, 2019**" as they appear in Section 3(c) and replacing the dates with "**June 1, 2019**" and "**June 15, 2019**", respectively.

4. Effective as of the date hereof, the Agreement is hereby changed and amended by deleting the dates "**January 15, 2016**" and "**January 31, 2016**" as they appear in Section 5(c), and replacing the dates with "**March 15, 2016**" and "**March 31, 2016**", respectively.

5. Effective as of the date hereof, the Agreement is hereby changed and amended by deleting the date "**March 1, 2016**" as it appears in Section 5(e), and replacing the date with "**May 1, 2016**".

6. This Amendment may be executed in two or more counterparts, each of which shall be an original, and all of which together shall constitute one and the same agreement.

7. The Agreement is hereby ratified and affirmed and, except as expressly amended herein, all other items and provisions of the Agreement remain unchanged and continue to be in full force and effect.

IN WITNESS WHEREOF, the Parties have caused this Amendment to be executed by their duly authorized representatives as of the date hereinabove written.

NORTHEAST ENERGY CENTER, LLC

By: Michael Petit

Printed Name: MICHAEL PETIT

Title: DEVELOPMENT MANAGER

BOSTON GAS COMPANY d/b/a NATIONAL GRID

By: for CEC

Printed Name: John V. Vaughn

Title: Authorized Signatory

The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

D.P.U. 15-129 May 13, 2016

Petition of Boston Gas Company and Colonial Gas Company, each d/b/a National Grid, for Approval of Contracts for Liquefied Natural Gas and Liquefaction Services, pursuant to G.L. c. 164, § 94A.

APPEARANCES: John K. Habib, Esq.
Jessica Buno, Esq.
Keegan Werlin LLP
265 Franklin Street, 6th Floor
Boston, Massachusetts 02110
-and-
Patricia Crowe, Esq.
Stacey Donnelly, Esq.
National Grid
40 Sylvan Road
Waltham, Massachusetts 02451
FOR: BOSTON GAS COMPANY AND COLONIAL GAS COMPANY
Petitioner

Maura Healey, Attorney General
Commonwealth of Massachusetts
By: Elizabeth Anderson
Matthew Saunders
William Stevens
Assistant Attorney General
Office of Ratepayer Advocacy
One Ashburton Place
Boston, Massachusetts 02108
Intervenor

Rachel Graham Evans, Esq.
Michael J. Altieri, Esq.
Department of Energy Resources
100 Cambridge Street, Suite 1020
Boston, Massachusetts 02114
Intervenor

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I. INTRODUCTION AND PROCEDURAL HISTORY

On August 20, 2015, Boston Gas Company and Colonial Gas Company, each d/b/a National Grid ("National Grid" or "Company"), filed a petition with the Department of Public Utilities ("Department") seeking approval of contracts for liquefied natural gas ("LNG") and liquefaction services, pursuant to G.L. c. 164, § 94A ("Section 94A"). The contracts for the purchase of LNG are with GDF Suez Gas NA, LLC ("GDF Suez")[1] and Gaz Metro LNG, L.P. ("Gaz Metro"). The contracts for liquefaction services are with Northeast Energy Center, LLC ("Northeast Energy") and National Grid LNG ("NGLNG"). Each contract is for a period in excess of one year and, therefore, subject to the Department's jurisdiction under Section 94A.

On August 25, 2015, the Attorney General of the Commonwealth of Massachusetts ("Attorney General") filed a notice of intervention pursuant to G.L. c. 12, § 11E(a), and was recognized as a full party to this proceeding. The Department also received a petition to intervene as a full participant in the matter from the Massachusetts Department of Energy Resources ("DOER"). The Department held a public hearing and procedural conference on September 29, 2015, pursuant to a duly issued notice. At the public hearing, the Department allowed intervention for DOER. The Department subsequently established the procedural schedule for this proceeding.

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[1] Boston Gas Company and Colonial Gas Company signed separate agreements with GDF Suez. GDF Suez later became ENGIE Gas and LNG LLC.

The Department conducted evidentiary hearings on December 2, 2015, and January 14, 2016.[2] The Company sponsored the testimony of the following National Grid employees: John E. Allocca, director of gas contracting and compliance; Elizabeth D. Arangio, director of gas supply planning; and Theodore Poe Jr., manager of gas load forecasting and analysis. In addition to the exhibits and witness testimony contained in the original filing, the record contains responses to 122 information requests and nine record requests. On January 29, 2016, the Company and the Attorney General filed initial briefs. On February 8, 2016, the Company filed a reply brief.

On March 14, 2016, the Department reopened the record to issue two additional record requests regarding the length of the GDF Suez contracts and the status of the other agreements. On March 21, 2016, the Company responded to the two record requests and indicated that it had negotiated shorter contracts with GDF Suez contracts and delayed the expected start date of the Northeast Energy contract (RR-DPU-6; RR-DPU-7).[3] To cover its immediate LNG needs, the Company requested that the Department approve the Gaz Metro contract by April 1, 2016, and stated that it would seek extensions of the other four contracts. On March 25, 2016, the Department issued an interim Order approving the Gaz Metro contract, and stated that we would provide our analysis and reasons in the final Order.

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2 After the first hearing day, the Department reopened the record to admit evidence that the Attorney General had subpoenaed from GDF Suez, and to hold an additional hearing day related to that information.

3 The Company responded to an additional record request regarding resources and requirements on March 29, 2016, and provided a revised response on April 5, 2016 (RR-DPU-8).

II. STANDARD OF REVIEW

In evaluating a gas company's options for the acquisition of commodity resources as well as for the acquisition of capacity under Section 94A, the Department examines whether the acquisition of the resource is consistent with the public interest. Commonwealth Gas Company, D.P.U. 94-174-A at 27 (1996). In order to demonstrate that the proposed acquisition of a resource that provides commodity and/or incremental resources is consistent with the public interest, a local gas distribution company ("LDC") must show that the acquisition is: (1) consistent with the company's portfolio objectives; and (2) compares favorably to the range of alternative options reasonably available to the company at the time of the acquisition or contract renegotiation. D.P.U. 94-174-A at 27.

In establishing that a resource is consistent with the company's portfolio objectives, the company may refer to portfolio objectives established in a recently approved forecast and requirements plan or in a recent review of supply contracts under Section 94A, or may describe its objectives in the filing accompanying the proposed resource. D.P.U. 94-174-A at 27-28. In comparing the proposed resource acquisition to current market offerings, the Department examines relevant price and non-price attributes of each contract to ensure a contribution to the strength of the overall supply portfolio. D.P.U. 94-174-A at 28. As part of the review of relevant price and non-price attributes, the Department considers whether the pricing terms are competitive with those for the broad range of capacity, storage, and commodity options that were available to the LDC at the time of the acquisition, as well as with those opportunities that were available to other LDCs in the region. D.P.U. 94-174-A at 28. In addition, the Department determines whether the acquisition satisfies the LDC's non-price objectives including, but not

limited to, flexibility of nominations and reliability and diversity of supplies. D.P.U. 94-174-A at 28-29. In making these determinations, the Department considers whether the LDC used a competitive solicitation process that was fair, open, and transparent. The Berkshire Gas Company, D.T.E. 02-56, at 10 (2002); Bay State Gas Company, D.T.E. 02-52, at 8-9 (2002); KeySpan Energy Delivery New England, D.T.E. 02-54, at 9-10 (2002); The Berkshire Gas Company, D.T.E. 02-19, at 6, 11 (2002).

III. DESCRIPTION OF COMPANY'S PROPOSAL

National Grid provides natural gas sales and transportation service to approximately 876,000 customers in 129 municipalities in Massachusetts (Exh. NGRID-EDA/JEA-1, at 8). To serve these customers, National Grid relies on a resource portfolio comprising transportation contracts, underground storage contracts, and imported liquefied natural gas ("LNG") (Exh. NGRID-EDA/JEA-1, at 8). The Company currently relies on LNG to satisfy approximately 40 percent (536,000 dekatherms ("Dth") or 0.54 billion cubic feet ("Bcf")) of its projected peak-day requirements (Exh. NGRID-EDA/JEA-1, at 6). The Company has 6,093,983 Dth or 6.1 Bcf of total LNG storage capacity in its portfolio, and seeks to fill its storage tanks by December 1st of each year (Exh. NGRID-EDA/JEA-1, at 13).

The Company states that it entered into the proposed agreements for the following reasons. First, GDF Suez is the only party capable of satisfying the Company's full requirement for LNG, but GDF Suez's rates have increased significantly since 2008 and there have been instances where National Grid has been unable to rely on GDF Suez to meet its supply requirements (Exh. NGRID-EDA/JEA-1, at 6, 13, 20-22). Thus, the Company does not have sufficient commercial alternatives and needs to develop other alternatives and avoid singular

reliance on GDF Suez to ensure consistent supply and reasonable prices (Exh. NGRID-EDA/JEA-1, at 6, 13, 22).

Second, according to the Company, the proposed agreements will provide diversity to the Company's LNG portfolio, thereby increasing reliability because the Company will not be reliant on a single third party to provide all of the Company's LNG services (Exh. NGRID-EDA/JEA-1, at 6). The proposed agreements will also reduce the Company's dependence on imported LNG and avoid the volatile pricing associated with those supplies (Exh. NGRID-EDA/JEA-1, at 6). Third, the Company states that the proposed agreements offer optimization benefits to National Grid's customers, such as allowing the Company to more fully use its existing pipeline capacity during the off-peak season (Exh. NGRID-EDA/JEA-1, at 7). Finally, the Company states that its long-term LNG strategy is to develop commercial alternatives that will: (a) provide alternatives for the liquefaction of natural gas; (b) reduce the Company's reliance on imported LNG; (c) allow the Company to access typically less expensive gas from the Marcellus shale region during the refill season and to utilize its existing off-peak pipeline capacity to transport such gas for liquefaction; and (d) reduce the number of trucks required to transport such LNG to its storage facilities (Exh. NGRID-EDA/JEA-1, at 13-14).

To address the foregoing, the Company seeks approval of the following contracts: (a) a 15-year contract for liquefaction services with Northeast Energy; (b) a 20-year contract for liquefaction services with NGLNG, which is a National Grid affiliate; (c) two five-year contracts for LNG with GDF Suez (one with Boston Gas Company, one with Colonial Gas Company);[4]

[4] Initially, the two GDF Suez contracts were for nine-year terms, but the Company later amended them to five-year terms (RR-DPU-6).

and (d) a three-year contract for LNG with GAZ Metro (Exhs. NGRID-EDA/JEA-1, at 16-19; NGRID-EDA/JEA-2; NGRID-EDA/JEA-3; NGRID-EDA/JEA-4; NGRID-EDA/JEA-5; NGRID-EDA/JEA-6; RR-DPU-6).[5] The Northeast Energy and NGLNG agreements are contingent on the construction of liquefaction facilities by Northeast Energy and NGLNG (Exh. NGRID-EDA/JEA-1, at 18). As further described below, the proposed agreements, in the aggregate, accomplish the Company's long-term and short-term LNG strategy (Exh. NGRID-EDA/JEA-1, at 14-15).

The proposed agreement with Northeast Energy is for annual liquefaction capacity of 2.6 Bcf or up to 12,240 Dth/day for a term of 15 years commencing upon completion of necessary facilities located in Massachusetts (Exh. NGRID-EDA/JEA-1, at 18, 24). The Company currently expects this project to be in service in spring 2020 (Exh. NGRID-EDA/JEA-1, at 18; RR-DPU-6; RR-DPU-7). The Northeast Energy project will connect to the Tennessee Gas Pipeline ("Tennessee") system in Massachusetts, and the Company will use its existing Tennessee capacity to transport volumes from the producing region to the proposed liquefaction facility (Exh. NGRID-EDA/JEA-1, at 18, 25).

The proposed agreement with NGLNG is for annual liquefaction capacity of 3.5 Bcf or up to 17,984 Dth/day for a term of 20 years commencing upon completion of liquefaction facilities in Providence, Rhode Island (Exh. NGRID-EDA/JEA-1, at 18, 24). The expanded liquefaction facilities have an expected in-service date of April 1, 2019, and will access the

---

[5] As noted above, to cover its immediate LNG needs, the Company requested that the Department approve the Gaz Metro contract by April 1, 2016. Therefore, for reasons further detailed herein, on March 25, 2016, the Department issued an interim Order approving the Gaz Metro contract.

Algonquin Gas Transmission ("Algonquin") system in Rhode Island, so that the Company can use its existing Algonquin capacity to transport volumes to the proposed liquefaction facility (Exh. NGRID-EDA/JEA-1, at 18, 25; RR-DPU-7).[6] In addition, because the NGLNG facility is located at the site of the Company's largest storage location, the NGLNG agreement will eliminate the need to truck 7,000 Dth/day, the equivalent of taking approximately 1,200 truck deliveries off the roads each year and, according to the Company, vastly improving reliability (Exh. NGRID-EDA/JEA-1, at 25).

Once in service, the two liquefaction projects will provide enough capacity to liquefy approximately 6.1 Bcf per year during the typical refill season (Exh. NGRID-EDA/JEA-1, at 24). This will enable the Company to achieve the goals set forth in its long-term LNG strategy, providing sufficient liquefaction capacity to enable the Company to fill its storage tanks and eliminate reliance on imported LNG (Exh. NGRID-EDA/JEA-1, at 14, 24). In addition, the two agreements offer diversity and contain price caps, thus protecting the Company from the yearly bidding risks that it currently faces through its negotiations with GDF Suez (Exh. NGRID-EDA/JEA-1, at 14, 26).

Nevertheless, since the liquefaction facilities required by these agreements are not expected to be in service until 2019 at the earliest, the Company has also secured the firm right to purchase LNG in the short term, by executing agreements with GDF Suez and Gaz Metro

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[6] Pursuant to the proposed NGLNG agreement, NGLNG may offer liquefaction service to its other storage customers, which may reduce the Company's liquefaction quantity on a pro-rata basis (based on storage contract quantities) (Exh. NGRID-EDA/JEA-1, at 19). This provision could result in a reduction of approximately 22 percent in the liquefaction services and associated costs provided to the Company (Exh. NGRID-EDA/JEA-1, at 19).

(Exh. NGRID-EDA/JEA-1, at 14, 17). The GDF Suez agreements have a term of five years and will ensure that there is adequate LNG supply until other alternatives are developed (Exh. NGRID-EDA/JEA-1, at 15; RR-DPU-6). The GDF Suez Agreements will provide firm annual entitlements of 2.3 Bcf commencing May 15, 2016 (Exhs. NGRID-EDA/JEA-1, at 15; NGRID-EDA/JEA-2 (March 29, 2016 Rev.); NGRID-EDA/JEA-3 (March 29, 2016 Rev.); RR-DPU-6). To supplement that quantity prior to the in-service date of the liquefaction facilities, the Company also negotiated a three-year agreement with Gaz Metro (Exhs. NGRID EDA/JEA-1, at 15; NGRID-EDA/JEA-6). The Gaz Metro agreement will serve as a bridge agreement providing up to 0.44 Bcf during the 2016 refill season and 1.3 Dth during the 2017 and 2018 refill seasons (Exh. NGRID-EDA/JEA-1, at 15). Together, the GDF Suez and Gaz Metro agreements satisfy the Company's short-term LNG strategy (Exh. NGRID-EDA/JEA-1, at 15).

The Company states that there are no alternatives to these contracts because the only other resource that could fulfill the identified need is pipeline capacity, but the Company cannot rely fully and exclusively on interstate pipeline capacity to meet customer requirements (Exh. NGRID-EDA/JEA-1, at 31). Regarding price considerations, the Company states that without the proposed agreements, it would have to continue to obtain LNG from GDF Suez, subject to increased rates and GDF Suez's inability or unwillingness to consistently meet National Grid's requirements (Exh. NGRID-EDA/JEA-1, at 20-22, 32). Moreover, the agreements contain provisions regarding cost and cost caps, rights of first refusal, discounts for contract extensions, and most-favored-nation status (Exh. NGRID-EDA/JEA-1, at 27-29). Regarding non-price factors, the proposed agreements offer reliability and diversity

(Exh. NGRID-EDA/JEA-1, at 26, 34). Thus, the Company concluded that the proposed agreements are the best available options to meet its winter peaking requirements based on both economic and non-economic factors (Exh. NGRID-EDA/JEA-1, at 7, 34).

