

**MASSACHUSETTS**

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October 18, 2016

Ms. Ruth A. Gold  
Supervising Air Quality Specialist  
Rhode Island Department of Environmental Management  
Office of Air Resources  
235 Promenade Street  
Providence, Rhode Island 02908

**Re: *Multisource Modeling Addendum  
Clear River Energy Center– Burrillville, Rhode Island***

Dear Ms. Gold:

The following is an addendum to the Major Source Permit Application submitted by ESS Group, Inc. (ESS) for the Clear River Energy Center (CREC), a combined-cycle electric generating facility being proposed by Clear River Energy LLC at the Spectra Energy Algonquin Compressor Station site on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility).

**INTRODUCTION**

The CREC Major Source Permit Application was submitted to RIDEM on June 26, 2015. An Air Dispersion Modeling Report was submitted to RIDEM on October 30, 2015, detailed the air quality impact analysis completed for the Project in accordance with the approved Modeling Protocol. A Health Risk Assessment Report for the Project was submitted to RIDEM on January 27, 2016.

On April 15, 2016, RIDEM issued a Completeness Determination letter stating that the Application was deemed to be administratively complete on March 29, 2016. The letter requested that CREC revise and resubmit the modeling analysis to model the Algonquin site consistent with the current site configuration and equipment including the equipment recently permitted under Approval No. 2289-2291 issued on June 3, 2015.

A Major Source Permit Application Addendum was submitted to RIDEM on September 15, 2016. The addendum provided RIDEM with the results of a revised CREC only air dispersion modeling analysis conducted based on changes to the Project, and to provide additional updates and clarifications to the application based on Project changes which had occurred subsequent to the previous submittals.

The Air Dispersion Modeling Report submitted to RIDEM included the results of multi-source modeling conducted for the CREC which included the impacts from the nearby Algonquin Compressor Station, Ocean State Power, and the RISE Compressor Station. The September 15, 2016 addendum did not include revised multi-source modeling results based on the updated Project configuration because at the time the future configuration of the Algonquin Compressor Station was being developed by Spectra.

On September 22, 2016 a Minor Source Permit Application was submitted to RIDEM for the Algonquin Compressor Station. This application proposed the installation of "clean burn" technology and an oxidation catalyst on one of the three existing 2,700 horsepower Clark lean-burn reciprocating internal combustion engines (RICE) identified as emission unit E003 in the facility Title V permit. In addition, the application proposes to shut down the other two existing RICE, emission units E001 and E002. According to Spectra, the Algonquin Compressor Station configuration proposed in the September 22, 2016 application will be implemented prior to the commencement of CREC operation.





The purpose of this addendum is to provide RIDEM with the results of the revised CREC multi-source air dispersion modeling analysis conducted based on the newly proposed Algonquin Compressor Station configuration. This addendum only includes the results of the revised multi-source modeling analysis. The Facility Description, Project Emissions, Emissions Control Technology Evaluation, and the CREC-only Air Quality Impact Analysis sections presented in the original submittals and the September 15, 2016 addendum remain unchanged. The tables and figures provided in the September 15, 2016 addendum which do not include information specific to the revised CREC multi-source modeling analysis remain unchanged and have not provided with this addendum to avoid any confusion.

## **MULTISOURCE MODELING ANALYSIS**

A revised multi-source air dispersion modeling analysis has been completed for the Project based on the latest CREC Site Arrangement and General Arrangement and the updated emissions estimates provided by GE). The analysis was completed in accordance with the approved Test Protocol and the methodology detailed in the Air Dispersion Modeling Report previously submitted. The results of the revised multi-source modeling are detailed in the attached tables and figures as follows. All modeling files associated with the revised CREC multi-source modeling analysis have been provided electronically on the enclosed CD-ROM. Attachment 1 contains isopleths of the revised CREC multi-source modeling results.

RIDEM requested that multi-source modeling be conducted for the CREC including the emissions from the Algonquin Compressor Station, Ocean State Power, and the Tennessee (RISE) Gas Compressor Station. No other significant emission sources are within the Project's Significant Impact Area (SIA), so the multi-source modeling analysis conducted only included these three sources.

Tables 11a, 11b, and 11c of the Air Dispersion Modeling Report presented the modeling input parameters used for the multi-source modeling sources. Attached is a revised version of Table 11a based on the future site configuration proposed for the Algonquin Compressor Station in the September 22, 2016 minor source permit application. Tables 11b and 11c are unchanged from the versions previously submitted and have not been included with this addendum.

