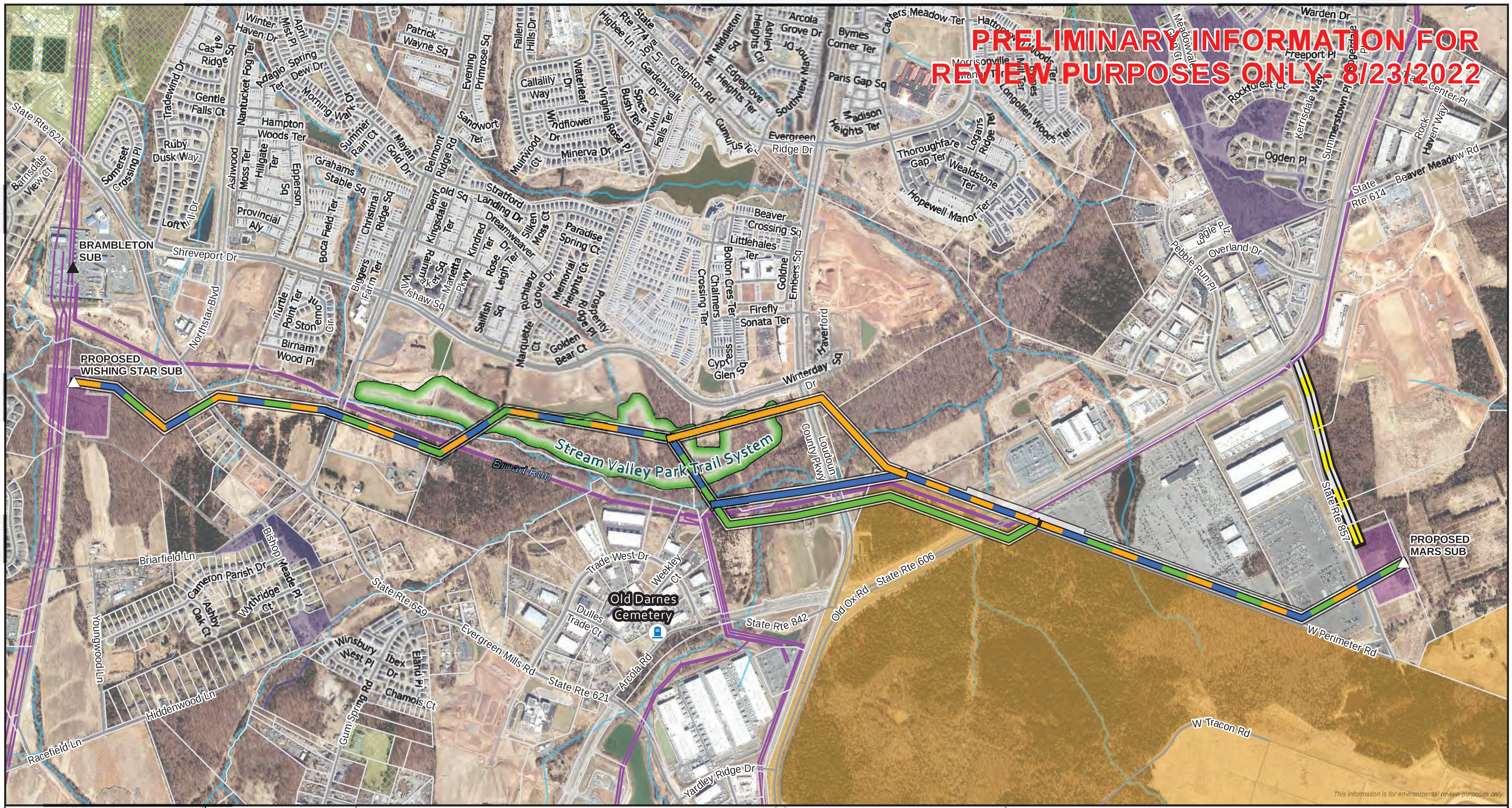

▲	Existing Substation
△	Proposed Substation
	Proposed Substation Area
	Existing Dominion Transmission Lines
	Route 1
	Route 1, 2
	Route 1, 2, 3
	Route 2
	Route 2, 3
	Route 3
	230 kV Loop
	Old Darnes Cemetery
	Stream Valley Park
	MWAA Property
	Board of Supervisors Easement
	Loudoun County Park

0 500 1,000
Feet
1:14,000

NOVA Reliability Project
Wishing Star to Mars 500-230 kV Transmission Line and Mars to Line 2137 230 kV Loop Project
Dominion Energy
Loudoun County, VA

Dominion Energy

ERM

MPLS \\USMINFS01\Data\Team\DMMV\GIS\Clients\D-F\DOM\Loudoun_500kV_ArcGIS\2022\08\04_South_Routes_Presentation_Maps\Loudoun Reliability Engagement Group.aprx_DOM_LREG_ProjectAnnouncmentMap | REVISED: 08/23/2022 | SCALE: 1:14,000 when printed at 11x17

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III. IMPACT OF LINE ON SCENIC, ENVIRONMENTAL AND HISTORIC FEATURES

K. Identify coordination with any non-governmental organizations or private citizen groups.

Response: On August 31, 2022, the Company began to solicit comments via letter from the nongovernmental organizations and private citizen groups identified below. A template of the letter, which included a Project overview map, is provided as Attachment III.K.1.

Name	Organization
Ms. Elizabeth S. Kostelny	Preservation Virginia
Mr. Thomas Gilmore	American Battlefield Trust
Mr. Jim Campi	American Battlefield Trust
Mr. Max Hokit	American Battlefield Trust
Mr. Steven Williams	Colonial National Historical Park
Ms. Eleanor Breen, PhD, RPA	Council of Virginia Archaeologists
Ms. Leighton Powell	Scenic Virginia
Ms. Elaine Chang	National Trust for Historic Preservation
Ms. Julie Bolthouse	Piedmont Environmental Council
Mr. John McCarthy	Piedmont Environmental Council
Dr. Cassandra Newby- Alexander, Dean	Norfolk State University
Mr. Roger Kirchen, Archaeologist	Virginia Department of Historic Resources
Ms. Adrienne Birge-Wilson	Virginia Department of Historic Resources
Mr. Dave Dutton	Dutton + Associates, LLC

Dominion Energy Virginia
Electric Transmission
P.O. Box 26666, Richmond, VA 23261-6666
DominionEnergy.com

Dominion Energy®

August 30, 2022

New Electric Transmission Project in Loudoun County

Dear:_____:

At Dominion Energy, we are committed to providing safe, reliable, affordable, and sustainable energy to all our customers. As such, we are moving forward with a series of electric transmission infrastructure projects designed to address the growing energy needs of Loudoun County.

The first project is to construct two new substations – named Wishing Star and Mars – and new 500 kilovolt (kV) and 230 kV transmission lines, on the same structure, between the two new substations. The new right of way is proposed to primarily be along existing transmission corridors (please see the enclosed map). These route options are not final but simply the next step in continuing the conversation with the community.

You can also view our proposed routes for the project at DominionEnergy.com/Nova. Click on the GeoVoice interactive mapping tool to explore the routes and leave a comment.

This newly proposed transmission project represents an investment that will enhance the local electric grid and improve reliability for all customers. We are committed to our public engagement process which includes working with you, as well as county, state, and community leaders to meet future energy demands.

If your time allows, you are welcome to attend our upcoming community meeting to learn more about our plans. This meeting is on **September 8, 2022, from 5p.m. to 8 p.m. at John Champe High School, 41535 Sacred Mountain St, Aldie, VA 20105.**

Please feel free to notify other relevant organizations that may have an interest in the project area. For reference, recipients of this letter include other county and statewide historic, cultural and scenic organizations and Native American Tribes.

If you would like any additional information, have questions, or would like to set up a meeting to discuss the project, please contact me by sending an email to Robert.E.Richardson@DominionEnergy.com or calling 888-291-0190.

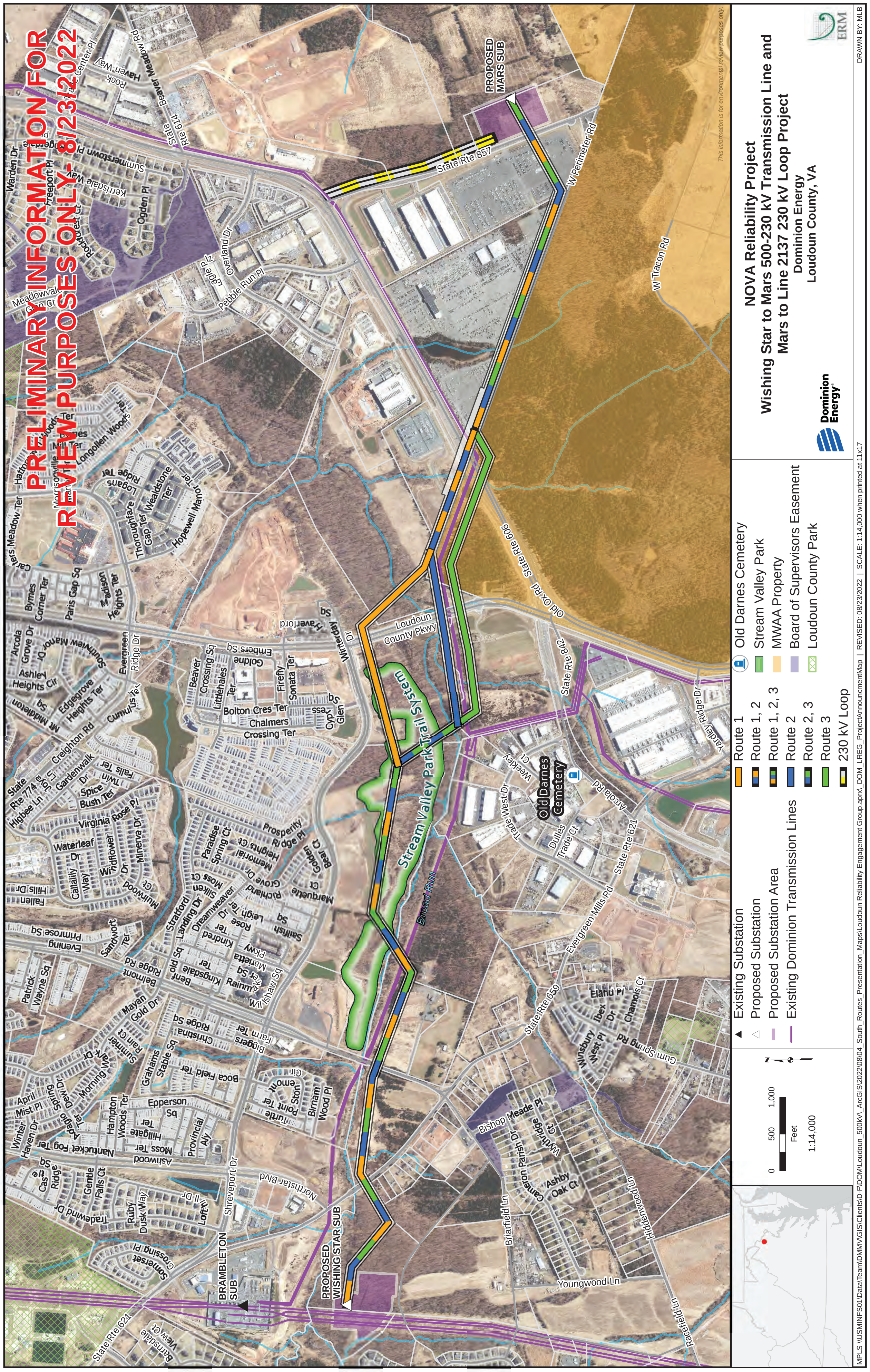
August 30, 2022
Wishing Star to Mars 500 kV-230 kV Electric Transmission Project

Thank you for your willingness to join us in our commitment to serving the community.

Sincerely,

Rob Richardson
Electric Transmission Communications

[enclosure]


PRELIMINARY INFORMATION FOR REVIEW PURPOSES ONLY- 8/23/2022
PROPOSED MARS SUB
PROPOSED WISHING STAR SUB
BRAMBLETON SUB
Stream Valley Park Trail System
Broad Run
Old Darnes Cemetery
State Rte 857
W Perimeter Rd
W Tracon Rd
State Rte 606
Old Ox Rd
Loudoun County Pkwy
State Rte 842
State Rte 621
State Rte 659
Evergreen Mills Rd
Arcola Rd
Youngwood Ln
This information is for environmental review purposes only
0 500 1,000
Feet
1:14,000
Existing Substation
Proposed Substation
Proposed Substation Area
Existing Dominion Transmission Lines
Route 1
Route 1, 2
Route 1, 2, 3
Route 2
Route 2, 3
Route 3
230 kV Loop
Old Darnes Cemetery
Stream Valley Park
MWAA Property
Board of Supervisors Easement
Loudoun County Park
NOVA Reliability Project
Wishing Star to Mars 500-230 kV Transmission Line and Mars to Line 2137 230 kV Loop Project
Dominion Energy
Loudoun County, VA
Dominion Energy
ERM
MPLS \\USMINFS01\Data\Team\DMMV\GIS\Clients\D-F\DOM\Loudoun_500kV_ArcGIS\2022\08\04_South_Routes_Presentation_Maps\Loudoun Reliability Engagement Group.aprx\ DOM_LREG_ProjectAnnouncementMap | REVISED: 08/23/2022 | SCALE: 1:14,000 when printed at 11x17
DRAWN BY: MLB

III. IMPACT OF LINE ON SCENIC, ENVIRONMENTAL AND HISTORIC FEATURES

L. Identify any environmental permits or special permissions anticipated to be needed.

Response: The permits or special permissions that are likely to be required for the proposed Project are listed below.

Potential Permits

Activity	Potential Permit	Agency/Organization
Impacts to wetlands and other waters of the U.S.	Nationwide Permit 57	U.S. Army Corps of Engineers
Section 10 Aerial Water	Subaqueous Habitat Management Permit	Virginia Marine Resource Commission
Impacts to wetlands and other waters of the U.S.	Virginia Water Protection Permit	Virginia Department of Environmental Quality
Discharge of stormwater from construction	Construction General Permit	Virginia Department of Environmental Quality
Work within VDOT rights-of-way	Land Use Permit	Virginia Department of Transportation
Airspace obstruction evaluation	FAA 7460-1	Dulles Airport

IV. HEALTH ASPECTS OF ELECTROMAGNETIC FIELDS ("EMF")

A. Provide the calculated maximum electric and magnetic field levels that are expected to occur at the edge of the ROW. If the new transmission line is to be constructed on an existing electric transmission line ROW, provide the present levels as well as the maximum levels calculated at the edge of ROW after the new line is operational.

Response: Public exposure to magnetic fields is best estimated by field levels from power lines calculated at annual average loading. For any day of the year, the EMF levels associated with average conditions provide the best estimate of potential exposure. Maximum (peak) values are less relevant as they may occur for only a few minutes or hours each year.

This section describes the levels of EMF associated with the proposed transmission lines. EMF levels are provided for future (2025) annual average and maximum (peak) loading conditions.

Existing lines – Historical average loading

EMF levels were calculated for the existing lines at the ***historical average*** load condition (1436 amps for Line #2172 and 670 amps for Line #2183) and at an operating voltage of 242 kV for each circuit when supported on the existing structures. See Attachment II.A.5.b.

