

APPENDIX 10.9
EMF CALCULATIONS

0	ISSUED FOR PERMITTING			
NO	REVISIONS	DATE	DESIGNER	DM REVIEWER
ZACHRY ZACHRY ENGINEERING CORPORATION • 1515 ARAPAHOE ST., TOWER 1, SUITE 900; DENVER, CO 80202-4255 AHARILLO, TX CHARLOTTE, NC HOUSTON, TX MINNEAPOLIS, MN OMAHA, NE SAN ANTONIO, TX Zachry Engineering Corporation Confidential This calculation package contains confidential information that is proprietary to Zachry Engineering Corporation (ZEC) which shall not be used, disclosed, or reproduced in any manner by any non-ZEC party without ZEC's prior written permission.				
GAINESVILLE RENEWABLE ENERGY CENTER BIOMASS GENERATING FACILITY ELECTRIC AND MAGNETIC FIELD (EMF) CALCULATION PACKAGE				
DATE 11/17/09		DESIGNER E. NIELSEN	REVIEWER D. Gilchrist	DM REVIEWER D. Gilchrist
CALCULATION NUMBER C-A013756-EHAE001		PAGES 36	REV 0	

C-A013756-EHAE001 R0

Samuel May
11/18/09

ZACHRY	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

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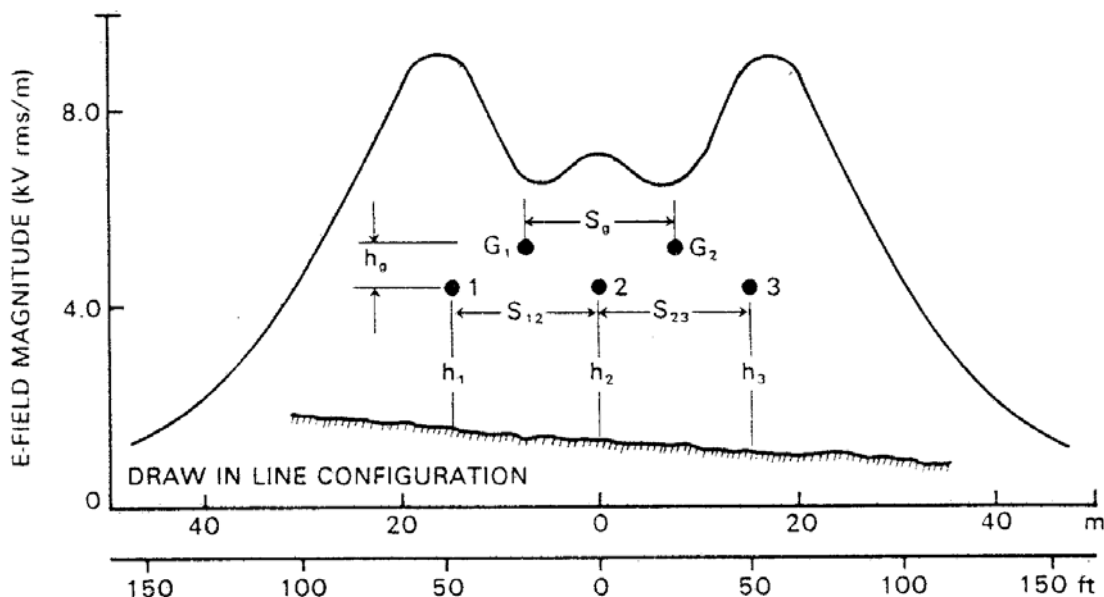
1.0 Purpose and Scope

- 1.1. This calculation is intended to demonstrate that the transmission lines associated with the proposed Gainesville Renewable Energy Center will meet the requirements set forth by the Florida Department of Environmental Protection (DEP) under provision 403.061(30), provision 403.523(14), F.S. and rule 62-814, F.A.C. for the Gainesville Renewable Energy Center (GREC). This calculation will also demonstrate that modifications to Gainesville Regional Utilities (GRU) existing transmission and distribution lines will also meet the requirements set forth by the Florida Department of Environmental Protection (DEP) under provision 403.061(30), provision 403.523(14), F.S. and rule 62-814, F.A.C.
- 1.2. The scope for this calculation includes calculating the electric and magnetic fields at lateral field cross sections that would represent the worst case scenarios of the transmission and distribution line additions and modifications. These cross sections are described as follows:
 - 1.2.1. Section 1: The GREC line at mid span (lowest conductor height) closest to the GREC property line (See Attachment A and page 2 of Attachment E).
 - 1.2.2. Section 2: GREC horizontal phasing as it enters the GRU switchyard (See Attachment A and page 6 of Attachment E).
 - 1.2.3. Section 3: GRU horizontal phasing as it exits the GRU switchyard (double contingency loading) (See Attachment A and page 5 of Attachment E).
 - 1.2.4. Section 4: GRU line 21 to Deerhaven (modeled with distribution line 539) (See Attachment A and page 4 of Attachment E).
 - 1.2.5. Section 5: GRU line 22 to Alachua (modeled with distribution line 539) (See Attachment A and page 3 of Attachment E).

2.0 Design Methodology

- 2.1. The EzEMF software package was used to calculate electric and magnetic fields within the right-of-ways. EzEMF is DEP approved software package used to calculate EMF fields based on the line layouts and operating characteristics using principles of classical physics. For the purpose of this calculation package, conservative line characteristics and data were entered. This is done by entering the lowest conductor heights (electric and magnetic fields decrease in proportion with the square of the distance), highest peak currents, and the narrowest right-of-ways (ROW). An example diagram of inputs is shown below.

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NOTE—The symbols (h_1 , S_{12} , etc.) represent conductor heights and spacings.

Example of lateral profile of vertical E -field strength at midspan (taken from IEEE 664-1994)

3.0 Design Inputs

- 3.1. The inputs used were energized conductor diameter, overhead ground wire diameter, line configuration, right of way distances, operating voltage, and maximum current.
 - 3.1.1. New transmission line as proposed for the GREC facility at mid span (lowest conductor height) closest to the GREC property line (Attachment A, Section 1).
 - 3.1.1.1. Conductor configurations as shown in Attachment B
 - 3.1.1.2. Energized conductor has a diameter of 1.11 inches.
 - 3.1.1.3. Static conductor has a diameter of 0.55 inches.
 - 3.1.1.4. Maximum current rating is 500 Amps.
 - 3.1.1.5. Operating voltage is 138 kV.
 - 3.1.2. Horizontal phasing of the new GREC transmission line as it enters the GRU switchyard as proposed (Attachment A, Section 2).
 - 3.1.2.1. Conductor configurations as shown in Attachment C
 - 3.1.2.2. Energized conductor has a diameter of 1.11 inches.
 - 3.1.2.3. Static conductor has a diameter of 0.55 inches.
 - 3.1.2.4. Maximum current rating is 500 Amps.
 - 3.1.2.5. Operating voltage is 138 kV.

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3.1.3. Horizontal phasing for the GRU modified transmission line exiting the GRU switchyard (double contingency loading) as determined with existing GRU provided data and new plant addition (Attachment A, Section 3).

3.1.3.1. Conductor configurations as shown in Attachment C.

3.1.3.2. Line 21

3.1.3.2.1. Energized conductor has a diameter of 1.34 inches

3.1.3.2.2. Static conductor has a diameter of 0.55 inches.

3.1.3.2.3. Maximum current rating is -954 Amps. Note this is negative, lines 21 and 22 are “flowing” in opposite directions.

3.1.3.2.4. Operating voltage is 138 kV.

3.1.3.3. Line 22

3.1.3.3.1. Energized conductor has a diameter of 1.34 inches.

3.1.3.3.2. Static conductor has a diameter of 0.55 inches.

3.1.3.3.3. Maximum current rating is 1385 Amps.

3.1.3.3.4. Operating voltage is 138 kV.

3.1.4. Vertical phasing for the modified GRU transmission line 21 to Deerhaven (modeled with distribution line 539) (Attachment A, Section 4) as determined with existing GRU provided data and new plant addition.

3.1.4.1. Conductor configurations as shown in Attachment D.

3.1.4.2. Line 21

3.1.4.2.1. Energized conductor has a diameter of 1.34 inches.

3.1.4.2.2. Static conductor has a diameter of 0.55 inches.

3.1.4.2.3. Maximum current rating is 954 Amps.

3.1.4.2.4. Operating voltage is 138 kV.

3.1.4.3. Line 539

3.1.4.3.1. Energized conductor has a diameter of 0.75 inches.

3.1.4.3.2. Static conductor has a diameter of 0.5 inches.

3.1.4.3.3. Maximum current rating is 200 Amps.

3.1.4.3.4. Operating voltage is 12 kV.

3.1.5. Existing transmission line information for GRU line 22 to Alachua (modeled with distribution line 539) (Attachment A, Section 5) as determined with existing GRU provided data and new plant addition.

3.1.5.1. Conductor configurations as shown in Attachment D.

3.1.5.2. Line 22

3.1.5.2.1. Energized conductor has a diameter of 1.34 inches.

3.1.5.2.2. Static conductor has a diameter of 0.55 inches.

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3.1.5.2.3. Maximum current rating is 1385 Amps.

3.1.5.2.4. Operating voltage is 138 kV.

3.1.5.3. Line 539

3.1.5.3.1. Energized conductor has a diameter of 0.75 inches.

3.1.5.3.2. Static conductor has a diameter of 0.5 inches.

3.1.5.3.3. Maximum current rating is 200 Amps.

3.1.5.3.4. Operating voltage is 12 kV.

3.2. Physical parameters and characteristics for transmission and distribution lines used for this calculation package were as provided by American Renewables.

4.0 Assumptions

4.1. Right of way distances are taken to be assumed distances. The switchyard and affected transmission lines lie within a much larger GRU owned property consisting of two parcels. There is no public access anywhere on either parcel. For section one, the property line is estimated to be 175 feet away, a distance of 70 feet to the edge of ROW was used in the calculation. Scenarios 2 and 3 have the switchyard dimensions, 140 feet, as the ROW. Scenarios 4 and 5 are part of an existing transmission corridor with a 25' right-of-way, or to the property boundary. It should be noted that the property boundary is adjacent to a railroad right of way. See Attachment A for transmission lateral cross section locations and property line definitions. Distances used and ROW width can also be determined from Attachment A.

5.0 References

- 5.1. Florida Department of Environmental Protection (DEP) Provision 403.061(30)
- 5.2. Florida Department of Environmental Protection (DEP) Provision 403.523(14)
- 5.3. Florida Department of Environmental Protection (DEP) Rule 62-814, F.A.C.
- 5.4. IEEE 664 – Frequency Electric and Magnetic Fields from AC Power Lines
- 5.5. EzEMF Version 1.19 – September, 2002

6.0 Calculations

6.1. Calculations performed with the EzEMF package show the electric and magnetic fields at cross sections perpendicular to the lateral profile. From these cross sections the maximum electric and magnetic fields can be found at distances within the right of way. These values are then compared to the allowable electric and magnetic fields provided by the Florida Department of Environmental Protection.