The CREC Prevention of Significant Deterioration (PSD) increment analysis was summarized on Table 14 in the Air Dispersion Modeling Report. Attached is a revised version of Table 14 based on the results of the multi-source modeling analysis. As shown on Table 14, there will be no increase in the ambient air concentration of any pollutant which exceeds the allowable percentage of the remaining available increment for that pollutant averaging period.

The CREC National Ambient Air Quality Standards (NAAQS) compliance determination was summarized on Table 15 in the Air Dispersion Modeling Report. Attached is a revised version of Table 15 based on the results of the multi-source modeling analysis. As shown on Table 15, the combined modeled pollutant concentrations from the Facility and the nearby interacting sources, when combined with representative background concentrations, will result in total pollutant concentrations that do not exceed any NAAQS. Based on these results, the Facility will not cause or contribute to an exceedance of any NAAQS.

Table 18 of the Air Dispersion Modeling Report presented the results of the CREC startup/shutdown modeling analysis. The modeled impacts during startup/shutdown periods included the impacts from the multi-source modeling sources. The attached version of Table 18 shows the results of the revised CREC startup/shutdown modeling including the multi-source modeling sources. As shown on Table 18, the CREC will not cause or contribute to an NAAQS exceedance during startup/shutdown events.





## TABLES, FIGURES & ATTACHMENTS

The table and figure numbers referenced above correspond to the tables and figures which were included in the CREC Air Dispersion Modeling Report. Revised versions of some of the tables, figures, and appendix materials from the CREC Air Dispersion Modeling Report were included in the September 15, 2016 Addendum. Some of the tables are no longer applicable because the turbine manufacturer and model for the Project have been selected. The following list indicates where revisions have been made to the tables, figures, and appendix materials for this addendum.

Table 1	Potential Emissions Criteria Pollutants (not revised/not included)
Table 2	Potential Emissions Non-criteria Pollutants (not revised/not included)
Table 3	Modeling Input Parameter Summary (not revised/not included)
Table 4	GEP Stack Height Analysis Summary (not revised/not included)
Table 5	Cavity Analysis (not revised/not included)
Table 6	Screening Modeling Results – GE Gas Turbines (not revised/not included)
Table 7	Screening Modeling Results – MHI Gas Turbines (not applicable/not included)
Table 8	Screening Modeling Results – Siemens Gas Turbines (not applicable/not included)
Table 9	Screening Modeling Results Summary (now Table 6/not included)
Table 10	AERMOD Modeling Results Summary – Significance Determinations (not revised/not included)
<b>Table 11a</b>	<b>Modeling Input Parameters – Algonquin Compressor Station (revised/included)</b>
Table 11b	Modeling Input Parameters – Ocean State Power (not revised/not included)
Table 11c	Modeling Input Parameters – RISE Compressor Station (not revised/not included)
Table 12	Comparison of Modeled Impacts to the Significant Monitoring Concentrations (not revised/not included)
Table 13	Background Concentrations (not revised/not included)
<b>Table 14</b>	<b>PSD Increment Analysis (revised/included)</b>
<b>Table 15</b>	<b>NAAQS Compliance Determination (revised/included)</b>
Table 16	Air Toxics Modeling Results Summary (not revised/not included)
Table 17	Soils and Vegetation Impact Summary (not revised/not included)
<b>Table 18</b>	<b>Startup/Shutdown NAAQS Compliance Summary (revised/included)</b>
Table A-1	GE GT/HRSG Emissions Estimates (not revised/not included)
Table A-2	Non-Criteria Pollutant Emissions Summaries (not revised/not included)
Table A-3	GE GT/HRSG Startup & Shutdown Emission Summaries (not revised/not included)
Table A-4	Polycyclic Organic Matter Emission Rate Calculations (not revised/not included)
Figure 1	Site Location (not revised/not included)
Figure 2	Site Layout (not revised/not included)
Figure 3	General Arrangement (not revised/not included)
Figure 4	Topographic Map (not revised/not included)
Figure 5	Surrounding Land Use (not revised/not included)
Figure 6	Receptor Grid (not revised/not included)
Figure 7	Receptor Grid Overview (not revised/not included)
Figure 8	Significant Impact Area (not revised/not included)
Figure 9	Mandatory Class I Federal Areas (not revised/not included)
<b>Attachment 1</b>	<b>Isopleths of Modeling Results (revised/included)</b>
Attachment 2	Health Risk Assessment Tables (not revised/not included)





**CONCLUSION**

Feel free to contact me at (781) 419-7749 or at [mfeinblatt@essgroup.com](mailto:mfeinblatt@essgroup.com) with any questions you may have about this Multisource Modeling Addendum for the Clear River Energy Center Project.

