

## Exhibit A: Public Comments

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**Republic Wind**

Seneca County, Ohio

**Public Information Meeting for Transmission Line**

May 29, 2019  
5:00 - 7:00 p.m.  
**Green Springs VFW**  
5912 E County Rd 44  
Green Springs  
OH 44836

Name Wyatt Schubach

Township, County of Residence Adams, Seneca

**Comments**

I think we need the wind turbines for a lot of reasons, too many to mention here. Mostly for \$ to the County for schools & roads. Also free power for electricity.

Thank you for your thoughts and insights regarding this project.



**Republic Wind**

Seneca County, Ohio

**Public Information Meeting for Transmission Line**

May 29, 2019  
5:00 - 7:00 p.m.  
**Green Springs VFW**  
5912 E County Rd 44  
Green Springs  
OH 44836

Name Chris Papa

Township, County of Residence Richmond, Huron

**Comments**

I do not feel there is a need for wind energy (more electricity from wind) in Ohio

Thank you for your thoughts and insights regarding this project.



## Republic Wind

Seneca County, Ohio

### Public Information Meeting for Transmission Line

May 29, 2019

5:00 - 7:00 p.m.

Green Springs VFW

5912 E County Rd 44

Green Springs

OH 44836

Name

Bret Cleveland

Township, County of Residence

Adams

Comments

I believe another form of Energy needs to happen in Ohio + Seneca Co.

Thank you for your thoughts and insights regarding this project.

## Exhibit B: EMF Study

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# **Republic Wind**

Electric and Magnetic Field Study  
398410-E-SP-TRN-0001-RF

June 24, 2019



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# **Republic Wind**

Electric and Magnetic Field Study  
398410-E-SP-TRN-0001-RF

June 24, 2019



# Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	09/14/18	B. Carroll	M. Bauer	C. Ferrell	Issue for Review
B	03/27/19	T. Le	M. Bauer	S. Akers	Issue for Review
C	04/10/19	T. Le	M. Bauer	S. Akers	Issue for Review
D	04/25/19	T. Le	M. Bauer	S. Akers	Issue for Review
E	05/29/19	T. Le	M. Bauer	S. Akers	Issue for Review
F	06/24/19	J. Struble	M. Bauer	S. Akers	Issue for Review

**Document reference:** 398410-E-SP-TRN-0001-RF

## Information class: Standard

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# Executive Summary

The Republic Wind Farm is a proposed utility-scale wind energy facility located in Seneca County, Ohio. The project, which is being developed by Apex Clean Energy, is proposed to interconnect into a 138 kV transmission line to deliver power to the Ohio State transmission system. Mott MacDonald (MM) is responsible for supporting the permitting process.

This report presents the Electric and Magnetic Field (EMF) calculations for the overhead transmission line conducted using PLS-CADD. The following cable configurations and alternatives were studied:

- 138 kV Single Circuit Overhead Transmission Span
- 138 kV Single Circuit Overhead H-Frame Transmission Span
- 138 kV Single Circuit Overhead Transmission between structure 2 and 3
- 138 kV Alternative Transmission Routes

The EMF Study of the lines and various configurations, as stated above, resulted in the electric and magnetic field levels as shown in the table below.

**Table: EMF Calculation Results**

Description	Magnetic Field Strength Calculated at Edge of Right-of-Way	Electric Field Strength Calculated at Edge of Right-of-Way
138 kV OH Transmission	35.085 mG @ ±50 ft.	0.307 kV/m @ ±50 ft.
138 kV OH H-Frame Transmission	55.489 mG @ ±50 ft.	0.646 kV/m @ ±50 ft.
138 kV OH STR 2 – STR 3 (94' to Western structure)	10.335 mG @ ±94 ft.	0.082 kV/m @ ±94 ft.
138 kV OH STR 2 – STR 3 (100' to Eastern structure)	9.796 mG @ ±100 ft.	0.091 kV/m @ ±100 ft.

# 1 Design Criteria

The following data points were used as inputs to PLS CADD for calculating the electric and magnetic fields for the Republic Wind Project:

- The Ohio Administrative Code for electric power transmission facilities was consulted for this study, 4906-5-07(A)(2).
- The right-of-way for the overhead cables is assumed to be 50 feet from centerline of the support structure which is largely within the substation fences.
- The 138 kV OH cables were set to carry 200 MW.
- Each calculation was set to calculate a value at 3.28 feet above the ground as this is equivalent to the 1-meter requirement set forth by the Ohio standard 4906-5-07(A)(2)(a).
- The overhead cables were studied based on the lowest sag tangent point seen in the project. The configuration was based on the typical single circuit tangent structure drawings for the project.
- OccupiedStructures\_REP\_20180426 file to be used in evaluation of all occupied structures in reference to centerline.

## 2 Overhead Cable Results

The Electric and Magnetic Field levels for the overhead cables were calculated at a height of 1-meter above grade as described in the Design Criteria, above. The entire overhead system consists of monopole and H-frame construction. The Electric and Magnetic Field levels shown in the Figures are representative of the overhead lines being fully loaded (i.e. the facility generating at maximum output). This is the single worst case for an isolated generation facility and satisfies the Winter Normal, Emergency, and Normal Maximum loadings as described in Ohio Code 4906-5-07(A)(2)(a)(i), (ii) and (iii).

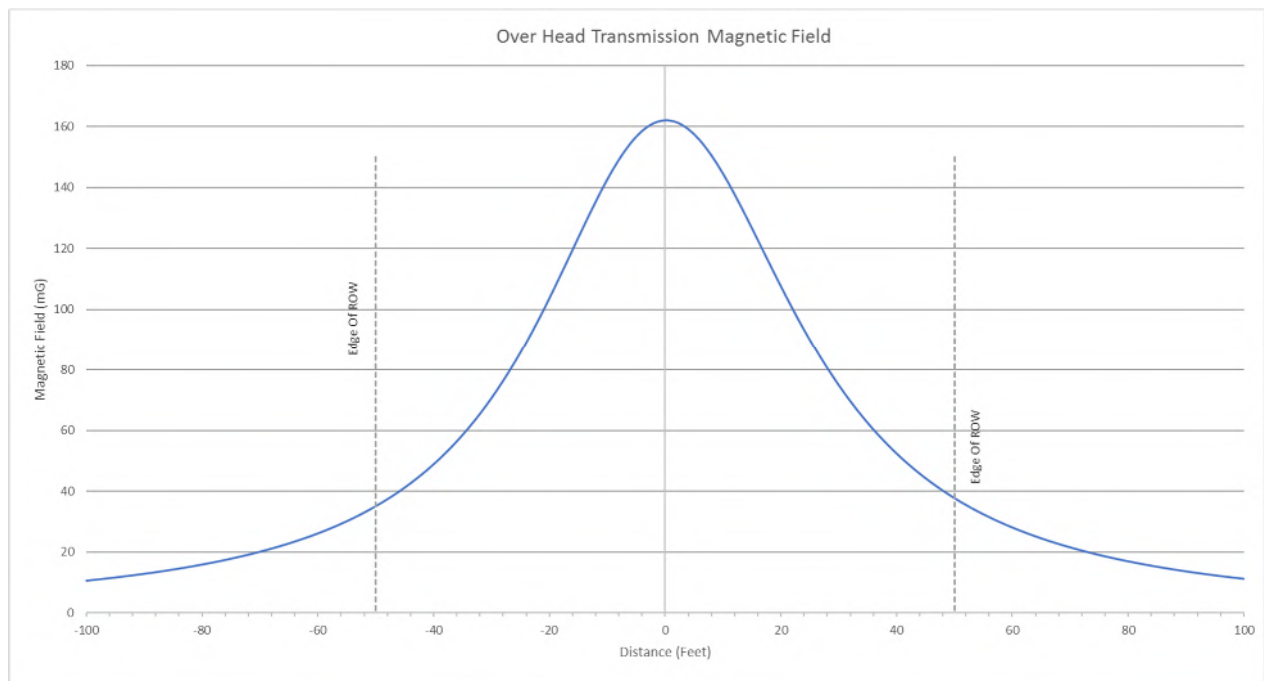
Refer to Appendix A for the typical overhead structure framing and plan & profile drawings.

### 2.1 138 kV Overhead Transmission Single Circuit Magnetic Field Levels

**Table 1: 138 kV Overhead Transmission Single Circuit Magnetic Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH Line	162.138 mG	35.085 mG @ ±50 ft.

**Figure 1: Magnetic Field Calculation**

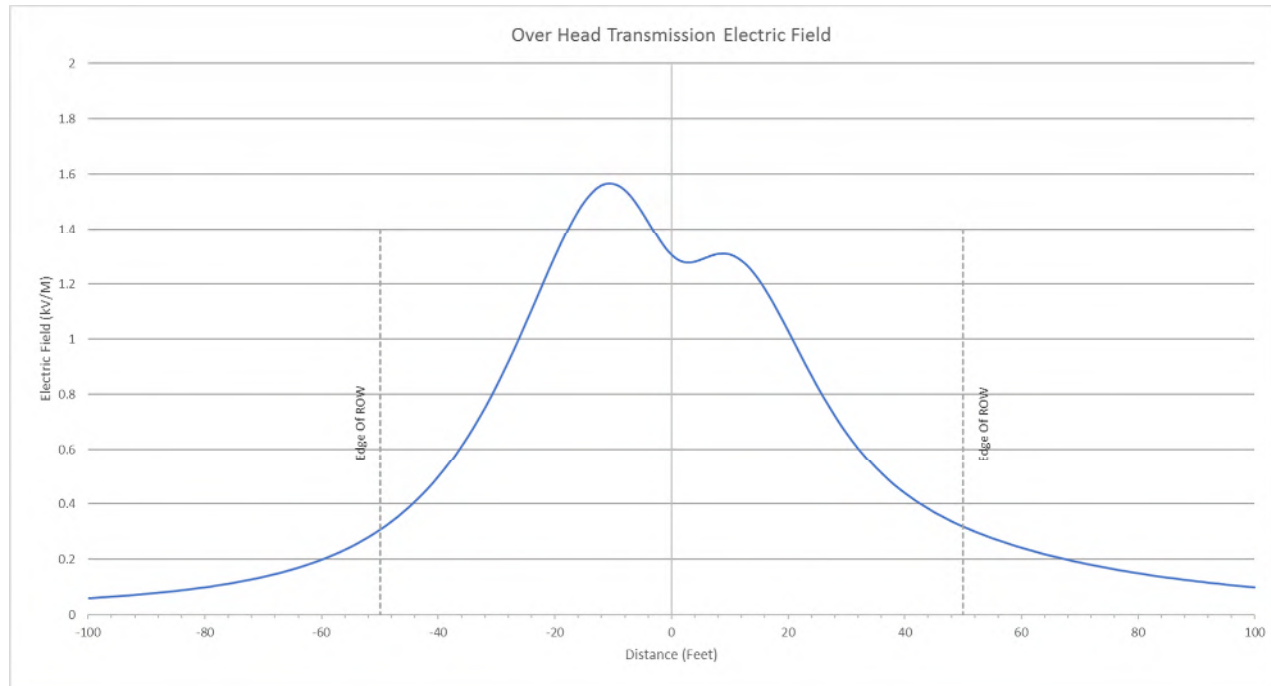


## 2.2 138 kV Overhead Transmission Single Circuit Electric Field Levels

**Table 2: 138 kV Overhead Transmission Single Circuit Electric Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH Line	1.305 kV/m	0.307 kV/m @ ±50 ft.

**Figure 2: Electric Field Calculation**

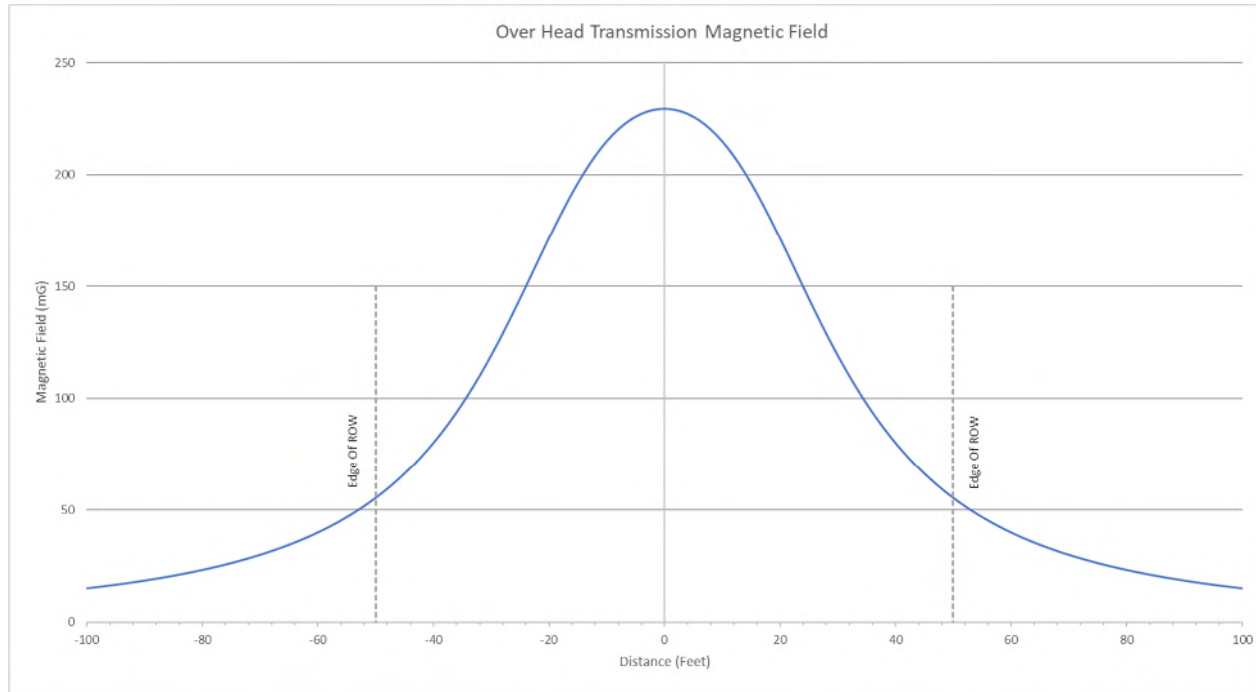


## 2.3 138 kV Overhead Transmission H-Frame Single Circuit Magnetic Field Levels

**Table 3: 138 kV Overhead Transmission H-Frame Single Circuit Magnetic Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH H-Frame Line	229.386 mG	55.489 mG @ $\pm 50$ ft.

**Figure 3: Magnetic Field Calculation**

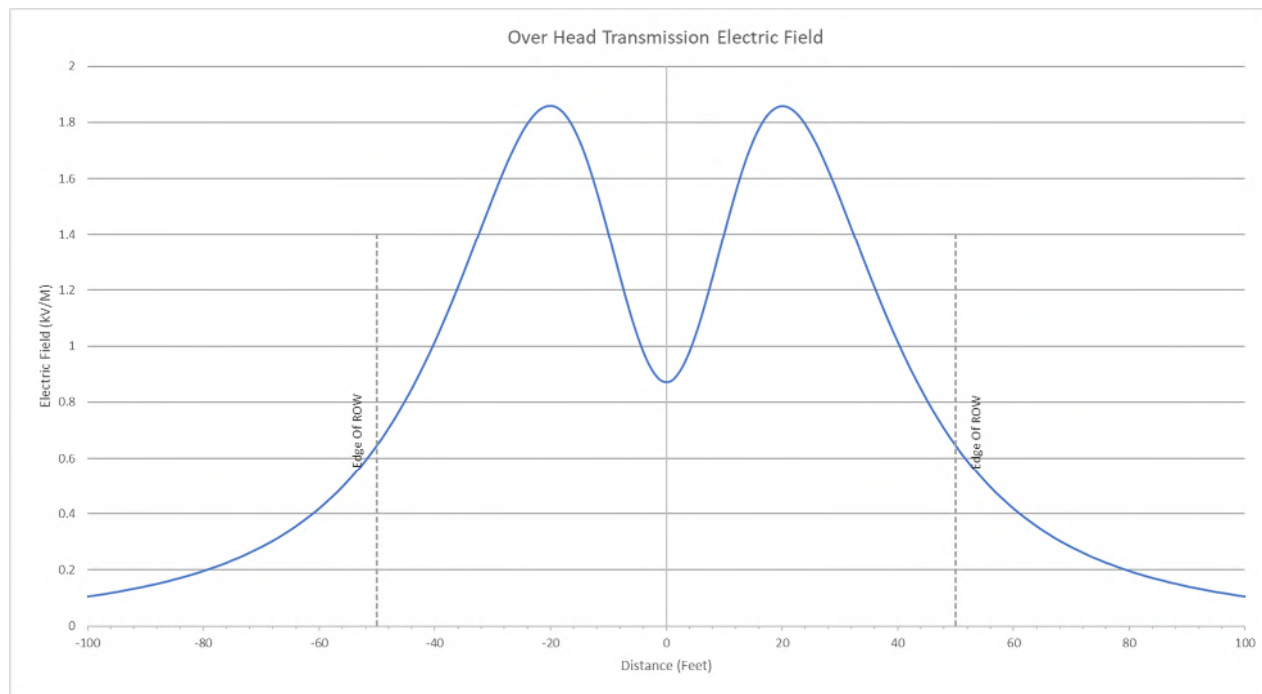


## 2.4 138 kV Overhead Transmission H-Frame Single Circuit Electric Field Levels

**Table 4: 138 kV Overhead Transmission H-Frame Single Circuit Electric Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH H-Frame Line	0.872 kV/m	0.646 kV/m @ ±50 ft.

**Figure 4: Electric Field Calculation**



The following span was studied to adhere to the Ohio Administrative code with an occupied structure being within 100' of an electrical facility. This is the only location on the Primary Alignment where a structure is within 100' of the facility so this case is analyzed for worst case explicitly. The location occurs at station 852' between structures 2 and 3 as seen on the Plan & Profile drawing in Appendix A. The Western structure is approximately 94 feet from the transmission line centerline. Also, the Eastern structure is approximately 100 feet from the transmission line centerline. If alternative alignment B was to be pursued, it would follow this alignment also, which would result in the same EMF values.

## 2.5 138 kV Overhead Transmission between (STR 2 – STR 3) Magnetic Field Levels

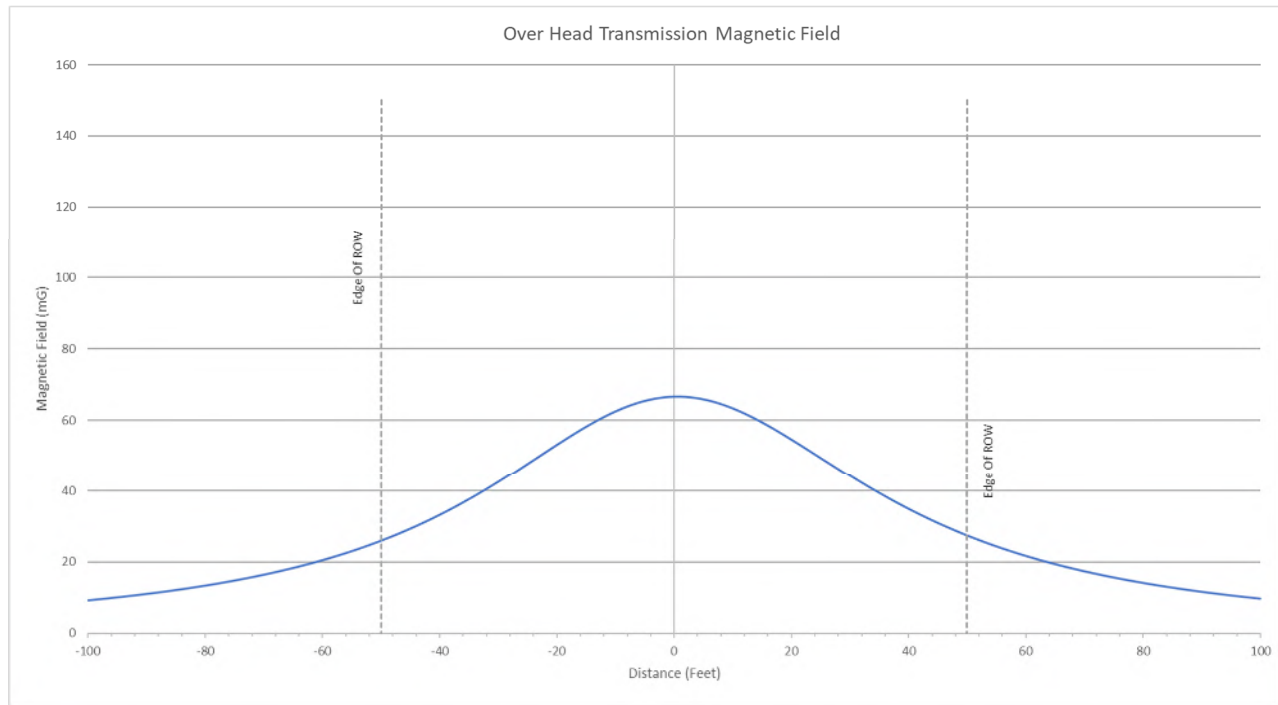
**Figure 5: 138 kV Overhead Transmission between (STR 2 – STR 3)**



**Table 5: 138 kV Overhead Transmission between (STR 2 – STR 3) Magnetic Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH STR 2 – STR 3 (94' to Western structure)	66.614 mG	10.335 mG @ ±94 ft.
138 kV OH STR 2 – STR 3 (100' to Eastern structure)	66.614 mG	9.796 mG @ ±100 ft.

**Figure 6: Magnetic Field Calculation**

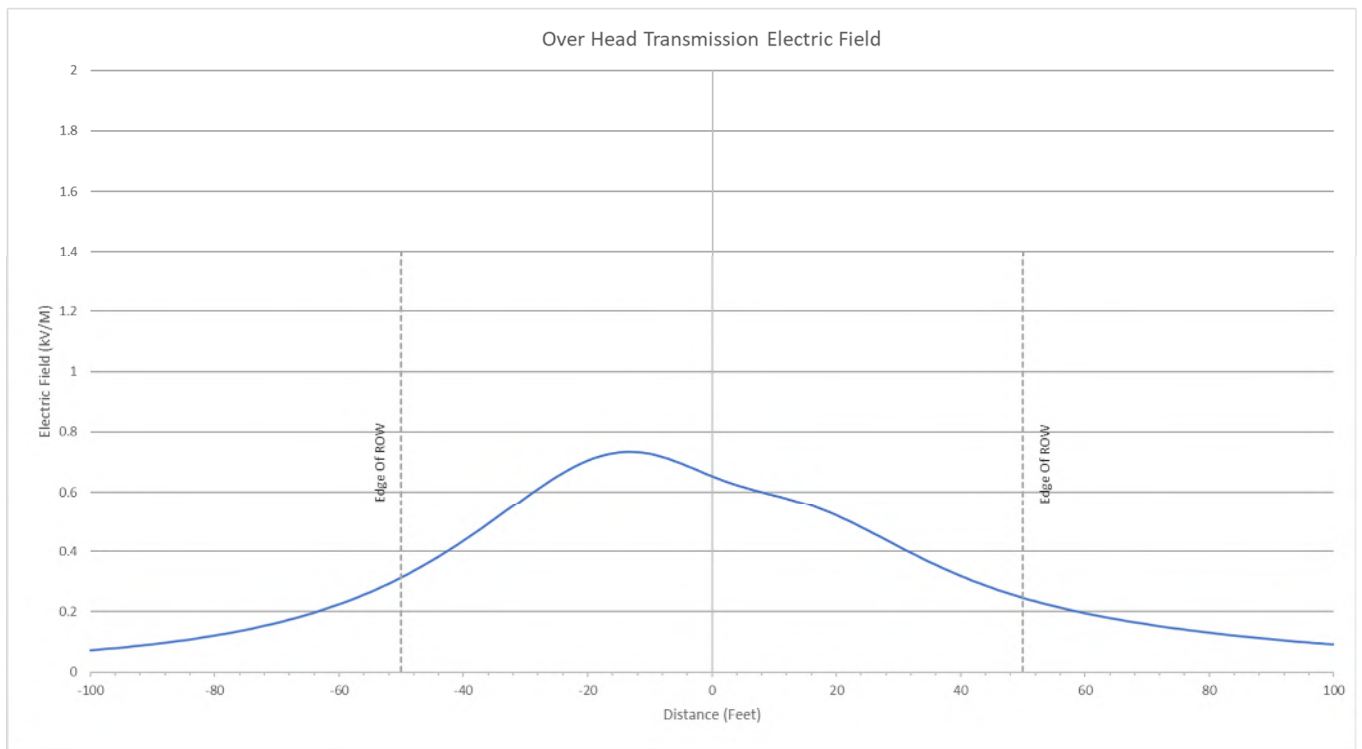


## 2.6 138 kV Overhead Transmission between (STR 2 – STR 3) Electric Field Levels

**Table 6: 138 kV Overhead Transmission between (STR 2 – STR 3) Electric Field Results**

Description	Field Strength Calculated at Centerline	Field Strength Calculated at Edge of Right-of-Way
138 kV OH STR 2 – STR 3 (94' to Western structure)	0.653 kV/m	0.082 kV/m @ ±94 ft.
138 kV OH STR 2 – STR 3 (100' to Eastern structure)	0.653 kV/m	0.091 kV/m @ ±100 ft.

**Figure 7: Electric Field Calculation**



### 3 Alternative Routes Evaluation

Alternative routes have also been developed in addition to the primary route. These routes are to serve as backups for the primary route but, to this date, no design work has been done on them. The typical structure configuration and design will be the same as the primary so the same worst-case values described in section 2 also apply in here.

Refer to Table 1-4 – “EMF Calculation Results” for the worst-case EMF values.

Refer to Appendix A for the typical overhead structure framing and plan & profile drawings.

The alternative routes considered were branches off and back onto the primary route. No additional structures within 100' were found.

## 4 Conclusion

The EMF Study concludes that all electric and magnetic field levels for the overhead cables are as stated below.

**Table 13: EMF Calculation Results**

Description	Magnetic Field Strength Calculated at Edge of Right-of-Way	Electric Field Strength Calculated at Edge of Right-of-Way
138 kV OH Transmission	35.085 mG @ ±50 ft.	0.307 kV/m @ ±50 ft.
138 kV OH H-Frame Transmission	55.489 mG @ ±50 ft.	0.646 kV/m @ ±50 ft.
138 kV OH STR 2 – STR 3 (94' to Western structure)	10.335 mG @ ±94 ft.	0.082 kV/m @ ±94 ft.
138 kV OH STR 2 – STR 3 (100' to Eastern structure)	9.796 mG @ ±100 ft.	0.091 kV/m @ ±100 ft.

## 5 References

No.	Type	Description
1.	Code	State of Ohio Administrative Code 4906-5-07(A)(2)

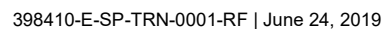
# Appendices

## A. Overhead Drawings

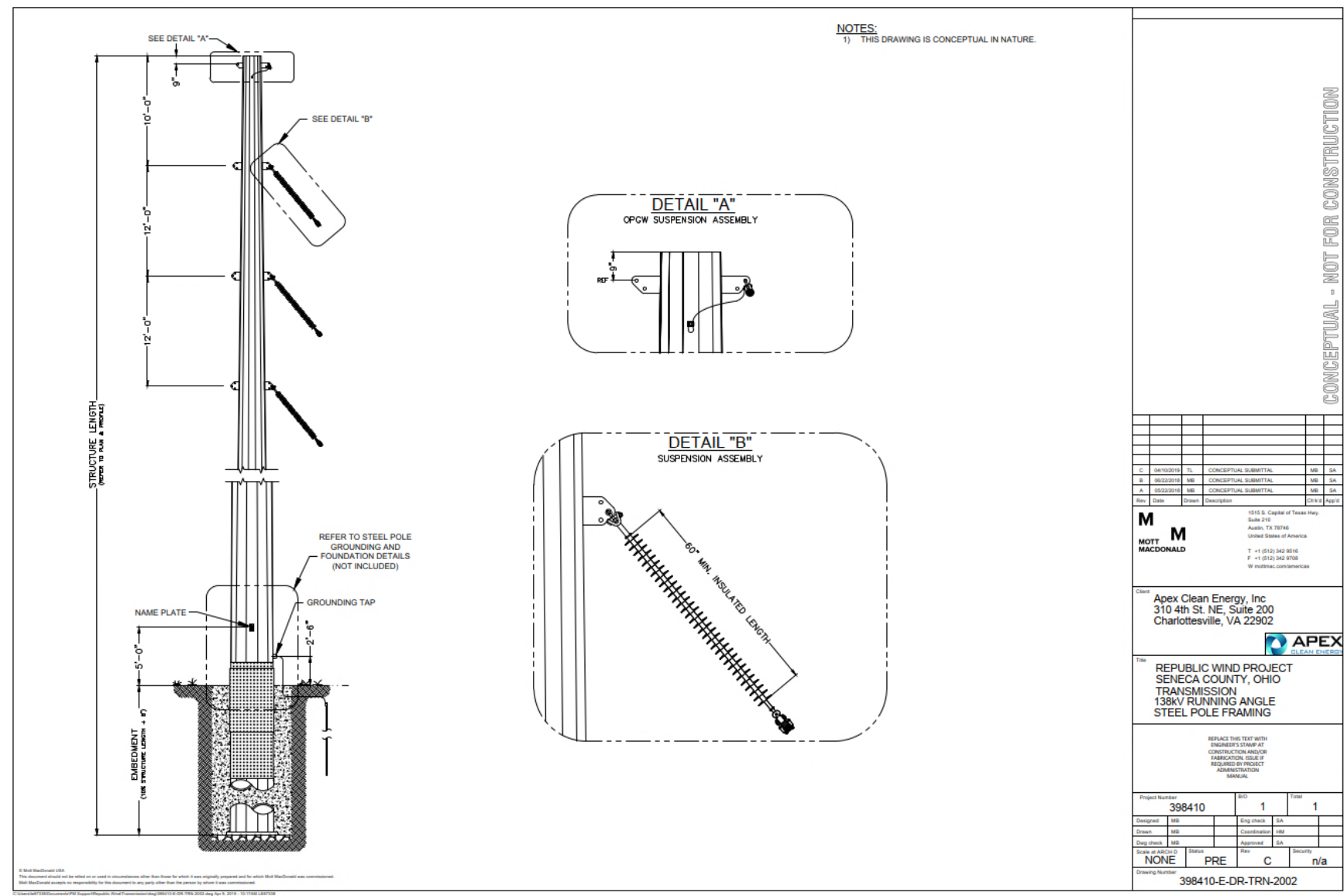
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## A. Overhead Drawings

## A.1 398410-E-DR-TRN-2001



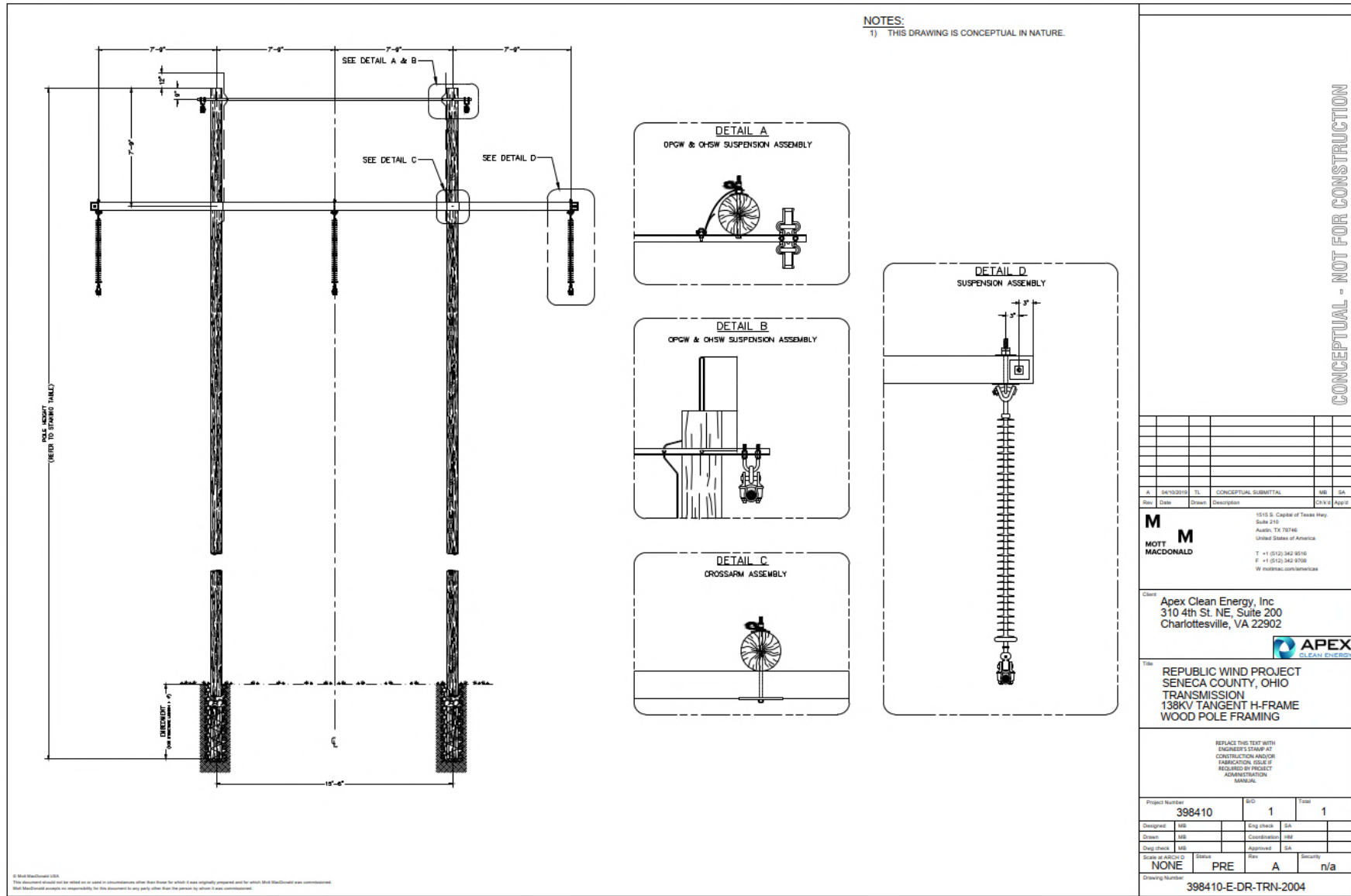
A.2 398410-E-DR-TRN-2002 138 kV Transmission Single Circuit Running Angle Drawing



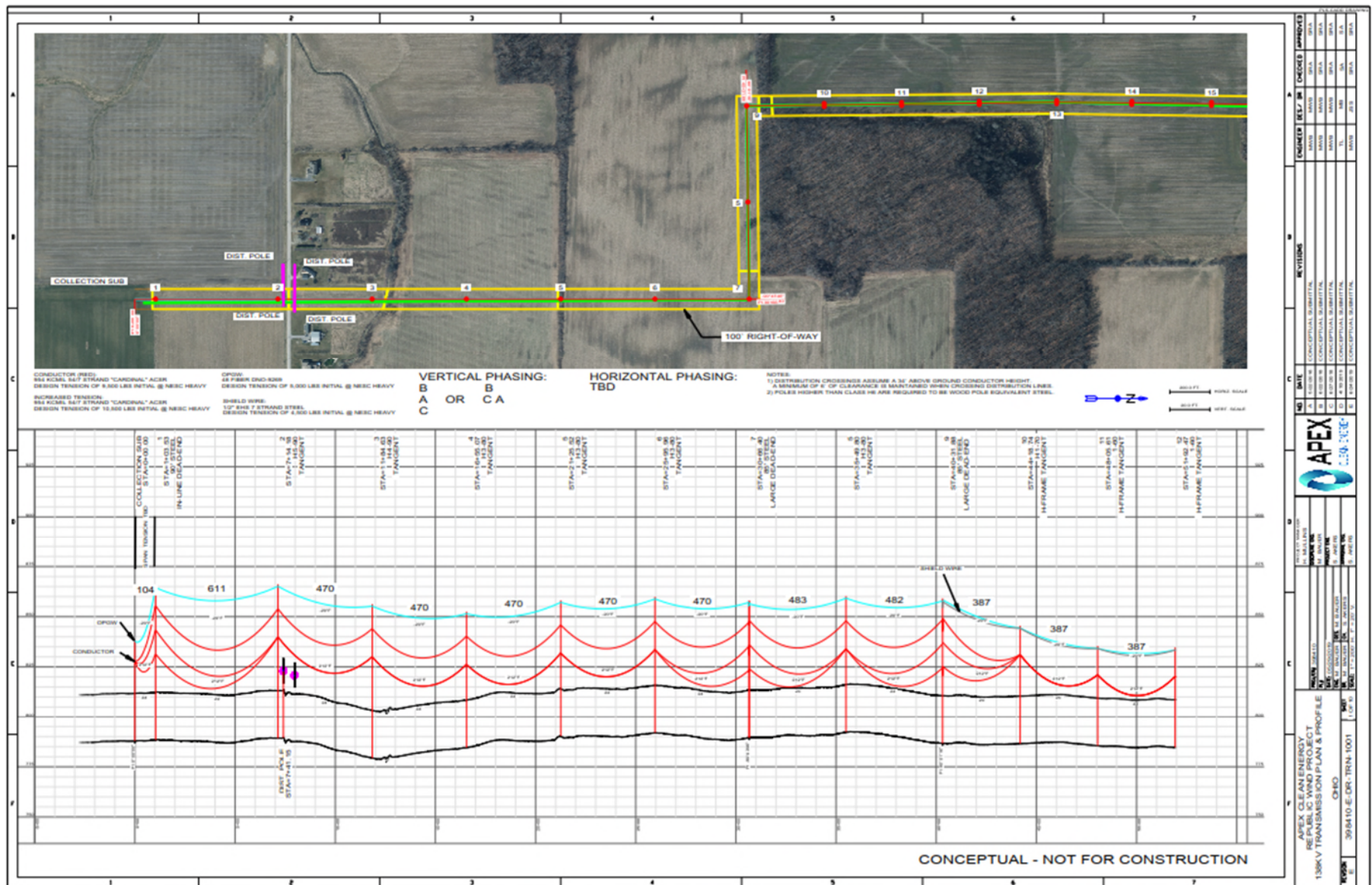
## 398410-E-SP-TRN-0001-RF | June 24, 2019

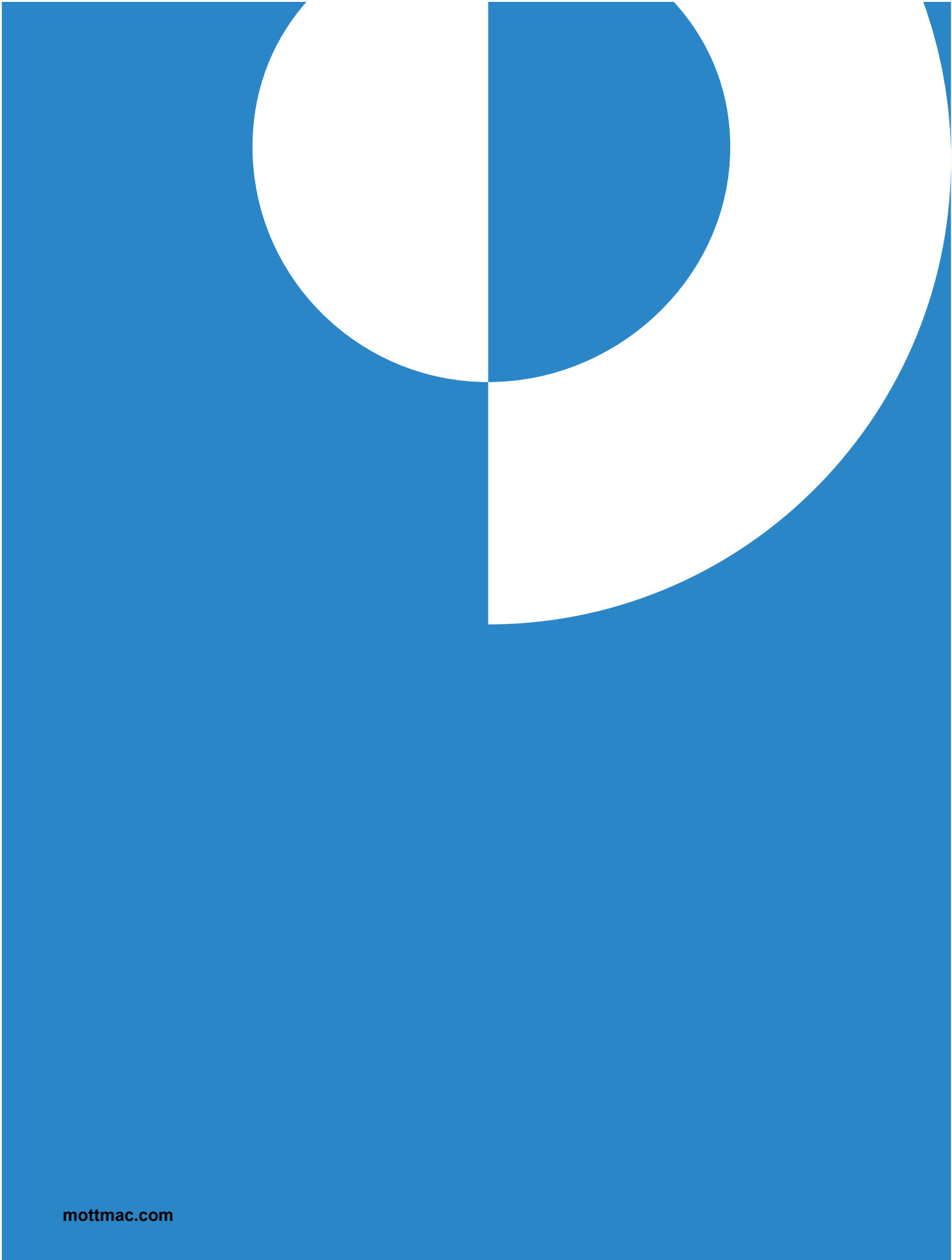


A.4 398410-E-DR-TRN-2004 138 kV Transmission Single Circuit H-Frame Tangent Drawing



## A.5 398410-E-DR-TRN-1001 138 kV Transmission Plan & Profile





## Exhibit C: Off-Air Television Analysis

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# Wind Power GeoPlanner™

## Off-Air TV Analysis

Republic Transmission Lines



Prepared on Behalf of  
Apex Clean Energy, Inc.

June 12, 2019





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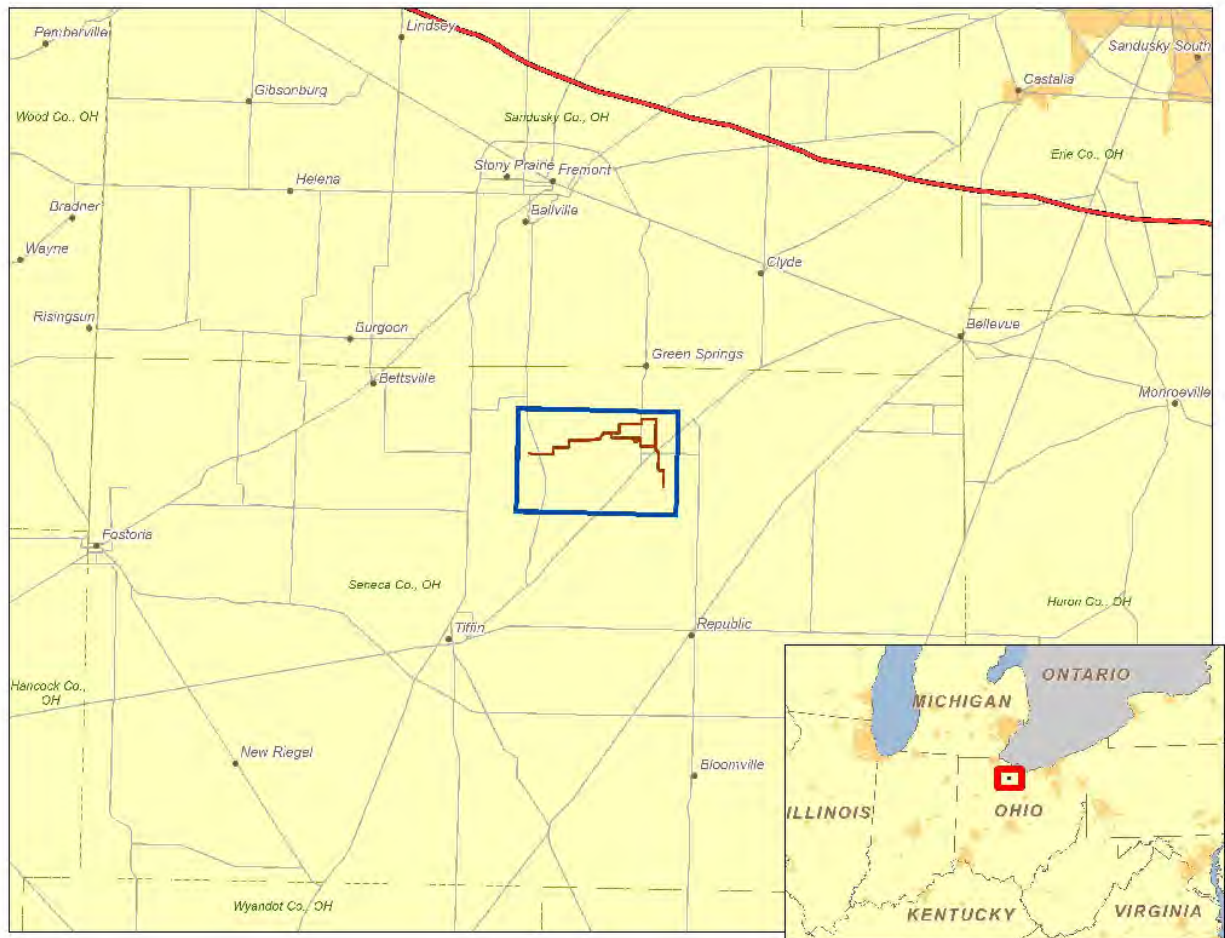
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<b>2. Summary of Results</b>	<b>- 1 -</b>
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<b>5. Contact</b>	<b>- 9 -</b>

## 1. Introduction

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Comsearch identified those off-air stations whose service could potentially be affected by the proposed Republic Transmission Lines project in Seneca County, Ohio. Comsearch then examined the coverage of the stations and the communities in the area that could potentially have degraded television reception due to the location of the transmission line.