These field levels were calculated at mid-span where the conductors are closest to the ground and the conductors are at an historical average load operating temperature.

EMF levels at the edge of the rights-of-way for the existing lines at the historical average loading:

Existing Lines - Historic Average Loading				
	Left Edge Looking towards Mars		**Right Edge Looking towards Mars**	
Attachment	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
II.A.5.b	0.467	27.968	0.461	13.244

Existing lines – Historical peak loading

EMF levels were calculated for the existing line at the ***historical peak*** load condition (2110 amps for Line #2172 and 2294 amps for Line #2183) and at an operating voltage of 242 kV for each circuit when supported on the existing structures. See Attachment II.A.5.b.

These field levels were calculated at mid-span where the conductors are closest to the ground and the conductors are at a historical peak load operating temperature.

EMF levels at the edge of the rights-of-way for the existing lines at the historical peak loading:

Existing Lines - Historic Peak Loading				
	Left Edge Looking toward Mars		Right Edge Looking towards Mars	
Attachment	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
II.A.5.b	0.425	28.005	0.421	34.158

Proposed Project – Projected average loading in 2025

EMF levels were calculated for the proposed Project at the ***projected average*** load condition (1034 amps for Line #2095, 630 amps for Line #2172, 300 amps for Line #2183, 374 amps for Line #2261, 79 amps for Line #2287, 967 amps for Line #2291, 906 amps for Line #2292, and 568 amps for Line #527) and at an operating voltages of 242 kV for each 230 kV circuit and 525 kV for Line #527 when supported on the proposed Project structures. See Attachments II.A.5.a, c, d, and e.

These field levels were calculated at mid-span where the conductors are closest to the ground and the conductors are at a projected average load operating temperature.

EMF levels at the edge of the rights-of-way for the proposed Project at the projected average loading:

Proposed Lines - Projected Average Loading				
	Left Edge Looking towards Mars		Right Edge Looking toward Mars	
Attachment	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
II.A.5.a	3.499	31.922	3.499	31.922
II.A.5.c	0.343	6.418	3.526	31.537
II.A.5.d	1.499	30.878	3.743	13.311
II.A.5.e	0.632	44.523	0.560	22.009

Proposed Project – Projected Peak loading in 2025

EMF levels were calculated for the proposed Project at the ***projected peak*** load condition (1724 amps for Line #2095, 926 amps for Line #2172, 1027 amps for Line #2183, 624 amps for Line #2261, 132 amps for Line #2287, 1611 amps for Line #2291, 1511 amps for Line #2292, and 947 amps for Line #527) and at an operating voltages of 242 kV for each 230 kV circuit and 525 kV for Line #527 when supported on the proposed Project structures. See Attachments II.A.5.a, c, d, and e.

These field levels were calculated at mid-span where the conductors are closest to the ground and the conductors are at a projected peak load operating temperature.

EMF levels at the edge of the rights-of-way for the proposed Project at the projected peak loading:

Proposed Lines - Projected Peak Loading				
	Left Edge Looking towards Mars		**Right Edge Looking towards Mars**	
Attachment	Electric Field (kV/m)	Magnetic Field (mG)	Electric Field (kV/m)	Magnetic Field (mG)
II.A.5.a	3.506	53.385	3.506	53.385
II.A.5.c	0.339	7.743	3.532	53.547
II.A.5.d	1.505	51.591	3.743	22.178
II.A.5.e	0.612	75.283	0.559	36.776

IV. HEALTH ASPECTS OF ELECTROMAGNETIC FIELDS ("EMF")

B. If the Applicant is of the opinion that no significant health effects will result from the construction and operation of the line, describe in detail the reasons for that opinion and provide references or citations to supporting documentation.

Response: The conclusions of multidisciplinary scientific review panels assembled by national and international scientific agencies during the past two decades are the foundation of the Company's opinion that no adverse health effects will result from the operation of the proposed Project. Each of these panels has evaluated the scientific research related to health and power-frequency EMF and provided conclusions that form the basis of guidance to governments and industries. The Company regularly monitors the recommendations of these expert panels to guide their approach to EMF.

Research on EMF and human health varies widely in approach. Some studies evaluate the effects of high, short-term EMF exposures not typically found in people's day-to-day lives on biological responses, while others evaluate the effects of common, lower EMF exposures found throughout communities. Studies also have evaluated the possibility of effects (*e.g.*, cancer, neurodegenerative diseases, and reproductive effects) of long-term exposure. Altogether, this research includes well over a hundred epidemiologic studies of people in their natural environment and many more laboratory studies of animals (*in vivo*) and isolated cells and tissues (*in vitro*). Standard scientific procedures, such as weight-of-evidence methods, were used by the expert panels assembled by agencies to identify, review, and summarize the results of this large and diverse research.

The reviews of EMF biological and health research have been conducted by numerous scientific and health agencies, including the European Health Risk Assessment Network on Electromagnetic Fields Exposure ("EFHRAN"), the International Commission on Non-Ionizing Radiation Protection ("ICNIRP"), the World Health Organization ("WHO"), the IEEE's International Committee on Electromagnetic Safety ("ICES"), the Scientific Committee on Emerging and Newly Identified Health Risks ("SCENIHR") of the European Commission, and the Swedish Radiation Safety Authority ("SSM") (formerly the Swedish Radiation Protection Authority ["SSI"]) (WHO, 2007; SCENIHR, 2009, 2015; EFHRAN, 2010, 2012; ICNIRP, 2010; SSM, 2015, 2016, 2018, 2019, 2020, 2021; ICES, 2019). The general scientific consensus of the agencies that have reviewed this research, relying on generally accepted scientific methods, is that the scientific evidence does not confirm that common sources of EMF in the environment, including transmission lines and other parts of the electric system, appliances, etc., are a cause of any adverse health effects.

The most recent reviews on this topic include the 2015 report by SCENIHR and annual reviews published by SSM (*e.g.*, for the years 2015 through 2021). These reports, similar to previous reviews, found that the scientific evidence does not confirm the existence of any adverse health effects caused by environmental or community exposure to EMF.

The WHO has recommended that countries adopt recognized international standards published ICNIRP and ICES. Typical levels of EMF from Dominion's power lines outside its property and rights-of-way are far below the screening reference levels of EMF recommended for the general public and still lower than exposures equivalent to restrictions to limits on fields within the body (ICNIRP, 2010; ICES, 2019).

Thus, based on the conclusions of scientific reviews and the levels of EMF associated with the proposed Project, the Company has determined that no adverse health effects are anticipated to result from the operation of the proposed Project.

References

European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN). Report on the Analysis of Risks Associated to Exposure to EMF: *In Vitro* and *In Vivo* (Animals) Studies. Milan, Italy: EFHRAN, 2010.

European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN). Risk Analysis of Human Exposure to Electromagnetic Fields (Revised). Report D2 of the EFHRAN Project. Milan, Italy: EFHRAN, 2012.

International Commission on Non-ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Phys 99: 818-36, 2010.

International Committee on Electromagnetic Safety (ICES). IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields 0 to 300 GHz. IEEE Std C95.1-2019. New York, NY: IEEE, 2019.

Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). Health Effects of Exposure to EMF. Brussels, Belgium: European Commission, 2009.

Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). Opinion on Potential Health Effects of Exposure to Electromagnetic Fields (EMF). Brussels, Belgium: European Commission, 2015.

Swedish Radiation Safety Authority (SSM). Research 2015:19. Recent Research on EMF and Health Risk - Tenth report from SSM's Scientific Council on Electromagnetic Fields. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2015.

Swedish Radiation Safety Authority (SSM). Research 2016:15. Recent Research on EMF and Health Risk - Eleventh report from SSM's Scientific Council on Electromagnetic Fields, 2016. Including Thirteen years of electromagnetic field research monitored by SSM's Scientific Council on EMF and health: How has the evidence changed over time? Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2016.

Swedish Radiation Safety Authority (SSM). Research 2018:09. Recent Research on EMF and Health Risk - Twelfth report from SSM's Scientific Council on Electromagnetic Fields, 2017. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2018.

Swedish Radiation Safety Authority (SSM). Research 2019:08. Recent Research on EMF and Health Risk – Thirteenth Report from SSM's Scientific Council on Electromagnetic Fields, 2018. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2019.

Swedish Radiation Safety Authority (SSM). Research 2020:04. Recent Research on EMF and Health Risk – Fourteenth Report from SSM's Scientific Council on Electromagnetic Fields, 2019. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2020.

Swedish Radiation Safety Authority (SSM). Research 2021:08. Recent Research on EMF and Health Risk – Fifteenth report from SSM's Scientific Council on Electromagnetic Fields, 2020. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2021.

World Health Organization (WHO). Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. Geneva, Switzerland: World Health Organization, 2007.

IV. HEALTH ASPECTS OF ELECTROMAGNETIC FIELDS ("EMF")

C. Describe and cite any research studies on EMF the Applicant is aware of that meet the following criteria:

1. **Became available for consideration since the completion of the Virginia Department of Health's most recent review of studies on EMF and its subsequent report to the Virginia General Assembly in compliance with 1985 Senate Joint Resolution No. 126;**

2. **Include findings regarding EMF that have not been reported previously and/or provide substantial additional insight into findings; and**

3. **Have been subjected to peer review.**

Response: The Virginia Department of Health ("VDH") conducted its most recent review and issued its report on the scientific evidence on potential health effects of extremely low frequency ("ELF") EMF in 2000: "[T]he Virginia Department of Health is of the opinion that there is no conclusive and convincing evidence that exposure to extremely low frequency EMF emanated from nearby high voltage transmission lines is causally associated with an increased incidence of cancer or other detrimental health effects in humans."[59]

The continuing scientific research on EMF exposure and health has resulted in many peer-reviewed publications since 2000. The accumulating research results have been regularly and repeatedly reviewed and evaluated by national and international health, scientific, and government agencies, including most notably:

(i) The WHO, which published one of the most comprehensive and detailed reviews of the relevant scientific peer-reviewed literature in 2007;

(ii) SCENIHR, a committee of the European Commission, which published its assessments in 2009 and 2015;

(iii) The SSM, which has published annual reviews of the relevant peer-reviewed scientific literature since 2003, with its most recent review published in 2021; and,

(iv) EFHRAN, which published its reviews in 2010 and 2012.

The above reviews provide detailed analyses and summaries of relevant recent peer-reviewed scientific publications. The conclusions of these reviews that the evidence overall does not confirm the existence of any adverse health effects due to exposure to EMF below scientifically established guideline values are consistent with the conclusions of the VDH report. With respect to the statistical association observed in some of the childhood leukemia epidemiologic studies, the most recent comprehensive review of the literature by SCENIHR, published in 2015, concluded

[59] *See* http://www.vdh.virginia.gov/content/uploads/sites/12/2016/02/highfinal.pdf.

that “no mechanisms have been identified and no support is existing [*sic*] from experimental studies that could explain these findings, which, together with shortcomings of the epidemiological studies prevent a causal interpretation” (SCENIHR, 2015, p. 16).

While research is continuing on multiple aspects of EMF exposure and health, many of the recent publications have focused on an epidemiologic assessment of the relationship between EMF exposure and childhood leukemia and EMF exposure and neurodegenerative diseases. Of these, the following recent publications, published following the inclusion date (June 2014) for the SCENIHR (2015) report through May 2021, provided additional evidence and contributed to clarification of previous findings. Overall, new research studies have not provided evidence to alter the previous conclusions of scientific and health organizations, including the WHO and SCENIHR.

Recent epidemiologic studies of EMF and childhood leukemia include:

- Bunch et al. (2015) assessed the potential association between residential proximity to high-voltage underground cables and development of childhood cancer in the United Kingdom largely using the same epidemiologic data as in a previously published study on overhead transmission lines (Bunch et al., 2014). No statistically significant associations or trends were reported with either distance to underground cables or calculated magnetic fields from underground cables for any type of childhood cancers.

- Pedersen et al. (2015) published a case-control study that investigated the potential association between residential proximity to power lines and childhood cancer in Denmark. The study included all cases of leukemia (n=1,536), central nervous system tumor, and malignant lymphoma (n=417) diagnosed before the age of 15 between 1968 and 2003 in Denmark, along with 9,129 healthy control children matched on sex and year of birth. Considering the entire study period, no statistically significant increases were reported for any of the childhood cancer types.

- Salvan et al. (2015) compared measured magnetic-field levels in the bedroom for 412 cases of childhood leukemia under the age of 10 and 587 healthy control children in Italy. Although the statistical power of the study was limited because of the small number of highly exposed subjects, no consistent statistical associations or trends were reported between measured magnetic-field levels and the occurrence of leukemia among children in the study.

- Bunch et al. (2016) and Swanson and Bunch (2018) published additional analyses using data from an earlier study (Bunch et al., 2014). Bunch et al. (2016) reported that the association with distance to power lines observed in earlier years was linked to calendar year of birth or year of cancer diagnosis, rather than the age of the power lines. Swanson and Bunch (2018) re-analyzed data using finer exposure categories (e.g., cut-points of every 50-meter distance) and broader groupings of diagnosis date (e.g., 1960-1979, 1980-1999, and 2000-on) and reported no overall associations between exposure categories and childhood leukemia for the later periods (1980 and on), and consistent pattern for the periods prior to 1980.

- Crespi et al. (2016) conducted a case-control epidemiologic study of childhood cancers and residential proximity to high-voltage power lines (60 kilovolts ["kV"] to 500 kV) in California. Childhood cancer cases, including 5,788 cases of leukemia and 3,308 cases of brain tumor, diagnosed under the age of 16 between 1986 and 2008, were identified from the California Cancer Registry. Controls, matched on age and sex, were selected from the California Birth Registry. Overall, no consistent statistically significant associations for leukemia or brain tumor and residential distance to power lines were reported.

- Kheifets et al. (2017) assessed the relationship between calculated magnetic-field levels from power lines and development of childhood leukemia within the same study population evaluated in Crespi et al. (2016). In the main analyses, which included 4,824 cases of leukemia and 4,782 controls matched on age and sex, the authors reported no consistent patterns, or statistically significant associations between calculated magnetic-field levels and childhood leukemia development. Similar results were reported in subgroup and sensitivity analyses. In two subsequent studies, Amoon et al. (2018a, 2019) examined the potential impact of residential mobility (i.e., moving residences between birth and diagnosis) on the associations reported in Crespi et al. (2016) and Kheifets et al. (2017). Amoon et al. (2018a) concluded that changing residences was not associated with either calculated magnetic-field levels or proximity to the power lines, while Amoon et al. (2019) concluded that while uncontrolled confounding by residential mobility had some impact on the association between EMF exposure and childhood leukemia, it was unlikely to be the primary driving force behind the previously reported associations in Crespi et al. (2016) and Kheifets et al. (2017).

- Amoon et al. (2018b) conducted a pooled analysis of 29,049 cases and 68,231 controls from 11 epidemiologic studies of childhood leukemia and residential distance from high-voltage power lines. The authors reported no statistically-significant association between childhood leukemia and proximity to transmission lines of any voltage. Among subgroup analyses, the reported associations were slightly stronger for leukemia cases diagnosed before 5 years of age and in study periods prior to 1980. Adjustment for various potential confounders (*e.g.*, socioeconomic status, dwelling type, residential mobility) had little effect on the estimated associations.

