Exhibit AA

Electromagnetic Frequencies from Transmission Lines

Nolin Hills Wind Power Project
January 2022

Prepared for

Capital Power
RESPONSIBLE ENERGY
FOR TOMORROW

d/b/a Nolin Hills Wind, LLC

Prepared by

TETRA TECH

Tetra Tech, Inc.

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Acronyms and Abbreviations

AC	alternating current
Applicant	Nolin Hills Wind, LLC
BPA	Bonneville Power Administration
EMF	electric and magnetic fields
G	gauss
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronics Engineers
kA	kiloampere
kV	kilovolt
kV/m	thousands of volts per meter
mA	milliampere
mG	milligauss
MHz	megahertz
NESC	National Electrical Safety Code
OAR	Oregon Administrative Rule
Project	Nolin Hills Wind Power Project
ROW	right-of-way
TV	television
UEC	Umatilla Electric Cooperative
V/m	volt per meter

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1.0 Introduction

This Exhibit AA was prepared to meet the submittal requirements in Oregon Administrative Rule (OAR) 345-021-0010(1)(aa).

2.0 Proposed Transmission Line – OAR 345-021-0010(1)(aa)(A)

> *OAR 345-021-0010(1)(aa) Exhibit AA. If the proposed energy facility is a transmission line or has, as a related or supporting facility, a transmission line of any size:*
>
> *(A) Information about the expected electric and magnetic fields, including:*

2.1 Assumptions and Methods Used in the Analysis – OAR 345-021-0010(1)(aa)(A)(vi)

> *(vi) The assumptions and methods used in the electric and magnetic field analysis, including the current in amperes on each proposed transmission line.*

2.1.1 Electric and Magnetic Field Background Information

Electric and magnetic fields (EMF) occur throughout nature and are one of the basic forces of nature. Any object with an electric charge on it has a voltage (potential) at its surface and can create an electric field. The change in voltage over distance is known as the electric field. When electrical charges move together (known as "current"), they create forces. These forces are represented by magnetic fields. All electric currents create magnetic fields.

The strength of EMF is related to the voltage and current, respectively, and to the distance away from the source. The strength of the electric field depends on the voltage (higher voltages create higher electric fields) and distance (electric fields grow weaker as the distance from the source increases). The strength of the magnetic field depends on the current or load (higher currents or loads create higher magnetic fields) and distance (magnetic fields grow weaker as the distance from the source increases). For transmission line sources, the arrangement of the conductors (line geometry) and phasing also influence the strength of the EMF.

The electric power distribution system creates alternating current (AC) EMF. In the United States, the power system uses current that alternates 60 times each second (60 hertz). For each electrical circuit, AC power is carried by each of the three-phase conductors. The AC voltage and current in each phase conductor is out of sync with the other two phases by 120 degrees, or one-third of a 360-degree cycle.

Transmission lines also create power-frequency electric and magnetic fields. Since the voltage of a transmission line is held relatively constant (typically within +/-5 percent), the electric field from a transmission line remains steady and is not affected by daily and seasonal fluctuations in usage of electricity by customers. However, the current in a transmission line does fluctuate due to consumer power usage and varies by time of day and also seasonally. Therefore, the magnetic field from a transmission line will also fluctuate (since magnetic field is related to the current or load on the line).

Electric fields are reported in units of volts per meter (V/m) or thousands of volts per meter (kV/m). Magnetic fields are reported in units of gauss (G), or more typically in units of milligauss (mG), which are equal to one-thousandth of a gauss (i.e., 1 mG = 0.001 G).

2.1.1.1 Electric Fields

The State of Oregon has an AC electric field limit of 9 kV/m at one meter above the ground surface in areas accessible to the public, as stated in OAR 345-024-0090.

2.1.1.2 Magnetic Fields

Presently, there are no magnetic field standards for the State of Oregon or federal health standards. Although there are no federal health standards in the United States specifically for 60 hertz, some non-regulatory organizations have developed guidelines: the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of Electrical and Electronics Engineers (IEEE). For the general public, the ICNIRP guideline is 2,000 mG (ICNIRP 2010) while the IEEE guideline is 9,040 mG (IEEE 2002).

2.1.2 Electromagnetic Frequency Modeling

2.1.2.1 Modeling Methods

Nolin Hills Wind, LLC (the Applicant) analyzed EMF levels by considering the peak electrical currents expected on the lines. These analyses were conducted conservatively, using the peak electrical currents expected on the lines that produce the highest magnetic fields. Additionally, the double-circuit collector line was modeled so that similar phases were located at the same elevation on each side of the support structure, which results in a conservative analysis. Finally, the modeling was performed at the point midway between transmission structures where the conductors are closest to the ground and where the EMF will be the highest.

The software tool program used for the analyses, Corona and Field Effects Program (Version 3.1), was developed by the Bonneville Power Administration (BPA) and is based on the methods and equations of the *Transmission Line Reference Book* (Electric Power Research Institute [EPRI] 1985).

2.1.2.2 Modeling Assumptions

The following assumptions were made during the development of the models:

- Elevation – 1,000 feet;

- Rain rate – 1 inch per hour;
- Wind speed – 2 miles per hour;
- Detector Information:
    - Radio interference antenna height – 6.6 feet;
    - Television (TV) interference antenna height – 9.8 feet;
    - Frequency at which radio interference values are to be calculated – 1 megahertz (MHz);
    - Frequency at which TV interference values are to be calculated – 75 MHz;
    - Magnetic field sensor height – 3.3 feet;
    - Ground conductivity – 6.7 millimhos per meter; and
    - Electric field sensor height – 3.3 feet;
- 230-kilovolt (kV)/115-kV double-circuit transmission line (Figure AA-1):
    - Width of modeling – 200 feet on each side of the center line. Sample points are taken every 4 feet uniformly in a perpendicular direction to the center line. The right-of-way (ROW) is estimated at 50 feet on each side of the center line;
    - Horizontal location of the three conductors – 10 feet (A circuit), 13 feet (B circuit), and 10 feet (C circuit) on each side of the double-circuit center line;
    - Height of conductors – 24.9 (C circuit), 40.9 (B circuit), and 56.9 (A circuit) feet, respectively;
    - Conductor diameters – 1.345 inches;
    - Power – 961 amps, or 0.961 kiloamperes (kA);
    - Horizontal location of the two ground wires – 6 feet and -6 feet from each side of the double-circuit center line;
    - Height of ground wires – 63.9 feet; and
    - Ground wire diameter – 0.5 inch;
- 230-kV single-circuit transmission line (Figure AA-2):
    - Width of modeling – 200 feet on each side of the center line (in the case of the line run parallel to the existing BPA H-frame to the Stanfield substation, out to 200 feet beyond the center line of both the proposed 230-kV Project transmission line and the existing BPA 230-kV transmission line). Sample points are taken every 4 feet (6 feet in the case of the line running parallel to the existing BPA H-frame to the Stanfield substation) uniformly in a perpendicular direction to the center line. The ROW is estimated at 50 feet on each side of the center line;

  - Horizontal location of the three conductors – 10 feet (A circuit), -10 feet (B circuit), and 10 feet (C circuit);
  - Height of conductors – 44.9 feet (A circuit), 34.9 feet (B circuit), and 24.9 feet (C circuit);
  - Conductor diameters – 1.345 inches;
  - Power – 961 amps, or 0.961 kA;
  - Horizontal location of the single ground wire – 5 feet from on one side of the center line;
  - Height of the single ground wire – 54.2 feet; and
  - Ground wire diameter – 0.5 inch.
- Existing BPA H-frame:
  - Horizontal location of the three conductors – -20 feet (A circuit), 0 feet (B circuit), and 20 feet (C circuit) from center line of the H-frame structure;
  - Height of conductors – 30 feet for all;
  - Conductor diameters – 1.345 inches; and
  - Power – 425 megawatts, calculated at 1,066 amps, or 1.066 kA.

2.2 Distance from Proposed Center Line – OAR 345-021-0010(1)(aa)(A)(i)

> *(i) The distance in feet from the proposed center line of each proposed transmission line to the edge of the right-of-way;*

The Nolin Hills Wind Power Project (Project) will interconnect to the regional grid via either publicly owned and operated transmission lines to be constructed locally by the Umatilla Electric Cooperative (UEC), or a new 230-kV transmission line anticipated to be constructed, owned, and operated by the Applicant to the proposed BPA Stanfield Substation.

The Applicant anticipates that the Project will connect to the BPA transmission system via new and modified/upgraded UEC transmission lines from the northern Project substation to the existing UEC Cottonwood Substation, or via a new overhead 230-kV transmission line to the proposed BPA Stanfield Substation north of the Umatilla River. From the Cottonwood Substation, an existing UEC 230-kV transmission line with capacity for the additional power generated by the Project would carry that power north to BPA's McNary Substation. The UEC Cottonwood route is currently considered the primary option, with the BPA Stanfield route as a backup option. The final decision regarding which route will be used will be made by the Applicant based on the final Project construction schedule, BPA and UEC system requirements, anticipated costs, and other factors such as transmission agreements.

The width of the ROW may vary, but will be at a minimum of 50 feet wide along the center line of each transmission line. This range is within the transmission line corridor width defined in OAR-345-001-0010(13).

2.3 Occupied Structures within 200 Feet of Proposed Center Line – OAR 345-021-0010(1)(aa)(A)(ii) and (iii)

> *(ii) The type of each occupied structure, including but not limited to residences, commercial establishments, industrial facilities, schools, daycare centers and hospitals, within 200 feet on each side of the proposed center line of each proposed transmission line;*
>
> *(iii) The approximate distance in feet from the proposed center line to each structure identified in (A);*

Table AA-1 shows potential receptors within 200 feet of either transmission lines.

Table AA-1. Potential Receptors within 200 Feet of Proposed Center Line

Receptor Number	Type of Structure	Approximate Distance to Transmission Line (Feet)
3	Occupied residence (house)	189
10	Occupied residence (house)	177
47	Occupied residence (house)	93
54	Occupied residence (house)	146
59	Occupied residence (house)	178
71	Occupied residence (house)	107
79	Occupied residence (house)	161
85	Occupied residence (house)	91
107	Occupied commercial building	114

2.4 Representative Field Strength along the Proposed Transmission Line – OAR 345-021-0010(1)(aa)(A)(iv)

> *(iv) At representative locations along each proposed transmission line, a graph of the predicted electric and magnetic fields levels from the proposed center line to 200 feet on each side of the proposed center line;*

Table AA-2 shows the results of the electric field calculations for the overhead 230-kV/115-kV double-circuit transmission lines and 230-kV single-circuit transmission lines. Figures AA-3, AA-4, and AA-5 provide graphs of the predicted electric field calculations for these lines from the proposed center line to 200 feet on each side of the proposed center line.

Table AA-2. Overhead Electric Field Calculations

Support Structure	Figure	Voltage	Electric Field (kV/m)[1]		
			Left Side (200 Feet)	Maximum (Location)	Right Side (200 Feet)
230-kV/115-kV Double-Circuit Transmission Line	AA-1, AA-3	230 kV	0.052	4.26 (8 feet right of center line)	0.061
230-kV Single-Circuit Transmission Line	AA-2, AA-4	230 kV	0.042	3.22 (12 feet right of center line)	0.044
230-kV Single-Circuit Transmission Line to Stanfield Substation	AA-2, AA-5	230 kV	0.046	3.18 (10 feet right of center line of single circuit transmission line)	N/A (within influence of existing BPA H-frame)
1. Oregon Electric Field Standard is 9 kV/m within the right of way.					

Table AA-3 shows the results of the magnetic field calculations for the overhead transmission lines. Figures AA-6, AA-7, and AA-8 provide graphs of the predicted magnetic field calculations for these lines from the proposed center line to 200 feet on each side of the proposed center line.

Table AA-3. Overhead Magnetic Field Calculations

Support Structure	Figure	Voltage	Magnetic Field (mG)				
			Left Side (200 Feet)	Left Side ROW	Centerline	Right Side ROW	Right Side (200 Feet)
230-kV/115-kV Double-Circuit Transmission Line	AA-1, AA-6	230 kV	15.0	30.7	225.6	30.7	14.3
230-kV Single-Circuit Transmission Line	AA-2, AA7	230 kV	3.1	12.0	159.5	12.1	3.1
230-kV Single-Circuit Transmission Line to Stanfield substation	AA-2, AA-8,	230 kV	3.7	12.9	150.2	40.1 (within influence of existing BPA H-frame)	N/A (within influence of existing BPA H-frame)

Tables AA-2 and AA-3 show the modeling results at the edges of and the highest values within 200 feet on either side of the center line of the overhead 230-kV/115-kV double-circuit transmission lines, 230-kV single-circuit transmission lines, and 230-kV single-circuit line adjacent to existing BPA 230-kV line. Results from the modeling software can be found in Attachments AA-1, AA-2, and AA-3 for the three scenarios. The electric fields on the corridor of the proposed 230-kV/115-kV double-circuit transmission lines do not exceed 9 kV/m (see Figure AA-6). The electric fields on the corridors of the proposed overhead 230-kV single-circuit transmission lines do not exceed 9 kV/m (see Figure AA-7). The electric fields on the corridors of the proposed overhead 230-kV single-circuit transmission line to the Stanfield substation do not exceed 9 kV/m (see Figure AA-8). These figures demonstrate that, for the proposed overhead transmission lines, the maximum electric field modeled is about 4.26 kV/m, which is less than the 9-kV/m standard set forth in OAR 345-024-0090(1).

As identified in Section 2.3, eight occupied residences and one commercial building will be within 200 feet of the overhead transmission lines. However, the maximum electric field modeled based on the 230-kV double-circuit transmission line configuration analyzed is less than 48 percent of the 9-kV/m standard set forth in OAR 345-024-0090(1). Therefore, the potential for human exposure to EMF from either the transmission lines is minimized.

2.5 Mitigation and Monitoring – OAR 345-021-0010(1)(aa)(A)(v)

> *(v) Any measures the applicant proposes to reduce electric or magnetic field levels.*

The highest electric fields within the ROW will be much less than the Oregon standard of 9 kV/m, and therefore no mitigation is required.

As the maximum electrical field modeled in Section 2.4 are lower than the 9-kV/m standard set forth in OAR 345-024-0090(1), no monitoring program is proposed by the Applicant.

2.6 Proposed Monitoring Program – OAR 345-021-0010(1)(aa)(A)(vii)

> *(vii) The applicant's proposed monitoring program, if any, for actual electric and magnetic field levels.*

As the maximum electrical field modeled in Section 2.4 is lower than the 9-kV/m standard set forth in OAR 345-024-0090(1), no monitoring program is proposed by the Applicant.

3.0 Radio and TV Interference

Radio and TV interference is caused by corona discharge from the line. This discharge will be greatest during rainy weather conditions. Interference may be noticed as a humming or buzzing sound on weak AM radio signals or as bands of snow across the picture in TV signals received by an over the air broadcast signal. FM radio signals and digital satellite or cable TV signals will not be affected.

The modeling results show that low levels of AM radio or TV interference may be noted due the corona discharge from the 230-kV transmission line. People listening to weak AM radio signals in their home or vehicle may notice some interference when located close to the transmission line. FM radio signals will not be affected. Satellite TV reception will not be affected because transmission line corona discharge does not affect satellite TV's digital format. Over the air TV signals are now broadcast in a digital format as well, which will not be affected unless the signal strength is extremely weak.

4.0 Induced Currents

4.1 Overview of Induced Current, Induced Voltage, and Nuisance Shock

The flow of electricity in a transmission line can induce a small electric charge, or voltage, in nearby conductive objects. An induced electric charge can flow, or become electric current, when a path to ground is presented. Induced current can be observed as a continuous flow of electricity or, under some circumstances, as a sudden discharge, commonly known as a “nuisance shock.” The most common example of a nuisance shock is when a vehicle, which is insulated from grounding by its tires, is parked under a transmission line for sufficient time to build up a charge. A person touching such a charged vehicle could become a conducting path for the current and can feel a momentary shock if the available electrical charge is sufficient, generally above 1 milliampere (mA) (Dalziel and Mansfield 1950).