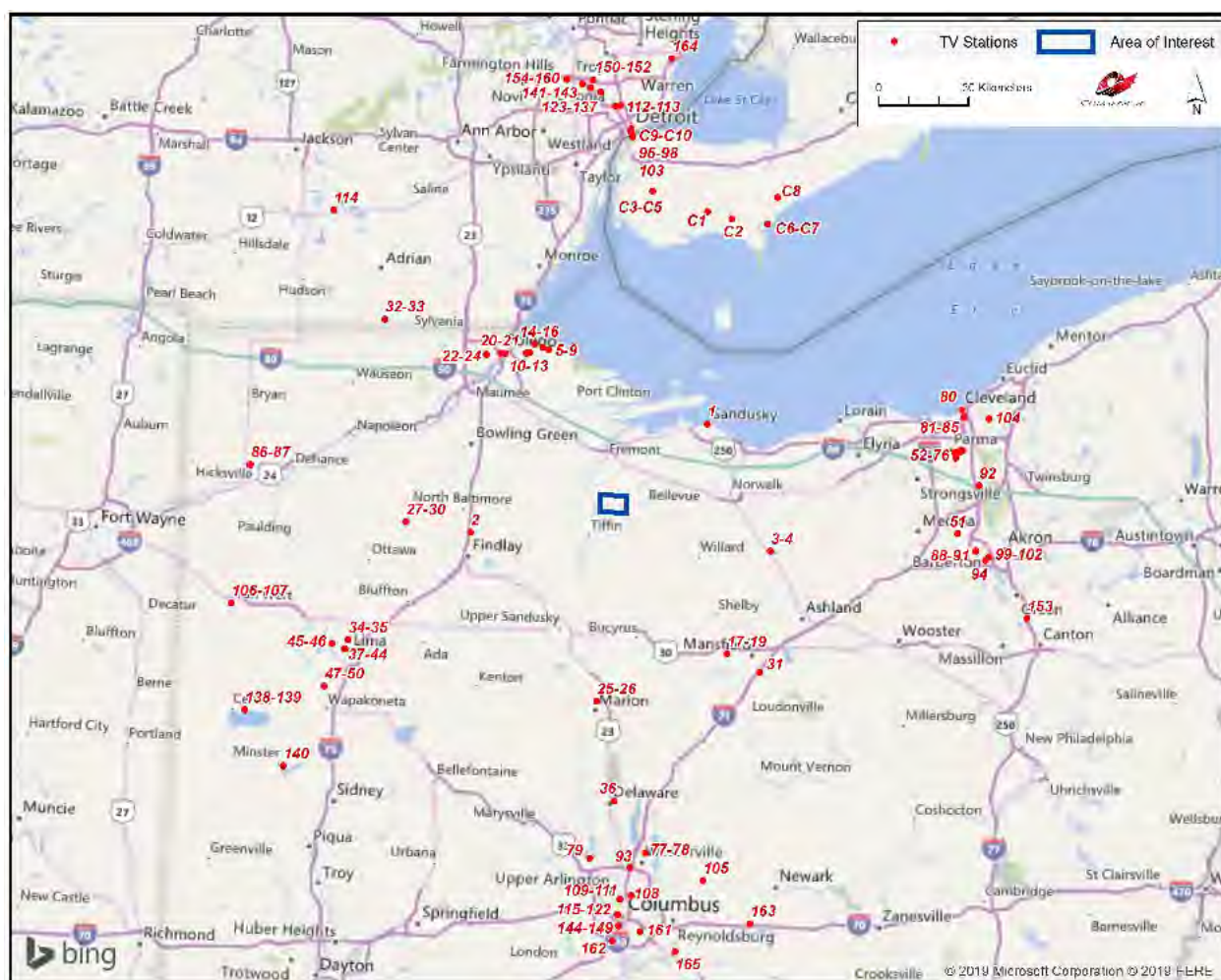
## 2. Summary of Results

The proposed transmission line project area and local communities are depicted in Figure 1, below.



*Figure 1: Transmission Line Project Area and Local Communities*

To begin the analysis, Comsearch compiled all off-air television stations<sup>1</sup> within 150 kilometers of the transmission line. TV stations at a distance of 150 kilometers or less are the most likely to provide off-air coverage to the project area and neighboring communities. These stations are listed in Tables 1 and 2, below, and a plot depicting their locations is provided in Figure 2. There are a total of 175 database records for stations within approximately 150 kilometers of the transmission line (165 in the United States and 10 in Canada). Of these stations, only eighty are currently licensed and operating, twenty-six of which are low-power stations or translators. Translator stations are low-power stations that receive signals from distant broadcasters and retransmit the signal to a local audience. These stations serve local audiences and have limited range, which is a function of their transmit power and the height of their transmit antenna.



*Figure 2: Plot of Off-Air TV Stations within 150 Kilometers of Transmission Line*

<sup>1</sup> Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the TV station's FCC license and governed by Comsearch's data license notification and agreement located at [http://www.comsearch.com/files/data\\_license.pdf](http://www.comsearch.com/files/data_license.pdf).

ID	Call Sign	Status	Service <sup>2</sup>	Channel	Transmit ERP <sup>3</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
1	W41AP	LIC	TX	41	10.0	41.455306	-82.713500	37.31
2	WFND-LD	LIC	LD	19	15.0	41.111417	-83.647972	45.00
3	WGGN-TV	CP	DT	3	10.0	41.075083	-82.451111	50.97
4	WGGN-TV	LIC	DT	42	450.0	41.075083	-82.451111	50.97
5	WNWO-TV	CP MOD	DT	23	275.0	41.667500	-83.356111	54.07
6	WNWO-TV	CP	DT	23	105.0	41.667500	-83.356111	54.07
7	WNWO-TV	LIC	DT	49	105.0	41.667500	-83.356111	54.07
8	WTOL	LIC	DT	11	16.9	41.672778	-83.379722	55.34
9	WTOL	APP	DT	11	26.0	41.672778	-83.379722	55.34
10	WGTE-TV	LIC	DT	29	49.5	41.657222	-83.431944	55.60
11	WUPW	CP MOD	DT	26	65.0	41.656111	-83.444722	55.99
12	WUPW	LIC	DT	46	110.0	41.656111	-83.444722	55.99
13	WUPW	CP	DT	46	200.0	41.656111	-83.444722	55.99
14	WTVG	LIC	DT	13	16.7	41.683333	-83.413611	57.54
15	WTVG	APP	DT	13	20.1	41.683333	-83.413611	57.54
16	WNWO-TV	CP	DT	23	120.0	41.683333	-83.413611	57.54
17	WMFD-TV	LIC	DT	12	14.0	40.763889	-82.617778	59.21
18	WOHZ-CD	CP	DC	20	9.2	40.763889	-82.617778	59.21
19	WOHZ-CD	LIC	DC	41	15.0	40.763889	-82.617778	59.21
20	WMNT-CD	LIC	DC	36	15.0	41.653361	-83.530611	59.46
21	WDTJ-LP	LIC	TX	68	6.6	41.653361	-83.547972	60.29
22	WDMY-LP	CP	TX	6	2.9	41.646861	-83.604917	62.62
23	WDMY-LP	CP	LD	23	8.0	41.646861	-83.604917	62.62
24	WDMY-LP	LIC	TX	38	8.2	41.646861	-83.604917	62.62
25	WXCB-CD	CP MOD	DC	25	15.0	40.612778	-83.130000	64.19
26	WXCB-CD	LIC	DC	45	15.0	40.612778	-83.130000	64.19
27	WBGU-TV	LIC	DT	22	137.0	41.136667	-83.906667	65.84
28	WBGU-TV	LIC	DX	22	137.0	41.136667	-83.906667	65.84
29	WBGU-TV	LIC	DT	27	153.0	41.136667	-83.906667	65.84
30	WPNM-LP	CP	LD	27	15.0	41.136667	-83.906667	65.84
31	W43CZ-D	CP	LD	18	15.0	40.709222	-82.486278	70.90

<sup>2</sup> Definitions of service and status codes:

DT – Digital television broadcast station

DX – Digital auxiliary (backup) facility

TX – Translator station

LD – Low power digital television broadcast station

CA – Class A analog television broadcast station

DC – Class A digital television broadcast station

LIC – Licensed and operational station

CP – Construction permit granted

CP MOD – Modification of construction permit

APP – Application for construction permit, not yet operational

<sup>3</sup> ERP = Transmit Effective Radiated Power



**Apex Clean Energy, Inc.**  
**Wind Power GeoPlanner™**  
**Off-Air Television Report**  
**Republic Transmission Lines**

ID	Call Sign	Status	Service <sup>2</sup>	Channel	Transmit ERP <sup>3</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
32	WLMB	LIC	DT	5	10.0	41.744722	-84.018333	95.03
33	WLMB	APP	DT	5	10.0	41.744722	-84.018333	95.03
34	WLIO	CP	DT	8	40.0	40.775444	-84.120611	96.54
35	WOHL-CD	CP	DC	15	11.5	40.775444	-84.120611	96.54
36	WOCB-CD	CP	DC	22	15.0	40.313056	-83.051111	97.46
37	WLIO	LIC	DT	8	27.5	40.747556	-84.131750	98.95
38	WLIO	CP	DT	8	16.5	40.747556	-84.131750	98.95
39	WLIO	CP	DT	8	14.8	40.747556	-84.131750	98.95
40	WPNM-LP	CP	TX	25	7.5	40.747556	-84.131750	98.95
41	WOHL-CD	LIC	DC	35	9.0	40.747556	-84.131750	98.95
42	WAMS-LP	CP	TX	38	5.3	40.747556	-84.131750	98.95
43	WPNM-LP	CP	LD	45	15.0	40.747556	-84.131750	98.95
44	WAMS-LP	CP	LD	47	15.0	40.747556	-84.131750	98.95
45	WTLW	CP MOD	DT	4	10.0	40.763056	-84.183611	101.84
46	WOIW-LD	LIC	LD	17	15.0	40.763056	-84.183611	101.84
47	WPNM-LP	LIC	TX	18	7.7	40.634194	-84.208000	111.30
48	WOIW-LD	LIC	LD	23	3.0	40.634194	-84.208000	111.30
49	WAMS-LP	LIC	TX	38	15.0	40.634194	-84.208000	111.30
50	WOIW-LD	CP	LD	43	7.9	40.634194	-84.208000	111.30
51	KONV-LD	LIC	LD	43	1.0	41.134806	-81.705750	112.00
52	WOIO	APP	DT	10	20.0	41.379167	-81.719722	112.14
53	WUAB	LIC	DT	28	200.0	41.379167	-81.719722	112.14
54	WJW	LIC	DT	8	11.0	41.363333	-81.715833	112.18
55	WJW	CP	DX	31	139.0	41.363333	-81.715833	112.18
56	WEWS-TV	LIC	DT	15	1000.0	41.373889	-81.717500	112.23
57	WEWS-TV	LIC	DX	15	850.9	41.373917	-81.717333	112.24
58	WLFM-LP	LIC	TX	6	3.0	41.382778	-81.701667	113.69
59	WLFM-LP	CP	TX	6	0.0	41.382778	-81.701667	113.69
60	WLFM-LP	CP	LD	20	15.0	41.382778	-81.701667	113.69
61	WRAP-LP	CP MOD	LD	32	15.0	41.382778	-81.701667	113.69
62	WQHS-DT	LIC	DT	34	525.0	41.382778	-81.701667	113.69
63	WQHS-DT	CP MOD	DT	36	780.0	41.382778	-81.701667	113.69
64	WCDN-LD	LIC	LD	7	0.3	41.383889	-81.695278	114.24
65	W16DO-D	LIC	DC	16	10.0	41.383889	-81.695278	114.24
66	WBNX-TV	CP	DT	17	505.0	41.383889	-81.695278	114.24
67	WBNX-TV	CP	DX	17	638.0	41.383889	-81.695278	114.24
68	W16DO-D	CP MOD	DC	27	15.0	41.383889	-81.695278	114.24
69	WUAB	CP	DT	10	9.5	41.387500	-81.695000	114.32
70	WOIO	CP	DT	10	9.5	41.387500	-81.695000	114.32
71	WKYC	LIC	DT	17	868.0	41.386083	-81.689083	114.78
72	WKYC	LIC	DX	17	930.0	41.386083	-81.689083	114.78
73	WKYC	CP	DT	17	868.0	41.386083	-81.689083	114.78

ID	Call Sign	Status	Service <sup>2</sup>	Channel	Transmit ERP <sup>3</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
74	WKYC	CP MOD	DT	19	1000.0	41.386083	-81.689083	114.78
75	WVIZ	LIC	DT	26	150.0	41.386083	-81.689083	114.78
76	WVIZ	CP MOD	DT	35	280.0	41.386083	-81.689083	114.78
77	WOSU-TV	CP MOD	DT	16	1000.0	40.159167	-82.923056	115.02
78	WOSU-TV	LIC	DT	38	503.0	40.159167	-82.923056	115.02
79	-	CP	TX	3	0.0	40.140556	-83.141111	116.62
80	WRAP-LP	LIC	TX	32	6.4	41.508361	-81.694000	117.10
81	WQDI-LD	LIC	LD	21	0.3	41.487000	-81.683639	117.35
82	WQDI-LD	CP	LD	21	5.0	41.487000	-81.683639	117.35
83	KONV-LD	CP	LD	23	4.0	41.487000	-81.683639	117.35
84	WUEK-LD	LIC	LD	25	7.0	41.487000	-81.683639	117.35
85	WEKA-LD	LIC	LD	27	5.0	41.487000	-81.683639	117.35
86	WNHO-LP	CP MOD	LD	35	15.0	41.292417	-84.533806	118.16
87	WNHO-LP	LIC	TX	26	7.5	41.291389	-84.537500	118.46
88	WEAO	CP MOD	DT	24	191.0	41.082778	-81.633611	118.54
89	WEAO	LIC	DT	50	250.0	41.082778	-81.633611	118.54
90	WEAO	CP	DT	50	250.0	41.082778	-81.633611	118.54
91	WRLM	CP	DT	50	250.0	41.082778	-81.633611	118.54
92	WEKA-LD	CP	LD	26	5.0	41.280556	-81.622500	118.98
93	WCBZ-CD	LIC	DC	18	15.0	40.114944	-82.982028	119.61
94	WVPX-TV	CP	DT	22	950.0	41.055556	-81.593611	122.24
95	WLPC-CD	CP MOD	DC	28	4.0	42.331944	-83.045000	122.36
96	WLPC-CD	APP	DC	28	4.0	42.331944	-83.045000	122.36
97	WLPC-CD	LIC	DC	40	2.3	42.331944	-83.045000	122.36
98	WLPC-CD	CP	DC	40	2.3	42.331944	-83.045000	122.36
99	WAKN-LP	LIC	TX	11	1.5	41.064639	-81.582861	123.01
100	WVPX-TV	CP	DT	23	1000.0	41.064639	-81.582861	123.01
101	WDLI-TV	CP	DT	23	1000.0	41.064639	-81.582861	123.01
102	WOIO	APP	LD	24	11.0	41.064639	-81.582861	123.01
103	-	CP	LD	4	0.0	42.340278	-83.045278	123.28
104	WRAP-LP	LIC	TX	32	0.1	41.482528	-81.585667	125.21
105	WSFJ-TV	LIC	DT	24	1000.0	40.079000	-82.694861	126.88
106	W29EL-D	CP	LD	29	0.5	40.872806	-84.588000	128.40
107	W49EM-D	CP	LD	49	0.5	40.872806	-84.588000	128.40
108	WGCT-CD	LIC	DC	8	0.2	40.031111	-82.974889	128.94
109	WCPX-LP	CP	LD	25	9.5	40.017222	-83.019722	130.38
110	WCSN-LD	CP	LD	26	15.0	40.017222	-83.019722	130.38
111	WCPX-LP	LIC	TX	48	150.0	40.017222	-83.019722	130.38
112	WHPS-CD	CP MOD	DC	15	15.0	42.406111	-83.112222	130.69
113	WHPS-CD	CP	DC	15	2.7	42.408083	-83.091583	130.85
114	-	CP	LD	26	0.1	42.066944	-84.240833	132.73
115	WCMH-TV	LIC	DT	14	902.0	39.971111	-83.027778	135.47



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**Republic Transmission Lines**

ID	Call Sign	Status	Service <sup>2</sup>	Channel	Transmit ERP <sup>3</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
116	WDEM-CD	LIC	DC	17	1.1	39.971111	-83.027778	135.47
117	W44DC-D	CP	LD	17	15.0	39.971111	-83.027778	135.47
118	WCLL-CD	LIC	DC	19	15.0	39.971111	-83.027778	135.47
119	WCLL-CD	CP	DC	19	15.0	39.971111	-83.027778	135.47
120	WSFJ-TV	CP	DT	19	15.0	39.971111	-83.027778	135.47
121	WBNS-TV	LIC	DT	21	1000.0	39.971111	-83.027778	135.47
122	W44DC-D	LIC	LD	44	15.0	39.971111	-83.027778	135.47
123	WHNE-LD	CP	LD	3	3.0	42.447917	-83.173083	135.60
124	WUDT-LD	CP	LD	8	3.0	42.447917	-83.173083	135.60
125	WUDL-LD	LIC	LD	19	11.6	42.447917	-83.173083	135.60
126	WHNE-LD	LIC	LD	20	15.0	42.447917	-83.173083	135.60
127	WTVS	CP	DT	20	345.0	42.447917	-83.173083	135.60
128	WWJ-TV	CP	DT	21	380.0	42.447917	-83.173083	135.60
129	WMYD	CP	DT	21	470.0	42.447917	-83.173083	135.60
130	WUDT-LD	LIC	LD	23	15.0	42.447917	-83.173083	135.60
131	WMYD	CP MOD	DT	31	935.0	42.447917	-83.173083	135.60
132	WUDL-LD	CP	LD	35	10.0	42.447917	-83.173083	135.60
133	WMYD	LIC	DT	21	500.0	42.448056	-83.173056	135.62
134	WUDT-LD	CP	LD	23	15.0	42.448056	-83.173056	135.62
135	WTVS	LIC	DT	43	600.0	42.448056	-83.173056	135.62
136	WWJ-TV	LIC	DT	44	425.0	42.448056	-83.173056	135.62
137	WJBK	LIC	DT	7	27.2	42.460556	-83.213889	137.29
138	W32DS-D	CP	LD	25	6.8	40.552917	-84.517250	138.07
139	W32DS-D	LIC	LD	32	6.8	40.552917	-84.517250	138.07
140	WAMS-LP	CP	LD	29	15.0	40.388667	-84.357333	138.27
141	WXYZ-TV	CP MOD	DT	25	765.0	42.470556	-83.250278	138.72
142	WXYZ-TV	LIC	DT	41	1000.0	42.470556	-83.250278	138.72
143	WXYZ-TV	LIC	DX	41	670.0	42.470556	-83.250278	138.72
144	W23BZ-D	CP	LD	15	15.0	39.937222	-83.021111	139.26
145	WWHO	CP MOD	DT	23	885.0	39.937222	-83.021111	139.26
146	WDEM-CD	CP MOD	DC	24	15.0	39.937222	-83.021111	139.26
147	WTTE	CP MOD	DT	27	1000.0	39.937222	-83.021111	139.26
148	WSYX	CP	DT	28	677.0	39.937222	-83.021111	139.26
149	WSYX	LIC	DT	48	1000.0	39.937222	-83.021111	139.26
150	WDIV-TV	CP	DT	32	720.0	42.482778	-83.205278	139.68
151	WDIV-TV	CP	DX	32	1000.0	42.482778	-83.205278	139.68
152	WDIV-TV	LIC	DT	45	872.0	42.482778	-83.205278	139.68
153	WIVX-LD	LIC	LD	13	2.5	40.880611	-81.427889	139.72
154	WKBD-TV	LIC	DT	14	180.0	42.483611	-83.312222	140.85
155	WDWO-CD	LIC	DC	18	14.0	42.483611	-83.312222	140.85
156	WDWO-CD	CP	DC	22	15.0	42.483611	-83.312222	140.85
157	WPXD-TV	CP MOD	DT	24	370.0	42.483611	-83.312222	140.85

ID	Call Sign	Status	Service <sup>2</sup>	Channel	Transmit ERP <sup>3</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
158	WKBD-TV	CP MOD	DT	34	285.0	42.483611	-83.312222	140.85
159	WPXD-TV	LIC	DT	50	345.0	42.483611	-83.312222	140.85
160	WPXD-TV	LIC	DX	50	49.5	42.483611	-83.312222	140.85
161	W29EG-D	CP	LD	29	1.4	39.921667	-82.937778	141.23
162	W23BZ-D	LIC	LD	23	15.0	39.891944	-83.045556	144.21
163	W29EG-D	LIC	LD	29	15.0	39.952278	-82.506806	144.74
164	WADL	CP	DT	27	605.0	42.554167	-82.887500	147.62
165	WGCT-CD	CP	DC	8	1.5	39.863333	-82.799167	148.84

*Table 1: Off-Air TV Stations within 150 Kilometers of Transmission Line (United States)*

ID	Call Sign	Status	Class <sup>4</sup>	Channel	Transmit ERP (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
C1	CFTV-DT	TO	LP	34	0.545	42.094444	-82.729722	99.43
C2	CFTV-DT	OP	LP	34	1.0	42.074444	-82.631389	99.43
C3	CICO-DT-32	AU	R	19	14.2	42.153333	-82.953056	102.81
C4	CICO-DT-32	OP	R	32	19.0	42.153333	-82.953056	102.81
C5	CBET-DT	OP	R	9	26.0	42.153333	-82.953056	102.81
C6	CIII-DT-22	AU	R	33	36.0	42.061389	-82.484722	103.41
C7	CIII-DT-22	OP	R	22	49.0	42.061389	-82.484722	103.41
C8	CHWI-DT	OP	R	16	3.4	42.141667	-82.446667	112.79
C9	CHWI-DT-60	AU	R	17	0.161	42.316111	-83.040000	120.60
C10	CHWI-DT-60	OP	R	26	0.2	42.316111	-83.040000	120.60

*Table 2: Off-Air TV Stations within 150 Kilometers of Transmission Line (Canada)*

<sup>4</sup> Definitions of class and status codes:  
R – Regular VHF Television Broadcast Station  
LP – Low-power Television Broadcast Station  
OP – Licensed and operational station  
TO – Temporary operation  
AU – Authorized; not yet operational

### 3. Impact Assessment

Typically, transmission lines do not create reception problems for television signals. This includes transmission lines carrying high voltages such as those planned for the Republic Transmission Lines project. However, if the transmission lines are not well maintained, corona and arcing may occur at the insulators or conductor connectors, creating broad band noise. The broad band noise could cause interference to television receivers in residences near the transmission line project, particularly those residents whose homes are within approximately 500 feet of the transmission line. This distance is based on a worst-case scenario, which requires the presence of foul weather and takes into account the variable characteristics of the transmission line.

Based on a contour analysis of the licensed stations within 150 kilometers of the project, it was determined that ten of the U.S. full-power digital stations, along with two Canadian stations, identified below in Tables 3 and 4, have service contours that overlap with the transmission line project area and thus fall within the range of potential impact as described above.

ID	Call Sign	Status	Service <sup>5</sup>	Channel	Transmit ERP <sup>6</sup> (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
4	WGGN-TV	LIC	DT	42	450.0	41.075083	-82.451111	50.97
7	WNWO-TV	LIC	DT	49	105.0	41.667500	-83.356111	54.07
8	WTOL	LIC	DT	11	16.9	41.672778	-83.379722	55.34
10	WGTE-TV	LIC	DT	29	49.5	41.657222	-83.431944	55.60
12	WUPW	LIC	DT	46	110.0	41.656111	-83.444722	55.99
14	WTVG	LIC	DT	13	16.7	41.683333	-83.413611	57.54
17	WMFD-TV	LIC	DT	12	14.0	40.763889	-82.617778	59.21
27	WBGU-TV	LIC	DT	22	137.0	41.136667	-83.906667	65.84
28	WBGU-TV	LIC	DX	22	137.0	41.136667	-83.906667	65.84
29	WBGU-TV	LIC	DT	27	153.0	41.136667	-83.906667	65.84

*Table 3: Licensed Off-Air TV Stations Subject to Degradation (United States)*

<sup>5</sup> Definitions of service and status codes (United States):

DT – Digital television broadcast station

LIC – Licensed and operational station

<sup>6</sup> ERP = Transmit Effective Radiated Power

ID	Call Sign	Status	Class <sup>7</sup>	Channel	Transmit ERP (kW)	Latitude (NAD 83)	Longitude (NAD 83)	Distance to Project Area (km)
C4	CICO-DT-32	OP	R	32	19.0	42.153333	-82.953056	102.36
C5	CBET-DT	OP	R	9	26.0	42.153333	-82.953056	102.36

*Table 4: Licensed Off-Air TV Stations Subject to Degradation (Canada)*

## 4. Recommendations

In order to prevent interference to television broadcast reception in the homes near the transmission line, there should be an effective quality control maintenance program in effect for the useful life period of the transmission line's operation. In the unlikely event that interference is observed in any of the TV service areas, a high-gain directional antenna may be employed, preferably outdoors, and oriented towards the signal origin in order to mitigate the interference.

Both cable service and direct broadcast satellite service will be unaffected by the presence of the transmission line and may be offered to those residents who can show that their off-air TV reception has been disrupted by the presence of the transmission line after it is installed.

## 5. Contact

For questions or information regarding the Off-Air TV Analysis, please contact:

Contact person: David Meyer  
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 Company: Comsearch  
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 Telephone: 703-726-5656  
 Fax: 703-726-5595  
 Email: dmeyer@comsearch.com  
 Web site: www.comsearch.com

<sup>7</sup> Definitions of class and status codes (Canada):  
 R – Regular VHF Television Broadcast Station  
 OP – Licensed and operational station

## Exhibit D: AM and FM Radio Report

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# Wind Power GeoPlanner™

## AM and FM Radio Report

### Republic Transmission Lines



Prepared on Behalf of  
Apex Clean Energy, Inc.

June 12, 2019





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## 1. Introduction

Comsearch analyzed AM and FM radio broadcast stations whose service could potentially be affected by the Republic Transmission Lines project in Seneca County, Ohio.

## 2. Summary of Results

### AM Radio Analysis

Comsearch found four database records<sup>1</sup> for AM stations within approximately 30 kilometers of the project transmission line, as shown in Table 1 and Figure 1. These records represent station WTTF, which broadcasts out Tiffin, Ohio, to the southwest of the project, and station WFOB, out of Fostoria, also to the southwest. Both stations are licensed separately for operations during daytime and nighttime hours.

ID	Call Sign	Status <sup>2</sup>	Frequency (kHz)	Transmit ERP <sup>3</sup> (kW)	Operation Time	Latitude (NAD 27)	Longitude (NAD 27)	Required Separation Distance <sup>4</sup> (km)	Distance to Trans. Line (km)
1	WTTF	LIC	1600	0.5	Daytime	41.125556	-83.231944	1.88	12.91
2	WTTF	LIC	1600	0.019	Nighttime	41.125556	-83.231944	1.88	12.91
3	WFOB	LIC	1430	1.0	Daytime	41.101667	-83.399722	2.10	25.83
4	WFOB	LIC	1430	1.0	Nighttime	41.101667	-83.399722	2.10	25.83

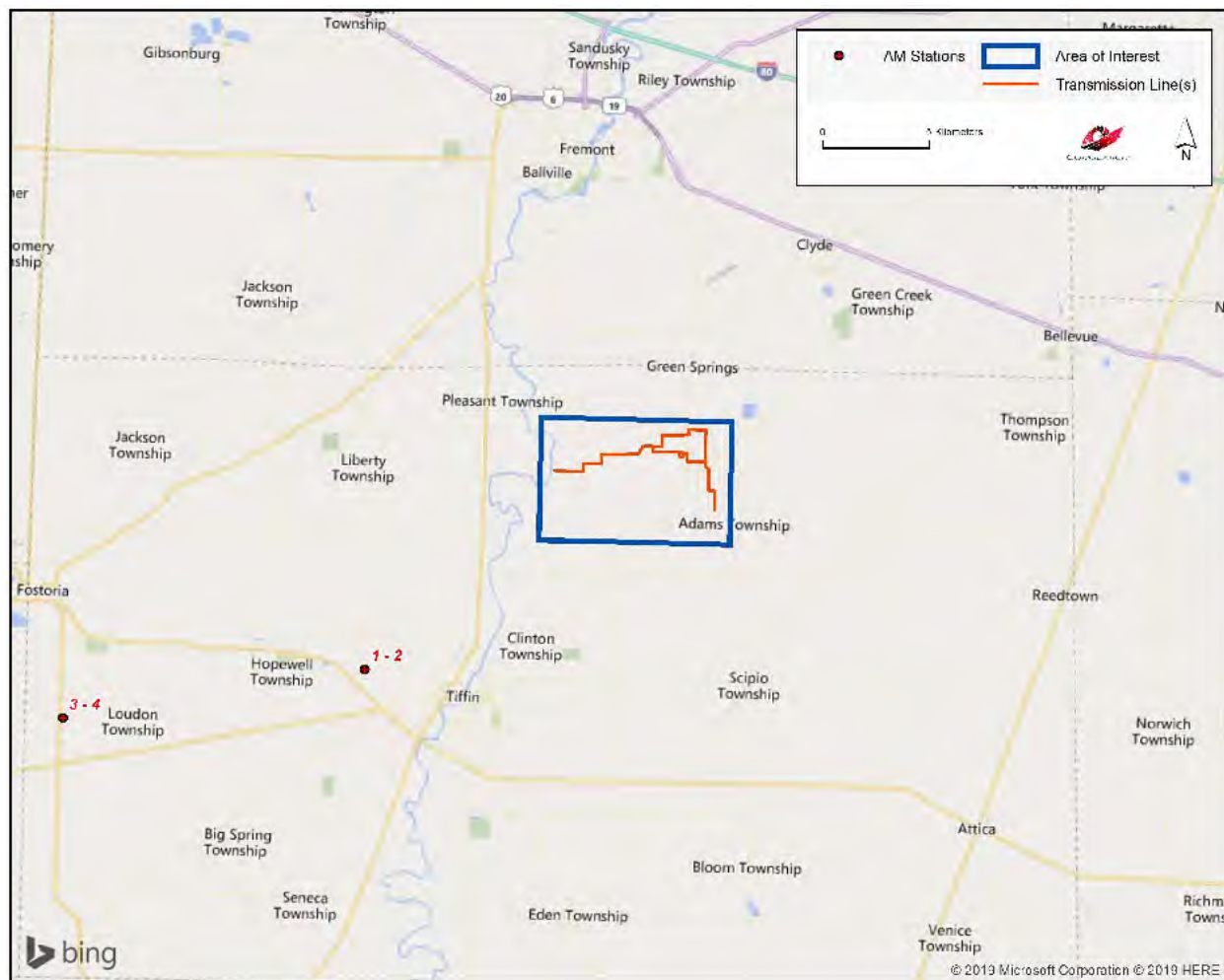
*Table 1: AM Radio Stations within 30 Kilometers of Transmission Line*

<sup>1</sup> Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data presented in this report is derived from the AM/FM station's FCC license and governed by Comsearch's data license notification and agreement located at [http://www.comsearch.com/files/data\\_license.pdf](http://www.comsearch.com/files/data_license.pdf).

<sup>2</sup> LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

<sup>3</sup> ERP = Transmit Effective Radiated Power.

<sup>4</sup> The required separation distance is based on the lesser of 10 wavelengths or 3 kilometers for directional antennas and 1 wavelength for non-directional antennas.



*Figure 1: AM Radio Stations within 30 Kilometers of Transmission Line*

## FM Radio Analysis

Comsearch determined that there were twenty database records for FM stations within 30 kilometers of the transmission line, as shown in Table 2 and Figure 2. Nineteen of these stations are currently licensed and operating, six of which are low-power or translator stations that broadcast with limited range.

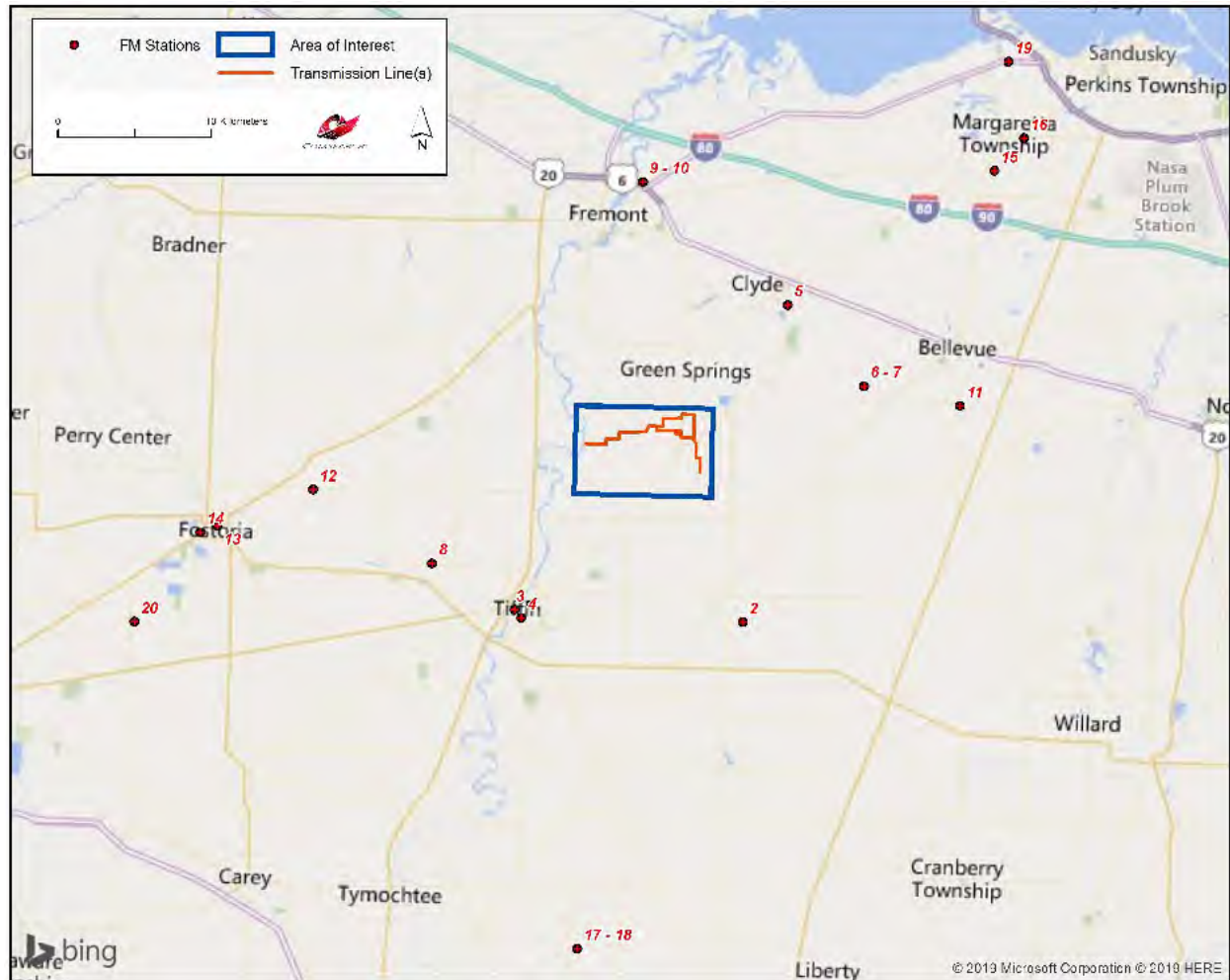
ID	Call Sign	Status <sup>5</sup>	Service <sup>6</sup>	Frequency (MHz)	Transmit ERP <sup>7</sup> (kW)	Latitude (NAD 27)	Longitude (NAD 27)	Distance to Trans. Line (km)
1	WHEI	LIC	FM	88.9	0.1	41.116389	-83.167500	11.06
2	WYOR	LIC	FM	88.5	0.1	41.108889	-83.003056	10.16
3	W227BJ	LIC	FX	93.3	0.25	41.112944	-83.180611	11.79
4	WSJG-LP	LIC	FL	103.3	0.1	41.108306	-83.175444	12.12
5	WHVT	LIC	FM	90.5	2.7	41.295833	-82.973889	9.39
6	WMJK	LIC	FM	100.9	3.0	41.249167	-82.913056	11.22
7	WYOR	CP	FM	88.5	20.0	41.248778	-82.912833	11.23
8	WCKY-FM	LIC	FM	103.7	50.0	41.138889	-83.245833	12.73
9	W206BX	LIC	FX	89.1	0.055	41.366111	-83.088889	15.37
10	WFRO-FM	LIC	FM	99.1	11.5	41.366111	-83.088889	15.37
11	WOHF	LIC	FM	92.1	5.8	41.238611	-82.837778	17.27
12	WLBj-LP	LIC	FL	104.1	0.075	41.180500	-83.339750	18.05
13	W289CP	LIC	FX	105.7	0.25	41.157778	-83.413611	24.65
14	W270CL	LIC	FX	101.9	0.055	41.153611	-83.426389	25.81
15	WHRQ	LIC	FM	88.1	0.38	41.377167	-82.814528	25.25
16	WGGN	LIC	FM	97.7	0.64	41.396667	-82.791944	28.09
17	WXMW	LIC	FM	89.3	0.39	40.914722	-83.125556	32.12
18	WXML	LIC	FM	90.1	15.0	40.914722	-83.125556	32.12
19	WVMS	LIC	FM	89.5	5.5	41.441389	-82.805556	30.83
20	WBVI	LIC	FM	96.7	3.0	41.100000	-83.475556	31.66

*Table 2: FM Radio Stations within 30 Kilometers of Transmission Line*

<sup>5</sup> LIC = Licensed and operational station; APP = Application for construction permit; CP=Construction permit granted; CP MOD = Modification of construction permit.

<sup>6</sup> FM = FM broadcast station; FX = FM translator station; FL = Low-power FM station; FS = FM auxiliary (backup) station; FB = FM booster station.

<sup>7</sup> ERP = Transmit Effective Radiated Power.



*Figure 2: FM Radio Stations within 30 Kilometers of Transmission Line*

### 3. Impact Assessment

The exclusion distance for AM broadcast stations varies as a function of the antenna type and broadcast frequency. For directional antennas, the exclusion distance is calculated by taking the lesser of 10 wavelengths or 3 kilometers. For non-directional antennas, the exclusion distance is simply equal to 1 wavelength. Potential problems with AM broadcast coverage are only anticipated when AM broadcast stations are located within their respective exclusion distance limit from the transmission line towers. The closest AM station to any point on the transmission line project is WTTF at a distance of approximately 12.9 kilometers. Since there were no AM stations found within 3 kilometers of the project, which is the maximum possible exclusion distance based on a directional AM antenna broadcasting at 1000 KHz or less, the project towers should not impact the coverage of local AM stations.

The coverage of FM stations is generally not susceptible to interference caused by large objects, such as transmission line towers, especially when they are sited in the *far field* region of the radiating FM antenna, which mitigates the risk of distorting the antenna's radiation pattern. However, within the antenna's *near field* region, radiation pattern distortion can become a factor. Signal attenuation is also possible but can be difficult to quantify without precise field measurements. The closest FM station to the transmission line project, WHVT, is more than 9.3 kilometers away. At this distance, there should be adequate separation to avoid radiation pattern distortion.

Electromagnetic interference (EMI) from a transmission line is caused by an induction field, which is created by the 60 Hz electrical power carried on the transmission line conductors and the harmonics of the 60 Hz fundamental waveform. Interference can also result from arcing that occurs at high-voltage interconnect points on the transmission line. In either case, the interfering signal is amplitude-modulated (AM), and the propagation of the interference occurs over very short distances. These distances are generally around 500 feet or less, and the frequency of the electromagnetic interference does not normally extend above 50 MHz.

Accordingly, the only reception devices that could be affected by EMI would be AM radios, which operate between 0.5 and 1.6 MHz. The degree of degradation to AM reception would be a function of the separation distance of the AM radio from the transmission line and the strength of the received signal. Generally speaking, however, this degradation would be no different than what occurs when a car radio passes under or near existing high voltage transmission lines that interconnect utility companies and their sub stations throughout the state.

### 4. Recommendations

Since no impact on the licensed and operational AM or FM broadcast stations was identified in our analysis, no recommendations or mitigation techniques are required for this project.



## **5. Contact**

For questions or information regarding the AM and FM Radio Report, please contact:

Contact person:	David Meyer
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Web site:	<a href="http://www.comsearch.com">www.comsearch.com</a>

## Exhibit E: Microwave Study

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# Wind Power GeoPlanner™

## Microwave Study

### Republic Transmission Line



Prepared on Behalf of  
Apex Clean Energy, Inc.

June 10, 2019





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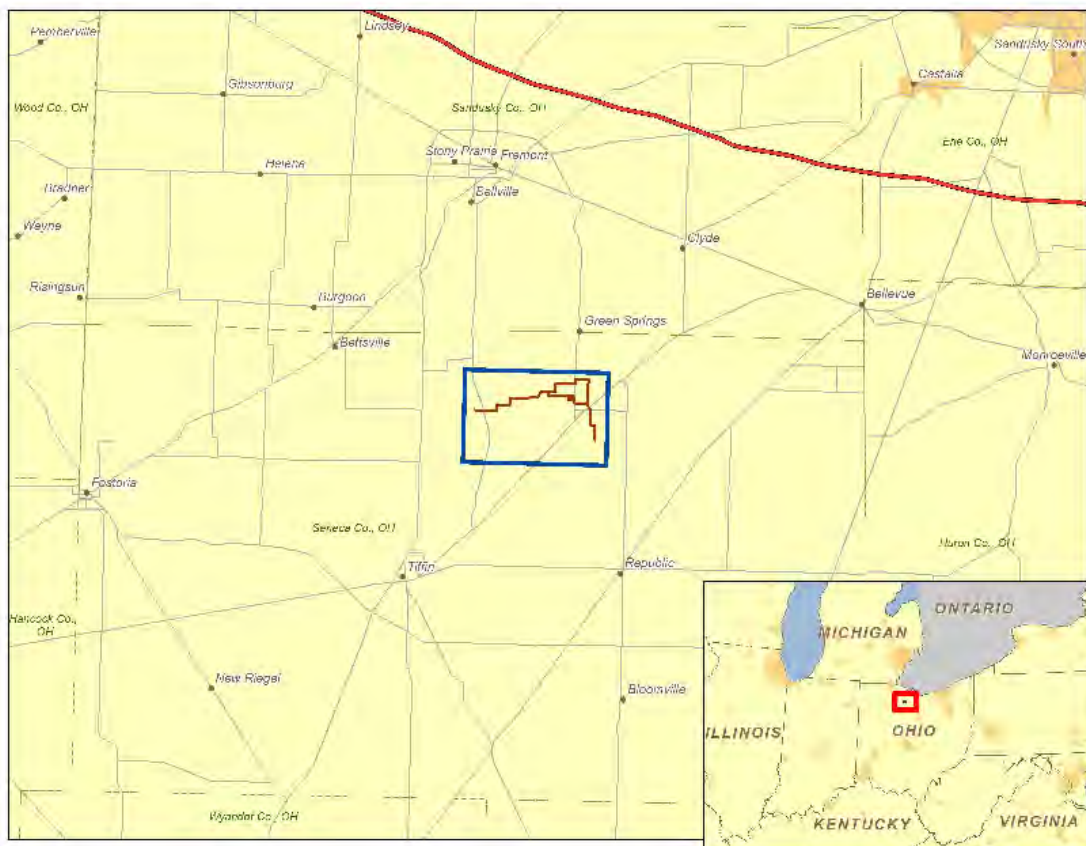
<b>1. Introduction</b>	<b>- 1 -</b>
<b>2. Project Overview</b>	<b>- 1 -</b>
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## 1. Introduction

Microwave bands that may be affected by the installation of a transmission line operate over a wide frequency range (900 MHz – 23 GHz). Comsearch has developed and maintains comprehensive technical databases containing information on licensed microwave networks throughout the United States. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. This report focuses on the potential impact of a transmission line on licensed, proposed and pending applications for non-federal government microwave systems.