- Kyriakopoulou et al. (2018) assessed the association between childhood acute leukemia and parental occupational exposure to social contacts, chemicals, and electromagnetic fields. The study was conducted at a major pediatric hospital in Greece and included 108 cases and 108 controls matched for age, gender, and ethnicity. Statistically non-significant associations were observed between paternal exposure to magnetic fields and childhood acute leukemia for any of the exposure periods examined (1 year before conception; during pregnancy; during breastfeeding; and from birth until diagnosis); maternal exposure was not assessed due to the limited sample size. No associations were observed between childhood acute leukemia and exposure to social contacts or chemicals.

- Auger et al. (2019) examined the relationship between exposure to EMF during pregnancy and risk of childhood cancer in a cohort of 784,000 children born in Quebéc. Exposure was defined using residential distance to the nearest high-voltage transmission line or transformer station. The authors reported statistically non-significant associations between proximity to transformer stations and any cancer, hematopoietic cancer, or solid tumors. No associations were reported with distance to transmission lines.

- Crespi et al. (2019) investigated the relationship between childhood leukemia and distance from high-voltage lines and calculated magnetic-field exposure, separately and combined, within the California study population previously analyzed in Crespi et al. (2016) and Kheifets et al. (2017). The authors reported that neither close proximity to high-voltage lines nor exposure to calculated magnetic fields alone were associated with childhood leukemia; an association was observed only for those participants who were both close to high-voltage lines (< 50 meters) and had high calculated magnetic fields (≥ 0.4 microtesla [i.e., ≥ 4 milligauss]). No associations were observed with low-voltage power lines (< 200 kV). In a subsequent study, Amoon et al. (2020) examined the potential impact of dwelling type on the associations reported in Crespi et al. (2019). Amoon et al. (2020) concluded that while the type of dwelling at which a child resides (e.g., single-family home, apartment, duplex, mobile home) was associated with socioeconomic status and race or ethnicity, it was not associated with childhood leukemia and did not appear to be a potential confounder in the relationship between childhood leukemia and magnetic-field exposure in this study population.

- Swanson et al. (2019) conducted a meta-analysis of 41 epidemiologic studies of childhood leukemia and magnetic-field exposure published between 1979 and 2017 to examine trends in childhood leukemia development over time. The authors reported that while the estimated risk of childhood leukemia initially increased during the earlier period, a statistically non-significant decline in estimated risk has been observed from the mid-1990s until the present (*i.e.*, 2019).

- Talibov et al. (2019) conducted a pooled analysis of 9,723 cases and 17,099 controls from 11 epidemiologic studies to examine the relationship between parental occupational exposure to magnetic fields and childhood leukemia. No statistically significant association was found between either paternal or maternal exposure and leukemia (overall or by subtype). No associations were observed in the meta-analyses.

- Núñez-Enríquez et al. (2020) assessed the relationship between residential magnetic-field exposure and B-lineage acute lymphoblastic leukemia ("B-ALL") in children under 16 years of age in Mexico. The study included 290 cases and 407 controls matched on age, gender, and health institution; magnetic-field exposure was assessed through the collection of 24-hour measurements in the participants' bedrooms. While the authors reported some statistically significant associations between elevated magnetic-field levels and development of B-ALL, the results were dependent on the chosen cut-points.

- Seomun et al. (2021) performed a meta-analysis based on 33 previously published epidemiologic studies investigating the potential relationship between magnetic-field exposure and childhood cancers, including leukemia and brain cancer. For childhood leukemia, the authors reported statistically significant associations with some, but not all, of the chosen cut-points for magnetic-field exposure. The associations between magnetic-field exposure and childhood brain cancer were statistically non-significant. The study provided limited new insight as most of the studies included in the current meta-analysis, were included in previously conducted meta- and pooled analyses.

Recent epidemiologic studies of EMF and neurodegenerative diseases include:

- Seelen et al. (2014) conducted a population-based case-control study in the Netherlands and included 1,139 cases diagnosed with amyotrophic lateral sclerosis ("ALS") between 2006 and 2013 and 2,864 frequency-matched controls. The shortest distance from the case and control residences to the nearest high-voltage power line (50 to 380 kilovolts [kV]) was determined by geocoding. No statistically significant associations between residential proximity to power lines with voltages of either 50 to 150 kV or 220 to 380 kV and ALS were reported.

(i) Sorahan and Mohammed (2014) analyzed mortality from neurodegenerative diseases in a cohort of approximately 73,000 electricity supply workers in the United Kingdom. Cumulative occupational exposure to magnetic-fields was calculated for each worker in the cohort based on their job titles and job locations. Death certificates were used to identify deaths from neurodegenerative diseases. No associations or trends for any of the included neurodegenerative diseases (Alzheimer's disease, Parkinson's disease, and ALS) were observed with various measures of calculated magnetic fields.

(ii) Koeman et al. (2015, 2017) analyzed data from the Netherlands Cohort Study of approximately 120,000 men and women who were enrolled in the cohort in 1986 and followed up until 2003. Lifetime occupational history, obtained through questionnaires, and job-exposure matrices on ELF magnetic fields and other occupational exposures were used to assign exposure to study subjects. Based on 1,552 deaths from vascular dementia, the researchers reported a statistically not significant association of vascular dementia with estimated exposure to metals, chlorinated solvents, and ELF magnetic fields. However, because no exposure-response relationship for cumulative exposure was observed and because magnetic fields and solvent exposures were highly correlated with exposure to metals, the authors attributed the association with ELF magnetic fields and solvents to confounding by exposure to metals (Koeman et al., 2015). Based on a total of 136 deaths from ALS among the cohort members, the authors reported a statistically significant, approximately two-fold association with ELF magnetic fields in the highest exposure category. This association, however, was no longer statistically significant when adjusted for exposure to insecticides (Koeman et al., 2017).

(iii) Fischer et al. (2015) conducted a population-based case-control study that included 4,709 cases of ALS diagnosed between 1990 and 2010 in Sweden and 23,335 controls matched to cases on year of birth and sex. The study subjects' occupational exposures to ELF magnetic fields and electric shocks were classified based on their occupations, as recorded in the censuses and corresponding job-exposure matrices. Overall, neither magnetic fields nor electric shocks were related to ALS.

(iv) Vergara et al. (2015) conducted a mortality case-control study of occupational exposure to electric shock and magnetic fields and ALS. They analyzed data on 5,886 deaths due to ALS and over 58,000 deaths from other causes in the United States between 1991 and 1999. Information on occupation was obtained from death certificates and job-exposure matrices were used to categorize exposure to electric shocks and magnetic fields. Occupations classified as "electric occupations" were moderately associated with ALS. The authors reported no consistent associations for ALS, however, with either electric shocks or magnetic fields, and they concluded that their findings did not support the hypothesis that exposure to either electric shocks or magnetic fields explained the observed association of ALS with "electric occupations."

(v) Pedersen et al. (2017) investigated the occurrence of central nervous system diseases among approximately 32,000 male Danish electric power company workers. Cases were identified through the national patient registry between 1982 and 2010. Exposure to ELF magnetic fields was determined for each worker based on their job titles and area of work. A statistically significant increase was reported for dementia in the high exposure category when compared to the general population, but no exposure-response pattern was identified, and no similar increase was reported in the internal comparisons among the workers. No other statistically significant increases among workers were reported for the incidence of Alzheimer's disease, Parkinson's disease, motor neuron disease, multiple sclerosis, or epilepsy, when compared to the general population, or when incidence among workers was analyzed across estimated exposure levels.

(vi) Vinceti et al. (2017) examined the association between ALS and calculated magnetic-field levels from high-voltage power lines in Italy. The authors included 703 ALS cases and 2,737 controls; exposure was assessed based on residential proximity to high-voltage power lines. No statistically significant associations were reported and no exposure-response trend was observed. Similar results were reported in subgroup analyses by age, calendar period of disease diagnosis, and study area.

(vii) Checkoway et al. (2018) investigated the association between Parkinsonism[60] and occupational exposure to magnetic fields and several other agents (endotoxins, solvents, shift work) among 800 female textile workers in Shanghai. Exposure to magnetic fields was assessed based on the participants' work histories. The authors reported no statistically significant associations between Parkinsonism and occupational exposure to any of the agents under study, including magnetic fields.

(viii) Gunnarsson and Bodin (2018) conducted a meta-analysis of occupational risk factors for ALS. The authors reported a statistically significant association between occupational exposures to EMF, estimated using a job-exposure matrix, and ALS among the 11 studies included. Statistically significant associations were also reported between ALS and jobs that involve working with electricity, heavy physical work, exposure to metals (including lead) and chemicals (including pesticides), and working as a nurse or physician. The authors reported some evidence for publication bias. In a subsequent publication, Gunnarsson and Bodin (2019) updated their previous meta-analysis to also include Parkinson's disease and Alzheimer's disease. A slight, statistically significant association was reported between occupational exposure to EMF and Alzheimer's disease; no association was observed for Parkinson's disease.

(ix) Huss et al. (2018) conducted a meta-analysis of 20 epidemiologic studies of ALS and occupational exposure to magnetic fields. The authors reported a weak overall association; a slightly stronger association was observed in a subset analysis of six studies with full occupational histories available. The authors noted substantial heterogeneity among studies, evidence for publication bias, and a lack of a clear exposure-response relationship between exposure and ALS.

(x) Jalilian et al. (2018) conducted a meta-analysis of 20 epidemiologic studies of occupational exposure to magnetic fields and Alzheimer's disease. The authors reported a moderate, statistically significant overall association; however, they noted substantial heterogeneity among studies and evidence for publication bias.

(xi) Röösli and Jalilian (2018) performed a meta-analysis using data from five epidemiologic studies examining residential exposure to magnetic fields and ALS. A statistically non-significant negative association was reported between ALS and the highest exposed group, where exposure was defined based on

[60] Parkinsonism is defined by Checkoway et al. (2018) as "*a syndrome whose cardinal clinical features are bradykinesia, rest tremor, muscle rigidity, and postural instability. Parkinson disease is the most common neurodegenerative form of [parkinsonism]*" (p. 887).

distance from power lines or calculated magnetic-field level.

(xii) Gervasi et al. (2019) assessed the relationship between residential distance to overhead power lines in Italy and risk of Alzheimer's dementia and Parkinson's disease. The authors included 9,835 cases of Alzheimer's dementia and 6,810 cases of Parkinson's disease; controls were matched by sex, year of birth, and municipality of residence. A weak, statistically non-significant association was observed between residences within 50 meters of overhead power lines and both Alzheimer's dementia and Parkinson's disease, compared to distances of over 600 meters.

(xiii) Peters et al. (2019) examined the relationship between ALS and occupational exposure to both magnetic fields and electric shock in a pooled study of data from three European countries. The study included 1,323 ALS cases and 2,704 controls matched for sex, age, and geographic location; exposure was assessed based on occupational title and defined as low (background), medium, or high. Statistically significant associations were observed between ALS and ever having been exposed above background levels to either magnetic fields or electric shocks; however, no clear exposure-response trends were observed with exposure duration or cumulative exposure. The authors also noted significant heterogeneity in risk by study location.

(xiv) Filippini et al. (2020) investigated the associations between ALS and several environmental and occupational exposures, including electromagnetic fields, within a case-control study in Italy. The study included 95 cases and 135 controls matched on age, gender, and residential province; exposure to electromagnetic fields was assessed using the participants' responses to questions related to occupational use of electric and electronic equipment, occupational EMF exposure, and residential distance to overhead power lines. The authors reported a statistically significant association between ALS and residential proximity to overhead power lines and a statistically non-significant association between ALS and occupational exposure to EMF; occupational use of electric and electronic equipment was associated with a statistically non-significant decrease in ALS development.

(xv) Huang et al. (2020) conducted a meta-analysis of 43 epidemiologic studies examining potential occupational risk factors for dementia or mild cognitive impairment. The authors included five cohort studies and seven case-control studies related to magnetic-field exposure. For both study types, the authors reported positive associations between dementia and work-related magnetic-field exposures. The paper, however, provided no information on the occupations held by the study participants, their magnetic-field exposure levels, or how magnetic-field levels were assessed; therefore, the results are difficult to interpret. The authors also reported a high level of heterogeneity among studies. Thus, this analysis adds little, if any, to the overall weight of evidence on a potential association between dementia and magnetic fields.

(xvi) Jalilian et al. (2020) conducted a meta-analysis of ALS and occupational exposure to both magnetic fields and electric shocks within 27 studies from Europe, the United States, and New Zealand. A weak, statistically significant association was reported between magnetic-field exposure and ALS; however, the authors noted evidence of study heterogeneity and publication bias. No association was observed between ALS and electric shocks.

(xvii) Chen et al. (2021) conducted a case-control study to examine the association between occupational exposure to electric shocks, magnetic fields, and motor neuron disease ("MND") in New Zealand. The study included 319 cases with a MND diagnosis (including ALS) and 604 controls, matched on age and gender; exposure was assessed using the participants' occupational history questionnaire responses and previously developed job-exposure matrices for electric shocks and magnetic fields. The authors reported no associations between MND and exposure to magnetic fields; positive associations were reported between MND and working at a job with the potential for electric shock exposure.

References

Amoon AT, Oksuzyan S, Crespi CM, Arah OA, Cockburn M, Vergara X, Kheifets L. Residential mobility and childhood leukemia. Environ Res 164: 459-466, 2018a.

Amoon AT, Crespi CM, Ahlbom A, Bhatnagar M, Bray I, Bunch KJ, Clavel J, Feychting M, Hemon D, Johansen C, Kreis C, Malagoli C, Marquant F, Pedersen C, Raaschou-Nielsen O, Röösli M, Spycher BD, Sudan M, Swanson J, Tittarelli A, Tuck DM, Tynes T, Vergara X, Vinceti M, Wunsch-Filho V, Kheifets L. Proximity to overhead power lines and childhood leukaemia: an international pooled analysis. Br J Cancer 119: 364-373, 2018b.

Amoon AT, Arah OA, Kheifets L. The sensitivity of reported effects of EMF on childhood leukemia to uncontrolled confounding by residential mobility: a hybrid simulation study and an empirical analysis using CAPS data. Cancer Causes Control 30: 901-908, 2019.

Amoon AT, Crespi CM, Nguyen A, Zhao X, Vergara X, Arah OA, and Kheifets L. The role of dwelling type when estimating the effect of magnetic fields on childhood leukemia in the California Power Line Study (CAPS). Cancer Causes Control 31:559-567, 2020.

Auger N, Bilodeau-Bertrand M, Marcoux S, Kosatsky T. Residential exposure to electromagnetic fields during pregnancy and risk of child cancer: A longitudinal cohort study. Environ Res 176: 108524, 2019.

Bunch KJ, Keegan TJ, Swanson J, Vincent TJ, Murphy MF. Residential distance at birth from overhead high-voltage powerlines: childhood cancer risk in Britain 1962-2008. Br J Cancer 110: 1402-1408, 2014.

Bunch KJ, Swanson J, Vincent TJ, Murphy MF. Magnetic fields and childhood cancer: an epidemiological investigation of the effects of high-voltage underground cables. J Radiol Prot 35: 695-705, 2015.

Bunch KJ, Swanson J, Vincent TJ, Murphy MF. Epidemiological study of power lines and childhood cancer in the UK: further analyses. J Radiol Prot 36: 437-455, 2016.