Sincerely,

**ESS GROUP, INC.**

A handwritten signature in blue ink, appearing to read "M. Feinblatt".

Michael E. Feinblatt  
Vice President, Energy & Industrial Services

Enclosures

C: John Niland, Clear River Energy LLC  
Terrence Gray, RIDEM  
Ron Gagnon, RIDEM



**Table 11a. Modeling Input Summary - Algonquin Compressor Station**

Emission Source	Units	Compressor Engine <sup>1</sup>	Combustion Turbines <sup>2</sup>		Emergency Gen. <sup>2</sup>	Boiler <sup>2</sup>	Turbine <sup>3</sup>
		(E003)	(E004)	(E005)	(E006)	(B001)	(E007)
Fuel Type		Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Annual Operation	hrs/yr	8,760	8,760	8,760	500	8,760	8,760
<b>Stack Parameters</b>							
Stack Location	UTM N (Z 19T)	4649873.5	4649877.8	4649882.6	4649837.7	4649837.7	4649863.1
Stack Location	UTM E (Z 19T)	271666.1	271675.1	271683.3	271668.5	271668.5	271613.8
Stack Base Elevation	ft AMSL	572.5	572.5	572.5	572.5	572.5	572.5
Stack Height	feet	54.5	54.5	54.5	22.0	26.0	55.14
Stack Diameter	inches	30.0	40.0	40.0	7.9	14.4	108.4
Stack Flow	acfm	25,000	99,006	99,006	15,295	38,067	794,634
Stack Exit Temperature	deg. F	845	841	841	752	344	899
<b>Maximum Emission Rate</b>							
NO <sub>x</sub>	lb/hr	6.50	5.80	5.80	5.81	0.45	4.69
CO	lb/hr	11.00	7.06	7.06	10.36	0.55	0.40
SO <sub>2</sub>	lb/hr	0.35	0.94	0.94	0.13	0.052	2.02
PM <sub>10</sub>	lb/hr	1.20	0.45	0.45	0.09	0.028	0.95
<b>Maximum Emission Rate</b>							
NO <sub>x</sub>	g/sec	0.82	0.73	0.73	0.73	0.057	0.59
CO	g/sec	1.39	0.89	0.89	1.31	0.069	0.050
SO <sub>2</sub>	g/sec	0.044	0.12	0.12	0.016	0.0066	0.25
PM/PM10/PM2.5	g/sec	0.15	0.057	0.057	0.012	0.0035	0.12

<sup>1</sup> Minor Source Permit Application (September 22, 2016)

<sup>2</sup> RIDEM Operating Permit No. RI-08-11 (March 25, 2011)

<sup>3</sup> RIDEM Minor Source Permit Nos. 2289 & 2290 (June 3, 2015)

E003	2700 hp Clark Model TLA-8
E004, E005	57.99 MMBtu/hr Solar Taurus 60-7000S
E006	585 hp Waukesha Model VGF24GL
B001	3.41 MMBtu/hr Cleaver Brooks Model CB-700-80-15
E007	Solar Mars Model 100-16002S4

Table 14. PSD Increment Analysis

Pollutant	Averaging Period	Rank	2010	2011	2012	2013	2014	5-year Average	Max	NAAQS	Background	Margin	Available Increment	Other Source Impacts	Available Increment	Allowable Increment	% of Allowable Increment	
<b>Normal Operation (turbines, dewpoint heater)</b>																		
NO <sub>2</sub>	Annual	Max	1.70	1.80	1.70	1.80	1.70		1.80	100	20	80	25	2.4	22.6	5.7	31.9	
SO <sub>2</sub>	3-hr	Max	1.49	1.69	1.70	1.60	1.59		1.70									
		H2H	1.42	1.37	1.68	1.49	1.58		1.68	1,300	45	1,255	512	45.2	466.8	350.1	0.5	
	24-hr	Max	1.06	0.78	0.82	1.09	0.90		1.09									
		H2H	0.75	0.61	0.72	0.66	0.74		0.75	365	21	344	91	22.7	68.3	51.2	1.5	
PM <sub>10</sub>	Annual	Max	0.09	0.09	0.09	0.08	0.10		0.10	80	4	76	20	0.4	19.6	4.9	2.1	
	24-hr	Max						12.46	12.46									
		6th high						7.37	7.37	150	17	133	30	4.1	25.9	19.4	37.9	
PM <sub>2.5</sub>	Annual	Max	0.45	0.46	0.48	0.44	0.54		0.54				17	0.5	16.5	4.1	13.1	
	24-hr	Max						7.96	7.96									
		98th Percentile						4.30	4.30	35	13	22	9	2.5	6.5	4.9	87.8	
	Annual	Max	0.45	0.46	0.48	0.44	0.54		0.54	12	5	7	4	0.5	3.5	0.9	61.4	