7.0 Summary of Results

7.1.1. See Appendix A for a complete table for each section.

8.0 Conclusions

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8.1. The results of these calculations indicate that the maximum EMF produced for the stated conditions are below the values.

Right-of-Way Configuration	Electric Field (kV/m)		Magnetic Field at MCR* on Edge of Right-of-Way (mG)
	On Right- of-Way	Edge of Right- of-Way	
The GREC line at mid span (lowest conductor height) closest to the GREC property line	1.75	1.57	57.3
GREC horizontal phasing as it enters the GRU switchyard.	0.71	0.46	17.79
GRU horizontal phasing as it exits the GRU switchyard (double contingency loading).	0.7	0.67	49.66
GRU line 21 to Deerhaven (modeled with distribution line 539)	0.42	0.42†	51.56†
GRU line 22 to Alachua (modeled with distribution line 539)	0.42	0.42†	71.85†
<i>Florida EMF Rule limit for new 230-kV and below lines‡</i>	<i>8</i>	<i>2</i>	<i>150</i>

Note: mG = milliGauss

*The field levels shown in this table for lines 21 and 22 are based on GRU-calculated loadings for the double-circuit contingency, which is a Category C5 situation. These loadings substantially exceed normal loadings on these lines. The field levels for the new GREC line are based on a current of 500-amperes, which is the maximum anticipated plant output.

†Corresponds to the edge of the right-of-way abutting the railroad right-of-way.

‡ These standards field levels are established in Rule 62-814.450(3), F.A.C.

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Appendix A

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Electric and Magnetic Field Effects

Gainsville Renewable Energy Center, LLC

Units: **English** Physical System: **4** Conductors (**3** Energized Phases)
 E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 1- The GREC line at mid span (lowest conductor height) close**

Circuit Name	Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
					# of	Diameter (in)	Spacing (in)			
GREC	1A1	6.00	6.00	40.00	1	1.11	0.00	145.0	0	500
GREC	1B1	6.00	6.00	32.00	1	1.11	0.00	145.0	120	500
GREC	1C1	6.00	6.00	24.00	1	1.11	0.00	145.0	240	500
GREC	1G1	0.70	0.70	49.30	1	0.55	0.00	0.0	0	0

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
0.00	1.57	57.30	28.00	0.50	35.31	62.00	0.07	11.37
70.00	0.08	9.16	29.00	0.45	34.05	63.00	0.08	11.06
-4.00	1.31	52.44	30.00	0.40	32.82	64.00	0.08	10.76
-3.00	1.38	53.78	31.00	0.36	31.64	65.00	0.08	10.46
-2.00	1.45	55.05	32.00	0.32	30.50	66.00	0.08	10.18
-1.00	1.51	56.23	33.00	0.29	29.41	67.00	0.08	9.91
0.00	1.57	57.30	34.00	0.25	28.35	68.00	0.08	9.65
1.00	1.62	58.23	35.00	0.22	27.34	69.00	0.08	9.40
2.00	1.67	59.03	36.00	0.20	26.37	70.00	0.08	9.16
3.00	1.71	59.66	37.00	0.17	25.43	71.00	0.08	8.93
4.00	1.73	60.13	38.00	0.15	24.54	72.00	0.08	8.70
5.00	1.75	60.41	39.00	0.13	23.68	73.00	0.08	8.48
6.00	1.75	60.50	40.00	0.11	22.86	74.00	0.08	8.28
7.00	1.75	60.41	41.00	0.09	22.07			
8.00	1.73	60.13	42.00	0.08	21.32			
9.00	1.70	59.66	43.00	0.06	20.60			
10.00	1.66	59.03	44.00	0.05	19.91			
11.00	1.62	58.23	45.00	0.04	19.24			
12.00	1.56	57.30	46.00	0.03	18.61			
13.00	1.50	56.23	47.00	0.03	18.00			
14.00	1.44	55.05	48.00	0.03	17.42			
15.00	1.37	53.78	49.00	0.04	16.86			
16.00	1.29	52.44	50.00	0.04	16.33			
17.00	1.22	51.04	51.00	0.04	15.81			
18.00	1.14	49.59	52.00	0.05	15.32			
19.00	1.07	48.12	53.00	0.05	14.85			
20.00	1.00	46.64	54.00	0.06	14.40			
21.00	0.92	45.15	55.00	0.06	13.96			
22.00	0.85	43.67	56.00	0.06	13.55			
23.00	0.79	42.21	57.00	0.06	13.15			
24.00	0.72	40.76	58.00	0.07	12.76			
25.00	0.66	39.35	59.00	0.07	12.39			
26.00	0.60	37.97	60.00	0.07	12.04			
27.00	0.55	36.62	61.00	0.07	11.70			

Electric and Magnetic Field Effects

Gainsville Renewable Energy Center, LLC

Units: **English** Physical System: **4** Conductors (**3** Energized Phases)
 E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 2- GREC horizontal phasing as it enters the GRU switchyard.**

Circuit Name	Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
					# of	Diameter (in)	Spacing (in)			
GREC	1A1	62.00	12.00	40.50	1	1.11	0.00	145.0	0	500
GREC	1B1	50.00	0.00	40.50	1	1.11	0.00	145.0	120	500
GREC	1C1	38.00	-12.00	40.50	1	1.11	0.00	145.0	240	500
GREC	1G1	50.00	0.00	50.50	1	0.55	0.00	0.0	0	0

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
0.00	0.46	17.79	28.00	0.70	35.21	62.00	0.52	41.42	96.00	0.51	19.70
140.00	0.15	7.28	29.00	0.69	35.91	63.00	0.54	40.91	97.00	0.50	19.21
-4.00	0.41	16.09	30.00	0.68	36.59	64.00	0.57	40.36	98.00	0.49	18.72
-3.00	0.42	16.50	31.00	0.67	37.27	65.00	0.59	39.79	99.00	0.47	18.25
-2.00	0.44	16.92	32.00	0.65	37.93	66.00	0.62	39.19	100.00	0.46	17.79
-1.00	0.45	17.35	33.00	0.64	38.57	67.00	0.64	38.57	101.00	0.45	17.35
0.00	0.46	17.79	34.00	0.62	39.19	68.00	0.65	37.93	102.00	0.44	16.92
1.00	0.47	18.25	35.00	0.59	39.79	69.00	0.67	37.27	103.00	0.42	16.50
2.00	0.49	18.72	36.00	0.57	40.36	70.00	0.68	36.59	104.00	0.41	16.09
3.00	0.50	19.21	37.00	0.54	40.91	71.00	0.69	35.91	105.00	0.40	15.70
4.00	0.51	19.70	38.00	0.52	41.42	72.00	0.70	35.21	106.00	0.39	15.32
5.00	0.52	20.22	39.00	0.49	41.90	73.00	0.70	34.50	107.00	0.38	14.94
6.00	0.54	20.74	40.00	0.45	42.35	74.00	0.71	33.79	108.00	0.37	14.58
7.00	0.55	21.28	41.00	0.42	42.76	75.00	0.71	33.07	109.00	0.36	14.23
8.00	0.56	21.84	42.00	0.38	43.13	76.00	0.71	32.35	110.00	0.35	13.90
9.00	0.58	22.41	43.00	0.35	43.47	77.00	0.71	31.64	111.00	0.34	13.57
10.00	0.59	22.99	44.00	0.31	43.76	78.00	0.70	30.92	112.00	0.33	13.25
11.00	0.60	23.58	45.00	0.28	44.01	79.00	0.70	30.21	113.00	0.32	12.94
12.00	0.61	24.19	46.00	0.24	44.21	80.00	0.69	29.51	114.00	0.31	12.64
13.00	0.63	24.82	47.00	0.21	44.37	81.00	0.69	28.81	115.00	0.30	12.35
14.00	0.64	25.45	48.00	0.18	44.49	82.00	0.68	28.12	116.00	0.29	12.07
15.00	0.65	26.10	49.00	0.16	44.55	83.00	0.67	27.43	117.00	0.29	11.79
16.00	0.66	26.76	50.00	0.15	44.58	84.00	0.66	26.76	118.00	0.28	11.53
17.00	0.67	27.43	51.00	0.16	44.55	85.00	0.65	26.10	119.00	0.27	11.27
18.00	0.68	28.12	52.00	0.18	44.49	86.00	0.64	25.45	120.00	0.26	11.02
19.00	0.69	28.81	53.00	0.21	44.37	87.00	0.63	24.82	121.00	0.26	10.78
20.00	0.69	29.51	54.00	0.24	44.21	88.00	0.61	24.19	122.00	0.25	10.54
21.00	0.70	30.21	55.00	0.28	44.01	89.00	0.60	23.58	123.00	0.24	10.31
22.00	0.70	30.92	56.00	0.31	43.76	90.00	0.59	22.99	124.00	0.23	10.09
23.00	0.71	31.64	57.00	0.35	43.47	91.00	0.58	22.41	125.00	0.23	9.87
24.00	0.71	32.35	58.00	0.38	43.13	92.00	0.56	21.84	126.00	0.22	9.66
25.00	0.71	33.07	59.00	0.42	42.76	93.00	0.55	21.28	127.00	0.22	9.46
26.00	0.71	33.79	60.00	0.45	42.35	94.00	0.54	20.74	128.00	0.21	9.26
27.00	0.70	34.50	61.00	0.49	41.90	95.00	0.52	20.22	129.00	0.20	9.07

Electric and Magnetic Field Effects

Gainesville Renewable Energy Center, LLC

Units: **English** Physical System: **4** Conductors (**3** Energized Phases)
E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 2- GREC horizontal phasing as it enters the GRU switchyard.**

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
130.00	0.20	8.88
131.00	0.19	8.70
132.00	0.19	8.53
133.00	0.18	8.36
134.00	0.18	8.19
135.00	0.17	8.03
136.00	0.17	7.87
137.00	0.17	7.72
138.00	0.16	7.57
139.00	0.16	7.42
140.00	0.15	7.28
141.00	0.15	7.14
142.00	0.15	7.01
143.00	0.14	6.88
144.00	0.14	6.75

Electric and Magnetic Field Effects

Gainsville Renewable Energy Center, LLC

Units: **English** Physical System: **8** Conductors (**6** Energized Phases)
E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 3- GRU horizontal phasing as it exits the GRU switchyard**