The amount of current flow, or the magnitude of the nuisance shock, is determined by the level of charge that can be induced and the nature (conductivity or impedance) of the path to ground. Metallic roofs, vehicles, equipment, or wire fences are examples of metallic objects in the vicinity of the Project in which a small electric charge could be induced. Factors to consider when assessing the potential hazards and mitigation measures for induced voltage include the characteristics of nearby objects, and the degree and nature of grounding of those objects. More conductive materials accumulate greater charge than less conductive materials while large objects, such as a tractor-trailer, will accumulate a greater charge than smaller objects such as a pick-up truck (EPRI 2005). A linear object that is parallel to the transmission line would be more greatly affected than one that is perpendicular to the line. An object passing quickly under the transmission line would be minimally affected compared to a stationary object. A grounded or partially grounded object will accumulate charge that could be discharged as a nuisance shock, while continuous current would occur in a grounded object. The total amount of charge that can be induced in a perfectly nongrounded object is limited by the strength of the magnetic field and the nature of the object; after a time, the field and the induced charge in the object will reach equilibrium (steady-state), and the induced charge would stop building.

Continuous induced current may occur if a metallic object is partially grounded or grounded some distance from the transmission line. Continuous induced current may occur in linear objects that are parallel to the transmission line, such as some fences, railroads, pipelines, irrigation piping, or other transmission or power distribution lines.

4.2 National Electrical Safety Code Provisions Relevant to Induced Current

The National Electrical Safety Code (NESC) sets the standards for practical safeguarding of people during the installation, operation, or maintenance of electric supply and communication lines and associated equipment. NESC Rule 234G.3 (NESC 2012) addresses induced current and sets forth a certain standard to ensure the safety and health implications of the same are properly addressed:

> *[f]or voltages exceeding 98 kV ac to ground, either the clearances shall be increased or the electric field, or the effects thereof, shall be reduced by other means, as required, to limit the steady-state current due to electrostatic effects to 5 mA, rms, if an ungrounded metal fence, building, sign, billboard, chimney, radio or television antenna, tank or other installation, or any ungrounded metal attachments thereto, were short-circuited to ground.*

The 5-mA figure embedded in the NESC rule is a scientifically derived health and safety limitation, intended to eliminate the potential for harmful electric shock. The threshold of perception for current flowing through the human body is approximately 1 mA (Dalziel and Mansfield 1950). If the current is increased sufficiently beyond a person's perception threshold, it can become bothersome and possibly startling. Larger currents can cause the muscles of the arm and hand to involuntarily contract so that a person cannot let go of an electrified object. The value at which 99.5 percent of men, women, and children can still let go of an object is approximately 9, 6, and 5 mA, respectively. To address this safety concern, NESC Rule 234G.3 limits the steady-state current due to electrostatic effects to 5 mA; it is a performance standard aimed at limiting the potential charge that could be developed so that a potential nuisance shock would not be harmful to children.

The NESC is updated every 5 years. The Applicant will design, construct, and operate the Project in accordance with the version of the NESC that is most current at the time final engineering of the Project is completed.

4.3 Predicted Induced Current

Empirical evidence has yielded a known relationship between short-circuit current and electric field strength for various types and sizes of objects (EPRI 2005). Based on these known relationships, Table AA-4 indicates the maximum current that could be induced in several types of vehicles and agricultural-related pieces of equipment potentially present in the transmission line right-of-way.

Table AA-4. Induced Current Factors

Object	I_{sc}/E (mA/kV/m)	Maximum Induced Current (mA)[1]
Car—L 4.6 m x W 1.78 m x 1.37 m	0.088	0.37
Pickup Truck—L 5.2 m x W 2.0 m x H 1.7m	0.10	0.43
Large Tractor-Trailer—Total Length 15.75 m Trailer: 12.2 m x W 2.4 m x H 3.7 m	0.64	2.7
Combine—L 9.15 m x W 2.3 m x H 3.5 m	0.38	1.6

Notes:
Source: Table 7.8-2, from EPRI 2005.
I_{sc} = short-circuit current
E = AC electric field
m = meter
[1] Maximum induced current calculated for strongest predicted electric field of 4.26 kV/m associated with the proposed Project.

Multiplying the factors listed in Table AA-4 by the transmission line electric field strength yields the short-circuit current expected under conditions expected to produce the greatest magnitude short-circuit currents. The strongest electric field calculated for the project configurations is 4.26 kV/m for the 230-kV/115-kV double-circuit transmission line. The vehicles and equipment listed in Table AA-4 will all have short-circuit currents less than the 5-mA current required by the NESC.

To eliminate the potential for induced current at the substations, the Applicant will construct a grounding mat that covers the entire substation footprint and out to a distance of 4 feet beyond the fence around the substation. The grounding mat will be designed based on the soil resistivity of the substation site. All aboveground structures that have conduction will be electrically connected to the grounding mat, which ensures there is no possibility of induced current.

4.4 Stray Voltage

Stray voltage is not an issue for this Project. Stray voltage is an issue that may occur with lower voltage distribution systems that have unequally loaded phases and an improperly grounded neutral wire. Stray voltage can also be an issue that occurs with the customer's electrical system beyond the local utility company's meter. The issue of stray voltage related to the Project is eliminated by the balanced three-phase configuration of the proposed transmission lines.

4.5 Program to Prevent Induced Current and Nuisance Shock

Nuisance shocks and induced currents can be reduced or eliminated by proper grounding of metallic objects near the transmission line, shielding them from the electric field, or positioning the transmission line farther from the objects. Grounding an object will reduce the induced potential to essentially zero and eliminate the object as a source of shocks or currents.

During final engineering and construction of the Project, the Applicant will identify all wire fences, pipelines, irrigation lines, metal roofs, and other objects near the right-of-way in which a current could be induced. All such objects will be properly grounded within or as close as practicable to the right-of-way in order to prevent induced current and nuisance shocks.

5.0 Conclusion

OAR Chapter 345, Division 21 does not provide an approval standard specific to Exhibit AA. However, compliance with OAR 345-024-0090 is demonstrated by the analysis above, as described in Exhibit DD.

6.0 References

Dalziel, C.F., and T H. Mansfield. 1950. Effects of Frequency on Perception Currents. AIEE Transactions 69:1162–1168.

EPRI (Electric Power Research Institute). 1985. *Transmission Line Reference Book*. Third Edition.

EPRI. 2005. AC Transmission Line Reference Book: 200 kV and Above. Third edition. EPRI, Palo Alto, CA. 1011974.

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IEEE (Institute of Electrical and Electronics Engineers), 2002. IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 – 3 kHz. IEEE Std C95.6-2002.

NESC (National Electric Safety Code). 2012. National Electrical Safety Code. 2012 ed. Institute of Electrical and Electronics Engineers, Inc., New York, NY. 287 pages.

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Figures

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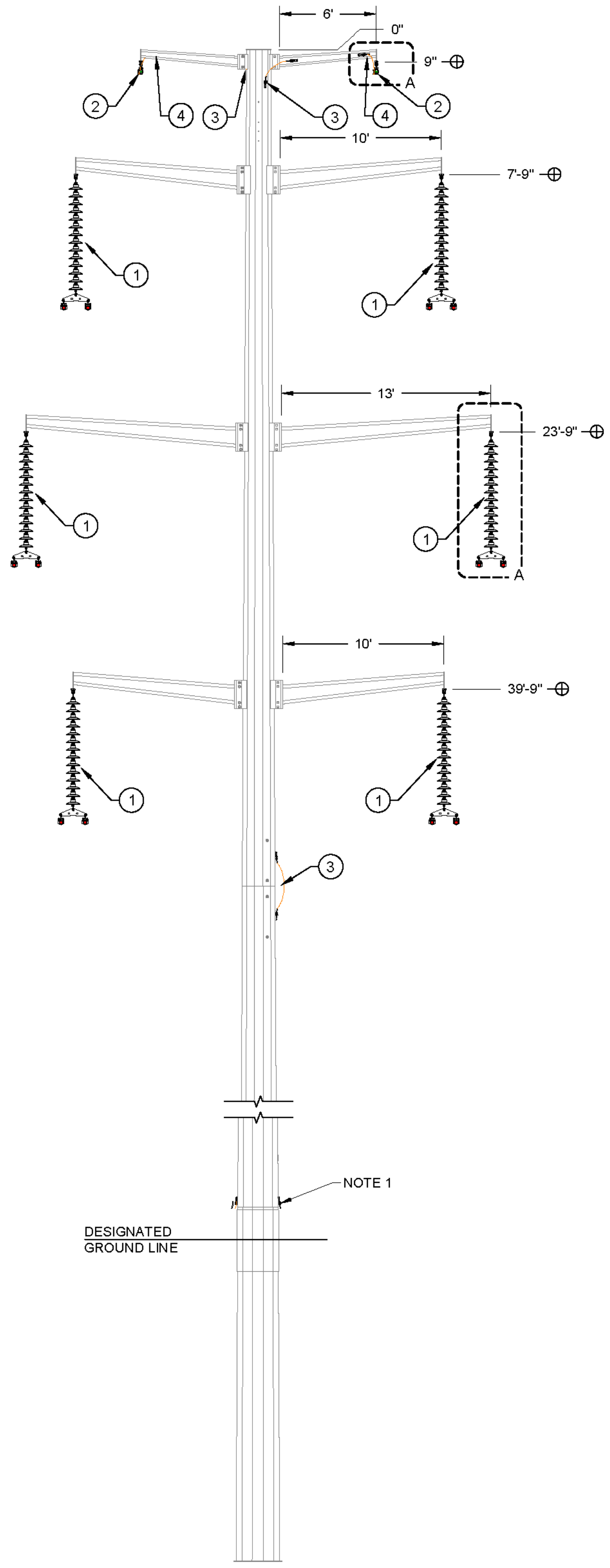
LIST OF MATERIALS

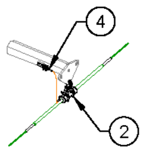
#	QTY	DESCRIPTION	MANUFACTURER	PART NO.
1	6	INSULATOR ASSEMBLY, TANGENT		TM-1C
2	2	OPGW ASSEMBLY, TANGENT		TM-4A(OPGW)
3	A.R.	STEEL POLE GROUNDING, JOINT		TMS-9C(JT)
4	2	STEEL POLE GROUNDING, TOP		TMS-9C(TP)

NOTES:

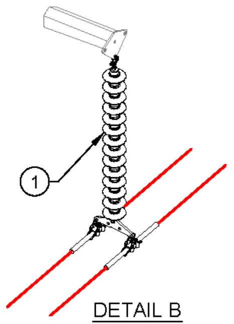
1. THE FOLLOWING MATERIALS ARE TO BE SPECIFIED SEPARATELY ON PLAN AN PROFILE DRAWINGS: POLES, POLE GROUNDING ASSEMBLY, AND ANY ADDITIONAL GROUNDING UNITS.



ELEVATION



DETAIL A



DETAIL B

DATE	REVISION	#
/ /	ISSUED FOR	0

WORKING

TOTH & ASSOCIATES
830 E PRIMROSE, SUITE 200
SPRINGFIELD, MO 65807
Ph: 417-888-0645 Fax: 417-888-0657
www.tothassociates.com
CERTIFICATE OF AUTHORITY:
OR# not required

DWN. BY: SRC
CKD. BY: SEZ
APPD. BY: JLB
DATE: 02/07/19

PROJECT:
LOCATION:
CLIENT: UMATILLA ELECTRIC COOPERATIVE
HERMISTON, OREGON
OREGON-14-UMATILLA

TITLE: TRANSMISSION LINE STRUCTURES
STEEL D.C. TANGENT WITH DAVIT ARMS

SHT NO: 1 of 1
TUS-230DC-1

Nolin Hills
Wind Power Project

Figure AA-1

Typical Double-Circuit Transmission Line

UMATILLA COUNTY, OREGON

TETRA TECH

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LIST OF MATERIALS

#	QTY	DESCRIPTION	MANUFACTURER	PART NO.
1	3	INSULATOR ASSEMBLY, TANGENT		TM-1C
2	2	OPGW ASSEMBLY, TANGENT		TM-4A(OPGW)
3	A.R.	STEEL POLE GROUNDING, JOINT		TMS-9C(JT)
4	1	STEEL POLE GROUNDING, TOP		TMS-9C(TP)

NOTES:

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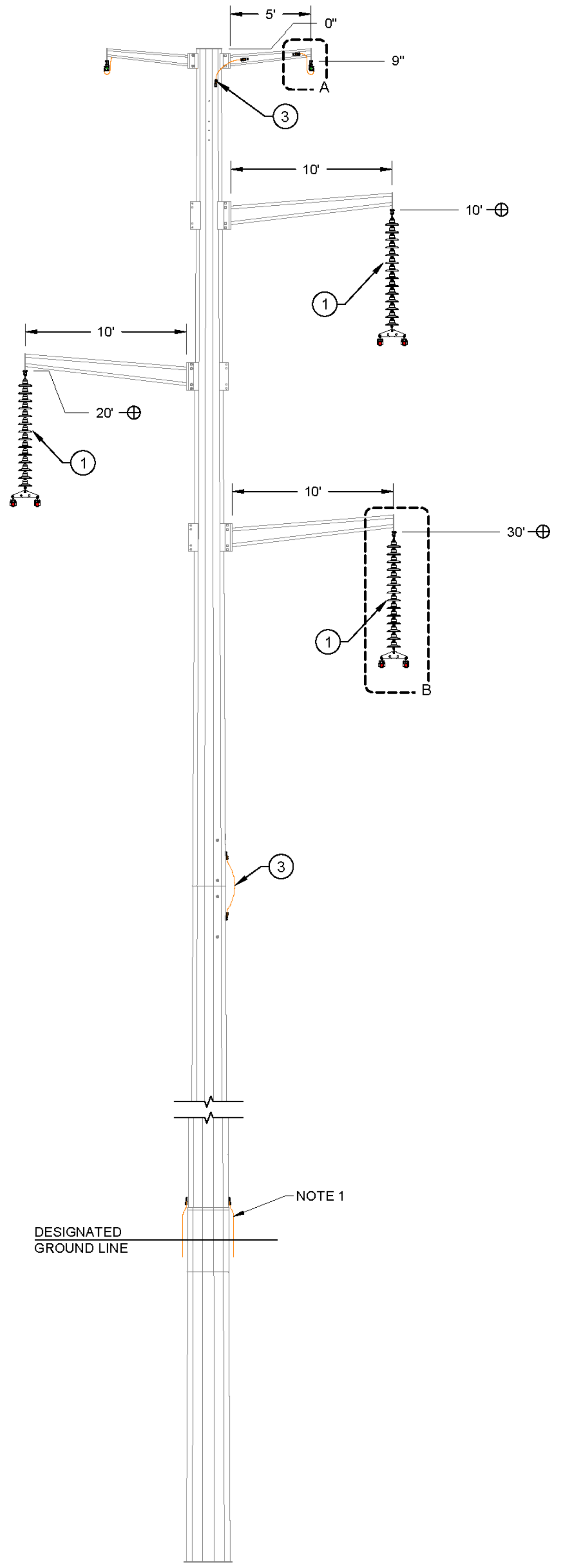
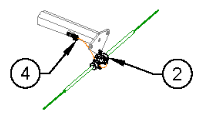
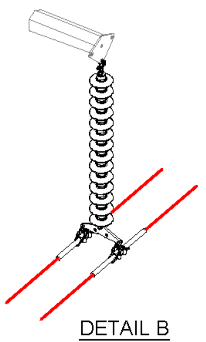


ELEVATION



DETAIL A



DETAIL B

DATE	REVISION	#
/ /	ISSUED FOR	0

WORKING

TOTH & ASSOCIATES
830 E PRIMROSE, SUITE 200
SPRINGFIELD, MO 65807
Ph: 417-888-0645 Fax: 417-888-0657
www.tothassociates.com
CERTIFICATE OF AUTHORITY:
OR# not required

DWN. BY: SRC
CKD. BY: SEZ
APPD. BY: JLB
DATE: 02/07/19
PROJECT:
LOCATION:
CLIENT: UMATILLA ELECTRIC COOPERATIVE
HERMISTON, OREGON
OREGON-14-UMATILLA
TITLE: TRANSMISSION LINE STRUCTURES
STEEL TANGENT WITH DAVIT ARMS
SHT NO: 1 of 1
TUS-230-1