Other source impacts include Algonquin Compressor Station, Ocean State Power, and RISE Compressor Station  
Modeled CREC concentrations are combined with the other modeled nearby source concentrations, regardless of time or space

Table 15. NAAQS Compliance Determination

Pollutant	Averaging Period	Rank	2010	2011	2012	2013	2014	5-year Avg	Max	Background	Total	NAAQS	% NAAQS
<b>Normal Operation (turbines, dewpoint heater)</b>													
CO	1-hr	Max	163.4	162.5	162.7	163	164		164.0				
		H2H	163.2	160.5	162.2	162.9	164		164.0	2,346.0	2,510.0	40,000	6.3
	8-hr	Max	148.1	139.3	140.7	138.2	142		148.1				
		H2H	142.3	134.6	139.7	134.3	133.4		142.3	1,495.0	1,637.3	10,000	16.4
NO <sub>2</sub>	1-hr	Max						63.5	63.5				
		98th Percentile						44.7	44.7	80.0	124.7	188	66.3
	Annual	Max	3.2	3	3.3	3.7	3.5		3.7	19.7	23.4	100	23.4
SO <sub>2</sub>	1-hr	Max						46.8	46.8				
		99th Percentile						41.0	41.0	36.0	77.0	195	39.5
	3-hr	Max	37.5	40.5	45.8	41.7	43.8		45.8				
		H2H	36.8	37.6	45.2	39.4	43.5		45.2	45.0	90.2	1,300	6.9
	24-hr	Max	24.8	22.7	24.6	26.1	22.5		26.1				
		H2H	21.3	18.6	22.7	22	21.5		22.7	21.0	43.7	365	12.0
	Annual	Max	0.35	0.25	0.34	0.43	0.35		0.4	3.69	4.1	80	5.2
PM <sub>10</sub>	24-hr	Max						12.7	12.7				
		6th high						7.5	7.5	17.0	24.5	150	16.3
PM <sub>2.5</sub>	24-hr	Max						8.2	8.2				
		98th Percentile						4.5	4.5	13.1	17.6	35	50.3
	Annual	Max	0.59	0.59	0.63	0.68	0.69		0.69	5.17	5.9	12	48.8
Lead	24-hr	Max (Toxics)						7.80E-04	0.00078	0.0	0.00078		
	Quarterly										0.00078	0.15	0.5

Modeled impacts include Algonquin Compressor Station, Ocean State Power and RISE Compressor Station, with the exception of lead.

**Table 18. Startup/Shutdown NAAQS Compliance Summary**

Pollutant	Averaging Period	Rank	2010	2011	2012	2013	2014	5-Yr Avg	Max	Background	Total	NAAQS	% NAAQS
CO	1-hr	Max	358.7	348.4	459.5	418.6	424.8		459.5				
		H2H	332.9	335.2	380.8	400.2	403.8		403.8	2,346	2,750	40,000	6.9
	8-hr	Max	148.5	162.8	141.2	164.5	137.4		164.5				
		H2H	142.9	147.0	140.1	149.2	133.8		149.2	1,495	1,644	10,000	16.4
NO <sub>2</sub>	1-hr	Max						63.5	63.5				
		98th Percentile						44.7	44.7	80	125	188	66.3
PM <sub>10</sub>	24-hr	Max						13.1	13.1				
		6th high						8.0	8.0	17	25	150	16.7
PM <sub>2.5</sub>	24-hr	Max						8.8	8.8				
		98th Percentile						4.9	4.9	13	18	35	51.4

Modeled impacts include Algonquin Compressor Station, Ocean State Power and RISE Compressor Station.