Circuit Name	Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
					# of	Diameter (in)	Spacing (in)			
LINE 22	1A1	62.00	12.00	40.50	1	1.34	0.00	145.0	0	1385
LINE 22	1B1	50.00	0.00	40.50	1	1.34	0.00	145.0	120	1385
LINE 22	1C1	38.00	-12.00	40.50	1	1.34	0.00	145.0	240	1385
LINE 22	1G1	30.00	-20.00	50.50	1	0.55	0.00	0.0	0	0
LINE 21	2A1	122.00	12.00	40.50	1	1.34	0.00	145.0	0	-954
LINE 21	2B1	110.00	0.00	40.50	1	1.34	0.00	145.0	120	-954
LINE 21	2C1	98.00	-12.00	40.50	1	1.34	0.00	145.0	240	-954
LINE 21	2G1	130.00	20.00	50.50	1	0.55	0.00	0.0	0	0

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
0.00	0.42	42.03	24.00	0.70	84.85	54.00	0.11	140.15	84.00	0.23	130.07
140.00	0.67	49.66	25.00	0.70	87.16	55.00	0.10	140.73	85.00	0.23	129.48
-4.00	0.37	37.44	26.00	0.70	89.49	56.00	0.10	141.20	86.00	0.23	128.90
-3.00	0.39	38.53	27.00	0.70	91.84	57.00	0.11	141.57	87.00	0.24	128.33
-2.00	0.40	39.66	28.00	0.70	94.21	58.00	0.12	141.84	88.00	0.24	127.75
-1.00	0.41	40.82	29.00	0.70	96.58	59.00	0.14	142.02	89.00	0.24	127.17
0.00	0.42	42.03	30.00	0.69	98.95	60.00	0.15	142.10	90.00	0.24	126.59
1.00	0.43	43.28	31.00	0.69	101.32	61.00	0.17	142.09	91.00	0.24	125.99
2.00	0.45	44.57	32.00	0.68	103.67	62.00	0.18	141.99	92.00	0.24	125.38
3.00	0.46	45.91	33.00	0.66	106.00	63.00	0.20	141.82	93.00	0.23	124.75
4.00	0.47	47.29	34.00	0.65	108.31	64.00	0.21	141.57	94.00	0.23	124.09
5.00	0.48	48.71	35.00	0.63	110.59	65.00	0.22	141.25	95.00	0.22	123.40
6.00	0.50	50.19	36.00	0.62	112.83	66.00	0.23	140.88	96.00	0.21	122.68
7.00	0.51	51.70	37.00	0.60	115.02	67.00	0.23	140.44	97.00	0.20	121.92
8.00	0.53	53.27	38.00	0.57	117.17	68.00	0.24	139.96	98.00	0.18	121.12
9.00	0.54	54.89	39.00	0.55	119.25	69.00	0.24	139.43	99.00	0.17	120.27
10.00	0.55	56.55	40.00	0.52	121.27	70.00	0.24	138.87	100.00	0.15	119.37
11.00	0.57	58.27	41.00	0.50	123.21	71.00	0.24	138.28	101.00	0.14	118.42
12.00	0.58	60.03	42.00	0.47	125.09	72.00	0.24	137.67	102.00	0.12	117.41
13.00	0.59	61.85	43.00	0.44	126.87	73.00	0.24	137.03	103.00	0.11	116.35
14.00	0.60	63.71	44.00	0.41	128.58	74.00	0.23	136.39	104.00	0.10	115.22
15.00	0.62	65.63	45.00	0.37	130.19	75.00	0.23	135.74	105.00	0.10	114.04
16.00	0.63	67.59	46.00	0.34	131.71	76.00	0.23	135.08	106.00	0.11	112.79
17.00	0.64	69.60	47.00	0.31	133.13	77.00	0.22	134.43	107.00	0.13	111.48
18.00	0.65	71.66	48.00	0.28	134.45	78.00	0.22	133.78	108.00	0.15	110.11
19.00	0.66	73.76	49.00	0.24	135.67	79.00	0.22	133.13	109.00	0.18	108.67
20.00	0.67	75.90	50.00	0.21	136.78	80.00	0.22	132.50	110.00	0.21	107.17
21.00	0.68	78.08	51.00	0.18	137.78	81.00	0.22	131.88	111.00	0.24	105.62
22.00	0.69	80.31	52.00	0.15	138.68	82.00	0.22	131.26	112.00	0.28	104.00
23.00	0.69	82.56	53.00	0.13	139.47	83.00	0.22	130.66	113.00	0.31	102.33

Electric and Magnetic Field Effects

Gainesville Renewable Energy Center, LLC

Units: **English** Physical System: **8** Conductors (**6** Energized Phases)
E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 3- GRU horizontal phasing as it exits the GRU switchyard**

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
114.00	0.34	100.60
115.00	0.37	98.82
116.00	0.41	97.00
117.00	0.44	95.13
118.00	0.47	93.21
119.00	0.50	91.26
120.00	0.52	89.28
121.00	0.55	87.27
122.00	0.57	85.23
123.00	0.60	83.17
124.00	0.62	81.10
125.00	0.63	79.02
126.00	0.65	76.94
127.00	0.66	74.86
128.00	0.68	72.78
129.00	0.69	70.71
130.00	0.69	68.65
131.00	0.70	66.61
132.00	0.70	64.60
133.00	0.70	62.61
134.00	0.70	60.65
135.00	0.70	58.72
136.00	0.70	56.83
137.00	0.69	54.97
138.00	0.69	53.16
139.00	0.68	51.39
140.00	0.67	49.66
141.00	0.66	47.97
142.00	0.65	46.33
143.00	0.64	44.73
144.00	0.63	43.19

Electric and Magnetic Field Effects

Gainsville Renewable Energy Center, LLC

Units: **English** Physical System: **8** Conductors (**6** Energized Phases)
 E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 4- GRU line 21 to Deerhaven (modeled with distribution line 539)**

Circuit Name	Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
					# of	Diameter (in)	Spacing (in)			
LINE 21	1A1	0.50	-6.00	56.00	1	1.34	0.00	145.0	0	954
LINE 21	1B1	0.50	-6.00	48.00	1	1.34	0.00	145.0	120	954
LINE 21	1C1	0.50	-6.00	40.00	1	1.34	0.00	145.0	240	954
LINE 21	1G1	5.80	-0.70	65.50	1	0.55	0.00	0.0	0	0
CKT 539	2A1	8.50	2.00	31.50	1	0.75	0.00	13.0	0	200
CKT 539	2B1	8.50	2.00	29.00	1	0.75	0.00	13.0	120	200
CKT 539	2C1	8.50	2.00	26.50	1	0.75	0.00	13.0	240	200
CKT 539	2G1	7.50	1.00	21.00	1	0.50	0.00	0.0	0	0

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
0.00	0.42	51.56	24.00	0.13	40.87
25.00	0.12	39.96	25.00	0.12	39.96
-4.00	0.44	50.05	26.00	0.11	39.06
-3.00	0.44	50.50	27.00	0.10	38.16
-2.00	0.43	50.90	28.00	0.10	37.27
-1.00	0.43	51.26	29.00	0.09	36.39
0.00	0.42	51.56			
1.00	0.41	51.82			
2.00	0.40	52.01			
3.00	0.39	52.15			
4.00	0.38	52.22			
5.00	0.37	52.22			
6.00	0.36	52.16			
7.00	0.34	52.02			
8.00	0.33	51.81			
9.00	0.32	51.53			
10.00	0.30	51.18			
11.00	0.29	50.75			
12.00	0.28	50.26			
13.00	0.26	49.70			
14.00	0.25	49.09			
15.00	0.24	48.42			
16.00	0.22	47.70			
17.00	0.21	46.93			
18.00	0.20	46.13			
19.00	0.19	45.30			
20.00	0.18	44.44			
21.00	0.17	43.57			
22.00	0.15	42.67			
23.00	0.14	41.77			

Electric and Magnetic Field Effects

Gainsville Renewable Energy Center, LLC

Units: **English** Physical System: **8** Conductors (**6** Energized Phases)
 E-Field Transducer Height **3.28** ft B-Field Transducer Height **3.28** ft

CrossSection: **SECTION 5- GRU line 22 to Alachua (modeled with distribution line 539)**

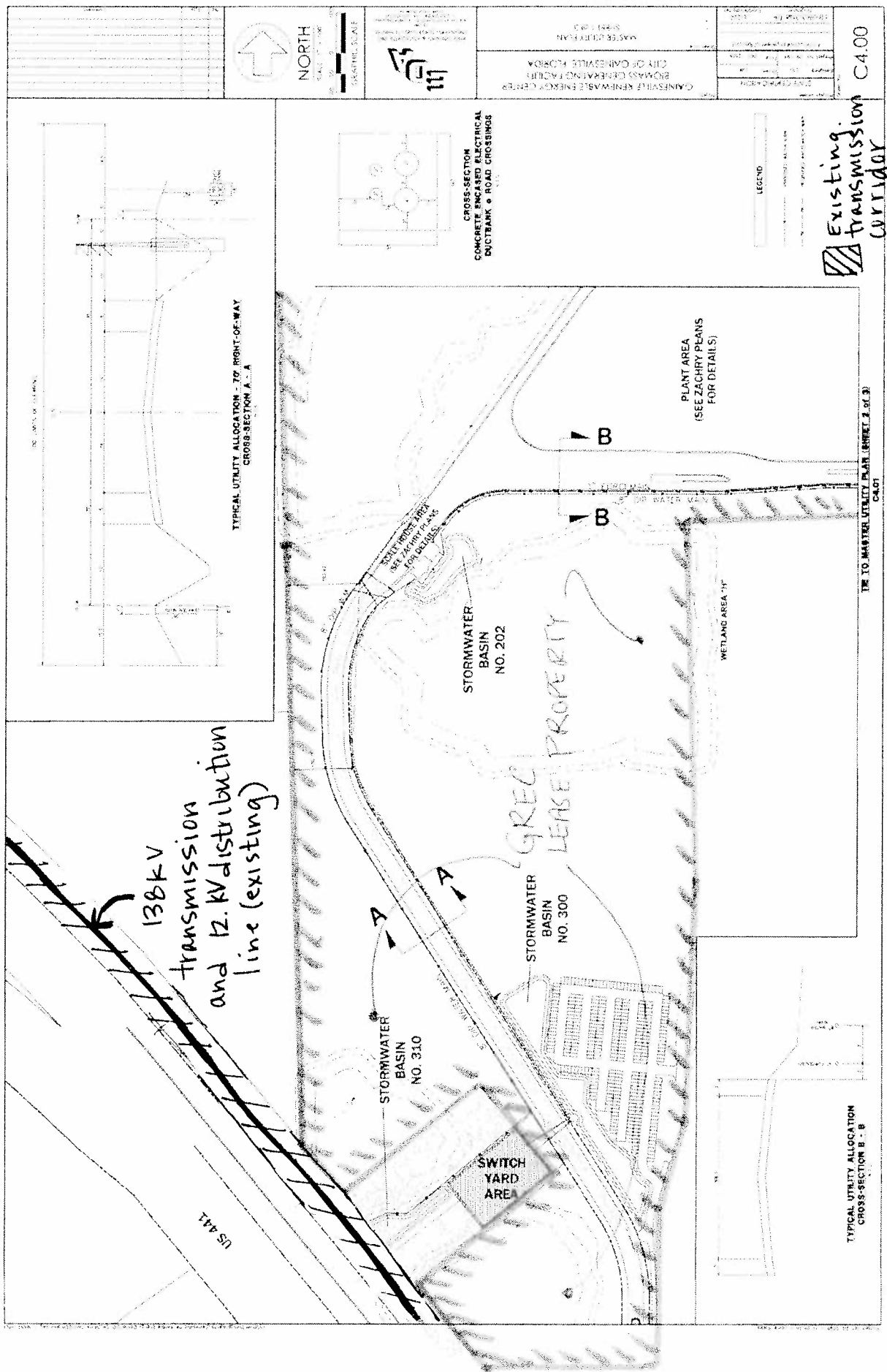
Circuit Name	Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
					# of	Diameter (in)	Spacing (in)			
LINE 22	1A1	0.50	-6.00	56.00	1	1.34	0.00	145.0	0	1385
LINE 22	1B1	0.50	-6.00	48.00	1	1.34	0.00	145.0	120	1385
LINE 22	1C1	0.50	-6.00	40.00	1	1.34	0.00	145.0	240	1385
LINE 22	1G1	5.80	-0.70	65.50	1	0.55	0.00	0.0	0	0
CKT 539	2A1	8.50	2.00	31.50	1	0.75	0.00	13.0	0	200
CKT 539	2B1	8.50	2.00	29.00	1	0.75	0.00	13.0	120	200
CKT 539	2C1	8.50	2.00	26.50	1	0.75	0.00	13.0	240	200
CKT 539	2G1	7.50	1.00	21.00	1	0.50	0.00	0.0	0	0

Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)	Dist From RowLeft (ft)	Electric Field (kV/m)	Magnetic Field (mG)
0.00	0.42	71.85	24.00	0.13	56.49
25.00	0.12	55.27	25.00	0.12	55.27
-4.00	0.44	70.11	26.00	0.11	54.06
-3.00	0.44	70.65	27.00	0.10	52.86
-2.00	0.43	71.12	28.00	0.10	51.67
-1.00	0.43	71.52	29.00	0.09	50.48
0.00	0.42	71.85			
1.00	0.41	72.10			
2.00	0.40	72.28			
3.00	0.39	72.37			
4.00	0.38	72.38			
5.00	0.37	72.30			
6.00	0.36	72.13			
7.00	0.34	71.87			
8.00	0.33	71.51			
9.00	0.32	71.07			
10.00	0.30	70.53			
11.00	0.29	69.91			
12.00	0.28	69.21			
13.00	0.26	68.42			
14.00	0.25	67.56			
15.00	0.24	66.64			
16.00	0.22	65.66			
17.00	0.21	64.62			
18.00	0.20	63.54			
19.00	0.19	62.42			
20.00	0.18	61.27			
21.00	0.17	60.09			
22.00	0.15	58.90			
23.00	0.14	57.70			

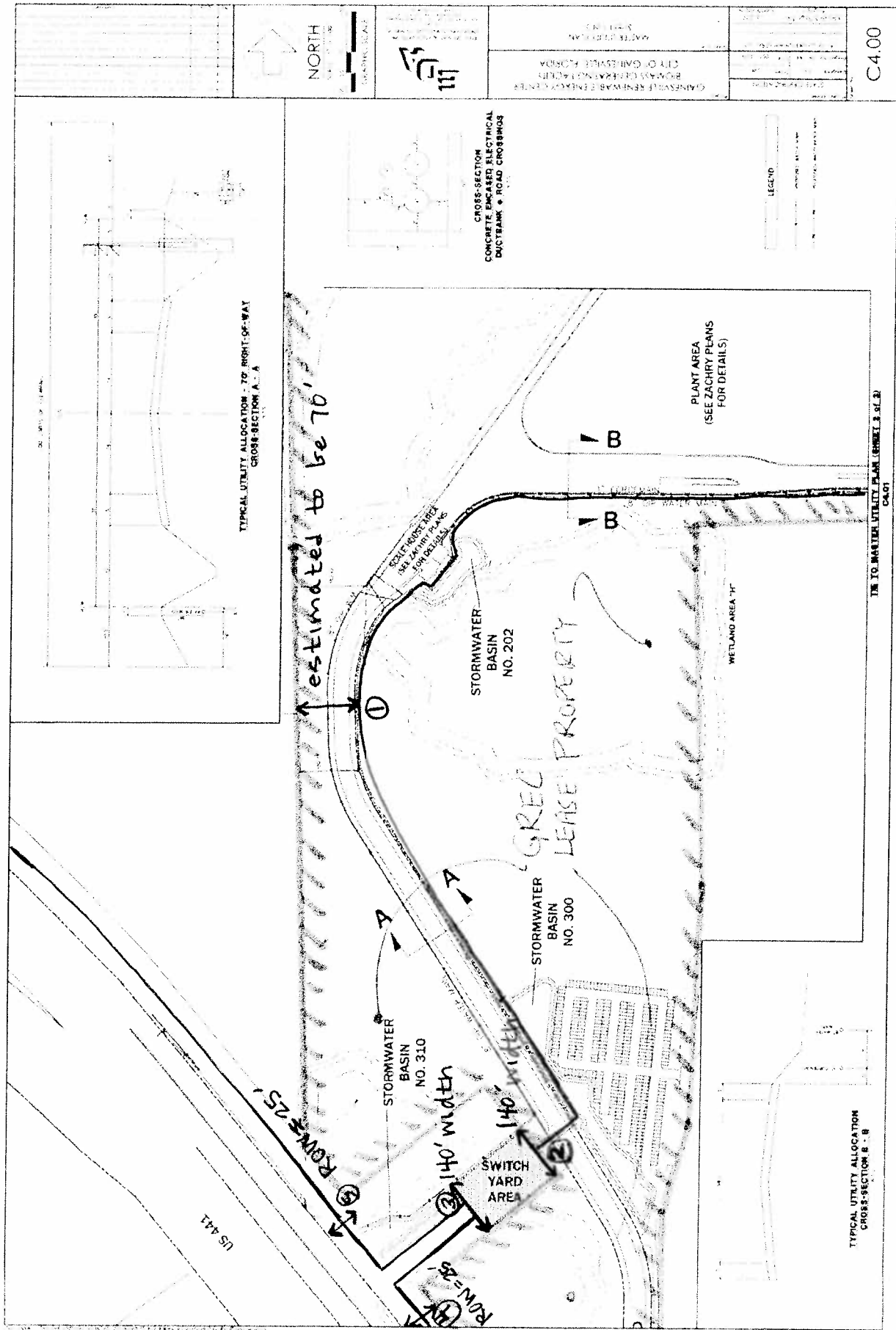
	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

Attachment A

GRU EXISTING TRANSMISSION / DISTRIBUTION LINE



GRV LINE MODIFICATION, NEW SWITCHYARD, & GREC
TRANSMISSION LINE



Sections 1-5 correspond to areas described in report

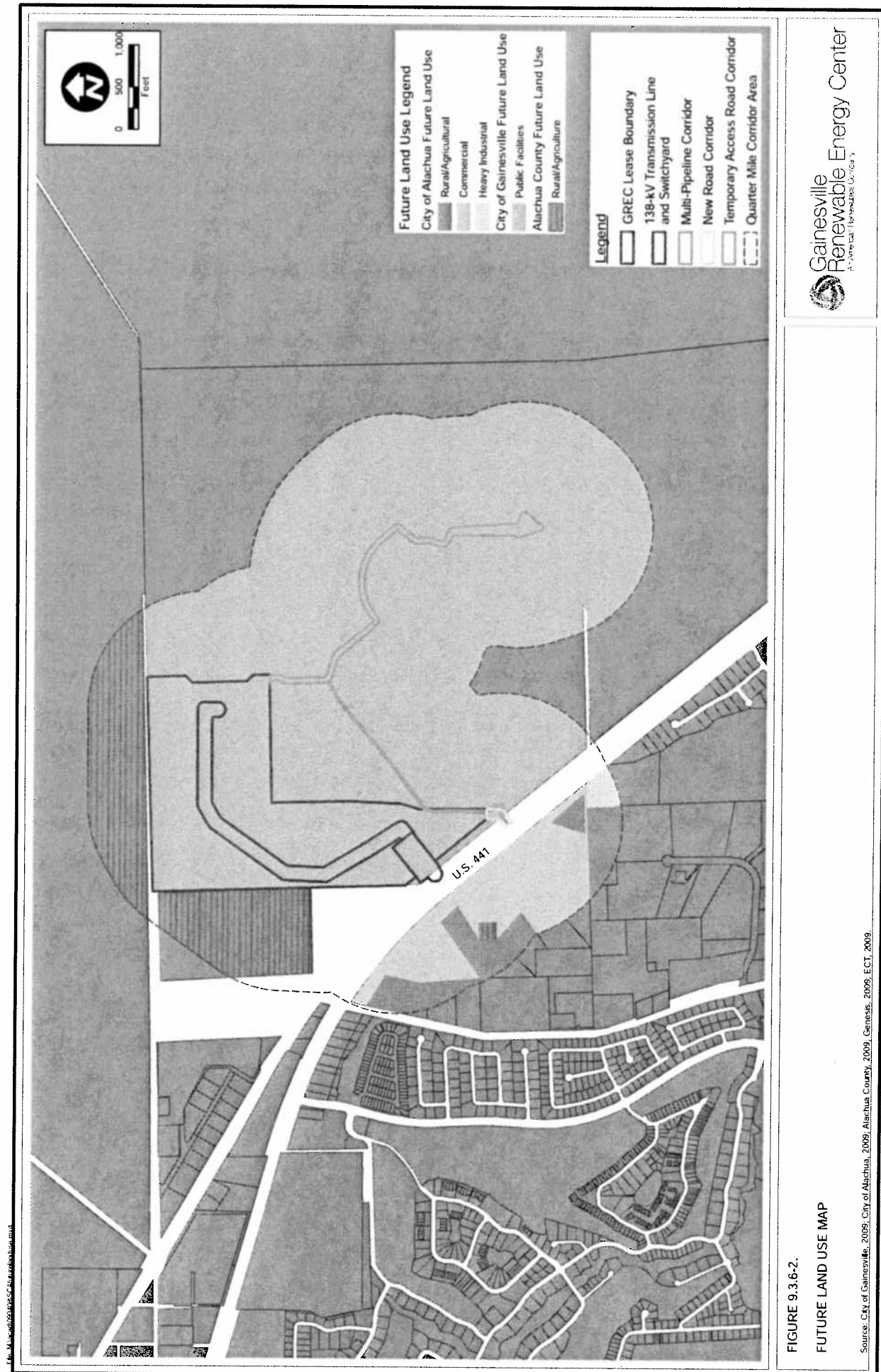


FIGURE 9.3.6-2.