IV. POSITIONS OF THE PARTIES

A. Attorney General

The Attorney General first argues that the Company has failed to show that the durations of the Northeast Energy and NGLNG liquefaction service agreements compare favorably to the range of alternatives, and argues that the terms of these 15- and 20-year agreements should be reduced (Attorney General Brief at 6 n.16, 21).[7] According to the Attorney General, there is no evidence to support the Company's claim that these terms are necessary to take advantage of lower unit rates (Attorney General Brief at 21-22, citing Exhs. DPU 1-5; DPU 1-6; AG 1-27; AG 1-28; Tr. 1, at 22-25). Moreover, the Attorney General claims that the Company admittedly never explored a fifteen-year rate from NGLNG, which might have been a reasonable alternative to the proposed 20-year contract (Attorney General Brief at 22, citing Tr. 1, at 83-84). Thus, the Attorney General contends that the Department cannot ascertain whether shorter-term contracts are a lower-cost solution for customers that better complement the Company's LNG portfolio (Attorney General Brief at 22).

Second, the Attorney General argues that the NGLNG contract raises affiliate transaction concerns because NGLNG is a National Grid affiliate (Attorney General Brief at 6, 23, citing

[7] The Attorney General also makes arguments regarding the six-year overlap between the GDF Suez contracts and the two liquefaction agreements, but those arguments have since been mooted by the reduced GDF contract terms accompanying the amended GDF Suez contracts (Exhs. NGRID-EDA/JEA-2 (March 29, 2016 Rev.); NGRID-EDA/JEA-3 (March 29, 2016 Rev.)).

220 C.M.R. § 12.04(3)).[8] According to the Attorney General, the Company did not adequately address whether the NGLNG contract is equal to or less than what would have been provided by a nonaffiliated entity (Attorney General Brief at 6, 23, citing Investigation Into the Means to Add Natural Gas Delivery Capacity to the New England Region, D.P.U. 15-37, at 45-46 (2015)). Further, the Attorney General maintains that the Company and Narragansett Electric Company, also a National Grid entity, have contracted for 100 percent of the NGLNG liquefaction capacity, with the Company alone contracting for 87.3 percent (Attorney General Brief at 23-24, citing Exh. DPU 1-40). The Attorney General contends that National Grid was, in effect, negotiating with and against itself for a 20-year agreement, and that but for this agreement, NGLNG has no reason to construct a liquefaction facility (Attorney General Brief at 24, 26). The Attorney General notes that the NGLNG contract includes a recourse rate rather than a negotiated rate because, according to the Company, NGLNG was not willing to agree to the alternative (Attorney General Brief at 24, citing Tr. 1, at 62). The Attorney General also argues that there is a dearth of documentary evidence regarding the Company's negotiations with NGLNG or proving that the 20-year agreement provides the Company with a lower unit rate than would a shorter-term agreement (Attorney General Brief at 25). Thus the Attorney General argues that by not fully investigating whether a better deal could have been struck with a nonaffiliated entity, and by not providing sufficient information regarding the negotiations, the Company raises

[8] The Department's affiliate transaction rules provide that dealings between distribution companies and their affiliates are permissible so long as the price charged to the distribution company by the affiliated company is no greater than the market value of the assets or services provided. 220 C.M.R. § 12.04(3).

concerns that the NGLNG agreement runs afoul of the Department's affiliate transaction rules (Attorney General Brief at 26).

Third, the Attorney General argues that the Company is not using processes to ensure that the Company meets its discovery obligations to provide all relevant information (Attorney General Brief at 26). The Attorney General claims, for example, that the Company appears to have limited its search for responsive documents to two computers and two Company employees/witnesses, rather than searching Company files and its entire data system (Attorney General Brief at 26, citing Tr. 1, at 19; Tr. 2, at 207-208).

Finally, the Attorney General argues that either the Company is not properly adhering to its record retention policy or that its policy is inadequate because it appears that the Company did not maintain e-mails or documents related to the LNG contract negotiations that began in 2013 (Attorney General Brief at 26-27, citing Tr. 2, at 208, 219). The Attorney General contends that the Department's record retention regulations contemplate that these records be retained for "six years after expiration or cancellation," but that the Company failed to maintain them for even two years (Attorney General Brief at 27, citing 220 CMR § 75.05(7)(g), (63)). Thus, the Attorney General contends that the Company does not appear to be complying with the spirit of the Department's record retention policy, and that the Department should review the Company's discovery and record retention policies (Attorney General Brief at 27).

B. Company

The Company asserts that the proposed agreements are consistent with the portfolio objectives established in the Company's 2013 forecast and supply plan, Boston Gas Company/Colonial Gas Company, D.P.U. 13-01 (2014), and compare favorably to the

reasonably available range of alternatives (Company Brief at 4, 24-26; Company Reply Brief at 4). First, the Company maintains that the proposed agreements are necessary to ensure that the Company can meet the long-term and short-term needs of its customers reliably and at least cost, and without significant reliance on imported LNG (Company Brief at 2, 6-7, 23). The Company states that it generated a ten-year forecast of customer requirements based on D.P.U. 13-01, with certain adjustments, and identified a significant resource gap in its design-day and design-year requirements over the forecast period (Company Brief at 25, 27-29, citing Exhs. NGRID-TEP-1, at 11-12; NGRID-TEP-2; NGRID-TEP-3; Company Reply Brief at 4). The Company states that without the proposed agreements, it will not be able to reliably meet its winter peaking requirements (Company Brief at 30, citing Exhs. NGRID-EDA/JEA-1, at 32; DPU 1-27). The Company contends that the NGLNG and Northeast Energy liquefaction agreements will allow National Grid to meet its shortfall, access reliable and inexpensive gas supplies from the Marcellus Shale region, and avoid reliance on imported LNG (Company Brief at 10-11, 19, citing Exh. NG-EDA/JEA-1, at 13-14, 24). Because the NGLNG and Northeast Energy projects will not be in service until at least 2019 and 2020, respectively, the Company states that the GDF Suez and Gaz Metro LNG agreements are necessary to meet National Grid's short-term needs (Company Brief at 11-12, citing Exh. NG-EDA/JEA-1, at 14-15; Company Reply Brief at 14-15, citing Exhs. AG 1-6; DPU 1-7).

Further, the Company argues that consideration of the proposed agreements is not complete without acknowledgement of the risks associated with other pending resource acquisitions (Company Reply Brief at 4). In particular, the Company asserts that its plan to meet future requirements relies on the implementation of three gas infrastructure projects (Kinder

Morgan's Northeast Energy Direct ("NED") natural gas pipeline project,[9] the NGLNG liquefaction facility, and the Northeast Energy liquefaction facility), none of which are permitted or constructed (Company Reply Brief at 4-5). The Company argues that the Department's decision in this proceeding should not rest on the assumption that all three infrastructure projects will be in-service on the dates planned (Company Reply Brief at 5). Further, the Company argues that if the Department were to deny the GDF Suez agreements or delay the NGLNG project, and if the NED project does not go forward or is delayed, the Company will face a dire situation in meeting its design-day and design-season needs (Company Reply Brief at 5).[10] Even with both the NED project and the proposed agreements in place, the Company argues that it would have continued to have an unserved customer requirement in the design season (Company Reply Brief at 7). Thus, the Company maintains that the proposed agreements are vital to meet winter peaking requirements reliably (Company Reply Brief at 8).

The Company also considered price and non-price factors. The Company maintains that until the liquefaction facilities are complete, the Company will continue to obtain LNG from GDF Suez (Company Brief at 30, citing Exh. NGRID-EDA/JEA-1, at 32). The Company further states that, in recent years, GDF Suez's rates have increased significantly and GDF Suez has been unable or unwilling to meet the Company's refill requirements under certain circumstances

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9 The Department approved this contract in Boston Gas Company, D.P.U. 15-34 (2015).

10 In fact, on April 20, 2016, Kinder Morgan announced that it would be suspending further work and spending on its NED project. The Berkshire Gas Company, D.P.U. 15-178, Hearing Officer Ruling at 1 (April 26, 2016). This announcement has resulted in suspension or outright withdrawals of NED-related project filings before the Department. See D.P.U. 15-178; Bay State Gas Company, D.P.U. 16-04; Massachusetts Electric Company and Nantucket Electric Company, D.P.U. 16-07.

(Company Brief at 30, 32, citing Exh. NGRID-EDA/JEA-1, at 32, 34). Thus, the Company states that it sought the proposed agreements to ensure reliability in serving all customer requirements, and to eliminate reliance on expensive, unreliable imported LNG (Company Brief at 32, citing Exh. NGRID-EDA/JEA-1, at 34). Further, the Company states that the addition of supply from Northeast Energy, NGLNG, and Gaz Metro to its current storage contracts will increase the LNG resources available to the Company (Company Brief at 32, citing Exh. NGRID-EDA/JEA-1, at 34). Overall, the Company contends that the proposed agreements allow the Company to use its portfolio as efficiently as possible, and represent the most viable alternative reasonably available to the Company to meet its winter peaking needs reliably and at least cost (Company Brief at 32, citing Exh. NGRID-EDA/JEA-1, at 34).

As for the Attorney General's affiliate transaction concerns, the Company asserts that the rates associated with the NGLNG agreement will be set forth in a tariff and approved by the Federal Energy Regulatory Commission ("FERC"), subject to a rate cap, thus ensuring that the prices charged will not be greater than the market value of the asset or service provided (Company Reply Brief at 21, citing 220 C.M.R. § 12.04(3); Exh. DPU 2-13, Att. D). Further, the Company disagrees with the Attorney General's argument that but for the proposed NGLNG agreement, NGLNG would have no reason to construct a liquefaction facility (Company Reply Brief at 21). According to the Company, the Attorney General ignores that NGLNG is a FERC-regulated entity, and that it is common practice for facility construction to be contingent on approved contracts for a certain amount of the facility's total capacity (Company Reply Brief at 21).

Finally, National Grid disputes the Attorney General's discovery and record retention concerns (Company Reply Brief at 22-23). The Company asserts that it can only answer information requests as they are posed, and the better a question is worded, the better the chance that the Company's answer will be directly responsive to the question as intended (Company Reply Brief at 23). According to the Company, the scope of the Attorney General's question was very limited and did not seek the broad range of documentation that the Attorney General now suggests (Company Reply Brief at 23). In addition, the Company argues that it researched the files of the employees with responsibility for the contract negotiations, but has no obligation to mount a search of its "entire data system" every time a discovery question is posed (Company Reply Brief at 23). Moreover, the Company contends that it cannot require employees to save every email and every piece of documentation that might ever be asked for, as this would be impractical and costly (Company Reply Brief at 23).

V. ANALYSIS AND FINDINGS

A. Introduction

The Department must evaluate whether the proposed acquisition is consistent with the public interest. Section 94A; D.P.U. 94-174-A at 27. To make this determination, the Department considers whether the acquisition is consistent with the Company's portfolio objectives and compares favorably to the range of alternative options reasonably available to the Company at the time of the acquisition or contract negotiations. D.P.U. 94-174-A at 27. We will apply this standard first to the long-term agreements, and then address the short-term, bridge agreements.

B. Long-Term Agreements

1. Consistency with Portfolio Objectives

In establishing that a resource is consistent with a company's portfolio objectives, a company may refer to portfolio objectives established in a recently approved forecast and requirements plan or in a recent review of supply contracts under Section 94A, or may describe its objectives in the filing accompanying the proposed resource. D.P.U. 94-174-A at 27-28. In the instant proceeding, the Company states that the proposed agreements are consistent with the portfolio objectives established in the Company's most recently approved forecast and supply plan, D.P.U. 13-01 (Exh. NGRID-TEP-1, at 6, 9-12). In that proceeding, the Department found National Grid's forecasting method to be appropriate and reliable, and found that its forecast met the G.L. c. 164, § 69*I* requirements. D.P.U. 13-01, at 16. Further, the Department found that the Company had formulated an appropriate process for identifying a comprehensive array of supply options, developed appropriate criteria for screening and comparing supply-side and demand-side resources, and a mechanism to undertake the comparison of resources on an equal basis. D.P.U. 13-01, at 26, 34-35.

For this filing, the Company updated its forecast and supply plan approved in D.P.U. 13-01 to cover a ten-year planning period, rather than the usual five-year planning horizon, and included in its planning load the expected load of capacity-exempt customers returning to default service during that time (Exh. NGRID-TEP-1, at 9-11). Based on this analysis, the Company identified a significant resource gap in its design-day and design-year requirements (Exhs. NGRID-TEP-1, at 11-14; NGRID-TEP-2; NGRID-TEP-3). To meet this gap, the Company entered into the proposed LNG contracts (Exh. NGRID-TEP-1, at 14-15).

For the following reasons, we find that the Northeast Energy and NGLNG agreements are consistent with the Company's portfolio objectives. The Company currently has 6.1 Bcf of total LNG storage capacity in its portfolio (Exh. NGRID-EDA/JEA-1, at 13). The Northeast Energy agreement is for annual liquefaction capacity of 2.6 Bcf or 12,240 Dth/day for 15 years (Exh. NGRID-EDA/JEA-1, at 24). The NGLNG agreement is for annual liquefaction capacity of 3.5 Bcf or 17,984 Dth/day for 20 years (Exh. NGRID-EDA/JEA-1, at 24). Thus, the two liquefaction agreements will provide National Grid with a total of 6.1 Bcf beginning in April 2020 and continuing over the following 15 years (the length of the Northeast Energy contract). We find that this capacity should be sufficient to enable the Company to fill its storage tanks during the refill season and avoid reliance on imported LNG (Exh. NGRID-EDA/JEA-1, at 14). Moreover, since the NED project has recently been suspended, the Company can no longer count on receiving the 151,962 Dth/day of interstate pipeline capacity from its 20-year firm transportation contract, which was to begin November 1, 2018. Boston Gas Company, D.P.U. 15-34, at 4-5 (2015) (currently on appeal before the Supreme Judicial Court).

Based on the foregoing, we find that the Company properly updated its previously reviewed and approved D.P.U. 13-01 forecast and supply plan to determine its supply requirements. We further find that the proposed liquefaction contracts are consistent overall with the Company's portfolio objectives.[11]

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[11] In finding that the NGLNG and Northeast Energy contracts are consistent with the Company's portfolio objectives, we need not address the Attorney General's suggestion that the lengths of these contracts should be reduced (Attorney General Brief at 21-22).

2. Comparison to Alternatives

The Section 94A public interest standard also requires the Company to demonstrate that the proposed agreements compare favorably to the range of alternative options reasonably available to the Company at the time of the acquisition. D.P.U. 94-174-A at 27. In evaluating this aspect of the proposed acquisition, the Department considers whether the Company used a competitive solicitation process that was fair, open, and transparent. D.T.E. 02-56, at 10; D.T.E. 02-52, at 8-9; D.T.E. 02-54, at 9-10; D.T.E. 02-19, at 6, 11.

In this case, the Company did not conduct a competitive solicitation process. Nonetheless, the Department does not consider the lack of a competitive solicitation process in this matter fatal to the Company's petition, as a competitive solicitation would not have produced a viable, cost-effective alternative to the proposed contracts. D.P.U. 15-34, at 35-36. The Company's only two principal means of acquiring gas supply to serve customers are transportation to the Company's system by interstate pipeline, and production of vaporized LNG (Exh. NGRID-EDA/JEA-1, at 5). As indicated elsewhere in this Order, with the suspension of the NED project, the availability of supply to transport via interstate pipeline remains in question. GDF Suez has been the only party capable of satisfying all of the Company's LNG requirements, but its rates have increased significantly since 2008, the Company has had to negotiate expensive annual contracts with GDF Suez, and there have been and could be disruptions associated with the importation and shipment of foreign LNG (Exh. NGRID-EDA/JEA-1, at 6, 13, 21). See D.P.U. 15-34, at 36. We find that the Company appropriately considered reliability, safety, availability of resources, and cost associated with LNG as an alternative, and properly concluded that incremental LNG was not a reasonable

alternative to meet the Company's long-term design needs (Exh. NGRID-EDA/JEA-1, at 13, 22). See D.P.U. 15-34, at 36-37.