## 2. Project Overview

Apex Clean Energy, Inc. is proposing to construct and place in utility service the Republic Transmission Line Project. The proposed transmission line is located in Seneca County, Ohio as shown below.

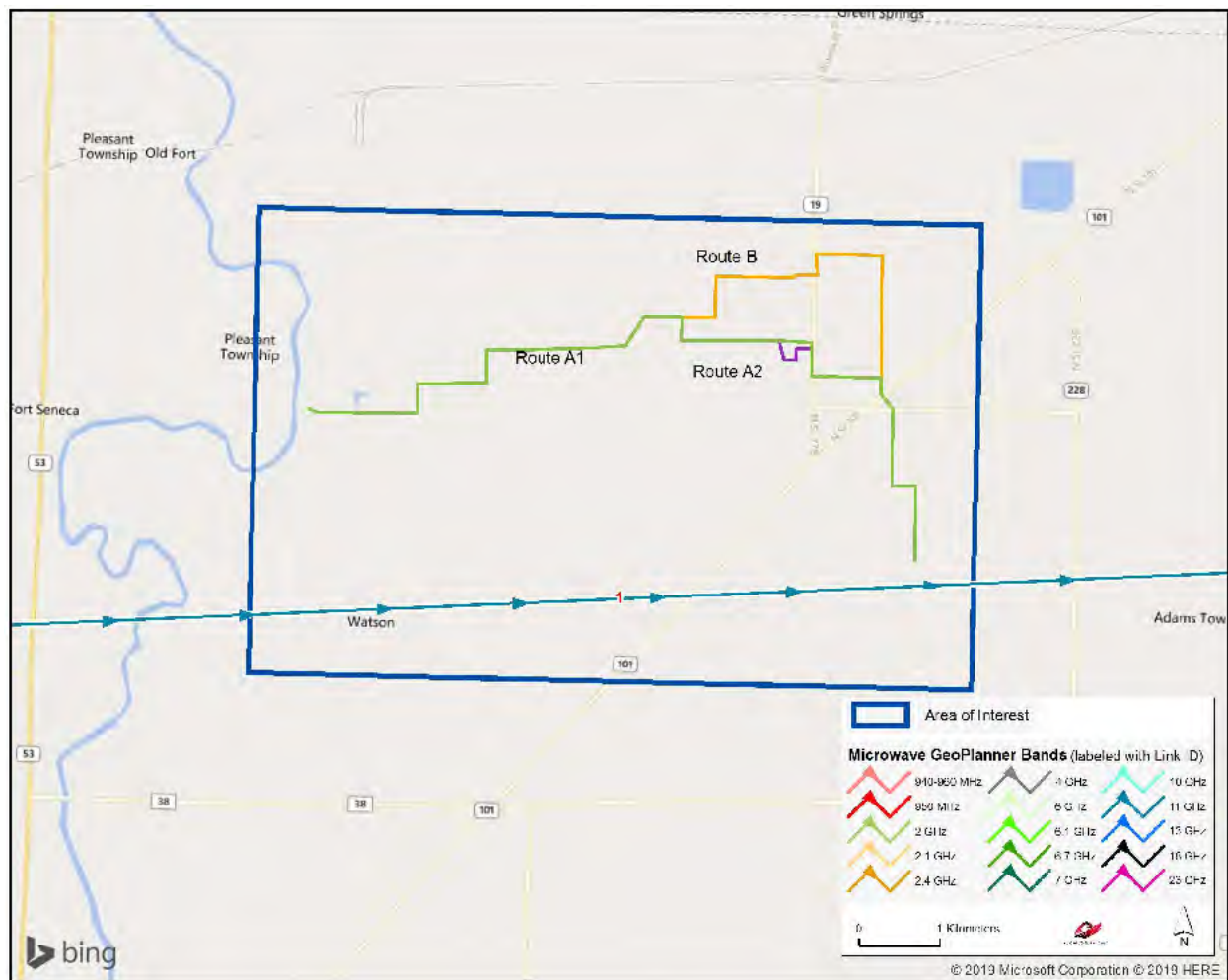


**Figure 1: Area of Interest with Proposed Transmission Line**

### 3. Fresnel Zone Analysis

#### Methodology

Our obstruction analysis was performed using Comsearch's proprietary microwave database, which contains all non-government licensed, proposed and applied paths from 0.9 - 23 GHz<sup>1</sup>. First, we determined which microwave paths intersect the transmission line<sup>2</sup> and listed them in Table 1. This path and the proposed transmission line are shown in Figure 2.



*Figure 2: Microwave Paths that Intersect the Area of Interest*

<sup>1</sup> Please note that this analysis does not include unlicensed microwave paths or federal government paths that are not registered with the FCC.

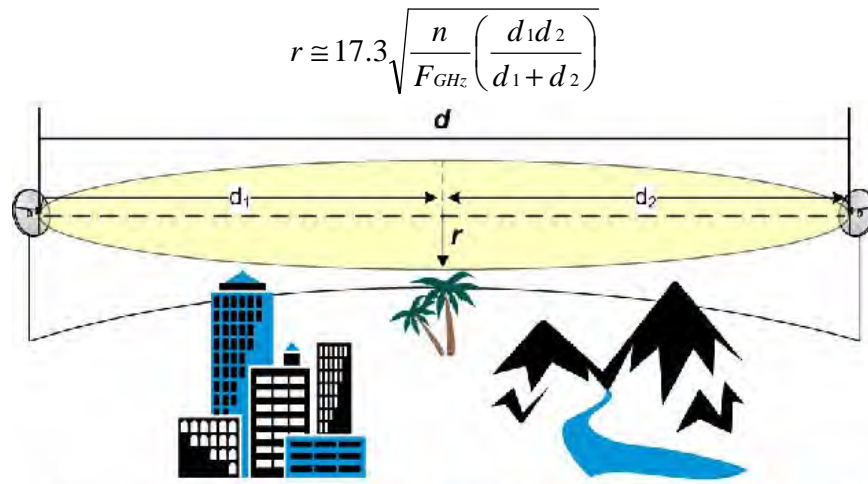
<sup>2</sup> We use FCC-licensed coordinates to determine which paths intersect the area of interest. It is possible that as-built coordinates may differ slightly from those on the FCC license.

ID	Status	Callsign 1	Callsign 2	Band	Path Length (km)	Licensee
1	Proposed	WQQX871	WESTLODI	11 GHz	40.97	Wireless Internetwork LLC

*Table 1: Summary of Microwave Paths that Intersect the Area of Interest*

(See enclosed *mw\_geopl.xlsx* for more information and  
*GP\_dict\_matrix\_description.xls* for detailed field descriptions)

Next, we calculated a Fresnel Zone for this path based on the following equation:



Where,

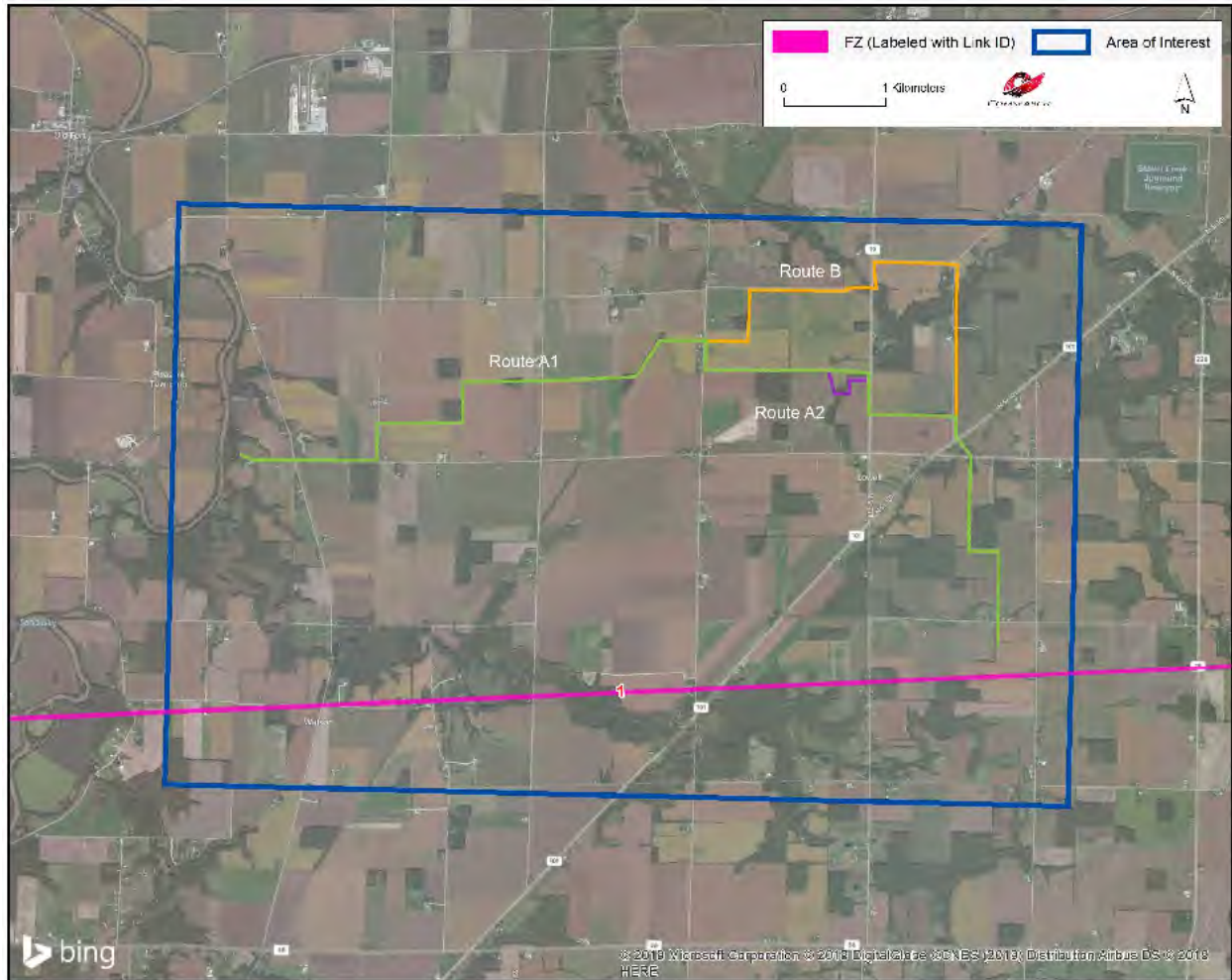
- r = Fresnel Zone radius at a specific point in the microwave path, meters
- n = Fresnel Zone number, 1
- $F_{\text{GHz}}$  = Frequency of microwave system, GHz
- $d_1$  = Distance from antenna 1 to a specific point in the microwave path, kilometers
- $d_2$  = Distance from antenna 2 to a specific point in the microwave path, kilometers

In general, this is the area where the planned structures should be avoided, if possible. Transmission support structures are considered to cause higher signal attenuation losses with more significant reflective and scattering properties. Transmission lines generally do not affect the operation of microwave paths, as their attenuation loss is considered insignificant.

A depiction of the Fresnel Zone is shown in Figure 3, and is also included in the shapefiles<sup>3,4</sup>.

<sup>3</sup> The ESRI® shapefiles enclosed are in NAD 83 UTM Zone 17 projected coordinate system.

<sup>4</sup> Comsearch makes no warranty as to the accuracy of the data included in this report beyond the date of the report. The data provided in this report is governed by Comsearch's data license notification and agreement located at [http://www.comsearch.com/files/data\\_license.pdf](http://www.comsearch.com/files/data_license.pdf).



*Figure 3: Fresnel Zones in the Area of Interest*

## 4. Conclusion

Total Microwave Paths	Paths with Affected Fresnel Zones	Transmission Line Structures intersecting the Fresnel Zones
1	0	0

*Table 2: Fresnel Zone Analysis Result*

Our study identified one proposed microwave path intersecting the Republic Transmission Line project area. The Fresnel Zone for this microwave path was calculated and mapped. No transmission lines or support structures were found to have potential obstruction with the microwave systems in the area.

## 5. Contact

For questions or information regarding the Microwave Study, please contact:

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Email: [dmeyer@comsearch.com](mailto:dmeyer@comsearch.com)  
Web site: [www.comsearch.com](http://www.comsearch.com)

## Exhibit F: Noise Impact Assessment

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**REPUBLIC TRANSMISSION LINE**

# **NOISE IMPACT ASSESSMENT**

**Report | August 9, 2019**



55 Railroad Row  
White River Junction, VT 05001  
802.295.4999  
[www.rsginc.com](http://www.rsginc.com)

**PREPARED FOR:**  
REPUBLIC TRANSMISSION LINE

**SUBMITTED BY:**  
RSG





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## INTRODUCTION

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The Republic Wind project is a wind power project proposed by Apex Clean Energy, to be located in Seneca and Sandusky County, Ohio, between the towns of Bellevue and Republic. The project is proposed to have between 50 and 58 turbines and a nameplate capacity of at least 200 MW. To support the project, there will be a collector substation, transmission line, and Point of Interconnect (POI) substation. The proposed transmission line will be 138 kV and will span the approximately 7.6 kilometer (4.8 mile) distance between the collector and POI substation.

As part of the Ohio Power Siting Board (OPSB) permitting process, Apex Clean Energy retained RSG to conduct a pre-construction noise assessment of the transmission line. The assessment includes both long-term background sound level monitoring along the route of the transmission line and sound propagation modeling of noise emissions from the line. This report includes:

- A project description;
- Summary of sound level limits applicable to the project;
- Background sound level monitoring procedures and results;
- Discussion of acoustical concerns particular to electrical transmission lines;
- Sound propagation modeling procedures and results;
- Construction noise modeling;
- Discussion; and
- Conclusions.

## 1.0 SITE DESCRIPTION

---

The proposed Republic Wind Transmission Line (“Line”) is proposed to run along and through the western part of the Republic Wind project area, starting in the collector substation, approximately 6.2 kilometers (3.9 miles) south-southeast of Green Springs, Ohio and running west to the Point of Interconnect (POI) substation, located approximately 3.3 kilometers southeast of Old Fort, Ohio and along the eastern bank of the Sandusky River. A map showing the transmission line in the surrounding area is shown in Figure 1. The closest horizontal distance between the proposed transmission line and any residence is a 24 meters (79 feet).

The Line is proposed to be 138 kV, with 3 phases, at average heights of 11.9, 16.0, and 20.0 meters (39.0, 52.5, and 65.6 feet, respectively). There are a total of three proposed routes, A1, A2, and Alt. B.



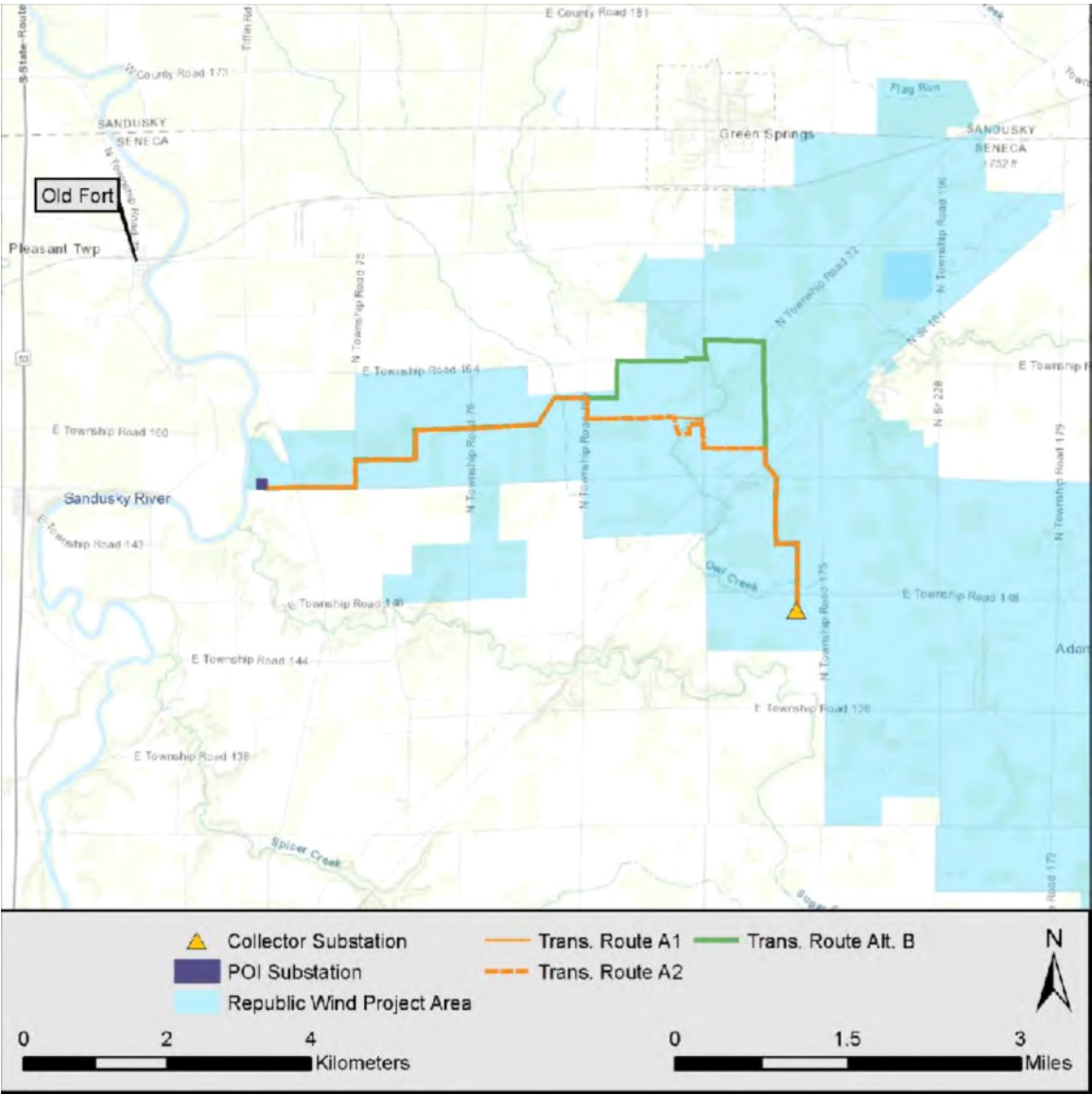


FIGURE 1: AREA MAP

## 2.0 SOUND LEVEL LIMITS/GUIDELINES

---

The criteria for sound emissions from electrical transmission lines is found in Ohio Administrative Code Chapter 4906-5 in Section (7)(A)(4).

(4) The applicant shall provide an estimate of the effect of noise generation due to the construction, operation, and maintenance of the transmission line or pipeline and associated facilities. The applicant shall describe any equipment and procedures designed to mitigate noise emissions during site clearing, construction, operation, and maintenance of the facility to minimize noise impact, including limits on the time of day at which construction activities may occur. The applicant shall estimate the nature of any intermittent, recurring, or particularly annoying sounds from the following sources:

- (a) Blasting activities.
- (b) Operation of earth moving and excavating equipment.
- (c) Driving of piles, rock breaking or hammering, and horizontal directional drilling.
- (d) Erection of structures.
- (e) Truck traffic.
- (f) Installation of equipment.

No sound level limits are set, only requirements of the kinds of sources and activities that need to be considered in a noise analysis, with emphasis placed on construction noise.

Criteria for wind power projects are found in Ohio Administrative Code Chapter 4906-4 Section (9)(F)(2).

(2) The facility shall be operated so that the facility noise contribution does not result in noise levels at any non-participating sensitive receptor within one mile of the project boundary that exceed the project area ambient nighttime average sound level (Leq) by five A-weighted decibels (dBA). During daytime operation only (seven a.m. to ten p.m.), the facility may operate at the greater of: the project area ambient nighttime Leq plus five dBA; or the validly measured ambient Leq plus five dBA at the location of the sensitive receptor. After measured ambient Leq plus five dBA at the location of the sensitive receptor. After commencement of commercial operation, the applicant shall conduct further review of the impact and possible mitigation of all project-related noise complaints through its complaint resolution process. Non-participating, as used in this context, refers to a property for which the owner has not signed a waiver or otherwise agreed to be subject to a higher noise level.

This sets the sound level limit at the higher of the site-wide nighttime  $L_{eq}$  plus 5 dB or the location-specific  $L_{eq}$  plus 5 dB. While this does not directly apply to the transmission line, this is what applies to the Republic Wind power project.

## 3.0 PRECONSTRUCTION BACKGROUND SOUND LEVELS

---

### 3.1 LOCATION DESCRIPTIONS

Background sound level monitoring was performed at three locations near the proposed transmission line routes. Each site was chosen to characterize a soundscape along the transmission line route, allowing identification of both overall sound levels and the sound sources that contribute to local soundscapes. A map showing the monitor locations in relation to proposed transmission line routes and the Republic Wind project area is shown in Figure 1.



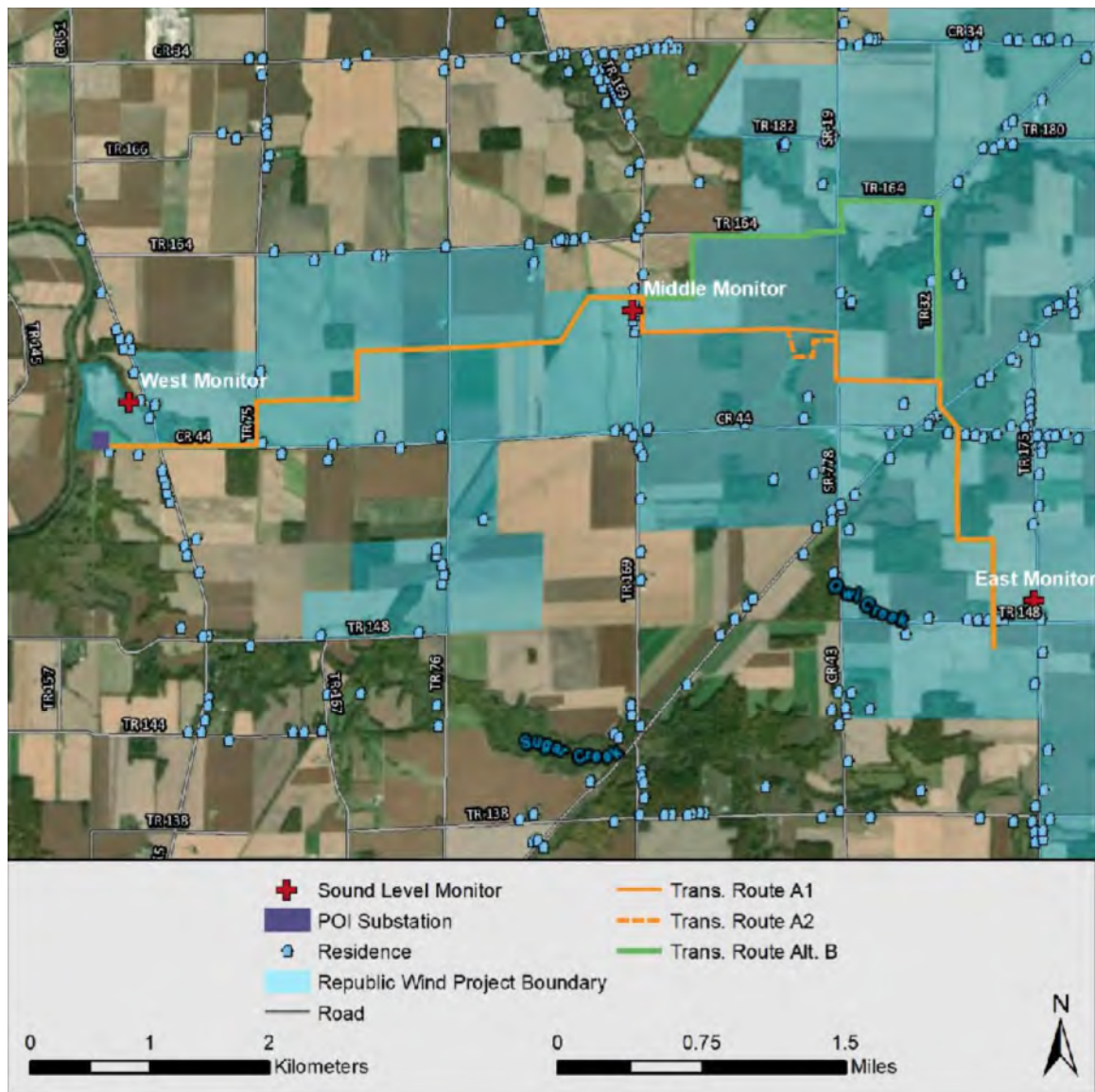


FIGURE 2: MONITOR LOCATIONS

## West Monitor

The West Monitor was located on the edge of a farm field, next to a small wooded area. A map of the monitoring location is shown in Figure 3, and a picture of the setup is shown in Figure 4. The monitor was approximately 45 meters (148 feet) from the closest residence to the east and 212 meters (696 feet) from the closest residence to the southeast. County Road (CR) 15 was located approximately 130 meters (427 feet) to the east. The proposed POI substation was located approximately 302 meters (991 feet) to the southwest and the Sandusky River was located approximately 410 meters (1,345 feet) to the west.

The purpose of this monitor location was to capture the soundscape near the western extent of the transmission line, and at a relatively lower elevation (about 210 meters or 690 feet) near the Sandusky River. While this location is relatively far from a road, CR 15 is well traveled.

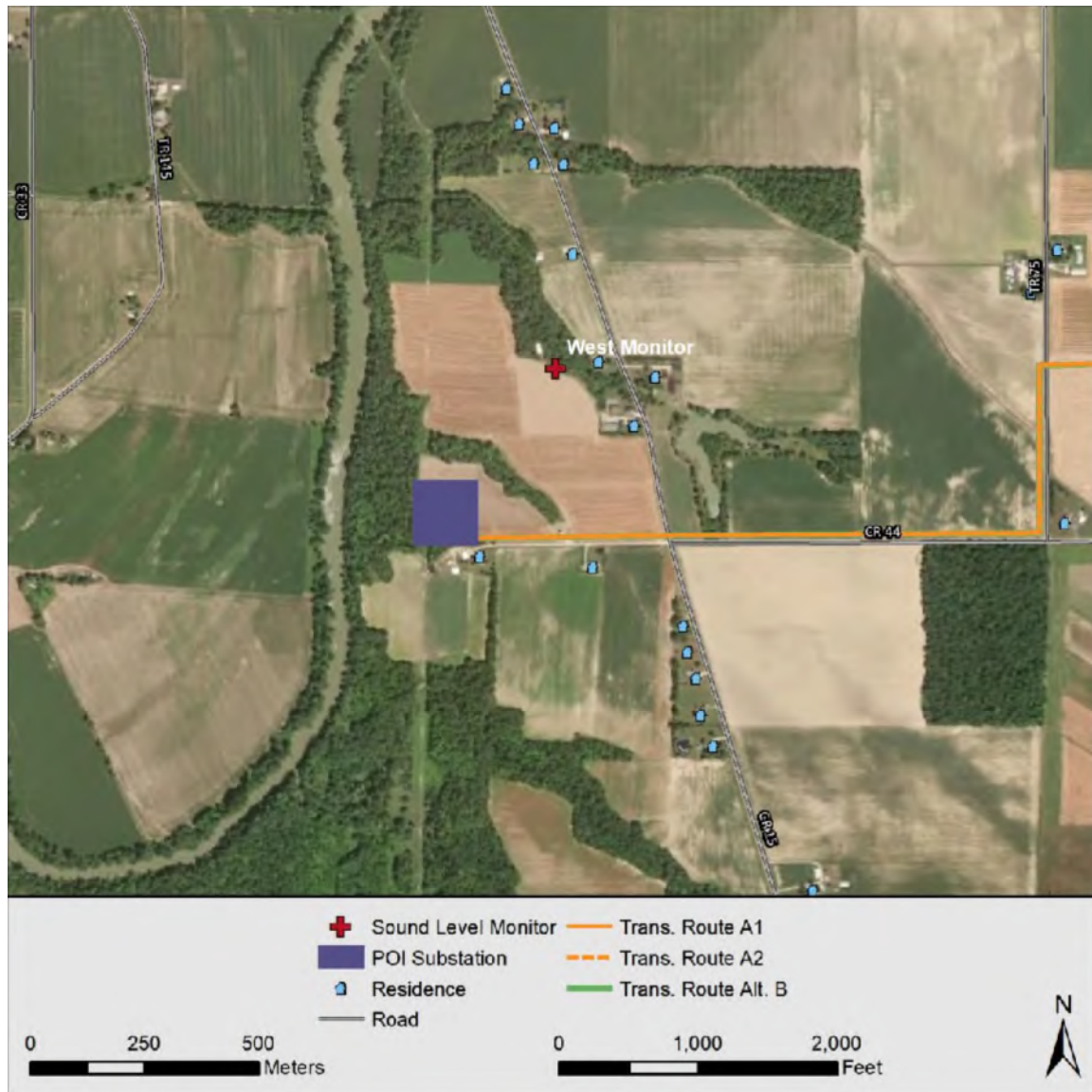


FIGURE 3: WESTERN MONITOR LOCATION MAP



**FIGURE 4: WESTERN MONITOR LOCATION - LOOKING WEST**

### **Middle Monitor**

The Middle monitor was located approximately 64 meters (210 feet) west of Town Road (TR) 169 in the yard of a residence and adjacent to a farm field. A map of the monitoring location is shown in Figure 5, and a picture of the monitoring setup is shown in Figure 6. The intersection between TR 169 and TR 164 is approximately 610 meters (2,000 feet) to the north. The closest residence was located approximately 24 meters (79 feet) to the east-southeast.

The purpose of this monitoring location was to capture the soundscape along the middle of the transmission line path. Nearby TR 169 is well traveled, but not busy.

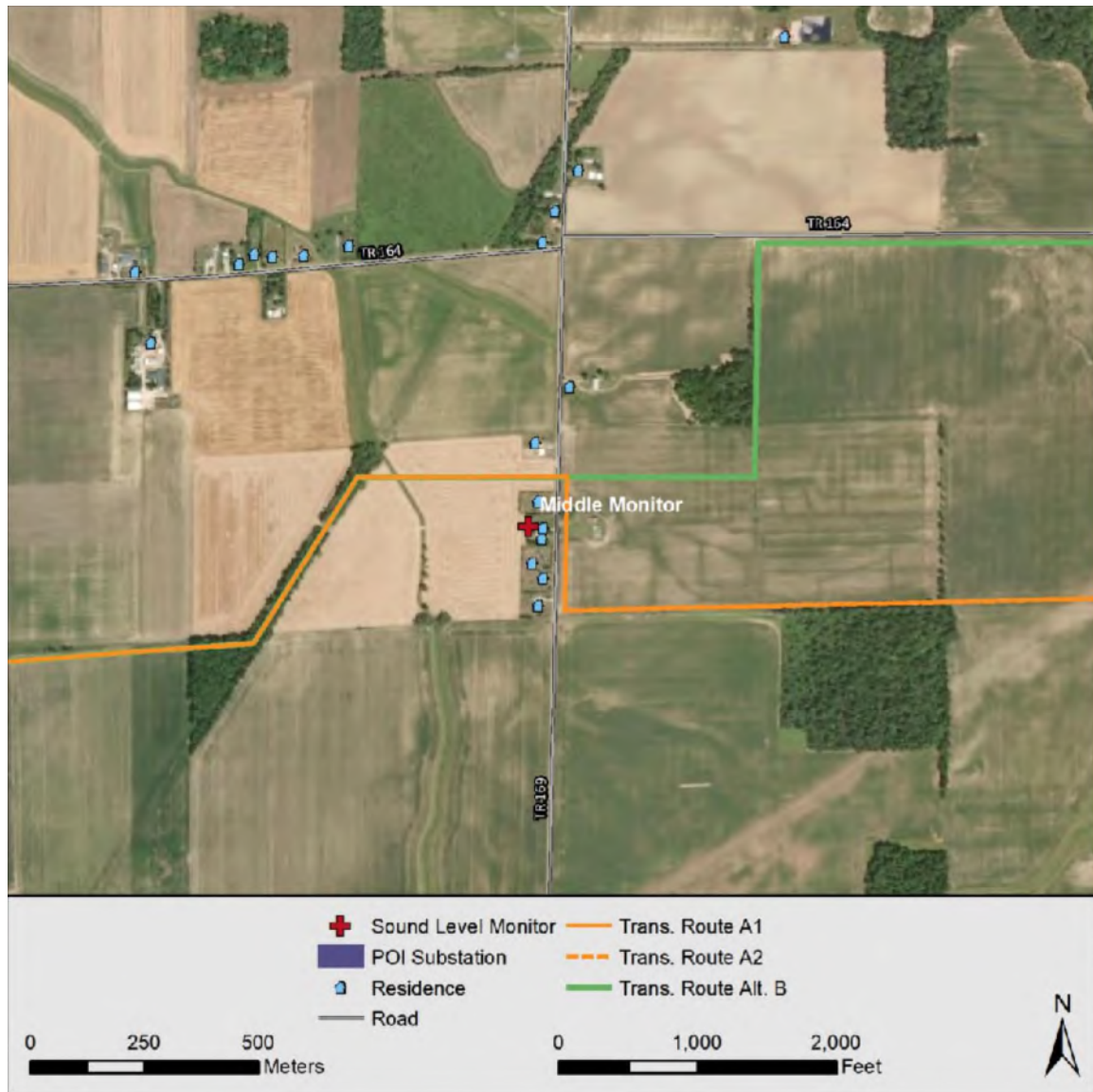


FIGURE 5: MIDDLE MONITOR LOCATION MAP



**FIGURE 6: MIDDLE MONITOR LOCATION - LOOKING NORTHWEST**

## **East Monitor**

The East monitor was located along a small drainage ditch, between two farm fields and along a row of trees. A map of the monitoring location is shown in Figure 7, and a picture of the monitoring setup is shown in Figure 8. The monitor was located approximately 40 meters (131 feet) west of TR 175 and 167 meters (548 feet) from the closest residence to the southeast. The intersection of TR 148 and TR 175 was located approximately 187 meters (614 feet) to the south-southeast. The proposed collector substation location was approximately 550 meters (1,800 feet) to the southwest.

The purpose of this monitoring location was to capture the soundscape in the area along the eastern extent of the transmission line and near the proposed collector substation. The elevation here is approximately 240 meters (787 feet), about 30 meters (100 feet) higher than the western monitor.

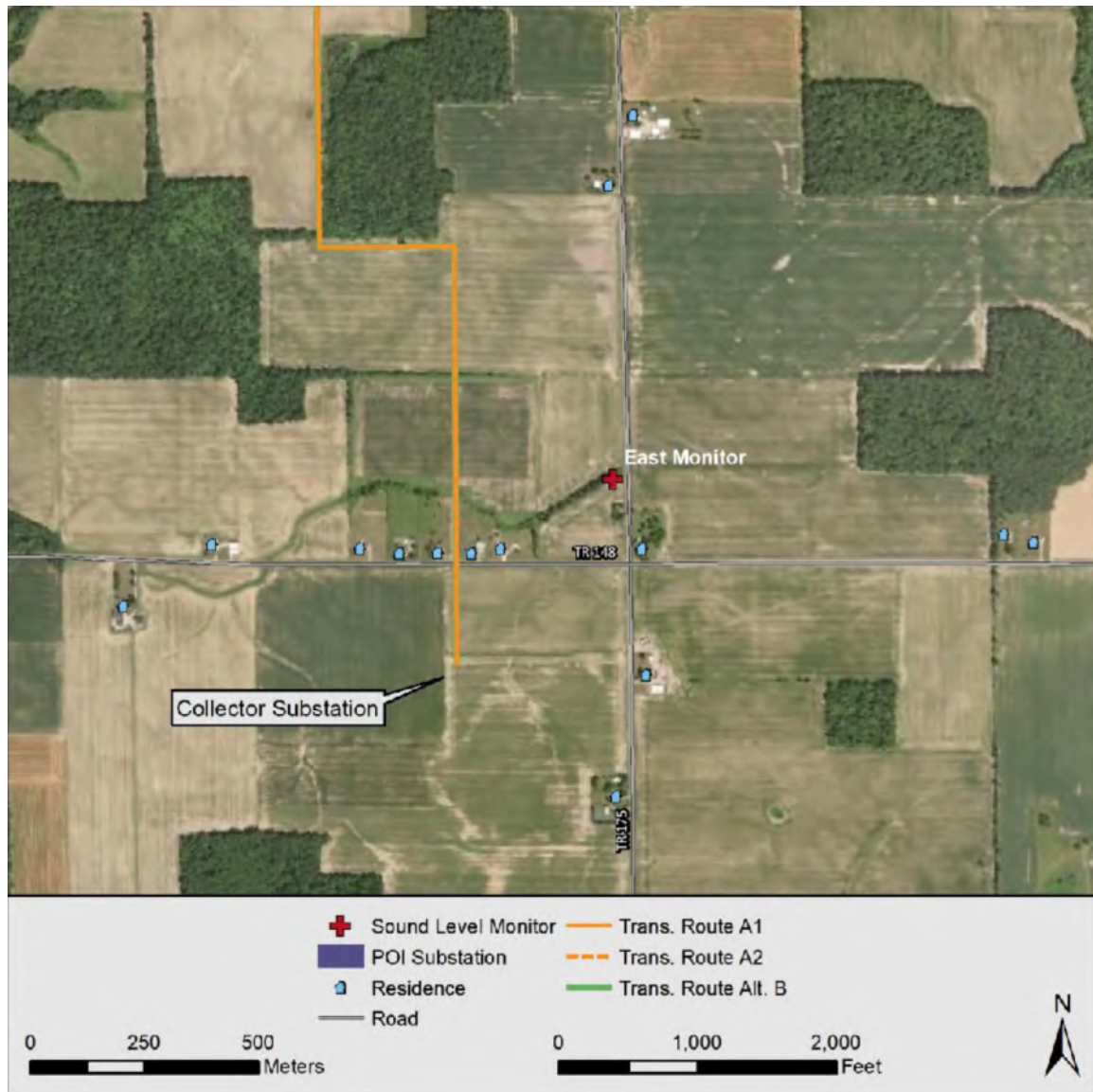


FIGURE 7: EASTERN MONITOR LOCATION MAP



**FIGURE 8: EASTERN MONITOR LOCATION - LOOKING SOUTHWEST**

## **3.2 PROCEDURES**

Background sound level monitoring was performed at the site from September 13 to 26, 2018.

Sound levels were measured with Cesva SC310 ANSI/IEC Type 1 sound level meters set to record A-weighted and 1/3 octave band sound levels once each second. Sound level meters were connected to audio recorders to allow for sound source identification. Microphone sensitivity was calibrated before and after measurements using Cesva CB-5 or Brüel and Kjær 4231 calibrators. Microphones were mounted at a height of approximately 1.4 meters (4.6 feet) and covered with 7-inch hydrophobic wind screens to reduce the influence of wind-caused sound on measurements.

Wind speed measurements were collected concurrent with sound level measurements using Onset HOBO wind speed sensors and loggers. Anemometers were mounted on stakes, also at

a height of approximately 1.4 meters (4.6 feet). The logger at the Western monitor was also equipped with a temperature sensor. Precipitation data was obtained from the Iowa State ASOS (<https://mesonet.agron.iastate.edu/ASOS/>) site for Mansfield, Ohio.

Sound level measurements have been summarized into 10-minute and period-long intervals. Periods during measurements with measurable precipitation and wind speeds over 5 m/s (11 mph) were removed from the data set. This is due to these kinds of weather events inflating sound levels in a way that is not representative of the actual landscape. Additional noise events that were removed were interaction of people or animals with the equipment, seasonal sound sources (mowing, etc.), or excessively loud anomalous sources. Due to persistent insect noise during the monitoring period, ANS weighting was applied to background sound level monitoring results.<sup>1</sup>

## 3.3 RESULTS

### Western Monitor

Time-history graphs from the western monitor are shown in Figures 9, 10, and 11, and overall results are shown in Table 1. The overall daytime sound level was 42 dBA  $L_{eq}$  and 28 dBA  $L_{90}$ . The overall nighttime sound level is 37 dBA  $L_{eq}$  and 21 dBA  $L_{90}$ . This relatively wide-spread between the  $L_{eq}$  and  $L_{90}$  is due to the existence of transient sound sources. This site has a relatively minimal diurnal pattern, with only slight sound level decreases during the nighttime period most days, due to less frequent car pass-bys.

Common sound sources at this site include car pass-bys on nearby roads, airplane overflights, train pass-bys and horns, and farm equipment.

---

<sup>1</sup> *Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas - ANSI S12.100-2014*, Melville, NY: American National Standards Institute, Inc., 2014.

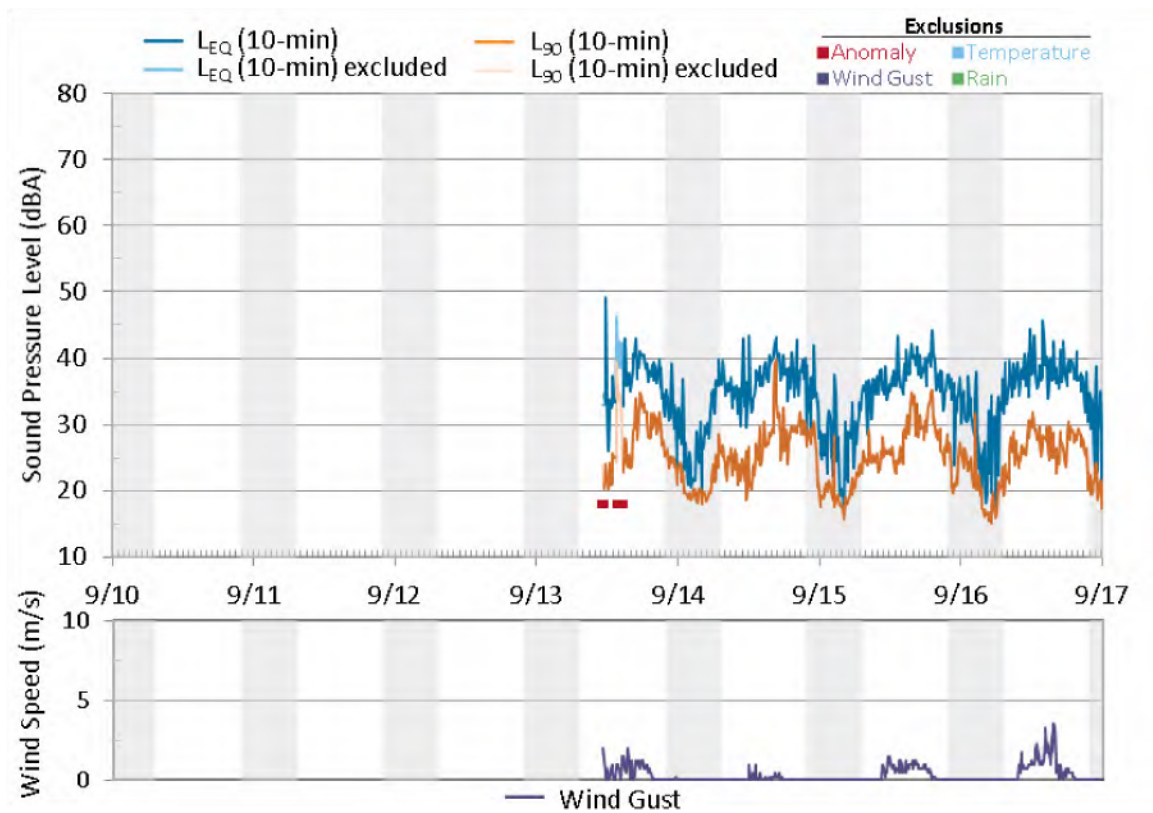


FIGURE 9: WESTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 1

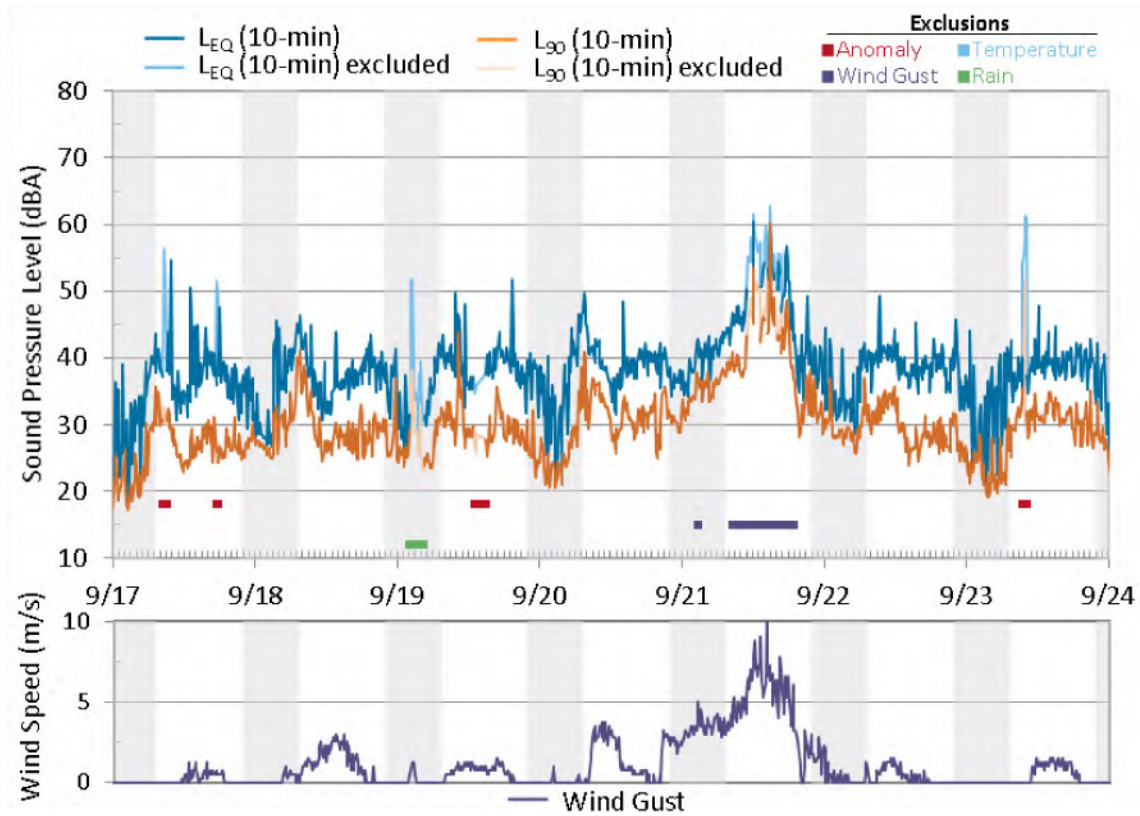


FIGURE 10: WESTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 2

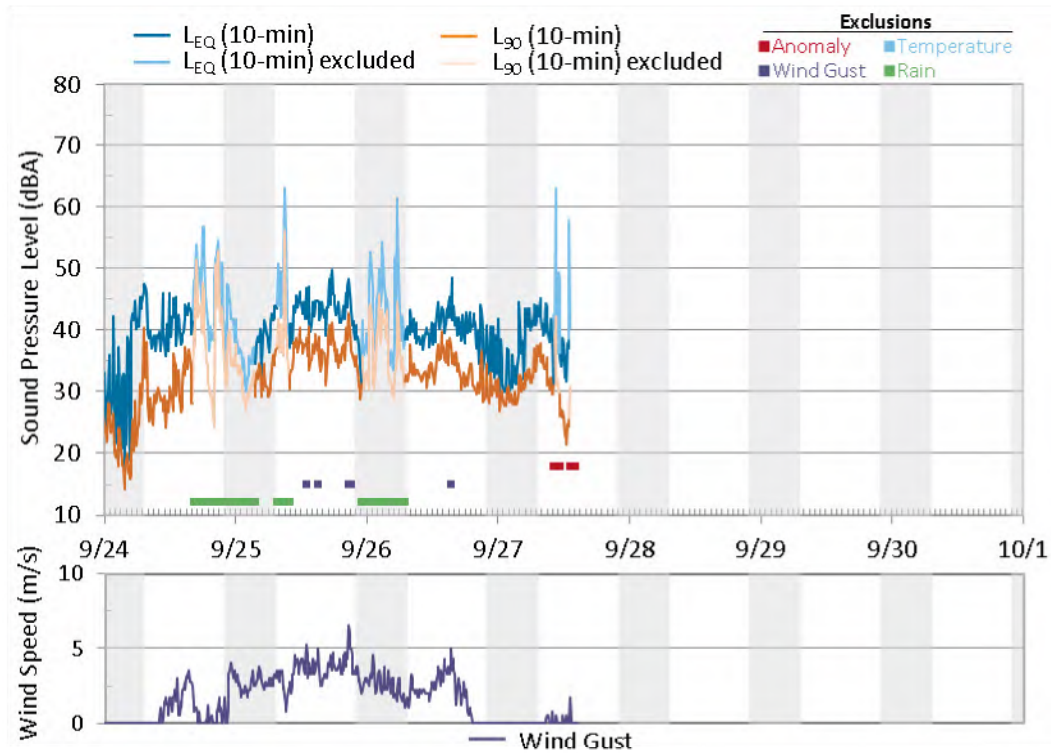


FIGURE 11: WESTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 3

## Middle Monitor

Time-history graphs from the middle monitor are shown in Figure 12, 13, and 14 with overall results shown in Table 1. Overall daytime sound levels are 38 dBA  $L_{eq}$  and 25 dBA  $L_{90}$  and overall nighttime sound levels are 35 dBA  $L_{eq}$  and 20 dBA  $L_{90}$ . Similar to the west monitor, this site has a minimal diurnal pattern, which seems to be driven primarily by a decrease in traffic volumes at night. The spread between the  $L_{eq}$  and  $L_{90}$  is relatively large, just not as large as at the Western monitor, due to the prevalence of transient sounds such as car pass-bys.

