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Before the State Corporation Commission of Virginia

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

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Environmental Routing Study

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 Project

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Signature Page

October 2022

Environmental Routing Study

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 Project

Berlin

Jon Berkin Partner

Jake Rosenberg Principal Consultant

Environmental Resources Management, Inc. 222 South 9th Street, Suite 2900 Minneapolis Minnesota 55402

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Acronyms and Abbreviations

Name	Description
ABPP	American Battlefield Protection Program
AMSL	above mean sea level
CBG	Census Block Group
ССВ	Center for Conservation Biology
Company	Virginia Electric and Power Company
CFR	Code of Federal Regulations
CPCN	Certificate of Public Convenience and Necessity
CWA	Clean Water Act
dB	decibel
Dominion Energy Virginia	Virginia Electric and Power Company
Dominion	Virginia Electric and Power Company
DTCI	Loudoun County Department of Transportation and Capital Infrastructure
Dulles Airport	Washington Dulles International Airport
EJ	environmental justice
ERM	Environmental Resources Management, Inc.
ESA	Endangered Species Act
FAA	Federal Aviation Administration
GIS	geographic information system
IAD	Washington Dulles International Airport
ID	identification
IPaC	Information for Planning and Consultation
KOP	key observation point
kV	kilovolt
Loudoun Water	Loudoun County Sanitation Authority
MWAA	Metropolitan Washington Airports Authority
NA	not applicable
NHD	National Hydrography Dataset
NHL	National Historic Landmark
NHP	Natural Heritage Program
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
PEM	palustrine emergent
PFO	palustrine forested
Project	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
PSS	palustrine scrub-shrub
Route 50	U.S. Route 50
SCC	State Corporation Commission
SCUs	stream conservation units
TERPS	terminal instrument procedures

Description
U.S. Army Corps of Engineers
U.S. Fish and Wildlife Service
U.S. Environmental Protection Agency
U.S. Geological Survey
Code of Virginia
Virginia Fish and Wildlife Information Service
Virginia Cultural Resource Information System
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality
Virginia Department of Historic Resources
Guidelines for Assessing Impacts of Proposed Electric Transmission Lines and Associated Facilities on Historic Resources in the Commonwealth of Virginia
Virginia Department of Transportation
Virginia Department of Wildlife Resources
Virginia Outdoors Foundation
visually sensitive resource

1. INTRODUCTION AND BACKGROUND

This report presents the results of an environmental constraint identification and routing study prepared by Environmental Resources Management, Inc. (ERM) on behalf of Virginia Electric and Power Company (herein referred to as Dominion Energy Virginia, Dominion, or the Company) for the proposed 500-230 kilovolt (kV) Wishing Star Substation, 500 kV and 230 kV Mars-Wishing Star Lines, 500-230 kV Mars Substation, and Mars 230 kV Loop Project (Mars-Wishing Star 500 kV Project, or Project) in Loudoun County, Virginia.

1.1 **Project Description**

Dominion proposes to construct and operate the following facilities, which are designed to relieve anticipated violations of North American Electric Reliability Corporation (NERC) reliability standards beginning in the Summer 2025 timeframe, meet expected demand growth, and maintain the structural integrity and reliability of the Company's transmission system:

- A new 500-230 kV substation, referred to as Wishing Star Substation, to be built east of and adjacent to Dominion's existing 500 kV Brambleton-Mosby Lines (#546 and #590) and 230 kV Brambleton-Loudoun Lines (#2094 and #2045), south of the existing Brambleton Substation, within existing Company-owned right-of-way and on property obtained by the Company;
- A new 500-230 kV substation, referred to as Mars Substation, to be built near the intersection of Carters School and West Perimeter roads on property obtained by the Company northwest of Washington Dulles International Airport (Dulles Airport or IAD);
- A new overhead 500 kV single circuit transmission line (#527) with a new 230 kV single circuit transmission line (#2291) underbuilt on the same structures, referred to as the Mars-Wishing Star Lines, between the proposed Wishing Star and Mars Substations; and
- Two new 230 kV double circuit transmission lines, referred to as the Mars 230 kV Loop, from the proposed Mars Substation to the Company's existing 230 kV Cabin Run-Shellhorn Road Line (#2095) and 230 kV Poland Road-Shellhorn Road Line (#2137).

The Company considered the facilities required to construct and operate the new infrastructure, the length of new right-of-way that would be required for the Project, the amount of existing development in the area, the potential for environmental impacts and impacts on communities, and cost. As discussed in more detail below, ERM identified six viable overhead route alternatives for the Mars-Wishing Star Lines and one route for the Mars 230 kV Loop.

1.2 Objectives of the Study

The Company requested ERM's services to complete the following: a) define a study area for routing the proposed transmission lines; b) collect information about routing constraints and opportunities within the study area; c) identify and compare alternative routes for the new transmission lines, and d) document these efforts in this report. More specifically, ERM's scope of work consisted of the following activities:

- Defining and describing a study area for routing the transmission lines proposed for the Project;
- Gathering and assessing information about routing constraints and opportunities to be considered as part of the study;
- Identifying and mapping routing constraints and opportunities within the study area;

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- Participating in public outreach efforts for the Project (i.e., public open house and agency meetings) to gather information from stakeholders, agency staff, and the public regarding constraints to be considered as part of the routing process;
- Identifying buildable alternative routes for the transmission lines meeting the siting criteria provided in the Code of Virginia (Va. Code) and included in the Virginia State Corporation Commission's (SCC's) minimum filing guidelines for transmission projects;
- Comparing the alternative routes based on an analysis of environmental impacts and use of routing opportunities; and
- Recommending preferred routes.

2. METHODOLOGY

As discussed in more detail below, ERM initially defined a study area for routing the proposed Mars-Wishing Star Lines and Mars 230 kV Loop. ERM next identified and mapped existing land uses, planned developments, and environmental, visual, recreational, and cultural features within the study area. To complete this work, the routing team used the following data sources:

- Loudoun County department websites and open geographic information system (GIS) datasets online portal (Loudoun County 2022f; Loudoun County 2022g; Loudoun County 2022h)
- Virginia Department of Transportation (VDOT) projects and studies database (VDOT 2022)
- National Conservation Easement database (NCED 2022)
- Virginia Department of Conservation and Recreation (VDCR) conservation lands database (VDCR 2022)
- United States Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EJSCREEN; USEPA 2020)
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping (USFWS 2022)
- Current aerial imagery taken in February 2022 (Planet Imagery 2022)

Sensitive environmental resources or cultural features identified through these and other sources were defined as routing constraints.

In addition to constraints, ERM identified existing electric transmission and distribution lines, other utility rights-of-way, and roads within the study area using a variety of digital map resources, current aerial imagery, and data provided by Dominion for its existing facilities. These existing linear corridor features were defined as potential opportunities for routing the new transmission lines.

ERM layered the routing opportunities over the constraints in GIS to identify preliminary alternative routes, which subsequently were refined to avoid constraints and utilize opportunities to the extent practicable. ERM then conducted an analysis using GIS to quantify potential impacts on constraints and the use of opportunities for each alternative route. Crossings of sensitive features were measured and tabulated to facilitate route comparisons. Other factors, such as visual and construction-related impacts, were assessed based on ERM's experience in electric transmission route selection.

Following a preliminary quantitative route assessment, Dominion Energy Virginia engaged the public, including elected officials and regulatory, planning, and land managing agencies, in discussions to gather feedback on the alternative routes. Some of this feedback resulted in adjustments to optimize the routes and, in certain cases, helped to inform the Company's decision to reject specific routes. Preferred routes were identified based on a comparison of the advantages and disadvantages of each route. The process considered both the sensitivity and extent of the constraints affected relative to each route.

2.1 Study Area

As a first step in identifying potential transmission line routes, ERM (as directed by the Company) defined a geographic study area for the Project based on Dominion's electric transmission and service needs as described in Section 1, Introduction and Background, above. Generally, the study area was defined to encompass the fixed beginning and ending points for the planned facilities (i.e., the proposed Wishing Star and Mars Substation sites and the Mars 230 kV Loop) as well as an area broad enough to allow for the identification of reasonable route alternatives meeting the Project's objectives. Additionally, and to the extent practicable, the limits of the study area were defined by reference to easily distinguishable landmarks, such as roads or other recognizable features.

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Based on the above, ERM and Dominion defined the boundaries of the study area for the Project as follows:

- The Company's existing Brambleton Substation, Evergreen Mills Road, and Overland Drive to the north;
- U.S. Route 50 (Route 50, formerly John Mosby Highway; renamed Little River Turnpike in 2020) to the south;
- Dulles Airport to the east; and
- The Company's existing Brambleton-Mosby Line (#546, #2094) and Brambleton-Loudoun Line (#2045, #590) to the west.

The limits of the study area are depicted in Figure 2.1 in Appendix A, Figures.

The study area encompasses approximately 3,700 acres and extends due west of Dulles Airport to Dominion's existing transmission line corridor containing the existing Brambleton-Mosby and Brambleton-Loudoun Lines. Land use and land cover consists of a mix of residential, commercial, data center, and industrial developments interspersed with open or agricultural lands, forest, and the Broad Run riparian corridor. Larger blocks of forest are found along Broad Run, the South Fork of Broad Run, Cabin Run, and in areas within the perimeter of Dulles Airport. Residential developments are found in areas north of Evergreen Mills Road; in the community of Arcola along and between Briarfield Lane, Arcola Mills Drive, Hiddenwood Lane, and Youngwood Lane; and along and south of Dulles West Boulevard. Commercial developments are found to the northeast along Old Ox Road; to the southeast along Loudoun County Parkway; and in the center of the study area along and between Arcola Mills Drive and Trade West Drive.

2.2 Inventory of Constraints and Opportunities

ERM identified several environmental features and other constraints in the study area, including the following:

- Federal, state, and county lands, including federal land at Dulles Airport;
- Planned future developments, which encompass much of the undeveloped land within the study area;
- Height limitations for developments near Dulles Airport to protect airspace and flight operations in and out of the airport;
- Wetlands and waterbodies (particularly Broad Run and its tributaries);
- Parks and trails (e.g., Stream Valley Park and Trail System);
- Forested land; and
- Historic sites (e.g., Arcola Community Center, Arcola Slave Quarters, and Dulles International Airport Historic District).

From these and other sources, environmental or other features potentially affecting the constructability of the Project facilities within the study area were defined as routing constraints.

ERM identified existing electric transmission lines, pipelines, roads, and other rights-of-way within the study area using a variety of digital map sources, current aerial imagery, and data provided by Dominion for its existing transmission facilities. These existing linear corridor features were defined as potential opportunities for routing/siting transmission infrastructure. ERM layered the routing opportunities over the constraints in GIS to identify potential routes for the Project. Descriptions of the specific constraints and

opportunities located along and near the alternative routes identified for the Project are provided in Section 3, Inventory of Existing Conditions.

Multiple significant routing constraints and opportunities are present in the area between the proposed Wishing Star Substation and Mars Substation sites and between Mars Substation and Lines #2095 and #2137. The following is a summary of the major constraints and opportunities that affected transmission line routing in the study area. Major routing constraints and opportunities are depicted in Figure 2.2 in Appendix A, Figures.

- Washington Dulles International Airport: Dulles Airport, which is operated by the Metropolitan Washington Airports Authority (MWAA), occupies over 20 square miles of federal land straddling Loudoun and Fairfax Counties, Virginia. MWAA must consent to any use of the federal land, thereby restricting potential routes from the west and south into the proposed Mars Substation site. Furthermore, the Federal Aviation Administration's (FAA) regulations governing air safety and the orientation of the airport runways relative to the Project pose engineering challenges in the area west of Runway 12, which would limit the heights of new transmission structures.
- Broad Run: Broad Run is a tributary of the Potomac River in Loudoun County with several named tributaries in the study area including South Fork Broad Run and Cabin Branch. Broad Run and its tributaries are surrounded by a riparian corridor of wetlands, hardwood forest, and biological habitat that has been increasingly fragmented due to development. Broad Run is widely recognized as a valuable ecological and recreational resource in Loudoun County and is the subject of many recent changes to land use policy and zoning regulations. This policy shift is aimed at preserving the riparian corridor and promoting public/private partnerships in the development of the planned county-wide "Emerald Ribbons" trail system. As a routing constraint, the riparian area contains wetlands, forests, bird habitat, previously identified cultural resources, and other environmental features.
- Stream Valley Park and Trail System: Stream Valley Park is located just southwest of the intersection of Loudoun County Parkway and Evergreen Mills Road. The park is an example of the County's implementation of the Loudoun County Linear Parks and Trail System Plan (Loudoun 2022) using private open space proffers to connect trails and parks along Broad Run. The park is maintained by the Brambleton Community Association but open to the public and is a popular local destination for walking, bird watching, and other passive recreation. The trail system uses existing cleared utility rights-of-way (mostly sewer easements) for wide grassy walking paths as well as narrower connector trails through the forest along Broad Run. The Stream Valley Park and Trail System is a valuable recreational asset whose user groups would be sensitive to visual impacts, especially in locations where transmission line routes would parallel trail segments and require tree removal.
- Arcola Boulevard Extension: The Arcola Boulevard Extension is a major road construction project connecting Route 50 to Route 606 (Old Ox Road). The final phase of construction is underway and will connect the remaining boulevard segment between Trade West Drive and Arcola Mills Drive (also planned for road widening). To the north of the road right-of-way is an existing commercial development and Old Darnes Cemetery (a historic African American site); to the south is a large data center development, the corridor for Dominion's existing right-of-way needed for the Arcola Boulevard Extension blocked the development of a route for the Mars-Wishing Star lines in the area between the road expansion project and existing transmission line corridor.
- <u>Residential Areas</u>: Existing and planned residential subdivisions and residences are located along Evergreen Mills Road to the north of Broad Run and throughout the Arcola area south of Arcola Mills Road. All routes presented in this study avoid residential areas to the maximum extent practicable to limit new right-of-way acquisition on residential lots.

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- Arcola Center: Arcola Center is a large, mixed-use development located between Arcola Boulevard to the south, Arcola Mills Drive to the north, and the Arcola Slave Quarters Historic Site to the east. Currently under phased construction, Arcola Center will feature attached single-family and multi-family housing, office and retail uses, and will be served by the new Elaine E. Thompson Elementary School. Although Arcola Center is only one of several planned developments underway in the study area, it mostly consists of high-density residential land uses and is therefore incompatible with the development of a major utility corridor. In contrast, data centers and other industrial development represent land uses more compatible with the development of transmission line infrastructure.
- Northern Virginia Electric Cooperative Delivery Points: The study area is divided between Northern Virginia Electric Cooperative's (NOVEC) and Dominion's service territories. NOVEC faces a similar increased load growth and is planning to construct two delivery points in the study area. NOVEC delivery points are both a routing constraint and opportunity. In locations where there is sufficient space, new transmission line routes can cross or abut these facilities without hindrance.
- Existing Transmission Lines: Several existing transmission line corridors, primarily operated by Dominion, cross the study area. It is often beneficial to build new transmission lines adjacent to existing corridors to minimize impacts on environmental and other resources. The SCC requires that existing transmission lines be considered as routing opportunities to the fullest extent when planning new transmission lines. Many of the existing transmission line corridors within the study area cross heavily developed areas where homes and other buildings have been built up to the edge of the right-of-way. Where feasible, portions of these corridors were considered as potential opportunities for routing the Mars-Wishing Star transmission lines.

In addition to the major routing constraints and opportunities described above, the study area contains historic resources and additional planned developments, and poses engineering challenges owing to a combination of topography, FAA height restrictions, and overhead crossings of existing transmission lines.

2.3 Route Identification

Once the routing opportunities and constraints were identified and assessed, potential routes were developed. Efforts were made to collocate routes with existing transmission lines and other linear corridor features, such as roads. After the identification of preliminary routes, ERM conducted several site visits and began evaluating each alternative. The Company also began stakeholder and agency outreach during this time to assist with route evaluation.

A dual component electrical solution was identified by Dominion to meet the Project need. The first component involves constructing an overhead single circuit 500 kV line with an underbuilt, single circuit, 230 kV line from the proposed Wishing Star Substation to the proposed Mars Substation. ERM and the Company identified 11 potential overhead routes and one potential underground route, of which six overhead routes (Routes 1 through 6) were deemed feasible for construction and retained for further analysis. Each of these routes is described in Sections 2.4.1 through 2.4.6 below. The five remaining overhead routes and the underground route were rejected from further consideration for the reasons discussed in Section 2.7, Routes Rejected from Further Consideration. The second component involves constructing two new 230 kV double circuit transmission lines from the proposed Mars Substation to the Company's existing 230 kV Cabin Run-Shellhorn Road Line (#2095) and 230 kV Poland Road-Shellhorn Road Line (#2137).

The proposed Mars and Wishing Star Substations would each be built on undeveloped parcels. The proposed site for the Mars Substation is situated north of MWAA property on the east side of Route 857(Carter School Road) in the Sterling area of Loudoun County. The proposed site for the Wishing Star

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Substation is located south of the Company's existing Brambleton Substation and west of Arcola Mills Drive in Arcola. The substations would occupy the same footprint for each of the Mars-Wishing Star alternative route. Impacts associated with construction and operation of the substations are included in the discussions of the existing and affected environments for each alternative route in Sections 3 and 4 of this report, respectively.

2.4 Mars-Wishing Star Line Route Alternatives

Descriptions of the six overhead routes deemed feasible for construction and retained for further analysis are provided below. The routes are depicted in the topographic and aerial based maps provided as Figure 2.4-1and 2.4-2 in Appendix A, Figures.

2.4.1 Route 1

Beginning at the proposed Wishing Star Substation site, Route 1 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. The route then continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road. After crossing the road, Route 1 parallels the south side of the Company's existing right-of-way for Lines #2172 and #2183 for 0.2 mile to the east on an undeveloped tract. The route then turns north, crossing the existing right-of-way and Broad Run, and continues another 0.2 mile onto an undeveloped parcel. Route 1 then turns east for 0.5 mile along the south side of a stormwater retention pond before turning slightly to the northeast and continuing for 0.3 mile, crossing a parcel dedicated as an open space proffer for the Brambleton Community Association.

At a point just south of the intersection of Evergreen Mills Road and Loudoun County Parkway, Route 1 crosses the parkway before turning southeast and continuing across Broad Run. The route then continues southeast along the southwestern edge of an undeveloped tract for 0.3 mile, rejoining the Company's existing right-of-way for Lines #2137 and #2213. Route 1 then continues 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning Lines #2137 and #2213. The route then continues southeast for 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 1 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the proposed Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road, then turns north to terminate on the south side of the proposed Mars Substation site.

Route 1 measures 3.63 miles in length, including the approximately 0.34-mile-long split of the 230 kV line from the 500 kV line in the approach to the Mars Substation site.

2.4.2 Route 2

Beginning at the proposed Wishing Star Substation site, Route 2 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. The route then continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road. After crossing the road, Route 2 parallels the south side of the Company's existing right-of-way for Lines #2172 and #2183 for 0.2 mile across an undeveloped tract. It then turns north, crossing Lines #2172 and #2183 and Broad Run, before continuing about 0.2 mile onto another undeveloped parcel. The route then turns east for 0.5 mile along the south side of stormwater

retention pond before turning to the southeast and again crossing Broad Run. The route then turns east for 0.3 mile to parallel the north side of the existing right-of-way for Lines #2137 and #2213.

Prior to crossing Loudoun County Parkway, Route 2 turns slightly northeast away from the existing Dominion right-of-way to avoid land owned by MWAA. It then turns southeast and continues about 0.3 mile along the southwestern edge of an undeveloped parcel before rejoining the existing Company's existing right-of-way for Lines #2137 and #2213. Route 2 then continues for 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning Lines #2137 and #2213. The route continues southeast for another 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 2 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road and turning north to terminate on the south side of the proposed Mars Substation site.

Route 2 measures 3.64 miles in length, including the approximately 0.34-mile-long split of the 230 kV line from the 500 kV line in the approach to the Mars Substation site.

2.4.3 Route 3

Beginning at the proposed Wishing Star Substation site, Route 3 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. Route 3 the continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road and paralleling the south side of the Company's existing right-of-way for Lines #2172 and #2183. Continuing along an undeveloped parcel for about 0.5-mile, Route 3 then turns northeast for 0.7 mile, crossing the existing Company right-of-way for Lines #2172 and #2183, Broad Run, and a parcel dedicated as open space proffer for the neighboring homeowners' association.

At a point just south of the intersection of Evergreen Mills Road and Loudoun County Parkway, Route 3 crosses the parkway before turning southeast and crossing Broad Run. It then continues southeast for 0.3 mile along the southwestern edge of an undeveloped parcel before rejoining the existing right-of-way for Lines #2137 and #2213. The route continues another 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning Lines #2137 and #2213. Route 3 the continues southeast for 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 3 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road and turning north to terminate on the south side of the proposed Mars Substation site.

Route 3 measures 3.62 miles in length, including the split of the proposed 500 kV and 230 kV lines into separate corridors in the approach to the Mars Substation site.

2.4.4 Route 4

Beginning at the proposed Wishing Star Substation site, Route 4 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. The route the continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road and paralleling the south side of the Company's existing right-of-way for Lines #2172 and #2183. Continuing along an undeveloped parcel for 0.5-mile, Route 4 the turns northeast for 0.4 mile, crossing the existing Company right-of-way, Broad Run, and an undeveloped

parcel. The route then turns back to the southeast for 0.2 mile, again crossing Broad Run, then turns east for 0.3 mile to parallel the north side of the existing right-of-way for Lines #2137 and #2213.

Before crossing Loudoun County Parkway, Route 4 turns slightly northeast away from the existing rightof-way to avoid land owned by MWAA. The route then turns and continues southeast for 0.3 mile along the southwestern edge of an undeveloped parcel before rejoining the Company's existing right-of-way for another 0.3 mile. Route 4 then continues 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning Lines #2137 and #2213. The route next continues southeast for 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 4 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road and turning north to terminate on the south side of the proposed Mars Substation site.

Route 4 measures 3.63 miles in length, including the split of the proposed 500 kV and 230 kV lines into separate corridors in the approach to the Mars Substation site.

2.4.5 Route 5

Beginning at the proposed Wishing Star Substation, Route 5 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. Route 5 then continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road and paralleling the south side of the Company's existing right-of-way of Lines #2172 and #2183. Continuing along an undeveloped parcel for 0.5 mile, the route then turns north to cross the Company's existing right-of-way then east to parallel the north side of the existing right-of-way. For approximately 0.5 mile, the route continues east along Broad Run, paralleling the north side of the Company's existing transmission corridor.

Before crossing Loudoun County Parkway, the route turns slightly northeast away from the existing rightof-way to avoid crossing land owned by MWAA. After crossing the parkway, Route 5 turns southeast for 0.3 along the southwestern edge of an undeveloped parcel, rejoining the existing right-of-way for Lines #2137 and #2213. The route then continues 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning Lines #2137 and #2213. Route 5 then continues southeast for 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 5 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road and turning north to terminate on the south side of the proposed Mars Substation site.

Route 5 measures 3.55 miles in length, including the split of the proposed 500 kV and 230 kV lines into separate corridors in the approach to the Mars Substation site.

2.4.6 Route 6

Beginning at the proposed Wishing Star Substation, Route 6 travels east for about 0.3 mile along the south side of Broad Run before crossing a future VDOT right-of-way associated with the Northstar Boulevard extension project. Route 6 then continues east for 0.3 mile along an undeveloped parcel before crossing Belmont Ridge Road and paralleling the south side of the Company's existing right-of-way for Lines #2172 and #2183. Continuing along an undeveloped parcel for 0.2 mile, Route 6 turns north to cross the existing right-of-way then east again to parallel the north side of the existing right-of-way. For

approximately 0.9 mile, the route continues east along Broad Run, paralleling the north side of the existing right-of-way.

Before crossing Loudoun County Parkway, Route 6 turns slightly northeast away from the Company's existing right-of-way to avoid land owned by MWAA. After crossing the parkway, Route 6 turns southeast and continues for 0.3 mile along the southwestern edge of undeveloped parcel, then rejoins the existing Company right-of-way for Lines #2137 and #2213. The route continues 0.2 mile across NOVEC-owned land before crossing Old Ox Road and spanning the Lines #2137 and #2213. Route 6 then continues southeast for 0.7 mile across a surface parking lot, paralleling the north side of MWAA's West Perimeter Road.

About 0.2 mile west of the proposed Mars Substation site, Route 5 splits into two separate rights-of-way, one for the 500 kV line and the other for the 230 kV line. The right-of-way for the 500 kV line turns east for 0.2 mile before crossing Carters School Road and terminating on the west side of the Mars Substation site. The right-of-way for the 230 kV line continues southeast for 0.2 mile before crossing Carters School Road and turning north to terminate on the south side of the proposed Mars Substation site.

Route 6 measures 3.56 miles in length, including the split of the proposed 500 kV and 230 kV lines into separate corridors in the approach to the Mars Substation site.