FUTURE LAND USE MAP

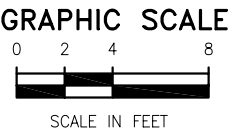
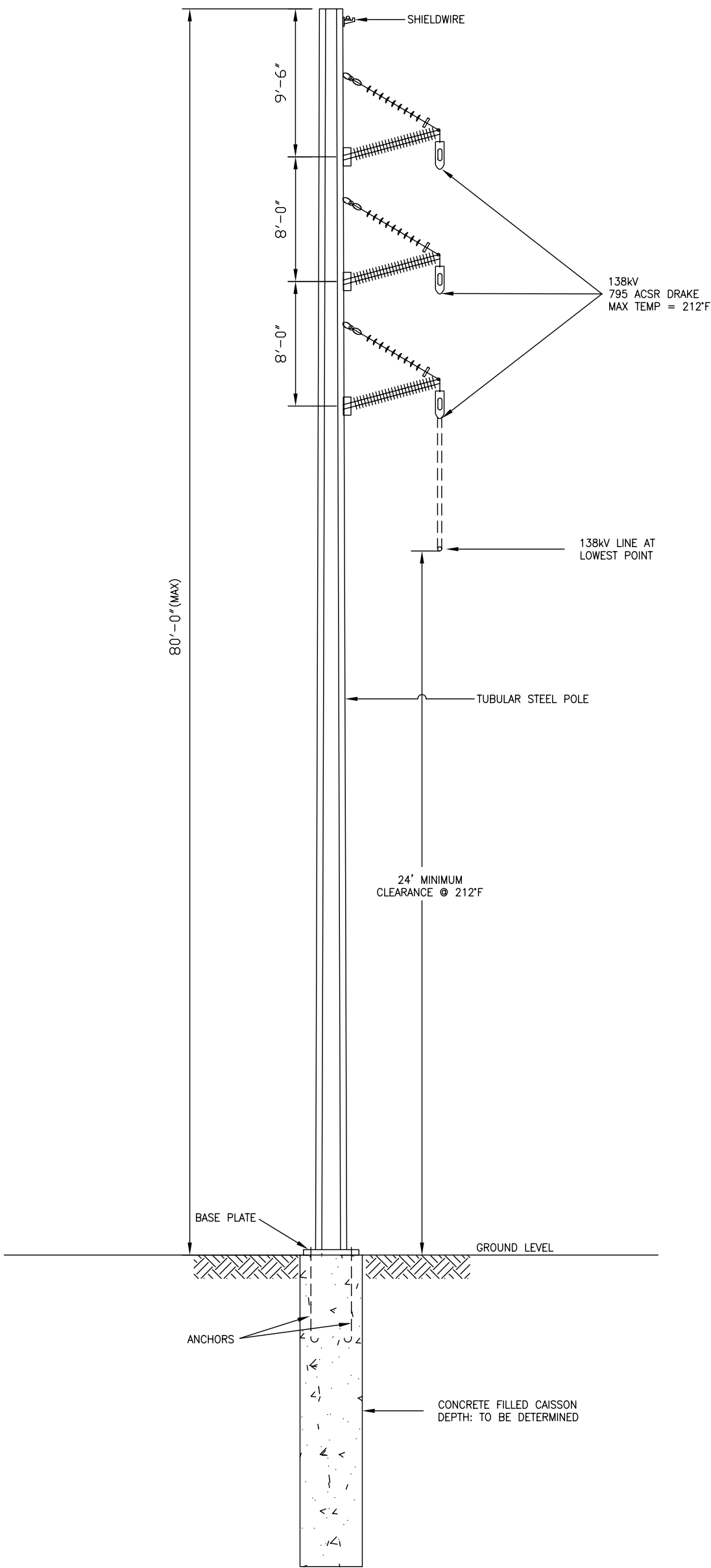
Source: City of Gainesville, 2009; City of Alachua, 2009; Alachua County, 2009; Genesis, 2009; ECT, 2009.