Checkoway H, Ilango S, Li W, Ray RM, Tanner CM, Hu SC, Wang X, Nielsen S, Gao DL, Thomas DB. Occupational exposures and parkinsonism among Shanghai women textile workers. Am J Ind Med 61: 886-892, 2018.

Chen GX, Mannetje A, Douwes J, Berg LH, Pearce N, Kromhout H, Glass B, Brewer N, McLean DJ. Occupational exposure to electric shocks and extremely low-frequency magnetic fields and motor neurone disease. Am J Epidemiol 190(3):393-402, 2021.

Crespi CM, Vergara XP, Hooper C, Oksuzyan S, Wu S, Cockburn M, Kheifets L. Childhood leukaemia and distance from power lines in California: a population-based case-control study. Br J Cancer 115: 122-128, 2016.

Crespi CM, Swanson J, Vergara XP, Kheifets L. Childhood leukemia risk in the California Power Line Study: Magnetic fields versus distance from power lines. Environ Res 171: 530-535, 2019.

European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN). Report on the Analysis of Risks Associated to Exposure to EMF: *In Vitro* and *In Vivo* (Animals) Studies. Milan, Italy: EFHRAN, 2010.

European Health Risk Assessment Network on Electromagnetic Fields Exposure (EFHRAN). Risk Analysis of Human Exposure to Electromagnetic Fields (Revised). Report D2 of the EFHRAN Project. Milan, Italy: EFHRAN, 2012.

Filippini T, Tesauro M, Fiore M, Malagoli C, Consonni M, Violi F, Iacuzio L, Arcolin E, Oliveri Conti G, Cristaldi A, Zuccarello P, Zucchi E, Mazzini L, Pisano F, Gagliardi I, Patti F, Mandrioli J, Ferrante M, Vinceti M. Environmental and occupational risk factors of amyotrophic lateral sclerosis: A population-based case-control study. Int J Environ Res Public Health 17(8):2882, 2020.

Fischer H, Kheifets L, Huss A, Peters TL, Vermeulen R, Ye W, Fang F, Wiebert P, Vergara XP, Feychting M. Occupational Exposure to Electric Shocks and Magnetic Fields and Amyotrophic Lateral Sclerosis in Sweden. Epidemiology 26: 824-830, 2015.

Gervasi F, Murtas R, Decarli A, Giampiero Russo A. Residential distance from high-voltage overhead power lines and risk of Alzheimer's dementia and Parkinson’s disease: a population-based case-control study in a metropolitan area of Northern Italy. Int J Epidemiol, 2019.

Gunnarsson LG and Bodin L. Amyotrophic lateral sclerosis and occupational exposures: A systematic literature review and meta-analyses. Int J Environ Res Public Health 15(11):2371, 2018.

Gunnarsson LG and Bodin L. Occupational exposures and neurodegenerative diseases: A systematic literature review and meta-analyses. Int J Environ Res Public Health 16(3):337, 2019.

Huang LY, Hu HY, Wang ZT, Ma YH, Dong Q, Tan L, Yu JT. Association of occupational factors and dementia or cognitive impairment: A systematic review and meta-analysis. J Alzheimers Dis 78(1):217-227, 2020.

Huss A, Peters S, Vermeulen R. Occupational exposure to extremely low-frequency magnetic fields and the risk of ALS: A systematic review and meta-analysis. Bioelectromagnetics 39: 156-163, 2018.

Jalilian H, Teshnizi SH, Röösli M, Neghab M. Occupational exposure to extremely low frequency magnetic fields and risk of Alzheimer disease: A systematic review and meta-analysis. Neurotoxicology 69: 242-252, 2018.

Jalilian H, Najafi K, Khosravi Y, and Röösli M. Amyotrophic lateral sclerosis, occupational exposure to extremely low frequency magnetic fields and electric shocks: A systematic review and meta-analysis. Rev Environ Health 36(1):129-142, 2020.

Kheifets L, Crespi CM, Hooper C, Cockburn M, Amoon AT, Vergara XP. Residential magnetic fields exposure and childhood leukemia: a population-based case-control study in California. Cancer Causes Control 28: 1117-1123, 2017.

Koeman T, Schouten LJ, van den Brandt PA, Slottje P, Huss A, Peters S, Kromhout H, Vermeulen R. Occupational exposures and risk of dementia-related mortality in the prospective Netherlands Cohort Study. Am J Ind Med 58: 625-635, 2015.

Koeman T, Slottje P, Schouten LJ, Peters S, Huss A, Veldink JH, Kromhout H, van den Brandt PA, Vermeulen R. Occupational exposure and amyotrophic lateral sclerosis in a prospective cohort. Occup Environ Med 74: 578-585, 2017.

Kyriakopoulou A, Meimeti E, Moisoglou I, Psarrou A, Provatopoulou X, Dounias G. Parental Occupational Exposures and Risk of Childhood Acute Leukemia. Mater Sociomed 30: 209-214, 2018.

Núñez-Enríquez JC, Correa-Correa V, Flores-Lujano J, Pérez-Saldivar ML, Jiménez-Hernández E, Martín-Trejo JA, Espinoza-Hernández LE, Medina-Sanson A, Cárdenas-Cardos R, Flores-Villegas LV, Peñaloza-González JG, Torres-Nava JR, Espinosa-Elizondo RM, Amador-Sánchez R, Rivera-Luna R, Dosta-Herrera JJ, Mondragón-García JA, González-Ulibarri JE, Martínez-Silva SI, Espinoza-Anrubio G, Duarte-Rodríguez DA, García-Cortés LR, Gil-Hernández AE, Mejía-Aranguré JM. Extremely low-frequency magnetic fields and the risk of childhood

B-lineage acute lymphoblastic leukemia in a city with high incidence of leukemia and elevated exposure to ELF magnetic fields. Bioelectromagnetics 41(8):581-597, 2020.

Pedersen C, Johansen C, Schüz J, Olsen JH, Raaschou-Nielsen O. Residential exposure to extremely low-frequency magnetic fields and risk of childhood leukaemia, CNS tumour and lymphoma in Denmark. Br J Cancer 113: 1370-1374, 2015.

Pedersen C, Poulsen AH, Rod NH, Frei P, Hansen J, Grell K, Raaschou-Nielsen O, Schüz J, Johansen C. Occupational exposure to extremely low-frequency magnetic fields and risk for central nervous system disease: an update of a Danish cohort study among utility workers. Int Arch Occup Environ Health 90: 619-628, 2017.

Peters S, Visser AE, D'Ovidio F, Beghi E, Chio A, Logroscino G, Hardiman O, Kromhout H, Huss A, Veldink J, Vermeulen R, van den Berg LH. Associations of Electric Shock and Extremely Low-Frequency Magnetic Field Exposure With the Risk of Amyotrophic Lateral Sclerosis. Am J Epidemiol 188: 796-805, 2019.

Röösli M and Jalilian H. A meta-analysis on residential exposure to magnetic fields and the risk of amyotrophic lateral sclerosis. Rev Environ Health 33: 295-299, 2018.

Salvan A, Ranucci A, Lagorio S, Magnani C. Childhood leukemia and 50 Hz magnetic fields: findings from the Italian SETIL case-control study. Int J Environ Res Public Health 12: 2184-2204, 2015.

Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). Health Effects of Exposure to EMF. Brussels, Belgium: European Commission, 2009.

Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR). Opinion on Potential Health Effects of Exposure to Electromagnetic Fields (EMF). Brussels, Belgium: European Commission, 2015.

Seelen M, Vermeulen RC, van Dillen LS, van der Kooi AJ, Huss A, de Visser M, van den Berg LH, Veldink JH. Residential exposure to extremely low frequency electromagnetic fields and the risk of ALS. Neurology 83: 1767-1769, 2014.

Seomun G, Lee J, Park J. Exposure to extremely low-frequency magnetic fields and childhood cancer: A systematic review and meta-analysis. PLoS One 16:e0251628, 2021.

Sorahan T and Mohammed N. Neurodegenerative disease and magnetic field exposure in UK electricity supply workers. Occup Med (Lond) 64: 454-460, 2014.

Swanson J and Bunch KJ. Reanalysis of risks of childhood leukaemia with distance from overhead power lines in the UK. J Radiol Prot 38: N30-N35, 2018.

Swanson J, Kheifets L, and Vergara X. Changes over time in the reported risk for childhood leukaemia and magnetic fields. J Radiol Prot 39:470-488, 2019.

Swedish Radiation Safety Authority (SSM). Research 2019:08. Recent Research on EMF and Health Risk – Thirteenth Report from SSM's Scientific Council on Electromagnetic Fields, 2018. Stockholm, Sweden: Swedish Radiation Safety Authority (SSM), 2019.

Talibov M, Olsson A, Bailey H, Erdmann F, Metayer C, Magnani C, Petridou E, Auvinen A, Spector L, Clavel J, Roman E, Dockerty J, Nikkila A, Lohi O, Kang A, Psaltopoulou T, Miligi L, Vila J, Cardis E, Schüz J. Parental occupational exposure to low-frequency magnetic fields and risk of leukaemia in the offspring: findings from the Childhood Leukaemia International Consortium (CLIC). Occup Environ Med 76:746-753, 2019.

Vergara X, Mezei G, Kheifets L. Case-control study of occupational exposure to electric shocks and magnetic fields and mortality from amyotrophic lateral sclerosis in the US, 1991-1999. J Expo Sci Environ Epidemiol 25: 65-71, 2015.

Vinceti M, Malagoli C, Fabbi S, Kheifets L, Violi F, Poli M, Caldara S, Sesti D, Violanti S, Zanichelli P, Notari B, Fava R, Arena A, Calzolari R, Filippini T, Iacuzio L, Arcolin E, Mandrioli J, Fini N, Odone A, Signorelli C, Patti F, Zappia M, Pietrini V, Oleari P, Teggi S, Ghermandi G, Dimartino A, Ledda C, Mauceri C, Sciacca S, Fiore M, Ferrante M. Magnetic fields exposure from high-voltage power lines and risk of amyotrophic lateral sclerosis in two Italian populations. Amyotroph Lateral Scler Frontotemporal Degener 18: 583-589, 2017.

World Health Organization (WHO). Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. Geneva, Switzerland: World Health Organization, 2007.

V. NOTICE

A. Furnish a proposed route description to be used for public notice purposes. Provide a map of suitable scale showing the route of the proposed project. For all routes that the Applicant proposed to be noticed, provide minimum, maximum and average structure heights.

Response: The Project includes construction of the 500-230 kV Mars-Wishing Star Lines and the Mars 230 kV Loop in Loudoun County, Virginia. A map showing the overhead Proposed Route and five overhead Alternative Routes for the proposed Mars-Wishing Star Lines, and the overhead Proposed Route for the Mars 230 kV Loop is provided in Attachment V.A. A written description of the Mars-Wishing Star Lines Proposed and Alternative Routes and the Mars 230 kV Loop Proposed Route is as follows:

MARS-WISHING STAR LINES

Proposed Route (Route 5)

The Proposed Route of the Mars-Wishing Star Lines is approximately 3.55 miles in length. The Proposed Route originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way. The route turns east and parallels the north side of the right-of-way before crossing Loudoun County Parkway, and then turns southeast before crossing Old Ox Road. The route continues southeast before entering the west side of the proposed Mars Substation.

The Proposed Route of the Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately 148 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

Alternative Route 1

Alternative Route 1 of the Mars-Wishing Star Lines is approximately 3.63 miles in length. Alternative Route 1 originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way and Broad Run. The route turns northeast and parallels the south side of Evergreen Mills Road before crossing Loudoun County

Parkway just south of the intersection with Evergreen Mills Road. The route turns southeast crossing Old Ox Road and continues southeast before entering the west side of the proposed Mars Substation.

Alternative Route 1 of the proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately 146 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

Alternative Route 2

Alternative Route 2 of the proposed Mars-Wishing Star Lines is approximately 3.64 miles in length. Alternative Route 2 originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way and Broad Run. The route then turns southeast to cross Broad Run again, then turns east to parallel the north side of the existing right-of-way before crossing Loudoun County Parkway. The route turns southeast crossing Old Ox Road and continues southeast before entering the west side of the proposed Mars Substation.

Alternative Route 2 of the proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately 147 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

Alternative Route 3

Alternative Route 3 of the Mars-Wishing Star Lines is approximately 3.62 miles in length. Alternative Route 3 originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way and Broad Run and paralleling the south side of Evergreen Mills Road before crossing Loudoun County Parkway just south of the intersection with Evergreen Mills Road. The route turns southeast crossing Old Ox Road and continues southeast before entering the west side of the proposed Mars Substation.

Alternative Route 3 of the proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately 145 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

Alternative Route 4

Alternative Route 4 of the Mars-Wishing Star Lines is approximately 3.63 miles in length. Alternative Route 4 originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way and Broad Run. The route then turns southeast to cross Broad Run again, then turns east to parallel the north side of the existing right-of-way before crossing Loudoun County Parkway. The route turns southeast crossing Old Ox Road and continues southeast before entering the west side of the proposed Mars Substation.

Alternative Route 4 of the proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately 146 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

Alternative Route 6

Alternative Route 6 of the Mars-Wishing Star Lines is approximately 3.56 miles in length. Alternative Route 6 originates at the proposed Wishing Star Substation located just south of the Company's existing Brambleton Substation. The route heads east, crossing Arcola Mills Road then Belmont Ridge Road. West of Belmont Ridge Road, the route joins the south side of the existing electric transmission right-of-way and continues east before turning northeast and crossing over the existing right-of-way. The route turns east and parallels the north side of the right-of-way before crossing Loudoun County Parkway, then turns southeast before crossing Old Ox Road. The route continues southeast before entering the west side of the proposed Mars Substation.