2.5 Substations

2.5.1.1 Wishing Star Substation

The proposed Wishing Star Substation site is located east and north of the intersection of Briarfield and Youngwood Lanes and about 0.5 mile south of the Company's existing Brambleton Substation. The site is adjacent to (east of) and partially overlaps the Company's existing right-of-way for Lines #546, #590, #2045, and #2094. The existing right-of-way also contains two natural gas transmission pipelines: a 24-inch-diameter pipeline owned by Berkshire Hathaway and operated by Eastern Gas Transmission and Storage, Inc., and a 36-inch-diameter pipeline owned by Dominion Energy and operated by Cove Point LNG, LP. The substation footprint encompasses approximately 20 acres of a 41-acre parcel. About 85 percent of the site is forested, and the remainder consist of maintained Company right-of-way.

2.5.2 Mars Substation

The Mars Substation site is located just east of Carters School Road, approximately 0.5 mile south of the intersection of Carters School and Old Ox Roads. The substation footprint occupies approximately 10 acres (of a 22-acre parcel) of which about 20 percent is forested and 80 percent is open space. An existing parking lot is located west of the site on the west side of Carters School Road.

2.6 Mars 230 kV Loop

The proposed Mars 230 kV Loop measures approximately 0.57 mile in length. It originates at proposed cut-in locations on the Company's existing 230 kV Cabin Run-Shellhorn Lines #2095 and Poland Road-Shellhorn Line #2137 at the southeast corner of the intersection of Old Ox Road and Carters School Roads. From here, the route heads south paralleling the east side of Carters School Road, crossing mostly forested lands between Old Ox Road and terminating at the proposed Mars Substation site.

2.7 Routes Rejected from Further Consideration

2.7.1 Overhead Routes

As noted above, ERM and the Company identified five additional overhead alternative routes and one underground alternative route which the Company rejected from further consideration for the Mars-Wishing Star Lines. Descriptions of these alternatives and the rationale for rejecting them from additional review are provided below. Figure 2.7 in Appendix A, Figures, depicts these routes.

2.7.1.1 Route 7

ERM identified Route 7 as a variation of Route 5 that continued further east to collocate along the southern side of the Company's right-of-way for Lines #2172 and #2183 before crossing over the existing 230 kV lines, then continuing east in the area north of the existing right-of-way.

As Route 7 was studied in detail, the following issues were identified:

- <u>Restrictive Preservation Areas</u>: Route 7 crosses Restrictive Preservation Areas along South Fork Broad Run to a greater degree than Route 5 without the benefit of better collocation or avoiding habitat fragmentation in the Broad Run riparian area.
- Engineering Challenges: Due to the location of commercial buildings, a buried sewer line, and the location of an existing 230 kV structure, it was determined that neither sufficient right-of-way nor spacing between the existing and proposed conductors could be achieved for the proposed crossing of the existing 230 kV lines (#2172 and #2183) near Broad Run.
- Stream Valley Park Trail Crossings: Route 7 includes two new crossings of a trail segment that would require extensive tree clearing, resulting in significant visual impacts to recreational users without the benefit of avoiding environmental impacts to forested habitat and wetlands.

For the reasons listed above, Route 7 was eliminated from further consideration.

2.7.1.2 Route 8

ERM identified Route 8 as a routing option that would collocate along the north side of Arcola Mills Drive before turning north and joining Route 7. In addition to the reasons listed above for rejecting Route 7, Route 8 was eliminated from consideration after consultation with the Loudoun County Department of Transportation and Capital Infrastructure (DTCI) staff revealed the future plan to widen Arcola Mills Drive. Given the extra right-of-way offset needed to accommodate the future road widening, Route 8 had no advantage over the other alternative routes and would have been in closer proximity to residences south of Arcola Mills Drive.

2.7.1.3 Route 9

ERM identified Route 9 as a routing option that also used collocation opportunities along Arcola Mills Drive and Old Ox Road.

As Route 9 was studied in detail, the following issues were identified:

- <u>Arcola Mills Road Widening</u>: As with Route 8, Route 9 relies on collocating with Arcola Mills Drive, which was deemed unfeasible given future plans to widen the road.
- Arcola Boulevard Extension: Route 9 was found to conflict with DTCI's plan for the Arcola Boulevard Extension project. Upon further study, it was determined that the right-of-way could not be shifted to the north or south of the road expansion project without encroaching on the existing 230 kV lines or crossing a portion of Old Darnes Cemetery.

MWAA Crossing: Route 9 crosses MWAA property along the north side of Old Ox Road. After (1) several unsuccessful attempts to consult with MWAA representatives, (2) the uncertainty about whether or not MWAA would convey land to Dominion, and (3) the uncertainty of qualifying for a Categorical Exclusion for the crossing of federal lands under the National Environmental Policy Act. If a Categorical Exclusion was not applicable, the required timeframe to complete an Environmental Assessment (EA) would not permit the project to meet its required construction and in service deadlines. The MWAA crossing was deemed too risky for the Project to achieve a 2025 in-service date.

For the reasons listed above, Route 9 was eliminated from further consideration.

2.7.1.4 Route 10

ERM identified Route 10 as a routing option that would cross undeveloped land further south in the Arcola area. After review of multiple planned developments and road projects in the area, and because of the need for a significant crossing of MWAA-owned land, Route 10 was deemed unfeasible and was eliminated from further consideration.

2.7.1.5 Route 11

ERM identified Route 11 as a routing option that would collocate along the Company's existing 500 kV right-of-way for Line #2094 to the south before crossing undeveloped land in the Arcola area and then collocating along Route 50. Route 11 would then follow the western edge of MWAA property north then east toward the proposed Mars Substation site. Despite the collocation opportunities afforded by this route, there were numerous conflicts with planned developments, visual impacts to the Route 50 corridor, and the uncertainty in the Company's ability to obtain over two miles of right-of-way on MWAA-owned land. For these reasons, Route 10 was eliminated from further consideration.

2.7.2 Underground Route

ERM identified one underground routing option that would be constructed using the open-trench method. The route avoids crossing Broad Run but instead crosses the South Fork Broad Run and Cabin Branch, both of which are perennial systems and direct tributaries to Broad Run The underground route used a narrower right-of-way (115 feet versus a typical width of 150 feet for overhead) and did not have any apparent conflicts with planned developments. Despite the possible environmental advantages and mitigation of visual impacts, the underground route required an additional 10 acres of land for the construction of each transition station that would convert the conductors from an overhead configuration to an underground configuration at both the Mars and Wishing Star Substation sites. Without additional available land adjacent to the proposed Wishing Star Substation site, siting a transition station was deemed impractical. The most significant limitation for the Underground Route, however, is that the Company determined that an underground transmission line could not be placed into service until well after the Summer 2025 NERC violation timeframe. For this reason, the underground route was eliminated from further consideration.

2.8 Structure Types and Right -Of -Way Widths

Dominion Energy Virginia proposes to use several structure and right-of-way configurations for the Project. For the Mars-Wishing Star Lines, the routes will be constructed on new right-of-way predominantly 150 feet wide to support a 5-2 transmission line configuration. The structure types are primarily 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 structure

height of approximately 148 feet. The estimated heights are based on preliminary conceptual design, do not include foundation reveal, and are subject to change based on final engineering design.

The Mars 230 kV Loop will be constructed on new 160-foot-wide right-of-way using a combination of double circuit monopoles and 2-pole structures situated in side-by-side configuration within the right-of-way. The new right-of-way will support two double circuit configurations on twelve tubular pole structures with a minimum structure height of approximately 100 feet, a maximum structure height of approximately 115 feet, and an average structure height of approximately 103 feet. The estimated heights are based on preliminary conceptual design, do not include foundation reveal, and are subject to change based on final engineering design.

Section views depicting typical right-of-way widths and structure configurations are provided as Appendix B, Structural Drawings.

2.9 Construction, Operation, and Maintenance Process

Construction of new overhead transmission lines may involve some or all the steps listed below:

- Detailed survey of the route alignment;
- Right-of-way acquisition and clearing;
- Construction of access roads, where necessary;
- Installation of tower foundations;
- Assembly and erection of new structures;
- Stringing and tensioning of conductors; and
- Final clean-up and land restoration.

All required materials for the Project's 500-230 kV structures would be delivered and assembled at each structure location within the proposed right-of-way. Detailed foundation design will be completed prior to construction. The foundation design could include poured concrete requiring excavation or steel piles or caissons that might be vibrated, drilled, or driven into place depending on soil conditions and final design. Structures would be erected with a crane and anchored to the foundation during final assembly. If there is excess soil from foundation construction, it would be evenly distributed at each structure, and the soil would be replanted and stabilized. In wetland areas, excess soil would be removed and evenly distributed on an upland site within Dominion's proposed right-of-way. Typical construction equipment may include hole diggers or drilling equipment, cranes, wire-stringing rigs, tensioners, backhoes, and trucks.

All conductors and shield wires would be strung under tension. This system involves stringing a "lead line" between structures for the conductors and ground wires. The rope pulls a steel cable that is connected to the conductors and shield wires, which are pulled through neoprene stringing blocks to protect the conductor and shield wire from damage. Stringing the conductors and shield wires under tension protects the wires from possible damage should they be allowed to touch the ground, fences, or other objects.

Maintaining the right-of-way under the transmission lines is essential for the reliable operation of the line, as well as for public safety. Operation and maintenance of the Project would include periodic inspections of the line and the right-of-way; occasional replacement of hardware as necessary; periodic clearing of vegetation, either mechanically or by selective, low-volume application of approved herbicides within the corridor; and the cutting of danger trees outside the right-of-way. Danger trees are trees outside the cleared corridor that are sufficiently tall enough to fall into the right-of-way and potentially impact the transmission line. Periodic inspections would use both aerial and walking patrols. Normal operation and maintenance would require only infrequent visits by Dominion Energy Virginia or its contractors.

ENVIRONMENTAL ROUTING STUDY

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 Project

Most maintenance activities consist of selective, low-volume herbicide applications targeting only tree species on the right-of-way every three to five years and the cutting of danger trees every three years. Dominion uses only herbicides that are approved by the U.S. Environmental Protection Agency (USEPA) on power line rights-of-way. Additionally, based on a discussion between the Company and VDCR Division of Natural Heritage (DNH) representatives on August 23, 2022, the Company will review its Integrated Vegetation Management Plan for application to both woody and herbaceous species, based on the species list available on the VDCR website. The Company will submit its updated Integrated Vegetation Management Plan to VDCR DNH for review once it is complete.

3. INVENTORY OF EXISTING CONDITIONS

After defining the study area, ERM developed a list of features to consider and assess as part of the routing process and to provide a basis for comparing potential routes (Table 3-1). These include routing constraints (e.g., land uses, planned developments, and biological resources) and routing opportunities (e.g., existing transmission lines, roads, and other linear features). ERM inventoried existing conditions, routing constraints, and routing opportunities using information from publicly available GIS and other databases; agency websites; published documents, such as county or municipal land use plans; and communication with agency and county staff, stakeholders, and elected officials. In cases where GIS data were not available for a particular environmental resource or other feature, ERM obtained the best available hard-copy or online map and hand digitized the information needed to complete the study.

Feature Type	Description			
Existing Corridors				
Existing electric facilities	 Transmission or distribution lines 			
Other utilities	Pipelines			
Transportation infrastructure	 Roads, railroads, and related corridors 			
Land Ownership	Federal, state, and local landsPrivate lands			
Land Uses				
Existing land use and land cover	 Existing subdivisions Land cover types (e.g., forested, agricultural, developed) Residences, churches, schools, cemeteries 			
Recreational areas	 Federal, state, county, or municipal parks Federal-, state-, county- or municipal-managed recreation areas Golf courses Trails (biking, hiking, birding, wildlife) 			
Land use planning and zoning	Zoning districts			
Planned developments	 Planned, proposed, or conceptual residential, commercial, or industrial developments 			
Conservation lands and easements	 VOF and VDCR conservation land and easements Loudoun County conservation easements Wetland mitigation banks Other conservation lands 			
Transportation	Road and railroad crossingsPublic and private airport facilities			

Table 3-1: Features Considered for Routing

ENVIRONMENTAL ROUTING STUDY

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 Project

Feature Type	Description			
Natural Resources				
Surface waters	WetlandsWaterbodies			
Protected or managed areas	 Resource protection areas Wildlife management areas Ecological cores 			
Protected species	Natural heritage resourcesThreatened and endangered speciesBald eagles			
Vegetation	Vegetation characteristicsForested land			
Visual Resources	·			
Visual resources	 Viewsheds to and from visually sensitive areas Scenic rivers Scenic byways 			
Cultural Resources				
Cultural resources	 Archaeological sites Historical or architectural sites and districts NRHP-listed and NRHP-eligible properties Battlefields VDHR-protected easements 			
Geological Resources	·			
Mineral resources	Mines or quarries			
Environmental Justice	 Low-income populations Minority populations Age groups (under age 5 and over age 64) Linguistically isolated communities 			

NRHP = National Register of Historic Places; VDCR = Virginia Department of Conservation and Recreation; VDHR = Virginia Department of Historic Resources; VOF = Virginia Outdoors Foundation

3.1 Land Use

3.1.1 Land Ownership

ERM reviewed information about land ownership in the study area using publicly available GIS databases and digital parcel data obtained from Loudoun County (Loudoun County 2022f). These data indicate that most of the parcels within the study area are privately owned. There are several County-owned properties in the study area including historic sites, open space easements, public safety facilities (firehouses), and schools. Dulles Airport, operated by MWAA, is located on the east side of the study area, but none of the routes cross MWAA property. VDOT-owned rights-of-way are located throughout the study area and are crossed by all routes. Figure 3.1.1 in Appendix A depicts land ownership in the study area.

3.1.2 Existing Land Use and Land Cover

Land use and land cover within the study area were classified using a combination of local and state-wide datasets (Planet Imagery, 2022) as well as aerial photo interpretation to identify the most current uses for a given area. Land use and land cover in the study area can be broken down into the following five main categories:¹

- Developed lands: These are areas characterized by medium to high density constructed buildings, such as certain residential subdivisions, industrial uses, and commercial areas and impervious surfaces. Additional information about residences and residential areas near the transmission line alternative routes is provided in Section 3.1.4, Residences, Residential Areas, and Commercial Structures. This category also includes planned developments and properties that are currently under construction.
- Open space: These are areas primarily covered by planted grasses, including vegetation planted in developed settings for erosion control or aesthetic purposes but also natural herbaceous vegetation and undeveloped land, parks, and open-space recreational facilities. Additional information about recreation areas near the routes, including parks and trails, is provided in Section 3.1.3, Recreation Areas.
- <u>Forested lands</u>: These are areas where land cover consists of natural or semi-natural woody vegetation. Additional information about forested lands near the routes is provided in Section 3.3.6, Vegetation.
- <u>Agricultural lands</u>: These are areas used for commercial farming (e.g., commercial row crops or specialized agricultural activities) or grazing.
- <u>Open water</u>: These are open-water features, including rivers, streams, and natural and artificial ponds.

Figure 3.1.2 in Appendix A depicts land use/land cover in the study area. Each of the land use/land cover categories described above would be crossed by the routes discussed in this report.

3.1.3 Recreation Areas

ERM reviewed digital data sets and maps, U.S. Geological Survey (USGS) topographic quadrangles, recent digital aerial photography, and county websites for parks, trails, and other recreational facilities in the area. Recreation areas closest to the overhead route alternatives are described below. Recreation areas within 0.25 mile of the Mars-Wishing Star route alternatives and Mars 230 kV Loop route are shown on Figure 3.1.3 (Appendix A, Figures).

Willowsford Conservancy Open Space Amenities

The Willowsford Conservancy maintains several open space parcels under common ownership of the Willowsford homeowners' association. Several of these open space parcels abut the west side of the existing 500 kV Brambleton-Mosby Lines (#546 and #590) and 230 kV Brambleton-Loudoun Lines (#2094 and #2045), approximately 0.1 mile to the west along Lenah's Run. Most of the open space parcels are unimproved and used for passive recreation and walking trails but there are two improved private parks approximately 0.12 mile east of the Wishing Star Substation site. At the end of the Marigold Mill Place culde-sac is a park with a trail system, community garden, and picnic tables. About 0.24 mile to the south is

¹ For purposes of land use/land cover, wetland areas have been classified as open space, forested land, or open water depending on wetland type. Wetlands near the routes are discussed separately in Section 4.2.1, Wetlands.

a small neighborhood park with playground equipment and sand volleyball pit near the intersection of Paddock Gate Place and Weathergate Place.

Broad Run Stream Valley Linear Park

The Broad Run Stream Valley Linear Park is a planned, and partially built trail system along Broad Run, extending from the Potomac River to Hanson Regional Park. As planned, the park will create an interconnected system of trails within the Broad Run stream corridor (Loudoun County 2022c). This public open space and trail system has been discussed since the early 2000s and is part of the *Loudoun County Linear Parks and Trail System Plan*, most recently adopted by the Board of Supervisors in July 2021 (Loudoun County 2021). Two parcels that are part of the Broad Run Steam Valley Linear Park and owned by the Loudoun County Board of Supervisors are located northwest of Old Ox Road approximately 0.8 mile north of the Mars-Wishing Star alternative routes. These public parcels are primarily undeveloped and wooded except for segments of Broad Run Trail within riparian corridor.

Broad Run Trail

To the west of the parcels owned by the Board of Supervisors, Broad Run (including the North Fork and South Fork of Broad Run) flows through an undeveloped parcel proposed for a subdivision (Farah Naples LLC), an open space parcel of the Birchwood at Brambleton development (Landbay D), and open space areas of properties proposed for development (Brambleton Shreveport South and Brambleton South Industrial Properties) (Loudoun County 2022a). The developments are described in Section 3.1.4, Residences, Residential Areas, and Commercial Structures.

The Conceptual Development Plan (CDP) and open space proffers for the Birchwood at Brambleton development require the applicant to convey to the County a 30-foot-wide permanent public access easement in locations depicted on the CDP as "Broad Run Trail."

Similarly, the CDP and proffers for Brambleton South Industrial Properties require the developer to dedicate a 150-foot Scenic Creek Valley Buffer (Loudoun 2022e) on either side of Broad Run and well as a permanent public access easement within the 100-year floodplain.

The Stream Valley Park and Trail System

The Birchwood at Brambleton open space parcel south of Evergreen Mills Road (Landbay D) contains several community open space amenities in addition to a segment of the Broad Run Trail. The CDP and proffers include a community garden, a nature garden, and a loop trail system to be dedicated to the County and connected to the Broad Run Trail system. This trail system would also connect to trails shown on the CDPs for developments to the west (Brambleton Shreveport South and Brambleton Industrial South) resulting in a trail system that includes the Broad Run Trail as well as other segments forming several trail loops within an open space area that follows Broad Run from Loudoun County Parkway to Belmont Ridge Road. The trail system would terminate at the Brambleton Community Center parcel, Landbay 3A of the Brambleton development (per ZCPA-2018-0012). Landbay 3A currently contains an unused dairy barn that is planned for conversion to a community center, with associated parking and community open space.

The planned open space and trail system created by the development plans noted above are shown on a brochure published by the Birchwood Community Association at Brambleton and referred to as the Stream Valley Park Trail System. Portions of the Mars-Wishing Star routes are within the open space areas (Figure 3.1.3, Appendix A.)

Birchwood Community Association at Brambleton Recreational Amenities

Several existing recreational amenities associated with the Brambleton developments are located on the north side of Evergreen Mills Road including a swimming pool complex (the Brambleton Corner Clubhouse and Pool), community multi-use paths, and small neighborhood park areas such as the landscaped pond east of the intersection of Evergreen Mills Road and Kingston Ferry Terrace.

3.1.4 Residences, Residential Areas, and Commercial Structures

The SCC requires that the number of dwellings and businesses within 500 feet of routes be considered. ERM identified buildings (dwellings, commercial structures, and outbuildings) within 100 feet, 250 feet and 500 feet of the Mars-Wishing Star alternative routes and Mars 230 kV Loop route centerlines by reviewing various digital data sets and maps, USGS topographic quadrangles (USGS 2022b), and recent (2022) aerial photography. Table 4-1 lists the number of dwellings by type within these buffers for each route. The locations of dwellings along the routes are depicted on Figure 3.1.4 (Appendix A, Figures).

The Mars-Wishing Star alternative routes and Mars 230 kV route cross an area with few existing residences. Residences nearest the routes are located along Arcola Mills Drive and west of the proposed Wishing Star Substation site. The majority of buildings near the routes are commercial/industrial structures and outbuildings. There are no residences located either within the rights-of-way or within 60 feet of the rights-of-way for the Mars-Wishing Star alternative routes and Mars 230 kV Loop route.

3.1.5 Schools, Cemeteries, and Places of Worship

ERM reviewed USGS topographic quadrangles (USGS 2022), recent digital aerial photography (ESRI 2022), county parcel data, and information from the Virginia Cultural Resource Information System (VCRIS) (Virginia Department of Historic Resources [VDHR] 2022) to identify cemeteries, schools, and/or places of worship within 0.25 mile of the Mars-Wishing Star route alternatives, Mars 230 kV Route, and proposed substation sites. No schools, cemeteries, or places of worship are located within 0.25 mile of the routes or substation sites. Figure 3.1.5 in Appendix A, Figures, depicts cemeteries, schools, and/or places of worship in the study area.

3.1.6 Planned Developments

ERM obtained information about planned future developments through publicly available data on county websites and consultations with county planning officials and other stakeholders. Planned developments located within the study area are described below, listed in alphabetical order. Unless otherwise noted, information about these planned developments was found on the Loudoun County Online Land Application System (Loudoun County 2022a). Planned developments are listed in Table 3.1.6-1 and described in the subsections below. Figure 3.1.6-1 in Appendix A, Figures, depicts the existing and planned developments in the study area.

Table 3.1.6-1: Planned Developments within 0.25 Mile of the Mars-Wishing StarAlternative Routes and the Mars 230 kV Loop

Development Name	Status	Routes Crossed	
606 Data Park	Existing; additional development potential	Not crossed.	
Brambleton	Existing and under construction	The Mars-Wishing Star routes do not cross the Brambleton developments north of Evergreen Road. Other Brambleton developments are identified below.	
Brambleton Active Adult and Birchwood at Brambleton	Existing, under construction, and planned	An open space proffer is crossed by all the Mars-Wishing Star routes.	
Brambleton Brandt Commercial Center	Existing, under construction and planned	Not crossed.	
Brambleton Business Campus	Planned, inactive	Crossed by all Mars-Wishing Star routes.	
Brambleton Community Center (Brambleton Landbay 3A)	Planned	Not crossed.	
Brambleton Shreveport South	Planned	Crossed by all routes.	
Brambleton South Industrial (Black Chamber Data Center)	Planned	Crossed by all routes.	
Digital Dulles	Planned	Crossed by all Mars-Wishing Star routes and Mars 230 kV Loop route	
Dulles Trade Center West	21 lots developed; planned development 6 lots	Not crossed.	
Evergreen Meadows	Planned	Not crossed.	
Farah Naples	Planned	Crossed by all Mars-Wishing Star routes.	
JK Technology Park #1	Planned	Not crossed.	
Perimeter Substation Site	Existing with planned expansion	Crossed by all Mars-Wishing Star routes.	
Prologis Park West	Existing	Not crossed.	

606 Data Park

The 606 Data Park is an existing data center on a 40-acre parcel on the northwest side of Route 606 (Old Ox Road) east of Loudoun County Parkway. The development received approval of a special exception in 2017 for an increase in floor area ratio for purposes of developing a data center. A single data center building was constructed in 2019. Additional site area remains to be developed.

Brambleton

Brambleton was approved in 1990 and 1995 as a 2,300-acre mixed use, planned development (ZMAP-1988-0320 and ZMAP-1993-0005). Several plan revisions have occurred throughout development, including approval of plan revisions for specific portions of the development (Birchwood at Brambleton, Brambleton Brandt Commercial Center, Brambleton Business Campus, Brambleton Community Center, Brambleton Shreveport South, and Brambleton South Industrial), each of which are described below. The areas of Brambleton on the north side of Evergreen Mills Road, west of the Brambleton Active Adult development, and within 0.25 mile of the routes, and are fully developed with a mix of detached, attached, and multi-family residences.

Birchwood at Brambleton (formerly Brambleton Active Adult)

The Brambleton Active Adult development was approved in 2007 (ZMAP-2005-0020). The 346-acre property was zoned to allow development of 1,502 age-restricted units, 140,000 square feet of commercial uses, a 3.75-acre library site, and 25,000 square feet of recreational uses. The property included an industrial portion that has since been subdivided and is discussed below (Brambleton Business Campus).

A Concept Development Plan revision approved in 2019 renamed the development "Birchwood at Brambleton." Revised zoning approvals changed aspects of the original approval, but the overall development plan remains a mix of residential, commercial, civic, and recreation areas. The eastern land bay is still in under development. More recently, a site plan was approved in April 2021 for a commercial center at the intersection of Evergreen Mills Road and Loudoun County Parkway (STPL-2020-0016).

Broad Run is crossed by the open space parcel south of Evergreen Mills Road. Plans for the open space parcel required by the approved proffers for ZMAP-2013-0002 (approved in July 2015) and ZCPA-2018-0008 (approved in December 2019), include a loop biking/walking trail, nature stations, and a greenhouse/garden area (see 3.1.3, Stream Valley Park and Trail System).