ZACHRY	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

Attachment B

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GREC 138 kV STRUCTURE

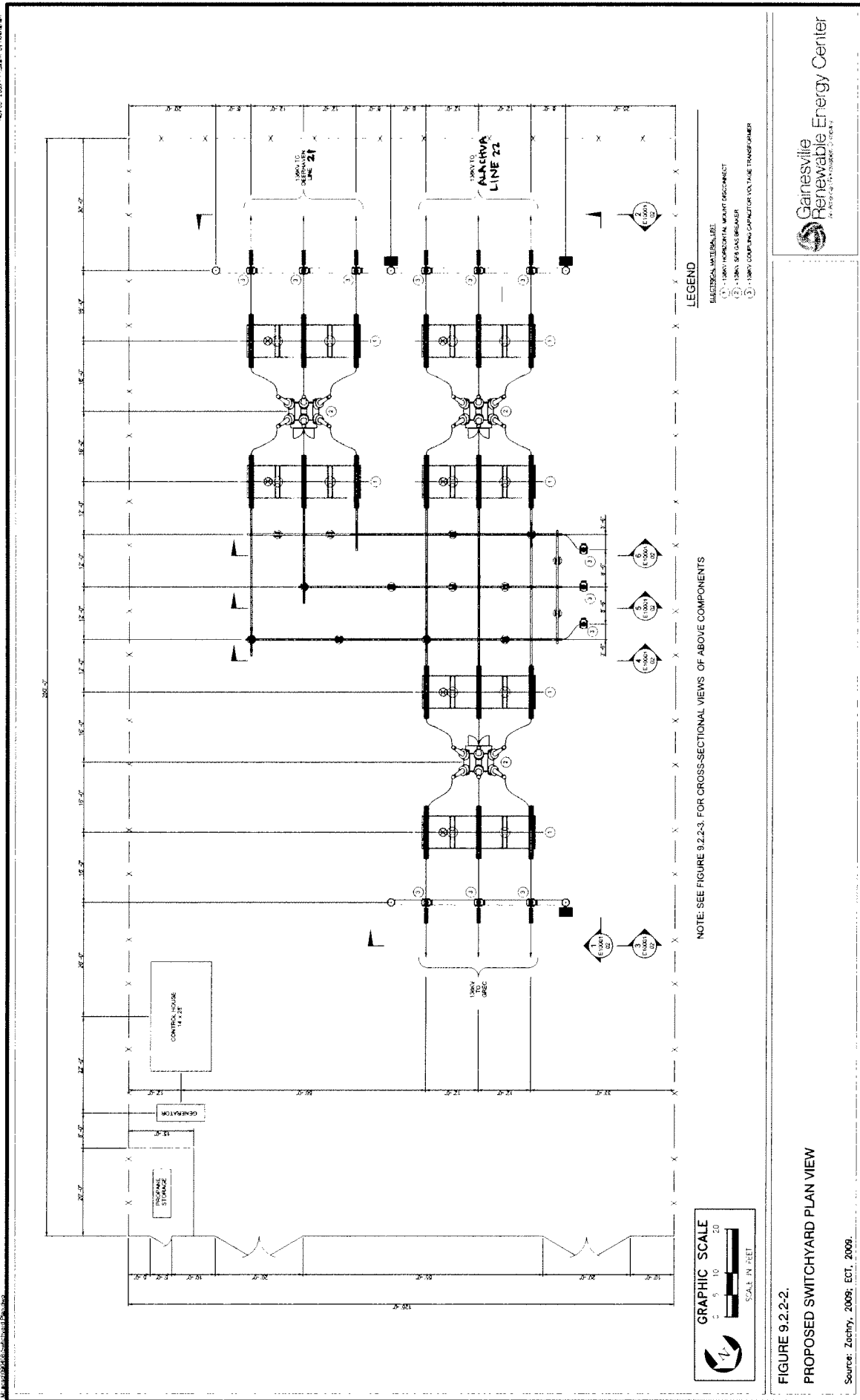


ZACHRY	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

Attachment C

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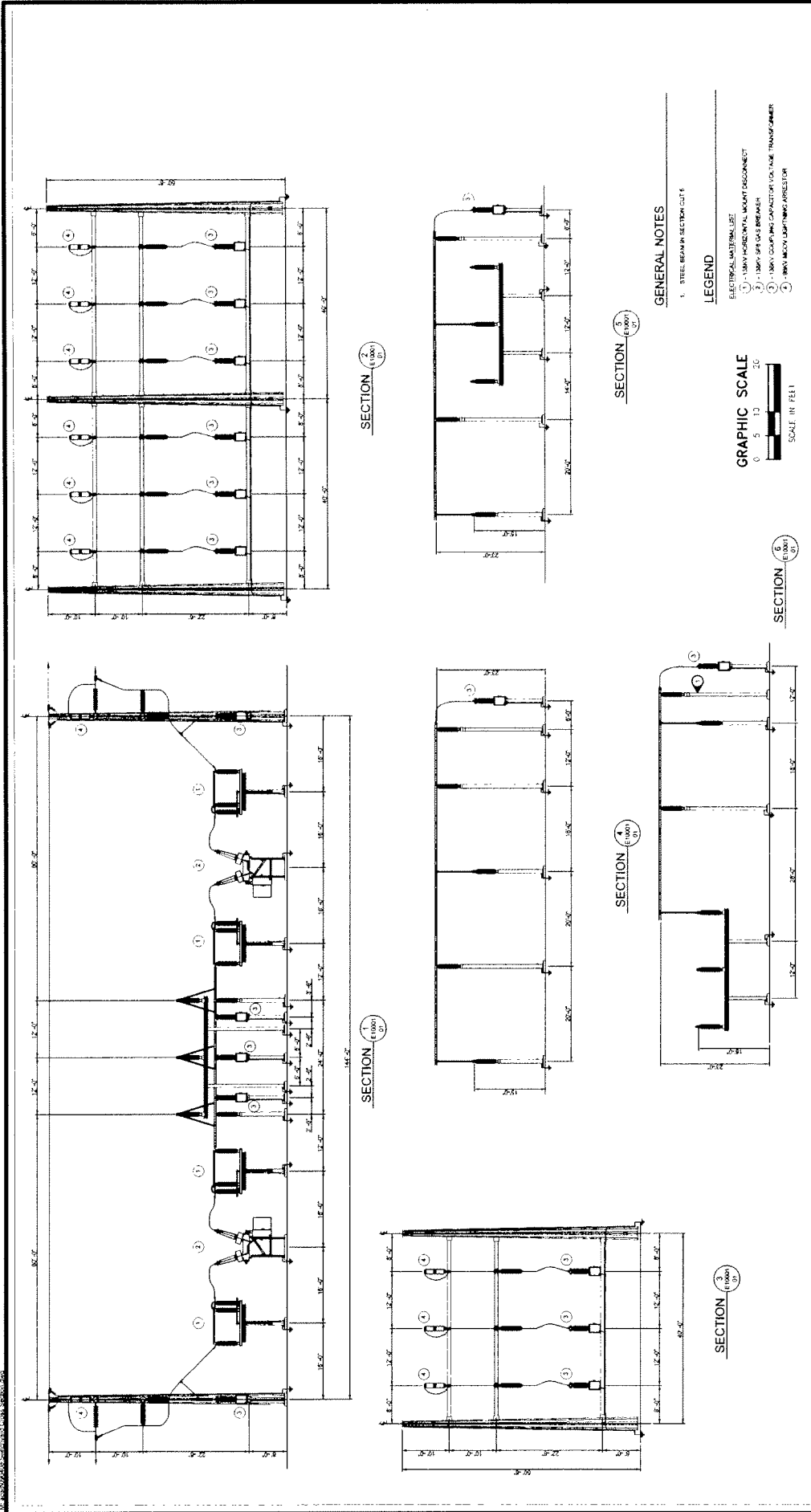
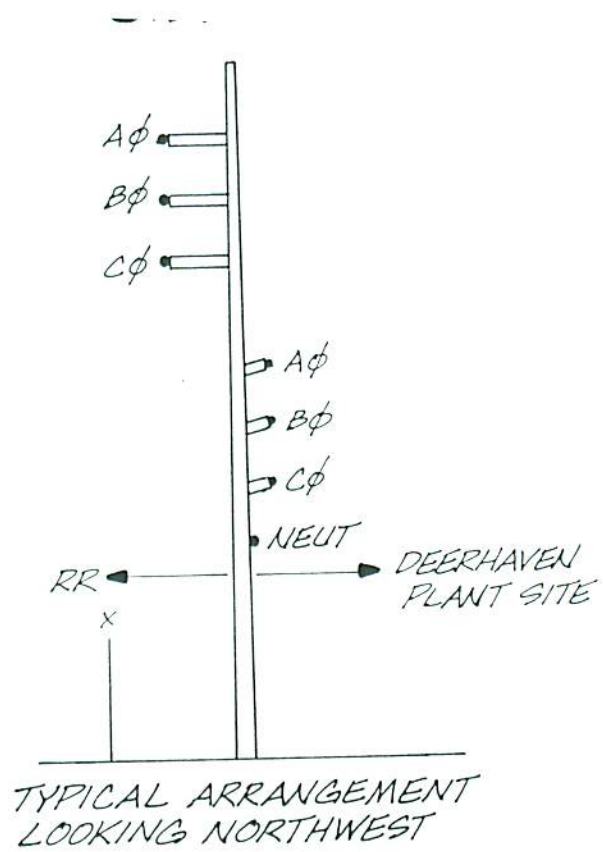


FIGURE 9.2.2-3.
PROPOSED SWITCHYARD CROSS-SECTIONAL VIEWS
Source: Zachry, 2009; ECT, 2009.

	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

Attachment D



COMPRESSION CONNECT
GROUND WIRE TO
REINFORCING STRAND

#2 S D STRANDED CU.
2'-0" LEAD (TYP.)
COMPRESSION
CONNECTED
TO EMBEDDED
GROUND WIRE

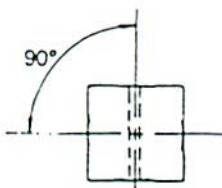
EMBEDDED
#2 STRANDED
S.D. COPPER

NAMEPLATE

10' COIL

X-1.5 FT

X+4 FT



CROSS SECTION
SECTION A

NOTES:

- 1 A = 13/16" BOLT HOLE
B = 11/16" BOLT HOLE
C = 17/16" BOLT HOLE
- 2 ALL HOLES SHALL BE PARALLEL
TO EACH OTHER, CENTERED ON
THE POLE FACE, AND PERPEN-
DICULAR TO THE POLE LONGITUD-
INAL CENTER LINE.

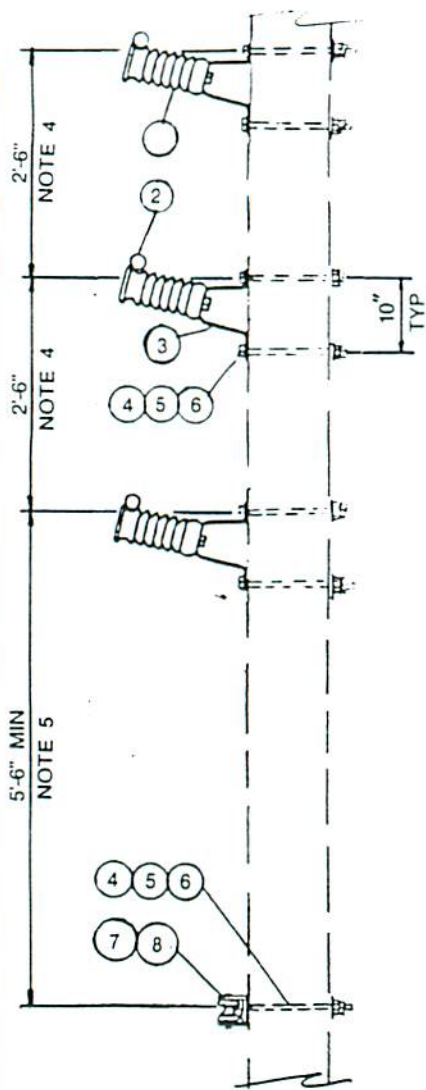
POLE LENGTH	60	65	70	75	80	85	90	95	100	105	110	115
X	11.5	12	12.5	13	13	13.5	14	14	14.5	15	15	15.5

GAINESVILLE
REGIONAL UTILITIES

CONCRETE POLE
FRAMING GUIDE

TYPE 2TD1





NOTES

1. SEE TM9 FOR GROUNDING
2. REFER TO LIST OF OWNER FURNISHED MATERIAL
3. FOR 394.5 AAAC "CANTON" 3/0 AAAC "AMHERST" NEUT.
4. DIMENSION IS 6'-0" ON POLES 17/3 AND 17/4
5. DIMENSION IS 4'-0" ON POLES 17/3 AND 17/4

LIST OF MATERIAL

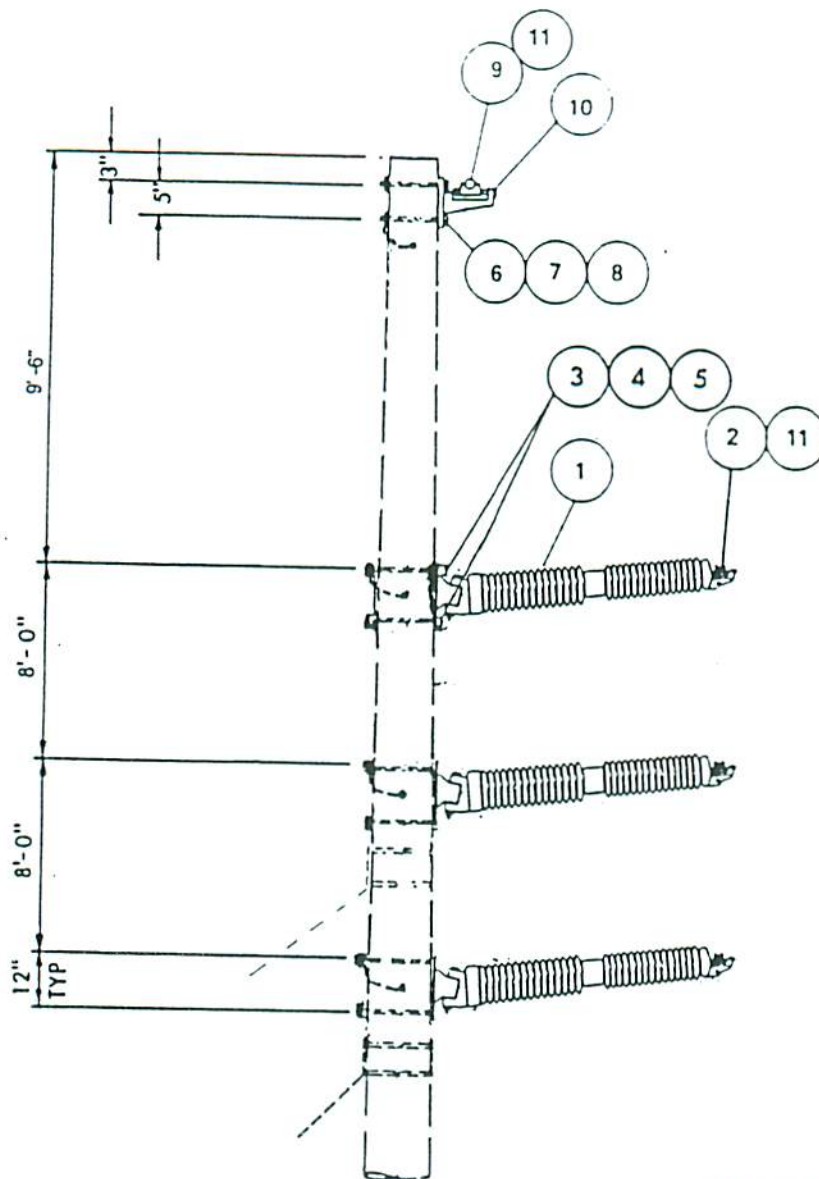
DWG. REF.	NO. REQ'D	DESCRIPTION
1	3	LINE POST INSULATOR, LAPP 9325-70, OR EQ.
2	3	CONDUCTOR TIE, PREFORMED STF-1160-P, OR EQ.
3	3	MOUNTING BRACKET, 7 1/2", LAPP 93361, OR EQ.
4	7	MACHINE BOLT, 3/8" x 28", HUGHES BROS. B628
5	7	WASHER, FLAT, GALV., 2 1/4" SQ x 3/16" x 11/16" HOLE
6	7	LOCKNUT FOR 3/8" BOLT
7	1	INSULATED BRACKET, HUGHES BROS. 2301 OR EQ.
8	1	SPOOL TIE, PREFORMED SPL-1322-P.