The most common sound sources at this site are car pass-bys, train pass-bys, airplane overflights, sounds from home maintenance, dogs, and farm equipment.

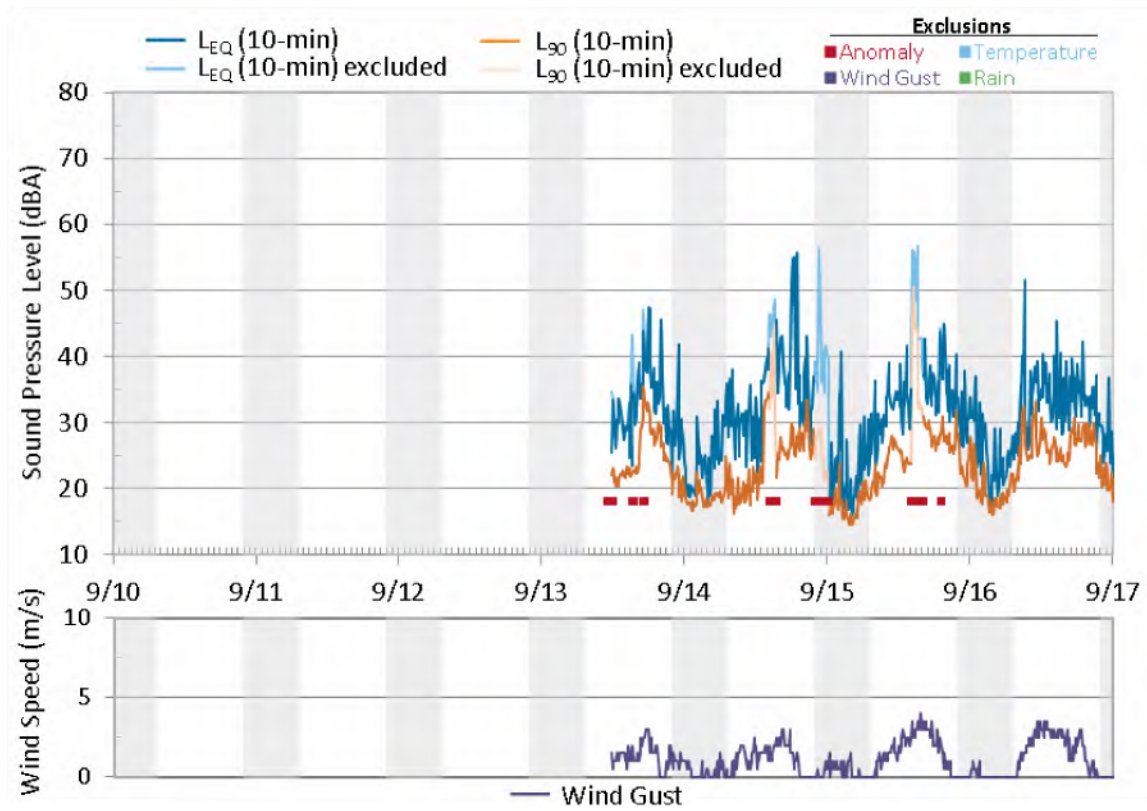


FIGURE 12: MIDDLE MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 1

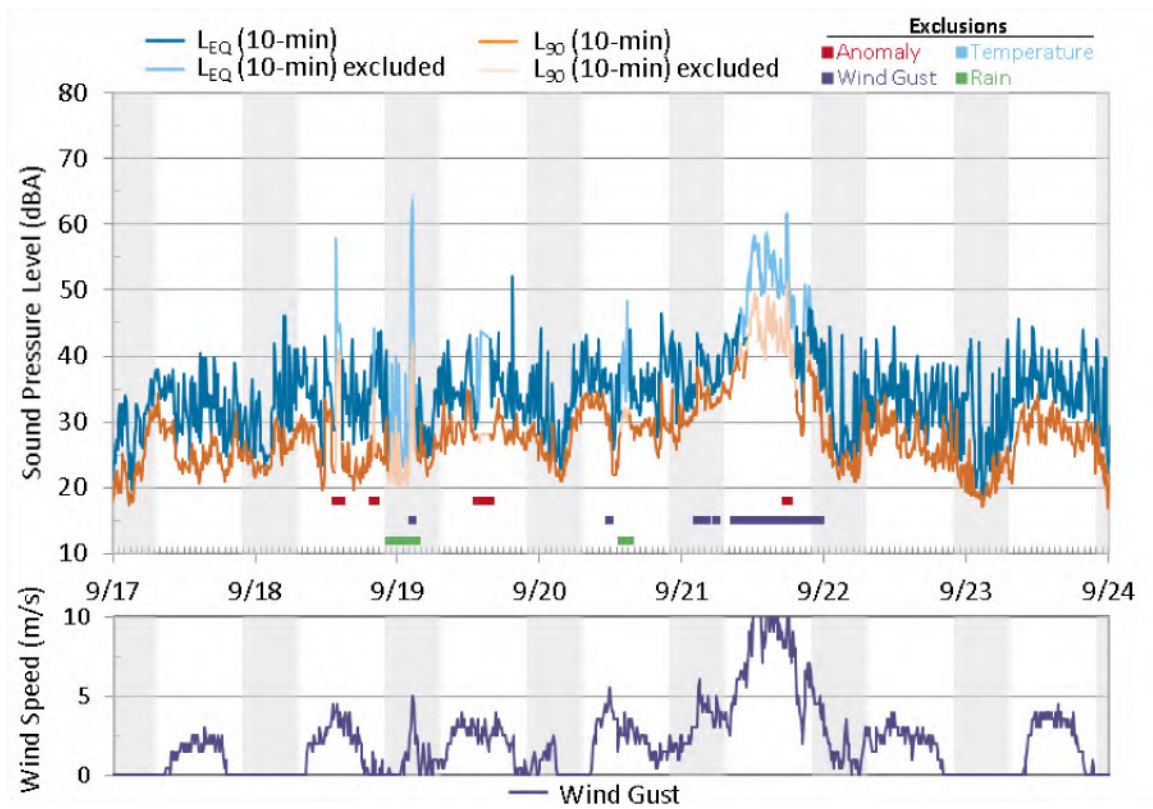


FIGURE 13: MIDDLE MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 2

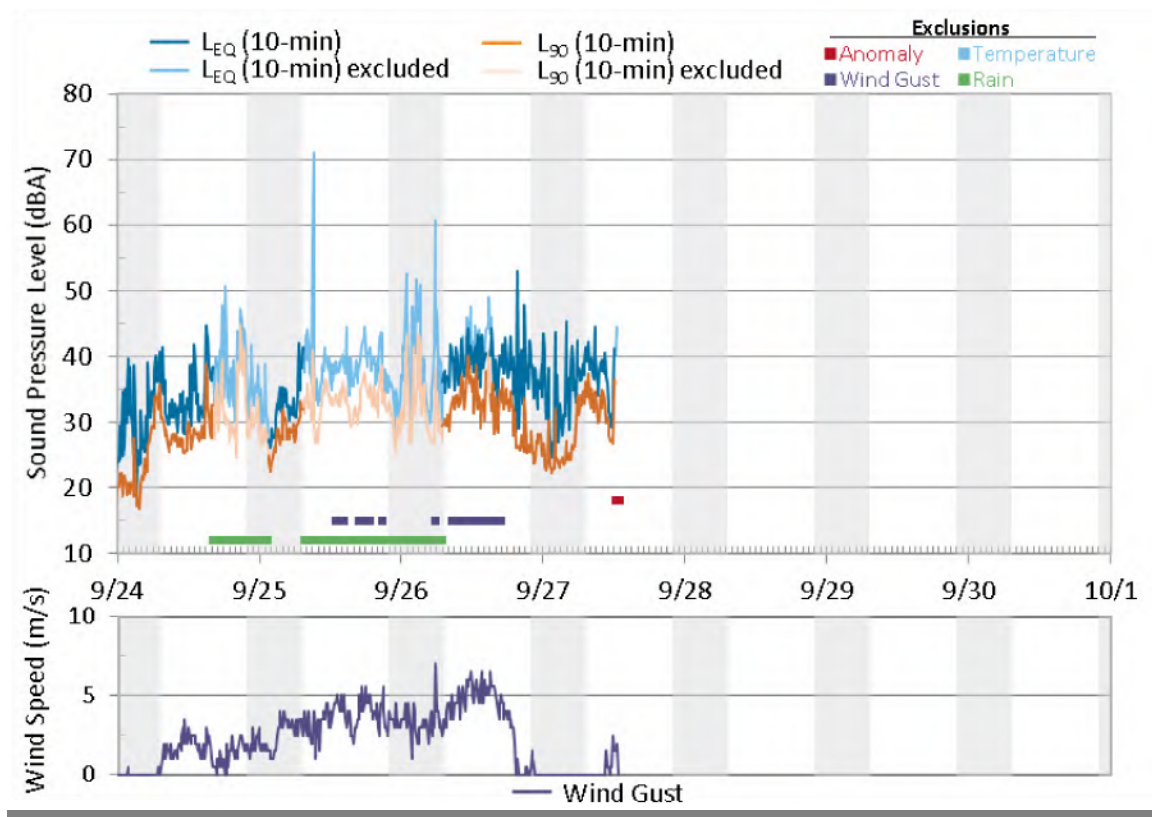


FIGURE 14: MIDDLE MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 3

## Eastern Monitor

Time-history graphs from the western monitor are shown Figures 15, 16, and 17, and overall results are shown in Table 1. Overall daytime sound levels are 43 dBA  $L_{eq}$  and 26 dBA  $L_{90}$  and nighttime overall sound levels are 37 dBA  $L_{eq}$  and 20 dBA  $L_{90}$ . Similar to the other sites, the soundscape is dominated by transient sound and there is minimal diurnal pattern to sound levels.

The most common sound sources at this location are airplane overflights, car pass-bys, farm, equipment, a few gunshots, and trains.

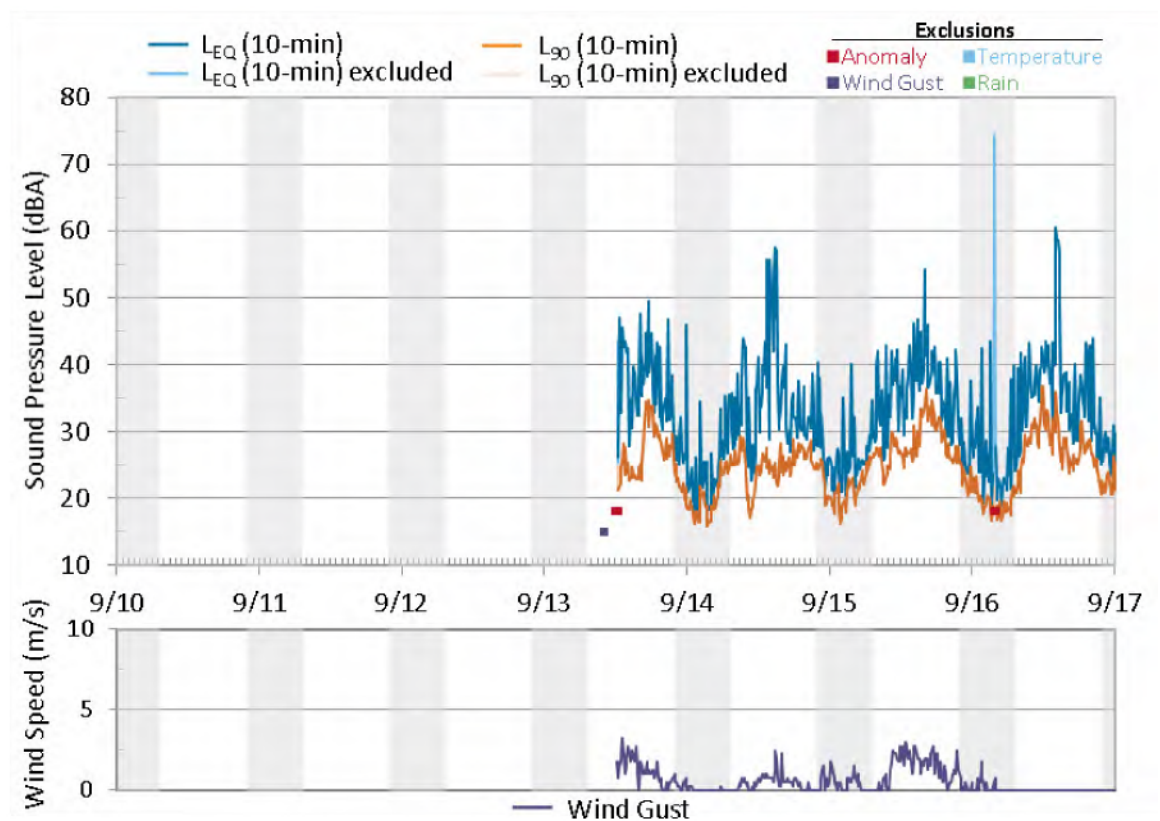


FIGURE 15: EASTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 1

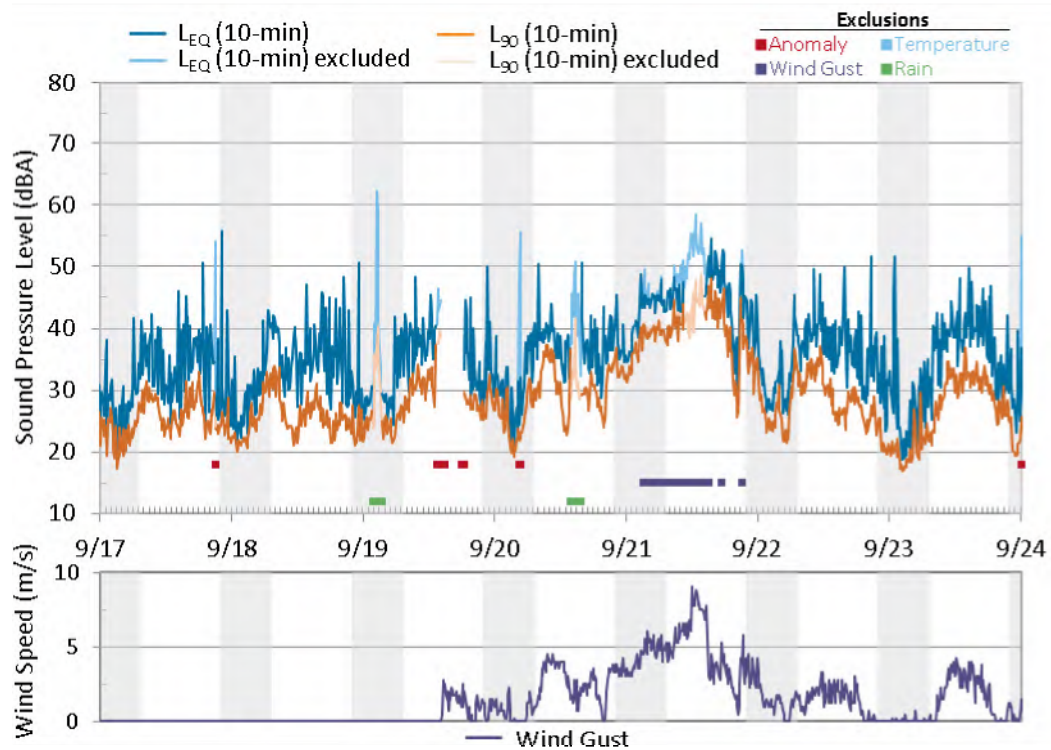


FIGURE 16: EASTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 2

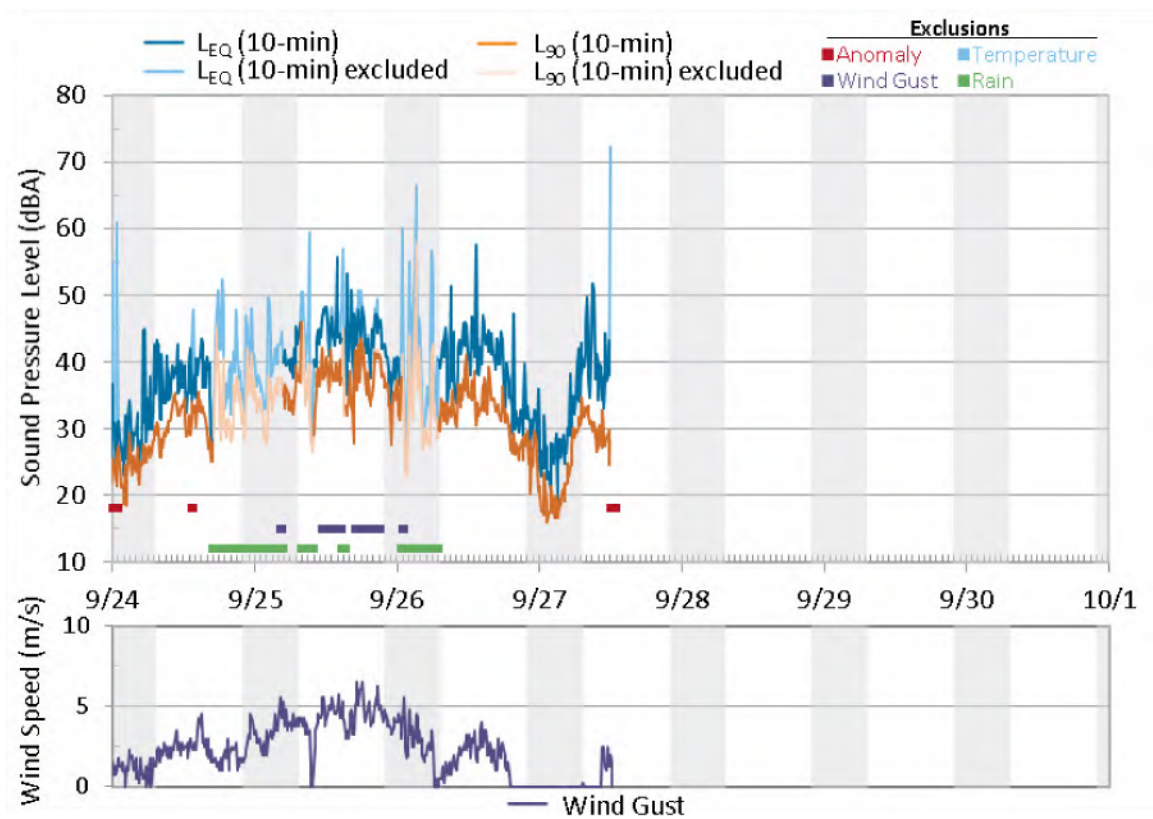


FIGURE 17: EASTERN MONITOR SOUND LEVEL TIME-HISTORY RESULTS - WEEK 3

Summary

A summary of background sound levels is shown in Table 1 and a summary of meteorological data is shown in Table 2. The windiest site is the middle site, with an average 1.5 meter wind speed of 0.6 m/s or 1.2 mph. Temperatures range between 6.4 and 34.3 °C (43.6 and 93.7 °F). Rain fell on September 18, 20, 24, and 25.

Results show that sound levels between the three sites are relatively consistent, particularly at night. All three locations were rural, with no major sound sources, other than traffic on nearby roads, which is an intermittent sound source. This can be seen by the relatively large differences between the  $L_{eq}$ s and  $L_{90}$ s for certain time periods. The arithmetic average of the nighttime  $L_{eq}$ s is 36 dBA.

**TABLE 1: BACKGROUND SOUND LEVEL SUMMARY BY LOCATION**

Monitor Location	Sound Pressure Level (dBA)											
	Overall				Day				Night			
	L <sub>eq</sub>	L <sub>90</sub>	L <sub>50</sub>	L <sub>10</sub>	L <sub>eq</sub>	L <sub>90</sub>	L <sub>50</sub>	L <sub>10</sub>	L <sub>eq</sub>	L <sub>90</sub>	L <sub>50</sub>	L <sub>10</sub>
Middle Monitor	37	22	30	38	38	25	31	39	35	20	27	37
East Monitor	43	23	31	41	43	26	33	43	37	20	27	38
West Monitor	40	24	34	44	42	28	36	44	37	21	30	41
Arithmetic Average	36											

**TABLE 2: METEOROLOGICAL DATA SUMMARY**

Monitor Location	Wind Speed				Temperature					
	m/s		mph		Fahrenheit			Celsius		
	Max. Gust	Avg.	Max. Gust	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg
Western	11.3	0.3	25.3	0.7	43.6	93.7	69.3	6.4	34.3	20.7
Middle	12.6	0.6	28.1	1.2	-	-	-	-	-	-
Eastern	9.1	0.2	20.3	0.6	-	-	-	-	-	-

## 4.0 ELECTRICAL TRANSMISSION LINE NOISE

---

Transmission lines, such as those proposed here, can generate noise during corona discharges. This occurs primarily in foul weather when water droplets form on the conductors. The types of foul weather that create the most audible noise are rain, fog, snow, and temperatures below the dew point. Dirty conductors can also lead to corona discharge.

Corona noise is generated through the discharge of electrons into neutral air molecules. These pulses occur randomly in time and space, generally resulting in a broadband noise spectrum. However, given that the peak voltage is synchronized with the supply voltage, there can also be a resultant pure tone at twice the supply frequency ( $60 \text{ Hz} \times 2 = 120 \text{ Hz}$ ). Harmonics of this tone may also be present, but to a much lesser extent. For this study, we use a spectral shape based on the arithmetic average from three 525 to 534 kV power line corona noise measurements (Figure 18) which includes both broadband and tonal components.<sup>2</sup>

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<sup>2</sup> From Chartier, V.L., and Stearns, R.D., "Formulas for predicting audible noise from overhead high voltage AC and DC lines," IEEE Transactions on Power Apparatus and Systems, Vol. PAS-100, No. 1, 1981.

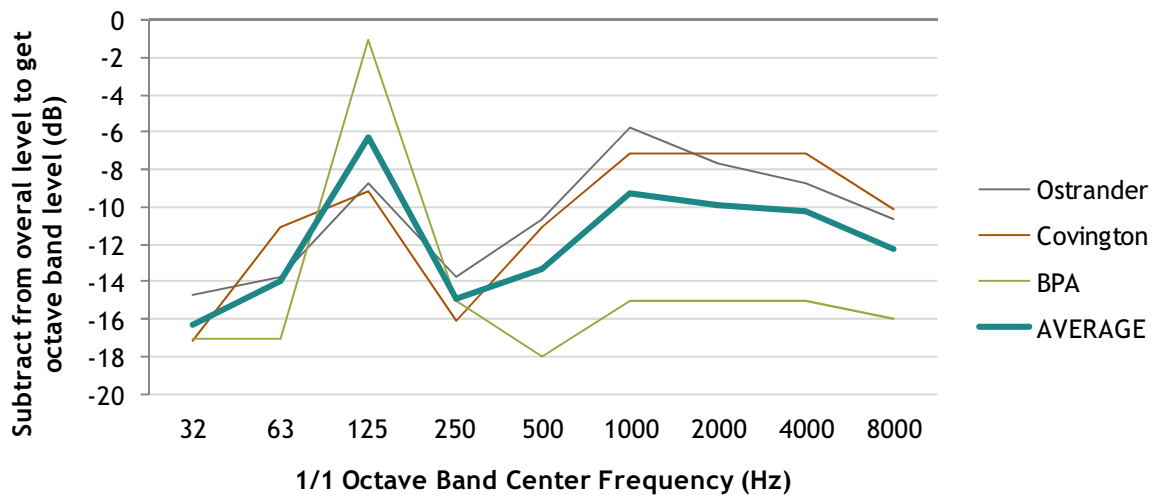


FIGURE 18: DIFFERENCE BETWEEN OVERALL LEVEL AND OCTAVE BAND LEVEL FOR THREE SITES, IN UNWEIGHTED dB

## 4.1 PREDICTING AUDIBLE NOISE FROM TRANSMISSION LINES

### Methodology

Predicting audible noise from overhead power lines has been done primarily through empirical formulas based on measurements of existing power lines. In a 2000 review of ten empirical equations,<sup>3</sup> the “BPA formula”<sup>4</sup> was found to be the most accurate. This equation is as follows:

$$AN = 120 \log(g) + 26.4 \log(n) + 55 \log(d) - 11.4 \log(r) - 128.4 + K$$

Where

AN is the 50<sup>th</sup> percentile audible noise level ( $L_{50}$ ) in dB(A) for foul weather

g is the average maximum bundle surface electric field gradient in kV/cm

n is the number of conductors per bundle

d is the sub-conductor diameter, and

r is the distance between the bundle and the observer

<sup>3</sup> Yang, K, Lee, D., “New formulas for predicting audible noise from overhead HVAC lines using evolutionary computations,” IEEE Transactions on power delivery, Vol. 15, No. 4, 2000

<sup>4</sup> Chartier and Stearns (1981) (see above). See also IEEE Committee Report, “A comparison of methods for calculating audible noise of high voltage transmission lines,” IEEE Trans., Vol PAS-101, 1982

$K = 0$  for  $L_{50}$  in foul weather,  $-25$  for  $L_{50}$  in fair weather,  $+3.5$  for  $L_{50}$  in heavy rain, and  $A/0.3$  for high altitudes, where  $A$  is the altitude above sea level in kilometers.

The total audible noise is the sum of audible noise from each conductor bundle.

For a typical line source, the distance term is  $-10 \log(r)$ . The use of  $-11.4 \log(r)$  in the BPA formula is to take into account the effects of atmospheric absorption, which, at the time, was a difficult calculation to make. However, since we can now accurately calculate atmospheric absorption using ISO 9613-1,<sup>5</sup> we chose to replace the BPA  $-11.3 \log(r)$  with  $-10 \log(r) - A_{\text{atm}}$ , where  $A_{\text{atm}}$  is the atmospheric attenuation (by octave band) for  $10^\circ\text{C}$ , 1 atmosphere, and 70% humidity as a function of distance to the receiver.

For this project, we assumed the average normal conductor height above ground per phase.

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<sup>5</sup> "Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere," ISO 9613-1, 1993.

## 5.0 SOUND PROPAGATION MODELING

### 5.1 PROCEDURES

Modeling for the project was in accordance with the standard ISO 9613-2, “Acoustics – Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation.” The ISO standard states,

This part of ISO 9613 specifies an engineering method for calculating the attenuation of sound during propagation outdoors in order to predict the levels of environmental noise at a distance from a variety of sources. The method predicts the equivalent continuous A-weighted sound pressure level ... under meteorological conditions favorable to propagation from sources of known sound emissions. These conditions are for downwind propagation ... or, equivalently, propagation under a well-developed moderate ground-based temperature inversion, such as commonly occurs at night.

The model takes into account source sound power levels, surface reflection and absorption, atmospheric absorption, geometric divergence, meteorological conditions, walls, barriers, berms, and terrain. The acoustical modeling software used here was CadnaA®, from Datakustik GmbH. CadnaA® is a widely accepted acoustical propagation modeling tool, used by many noise control professionals in the United States and internationally.

ISO 9613-2 also assumes downwind sound propagation between every source and every receiver, consequently, all wind directions, including the prevailing wind directions, are considered.

The sound sources modeled for this project are the transmission lines, except in the cumulative case where turbines for the Republic Wind project are included along with the collector substation transformer. The Point of Interconnect (POI) substation includes breakers, relays, a control building, batteries, and current transformers. Breakers rarely emit sound and the other equipment is not expected to be a major sound source. As a result, no equipment in the POI substation is modeled.

### 5.2 RESULTS

Modeling results for all three proposed power line routes are shown in Figures 19 to 21.

Modeling results show the maximum corona noise for the new 138 kV transmission line, under foul weather, was 29 dBA right under the power line and 23 dBA at 34 meters, the approximate distance of the closest receiver for each route. For reference the nighttime background  $L_{eq}$  measured for the three monitoring sites described above was 36 dBA and 35 dBA at the

quietest location. This indicates that corona sound levels will be below the background sound levels at most, if not all, locations.

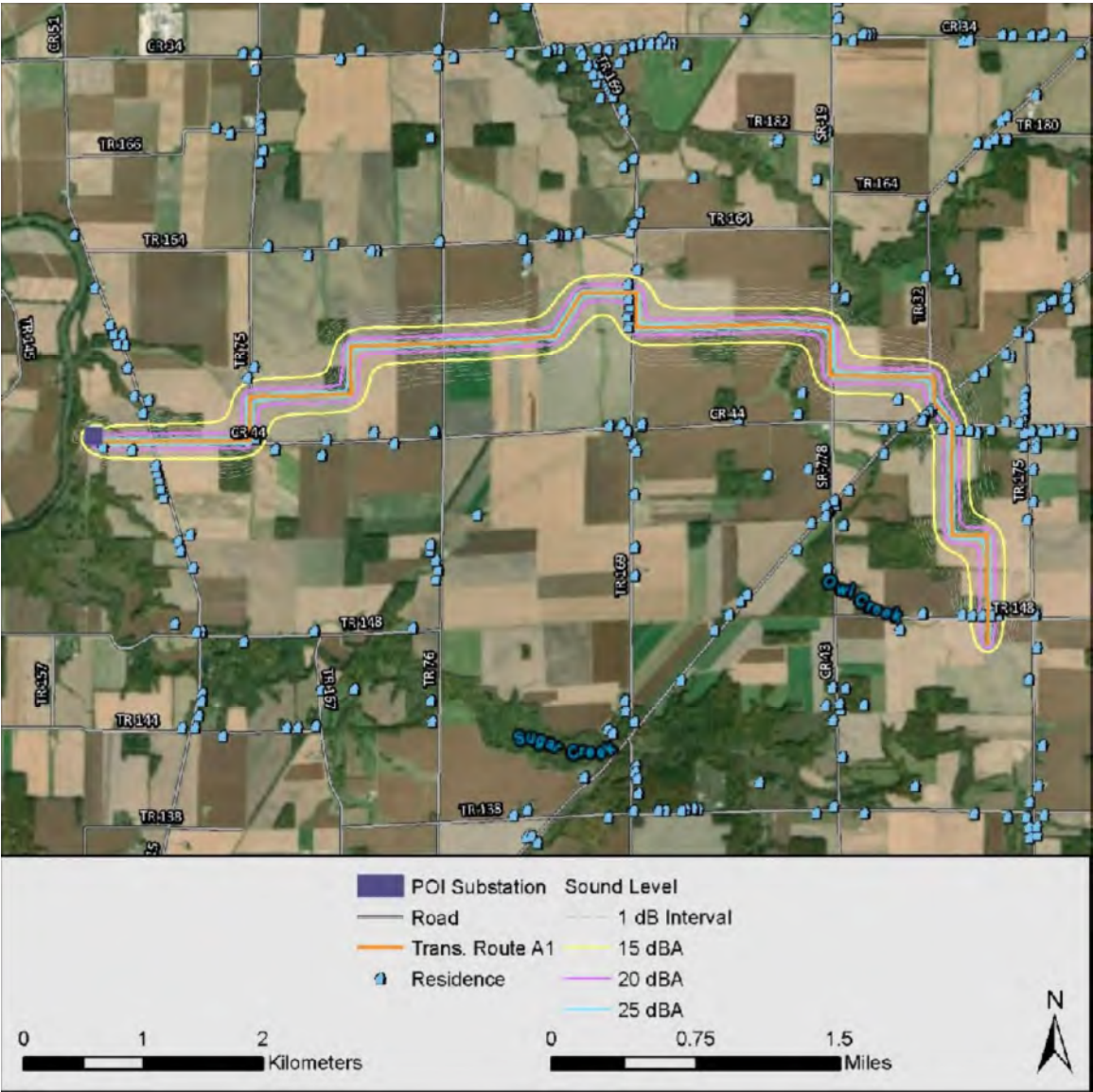


FIGURE 19: SOUND PROPAGATION MODELING RESULTS - ROUTE A1

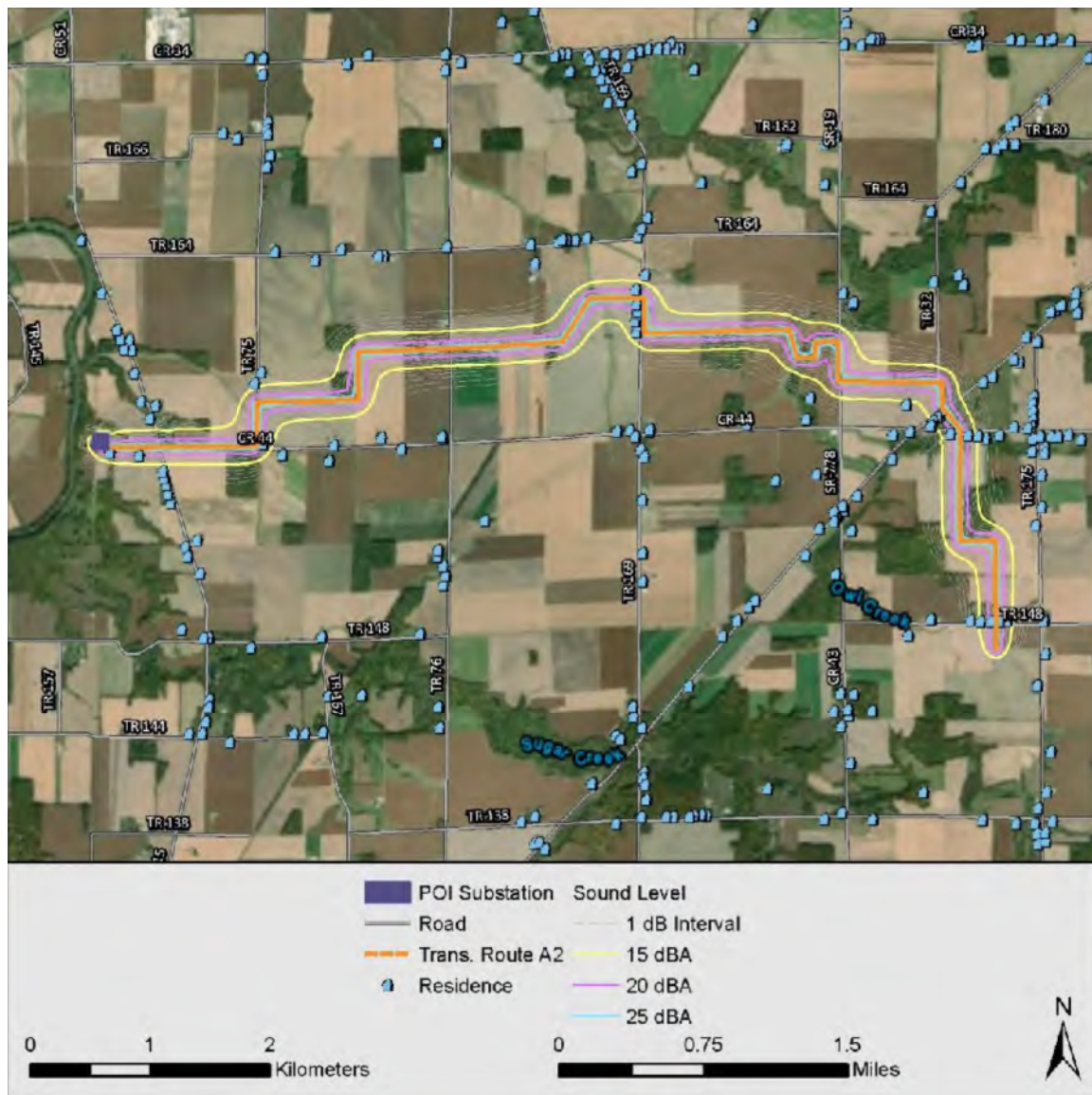


FIGURE 20: SOUND PROPAGATION MODELING RESULTS - ROUTE A2

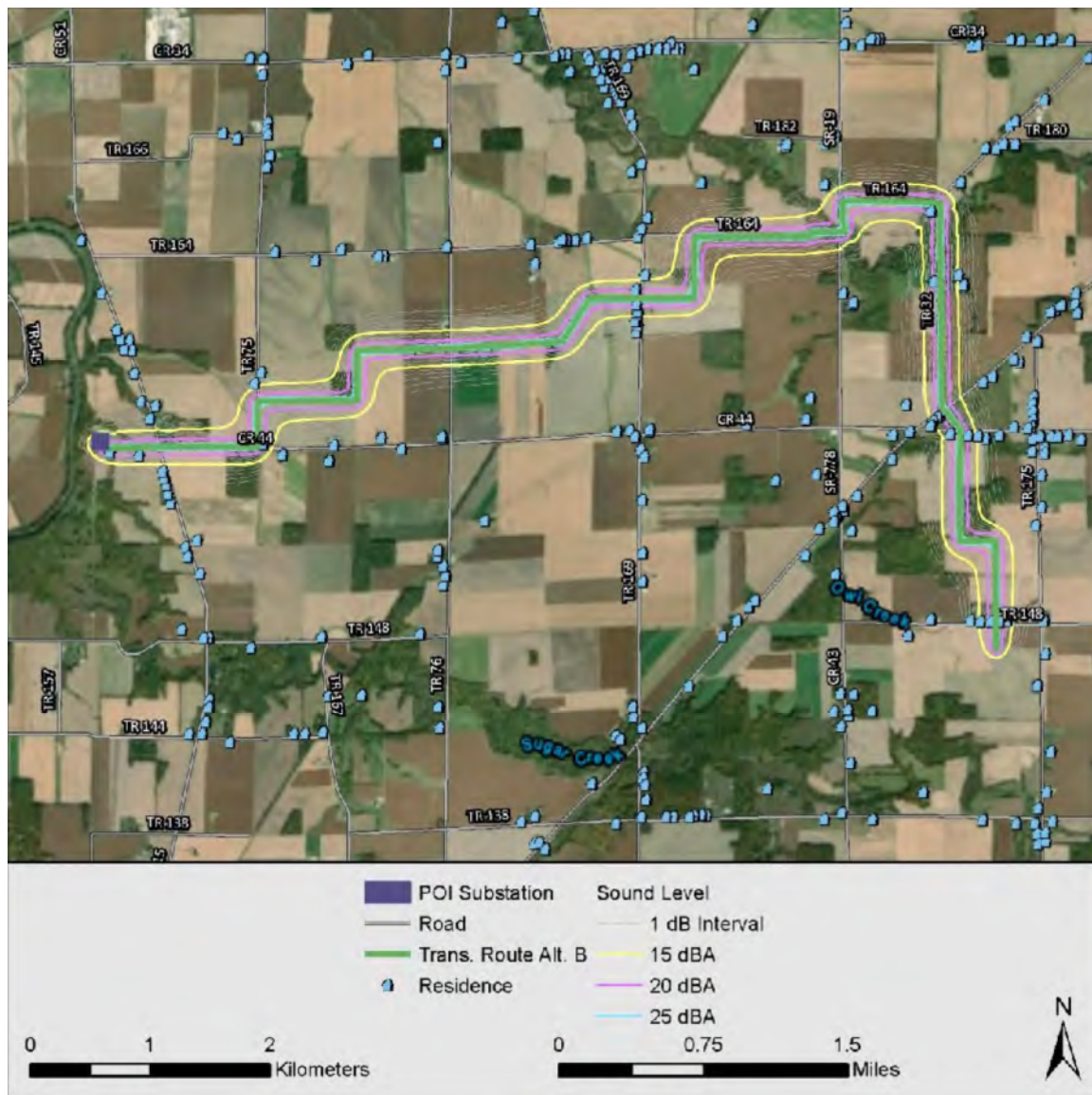


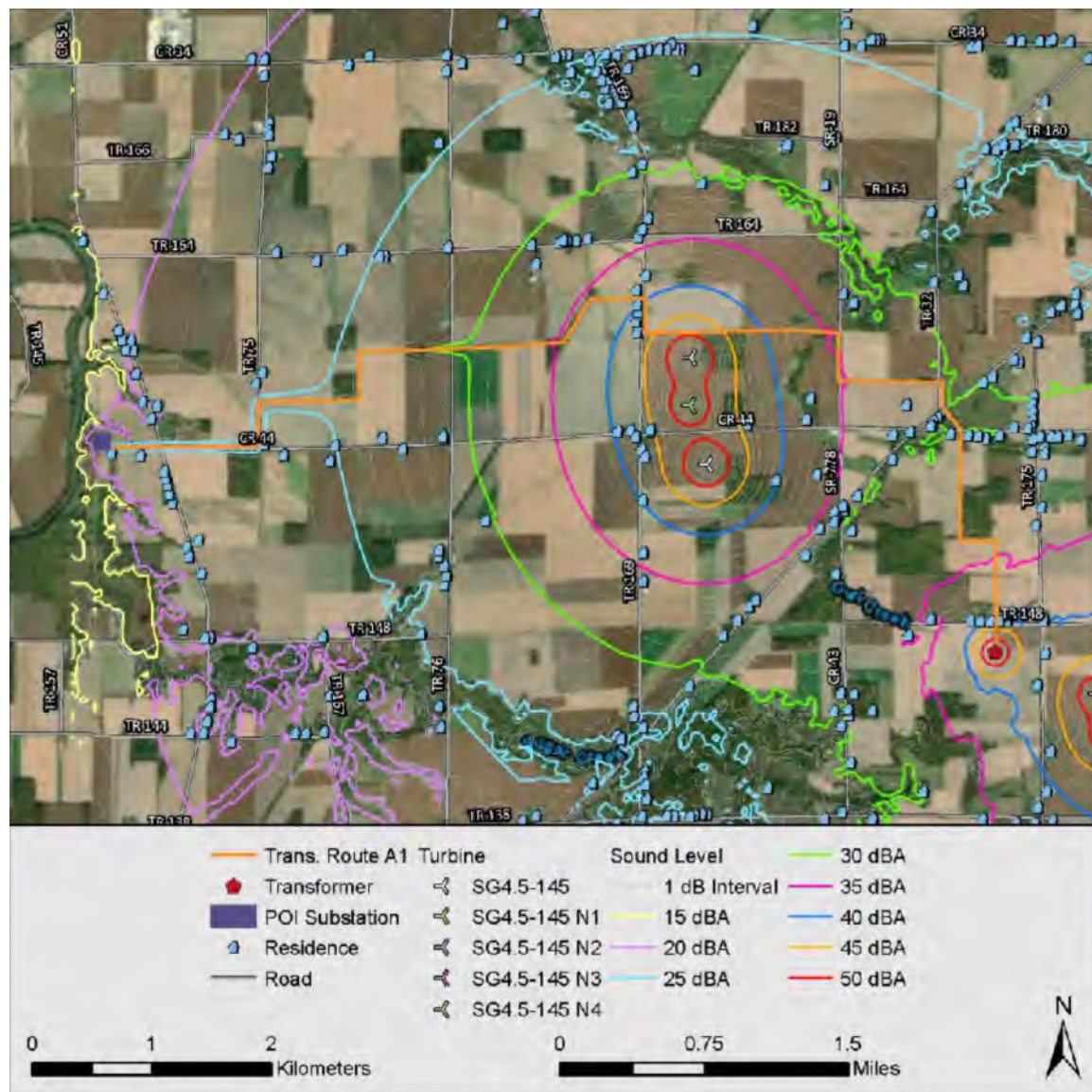
FIGURE 21: SOUND PROPAGATION MODELING RESULTS - ROUTE ALT. B

### 5.3 CUMULATIVE

Cumulative sound propagation modeling was performed to include the proposed Republic Wind power project, along with the proposed transmission line. Modeling was performed, assuming the turbine array presented in RSG's December 2018 report *Noise Impact Assessment for Republic Wind – Seneca and Sandusky County, Ohio*. The turbine modeled was the worst-case presented in that report, the Siemens-Gamesa SG4.5-145, with the same Noise Reduced

Operations (NROs) implemented. A graphic of the sound propagation modeling results is shown for Route A1 in Figure 22 and the other routes are shown in Figures 33 and 34 in Appendix D. Discrete modeling results are also shown in Table 6 of Appendix D.