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Drawing Date: 2016/10/11

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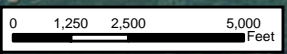
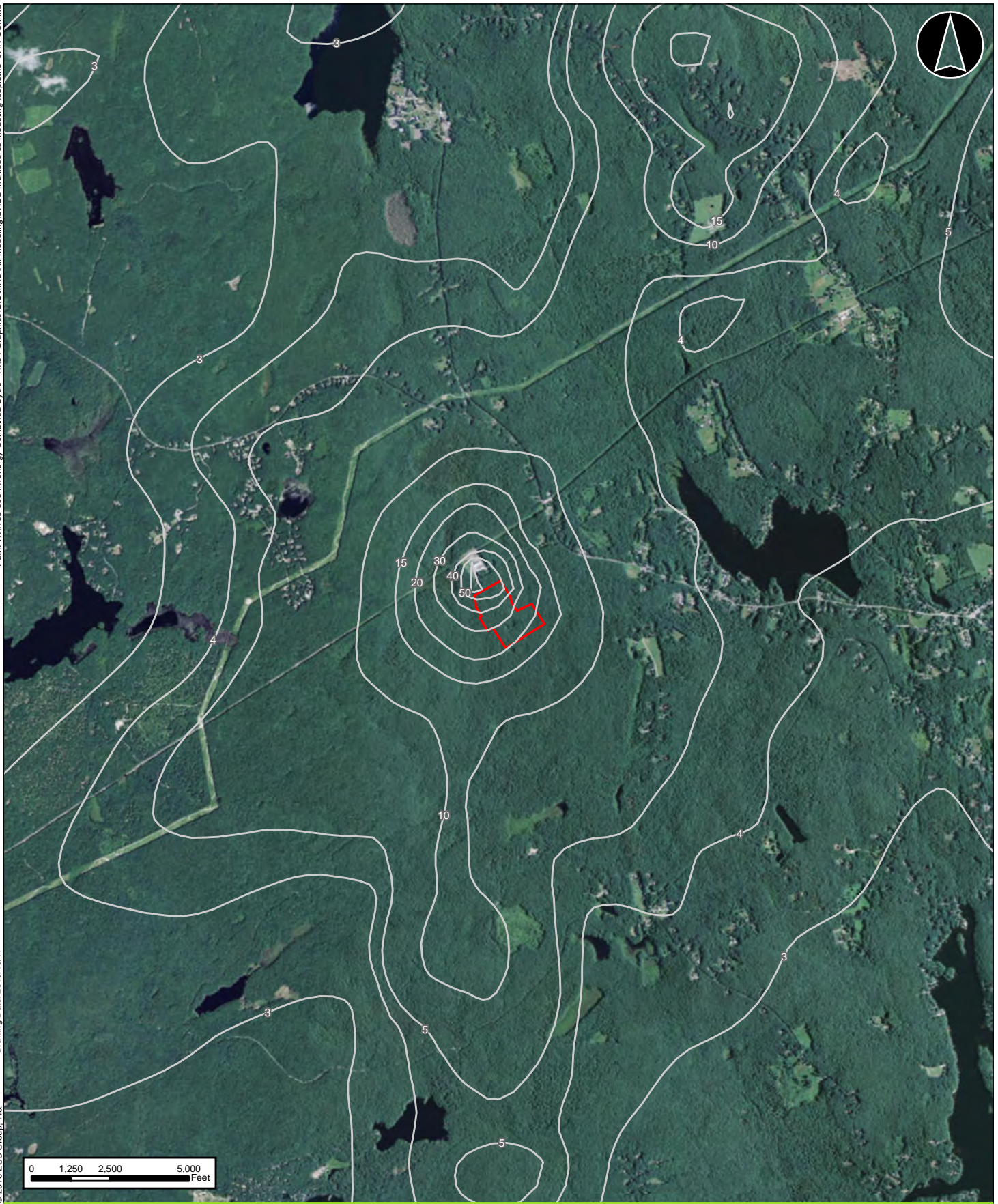
**Clear River Energy Center**  
Burrillville, Rhode Island

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**1-Hour CO**

1 inch = 4,167 feet

- Source: 1) ESRI, Imagery, 2016  
2) HDR, Site Layout, 2016  
3) ESS, Criteria Pollutant Concentrations, 2016

**Legend**  
— CREC Fenceline



**Clear River Energy Center**  
Burrillville, Rhode Island

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**8-Hour CO**

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Legend**  
 — CREC Fenceline