GAINESVILLE
REGIONAL UTILITIES

DISTRIBUTION TANGENT ASSEMBLY
13.2 GY/7.62 KV
0° - 5° LINE ANGLES

C 10





REFER TO LIST OF OWNER
FURNISHED MATERIALS

SEE TM-9 DETAIL DRAWING
FOR GROUNDING ASSEMBLY

LIST OF MATERIALS

DRG. REF.	NO. REQ.	DESCRIPTION
1	3	HORIZ. POST INSULATOR LAPP 305504-PA
2	3	ARMOR GRIP SUPPORT LAPP 77407D
3	6	MACHINE BOLT, 3/4" x 20"
4	6	GALV. FLAT WASHER 2 1/4" SQ x 3/16 13/16" HOLE
5	6	LOCKNUTS FOR 3/4" BOLT
6	2	MACHINE BOLT, 5/8" x 16"
7	2	GALV. WASHER, 2" SQ x 1/8", 11/16" HOLE
8	2	5/8" LOCKNUT
9	1	CLAMP POST CLAMP FOR OHGW LAPP 47112
10	1	GROUND WIRE BRKT. LAPP 91526
11	3	ARMOR ROD PREFORMED AR- 2128

GAINESVILLE REGIONAL UTILITIES

**TRANSMISSION LINE TANGENT STRUCTURE
138 kV HORIZONTAL LINE POST
0° to 15° ANGLE**

TP-138 X



ZACHRY	CLIENT NAME: American Renewables, LLC.	NAME: E. Nielsen	DATE: 11/17/09
	PROJECT NUMBER/NAME: 013756 - Gainesville Renewable Energy Center, LLC Biomass Generating Facility	CALC NO: C-A013756-EHAE001	REV: 0
STANDARD CALCULATION SHEET	TITLE: Electric and Magnetic Field (EMF) Calculation Package		

Attachment E

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Florida Department of Environmental Protection

Twin Tower Office Bldg * 2600 Blair Stone Road * Tallahassee, Florida 32399-2400

Report on Compliance with Electric and Magnetic Field (EMF) Standards

Agent/Facility Information

Gainesville Renewable Energy Center, LLC

Name of Transmission Line/InterestPoint

November 14, 2009

Date of Proposed Construction

Gainesville Renewable Energy Center, LLC

U.S. Route 441

Name and Address of Facility (Utility) Owner

Sam Marquez, Zachry Engineering Corp.

1515 Arapahoe Street, Tower 1 Suite 900

Denver, CO

Name and Address of Professional Engineer

Mr. Josh Levine, American Renewables, LLC

75 Arlington Street, 5th Floor

Boston, MA

Name and Address of Authorized Agent

Samuel Marquez

Signature of Authorized Agent

Signature and Seal of Professional Engineer

Date

11/18/09
Date

Field Strength Information

Transmission Lines

Cross Section	Right-of-Way (ROW) Width (ft)	Maximum Calculated Fields and Distance From ROW Left					
		Electric				Magnetic	
		Within ROW		At Edge of ROW		At Edge of ROW	
		(kV/m)	(ft)	(kV/m)	(ft)	(mG)	(ft)
SECTION 1	70	1.8	6	1.6	0		
SECTION 5	25					71.8	0

Substations

None

Florida Department of Environmental Protection

Twin Tower Office Bldg * 2600 Blair Stone Road * Tallahassee, Florida 32399-2400

Details for CrossSection: **SECTION 5- GRU line 22 to Alachua (modeled with distribution line 539)**

LINE 22

Circuit Name

138 kV

Rated Voltage

NEW CIRCUIT

New/Existing

Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
1A1	0.50	-6.00	56.00	1	1.34	0.00	145.0	0	1385
1B1	0.50	-6.00	48.00	1	1.34	0.00	145.0	120	1385
1C1	0.50	-6.00	40.00	1	1.34	0.00	145.0	240	1385
1G1	5.80	-0.70	65.50	1	0.55	0.00	0.0	0	0

CKT 539

Circuit Name

12 kV

Rated Voltage

NEW CIRCUIT

New/Existing

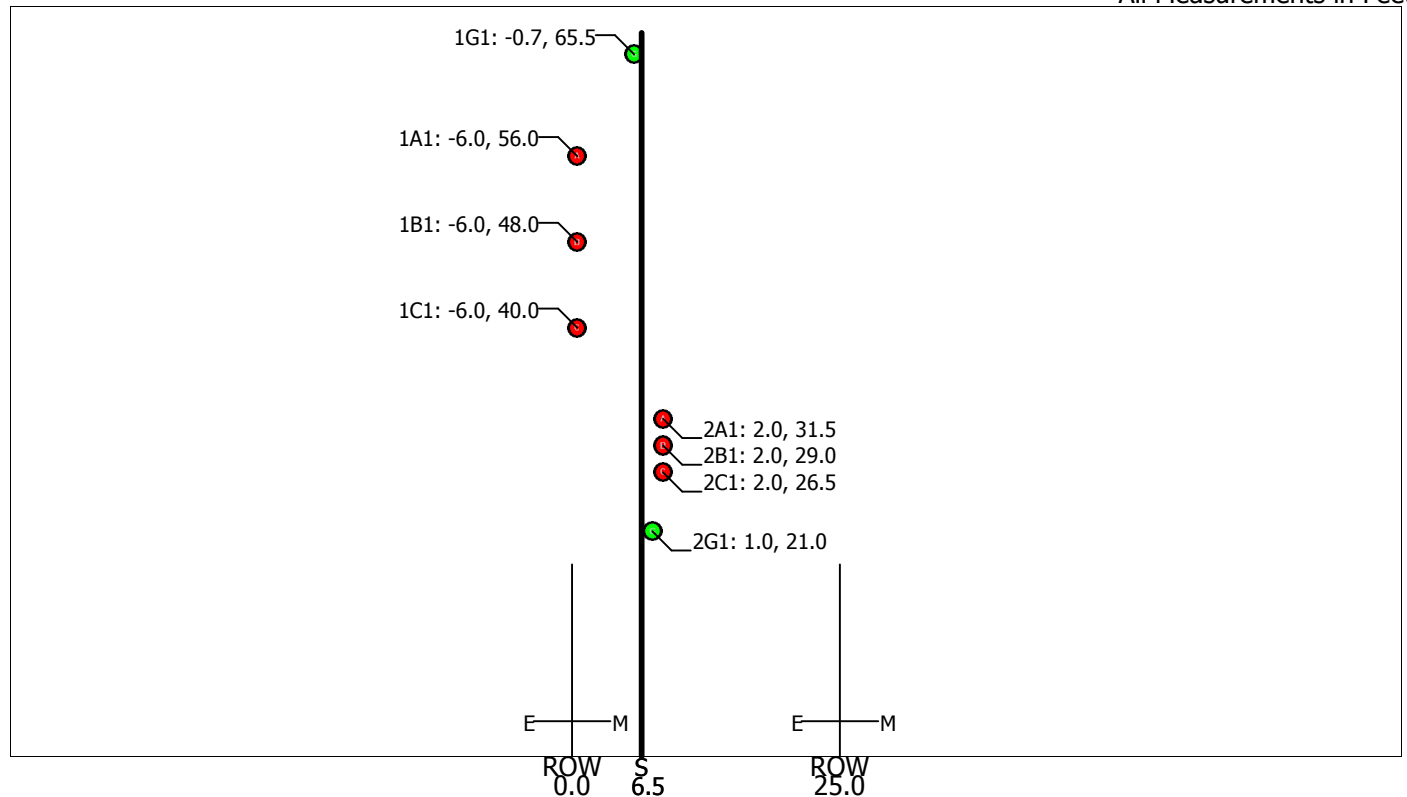
Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
2A1	8.50	2.00	31.50	1	0.75	0.00	13.0	0	200
2B1	8.50	2.00	29.00	1	0.75	0.00	13.0	120	200
2C1	8.50	2.00	26.50	1	0.75	0.00	13.0	240	200
2G1	7.50	1.00	21.00	1	0.50	0.00	0.0	0	0

Points of Interest

None

Phase Configuration

All Measurements in Feet



Florida Department of Environmental Protection

Twin Tower Office Bldg * 2600 Blair Stone Road * Tallahassee, Florida 32399-2400

Details for CrossSection: **SECTION 1- The GREC line at mid span (lowest conductor height) close**

GREC

Circuit Name

138 kV

Rated Voltage

NEW CIRCUIT

New/Existing

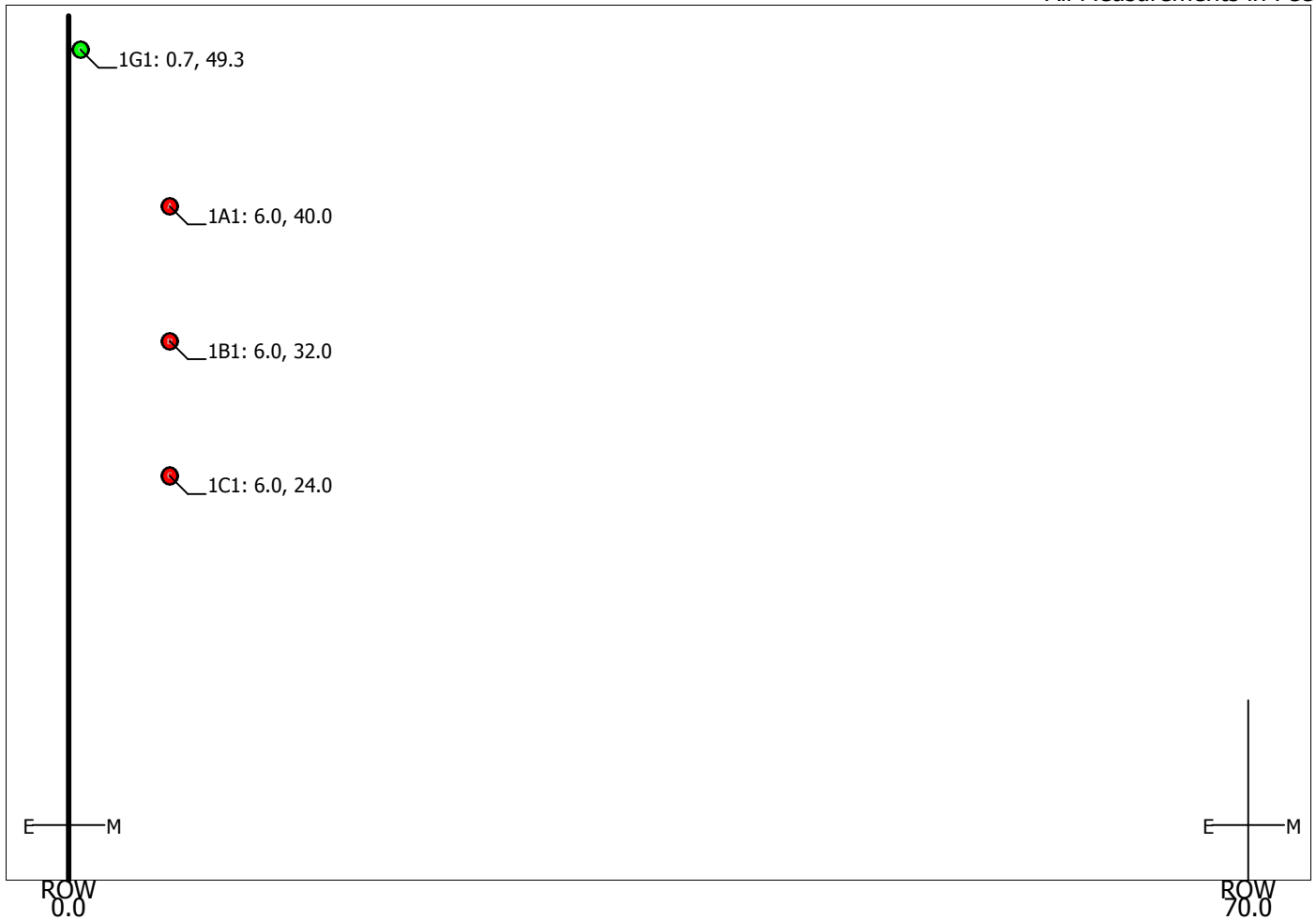
Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
1A1	6.00	6.00	40.00	1	1.11	0.00	145.0	0	500
1B1	6.00	6.00	32.00	1	1.11	0.00	145.0	120	500
1C1	6.00	6.00	24.00	1	1.11	0.00	145.0	240	500
1G1	0.70	0.70	49.30	1	0.55	0.00	0.0	0	0