Alternative Route 6 of the proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet wide to support a 5/2 configuration primarily on double circuit three-pole or two-pole H-frame structures with a minimum structure height of approximately 90 feet, a maximum structure height of approximately 190 feet, and an average proposed structure height of approximately

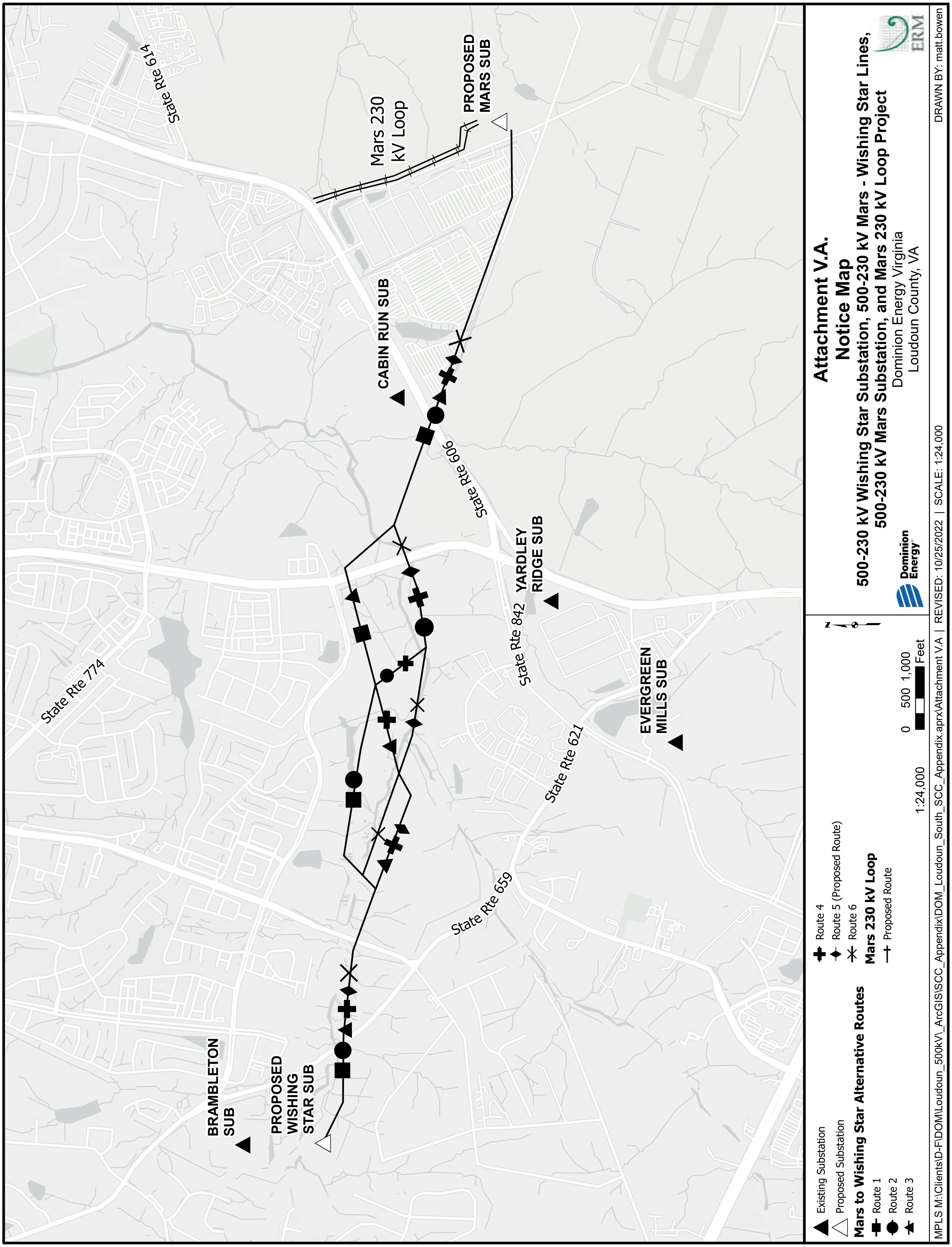
147 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.

MARS 230 kV LOOP

Mars 230 kV Loop Proposed Route

The Mars 230 kV Loop Proposed Route is approximately 0.57 mile in length. The Mars 230 kV Loop originates on the southeast corner of the intersection of Old Ox Road and Carters School Road. The line travels south and parallels the east side of Carters School Road for 0.5 mile before entering the north side of proposed Mars Substation.

The Mars 230 kV Loop Proposed Route will be constructed on new 160-foot-wide right-of-way supported by primarily a combination of double circuit monopoles and two-pole structures situated side-by-side in the right-of-way with a minimum structure height of approximately 100 feet, a maximum structure height of approximately 115 feet, and an average proposed structure height of approximately 103 feet, based on preliminary conceptual design, not including foundation reveal and subject to change based on final engineering design.


State Rte 614
Mars 230 kV Loop
PROPOSED MARS SUB
CABIN RUN SUB
State Rte 606
YARDLEY RIDGE SUB
State Rte 842
State Rte 774
EVERGREEN MILLS SUB
State Rte 621
State Rte 659
BRAMBLETON SUB
PROPOSED WISHING STAR SUB
Existing Substation
Proposed Substation
Mars to Wishing Star Alternative Routes
Route 1
Route 2
Route 3
Route 4
Route 5 (Proposed Route)
Route 6
Mars 230 kV Loop
Proposed Route
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Attachment V.A.
Notice Map
500-230 kV Wishing Star Substation, 500-230 kV Mars - Wishing Star Lines,
500-230 kV Mars Substation, and Mars 230 kV Loop Project
Dominion Energy Virginia
Loudoun County, VA
Dominion Energy
ERM
MPLS M:\Clients\D-F\DOM\Loudoun_500kV_ArcGIS\SCC_Appendix\DOM_Loudoun_South_SCC_Appendix.aprx\Attachment V.A | REVISED: 10/25/2022 | SCALE: 1:24,000
DRAWN BY: matt.bowen

V. NOTICE

B. List Applicant offices where members of the public may inspect the application. If applicable, provide a link to website(s) where the application may be found.

Response: The Application will be made available electronically for public inspection at: www.dominionenergy.com/NOVA.

V. NOTICE

C. List all federal, state, and local agencies and/or officials that may reasonably be expected to have an interest in the proposed construction and to whom the Applicant has furnished or will furnish a copy of the application.

Response:

Ms. Bettina Rayfield
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Virginia Marine Resources Commission
Habitat Management Division
Building 96, 380 Fenwick Road
Ft. Monroe, Virginia 23651

Mr. Troy Andersen
US Fish and Wildlife Service
Virginia Field Office, Ecological Services
6669 Short Lane
Gloucester, Virginia 23061

Regulator of the Day
US Army Corps of Engineers
Norfolk District
803 Front Street
Norfolk, Virginia 23510

Mike Helvey
Obstruction Evaluation Group Manager
Federal Aviation Administration, FAA Eastern Regional Office
800 Independence Ave, SW, Room 400 East
Washington, DC 20591

Sunil Rabindranath
Project Manager, Engineering Division
Metropolitan Washington Airports Authority
P.O. Box 17045, MA-224
Washington, DC 20041

Mr. Scott Denny
Virginia Department of Aviation
Airport Services Division
5702 Gulfstream Road
Richmond, Virginia 23250

Ms. Martha Little
Virginia Outdoors Foundation
600 East Main Street, Suite 402
Richmond, Virginia 23219
John D. Lynch

Northern Virginia District Engineer
Virginia Department of Transportation, Northern Virginia District Office
4975 Alliance Drive
Fairfax, Virginia 22030

Kamal Suliman
Regional Operations Director
Virginia Department of Transportation, Northern Virginia District Office
4975 Alliance Drive
Fairfax, Virginia 22030

Tim Hemstreet
Loudoun County Administrator
PO Box 7000
Leesburg, Virginia 20177

Mr. Tony Buffington, Jr.
Blue Ridge District Supervisor
PO Box 7000
Leesburg, Virginia 20177

Mr. Matthew Letourneau
Dulles District Supervisor
PO Box 7000
Leesburg, Virginia 20177

Mr. Stephen Thompson
Archaeologist, Loudoun County
PO Box 7000
Leesburg, Virginia 20177

Mr. Mike DePue
Land Manager
Northern Virginia Regional Park Authority
5400 Ox Road
Fairfax Station, Virginia 22039

Mr. Brian Nolan
Planning & Development Director
Northern Virginia Regional Park Authority
5400 Ox Road
Fairfax Station, Virginia 22039

V. NOTICE

D. If the application is for a transmission line with a voltage of 138 kV or greater, provide a statement and any associated correspondence indicating that prior to the filing of the application with the SCC the Applicant has notified the chief administrative officer of every locality in which it plans to undertake construction of the proposed line of its intention to file such an application, and that the Applicant gave the locality a reasonable opportunity for consultation about the proposed line (similar to the requirements of § 15.2-2202 of the Code for electric transmission lines of 150 kV or more).

Response: In accordance with Va. Code §15.2-2202 E, a letter dated September 23, 2022, was delivered to Mr. Tim Hemstreet, Administrator of Loudoun County, where the Project is located. The letter stated the Company's intention to file this Application and invited the County to consult with the Company about the Project. This letter is included as Attachment V.D.1.

Dominion Energy Virginia
10900 Nuckols Rd, 4th Floor
Glen Allen, VA 23060
DominionEnergy.com

Dominion Energy

September 23, 2022

Mr. Tim Hemstreet
Loudoun County Administrator
PO Box 7000
Leesburg, Virginia 20177

Reference: **Dominion Energy Virginia's Proposed 500-230 kV Wishing Star Substation, 500-230 kV Mars-Wishing Star Lines, 500-230 kV Mars Substation, and Mars 230 kV Loop**
Loudoun County, Virginia
Notice Pursuant to Va. Code §15.2-2202 E

Dear Mr. Hemstreet,

Dominion Energy Virginia (the "Company") is proposing to construct a new 500-230 kV substation (the "Wishing Star Substation"), a new overhead 500 kV transmission line with a 230 kV transmission line underbuilt (the "Mars-Wishing Star Lines"), a new 500-230 kV substation (the "Mars Substation"), and two new overhead 230 kV transmission lines (the "Mars 230 kV Loop") in Loudoun County, Virginia. Collectively, the Wishing Star Substation, the Mars-Wishing Star Lines, the Mars Substation, the Mars 230 kV Loop, and related substation work are referred to as the "Project." The Company has identified proposed and alternative routes in new right-of-way for the Mars-Wishing Star Lines and Mars 230 kV Loop, as shown on the attached map.

The Project is needed in response to significant increases in electrical demand over recent years as well as expected demand growth projected for the future, and to comply with mandatory North American Electric Reliability Corporation Reliability Standards.

The Company is in process of preparing an application for a certificate of public convenience and necessity ("CPCN") from the State Corporation Commission of Virginia (the "Commission"). In advance of the filing an application for a CPCN from the Commission, the Company respectfully requests that you submit any comments or additional information that would have bearing on the proposed Project within 30 days of the date of this letter. Enclosed is a Project Overview Map depicting the proposed and alternative routes of the Mars-Wishing Star Lines and Mars 230 kV Loop, as well as the general Project location.

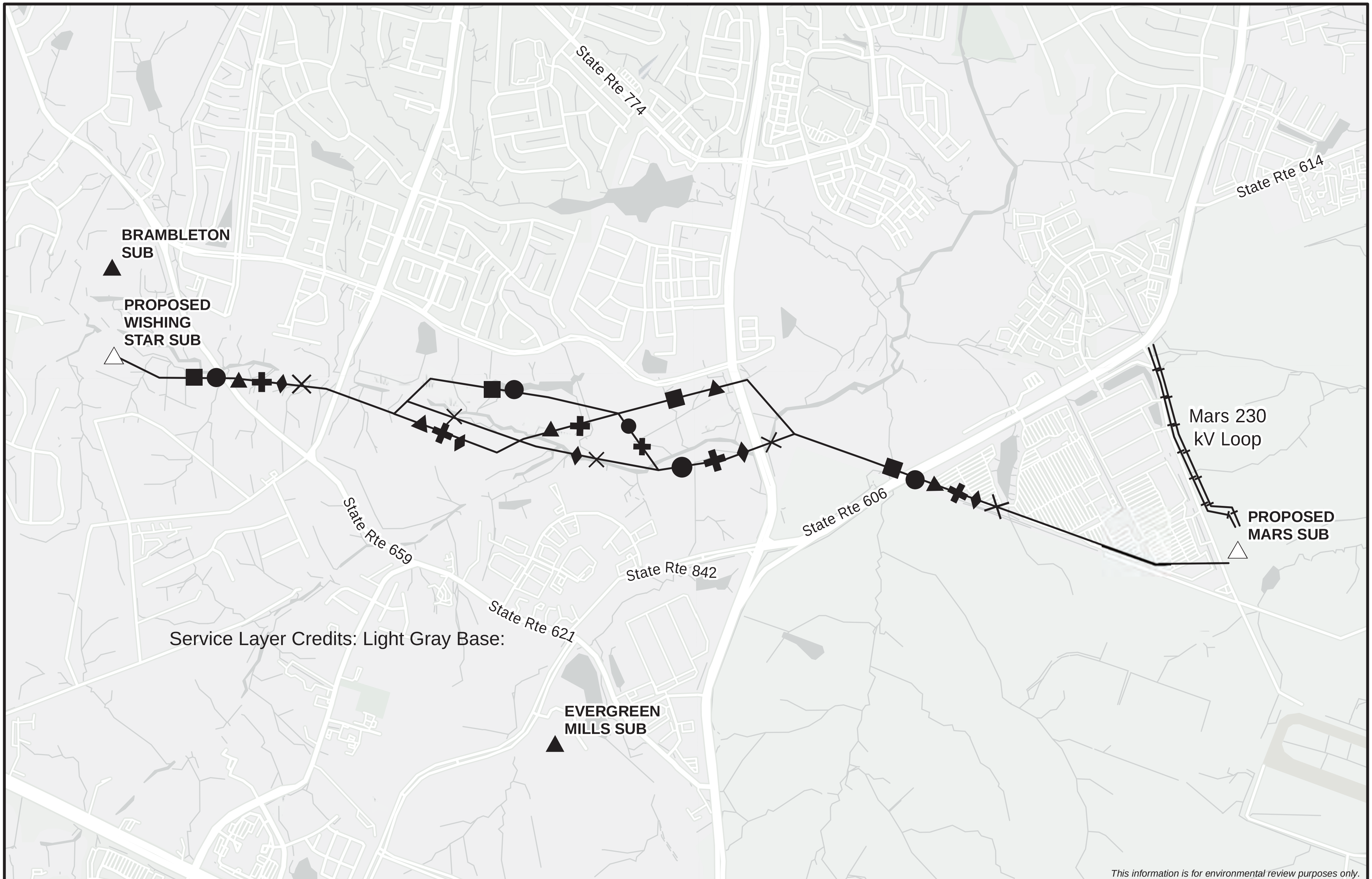
If you would like to receive a GIS shapefile of the transmission line routes to assist in the project review or if there are any questions, please do not hesitate to contact Laura Meadows at (804) 239-8246 or Laura.P.Meadows@dominionenergy.com. We appreciate your assistance with this project review and look forward to any additional information you may have to offer.

Regards,

Christine F. Conrad

Christine F. Conrad, Ph.D.
Director Environmental Services, C2 Environmental, Inc.