Results indicate that, with the transmission line included, the highest sound level at a nonparticipating residence is 46 dBA, which is the sound level limit for the Republic Wind project.



**FIGURE 22: CUMULATIVE SOUND PROPAGATION MODELING RESULTS - ROUTE A1, SIEMENS-GAMESA SG4.5-145 TURBINES**

## 6.0 CONSTRUCTION NOISE MODELING

---

Construction will be located at the Point of Interconnect (POI) substation and along the transmission line route. Most construction along the route of the transmission line will be relatively brief, involving installation of poles and conductors.

Equipment used for construction will vary. We modeled the 28 loudest sound sources that are expected to be used. These are shown in Table 3 along with the modeled maximum sound pressure level at 34 meters or 112 feet (the closest residence to the transmission line), 25 meters or 82 feet (the closest residence to the POI substation), reference sound levels at 15.2 meters (50 feet), and at 257 meters or 842 feet (the distance of the next closest residence to the POI substation).

The method used for modeling construction noise impacts is the Federal Highway Administration's (FHWA) Roadway Construction Noise Model (RCNM). The sound levels shown below are those typically used within the RCNM, unless RSG has measured a sound source of that type. Ground was assumed to be non-porous near the sound sources and porous near the receivers.

Major construction work, such as drilling, will occur during the day. Some construction activity such as extended concrete pours, and minor construction work may extend earlier or later. Construction is expected to be intermittent.

Work on the POI substation will be at least 25 meters (82 feet) from the nearest residence.

**TABLE 3: CONSTRUCTION NOISE MODELING RESULTS**

Equipment Type	Sound Pressure Level (dBA)			
	50 feet (15.2 meters)	82 feet (25 meters)	112 feet (34 meters)	842 feet (257 meters)
Loader	79	75	72	49
Backhoe	80	76	73	51
Auger Drill Rig	88	84	80	59
Bucket Truck	78	74	70	48
Cable Tensioner	80	76	72	50
Chain Saw	85	81	77	56
Compactor	82	78	74	53
Concrete Mixer	85	81	78	56
Concrete Pump	82	78	75	53
Crane	88	84	81	59
Dozer	85	81	78	56
Drill Rig	88	84	81	59
Excavator	83	79	76	54
Generator	81	77	74	52
Gradall	86	82	79	57
Grader	77	72	70	47
Hydro Mulcher	78	74	70	48
Impact Pile Driver	101	97	94	72
Jackhammer	89	85	81	60
Rock Drill	98	94	91	69
Roller	80	76	73	51
Forklift	68	64	61	39
Scraper	89	85	82	60
Slurry Machine	91	87	84	62
Small Track Crane	87	83	80	58
Tractor Trailer	83	79	75	53
Utility Truck	78	74	70	48
Vacuum Excavator	85	81	78	56

## 7.0 SUMMARY AND CONCLUSIONS

The Republic Wind project is a wind power project proposed by Apex Clean Energy, to be located in Seneca and Sandusky County, Ohio, between the towns of Bellevue and Republic. The project is proposed to have between 50 and 58 turbines and a nameplate capacity of at least 200 MW. To support the project, there will be a collector substation, transmission line, and Point of Interconnect (POI) substation. The proposed transmission line will be 138 kV and will span the approximately 7.6 kilometer (4.8 mile) distance between the collector and Point of Interconnect (POI) substation.

As part of the Ohio Power Siting Board (OPSB) permitting process, Apex Clean Energy retained RSG to conduct a pre-construction noise assessment of the transmission line.

Conclusions are as follows:

- The sound level limit specified in Ohio Administrative Code Section 4906-4-09(F) for wind power facilities has set the applicable nighttime noise limit at a home to 5 dBA above the facility area nighttime ambient sound levels ( $L_{eq}$ ). This is not directly applicable to electrical transmission lines. There are no sound level limits applicable to electrical transmission lines. Instead, requirements in Ohio Administrative Code Chapter 4906-5 Section (7)(A)(4) focus on what needs to be taken into account by noise studies.
- Background sound level monitoring was performed at three locations along the proposed power line routes. Daytime and nighttime equivalent continuous sound levels ( $L_{eq}$ ) ranged from 38 to 43 dBA and 35 to 37 dBA respectively. Daytime and nighttime lower tenth-percentile sound levels ( $L_{90}$ ) ranged from 25 to 38 dBA and 20 to 21 dBA respectively.
- Sound propagation modeling was performed in accordance with international standard ISO 9613-2 at 623 discrete receivers that surround the project. Transmission line sound emissions were determined using the BPA formula for audible corona noise. Modeling was performed assuming half hard and half porous ground ( $G=0.5$ ). Three total transmission line routes were modeled: A1, A2, and Alt. B. The breakers in the POI substation will only intermittently emit sound and no other major noise sources are expected to be located in the POI substation.
- The highest modeled sound level at any residence from the transmission line alone is 23 dBA. If Republic Wind power project is included in modeling, the highest sound level at any residence is modeled to be 46 dBA.
- Other than extended concrete pours and similar events, major construction will take place during normal business hours. Construction activities that increase sound

above ambient levels at sensitive receptors will be limited to the hours of 7 AM to 7 PM or dusk, whichever is later. Extended duration construction will only occur in and around the Point of Interconnect (POI) substation. Construction for pole placements and conductor installation will be short duration.



## APPENDIX A. ACOUSTICS PRIMER

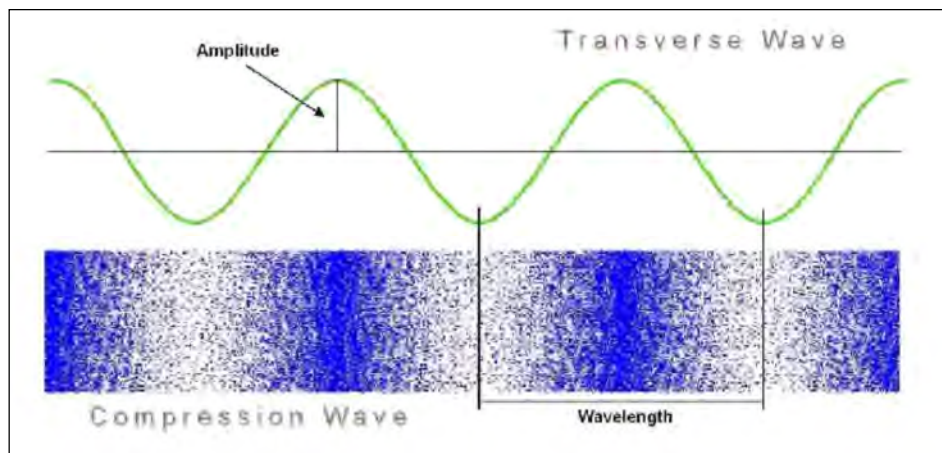
This report uses a variety of terms used to describe sound levels. Since sound can have many characteristics, there are many different ways to describe sound.

### A.1 | SOUND AS A WAVE

Sound is the rapid oscillation of particles in any medium. Using this definition, the sound we experience day-to-day is the rapid vibration of air that we can sense with our ears. However, sound can also propagate through solids such as steel, rock, or wood and through liquids such as water.

Through air, sound propagates as a compression wave. That is, sound travels as fluctuations of air pressure above and below the atmospheric pressure. Sound can also be described in terms of vibrating of air particles where, at certain points along the wave, air particles are compressed and, at other points, the air particles are spread out.

Figure 23 illustrates two ways of describing sound. The blue section at the bottom shows an example of a compression wave, with air particles represented in blue. The green at the top of the figure shows a transverse wave. A transverse wave is similar to a vibrating string. While sound does not physically propagate as a transverse wave, the transverse wave can be used to describe the two main properties of waves in general: amplitude and wavelength.



**FIGURE 23: SOUND AS A WAVE**

In reference to sound, amplitude is what we perceive as the sound pressure level or how loud a source is. The higher the amplitude of the sound wave, the louder it is. Physically, sound amplitude is a measure of the extent to which the air pressure, due to a sound wave, fluctuates

above and below atmospheric pressure. In terms of the compression wave shown in Figure 23, amplitude is expressed by how compressed or spread out the air particles are at the various points along the sound wave.

Wavelength is the distance between two maximum compression locations in a sound wave. One wavelength is one complete cycle of the sound wave. Wavelength is important because it is directly related to the frequency of the sound, which is what the human ear perceives as pitch. Sounds with longer wavelengths are lower in frequency, and shorter wavelengths are higher in frequency. Frequency is dealt with in greater depth in Section A.3 | Spectral Sound Levels.

## A.2 | SOUND PRESSURE LEVEL

The level of a sound is typically quantified by the pressure it exerts. The air pressures from sound that humans can hear range from 20  $\mu\text{Pa}$  to over 10,000,000  $\mu\text{Pa}$ . In order to scale the range down and better approximate the human perception of relative loudness, we use a logarithmic scale for sound pressure level. The unit used for the logarithmic scale is the decibel (dB).

The lower threshold of human hearing is 0 dB at 1000 Hz and the threshold of pain is around 130 dB. A typical conversation in a room is between 50 and 60 dBA (“dBA” indicates that these levels are A-weighted. A-weighting is discussed in Section A.3 | Spectral Sound Levels).

Sound is difficult to describe in individual instantaneous measurements, which gives the sound pressure level at an exact moment in time. The level reading could be 62 dB, but a second later it could be 57 dB. Sound pressure levels are constantly changing. It is for this reason that it makes sense to describe sound levels over time.

Take as an example, the sound levels measured over time shown in Figure 24. Instantaneous measurements are shown as a ragged grey line. The sound levels that occur over this time can be described verbally, but it is much easier to describe the recorded levels statistically. This is done using a variety of “levels” which are described below.

### **$L_{\min}$ and $L_{\max}$**

$L_{\min}$  and  $L_{\max}$  are simply the minimum and maximum sound level, respectively, monitored over a period of time. Note that “maximum” is not the same as “peak”. Peak levels have a different meaning, which is more applicable to sounds which can create hearing damage, which is not dealt with here.

### **Percentile Sound Level - $L_N$**

$L_N$  is the sound level exceeded N percent of the time. This type of statistical sound level, also shown in Figure 24, gives us information about the distribution of sound levels. For example, the  $L_{10}$  is the sound level that is exceeded 10 percent of the time, while the  $L_{90}$  is the sound level

exceeded 90 percent of the time. The L50 is the median and is exceeded half the time. The L90 is often described as the “residual” level, describing a condition when most short-term contaminating sources are removed.

## Equivalent Continuous Sound Level - $L_{EQ}$

One of the most common ways of describing noise levels is in terms of the equivalent continuous sound level ( $L_{EQ}$ ). The  $L_{EQ}$  is the average of the sound *pressure* over an entire monitoring period and expressed as a decibel:

$$Leq_T = 10 * \log_{10} \left( \frac{1}{T} \int_0^T p_A^2(t) dt / p_0^2 \right)$$

where  $p_0^2$  is the squared instantaneous weighted sound pressure signal, as a function of elapsed time  $t$ ,  $p_0$  is the reference pressure of 20 $\mu$ Pa, and  $T$  is the stated time interval.

The monitoring period,  $T$ , can be for any amount of time. It could be one second ( $L_{eq \text{ 1-sec}}$ ), one hour ( $L_{eq(1)}$ ), or 24 hours ( $L_{eq(24)}$ ). Because  $L_{EQ}$  is a logarithmic function of the average pressure, loud and infrequent sounds have a greater effect on the resulting  $L_{EQ}$  than quieter and more frequent sounds. For example, in Figure 24, the  $L_{50}$  (median) is about 47 dB, but the  $L_{eq}$  is 53 dB. Because it tends to weight the higher sound levels and is representative of sound that takes place over time, the  $L_{EQ}$  is the most commonly used descriptor in noise standards and regulations.

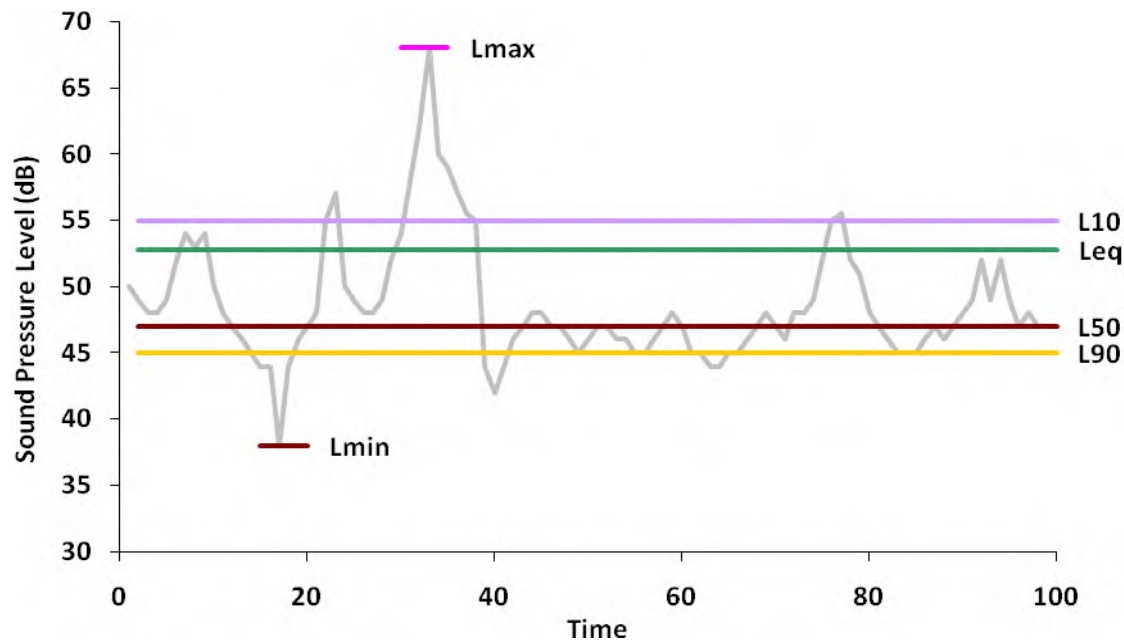


FIGURE 24: EXAMPLE OF DESCRIPTIVE TERMS OF SOUND MEASUREMENT OVER TIME

## A.3 | SPECTRAL SOUND LEVELS

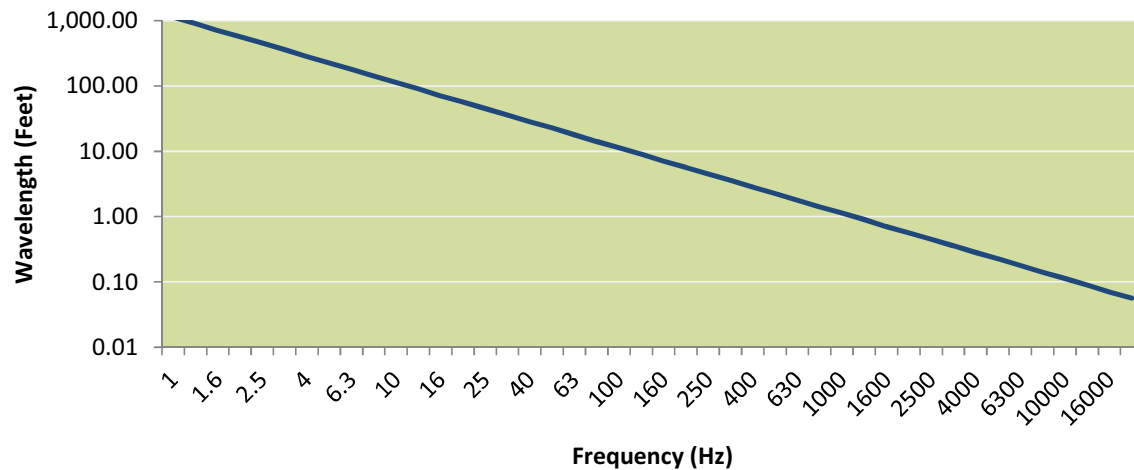
As previously stated, frequency is inversely related to wavelength. The unit used for frequency is cycles per second or hertz (Hz). The relationship between wavelength and frequency is dependent on the speed of sound.

$$\lambda = \frac{c}{f}$$

where  $\lambda$  is wavelength,  $c$  is the speed of sound, and  $f$  is frequency.

Figure 25 shows corresponding wavelengths and frequencies for sound in air at 68°F. People can generally hear sounds at frequencies between 20 and 20,000 Hz (also designated as 20 kHz). As shown, wavelengths in the range of human hearing vary considerably from 56 feet at 20 Hz, to less than an inch at 20 kHz.

Sound below 20 Hz is known as infrasound. Sometimes, we can perceive frequencies below 20 Hz, but that is typically due to our sense of vibration rather than hearing or if the levels are very high. Infrasound wavelengths are very long, with sound at 1 Hz having a wavelength of just over 1,000 feet. Sound above 20 kHz is called ultrasound and is not perceptible by the human ear.



**FIGURE 25: RELATIONSHIP BETWEEN FREQUENCY AND WAVELENGTH**

Most sources are complex and composed of a wide range of frequencies at different sound levels. The range of frequencies and their corresponding sound levels is called a frequency spectrum.

Some sources are tonal, like the individual notes on a piano. Others are broadband, like fans. Human speech typically occurs between 200 Hz and 5 kHz.

## Octave Bands

For analysis purposes, sound is typically broken down into different frequency divisions, or bands. The most common division is the standard octave band. An octave is a band of frequencies whose lower frequency limit is half of the upper frequency limit. An octave band is identified by its center frequency. As an example, the 500 Hz octave band contains all frequencies between 360 Hz and 720 Hz. An octave higher would be twice this. That is, it would be centered at 1,000 Hz with a range between 720 and 1,440 Hz. The range of human hearing is divided into 10 standardized octave bands: 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, and 16 kHz. For analyses that require even further frequency detail, each octave band is often broken down into parts, such as 1/3 octave bands.

## Frequency Weighting

As previously mentioned, sound pressure levels are expressed in terms of decibels. Since the human ear is not sensitive to all frequencies equally, some frequencies, despite being the same decibel level, seem louder than others. For example, a 500 Hz tone at 80 dB sounds louder than a 63 Hz tone at 80 dB. For this reason, frequency weightings are applied to sound levels (Figure 26). The most common weighting scale used in environmental noise analysis is the A-weight,

which more accurately represents the sensitivity of the human ear at low to moderate sound energy. An A-weighted sound level is usually denoted with the unit dBA or dB(A).

The C-weighting is often used for high-energy sounds such as explosions. It weights low-frequency sounds more than the A-weighting. The Z-weighting is used to designate no weighting.

Recently, a new weighting has been proposed – the ANS weighting.<sup>6</sup> This is the A-weighted sound level with all sound above 1,250 Hz eliminated. This weighting is intended to be used to filter out biogenic sound that occurs at high frequencies, such as insects and birds.

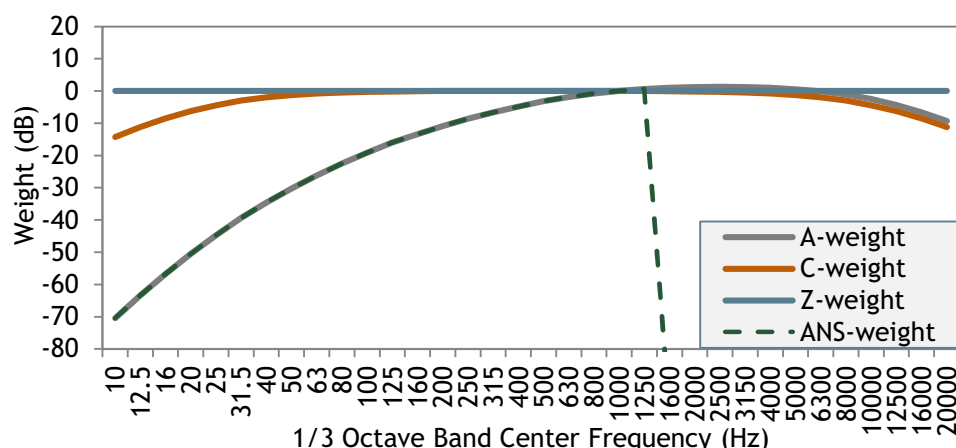


FIGURE 26: SOUND WEIGHTING SCHEMES

## A.4 | SOUND LEVEL METER RESPONSE

As noted in Section 0.2, sound levels vary over time. In fact, the variation is so fast, that one would not be able to reliably read the level on a sound level meter. For that reason, the level shown on sound level meters is often subject to exponential time response, which dampens the reading shown on the meter display to make it readable.

There are three responses available on most sound level meters: slow, fast, and impulse. These levels are denoted as  $L_s$ ,  $L_f$ , and  $L_i$ , respectively. These may also be designated with a weighting, such as  $L_{Af}$  for A-weighted fast –response level. Fast response has a time constant of 125 ms. This response is similar to the response of the human ear. The slow response has a time constant of 1 second. This is often used in environmental noise measurement in that it has a slow rise and fall time, which eliminates very short spikes in noise that are not related to the measurement. The impulse response has a very fast rise time of 35 ms and a slow decay time

<sup>6</sup> *Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas - ANSI S12.100-2014*, Melville, NY: American National Standards Institute, Inc., 2014.

of 1.5 seconds. It is rarely used in environmental noise measurements, but can be used with other metrics to evaluate the impulsivity of a sound event.

Fast, slow, and impulse sound levels cannot be averaged, since they are not representative of the actual sound level over time – they are simply applied to the actual sound level to slow the meter reading. So, an integration of fast, slow, or impulse sound levels will not give an accurate representation of the energy average sound level over time. However, percentiles can be used when this is needed. A true energy average, or equivalent average sound level can be calculated using the  $L_{EQ}$  metric, which is independent of the sound level meter response setting.

## APPENDIX B. MODELING INFORMATION

**TABLE 4: SOUND PROPGATION MODELING PARAMETERS**

Parameter	Setting
Ground Absorption	Spectral for all sources, Mixed Ground (G=0.5)
Atmospheric Attenuation	Based on 10 Degrees Celsius, 70% Relative Humidity
Reflections	None
Receiver Height	4 meters for residences, 1.5 meters for grid
Search Distance	10,000 meters



## APPENDIX C. RECEIVER INFORMATION

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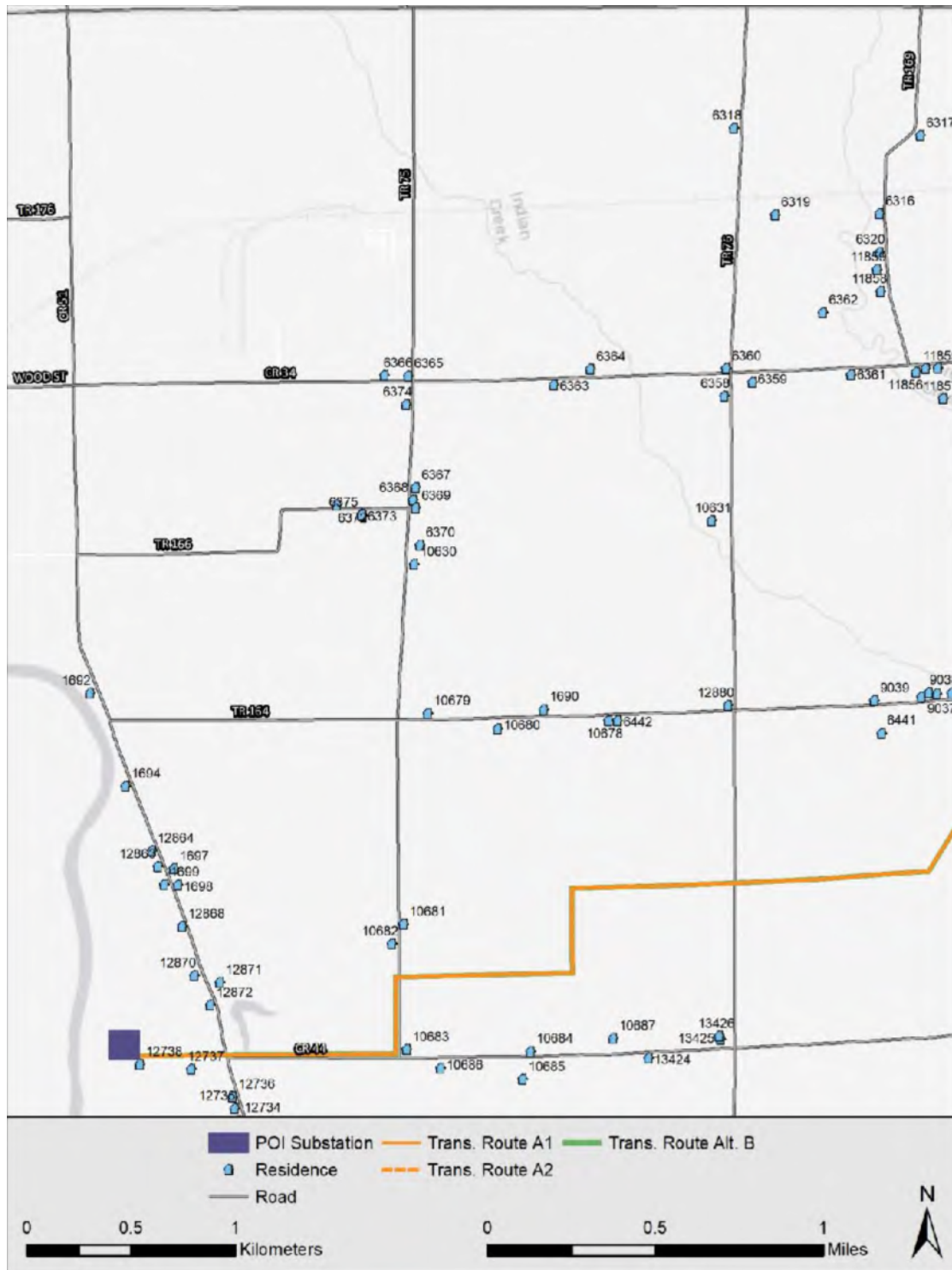


FIGURE 27: MODELED RECEIVERS - NORTHWEST CORNER



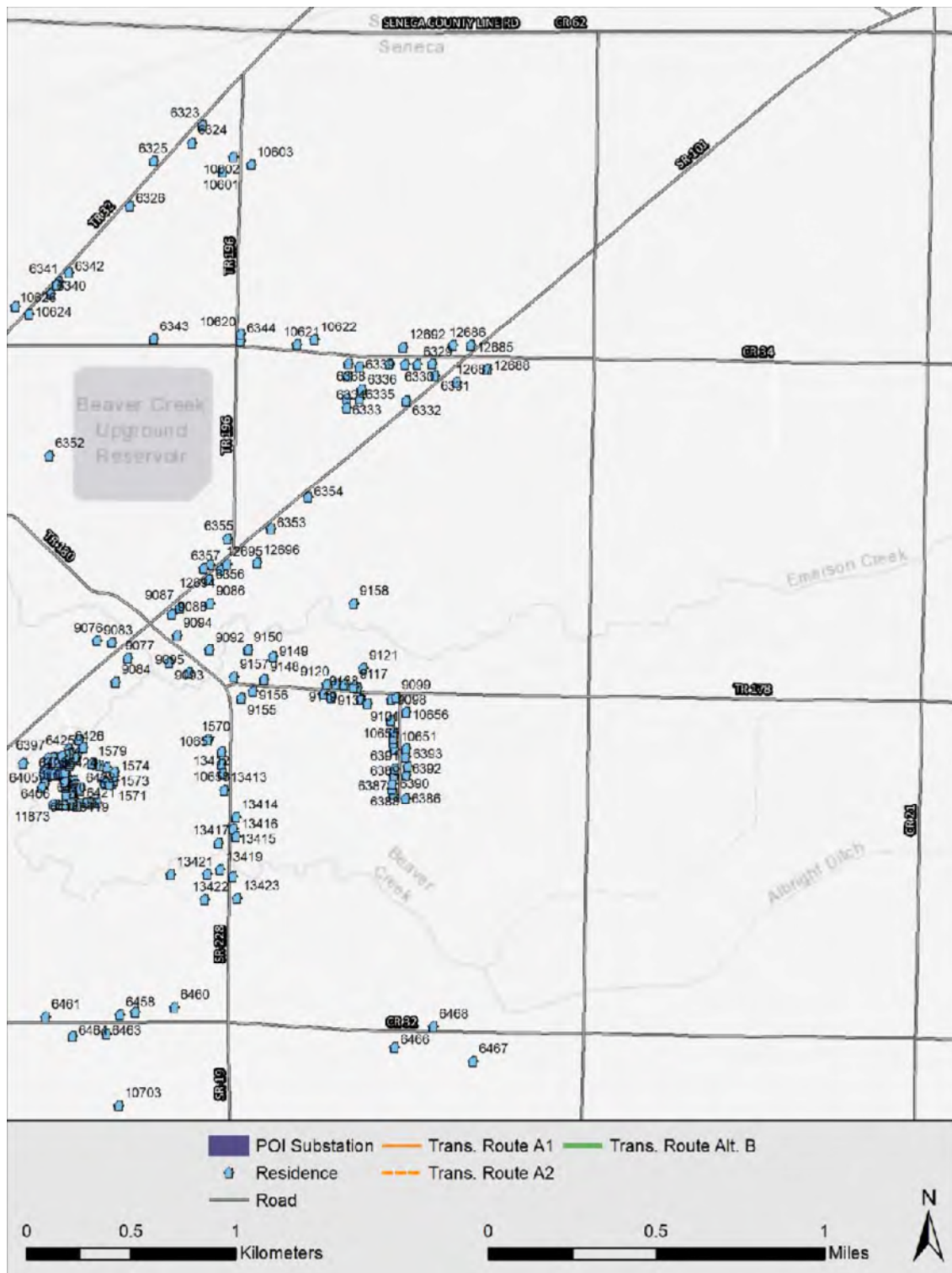
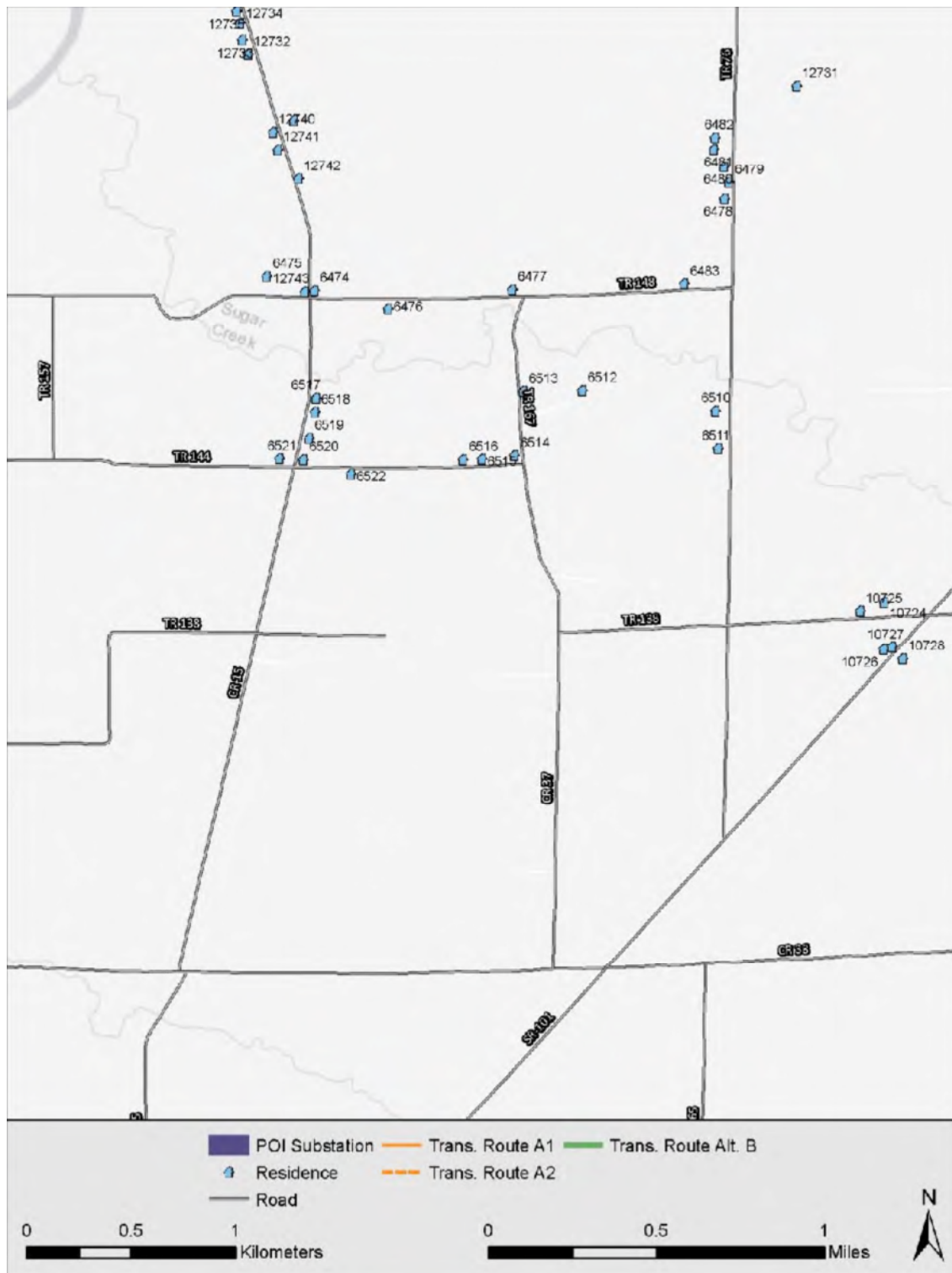
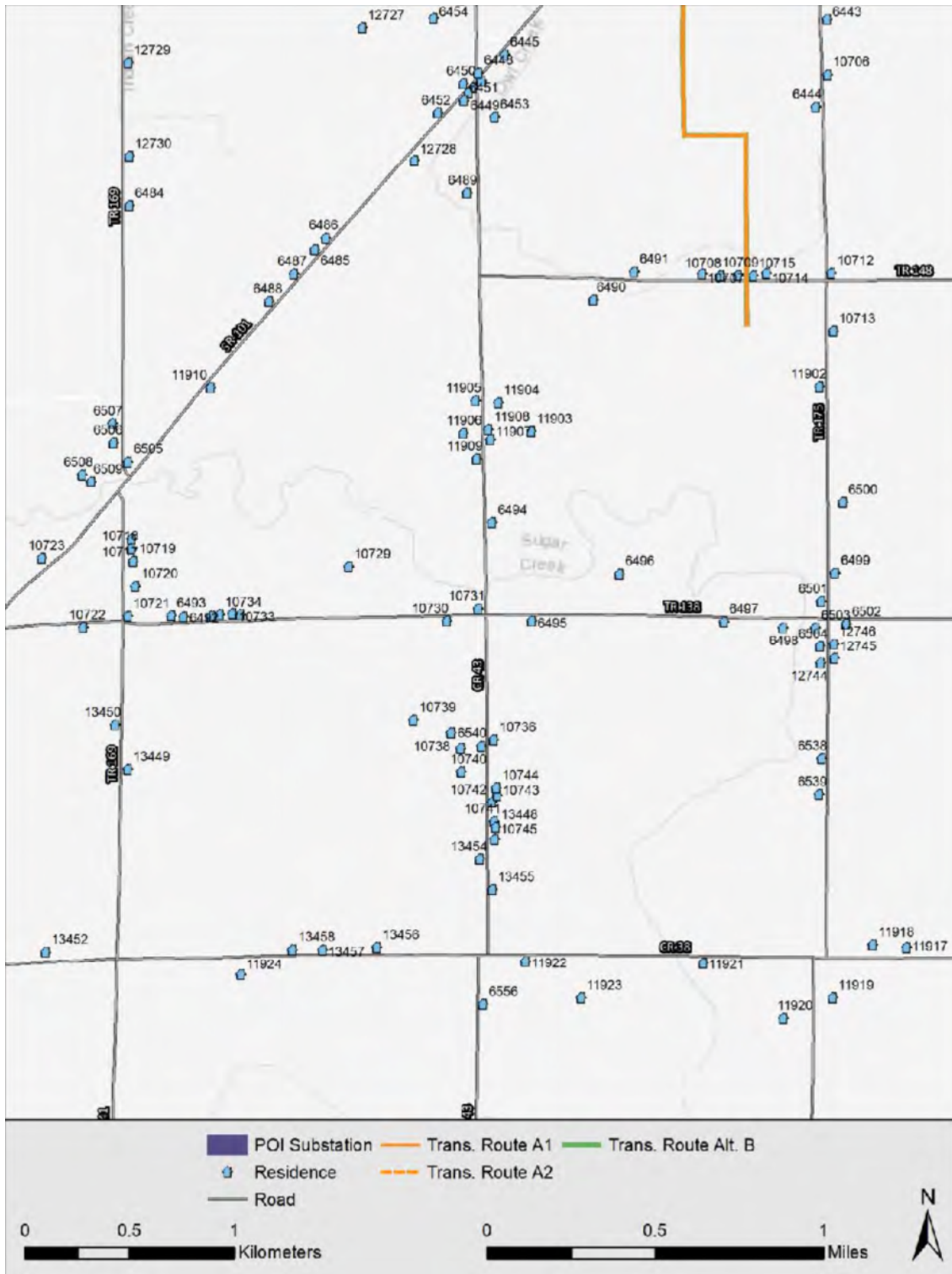


FIGURE 29: MODELED RECEIVERS - NORTHEAST CORNER



**FIGURE 30: MODELED RECEIVERS - SOUTHWEST CORNER**



**FIGURE 31: MODELED RECEIVERS - CENTER SOUTH**

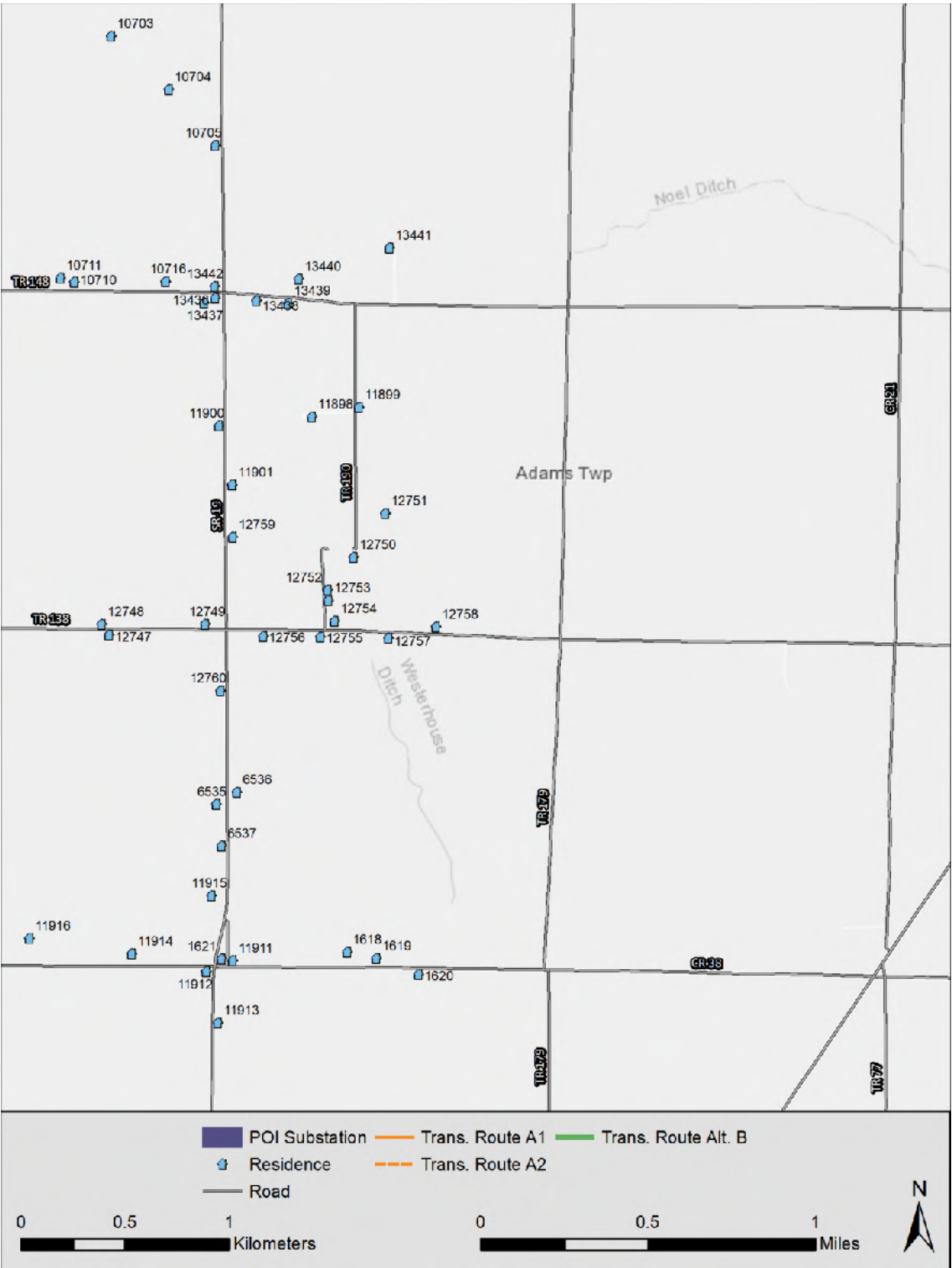


FIGURE 32: MODELED RECEIVERS - SOUTHEAST CORNER

**TABLE 5: DISCRETE RECEIVER SOUND PROPAGATION MODELING RESULTS – TRANSMISSION LINE OPERATIONAL SOUND**

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
1557	0	0	0	4	553576	175421	220
1558	0	0	0	4	553575	175473	219
1559	0	0	0	4	553498	175461	220
1560	0	0	0	4	552797	175257	219
1561	0	0	0	4	552191	175058	217
1562	0	0	0	4	552306	174887	219
1563	0	0	0	4	552147	175058	217
1564	0	0	0	4	552111	175106	216
1565	0	0	0	4	552072	175059	216
1566	0	0	0	4	552010	175060	216
1567	0	0	0	4	551915	175053	216
1568	0	0	0	4	551849	175039	216
1569	0	0	0	4	551784	175014	216
1570	0	0	0	4	556696	173215	242
1571	0	0	0	4	556238	173009	244
1572	0	0	0	4	556248	173020	244
1573	0	0	0	4	556248	173042	244
1574	0	0	0	4	556251	173061	243
1575	0	0	0	4	556213	173085	242
1576	0	0	0	4	556180	173093	241
1577	0	0	0	4	556164	173096	241
1578	0	0	0	4	556147	173103	240
1579	0	0	0	4	556142	173103	240
1580	0	0	0	4	556200	173022	243
1581	0	0	0	4	556204	173011	243
1582	0	0	0	4	556225	173002	243
1583	9	9	7	4	553969	171821	234
1584	10	12	2	4	553280	172133	227
1585	4	4	6	4	555027	172433	242
1586	4	4	6	4	554980	172451	240
1587	6	6	8	4	554802	172311	241
1588	9	9	10	4	554724	172264	241