We further find that the Company properly chose the NGLNG and Northeast Energy contracts to provide alternatives for liquefaction, reduce the Company's reliance on imported LNG and the trucking thereof, and allow the Company to access less expensive gas (Exh. NGRID-EDA/JEA-1, at 13-14). D.P.U. 15-34, at 36. The Company selected the Providence, Rhode Island NGLNG project based on a study performed by CH-IV International, on behalf of National Grid, comparing the costs and benefits of adding liquefaction installations to its Dorchester, Massachusetts and Providence, Rhode Island facilities (Exhs. NGRID-EDA/JEA-1, at 23; DPU 2-13, Atts.). The Company preferred the Providence, Rhode Island NGLNG project based on storage tank volume, reduced LNG trucking, highway access and other transportation benefits, industrial zoning, room for construction, access to interstate transmission pipeline, and access to gas distribution facilities (Exh. NGRID-EDA/JEA-1, at 23). The Company also determined that the total costs for both facilities were similar, and that the NGLNG contract's recourse rate will be established and approved by FERC based on the cost of constructing the facility (Exh. DPU 2-13; Tr. 1, at 55).

In addition, the Company and other New England gas distribution companies met with various parties to discuss the development of new third-party liquefaction services, and the Company eventually selected the Northeast Energy project based on price, location, and volume availability (Exh. NGRID-EDA/JEA-1, at 23-24, 26). Despite its shorter term, the price that the Company secured for the Northeast Energy contract is lower than that of the NGLNG contract (Tr. 1, at 150-151). Both the NGLNG and Northeast Energy agreements include cost caps, rights

of first refusal, and most-favored-nation provisions (Exhs. NGRID-EDA/JEA-1, at 27-29; NGRID-EDA/JEA-4; NGRID-EDA/JEA-5). These provisions will protect ratepayers from possible cost overruns and ensure reliability of service.

In terms of non-price factors, we find that the proposed Northeast Energy and NGLNG contracts will contribute to a flexible, reliable, and diversified portfolio (Exh. NGRID-EDA/JEA-1, at 34). We agree with the Company that contracting for two liquefaction projects rather than one will increase diversity, mitigate risk, and ensure adequate supply (Exh. NGRID-EDA/JEA-1, at 26). Moreover, the proposed Northeast Energy and NGLNG contracts will increase the LNG resources available to the Company, allow National Grid to use its portfolio efficiently, and optimize use of its pipeline capacity (Exh. NGRID-EDA/JEA-1, at 34). We find that the NGLNG contract will enhance reliability because: (1) the facility accesses the Algonquin gas system in Rhode Island and is located at the site of the Company's largest storage location, thus eliminating the need to truck 7,000 Dth/day (equivalent to taking about 1,200 truck deliveries off the road each year) (Exh. NGRID-EDA/JEA-1, at 25); and (2) National Grid will exercise control over its own liquefaction facility (Exh. NGRID-EDA/JEA-1, at 26).

The Attorney General contends that the NGLNG agreement runs afoul of the Department's affiliate transaction regulations (Attorney General Brief at 23-26). We disagree.[12]

[12] We also note that the Attorney General incorrectly relies on D.P.U. 15-37 to support its argument that the Company did not adequately address whether the NGLNG contract is equal to or less than what a nonaffiliated entity would have provided. The standard set forth in D.P.U. 15-37 should not be read as altering our established affiliate transaction rules, and should apply only to a filing made by an electric distribution company seeking

The Department's affiliate transaction regulation, 220 C.M.R. § 12.04(3), states that an affiliated company may provide services to a distribution company if the price charged is no greater than the market value of the asset or service provided. Since NGLNG is a FERC-regulated entity, the rate charged will be subject to FERC approval. Further, the NGLNG agreement contains a most-favored-nation clause, ensuring that if NGLNG offers liquefaction services to any customer at a lower rate, it must offer those same terms to the Company (Exhs. NGRID-EDA/JEA-1, at 29; NGRID-EDA/JEA-5, at 12, 14). Therefore, we find that there is no danger that the prices charged to the Company will be greater than the market value of the service provided (Tr. 1, at 55). Moreover, the NGLNG contract contains a recourse rate with cost caps, thus protecting the Company's ratepayers from price volatility (Exhs. NGRID-EDA/JEA-1, at 27-28; NGRID-EDA/JEA-5).

Therefore, based on both price and non-price factors, the Company has established that the NGLNG and Northeast Energy contracts represent the most viable, reasonably available alternatives for the Company to meet its customer requirements in a least-cost, reliable manner. Based on the foregoing, we find that the Company has shown that the proposed acquisitions compare favorably to the range of reasonably available alternative options.

C. Short-Term Agreements

Regarding the GDF Suez and Gaz Metro agreements, we find that these contracts are consistent with the Company's portfolio objectives because they are necessary to ensure reliable, least-cost supply for customers until the long-term liquefaction contracts go into effect

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Department review and approval of a gas contract. We do not find those circumstances in this proceeding.

(Exhs. NGRID-EDA/JEA-1, at 14-15, 17). The NGLNG and Northeast Energy agreements are not expected to be available until at least 2019 and 2020, respectively (Exh. NGRID-EDA/JEA-1, at 14; RR-DPU-6, at 2). Without the proposed GDF Suez agreements, National Grid will be forced to enter into annual agreements to meet its LNG requirements in the short term, with no assurance of service and possibly at higher market rates (Exh. NGRID-EDA/JEA-1, at 15, 17-18, 20-22, 32). The GDF Suez agreements will provide the Company with firm annual entitlements of 2.3 Bcf (Exh. NGRID-EDA/JEA-1, at 15). The Gaz Metro contract -- providing 0.44 Bcf in the first year and 1.3 Bcf in each of the following two years -- will serve as a bridge contract to supplement the GDF Suez contracts (Exh. NGRID-EDA/JEA-1, at 15). Together, the two short-term agreements will provide the Company with sufficient LNG to meet its needs, thereby ensuring its ability to serve customer requirements (Exh. NGRID-EDA/JEA-1, at 15, 34). The Company simply has no alternative source of LNG for the volume required to fill all of its storage tanks, and as noted above, the use of annual GDF Suez contracts would cost more with some measure of uncertainty and unreliability (Exh. NGRID-EDA/JEA-1 at 15, 22, 32).

We note that there may be an overlap of over one year between the expected in-service date of the NGLNG contract (April 1, 2019) and the end of the GDF Suez contracts (November 30, 2020) (RR-DPU-6, at 4). We do not consider this overlap unreasonable under the circumstances. Moreover, we have recognized that there may often be an overlap in resources as a company transitions from one resource to another. See D.P.U. 15-34, at 33; Bay State Gas Company, D.P.U. 13-158, at 6 n.6 (2014).

Accordingly, we find that the GDF Suez and Gaz Metro contracts are consistent with the Company's portfolio objectives for its short-term LNG strategy and will provide National Grid with the resources it requires to meet its customer needs. In addition, we find that these contracts represent the most viable, reasonably available alternatives for the Company to meet its short-term needs in a least-cost, reliable manner. Based on the foregoing, we find that the Company has shown that the proposed GDF Suez and Gaz Metro contracts are consistent with the public interest.

D. Remaining Issues

The Attorney General argues that the Company did not use an appropriate process to meet its discovery obligations and is not properly adhering to its record retention policy (Attorney General Brief at 26-27). We disagree. The Attorney General asked a much broader question in its subsequent subpoena to GDF Suez than it did in its initial discovery question to the Company (Company Reply Brief at 23; compare Exh. AG 1-16 with Exh. AG-1). D.P.U. 15-129, Hearing Officer Ruling on Attorney General's Motion to Reopen Record at 5 n.3 (December 30, 2015). Only after comparing the two responses did the Attorney General raise concerns about the Company's process in responding to the discovery. Moreover, there is no evidence that anyone other than the two witnesses would have had any responsive documents. Thus, in the circumstances in this case, a full system search would be impractical and unnecessary. Nevertheless, we note that the Company did not retain any relevant emails from 2013 (Tr. 2, at 208). Pursuant to 220 C.M.R. § 75.05(7), the Company is required to retain contracts and memoranda essential to clarifying or explaining contract provisions for at least six years after the expiration or cancellation of the contract. Therefore, we direct the Company

to retain its records, where necessary, in compliance with the applicable provisions of 220 C.M.R. § 75.00.

We further note that the Company plans to hire a third-party consultant to monitor the costs of the NGLNG facility and ensure that all the costs incurred are proper (Tr. 1, at 140). We direct the Company to notify the Department when the third-party consultant is retained and provide the Department with copies of the consultant's reports to the Company.

VI. CONCLUSION

The Department has reviewed the Company's petition and the evidence presented to determine whether acquisition of the proposed contracts with GDF Suez, Gaz Metro, Northeast Energy, and NGLNG (1) are consistent with the Company's portfolio objectives, and (2) compare favorably to the range of available alternative options. The Department finds that the Company has identified a need for this capacity to ensure reliability and deliverability of natural gas to meet customer requirements. We further find that the proposed acquisition of these resources will enhance the reliability, flexibility, and diversity of the Company's supply portfolio. Accordingly, based on our review, the Department finds that the Company's proposed acquisitions are consistent with the Company's portfolio objectives, compare favorably to the range of reasonable alternatives, and are therefore consistent with the public interest. For all of the foregoing reasons, the Department approves the proposed contracts.

VII. ORDER

Accordingly after due notice, hearing, and consideration, it is hereby

ORDERED: That Colonial Gas Company's five-year contract for LNG with GDF Suez Gas NA, LLC is APPROVED; and it is

FURTHER ORDERED: That Boston Gas Company's five-year contract for LNG with GDF Suez Gas NA, LLC is APPROVED; and it is

FURTHER ORDERED: That Boston Gas Company's three-year contract for LNG with GAZ Metro LNG, L.P. is APPROVED; and it is

FURTHER ORDERED: That Boston Gas Company's 15-year contract for liquefaction services with Northeast Energy, LLC is APPROVED; and it is

FURTHER ORDERED: That Boston Gas Company's 20-year contract for liquefaction services with National Grid LNG is APPROVED; and it is

FURTHER ORDERED: That Boston Gas Company and Colonial Gas Company shall comply with all directives contained in this Order.

By Order of the Department,

/s/

Angela M. O'Connor, Chairman

/s/

Jolette A. Westbrook, Commissioner

/s/

Robert E. Hayden, Commissioner

An appeal as to matters of law from any final decision, order or ruling of the Commission may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the Order of the Commission be modified or set aside in whole or in part. Such petition for appeal shall be filed with the Secretary of the Commission within twenty days after the date of service of the decision, order or ruling of the Commission, or within such further time as the Commission may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the Clerk of said Court. G.L. c. 25, § 5.

Appendix I

Siting Board Compliance

APPENDIX I COMPLIANCE WITH SITING REQUIREMENTS WITHIN EFSB REGULATIONS

I-1.0 SUMMARY OF COMPLIANCE WITH SITING REQUIREMENTS WITHIN EFSB REGULATIONS AND OVERVIEW OF ALL MAPPING REQUIREMENTS

The Siting Board's regulations, 980 CMR 10.00, contain several requirements to be met by applicants seeking to construct and operate an LNG facility. Some of these requirements are "presentational" while others relate to substantive design requirements or elements. For example, a range of mapping analyses are required to be presented in the application to the Siting Board, which seems intended to facilitate the Siting Board's analysis of site alternatives. Other Siting Board regulations reflect specifically-calculated exclusion or control zones or that equipment at a facility be appropriately separated or spaced. The final element in the Applicant's site selection process was the confirmation that the Route 169 Site will meet or exceed all substantive requirements in the Siting Board regulations and, later, to be sure that all presentational requirements were satisfied. The Analysis in support of the amended and restated petitions addresses all presentational requirements (e.g., presentation of particular maps or matrix analyses.) The table below demonstrates how these various requirements were satisfied and provides convenient cross-references to where within the Applicant's Analysis responsive information can be found.

Requirement per 980 CMR 10.00	How Satisfied
10.02(1)	"Facility Need Requirement" which requires the analysis of need alternatives and at least one site in a non-urban area – please refer to Section 3.0 and Section 4.0 of the Amended Analysis
10.02(2)	"Mapping Requirements" a range of maps of uses are required to facilities review – please refer to Appendix I, Section I-1.1, EFSB Mapping Requirements (below)
10.02(3)/10.03	"Demonstration of Conformity with Siting Standards" and "Performance Standards for Determining Site Sizes" – please refer to Appendix I, Sections I-2.0, I-3.0 and I-4.0 for detailed presentations supporting the derivation and supporting calculations for the Thermal Radiation Protection Zone and Vapor Dispersion Exclusion Zone
10.02(4)	"Alternative Site Evaluation Matrices" – please refer to Section 4.0, Figures 4.6-2, 4.6-3 and 4.6-4 of the Amended Analysis
10.04(1)	"Dike Requirements" – please refer to Appendix A, Section A-6.2.
10.04(2)	"Separation of Components" – please refer to Appendix A, Section A-6.1
10.04(3)	"Inspection of Insulating Material" – please refer to Appendix C-1.0
10.04(4)	"Plan for Removal of Precipitation" – please refer to Appendix C-1.0
10.04(5)	"Safety Plan" – please refer to Appendix C-2.0
10.04(6)	"Alarm System" – please refer to Appendix A, Section A-5.7

I-1.1 EFSB Mapping Requirements

Relevant Siting Board regulations require developers to provide maps of a range of background data or uses on site areas within any application to the Siting Board for approval of an LNG facility. The "mapping" or presentational requirements from the Siting Board's regulations, 980 CMR 10.02 (2), are listed below, along with a description or reference to how each requirement is satisfied and where the required information is presented. The Siting Board's requirements with respect to mapping require, among other items, the calculation and presentation of specified 2,000, 1,000 and 460 Btu/hr-ft^2 zones. The apparent intent of these requirements is to help to identify and consider special or sensitive "off-site" receptors that could theoretically be affected by the construction or operation of an LNG facility. These receptors include such areas as natural preserves, historic or scenic districts, hospitals, schools, nursing homes, churches, places of outdoor assembly, population densities, and surface water and groundwater resources, which are all typically germane to the Siting Board's analysis. For the Route 169 Site and alternative Route 20 Site and Sherwood Lane Site, no relevant "off-site" receptors are located within the specified thermal radiation zones. See Figures I-1.1 through I-1.6. For the Route 169 Site, a small commercial business is within the 2,000 and 1,000 Btu/hr-ft^2 thermal radiation zones. The Applicant is in negotiations for the purchase of this property.