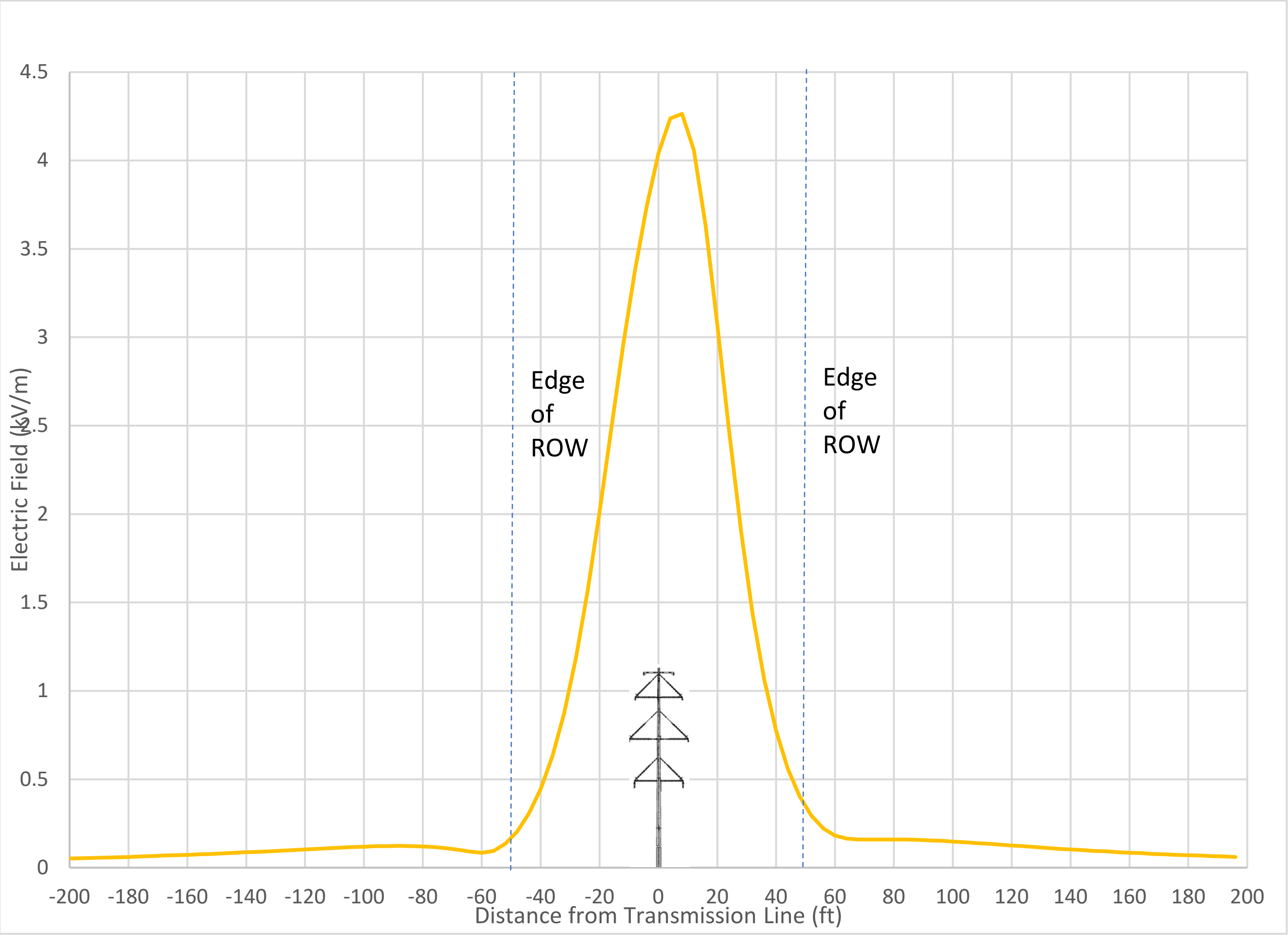
Nolin Hills Wind Power Project

Figure AA-2

Typical Single-Circuit Transmission Line

UMATILLA COUNTY, OREGON

TETRA TECH



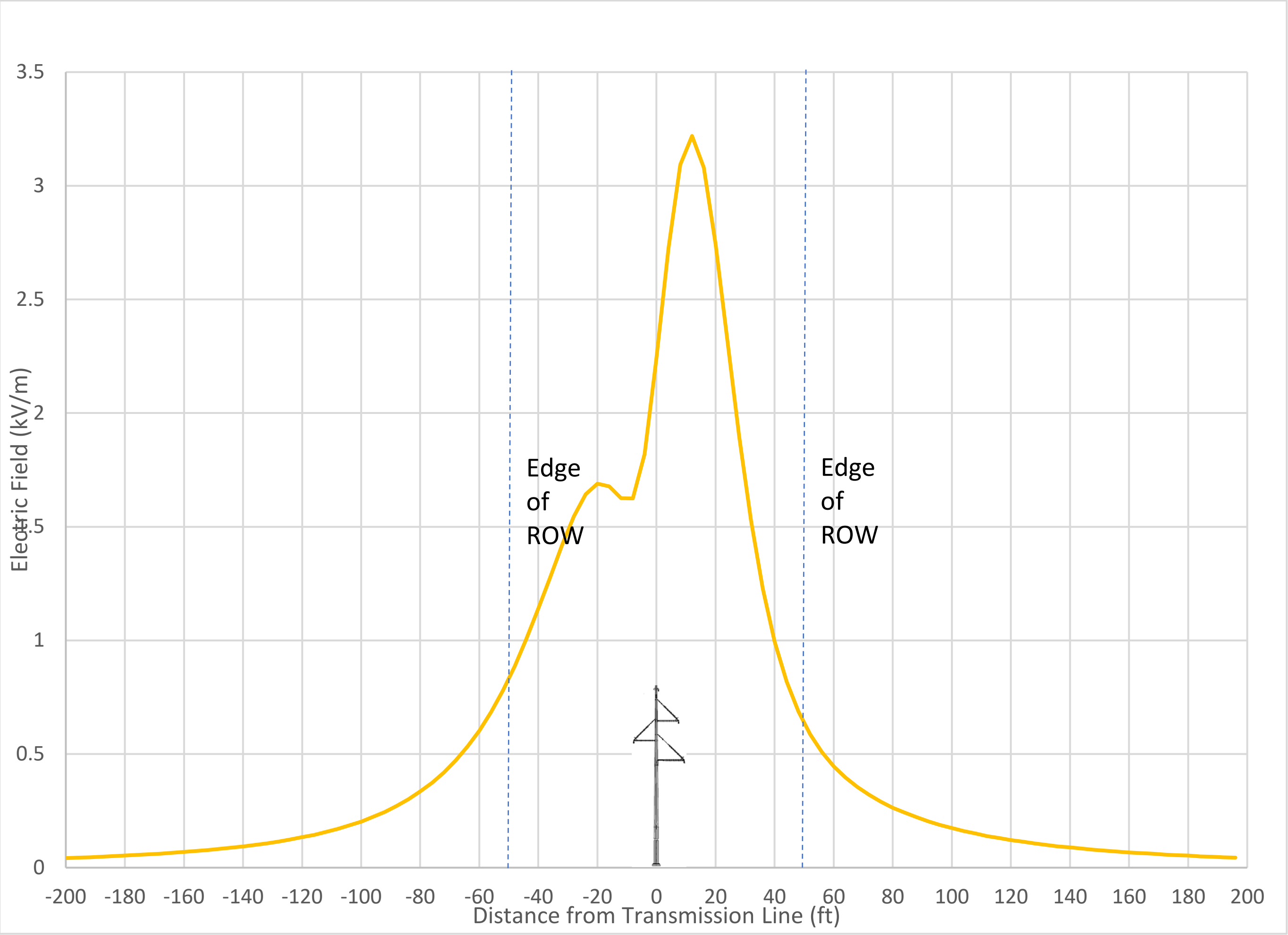
Nolin Hills Wind Power Project

Figure AA-3

Nolin Hills Double-Circuit 230-kV/115-kV Electric Field

UMATILLA COUNTY, OREGON

TETRA TECH



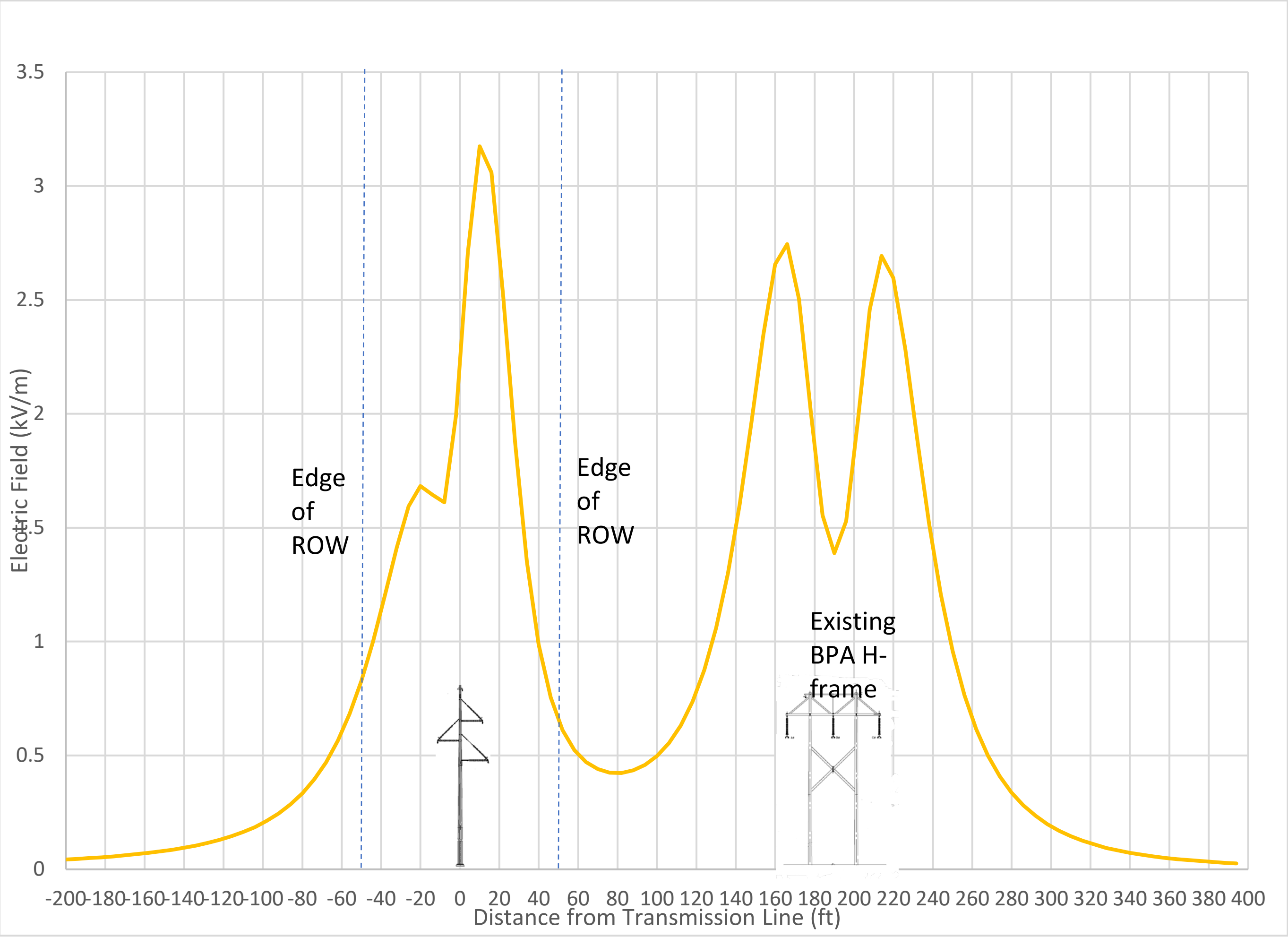
Nolin Hills Wind Power Project

Figure AA-4

Nolin Hills Single-Circuit 230-kV Electric Field

UMATILLA COUNTY, OREGON

TETRA TECH



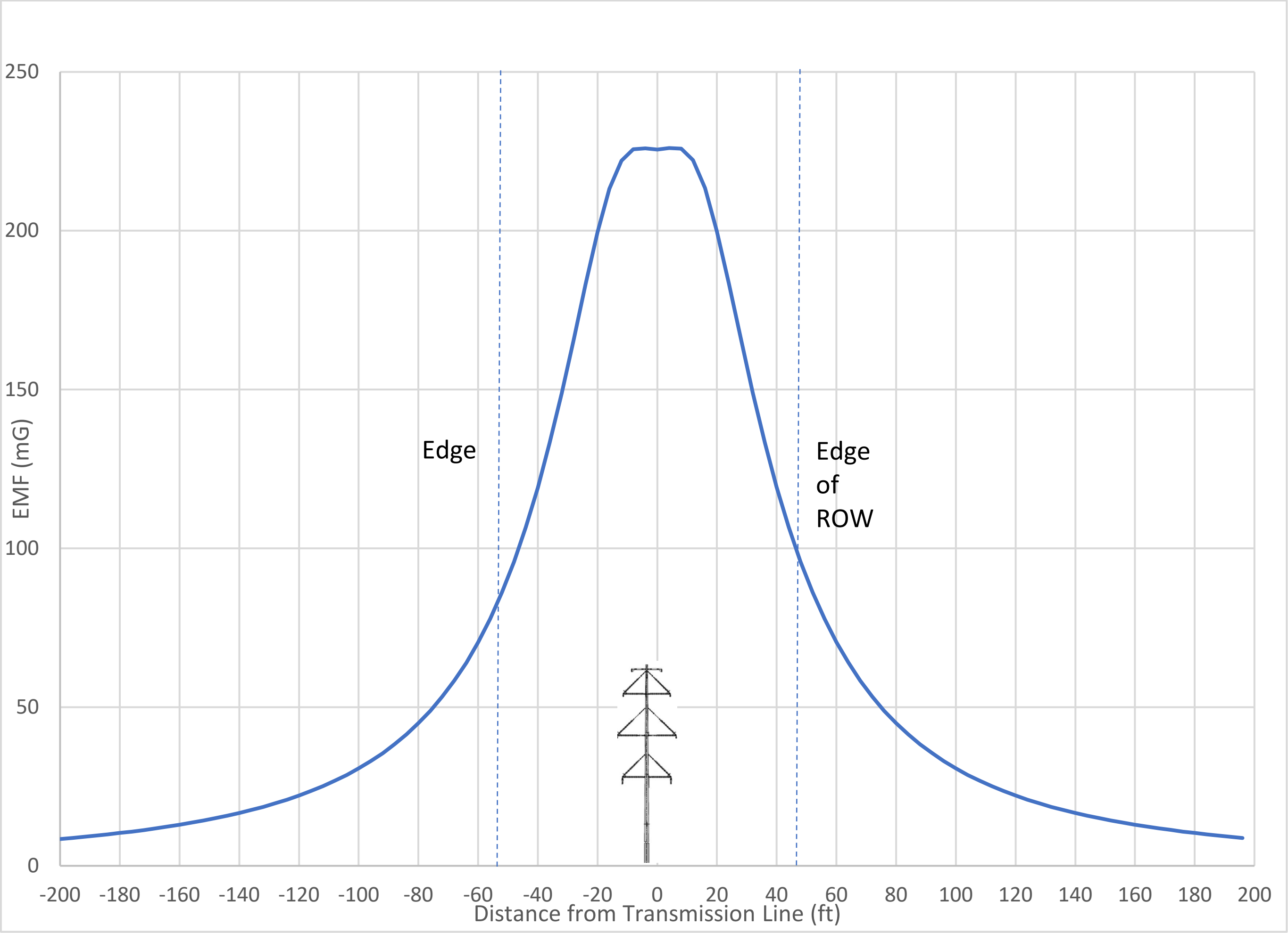
Nolin Hills Wind Power Project

Figure AA-5

Nolin Hills Single-Circuit 230-kV Line to Stanfield Substation Electric Field

UMATILLA COUNTY, OREGON

TETRA TECH



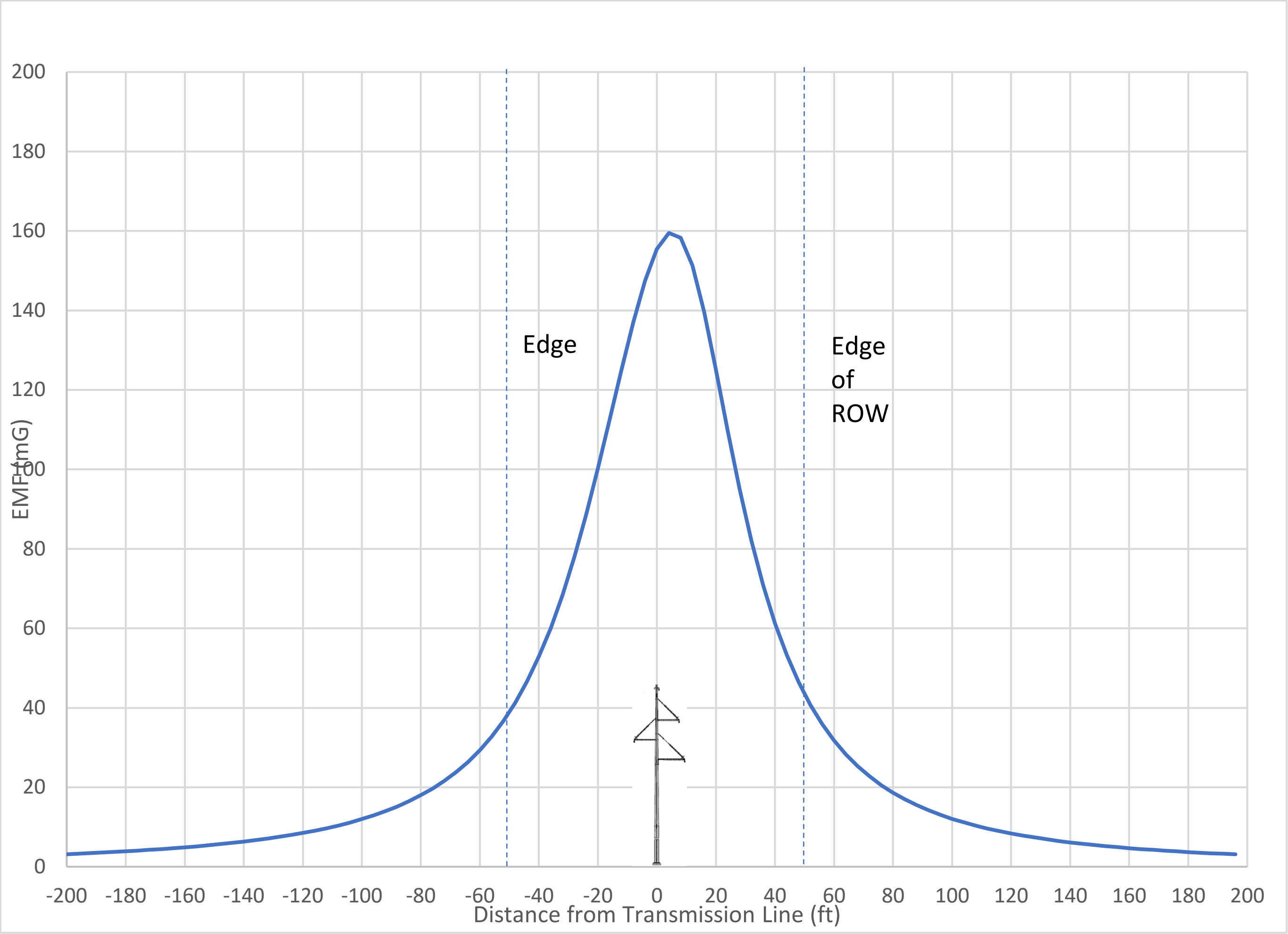
Nolin Hills Wind Power Project

Figure AA-6

Nolin Hills Double-Circuit 230-kV/115-kV Magnetic Field

UMATILLA COUNTY, OREGON

TETRA TECH



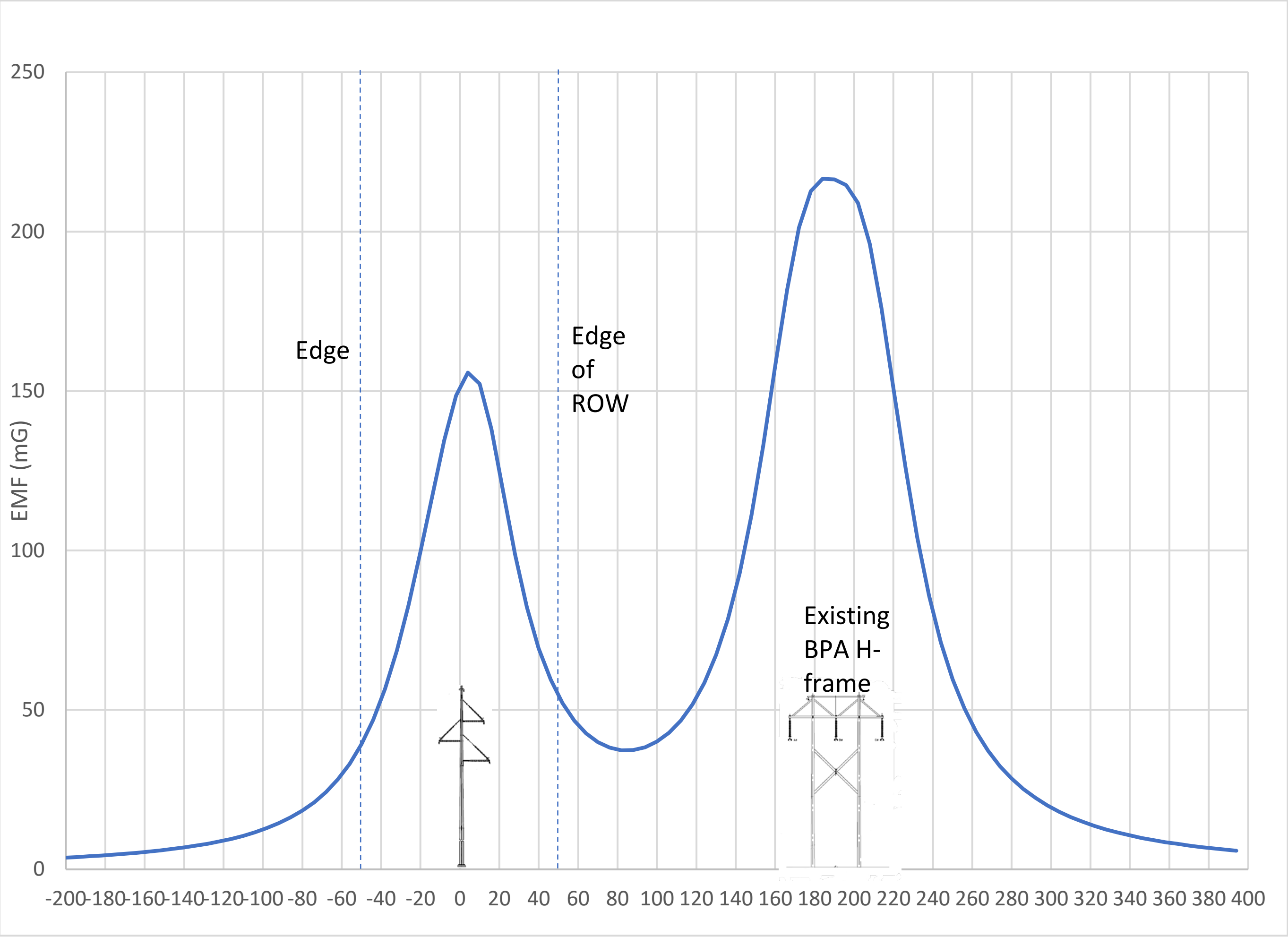
Nolin Hills Wind Power Project

Figure AA-7

Nolin Hills Single-Circuit 230-kV Magnetic Field

UMATILLA COUNTY, OREGON

TETRA TECH



Nolin Hills Wind Power Project

Figure AA-8

Nolin Hills Single-Circuit 230-kV Line to Stanfield Substation Magnetic Field

UMATILLA COUNTY, OREGON

Attachment AA-1. Results of the Bonneville Power Administration Corona and Field Effects Program for the 230-kV/115-kV Double-Circuit Transmission Line

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     ÛßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßÛ
     Û       C O R O N A   A N D   F I E L D      Û
     Û E F F E C T S   P R O G R A M   V E R.  3   Û
     Û   Source: Bonneville Power Administration   Û
     ÛÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÛ


                                INPUT DATA LIST


                 12/16/2019          14:00:51
  Nolin Hills UEC Double Circuit
  Buttercreek North