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
1589	3	3	4	4	555145	172145	242
1590	4	4	5	4	555135	172082	242
1591	4	4	4	4	555144	172024	242
1592	4	4	4	4	555143	171952	242
1593	5	5	5	4	555128	171896	241
1594	5	5	5	4	555095	171880	241
1595	7	7	7	4	554982	171888	241
1618	0	0	0	4	557406	167057	256
1619	0	0	0	4	557546	167027	255
1620	0	0	0	4	557748	166949	252
1621	0	0	0	4	556800	167023	255
1690	2	2	2	4	549358	173377	215
1692	0	0	0	4	547181	173454	213
1694	0	0	0	4	547351	173011	214
1697	0	0	0	4	547583	172615	214
1698	1	1	1	4	547603	172536	214
1699	2	2	2	4	547536	172539	214
5987	0	0	0	4	553627	176080	220
5988	0	0	0	4	553630	176094	220
5989	0	0	0	4	553653	176134	220
5990	0	0	0	4	553570	176048	219
5991	0	0	0	4	553583	176089	219
5992	0	0	0	4	553591	176125	220
5993	0	0	0	4	553603	176153	220
5994	0	0	0	4	553624	176208	220
5995	0	0	0	4	553647	176231	220
5999	0	0	0	4	553672	176168	220
6000	0	0	0	4	553693	176232	220
6033	0	0	0	4	553511	175851	218
6034	0	0	0	4	553508	175815	218
6316	0	0	0	4	550968	175753	212
6317	0	0	0	4	551163	176130	211
6318	0	0	0	4	550270	176164	211

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6319	0	0	0	4	550467	175749	210
6320	0	0	0	4	550967	175570	214
6323	0	0	0	4	556671	176158	228
6324	0	0	0	4	556620	176075	227
6325	0	0	0	4	556439	175986	226
6326	0	0	0	4	556325	175769	228
6327	0	0	0	4	557565	175012	235
6328	0	0	0	4	557641	175009	236
6329	0	0	0	4	557702	175010	238
6330	0	0	0	4	557771	175013	239
6331	0	0	0	4	557785	174956	240
6332	0	0	0	4	557647	174838	241
6333	0	0	0	4	557362	174848	236
6334	0	0	0	4	557362	174805	236
6335	0	0	0	4	557425	174848	237
6336	0	0	0	4	557433	174890	236
6337	0	0	0	4	557368	174954	234
6338	0	0	0	4	557371	175014	234
6339	0	0	0	4	557425	174999	234
6340	0	0	0	4	555945	175350	228
6341	0	0	0	4	555984	175408	228
6342	0	0	0	4	556031	175451	228
6343	0	0	0	4	556439	175131	228
6344	0	0	0	4	556855	175121	230
6345	0	0	5	4	553061	174259	221
6346	0	0	3	4	554835	174222	227
6347	0	0	0	4	554899	174264	224
6348	0	0	1	4	554993	174256	226
6349	0	0	0	4	554944	174420	227
6350	0	0	0	4	554995	174454	228
6351	0	0	0	4	555238	174634	229
6352	0	0	0	4	555938	174576	228
6353	0	0	0	4	557000	174225	240

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6354	0	0	0	4	557178	174376	241
6355	0	0	0	4	556790	174177	238
6356	0	0	0	4	556706	174053	238
6357	0	0	0	4	556677	174035	238
6358	0	0	0	4	550223	174879	213
6359	0	0	0	4	550357	174946	214
6360	0	0	0	4	550231	175013	213
6361	0	0	0	4	550831	174982	214
6362	0	0	0	4	550697	175282	213
6363	0	0	0	4	549406	174934	212
6364	0	0	0	4	549581	175009	212
6365	0	0	0	4	548706	174976	212
6366	0	0	0	4	548593	174979	211
6367	0	0	0	4	548743	174440	214
6368	0	0	0	4	548731	174381	214
6369	0	0	0	4	548742	174342	214
6370	0	0	0	4	548762	174163	213
6371	0	0	0	4	548489	174304	214
6372	0	0	0	4	548363	174355	214
6373	0	0	0	4	548483	174310	214
6374	0	0	0	4	548696	174840	212
6375	0	0	0	4	548485	174309	214
6386	0	0	0	4	557645	172936	246
6387	0	0	0	4	557586	172955	245
6388	0	0	0	4	557579	172981	245
6389	0	0	0	4	557581	173006	245
6390	0	0	0	4	557590	173045	245
6391	0	0	0	4	557592	173077	244
6392	0	0	0	4	557647	173045	244
6393	0	0	0	4	557654	173086	244
6394	0	0	0	4	556009	173138	237
6395	0	0	0	4	555969	173130	236
6396	0	0	0	4	555957	173130	236

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6397	0	0	0	4	555933	173127	235
6398	0	0	0	4	555936	173107	236
6399	0	0	0	4	555957	173108	236
6400	0	0	0	4	555983	173107	238
6401	0	0	0	4	556009	173108	239
6402	0	0	0	4	556021	173115	239
6403	0	0	0	4	555917	173075	239
6404	0	0	0	4	555916	173058	239
6405	0	0	0	4	555916	173044	239
6406	0	0	0	4	555921	173019	240
6407	0	0	0	4	556042	172972	242
6408	0	0	0	4	556041	172982	242
6409	0	0	0	4	556041	172997	242
6410	0	0	0	4	556041	173008	241
6411	0	0	0	4	556041	173020	241
6412	0	0	0	4	556058	173020	240
6413	0	0	0	4	556058	173003	241
6414	0	0	0	4	556058	172997	242
6415	0	0	0	4	556058	172985	242
6416	0	0	0	4	556057	172977	242
6417	0	0	0	4	556056	172969	242
6418	0	0	0	4	556055	172953	242
6419	0	0	0	4	556055	172937	241
6420	0	0	0	4	556055	172927	241
6421	0	0	0	4	556087	172976	242
6422	0	0	0	4	556086	172986	242
6423	0	0	0	4	556017	173043	241
6424	0	0	0	4	556000	173043	241
6425	0	0	0	4	556074	173150	238
6426	0	0	0	4	556033	173170	232
6427	2	2	13	4	554563	173082	228
6428	2	2	15	4	554519	173167	229
6429	1	1	21	4	554310	173106	226

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6430	9	8	8	4	553550	173013	228
6431	10	9	6	4	553633	172914	226
6432	9	8	7	4	553639	172938	226
6433	20	20	12	4	551826	172685	220
6434	22	22	13	4	551837	172745	220
6435	20	20	14	4	551813	172778	220
6436	22	22	16	4	551833	172832	220
6437	22	22	17	4	551837	172855	220
6438	23	23	21	4	551826	172914	220
6439	19	19	19	4	551819	173043	219
6440	12	12	14	4	551895	173166	219
6441	6	6	6	4	550977	173263	219
6442	3	3	4	4	549710	173323	216
6443	5	5	5	4	555213	171486	241
6444	8	8	8	4	555161	171067	243
6445	4	4	3	4	553671	171316	239
6446	2	2	1	4	553518	171159	239
6447	2	2	1	4	553561	171193	239
6448	2	2	0	4	553545	171231	239
6449	2	2	1	4	553498	171135	239
6450	2	2	0	4	553474	171179	238
6451	1	1	0	4	553475	171098	238
6452	1	1	0	4	553352	171040	238
6453	2	2	1	4	553622	171019	240
6454	3	4	0	4	553331	171492	235
6455	4	4	1	4	553461	171578	234
6456	5	5	5	4	555130	171687	241
6457	0	0	0	4	556349	171909	243
6458	0	0	0	4	556277	171896	243
6459	2	2	2	4	555435	171826	243
6460	0	0	0	4	556538	171930	243
6461	0	0	0	4	555921	171886	242
6462	0	0	1	4	555543	171782	242

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6463	0	0	0	4	556211	171805	239
6464	0	0	0	4	556050	171794	241
6465	5	5	5	4	555139	171786	242
6466	0	0	0	4	557591	171742	246
6467	0	0	0	4	557968	171675	246
6468	0	0	0	4	557777	171840	245
6474	0	0	0	4	548246	170125	219
6475	0	0	0	4	548019	170194	220
6476	0	0	0	4	548600	170040	221
6477	0	0	0	4	549194	170130	223
6478	0	0	0	4	550211	170565	226
6479	0	0	0	4	550232	170643	224
6480	0	0	0	4	550208	170720	226
6481	0	0	0	4	550160	170804	227
6482	0	0	0	4	550164	170860	226
6483	0	0	0	4	550018	170156	227
6484	0	0	0	4	551875	170593	230
6485	0	0	0	4	552763	170380	239
6486	0	0	0	4	552815	170439	240
6487	0	0	0	4	552662	170268	239
6488	0	0	0	4	552544	170136	240
6489	0	0	0	4	553492	170653	243
6490	2	2	2	4	554096	170142	242
6491	5	5	5	4	554291	170277	243
6492	0	0	0	4	552135	168626	242
6493	0	0	0	4	552075	168630	242
6494	0	0	0	4	553611	169077	245
6495	0	0	0	4	553802	168606	244
6496	0	0	0	4	554221	168831	244
6497	0	0	0	4	554720	168602	245
6498	0	0	0	4	555001	168573	245
6499	0	0	0	4	555252	168834	245
6500	0	0	0	4	555288	169172	242

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6501	0	0	0	4	555184	168699	244
6502	0	0	0	4	555305	168591	241
6503	0	0	0	4	555158	168573	243
6504	0	0	0	4	555180	168483	244
6505	0	0	0	4	551868	169369	225
6506	0	0	0	4	551798	169460	234
6507	0	0	0	4	551794	169550	236
6508	0	0	0	4	551650	169306	236
6509	0	0	0	4	551694	169274	236
6510	0	0	0	4	550167	169548	224
6511	0	0	0	4	550181	169369	230
6512	0	0	0	4	549529	169645	221
6513	0	0	0	4	549247	169641	226
6514	0	0	0	4	549206	169336	222
6515	0	0	0	4	549049	169320	227
6516	0	0	0	4	548959	169318	227
6517	0	0	0	4	548255	169610	220
6518	0	0	0	4	548251	169543	218
6519	0	0	0	4	548221	169419	220
6520	0	0	0	4	548195	169317	222
6521	0	0	0	4	548079	169321	222
6522	0	0	0	4	548422	169249	222
6535	0	0	0	4	556776	167767	251
6536	0	0	0	4	556875	167825	251
6537	0	0	0	4	556801	167567	250
6538	0	0	0	4	555188	167947	245
6539	0	0	0	4	555175	167778	245
6540	0	0	0	4	553560	168008	244
6556	0	0	0	4	553568	166769	246
9035	6	6	6	4	551312	173455	216
9036	6	6	6	4	551242	173452	217
9037	5	5	5	4	551169	173437	218
9038	5	5	5	4	551203	173458	217

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
9039	4	4	4	4	550941	173418	218
9048	6	6	6	4	551410	173476	217
9049	4	4	8	4	551914	173642	219
9050	6	6	9	4	551835	173484	219
9051	5	5	8	4	551863	173552	219
9056	0	0	22	4	554286	173699	227
9063	0	0	12	4	553401	173921	220
9076	0	0	0	4	556167	173688	237
9077	0	0	0	4	556313	173602	233
9083	0	0	0	4	556237	173678	236
9084	0	0	0	4	556255	173487	229
9086	0	0	0	4	556708	173867	239
9087	0	0	0	4	556562	173847	240
9088	0	0	0	4	556525	173817	240
9092	0	0	0	4	556705	173643	235
9093	0	0	0	4	556513	173581	229
9094	0	0	0	4	556549	173714	239
9095	0	0	0	4	556606	173534	230
9098	0	0	0	4	557577	173407	241
9099	0	0	0	4	557598	173413	240
9100	0	0	0	4	557429	173406	243
9101	0	0	0	4	557462	173387	242
9116	0	0	0	4	557414	173460	240
9117	0	0	0	4	557395	173466	238
9118	0	0	0	4	557351	173474	241
9119	0	0	0	4	557310	173481	243
9120	0	0	0	4	557265	173478	244
9121	0	0	0	4	557441	173555	240
9137	0	0	0	4	557289	173414	242
9138	0	0	0	4	557252	173432	244
9148	0	0	0	4	556967	173500	243
9149	0	0	0	4	557010	173609	239
9150	0	0	0	4	556889	173644	240

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
9155	0	0	0	4	556857	173411	238
9156	0	0	0	4	556914	173444	241
9157	0	0	0	4	556823	173514	237
9158	0	0	0	4	557397	173866	238
10393	0	0	0	4	553850	176170	220
10394	0	0	0	4	553815	176181	220
10395	0	0	0	4	553791	176182	220
10396	0	0	0	4	553757	176216	220
10397	0	0	0	4	553800	176220	220
10425	0	0	0	4	553516	176119	220
10426	0	0	0	4	553527	176153	220
10601	0	0	0	4	556767	175931	229
10602	0	0	0	4	556820	176009	228
10603	0	0	0	4	556904	175969	231
10620	0	0	0	4	556856	175155	229
10621	0	0	0	4	557124	175103	232
10622	0	0	0	4	557207	175128	233
10623	0	0	0	4	555776	175289	225
10624	0	0	0	4	555841	175252	228
10625	0	0	0	4	555607	174985	228
10626	0	0	0	4	555973	175394	228
10627	0	0	0	4	555452	175125	224
10628	0	0	0	4	555271	175124	222
10629	0	0	0	4	555307	175141	223
10630	0	0	0	4	548736	174071	213
10631	0	0	0	4	550164	174279	214
10632	0	0	0	4	551618	174771	216
10633	0	0	0	4	551634	174736	216
10634	0	0	0	4	551650	174708	216
10635	0	0	0	4	551661	174680	217
10636	0	0	0	4	551677	174650	217
10637	0	0	0	4	551698	174615	217
10638	0	0	0	4	551586	174605	215

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10639	0	0	0	4	551556	174733	215
10640	0	0	0	4	551773	174509	217
10641	0	0	0	4	551792	174419	214
10642	0	0	3	4	551864	174099	219
10643	0	0	3	4	551782	174036	219
10644	0	0	6	4	553402	174264	218
10645	0	0	5	4	553490	174326	220
10646	0	0	4	4	553075	174266	221
10647	0	0	5	4	553073	174240	220
10648	0	0	5	4	553084	174260	221
10649	0	0	0	4	557644	173132	244
10650	0	0	0	4	557646	173174	244
10651	0	0	0	4	557591	173168	244
10652	0	0	0	4	557586	173200	244
10653	0	0	0	4	557586	173221	244
10654	0	0	0	4	557586	173248	243
10655	0	0	0	4	557573	173305	243
10656	0	0	0	4	557647	173346	243
10657	0	0	0	4	556764	173159	242
10658	0	0	0	4	556763	173100	242
10659	0	0	0	4	555986	173045	241
10660	0	0	0	4	555969	173045	241
10661	0	0	0	4	555945	173046	240
10662	0	0	0	4	555933	173053	240
10663	0	0	0	4	555948	173054	241
10664	0	0	0	4	555961	173052	241
10665	0	0	0	4	555980	173052	241
10666	0	0	0	4	555991	173054	241
10667	0	0	0	4	556004	173057	241
10668	0	0	0	4	556014	173059	241
10669	0	0	0	4	556034	173092	239
10670	0	0	0	4	556037	173102	239
10671	0	0	0	4	556043	173113	238

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10672	0	0	0	4	556053	173121	238
10673	0	0	0	4	556063	173132	238
10674	0	0	0	4	556043	173150	237
10675	0	0	0	4	556035	173149	237
10676	0	0	0	4	556020	173143	236
10677	0	0	0	4	555998	173137	236
10678	2	2	2	4	549667	173324	216
10679	0	0	0	4	548801	173358	214
10680	1	1	1	4	549137	173286	215
10681	11	11	12	4	548685	172347	217
10682	14	14	14	4	548627	172253	217
10683	20	20	21	4	548700	171747	218
10684	9	9	10	4	549293	171737	220
10685	8	8	8	4	549256	171603	220
10686	12	12	12	4	548862	171656	219
10687	8	8	8	4	549690	171800	220
10703	0	0	0	4	556271	171463	237
10704	0	0	0	4	556547	171206	245
10705	0	0	0	4	556770	170937	247
10706	6	6	6	4	555215	171221	243
10707	12	12	12	4	554616	170268	243
10708	16	16	16	4	554701	170258	244
10709	22	22	22	4	554785	170259	244
10710	0	0	0	4	556093	170281	247
10711	0	0	0	4	556028	170300	247
10712	6	6	6	4	555234	170268	244
10713	5	5	5	4	555244	169991	245
10714	17	17	17	4	554924	170268	243
10715	23	23	23	4	554860	170258	243
10716	0	0	0	4	556533	170283	245
10717	0	0	0	4	551887	168998	240
10718	0	0	0	4	551882	168951	241
10719	0	0	0	4	551894	168891	241

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10720	0	0	0	4	551904	168772	243
10721	0	0	0	4	551867	168629	239
10722	0	0	0	4	551654	168575	240
10723	0	0	0	4	551455	168907	241
10724	0	0	0	4	550975	168631	235
10725	0	0	0	4	550860	168590	233
10726	0	0	0	4	550973	168405	239
10727	0	0	0	4	551013	168417	241
10728	0	0	0	4	551064	168360	237
10729	0	0	0	4	552924	168864	242
10730	0	0	0	4	553394	168606	243
10731	0	0	0	4	553544	168665	242
10732	0	0	0	4	552407	168637	244
10733	0	0	0	4	552369	168641	244
10734	0	0	0	4	552307	168637	242
10735	0	0	0	4	552268	168630	242
10736	0	0	0	4	553618	168036	245
10737	0	0	0	4	553460	167997	245
10738	0	0	0	4	553416	168069	246
10739	0	0	0	4	553235	168131	246
10740	0	0	0	4	553463	167884	245
10741	0	0	0	4	553619	167646	246
10742	0	0	0	4	553610	167739	246
10743	0	0	0	4	553635	167774	245
10744	0	0	0	4	553632	167808	245
10745	0	0	0	4	553624	167559	246
11843	0	0	0	4	551746	174903	216
11844	0	0	0	4	551612	174864	216
11845	0	0	0	4	551582	174882	215
11846	0	0	0	4	551552	174890	215
11847	0	0	0	4	551562	175021	215
11848	0	0	0	4	551653	175009	215
11849	0	0	0	4	551417	175006	213

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11850	0	0	0	4	551435	174963	214
11851	0	0	0	4	551485	174869	212
11852	0	0	0	4	551526	174799	215
11853	0	0	0	4	551608	174812	216
11854	0	0	0	4	551246	175014	214
11855	0	0	0	4	551188	175012	214
11856	0	0	0	4	551142	174994	211
11857	0	0	0	4	551273	174868	212
11858	0	0	0	4	550972	175382	214
11859	0	0	0	4	550955	175486	213
11860	0	0	0	4	556165	172913	241
11861	0	0	0	4	556141	172914	241
11862	0	0	0	4	556130	172915	241
11863	0	0	0	4	556117	172915	241
11864	0	0	0	4	556105	172915	240
11865	0	0	0	4	556083	172908	240
11866	0	0	0	4	556071	172897	239
11867	0	0	0	4	556048	172905	240
11868	0	0	0	4	556035	172902	239
11869	0	0	0	4	556019	172902	239
11870	0	0	0	4	556008	172902	239
11871	0	0	0	4	555984	172902	238
11872	0	0	0	4	555969	172903	238
11873	0	0	0	4	555955	172907	238
11874	0	0	0	4	556043	172939	241
11875	0	0	0	4	556042	172954	242
11876	0	0	0	4	556042	172963	242
11877	9	9	9	4	554859	171816	239
11878	12	12	12	4	554744	171791	240
11879	14	14	14	4	554678	171814	239
11880	19	19	19	4	554600	171817	239
11881	20	20	20	4	554450	171832	239
11882	22	22	22	4	554367	171992	238

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11883	19	19	19	4	554340	171969	238
11884	16	16	16	4	554304	171939	239
11885	15	15	14	4	554287	171902	239
11886	15	15	10	4	554078	172079	235
11887	11	11	9	4	554109	171851	236
11888	7	7	6	4	553961	171622	239
11889	4	4	4	4	555204	171806	242
11890	3	3	3	4	555297	171808	243
11891	3	3	3	4	555352	171811	243
11892	4	4	4	4	555239	171717	242
11893	4	4	4	4	555237	171672	241
11898	0	0	0	4	557235	169631	248
11899	0	0	0	4	557463	169677	248
11900	0	0	0	4	556789	169590	247
11901	0	0	0	4	556853	169304	248
11902	3	3	3	4	555177	169725	245
11903	0	0	0	4	553798	169513	243
11904	0	0	0	4	553641	169649	243
11905	0	0	0	4	553531	169660	243
11906	0	0	0	4	553474	169505	241
11907	0	0	0	4	553602	169474	243
11908	0	0	0	4	553593	169522	241
11909	0	0	0	4	553537	169382	242
11910	0	0	0	4	552264	169720	240
11911	0	0	0	4	556854	167016	255
11912	0	0	0	4	556729	166963	254
11913	0	0	0	4	556784	166717	254
11914	0	0	0	4	556369	167050	253
11915	0	0	0	4	556754	167328	252
11916	0	0	0	4	555877	167123	250
11917	0	0	0	4	555593	167045	247
11918	0	0	0	4	555432	167058	249
11919	0	0	0	4	555240	166800	246

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11920	0	0	0	4	555003	166703	247
11921	0	0	0	4	554621	166969	245
11922	0	0	0	4	553771	166974	246
11923	0	0	0	4	554036	166800	248
11924	0	0	0	4	552408	166912	247
12590	0	0	0	4	553502	175785	218
12685	0	0	0	4	557956	175101	243
12686	0	0	0	4	557870	175101	241
12687	0	0	0	4	557889	174926	242
12688	0	0	0	4	558035	174986	243
12692	0	0	0	4	557633	175091	236
12693	0	0	0	4	556702	173982	239
12694	0	0	0	4	556759	174027	240
12695	0	0	0	4	556788	174055	240
12696	0	0	0	4	556934	174061	241
12710	0	0	0	4	555916	173006	240
12711	0	0	0	4	555902	172987	241
12712	0	0	0	4	556019	172954	241
12713	0	0	0	4	556015	172990	242
12714	0	0	0	4	556015	172998	242
12715	0	0	0	4	556012	173013	241
12716	0	0	0	4	555813	173101	230
12717	0	0	0	4	555494	172927	239
12718	0	0	0	4	555514	172847	238
12719	0	0	1	4	555500	173013	241
12720	0	0	2	4	555178	172605	241
12721	2	2	5	4	555084	172646	240
12722	0	0	1	4	555333	172875	241
12723	0	0	0	4	555380	172909	241
12724	0	0	2	4	555292	172853	240
12725	0	0	0	4	556081	173214	234
12726	0	0	0	4	556100	173179	237
12727	2	2	0	4	552990	171445	230

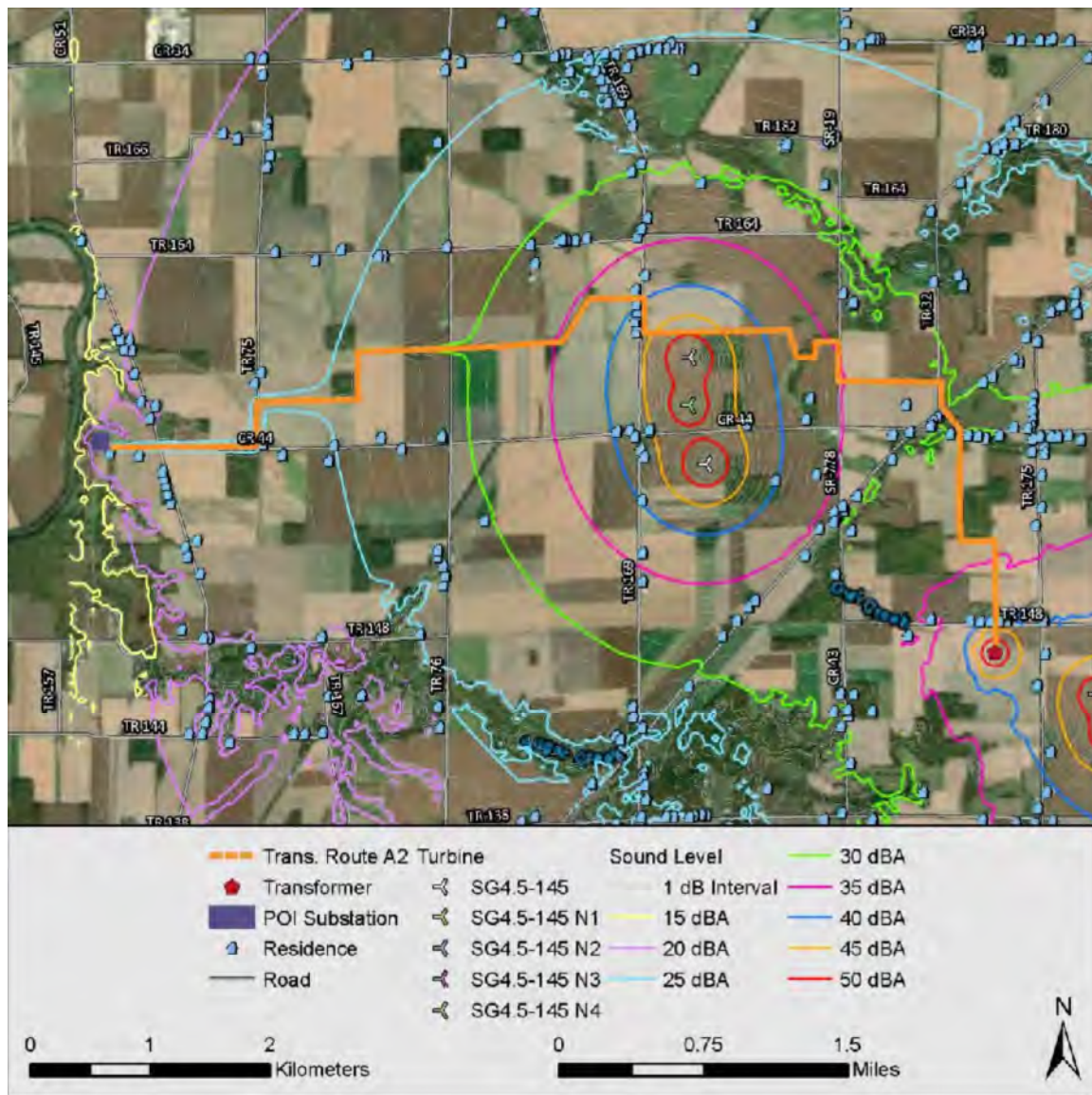
Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
12728	0	0	0	4	553239	170811	239
12729	0	0	0	4	551869	171278	228
12730	0	0	0	4	551875	170831	228
12731	0	0	0	4	550555	171106	227
12732	7	7	7	4	547930	171256	219
12733	8	8	8	4	547903	171325	218
12734	10	10	10	4	547892	171407	218
12735	11	11	12	4	547874	171463	218
12736	13	13	13	4	547865	171520	218
12737	20	20	20	4	547666	171651	217
12738	22	22	23	4	547419	171674	217
12739	3	3	3	4	548149	170941	220
12740	2	2	2	4	548048	170885	219
12741	1	1	1	4	548072	170800	219
12742	0	0	0	4	548171	170662	220
12743	0	0	0	4	548202	170121	219
12744	0	0	0	4	555184	168402	246
12745	0	0	0	4	555248	168426	245
12746	0	0	0	4	555246	168495	244
12747	0	0	0	4	556262	168583	248
12748	0	0	0	4	556224	168633	248
12749	0	0	0	4	556723	168634	250
12750	0	0	0	4	557436	168956	249
12751	0	0	0	4	557588	169166	250
12752	0	0	0	4	557312	168799	249
12753	0	0	0	4	557315	168748	250
12754	0	0	0	4	557346	168649	251
12755	0	0	0	4	557276	168574	250
12756	0	0	0	4	557001	168576	251
12757	0	0	0	4	557605	168569	249
12758	0	0	0	4	557833	168621	253
12759	0	0	0	4	556854	169054	248
12760	0	0	0	4	556797	168313	250

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
12863	0	0	0	4	547505	172624	213
12864	0	0	0	4	547477	172702	214
12868	5	5	5	4	547622	172338	215
12870	8	8	8	4	547680	172101	215
12871	9	9	9	4	547803	172069	216
12872	12	12	12	4	547757	171960	216
12880	3	3	3	4	550241	173397	217
13316	0	0	0	4	553360	176170	218
13400	0	0	0	4	555196	175128	222
13401	0	0	0	4	555040	175128	222
13402	0	0	0	4	554955	175135	221
13403	0	0	0	4	554626	175081	220
13404	0	0	0	4	554679	175089	220
13405	0	0	0	4	554593	175211	220
13406	0	0	0	4	553859	175139	219
13407	0	0	0	4	553828	175136	219
13408	0	0	0	4	553785	175143	219
13409	0	0	0	4	553701	175092	219
13410	0	0	0	4	553562	175097	219
13411	0	0	0	4	553580	175277	218
13412	0	0	0	4	556769	173054	242
13413	0	0	0	4	556777	172975	244
13414	0	0	0	4	556831	172843	243
13415	0	0	0	4	556820	172788	242
13416	0	0	0	4	556831	172748	241
13417	0	0	0	4	556748	172719	240
13418	0	0	0	4	556817	172558	240
13419	0	0	0	4	556756	172592	239
13420	0	0	0	4	556695	172571	239
13421	0	0	0	4	556520	172569	236
13422	0	0	0	4	556681	172449	243
13423	0	0	0	4	556837	172454	244
13424	6	6	6	4	549859	171704	221

Receiver ID	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
	Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
13425	5	5	5	4	550206	171794	221
13426	5	5	5	4	550197	171810	221
13427	3	3	2	4	551663	171852	225
13428	3	3	2	4	551769	171863	227
13429	1	2	0	4	551930	171846	227
13430	0	1	0	4	551859	171704	227
13431	0	0	0	4	551893	171638	225
13432	2	3	0	4	551936	171871	228
13433	2	2	0	4	551814	171806	228
13434	7	8	1	4	553242	171954	228
13435	5	5	0	4	552751	171913	227
13436	0	0	0	4	556772	170204	244
13437	0	0	0	4	556719	170181	245
13438	0	0	0	4	556968	170191	241
13439	0	0	0	4	557122	170179	243
13440	0	0	0	4	557173	170294	245
13441	0	0	0	4	557609	170445	247
13442	0	0	0	4	556768	170259	246
13448	0	0	0	4	553627	167618	246
13449	0	0	0	4	551867	167897	244
13450	0	0	0	4	551807	168107	244
13452	0	0	0	4	551475	167020	245
13454	0	0	0	4	553552	167466	246
13455	0	0	0	4	553612	167321	246
13456	0	0	0	4	553060	167044	246
13457	0	0	0	4	552800	167031	246
13458	0	0	0	4	552656	167032	247
14025	1	1	7	4	552366	173936	219
14028	0	0	10	4	554535	173940	228
14029	0	0	3	4	554745	174226	227

## **APPENDIX D. CUMULATIVE SOUND PROPAGATION MODELING RESULTS**

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**FIGURE 33: CUMULATIVE SOUND PROPAGATION MODELING RESULTS - ROUTE A2, SIEMENS-GAMESA SG4.5-145 TURBINES**

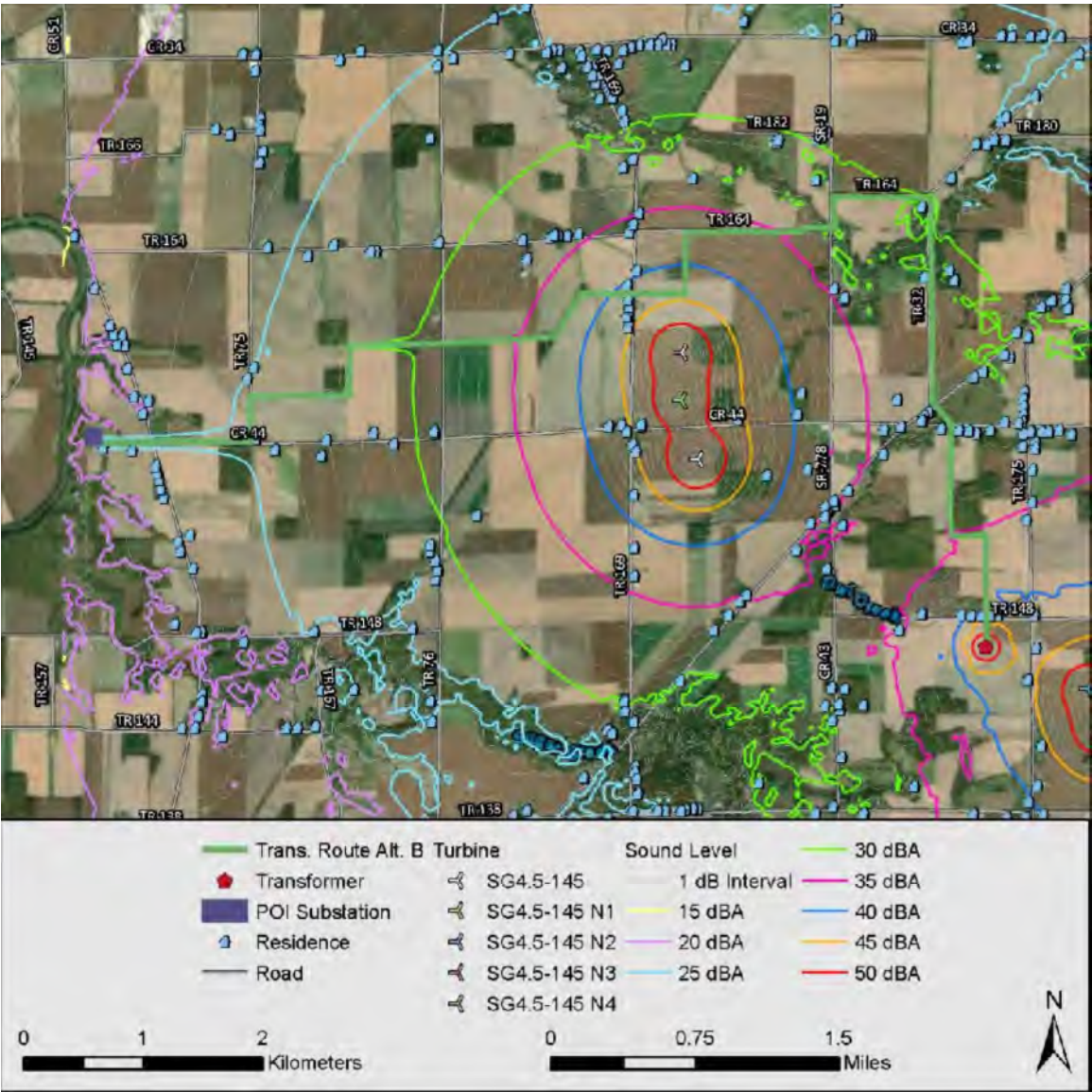


FIGURE 34: CUMULATIVE SOUND PROPAGATION MODELING RESULTS - ROUTE ALT. B, SIEMENS-GAMESA SG4.5-145 TURBINES

**TABLE 6: DISCRETE RECEIVER SOUND PROPAGATION MODELING RESULTS - INCLUDING SIEMENS-GAMESA SG 4.5-145 TURBINES**

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
1557	248	Non-Part.	27	27	27	4	553576	175421	220
1558	249	Non-Part.	27	27	27	4	553575	175473	219
1559	250	Non-Part.	26	26	26	4	553498	175461	220
1560	251	Non-Part.	28	28	28	4	552797	175257	219
1561	252	Non-Part.	29	29	29	4	552191	175058	217
1562	253	Non-Part.	29	29	29	4	552306	174887	219
1563	254	Non-Part.	29	29	29	4	552147	175058	217
1564	255	Non-Part.	28	28	28	4	552111	175106	216
1565	256	Non-Part.	29	29	29	4	552072	175059	216
1566	257	Non-Part.	29	29	29	4	552010	175060	216
1567	258	Non-Part.	29	29	29	4	551915	175053	216
1568	259	Non-Part.	29	29	29	4	551849	175039	216
1569	260	Non-Part.	29	29	29	4	551784	175014	216
1570	261	Non-Part.	31	31	31	4	556696	173215	242
1571	262	Non-Part.	31	31	31	4	556238	173009	244
1572	263	Non-Part.	31	31	31	4	556248	173020	244
1573	264	Non-Part.	31	31	31	4	556248	173042	244
1574	265	Non-Part.	31	31	31	4	556251	173061	243
1575	266	Non-Part.	30	30	30	4	556213	173085	242
1576	267	Non-Part.	30	30	30	4	556180	173093	241
1577	268	Non-Part.	30	30	30	4	556164	173096	241
1578	269	Non-Part.	29	29	29	4	556147	173103	240
1579	270	Non-Part.	29	29	29	4	556142	173103	240
1580	271	Non-Part.	31	31	31	4	556200	173022	243
1581	272	Non-Part.	31	31	31	4	556204	173011	243
1582	273	Non-Part.	31	31	31	4	556225	173002	243
1583	274	Non-Part.	36	36	36	4	553969	171821	234
1584	3920	Part.	40	40	40	4	553280	172133	227
1585	275	Non-Part.	33	33	33	4	555027	172433	242
1586	276	Non-Part.	32	32	32	4	554980	172451	240
1587	277	Non-Part.	33	33	33	4	554802	172311	241

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
1588	278	Non-Part.	33	33	33	4	554724	172264	241
1589	279	Non-Part.	33	33	33	4	555145	172145	242
1590	280	Non-Part.	33	33	33	4	555135	172082	242
1591	281	Non-Part.	34	34	34	4	555144	172024	242
1592	282	Non-Part.	34	34	34	4	555143	171952	242
1593	283	Non-Part.	34	34	34	4	555128	171896	241
1594	284	Non-Part.	34	34	34	4	555095	171880	241
1595	285	Non-Part.	34	34	34	4	554982	171888	241
1618	307	Non-Part.	46	46	46	4	557406	167057	256
1619	3966	Part.	45	45	45	4	557546	167027	255
1620	308	Non-Part.	44	44	44	4	557748	166949	252
1621	309	Non-Part.	43	43	43	4	556800	167023	255
1690	369	Non-Part.	27	27	27	4	549358	173377	215
1692	370	Non-Part.	20	20	20	4	547181	173454	213
1694	371	Non-Part.	22	22	22	4	547351	173011	214
1697	372	Non-Part.	23	23	23	4	547583	172615	214
1698	373	Non-Part.	23	23	23	4	547603	172536	214
1699	374	Non-Part.	23	23	23	4	547536	172539	214
5987	885	Non-Part.	25	25	25	4	553627	176080	220
5988	886	Non-Part.	25	25	25	4	553630	176094	220
5989	887	Non-Part.	25	25	25	4	553653	176134	220
5990	888	Non-Part.	26	26	26	4	553570	176048	219
5991	889	Non-Part.	25	25	25	4	553583	176089	219
5992	890	Non-Part.	25	25	25	4	553591	176125	220
5993	891	Non-Part.	25	25	25	4	553603	176153	220
5994	892	Non-Part.	25	25	25	4	553624	176208	220
5995	893	Non-Part.	25	25	25	4	553647	176231	220
5999	897	Non-Part.	25	25	25	4	553672	176168	220
6000	898	Non-Part.	25	25	25	4	553693	176232	220
6033	931	Non-Part.	26	26	26	4	553511	175851	218
6034	932	Non-Part.	26	26	26	4	553508	175815	218
6316	1213	Non-Part.	25	25	25	4	550968	175753	212
6317	1214	Non-Part.	24	24	24	4	551163	176130	211

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6318	1215	Non-Part.	23	23	23	4	550270	176164	211
6319	1216	Non-Part.	22	22	22	4	550467	175749	210
6320	1217	Non-Part.	26	26	26	4	550967	175570	214
6323	1220	Non-Part.	23	23	23	4	556671	176158	228
6324	1221	Non-Part.	23	23	23	4	556620	176075	227
6325	1222	Non-Part.	21	21	21	4	556439	175986	226
6326	1223	Non-Part.	25	25	25	4	556325	175769	228
6327	3942	Part.	25	25	25	4	557565	175012	235
6328	1224	Non-Part.	23	23	23	4	557641	175009	236
6329	1225	Non-Part.	24	24	24	4	557702	175010	238
6330	1226	Non-Part.	24	24	24	4	557771	175013	239
6331	1227	Non-Part.	26	26	26	4	557785	174956	240
6332	1228	Non-Part.	27	27	27	4	557647	174838	241
6333	1229	Non-Part.	25	25	25	4	557362	174848	236
6334	1230	Non-Part.	26	26	26	4	557362	174805	236
6335	1231	Non-Part.	26	26	26	4	557425	174848	237
6336	1232	Non-Part.	24	24	24	4	557433	174890	236
6337	1233	Non-Part.	24	24	24	4	557368	174954	234
6338	1234	Non-Part.	25	25	25	4	557371	175014	234
6339	1235	Non-Part.	25	25	25	4	557425	174999	234
6340	1236	Non-Part.	25	25	25	4	555945	175350	228
6341	1237	Non-Part.	25	25	25	4	555984	175408	228
6342	1238	Non-Part.	26	26	26	4	556031	175451	228
6343	1239	Non-Part.	21	21	21	4	556439	175131	228
6344	1240	Non-Part.	25	25	25	4	556855	175121	230
6345	4051	Part.	32	32	32	4	553061	174259	221
6346	1241	Non-Part.	29	29	29	4	554835	174222	227
6347	1242	Non-Part.	27	27	27	4	554899	174264	224
6348	4052	Part.	29	29	29	4	554993	174256	226
6349	4053	Part.	27	27	27	4	554944	174420	227
6350	4054	Part.	27	27	27	4	554995	174454	228
6351	1243	Non-Part.	27	27	27	4	555238	174634	229
6352	1244	Non-Part.	27	27	27	4	555938	174576	228

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6353	1245	Non-Part.	28	28	28	4	557000	174225	240
6354	1246	Non-Part.	28	28	28	4	557178	174376	241
6355	1247	Non-Part.	26	26	26	4	556790	174177	238
6356	1248	Non-Part.	27	27	27	4	556706	174053	238
6357	1249	Non-Part.	27	27	27	4	556677	174035	238
6358	1250	Non-Part.	26	26	26	4	550223	174879	213
6359	1251	Non-Part.	27	27	27	4	550357	174946	214
6360	1252	Non-Part.	26	26	26	4	550231	175013	213
6361	1253	Non-Part.	28	28	28	4	550831	174982	214
6362	1254	Non-Part.	26	26	26	4	550697	175282	213
6363	1255	Non-Part.	25	25	25	4	549406	174934	212
6364	1256	Non-Part.	25	25	25	4	549581	175009	212
6365	1257	Non-Part.	23	23	23	4	548706	174976	212
6366	1258	Non-Part.	23	23	23	4	548593	174979	211
6367	1259	Non-Part.	24	24	24	4	548743	174440	214
6368	1260	Non-Part.	24	24	24	4	548731	174381	214
6369	1261	Non-Part.	24	24	24	4	548742	174342	214
6370	1262	Non-Part.	25	25	25	4	548762	174163	213
6371	1263	Non-Part.	24	24	24	4	548489	174304	214
6372	1264	Non-Part.	22	22	22	4	548363	174355	214
6373	1265	Non-Part.	24	24	24	4	548483	174310	214
6374	1266	Non-Part.	23	23	23	4	548696	174840	212
6375	1267	Non-Part.	24	24	24	4	548485	174309	214
6386	1278	Non-Part.	31	31	31	4	557645	172936	246
6387	1279	Non-Part.	31	31	31	4	557586	172955	245
6388	1280	Non-Part.	31	31	31	4	557579	172981	245
6389	1281	Non-Part.	31	31	31	4	557581	173006	245
6390	1282	Non-Part.	31	31	31	4	557590	173045	245
6391	1283	Non-Part.	31	31	31	4	557592	173077	244
6392	1284	Non-Part.	31	31	31	4	557647	173045	244
6393	1285	Non-Part.	31	31	31	4	557654	173086	244
6394	1286	Non-Part.	28	28	28	4	556009	173138	237
6395	1287	Non-Part.	28	28	28	4	555969	173130	236