Requirement per 310 CMR 10.02 (2)	How Satisfied
(a) The applicant shall provide a map or series of maps of the preferred site and all alternative sites proposed which show the following at a useful scale:	See below
1. location of property	Figures: 1.1-1, 1.1-2, 1.1-3
2. property boundaries and dimensions	Figures 2.1-3, 2.1-4, 2.1-5
3. major existing structures and equipment on the property	Figure 2.1-3
4. location of the following zones:	
- 2,000 BTU/ft2 hr zone;	Figures I-3.1, I-3.2, I-3.3
- 1,000 BTU/ft2 hr zone;	Figures I-3.1, I-3.2, I-3.3
- 460 BTU/ft2 hr zone; and the	Figures I-3.1, I-3.2, I-3.3
- vapor dispersion zone.	Figure I-4.1, I-4.2, I-4.3
5. anticipated location and dimensions of the storage tank, new ancillary facilities, and dike	Figure 2.1-1
6. topography of the site out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.	Figure I-3.1
7. current zoning scheme out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.	Figures I-1.1, I-1.2, I.1.3
8. special land uses including agricultural land, parks, forests, recreational areas, and areas designated by a governmental agency for protection as natural preserves or historic or scenic districts out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.	Figures I-1.1, I-1.2, I.1.3
9. location of all hospitals, schools, nursing homes and churches, and places of outdoor assembly out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.	Figures I-1.1, I-1.2, I.1.3

Requirement per 310 CMR 10.02 (2)	How Satisfied
10. surface water and groundwater resources out to and including the most distant zone specified in 980 CMR 10.03(2)(a)4.	Figures I-1.4, I-1.5, I-1.6
11. population densities out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4.	Figures I-1.1, I-1.2, I.1.3
12. alternative truck routes from exit of nearest highway to site, showing local street names, bridges and elevated roadways, underpasses and tunnels, unpaved roads, and all locations on these routes requiring the exercise of additional caution. Information provided here should also include a general demographic description of the area through which these routes will pass.	Figures 5.3-3, 5.3-4, 5.3-5. Demographics in Section 5.3.5.
13. nearby gas pipelines and point of interconnection for new facility	Figure 2.1-6, 2.1-7, 2.1-8
14. sewers, subway tunnels, drainage systems, underground electrical systems, and all other underground conduits out to and including the most distant zone specified in 980 CMR 10.02(2)(a)4 as well as for all truck routes specified in 980 CMR 10.02(2)(a)4.	Figure I-1.7
(b) The applicant shall provide a system map, showing location of preferred and alternative sites.	Figure 4.5-1

Other applicable federal regulations require a developer to present or map information on areas surrounding a proposed LNG facility. The mapping zones described in these regulations are generally complementary to those contained within the Siting Board's regulations and are summarized here for convenience.

The Applicant has also fully addressed the federal siting and mapping requirements with respect to the Facility. The federal code for LNG facilities pursuant to 49 CFR Part 193 and, in accordance with section 2.2.3.2 of NFPA 59A-2001, requires that provisions need to be made to prevent thermal radiation from a fire from exceeding the following limits:

- 1,600 Btu/hr-ft^2 at a property line that can be built upon assuming the ignition of a design spill (as specified by section 2.2.2.1 of NFPA 59A-2001).

- 1,600 Btu/hr-ft^2 at the nearest point located outside the owner's property line that, at the time of facility siting, is used for outdoor assembly by groups of 50 or more persons assuming a fire over an LNG tank impounding area.

- 3,000 Btu/hr-ft^2 at the nearest point of the building or structure outside the owner's property line that is in existence at the time of facility siting and used for occupancies classified by *NFPA 101 Life Safety Code®* as assembly, educational, health care, detention and correction or residential assuming a fire over an LNG tank impounding area.

- 10,000 Btu/hr-ft^2 at a property line that can be built upon assuming a fire over an LNG tank impounding area.

In addressing the requirements of these regulations, the relevant exclusion zones were calculated for the Facility's two impoundment mapping types: (i) the structure or outer containment serving the LNG tank; and (ii) the single sump serving the truck-loading station. Since the LNG storage tank being proposed is a full-containment design, the latter calculation was based upon the outer tank wall being the impoundment dike or structure for the tank. Guidance was not provided in 980 CMR 10.02(2)(a) in terms of the manner how the thermal radiation should be calculated, so the Applicant applied the federal requirements in 49 CFR Part 193. As such, the derivation of the exclusion zones was performed using the computer model LNGFIRE3. In calculating these zones, conservative assumptions with respect to wind speed, temperature, and relative humidity that occur less than five percent of the time based on recorded data for the area (many of which would not be likely to occur simultaneously) and that produce the maximum thermal radiation zone distances were applied as required by 49 CFR Part 193. See Figures I-3.1, I-3.2, and I-3.3 for a map of the thermal radiation zones.

All thermal radiation zones were plotted on the site plans for each site alternative and are summarized in the table below. The model outputs for each impoundment as provided in Section 1.3.2.

Thermal Radiation Zone Btu/ft^2-hr	Distance from the Center of the Impoundment Dike (ft)	
	2,000,000-gallon Tank	Truck Station Sump
10,000	37.6[2]	N/A
3,000	264	N/A
2,000[1]	314	N/A
1,600	343	104[3]
1,000[1]	412	N/A
460[1]	555	N/A

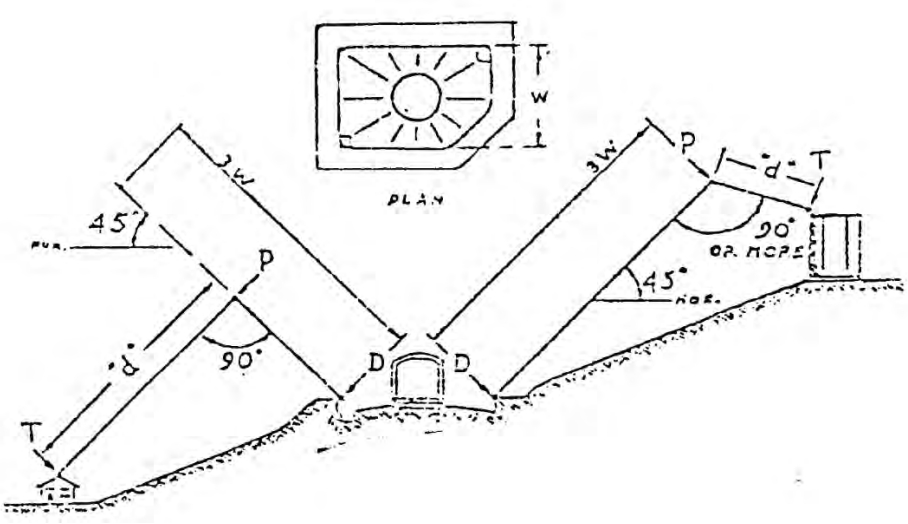
Notes:
1. Mapping requirements only as required by 980 CMR 10.02(2)(a)4.
2. Model was unable to compute a distance to this thermal radiation zone. The distance of 37.6 feet represents a thermal radiation zone of about 7,024 Btu/ft^2-hr.
3. Represents the minimum distance from a property line that can be built upon for ignition of a design spill in accordance with NFPA 59A-2001.

As with the thermal radiation zones required to be mapped in accordance with 980 CMR 10.02(2)(a), the Route 169 Site and alternative Route 20 Site and Sherwood Lane Site were all found to also satisfy or address the limits for each zone as required by 49 CFR Part 193 and NFPA 59A.

I-2.0 THERMAL RADIATION PROTECTION ZONE

Section 10.03 of the regulations of the Siting Board include specific "Performance Standards for Determining Site Sizes." These regulations define areas for a thermal radiation protection zone. As shown below, the Route 169 Site and alternative Route 20 and Sherwood Lane Sites with the application of traditional, established design approaches, can fully satisfy the requirements for the thermal protective zone. These exclusion zones have been mapped on Figures I-3.1, I-3.2, and I-3.3. The Siting Board requires that any new LNG facility maintain

sufficient area to incorporate a thermal protective zone as derived by a specific, conservative formula. This zone is defined geometrically based upon a minimum "straight line" distance required from the conical area potentially encompassed by flame during a theoretical and highly unusual fire over the impoundment under theoretical or design conditions that result in a 45-degree flame tilt. The geometrical description of the calculation from 980 CMR 10.03(1) is reproduced below from the Siting Board's regulations:



Within the protection zone "d", the Siting Board regulations define specific exclusion zones depending upon whether the relevant area is zoned for industrial or another type of use. All three noticed alternative sites are within areas zoned for industrial use. For the Route 169 Site, two off-site receptors were identified as being closest to the outer wall of the proposed location of the LNG tank. These receptors are located to the south of the site (one a commercial business and the other a residence), all along Route 169 within an area zoned for industrial use. The closest receptor to the Route 20 Site is a residence to the south off of Hill Road within an area zoned for residential use. For the Sherwood Lane Site, the closest receptor is a commercial business to the east along Route 169 within an area zoned for industrial use. See Receptors 1, 2, 3, and 4.

The protection zone distance calculations were performed based on the outer wall of the full-containment LNG tank being the impoundment dike. This outer wall has an inside diameter of 74.5 feet and an area, A, of 4,359 square feet. The inside distance across the top of the impoundment, w, is 74.5 feet (inside diameter). 980 CMR 10.03 of the Siting Board's regulations requires a thermal protection zone straight line distance, d, from a potential off-site receptor, "T", at the top of the receptor to the theoretical 45-degree cone described by the formula PD = 3w = 223.5 feet of at least:

$$d = (2.0)*(A)^{0.5} = 132.5 \text{ feet (industrial zoned receptors)}$$

$$d = (3.6)*(A)^{0.5} = 238.25 \text{ feet (non-industrial zoned receptors)}$$

The actual straight-line distance, d, for the closest off-site receptors for each site are shown in the figures in Section 1.3.1. For all three noticed alternative sites, no receptors are located within the thermal radiation protection zone established by the Siting Board's regulations.

I-3.0 VAPOR DISPERSION EXCLUSION ZONE

In addition to thermal protection zones, Section 10.03 of the regulations of the Siting Board include specific "Performance Standards for Determining Site Sizes" for determining vapor dispersion exclusion zones. As shown below, the Route 169 Site and alternative Route 20 and Sherwood Lane Sites with the application of traditional, established design approaches, can fully satisfy the requirements for the vapor dispersion exclusion zone. The Applicant must also demonstrate that a sufficient area has been provided for vapor dispersion protection in accordance with 980 CMR 10.03(2) in order to prevent vapor from a design spill from crossing the property line. The calculation prescribed for this calculation is from applicable sections of Appendices A, B, and C of the publication "Evaluation of LNG Vapor Control Methods" (American Gas Association, Arlington, VA, 1974) using the following parameters:

- Average gas concentration in air of 2% by volume
- Wind speed of 5 mph
- Source height of zero
- Source width of $A^{0.5}$, where A is the inside area of the impounding space
- The Gifford-Pasquill stability category of F (moderately stable)
- Initial temperature of the impounding area of 47°C (116.6°F)

Since a full-containment LNG storage tank with no penetrations below the maximum liquid level is being proposed, the vapor dispersion calculation was based upon the vapor generation rate equal to the maximum constant rate of discharge from failed transfer piping having the greatest overall flow capacity in accordance with 980 CMR 10.03(2)(b)1.a. The LNG transfer piping from the LNG tank to the truck loading station represents the transfer piping having the greatest overall flow capacity (assuming all 3 pumps operating = 1200 gpm total). This design spill was assumed to be collected by a system of trenches and ultimately impounded in the truck station sump.

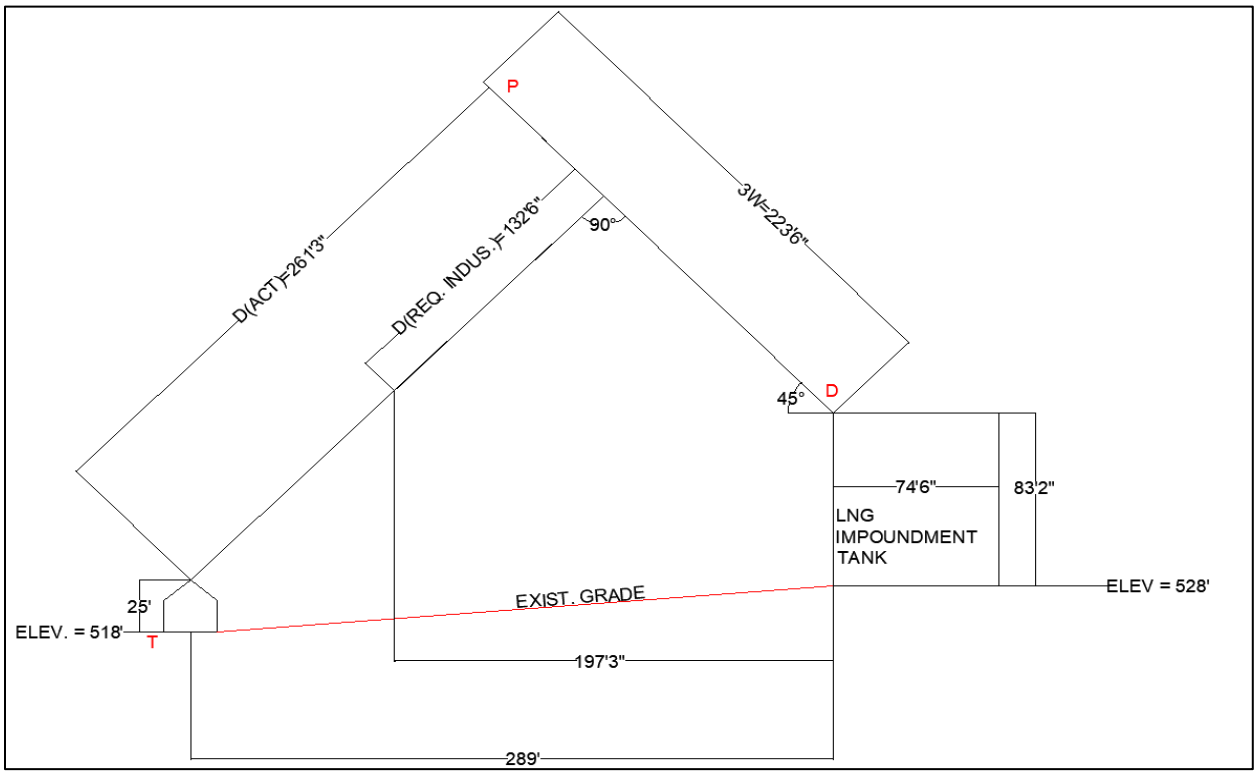
Using the sump geometry of 15' wide x 15' long x 9' deep and assuming a concrete sump for the truck station, the models described by the above document predict cold vapor overflow of the truck station sump at approximately 23 seconds after the initial spill, and a vapor evaporation rate at that moment of 19,415 lbm/hr. Conservatively assuming this evaporation rate remains constant with no site vapor fencing present, and no high expansion foam, the downwind vapor concentrations of at least 2% are predicted to occur up to 575 feet from the inside edge of the sump. For the Route 169 and Sherwood Lane Sites, this would

exceed the requirement of preventing vapor from a design spill from crossing the Facility's property line. At the Route 20 Site, this vapor dispersion exclusion distance would remain within the site's property line but would fall outside of the Facility's controlled perimeter fence.