 1,0, 6, 8,0.0,   2.00,   1.00,1000.00

 (ENGLISH UNITS OPTION)

 (GRADIENTS ARE COMPUTED BY PROGRAM)

 PHYSICAL SYSTEM CONSISTS OF  8 CONDUCTORS, OF WHICH  6 ARE ENERGIZED PHASES

 OPTIONS: ALL
   4.921,  6.562,  9.842,   .000,  1.000, 75.000,  3.280,  6.700,  3.280
 '230A    ','A',   10.00,   56.90, 1,   1.345,    .000, 132.800,    .000,    .961,
 .000
 '230B    ','A',   13.00,   40.90, 1,   1.345,    .000, 132.800,-120.000,    .961,
 .000
 '230C    ','A',   10.00,   24.90, 1,   1.345,    .000, 132.800, 120.000,    .961,
 .000
 '115A    ','A',  -10.00,   56.90, 1,   1.345,    .000,  66.400,    .000,    .958,
 .000
 '115B    ','A',  -13.00,   40.90, 1,   1.345,    .000,  66.400,-120.000,    .958,
 .000
 '115C    ','A',  -10.00,   24.90, 1,   1.345,    .000,  66.400, 120.000,    .958,
 .000
 '230G    ','A',    6.00,   63.90, 1,    .500,    .000,    .000,    .000,    .000,
 .000
 '115G    ','A',   -6.00,   63.90, 1,    .500,    .000,    .000,    .000,    .000,
 .000
 100 -200.0    4.0


1ELECTRIC FIELD CALCULATIONS


  Nolin Hills UEC Double Circuit
  Buttercreek North
              DIST. FROM            MAXIMUM   SUBCON.   NO. OF     PHASE
               REFERENCE    HEIGHT  GRADIENT   DIAM.    SUBCON.    ANGLE
                 FEET        FEET   (KV/CM)    (IN)               (DEGREES)

 230A            10.00       56.90    13.38     1.35         1          .0
 230B            13.00       40.90    13.79     1.35         1      -120.0
 230C            10.00       24.90    13.17     1.35         1       120.0
 115A           -10.00       56.90     6.27     1.35         1          .0
 115B           -13.00       40.90     6.78     1.35         1      -120.0
 115C           -10.00       24.90     6.11     1.35         1       120.0
 230G             6.00       63.90     7.19      .50         1          .0
 115G            -6.00       63.90     5.26      .50         1          .0