Brambleton Brandt Commercial Center

Brambleton Brandt is a six-lot commercial development at the intersection of Arcola Mills Drive, Evergreen Mills Road, and the future extension of Northstar Boulevard. Construction is complete on three lots, including retail stores, offices, and a day care/preschool. Three remaining lots had site plans approved in 2019 for a single building on each lot (STPL-2017-0028 and SPAM-2019-0033). The uses indicated on the site plan are a fast-food restaurant, a gas station, and an automotive service facility.

Brambleton Business Campus

This 54-acre property is south of the Birchwood at Brambleton open space parcel, on the west side of Loudoun County Parkway and north side of Arcola Road. As the southernmost land bay in the 2005 zoning approval for the Brambleton Active Adult community, it was designated for industrial use, not residential use, likely due to its location within the Airport Impact Overlay District (see Section 3.1.7.1, Land Use Planning). In a subsequent rezoning approved in 2015, the parcel was rezoned from PD-GI (General Industrial) to PD-IP (Industrial Park) (ZMAP-2012-0017). The concept development plan included an illustrative plan for the possible establishment of a community college campus on the site. No development plan has been submitted since 2015.

Brambleton Community Center (Brambleton Landbay 3A)

Brambleton Community Center is a 20-acre parcel on the south side of Evergreen Mills Road and east side of Belmont Ridge Road. In 2015, the parcel was added to the Brambleton development as Landbay 3A (ZMAP-2012-0013). The proffers that govern use of this property indicate that an existing dairy barn on the property is to be rehabilitated and used as the basis for the "Brambleton Center", a community center able to accommodate up to 500 people for community meetings and gatherings. Other improvements on the property would include parking and open space. The property is currently unimproved except for the unused dairy barn and smaller farm structures.

Brambleton Shreveport South

Brambleton Shreveport South includes land south of Evergreen Mills Road and east of Arcola Mills Road. It is adjacent to the Brambleton South Industrial development to the south and the Brandt Commercial Center development to the west. This property was originally part of plans for the Brambleton community, a larger planned development established by zoning approvals in 1993 and largely developed to the north of Evergreen Mills Road.

A zoning amendment for Brambleton Shreveport South was submitted to Loudoun County in October of 2021 (ZMAP-2021-0019). The rezoning includes 76.5 total acres divided into two, noncontiguous development areas. A 26-acre tract at the intersection of Evergreen Mills Road and the proposed Northstar Boulevard would be developed with multi-family dwellings, two retail buildings, a parking garage, and open space along Broad Run on the southern portion of the tract. The second area, a 50-acre tract further east, would be developed with single-family attached and multi-family dwellings. In total, the applicant proposes to develop up to 1,162 dwellings (single-family attached and multi-family) and up to 40,000 square feet of commercial floor space. The first round of County staff comment was sent to the applicant on January 31, 2022. As of October 2022, the applicant has not replied to or addressed staff comments.

Brambleton South Industrial (Black Chamber Data Center)

A zoning map amendment with a CDP was approved on February 15, 2022, to rezone the 160-acre Brambleton South Industrial property to PD-IP for data center development (ZMAP-2020-0003). The Brambleton South Industrial property is located on both sides of Broad Run and has road frontage on Arcola Mills Drive to the southwest. The property is bisected by Belmont Ridge Road (Route 659).

The approved CDP shows two development envelopes south of Broad Run, with road access via Belmont Ridge Road. The northern portion of the site along Broad Run Creek and the eastern portion along South Fork Broad Run would be environmental preservation areas. A total of 92 acres of the 160-acre site would be open space, leaving 68 acres of development area. The maximum gross floor area permissible within the site per the CDP would be 4.3 million square feet.

A site plan was submitted to Loudoun County on September 22, 2022, which proposes two data center buildings. The data center development could include a new NOVEC delivery point just south of Dominion's existing right-of-way for Lines #2172 and #2183 on the eastern end of the site.

Digital Dulles

Digital Dulles is a planned, 11-building data center on a former MWAA-owned site comprising approximately 414 acres east of Old Ox Road extending from Beaver Meadow Road to the north to Carters School Road to the west. A site plan for two buildings was approved on April 13, 2022 (STMP-2020-0008). The site is across Carters School Road from the ADESA Washington DC auto auction facilities discussed above.

Dulles Trade Center West

Dulles Trade Center is a 28-lot, 106-acre industrial subdivision north of the intersection of Arcola Mills Road and Arcola Road with one internal subdivision road (Trade West Road). The lots were recorded in 2007 and all except seven lots were developed by 2021, according to July 2021 aerial photography. Development plans have been approved or are under review for 6 of the 7 undeveloped lots. The rightsof-way of Mars-Wishing Star Routes 5 and 6 border the rear (north) lot line of one lot in Dulles Trade Center West and is within 200 feet of four other lots. Bordering the Dulles Trade Center to the southeast is the right-of-way of the planned connection of Arcola Boulevard from Arcola Mills Drive to Loudoun County Parkway. This section of Arcola Boulevard is Phase 3 of the planned construction of the road from U.S. 50 to Loudoun County Parkway, which had not begun construction as of September 2022. The southern sections of this planned road (Phases 1 and 2) were under construction or complete.

Evergreen Meadows

Evergreen Meadows is a 4.5-acre site on the south side of Evergreen Mills Road west of Belmont Ridge Road. A special exception and rezoning were approved in 2017 to allow construction of two buildings on the site, one to be used as a child day care center and the other to be used for outpatient medical care and education (dance lessons, sports training). A site plan for the buildings, parking, and other site improvements was approved on March 11, 2022 (STPL-2018-0009).

Farah Naples

A subdivision waiver application currently under review by Loudoun County would divide this 79-acre parcel, bisected from east to west by Broad Run, into two lots of 52 and 27 acres. The subdivision would also create floodplain easements and establish the Scenic Creek Valley Buffer along Broad Run. County meeting notes indicate that the end use of the smaller parcel, south of Broad Run, may be a data center. The subdivision waiver application has not yet been approved and no site plan for a specific building layout or land use has been submitted to Loudoun County.

JK Technology Park #1

A zoning map amendment and special exception was approved on October 20, 2020, to rezone 71.5 acres of unimproved land to PD-IP for office and data center uses. The site is south of the proposed Wishing Star Substation. The JK Technology Park #1 is bordered to the west by an existing Dominion transmission line and will be bisected by the future alignment of Northstar Boulevard. According to the approved CDP, the road dedication area for Northstar Boulevard would be 6.7 acres. On-site open space areas, including perimeter setbacks and a tree conservation area, would encompass 16.3 acres of the 71.5-acre site. The applicant has not submitted any additional land use petitions since the prior zoning approval.

Perimeter Substation Site

An existing, substation and switching station share a parcel on the northwest side of Old Ox Road, across Old Ox Road from the ADESA Washington DC Auto Auction facility. Known as the Perimeter Substation and Cabin Run Switching Station, this NOVEC-owned site is bordered to the south and west by the Company's existing Lines #2137 and #2213. A new delivery point facility is planned to for development on the west side of the site adjacent to the Line #2137 and #2213 right-of-way.

Prologis Park West Dulles

Prologis Park West is an existing, three-building data center on a 37.5-acre parcel at the intersection of Old Ox Road and SR 857 (Carters Mill Road). The site plan was approved in April 2018 (STMP-2017-0011).

3.1.7 Land Use Planning and Zoning

3.1.7.1 Land Use Planning

Section 15.2-2223 of the Va. Code requires local planning commissions to adopt a comprehensive plan that provides guidance for the physical development of the territory within its jurisdiction. The plan considers existing and future land uses, anticipates development trends, and makes recommendations for guiding long-term development decisions of a city or county. Loudoun County has adopted a comprehensive plan and zoning ordinances within its jurisdiction. The *Loudoun County Comprehensive Plan* was updated in 2019, however, several Comprehensive Plan Amendments (CPAM) are currently under review.

Local governments often use zoning to implement objectives of the comprehensive plan. A zoning ordinance creates land use categories that separate incompatible uses and establishes development standards to guide orderly and efficient land use. Virginia requires that a comprehensive plan be reviewed at least once every 5 years to adjust to actual or projected changes in land use conditions or needs (Section 15.2-2230). Zoning ordinances may be modified by the local land manager and governing bodies or through requests from residents or businesses to change zoning designations or approved new uses. Under Virginia law, public utilities planning to construct any transmission line of 138 kV or higher may either obtain a Certificate of Public Convenience and Necessity (CPCN) from the SCC or obtain the applicable local zoning ordinance approvals. The SCC's issuance of a CPCN preempts the local zoning ordinances.

Airport Impact Overlay District

The County is currently reviewing a CPAM with particular significance to the study area: the Airport Impact Overlay District Update (CPAM-2021-0001). This CPAM would amend the County's Airport Impact Overlay District to reflect the results of the *2019 Dulles Noise Contour Update Report*. The Airport Impact Overlay District indicates where airplane noise is anticipated to affect residential, school, and commercial buildings. The current overlay district was implemented by the Board of Supervisors in the early 1990s to both prevent residential development in areas that would be affected by aircraft noise and mitigate impacts to prospective homebuyers (Loudoun 2022j). The significance of the amendment to the Airport Impact Overlay District is that it will update the boundaries of the district based on updated maps of noise contours for Dulles Airport. This will directly impact planned developments and future land use in the study area by shifting the three noise tiers and redrawing the *Ldn 65 or Higher* tier contour, within which new residential development would be prohibited if the amendment is adopted. In identifying route alternatives for the Mars-Wishing Star Lines and the Mars 230 kV Loop, ERM considered the existing and proposed Airport Impact Overlay District to concentrate potential Project impacts and route alignments, to the extent practicable, in areas where future residential development would likely be prohibited.

Subarea Plans

The Project is located in the *Dulles Planning Subarea* which is the fastest growing area in Loudoun County. The current estimated population in the Dulles Planning Subarea is 37,151. The Subarea's population is forecast to be 83,173 by 2026, a growth of over 123 percent (Loudoun 2022i). The County anticipates that the Dulles Planning Subarea will continue to see significant residential and commercial growth as previously approved rezoning and site plan applications reach development stage.

3.1.7.2 Zoning

The Project is in an area under the zoning ordinance's *Suburban Zoning District Regulations*. The Wishing Star and Mars Substations are subject to the provisions of the zoning ordinance; however, the

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 Project

Mars-Wishing Star Lines and Mars 230 kV Loop are exempt under the CPCN. Listed below are descriptions of zoning districts crossed by the Mars-Wishing Star routes and the Mars 230 kV Loop route:

- Countryside Residential-1 (CR-1)—This district is established to foster the conversion of existing residential properties zoned R-1 under the 1972 Zoning Ordinance that are not served by communal or municipal water and sewer. These areas can be served by on-site well and wastewater systems but are areas in which the County encourages a countryside hamlet pattern served by public water and sewer facilities to preserve open space.
- <u>Planned Development-General Industrial (PDGI)</u>—The district is established for medium intensity industrial uses with public nuisance potential.
- Planned Development-Active Adult/Age Restricted (PD-AAAR)—This district is established to provide planned adult residential communities for a population 55 years of age or older, in accordance with Va. Code Section 36-96.7. The PD-AAAR district is intended to be located in urban and suburban areas of the County where high-density residential uses would otherwise be consistent with the County's Comprehensive Plan policies. PD-AAAR districts are on a minimum of 25 acres, have public sewer and water, and are served by one or more major arterial or collector roads.
- Planned Development-Industrial Park (PDIP)—The district is established for light and medium industrial uses, office uses, and accessory uses and facilities, and was designed with appropriate siting of buildings and service areas, attractive architecture, and effective landscape buffering to create a park-like atmosphere to complement surrounding land uses.

Wishing Star Substation and Mars Substation are located in the PDIP and PDGI zoning district, respectively.

3.1.8 Conservation Easements and Conservation Lands

The Virginia Open-Space Land Act provides for the creation of open-space easements by public bodies as a means of preserving open-space or significant natural, cultural, and recreational resources on public or private lands. Most easements created under the Virginia Open-Space Land Act are held by the Virginia Outdoors Foundation (VOF), but any state agency is authorized to create and hold an open-space easement. The Virginia Conservation Easement Act also provides for the creation of conservation easements on public or private lands but under the auspices of charitable organizations (such as conservation trusts) rather than public agencies. In both cases, these easements are designed to preserve and protect open-space and other resources in perpetuity. Easements negotiated with private landowners allow the lands to remain in private ownership but with protections imposed to limit or restrict land uses on the property. Dominion understands that properties are placed under easement throughout the year, and additional easements may be identified as the Project moves forward. Dominion will continue to consult with the various land managing entities regarding potential new easements in the study area. Figure 3.1.8 in Appendix A, Figures depicts conservation easements and conservation lands is provided in the study area.

Virginia Outdoors Foundation

The VOF leads Virginia in land conservation, protecting over 850,000 acres across the state. The VOF was created under the Virginia Open-Space Land Act. Most easements created under the Virginia Open Space Land Act are held by the VOF, but any state agency is authorized to create and hold an open space easement. These easements are designed to preserve and protect open space or other resources in perpetuity. Easements negotiated with private landowners allow the lands to remain in private ownership but with protections imposed to limit or restrict land uses on the property (VOF 2021). There

are currently no VOF easements crossed by or within six miles of the Project alternative routes and other facilities.

Agricultural and Forestal Districts

The Virginia Agricultural and Forestal Districts Act provides for the creation of conservation districts (Commonwealth of Virginia 1997). These districts are designed to conserve, protect, and encourage the development and improvement of a locality's agricultural and forested lands for the production of food and other products, while also conserving and protecting land as valued natural and ecological resources. These districts are voluntary agreements between landowners and the locality and offer benefits to landowners when they agree to keep their land in its current use for between 4 to 10 years. A district must contain at least 200 acres. There are no Virginia Agricultural and Forestal Districts in the study area.

Loudoun County Conservation Easements

Over 75,000 acres of land are protected by easements managed under the Loudoun County Conservation Easement Stewardship Program. Loudoun County easements restrict the use or development of a property for a variety of purposes including the following:

- Retaining or protecting natural or open-space values of the property;
- Assuring its availability for agricultural, forestall, recreational, or open-space use;
- Protecting natural resources;
- Maintaining or enhancing air or water quality; and
- Preserving historical, architectural, or archaeological aspects of the property.

Easements negotiated with private landowners allow the lands to remain in private ownership but with protections imposed to limit or restrict land uses on the property. No easements dedicated to Loudoun County are crossed by the routes.

Scenic Creek Valley Buffer

The Scenic Creek Valley Buffer is a 150-foot buffer required by the Loudoun County Zoning Ordinance, Section 5-1002, on either side of waterways draining more than 640 acres (Loudoun County 2022e). The 150-foot buffer is measured from the channel scar line of the creek. Approved development plans within the study area establish the boundaries of this buffer along Broad Run, North Fork Broad Run, and Cabin Run. The construction of new buildings, structures, parking lots, or other impermeable surfaces within the Scenic Creek Valley Buffer is prohibited, and the Zoning Ordinance encourages the growth, through plantings or natural succession, of vegetative and forest cover. Utilities may be located within the buffer; however, the Mars-Wishing Star Lines and Mars 230 kV Loop would be exempt from these provisions under a CPCN. All Mars-Wishing Star route alternatives cross a portion of the Scenic Creek Valley Buffer where they intersect Broad Run or South Fork Broad Run.

Wetland Mitigation Areas and Restrictive Preservation Areas

Portions of the Brambleton development are protected under restrictive covenants that designate *Restrictive Preservation Areas and Wetland Mitigations Areas*. These preservation areas were established in conjunction with Virginia Department of Environmental Quality (VDEQ) and U.S. Army Corps of Engineers (USACE) permitting for various Brambleton developments to offset and mitigate impacts on wetlands and forests. As part of USACE and VDEQ permitting conditions, a Declaration of Restrictions and Covenants recorded for these areas required that they be preserved in their natural state. Prohibited activities include any alteration except for installing unpaved trails and wildlife

management structures. No new structures may be built or placed in the protected areas. Land clearing is prohibited except as may be necessary on a case-by-case basis with prior approval by the VDEQ and USACE. The preservation areas are located along Broad Run within the Brambleton Shreveport South and Brambleton Industrial South developments. All the Mars-Wishing Star routes cross either a Wetland Mitigation Area, Restrictive Preservation Area, or both.

Other Conservation Lands

ERM obtained information about other conservation lands by reviewing a digital dataset obtained from the VDCR and Loudoun County. The dataset identifies "lands of conservation and recreational interest" in Virginia, including federal, state, local, and privately owned lands. There are no VDCR stream conservation units (SCUs) or other conservation lands within the study area.

3.1.9 Transportation

The road network in the study area consists of a variety of road types from principal arterials (such as Route 50) to minor arterials (Belmont Ridge Road) to minor collectors (such as Carters School Road) The Mars-Wishing Star alternative routes cross five existing roads and one planned road. The Mars 230 kV Loop does not cross any roads.

Existing roads crossed by the Mars-Wishing Star routes are Carters School Road (Route 857), Old Ox Road (Route 606), Loudoun County Parkway (Route 607), Belmont Ridge Road (Route 649), and Arcola Mills Drive (Route 621).

The Mars-Wishing Star alternative routes cross one planned road extension project and two road widening projects (Loudoun County 2022b and 2022c). Another road extension project, Arcola Boulevard Extension, was identified as a major constraint and led to the rejection of Mars-Wishing Star Route 9 (see Section 2.7, Routes Rejected from Further Consideration). Descriptions of these road projects are provided below.

- Improvements to Arcola Mills Drive—Belmont Ridge Road to Stone Springs Blvd: This project includes the widening of Arcola Mills Drive (SR 621) from two lanes to a three-lane roadway with a continuous left turn lane, and right turn lanes between Belmont Ridge Road and Stone Springs Boulevard. Construction includes improvements at the intersections of Belmont Ridge Road and Stone Springs Boulevard, and a new bridge to carry Belmont Ridge Road over the South Fork of Broad Run. The project includes the construction of a sidewalk on one side of the road and a shared use path on the other.
- Improvements to Belmont Ridge Road—Arcola Mills Drive to Evergreen Mills Road (previously known as Shreveport Drive): The project is identified in the Loudoun County FY 2022 Amended Capital Improvement Program as a "future road project", indicating that its funding is completely within "Future Funding Years" or at least four years beyond the planning period of FY 2023 through FY 2028 (Loudoun County 2022b). The Mars-Wishing Star alternative routes cross the existing Belmont Ridge Road, currently a two-lane road with no shoulders, along the road section planned for improvement and widening.
- Northstar Boulevard Extension—A 1.6-mile-long road extension of Northstar Boulevard has been planned as a new four-lane divided highway from Evergreen Mills Road (formerly Shreveport Drive) to U.S. Route 50 (VDOT 2022). The project scope includes a 10-foot-wide shared use path on both sides of the roadway and a traffic signal at Route 50. At the northern end of the project, a new bridge will carry Northstar Boulevard over the North Fork of Broad Run. Evergreen Mills Road will then be realigned to the south to intersect with Northstar Boulevard. Once constructed, the new 1.6 mile-long

segment of Northstar Boulevard will serve as a minor arterial roadway. The project is expected to be completed in mid-2024.

Arcola Boulevard Extension (Route 50 to Route 606)—This project will entail construction of a fourlane median divided roadway between Route 50 and Old Ox Road; the project is approximately 1.7 miles in length and is mostly complete. The remaining segment between Trade West Drive and Arcola Mills Drive is planned for construction in late 2022.

3.1.10 Airport Facilities

Transmission line structures have the potential to affect airspace in and around airports. The following sections describe the airports in the vicinity of the study area and the airspace regulations that could impact the Project. Potential impacts on airports and airspace are addressed in Section 4.1.10, Airport Facilities.

3.1.10.1 Airports Near the Project Area

ERM reviewed the FAA's website to identify public use airports, airports operated by a federal agency or the U.S. Department of Defense, airports or heliports with at least one FAA-approved instrument approach procedure, and public use or military airports under construction (FAA 2021). Based on this review, there are nine airports, private airstrips, or heliports located within 10 nautical miles of the Project facilities (Figure 3.1.10-1 in Appendix A). Table 3.1.10-1 lists the airports, heliports, or private airstrips in the Project vicinity, including airport identification (ID) number, distance and direction from the nearest route or substation to the nearest runway/heliport, type of use, and maximum runway length.

Airport/Heliport Name	FAA Identifier	Approximate Distance and Direction from Nearest Project Facility (miles)	Use	Maximum Runway Length (feet)
Dulles Airport	IAD	0.1 mile south of Mars Substation	Public	11,500
Stonesprings Heliport	6VG4	1.2 miles south of Wishing Star Substation	Private	NA
Goose Hunt Farm Airport	3VA5	6.2 miles northwest of Wishing Star Substation	Private	1,700
Reston Hospital Heliport	43VA	6.9 miles east of Mars Substation	Private	NA
Leesburg Municipal Airport	KJYO	7.2 miles north of Wishing Star Substation	Public	5,500
Inova Fair Oaks Hospital Heliport	74VA	7.6 miles southeast of Mars Substation	Private	NA
Inova Loudoun Hospital Heliport	34VA	8.2 miles north of Routes 1 and 3	Private	NA
Fairfax County Police Heliport	26VA	9.3 miles southeast of Mars Substation	Private	NA
Crippen's Heliport	VA54	9.5 miles northeast of Mars Substation	Private	NA

Table 3.1.10-1: Airports and Heliports Located in the Project Vicinity

FAA = Federal Aviation Administration; NA = not applicable

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3.1.10.2 Federal Aviation Administration Regulations

The FAA is responsible for overseeing air transportation in the United States. The FAA focuses on air transportation safety, including the enforcement of safety standards for aircraft manufacturing, operation, and maintenance. The FAA also manages air traffic in the United States and evaluates physical objects that may affect the safety of aeronautical operations through an obstruction evaluation. The prime objective of the FAA in conducting an obstruction evaluation is to ensure the safety of air navigation and the efficient utilization of navigable airspace by aircraft.

The regulations that govern objects that may affect navigable airspace are codified in the Code of Federal Regulations (CFR), Title 14, Part 77 (14 CFR Part 77). A summary of the rule as it relates to the Project is provided below, and the full rule is provided in Appendix D.

Civil Airport Imaginary Surfaces

Civil airport imaginary surfaces have been established with relation to each airport and each runway. The imaginary surfaces were developed to prevent existing or proposed objects from extending from the ground into navigable airspace. Following is a description of the civil imaginary surfaces:

- Horizontal surface: This surface is a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs by lines tangent to those arcs.
- **Conical surface**: This is a surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.
- Primary surface: This is a surface longitudinally centered on a runway. The primary surface extends 200 feet beyond the end of each runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.
- Approach surface: This is a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based upon the type of approach available or planned for that runway end (e.g., precision instrument approach, visual approach).
- Transitional surface: These surfaces extend outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces. Transitional surfaces for those portions of the precision approach surface that project through and beyond the limits of the conical surface extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at right angles to the runway centerline.

Figure 3.1.10-2 in Appendix A provides a visual representation of where these imaginary surfaces are located for Dulles Airport.

Terminal Instrument Procedures

In addition to the civil airport imaginary surfaces, there are imaginary surfaces associated with terminal instrument procedures (TERPS). TERPS are procedures for instrument approach and departure of aircraft to and from civil and military airports. TERPS are used for airport obstruction analysis to protect airspace by establishing restrictions on the height of buildings, antennas, trees, and other objects, as necessary, to protect the airspace needed for aircraft during preparation for, and completion of, the landing or departure phases of flight. None of the route alternatives discussed in this report would exceed the TERPS surfaces of the airports identified in Table 3.1.9-1. Dulles Airport, specifically Runway 12 with

a precision approach procedure and a 50:1 Terps restrictive surface, is the most critical terps surface in the Project vicinity.

Federal Aviation Administration Notice Requirements and Timing

Based on the runway categories and dimensional standards described above, a notice must be filed with the FAA in any of the following conditions:

- Any construction or alteration is more than 200 feet above ground level at its site;
- Any construction or alteration exceeds an imaginary surface extending outward and upward at the following slope:
 - 25 to 1 for a horizontal distance of 5,000 feet from the nearest point of the nearest landing and takeoff area of each heliport;
 - 50 to 1 for a horizontal distance of 10,000 feet from the nearest point of the nearest runway that is no more than 3,200 feet in actual length; or
 - 100 to 1 for a horizontal distance of 20,000 feet from the nearest point of the nearest runway that is more than 3,200 feet in actual length; or
- If requested by the FAA.

Construction or alteration of any structure that meets the notification requirements set forth above requires submittal of an FAA Form 7460-1, Notice of Proposed Construction or Alteration, to the FAA regional office with jurisdiction over the area within which the construction or alteration will be located or submitted electronically via the FAA website. The information that needs to be provided with the notice includes the coordinates, site elevation, and structure height above ground level for each pole/structure and the height of construction equipment, such as cranes.

Based on the current plans, the proposed transmission line structures for the Project would range in height from 90 to 190 feet tall, depending on route and structure locations. It is anticipated that cranes would be used to install the structures. Based on current plans, the proposed Project, regardless of the route selected, would exceed the FAA notification thresholds described above for Dulles Airport.