Attachment: Project Location Map



- Existing Substation
- Proposed Substation
- Mars-Wishing Star Route 1
- Mars-Wishing Star Route 2
- Mars-Wishing Star Route 3
- Mars-Wishing Star Route 4
- Mars-Wishing Star Route 5
- Mars-Wishing Star Route 6
- Mars 230 kV Loop

1:24,000

0 500 1,000 Feet

N

Project Overview Map

500-230 kV Wishing Star Substation, 500-230 kV Mars Wishing Star Lines, 500-230 kV Mars Substation, and Mars 230 kV Loop Project

Dominion Energy Virginia
Loudoun County, VA

Dominion Energy

ERM

MPLS M:\Clients\D-F\DOM\Loudoun_500kV_ArcGIS\SCC_Appendix\DOM_Loudoun_South_SCC_Appendix.aprx\LS Attachment V.A | REVISED: 09/22/2022 | SCALE: 1:24,000 DRAWN BY: MLB

COMMONWEALTH OF VIRGINIA

STATE CORPORATION COMMISSION

APPLICATION OF VIRGINIA ELECTRIC AND POWER COMPANY For approval and certification of electric transmission facilities: 500-230 kV Wishing Star Substation, 500 kV and 230 kV Mars-Wishing Star Lines, 500-230 kV Mars Substation, and Mars 230 kV Loop	)))))))))	Case No. PUR-2022-00183

IDENTIFICATION, SUMMARIES, AND TESTIMONY OF DIRECT WITNESSES OF VIRGINIA ELECTRIC AND POWER COMPANY

Harrison S. Potter

Witness Direct Testimony Summary
Direct Testimony
Appendix A: Background and Qualifications

Matthew B. Vinson

Witness Direct Testimony Summary
Direct Testimony
Appendix A: Background and Qualifications

Santosh Bhattarai

Witness Direct Testimony Summary
Direct Testimony
Appendix A: Background and Qualifications

Laura P. Meadows

Witness Direct Testimony Summary
Direct Testimony
Appendix A: Background and Qualifications

Jacob M. Rosenberg

Witness Direct Testimony Summary
Direct Testimony
Appendix A: Background and Qualifications

WITNESS DIRECT TESTIMONY SUMMARY

Witness: Harrison S. Potter

Title: Engineer III – Electric Transmission Planning

Summary:

Company Witness Harrison S. Potter sponsors those portions of the Appendix describing the Company's electric transmission system and the need for, and benefits of, the proposed Project, as follows:

- Section I.B: This section details the engineering justifications for the proposed Project.
- Section I.C: This section describes the present system and details how the proposed Project will effectively satisfy present and projected future load demand requirements.
- Section I.D: This section describes critical contingencies and associated violations due to the inadequacy of the existing system.
- Section I.E: This section explains feasible project alternatives, when applicable.
- Section I.G: This section provides a system map of the affected area.
- Section I.H: This section provides the desired in-service date of the proposed Project and the estimated construction time.
- Section I.J: This section provides information about the project if approved by the RTO.
- Section I.K: Although not applicable to the proposed Project, this section, when applicable, provides outage history and maintenance history for existing transmission lines if the proposed project is a rebuild and is due in part to reliability issues.
- Section I.M: Although not applicable to the proposed Project, this section, when applicable, contains information for transmission lines interconnecting a non-utility generator.
- Section I.N: This section provides the proposed and existing generating sources, distribution circuits or load centers planned to be served by all new substations, switching stations, and other ground facilities associated with the proposed Project.
- Section II.A.3: This section provides color maps of existing or proposed rights-of-way in the vicinity of the proposed Project.
- Section II.A.10: This section provides details of the construction plans for the proposed Project, including requested line outage schedules.

Additionally, Company Witness Potter co-sponsors the following portions of the Appendix:

- Section I.A (co-sponsored with Company Witnesses Matthew B. Vinson, Santosh Bhattarai, Laura P. Meadows, and Jacob M. Rosenberg): This section details the primary justifications for the proposed Project.
- Section I.L (co-sponsored with Company Witness Matthew B. Vinson): Although not applicable to the proposed Project, this section, when applicable, provides details on the deterioration of structures and associated equipment.

A statement of Mr. Potter's background and qualifications is attached to his testimony as Appendix A.

DIRECT TESTIMONY
OF
HARRISON S. POTTER
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2022-00183

Q. Please state your name, position with Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"), and business address.

A. My name is Harrison S. Potter, and I am an Engineer III in Electric Transmission Planning for the Company. My business address is 10900 Nuckols Road, Glen Allen, Virginia 23060. A statement of my qualifications and background is provided as Appendix A.

Q. Please describe your areas of responsibility with the Company.

A. I am responsible for planning the Company's electric transmission system for voltages of 69 kilovolt ("kV") through 500 kV.

Q. What is the purpose of your testimony in this proceeding?

A. In order to relieve identified violations of mandatory North American Electric Reliability Corporation ("NERC") Reliability Standards beginning in the summer 2025 timeframe brought on by significant increase in electrical demand as well as expected demand growth projected for the future, and to maintain the structural integrity and reliability of its transmission system, Dominion Energy Virginia proposes in Loudoun County, Virginia, to:

(i) Construct a new 500-230 kV substation in Loudoun County, Virginia, within existing Company-owned right-of-way and on property obtained by the Company ("Wishing Star Substation"). The 500-230 kV source to the Wishing Star Substation will be created by cutting the Company's existing 500 kV

Brambleton-Mosby Lines #546 and #590 into the Wishing Star Substation at Structures #546/26 and #590/1893 just south of the Company's existing Brambleton Substation. The tie-in of Lines #546 and #590 to the Wishing Star Substation will result in (i) 500 kV Brambleton-Wishing Star Line #589, (ii) 500 kV Brambleton-Wishing Star Line #501, (iii) Mosby-Wishing Star Line #546, and (iv) Mosby-Wishing Star Line #590.

(ii) Construct a new approximately 3.55-mile overhead 500 kV single circuit transmission line with a 230 kV single circuit transmission line underbuilt on predominantly new right-of-way. The new transmission lines will originate at the 500 kV and 230 kV buses of the proposed Wishing Star Substation and continue east to the proposed 500-230 kV Mars Substation, resulting in (i) 500 kV Mars-Wishing Star Line #527, and (ii) 230 kV Mars-Wishing Star Line #2291 (the "Mars-Wishing Star Lines"). From the proposed Wishing Star Substation, the Mars-Wishing Star Lines will extend generally east to the proposed Mars Substation, where the Mars-Wishing Star Lines will terminate. The proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet in width (approximately 2.67 miles of the 3.55-mile total length) to support a 5-2 configuration primarily on dulled galvanized steel double circuit three-pole or two-pole H-frame structures. The new 500 kV line will utilize three-phase triple-bundled 1351.5 ACSR conductors with a summer transfer capability of 4,357 MVA; the new 230 kV line will utilize three-phase twin-bundled 768.2 ACSS/TW/HS type conductor with a summer transfer capability of 1,573 MVA.

(iii) Construct a new 500-230 kV substation in Loudoun County, Virginia, on property obtained by the Company ("Mars Substation").

(iv) Construct two new approximately 0.57-mile overhead 230 kV double circuit lines on two sets of double circuit structures from Mars Substation to cut in locations on the Company's existing 230 kV Cabin Run-Shellhorn Road Line #2095 and 230 kV Poland Road-Shellhorn Road Line #2137, between Structures #2095/72 / #2137/82 and #2095/73 / #2137/83 resulting in (i) 230 kV Cabin Run-Mars Line #2287, (ii) 230 kV Celestial-Mars Line #2261, (iii) 230 kV Mars-Shellhorn Road Line #2095, and (iv) 230 kV Mars-Sojourner Line #2292 (the "Mars 230 kV Loop"). Where the Mars 230 kV Loop cuts into Lines #2095 and #2137, two new two-pole double circuit structures will be installed within existing right-of-way in order to loop the new lines into the Mars Substation and then back to the existing Lines #2095/#2137 corridor. While the cut-in location is within existing right-of-way, the proposed Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way supported by a combination of dulled galvanized steel double circuit monopoles and two-pole structures situated side-by-side in the right-of-way and will utilize three-phase twin-bundled 768.2 ACSS/TW type conductor with a summer transfer capability of 1,573 MVA.

(v) Conduct line protection upgrades at the Company's existing remote end substations, including the Company's existing Brambleton, Cabin Run, Mosby, and Shellhorn Road Substations, as well as the future Celestial and Sojourner Substations.

The Wishing Star Substation, Mars-Wishing Star Lines, Mars Substation, Mars 230 kV Loop and related substation work are collectively referred to as the "Project."

There is an immediate need for the Project to maintain and improve reliable electric service to customers in the eastern Loudoun load area ("Eastern Loudoun Load Area"), which is generally to the north and west of the Dulles International Airport and is inclusive of Data Center Alley; to address significant load growth in the Eastern Loudoun Load Area; and to resolve identified NERC reliability violations.

The purpose of my testimony is to describe the Company's electric transmission system and the need for, and benefits of, the proposed Project. I sponsor Sections I.B, I.C, I.D, I.E, I.G, I.H, I.J, I.K, I.M, I.N, II.A.3, and II.A.10 of the Appendix. Additionally, I co-sponsor the Executive Summary and Sections I.A with Company Witnesses Matthew B. Vinson, Santosh Bhattarai, Laura P. Meadows, and Jacob M. Rosenberg; and Section I.L with Company Witness Matthew B. Vinson.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

APPENDIX A

BACKGROUND AND QUALIFICATIONS
OF
HARRISON S. POTTER

Harrison Potter is a 2012 graduate from Virginia Commonwealth University with a Masters in Business Administration and a 2005 graduate from Virginia Polytechnic Institute and State University with a Bachelor of Science in Mechanical Engineering. Mr. Potter has been employed by the Company for 15 years. His experience with the Company includes distribution planning (11 years), distribution design (two years), and GIS services (two years). Mr. Potter was promoted to his current role in transmission planning in 2019.

Mr. Potter has previously testified before the State Corporation Commission of Virginia.

<u>WITNESS DIRECT TESTIMONY SUMMARY</u>

<u>Witness</u>: Matthew B. Vinson

<u>Title</u>: Engineer III – Electric Transmission Line Engineering

<u>Summary</u>:

Company Witness Matthew B. Vinson sponsors those portions of the Appendix providing an overview of the design characteristics of the transmission facilities for the proposed Project, and discussing electric and magnetic field levels, as follows:

- <u>Section I.F</u>: This section describes any lines or facilities that will be removed, replaced, or taken out of service upon completion of the proposed Project.
- <u>Section II.A.5</u>: This section provides drawings of the right-of-way cross section showing typical transmission lines structure placements.
- <u>Section II.B.1 to II.B.2</u>: These sections provide the line design and operational features of the proposed Project, as applicable.
- <u>Section IV</u>: This section provides analysis on the health aspects of electric and magnetic field levels.

Additionally, Company Witness Vinson co-sponsors the following portions of the Appendix:

- <u>Section I.A (co-sponsored with Company Witnesses Harrison S. Potter, Santosh Bhattarai, Laura P. Meadows, and Jacob M. Rosenberg)</u>: This section details the primary justifications for the proposed Project.
- <u>Section I.I (co-sponsored with Company Witness Santosh Bhattarai)</u>: This section provides the estimated total cost of the proposed Project.
- <u>Section I.L (co-sponsored with Company Witness Kunal S. Amare)</u>: This section, when applicable, provides details on the deterioration of structures and associated equipment.
- <u>Sections II.B.3 to II.B.5 (co-sponsored with Company Witness Laura P. Meadows)</u>: These sections, when applicable, provide supporting structure details along the proposed and alternative routes.
- <u>Section II.B.6 (co-sponsored with Company Witnesses Laura P. Meadows and Jacob M. Rosenberg)</u>: This section provides photographs of existing facilities, representations of proposed facilities, and visual simulations.
- <u>Section V.A (co-sponsored with Company Witnesses Laura P. Meadows, and Jacob M. Rosenberg)</u>: This section provides the proposed route description and structure heights for notice purposes.

A statement of Mr. Vinson’s background and qualifications is attached to his testimony as Appendix A.

DIRECT TESTIMONY
OF
MATTHEW B. VINSON
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2022-00183

Q. Please state your name, position with Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"), and business address.

A. My name is Matthew B. Vinson, and I am an Engineer III in the Electric Transmission Line Engineering Department of the Company. My business address is 10900 Nuckols Road, Glen Allen, Virginia 23060. A statement of my qualifications and background is provided as Appendix A.

Q. Please describe your areas of responsibility with the Company.

A. I am responsible for the estimating, conceptual, and final design of high voltage transmission line projects from 69 kilovolt ("kV") to 500 kV.

Q. What is the purpose of your testimony in this proceeding?

A. In order to relieve identified violations of mandatory North American Electric Reliability Corporation ("NERC") Reliability Standards beginning in the summer 2025 timeframe brought on by significant increase in electrical demand as well as expected demand growth projected for the future, and to maintain the structural integrity and reliability of its transmission system, Dominion Energy Virginia proposes in Loudoun County, Virginia, to:

(i) Construct a new 500-230 kV substation in Loudoun County, Virginia, within existing Company-owned right-of-way and on property obtained by the Company ("Wishing Star Substation"). The 500-230 kV source to the Wishing Star Substation will be created by cutting the Company's existing 500 kV

Brambleton-Mosby Lines #546 and #590 into the Wishing Star Substation at Structures #546/26 and #590/1893 just south of the Company's existing Brambleton Substation. The tie-in of Lines #546 and #590 to the Wishing Star Substation will result in (i) 500 kV Brambleton-Wishing Star Line #589, (ii) 500 kV Brambleton-Wishing Star Line #501, (iii) Mosby-Wishing Star Line #546, and (iv) Mosby-Wishing Star Line #590.

(ii) Construct a new approximately 3.55-mile overhead 500 kV single circuit transmission line with a 230 kV single circuit transmission line underbuilt on predominantly new right-of-way. The new transmission lines will originate at the 500 kV and 230 kV buses of the proposed Wishing Star Substation and continue east to the proposed 500-230 kV Mars Substation, resulting in (i) 500 kV Mars-Wishing Star Line #527, and (ii) 230 kV Mars-Wishing Star Line #2291 (the "Mars-Wishing Star Lines"). From the proposed Wishing Star Substation, the Mars-Wishing Star Lines will extend generally east to the proposed Mars Substation, where the Mars-Wishing Star Lines will terminate. The proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet in width (approximately 2.67 miles of the 3.55-mile total length) to support a 5-2 configuration primarily on dulled galvanized steel double circuit three-pole or two-pole H-frame structures. The new 500 kV line will utilize three-phase triple-bundled 1351.5 ACSR conductors with a summer transfer capability of 4,357 MVA; the new 230 kV line will utilize three-phase twin-bundled 768.2 ACSS/TW/HS type conductor with a summer transfer capability of 1,573 MVA.

(iii) Construct a new 500-230 kV substation in Loudoun County, Virginia, on property obtained by the Company ("Mars Substation").

(iv) Construct two new approximately 0.57-mile overhead 230 kV double circuit lines on two sets of double circuit structures from Mars Substation to cut in locations on the Company's existing 230 kV Cabin Run-Shellhorn Road Line #2095 and 230 kV Poland Road-Shellhorn Road Line #2137, between Structures #2095/72 / #2137/82 and #2095/73 / #2137/83 resulting in (i) 230 kV Cabin Run-Mars Line #2287, (ii) 230 kV Celestial-Mars Line #2261, (iii) 230 kV Mars-Shellhorn Road Line #2095, and (iv) 230 kV Mars-Sojourner Line #2292 (the "Mars 230 kV Loop"). Where the Mars 230 kV Loop cuts into Lines #2095 and #2137, two new two-pole double circuit structures will be installed within existing right-of-way in order to loop the new lines into the Mars Substation and then back to the existing Lines #2095/#2137 corridor. While the cut-in location is within existing right-of-way, the proposed Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way supported by a combination of dulled galvanized steel double circuit monopoles and two-pole structures situated side-by-side in the right-of-way and will utilize three-phase twin-bundled 768.2 ACSS/TW type conductor with a summer transfer capability of 1,573 MVA.

(v) Conduct line protection upgrades at the Company's existing remote end substations, including the Company's existing Brambleton, Cabin Run, Mosby, and Shellhorn Road Substations, as well as the future Celestial and Sojourner Substations.

The Wishing Star Substation, Mars-Wishing Star Lines, Mars Substation, Mars 230 kV Loop and related substation work are collectively referred to as the "Project."

There is an immediate need for the Project to maintain and improve reliable electric service to customers in the eastern Loudoun load area ("Eastern Loudoun Load Area"), which is generally to the north and west of the Dulles International Airport and is inclusive of Data Center Alley; to address significant load growth in the Eastern Loudoun Load Area; and to resolve identified NERC reliability violations.