 SENSOR HT. =  3.3 FEET

 DIST FROM
```

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REFERENCE      E-FIELD          THETA      EY-FIELD         THETAY        EX-FIELD
    THETAX   SPACE POTENTIAL
    FEET      (KV/METER)      (DEGREES)    (KV/METER)      (DEGREES)     (KV/METER)
   (DEGREES)     (VOLTS)

  -200.0          .052           88.5          .051          150.6          .001
     147.0          51.5
  -196.0          .053           88.5          .053          150.5          .001
     146.7          53.2
  -192.0          .055           88.4          .055          150.3          .001
     146.3          55.0
  -188.0          .057           88.4          .057          150.2          .002
     146.0          56.8
  -184.0          .059           88.4          .059          150.1          .002
     145.5          58.8
  -180.0          .061           88.4          .061          149.9          .002
     145.1          60.8
  -176.0          .063           88.4          .063          149.7          .002
     144.6          63.0
  -172.0          .065           88.4          .065          149.5          .002
     144.0          65.2
  -168.0          .068           88.4          .067          149.3          .002
     143.4          67.5
  -164.0          .070           88.3          .070          149.1          .002
     142.7          69.9
  -160.0          .072           88.3          .072          148.9          .002
     142.0          72.4
  -156.0          .075           88.3          .075          148.6          .002
     141.2          75.1
  -152.0          .078           88.3          .078          148.4          .002
     140.2          77.8
  -148.0          .081           88.3          .081          148.0          .002
     139.2          80.6
  -144.0          .084           88.3          .084          147.7          .002
     137.9          83.6
  -140.0          .087           88.3          .087          147.3          .003
     136.6          86.6
  -136.0          .090           88.3          .090          146.9          .003
     135.0          89.8
  -132.0          .093           88.3          .093          146.5          .003
     133.1          93.0
  -128.0          .096           88.4          .096          146.0          .003
     130.9          96.3
  -124.0          .100           88.4          .100          145.4          .003
     128.2          99.7
  -120.0          .103           88.5          .103          144.8          .003
     125.0         103.0
  -116.0          .106           88.5          .106          144.1          .003
     121.0         106.4
  -112.0          .110           88.6          .110          143.3          .003
     116.0         109.7
  -108.0          .113           88.7          .113          142.3          .003
     109.6         112.8
  -104.0          .116           88.9          .116          141.3          .003
     101.2         115.8
  -100.0          .119           89.1          .119          140.0          .003
      90.3         118.3
   -96.0          .121           89.3          .121          138.6          .003
      76.4         120.4
   -92.0          .122           89.6          .122          136.8          .003
      60.3         121.8
   -88.0          .123           90.0          .123          134.7          .004
      43.6         122.3
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-84.0          .122           90.6          .122          132.1          .005
   28.7         121.6
-80.0          .120           91.3          .120          128.8          .007
   16.4         119.2
-76.0          .116           92.2          .116          124.4          .010
    6.6         114.9
-72.0          .109           93.4          .109          118.3          .013
   -1.3         108.3
-68.0          .101           94.8          .101          109.4          .018
   -7.8          99.4
-64.0          .091           95.3          .091           95.6          .024
  -13.5          89.6
-60.0          .085           91.0          .085           73.8          .033
  -18.5          83.8
-56.0          .095           77.7          .093           44.6          .044
  -23.2          93.6
-52.0          .135           70.4          .128           18.1          .059
  -27.6         130.3
-48.0          .204           70.2          .193            -.1          .078
  -31.9         197.2
-44.0          .306           71.5          .290          -12.1          .104
  -36.0         296.5
-40.0          .445           72.8          .425          -20.5          .138
  -39.9         434.0
-36.0          .631           74.0          .607          -26.9          .180
  -43.5         618.5
-32.0          .876           75.1          .847          -32.1          .231
  -46.8         860.1
-28.0         1.188           76.3         1.154          -36.5          .288
  -49.5        1168.1
-24.0         1.570           77.6         1.533          -40.0          .343
  -51.7        1545.4
-20.0         2.012           79.2         1.976          -42.9          .383
  -53.1        1982.8
-16.0         2.487           81.0         2.456          -45.0          .394
  -53.6        2454.0
-12.0         2.954           82.8         2.930          -46.4          .372
  -53.3        2920.2
 -8.0         3.376           84.4         3.361          -47.2          .329
  -52.4        3346.4
 -4.0         3.741           85.8         3.731          -47.7          .276
  -51.5        3714.4
   .0         4.041           87.1         4.035          -48.0          .206
  -50.4        4010.2
  4.0         4.238           88.8         4.237          -48.0          .092
  -43.7        4197.3
  8.0         4.264           91.0         4.263          -47.7          .084
  108.6        4211.2
 12.0         4.059           93.8         4.050          -46.9          .276
  118.8        4000.2
 16.0         3.632           96.6         3.608          -45.2          .429
  121.2        3575.7
 20.0         3.065           99.1         3.026          -42.7          .500
  123.2        3016.8
 24.0         2.464          101.1         2.417          -39.4          .492
  125.5        2425.0
 28.0         1.908          102.7         1.862          -35.1          .434
  128.3        1878.1
 32.0         1.439          103.8         1.398          -30.0          .358
  131.6        1415.4
 36.0         1.064          104.6         1.030          -23.9          .284
  135.4        1045.8
 40.0          .776          105.2          .749          -16.7          .219
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  139.7         761.6
 44.0          .560          105.5          .540           -7.9          .166
  144.2         549.4
 48.0          .403          105.4          .389            3.0          .126
  149.0         395.5
 52.0          .294          104.4          .285           16.8          .095
  154.1         288.6
 56.0          .222          101.5          .218           33.6          .071
  159.3         219.9
 60.0          .182           97.0          .181           52.2          .053
  164.8         181.2
 64.0          .164           92.8          .164           69.9          .040
  170.6         163.6
 68.0          .159           90.4          .159           84.8          .030
  177.0         158.2
 72.0          .159           89.7          .159           96.3          .023
 -176.0         157.9
 76.0          .160           89.7          .160          105.0          .018
 -168.1         158.9
 80.0          .160           89.9          .160          111.6          .014
 -159.2         159.5
 84.0          .160           90.3          .160          116.8          .011
 -149.2         159.1
 88.0          .158           90.6          .158          120.9          .009
 -138.2         157.6
 92.0          .155           90.9          .155          124.3          .007
 -126.7         155.1
 96.0          .152           91.1          .152          127.0          .006
 -115.3         151.9
100.0          .148           91.3          .148          129.3          .006
 -104.7         148.1
104.0          .144           91.4          .144          131.3          .005
  -95.3         143.8
108.0          .139           91.5          .139          133.0          .005
  -87.2         139.3
112.0          .135           91.6          .135          134.5          .005
  -80.3         134.7
116.0          .130           91.7          .130          135.8          .004
  -74.6         129.9
120.0          .125           91.8          .125          136.9          .004
  -69.8         125.2
124.0          .121           91.8          .121          138.0          .004
  -65.8         120.6
128.0          .116           91.8          .116          138.9          .004
  -62.4         116.0
132.0          .112           91.8          .112          139.7          .004
  -59.4         111.5
136.0          .107           91.9          .107          140.4          .004
  -56.9         107.2
140.0          .103           91.9          .103          141.1          .003
  -54.7         103.1
144.0          .099           91.9          .099          141.7          .003
  -52.8          99.1
148.0          .095           91.9          .095          142.2          .003
  -51.0          95.3
152.0          .092           91.8          .092          142.8          .003
  -49.5          91.6
156.0          .088           91.8          .088          143.2          .003
  -48.2          88.1
160.0          .085           91.8          .085          143.7          .003
  -47.0          84.7
164.0          .082           91.8          .082          144.0          .003
  -45.9          81.5
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    168.0          .078           91.8          .078          144.4          .002
      -44.9          78.5
    172.0          .076           91.8          .076          144.8          .002
      -44.0          75.6
    176.0          .073           91.7          .073          145.1          .002
      -43.2          72.8
    180.0          .070           91.7          .070          145.4          .002
      -42.4          70.1
    184.0          .068           91.7          .068          145.7          .002
      -41.7          67.6
    188.0          .065           91.7          .065          145.9          .002
      -41.1          65.2
    192.0          .063           91.7          .063          146.2          .002
      -40.5          62.9
    196.0          .061           91.6          .061          146.4          .002
      -39.9          60.8
1MAGNETIC FIELD CALCULATIONS



 SENSOR HT. =  3.3 FEET

 DIST FROM
 REFERENCE    B-FIELD      THETA     BY-FIELD      THETAY     BX-FIELD      THETAX
    FEET      (GAUSS)                 (GAUSS)                  (GAUSS)

   -200.0    .00843285      21.3    .00309390      -22.3    .00785940     -31.9
   -196.0    .00876851      21.7    .00327779      -22.4    .00814865     -32.0
   -192.0    .00912435      22.2    .00347633      -22.4    .00845334     -32.1
   -188.0    .00950202      22.6    .00369100      -22.5    .00877450     -32.1
   -184.0    .00990329      23.1    .00392343      -22.5    .00911327     -32.2
   -180.0    .01033015      23.6    .00417548      -22.6    .00947083     -32.3
   -176.0    .01078479      24.1    .00444920      -22.7    .00984849     -32.4
   -172.0    .01126963      24.6    .00474696      -22.7    .01024762     -32.6
   -168.0    .01178737      25.2    .00507138      -22.8    .01066973     -32.7
   -164.0    .01234098      25.8    .00542544      -22.9    .01111641     -32.8
   -160.0    .01293380      26.4    .00581256      -23.0    .01158937     -33.0
   -156.0    .01356955      27.1    .00623657      -23.1    .01209041     -33.1
   -152.0    .01425237      27.8    .00670186      -23.2    .01262149     -33.3
   -148.0    .01498694      28.5    .00721347      -23.3    .01318464     -33.5
   -144.0    .01577847      29.2    .00777711      -23.4    .01378200     -33.6
   -140.0    .01663288      30.0    .00839939      -23.5    .01441583     -33.9
   -136.0    .01755683      30.9    .00908787      -23.6    .01508842     -34.1
   -132.0    .01855784      31.7    .00985130      -23.8    .01580212     -34.3
   -128.0    .01964448      32.7    .01069978      -23.9    .01655928     -34.6
   -124.0    .02082646      33.7    .01164500      -24.1    .01736213     -34.9
   -120.0    .02211489      34.7    .01270056      -24.3    .01821275     -35.2
   -116.0    .02352248      35.8    .01388229      -24.5    .01911288     -35.6
   -112.0    .02506379      37.0    .01520866      -24.7    .02006374     -36.0
   -108.0    .02675557      38.3    .01670124      -25.0    .02106576     -36.5
   -104.0    .02861717      39.6    .01838537      -25.3    .02211819     -37.0
   -100.0    .03067096      41.1    .02029071      -25.6    .02321862     -37.5
    -96.0    .03294291      42.6    .02245219      -25.9    .02436225     -38.2
    -92.0    .03546320      44.3    .02491084      -26.3    .02554090     -38.9
    -88.0    .03826709      46.1    .02771495      -26.8    .02674176     -39.7
    -84.0    .04139581      48.0    .03092127      -27.2    .02794555     -40.7
    -80.0    .04489767      50.1    .03459635      -27.8    .02912406     -41.7
    -76.0    .04882940      52.3    .03881796      -28.4    .03023687     -43.0
    -72.0    .05325770      54.8    .04367632      -29.1    .03122680     -44.5
    -68.0    .05826097      57.4    .04927500      -29.9    .03201389     -46.3
    -64.0    .06393124      60.4    .05573080      -30.8    .03248759     -48.5
    -60.0    .07037605      63.6    .06317162      -31.7    .03249708     -51.2
    -56.0    .07771998      67.1    .07173046      -32.9    .03184110     -54.6
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   -52.0    .08610509       71.0    .08153219     -34.1    .03026345     -59.4
   -48.0    .09568854       75.4    .09266687     -35.5    .02747894     -66.4
   -44.0    .10663440       80.3    .10513950     -37.1    .02333698     -78.1
   -40.0    .11909370       85.8    .11877900     -38.8    .01865475     258.6
   -36.0    .13316320       92.0    .13308260     -40.5    .01836988     215.0
   -32.0    .14880510       99.1    .14697230     -42.3    .02983184     176.9
   -28.0    .16571240      107.1    .15847880     -44.1    .05197949     158.2
   -24.0    .18311440      116.2    .16450070     -45.7    .08247465     148.5
   -20.0    .19959810      126.3    .16107460     -47.0    .11900990     142.9
   -16.0    .21318330      137.3    .14483580     -47.9    .15700590     139.4
   -12.0    .22202020      148.7    .11564920     -48.3    .18977180     137.4
    -8.0    .22568440      159.8    .07807843     -48.2    .21183180     136.4
    -4.0    .22594370      170.2    .03855953     -47.9    .22264530     136.1
      .0    .22560510      179.9    .00024727     -40.5    .22560490     136.1
     4.0    .22603200     -170.3    .03810817     132.0    .22281310     136.1
     8.0    .22584220     -159.9    .07773233     131.7    .21212830     136.4
    12.0    .22221890     -148.8    .11544200     131.7    .19013290     137.4
    16.0    .21339560     -137.4    .14476190     132.1    .15736740     139.4
    20.0    .19980440     -126.4    .16110170     133.0    .11932820     142.9
    24.0    .18330380     -116.3    .16458970     134.3    .08273257     148.5
    28.0    .16588060     -107.2    .15859750     135.9    .05217795     158.2
    32.0    .14895180      -99.1    .14709940     137.6    .02997665     176.8
    36.0    .13328990      -92.0    .13320610     139.4    .01845108     214.7
    40.0    .11920290      -85.8    .11889310     141.2    .01867382     258.3
    44.0    .10672840      -80.3    .10524190     142.9    .02333766     -78.3
    48.0    .09576970      -75.4    .09275721     144.4    .02747907     -66.5
    52.0    .08617536      -71.1    .08161121     145.9    .03026667     -59.5
    56.0    .07778102      -67.1    .07179925     147.1    .03184746     -54.7
    60.0    .07042927      -63.6    .06323136     148.3    .03250587     -51.2
    64.0    .06397783      -60.4    .05578266     149.3    .03249802     -48.5
    68.0    .05830192      -57.5    .04932006     150.1    .03202532     -46.3
    72.0    .05329382      -54.8    .04371552     150.9    .03123874     -44.5
    76.0    .04886138      -52.3    .03885214     151.6    .03024895     -43.0
    80.0    .04492610      -50.1    .03462622     152.2    .02913603     -41.8
    84.0    .04142116      -48.0    .03094744     152.8    .02795722     -40.7
    88.0    .03828978      -46.1    .02773795     153.3    .02675302     -39.7
    92.0    .03548356      -44.3    .02493111     153.7    .02555167     -38.9
    96.0    .03296124      -42.6    .02247011     154.1    .02437251     -38.2
   100.0    .03068752      -41.1    .02030659     154.4    .02322835     -37.6
   104.0    .02863217      -39.6    .01839948     154.7    .02212738     -37.0
   108.0    .02676919      -38.3    .01671383     155.0    .02107441     -36.5
   112.0    .02507618      -37.0    .01521991     155.3    .02007188     -36.0
   116.0    .02353379      -35.8    .01389238     155.5    .01912053     -35.6
   120.0    .02212524      -34.7    .01270963     155.7    .01821994     -35.3
   124.0    .02083595      -33.7    .01165317     155.9    .01736888     -34.9
   128.0    .01965319      -32.7    .01070717     156.1    .01656562     -34.6
   132.0    .01856587      -31.8    .00985800     156.2    .01580808     -34.4
   136.0    .01756424      -30.9    .00909395     156.4    .01509401     -34.1
   140.0    .01663973      -30.0    .00840493     156.5    .01442108     -33.9
   144.0    .01578481      -29.2    .00778216     156.7    .01378694     -33.7
   148.0    .01499282      -28.5    .00721809     156.8    .01318928     -33.5
   152.0    .01425783      -27.8    .00670609     156.9    .01262586     -33.3
   156.0    .01357463      -27.1    .00624046     157.0    .01209452     -33.1
   160.0    .01293854      -26.4    .00581613     157.1    .01159324     -33.0
   164.0    .01234541      -25.8    .00542874     157.2    .01112006     -32.8
   168.0    .01179151      -25.2    .00507442     157.2    .01067318     -32.7
   172.0    .01127351      -24.6    .00474978     157.3    .01025088     -32.6
   176.0    .01078842      -24.1    .00445182     157.4    .00985156     -32.5
   180.0    .01033356      -23.6    .00417791     157.4    .00947374     -32.3
   184.0    .00990649      -23.1    .00392569     157.5    .00911602     -32.2
   188.0    .00950503      -22.6    .00369311     157.6    .00877711     -32.1
   192.0    .00912719      -22.2    .00347830     157.6    .00845581     -32.1
   196.0    .00877119      -21.7    .00327963     157.7    .00815099     -32.0