State and Local Regulations Commonwealth of Virginia Aviation Regulations

Section 5.1-25.1 of the Va. Code establishes that it is unlawful for a person to erect any structure that penetrates into or through any licensed airport's clear zone, approach zone, imaginary surface, obstruction clearance surface, obstruction clearance zone, or surface or zone as described in regulations of the Virginia Department of Aviation or the FAA without first securing a permit for its erection from the Board of Aviation. However, it also states that this requirement does not apply to any structure to be erected in a county, city, or town that has an ordinance regulating the height of such structures to prevent the penetration of zones and surfaces provided for in 14 CFR Part 77 and Rule 19 of the Virginia Department of Aviation. Dulles Airport has drafted land use restrictions associated with noise contour lines, but not regulating the height of structures as mentioned above. Therefore, the Part 77 airspace restrictions as codified in the Va. Code apply.

Local Airport Regulations

Va. Code Sections 15.2-2280, 15.2-2282, 15.2-2293, and 15.2-2294 give local jurisdictions the power to establish and regulate zoning districts, make airspace subject to their zoning ordinance, and establish airport safety zoning. Following is a summary of the zoning regulations applicable to the airports listed in Table 3.1.9-1.

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Loudoun County has established restricted-use zones to regulate the use of property in the vicinity of Dulles Airport. The Airport Impact Overlay District is a zoning overlay district administered by the Loudoun County Department of Building and Development. This district is established to acknowledge the unique land use impacts of airports, regulate the siting of noise-sensitive uses, ensure that the heights of structures are compatible with airport operations, and complement FAA regulations regarding noise and height.

The Airport Impact Overlay District boundaries are based on the 60 decibels (dBs) and 65 dB loudness day-night noise contours and a 1-mile buffer that extends beyond the 60 dB day-night average sound level contour for Dulles Airport. The zones include all land lying beneath the approach surfaces, transitional surfaces, horizontal surfaces, and conical surfaces as they apply to this airport.

3.2 Environmental Justice

ERM completed a desktop environmental justice (EJ) review for the Mars-Wishing Star routes and Mars 230 kV Loop route. The review followed federal guidance and recommended methodologies outlined by the Council on Environmental Quality and the Federal Interagency Working Group on Environmental Justice and National Environmental Policy Act Committee. The analysis additionally used definitions provided in the Virginia Environmental Justice Act for different categories of EJ populations (Va. Code §§ 2.2-234, 2.2-235). The purpose of conducting the EJ review was to determine if construction or operation of the alternative routes would result in disproportionately high and adverse environmental impacts on populations of color, low-income populations, linguistically isolated communities, or age-based vulnerable communities (i.e., EJ populations). This approach is consistent with requirements outlined in the Virginia Clean Economy Act of 2020 pertaining to the development of new, or expansion of existing, energy resources or facilities (Va. Code § 56-585.1).

In identifying potential areas of concern, federal guidelines state that the size of the area surrounding a project selected for the EJ assessment should be an appropriate unit of geographic analysis that does not artificially dilute or inflate the affected minority population. For this review, the Census Block Group (CBG) was used as the primary unit of analysis because it is the smallest geographic unit for which U.S. Census Bureau demographic and economic data are available, providing robust information at a sub-county level. All CBGs crossed by and within a 1-mile radius of all routes were included in the screening area. Figures 3.2-1 through 3.2-7 in Appendix A, Figures, depict where potential EJ populations were identified along the routes.

The Commonwealth of Virginia was used as the reference population for the desktop analysis. Data for the counties were also considered in the review to assess regional demographic variations. Demographic data for the Commonwealth were compared with individual CBGs to help identify the presence of potential EJ populations. For example, in cases where the reported percentage of population of color within an individual CBG is greater than the percentage of population of color in Virginia as a whole, a potential EJ population was identified. The USEPA EJ mapping and screening tool, EJSCREEN 2.0 (USEPA 2022), and census data from the U.S. Census Bureau *2015–2019 American Community Survey* (U.S. Census Bureau 2019) were used to collect demographic data for the state, counties, and CBGs.

The Commonwealth of Virginia defines "population of color" as a group of individuals belonging to one or more of the following racial and ethnic categories: "Black, African American, Asian, Pacific Islander, Native American, other, nonwhite race, mixed race, Hispanic, Latino or linguistically isolated" (Va. Code §§ 2.2-234). The USEPA's definition of a population of color is analogous to Virginia's definition of population of color but does not include linguistically isolated individuals; however, EJSCREEN includes a separate demographic indicator for linguistic isolation.

The Commonwealth of Virginia identifies a minority population, or what it terms a "community of color," if an analysis area has a greater "population of color" percentage than that of the state as a whole. If a "community of color" is composed primarily of a specific "population of color," however, then the percentage population of that single group in the state is used instead of the percentage for the total "population of color" (Va. Code §§ 2.2-234). The Commonwealth of Virginia's criteria for an identified "community of color" or "population of color" and what constitutes an EJ population have a lower threshold and are more inclusive than is suggested in the federal guidance. Therefore, the state's criteria were used to identify CBGs that contain populations of color for this study.

Federal guidelines recommend using an appropriate poverty threshold and comparing the analysis area with a reference population to identify low-income populations. The Commonwealth of Virginia identifies low-income populations as any CBG in which 30 percent of the population is composed of low-income residents. It defines low income as "having an annual household income equal to or less than the greater of (i) an amount equal to 80 percent of the median income of the area in which the household is located, as reported by the Department of Housing and Urban Development, and (ii) 200 percent of the Federal Poverty Level" (Va. Code § 2.2-234). For this review, a low-income population was considered present when the low-income population percentage in the CBG exceeds 30 percent.

The EJ review assessed the potential for other factors that could limit low-income or minority communities from reviewing and commenting on the alternative routes, including age-based vulnerabilities (i.e., the percentage of the people in a CBG under age 5 or over age 64), linguistic isolation (i.e., the percentage of people or households in a CBG in which all members over age 14 speak a language other than English and also speak English less than very well), and the percentage of people over age 25 in a CBG with less than a high school education. These communities were identified using the federal guidance of a meaningfully greater threshold. A CBG was considered to contain a potential EJ community when the percentage of people with language barriers, educational attainment less than high school, and/or populations below age 5 or above age 64 equals or exceeds 200 percent of the corresponding state averages.

3.2.1 Cultural Context

The Virginia Environmental Justice Act defines the term "environment" to include the cultural components of a community in addition to the socioeconomic and natural aspects. Therefore, this assessment was informed by online research to identify potential cultural impacts on underserved communities that may have historically resided in the area. Three notable African American places (Old Darnes Cemetery; Arcola Quarters for the Enslaved; and the Kavanaugh and Royville Colored School, Broad Run District) are near (but are not crossed by) the Project, each of which are briefly described below. The places are depicted on Figures 3.2-1 through 3.2-7 in Appendix A, Figures.

- Old Darnes Cemetery is located on the north side of Arcola Road west of Trade West Drive. It contains headstones with interment dates ranging between 1821 and 1936. The cemetery includes 20 burials of enslaved people (Historic African American Sites and Communities of Loudoun County, 2022; Loudoun County, 2020).
- Arcola Quarters for the Enslaved is a stone building from circa 1800 that served as slave quarters. The site boundary encompasses about 4.4 acres of a former plantation owned by the Lewis family, which had land holdings dating to the seventeenth century and was considered a family of prominent citizens in Loudoun County at the time (Andre, 2008). Charles Lewis willed his land and slaves to his brother in 1843, including the 333-acre plantation and 31 slaves. The extant stone living quarters may have been one of several located on the plantation. The site is listed on the National Register of Historic Places (NRHP) and on the Virginia Landmarks Register (VDHR File No. 053-0984).

Kavanaugh and Royville Colored School, Broad Run District, is a one-room school located between Route 659 and Fallen Hills Drive south of Creighton Road. The school served Black students from Loudoun County between 1886 and 1900. Based on the historic record, it appears that the school may have operated as the Kavanaugh School between 1886 and 1891 and as the Royville School between 1898 and 1900 (Edwin Washington Project, 2022).

3.2.2 Environmental Justice Desktop Results

The desktop review identified eight CBGs within the 1-mile analysis area around the routes, of which the same four CBGs are crossed by the six alternative routes for the Mars-Wishing Star Lines and the Mars 230 kV Loop route (see Figures 3.2-1 through 3.2-7 in Appendix A, Figures). The remaining four CBGs are within 1 mile of, but not directly crossed by, the routes. Table 3.2. 1 identifies the demographic indicators for the populations in each CBG within the 1-mile analysis area as well as the reference populations for identifying EJ populations.

The results of the analysis are discussed below. An assessment of potential impacts on identified EJ populations is provided in Section 4.2, Environmental Justice.

3.2.3 Mars-Wishing Star Routes 1, 2, 3, 4, 5, and 6

Low-Income Populations

Virginia has a low-income population of 25 percent, while Loudoun County has a low-income population of 10 percent. Among the CBGs in the analysis area, the low-income population percentages range between 3 and 10 percent. None of the CBGs in the analysis area have low-income populations that are greater than the 30 percent threshold for low-income populations identified by the state.

Populations of Color

The Commonwealth of Virginia has a total population of color of 38 percent, including Black/African American (19 percent), Hispanic (9 percent), and Asian (6 percent). Two or more races make up 3 percent of the total population. Native Americans, Native Hawaiian and Pacific Islanders, and "some other race alone" make up less than 1 percent each but can occur locally in higher concentrations. Seven CBGs are identified as encompassing communities of color that are predominantly Asian (Table 3.2-1). Routes 1 through 6 cross three of these CBGs.

Other Sensitive Populations

Virginia has a linguistically isolated population of 3 percent, a population under age 5 of 6 percent, a population over age 64 of 15 percent, and a population with less than a high school education of 7 percent. None of the CBGs contain population percentages greater than 200 percent when compared to the applicable reference populations regarding linguistic isolation, educational attainment, or being over age 64 (Table 3.2-1). One CBG exceeds the threshold for populations under age 5.

3.2.4 Mars 230 kV Loop Route

The Mars 230 kV Loop crosses two CBGs. One CBG encompasses Dulles Airport which does not contain a resident population. The second CBG is identified as encompassing communities of color that are predominantly Asian (Table 3.2-1).

3.2.5 Wishing Star Substation

The proposed Wishing Star Substation is located within a CBG that exceeds the threshold for population of color. This CBG is identified as encompassing communities of color that are predominantly Asian (Table 3.2-1).

3.2.6 Mars Substation

The Mars Substation is located within a CBG that encompasses Dulles Airport, which does not contain a resident population (Table 3.2-1).

Table 3.2-1: Pop	ulations o	f Color and	d Low-Inc	ome Pop	ulations in	Analysi	s Area									
State/County Census Block Group (Census Tract, Block Group)	Population	Total Populatio n of Color ^a (%)	White, Non- Hispanic (%)	Black or African America (%)	American Indian and Alaska Native (%)	Asian (%)	Native Hawailan or Other Pacific Islander (%)	Some Other Race Alone (%)	Two or More Races (%)	Hispani c or Latino (%)	Low-Incom e Population (%)	Linguistically Isolated Population (%)	Populatio n with Less than High School Education (%)	Population Under Age 5 (%)	Populatio n Over Age 64 (%)	Facility Crossing CBG
VIRGINIA	8,454,463	38	62	19	<0.1	9	<0.1	<0.1	e	6	25	ę	7	9	15	
Loudoun County	413,538	45	55	œ	<0.1	20	<0.1	<0.1	4	14	10	4	9	7	ი	
511076110241 (CT 6110.24, BG 1)	4,742	22	78	0.1	<0.1	თ	<0.1	<0.1	4	10	m	<0.1	e	10	თ	
511076110251 (CT 6110.25, BG 1)																Route 1 Route 2
	5,853	67	33	2	0.0	37	0.1	<0.1	თ	13	10	ო	4	o	N	Route 3 Route 4 Route 5 Route 6
511076110253 (CT 6110.25, BG 3)	5,003	49	51	7	<0.1	31	<0.1	<0.1	Ω	7	9	-	e	11	Ω	
511076118012 (CT 6118.01, BG 2)	3,976	52	48	12	8.0	23	0.5	<0.1	ω	۲	ω	7	7	Q	σ	Route 1 Route 2 Route 3 Route 5 Route 5 Route 5
																Wishing Star Substation
511076118061 (CT 6118.06, BG 1)	4,864	35	65	9	<0.1	17	<0.1	<0.1	ω	4	4	-	-	12	9	
511076119001 (CT 6119.00, BG 1)	5,692	75	25	Q	8. O	20	ю. О	0 1.	m	۵	ω	4	4	5	4	Route 1 Route 2 Route 3 Route 4 Route 5 Route 6 Mars 220 kV Loop
511076119003 (CT 6119.00, BG 3)	3,851	61	30	-	0.3	53	<0.1	0.4	4	7	8	<0.1	0.6	σ	4	
511079801001 (CT 9801.00, BG 1) b	0	0	o	0	0	o	o	ō	o	o	o	o	o	o	o	Route 1 Route 2 Route 3 Route 4 Route 5 Route 6 Mars Substation Mars 230 kV Loop

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Sources: USEPA 2022, EJSCREEN (Version 2.0, issued 2/18/2022), U.S. Census Bureau 2019, 5-year American Community Survey (2015–2019) Files #B03002, B01001, \$1505, C17002, and C16002.

^a The demographic data in this table have been rounded for presentation purposes. As a result, the total populations of color percentages may not reflect the sum of the addends

^b This CBG is encompassed by Dulles Airport and does not contain a resident population.

Gray shaded cells indicate reference populations.

Blue shaded cells indicate populations of color where the percentage is greater than that of the state as a whole. Pink shaded cells indicate that the community of color is composed primarily of one of the groups listed in the VEJA definition of "population of color" or the analysis area has a greater percentage of a community of color than the state as a whole. Purple shaded cells indicate age populations.

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3.3 Natural Resources

3.3.1 Watershed

Watersheds are used to define the geographic area within the boundaries of drainage divides throughout the country. For purposes of classifying watersheds, the United States is divided into hydrologic units in four levels—regions, subregions, accounting units, and cataloging units—which may contain an entire or part of a watershed. Each level is identified by a hydrologic unit code (HUC), beginning with major geographic areas or regions. The first level—HUC 2—is a major geographic area or region containing either several rivers or the drainage area of a major river. Subsequent levels encompass progressively smaller areas based on the drainage divides of lower order waterbodies.

The study area is within the following HUC areas:

- The Mid-Atlantic HUC 2 (02) region, which discharges into the Atlantic Ocean, Long Island Sound, and the Riviere Richelieu, a tributary of the St. Lawrence River;
- The Potomac HUC 4 (0207) subregion, which drains about 14,600 square miles within the Potomac River basin, including Washington D.C., Maryland, Pennsylvania, Virginia, and West Virginia;
- The Middle Potomac-Catoctin HUC 8 (02070008) watershed, which drains about 1,210 square miles into the Potomac River; and
- The Middle Potomac-Anacostia-Occoquan HUC 8 (02070010) watershed, which drains 1,280 square miles into the Occoquan Reservoir then to Occoquan Bay and into the Potomac River.

All but about 0.2 square mile of the study area is within the Middle Potomac-Catoctin (02020008) HUC 8 watershed, with the remainder within the Middle Potomac-Anacostia-Occoquan (02070010) HUC 8 watershed (USGS 2019).

The study area is further split into smaller HUC 10 watersheds, with the majority within the Broad Run-Potomac River (0207000809) watershed. Surface waters in this watershed drain into the perennial Broad Run and Beaverdam Run, tributaries to the Potomac River, at the northeast edge of the study area. This HUC contains multiple perennial waterbodies, including South Fork Broad Run, Cabin Branch, Horsepen Run, and Indian Creek. The small portion of the study area within the Middle Potomac-Anacostia-Occoquan HUC 8 watershed is also within the Bull Run (0207001007) HUC 10 watershed, which contains intermittent and perennial tributaries to the perennial Elklick Run south of the study area.

The Mars-Wishing Star routes and the Mars 230 kV Loop are entirely within the Broad Run-Potomac HUC10 watershed (0207000809).

3.3.2 Wetlands

ERM identified and mapped wetlands in the study area using publicly available sources, including these:

- USGS 7.5-minute series topographic quadrangles (USGS 2022)
- NWI maps from the USFWS online data mapping portal (USFWS 2022)
- Soils data from the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) Soil Survey Geographic (SSURGO) Database (USDA-NRCS 2022)
- The National Hydrography Dataset (NHD) (USGS 2022b)
- Recent digital aerial photography (ESRI 2022)

For reference, an overview map illustrating the locations of NWI wetlands in the study area is provided as Figure 3.3.1 in Appendix A, Figures. A complete desktop wetland and waterbody report, including wetland mapping based on the sources listed above, is attached as Appendix E, Wetland and Waterbody Desktop Summary. This report quantifies the wetland types that would be crossed by each route. ERM did not conduct an onsite delineation of wetlands or waterbodies along the routes.

Most wetlands in the study area are adjacent to, or contiguous with, rivers, streams, and associated tributaries regulated by the USACE and VDEQ under Sections 404 and 401 of the Clean Water Act (CWA). Based on the wetland classification system defined by Cowardin, et al. (1979), wetlands along the routes primarily are classified as palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO). PEM wetlands are characterized by erect, rooted, herbaceous hydrophytes (i.e., aquatic plants), excluding mosses and lichens; PSS wetlands are characterized by woody vegetation that is less than 20 feet tall; and PFO wetlands are characterized by woody vegetation that is at least 20 feet tall.

Wetlands identified by ERM in the rights-of-way for each route consist of PEM, PFO, and PSS wetlands associated with headwater landforms within the Broad Run-Potomac watershed. Wetland systems have a positive influence on adjacent stream systems with the ability to reduce flooding and erosion through increased sheer stress and runoff/overflow water retention. Riparian wetland systems have a direct impact on rate/volume control, chemical and biological processes, and the larger watershed functionality. Surface flow within wetlands generally drains via gradually sloping swales and drainageways, that have been affected over time by surrounding land development, into Broad Run and associated tributaries, with Broad Run flowing from west to east across the study area.

Additional detail on the desktop wetland study and an assessment of wetland impacts by route is provided in Section 4.3.1, Wetlands.

3.3.3 Waterbodies

ERM identified and mapped waterbodies in the study area using publicly available GIS databases, the USGS NHD, USGS topographic maps (1:24,000) (USGS 2022), and recent (2022) digital aerial photography (ESRI 2022). The Mars 230 kV Loop route does not cross any NHD-mapped intermittent or perennial waterbodies. The Mars-Wishing Star routes all cross NHD-mapped perennial and intermittent waterbodies (streams and tributaries). The perennial waterbodies include Broad Run, South Fork Broad Run, and Cabin Branch. No navigable waters are crossed by the Mars-Wishing Star alternative routes or the Mars 230 kV Loop route; therefore, no Rivers and Harbors Act Section 10 authorization from the USACE would be required for the Project. For reference, a general location map illustrating the waterbodies crossed by each route is provided as Attachment 1 in Appendix E, Wetland and Waterbody Desktop Summary.

The desktop wetland and waterbody assessment quantifies the waterbody types crossed by each route. Activities within and over subaqueous lands of Virginia with more than five square-mile drainage areas also require a permit from the Virginia Marine Resources Commission pursuant to Va. Code Section 28.2-1205.

Many of the waterbodies within the study area have forested stream buffers. These buffers, as noted by the Loudoun County Natural Resource Team (Loudoun County 2022), protect water quality by:

- Filtering impurities from stormwater runoff
- Stabilizing soil and preventing stream bank erosion
- Peak flow reduction, reducing the energy of moving floodwaters
- Shading streams, keeping water cool and oxygenated

Providing a contiguous and diverse habitat and food source for fish, insects, and wildlife.

In addition to streams and riverine waterbodies, ERM reviewed NWI/NHD datasets and aerial imagery to identify potential open water features (e.g., reservoirs, lakes, and ponds) along and near the routes. One or more of the Mars-Wishing Star alternative routes crosses the following: an open waterbody feature excavated between 2012 and 2014 (based on historic aerials) located south of Evergreen Mills Road between Belmont Ridge Road and Loudoun Parkway; an open waterbody feature adjacent to Broad Run near its confluence with South Fork Broad Run; and an open waterbody feature adjacent to Broad Run underneath the Loudoun County Parkway bridge.

3.3.4 Areas of Ecological Significance

ERM reviewed available ecological datasets for the area within a 1-mile buffer around the rights-of-way for each route. ERM also consulted the VDCR's Natural Heritage Program (NHP) (VDCR 2022a) and requested a formal review of the routes from the VDCR to identify areas of ecological significance along and near the alternative routes, including natural area preserves, conservation sites, SCUs, ecological cores, and general location areas for natural heritage resources. These areas collectively delineate habitats containing rare, threatened, or endangered plants and animals, unique or exemplary natural communities, and/or significant geologic formations.

The VDCR responded to Dominion's request for formal review of the routes in a letter dated July 1, 2022 (attached as Appendix C). Based on that response and research conducted by ERM, no SCUs, natural area preserves, conservation sites, state-listed plants or insects, or general location areas for natural heritage resources are present along the routes, and no further discussion of these resource types is provided in this study. Areas of ecological significance that are present along the routes are limited to ecological cores, which are defined as follows:

Ecological cores are areas of at least 100 acres of continuous interior, natural cover that provide habitat for a wide range of species, from interior-dependent forest species to habitat generalists, as well as species that use marsh, dune, and beach habitats. Interior ecological core areas begin 100 meters inside the nearest core edges and continue to the deepest parts of the ecological core. Ecological cores also provide natural and economic benefits of open space, recreation, water quality (including drinking water recharge and protection, and erosion prevention), and air quality (including carbon sequestration and oxygen production). Ecological cores are ranked from C1 to C5 (C5 being the least significant) using nine prioritization criteria, including the habitats of the natural heritage resources the cores contain.

The VDCR's response to Dominion identified two ecological core map units [Core ID 33546 (C4: Moderate) and ID 33299 (C5: General)] that may be affected by tree removal required for the Project. ERM identified two additional ecological cores [Core ID 33643 (C5) and ID 33785 (C5)] within the study area by reviewing VDCR GIS data. As shown in Figure 3.3-3 (Appendix A, Figures), none of the routes cross any of the cores. A description of ecological cores is presented in Table 3.3.4-1.

Ecological Core ID	Ecological Core Rank	Acres	Location	Condition
33546	C4: Moderate	515	Adjacent to the southeast side of the intersection of Loudoun County Parkway and Old Ox Road; west of Dulles Airport; adjacent to the south side of an approximately 0.68-mile- long segment of all six Mars-Wishing Star routes	Not fragmented by any existing rights-of-way or roads
33299	C5: General	98	Approximately 0.1 mile northeast from the nearest routes, east of Loudoun County Parkway	Fragmented by existing NOVEC transmission line right- of-way; partially fragmented by Overland Drive
33643	C5: General	88	Approximately 0.54 mile south of the nearest route, west of Stone Springs Boulevard	Approximately 15 acres containing impervious surfaces and structures
33785	C5: General	50	Approximately 0.95 mile south of the nearest route, east of Arcola Boulevard and north of Dulles West Boulevard	Approximately 5.9 acres containing forested land; the remainder consisting of impervious surface and developed land

3.3.5 Protected Species

To protect and recover imperiled species and the ecosystems they depend on, Congress passed the federal Endangered Species Act (ESA) in 1973, which states that threatened and endangered plant and animal species are of aesthetic, ecological, educational, historic, and scientific value to the United States, and protection of these species and their habitats is required. The ESA is administered by both the National Oceanic and Atmospheric Administration and USFWS. It protects fish, wildlife, plants, and invertebrates that are federally listed as endangered or threatened by prohibiting the "take" of these species and the interstate or international trade of the species, including their parts and products, unless federally permitted.

To take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." A federally endangered species is any species that is in danger of extinction throughout all or a significant portion of its range, with exceptions for certain insect pests. A federally threatened species is any species that is likely to become endangered in the near future throughout all or a significant portion of its range.

Virginia has adopted separate acts for protecting animals and plants in the state. The Virginia ESA (Va. Code Sections 29.1-563–29.1-570) designates the Virginia Department of Wildlife Resources (VDWR) as the state agency with jurisdiction over state-listed endangered or threatened fish and wildlife. The Virginia ESA authorizes the Board of the VDWR to adopt the federal list of endangered and threatened species and to identify and protect state-listed wildlife. The Virginia ESA prohibits, by regulation, the taking, transportation, processing, sale, or offer for sale of those species.

Under the Endangered Plant and Insect Species Act (2 VAC 5-320-10), the taking or possession of endangered or threatened plant and insect species is prohibited. The VDCR represents the Virginia Department of Agriculture and Consumer Services, which is responsible for state-listed plants and insects, in providing comments regarding potential impacts on these species.