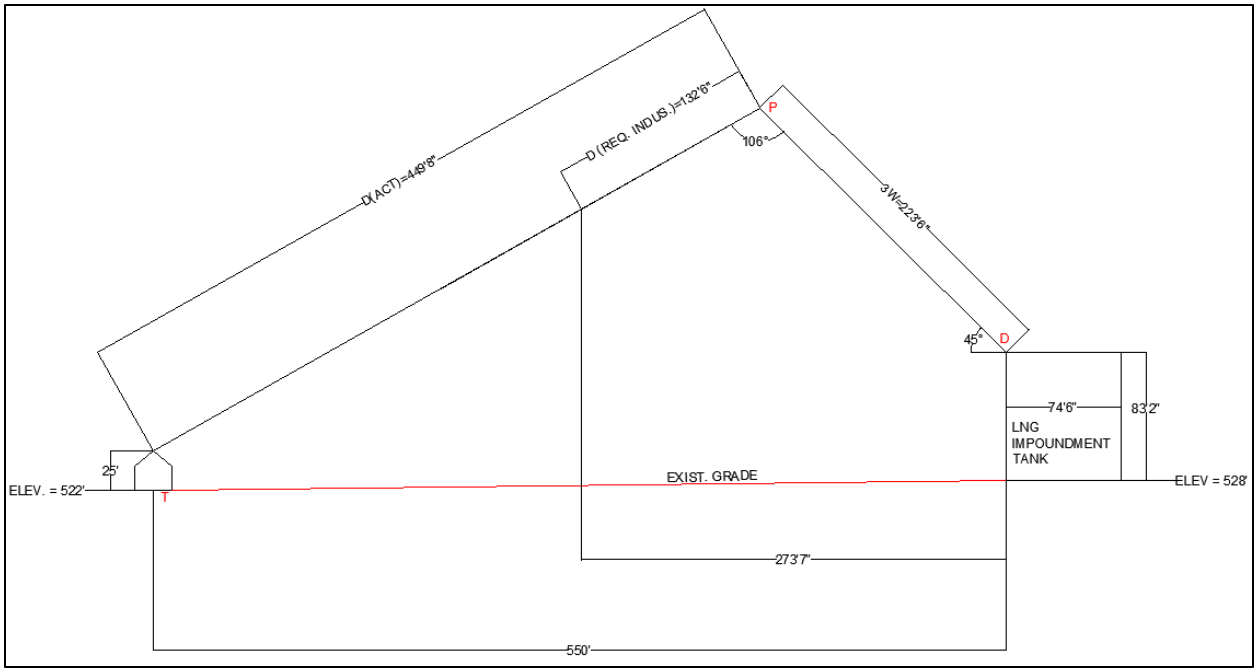
Consistent with established design protocols, in order to meet the vapor dispersion exclusion zone requirements of 980 CMR 10.03(2), specialized mitigation methods will be employed. Vapor fencing is a traditional and accepted method to mitigate vapor dispersion. Accordingly, using a vapor fence surrounding the truck station sump (approximately 32,250 sq. ft. or 0.7 acres) as the volume for vapor containment, the calculation indicates that this vapor fence would contain the total amount of vapor assumed to be generated in the event of a design spill with a dispersion distance of approximately only 19 feet being generated when overflow of the vapor fence occurs. This dispersion distance would be within the perimeter fence line of the Facility and property lines of each of the noticed alternative sites, and thus would fully satisfy the requirements of 980 CMR 10.03(2). The vapor dispersion exclusion zones have been mapped on figures I-4.1, I-4.2, and I-4.3.

I-4.0 CALCULATIONS AND MODEL OUTPUTS

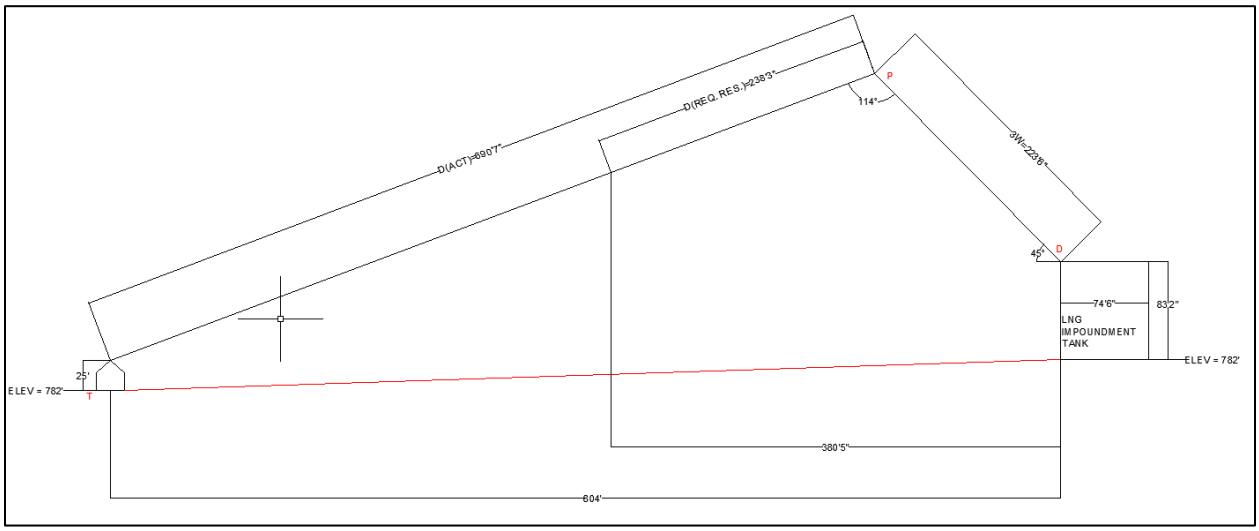
I-4.1 Thermal Radiation Protection Zone Calculations



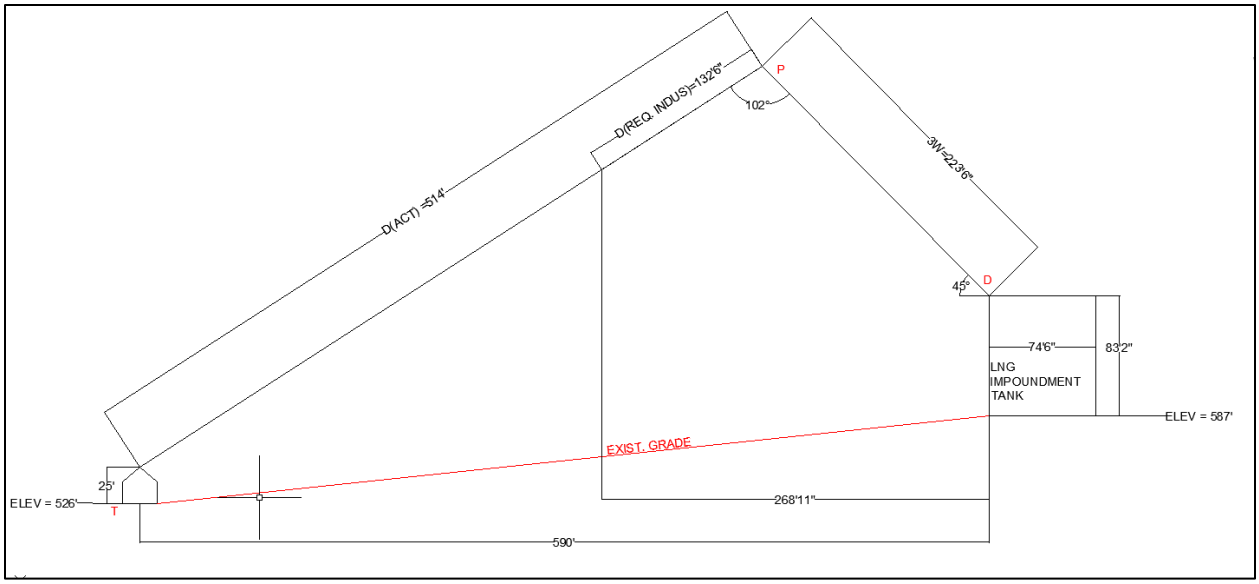
Receptor 1 – South (Route 169 Site)



Receptor 2 – South (Route 169 Site)



Receptor 3– South (Route 20 Site)



Receptor 4– East (Sherwood Lane Site)

I-4.2 LNGFIRE3 Output Files

LNGFIRE MODEL RESULTS: 74.5 FT DIAMETER CIRCULAR POOL

INPUT

MOLECULAR WEIGHT	17.00
LNG LIQUID DENSITY (LB/FT^3)	26.97
BOILING TEMPERATURE (R)	201.60
FLAME BASE HEIGHT (FT)	82.50
TARGET HEIGHT (FT)	0.00
POOL DIAMETER (FT)	74.50
WIND SPEED (MPH)	20.00
AMBIENT TEMPERATURE (F)	17.00
RELATIVE HUMIDITY (%)	36.20

OUTPUT

MASS BURNING RATE (LB/FT^2 S)	0.02253
FLAME LENGTH (FT)	131.49
FLAME TILT FROM VERTICAL (DEG)	59.05
FLAME DRAG RATIO	1.00
EFF. EMISSIVE POWER (BTU/FT^2 HR)	60251.10

THERMAL FLUX (BTU/FT^2 HR)	FEDERAL CODE DISTANCE FROM CENTER OF POOL (FT)
10,000	UNABLE TO COMPUTE DISTANCE TO THIS FLUX DISTANCE TO 7023.62 BTU/FT^2 HR = 37.58
6,700	167.13
4,000	231.18
1,600	342.84

LNGFIRE MODEL RESULTS: 74.5 FT DIAMETER CIRCULAR POOL

INPUT

MOLECULAR WEIGHT	17.00
LNG LIQUID DENSITY (LB/FT^3)	26.97
BOILING TEMPERATURE (R)	201.60
FLAME BASE HEIGHT (FT)	82.50
TARGET HEIGHT (FT)	0.00
POOL DIAMETER (FT)	74.50
WIND SPEED (MPH)	20.00
AMBIENT TEMPERATURE (F)	17.00
RELATIVE HUMIDITY (%)	36.20

OUTPUT

MASS BURNING RATE (LB/FT^2 S)	0.02253
FLAME LENGTH (FT)	131.49
FLAME TILT FROM VERTICAL (DEG)	59.05
FLAME DRAG RATIO	1.00
EFF. EMISSIVE POWER (BTU/FT^2 HR)	60251.10

	THERMAL FLUX TO:		
DISTANCE FROM CENTER OF POOL (FT)	HORIZONTAL TARGET (BTU/FT^2 HR)	VERTICAL TARGET (BTU/FT^2 HR)	MAXIMUM FLUX TO TARGET (BTU/FT^2 HR)
555.00	116	446	460
411.00	361	937	1004
412.00	358	932	998
313.00	990	1754	2015
314.00	979	1743	1999

LNGFIRE MODEL RESULTS: 15 X 15 FT RECTANGULAR POOL

INPUT

MOLECULAR WEIGHT		17.00
LNG LIQUID DENSITY (LB/FT^3)		26.97
BOILING TEMPERATURE (R)		201.60
FLAME BASE HEIGHT (FT)		0.00
TARGET HEIGHT (FT)		0.00
POOL WIDTH (FT)		15.00
POOL LENGTH (FT)		15.00
WIND SPEED (MPH)		20.00
AMBIENT TEMPERATURE (F)		17.00
RELATIVE HUMIDITY (%)		36.20

OUTPUT

MASS BURNING RATE (LB/FT^2 S)		0.02253
FLAME LENGTH (FT)		43.16
FLAME TILT FROM VERTICAL (DEG)	(FRONT)	66.81
	(SIDE)	66.81
FLAME DRAG RATIO	(FRONT)	1.93
	(SIDE)	1.93
EFF. EMISSIVE POWER (BTU/FT^2 HR)	(FRONT)	56019.74
	(SIDE)	56019.74

FRONT VIEW	
THERMAL FLUX (BTU/FT^2 HR)	FEDERAL CODE DISTANCE FROM CENTER OF POOL (FT)
10,000	70.02
6,700	75.80
4,000	84.26
1,600	103.85
SIDE VIEW	
10,000	70.02
6,700	75.80
4,000	84.26
1,600	103.85

I-4.3 Vapor Dispersion Calculation

MA 90 CMR VAPOR DISPERSION CALCULATION - 15'x15' IMPOUNDMENT, FINITE SPILL RATE OF THE FULL TRUCK LOADING STATION OUTPUT (1,200 GPM)

"Evaluation of LNG Vapor Control Methods" AGA 1974, Appendix C: Boiling in a Flat Dike with a Finite Spill Rate
(Point Model, slightly more conservative of the two models described, vaporization is assumed constant at the spill rate until the spill reaches the dike walls)

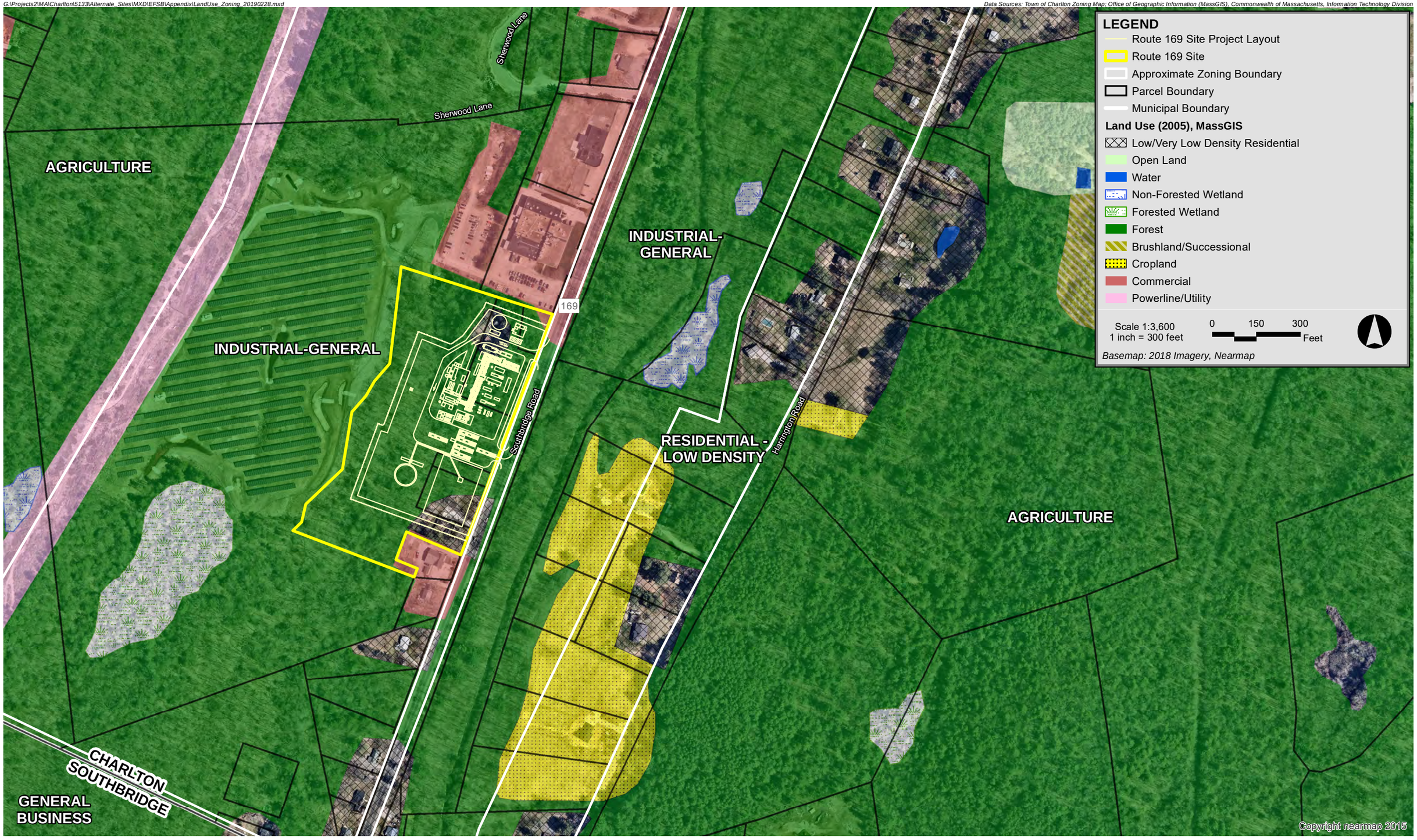
Impoundment Info				
Width	w_i	15	ft	
Length	l_i	15	ft	
Floor Area	A_i	225	ft^2	$A_i = w_i * l_i$
Equivalent Radius	R_i	8.46	ft	$R_i = \sqrt{(\frac{A_i}{\pi})}$
Depth	h_i	9	ft	(15,000 gal min by MA CMR 220.112)
Material		Concrete		
Floor Thermal Conductivity	k	1.5	BTU/hr-ft-°F	(soil data given in AGA 1974 as representative, concrete from ASHRAE 1998 Fundamentals Handbook)
Floor Thermal Diffusivity	α	0.0446	ft^2/hr	
Heat of Vaporization (methane)	λ	219.76	BTU/lbm	(NIST Thermophysical Properties of Fluid Systems, methane @ 14.7 psia)
Temperature of Boiling LNG	T_{LNG}	-258.7	°F	(Methane Boiling Temp @ 14.7 psia)
Original Temperature of Impoundment Floor	T_{oo}	116.6	°F	(47 °C per MA 980 CMR 10.03 (2)[d]6)
Temperature Difference (Floor-LNG)	ΔT	375.3	°F	
Density of Saturated LNG Vapor	ρ_v	0.11342	lbm/ft^3	(NIST Thermophysical Properties of Fluid Systems, methane @ 14.7 psia)
Spill Info				
Spill Rate, liquid volumetric	$\dot{V}_{liq}$	1,200	gpm	$\dot{V}_{liq,\,cfs} = \dot{V}_{liq,\,gpm} * (\frac{0.133368\ cf/gal}{60\ s/min})$
Spill Rate, liquid mass	$\dot{m}_{liq}$	259,200	lbm/hr	(Density of LNG= 3.6 lbm/gal)
Impoundment Fill Info	a	87.61	$ft/hr^{0.25}$	$a = \sqrt{\frac{2\lambda\sqrt{\pi\alpha}}{\pi^2 k\Delta T} * \dot{m}_{liq}}$
Time Liquid Reaches Impoundment Wall	t_R	0.31	s	$t_R = (\frac{R_i}{a})^4 * 3600\ s/hr$
Vapor Created when Liquid Reaches Impoundment Wall (t_R)	V_R	199	ft^3	$V_R = \frac{\dot{m}_{liq} * tR}{\rho_{v\ @\ -360}\ s/hr}$
Impoundment Volume	V_i	2,025	ft^3	
Unfilled Impoundment Volume at t_R	ΔV_i	1,826	ft^3	***If $\Delta V_R > 0$ (and therefore $t_{ov} > t_r$), then Refer to Evap Model for t_{ov} and $\dot{m}_{e,\,ov}$**
Time at Vapor Overflow of Impoundment	t_{ov}	**22.75**	s	***If $\Delta V_R \leq 0$ (and therefore $t_{ov} \leq t_r$), then** $t_{ov} = (\frac{R_i}{a})^4 * (\frac{2}{\pi})^2 * 3600\ s/hr$
Mass Evaporation Rate at Impoundment Vapor Overflow	$\dot{m}_{e,\,ov}$	19,415	lbm/hr	***If $\Delta V_R \leq 0$ (and therefore $t_{ov} \leq t_r$), then $\dot{m}_{e,\,ov} = \dot{m}_{liq}$**
Time at Liquid Overflow of Impoundment	$t_{ov,\,liq}$	776	s	**From Model, Confirm This Exceeds Design Conditions**
Vapor Fence Info				
Vapor Fenced Area	A_f	32,250	ft^2	$A_f = w_f * l_f$
Height of Vapor Fence	h_f	12	ft	
Volume of Vapor Fence	V_f	387,000	ft^3	$V_f = A_f * h_f$
Equivalent Radius	R_f	101.32	ft	$R_f = \sqrt{(\frac{A_f}{\pi})}$
Mass Evaporation Rate at Vapor Fence Overflow	$\dot{m}_{e,\,ov\,fence}$	3,772	lbm/hr	From Model, Worst Case Scenario from Model after t=600s