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Attachment AA-2. Results of the Bonneville Power Administration Corona and Field Effects Program for the 230-kV Single-Circuit Transmission Line

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     Û       C O R O N A   A N D   F I E L D       Û
     Û E F F E C T S   P R O G R A M   V E R.  3   Û
     Û   Source: Bonneville Power Administration   Û
     ÛÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÛ


                              INPUT DATA LIST


                12/16/2019          13:55:54
  Nolin Hills UEC Single Circuit
  NH to Buttercreek
 1,0, 3, 4,0.0,   2.00,   1.00,1000.00

 (ENGLISH UNITS OPTION)

 (GRADIENTS ARE COMPUTED BY PROGRAM)

 PHYSICAL SYSTEM CONSISTS OF  4 CONDUCTORS, OF WHICH  3 ARE ENERGIZED PHASES

 OPTIONS: ALL
   4.921,  6.562,  9.842,   .000,  1.000, 75.000,  3.280,  6.700,  3.280
 '230A    ','A',   10.00,   44.90, 1,   1.345,    .000, 132.800,    .000,    .961,
 .000
 '230B    ','A',  -10.00,   34.90, 1,   1.345,    .000, 132.800,-120.000,    .961,
 .000
 '230C    ','A',   10.00,   24.90, 1,   1.345,    .000, 132.800, 120.000,    .961,
 .000
 '230G    ','A',    5.00,   54.15, 1,    .500,    .000,    .000,    .000,    .000,
 .000
 100 -200.0    4.0

1ELECTRIC FIELD CALCULATIONS


  Nolin Hills UEC Single Circuit
  NH to Buttercreek
             DIST. FROM            MAXIMUM   SUBCON.   NO. OF     PHASE
              REFERENCE    HEIGHT  GRADIENT   DIAM.    SUBCON.    ANGLE
                FEET        FEET   (KV/CM)    (IN)              (DEGREES)

 230A           10.00      44.90    13.39     1.35         1         .0
 230B          -10.00      34.90    12.98     1.35         1     -120.0
 230C           10.00      24.90    13.50     1.35         1      120.0
 230G            5.00      54.15     4.73      .50         1         .0

 SENSOR HT. =  3.3 FEET

 DIST FROM
 REFERENCE      E-FIELD        THETA       EY-FIELD        THETAY        EX-FIELD
     THETAX   SPACE POTENTIAL
     FEET    (KV/METER)      (DEGREES)    (KV/METER)      (DEGREES)     (KV/METER)
   (DEGREES)     (VOLTS)

   -200.0         .042          87.9          .042          104.9          .002
       91.4         42.0
   -196.0         .044          87.9          .044          104.3          .002
       90.7         43.9
   -192.0         .046          87.8          .046          103.7          .002
       90.0         46.0
   -188.0         .048          87.8          .048          103.0          .002
       89.3         48.2
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-184.0          .051           87.7          .051          102.3          .002
    88.6          50.5
-180.0          .053           87.7          .053          101.7          .002
    87.8          53.1
-176.0          .056           87.6          .056          101.0          .002
    87.1          55.8
-172.0          .059           87.6          .059          100.2          .003
    86.3          58.7
-168.0          .062           87.5          .062           99.5          .003
    85.5          61.9
-164.0          .065           87.4          .065           98.7          .003
    84.7          65.4
-160.0          .069           87.3          .069           97.9          .003
    83.9          69.1
-156.0          .073           87.3          .073           97.1          .004
    83.1          73.2
-152.0          .078           87.2          .078           96.3          .004
    82.2          77.6
-148.0          .083           87.1          .082           95.4          .004
    81.4          82.5
-144.0          .088           87.0          .088           94.5          .005
    80.5          87.8
-140.0          .094           86.9          .094           93.6          .005
    79.6          93.7
-136.0          .100           86.8          .100           92.7          .006
    78.7         100.1
-132.0          .107           86.7          .107           91.7          .006
    77.8         107.2
-128.0          .115           86.6          .115           90.7          .007
    76.8         115.0
-124.0          .124           86.5          .124           89.7          .008
    75.9         123.8
-120.0          .134           86.4          .133           88.6          .009
    74.9         133.5
-116.0          .144           86.3          .144           87.5          .010
    73.9         144.3
-112.0          .157           86.1          .156           86.4          .011
    72.9         156.4
-108.0          .170           86.0          .170           85.3          .012
    71.9         170.1
-104.0          .186           85.9          .185           84.1          .014
    70.9         185.4
-100.0          .203           85.7          .202           82.9          .016
    69.8         202.8
 -96.0          .223           85.6          .222           81.7          .018
    68.7         222.6
 -92.0          .245           85.4          .244           80.4          .020
    67.7         245.1
 -88.0          .271           85.2          .270           79.2          .023
    66.5         270.8
 -84.0          .301           85.1          .299           77.9          .027
    65.4         300.3
 -80.0          .335           84.9          .333           76.5          .031
    64.2         334.2
 -76.0          .374           84.7          .372           75.2          .035
    63.0         373.3
 -72.0          .419           84.5          .417           73.8          .041
    61.8         418.6
 -68.0          .472           84.4          .469           72.4          .047
    60.4         471.0
 -64.0          .533           84.2          .530           70.9          .055
    59.0         531.8
 -60.0          .603           84.1          .600           69.4          .063
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   57.5         602.2
-56.0          .685           84.0          .681           67.9          .073
   55.9         683.6
-52.0          .779           84.0          .775           66.3          .084
   53.9         777.2
-48.0          .886           84.0          .881           64.7          .095
   51.6         883.8
-44.0         1.007           84.1         1.001           63.0          .106
   48.7        1003.5
-40.0         1.139           84.4         1.133           61.1          .116
   44.8        1134.5
-36.0         1.279           84.9         1.274           59.0          .122
   39.1        1272.9
-32.0         1.419           85.6         1.415           56.6          .122
   29.9        1410.6
-28.0         1.546           86.6         1.543           53.7          .119
   13.9        1534.6
-24.0         1.643           88.0         1.642           49.8          .123
  -12.5        1627.4
-20.0         1.690           89.7         1.690           44.4          .162
  -42.2        1670.6
-16.0         1.678           91.3         1.677           36.2          .247
  -62.2        1656.1
-12.0         1.626           91.5         1.626           23.6          .362
  -72.7        1609.1
 -8.0         1.624           87.9         1.623            5.2          .482
  -78.2        1616.9
 -4.0         1.820           81.8         1.803          -16.3          .570
  -81.5        1802.3
   .0         2.239           79.9         2.206          -34.2          .588
  -84.5        2191.8
  4.0         2.724           82.2         2.699          -46.1          .507
  -90.0        2658.7
  8.0         3.093           86.0         3.085          -53.7          .342
 -104.5        3023.2
 12.0         3.219           90.0         3.219          -58.9          .208
 -149.7        3154.5
 16.0         3.079           93.7         3.072          -63.2          .268
  158.7        3024.3
 20.0         2.742           96.6         2.724          -67.3          .356
  140.3        2700.5
 24.0         2.319           98.6         2.292          -71.9          .381
  132.5        2288.6
 28.0         1.897           99.8         1.869          -77.1          .353
  127.7        1876.6
 32.0         1.528          100.2         1.504          -82.9          .301
  123.7        1514.6
 36.0         1.228          100.1         1.209          -89.4          .244
  119.8        1220.0
 40.0          .996           99.5          .982          -96.4          .192
  115.6         990.7
 44.0          .819           98.7          .810         -103.5          .149
  111.0         816.4
 48.0          .687           97.9          .680         -110.5          .116
  105.9         684.7
 52.0          .586           97.1          .581         -117.2          .090
  100.4         584.5
 56.0          .508           96.4          .505         -123.4          .071
   94.7         507.0
 60.0          .446           95.8          .444         -129.0          .057
   88.7         445.6
 64.0          .396           95.3          .395         -134.0          .046
   82.7         395.9
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 68.0          .355           95.0          .354         -138.4          .038
   76.8         354.7
 72.0          .320           94.7          .319         -142.4          .032
   71.2         319.9
 76.0          .290           94.5          .289         -145.9          .027
   65.9         290.1
 80.0          .264           94.3          .264         -149.1          .023
   61.0         264.2
 84.0          .242           94.1          .241         -151.9          .020
   56.5         241.5
 88.0          .222           94.0          .221         -154.5          .017
   52.4         221.5
 92.0          .204           93.9          .203         -156.8          .015
   48.7         203.7
 96.0          .188           93.7          .188         -158.9          .013
   45.3         187.9
100.0          .174           93.6          .173         -160.8          .012
   42.2         173.7
104.0          .161           93.5          .161         -162.6          .011
   39.4         161.0
108.0          .150           93.4          .149         -164.3          .010
   36.8         149.5
112.0          .139           93.3          .139         -165.8          .009
   34.5         139.2
116.0          .130           93.2          .130         -167.3          .008
   32.3         129.8
120.0          .121           93.2          .121         -168.6          .007
   30.3         121.2
124.0          .114           93.1          .113         -169.9          .006
   28.5         113.5
128.0          .106           93.0          .106         -171.1          .006
   26.7         106.4
132.0          .100           92.9          .100         -172.2          .005
   25.1          99.9
136.0          .094           92.8          .094         -173.3          .005
   23.6          94.0
140.0          .089           92.8          .089         -174.3          .004
   22.2          88.6
144.0          .084           92.7          .084         -175.3          .004
   20.9          83.6
148.0          .079           92.6          .079         -176.2          .004
   19.6          79.0
152.0          .075           92.6          .075         -177.1          .003
   18.4          74.7
156.0          .071           92.5          .071         -177.9          .003
   17.3          70.8
160.0          .067           92.4          .067         -178.8          .003
   16.2          67.2
164.0          .064           92.4          .064         -179.5          .003
   15.1          63.8
168.0          .061           92.3          .061          179.7          .003
   14.1          60.7
172.0          .058           92.3          .058          179.0          .002
   13.2          57.8
176.0          .055           92.2          .055          178.3          .002
   12.3          55.1
180.0          .053           92.2          .053          177.7          .002
   11.4          52.5
184.0          .050           92.1          .050          177.0          .002
   10.6          50.2
188.0          .048           92.1          .048          176.4          .002
    9.8          47.9
192.0          .046           92.1          .046          175.8          .002
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       9.0          45.9
    196.0          .044           92.0           .044           175.2           .002
       8.3          43.9
1MAGNETIC FIELD CALCULATIONS



 SENSOR HT. =  3.3 FEET

 DIST FROM
 REFERENCE    B-FIELD      THETA    BY-FIELD     THETAY    BX-FIELD     THETAX
     FEET    (GAUSS)                 (GAUSS)                (GAUSS)

   -200.0    .00314909     -70.3    .00307442      46.6    .00250990     -53.0
   -196.0    .00327712     -69.9    .00319568      46.4    .00261080     -53.5
   -192.0    .00341304     -69.4    .00332406      46.2    .00271803     -54.0
   -188.0    .00355752     -69.0    .00346013      45.9    .00283212     -54.6
   -184.0    .00371127     -68.5    .00360448      45.7    .00295368     -55.1
   -180.0    .00387511     -68.0    .00375777      45.4    .00308341     -55.7
   -176.0    .00404991     -67.5    .00392074      45.1    .00322206     -56.3
   -172.0    .00423668     -67.0    .00409418      44.8    .00337048     -56.9
   -168.0    .00443650     -66.4    .00427896      44.5    .00352963     -57.5
   -164.0    .00465063     -65.9    .00447607      44.2    .00370059     -58.2
   -160.0    .00488042     -65.3    .00468654      43.8    .00388459     -58.9
   -156.0    .00512744     -64.6    .00491158      43.5    .00408301     -59.7
   -152.0    .00539341     -63.9    .00515246      43.1    .00429742     -60.5
   -148.0    .00568029     -63.2    .00541061      42.7    .00452964     -61.3
   -144.0    .00599030     -62.5    .00568763      42.3    .00478172     -62.1
   -140.0    .00632595     -61.7    .00598526      41.9    .00505604     -63.0
   -136.0    .00669009     -60.9    .00630544      41.4    .00535533     -64.0
   -132.0    .00708597     -60.0    .00665029      40.9    .00568276     -65.0
   -128.0    .00751731     -59.0    .00702219      40.4    .00604202     -66.0
   -124.0    .00798837     -58.0    .00742373      39.9    .00643742     -67.1
   -120.0    .00850406     -57.0    .00785777      39.3    .00687401     -68.2
   -116.0    .00907005     -55.9    .00832747      38.7    .00735773     -69.4
   -112.0    .00969290     -54.7    .00883626      38.0    .00789561     -70.7
   -108.0    .01038026     -53.4    .00938786      37.3    .00849599     -72.0
   -104.0    .01114104     -52.0    .00998629      36.6    .00916883     -73.4
   -100.0    .01198569     -50.6    .01063582      35.7    .00992603     -74.9
    -96.0    .01292649     -49.0    .01134093      34.8    .01078189     -76.4
    -92.0    .01397795     -47.3    .01210616      33.8    .01175367     -78.0
    -88.0    .01515727     -45.4    .01293604      32.7    .01286220     -79.7
    -84.0    .01648489     -43.4    .01383473      31.5    .01413272     -81.4
    -80.0    .01798521     -41.3    .01480571      30.1    .01559583     -83.2
    -76.0    .01968743     -38.9    .01585133      28.5    .01728859     -85.1
    -72.0    .02162659     -36.3    .01697213      26.7    .01925572     -87.1
    -68.0    .02384478     -33.5    .01816624      24.6    .02155084     -89.1
    -64.0    .02639260     -30.3    .01942887      22.1    .02423745     268.8
    -60.0    .02933070     -26.9    .02075277      19.1    .02738919     266.6
    -56.0    .03273150     -23.0    .02213101      15.5    .03108843     264.4
    -52.0    .03668060     -18.7    .02356561      10.9    .03542158     262.2
    -48.0    .04127759     -13.9    .02508878       5.1    .04046823     259.9
    -44.0    .04663524      -8.6    .02680904      -2.2    .04627957     257.6
    -40.0    .05287560      -2.5    .02899706     -11.5    .05283955     255.3
    -36.0    .06012062       4.3    .03220887     -22.9    .06000059     252.9
    -32.0    .06847470      12.0    .03737049     -35.7    .06738890     250.3
    -28.0    .07799604      20.6    .04565079     -48.7    .07428717     247.6
    -24.0    .08865727      30.3    .05803761     -60.3    .07953899     244.3
    -20.0    .10030120      41.1    .07480793     -69.7    .08158921     240.0
    -16.0    .11260510      53.1    .09509324     -76.7    .07888903     233.5
    -12.0    .12506610      66.2    .11658130     -81.8    .07111335     222.4
     -8.0    .13700090      80.5    .13546990     -85.7    .06215644     201.6
     -4.0    .14752380      95.8    .14689420     -89.0    .06388669     169.8
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    .0    .15548710     112.2    .14608780    267.1    .08467324    142.9
   4.0    .15949500     129.4    .13067450    260.9    .11433190    128.0
   8.0    .15824690     147.2    .10412420    249.3    .13830260    119.8
  12.0    .15127460     164.8    .07832495    227.6    .14714190    114.3
  16.0    .13950390    -178.3    .06799472    196.8    .13945660    109.5
  20.0    .12492580    -162.7    .07163842    172.0    .12080710    104.1
  24.0    .10963260    -148.8    .07625270    157.6    .09871171     97.5
  28.0    .09510680    -136.5    .07640863    149.1    .07852692     89.5
  32.0    .08210028    -125.8    .07255061    143.4    .06253964     80.1
  36.0    .07083938    -116.5    .06643008    139.0    .05089280     70.0
  40.0    .06126333    -108.4    .05949540    135.4    .04273105     60.0
  44.0    .05318855    -101.3    .05263657    132.1    .03698835     50.7
  48.0    .04639819     -95.1    .04630633    129.0    .03278099     42.6
  52.0    .04068386     -89.6    .04068338    126.1    .02951113     35.8
  56.0    .03586180     -84.8    .03579505    123.2    .02682170     30.1
  60.0    .03177660     -80.5    .03159434    120.5    .02451413     25.4
  64.0    .02829966     -76.6    .02800389    117.9    .02248084     21.5
  68.0    .02532572     -73.2    .02493925    115.4    .02066248     18.2
  72.0    .02276910     -70.2    .02232020    112.9    .01902397     15.3
  76.0    .02056005     -67.5    .02007539    110.6    .01754225     12.9
  80.0    .01864183     -65.1    .01814367    108.5    .01620010     10.7
  84.0    .01696808     -62.9    .01647365    106.4    .01498342      8.9
  88.0    .01550086     -61.0    .01502271    104.5    .01387985      7.2
  92.0    .01420893     -59.3    .01375566    102.6    .01287832      5.7
  96.0    .01306653     -57.8    .01264358    100.9    .01196873      4.3
 100.0    .01205223     -56.5    .01166265     99.3    .01114189      3.1
 104.0    .01114823     -55.4    .01079325     97.7    .01038946      1.9
 108.0    .01033957     -54.4    .01001917     96.3    .00970391       .9
 112.0    .00961370     -53.6    .00932695     94.9    .00907843      -.1
 116.0    .00896000     -53.0    .00870539     93.7    .00850694     -1.0