ERM obtained query results from the VDCR NHP (VDCR 2022a), the VDWR Virginia Fish and Wildlife Information Service (VaFWIS) (VDWR 2022), and the USFWS Information for Planning and Consultation (IPaC) (USFWS 2022) to identify federally and state listed species that may occur within the study area. Digital data were obtained from the VDCR to identify locations within the rights-of-way of the alternative routes and an associated 100-foot buffer that potentially support protected species. Query results from the VDCR include species known to occur in the area and communities known to historically or currently contain protected species (VDCR 2022a). Query results from USFWS IPaC includes species that may occur within the study area (USFWS 2022). Query results from VaFWIS include species that are known or likely to occur within a 10-mile radius from the geographic center of the study area (VDWR 2022).

The VDCR's element occurrence data are mapped representations of plants, animals, and exemplary natural communities, which are tracked by the VDCR NHP due to their rarity. Each occurrence is represented by a polygon indicating its known location. The polygons are intended to indicate the full known aerial extent of the occurrence, modified to account for the locational uncertainty of the source data. VDWR's Species Observation dataset includes all verified species documentations maintained by the VDWR.

ERM assessed two federally listed and two state-listed threatened or endangered species for potential of occurrence within and adjacent to the Project facilities based on the sources identified above. One federal candidate species (i.e., a species whose status is currently under review to determine whether it warrants listing under the Endangered Species Act) was also reviewed for potential occurrence. A summary of the findings is provided in Section 3.3.5.1, Federally and State-Listed Endangered and Threatened Species.

3.3.5.1 Federally and State-Listed Endangered and Threatened Species

Because the various queries that indicate potential or actual occurrences of protected species do not specify exact locations, a summary of the federal- and state-listed species documented in the vicinity of the study area is presented in Table 3.3.5-1.

The VaFWIS database query identified the Wood turtle (*Glyptemys insculpta*) and Henslow's sparrow (*Ammodramus henslowii*) as state-listed species within 10 miles of the geographic center of the study area. The IPaC database query identified two federally listed species: the Northern long-eared bat (*Myotis septentrionalis*) and the Dwarf wedgemussel (*Alasmidonta heterodon*). The IPaC database also identified the Monarch butterfly (*Danaus plexippus*) as a candidate species. According to the IPaC database review, each of these species has potential to occur in the study area; however, none have confirmed occurrences.

The VaFWIS database query recorded the Wood turtle and Henslow's sparrow as having the potential to occur given the presence of predicated suitable habitat. The Wood turtle habitat typically includes forested communities near streams used for hibernation. Suitable stream habitat for the Wood turtle includes well-oxygenated water that is free from pollutants, with streambed material composed of sand, gravel, or rock. Wood turtles are semiaquatic and leave the water in the spring to move into open grasslands, barrens, and sandy shores for nesting and foraging. Henslow's sparrow typically forages in open habitats that lack dense forested cover; this habitat is present in multiple locations across each of the routes.

The Dwarf wedgemussel is described by VDWR as a habitat "generalist" in terms of its preference for stream size, substrate, and flow conditions. This mussel species can live in a range of habitats, from small streams less than 15 feet wide, to large rivers more than 330 feet wide. It can inhabit a variety of substrate types including clay, sand, gravel, and pebble, and sometimes lives in silt depositional areas near streambanks. It also has the potential to occur in perennial waterbodies. Dwarf wedgemussel occurrences are usually associated with hydrologically stable areas, including very shallow water along streambanks and under root mats of trees along streambanks (VDWR 2022).

According to the USFWS, the Monarch butterfly can live in a range of habitats but relies solely on the host plant, milkweed, to lay eggs and feed (USFWS 2022). Milkweed can be found in semi-open areas with herbaceous vegetation and is frequently found in prairies and fields. The Monarch butterfly migrates south to overwintering sites in Mexico. In the spring, the butterflies migrate north through Virginia, and then in fall migrate south to overwinter.

The VDWR operates a Northern Long-Eared Bat Winter Habitat and Roost Trees online mapping system, which shows general locations of known Northern long-eared bat hibernacula and roost trees. A review of this system did not indicate the presence of a hibernaculum or roost tree in Loudoun County. The Northern long-eared bat occupies a variety of forested habitats in summer, and the species hibernates in caves in winter (USFWS 2022).

Table 3.3.5-1:	Potential Fede	erally and	State-List	ted Spe	cies in the Study Area		
Common Name	Scientific Name	Federal Status	State Status	Global Rank	Habitat	Potential Route Occurrence	Source
FEDERALLY LIS	TED SPECIES						
Mammals							
Northern Iong-eared bat	Myotis septentrionalis	LT	LT	G4	Generally associated with old-growth or late successional interior forests. Partially dead or decaying trees are used for breeding, summer day roosting, and foraging. Hibernation occurs primarily in caves, mines, and tunnels.	All	IPaC VDWR—Winter Habitat and Roost Tree Map
Invertebrates							
Dwarf wedgemussel	Alasmidonta heterodon	Ë	LE	6	Deep quick running water on cobble, fine gravel, or on firm silt or sandy bottoms.	AII	IPaC
Monarch butterfly	Danaus plexippus	Candidate	Candidate	None	Semi-open areas with herbaceous vegetation.	All	IPaC
STATE-LISTED S	PECIES						
Reptiles							
Wood turtle	Glyptemys insculpta	None	LT	G3	Forested floodplains, fields, wet meadows, and farmland with a perennial stream nearby.	All	VaFWIS
Birds							
Henslow's Sparrow	Ammodramus henslowii	None	ГТ	G4	Open grasslands with few or no woody plants and tall dense grasses and litter layer.	All	VaFWIS
Sources: USFWS 2	022; VDCR 2022a;	VDWR 2022					
IPaC = Information Wildlife Resources	for Planning and Co	nsultation; N/	A = not applica	ıble; VaFW	'IS = Virginia Fish and Wildlife Information Se	ervice; VDWR = Virg	inia Department of
Federal/State Statu LE Listed as ∈ LT Listed as ti Global Rank	s: endangered hreatened						
					· · · · · · · · · · · · · · · · · · ·		

Critically Imperiled: At very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors G 1

- Imperiled: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors Vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or G2 G3
- other factors
 - Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors Secure: Common, widespread, and abundant G4 G5

3.3.5.2 Bald Eagle Management

The Bald eagle (*Haliaeetus leucocephalus*) is no longer federally listed under the ESA, but it is a state-listed threatened species in Virginia under the Virginia ESA and is protected under Va. Code Section 29.1-521 and VDWR regulations (4 VAC 15-30-10). The Bald eagle is also protected under the federal Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. The "Management of Bald Eagle Nests, Concentration Areas, and Communal Roosts in Virginia: A Guide for Landowners," issued by the then Virginia Department of Game and Inland Fisheries (now VDWR) provides management practices for avoiding the take of Bald eagles and outlines restrictions on construction activities within defined management zones around nests. Proposed activities that have the potential to affect Bald eagles are evaluated by the agency on a case-by-case basis (Virginia Department of Game and Inland Fisheries et al. 2012).

To obtain the most current eagle nest data, ERM reviewed the Center for Conservation Biology (CCB) website (CCB 2022), which provides information about the Virginia Bald eagle population, including the results of the CCB's annual eagle nest survey. According to the CCB database, there are no known Bald eagle nests within the study area. The nearest Bald eagle nest (CCB ID LD1901) is located about 4.2 miles northeast of the northernmost segment of the routes (Routes 1 and 3 at the intersection of Evergreen Mills Road and Loudoun County Parkway) and about 3.9 miles northeast of the northernmost segment of Old Ox Road and Carters School Road). Nest LD1901 was documented to be occupied in 2019. None of the routes are within the 660-foot management buffer for the nest.

3.3.5.3 Species of Concern and Other Documented Occurrences

Species of concern typically are not afforded the same level of protection as federally and state-listed endangered and threatened species. NatureServe, an international network of NHPs, assigns a Global Rank based on rarity and conservation status for these species. Species ranked "G1" (global rank 1/critically imperiled) or "G2" (global rank 2/imperiled) are most at risk.

The VDCR conducted an official review of the Project on July 1, 2022. As part of this review, the VDCR concluded that the Project as planned would not affect any documented state-listed plants or insects and does not cross any state natural area preserves under VDCR's jurisdiction. However, the VDCR indicated that several rare plants have the potential to occur in the study area if suitable habitat is present (VDCR 2022b). These plants are typically associated with prairie vegetation and have the potential to inhabit semi-open diabase glades in Virginia. A list of these species is provided in Table 3.3.5-2.

Common Name	Scientific Name	Federal Status	State Status	Global Rank	State Rank	Habitat	Source
Plants							
Earleaf False Foxglove	Agalinis auriculata	None	None	G3	S1	Exposed Diabase flatrock located within Triassic Basins	VDCR
Purple milkweed	Asclepias purpurascens	None	None	G5?*	S2	Exposed Diabase flatrock located within Triassic Basins	VDCR
American bluehearts	Buchnera americana	None	None	G5?*	S1/ S2	Exposed Diabase flatrock located within Triassic Basins	VDCR

Table 3.3.5-2: Rare Plant Species with the Potential to Occur in the Study Area

ENVIRONMENTAL ROUTING STUDY

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 Project

Common Name	Scientific Name	Federal Status	State Status	Global Rank	State Rank	Habitat	Source
Downy phlox	Phlox pilosa	None	None	G5	S1	Exposed Diabase flatrock located within Triassic Basins	VDCR
Torrey's mountain-mint	Pycnantheum torreyi	None	None	G2	S2	Exposed Diabase flatrock located within Triassic Basins	VDCR
Stiff goldenrod	Solidago rigida var. rigida	None	None	G5	S2	Exposed Diabase flatrock located within Triassic Basins	VDCR
Hairy hedgenettle	Stachys arenicola	None	None	G4?*	S1	Exposed Diabase flatrock located within Triassic Basins	VDCR

Source: VDCR 2022b

VDCR = Virginia Department of Conservation and Recreation

Global Rank:

- G1 Critically Imperiled: At very high risk of extinction due to extreme rarity (often five or fewer populations), very steep declines, or other factors
- G2 Imperiled: At high risk of extinction due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors
- G3 Vulnerable: At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors
- G4 Apparently Secure: Uncommon but not rare; some cause for long-term concern due to declines or other factors
- G5 Secure: Common, widespread, and abundant

* Global ranks followed by a question mark denote inexact or uncertain ranking by the VDCR

State Rank:

- S1 Critically Imperiled: At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors
- S2 Imperiled: At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors
- S3 Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors
- S4 Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors
- S5 Secure: At very low or no risk of extirpation in the jurisdiction due to a very extensive range, abundant populations or occurrences, with little to no concern from declines or threats

3.3.6 Vegetation

3.3.6.1 Local Vegetation Characteristics

The study area is situated within the Northern Piedmont physiographic province. Vegetation in this province has been severely altered by clearing as part of ongoing agricultural and silvicultural practices occurring since European settlement. Prior to the effects of European settlement, the vegetation was influenced by the practices of Native Americans. Literature from early explorers indicate that parts of the Piedmont were once open, savanna-like woodlands and grasslands. Native American practices included burning the forests to drive game and keep the understory of forests clear for hunting. More recently, forests in this area have undergone a cycle of clearing, farming, and regenerating. Fallow farmlands left

unattended undergo a successional regeneration process that generally results in a prevalence of early successional trees such as Virginia pine (*Pinus virginiana*) and Tulip poplar (*Liriodendron tulipifera*). Over time, early successional communities in the Northern Piedmont ultimately mature into late-successional oak-hickory forests (VDCR 2021).

The effects of human development activities on the landscape have resulted in a patchwork of early and late successional forests, pastures, and agricultural fields. The study area lies in a highly developed portion of Loudoun County where remnant communities of forested vegetation and open fields are commonly interspersed with developed land. As such, the vegetation in the study area is typically limited to small fragments of mixed pine (*Pinus* sp.) and hardwood forest communities, turfgrass communities associated with developed land, and forested "edge" communities that border larger forested tracts.

3.3.6.2 Forested Vegetation

Forested vegetation within the study area is generally associated with relatively small contiguous tracts of trees found in upland and/or alluvial forests. Upland forests are composed of tree species typically found in the Northern Piedmont physiographic province, with vegetation assemblages such as pine forest and mixed hardwood forest dominated by Loblolly pine (*Pinus taeda*) species, Red maples (*Acer rubrum*), Shortleaf pine (*Pinus echinata*), Sweetgum (*Liquidambar styraciflua*), Tulip tree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), hickories (*Carya* spp.), and various upland oaks (*Quercus* spp.). Upland forest communities have usually become smaller because of historic encroachment from agricultural land use and residential development, and usually exist in small contiguous tracts of woodlands or fragmented forests located between croplands, pastures, and developed areas.

Alluvial forests in the study area are found at lower topographic elevations in floodplains and drainageways associated with wetlands and waterbodies like the Broad Run floodplain. Alluvial forest composition typically includes species like Silver maple (*Acer saccharinum*), Sycamore (*Platanus occidentalis*), American elm (*Ulmus americana*), Box elder (*Acer negundo*), Hackberry (*Celtis occidentalis*), and River birch (*Betula nigra*). Floodplain sloughs and backswamps are common landforms in the Northern Piedmont region and can support a variety of water-tolerant oak species in the forest canopy, like Pin oak (*Quercus palustris*), Swamp white oak (*Quercus bicolor*), Willow oak (*Quercus phellos*), and Swamp chestnut oak (*Quercus michauxii*). Beneath the forest canopy, understory plants include a variety of shrubs and herbaceous species such as Sweet pepperbush (*Clethra alnifolia*), Spicebush (*Lindera benzoin*), Arrowwood (*Viburnum dentatum*), sedges (*Carex* spp.), and rushes (*Juncus* spp.).

As noted in Section 3.1.2, Existing Land Use and Land Cover, ERM classified land cover along the routes using a combination of local and state-wide datasets as well as aerial photo interpretation to identify the most current uses for a given area. Figure 3.1-2 in Appendix A, Figures, depicts land use/land cover, including forested areas, along the routes.

3.3.6.3 Forest Conservation Values

The Forest Conservation Value (FCV) model is a tool designed by the Virginia Department of Forestry (VDOF) to strategically identify the highest priority forestland for conservation in Virginia (VDCR 2020). The intent is to maximize the efficiency of limited resources by focusing conservation efforts on the highest quality, most productive, and most vulnerable forestland statewide. The FCV model identifies five conservation values: 5-Outstanding, 4-Very High, 3-High, 2-Moderate, and 1-Average.

ERM reviewed publicly available FCV model data prepared by the VDCR to assess the value of forest resources crossed by the alternative routes (VDCR 2020). The area of forested habitat through which each route alternative passes is ranked by the VDCR as C1: Average and C2: Moderate. Overall, the

habitats through which the routes pass are not designated as high-ranking areas for conservation planning by the VDCR.

3.4 Visual Conditions

ERM conducted the following analyses to understand the existing visual conditions and potential impact from the installation of Project components:

- Identification of visually sensitive resources (VSRs) through the review of recent (2021) digital aerial photography;
- Site reconnaissance and local outreach;
- Definition of potential user groups;
- Preparation and review of visual simulations of the route alternatives; and
- Evaluation of the route alternatives with respect to visual impacts.

VSRs were defined as areas where the Project components and any associated vegetation clearing are additions to the surrounding landscape and/or affected resources possessing unique scenic qualities or sensitive viewsheds. Examples of visually sensitive areas include residential or recreational areas, historic landscapes or districts, open space, natural features, and areas of high public concentration. The VSRs identified in the study area are Highways 606, 659, and 857; Arcola Mills Drive; Evergreen Mills Road and the residences located to the north; and Loudoun County Parkway. The residences, consisting of a new development made up of single-family homes, townhome style residences, and multi-story apartment complexes, are located to the north of the alternative routes and Evergreen Mills Road, spread across the north and central portions of the study area. Loudoun County Parkway/Highway 606 bisect the study area from north to south; all alternative routes for the Mars-Wishing Star lines cross the parkway. The proposed Mars 230 kV Loop runs on the east side of Highway 857/Carter School Road south of Highway 606 towards the proposed Mars Substation site. A description of each VSR and its associated user groups is provided in Table 3.4-1.

User groups include local residents/workers, commuter/through travelers, and recreationalists. Recreational users often experience the greatest visual impact based on their high sensitivity to change in the landscape. Local residents/workers may experience a similar sensitivity to change as recreational users; however, this is often centered around static views from their homes and workplaces. Commuter/through travelers have the lowest sensitivity to visual change in the landscape based on their activity and average speed associated with the roadway.

VSR Name	VSR Type	Impacted User Groups	General Information/Visual Sensitivity
Highway 606 (Old Ox Road)	High-use public resource	Local residents/workers and Commuter/through travelers	This VSR consists of a four-plus-lane, limited-access divided highway with a speed limit of 55 miles per hour. The average daily traffic count is 29,000. The most common user group is commuter/through travelers that have a low sensitivity to visual change. Local residents/workers have a higher sensitivity to visual change; however, that is from static locations (such as homes) and prolonged views, neither of which is present at this VSR.

Table 3.4-1: Visually Sensitive Resources and User Groups

ENVIRONMENTAL ROUTING STUDY

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 Project

			-
VSR Name	VSR Type	Impacted User Groups	General Information/Visual Sensitivity
Highway 659 (Belmont Ridge Road)	High-use public resource	Local residents/workers and Commuter/through travelers	This VSR consists of a two-lane, limited- access striped highway with a speed limit of 45 miles per hour. The average daily traffic count is 9,400. Commuter/through travelers have a low sensitivity to visual change, as do local residents/workers from non-static views.
Route 857	Moderate-use public resource	Local residents/workers	This VSR consists of a two-lane striped highway with a speed limit of 45 miles per hour. The average daily traffic count is 30. Local residents/workers have a low sensitivity to visual change at this VSR.
Arcola Mills Drive	High-use public resource	Local residents/workers and Commuter/through travelers	This VSR consists of a two-lane striped highway with a speed limit of 45 miles per hour. The average daily traffic count is 5,200. Commuter/through travelers have a low sensitivity to visual change, as do local residents/workers from non-static views.
Evergreen Mills Road, and multi-use paths	Moderate-use public resource	Local residents/workers	This VSR consists of a four-plus-lane road with a median and a speed limit of 35 miles per hour. Multi-use trails are located on either side of the corridor. Local residents/workers have a moderate sensitivity to visual change while experiencing views from this VSR.
Loudoun County Parkway	Moderate-use public resource	Commuter/through travelers	This VSR consists of a four-plus-lane, limited- access highway with median with a speed limit of 50 miles per hour. The average daily traffic count is not available for this road segment. Commuter/through travelers have a low sensitivity to visual change.
Evergreen Mills Road, area residents	High-use public resource/ adjacent residence	Local residents/workers	The residential area is located on the north side of Evergreen Mills Road between Highway 659 to the west and Loudoun County Parkway to the east. There is a mix of townhouses (three stories) and condominiums/apartments (four-stories). The residential properties have a medium to low sensitivity to visual change.
Stream Valley Park and Broad Run Stream Valley Trail	Recreational resource	Local residents/workers and Recreationalists	These VSRs consists of an off-road trail network that connects (or has plans to connect) the various communities and cultural resources located along Broad Run. Local residents/workers and recreationalists have a high sensitivity to visual change in this area.

VSR = visually sensitive resource

3.4.1 Key Observation Points

To illustrate potential changes from the installation of transmission infrastructure along the various routes, 10 key observation points (KOPs) were chosen to represent views of potential impacts for users along the Mars-Wishing Star alternative routes and Mars 230 kV Loop route. The KOPs were chosen because they serve the following purposes:

- Illustrate visibility from specific VSRs;
- Illustrate representative views that would be available to identified user groups;

- Illustrate the Routes 1 through 6, Wishing Star Substation, and Mars Substation; and
- Provide open views of Project structures and vegetative clearing.

Table 3.4-2 below identifies the location of each KOP as well as the routes represented in the visual simulations prepared for each KOP (discussed in more detail in Section 4.4, Visual Assessment).

	Table 3	3.4-2:	Kev	Observation	Points
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KOP #	Latitude/Longitude	Location	Reason for Inclusion	Routes
1	38.958982°, -77.552055°	View northeast from the terminus of Weathervane Place	Illustrates the user experience of a local resident/worker from a stationary viewpoint	Mars-Wishing Star Routes 1 through 6 and Wishing Star Substation
1c	38.961878°, -77.553193°	View southeast from the terminus of Marigold Mill Place	Illustrates the user experience of a local resident/worker from a stationary viewpoint	Mars-Wishing Star Routes 1 through 6 and Wishing Star Substation
3	38.955383°, -77.540988°	View northwest from Arcola Mills Drive, just south of its intersection with Briarfield Lane	Illustrates the user experience of a local resident/worker and recreationalist (representative of nearby Virginia Fusion Park)	Mars-Wishing Star Routes 1 through 6
5	38.961053°, -77.539985°	View south from the Birnam Wood Place/Evermont Trace Drive intersection	Illustrates the user experience of a local resident/worker from a stationary viewpoint	Mars-Wishing Star Routes 1 through 6
13	38.954198°, -77.510327°	View northeast from the northbound lane of Old Ox Road, northeast of its interchange with the Loudoun County Parkway	Illustrates the user experience of a local resident/worker, recreationalist, and commuter/through traveler of non-static views	Mars-Wishing Star Routes 1 through 6
14	38.951048°, -77.492573°	U-turn circle at the terminus of Carters School Road	Illustrates the user experience of a local resident/worker with a view to the proposed Mars Substation site	Mars 230 kV Loop and Mars Substation
16	38.960665°, -77.496862°	View southwest from the warehouse parking area on the north side of Highway 606	Illustrates the user experience of a commuter/through traveler, local resident/worker, and recreationalist from a moving vehicle	Mars 230 kV Loop and Mars Substation
21	38.955073°, -77.515585°	View north from Loudoun County Parkway north of its intersection with Highway 606	Illustrates the user experience of a commuter/through traveler and recreationalist viewers	Mars-Wishing Star Route 1 through 6

KOP #	Latitude/Longitude	Location	Reason for Inclusion	Routes
24	38.960242°, -77.520712°	View south from Cypress Glen Square residences	Illustrates the user experience of a local resident/worker from a stationary viewpoint	Mars-Wishing Star Route 1 through 6
26	38.960743°, -77.525385°	View south from Evergreen Mills Road	Illustrates the user experience of a local resident/worker, recreationalist, and commuter/through traveler from a stationary viewpoint	Mars-Wishing Star Route 1 through 6

KOP = key observation point

3.5 Cultural Resources

ERM conducted an analysis of potential cultural resource impacts for the route alternatives under consideration in accordance with the VDHR January 2008 *Guidelines for Assessing Impacts of Proposed Electric Transmission Lines and Associated Facilities on Historic Resources in the Commonwealth of Virginia* (VDHR 2008) (herein referred to as "VDHR Guidelines"). For each transmission line route or alternative, the analysis identified and considered previously recorded resources within the following study tiers as specified in the VDHR Guidelines:

- National Historic Landmark (NHL) properties located within a 1.5-mile radius of route centerlines;
- NRHP listed properties, NHLs, battlefields, and historic landscapes within a 1-mile radius of route centerlines;
- NRHP eligible and NRHP listed properties, NHLs, battlefields, and historic landscapes within a 0.5 mile radius of route centerlines; and
- All of the above qualifying architectural resources as well as archaeological sites located within the right-of-way for each route or alternative.

These study tiers additionally encompass the proposed Mars and Wishing Star Substation sites. Information on previously recorded cultural resources in each tier was collected from the VCRIS (VDHR 2022).

In addition to the VCRIS, ERM reviewed information from the Loudoun Preservation Society (2022) to find locally significant resources within a 1.0-mile radius of each route centerline. No additional resources were identified through this source. ERM additionally collected information about battlefields surveyed and assessed by the National Park Service's American Battlefield Protection Program (ABPP; NPS 2022). In its focus on nationally significant Civil War battlefields, the ABPP identifies the historic extent of the battle (defines a study area), the areas of fighting on the battlefield (the core area located within the study area), and potential NRHP boundaries. No ABPP study areas, core areas, or potential NRHP boundaries for battlefields were identified within the relevant study tiers for the various Mars-Wishing Star route alternatives, the Mars 230 kV Loop, or the two substations.

Many of the previously recorded cultural resource sites along and near the route alternatives have not been assessed for NRHP eligibility and, therefore, are not included in the Pre-Application Analysis Report, according to VDHR Guidelines. Until these resources have been assessed and a determination of their eligibility has been made by VDHR, these resources should be considered as potentially eligible for listing in the NRHP. Likewise, unreported historic and archaeological resources that have not yet been reported may be affected by the proposed undertaking. Any such resources would be addressed during

an intensive cultural resources survey to be conducted in a subsequent phase of cultural resource studies for the Project.

Along with the records review, ERM conducted field assessments of the considered architectural resources and historic districts identified in the VCRIS for each Mars-Wishing Star route alternative, the Mars 230 kV Loop, and both substations in accordance with the VDHR Guidelines. Digital photographs were taken of each architectural resource with views toward the applicable transmission line route (or routes) or other facility. Photo simulations and 3D aerial renderings were prepared to assess potential visual impacts on the considered resources within the tiered study area. For the previously recorded archaeological sites under consideration, aerial photographs were examined to assess the current land condition and spatial relationship between the sites and any existing or planned transmission lines. The results of these assessments are presented in Section 4.5, Cultural Resources.