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6396	1288	Non-Part.	28	28	28	4	555957	173130	236
6397	1289	Non-Part.	27	27	27	4	555933	173127	235
6398	1290	Non-Part.	27	27	27	4	555936	173107	236
6399	1291	Non-Part.	27	27	27	4	555957	173108	236
6400	1292	Non-Part.	29	29	29	4	555983	173107	238
6401	1293	Non-Part.	29	29	29	4	556009	173108	239
6402	1294	Non-Part.	30	30	30	4	556021	173115	239
6403	1295	Non-Part.	30	30	30	4	555917	173075	239
6404	1296	Non-Part.	30	30	30	4	555916	173058	239
6405	1297	Non-Part.	30	30	30	4	555916	173044	239
6406	1298	Non-Part.	30	30	30	4	555921	173019	240
6407	1299	Non-Part.	31	31	31	4	556042	172972	242
6408	1300	Non-Part.	31	31	31	4	556041	172982	242
6409	1301	Non-Part.	31	31	31	4	556041	172997	242
6410	1302	Non-Part.	30	30	30	4	556041	173008	241
6411	1303	Non-Part.	30	30	30	4	556041	173020	241
6412	1304	Non-Part.	30	30	30	4	556058	173020	240
6413	1305	Non-Part.	30	30	30	4	556058	173003	241
6414	1306	Non-Part.	31	31	31	4	556058	172997	242
6415	1307	Non-Part.	31	31	31	4	556058	172985	242
6416	1308	Non-Part.	31	31	31	4	556057	172977	242
6417	1309	Non-Part.	31	31	31	4	556056	172969	242
6418	1310	Non-Part.	31	31	31	4	556055	172953	242
6419	1311	Non-Part.	31	31	31	4	556055	172937	241
6420	1312	Non-Part.	31	31	31	4	556055	172927	241
6421	1313	Non-Part.	31	31	31	4	556087	172976	242
6422	1314	Non-Part.	31	31	31	4	556086	172986	242
6423	1315	Non-Part.	31	31	31	4	556017	173043	241
6424	1316	Non-Part.	31	31	31	4	556000	173043	241
6425	1317	Non-Part.	30	30	30	4	556074	173150	238
6426	1318	Non-Part.	27	27	27	4	556033	173170	232
6427	4055	Part.	32	32	32	4	554563	173082	228
6428	4056	Part.	32	32	32	4	554519	173167	229

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6429	1319	Non-Part.	32	32	32	4	554310	173106	226
6430	1320	Non-Part.	36	36	36	4	553550	173013	228
6431	1321	Non-Part.	36	36	36	4	553633	172914	226
6432	1322	Non-Part.	36	36	36	4	553639	172938	226
6433	1323	Non-Part.	45	45	45	4	551826	172685	220
6434	1324	Non-Part.	45	45	45	4	551837	172745	220
6435	1325	Non-Part.	44	44	44	4	551813	172778	220
6436	4057	Part.	44	44	44	4	551833	172832	220
6437	4058	Part.	44	44	44	4	551837	172855	220
6438	1326	Non-Part.	43	43	43	4	551826	172914	220
6439	1327	Non-Part.	42	42	42	4	551819	173043	219
6440	1328	Non-Part.	41	41	41	4	551895	173166	219
6441	1329	Non-Part.	35	35	35	4	550977	173263	219
6442	1330	Non-Part.	29	29	29	4	549710	173323	216
6443	1331	Non-Part.	35	35	35	4	555213	171486	241
6444	1332	Non-Part.	37	37	37	4	555161	171067	243
6445	1333	Non-Part.	37	37	37	4	553671	171316	239
6446	1334	Non-Part.	38	38	38	4	553518	171159	239
6447	1335	Non-Part.	37	37	37	4	553561	171193	239
6448	1336	Non-Part.	38	38	38	4	553545	171231	239
6449	1337	Non-Part.	38	38	38	4	553498	171135	239
6450	1338	Non-Part.	38	38	38	4	553474	171179	238
6451	1339	Non-Part.	37	37	37	4	553475	171098	238
6452	1340	Non-Part.	38	38	38	4	553352	171040	238
6453	1341	Non-Part.	37	37	37	4	553622	171019	240
6454	1342	Non-Part.	40	40	40	4	553331	171492	235
6455	1343	Non-Part.	39	39	39	4	553461	171578	234
6456	1344	Non-Part.	34	34	34	4	555130	171687	241
6457	1345	Non-Part.	36	36	36	4	556349	171909	243
6458	1346	Non-Part.	35	35	35	4	556277	171896	243
6459	1347	Non-Part.	34	34	34	4	555435	171826	243
6460	1348	Non-Part.	36	36	36	4	556538	171930	243
6461	1349	Non-Part.	35	35	35	4	555921	171886	242

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6462	1350	Non-Part.	35	35	35	4	555543	171782	242
6463	1351	Non-Part.	36	36	36	4	556211	171805	239
6464	1352	Non-Part.	36	36	36	4	556050	171794	241
6465	1353	Non-Part.	34	34	34	4	555139	171786	242
6466	1354	Non-Part.	37	37	37	4	557591	171742	246
6467	4059	Part.	36	36	36	4	557968	171675	246
6468	1355	Non-Part.	36	36	36	4	557777	171840	245
6474	1361	Non-Part.	21	21	21	4	548246	170125	219
6475	1362	Non-Part.	24	24	24	4	548019	170194	220
6476	1363	Non-Part.	25	25	25	4	548600	170040	221
6477	4060	Part.	27	27	27	4	549194	170130	223
6478	1364	Non-Part.	30	30	30	4	550211	170565	226
6479	1365	Non-Part.	30	30	30	4	550232	170643	224
6480	1366	Non-Part.	31	31	31	4	550208	170720	226
6481	1367	Non-Part.	31	31	31	4	550160	170804	227
6482	1368	Non-Part.	31	31	31	4	550164	170860	226
6483	1369	Non-Part.	29	29	29	4	550018	170156	227
6484	1370	Non-Part.	37	37	37	4	551875	170593	230
6485	1371	Non-Part.	36	36	36	4	552763	170380	239
6486	1372	Non-Part.	37	37	37	4	552815	170439	240
6487	1373	Non-Part.	36	36	36	4	552662	170268	239
6488	1374	Non-Part.	35	35	35	4	552544	170136	240
6489	1375	Non-Part.	35	35	35	4	553492	170653	243
6490	4061	Part.	36	36	36	4	554096	170142	242
6491	1376	Non-Part.	37	37	37	4	554291	170277	243
6492	1377	Non-Part.	30	30	30	4	552135	168626	242
6493	1378	Non-Part.	30	30	30	4	552075	168630	242
6494	1379	Non-Part.	34	34	34	4	553611	169077	245
6495	4062	Part.	34	34	34	4	553802	168606	244
6496	1380	Non-Part.	36	36	36	4	554221	168831	244
6497	1381	Non-Part.	38	38	38	4	554720	168602	245
6498	1382	Non-Part.	39	39	39	4	555001	168573	245
6499	1383	Non-Part.	42	42	42	4	555252	168834	245

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
6500	1384	Non-Part.	45	45	45	4	555288	169172	242
6501	1385	Non-Part.	41	41	41	4	555184	168699	244
6502	1386	Non-Part.	41	41	41	4	555305	168591	241
6503	1387	Non-Part.	40	40	40	4	555158	168573	243
6504	1388	Non-Part.	40	40	40	4	555180	168483	244
6505	1389	Non-Part.	28	28	28	4	551868	169369	225
6506	1390	Non-Part.	31	31	31	4	551798	169460	234
6507	1391	Non-Part.	32	32	32	4	551794	169550	236
6508	1392	Non-Part.	31	31	31	4	551650	169306	236
6509	1393	Non-Part.	30	30	30	4	551694	169274	236
6510	1394	Non-Part.	26	26	26	4	550167	169548	224
6511	1395	Non-Part.	28	28	28	4	550181	169369	230
6512	1396	Non-Part.	27	27	27	4	549529	169645	221
6513	1397	Non-Part.	26	26	26	4	549247	169641	226
6514	1398	Non-Part.	26	26	26	4	549206	169336	222
6515	1399	Non-Part.	25	25	25	4	549049	169320	227
6516	1400	Non-Part.	25	25	25	4	548959	169318	227
6517	1401	Non-Part.	24	24	24	4	548255	169610	220
6518	1402	Non-Part.	22	22	22	4	548251	169543	218
6519	1403	Non-Part.	23	23	23	4	548221	169419	220
6520	1404	Non-Part.	24	24	24	4	548195	169317	222
6521	1405	Non-Part.	24	24	24	4	548079	169321	222
6522	1406	Non-Part.	22	22	22	4	548422	169249	222
6535	1413	Non-Part.	45	45	45	4	556776	167767	251
6536	1414	Non-Part.	46	46	46	4	556875	167825	251
6537	4069	Part.	45	45	45	4	556801	167567	250
6538	1415	Non-Part.	39	39	39	4	555188	167947	245
6539	4070	Part.	38	38	38	4	555175	167778	245
6540	1416	Non-Part.	32	32	32	4	553560	168008	244
6556	1429	Non-Part.	30	30	30	4	553568	166769	246
9035	1652	Non-Part.	35	35	35	4	551312	173455	216
9036	1653	Non-Part.	35	35	35	4	551242	173452	217
9037	1654	Non-Part.	35	35	35	4	551169	173437	218

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
9038	1655	Non-Part.	35	35	35	4	551203	173458	217
9039	1656	Non-Part.	34	34	34	4	550941	173418	218
9048	1657	Non-Part.	36	36	36	4	551410	173476	217
9049	1658	Non-Part.	36	36	36	4	551914	173642	219
9050	1659	Non-Part.	37	37	37	4	551835	173484	219
9051	1660	Non-Part.	37	37	37	4	551863	173552	219
9056	1661	Non-Part.	31	31	32	4	554286	173699	227
9063	1662	Non-Part.	32	32	32	4	553401	173921	220
9076	4088	Part.	30	30	30	4	556167	173688	237
9077	1663	Non-Part.	28	28	28	4	556313	173602	233
9083	4089	Part.	29	29	29	4	556237	173678	236
9084	1664	Non-Part.	24	24	24	4	556255	173487	229
9086	1665	Non-Part.	28	28	28	4	556708	173867	239
9087	1666	Non-Part.	28	28	28	4	556562	173847	240
9088	1667	Non-Part.	28	28	28	4	556525	173817	240
9092	1668	Non-Part.	29	29	29	4	556705	173643	235
9093	4090	Part.	27	27	27	4	556513	173581	229
9094	1669	Non-Part.	29	29	29	4	556549	173714	239
9095	1670	Non-Part.	24	24	24	4	556606	173534	230
9098	1671	Non-Part.	27	27	27	4	557577	173407	241
9099	1672	Non-Part.	27	27	27	4	557598	173413	240
9100	1673	Non-Part.	30	30	30	4	557429	173406	243
9101	1674	Non-Part.	30	30	30	4	557462	173387	242
9116	1675	Non-Part.	27	27	27	4	557414	173460	240
9117	1676	Non-Part.	26	26	26	4	557395	173466	238
9118	1677	Non-Part.	29	29	29	4	557351	173474	241
9119	1678	Non-Part.	30	30	30	4	557310	173481	243
9120	1679	Non-Part.	30	30	30	4	557265	173478	244
9121	1680	Non-Part.	28	28	28	4	557441	173555	240
9137	1681	Non-Part.	30	30	30	4	557289	173414	242
9138	1682	Non-Part.	30	30	30	4	557252	173432	244
9148	1683	Non-Part.	30	30	30	4	556967	173500	243
9149	1684	Non-Part.	27	27	27	4	557010	173609	239

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
9150	1685	Non-Part.	28	28	28	4	556889	173644	240
9155	1686	Non-Part.	27	27	27	4	556857	173411	238
9156	1687	Non-Part.	29	29	29	4	556914	173444	241
9157	1688	Non-Part.	29	29	29	4	556823	173514	237
9158	1689	Non-Part.	28	28	28	4	557397	173866	238
10393	1953	Non-Part.	25	25	25	4	553850	176170	220
10394	1954	Non-Part.	25	25	25	4	553815	176181	220
10395	1955	Non-Part.	25	25	25	4	553791	176182	220
10396	1956	Non-Part.	25	25	25	4	553757	176216	220
10397	1957	Non-Part.	25	25	25	4	553800	176220	220
10425	1985	Non-Part.	25	25	25	4	553516	176119	220
10426	1986	Non-Part.	25	25	25	4	553527	176153	220
10601	2161	Non-Part.	25	25	25	4	556767	175931	229
10602	2162	Non-Part.	23	23	23	4	556820	176009	228
10603	2163	Non-Part.	25	25	25	4	556904	175969	231
10620	2180	Non-Part.	25	25	25	4	556856	175155	229
10621	2181	Non-Part.	25	25	25	4	557124	175103	232
10622	4141	Part.	26	26	26	4	557207	175128	233
10623	2182	Non-Part.	24	24	24	4	555776	175289	225
10624	2183	Non-Part.	25	25	25	4	555841	175252	228
10625	4142	Part.	27	27	27	4	555607	174985	228
10626	2184	Non-Part.	25	25	25	4	555973	175394	228
10627	2185	Non-Part.	26	26	26	4	555452	175125	224
10628	2186	Non-Part.	26	26	26	4	555271	175124	222
10629	2187	Non-Part.	26	26	26	4	555307	175141	223
10630	2188	Non-Part.	25	25	25	4	548736	174071	213
10631	2189	Non-Part.	28	28	28	4	550164	174279	214
10632	2190	Non-Part.	30	30	30	4	551618	174771	216
10633	2191	Non-Part.	30	30	30	4	551634	174736	216
10634	2192	Non-Part.	30	30	30	4	551650	174708	216
10635	2193	Non-Part.	30	30	30	4	551661	174680	217
10636	2194	Non-Part.	30	30	30	4	551677	174650	217
10637	2195	Non-Part.	30	30	30	4	551698	174615	217

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10638	2196	Non-Part.	30	30	30	4	551586	174605	215
10639	2197	Non-Part.	29	29	29	4	551556	174733	215
10640	2198	Non-Part.	31	31	31	4	551773	174509	217
10641	2199	Non-Part.	31	31	31	4	551792	174419	214
10642	2200	Non-Part.	33	33	33	4	551864	174099	219
10643	2201	Non-Part.	33	33	33	4	551782	174036	219
10644	2202	Non-Part.	31	31	31	4	553402	174264	218
10645	4143	Part.	31	31	31	4	553490	174326	220
10646	4144	Part.	32	32	32	4	553075	174266	221
10647	4145	Part.	32	32	32	4	553073	174240	220
10648	4146	Part.	32	32	32	4	553084	174260	221
10649	2203	Non-Part.	30	30	30	4	557644	173132	244
10650	2204	Non-Part.	31	31	31	4	557646	173174	244
10651	2205	Non-Part.	31	31	31	4	557591	173168	244
10652	2206	Non-Part.	30	30	30	4	557586	173200	244
10653	2207	Non-Part.	30	30	30	4	557586	173221	244
10654	2208	Non-Part.	30	30	30	4	557586	173248	243
10655	2209	Non-Part.	30	30	30	4	557573	173305	243
10656	2210	Non-Part.	30	30	30	4	557647	173346	243
10657	2211	Non-Part.	30	30	30	4	556764	173159	242
10658	2212	Non-Part.	31	31	31	4	556763	173100	242
10659	2213	Non-Part.	31	31	31	4	555986	173045	241
10660	2214	Non-Part.	31	31	31	4	555969	173045	241
10661	2215	Non-Part.	31	31	31	4	555945	173046	240
10662	2216	Non-Part.	30	30	30	4	555933	173053	240
10663	2217	Non-Part.	30	30	30	4	555948	173054	241
10664	2218	Non-Part.	31	31	31	4	555961	173052	241
10665	2219	Non-Part.	31	31	31	4	555980	173052	241
10666	2220	Non-Part.	30	30	30	4	555991	173054	241
10667	2221	Non-Part.	30	30	30	4	556004	173057	241
10668	2222	Non-Part.	30	30	30	4	556014	173059	241
10669	2223	Non-Part.	29	29	29	4	556034	173092	239
10670	2224	Non-Part.	30	30	30	4	556037	173102	239

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10671	2225	Non-Part.	29	29	29	4	556043	173113	238
10672	2226	Non-Part.	29	29	29	4	556053	173121	238
10673	2227	Non-Part.	30	30	30	4	556063	173132	238
10674	2228	Non-Part.	29	29	29	4	556043	173150	237
10675	2229	Non-Part.	29	29	29	4	556035	173149	237
10676	2230	Non-Part.	28	28	28	4	556020	173143	236
10677	2231	Non-Part.	28	28	28	4	555998	173137	236
10678	2232	Non-Part.	29	29	29	4	549667	173324	216
10679	2233	Non-Part.	26	26	26	4	548801	173358	214
10680	2234	Non-Part.	27	27	27	4	549137	173286	215
10681	2235	Non-Part.	26	26	26	4	548685	172347	217
10682	2236	Non-Part.	26	26	26	4	548627	172253	217
10683	2237	Non-Part.	27	27	27	4	548700	171747	218
10684	2238	Non-Part.	28	28	28	4	549293	171737	220
10685	2239	Non-Part.	28	28	28	4	549256	171603	220
10686	2240	Non-Part.	27	27	27	4	548862	171656	219
10687	2241	Non-Part.	30	30	30	4	549690	171800	220
10703	2249	Non-Part.	37	37	37	4	556271	171463	237
10704	3914	Part.	41	41	41	4	556547	171206	245
10705	2250	Non-Part.	45	45	45	4	556770	170937	247
10706	2251	Non-Part.	36	36	36	4	555215	171221	243
10707	2252	Non-Part.	41	41	41	4	554616	170268	243
10708	2253	Non-Part.	42	42	42	4	554701	170258	244
10709	2254	Non-Part.	44	44	44	4	554785	170259	244
10710	2255	Non-Part.	45	45	45	4	556093	170281	247
10711	4155	Part.	44	44	44	4	556028	170300	247
10712	2256	Non-Part.	43	43	43	4	555234	170268	244
10713	4156	Part.	45	45	45	4	555244	169991	245
10714	2257	Non-Part.	43	43	43	4	554924	170268	243
10715	2258	Non-Part.	44	44	44	4	554860	170258	243
10716	4157	Part.	44	44	44	4	556533	170283	245
10717	2259	Non-Part.	30	30	30	4	551887	168998	240
10718	2260	Non-Part.	30	30	30	4	551882	168951	241

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			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
10719	2261	Non-Part.	29	29	29	4	551894	168891	241
10720	2262	Non-Part.	30	30	30	4	551904	168772	243
10721	2263	Non-Part.	29	29	29	4	551867	168629	239
10722	2264	Non-Part.	29	29	29	4	551654	168575	240
10723	2265	Non-Part.	29	29	29	4	551455	168907	241
10724	2266	Non-Part.	27	27	27	4	550975	168631	235
10725	2267	Non-Part.	27	27	27	4	550860	168590	233
10726	2268	Non-Part.	26	26	26	4	550973	168405	239
10727	2269	Non-Part.	27	27	27	4	551013	168417	241
10728	2270	Non-Part.	24	24	24	4	551064	168360	237
10729	2271	Non-Part.	32	32	32	4	552924	168864	242
10730	2272	Non-Part.	32	32	32	4	553394	168606	243
10731	2273	Non-Part.	33	33	33	4	553544	168665	242
10732	2274	Non-Part.	30	30	30	4	552407	168637	244
10733	2275	Non-Part.	30	30	30	4	552369	168641	244
10734	2276	Non-Part.	30	30	30	4	552307	168637	242
10735	2277	Non-Part.	30	30	30	4	552268	168630	242
10736	2278	Non-Part.	32	32	32	4	553618	168036	245
10737	2279	Non-Part.	32	32	32	4	553460	167997	245
10738	2280	Non-Part.	32	32	32	4	553416	168069	246
10739	2281	Non-Part.	31	31	31	4	553235	168131	246
10740	2282	Non-Part.	32	32	32	4	553463	167884	245
10741	2283	Non-Part.	32	32	32	4	553619	167646	246
10742	2284	Non-Part.	32	32	32	4	553610	167739	246
10743	2285	Non-Part.	32	32	32	4	553635	167774	245
10744	2286	Non-Part.	32	32	32	4	553632	167808	245
10745	2287	Non-Part.	32	32	32	4	553624	167559	246
11843	2746	Non-Part.	29	29	29	4	551746	174903	216
11844	2747	Non-Part.	29	29	29	4	551612	174864	216
11845	2748	Non-Part.	29	29	29	4	551582	174882	215
11846	2749	Non-Part.	29	29	29	4	551552	174890	215
11847	2750	Non-Part.	28	28	28	4	551562	175021	215
11848	2751	Non-Part.	29	29	29	4	551653	175009	215

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11849	2752	Non-Part.	28	28	28	4	551417	175006	213
11850	2753	Non-Part.	28	28	28	4	551435	174963	214
11851	2754	Non-Part.	28	28	28	4	551485	174869	212
11852	2755	Non-Part.	29	29	29	4	551526	174799	215
11853	2756	Non-Part.	29	29	29	4	551608	174812	216
11854	2757	Non-Part.	28	28	28	4	551246	175014	214
11855	2758	Non-Part.	28	28	28	4	551188	175012	214
11856	2759	Non-Part.	28	28	28	4	551142	174994	211
11857	2760	Non-Part.	29	29	29	4	551273	174868	212
11858	2761	Non-Part.	27	27	27	4	550972	175382	214
11859	2762	Non-Part.	24	24	24	4	550955	175486	213
11860	2763	Non-Part.	31	31	31	4	556165	172913	241
11861	2764	Non-Part.	31	31	31	4	556141	172914	241
11862	2765	Non-Part.	31	31	31	4	556130	172915	241
11863	2766	Non-Part.	31	31	31	4	556117	172915	241
11864	2767	Non-Part.	31	31	31	4	556105	172915	240
11865	2768	Non-Part.	31	31	31	4	556083	172908	240
11866	2769	Non-Part.	31	31	31	4	556071	172897	239
11867	2770	Non-Part.	31	31	31	4	556048	172905	240
11868	2771	Non-Part.	31	31	31	4	556035	172902	239
11869	2772	Non-Part.	31	31	31	4	556019	172902	239
11870	2773	Non-Part.	31	31	31	4	556008	172902	239
11871	2774	Non-Part.	31	31	31	4	555984	172902	238
11872	2775	Non-Part.	30	30	30	4	555969	172903	238
11873	2776	Non-Part.	30	30	30	4	555955	172907	238
11874	2777	Non-Part.	31	31	31	4	556043	172939	241
11875	2778	Non-Part.	31	31	31	4	556042	172954	242
11876	2779	Non-Part.	31	31	31	4	556042	172963	242
11877	2780	Non-Part.	34	34	34	4	554859	171816	239
11878	4202	Part.	34	34	34	4	554744	171791	240
11879	2781	Non-Part.	34	34	34	4	554678	171814	239
11880	2782	Non-Part.	34	34	34	4	554600	171817	239
11881	2783	Non-Part.	34	34	34	4	554450	171832	239

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11882	2784	Non-Part.	34	34	34	4	554367	171992	238
11883	2785	Non-Part.	35	35	35	4	554340	171969	238
11884	2786	Non-Part.	35	35	35	4	554304	171939	239
11885	2787	Non-Part.	34	34	34	4	554287	171902	239
11886	4203	Part.	35	35	35	4	554078	172079	235
11887	2788	Non-Part.	35	35	35	4	554109	171851	236
11888	2789	Non-Part.	36	36	36	4	553961	171622	239
11889	2790	Non-Part.	34	34	34	4	555204	171806	242
11890	2791	Non-Part.	34	34	34	4	555297	171808	243
11891	2792	Non-Part.	34	34	34	4	555352	171811	243
11892	2793	Non-Part.	35	35	35	4	555239	171717	242
11893	2794	Non-Part.	35	35	35	4	555237	171672	241
11898	4206	Part.	42	42	42	4	557235	169631	248
11899	2797	Non-Part.	41	41	41	4	557463	169677	248
11900	2798	Non-Part.	46	46	46	4	556789	169590	247
11901	2799	Non-Part.	45	45	45	4	556853	169304	248
11902	2800	Non-Part.	46	46	46	4	555177	169725	245
11903	2801	Non-Part.	35	35	35	4	553798	169513	243
11904	2802	Non-Part.	35	35	35	4	553641	169649	243
11905	2803	Non-Part.	34	34	34	4	553531	169660	243
11906	2804	Non-Part.	34	34	34	4	553474	169505	241
11907	2805	Non-Part.	34	34	34	4	553602	169474	243
11908	2806	Non-Part.	34	34	34	4	553593	169522	241
11909	2807	Non-Part.	34	34	34	4	553537	169382	242
11910	2808	Non-Part.	33	33	33	4	552264	169720	240
11911	2809	Non-Part.	44	44	44	4	556854	167016	255
11912	2810	Non-Part.	43	43	43	4	556729	166963	254
11913	4207	Part.	44	44	44	4	556784	166717	254
11914	2811	Non-Part.	41	41	41	4	556369	167050	253
11915	2812	Non-Part.	44	44	44	4	556754	167328	252
11916	4208	Part.	40	40	40	4	555877	167123	250
11917	2813	Non-Part.	38	38	38	4	555593	167045	247
11918	2814	Non-Part.	37	37	37	4	555432	167058	249

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
11919	2815	Non-Part.	35	35	35	4	555240	166800	246
11920	2816	Non-Part.	34	34	34	4	555003	166703	247
11921	2817	Non-Part.	34	34	34	4	554621	166969	245
11922	2818	Non-Part.	31	31	31	4	553771	166974	246
11923	2819	Non-Part.	32	32	32	4	554036	166800	248
11924	2820	Non-Part.	28	28	28	4	552408	166912	247
12590	3086	Non-Part.	26	26	26	4	553502	175785	218
12685	3181	Non-Part.	27	27	27	4	557956	175101	243
12686	3182	Non-Part.	26	26	26	4	557870	175101	241
12687	3183	Non-Part.	27	27	27	4	557889	174926	242
12688	3184	Non-Part.	27	27	27	4	558035	174986	243
12692	3188	Non-Part.	24	24	24	4	557633	175091	236
12693	3189	Non-Part.	29	29	29	4	556702	173982	239
12694	3190	Non-Part.	29	29	29	4	556759	174027	240
12695	3191	Non-Part.	28	28	28	4	556788	174055	240
12696	3192	Non-Part.	28	28	28	4	556934	174061	241
12710	3206	Non-Part.	30	30	30	4	555916	173006	240
12711	3207	Non-Part.	30	30	30	4	555902	172987	241
12712	3208	Non-Part.	31	31	31	4	556019	172954	241
12713	3209	Non-Part.	31	31	31	4	556015	172990	242
12714	3210	Non-Part.	31	31	31	4	556015	172998	242
12715	3211	Non-Part.	30	30	30	4	556012	173013	241
12716	4247	Part.	28	28	28	4	555813	173101	230
12717	3212	Non-Part.	31	31	31	4	555494	172927	239
12718	3213	Non-Part.	29	29	29	4	555514	172847	238
12719	3214	Non-Part.	31	31	31	4	555500	173013	241
12720	4248	Part.	32	32	32	4	555178	172605	241
12721	3215	Non-Part.	32	32	32	4	555084	172646	240
12722	3216	Non-Part.	31	31	31	4	555333	172875	241
12723	4249	Part.	31	31	31	4	555380	172909	241
12724	4250	Part.	31	31	31	4	555292	172853	240
12725	3217	Non-Part.	28	28	28	4	556081	173214	234
12726	3218	Non-Part.	30	30	30	4	556100	173179	237

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			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
12727	4251	Part.	43	43	43	4	552990	171445	230
12728	3219	Non-Part.	37	37	37	4	553239	170811	239
12729	4252	Part.	43	43	43	4	551869	171278	228
12730	3220	Non-Part.	39	39	39	4	551875	170831	228
12731	3221	Non-Part.	33	33	33	4	550555	171106	227
12732	3222	Non-Part.	24	24	24	4	547930	171256	219
12733	3223	Non-Part.	24	24	24	4	547903	171325	218
12734	3224	Non-Part.	24	24	24	4	547892	171407	218
12735	3225	Non-Part.	24	24	24	4	547874	171463	218
12736	3226	Non-Part.	24	24	24	4	547865	171520	218
12737	3227	Non-Part.	25	25	25	4	547666	171651	217
12738	3228	Non-Part.	26	26	26	4	547419	171674	217
12739	3229	Part.	25	25	25	4	548149	170941	220
12740	3230	Non-Part.	23	23	23	4	548048	170885	219
12741	3231	Non-Part.	24	24	24	4	548072	170800	219
12742	3232	Non-Part.	25	25	25	4	548171	170662	220
12743	3233	Non-Part.	24	24	24	4	548202	170121	219
12744	3234	Non-Part.	40	40	40	4	555184	168402	246
12745	3235	Non-Part.	40	40	40	4	555248	168426	245
12746	3236	Non-Part.	40	40	40	4	555246	168495	244
12747	3237	Non-Part.	44	44	44	4	556262	168583	248
12748	3238	Non-Part.	45	45	45	4	556224	168633	248
12749	4253	Part.	44	44	44	4	556723	168634	250
12750	3239	Non-Part.	42	42	42	4	557436	168956	249
12751	3240	Non-Part.	41	41	41	4	557588	169166	250
12752	3241	Non-Part.	43	43	43	4	557312	168799	249
12753	3242	Non-Part.	43	43	43	4	557315	168748	250
12754	3243	Non-Part.	44	44	44	4	557346	168649	251
12755	3244	Non-Part.	45	45	45	4	557276	168574	250
12756	4254	Part.	44	44	44	4	557001	168576	251
12757	3245	Non-Part.	46	46	46	4	557605	168569	249
12758	3246	Non-Part.	44	44	44	4	557833	168621	253
12759	3247	Non-Part.	44	44	44	4	556854	169054	248

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			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
12760	3248	Non-Part.	44	44	44	4	556797	168313	250
12863	3320	Non-Part.	21	21	21	4	547505	172624	213
12864	3321	Non-Part.	23	23	23	4	547477	172702	214
12868	3322	Non-Part.	23	23	23	4	547622	172338	215
12870	3323	Non-Part.	22	22	22	4	547680	172101	215
12871	4259	Part.	24	24	24	4	547803	172069	216
12872	4260	Part.	24	24	24	4	547757	171960	216
12880	3324	Non-Part.	31	31	31	4	550241	173397	217
13316	3440	Non-Part.	25	25	25	4	553360	176170	218
13400	3524	Non-Part.	27	27	27	4	555196	175128	222
13401	3525	Non-Part.	27	27	27	4	555040	175128	222
13402	3526	Non-Part.	27	27	27	4	554955	175135	221
13403	3527	Non-Part.	26	26	26	4	554626	175081	220
13404	3528	Non-Part.	27	27	27	4	554679	175089	220
13405	3529	Non-Part.	27	27	27	4	554593	175211	220
13406	3530	Non-Part.	28	28	28	4	553859	175139	219
13407	3531	Non-Part.	27	27	27	4	553828	175136	219
13408	3532	Non-Part.	27	27	27	4	553785	175143	219
13409	3533	Non-Part.	28	28	28	4	553701	175092	219
13410	4291	Part.	28	28	28	4	553562	175097	219
13411	3534	Non-Part.	28	28	28	4	553580	175277	218
13412	3535	Non-Part.	31	31	31	4	556769	173054	242
13413	3536	Non-Part.	32	32	32	4	556777	172975	244
13414	3537	Non-Part.	32	32	32	4	556831	172843	243
13415	3538	Non-Part.	32	32	32	4	556820	172788	242
13416	3539	Non-Part.	32	32	32	4	556831	172748	241
13417	3540	Non-Part.	32	32	32	4	556748	172719	240
13418	3541	Non-Part.	32	32	32	4	556817	172558	240
13419	3542	Non-Part.	31	31	31	4	556756	172592	239
13420	3543	Non-Part.	31	31	31	4	556695	172571	239
13421	3544	Non-Part.	31	31	31	4	556520	172569	236
13422	3545	Non-Part.	33	33	33	4	556681	172449	243
13423	3546	Non-Part.	34	34	34	4	556837	172454	244

Receiver ID	Republic Receiver ID	Republic Receiver Status	Sound Pressure Level (dBA)			Relative Height (m)	Coordinates (Ohio State Plane North)		
			Route A1	Route A2	Route Alt B		X (m)	Y (m)	Z (m)
13424	3547	Non-Part.	31	31	31	4	549859	171704	221
13425	3548	Non-Part.	32	32	32	4	550206	171794	221
13426	3549	Non-Part.	32	32	32	4	550197	171810	221
13427	3550	Non-Part.	44	44	44	4	551663	171852	225
13428	3912	Part.	45	45	45	4	551769	171863	227
13429	3902	Part.	48	48	48	4	551930	171846	227
13430	4292	Part.	46	46	46	4	551859	171704	227
13431	4293	Part.	46	46	46	4	551893	171638	225
13432	3901	Part.	48	48	48	4	551936	171871	228
13433	3551	Non-Part.	46	46	46	4	551814	171806	228
13434	3919	Part.	41	41	41	4	553242	171954	228
13435	3906	Part.	47	47	47	4	552751	171913	227
13436	3552	Non-Part.	44	44	44	4	556772	170204	244
13437	3553	Non-Part.	44	44	44	4	556719	170181	245
13438	3554	Non-Part.	44	44	44	4	556968	170191	241
13439	3555	Non-Part.	44	44	44	4	557122	170179	243
13440	4294	Part.	45	45	45	4	557173	170294	245
13441	3556	Non-Part.	44	44	44	4	557609	170445	247
13442	3557	Non-Part.	44	44	44	4	556768	170259	246
13448	3561	Non-Part.	32	32	32	4	553627	167618	246
13449	3562	Non-Part.	28	28	28	4	551867	167897	244
13450	3563	Non-Part.	29	29	29	4	551807	168107	244
13452	3565	Non-Part.	27	27	27	4	551475	167020	245
13454	3567	Non-Part.	31	31	31	4	553552	167466	246
13455	3568	Non-Part.	31	31	31	4	553612	167321	246
13456	3569	Non-Part.	29	29	29	4	553060	167044	246
13457	3570	Non-Part.	29	29	29	4	552800	167031	246
13458	3571	Non-Part.	29	29	29	4	552656	167032	247
14025	NA	NA	35	35	35	4	552366	173936	219
14028	NA	NA	30	30	30	4	554535	173940	228
14029	NA	NA	28	28	28	4	554745	174226	227





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## Exhibit G: Cultural Resources Records Review

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# Cultural Resources Records Review

## Republic Transmission Line

Adams and Pleasant Townships, Seneca County

Prepared for:



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**July 2019**

## MANAGEMENT SUMMARY

Involved State and Federal Agencies:	Ohio Power Siting Board (OPSB) Ohio Historic Preservation Office (OHPO)
Phase of Survey:	Cultural Resources Records Review
Location Information:	Adams and Pleasant Townships, Seneca County
Survey Area:	
Project Description:	A 7.1-mile 138kV transmission line with POI switchyard
Study Area:	1,000 feet around POI and each proposed transmission line route
USGS 7.5-Minute Quadrangle Maps:	<i>Watson, Ohio</i>
Report Authors:	Susan Lawson, Doug Pippin, Patrick Heaton, RPA
Date of Report:	July 2019

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## **1.0 INTRODUCTION**

### **1.1 Purpose and Goals of the Investigation**

Republic Wind, LLC (hereafter referred to as the Applicant) is proposing to construct the Republic Transmission Line and Point of Interconnect (POI) Switchyard in Adams and Pleasant Townships, Seneca County, Ohio. The Applicant is currently in the process of applying for their Application for a Certificate of Environmental Compatibility and Public Need (the Application), in compliance with Section 4906.06 of the Ohio Revised Code and in accordance with Chapters 4906-5-01 through 4906-5-08 of the Ohio Administrative Code (OAC).

On behalf of the Applicant, EDR prepared the following cultural resources records review in support of environmental review and permitting for the proposed Republic Transmission Line and two alternative routes, as well as the POI Switchyard (hereafter referred to as the Project). This cultural resources records review has been prepared by a Registered Professional Archaeologist (RPA) who meets the Secretary of the Interior's Standards for Archaeology (36 C.F.R. Part 61) and a qualified architectural historian who meets the U.S. Secretary of Interior's Standards for Historic Preservation (36 C.F.R. Part 61). Per the requirements of Ohio Administrative Code Chapter 4906-5-07(E), the Applicant has identified cultural resources within 1,000 feet of the preferred and alternate routes (hereafter referred to as the Study Area). This review was completed using the online Geographic Information Systems (GIS) mapping system of the Ohio Historic Preservation Office (OHPO).

### **1.2 Project Location and Description**

The Applicant is proposing to construct a 7.2-mile 138 kilovolt (kV) transmission line with a POI switchyard, collectively referred to as the Project, in rural Pleasant and Adams Townships in Seneca County, Ohio (see Figure 1). The primary purpose of the Republic Transmission Line is to deliver electricity generated by the Republic Wind Farm from the collection substation<sup>1</sup> to the Republic POI switchyard. The purpose of the POI switchyard is to allow for and make the interconnection to the American Electric Power (AEP) existing Freemont Center-Tiffin Center 138kV circuit. Collectively, the proposed Project will allow electricity generated by the Republic Wind Farm to be transferred to the transmission grid operated by PJM Interconnection, LLC (PJM) for sale at wholesale or under a power purchase agreement. The Republic POI switchyard will not require a voltage step-up and will not require voltage transformers. Since the Applicant's queue position for this PJM interconnection point totals 200 megawatts (MW), the Applicant seeks approval to build out the POI switchyard to accommodate 200 MW. The Applicant does not have specific future expansion plans.

---

<sup>1</sup> The collection substation is being permitted as part of the Republic Wind Farm. See OPSB Case No. 17-2295-EL-BGN.

The Republic Transmission Line will initially travel north from the collection substation, which is located along Township Road (TR) 175 just south of its intersection with Hoppes Road in Adams Township. The Republic Transmission Line then turns and travels west just north of the intersection of State Route (SR) 101 and TR 32, ending at the Republic POI switchyard, which will be located off County Route (CR) 44 just west of its intersection with CR15. This route is hereafter referred to as the "Preferred Transmission Route A2". A secondary preferred transmission route, hereafter referred to as Alternate Transmission Route A1, has been identified. Preferred Transmission Route A2 is largely identical to Alternate Transmission Route A1, except for a short portion west of SR 119 that deviates for approximately 0.4 mile. An additional alternate route has been identified for the transmission line for a total of three potential routes. Alternate Route B travels further north compared to the Preferred Transmission Route A2 and Alternate Transmission Route A1.

A more detailed description of each proposed transmission route can be found in Section 4906-5-02(A) of the Application.

The following terms are used throughout this document to describe the proposed action:

- Project: Collectively refers to all components of the preferred and alternate routes of the 138 kV Republic Transmission Line with a POI switchyard in Seneca County, Ohio. The Preferred Transmission Route A2 is 7.2 miles and the alternates routes range from 7.1 to 8.1 miles.
- Study Area: The area within 1,000 feet of the Project, per the requirements of Ohio Administrative Code Chapter 4906-5-07(E).

### **1.3 Area of Potential Effect**

The Area of Potential Effect (APE) for Direct Effects to historic resources is defined as all areas where potential soil disturbance (or other direct, physical impacts) is anticipated during construction of the Project. Although preliminary design of the Project is underway, the final route of the transmission line is anticipated to occupy only a portion of the Study Area (see Figure 2). Therefore, the total ground disturbance during construction is anticipated to be minimal relative to the overall size of the Study Area.

The APE for Indirect Effects on historic resources includes those areas within 1,000 feet of each transmission line route (the Study Area) where the Project may result in indirect effects such as visual or auditory impacts per the requirements of Ohio Administrative Code Chapter 4906-5-07(E). The Project's potential indirect effect on historic resources would be a change in the historic resources setting of a property resulting from the introduction of the transmission line or POI switchyard. This could theoretically consist of auditory and/or visual impacts; however, the transmission line and will produce minimal noise, so auditory impacts resulting from the Project are not considered a significant type of impact

to the setting of historic resources. Therefore, potential visual impacts associated with the Project are the most significant consideration for defining an APE for Indirect Effects.

## **2.0 RECORDS REVIEW AND IMPACT ASSESSMENT**

### **2.1 Methodology**

Per the requirements of Ohio Administrative Code Chapter 4906-05-07(E), the cultural resources records review was completed for the area within 1,000 feet of the POI switchyard and each route alternative and included the following records available from the Ohio State Historic Preservation Office (OHPO):

- National Register of Historic Places (NRHP)
- NRHP Determination of Eligibility (DOE)
- National Historic Landmarks (NHL)
- Ohio Historic Inventory (OHI)
- Ohio Department of Transportation (ODOT) Historic Bridge Inventory
- Ohio Archaeological Inventory (OAI)
- Ohio Genealogical Society (OGS) cemetery files
- Mills *Archaeological Atlas of Ohio* (1914)
- OHPO previous cultural resources surveys

### **2.2 Cultural Resources Records Review**

Archives and repositories consulted during EDR's research for the Project included the online Geographic Information Systems (GIS) mapping system of the OHPO (Ohio History Connection, 2019), the David Rumsey map collection (Cartography Associates, 2019), and EDR's in-house collection of reference materials. The results of the cultural resources records review for the Study Area associated with the Project are described below and depicted on Figure 3.

#### **2.2.1 National Register of Historic Places (NRHP)**

No NRHP-listed resources are located within the Study Area.

#### **2.2.2 NRHP Determination of Eligibility (DOE)**

No NRHP-eligible resources are located within the Study Area.

#### **2.2.3 National Historic Landmarks (NHL)**

No designated National Historic Landmarks are located within the Study Area.

#### **2.2.4 Ohio Historic Inventory (OHI)**

No OHI resources are located within the Study Area.

### **2.2.5 Historic Bridge Inventory (ODOT)**

No designated historic bridges are located within the Study Area.

### **2.2.6 Ohio Archaeological Inventory (OAI)**

The records review of the OHPO online GIS mapping system identified one previously recorded OAI property located within the Study Area (see Figure 3). [REDACTED]

### **2.2.7 Ohio Genealogical Society (OGS)**

One OGS cemetery has been recorded within the Study Area, located approximately 905 feet southwest of the Preferred Routes A1 and A2.

- The Lowell School Cemetery (OGS ID 1170) is located at the southeast of the intersection of E. State Route 19 and N. State Route 101 (see Figure 3).

### **2.2.8 Mills Archaeological Atlas of Ohio (1914)**

A review of the 1914 *Archaeological Atlas of Ohio* (Mills, 1914) indicates the following for Seneca County, where the Study Area is located:

- **Seneca County:** According to Mills (1914:74), Seneca County contains 23 pre-contact archaeological sites. These sites included three mounds, two enclosures, seven villages, 10 burials, and one cemetery. These 23 sites are spread throughout the county, although a few clusters are present along the Sandusky River and its tributaries, south of the City of Tiffin and near the community of Fort Seneca. Another cluster is located in the northeast corner of the county within Thompson Township. The large majority of sites are located along creeks and rivers. The Scioto Trail, a Native American trail, also passes through the county running north/south west of, and parallel to, the Sandusky River.
- **Study Area:** Mills (1914:74) depicts two pre-contact archaeological sites immediately adjacent to the Study Area (Figure 4). Although these are technically outside the Study Area, they are included in this discussion because the locations mapped by Mills (1914) do not have a high level of precision. Therefore, it is possible that these sites could occur partially or wholly within the Study Area. One of these sites, a village, is depicted across the Sandusky River and as such will not occur within the proposed Project. The other site, an interment burial, is depicted near the confluence of Beaver and Owl Creeks, near the location of OAI Site SE0192 which

### **2.2.10 Historic Map Review**

Historic maps reviewed included the 1914 Mills *Archaeological Atlas of Ohio* (Figure 4); 1872 Gray and Walling *Topographical Atlas of Cuyahoga, Erie, Huron, Lorain, Medina, Ottawa, Sandusky, Seneca, and Summit Counties, Ohio* (Figure 5); and the USGS 1901 *Elmore, OH*; 1901 *Fostoria, OH*; 1903 *Bellevue, OH*; 1903 *Fremont, OH*; 1904 *Sandusky, OH*; 1906 *Sycamore, OH*; 1904 *Tiffin, OH*; 1915 *Bucyrus, OH*; 1915 *Crestline, OH*; 1915 *Norwalk, OH*; and 1915 *Siam, OH* 1:62500 Topographic Quadrangles (Figure 6).

An excerpt from the 1872 Gray and Walling *Topographical Atlas of Cuyahoga, Erie, Huron, Lorain, Medina, Ottawa, Sandusky, Seneca, and Summit Counties, Ohio* (Figure 5) depicts the Study Area within Adams and Pleasant Townships in Seneca County. East of the Sandusky River, lots are separated into 1-mile grids, with orthogonal roadways along most of those boundaries. The Sandusky River passes through the Study Area at the far west, the Green Creek passes through at the north, Owl Creek at the east, and Sugar Creek at the south. Diagonal thoroughfares, including the Cleveland Railway cross through the grid at the western side of the Study Area through Watson Station (opened 1854). The diagonal coach road (later called OH-101) that bisects the Study Area connects the settlement of Adams south to the Village of Tiffin, nine miles to its south. Though generally the Atlas does not depict structures, a handful of buildings in the Village of Adams (present-day Lowell) were drawn, suggesting that by 1872 it was a burgeoning settlement in an agricultural landscape. In addition to the residences and train station, the Lowell Post Office was located in Adams.