**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**1-Hour NO<sub>2</sub>**

**Legend**  
 — CREC Fenceline

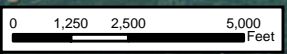
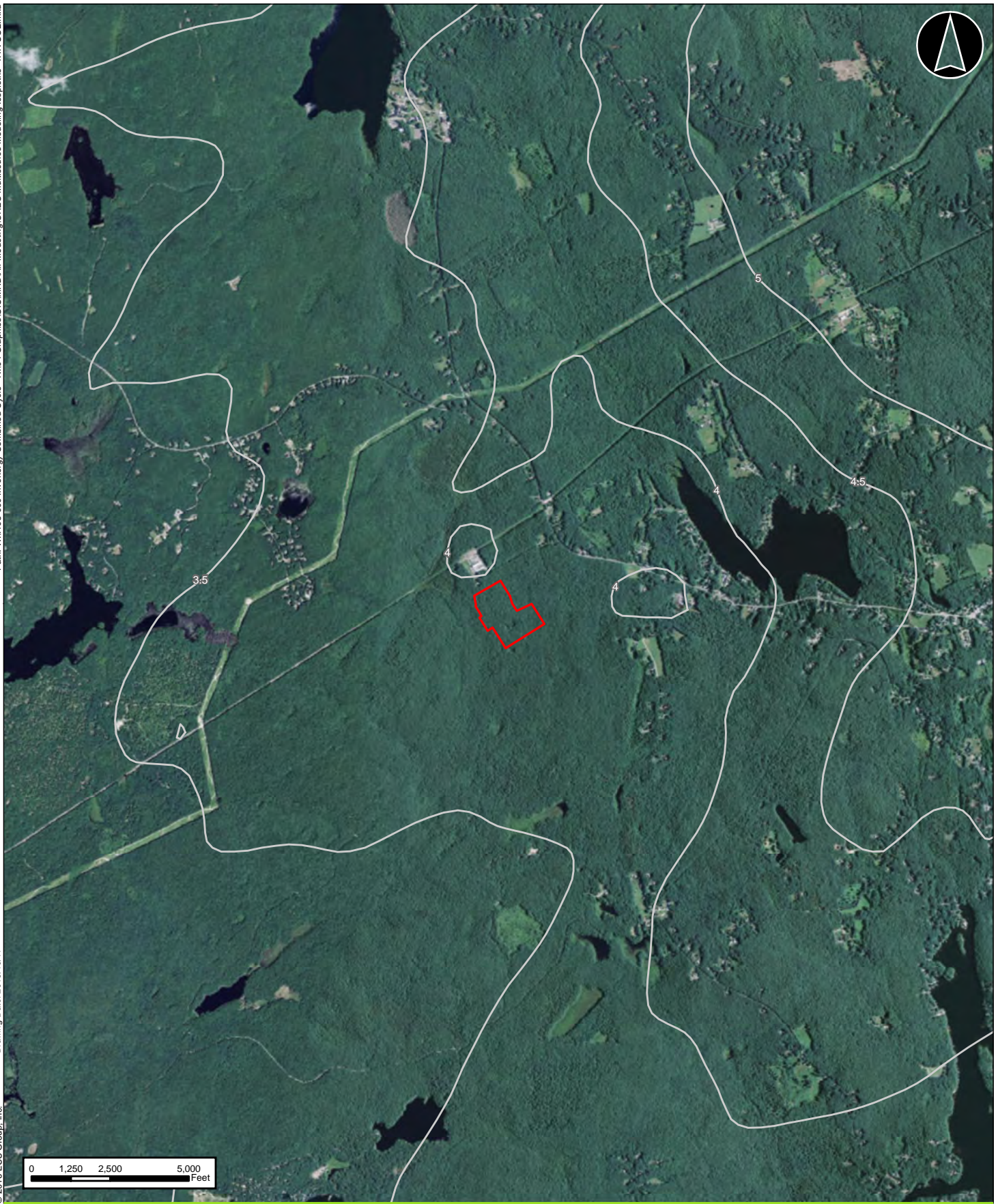


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Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**Annual NO<sub>2</sub>**