As enumerated in more detail below, ERM identified eight previously recorded archaeological sites for this review. Because portions of the route alternatives use common alignments, some archaeological sites are crossed by more than one route. Of the eight sites, five have been determined not eligible for listing in the NRHP and three have not been formally evaluated for listing in the NRHP.

Regarding historic architectural resources, ERM identified three previously recorded sites and/or districts within the study tiers defined above. All three sites are within the VDHR study tiers for Mars-Wishing Star Routes 1 through 6, and one site each is within the study tiers for the Mars 230 kV Loop, Mars Substation site, and Wishing Star Substation site. Of the three resources, two are listed in the NRHP and one is eligible for listing in the NRHP.

ERM's Stage I Pre-Application Analysis of Cultural Resources report (Pre-Application Analysis) is provided in Appendix G.

3.5.1 Archaeological Sites

Crossings of archaeological sites were considered a constraint because of the potential of an electric transmission line impacting archaeological deposits in these areas (e.g., due to transmission structure placement, tree clearing, or heavy equipment usage within a site). The known archaeological sites in the right-of-way for each Mars-Wishing Star route alternative, the Mars 230 kV Loop route, and the two substation sites are listed and described in Table 3.5-1. A desktop assessment of potential impacts on the archaeological sites is provided in Section 4.5, Cultural Resources. A confident and complete assessment of the integrity of each site would require archaeological field investigations, which would be completed in a subsequent phase of studies for the Project.

Table 3.5-1: Archaeological Sites in the Rights-of-Way for the Mars-Wishing Star Route Alternatives, Mars 230 kV Loop Route, and Wishing Star and Mars Substations

Route Alternative/ Substation	Greenfield or Existing/ Expanded ROW	Site Number	Description	NRHP Status
Mars-Wishing Star	Greenfield	44LD0167	Temporary camp (Pre-Contact)	Not Evaluated
Route 1	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
Mars-Wishing Star	Greenfield	44LD0167	Temporary camp (Pre-Contact)	Not Evaluated
Route 2	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
	Greenfield	44LD0173	Temporary camp and Lithic scatter (Pre-Contact)	Not Eligible

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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 Project

Route Alternative/ Substation	Greenfield or Existing/ Expanded ROW	Site Number	Description	NRHP Status
	Greenfield	44LD0970	Lithic scatter (Late Archaic Period)	Not Evaluated
Mars-Wishing Star Route 3	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
Mars-Wishing Star	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
Route 4	Greenfield	44LD0173	Temporary camp and Lithic scatter (Pre-Contact)	Not Eligible
	Greenfield	44LD0970	Lithic scatter (Late Archaic Period)	Not Evaluated
Mars-Wishing Star	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
Route 5	Greenfield	44LD0173	Temporary camp and Lithic scatter (Pre-Contact)	Not Eligible
	Greenfield	44LD0174	Temporary camp (Pre-Contact)	Not Eligible
	Greenfield	44LD0609	Base camp (Early Woodland)	Not Evaluated
	Greenfield	44LD0970	Lithic scatter (Late Archaic Period)	Not Evaluated
Mars-Wishing Star	Greenfield	44LD0168	Temporary camp (Pre-Contact)	Not Eligible
Route 6	Greenfield	44LD0173	Temporary camp and Lithic scatter (Pre-Contact)	Not Eligible
	Greenfield	44LD0174	Temporary camp (Pre-Contact)	Not Eligible
	Greenfield	44LD0609	Base camp (Early Woodland)	Not Evaluated
	Greenfield	44LD0970	Lithic scatter (Late Archaic Period)	Not Evaluated
Mars 230 kV Loop	Greenfield	44LD1742	Carter Schoolhouse (World War I to World War II)	Not Eligible
Wishing Star Substation	Greenfield	44LD1280	Railroad bed (Antebellum Period, Civil War, Early National Period, Reconstruction and Growth)	Not Eligible
Mars Substation	-	-	-	-

ROW = right-of-way

3.5.2 Historic Resources and Architectural Sites

Each Mars-Wishing Star route alternative, the Mars 230 kV Loop route, and associated facilities reviewed in this study has the potential to affect historic architectural resources and/or districts. This section of the report presents information about known architectural resources in the vicinity of each route using the VDHR's tiered study area model. The locations of resources relevant to each route are shown on Figure 3.5.1 (Appendix A, Figures). Individual descriptions of the resources are provided in the Pre-Application Analysis Report, which is attached as Appendix G.

3.5.2.1 Mars to Wishing Star Route Alternatives (Routes 1, 2, 3, 4, 5, and 6)

The three considered resources that lie within the VDHR study tiers for Routes 1 through 6 are presented in Table 3.5-2. These resources are located in the same study tier for all six Mars-Wishing Star routes. ERM conducted a field reconnaissance of these resources. A preliminary assessment of impacts is provided in Section 4.5, Cultural Resources.

Table 3.5-2: Historic Resources in VDHR Tiers for Mars-Wishing Star Routes 1, 2,3, 4, 5, and 6

Buffer (mile)	Resource Category	Resource Number	Description
1.0 to 1.5	National Historic Landmarks	Not applicable	None identified
0.5 to 1.0	National Register Properties (listed)	053-0982	Arcola Elementary School
		053-0984	Arcola Slave Quarters
0.0 to 0.5	National Register Properties (eligible)	053-0008	Dulles International Airport Historic District
0.0 (within the ROW)	National Historic Landmarks, National Register Properties (listed and eligible)	Not applicable	None identified

ROW = right-of-way

3.5.2.2 Mars 230 kV Loop

No historic architectural resources were identified within the VDHR study tiers for the Mars 230 kV Loop.

3.5.2.3 Wishing Star Substation

The one considered resource that lies within the VDHR study tiers for the Wishing Star Substation is presented in Table 3.5-3. ERM conducted a field reconnaissance of this resource. A preliminary assessment of impacts is provided in Section 4.5, Cultural Resources.

Table 3.5-3: Historic Resources in VDHR Tiers for Wishing Star Substation

Buffer (mile)	Resource Category	Resource Number	Description
1.0 to 1.5	National Historic Landmarks	Not applicable	None identified
0.5 to 1.0	National Register Properties (listed)	053-0982	Arcola Elementary School
0.0 to 0.5	National Register Properties (eligible)	Not applicable	None identified
0.0 (within the ROW)	National Historic Landmarks, National Register Properties (listed and eligible)	Not applicable	None identified

ROW = right-of-way

3.5.2.4 Mars Substation

The one considered resource that lies within the VDHR study tiers for the Mars Substation is presented in Table 3.5-4. ERM conducted a field reconnaissance of this resource. A preliminary assessment of impacts is provided in Section 4.5, Cultural Resources.

Table 3.5-4: Historic Resources in VDHR Tiers for Mars Substation

Buffer (mile)	Resource Category	Resource Number	Description
1.0 to 1.5	National Historic Landmarks	Not applicable	None identified
0.5 to 1.0	National Register Properties (listed)	Not applicable	None identified
0.0 to 0.5	National Register Properties (eligible)	053-0008	Dulles International Airport Historic District

Buffer (mile)	Resource Category	Resource Number	Description
0.0 (within the ROW)	National Historic Landmarks, National Register Properties (listed and eligible)	Not applicable	None identified

ROW = right-of-way

3.5.3 Summary of Existing Survey Data Performed Under Section 106 or Section 110 of the National Historic Preservation Act

Some portions of the Mars-Wishing Star route alternatives, Mars 230 kV Loop route, and associated facilities were previously surveyed for cultural resources. Research indicates that 14 prior Phase I cultural resource surveys have been conducted that overlap portions of various individual routes. Because the Mars-Wishing Star route alternatives, Mars 230 kV Loop route, and associated facilities share some common segments, many of the previous surveys have covered portions of multiple routes. The previous surveys relevant to the routes are identified in Table 3.5-5 and shown on Figure 3.5.2 (Appendix A, Figures).

Table 3.5-5: Cultural Resource Surveys Covering Portions of the Mars-WishingStar Route Alternatives, 230 kV Loop, and Substations

VDHR Survey #	Title	Author	Date
LD-144	Phase I Archaeological Survey of the Washington Dulles International Airport Portion of the Proposed W-132, Route 606 Water Main, Route 50 to Dulles Trade Center II	Fuess and Butina	2003
LD-191	Cultural Resource Survey of the Proposed 230 kV Brambleton-Greenway Transmission Line, Loudoun County, Virginia	Butler, Moore, and Rupnik	2006
LD-053	Historic and Archaeological Survey Report Washington Dulles International Airport, Loudoun and Fairfax Counties, VA.	No Data	1989
LD-249	A Phase I Archaeological Study of Circa 119 Acres Proposed for Development as Wetland Mitigation Area, Loudoun County, Virginia	Gardner, Clem, and Hurst	1999
LD-250	A Phase I Archaeological Study of Circa 1300 Acres Proposed for Development as Part of the Brambleton Planned Community, Loudoun County, Virginia	Gardner, Snyder, and Hurst	2001
LD-027	A Phase I Cultural Resources Reconnaissance of the Route 621 Modernization Project, Loudoun County, Virginia	Mueller	1979
LD-323	Cultural Resources Survey for the Dulles Loop-Route 606 Project, Loudoun County, Virginia	Goode and Traum	2012
LD-333	Supplemental Cultural Resources Survey for the Dulles Loop-Route 606 Project, Loudoun County, Virginia	Goode and Traum	2013
LD-334	Cultural Resources Survey Environmental Assessment for the Proposed Dulles Air Cargo, Passenger, and Metro Access Highway, Loudoun County, Virginia	Deetz, van den Hurk, Flood, D. Poyner, Keeny, and Bamann	2013
LD-472	Cultural Resources Survey of Unsurveyed Portion of the Northstar Boulevard Project, Loudoun County, Virginia	Callaway, Monroe, and Hanbury	2018
LD-365	Phase I Archaeological Investigations of the 82.9 Acre Property at 43461 Old Ox Road, Loudoun County, Virginia	Buchanan	2005

VDHR Survey #	Title	Author	Date
LD-356	A Phase I Cultural Resources Survey of Approximately 5.0 Miles of Proposed Improvements to the Dominion Virginia Power 500 kV Transmission Line From the Brambleton Substation to the Loudoun Substation, Loudoun County, Virginia	Stewart, DeChard, and Brady	2014
LD-420	Phase I and Phase II Archaeological Investigations for Western Lands Area, Washington Dulles International Airport, Loudoun County, Virginia	Ward, Read, Wanner, and Seiter	2016
PW-174	Phase I Survey and Phase II Testing Along the CNG Natural Gas Pipeline (TL-465) and Facilities, Prince William and Loudoun Counties, Virginia	Rosenthal, Elena, Petraglia, Pappas, and Martin	1992

Route 50 = U.S. Route 50; VDHR = Virginia Department of Historic Resources

3.6 Geological Constraints

The study area is located within the Piedmont geologic province, which is characterized by strongly weathered bedrock due to the humid climate, thick soils overlying saprolite (weathered bedrock), and rolling topography that becomes more rugged to the west near the Blue Ridge Mountains. In general, the Piedmont province consists of several complex geologic terranes where faults separate rock units with differing igneous and metamorphic histories. Based on review of the Geologic Map of Virginia, the study area is within a basin that formed as the Atlantic Ocean began opening during the early Mesozoic Era. Within this Mesozoic-age basin, the bedrock underlying the study area comprises Triassic-age sandstones, shales, and siltstones that were deposited between approximately 225 and 190 million years ago and were subsequently intruded by fine-grained, dark-colored igneous dikes (Virginia Department of Energy 2022a; William and Mary Department of Geology 2022).

3.6.1 Mineral Resources

ERM reviewed publicly available Virginia Department of Energy datasets (2022b), USGS topographic quadrangles, and recent (2021) digital aerial photographs to identify mineral resources in the study area. Based on that review, no mineral resources were identified within 0.25 mile of the study area. The Chantilly Crushed Stone quarry, the nearest mineral resource, is located 1.5 miles south of the study area.

3.7 Existing and Planned Corridors within the Study Area

ERM identified existing and planned corridors within the study area through review of 2022 digital aerial photography, data from Dominion about its existing transmission system, the Loudoun County 2019 General Plan (Loudoun County 2019a), the Loudoun County 2019 Countywide Transportation Plan (Loudoun County 2019b), meetings with the Loudoun County DTCI, and various publicly available data layers. Existing corridors within the study area include electric transmission and distribution lines, pipeline facilities, other utility easements, and major road corridors. The existing corridors were identified for the purpose of assessing their potential use as collocation routing opportunities. These existing corridors are described below.

3.7.1 Electric Transmission Corridors

Existing electrical transmission corridors are found throughout the study area. The Mars-Wishing Star alternative routes will collocate along portions of the Company's existing right-of-way for the 230 kV Brambleton-Evergreen Mills Line (#2172) and Brambleton-Poland Road Line (#2183), and the Company's

existing right-of-way for the 230 kV Cabin Run-Shellhorn Road Line (#2095) and Poland Road-Shellhorn Road Line (#2137) and Cabin Run-Yardley Ridge Line (#2213). The Mars 230 kV Loop is not collocated with any existing electric transmission corridors but will cut into the existing 230 kV Cabin Run-Shellhorn Road Line (#2095) and 230 kV Poland Road-Shellhorn Road Line (#2137).

3.7.2 Electric Distribution Corridors

Overhead distribution line rights-of-way are common throughout the study area in those areas that have not recently been developed or redeveloped. In areas of new development, buried distribution rights-ofway are more common. The existing distribution rights-of-way in the study area are not wide enough to accommodate a transmission line and are often situated in narrow corridors between existing roads and residences or other developments.

3.7.3 Utility Easements

There are multiple major and minor utility easements located throughout the study area, including sanitary sewers, water lines, natural gas pipelines, and minor buried utilities serving residential and industrial developments. The Mars-Wishing Star alternative routes all cross or are near a major sanitary sewer easement belonging to Loudoun County Sanitation Authority (Loudoun Water). The existing sewer easement is visible on aerial photography as several interconnected, cleared rights-of-way in the forested area along Broad Run. The sewer easement, which is maintained to 60 feet in width, also serves as a significant part of the Stream Valley Park Trail System. The Mars 230 kV Loop route is not located along any major utility easements along Carters School Road.

3.7.4 Road Corridors

Major Road Corridors

The Mars-Wishing Star alternative routes are located south of Evergreen Mills Drive, a four-lane, mediandivided roadway that has been constructed or upgraded in connection with the Brambleton, Birchwood, and other large developments. Evergreen Mills Drive is not suitable as a collocation corridor for the Mars-Wishing Star routes due to its curvilinear design and its proximity to residential development to the north, including single-family attached and detached dwellings within 100 feet of the road right-of-way.

Other major roadway corridors within the study area include Arcola Mills Drive, Arcola Boulevard, Belmont Ridge Road, Northstar Boulevard, Arcola Boulevard, Loudoun County Parkway, and Old Ox Road. Of these, Belmont Ridge Road, Loudoun County Parkway, and Old Ox Road are crossed by the Mars-Wishing Star routes, but do not provide good opportunities for routing the new transmission infrastructure. This is because the roads are generally oriented north/south, whereas the routes are generally oriented east/west. Additionally, Loudoun County Parkway is constrained on both sides by sensitive environmental features along Broad Run, including Stream Valley Park, and by insufficient space. Arcola Mills Drive is unsuitable for collocation because of residences near the roadway and future encumbrances associated with a planned road-widening project. Loudoun County Parkway was considered as a potential collocation corridor but is constrained on both sides by sensitive environmental features along Broad Run, including Stream Valley Parkway was considered as a potential collocation corridor but is constrained on both sides by sensitive environmental features along Broad Run, including Stream Valley Parkway was considered as a potential collocation corridor but is constrained on both sides by sensitive environmental features along Broad Run, including Stream Valley Park to the west. The east side of Loudoun County Parkway was dismissed as a potential collocation opportunity because of specific engineering challenges involved in spanning Broad Run that precluded placement of a transmission structure between Broad Run and an existing 230 kV structure east of the Loudoun County Parkway bridge spanning Broad Run.

Carters School Road will be used as a collocation corridor for the Mars 230 kV Loop from Mars Substation north to the Company's existing transmission lines along Old Ox Road.

Planned Road Corridors

As described in Section 3.1.8, Conservation Easements and Conservation Lands, several road-widening projects and road extension projects are planned in the study area, including improvements to Belmont Ridge Road and Arcola Mills Drive. The planned improvements to Arcola Mills Drive preclude collocation routing opportunities for the Mars-Wishing Star alternatives because of adjacent existing and planned development. None of the Mars-Wishing Star alternative routes follow Belmont Ridge Road, which runs in a north/south rather than an east/west direction.

The Mars-Wishing Star alternative routes all cross the planned Northstar Boulevard Extension. The Arcola Boulevard Extension was assessed for a potential collocation opportunity but rejected due to lack of adequate right-of-way and proximity to Old Darnes Cemetery.

4. AFFECTED ENVIRONMENT

The potential environmental impacts associated with each route are quantified in Table 4-1, Environmental Feature Crossing Table, and discussed by resource in the following subsections. A comparative analysis of the advantages and disadvantages of each route is provided in Section 5, Analysis of Route Alternatives. The Mars 230 kV Loop route has no proposed alternatives but is included along with the Mars-Wishing Star route alternatives to demonstrate total Project impacts.

			-			-		
Environmental Feature	Unit	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Mars 230 kV Loop
ROUTE LENGTH AND CO	NSTRUCTIC	N FOOTP	RINT					
Route Length ^a	miles	3.63	3.64	3.62	3.63	3.55	3.56	0.57
Construction Footprint ^b	acres	91.87	92.08	91.68	91.90	92.77	92.88	10.34
LAND USE								
Land Ownership								
Parcels Affected (total)	number	14	15	14	15	18	18	5
Private	number	14	15	14	15	18	18	5
Public	number	0	0	0	0	0	0	0
Land Use/Land Cover								
Forested	acres	33.98	34.96	40.69	41.66	42.84	42.96	8.84
Agricultural	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Developed	acres	18.88	18.81	18.88	18.81	18.81	18.81	1.50
Open space	acres	37.73	36.21	30.94	29.42	28.91	28.36	0.00
Open water	acres	1.28	2.11	1.17	2.01	2.21	2.74	0.00
Residences and Other Str	uctures							
Dwellings within ROW	number	0	0	0	0	0	0	0
Dwellings within 60 feet of ROW	number	0	0	0	0	0	0	0
Dwellings within 100 feet of centerline	number	0	0	0	0	0	0	0
Dwellings within 250 feet of centerline	number	1	1	1	1	1	1	0
Dwellings within 500 feet of centerline	number	6	6	6	6	6	6	0
Non-residential Buildings within ROW	number	0	0	0	0	0	0	0
Non-residential Buildings within 500 feet of centerline	number	7	8	7	8	9	9	6

Table 4-1: Environmental Feature Crossing Table

Cemeteries, Schools, and Places of Worship

Environmental Feature	Unit	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Mars 230 kV Loop
Cemeteries within 500 feet of centerline	number	0	0	0	0	0	0	0
Schools within 500 feet of centerline	number	0	0	0	0	0	0	0
Places of Worship within 500 feet of centerline	number	0	0	0	0	0	0	0
Zoning Districts								
Countryside Residential	miles	0.02	0.02	0.02	0.02	0.02	0.02	0.00
Planned Development— General Industrial	miles	1.80	1.63	1.80	1.63	1.68	1.68	0.57
Planned Development— Active Adult/Age Restricted	miles	0.31	0.27	0.31	0.27	0.23	0.23	0.00
Planned Development— Industrial Park	miles	1.50	1.72	1.49	1.71	1.63	1.64	0.00
Planned Developments								
Planned Developments— total	(number) acres	(10) 60.51	(11) 61.28	(10) 60.33	(11) 61.09	(11) 60.36	(11) 60.48	(1) 9.39
Arcola Lotus and Stoneway Properties	acres	9.28	9.28	9.28	9.28	9.28	9.28	0.00
Arcola Mills Road	acres	0.23	0.23	0.23	0.23	0.23	0.23	0.00
Birchwood at Brambleton	acres	5.14	4.93	5.14	4.93	4.84	4.84	0.00
Brambleton Shreveport South 2	acres	7.28	6.55	1.22	0.49	0.00	0.00	0.00
Brambleton South Industrial 1 and 2	acres	14.23	15.72	20.11	21.59	20.85	20.97	0.00
Digital Dulles	acres	11.54	11.54	11.54	11.54	11.54	11.54	9.39
Farah-Naples Subdivision	acres	4.87	3.51	4.87	3.51	3.51	3.51	0.00
Northstar Blvd: Shreveport Dr. to Route 50	acres	0.85	0.85	0.85	0.85	0.85	0.85	0.00
NOVEC Sub	acres	4.44	4.44	4.44	4.44	4.44	4.44	0.00
JK Technology Park #1	acres	2.65	2.65	2.65	2.65	2.65	2.65	0.00
Brambleton Business Campus	acres	0.00	1.58	0.00	1.58	1.79	1.79	0.00
Dulles Trade Center Lot	acres	0.00	0.00	0.00	0.00	0.38	0.38	0.00
Easements and Restrictiv	e Covenants	6						
VOF Easement	acres	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Environmental Feature	Unit	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Mars 230 kV Loop
USACE Flowage Easement	acres	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DCR CREP Easement	acres	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Restrictive Preservation Areas	acres	2.68	4.11	3.27	4.71	5.06	10.93	0.0
Wetland Mitigation Areas	acres	4.32	4.32	2.20	2.20	0.0	0.0	0.0
Transportation								
Roads	number	5	5	5	5	5	5	0
Railroads	number	0	0	0	0	0	0	0
Recreation Areas								
Stream Valley Park (Birchwood Community Assoc. at Brambleton Open Space Proffer)	acres miles	5.14 0.27	4.93 0.36	5.14 0.27	4.93 0.36	4.84 0.22	4.84 0.22	0.00 0.00
Stream Valley Park Trail Crossings	number	9	8	5	4	0	0	0
Stream Valley Park Trail segment in proposed right-of-way	miles	0.50	0.45	0.20	0.16	0.04	0.04	0.0
NATURAL RESOURCES								
Wetlands								
Wetlands Affected— total ^c	acres	22.03	21.92	19.09	18.98	17.61	19.56	2.35
Palustrine Forested	acres	11.05	9.78	9.66	8.40	6.50	7.71	2.24
Palustrine Emergent	acres	7.06	6.89	6.83	6.66	6.70	7.03	0.0
Palustrine Scrub Shrub	acres	1.55	1.55	0.44	0.44	0.44	0.44	0.0
Palustrine Unconsolidated Bottom	acres	1.16	1.78	0.84	1.46	0.62	0.62	0.0
Riverine	acres	1.20	1.91	1.32	2.02	3.35	3.76	0.11
Waterbodies					1		1	
Waterbodies-total	number	6	9	6	9	11	11	0
Perennial	number	3	6	3	6	9	9	0
Intermittent	number	3	3	3	3	2	2	0
Forest Conservation Value	9							
Average	acres	33.77	33.52	40.62	40.37	40.17	37.20	5.45
Moderate	acres	2.83	5.10	3.51	5.78	8.77	12.14	0.00
High	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Environmental Feature	Unit	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Mars 230 kV Loop
Very High	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Outstanding	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Areas of Ecological Signif	ficance							
Areas of Ecological Significance	number	0	0	0	0	0	0	0
Ecological Cores								
Outstanding	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Very High	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moderate	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
General	acres	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Protected Species								
Bald eagle nests within 330 feet	number	0	0	0	0	0	0	0
Bald eagle nests within 660 Feet	number	0	0	0	0	0	0	0
CULTURAL RESOURCES								
Archaeological sites within ROW ^d	number	2	4	1	3	5	5	1
NRHP-eligible and NRHP-listed Properties, NHLs, Battlefields, and Historic Landscapes within ROW	number	0	0	0	0	0	0	0
NRHP-eligible and NRHP-listed Properties, NHLs, Battlefields, and Historic Landscapes within 0.5-mile °	number	1	1	1	1	1	1	0
NRHP-listed Properties, NHLs, Battlefields, Historic Landscapes, and NHLs between 0.5 and 1.0 mile	number	2	2	2	2	2	2	0
NHLs between 1.0 and 1.5 miles	number	0	0	0	0	0	0	0
Historic Districts Crossed	miles	0	0	0	0	0	0	0
NRHP-listed Battlefields Crossed	number	0	0	0	0	0	0	0
NRHP-eligible Battlefields Crossed	number	0	0	0	0	0	0	0

ENVIRONMENTAL ROUTING STUDY

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 Project

Environmental Feature	Unit	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Mars 230 kV Loop
VDHR Easements Crossed	number	0	0	0	0	0	0	0
Battlefields (National Park Service ABPP) Crossed	number	0	0	0	0	0	0	0
Routing Opportunities								
Collocation—total	miles	0.57	0.96	0.95	1.33	1.73	1.73	0.47
Existing Transmission Lines	miles	0.57	0.96	0.95	1.33	1.73	1.73	0.00
Existing Pipelines	miles	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Existing Roads	miles	0.0	0.0	0.0	0.0	0.0	0.0	0.47

ABPP = American Battlefield Protection Program; NHL = National Historic Landmark; NRHP = National Register of Historic Places; ROW = right-of-way; VDHR = Virginia Department of Historic Resources

^a Mars-Wishing Star route lengths include 0.34 mile of the 230 kV line where the Mars-Wishing Star Lines enter the proposed Mars Substation and the 5/2 configured 150-foot-wide right-of-way splits into two separate rights-of-way, with a 150-foot-wide right-of-way for Line #527 (500 kV) and a 100-foot-wide right-of-way for Line #2291 (230 kV).