"Evaluation of LNG Vapor Control Methods" AGA 1974, Appendix B: Vapor Dispersion Model
(Assume constant evaporation rate from the moment vapor overflows, no heat transfer takes place to sat. vapor evolved)

No Vapor Fence				
Source Evaporation Rate	$\dot{m}_{e,\,ov}$	19,415	lb/hr	
		5.39	lb/s	lb/s = (lb/hr)/(60*60)
Wind Speed	u	26,400	ft/hr	5 mph per MA 980 CMR 10.03 (2)(d)6
		7.33	ft/s	Converted from 5 mph in AGA book
Source Equivalent Length	L	15.00	ft	SQRT(a) per MA 980 CMR 10.03 (2)(d)4
Centerline Distance of Interest	x	574.84	ft	**GOAL SEEK, Set C(x) to 2.0% by Changing x**
Centerline Distance of Interest	x	175.20	m	ft/3.281
Gifford Constants	a	14.457		Pasquill Stability Category F, 0.2 km < x < 0.7 km
	b	0.78407		Pasquill Stability Category F, 0.2 km < x < 0.7 km
	c	4.1667		Pasquill Stability Category F
	d	0.3619		Pasquill Stability Category F
Gifford Lateral Dispersion Parameter for Plumes	σ_y	6.86	m	σy= 465.12x*tan(0.0175(c-d*ln(x))) where x is in km and σy is in m, Stability Category F per MA 980 CMR 10.03 (2)(d)5
Gifford Vertical Dispersion Parameter for Plumes	σ_z	3.69	m	σz= ax^b where x is in km and σz is in m, Stability Category F per MA 980 CMR 10.03 (2)(d)5
Gifford Lateral Dispersion Parameter for Plumes	σ_y	22.50	ft	
Gifford Vertical Dispersion Parameter for Plumes	σ_z	12.11	ft	
Dispersion Function Lateral	Y*	0.261		Y* = erf (L /(2√2*σ_y))
Dispersion Function Vertical	Z*	0.066		Z* = 2 / (√(2π)*σ_z)
Concentration at Distance of Interest	$C(x)_{no\ vf}$	**2.00**		C(x,0,0)=(M_e/(u*L))*Z**Y**(100*379/16)
Vapor Fence				
Source Evaporation Rate	$\dot{m}_{e,\,ov\,fence}$	3,772	lb/hr	
		1.05	lb/s	lb/s = (lb/hr)/(60*60)
Wind Speed	u	26,400	ft/hr	5 mph per MA 980 CMR 10.03 (2)(d)6
		7.33	ft/s	Converted from 5 mph in AGA book
Source Equivalent Length	L	179.58	ft	SQRT(a) per MA 980 CMR 10.03 (2)(d)4
Centerline Distance of Interest	x	19.15	ft	**GOAL SEEK, Set C(x) to 2.0% by Changing x**
Centerline Distance of Interest	x	5.84	m	ft/3.281
Gifford Constants	a	15.209		Pasquill Stability Category F, x < 0.2 km
	b	0.81558		Pasquill Stability Category F, x < 0.2 km
	c	4.1667		Pasquill Stability Category F
	d	0.3619		Pasquill Stability Category F
Gifford Lateral Dispersion Parameter for Plumes	σ_y	0.29	m	σy= 465.12x*tan(0.0175(c-d*ln(x))) where x is in km and σy is in m, Stability Category F per MA 980 CMR 10.03 (2)(d)5
Gifford Vertical Dispersion Parameter for Plumes	σ_z	0.23	m	σz= ax^b where x is in km and σz is in m, Stability Category F per MA 980 CMR 10.03 (2)(d)5
Gifford Lateral Dispersion Parameter for Plumes	σ_y	0.94	ft	
Gifford Vertical Dispersion Parameter for Plumes	σ_z	0.75	ft	
Dispersion Function Lateral	Y*	1.000		Y* = erf (L /(2√2*σ_y))
Dispersion Function Vertical	Z*	1.061		Z* = 2 / (√(2π)*σ_z)
Concentration at Distance of Interest	$C(x)_{vf}$	**2.00**		C(x,0,0)=(M_e/(u*L))*Z**Y**(100*379/16)

G:\Projects2\MA\Charlton\5133\Alternate_Sites\MXD\EFSB\Appendix\LandUse_Zoning_20190228.mxd

Data Sources: Town of Charlton Zoning Map; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



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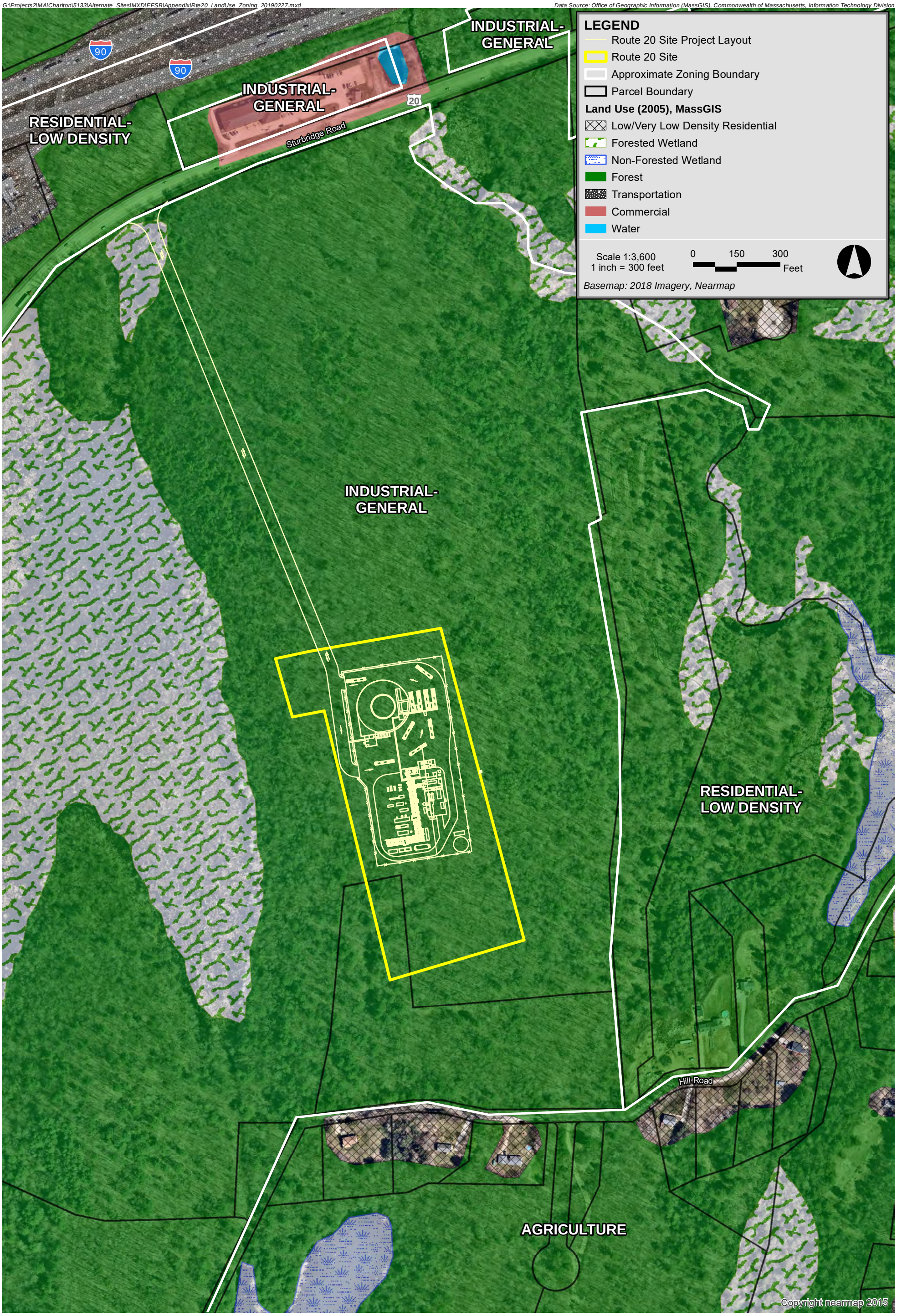
Epsilon Associates Inc.

Figure I-1.1

Land Use and Zoning, Route 169 Site

G:\Projects2\MA\Charlton\5133\Alternate_Sites\MXD\EFSB\Appendix\Rte20_LandUse_Zoning_20190227.mxd

Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



Northeast Energy Center **Charlton, Massachusetts**

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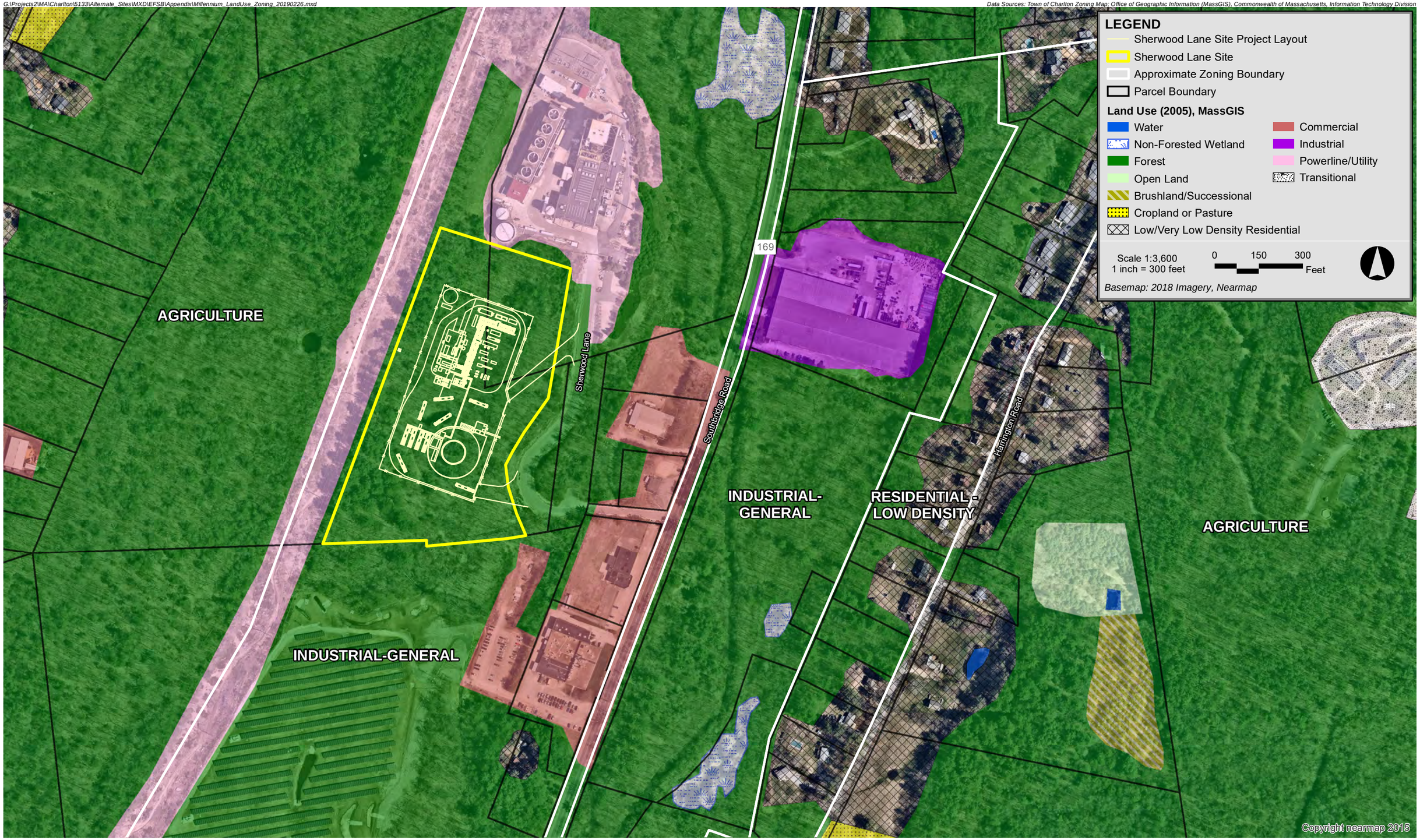
Figure I-1.2
Land Use and Zoning, Route 20 Site

G:\Projects2\MA\Charlton\5133\Alternate_Sites\MXD\EFSB\Appendix\Millennium_LandUse_Zoning_20190226.mxd

Data Sources: Town of Charlton Zoning Map; Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