The purpose of my testimony is to describe the design characteristics of the transmission facilities for the proposed Project, and also to discuss electric and magnetic field levels. I sponsor Sections I.F, II.A.5, II.B.1, II.B.2, and IV of the Appendix. Additionally, I co-sponsor the Executive Summary and Sections I.A with Company Witnesses Harrison S. Potter, Santosh Bhattarai, Laura P. Meadows, and Jacob M. Rosenberg; Section I.I with Company Witness Santosh Bhattarai; Section I.L with Company Witness Harrison S. Potter; Sections II.B.3 to II.B.5 with Company Witness Laura P. Meadows; Section II.B.6 and V.A with Company Witnesses Laura P. Meadows and Jacob M. Rosenberg.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

APPENDIX A

BACKGROUND AND QUALIFICATIONS OF MATTHEW B. VINSON

Matthew B. Vinson graduated from the University of Virginia in 2010 with a Bachelor of Science in Civil Engineering. In the fall of 2011, he was hired as a contractor at the Company in the Operation and Maintenance Department of Electric Transmission. After a year, he was hired fulltime by the Company in the Line Engineering Department of Electric Transmission as an Engineer I. In September of 2015, he was promoted to Engineer II; and in July of 2019, he was promoted to Engineer III. He is now the senior Project Engineer in his group.

Mr. Vinson has previously submitted pre-filed testimony to the State Corporation Commission of Virginia.

WITNESS DIRECT TESTIMONY SUMMARY

Witness: Santosh Bhattarai

Title: Consulting Engineer – Substation Engineering

Summary:

Company Witness Santosh Bhattarai sponsors or co-sponsors the following sections of the Appendix describing the substation work to be performed for the proposed Project as follows:

- Section I.A (co-sponsored with Company Witnesses Harrison S. Potter, Matthew B. Vinson, Laura P. Meadows, and Jacob M. Rosenberg): This section details the primary justifications for the proposed Project.

- Section I.I (co-sponsored with Company Witness Matthew B. Vinson): This section provides the estimated total cost of the proposed Project.

- Section II.C: This section describes and furnishes a one-line diagram of the substation associated with the proposed Project.

A statement of Mr. Bhattarai's background and qualifications is attached to his testimony as Appendix A.

DIRECT TESTIMONY
OF
SANTOSH BHATTARAI
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2022-00183

Q. Please state your name, position with Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"), and business address.

A. My name is Santosh Bhattarai, and I am a Consulting Engineer in the Substation Engineering section of the Electric Transmission group of the Company. My business address is 2400 Grayland Avenue, Richmond, Virginia 23220. A statement of my qualifications and background is provided as Appendix A.

Q. What are your responsibilities as a Consulting Engineer?

A. I am responsible for evaluation of the substation project requirements, feasibility studies, conceptual physical design, scope development, preliminary engineering and cost estimating for high voltage transmission and distribution substations.

Q. What is the purpose of your testimony in this proceeding?

A. In order to relieve identified violations of mandatory North American Electric Reliability Corporation ("NERC") Reliability Standards beginning in the summer 2025 timeframe brought on by significant increase in electrical demand as well as expected demand growth projected for the future, and to maintain the structural integrity and reliability of its transmission system, Dominion Energy Virginia proposes in Loudoun County, Virginia, to:

(i) Construct a new 500-230 kV substation in Loudoun County, Virginia, within existing Company-owned right-of-way and on property obtained by the

Company ("Wishing Star Substation"). The 500-230 kV source to the Wishing Star Substation will be created by cutting the Company's existing 500 kV Brambleton-Mosby Lines #546 and #590 into the Wishing Star Substation at Structures #546/26 and #590/1893 just south of the Company's existing Brambleton Substation. The tie-in of Lines #546 and #590 to the Wishing Star Substation will result in (i) 500 kV Brambleton-Wishing Star Line #589, (ii) 500 kV Brambleton-Wishing Star Line #501, (iii) Mosby-Wishing Star Line #546, and (iv) Mosby-Wishing Star Line #590.

(ii) Construct a new approximately 3.55-mile overhead 500 kV single circuit transmission line with a 230 kV single circuit transmission line underbuilt on predominantly new right-of-way. The new transmission lines will originate at the 500 kV and 230 kV buses of the proposed Wishing Star Substation and continue east to the proposed 500-230 kV Mars Substation, resulting in (i) 500 kV Mars-Wishing Star Line #527, and (ii) 230 kV Mars-Wishing Star Line #2291 (the "Mars-Wishing Star Lines"). From the proposed Wishing Star Substation, the Mars-Wishing Star Lines will extend generally east to the proposed Mars Substation, where the Mars-Wishing Star Lines will terminate. The proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet in width (approximately 2.67 miles of the 3.55-mile total length) to support a 5-2 configuration primarily on dulled galvanized steel double circuit three-pole or two-pole H-frame structures. The new 500 kV line will utilize three-phase triple-bundled 1351.5 ACSR conductors with a summer transfer capability of 4,357 MVA; the new 230 kV line will utilize three-phase twin-bundled 768.2 ACSS/TW/HS type conductor with a summer transfer capability of 1,573 MVA.

(iii) Construct a new 500-230 kV substation in Loudoun County, Virginia, on property obtained by the Company ("Mars Substation").

(iv) Construct two new approximately 0.57-mile overhead 230 kV double circuit lines on two sets of double circuit structures from Mars Substation to cut in locations on the Company's existing 230 kV Cabin Run-Shellhorn Road Line #2095 and 230 kV Poland Road-Shellhorn Road Line #2137, between Structures #2095/72 / #2137/82 and #2095/73 / #2137/83 resulting in (i) 230 kV Cabin Run-Mars Line #2287, (ii) 230 kV Celestial-Mars Line #2261, (iii) 230 kV Mars-Shellhorn Road Line #2095, and (iv) 230 kV Mars-Sojourner Line #2292 (the "Mars 230 kV Loop"). Where the Mars 230 kV Loop cuts into Lines #2095 and #2137, two new two-pole double circuit structures will be installed within existing right-of-way in order to loop the new lines into the Mars Substation and then back to the existing Lines #2095/#2137 corridor. While the cut-in location is within existing right-of-way, the proposed Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way supported by a combination of dulled galvanized steel double circuit monopoles and two-pole structures situated side-by-side in the right-of-way and will utilize three-phase twin-bundled 768.2 ACSS/TW type conductor with a summer transfer capability of 1,573 MVA.

(v) Conduct line protection upgrades at the Company's existing remote end substations, including the Company's existing Brambleton, Cabin Run, Mosby, and Shellhorn Road Substations, as well as the future Celestial and Sojourner Substations.

The Wishing Star Substation, Mars-Wishing Star Lines, Mars Substation, Mars 230 kV Loop and related substation work are collectively referred to as the "Project."

There is an immediate need for the Project to maintain and improve reliable electric service to customers in the eastern Loudoun load area ("Eastern Loudoun Load Area"), which is generally to the north and west of the Dulles International Airport and is inclusive of Data Center Alley; to address significant load growth in the Eastern Loudoun Load Area; and to resolve identified NERC reliability violations.

The purpose of my testimony is to describe the work to be performed as part of the Project. As it pertains to station work, I sponsor Section II.C of the Appendix. Additionally, I co-sponsor the Executive Summary and Section I.A with Company Witnesses Harrison S. Potter, Matthew B. Vinson, Laura P. Meadows, and Jacob M. Rosenberg; and Section I.I of the Appendix with Company Witness Matthew B. Vinson

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

APPENDIX A

BACKGROUND AND QUALIFICATIONS OF SANTOSH BHATTARAI

Santosh Bhattarai received a Master of Science degree in Electrical Engineering from South Dakota State University in 2006. Before working for the Company, Mr. Bhattarai worked at Electrical Consultants, Inc. from 2006 to 2009 in Billings, Montana as a Substation Design Engineer. Then, from 2010 to 2013, he worked at Electrical Consultants, Inc. in Madison, Wisconsin as a Substation Project Engineer. Mr. Bhattarai's responsibilities included the evaluation of the substation project requirements, development of project scope documents, estimates and schedules, preparation of specifications and bid documents, material procurement, development of detailed physical drawings, bill of materials, electrical schematics and wiring diagrams. Mr. Bhattarai joined the Dominion Energy Virginia Substation Engineering department in November 2013 as an Engineer III. He was promoted to Consulting Engineer in July 2019. He has been licensed as a Professional Engineer in the Commonwealth of Virginia since 2015. In recognition of his professional standing, the Institute of Electrical and Electronics Engineers board elected him to the grade of Senior Member in 2017.

Mr. Bhattarai has previously testified before the State Corporation Commission of Virginia.

<u>Witness Direct Testimony Summary</u>

<u>Witness</u>: Laura P. Meadows
<u>Title</u>: Siting and Permitting Specialist
<u>Summary</u>:

Company Witness Laura P. Meadows will sponsor those portions of the Appendix providing an overview of the design of the route for the proposed Project, and related permitting, as follows:

- <u>Section II.A.12</u>: This section identifies the counties and localities through which the proposed Project will pass and provides General Highway Maps for these localities.
- <u>Sections V.B-D</u>: These sections provide information related to public notice of the proposed Project.

Additionally, Ms. Meadows co-sponsors the following section of the Appendix:

- <u>Section I.A (co-sponsored with Company Witnesses Harrison S. Potter, Mathew B. Vinson, Santosh Bhattarai, and Jacob M. Rosenberg)</u>: This section details the primary justifications for the proposed Project.
- <u>Section II.A.1 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section provides the length of the proposed corridor and viable alternatives to the proposed Project.
- <u>Section II.A.2 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section provides a map showing the route of the proposed Project in relation to notable points close to the proposed Project.
- <u>Section II.A.4 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section explains why the existing right-of-way is not adequate to serve the need.
- <u>Sections II.A.6 to II.A.8 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: These sections provide detail regarding the right-of-way for the proposed Project.
- <u>Section II.A.9 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section describes the proposed route selection procedures and details alternative routes considered.
- <u>Section II.A.11 (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section details how the construction of the proposed Project follows the provisions discussed in Attachment 1 of the Transmission Appendix Guidelines.
- <u>Sections II.B.3 to II.B.5 (co-sponsored with Company Witness Mathew B. Vinson)</u>: These sections, when applicable, provide supporting structure details along the proposed and alternative routes.
- <u>Section II.B.6 (co-sponsored with Company Witnesses Mathew B. Vinson and Jacob M. Rosenberg)</u>: This section provides photographs of existing facilities, representations of proposed facilities, and visual simulations.
- <u>Section III (co-sponsored with Company Witness Jacob M. Rosenberg)</u>: This section details the impact of the proposed project on scenic, environmental, and historic features.
- <u>Section V.A (co-sponsored with Company Witnesses Mathew B. Vinson and Jacob M. Rosenberg)</u>: This section provides the proposed route description and structure heights for notice purposes.

Finally, Ms. Meadows co-sponsors the DEQ Supplement filed with the Application with Company Witness <u>Jacob M. Rosenberg</u>. A statement of Ms. Meadows' background and qualifications is attached to her testimony as Appendix A.

DIRECT TESTIMONY
OF
LAURA P. MEADOWS
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2022-00183

Q. Please state your name, position with Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"), and business address.

A. My name is Laura P. Meadows, and I am the Electric Transmission Siting and Permitting Supervisor for Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"). My business address is 10900 Nuckols Road, Glen Allen, Virginia 23060. A statement of my qualifications and background is provided as Appendix A.

Q. Please describe your areas of responsibility with the Company.

A. I am responsible for identifying appropriate routes for transmission lines and obtaining necessary federal, state, and local approvals and environmental permits for those facilities. In this position, I work closely with government officials, permitting agencies, property owners, and other interested parties, as well as with other Company personnel, to develop facilities needed by the public so as to reasonably minimize environmental and other impacts on the public in a reliable, cost-effective manner.

Q. What is the purpose of your testimony in this proceeding?

A. In order to relieve identified violations of mandatory North American Electric Reliability Corporation ("NERC") Reliability Standards beginning in the summer 2025 timeframe brought on by significant increase in electrical demand as well as expected demand growth projected for the future, and to maintain the structural integrity and reliability of its transmission system, Dominion Energy Virginia proposes in Loudoun County, Virginia, to:

(i) Construct a new 500-230 kV substation in Loudoun County, Virginia, within existing Company-owned right-of-way and on property obtained by the Company ("Wishing Star Substation"). The 500-230 kV source to the Wishing Star Substation will be created by cutting the Company's existing 500 kV Brambleton-Mosby Lines #546 and #590 into the Wishing Star Substation at Structures #546/26 and #590/1893 just south of the Company's existing Brambleton Substation. The tie-in of Lines #546 and #590 to the Wishing Star Substation will result in (i) 500 kV Brambleton-Wishing Star Line #589, (ii) 500 kV Brambleton-Wishing Star Line #501, (iii) Mosby-Wishing Star Line #546, and (iv) Mosby-Wishing Star Line #590.

(ii) Construct a new approximately 3.55-mile overhead 500 kV single circuit transmission line with a 230 kV single circuit transmission line underbuilt on predominantly new right-of-way. The new transmission lines will originate at the 500 kV and 230 kV buses of the proposed Wishing Star Substation and continue east to the proposed 500-230 kV Mars Substation, resulting in (i) 500 kV Mars-Wishing Star Line #527, and (ii) 230 kV Mars-Wishing Star Line #2291 (the "Mars-Wishing Star Lines"). From the proposed Wishing Star Substation, the Mars-Wishing Star Lines will extend generally east to the proposed Mars Substation, where the Mars-Wishing Star Lines will terminate. The proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet in width (approximately 2.67 miles of the 3.55-mile total length) to support a 5-2 configuration primarily on dulled galvanized steel double circuit three-pole or two-pole H-frame structures. The new 500 kV line will utilize three-phase triple-bundled 1351.5 ACSR conductors with a summer transfer capability of 4,357 MVA; the new 230 kV line will utilize three-phase twin-bundled 768.2 ACSS/TW/HS type conductor with a summer transfer capability of 1,573 MVA.

(iii) Construct a new 500-230 kV substation in Loudoun County, Virginia, on property obtained by the Company ("Mars Substation").

(iv) Construct two new approximately 0.57-mile overhead 230 kV double circuit lines on two sets of double circuit structures from Mars Substation to cut in locations on the Company's existing 230 kV Cabin Run-Shellhorn Road Line #2095 and 230 kV Poland Road-Shellhorn Road Line #2137, between Structures #2095/72 / #2137/82 and #2095/73 / #2137/83 resulting in (i) 230 kV Cabin Run-Mars Line #2287, (ii) 230 kV Celestial-Mars Line #2261, (iii) 230 kV Mars-Shellhorn Road Line #2095, and (iv) 230 kV Mars-Sojourner Line #2292 (the "Mars 230 kV Loop"). Where the Mars 230 kV Loop cuts into Lines #2095 and #2137, two new two-pole double circuit structures will be installed within existing right-of-way in order to loop the new lines into the Mars Substation and then back to the existing Lines #2095/#2137 corridor.

While the cut-in location is within existing right-of-way, the proposed Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way supported by a combination of dulled galvanized steel double circuit monopoles and two-pole structures situated side-by-side in the right-of-way and will utilize three-phase twin-bundled 768.2 ACSS/TW type conductor with a summer transfer capability of 1,573 MVA.