 120.0    .00836948     -52.5    .00814510     92.5    .00798398     -1.8
 124.0    .00783445     -52.2    .00763820     91.3    .00750468     -2.6
 128.0    .00734836     -52.1    .00717804     90.3    .00706468     -3.3
 132.0    .00690557     -52.2    .00675896     89.3    .00666012     -4.0
 136.0    .00650123     -52.5    .00637614     88.3    .00628754     -4.7
 140.0    .00613115     -53.0    .00602546     87.4    .00594386     -5.3
 144.0    .00579167     -53.7    .00570336     86.6    .00562633     -5.9
 148.0    .00547965     -54.8    .00540677     85.8    .00533250     -6.5
 152.0    .00519230     -56.1    .00513302     85.0    .00506020     -7.0
 156.0    .00492723     -57.7    .00487980     84.3    .00480745     -7.5
 160.0    .00468231     -59.7    .00464507     83.6    .00457252     -8.0
 164.0    .00445565     -62.0    .00442705     83.0    .00435383     -8.4
 168.0    .00424560     -64.6    .00422418     82.4    .00414997     -8.9
 172.0    .00405064     -67.4    .00403505     81.8    .00395968     -9.3
 176.0    .00386944     -70.4    .00385845     81.2    .00378182     -9.7
 180.0    .00370074     -73.4    .00369328     80.7    .00361537    -10.1
 184.0    .00354342     -76.4    .00353856     80.2    .00345940    -10.5
 188.0    .00339641     -79.2    .00339342     79.7    .00331307    -10.8
 192.0    .00325880     -81.8    .00325708     79.2    .00317562    -11.2
 196.0    .00312972     -84.1    .00312884     78.8    .00304637    -11.5
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Attachment AA-3. Results of the Bonneville Power Administration Corona and Field Effects Program for the 230-kV Single-Circuit Transmission Line to the Stanfield Substation

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    ÛßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßßÛ
    Û       C O R O N A   A N D   F I E L D      Û
    Û E F F E C T S   P R O G R A M   V E R. 3   Û
    Û   Source: Bonneville Power Administration   Û
    ÛÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÜÛ


                                INPUT DATA LIST


                  5/13/2021         13:56:14
  Nolin Hills BPA to Stanfield
  with nearby 230 kV H frame circuit Peak Power
 1,0, 6, 7,0.0,   2.00,   1.00,1000.00

 (ENGLISH UNITS OPTION)

 (GRADIENTS ARE COMPUTED BY PROGRAM)

 PHYSICAL SYSTEM CONSISTS OF  7 CONDUCTORS, OF WHICH  6 ARE ENERGIZED PHASES

 OPTIONS: MF,EF,AN
   4.921,  6.562,  9.842,   .000,  1.000, 75.000,  3.280,  6.700,  3.280
 '230A    ','A',   10.00,   44.90, 1,   1.345,    .000, 132.800,    .000,    .961,
  .000
 '230B    ','A',  -10.00,   34.90, 1,   1.345,    .000, 132.800, 120.000,    .961,
  .000
 '230C    ','A',   10.00,   24.90, 1,   1.345,    .000, 132.800,-120.000,    .961,
  .000
 '230HA   ','A',  170.00,   30.00, 1,   1.345,    .000, 132.800,    .000,   1.066,
  .000
 '230HB   ','A',  190.00,   30.00, 1,   1.345,    .000, 132.800, 120.000,   1.066,
  .000
 '230HC   ','A',  210.00,   30.00, 1,   1.345,    .000, 132.800,-120.000,   1.066,
  .000
 '230G    ','A',    5.00,   54.15, 1,    .500,    .000,    .000,    .000,    .000,
  .000
 100 -200.0    6.0
1AUDIBLE NOISE CALCULATION - RAIN


 DIST FROM    TOTALS
 REFERENCE    L5       L50    230A     230B     230C     230HA    230HB    230HC
  (FEET)     (DBA)    (DBA)


   -200.0     39.0     35.5     29.4     28.4     30.1     24.1     27.1     23.8
   -194.0     39.2     35.7     29.5     28.6     30.2     24.2     27.1     23.9
   -188.0     39.3     35.8     29.7     28.7     30.3     24.3     27.2     24.0
   -182.0     39.4     35.9     29.8     28.9     30.5     24.4     27.3     24.0
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 -176.0    39.6    36.1    30.0    29.1    30.7    24.5    27.4    24.1
 -170.0    39.7    36.2    30.1    29.2    30.8    24.5    27.4    24.2
 -164.0    39.9    36.4    30.3    29.4    31.0    24.6    27.5    24.3
 -158.0    40.0    36.5    30.4    29.6    31.1    24.7    27.6    24.3
 -152.0    40.2    36.7    30.6    29.8    31.3    24.8    27.7    24.4
 -146.0    40.3    36.8    30.8    30.0    31.5    24.9    27.8    24.5
 -140.0    40.5    37.0    31.0    30.2    31.7    25.0    27.9    24.6
 -134.0    40.7    37.2    31.2    30.4    31.9    25.1    28.0    24.7
 -128.0    40.8    37.3    31.4    30.7    32.1    25.2    28.1    24.8
 -122.0    41.0    37.5    31.6    30.9    32.3    25.3    28.2    24.9
 -116.0    41.2    37.7    31.8    31.2    32.5    25.4    28.2    24.9
 -110.0    41.4    37.9    32.0    31.4    32.8    25.5    28.3    25.0
 -104.0    41.7    38.2    32.2    31.7    33.0    25.6    28.4    25.1
  -98.0    41.9    38.4    32.4    32.0    33.3    25.7    28.5    25.2
  -92.0    42.1    38.6    32.7    32.3    33.6    25.8    28.6    25.3
  -86.0    42.4    38.9    33.0    32.6    33.8    25.9    28.8    25.4
  -80.0    42.7    39.2    33.2    33.0    34.2    26.0    28.9    25.5
  -74.0    42.9    39.4    33.5    33.4    34.5    26.2    29.0    25.6
  -68.0    43.2    39.7    33.8    33.8    34.8    26.3    29.1    25.7
  -62.0    43.6    40.1    34.1    34.2    35.2    26.4    29.2    25.8
  -56.0    43.9    40.4    34.4    34.6    35.6    26.5    29.3    25.9
  -50.0    44.3    40.8    34.8    35.1    36.0    26.7    29.4    26.1
  -44.0    44.7    41.2    35.1    35.6    36.5    26.8    29.6    26.2
  -38.0    45.1    41.6    35.5    36.1    37.0    26.9    29.7    26.3
  -32.0    45.5    42.0    35.8    36.5    37.5    27.1    29.8    26.4
  -26.0    46.0    42.5    36.2    37.0    38.1    27.2    30.0    26.5
  -20.0    46.4    42.9    36.6    37.3    38.8    27.4    30.1    26.7
  -14.0    46.9    43.4    36.9    37.6    39.5    27.5    30.2    26.8
   -8.0    47.3    43.8    37.2    37.6    40.3    27.7    30.4    26.9
   -2.0    47.6    44.1    37.5    37.4    41.0    27.9    30.5    27.1
    4.0    47.9    44.4    37.6    37.1    41.5    28.0    30.7    27.2
   10.0    47.9    44.4    37.7    36.7    41.7    28.2    30.8    27.3
   16.0    47.8    44.3    37.6    36.2    41.5    28.4    31.0    27.5
   22.0    47.4    43.9    37.5    35.7    41.0    28.6    31.2    27.6
   28.0    46.9    43.4    37.2    35.2    40.3    28.8    31.4    27.8
   34.0    46.4    42.9    36.9    34.8    39.5    29.0    31.5    28.0
   40.0    46.0    42.5    36.6    34.3    38.8    29.2    31.7    28.1
   46.0    45.6    42.1    36.2    33.9    38.1    29.4    31.9    28.3
   52.0    45.3    41.8    35.8    33.5    37.5    29.7    32.1    28.5
   58.0    45.0    41.5    35.5    33.1    37.0    29.9    32.3    28.7
   64.0    44.7    41.2    35.1    32.8    36.5    30.2    32.6    28.9
   70.0    44.5    41.0    34.8    32.4    36.0    30.5    32.8    29.1
   76.0    44.3    40.8    34.4    32.1    35.6    30.7    33.0    29.3
   82.0    44.2    40.7    34.1    31.8    35.2    31.0    33.3    29.5
   88.0    44.1    40.6    33.8    31.5    34.8    31.4    33.6    29.7
   94.0    44.0    40.5    33.5    31.3    34.5    31.7    33.8    30.0
  100.0    44.0    40.5    33.2    31.0    34.2    32.1    34.1    30.2
  106.0    44.0    40.5    33.0    30.8    33.8    32.5    34.5    30.5
  112.0    44.1    40.6    32.7    30.5    33.6    32.9    34.8    30.8
  118.0    44.2    40.7    32.4    30.3    33.3    33.3    35.1    31.0
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    124.0     44.3     40.8     32.2     30.1     33.0     33.8     35.5     31.4
    130.0     44.5     41.0     32.0     29.9     32.8     34.3     35.9     31.7
    136.0     44.7     41.2     31.8     29.7     32.5     34.9     36.4     32.0
    142.0     45.0     41.5     31.6     29.5     32.3     35.5     36.8     32.4
    148.0     45.3     41.8     31.4     29.3     32.1     36.0     37.3     32.8
    154.0     45.7     42.2     31.2     29.1     31.9     36.6     37.9     33.2
    160.0     46.0     42.5     31.0     28.9     31.7     37.1     38.4     33.7
    166.0     46.4     42.9     30.8     28.8     31.5     37.4     39.0     34.2
    172.0     46.7     43.2     30.6     28.6     31.3     37.4     39.6     34.7
    178.0     46.9     43.4     30.4     28.5     31.1     37.2     40.1     35.3
    184.0     47.1     43.6     30.3     28.3     31.0     36.8     40.5     35.8
    190.0     47.1     43.6     30.1     28.2     30.8     36.2     40.6     36.4
    196.0     47.1     43.6     30.0     28.0     30.7     35.7     40.5     37.0
    202.0     46.9     43.4     29.8     27.9     30.5     35.1     40.1     37.4
    208.0     46.6     43.1     29.7     27.7     30.3     34.5     39.6     37.6
    214.0     46.2     42.7     29.5     27.6     30.2     34.0     39.0     37.6
    220.0     45.8     42.3     29.4     27.5     30.1     33.5     38.4     37.3
    226.0     45.3     41.8     29.3     27.4     29.9     33.0     37.9     36.8
    232.0     44.9     41.4     29.1     27.2     29.8     32.6     37.3     36.2
    238.0     44.4     40.9     29.0     27.1     29.7     32.2     36.8     35.7
    244.0     44.0     40.5     28.9     27.0     29.5     31.8     36.4     35.1
    250.0     43.6     40.1     28.7     26.9     29.4     31.5     35.9     34.5
    256.0     43.2     39.7     28.6     26.8     29.3     31.2     35.5     34.0
    262.0     42.9     39.4     28.5     26.7     29.2     30.8     35.1     33.5
    268.0     42.6     39.1     28.4     26.6     29.0     30.6     34.8     33.1
    274.0     42.3     38.8     28.3     26.5     28.9     30.3     34.5     32.7
    280.0     42.0     38.5     28.2     26.3     28.8     30.0     34.1     32.3
    286.0     41.8     38.3     28.1     26.2     28.7     29.8     33.8     31.9
    292.0     41.5     38.0     28.0     26.1     28.6     29.5     33.6     31.6
    298.0     41.3     37.8     27.9     26.1     28.5     29.3     33.3     31.2
    304.0     41.1     37.6     27.8     26.0     28.4     29.1     33.0     30.9
    310.0     40.9     37.4     27.7     25.9     28.3     28.9     32.8     30.7
    316.0     40.7     37.2     27.6     25.8     28.2     28.7     32.6     30.4
    322.0     40.5     37.0     27.5     25.7     28.1     28.5     32.3     30.1
    328.0     40.3     36.8     27.4     25.6     28.0     28.3     32.1     29.9
    334.0     40.2     36.7     27.3     25.5     27.9     28.1     31.9     29.6
    340.0     40.0     36.5     27.2     25.4     27.8     27.9     31.7     29.4
    346.0     39.8     36.3     27.1     25.3     27.7     27.8     31.5     29.2
    352.0     39.7     36.2     27.0     25.3     27.7     27.6     31.4     29.0
    358.0     39.5     36.0     26.9     25.2     27.6     27.4     31.2     28.8
    364.0     39.4     35.9     26.9     25.1     27.5     27.3     31.0     28.6
    370.0     39.3     35.8     26.8     25.0     27.4     27.1     30.8     28.4
    376.0     39.1     35.6     26.7     24.9     27.3     27.0     30.7     28.2
    382.0     39.0     35.5     26.6     24.9     27.2     26.9     30.5     28.1
    388.0     38.9     35.4     26.5     24.8     27.2     26.7     30.4     27.9
    394.0     38.8     35.3     26.5     24.7     27.1     26.6     30.2     27.7
1AUDIBLE NOISE CALCULATION - FAIR


 DIST FROM    TOTALS
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 REFERENCE     L5       L50    230A     230B     230C     230HA    230HB    230HC
  (FEET)      (DBA)    (DBA)


  -200.0      14.0     10.5      4.4      3.4      5.1      -.9      2.1     -1.2
  -194.0      14.2     10.7      4.5      3.6      5.2      -.8      2.1     -1.1
  -188.0      14.3     10.8      4.7      3.7      5.3      -.7      2.2     -1.0
  -182.0      14.4     10.9      4.8      3.9      5.5      -.6      2.3     -1.0
  -176.0      14.6     11.1      5.0      4.1      5.7      -.5      2.4      -.9
  -170.0      14.7     11.2      5.1      4.2      5.8      -.5      2.4      -.8
  -164.0      14.9     11.4      5.3      4.4      6.0      -.4      2.5      -.7
  -158.0      15.0     11.5      5.4      4.6      6.1      -.3      2.6      -.7
  -152.0      15.2     11.7      5.6      4.8      6.3      -.2      2.7      -.6
  -146.0      15.3     11.8      5.8      5.0      6.5      -.1      2.8      -.5
  -140.0      15.5     12.0      6.0      5.2      6.7       .0      2.9      -.4
  -134.0      15.7     12.2      6.2      5.4      6.9       .1      3.0      -.3
  -128.0      15.8     12.3      6.4      5.7      7.1       .2      3.1      -.2
  -122.0      16.0     12.5      6.6      5.9      7.3       .3      3.2      -.1
  -116.0      16.2     12.7      6.8      6.2      7.5       .4      3.2      -.1
  -110.0      16.4     12.9      7.0      6.4      7.8       .5      3.3       .0
  -104.0      16.7     13.2      7.2      6.7      8.0       .6      3.4       .1
   -98.0      16.9     13.4      7.4      7.0      8.3       .7      3.5       .2
   -92.0      17.1     13.6      7.7      7.3      8.6       .8      3.6       .3
   -86.0      17.4     13.9      8.0      7.6      8.8       .9      3.8       .4
   -80.0      17.7     14.2      8.2      8.0      9.2      1.0      3.9       .5
   -74.0      17.9     14.4      8.5      8.4      9.5      1.2      4.0       .6
   -68.0      18.2     14.7      8.8      8.8      9.8      1.3      4.1       .7
   -62.0      18.6     15.1      9.1      9.2     10.2      1.4      4.2       .8
   -56.0      18.9     15.4      9.4      9.6     10.6      1.5      4.3       .9
   -50.0      19.3     15.8      9.8     10.1     11.0      1.7      4.4      1.1
   -44.0      19.7     16.2     10.1     10.6     11.5      1.8      4.6      1.2
   -38.0      20.1     16.6     10.5     11.1     12.0      1.9      4.7      1.3
   -32.0      20.5     17.0     10.8     11.5     12.5      2.1      4.8      1.4
   -26.0      21.0     17.5     11.2     12.0     13.1      2.2      5.0      1.5
   -20.0      21.4     17.9     11.6     12.3     13.8      2.4      5.1      1.7
   -14.0      21.9     18.4     11.9     12.6     14.5      2.5      5.2      1.8
    -8.0      22.3     18.8     12.2     12.6     15.3      2.7      5.4      1.9
    -2.0      22.6     19.1     12.5     12.4     16.0      2.9      5.5      2.1
     4.0      22.9     19.4     12.6     12.1     16.5      3.0      5.7      2.2
    10.0      22.9     19.4     12.7     11.7     16.7      3.2      5.8      2.3
    16.0      22.8     19.3     12.6     11.2     16.5      3.4      6.0      2.5
    22.0      22.4     18.9     12.5     10.7     16.0      3.6      6.2      2.6
    28.0      21.9     18.4     12.2     10.2     15.3      3.8      6.4      2.8
    34.0      21.4     17.9     11.9      9.8     14.5      4.0      6.5      3.0
    40.0      21.0     17.5     11.6      9.3     13.8      4.2      6.7      3.1
    46.0      20.6     17.1     11.2      8.9     13.1      4.4      6.9      3.3
    52.0      20.3     16.8     10.8      8.5     12.5      4.7      7.1      3.5
    58.0      20.0     16.5     10.5      8.1     12.0      4.9      7.3      3.7
    64.0      19.7     16.2     10.1      7.8     11.5      5.2      7.6      3.9
    70.0      19.5     16.0      9.8      7.4     11.0      5.5      7.8      4.1
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  76.0      19.3      15.8       9.4       7.1      10.6       5.7       8.0       4.3
  82.0      19.2      15.7       9.1       6.8      10.2       6.0       8.3       4.5
  88.0      19.1      15.6       8.8       6.5       9.8       6.4       8.6       4.7
  94.0      19.0      15.5       8.5       6.3       9.5       6.7       8.8       5.0
 100.0      19.0      15.5       8.2       6.0       9.2       7.1       9.1       5.2
 106.0      19.0      15.5       8.0       5.8       8.8       7.5       9.5       5.5
 112.0      19.1      15.6       7.7       5.5       8.6       7.9       9.8       5.8
 118.0      19.2      15.7       7.4       5.3       8.3       8.3      10.1       6.0
 124.0      19.3      15.8       7.2       5.1       8.0       8.8      10.5       6.4
 130.0      19.5      16.0       7.0       4.9       7.8       9.3      10.9       6.7
 136.0      19.7      16.2       6.8       4.7       7.5       9.9      11.4       7.0
 142.0      20.0      16.5       6.6       4.5       7.3      10.5      11.8       7.4
 148.0      20.3      16.8       6.4       4.3       7.1      11.0      12.3       7.8
 154.0      20.7      17.2       6.2       4.1       6.9      11.6      12.9       8.2
 160.0      21.0      17.5       6.0       3.9       6.7      12.1      13.4       8.7
 166.0      21.4      17.9       5.8       3.8       6.5      12.4      14.0       9.2
 172.0      21.7      18.2       5.6       3.6       6.3      12.4      14.6       9.7
 178.0      21.9      18.4       5.4       3.5       6.1      12.2      15.1      10.3
 184.0      22.1      18.6       5.3       3.3       6.0      11.8      15.5      10.8
 190.0      22.1      18.6       5.1       3.2       5.8      11.2      15.6      11.4
 196.0      22.1      18.6       5.0       3.0       5.7      10.7      15.5      12.0
 202.0      21.9      18.4       4.8       2.9       5.5      10.1      15.1      12.4
 208.0      21.6      18.1       4.7       2.7       5.3       9.5      14.6      12.6
 214.0      21.2      17.7       4.5       2.6       5.2       9.0      14.0      12.6
 220.0      20.8      17.3       4.4       2.5       5.1       8.5      13.4      12.3
 226.0      20.3      16.8       4.3       2.4       4.9       8.0      12.9      11.8
 232.0      19.9      16.4       4.1       2.2       4.8       7.6      12.3      11.2
 238.0      19.4      15.9       4.0       2.1       4.7       7.2      11.8      10.7
 244.0      19.0      15.5       3.9       2.0       4.5       6.8      11.4      10.1
 250.0      18.6      15.1       3.7       1.9       4.4       6.5      10.9       9.5
 256.0      18.2      14.7       3.6       1.8       4.3       6.2      10.5       9.0
 262.0      17.9      14.4       3.5       1.7       4.2       5.8      10.1       8.5
 268.0      17.6      14.1       3.4       1.6       4.0       5.6       9.8       8.1
 274.0      17.3      13.8       3.3       1.5       3.9       5.3       9.5       7.7
 280.0      17.0      13.5       3.2       1.3       3.8       5.0       9.1       7.3
 286.0      16.8      13.3       3.1       1.2       3.7       4.8       8.8       6.9
 292.0      16.5      13.0       3.0       1.1       3.6       4.5       8.6       6.6
 298.0      16.3      12.8       2.9       1.1       3.5       4.3       8.3       6.2
 304.0      16.1      12.6       2.8       1.0       3.4       4.1       8.0       5.9
 310.0      15.9      12.4       2.7        .9       3.3       3.9       7.8       5.7
 316.0      15.7      12.2       2.6        .8       3.2       3.7       7.6       5.4
 322.0      15.5      12.0       2.5        .7       3.1       3.5       7.3       5.1
 328.0      15.3      11.8       2.4        .6       3.0       3.3       7.1       4.9
 334.0      15.2      11.7       2.3        .5       2.9       3.1       6.9       4.6