**Legend**  
 — CREC Fence Line



**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**1-Hour SO<sub>2</sub>**

**Legend**  
 — CREC Fenceline



**Clear River Energy Center**  
Burrillville, Rhode Island

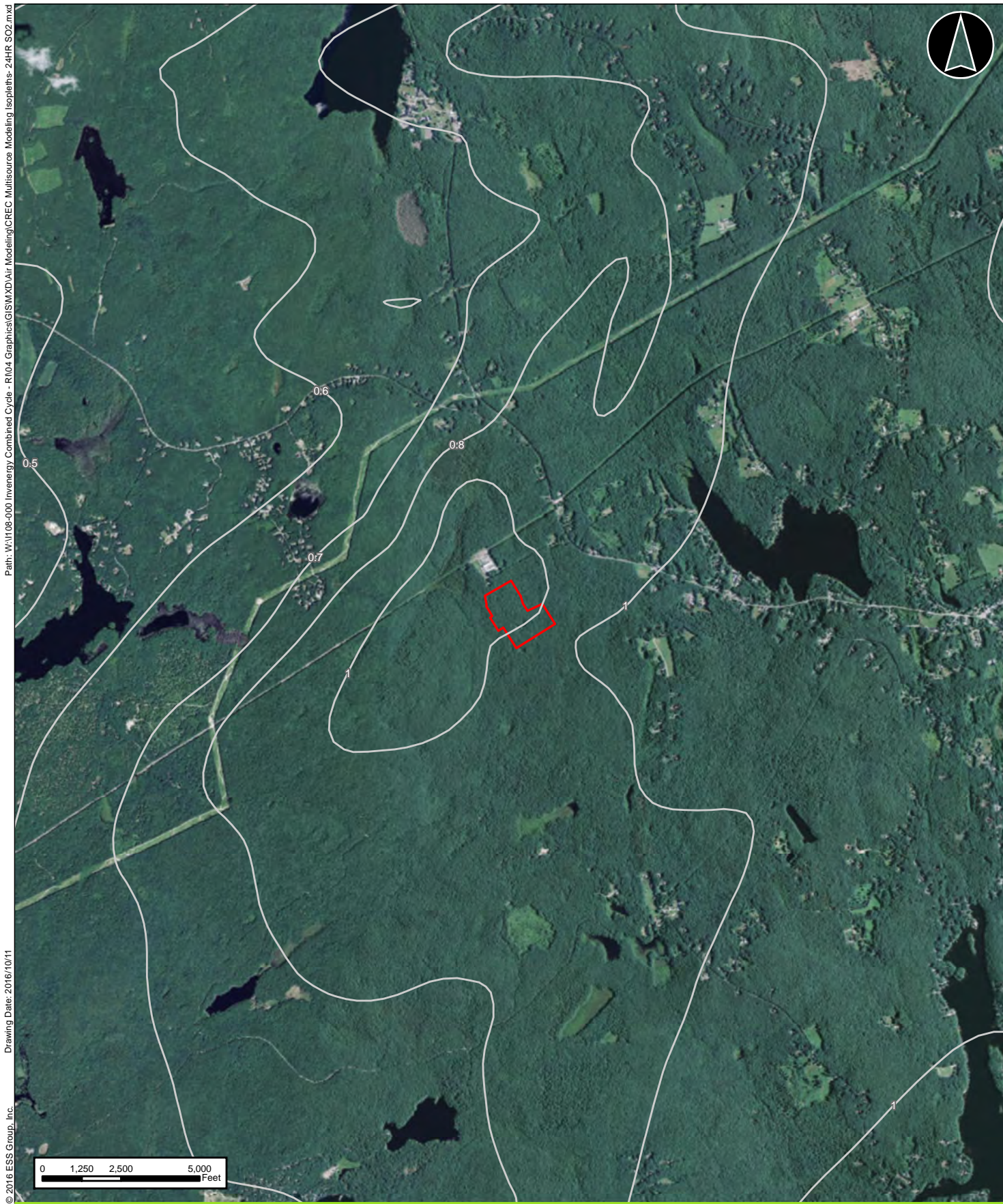
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**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**3-Hour SO<sub>2</sub>**

**Legend**

— CREC Fence Line



**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**24-Hour  $\text{SO}_2$**

**Legend**  
 — CREC Fenceline



**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**Annual SO<sub>2</sub>**

**Legend**  
 — CREC Fenceline

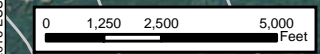




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Drawing Date: 2016/10/11

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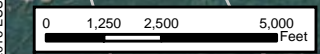