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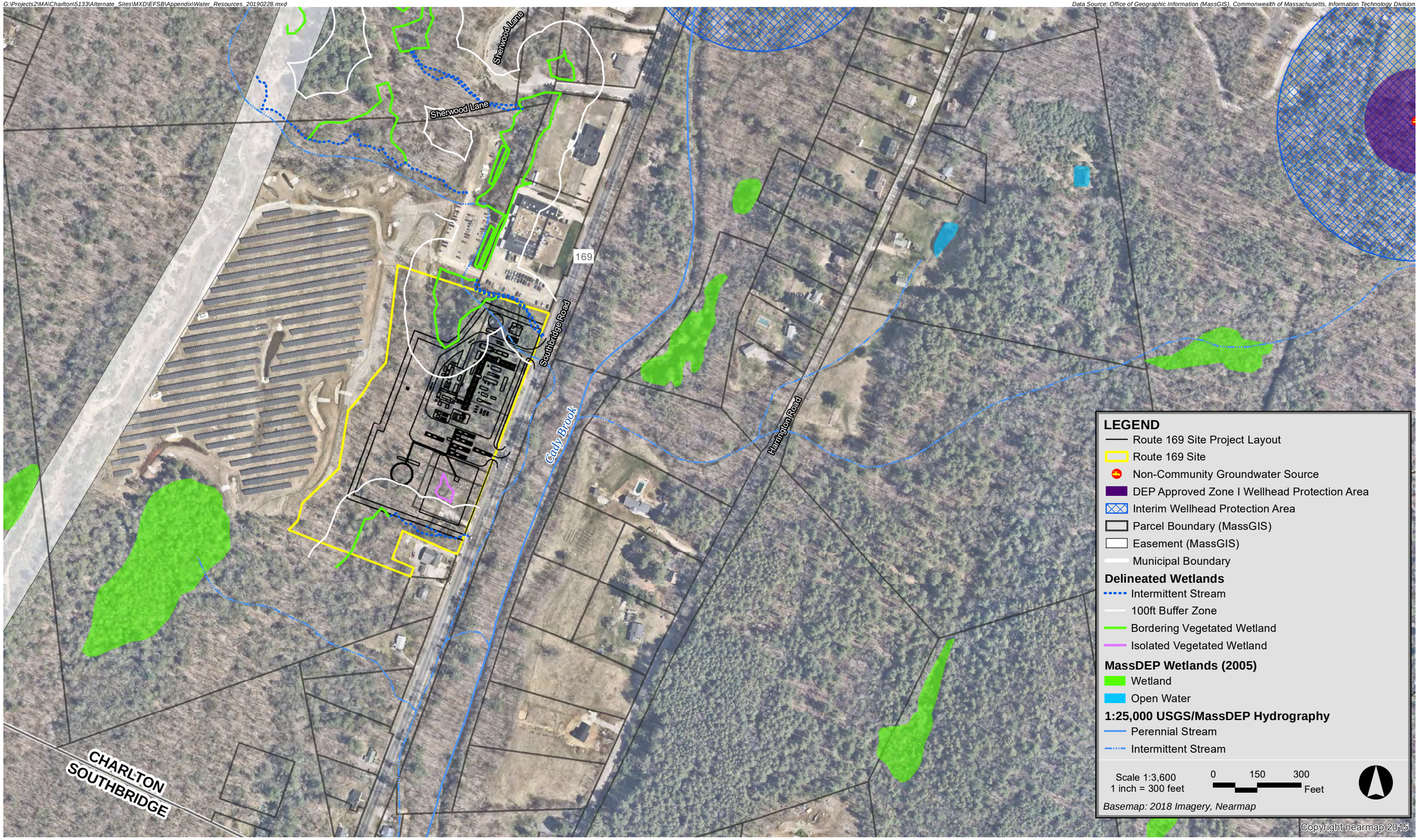
Epsilon ASSOCIATES INC.

Figure I-1.3

Land Use and Zoning, Sherwood Lane Site

G:\Projects2\MA\Charlton\5133\Alternate_Sites\MXD\EFSB\Appendix\Water_Resources_20190228.mxd

Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



Northeast Energy Center **Charlton, Massachusetts**

Epsilon Associates Inc.

Figure I-1.4

Surface Water and Groundwater Resources, Route 169 Site

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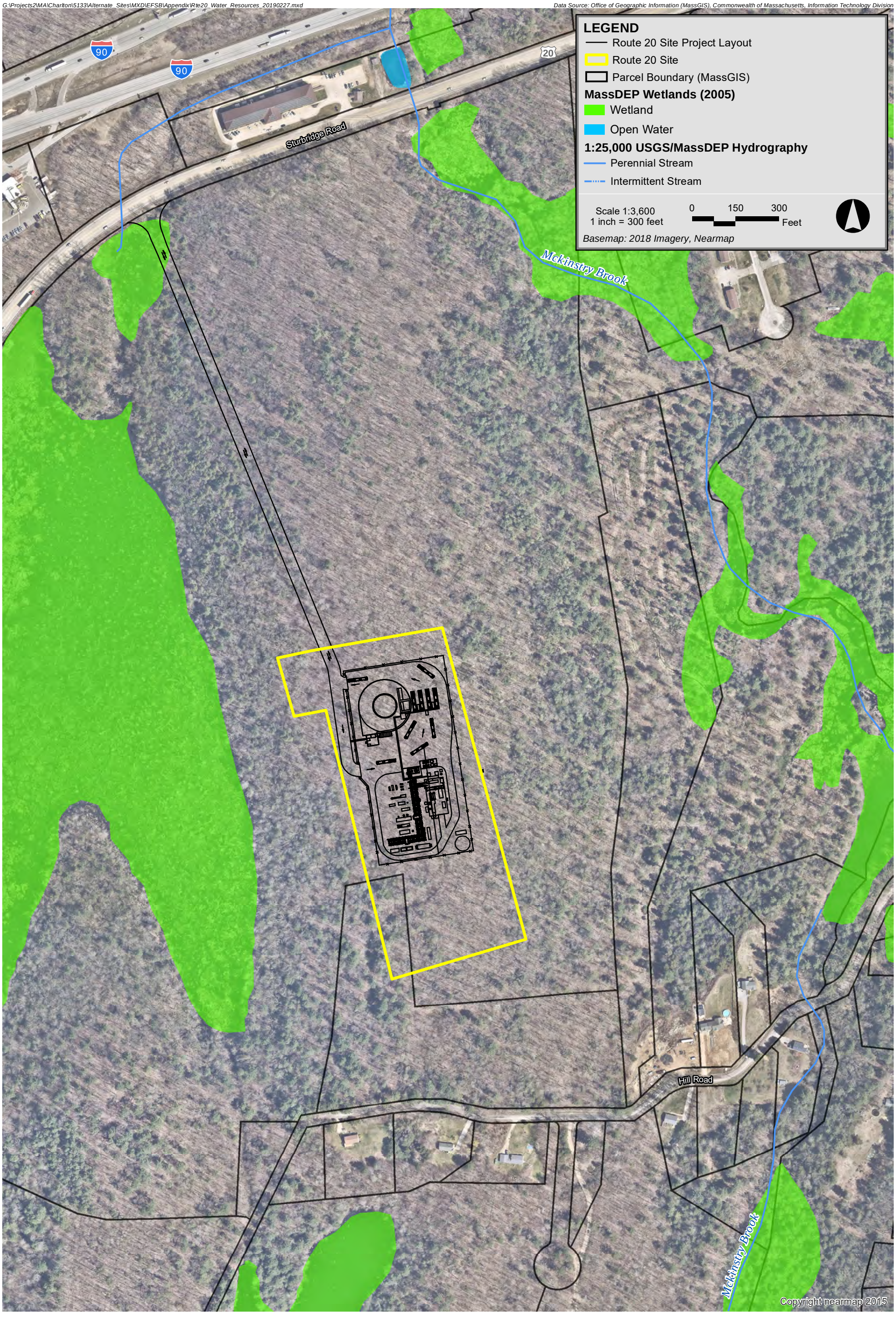
Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division



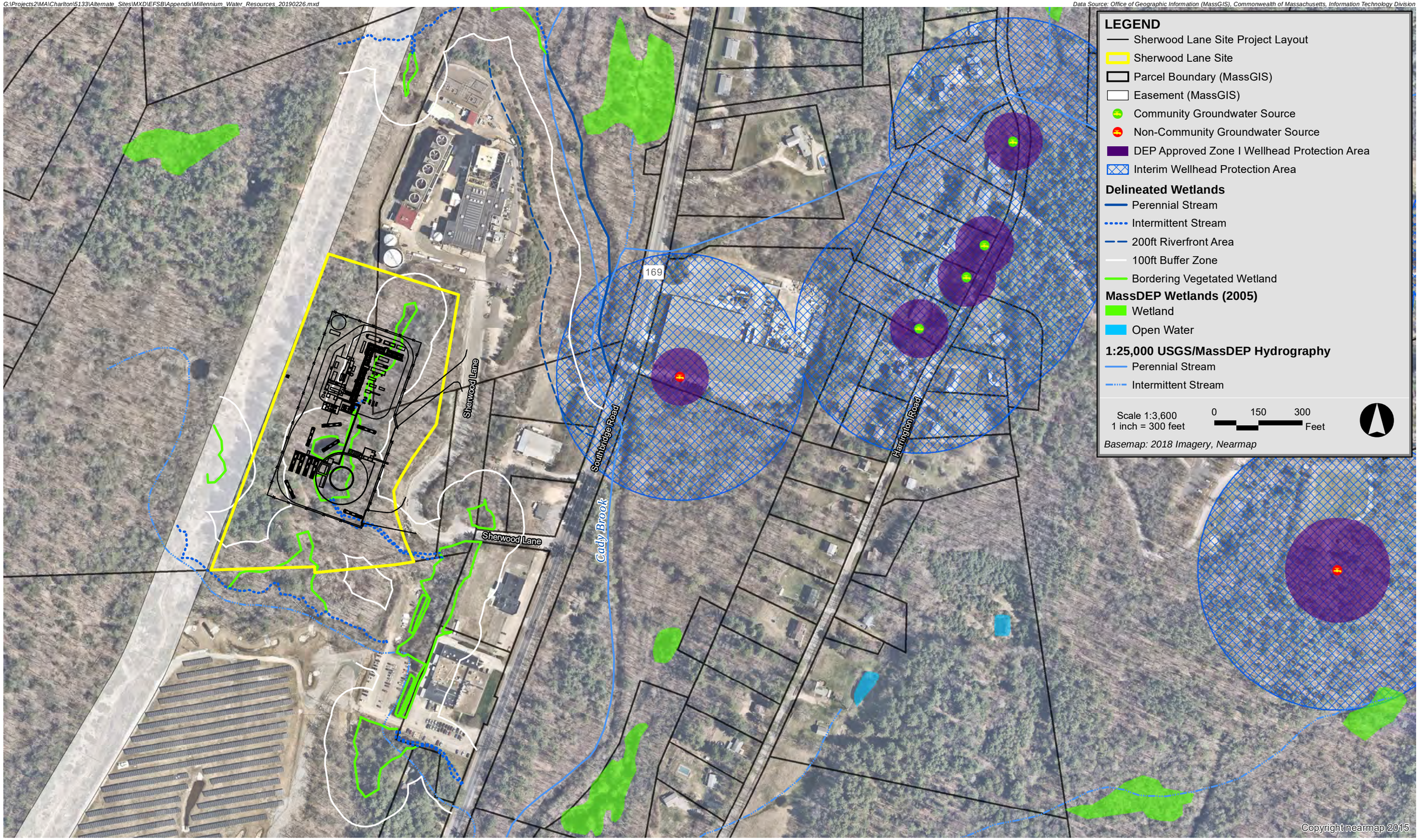
Northeast Energy Center **Charlton, Massachusetts**

Figure I-1.5

Surface Water and Groundwater Resources, Route 20 Site

G:\Projects2\MA\Charlton\5133\Alternate_Sites\MXD\EFSB\Appendix\Millennium_Water_Resources_20190226.mxd

Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division

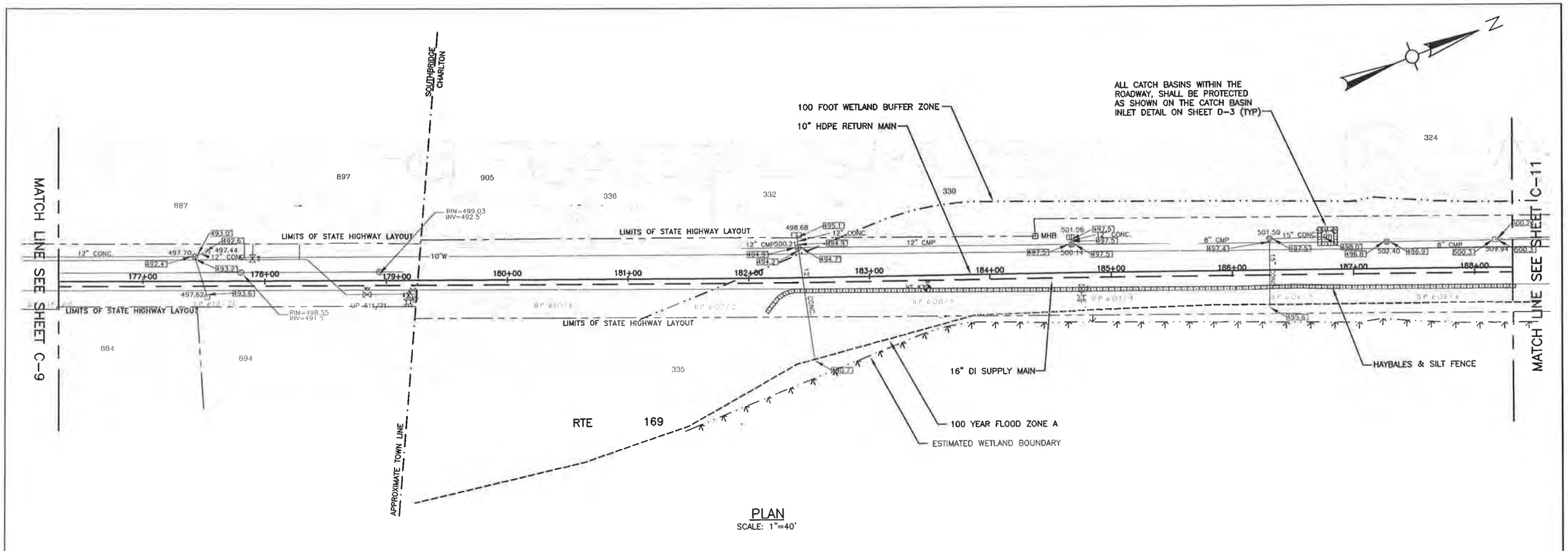


Northeast Energy Center **Charlton, Massachusetts**

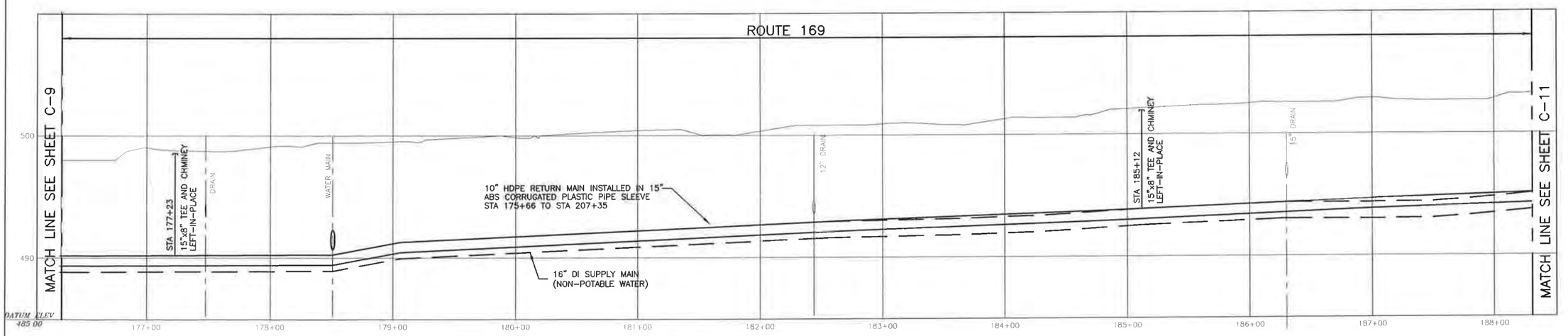
Epsilon ASSOCIATES INC.