 340.0      15.0      11.5       2.2        .4       2.8       2.9       6.7       4.4
 346.0      14.8      11.3       2.1        .3       2.7       2.8       6.5       4.2
 352.0      14.7      11.2       2.0        .3       2.7       2.6       6.4       4.0
 358.0      14.5      11.0       1.9        .2       2.6       2.4       6.2       3.8
 364.0      14.4      10.9       1.9        .1       2.5       2.3       6.0       3.6
 370.0      14.3      10.8       1.8        .0       2.4       2.1       5.8       3.4
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    376.0     14.1     10.6      1.7      -.1      2.3      2.0      5.7      3.2
    382.0     14.0     10.5      1.6      -.1      2.2      1.9      5.5      3.1
    388.0     13.9     10.4      1.5      -.2      2.2      1.7      5.4      2.9
    394.0     13.8     10.3      1.5      -.3      2.1      1.6      5.2      2.7
1ELECTRIC FIELD CALCULATIONS


  Nolin Hills BPA to Stanfield
  with nearby 230 kV H frame circuit Peak Power
              DIST. FROM            MAXIMUM   SUBCON.   NO. OF     PHASE
               REFERENCE    HEIGHT  GRADIENT   DIAM.    SUBCON.    ANGLE
                 FEET        FEET   (KV/CM)    (IN)              (DEGREES)

 230A            10.00       44.90    13.36     1.35         1          .0
 230B           -10.00       34.90    12.98     1.35         1       120.0
 230C            10.00       24.90    13.52     1.35         1      -120.0
 230HA          170.00       30.00    12.73     1.35         1          .0
 230HB          190.00       30.00    13.53     1.35         1       120.0
 230HC          210.00       30.00    12.78     1.35         1      -120.0
 230G             5.00       54.15     4.81      .50         1          .0

 SENSOR HT. =  3.3 FEET

 DIST FROM
 REFERENCE       E-FIELD         THETA       EY-FIELD         THETAY         EX-FIELD
      THETAX   SPACE POTENTIAL
     FEET      (KV/METER)      (DEGREES)    (KV/METER)      (DEGREES)
(KV/METER)     (DEGREES)     (VOLTS)

   -200.0          .043           88.0          .043         -109.9           .002
       -94.6          43.5
   -194.0          .046           87.9          .046         -108.9           .002
       -93.5          46.4
   -188.0          .050           87.8          .050         -107.8           .002
       -92.3          49.6
   -182.0          .053           87.8          .053         -106.7           .002
       -91.0          53.3
   -176.0          .057           87.7          .057         -105.5           .002
       -89.7          57.3
   -170.0          .062           87.6          .062         -104.3           .003
       -88.4          61.8
   -164.0          .067           87.5          .067         -103.0           .003
       -87.1          66.8
   -158.0          .073           87.4          .073         -101.7           .003
       -85.7          72.6
   -152.0          .079           87.3          .079         -100.3           .004
       -84.3          79.0
   -146.0          .086           87.1          .086          -98.8           .005
       -82.8          86.5
   -140.0          .095           87.0          .095          -97.3           .005
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    -81.3          95.0
-134.0          .105           86.8          .105          -95.7          .006
    -79.8         104.8
-128.0          .116           86.7          .116          -94.0          .007
    -78.3         116.2
-122.0          .130           86.5          .129          -92.3          .008
    -76.7         129.5
-116.0          .145           86.3          .145          -90.5          .010
    -75.0         145.2
-110.0          .164           86.1          .163          -88.6          .011
    -73.4         163.8
-104.0          .186           85.9          .186          -86.6          .014
    -71.7         186.0
 -98.0          .213           85.7          .212          -84.6          .017
    -70.0         212.7
 -92.0          .245           85.4          .245          -82.5          .020
    -68.3         245.1
 -86.0          .285           85.2          .284          -80.4          .025
    -66.5         284.8
 -80.0          .334           84.9          .333          -78.2          .030
    -64.6         333.6
 -74.0          .395           84.6          .393          -75.9          .038
    -62.7         394.2
 -68.0          .470           84.4          .468          -73.6          .047
    -60.7         469.7
 -62.0          .565           84.2          .562          -71.3          .059
    -58.5         564.0
 -56.0          .683           84.0          .679          -68.8          .073
    -56.0         681.4
 -50.0          .828           84.0          .824          -66.3          .090
    -52.9         826.2
 -44.0         1.003           84.1          .998          -63.6          .106
    -48.8        1000.2
 -38.0         1.205           84.6         1.199          -60.6          .119
    -42.3        1199.4
 -32.0         1.414           85.6         1.410          -57.1          .122
    -29.9        1406.1
 -26.0         1.594           87.3         1.592          -52.3          .118
     -2.0        1580.8
 -20.0         1.683           89.7         1.683          -44.7          .162
     42.2        1663.8
 -14.0         1.644           91.8         1.643          -30.9          .302
     68.4        1623.5
  -8.0         1.611           87.9         1.610           -5.3          .481
     78.3        1603.9
  -2.0         1.995           80.1         1.967           26.1          .590
     83.0        1962.0
   4.0         2.709           82.1         2.684           46.3          .507
     90.2        2643.6
  10.0         3.175           88.0         3.173           56.8          .258
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   121.9        3106.0
 16.0         3.060           93.8         3.054           63.6          .272
  -158.8        3005.6
 22.0         2.515           97.8         2.491           70.2          .381
  -136.1        2478.4
 28.0         1.877           99.9         1.849           78.3          .357
  -128.2        1855.8
 34.0         1.352          100.2         1.331           88.4          .276
  -122.6        1341.7
 40.0          .987           99.2          .975          100.3          .196
  -117.0         982.8
 46.0          .755           97.5          .748          113.1          .135
  -111.0         752.9
 52.0          .612           95.7          .609          125.8          .094
  -104.9         611.0
 58.0          .524           94.0          .523          137.4          .066
   -99.3         524.1
 64.0          .471           92.7          .470          147.6          .048
   -95.4         471.1
 70.0          .440           91.6          .440          156.3          .036
   -94.4         440.2
 76.0          .425           90.6          .425          163.7          .028
   -97.7         425.4
 82.0          .423           89.6          .423          170.0          .024
  -106.7         424.0
 88.0          .435           88.7          .434          175.2          .022
  -120.7         435.3
 94.0          .459           87.9          .458          179.5          .024
  -135.7         459.6
100.0          .498           87.0          .497         -177.0          .030
  -147.6         498.5
106.0          .554           86.3          .553         -174.4          .038
  -155.5         554.7
112.0          .632           85.5          .630         -172.3          .050
  -160.4         632.2
118.0          .737           84.9          .734         -170.9          .066
  -163.4         736.8
124.0          .876           84.3          .872         -169.9          .088
  -165.3         876.1
130.0         1.061           83.8         1.055         -169.2          .115
  -166.3        1059.7
136.0         1.300           83.5         1.292         -168.7          .147
  -166.5        1297.9
142.0         1.603           83.5         1.593         -168.2          .181
  -165.8        1598.2
148.0         1.964           84.0         1.953         -167.6          .206
  -163.2        1954.9
154.0         2.346           85.2         2.338         -166.5          .199
  -156.1        2330.1
160.0         2.656           87.5         2.653         -164.3          .142
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  -129.8        2629.2
166.0         2.745           90.9         2.745         -159.9          .169
   -54.4        2706.4
172.0         2.504           95.2         2.494         -150.9          .367
   -23.0        2455.3
178.0         2.010           98.7         1.988         -133.0          .528
    -9.6        1959.0
184.0         1.554           97.3         1.543         -101.7          .569
     6.1        1509.0
190.0         1.388           90.3         1.388          -60.8          .555
    29.9        1341.6
196.0         1.529           83.0         1.519          -19.5          .567
    53.8        1485.3
202.0         1.972           81.2         1.950           12.5          .526
    69.6        1921.5
208.0         2.459           84.7         2.449           30.7          .364
    83.1        2410.5
214.0         2.694           89.1         2.693           39.8          .166
   115.4        2655.0
220.0         2.597           92.7         2.594           44.2          .144
  -168.7        2570.2
226.0         2.280           95.0         2.271           46.4          .203
  -143.2        2262.7
232.0         1.889           96.4         1.877           47.4          .211
  -136.1        1879.0
238.0         1.520           97.0         1.508           47.8          .186
  -133.4        1513.5
244.0         1.208           97.2         1.199           47.9          .152
  -132.3        1204.5
250.0          .960           97.2          .952           47.9          .119
  -131.9         957.2
256.0          .766           97.0          .760           47.8          .093
  -131.8         764.1
262.0          .616           96.7          .611           47.7          .072
  -131.9         614.5
268.0          .499           96.4          .496           47.7          .056
  -132.1         498.5
274.0          .409           96.1          .406           47.7          .044
  -132.3         408.1
280.0          .337           95.9          .336           47.7          .034
  -132.6         337.0
286.0          .281           95.6          .280           47.7          .027
  -132.8         280.6
292.0          .236           95.4          .235           47.9          .022
  -133.0         235.6
298.0          .199           95.1          .199           48.0          .018
  -133.1         199.2
304.0          .170           94.9          .169           48.2          .015
  -133.2         169.6
310.0          .145           94.8          .145           48.5          .012
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    -133.3         145.3
   316.0          .125           94.6          .125           48.8           .010
    -133.4         125.2
   322.0          .109           94.4          .108           49.1           .008
    -133.4         108.4
   328.0          .094           94.3          .094           49.5           .007
    -133.4          94.4
   334.0          .083           94.1          .082           49.9           .006
    -133.4          82.5
   340.0          .073           94.0          .072           50.4           .005
    -133.3          72.5
   346.0          .064           93.9          .064           50.9           .004
    -133.2          63.9
   352.0          .057           93.8          .056           51.4           .004
    -133.1          56.5
   358.0          .050           93.7          .050           52.0           .003
    -133.0          50.2
   364.0          .045           93.6          .045           52.6           .003
    -132.9          44.6
   370.0          .040           93.5          .040           53.2           .002
    -132.7          39.9
   376.0          .036           93.4          .036           53.9           .002
    -132.5          35.7
   382.0          .032           93.4          .032           54.6           .002
    -132.3          32.0
   388.0          .029           93.3          .029           55.4           .002
    -132.1          28.8
   394.0          .026           93.2          .026           56.2           .001
    -131.8          26.0
1MAGNETIC FIELD CALCULATIONS



 SENSOR HT. =  3.3 FEET

 DIST FROM
 REFERENCE   B-FIELD     THETA    BY-FIELD     THETAY    BX-FIELD     THETAX
     FEET    (GAUSS)               (GAUSS)                (GAUSS)

   -200.0    .00367876     129.2    .00306963    -76.4    .00270784     51.0
   -194.0    .00387734     129.4    .00323213    -75.3    .00286966     51.7
   -188.0    .00409389     129.7    .00340902    -74.1    .00304666     52.5
   -182.0    .00433075     129.9    .00360208    -73.0    .00324087     53.3
   -176.0    .00459064     130.2    .00381332    -71.8    .00345465     54.2
   -170.0    .00487674     130.5    .00404508    -70.5    .00369080     55.1
   -164.0    .00519281     130.8    .00430006    -69.2    .00395264     56.1
   -158.0    .00554332     131.2    .00458140    -67.8    .00424416     57.1
   -152.0    .00593357     131.6    .00489272    -66.4    .00457017     58.2
   -146.0    .00636993     132.0    .00523824    -64.9    .00493652     59.5
   -140.0    .00686007     132.5    .00562287    -63.3    .00535037     60.8
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-134.0    .00741328     133.0    .00605230     -61.7    .00582056      62.2
-128.0    .00804092     133.6    .00653312     -60.0    .00635812      63.7
-122.0    .00875694     134.3    .00707298     -58.3    .00697691      65.4
-116.0    .00957859     135.1    .00768062     -56.4    .00769454      67.2
-110.0    .01052734     136.0    .00836594     -54.4    .00853359      69.1
-104.0    .01163022     137.1    .00914000     -52.3    .00952329      71.2
 -98.0    .01292137     138.4    .01001469     -50.1    .01070184      73.4
 -92.0    .01444437     140.0    .01100218     -47.6    .01211960      75.9
 -86.0    .01625525     141.8    .01211366     -44.9    .01384342      78.5
 -80.0    .01842660     144.1    .01335711     -42.0    .01596254      81.3
 -74.0    .02105305     146.7    .01473353     -38.6    .01859602      84.2
 -68.0    .02425858     149.9    .01623158     -34.5    .02190178      87.4
 -62.0    .02820579     153.9    .01782182     -29.6    .02608499      90.7
 -56.0    .03310682     158.6    .01945894     -23.3    .03140047      94.1
 -50.0    .03923381     164.4    .02112271     -14.6    .03813335      97.6
 -44.0    .04692294     171.5    .02299634      -2.3    .04652284     101.2
 -38.0    .05655657    -179.8    .02600065      15.2    .05655633     104.8
 -32.0    .06849458    -169.2    .03268278      37.0    .06752094     108.7
 -26.0    .08291364    -156.2    .04691736      57.6    .07725363     113.0
 -20.0    .09953965    -140.7    .07101358      72.6    .08149006     119.0
 -14.0    .11737300    -122.3    .10258940      81.9    .07514495     130.1
  -8.0    .13459970    -101.2    .13250490      87.9    .06103883     157.3
  -2.0    .14860280     -77.3    .14562830      93.1    .07040584     205.2
   4.0    .15575750     -50.9    .12882360     102.0    .11257210     232.5
  10.0    .15229470     -23.0    .09079379     124.5    .14319840     243.7
  16.0    .13808760       4.4    .07367989     167.2    .13778990     251.3
  22.0    .11830240      29.3    .08233584     197.2    .10825340     260.2
  28.0    .09874539      50.7    .08502024     210.5    .07737918     -87.5
  34.0    .08226815      68.5    .07873068     217.4    .05578586     -71.8
  40.0    .06933741      82.9    .06900660     222.0    .04330177     -55.1
  46.0    .05948419     -85.7    .05937863     225.3    .03639898     -40.2
  52.0    .05207970     -76.8    .05119317     227.8    .03223687     -28.5
  58.0    .04658851     -70.1    .04470821     229.5    .02939215     -19.4
  64.0    .04261053     -65.0    .03977935     230.3    .02731286     -12.3
  70.0    .03986275     -61.1    .03616689     230.4    .02581791      -6.6
  76.0    .03815336     -58.1    .03364869     229.7    .02486200      -1.8
  82.0    .03736125     -55.8    .03205014     228.5    .02445185       2.3
  88.0    .03742252     -53.8    .03124299     226.7    .02462369       5.7
  94.0    .03832300     -52.1    .03113461     224.6    .02544319       8.6
 100.0    .04009583     -50.3    .03165485     222.4    .02701461      11.0
 106.0    .04282402     -48.4    .03274118     220.3    .02949599      12.8
 112.0    .04664779     -46.1    .03431892     218.3    .03312063      14.2
 118.0    .05177739     -43.4    .03626929     216.6    .03822601      15.2
 124.0    .05851076     -40.0    .03837260     215.5    .04528956      15.8
 130.0    .06725330     -35.7    .04020582     215.1    .05496234      16.1
 136.0    .07852877     -30.3    .04097021     216.0    .06806655      16.2
 142.0    .09295027     -23.5    .03927167     219.6    .08545549      16.2
 148.0    .11107570     -14.8    .03329313     230.4    .10748960      16.4
 154.0    .13301000      -3.9    .02540628     266.8    .13270770      17.1
 160.0    .15764590       9.4    .04103366     -34.0    .15561220      19.0
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    166.0    .18191190      25.1    .08692543    -10.9    .16582090     23.1
    172.0    .20133880      42.3    .14231830     -1.0    .15423050     31.9
    178.0    .21272630      59.5    .18726230      7.1    .12585520     49.8
    184.0    .21658520      75.4    .21075100     16.9    .10143210     80.4
    190.0    .21644020      89.4    .21643180     29.2    .09299503    118.1
    196.0    .21461550     103.5    .20962780     41.4    .09777759    156.8
    202.0    .20899890     119.5    .18529080     51.1    .12017970    189.0
    208.0    .19622460     136.9    .13970830     58.6    .14797570    207.8
    214.0    .17585950     154.3    .08352204     67.1    .15937520    216.9
    220.0    .15106590     170.3    .03577588     87.7    .14898930    221.1
    226.0    .12617630    -175.9    .01907771    160.8    .12585600    223.0
    232.0    .10410720    -164.5    .02980560    201.1    .10035350    223.6
    238.0    .08585000    -155.2    .03662854    211.2    .07798082    223.7
    244.0    .07123004    -147.6    .03838503    215.0    .06019758    223.5
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    382.0    .00659005     -99.3    .00650386    220.5    .00106720    226.1
    388.0    .00620735     -98.6    .00613767    220.7    .00093294    226.9
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