(v) Conduct line protection upgrades at the Company’s existing remote end substations, including the Company’s existing Brambleton, Cabin Run, Mosby, and Shellhorn Road Substations, as well as the future Celestial and Sojourner Substations.

The Wishing Star Substation, Mars-Wishing Star Lines, Mars Substation, Mars 230 kV Loop and related substation work are collectively referred to as the “Project.”

There is an immediate need for the Project to maintain and improve reliable electric service to customers in the eastern Loudoun load area (“Eastern Loudoun Load Area”), which is generally to the north and west of the Dulles International Airport and is inclusive of Data Center Alley; to address significant load growth in the Eastern Loudoun Load Area; and to resolve identified NERC reliability violations.

The purpose of my testimony is to provide an overview of the route and permitting for the proposed Project. I sponsor Sections II.A.11 and V.B to V.D of the Appendix. Additionally, I co-sponsor the Executive Summary and Section I.A with Company Witnesses Harrison S. Potter, Mathew B. Vinson, Santosh Bhattarai, and Jacob M. Rosenberg; Sections II.A.1, II.A.2, II.A.4, II.A.6 to II.A.9, II.A.11, and III with Company Witness Jacob M. Rosenberg; Sections II.B.3 to II.B.5 with Company Witness Mathew B. Vinson; and Section II.B.6 and V.A with Company Witnesses Mathew B. Vinson and Jacob M. Rosenberg. Finally, I co-sponsor the DEQ Supplement with Company Witness Jacob M. Rosenberg.

Q. Has the Company complied with Va. Code § 15.2-2202 E?

A. Yes. In accordance with Va. Code § 15.2-2202 E, a letter dated September 23, 2022, was delivered to Mr. Tim Hemstreet, Administrator of Loudoun County, where the Project is located. The letter stated the Company's intention to file this Application and invited the County to consult with the Company about the proposed Project. A copy of this letter is included as Attachment V.D.1 to the Appendix.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

APPENDIX A

BACKGROUND AND QUALIFICATIONS
OF
LAURA P. MEADOWS

Ms. Laura P. Meadows earned her Bachelor of Arts in History from Longwood University in 2012 and her Master of Arts in Museum Studies from Johns Hopkins University in 2014. In 2013, she began working as an Environmental Specialist and Transportation Planner, coordinating technical NEPA review for linear transportation projects. Ms. Meadows joined the Company in 2017 as a Siting and Permitting Specialist to secure permits for electric transmission and substation projects.

Ms. Meadows has previously submitted pre-filed testimony to the State Corporation Commission of Virginia.

WITNESS REBUTTAL TESTIMONY SUMMARY

Witness: Jacob M. Rosenberg

Title: Principal Consultant, Environmental Resource Management

Summary:

Company Witness Jacob M. Rosenberg sponsors the Environmental Routing Study provided as part of the Company's Application.

Additionally, Mr. Rosenberg co-sponsors the following portion of the Appendix:

- Section I.A (co-sponsored with Company Witnesses Harrison S. Potter, Matthew B. Vinson, Santosh Bhattarai, and Laura P. Meadows): This section details the primary justifications for the proposed Project.
- Section II.A.1 (co-sponsored with Company Witness Laura P. Meadows): This section provides the length of the proposed corridor and viable alternatives to the proposed Project.
- Section II.A.2 (co-sponsored with Company Witness Laura P. Meadows): This section provides a map showing the route of the proposed Project in relation to notable points close to the proposed Project.
- Section II.A.4 (co-sponsored with Company Witness Laura P. Meadows): This section explains why the existing right-of-way is not adequate to serve the need.
- Sections II.A.6 to II.A.8 (co-sponsored with Company Witness Laura P. Meadows): These sections provide detail regarding the right-of-way for the proposed Project.
- Section II.A.9 (co-sponsored with Company Witness Laura P. Meadows): This section describes the proposed route selection procedures and details alternative routes considered.
- Section II.A.11 (co-sponsored with Company Witness Laura P. Meadows): This section details how the construction of the proposed project follows the provisions discussed in Attachment 1 of the Transmission Appendix Guidelines.
- Section II.B.6 (co-sponsored with Company Witnesses Matthew B. Vinson and Laura P. Meadows): This section provides photographs of existing facilities, representations of proposed facilities, and visual simulations.
- Section III (co-sponsored with Company Witness Laura P. Meadows): This section details the impact of the proposed Project on scenic, environmental, and historic features.
- Section V.A (co-sponsored with Company Witnesses Matthew B. Vinson and Laura P. Meadows): This section provides the proposed route description and structure heights for notice purposes.

Finally, Mr. Rosenberg co-sponsors the DEQ Supplement filed with this Application with Company Witness Laura P. Meadows.

A statement of Mr. Rosenberg's background and qualifications is attached to his testimony as Appendix A.

DIRECT TESTIMONY
OF
JACOB M. ROSENBERG
ON BEHALF OF
VIRGINIA ELECTRIC AND POWER COMPANY
BEFORE THE
STATE CORPORATION COMMISSION OF VIRGINIA
CASE NO. PUR-2022-00183

Q. Please state your name, position and place of employment and business address.

A. My name is Jacob M. Rosenberg. I am employed as a Principal Consultant with Environmental Resource Management ("ERM"). My business address is 222 South 9th Street, Suite 2900, Minneapolis, Minnesota 55402. A statement of my qualifications and background is provided as Appendix A.

Q. Please describe your areas of responsibility with the Company.

A. I am responsible for directly supporting transmission project managers and their respective project teams by handling direct communication with property owners (*i.e.*, residential, commercial, industrial, and governmental property owners) and other stakeholders impacted by the Company's proposed electric transmission projects. I also communicate the impacts and benefits of the Company's projects to the public by acting as a liaison between the community and the Dominion Energy Virginia Electric Transmission Team.

Q. What professional experience does ERM have with the routing of linear energy transportation facilities?

A. ERM has extensive experience in the routing, feasibility assessments, and permitting of energy infrastructure projects. It has assisted its clients in the identification, evaluation and development of linear energy facilities for the past 30 years. During this time, it has developed a consistent approach for linear facility routing and route selection based on the identification, mapping and comparative evaluation of routing constraints and opportunities within defined study areas. ERM uses data-intensive Geographic Information System spatial and dimensional analysis and the most current and refined data layers and aerial photography resources available for the identification, evaluation and selection of transmission line routes.

In addition to Virginia Electric and Power Company ("Dominion Energy Virginia" or the "Company"), its clients include some of the largest energy companies in the United States, Canada, and the world, including ExxonMobil, TC Energy, Shell, NextEra Energy, Phillips 66, Kinder Morgan, British Petroleum, Enbridge Energy, and others. ERM also routinely assists the staff of the Federal Energy Regulatory Commission, United States Army Corps of Engineers, and the U.S. Forest Service in the identification and/or evaluation of linear energy routes to support federal National Environmental Policy Act evaluations. ERM works on both small and large energy projects and has assisted in or conducted the routing and route evaluation of some of the largest electric transmission line and pipeline facilities in North America.

In Virginia, ERM served as routing consultant to Dominion Energy Virginia for many projects over the last 15 years, including:

- Cannon Branch-Cloverhill 230 kV transmission line project in the City of Manassas and Prince William County (Case No. PUE-2011-00011);
- Dahlgren 230 kV double circuit transmission line project in King George County (Case No. PUE-2011-00113);
- Surry-Skiffes Creek-Whealton 500 and 230 kV transmission lines (Case No. PUE-2012-00029);

- Remington CT-Warrenton 230 kV double circuit transmission line (Case No. PUE-2014-00025);
- Haymarket 230 kV Line and Substation Project (Case No. PUE-2015-00107);
- Remington-Gordonsville Electric Transmission Project (Case No. PUE-2015-00117);
- Norris Bridge (Case No. PUE-2016-00021);
- Idylwood-Tysons 230 kV single circuit underground transmission line, Tysons Substation rebuild, and related transmission facilities (Case No. PUR-2017-00143);
- Lockridge 230 kV Line Loop and Substation (Case No. PUR-2019-00215);
- DTC 230 kV Line Loop and DTC Substation (Case No. PUR-2021-00280); and
- Nimbus Substation and 230 Farmwell-Nimbus Transmission Line (Case No. PUR-2022-00027).

Most recently, ERM served as the routing consultant for the Company's Coastal Virginia Offshore Wind Commercial Project, in Case No. PUR-2021-00142; Aviator 230 kV Line Loop and Substation, in Case. No. PUR-2022-00012; 500-230 kV Unity Switching Station, 230 kV Tunstall-Unity Lines #2259 and #2262, 230-36.5 kV Tunstall, Evans Creek, Raines Substations, and 230 kV Substation Interconnect Lines, in Case No. PUR-2022-00167; and Butler Farm to Clover 230 kV Line and Butler Farm to Finneywood 230 kV Line, in Case No. PUR-2022-00175.

ERM's role as routing consultant for each of these transmission line projects included preparation of an Environmental Routing Study for the project and submission of testimony sponsoring it.

Q. What were you asked to do in connection with this case?

A. In order to relieve identified violations of mandatory North American Electric Reliability Corporation ("NERC") Reliability Standards beginning in the summer 2025 timeframe brought on by significant increase in electrical demand as well as expected demand growth projected for the future, and to maintain the structural integrity and reliability of its transmission system, Dominion Energy Virginia proposes in Loudoun County, Virginia, to:

(i) Construct a new 500-230 kV substation in Loudoun County, Virginia, within existing Company-owned right-of-way and on property obtained by the Company ("Wishing Star Substation"). The 500-230 kV source to the Wishing Star Substation will be created by cutting the Company's existing 500 kV Brambleton-Mosby Lines #546 and #590 into the Wishing Star Substation at Structures #546/26 and #590/1893 just south of the Company's existing Brambleton Substation. The tie-in of Lines #546 and #590 to the Wishing Star Substation will result in (i) 500 kV Brambleton-Wishing Star Line #589, (ii) 500 kV Brambleton-Wishing Star Line #501, (iii) Mosby-Wishing Star Line #546, and (iv) Mosby-Wishing Star Line #590.

(ii) Construct a new approximately 3.55-mile overhead 500 kV single circuit transmission line with a 230 kV single circuit transmission line underbuilt on predominantly new right-of-way. The new transmission lines will originate at the 500 kV and 230 kV buses of the proposed Wishing Star Substation and continue east to the proposed 500-230 kV Mars Substation, resulting in (i) 500 kV Mars-Wishing Star Line #527, and (ii) 230 kV Mars-Wishing Star Line #2291 (the "Mars-Wishing Star Lines"). From the proposed Wishing Star Substation, the Mars-Wishing Star Lines will extend generally east to the proposed Mars Substation, where the Mars-Wishing Star Lines will terminate. The proposed Mars-Wishing Star Lines will be constructed on new right-of-way predominantly 150 feet in width (approximately 2.67 miles of the 3.55-mile total length) to support a 5-2 configuration primarily on dulled galvanized steel double circuit three-pole or two-pole H-frame structures. The new 500 kV line will utilize three-phase triple-bundled 1351.5 ACSR conductors with a summer transfer capability of 4,357 MVA; the new 230 kV line will utilize three-phase twin-bundled 768.2 ACSS/TW/HS type conductor with a summer transfer capability of 1,573 MVA.

(iii) Construct a new 500-230 kV substation in Loudoun County, Virginia, on property obtained by the Company ("Mars Substation").

(iv) Construct two new approximately 0.57-mile overhead 230 kV double circuit lines on two sets of double circuit structures from Mars Substation to cut in locations on the Company's existing 230 kV Cabin Run-Shellhorn Road Line #2095 and 230 kV Poland Road-Shellhorn Road Line #2137, between Structures #2095/72 / #2137/82 and #2095/73 / #2137/83 resulting in (i) 230 kV Cabin Run-Mars Line #2287, (ii) 230 kV Celestial-Mars Line #2261, (iii) 230 kV Mars-Shellhorn Road Line #2095, and (iv) 230 kV Mars-Sojourner Line

#2292 (the "Mars 230 kV Loop"). Where the Mars 230 kV Loop cuts into Lines #2095 and #2137, two new two-pole double circuit structures will be installed within existing right-of-way in order to loop the new lines into the Mars Substation and then back to the existing Lines #2095/#2137 corridor. While the cut-in location is within existing right-of-way, the proposed Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way supported by a combination of dulled galvanized steel double circuit monopoles and two-pole structures situated side-by-side in the right-of-way and will utilize three-phase twin-bundled 768.2 ACSS/TW type conductor with a summer transfer capability of 1,573 MVA.

(v) Conduct line protection upgrades at the Company's existing remote end substations, including the Company's existing Brambleton, Cabin Run, Mosby, and Shellhorn Road Substations, as well as the future Celestial and Sojourner Substations.

The Wishing Star Substation, Mars-Wishing Star Lines, Mars Substation, Mars 230 kV Loop and related substation work are collectively referred to as the "Project."

There is an immediate need for the Project to maintain and improve reliable electric service to customers in the eastern Loudoun load area ("Eastern Loudoun Load Area"), which is generally to the north and west of the Dulles International Airport and is inclusive of Data Center Alley; to address significant load growth in the Eastern Loudoun Load Area; and to resolve identified NERC reliability violations.

ERM was engaged on behalf of the Company to assist it in the identification and evaluation of route alternatives to resolve the identified electrical need that would meet the applicable criteria of Virginia law and the Company's operating needs.

The purpose of my testimony is to introduce and sponsor the Environmental Routing Study, which is included as part of the Application filed by the Company in this proceeding. Additionally, I co-sponsor the Executive Summary and Section I.A with Company Witnesses Harrison S. Potter, Matthew B. Vinson, Santosh Bhattarai, and

Laura P. Meadows; Sections II.A.1, II.A.2, II.A.4, II.A.6 to II.A.9, II.A.11, and III with Company Witness Laura P. Meadows; and Sections II.B.6 and V.A with Company Witnesses Matthew B. Vinson and Laura P. Meadows. Lastly, I co-sponsor the DEQ Supplement with Company Witness Laura P. Meadows.

Q. Does this conclude your pre-filed direct testimony?

A. Yes, it does.

BACKGROUND AND QUALIFICATIONS OF JACOB M. ROSENBERG

Jacob M. Rosenberg earned a Bachelor of Arts degree and a Master of Science degree from University of Iowa. He has approximately eight years of experience working in the energy-related consulting field specializing in the siting and regulatory permitting of major linear energy facilities, including both interstate and intrastate electric transmission lines and gas and oil pipelines throughout the United States, as well as seven years of experience working in local government specializing in urban and regional planning and community development. During this time, he was employed for three years with the Routt County Planning Department; three years with the City of Brooklyn Park Planning, Zoning, and Development Department; and eight years with ERM, a privately-owned consulting company specializing in the siting, licensing and environmental construction compliance of large, multi-state energy transportation facilities.

Mr. Rosenberg's professional experience related to electric transmission line projects includes the direct management of field studies, impact assessments and agency consultations associated with the routing and licensing of multiple transmission line projects in the mid-Atlantic region, including the management and/or supervision of the routing and permitting. Work on these projects included studies to identify and delineate routing constraints and options; identification and evaluation of route alternatives; and the direction of field studies to inventory wetlands, stream crossings, cultural resources and sensitive habitats and land uses. Within the last several years he has assisted with or managed the identification and evaluation of seven 230 kV transmission line projects in the Commonwealth for Virginia Electric and Power Company.