The USGS 1901 *Elmore, OH*; 1901 *Fostoria, OH*; 1903 *Bellevue, OH*; 1903 *Fremont, OH*; 1904 *Sandusky, OH*; 1906 *Sycamore, OH*; 1904 *Tiffin, OH*; 1915 *Bucyrus, OH*; 1915 *Crestline, OH*; 1915 *Norwalk, OH*; and 1915 *Siam, OH* 1:62500 Topographic Quadrangles (Figure 6) are largely similar to the 1872 Gray and Walling Atlas. However, the early twentieth century depicts additional buildings scattered along major thoroughfares, and increased density appearing in Lowell (formerly Adams). The Study Area remained primary agricultural. The only notable change was the renaming of Green Creek to Beaver Creek.

The 1914 Mills *Archaeological Atlas of Ohio* (Figure 4) was also reviewed during background research for the Study Area, and pre-contact archaeological sites depicted in the atlas were discussed in Section 2.2.8 of this report. In addition to archaeological sites, the Mills Atlas also depicts the state of development throughout Ohio in 1914. Relative to the earlier maps of Seneca County, the Mills (1914) maps show a similar pattern of development in the Study Area, albeit at a decreased level of detail, with the landscape divided into 1-mile sections and major roads radiating out from population centers, including Lowell. Roads in the 1914 Mills Atlas are approximately in their modern alignment.

## **2.3 Impact Assessment**

Per the requirements of 4906-4-08(D) of the Ohio Administrative Code, EDR assessed the potential impact(s) on cultural resources that could result from construction and operation of the Project. The results of this impact assessment are discussed below.

### **2.3.1 Potential Direct Effects**

Based on current design, there will be no direct impacts to known cultural resources (i.e., cemeteries or historic structures) from construction of the Project. Although one previously recorded archaeological site occurs within the Study Area, it is located approximately 610 feet (186 meters) away from the proposed transmission line and will not be impacted by the Project. The Study Area has not been systematically surveyed for archaeological resources.

### **2.3.2 Potential Indirect Effects**

Per 4906-5-07(E), the impact of the Project on resources eligible for listing in the S/NRHP must be evaluated. The Project has the potential to cause indirect (visual) impacts to aboveground historic resources within the Study Area. However, the extent of transmission line and POI switchyard visibility and its visual impact are likely to be highly variable, depending on a number of factors, including proximity to viewers; viewer sensitivity; the extent of screening provided by intervening topography, vegetation, and structures; and the presence of other built features in the view. Both the Preferred and Alternate Transmission Routes largely run cross-county, traversing agricultural fields and only following the right-of-way public roads to a limited extent. The POI switchyard is also located in cropland, in a small agricultural field bordered by woodlots on three sides.

### **3.0 SUMMARY AND CONCLUSIONS**

#### **3.1 Summary of Cultural Resources Records Review**

EDR prepared this cultural resources records review in support of environmental review and permitting for the proposed Republic Transmission Line and POI switchyard. This report is designed to satisfy the requirements of Ohio Administrative Code Chapter 4906-05-07(E)(1) and (2) for the OPSB. The results of the Cultural Resources Records Review for the proposed Project can be summarized as follows:

- No NRHP-listed resources have been recorded within the Study Area.
- No resources previously determined NRHP-eligible have been recorded within the Study Area.
- No NHLs have been recorded within the Study Area.
- No OHI properties have been recorded within the Study Area.
- One OAI property is located within the Study Area.
- No historic bridges within the ODOT inventory have been recorded within the Study Area.
- One OGS cemetery has been recorded within the Study Area.
- No archaeological surveys have been completed within the Study Area.
- The 1914 Mills *Archaeological Atlas of Ohio* depicts two pre-contact archaeological sites adjacent to the Study Area. These sites consist of a village which is on the opposite site of the Seneca River from the Project and an interment burial which could potentially overlap with the Project due to the imprecise mapping of Mills (1914).

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USGS. 1906. *Tiffin, Ohio*. 15-minute series (Topographic). United States Department of the Interior, Geological Survey, Washington, D.C.

USGS. 1915. *Bucyrus, Ohio*. 15-minute series (Topographic). United States Department of the Interior, Geological Survey, Washington, D.C.

USGS. 1915. *Crestline, Ohio*. 15-minute series (Topographic). United States Department of the Interior, Geological Survey, Washington, D.C.

USGS. 1915. *Norwalk, Ohio*. 15-minute series (Topographic). United States Department of the Interior, Geological Survey, Washington, D.C.

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## Figures



## Republic Transmission Line

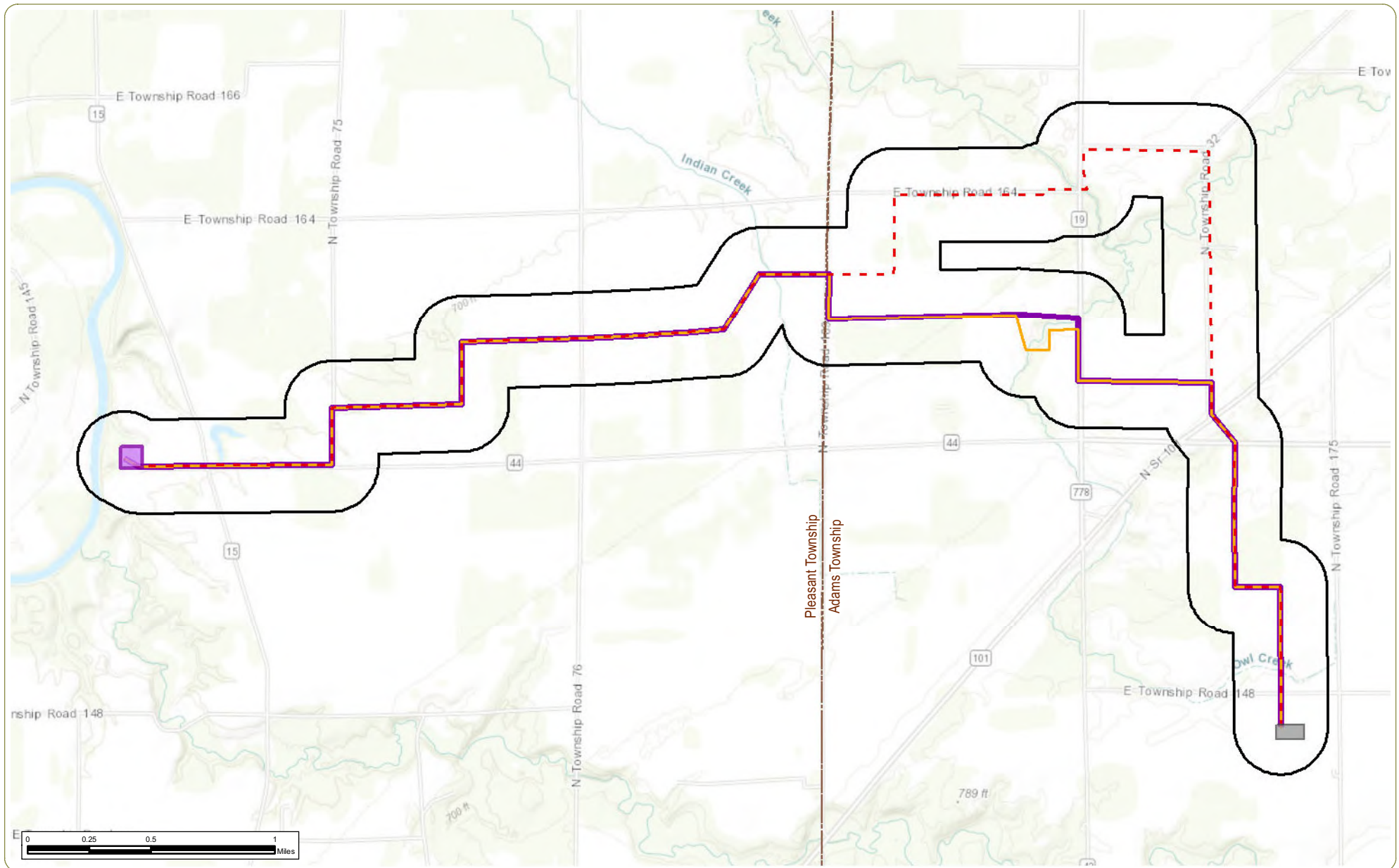
Adams and Pleasant Townships, Seneca County, Ohio

**Figure 1: Regional Project Location**

**Notes:** 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on June 13, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.



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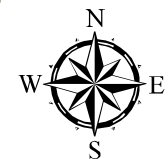
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Adams and Pleasant Townships, Seneca County, Ohio

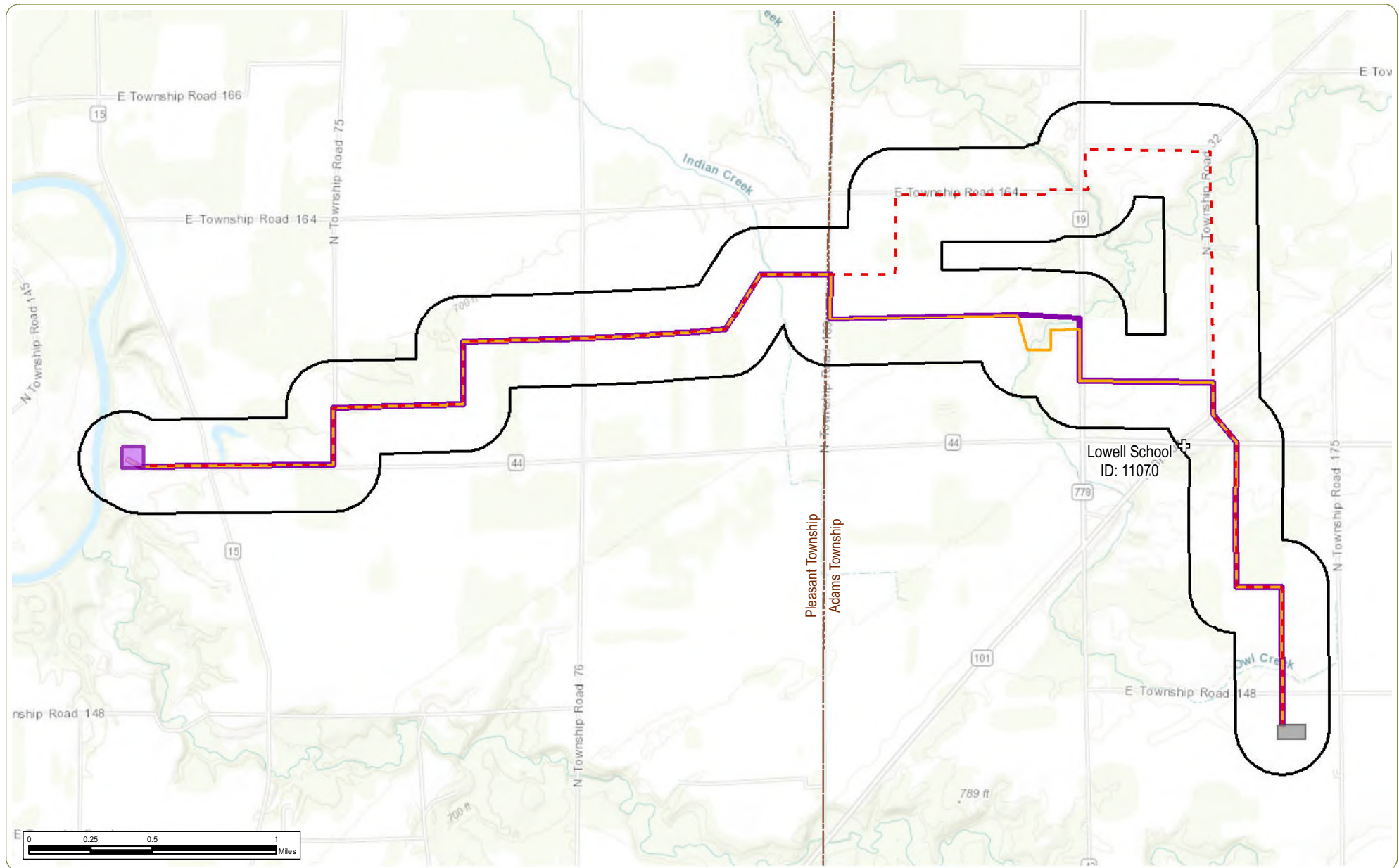
**Figure 2: Transmission Line Options and Study Area**

**Notes:** 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on August 8, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- Alternate Route A1
- Preferred Route A2
- - Alternate Route B
- POI Switchyard
- Collection Substation (Not Included in Study Area)
- 1000-Foot Study Area
- Township Boundary



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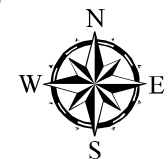
## Republic Wind Project

Adams and Pleasant Townships, Seneca County, Ohio

### Figure 3: Previously Identified Cultural Resources

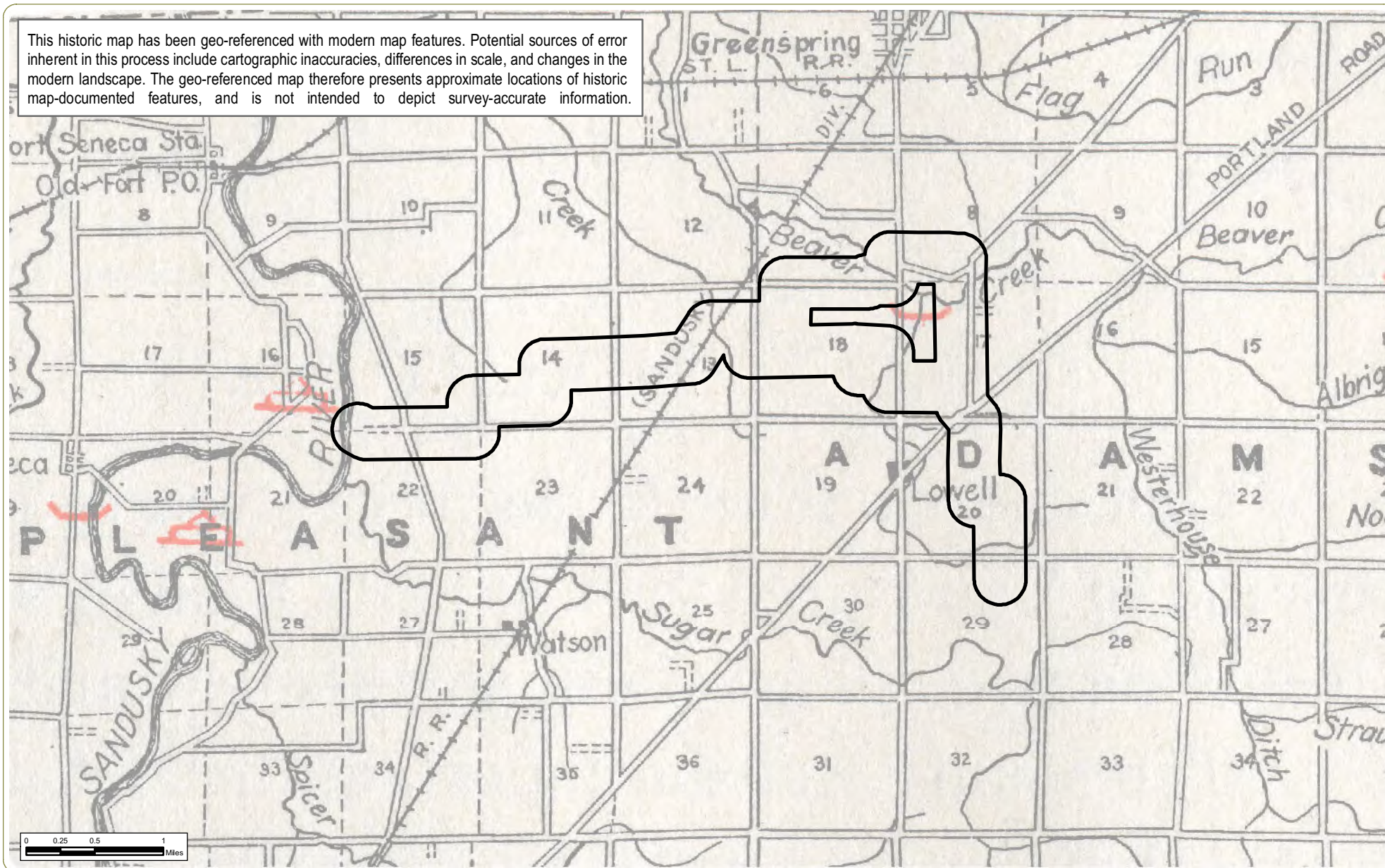
**Notes:** 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on August 8, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- |                       |  |
|-----------------------|--|
| ⊕ OGS Cemetery        | POI Switchyard                                     |
| — Alternate Route A1  | Collection Substation (Not Included in Study Area) |
| — Preferred Route A2  | 1000-Foot Study Area                               |
| - - Alternate Route B | — Township Boundary                                |



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This historic map has been geo-referenced with modern map features. Potential sources of error inherent in this process include cartographic inaccuracies, differences in scale, and changes in the modern landscape. The geo-referenced map therefore presents approximate locations of historic map-documented features, and is not intended to depict survey-accurate information.

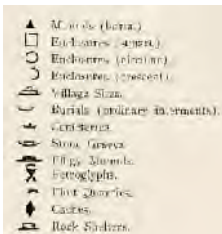


## Republic Transmission Line

Adams and Pleasant Townships, Seneca County, Ohio

**Figure 4: 1914 Mills Archaeological Atlas of Ohio**

**Notes:** 1. Basemap: 1914 Mills Archaeological Atlas of Ohio. 2. This map was generated in ArcMap on August 16, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

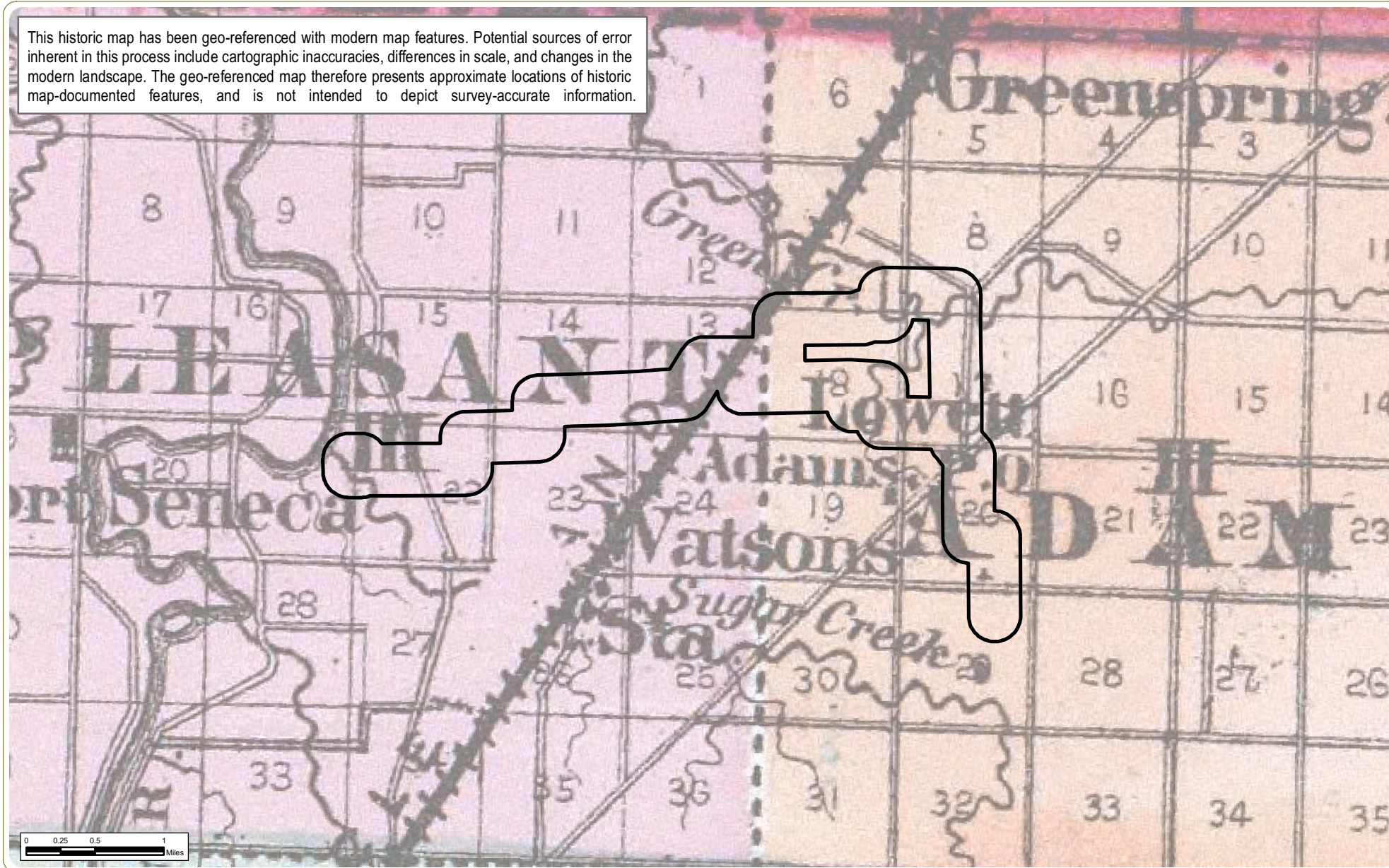


1000-Foot Study Area



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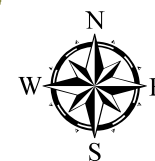
## Republic Transmission Line

Adams and Pleasant Townships, Seneca County, Ohio

**Figure 5: 1872 Gray and Walling *Topographical Atlas of Ohio***

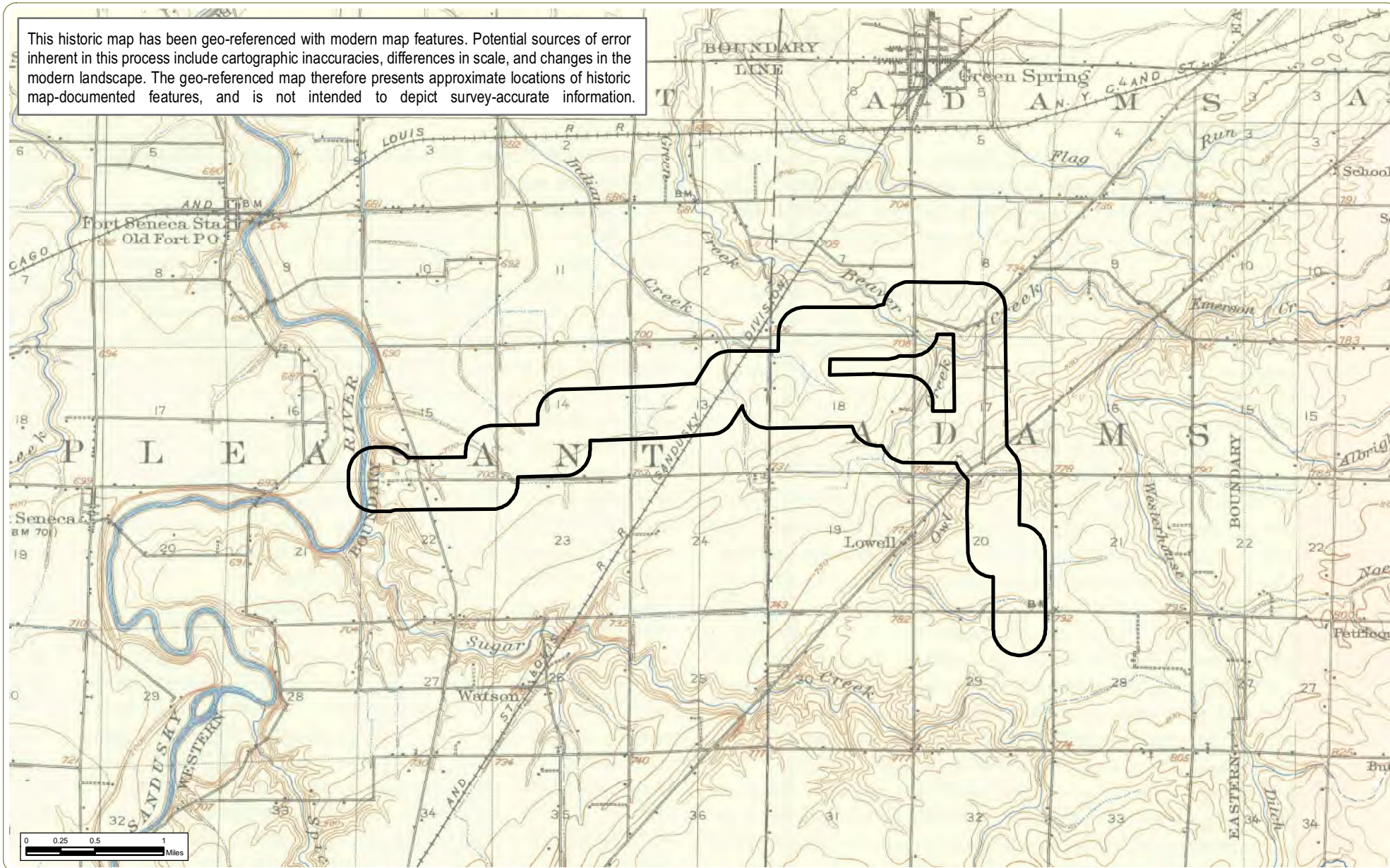
**Notes:** 1. Basemap: 1872 Gray and Walling *Topographical Atlas of Ohio* 2. This map was generated in ArcMap on June 19, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

 1000-Foot Study Area



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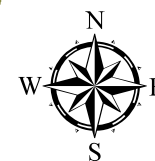
## Republic Transmission Line

Adams and Pleasant Townships, Seneca County, Ohio

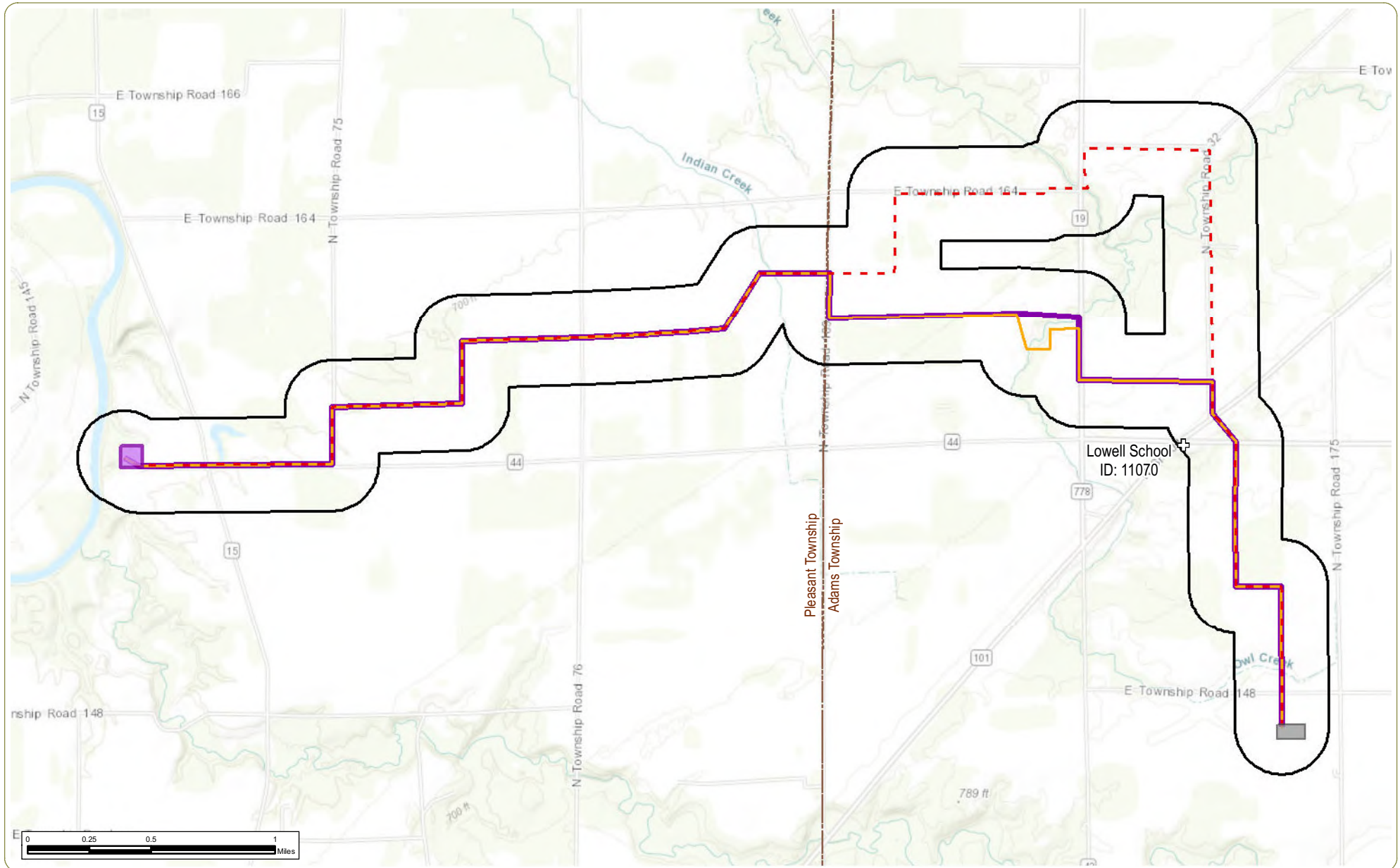
**Figure 6: 1901 Elmore, OH, 1901 Fostoria, OH, 1903 Bellevue, OH, 1903 Fremont, OH, 1904 Sandusky, OH, 1906 Sycamore, OH, 1904 Tiffin, OH, 1915 Bucyrus, OH, 1915 Crestline, OH, 1915 Norwalk, OH, and 1915 Siam, OH, USGS 1:62500 Topographic Quadrangles**

**Notes:** 1. Basemap: 1901 Elmore, OH, 1901 Fostoria, OH, 1903 Bellevue, OH, 1903 Fremont, OH, 1904 Sandusky, OH, 1906 Sycamore, OH, 1904 Tiffin, OH, 1915 Bucyrus, OH, 1915 Crestline, OH, 1915 Norwalk, OH, and 1915 Siam, OH, USGS 1:62500 Topographic Quadrangles. 2. This map was generated in ArcMap on June 19, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

1000-Foot Study Area



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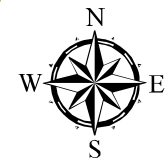
## Republic Wind Project

Adams and Pleasant Townships, Seneca County, Ohio

### Figure 3: Previously Identified Cultural Resources

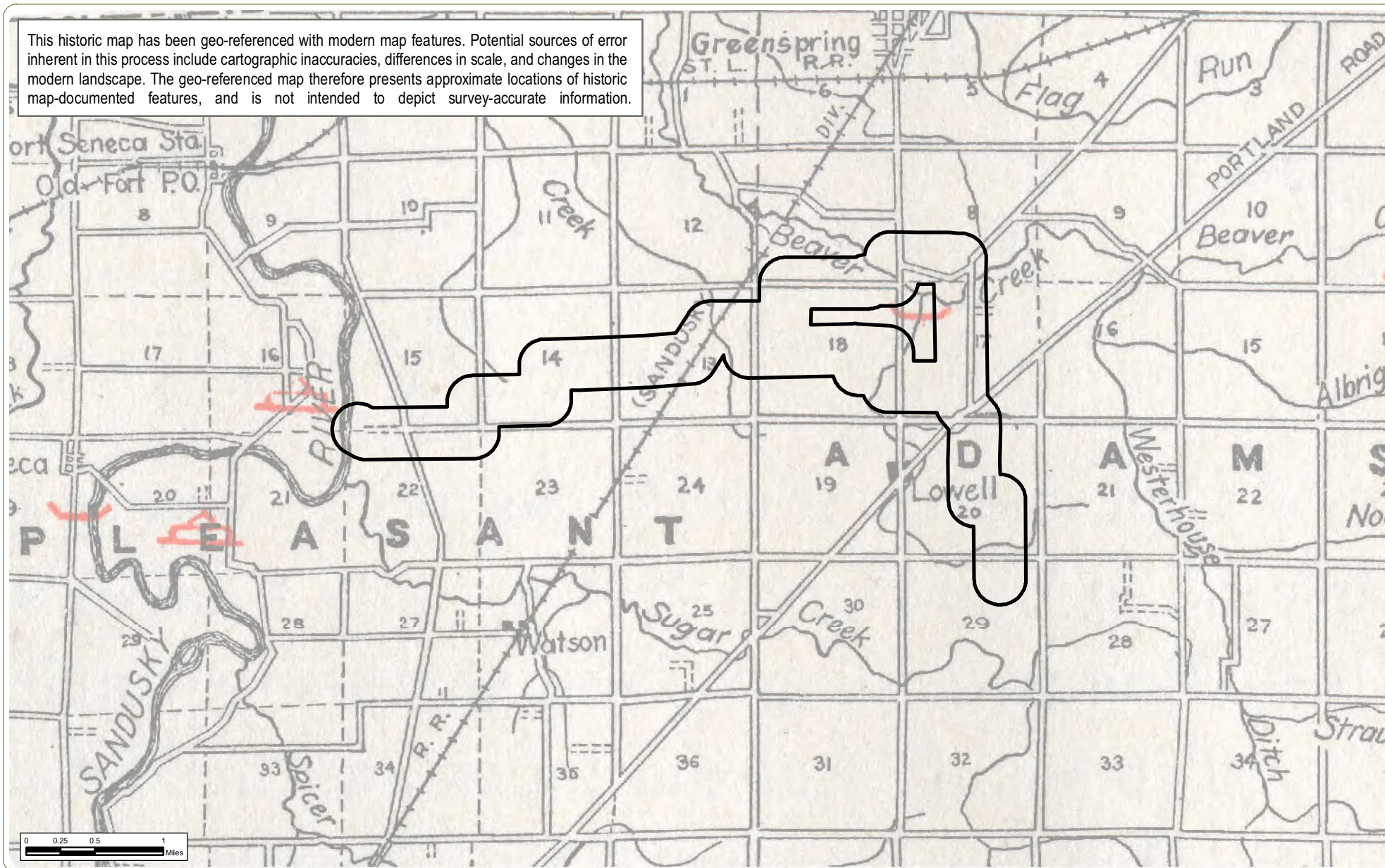
**Notes:** 1. Basemap: ESRI ArcGIS Online "World Topographic Map" map service. 2. This map was generated in ArcMap on August 8, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

- |                       |  |
|-----------------------|--|
| ⊕ OGS Cemetery        | POI Switchyard                                     |
| — Alternate Route A1  | Collection Substation (Not Included in Study Area) |
| — Preferred Route A2  | 1000-Foot Study Area                               |
| - - Alternate Route B | Township Boundary                                  |



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This historic map has been geo-referenced with modern map features. Potential sources of error inherent in this process include cartographic inaccuracies, differences in scale, and changes in the modern landscape. The geo-referenced map therefore presents approximate locations of historic map-documented features, and is not intended to depict survey-accurate information.

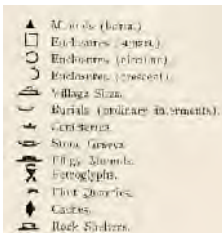


## Republic Transmission Line

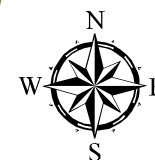
Adams and Pleasant Townships, Seneca County, Ohio

**Figure 4: 1914 Mills Archaeological Atlas of Ohio**

**Notes:** 1. Basemap: 1914 Mills *Archaeological Atlas of Ohio*. 2. This map was generated in ArcMap on August 16, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

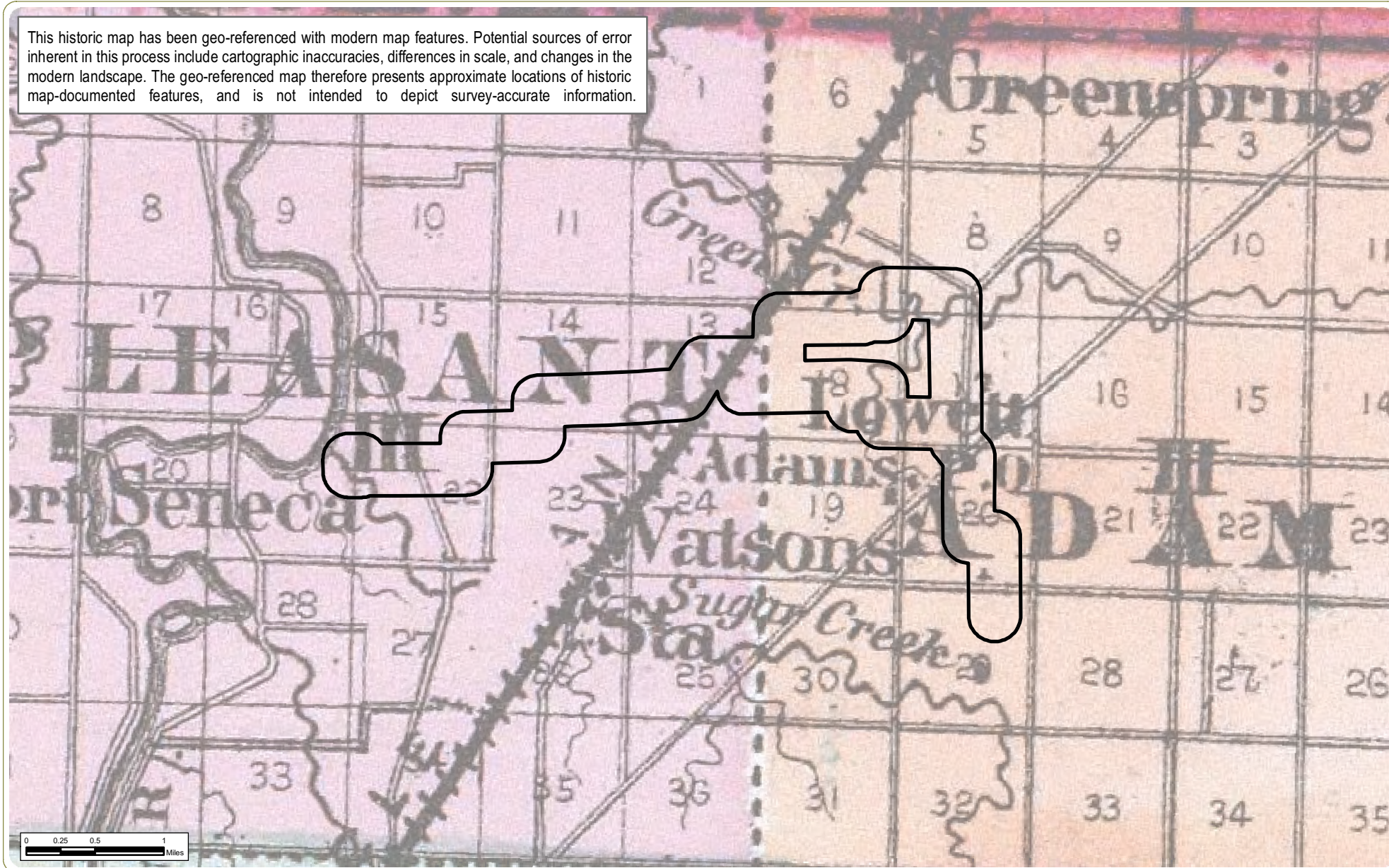


1000-Foot Study Area



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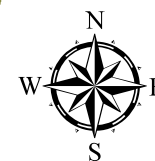
## Republic Transmission Line

Adams and Pleasant Townships, Seneca County, Ohio

**Figure 5: 1872 Gray and Walling *Topographical Atlas of Ohio***

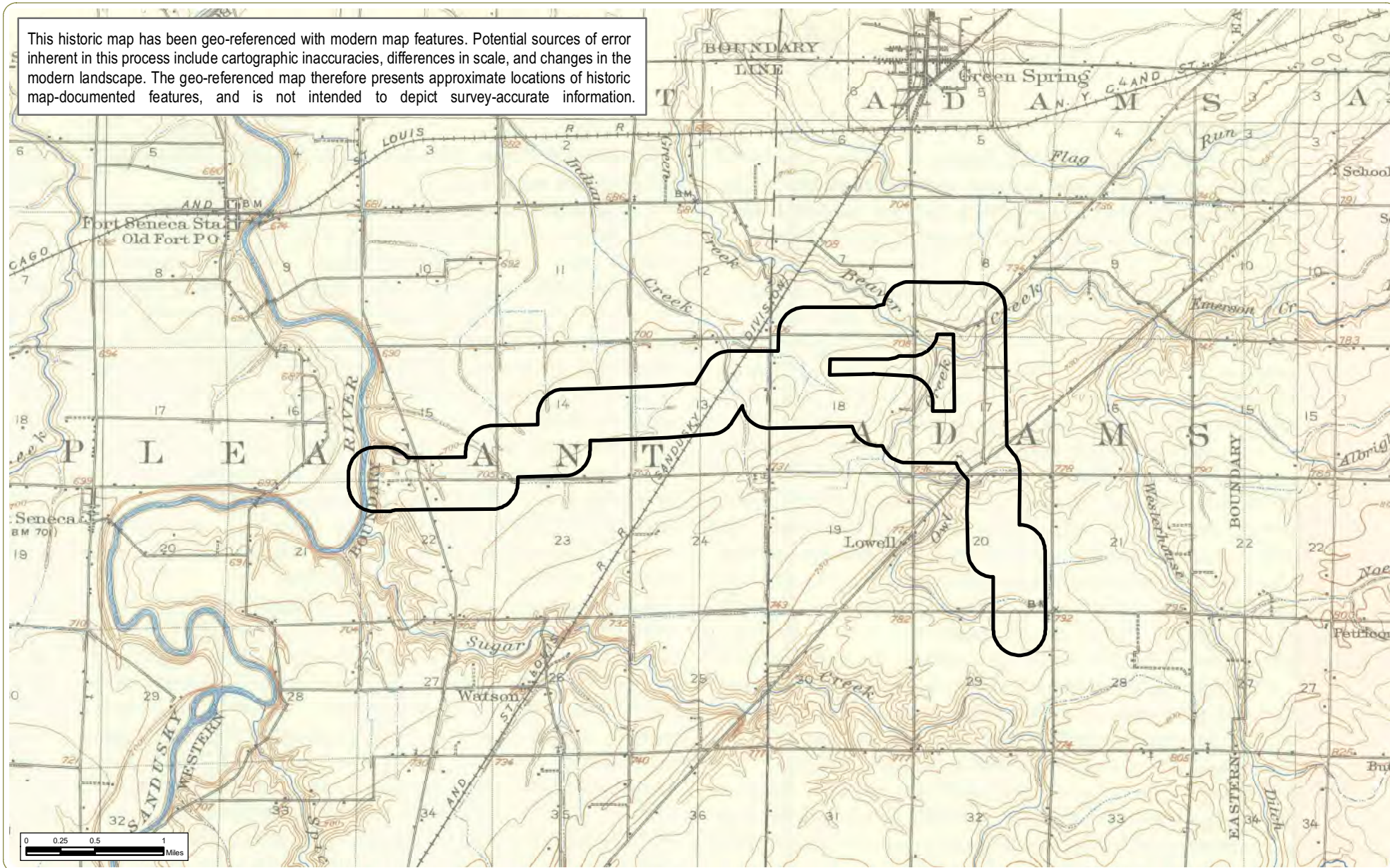
**Notes:** 1. Basemap: 1872 Gray and Walling *Topographical Atlas of Ohio* 2. This map was generated in ArcMap on June 19, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

1000-Foot Study Area



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This historic map has been geo-referenced with modern map features. Potential sources of error inherent in this process include cartographic inaccuracies, differences in scale, and changes in the modern landscape. The geo-referenced map therefore presents approximate locations of historic map-documented features, and is not intended to depict survey-accurate information.



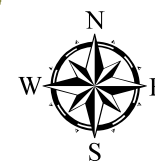
## Republic Transmission Line

Adams and Pleasant Townships, Seneca County, Ohio

**Figure 6: 1901 Elmore, OH, 1901 Fostoria, OH, 1903 Bellevue, OH, 1903 Fremont, OH, 1904 Sandusky, OH, 1906 Sycamore, OH, 1904 Tiffin, OH, 1915 Bucyrus, OH, 1915 Crestline, OH, 1915 Norwalk, OH, and 1915 Siam, OH, USGS 1:62500 Topographic Quadrangles**

**Notes:** 1. Basemap: 1901 Elmore, OH, 1901 Fostoria, OH, 1903 Bellevue, OH, 1903 Fremont, OH, 1904 Sandusky, OH, 1906 Sycamore, OH, 1904 Tiffin, OH, 1915 Bucyrus, OH, 1915 Crestline, OH, 1915 Norwalk, OH, and 1915 Siam, OH, USGS 1:62500 Topographic Quadrangles. 2. This map was generated in ArcMap on June 19, 2019. 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

1000-Foot Study Area



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**This foregoing document was electronically filed with the Public Utilities**

**Commission of Ohio Docketing Information System on**

**8/27/2019 2:50:56 PM**

**in**

**Case No(s). 19-1066-EL-BTX**

Summary: Application of Republic Wind, LLC to Build and Operate a 138 kV Electric Transmission Line - Part 2 electronically filed by Teresa Orahod on behalf of Dylan F. Borchers