Figure I-1.6

Surface Water and Groundwater Resources, Sherwood Lane Site



PLAN
SCALE: 1"=40'



PROFILE
SCALE: 1"=40' HORIZ
1"=4' VERT

NOTES:

1. ALL EARTHWORK BENEATH AND IN CLOSE PROXIMITY OF DRAINS/ CULVERTS SHALL BE PERFORMED CAREFULLY TO AVOID ANY DAMAGE TO THE CULVERT STRUCTURE. CLOSE WORK SHALL BE DONE BY HAND. ALL EXISTING CULVERTS AND DRAINS SHALL BE ADEQUATELY SUPPORTED AND PROTECTED DURING EARTHWORK FOR THE PROPOSED UTILITIES.

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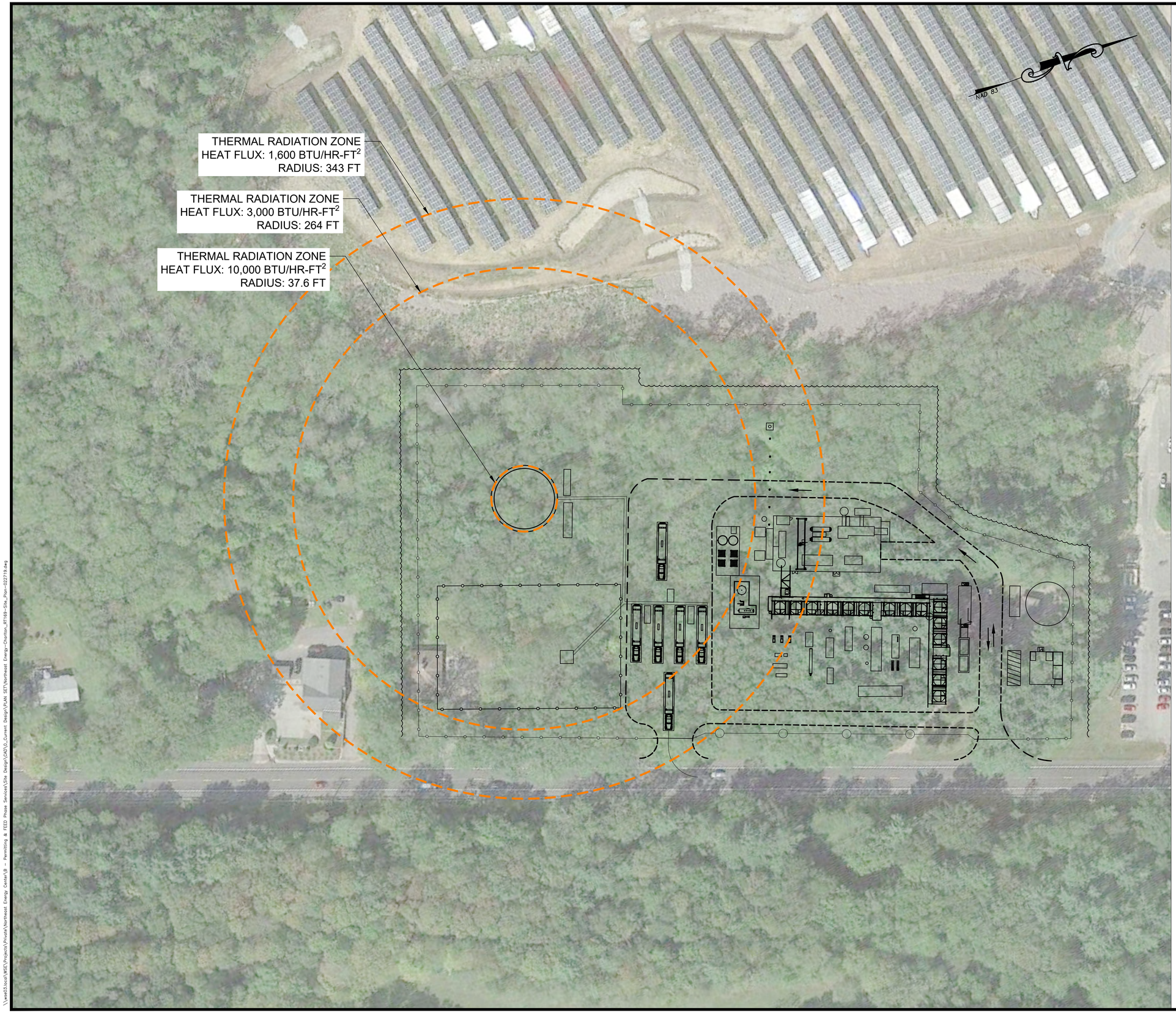
Figure I-1.7



SITE PLAN LEGEND

- APPROXIMATE LOCATION OF 294 SOUTHBRIDGE SITE FENCING
- PROPOSED VAPOR FENCE
- PROPOSED PAVED AREA
- PROPOSED FENCE LINE
- LIMIT OF CLEARING
- SOUND WALL
- TRAFFIC DIRECTION

50 25 0 50 100
SCALE: 1"=50'

GENERAL NOTES:

1. SITE PLAN REFERENCES THE MASSACHUSETTS NAD 83 STATE PLANE COORDINATE SYSTEM (MAINLAND ZONE).
2. ELEVATIONS REFER TO THE 1988 NORTH AMERICAN DATUM (NAVD 88).
3. BASEMAP TAKEN FROM THE OFFICE OF ENVIRONMENTAL AND GEOGRAPHICAL INFORMATION (MASSGIS), COMMONWEALTH OF MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS DATABASE.

49 CFR 193/NFPA 59A THERMAL RADIATION ZONES

HEAT FLUX (BTU/HR-FT^2)	RADIUS (FT)
10,000	37.6*
3,000	264
1600	343

* MODEL WAS UNABLE TO COMPUTE A DISTANCE TO THIS THERMAL RADIATION ZONE. THE DISTANCE OF 37.6 FEET REPRESENTS A THERMAL RADIATION ZONE OF ABOUT 7,024 BTU/HR-FT^2.

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NORTHEAST ENERGY CENTER, LLC
100 FRONT STREET
WEST CONSHOHOCKEN, PA 19428

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CHARLTON, MASSACHUSETTS

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49 CFR 193 / NFPA 59A THERMAL RADIATION ZONES

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SITE PLAN LEGEND

- PROPOSED VAPOR FENCE
- PROPOSED PAVED AREA
- PROPOSED FENCE LINE
- TRAFFIC DIRECTION

150 75 0 150 300

SCALE: 1"=150'

GENERAL NOTES:

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1600	343

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ALTERNATE SITE PLAN - RT. 20

49 CFR 193 / NFPA 59A THERMAL RADIATION ZONES

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SITE PLAN LEGEND

- PROPOSED VAPOR FENCE
- PROPOSED PAVED AREA
- PROPOSED FENCE LINE
- TRAFFIC DIRECTION

50 25 0 50 100

SCALE: 1"=50'

GENERAL NOTES:

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49 CFR 193/NFPA 59A THERMAL RADIATION ZONES

HEAT FLUX (BTU/HR-FT^2)	RADIUS (FT)
10,000	37.6*
3,000	264
1600	343

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ALTERNATE SITE PLAN - SHERWOOD LANE

THERMAL RADIATION ZONES

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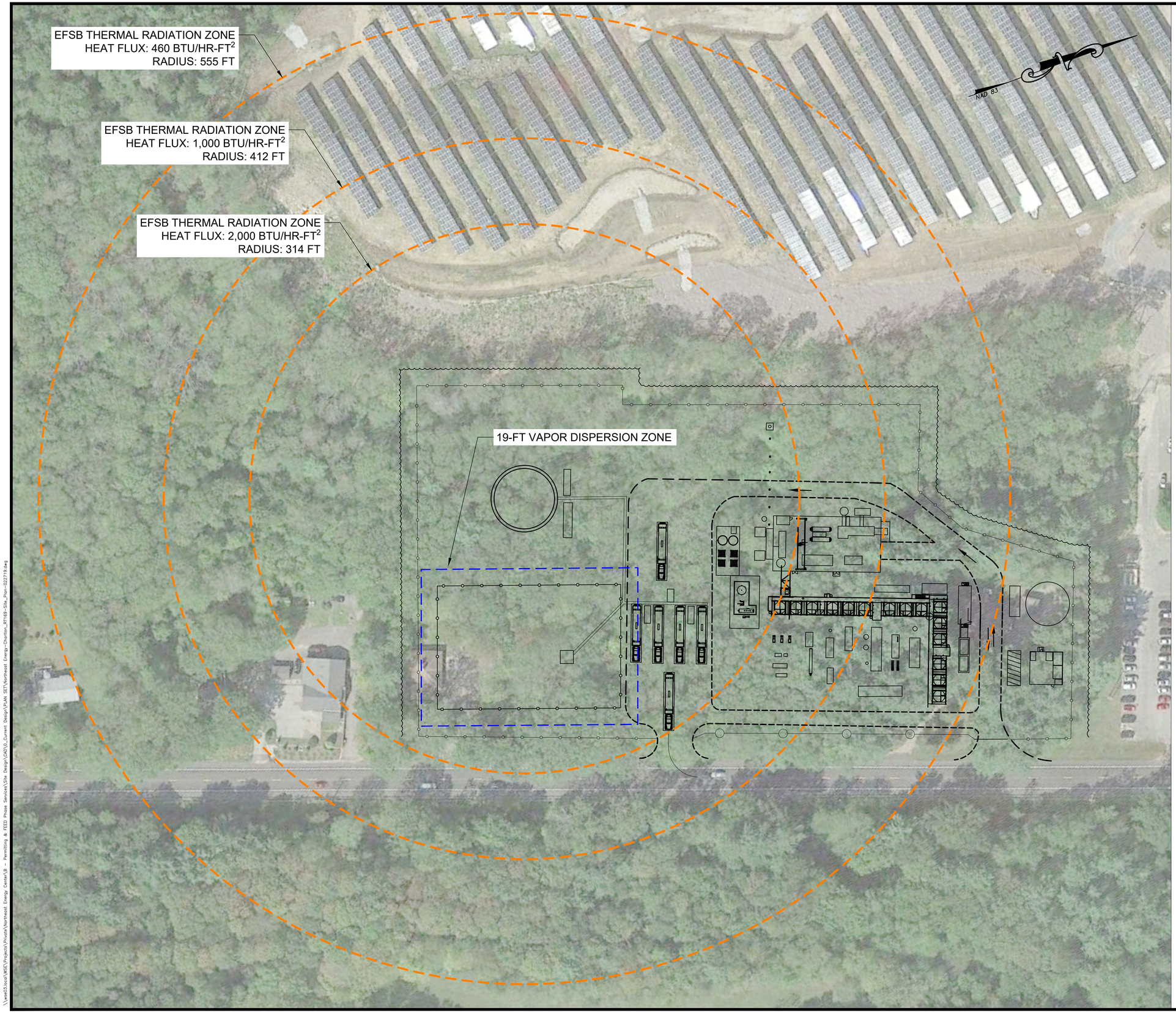

SITE PLAN LEGEND

- APPROXIMATE LOCATION OF 294 SOUTHBRIDGE SITE FENCING
- PROPOSED VAPOR FENCE
- PROPOSED PAVED AREA
- PROPOSED FENCE LINE
- LIMIT OF CLEARING
- SOUND WALL
- TRAFFIC DIRECTION

50 25 0 50 100
SCALE: 1"=50'

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EFSB 980 CFR 10.02 THERMAL RADIATION ZONES

HEAT FLUX (BTU/HR-FT^2)	RADIUS (FT)
2,000	314
1,000	412
460	555

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ROUTE 169 SITE

THERMAL RADIATION AND VAPOR DISPERSION

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SITE PLAN LEGEND

- PROPOSED VAPOR FENCE
- PROPOSED PAVED AREA
- PROPOSED FENCE LINE
- TRAFFIC DIRECTION

150 75 0 150 300
SCALE: 1"=150'

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EFSB 980 CFR 10.02 THERMAL RADIATION ZONES

HEAT FLUX (BTU/HR-FT^2)	RADIUS (FT)
2,000	314
1,000	412
460	555

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THERMAL RADIATION AND VAPOR DISPERSION

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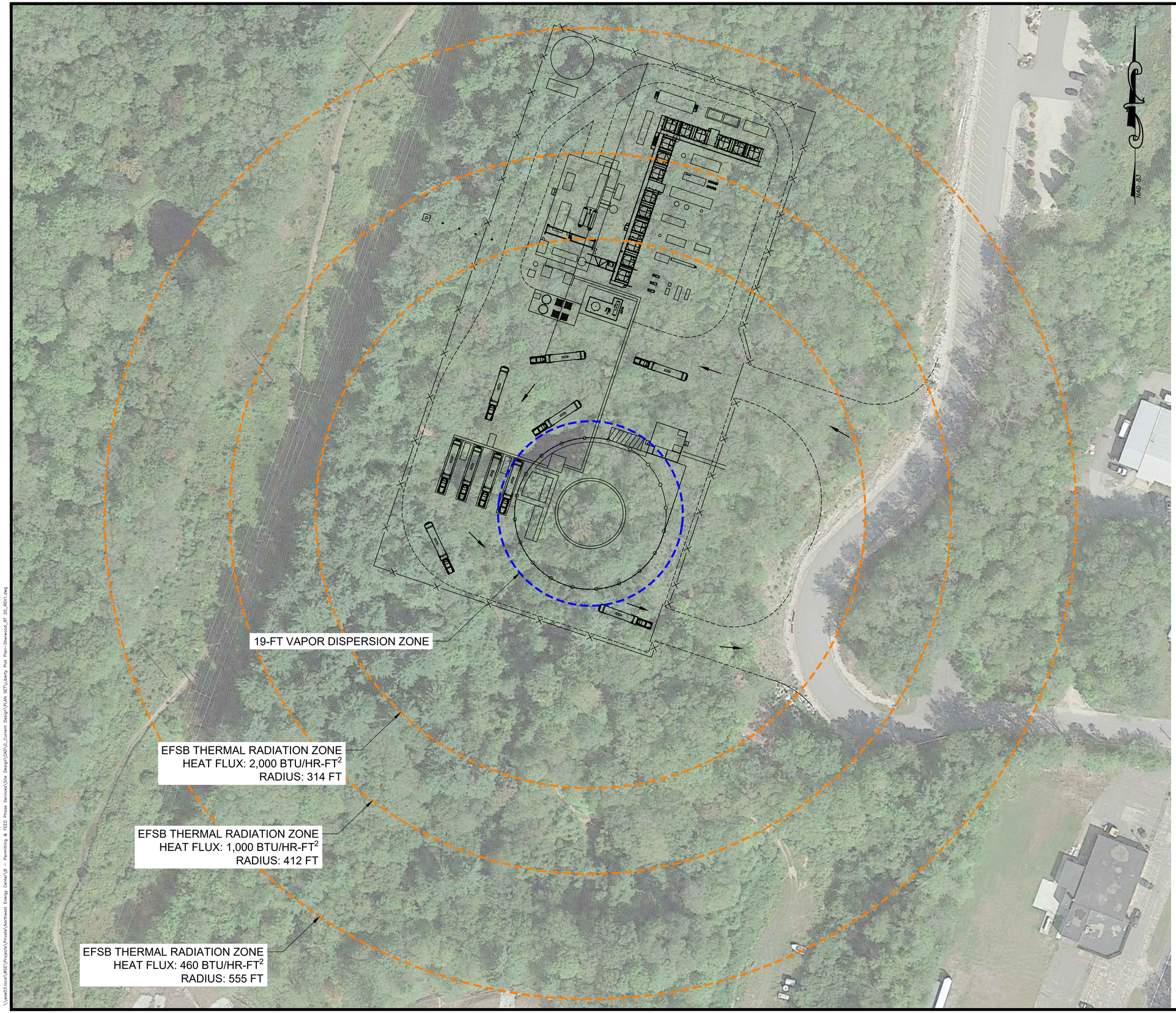

SITE PLAN LEGEND

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- PROPOSED FENCE LINE
- TRAFFIC DIRECTION

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SCALE: 1"=50'

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EFSB 980 CFR 10.02 THERMAL RADIATION ZONES	
HEAT FLUX ($BTU/HR\text{-}FT^2$)	RADIUS (FT)
2,000	314
1,000	412
460	555

Project:

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