Points of Interest

None

Phase Configuration

All Measurements in Feet



Florida Department of Environmental Protection

Twin Tower Office Bldg * 2600 Blair Stone Road * Tallahassee, Florida 32399-2400

Details for CrossSection: **SECTION 4- GRU line 21 to Deerhaven (modeled with distribution line 1)**

LINE 21

Circuit Name

138 kV

Rated Voltage

NEW CIRCUIT

New/Existing

Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
1A1	0.50	-6.00	56.00	1	1.34	0.00	145.0	0	954
1B1	0.50	-6.00	48.00	1	1.34	0.00	145.0	120	954
1C1	0.50	-6.00	40.00	1	1.34	0.00	145.0	240	954
1G1	5.80	-0.70	65.50	1	0.55	0.00	0.0	0	0

CKT 539

Circuit Name

12 kV

Rated Voltage

NEW CIRCUIT

New/Existing

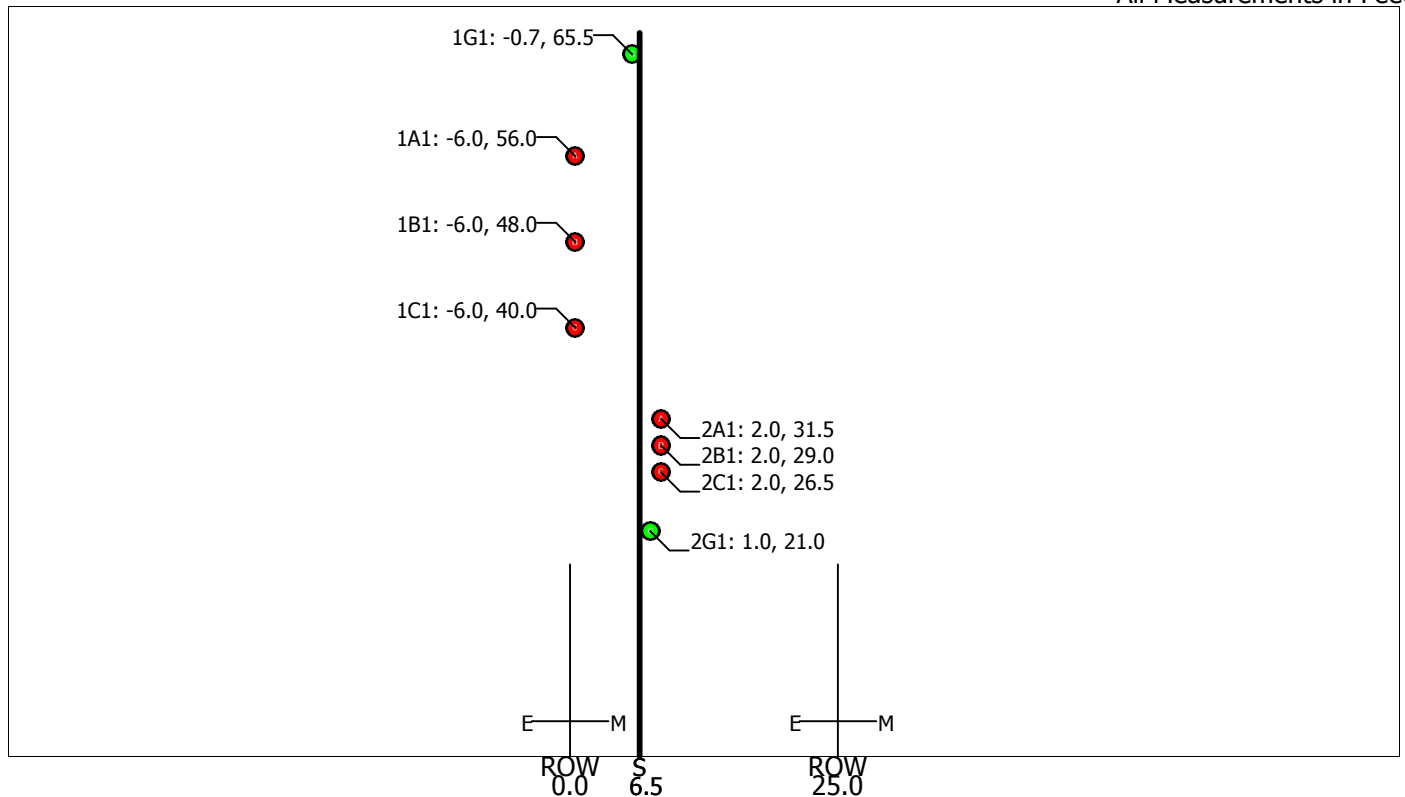
Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
2A1	8.50	2.00	31.50	1	0.75	0.00	13.0	0	200
2B1	8.50	2.00	29.00	1	0.75	0.00	13.0	120	200
2C1	8.50	2.00	26.50	1	0.75	0.00	13.0	240	200
2G1	7.50	1.00	21.00	1	0.50	0.00	0.0	0	0

Points of Interest

None

Phase Configuration

All Measurements in Feet



Florida Department of Environmental Protection

Twin Tower Office Bldg * 2600 Blair Stone Road * Tallahassee, Florida 32399-2400

Details for CrossSection: **SECTION 3- GRU horizontal phasing as it exits the GRU switchyard**

LINE 22

Circuit Name

138 kV

Rated Voltage

NEW CIRCUIT

New/Existing

Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
1A1	62.00	12.00	40.50	1	1.34	0.00	145.0	0	1385
1B1	50.00	0.00	40.50	1	1.34	0.00	145.0	120	1385
1C1	38.00	-12.00	40.50	1	1.34	0.00	145.0	240	1385
1G1	30.00	-20.00	50.50	1	0.55	0.00	0.0	0	0

LINE 21

Circuit Name

138 kV

Rated Voltage

NEW CIRCUIT

New/Existing

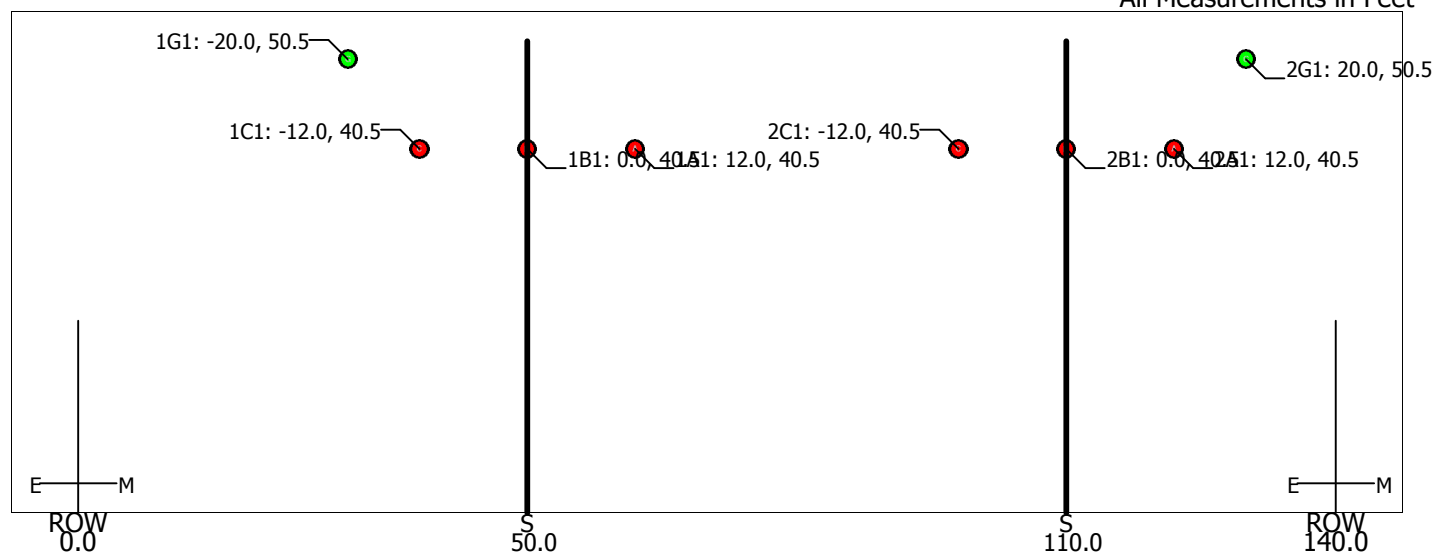
Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
2A1	122.00	12.00	40.50	1	1.34	0.00	145.0	0	-954
2B1	110.00	0.00	40.50	1	1.34	0.00	145.0	120	-954
2C1	98.00	-12.00	40.50	1	1.34	0.00	145.0	240	-954
2G1	130.00	20.00	50.50	1	0.55	0.00	0.0	0	0

Points of Interest

None

Phase Configuration

All Measurements in Feet



Details for CrossSection: **SECTION 2- GREC horizontal phasing as it enters the GRU switchyard.**

GREC
Circuit Name

138 kV
Rated Voltage

NEW CIRCUIT
New/Existing

Id	Dist From Left ROW (ft)	Dist From Circuit CL (ft)	Minimum Height (ft)	SubConductors			Maximum Voltage (kV)	Angle (Degrees)	MCR (Amps)
				# of	Diameter (in)	Spacing (in)			
1A1	62.00	12.00	40.50	1	1.11	0.00	145.0	0	500
1B1	50.00	0.00	40.50	1	1.11	0.00	145.0	120	500
1C1	38.00	-12.00	40.50	1	1.11	0.00	145.0	240	500
1G1	50.00	0.00	50.50	1	0.55	0.00	0.0	0	0

Points of Interest

None

Phase Configuration

All Measurements in Feet