^b For comparison purposes, each of the Mars-Wishing Star routes includes the potential impacts associated with the Wishing Star Substation footprint (19.99 acres), Mars Substation footprint (10.02 acres), and 230 kV split (3.36 acres). The potential impacts associated with the Mars 230 kV Loop are inclusive of the transmission lines only, as the potential impacts of the Mars Substation are already included in the calculation of impacts associated with the Mars-Wishing Star Lines.

^c Based on results of the desktop waterbody and wetlands study (see Appendix E).

^d The footprint of the proposed Wishing Star Substation also includes an archaeological site, 44LD1280.

^e 053-0008 is also located within a half-mile of the proposed Mars Substation.

*The sum of the addends may not equal the totals due to rounding.

*The crossing lengths presented in this table for all feature categories were calculated using the centerline of each route.

4.1 Land Use

4.1.1 Land Ownership

ERM quantified information about land ownership in the study area using publicly available GIS databases and digital tract data obtained from Loudoun County. Data on landownership for each route are provided in Table 4-1, Environmental Feature Crossing Table. The Project facilities are located entirely on private property except at road crossings where the Mars-Wishing Star routes span existing and future VDOT rights-of-way. The Mars 230 kV Loop crosses only private property and does not cross VDOT rights-of-way.

Mars-Wishing Star Routes 1 and 3 both cross 14 private parcels, Routes 2 and 4 both cross 15 private parcels, and Routes 5 and 6 both cross 18 private parcels. Unlike Routes 1 through 4, Routes 5 and 6 are collocated along the north side of the Company's existing right-of-way for Lines #2172 and #2183 where the existing and proposed transmission rights-of-way cross three lots in the Dulles Trade Center West Subdivision. The Mars 230 kV Loop route crosses five private parcels.

4.1.2 Land Use/Land Cover

ERM categorized and quantified land use/land cover types along and within the alternative transmission line routes and associated facilities based on review of local and statewide datasets and recent aerial photography to identify the most current land uses using the following categories: Developed Lands, Open Space, Forested Lands, Agricultural Lands, and Open Water.^{2, 3} Definitions of these categories are provided in Section 3.1.2, Existing Land Use/Land Cover.

Route 1

The Mars-Wishing Star Route 1 right-of-way crosses 3.63 miles of land affecting 91.87 acres.⁴ Land use along and within the Route 1 right-of-way consists of 33.98 acres of forested land, 37.73 acres of open space, 18.88 acres of developed land, and 1.28 acres of open water.

Route 2

The Mars-Wishing Star Route 2 right-of-way crosses 3.64 miles of land affecting 92.08 acres. Land use along and within the Route 2 right-of-way consists of 34.96 acres of forested land, 36.21 acres of open space, 18.81 acres of developed land, and 2.11 acres of open water.

Route 3

The Mars-Wishing Star Route 3 right-of-way crosses 3.62 miles of land affecting 91.68 acres. Land use along the Route 3 right-of-way consists of 40.69 acres of forested land, 30.94 acres of open space, 18.88 acres of developed land, and 1.17 acres of open water.

Route 4

The Mars-Wishing Star Route 4 right-of-way crosses 3.63 miles of land affecting 91.90 acres. Land use along the Route 4 right-of-way consists of 41.66 acres of forested land, 29.42 acres of open space, 18.81 acres of developed land, and 2.01 acres of open water.

Route 5

The Mars-Wishing Star Route 5 right-of-way crosses 3.55 miles of land affecting 92.77 acres. Land use along the Route 5 right-of-way consists of 42.84 acres of forested land, 28.91 acres of open space, 18.81 acres of developed land, and 2.21 acres of open water.

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² For purposes of land use/land cover, wetland areas have been classified as open space, forested land, or open water. Wetland impacts for each route are addressed in Section 4.3.1, Wetlands. The desktop wetland report is provided as Appendix F, Wetland and Waterbody Report.

³ The land use/land cover values discussed in the subsections below for the Mars-Wishing Star Alternative Routes are inclusive of the Mars and Wishing Star Substation sites.

⁴ Land use impacts for the Mars-Wishing Star routes include the 0.34-mile-long split of the proposed 230 kV line (100-foot-wide right-of-way) from the 500 kV line (150-foot-wide right-of-way) in the approach to Mars Substation. The right-of-way width for all Mars-Wishing Star routes would predominately be 150 feet with two exceptions. For one segment of three spans (approximately 1,500 feet), the right-of-way would be 200 feet wide where the Mars-Wishing Star alternative routes cross over the Company's existing corridor for Lines #2213/2137 and Old Ox Road. For Routes 5 and 6, an approximately 1,400-foot-long segment of the right-of-way would expand to 200 feet in width to span Broad Run from a point near its confluence with the South Fork of Broad Run to a bluff above the south bank of Broad Run to accommodate conductor blowout.
Route 6

The Mars-Wishing Star Route 6 right-of-way crosses 3.56 miles of land affecting 92.88 acres. Land use along the Route 5 right-of-way consists of 42.96 acres of forested land, 28.36 acres of open space, 18.81 acres of developed land, and 2.74 acres of open water.

Mars 230 kV Loop

The Mars 230 kV Loop route right-of-way crosses 0.57 mile of land affecting 10.34 acres. Land use along and within the Mars 230 kV Loop right-of-way consists of 8.84 acres of forest and 1.50 acres of developed land.

Wishing Star Substation

The Wishing Star Substation footprint encompasses 19.99 acres of land containing 3 privately owned parcels. Existing land use on the site consists of 15.91 acres of forested land and 4.08 acres of open land.

Mars Substation

The Mars Substation footprint encompasses 10.02 acres of land. Existing land use on the site consists of 1.71 acres of forested land and 8.30 acres of open land.

4.1.3 Recreation Areas

ERM reviewed digital datasets and maps, USGS topographic quadrangles, recent (2022) digital aerial photography, and County websites to identify parks, trails, and other recreational resources along and near the alternative routes and associated facilities. Descriptions of the individual recreation areas discussed in the subsections below are provided in Section 3.1.3, Recreation Areas. Figure 3.1.3 (Appendix A, Figures) depicts recreation areas within 0.25 mile of the Mars-Wishing Star route alternatives and Mars 230 kV Loop route. Visual impacts on recreation areas are addressed in Section 4.4, Visual Assessment.

Route 1

Mars-Wishing Star Route 1 would cross or affect portions of the Stream Valley Park and Trail System, which is privately owned and maintained by the Birchwood Community Association at Brambleton but is open to the public (with the exception of the Association's private greenhouse and community garden). Although the Stream Valley Park proffer is limited to the Birchwood at Brambleton open space parcel, the trail system extends west on portions of the Brambleton Shreveport South development. As envisioned in the *Loudoun County Linear Parks and Trail System Plan* (Plan), the Stream Valley Park and Trail System will eventually connect with the county-wide Broad Run Stream Valley Linear Park System. Loudoun County will likely continue implementation of the Plan by pursuing public/private partnerships to obtain the needed open space proffers along Broad Run to complete and link the trail systems.

Route 1 crosses Stream Valley Park approximately 130 feet south of Evergreen Mills Road just outside of the Broad Run floodplain. The Route 1 right-of-way passes immediately south of the community garden plot and is approximately 50 feet south of the greenhouse building. Route 1 crosses Stream Valley Park for 0.27 mile affecting 5.14 acres. The route partially avoids the riparian and forested areas within the park but would require tree removal and clearing in areas visible from Evergreen Mills Road and adjacent pedestrian sidewalks and trail. Although Route 1 has the potential to significantly change the visual character along this portion of the park, it avoids tree clearing within the more densely forested areas to the south and nearer to Broad Run. Route 1 is not anticipated to impact the use or function of the park or

trail system past Project construction but would require tree clearing resulting in visual impacts near Evergreen Mills Road and the community gardens.

Route 1 intersects segments of the Stream Valley Park and Trails System at nine locations. Approximately 0.5 mile of trail would be within the right-of-way for the route with several trail crossings occurring south of and adjacent to the Brambleton Shreveport South stormwater pond where Route 1 parallels the trail for 0.38 mile.

Route 2

Route 2 crosses Stream Valley Park along the southern bank of Broad Run, adjacent to the Company's existing right-of-way for Lines #2137 and #2213. Route 2 avoids the community garden and greenhouse by turning southeast to cross Broad Run, then follows the existing right-of-way east towards Loudoun County Parkway. Route 2 crosses Stream Valley Park for 0.36 mile affecting 4.93 acres. The route avoids higher visibility areas adjacent to Evergreen Mills Road but would require tree removal and clearing within the Broad Run floodplain and riparian area. Route 2 would avoid tree clearing along trail segments within the open space proffer and would not impact the use or function of the park or the trail system beyond the period of construction.

Route 2 intersects segments of the Stream Valley Park and Trails System eight times. As is true of Route 1, several trail crossings occur south of and adjacent to the Brambleton Shreveport South stormwater pond where Route 2 parallels the trail for 0.38 mile. Approximately 0.45 mile of trail would be within the right-of-way associated with this route.

Route 3

Route 3 follows the same alignment and uses the same design as Route 1 where it crosses Stream Valley Park; impacts on this resource from Route 3 would be the same as described above for Route 1.

Route 3 intersects segments of the Stream Valley Park and Trails System in five locations. Approximately 0.20 mile of trail would be within the right-of-way associated with Route 3. Because most of the trail crossings would be perpendicular, visual impacts would be mitigated by limiting trail users' direct views of the maintained right-of-way during Project operations.

Route 4

Route 4 follows the same alignment and uses the same design as Route 2 where it crosses Stream Valley Park; impacts on this resource from Route 4 would be the same as described above for Route 2.

Route 4 intersects segments of the Stream Valley Park and Trails System in four locations. Approximately 0.16 mile of trail would be within the right-of-way associated with this alternative. Unlike Routes, 1, 2, and 3, Route 4 avoids overlapping both the parallel trail segments south of the Brambleton Shreveport South stormwater pond and the community gardens near Evergreen Mills Road. Because Route 4 crosses trail segments perpendicularly, visual impacts would be mitigated by limiting trail users' direct views of the maintained right-of-way during Project operations.

Route 5

Route 5 crosses 0.22 mile (4.84 acres) of Stream Valley Park along Broad Run adjacent to the Company's existing right-of-way for Lines #2137 and #2213. Like Routes 2 and 4, this alternative would avoid higher visibility areas adjacent to Evergreen Mills Road. Although Route 5 would require tree removal and clearing within the Broad Run riparian area and along both the north and south banks of the waterbody, the impacts would be contiguous to the existing cleared right-of-way.

The Route 5 centerline does not intersect any segments of the Stream Valley Park and Trails System; however, approximately 0.04 mile of trail would overlap the right-of-way associated with this alternative. By collocating with the existing transmission line, Route 5 would impact the smallest amount of trail compared with the other alternatives whose tree and vegetation clearing are limited to areas adjacent to the existing right-of-way.

Route 6

Route 6 follows the same alignment and uses the same design as Route 5 where it crosses Stream Valley Park; impacts on this resource from Route 6 would be the same as described above for Route 5.

Like Route 5, Route 6 does not intersect any segments of the Stream Valley Park and Trails System; however, approximately 0.04 mile of trail is within the right-of-way associated with this alternative. By collocating with the existing transmission line, Route 6 would limit tree and vegetation clearing to areas adjacent to the existing right-of-way.

Mars 230 kV Loop

The Mars 230 kV Loop route would not affect any of the recreational areas described in this report.

4.1.4 Residences, Residential Areas, and Commercial Structures

As discussed in Section 3.1.4, Residences, Residential Areas, and Commercial Structures, ERM counted the number of dwellings and non-residential structures within 100 feet, 250 feet, and 500 feet of each route centerline and the footprints of the proposed Wishing Star and Mars Substation sites. The results of this analysis are presented in Table 4-1.

To provide additional context and to focus the analysis on areas where new impacts would occur, ERM sorted the building counts to differentiate transmission route segments representing new (greenfield) rights-of-way from route segments collocated with existing Dominion transmission infrastructure. Table 4.1-1 provides the number of structures in each of these categories within 100 feet, 250 feet, and 500 feet of the centerline of each alternative route.

		Structures within 100 Feet		Structures within 250 Feet		Structures within 500 Feet	
Route Name	Structure Type	Non- collocated ROW	Collocated ROW	Non- collocated ROW	Collocated ROW	Non- collocated ROW	Collocated ROW
Mars-	Commercial	0	0	2	0	4	2
Wishing Star	Non-residential	0	0	0	0	1	0
Route 1	Single-Family Residence	0	0	1	0	3	2
	Multi-family Residence	0	0	0	0	1	0
Mars-	Commercial	0	0	2	0	4	2
Wishing	Non-residential	0	0	0	1	1	1

Table 4.1-1: Residences and Other Structures within 100 Feet, 250 Feet, and 500 Feet of the Centerline⁵

⁵ Residence and structure counts for Mars-Wishing Star Routes 1-6 include counts for Wishing Star Substation and Mars Substation.

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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 Project

		Structures within 100 Feet		Structures Fe	within 250 eet	Structures within 500 Feet	
Route Name	Structure Type	Non- collocated ROW	Collocated ROW	Non- collocated ROW	Collocated ROW	Non- collocated ROW	Collocated ROW
Star Route 2	Single-Family Residence	0	0	1	0	3	3
	Multi-family Residence	0	0	0	0	0	0
Mars-	Commercial	0	0	2	0	4	2
Wishing Star	Non-residential	0	0	0	0	1	0
Route 3	Single-Family Residence	0	0	1	0	3	2
	Multi-family Residence	0	0	0	0	1	0
Mars-	Commercial	0	0	2	0	4	2
Wishing Star	Non-residential	0	0	0	1	1	1
Route 4	Single-Family Residence	0	0	1	0	3	3
	Multi-family Residence	0	0	0	0	0	0
Mars-	Commercial	0	0	2	0	4	3
Wishing Star	Non-residential	0	0	0	1	1	1
Route 5	Single-Family Residence	0	0	1	0	3	3
	Multi-family Residence	0	0	0	0	0	0
Mars-	Commercial	0	0	2	0	4	3
Wishing Star	Non-residential	0	0	0	1	1	1
Route 6	Single-Family Residence	0	0	1	0	3	3
	Multi-family Residence	0	0	0	0	0	0
Mars 230 kV Loop	Commercial	0	0	1	0	3	3
	Non-residential	0	0	0	0	0	0
	Single-Family Residence	0	0	0	0	0	0
	Multi-family Residence	0	0	0	0	0	0

ROW = right-of-way

Route 1

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 1 centerline. Four of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (2 residences) are in areas where the route is collocated with existing transmission infrastructure. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route at four of the six residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

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Route 2

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 2 centerline. Three of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (3 residences) are in areas where the route is collocated with existing transmission infrastructure. In most places, trees are present between the route and the residences. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route and five of the six residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

Route 3

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 3 centerline. Four of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (2 residences) are in areas where the route is collocated with existing transmission infrastructure. In most places, trees are present between the route and the residences. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route and 4 of the 6 residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

Route 4

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 4 centerline. Three of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (3 residences) are in areas where the route is collocated with existing transmission infrastructure. In most places, trees are present between the route and the residences. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route and 5 of the 6 residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

Route 5

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 5 centerline. Three of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (3 residences) are in areas where the route is collocated with existing transmission infrastructure. In most places, trees are present between the route and the residences. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route and 5 of the 6 residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

Route 6

There are no residences within 100 feet, 1 residence within 250 feet, and 6 residences within 500 feet of the Route 6 centerline. Three of the 6 residences within 500 feet of the centerline are in areas where new (greenfield) right-of-way would be required. The remainder (3 residences) are in areas where the route is collocated with existing transmission infrastructure. In most places, trees are present between the route and the residences. Additionally, a tree buffer would be present between the new or expanded right-of-way for the route and 5 of the 6 residences within 500 feet of the centerline, which would help shield views of the route from nearby homes during Project operations.

Mars 230 kV Loop

There are no residences within 100 feet, 250 feet, or 500 feet of the Mars 230 kV Loop route centerline.

Mars Substation

There are no residences within 100 feet, 250 feet, or 500 feet of the Mars Substation footprint.

Wishing Star Substation

There are no residences within 100 feet, no residences within 250 feet, and 3 residences within 500 feet of the Wishing Star Substation footprint. These residences are included in the counts for each Mars-Wishing Star Route Alternative in Table 4.1-1.

4.1.5 Schools, Cemeteries and Places of Worship

ERM identified schools, cemeteries, and places of worship along and near the route alternatives and other Project facilities through review of digital maps, aerial photography, county parcel data, and other sources. No schools, cemeteries, or places of worship are crossed by or within 500 feet of the Mars-Wishing Star alternative routes, Mars 230 kV Loop route, and associated facilities.

4.1.6 Planned Developments

ERM identified planned developments along the Project alternative routes and associated facilities through review of County websites and consultations with County staff and other stakeholders. The number and distribution of planned developments in the area significantly influenced the development of the Mars-Wishing Star route alternatives, and in some instances, routes were adjusted following consultation with developers or landowners to avoid or minimize conflicts with future developments.

The planned developments described in Section 3.1.6, Existing and Planned Developments, are under various stages of review and approval while others are either in a conceptual pre-application stage, are not yet zoned to allow the proposed use, or have not been made public. Rather than quantify Project impacts to planned developments in disparate stages of design, review, and approval, the following discussion addresses the relative impact of the Mars-Wishing Star route alternatives on planned developments where potential land use conflicts were identified.

Descriptions of the individual planned developments referenced below are provided in Section 3.1.6, Planned Developments. Impacts on planned developments are quantified in Table 4-1.

No conflicts with planned developments were identified for the Mars or Wishing Star Substation sites or the Mars 230 kV Loop route.

Descriptions of the individual planned developments referenced below are provided in Section 3.1.6, Planned Developments. Impacts on planned developments are quantified in Table 4-1.

Brambleton Shreveport South

As discussed in Section 3.1.6, Existing and Planned Developments, the Brambleton Shreveport South development is currently under County review for a rezoning from industrial (PDIP) to high density residential zoning (Planned Development-Housing (PD-H4)). If approved, the CDP proposes attached single-family and multi-family residences.

While avoiding other major constraints, Routes 1 and 3 each cross the proposed footprint of one multifamily building at the far eastern end of the Brambleton Shreveport South planned development. The routes nonetheless were carried forward for analysis in this study because the residential rezoning required by the development has not been approved by the County, and also because the location of the residential structures would not be permitted under the proposed CPAM for the Airport Impact Overlay District Update (CPAM-2021-0001). In contrast, Routes 2 and 4, which are designed to avoid the riparian area along Broad Run, avoid the proposed residential building footprints but their rights-of-way pass within 70 feet of the conceptual footprint of the nearest multi-family building. Routes 5 and 6 are located approximately 0.14 mile south of the proposed residential buildings to collocate along the north side of the Company's existing transmission corridor for Lines #2172 and #2183. Along this segment, Routes 5 and 6 require a 0.27-mile-long parallel span of Broad Run.

Routes 1, 2, 3, and 4 would each result in visual impacts to any future residents within the Brambleton Shreveport South development, whereas Routes 5 and 6 would have less impact because they are collocated along the Company's existing right-of-way, approximately 0.14 mile to the south. Based on the visual assessment conducted for this area (see Section 4.4), collocating Routes 5 and 6 with the existing right-of-way would greatly reduce visual impacts to future residents.

In letter dated October 14, 2022, Brambleton Group L.L.C. expressed support for Route 5 because it would minimize impacts on the planned development, mitigate visual impacts to the nearby residential communities, and avoid sensitive environmental features.

Brambleton South Industrial (Black Chamber Group Data Center)

Black Chamber Group (as Tech Park at Brambleton LLC) submitted a site plan to the County in September 2022 for a new data center development on the Brambleton South Industrial parcels. Prior to submittal, Dominion and ERM staff contacted Black Chamber Group to discuss plans for the property, which includes two data center buildings and improvements, such as parking lots, interior driveways, a stormwater pond, and other associated infrastructure. Early in discussions with Black Chamber Group, two potential land use conflicts between this development and the Project were identified: a) the planned location of the stormwater pond on the site; and b) the planned location of a proposed NOVEC delivery point.

As discussions with the developer and NOVEC progressed, Routes 1, 3, and 6 were designed to avoid these features and cross the Company's existing right-of-way for Lines #2183 and #2172 further west, approximately 0.16 mile west of Belmont Ridge Road. Anticipating a resolution to this matter, Routes 2, 4, and 5 were designed to span the proposed stormwater pond and cross the northside of the proposed NOVEC delivery point footprint. By following this alignment, Routes 2, 4, and 5 are collocated with existing Dominion right-of-way for an additional 0.31 mile and avoid additional impacts to Restrictive Preservation Areas and Broad Run to the north.

In letter dated October 20, 2022, Black Chamber Group, in consultation with NOVEC, expressed support for Route 5 after a solution for crossing the NOVEC site was identified.

4.1.7 Land Use Planning and Zoning

ERM reviewed Loudoun Geohub (Loudoun County 2022f) for current zoning data on all parcels crossed by the Mars-Wishing Star route alternatives and the Mars 230 kV Loop route. The Mars-Wishing Star route alternatives all cross approximately 3.29 miles or more (greater than 90 percent of the route length) industrial zoned land in either the PDGI or PDIP zoning districts. The Mars-Wishing Star routes also cross residential zoned land including 0.02 mile of Countryside Residential zoned land and between 0.23-0.31 mile of land zoned Planned Development – Active Adult/Age Restricted. The Mars 230 kV Loop route crosses only the PDIP zoning district.

4.1.8 Conservation Lands

ERM reviewed various digital datasets and site plans and coordinated with local, state, and federal agencies to identify easements and other protected lands along the Mars-Wishing Star route alternatives, Mars 230 kV Loop, and the Mars and Wishing Star Substation sites. Descriptions of the different easement and conservation land types referenced in the subsections below are provided in Section 3.1.8,

Conservation Easements and Conservation Lands. The Project facilities would not impact any existing easements; however, the Mars-Wishing Star route alternatives cross land encumbered with restrictive covenants (restrictive preservation areas and wetland mitigation areas) imposed through conditions of VDEQ and USACE permits associated with previous development projects in the Brambleton area. By Mars-Wishing route, crossings of these areas are as follows:

- Route 1: 2.68 acres of restrictive preservation areas and 4.32 acres of wetland mitigation areas;
- Route 2: 4.11 acres of restrictive preservation areas and 4.32 acres of wetland mitigation areas;
- Route 3: 3.27 acres of restrictive preservation areas and 2.20 acres of wetland mitigation areas;
- Route 4: 4.71 acres of restrictive preservation areas and 2.20 acres of wetland mitigation areas;
- Route 5: 5.06 acres of restrictive preservation areas; and
- Route 6: 10.93 acres of restrictive preservation areas.

No conservation areas would be affected by the Mars 230 kV Loop route, Mars Substation, or Wishing Star Substation.

Crossings of restrictive preservation or wetland mitigation areas will need to be resolved through a formal amendment process involving the consent and permission of the landowner as well as the VDEQ and USACE, who have final approval authority over modifications to the restrictive covenants.

4.1.9 Transportation

All Mars-Wishing Star route alternatives cross SR 857 (Carters School Road), SR 606 (Old Ox Road), SR 607 (Loudoun County Parkway), SR 649 (Belmont Ridge Road), and SR 621 (Arcola Mills Drive). The route alternatives also cross the proposed Northstar Boulevard Extension. Beyond crossing road rights-of-way, no route would utilize parallel portions of VDOT road rights-of-way.

Temporary closures of roads and/or traffic lanes may be required during Project construction. No longterm impacts on roads are anticipated. The project will comply with VDOT requirements for access to the rights-of-way from public roads. At the appropriate time, the Project will obtain the necessary VDOT permits, as required, and comply with permit conditions.

4.1.10 Airport Facilities

Of the nine airports listed in Table 3.10.1-1, only Dulles Airport is close enough to a route alternative for a transmission structure to potentially impact navigable airspace. ERM conducted an airport analysis to determine if any of the FAA-defined airport imaginary surfaces at this airport could be penetrated by transmission structures associated with the Project. ERM reviewed the height limitations associated with the FAA-defined imaginary surfaces for all runways at the airport, but Runway 12/30 in particular.

Standard GIS tools, including ESRI's ArcMap 3D and Spatial Extension software, were used to create and geo-reference the airport imaginary surfaces in space and in relation to the locations and heights of transmission structures along the alternative routes. Ground surface data was derived by using a USGS 10 Meter Digital Elevation Model. Height limitations for the route alternatives were analyzed along with FAA Part 77 airspace surfaces. Given the planned 90-to-190-foot structure heights for the Project, no structure associated with a route alternative would penetrate the restricted Part 77 Airspace surface. Temporary construction equipment (e.g., cranes) must also be cognizant of Part 77 airspace surfaces.