**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**24-Hour  $\text{PM}_{10}$**

**Legend**  
 — CREC Fenceline

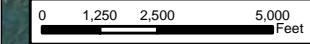
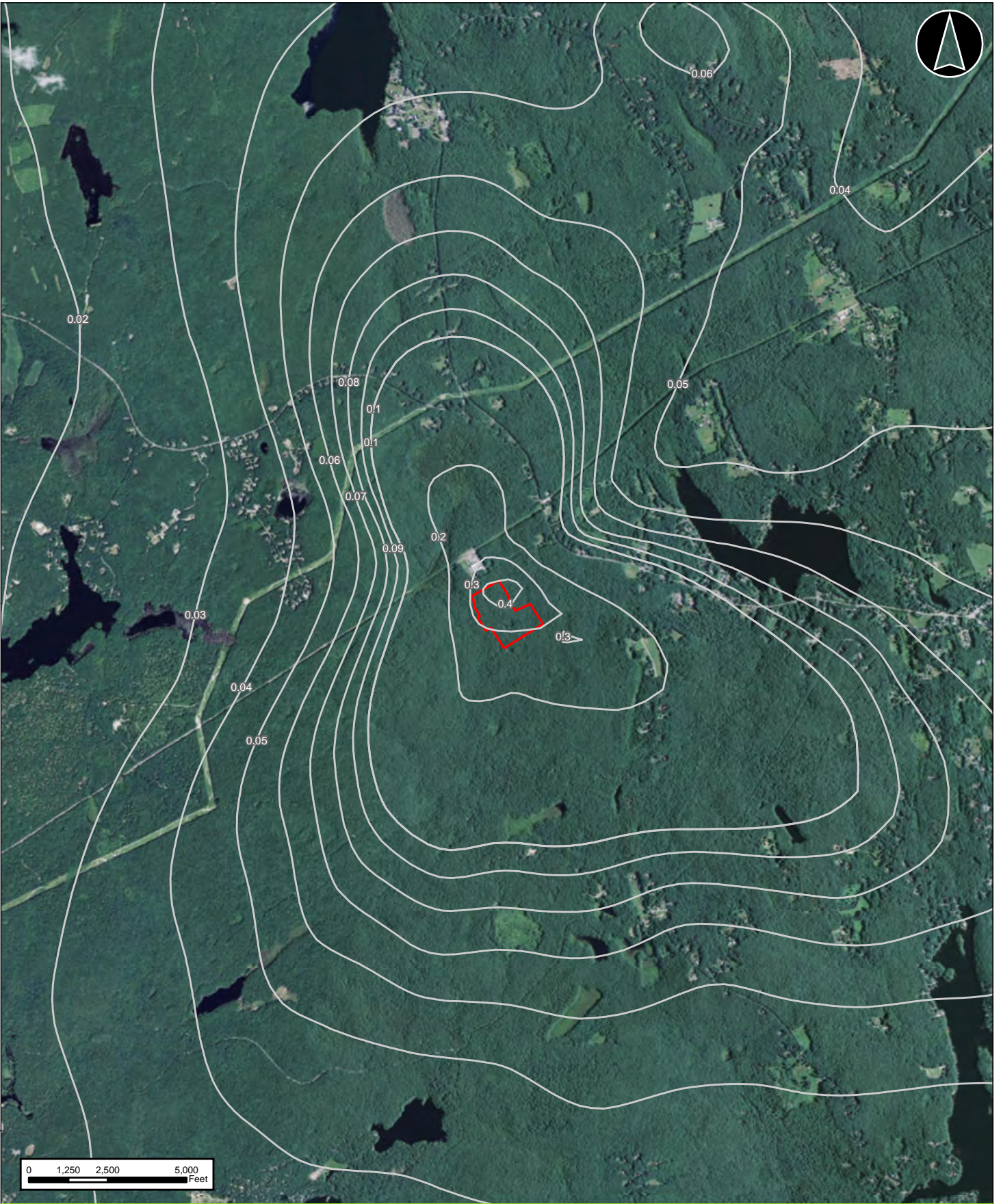


**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet  
 Source: 1) ESRI, Imagery, 2016  
 2) HDR, Site Layout, 2016  
 3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isoleths ( $\mu\text{g}/\text{m}^3$ )**  
**24-Hour  $\text{PM}_{2.5}$**

**Legend**  
 — CREC Fenceline



**Clear River Energy Center**  
Burrillville, Rhode Island

1 inch = 4,167 feet

- Source: 1) ESRI, Imagery, 2016  
2) HDR, Site Layout, 2016  
3) ESS, Criteria Pollutant Concentrations, 2016

**Multisource Modeling NAAQS Isopleths ( $\mu\text{g}/\text{m}^3$ )**  
**Annual  $\text{PM}_{2.5}$**

**Legend**

- CREC Fenceline