The most restrictive area for structure heights near the routes is the area just west of the Mars Substation. In this area, the ground elevation is nearly the same as the ground elevation for the Dulles Airport, limiting

tower heights to 151 feet. The restricting surface in this area is the horizontal surface. All route alternatives use the same alignment in this area.

All routes would require filing FAA Form 7460-1 in accordance with 14 CFR Part 77.9

Civil airport imaginary surfaces have been established by the FAA with relation to each airport and each runway, including Runway 12/30 at Dulles Airport. The imaginary surfaces were developed to prevent existing or proposed objects from extending from the ground into navigable airspace. As part of the D2 Dulles Development Project for the airport, a fifth runway is proposed (D2 Dulles Development). The future runway would be located south and parallel to the existing Runway 12/30. Dominion has incorporated this future runway into the analysis for this report.

The civil airport imaginary surfaces evaluated for the Project include:

- Horizontal surface at 463 feet above mean sea level (AMSL): A horizontal plane 150 feet above the established airport elevation of 313 feet AMSL, the perimeter of which is constructed by swinging arcs of radius 10,000 feet from the center of each end of the primary surface of each runway and connecting the adjacent arcs by lines tangent to those arcs.
- Conical surface: A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet. The conical surfaces for this airport have an elevation that extends from 463 feet to 663 feet AMSL.
- Primary surface: A surface longitudinally centered on the runway. The primary surface extends 200 feet beyond each end of the runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline (313 feet AMSL). The width of the primary surface is 1,000 feet.
- Approach surface: A surface longitudinally centered on the extended runway centerline and extending outward and upward from the end of each primary surface. The inner edge of the approach surface is the same width as the primary surface (1,000 feet), and it expands uniformly to a width of 16,000 feet. The approach surfaces extend for a horizontal distance of 10,000 feet at a slope of 50 to 1 with an additional 40,000 feet at a slope of 40 to 1.
- Transitional surface: These surfaces extend outward and upward at right angles to the runway centerline and the runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.

While the structures associated with the route alternatives would be located below some of these surfaces, none of the structures would penetrate any of the surfaces. Generally, the area along the route alternatives is at or below the airport elevation; therefore, the effective height limitation at any point along the route alternatives would be no less than 150 feet tall. Figure 4.1.10, in Appendix A, Figures, depicts the maximum structure heights for each structure location.

Since the FAA manages air traffic in the United States, it evaluates any physical objects that may affect the safety of aeronautical operations through an obstruction evaluation. It is anticipated that regardless of the route selected for the Project, submittal of FAA Form 7460-1, Notice of Proposed Construction or Alteration, would be required pursuant to 14 CFR Part 77. Submittal of this notice would take place during the permitting phase of the Project.

4.2 Environmental Justice

The EJ desktop review analysis area (i.e., the area within 1 mile of each route) is broad, extending beyond the areas where Project impacts on EJ populations could occur. The desktop review results

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 Project

suggest that construction of the proposed facilities could potentially affect populations of color in the review area.

Based on the EJ criteria thresholds identified in Section 3.2, Environmental Justice, seven of the eight CBGs within the analysis area contain potential EJ communities including one that also contains an under age 5 population. None of the eight CBGs exceed the thresholds for low-income populations, populations with less than a high school education, populations over age 64, or households with language barriers. Four of the eight CBGs are crossed by the six Mars-Wishing Star alternative routes.

To ensure that stakeholder concerns regarding the potential direct and indirect impacts of the Project are understood and considered in routing decisions, Dominion designed and implemented a comprehensive outreach program early in the Project's development phase to identify and engage with all community stakeholders regardless of EJ community status, including federally recognized tribes. The outreach program was designed to share Project materials through written and in-person methods (e.g., letters and open houses), to document comments provided by stakeholders, and to respond to feedback by seeking ways to mitigate or avoid identified impacts, including any potential disproportionate impacts on vulnerable communities.

As part of the regulatory review process, Dominion will complete an evaluation of potential environmental, cultural, and historical impacts of the Project. Dominion will continue to engage with local and state agencies to complete these evaluations and mitigate any impacts from construction. In addition, Dominion will obtain all required environmental permits and comply with applicable permit conditions. Dominion anticipates that environmental impacts generally will be mitigated through design and construction best practices.

In assessing whether a community would bear a disproportionate impact of the negative environmental and health related impacts of the Project, ERM considered temporary construction impacts, visual impacts, property devaluation, and health impacts related to electric and magnetic fields as discussed in Sections 4.2.1 through 4.2.4.

4.2.1 Construction Activities

Impacts associated with Project construction are considered temporary, lasting between 12 and 18 months. Various regulations, industry standards, and best management practices would guide construction and restoration of the right-of-way. The short-term impacts associated with construction may include equipment noise, potential changes in traffic patterns, and general ground disturbance.

Noise is generally defined as unwanted sound. The primary noise receptors in the Project area would be commercial and industrial properties and residences. During construction, temporary, localized noise from heavy equipment and increased vehicle traffic is expected to occur during daytime hours. Exceedances of daytime noise limits are not expected; if they occur, the exceedances would be temporary.

Construction could occasionally cause lanes or roadways to be closed, although these closures would only last for the duration of the construction activity in a given area. No long-term impacts on roads are anticipated. At the appropriate time, the Company will obtain the required crossing permits from VDOT and comply with applicable permit conditions and any associated restrictions on the timing of construction or road and lane closures.

During construction, Dominion will minimize ground-disturbing activities to the extent practicable. Following construction, Dominion will remove construction-related equipment and debris from the right-ofway and restore the land within the right-of-way as closely as possible to pre-construction conditions. 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 Project

4.2.2 Visual Impacts

The Company used the routing process as a tool for minimizing visual impacts by identifying route alternatives that are most harmonious with the landscape to the extent practicable. Mitigation measures include avoiding unique viewsheds, placing structures to take advantage of natural screening (e.g., tall trees), and avoiding the placement of structures directly in front of residences. ERM evaluated existing visual conditions by identifying visually sensitive areas, describing the landscape and viewer types (e.g., local residents), identifying KOPs, and preparing photo simulations to represent landscapes, sensitive areas, and viewer types.

Mars-Wishing Star Routes 1 through 6 and the Mars 230 kV Loop both cross CBGs that exceed the threshold for populations of color. The nearest residential area in these CBGs to the Project is located on the north side of Evergreen Mills Road between Highway 659 and Loudoun County Parkway and includes a mix of townhouses, condominiums, and apartments. These residential properties would have views of Mars-Wishing Star Routes 1 through 6, with Routes 2 and 3 being closest to the residences. Views of the Project would generally be obscured by existing transmission lines, current and planned developments, and intervening vegetation along the alternative routes. The impact of visual change resulting from the Project is anticipated to be low for the residences.

4.2.3 Property Values

Affected communities and landowners often express concern that the presence of transmission lines in the viewshed of homes could adversely affect aesthetics, resulting in the reduction of property values and deterring potential buyers. Indirect impacts on property values caused by direct visual impacts from high-voltage transmission lines (i.e., lines carrying more than 69 kV) depend on proximity, visibility, size, and type of transmission structures; easement landscaping; and surrounding topography. Based on a review of peer-reviewed and industry research published in peer-reviewed journals and trade journals, residential property values and sales prices primarily are affected by factors unrelated to the presence of a transmission line. Other factors have been shown through research to have greater influence on the value of residential property than the presence of a transmission line, such as location, type, and condition of improvements to the property; neighborhood; and local real estate market conditions (Jackson and Pitts 2010; Anderson et al. 2017).

4.2.4 Health Impacts

The conclusions of multidisciplinary scientific review panels assembled by national and international scientific agencies during the past two decades are the foundation of Dominion's opinion that no adverse health impacts would result from the operation of the transmission infrastructure. The general scientific consensus of agencies that have reviewed this research, relying on generally accepted scientific methods, is that common sources of electromagnetic fields (EMFs) in the environment, including from transmission lines and other parts of the electric system, appliances, etc., are not a cause of any adverse health impacts.

Research on EMF and human health varies widely in approach. Some studies evaluate the impacts of high, short-term EMF exposures not typically found in people's day-to-day lives on biological responses, while others evaluate the impacts of common, lower EMF exposures found throughout communities. Studies also have evaluated the possibility of impacts (e.g., cancer, neurodegenerative diseases, and reproductive impacts) of long-term exposure. Altogether, this research includes well over 100 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, the International Commission on Non-Ionizing Radiation Protection, the World Health Organization, the Institute of Electrical and Electronics Engineers International Committee on Electromagnetic Safety, the Scientific Committee on Emerging and Newly Identified Health Risks of the European Commission, and the Swedish Radiation Safety Authority (formerly the Swedish Radiation Protection Authority) (WHO 2007; SCENIHR 2009, 2015; 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 impacts.

The desktop review suggests that EJ populations would not bear disproportionate impacts associated with construction, visual aesthetics, property values, and health related impacts of the Project regardless of which route alternative is selected. Should outreach reveal that there are specific EJ community concerns in the Project area, Dominion will work directly with the communities to understand their concerns and determine appropriate measures to avoid or minimize impacts where possible.

4.3 Natural Resources

4.3.1 Wetlands

To minimize impacts on wetland areas, the Mars-Wishing Star routes and Mars 230 kV Loop route were designed to span or avoid wetlands where possible. Most of the wetlands in the area are associated with Broad Run and its tributaries. It is anticipated that these features can be spanned along the alternative routes, keeping structure locations outside of wetlands to the extent practicable. Where structures are required, the permanent impact to the wetland would be limited to the footprint of the structure. Wetlands within the permanent maintained facilities for the Wishing Star and Mars Substations would be cleared and converted to upland.⁶ Where the removal of trees or shrubby vegetation occurs within wetlands, Dominion would use the least intrusive method reasonably possible to clear the corridor. Hand-cutting of vegetation would be conducted where needed to avoid and minimize impacts on aquatic resources. There would be no change in contours of wetlands and waterbodies or redirection of water flow, and the amount of spoil from foundation installation and structure placement would be minimal. Excess soil in wetlands generated through foundation construction would be removed from the wetland.

Mats would be used for construction equipment to travel over wetlands, as appropriate. Due to the absence of existing right-of-way along parts of the routes, new temporary access roads may be necessary. Additionally, if a route section cannot be accessed from existing roads, Dominion may need to install a culvert, ford, or temporary bridge along the right-of-way to cross small streams, where present. In such cases, some temporary fill material in wetlands adjacent to the crossings may be required. This fill would be placed on erosion control fabric and removed when work is completed, returning ground elevations to original contours.

Where tree clearing is required within the new right-of-way, forested wetlands would be permanently converted to scrub-shrub or emergent types. As discussed in Section 3.3.2, Wetlands, forested wetlands provide functions such as peak flood flow reduction, nutrient and sediment capture, filtration of pollutants to adjacent waterbodies, and habitat diversity. The conversion of forested wetlands would reduce or eliminate some of these functions but would not permanently convert wetlands to uplands.

⁶ Pending final substation construction plans.

Upon SCC approval of a route and final line engineering, Dominion will obtain the appropriate permits from the USACE and VDEQ for work within wetlands and waterbodies to ensure compliance with Sections 404 and 401 of the CWA and to minimize potential impacts on aquatic resources located within the transmission line corridor.

The acreages provided in the subsections below for wetland crossings by route are based on ERM's desktop wetland and waterbody analysis (see Appendix E, Wetland and Waterbody Desktop Summary).⁷

Route 1

Mars-Wishing Star Route 1 would affect 22.03 acres of wetlands, including 11.05 acres of PFO wetlands, 1.55 acres of PSS wetlands, 7.06 acres of PEM wetlands, 1.20 acres of riverine wetlands, and 1.16 acres of freshwater ponds.

Route 2

Mars-Wishing Star Route 2 would affect 21.92 acres of wetlands, including 9.78 acres of PFO wetlands, 1.55 acres of PSS wetlands, 6.89 acres of PEM wetlands, 1.91 acres of riverine wetlands, and 1.78 acres of freshwater ponds.

Route 3

Mars-Wishing Star Route 3 would affect 19.09 acres of wetlands, including 9.66 acres of PFO wetlands, 0.44 acre of PSS wetlands, 6.83 acres of PEM wetlands, 1.32 acres of riverine wetlands, and 0.84 acre of freshwater ponds.

Route 4

Mars-Wishing Star Route 4 would affect 18.98 acres of wetlands, including 8.40 acres of PFO wetlands, 0.44 acre of PSS wetlands, 6.66 acres of PEM wetlands, 2.02 acres of riverine wetlands, and 1.46 acres of freshwater ponds.

Route 5

Mars-Wishing Star Route 5 would affect 17.61 acres of wetlands, including 6.50 acres of PFO wetlands, 0.44 acre of PSS wetlands, 6.70 acres of PEM wetlands, 3.35 acres of riverine wetlands, and 0.62 acre of freshwater ponds.

Route 6

Mars-Wishing Star Route 6 would affect 19.56 acres of wetlands, including 7.71 acres of PFO wetlands, 0.44 acre of PSS wetlands, 7.03 acres of PEM wetlands, 3.76 acres of riverine wetlands, and 0.62 acre of freshwater ponds.

Mars 230 kV Loop

The Mars 230 kV Loop route would affect 2.35 acres of wetlands, including 2.24 acres of PFO wetlands and 0.11 acre of riverine wetlands.

⁷ The acreages provided in Sections 4.3.1.3 through 4.3.1.6 include wetland impacts within the proposed Wishing Star and Mars Substation sites in addition to wetlands within the right-of-way for the respective Mars-Wishing Star routes. The sum of addends in these sections may not equal the totals due to rounding.

4.3.2 Waterbodies

Because each route crosses waterbodies, short-term, minor impacts on water quality could occur during construction because soils from disturbed areas are transported by storm water into adjacent surface waters during rain events. Increased turbidity and localized sedimentation of stream bottoms may occur as a result of runoff. However, these impacts would be mitigated by the implementation of Dominion's erosion-control measures, including the installation of erosion-control structures and materials

Waterways crossed by the Project would be maintained for proper drainage using culverts or other crossing devices in accordance with Dominion's standard policies. Where removal of trees and/or woody shrubs is required, clearing within 100 feet of a stream would be conducted by hand. Vegetation would be cut at or slightly above ground level and there would be no grubbing of stumps. Dominion would use sediment barriers along waterways and steep slopes during construction to protect waterways from soil erosion and sedimentation.

As noted above, if a section of right-of-way cannot be accessed from existing roads, Dominion may need to install a culvert or temporary bridge to cross small streams. In such cases, temporary fill material may be required. The fill would be placed on erosion control fabric and removed when work is completed, returning the surface to original contours.

Tree removal adjacent to waterbodies would reduce riparian buffer functions such as stream bank stabilization and erosion control, nutrient and sediment filtration, floodwater storage and peak flow reduction, and water temperature modification from shading. The right-of-way would be maintained with a cover of herbaceous vegetation during operations, which would provide some filtration stabilization to protect waterbodies from runoff.

Route 1

Mars-Wishing Star Route 1 crosses 6 NHD-mapped waterbodies, including 3 perennial and 3 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 1 right-of-way encompasses approximately 1.20 acres of riverine waterbodies and 1.16 acres of open water. Named waterbodies along the route include Broad Run (two crossings) and Cabin Branch.

Route 2

Mars-Wishing Star Route 2 crosses 9 NHD-mapped waterbodies, including 6 perennial and 3 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 2 right-of-way encompasses approximately 1.91 acres of riverine waterbodies and 1.78 acres of open water. Named waterbodies along the route include Broad Run (three crossings) and Cabin Branch.

Route 3

Mars-Wishing Star Route 3 crosses 6 NHD-mapped waterbodies, including 3 perennial and 3 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 3 right-of-way encompasses approximately 1.32 acres of riverine waterbodies and 0.84 acre of open water. Named waterbodies along the route include Broad Run (two crossings) and Cabin Branch.

Route 4

Mars-Wishing Star Route 4 crosses 9 NHD-mapped waterbodies, including 6 perennial and 3 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 4 right-of-way encompasses approximately 2.02 acres of riverine waterbodies and 1.46 acres of open water. Named waterbodies along the route include Broad Run (three crossings) and Cabin Branch.

Route 5

Mars-Wishing Star Route 5 crosses 11 NHD-mapped waterbodies, including 9 perennial and 2 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 5 right-of-way encompasses approximately 3.35 acres of riverine waterbodies and 0.62 acre of open water. Named waterbodies along the route include Broad Run (two crossings) and Cabin Branch.

Route 6

Mars-Wishing Star Route 6 crosses 11 NHD-mapped waterbodies, including 9 perennial and 2 intermittent streams. Based on ERM's desktop wetland and waterbody analysis, the Route 6 right-of-way encompasses approximately 3.76 acres of riverine waterbodies and 0.62 acres of open water. Named waterbodies along the route include Broad Run (two crossings) and Cabin Branch.

Mars 230 kV Loop

The Mars 230 kV Loop route does not cross any NHD-mapped waterbodies. Based on ERM's desktop wetland and waterbody analysis, however, the right-of-way for the loop encompasses approximately 0.11 acre of potential intermittent riverine waterbodies.

Wishing Star Substation

There are no NHD-mapped waterbodies within the proposed Wishing Star Substation site. Based on ERM's desktop wetland and waterbody analysis, however, the substation footprint encompasses approximately 0.25 acre of potential intermittent riverine waterbodies.

Proposed Mars Substation

There are no NHD-mapped waterbodies within the proposed Mars Substation site. Additionally, based on ERM's desktop wetland and waterbody analysis, the substation footprint encompasses no riverine waterbodies and no open water.

4.3.3 Areas of Ecological Significance

According to the Project review completed by the VDCR on July 1, 2022, the alternative transmission line routes within the study area would not affect conservation sites, SCUs, general location areas for natural heritage resources, or state natural area preserves. The VDCR identified two ecological core map units (Core ID 33546 and 33299) within the study area, with ecological integrity rankings of C4 (Moderate) and C5 (General), respectively, which are depicted by the VDCR in association with forested vegetation communities. No Project facilities would cross or would otherwise affect the ecological cores.

4.3.4 Protected Species

4.3.4.1 Federally and/or State-Listed Species

Two federally listed and two state-listed threatened or endangered species were identified that may potentially occur within the study area. One candidate species was also identified that may occur. These species are identified in Table 4.3.4-1, along with a summary of potential impacts on the species which could result from the Project.

Based on landscape and vegetation within the study area, each route crosses a variety of potential habitat types, including forested land, open grass land, and waterbodies with perennial or intermittent stream flow. These habitat types each have potential to provide suitable habitat for one or more of the species identified in Table 4.3.4-1.

Dominion will coordinate with state and federal agencies as needed to determine if any surveys, construction timing windows, or other mitigations for impacts on federally or state-listed species will be required for the Project.

Common Name	Scientific Name	Species Info/Habitat	Results/Potential Impacts					
FEDERALLY LISTED SPECIES								
Mammals								
Northern long-eared bat	Myotis septentrionalis	Generally associated with old-growth or late successional interior forests. Partially dead or decaying trees are used for breeding, summer day roosting, and foraging. Hibernation occurs primarily in caves, mines, and tunnels.	Summer foraging habitat present, but no hibernacula or roost trees were identified within a 0.5-mile radius of the routes. No impacts are anticipated if trees are cleared during the winter.					
Invertebrates								
Dwarf wedgemussel	Alasmidonta heterodon	Deep quick running water on cobble, fine gravel, or on firm silt or sandy bottoms.	No impacts are anticipated if construction methods meet VDWR guidelines.					
Reptiles								
Wood turtle	Glyptemys insculpta	Forested floodplains, fields, wet meadows, and farmland with a perennial stream nearby.	Confirmed as "potential" in VAFWIS Search Report. No instream work would be performed, but forested floodplains may be cleared. Coordination with the VDWR will be needed to determine if surveys and/or construction timing windows are warranted for the Project.					
Birds								
Henslow's sparrow	Ammodramus henslowii	Open grasslands with few or no woody plants and tall dense grasses and litter layer.	Confirmed as "potential" in VaFWIS Search Report. Coordination with the VDWR will be needed to determine if surveys and/or construction timing windows are warranted for the Project.					

Table 4.3.4-1: Federal and State-Listed Species Impacts

Sources: USFWS 2022; VDCR 2022a; VDWR 2022

VaFWIS = Virginia Fish and Wildlife Information Service; VDWR = Virginia Department of Wildlife Resources

4.3.4.2 Bald Eagle Management

The study area is not located within an eagle concentration area and none of the routes are located within the primary or secondary buffers of any documented eagle nest locations. The nearest Bald eagle nest (CCB ID LD1901) is located about 4.2 miles northeast of the northernmost segment (Routes 1 and 3 at the Evergreen Mills Road and Loudoun County Parkway intersection) and about 3.9 miles northeast of the northernmost segment of the Mars 230 kV Loop (at Old Ox Road and Carters School Road)., well outside the 660-foot management buffer for the nest, which was last reported occupied in 2019. If additional eagle nests are identified within 660 feet of Project facilities, Dominion Energy Virginia will work with the appropriate jurisdictional agencies to minimize any impacts on the species.

4.3.4.3 Species of Concern and Other Documented Occurrences

No federally listed species of concern were identified in the USFWS IPaC review of the study area.

4.3.5 Vegetation

ERM reviewed publicly available Loudoun County aerial photography (Planet Imagery 2022) to calculate impacts on vegetation. Herbaceous vegetation could be temporarily affected by construction and vehicular movement. In forested areas, trees would be cleared during construction and the right-of-way would be maintained with an herbaceous cover during Project operation. Disturbed areas resulting from use of temporary workspace would revert to pre-construction vegetative conditions. As shown in Table 4.3.5-1, forest is the vegetation resource that would primarily be affected by the alternative routes.

	Mars-Wishing Star Routes and Mars 230 kV Loop Route						
Vegetation Type	Route 1 (acres)	Route 2 (acres)	Route 3 (acres)	Route 4 (acres)	Route 5 (acres)	Route 6 (acres)	Mars 230 kV Loop (acres)
Forest	33.98	34.96	40.69	41.66	42.84	42.96	8.84
Open Space	37.73	36.21	30.94	29.42	28.91	28.36	0.00
Total	71.71	71.17	71.63	71.08	71.75	71.32	8.84

Table 4.3.5-1: Vegetation Impacts

ERM additionally revied FCV data to characterize the quality of vegetation along the routes. Table 4.3.5-2 summarizes the impact in acres by FCV value for each route. Of all routes, Mars-Wishing Star Route 6 crosses the highest amount (49.34 acres) of forested habitat with Average and Moderate FCV combined; Mars-Wishing Star Route 1 crosses the least amount (36.60 acres) of forested habitat with Average and Moderate FCV combined. The Mars 230 kV Loop route crosses 5.45 acres of forest with Average FCV.

Table 4.3.5-2: Forest Conservation Value Along Routes

	Mars-Wishing Star Routes and Mars 230 kV Loop Route						
Conservation Value	Route 1 (acres)	Route 2 (acres)	Route 3 (acres)	Route 4 (acres)	Route 5 (acres)	Route 6 (acres)	Mars 230 kV Loop (acres)
Average	33.77	33.52	40.62	40.37	40.17	37.20	5.45
Moderate	2.83	5.10	3.51	5.78	8.77	12.14	0.00
Total	36.60	38.62	44.13	46.15	48.94	49.34	5.45

4.4 Visual Assessment

The purpose of the visual assessment was to:

- Define the aesthetic components to be evaluated for each route alternative.
- Inventory and evaluate existing visually sensitive features and user groups within the study area.
- Describe the appearance of the visible components of the Project facilities.
- Evaluate potential facility visibility within the study area.
- Identify KOPs for visual assessment.
- Assess the visual impacts associated with the Project facilities and compare visual impacts for the alternative routes.

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 Project

To assess potential visual impacts on the VSRs associated with each route, ERM reviewed aerial photographs, online resources, and the Route 50 Corridor Design Guidelines from January 4, 2007 (Loudoun County 2007). Specific viewer groups were identified and considered, including commuters/through travelers, local residents/workers, and recreationalists. 3D visual renderings (renderings) were prepared from 10 representative KOPs for the six Mars-Wishing Star alternative routes and the Mars 230 kV Loop route. The renderings prepared from the KOPs capture potential views representing associated VSRs and viewer groups. A field investigation was undertaken on August 4, 2022, to assess potential visual impacts on identified VSRs and viewer groups for each route.

The new rights-of way required for each of the Project routes would result in a visible change due to vegetation clearing and the introduction of new transmission structures and conductors. As discussed in Section 4.6, however, the Mars-Wishing Star route alternatives parallel existing transmission lines for varying distances. Moreover, there are additional transmission and distribution corridors within and adjacent to the study area. These existing corridors lower the sensitivity to visual change from around and near VSRs in the study area. Changes in visual conditions nonetheless would be noticeable from the numerous residences on the north side of Evergreen Mills Road between Northstar Road and Loudoun County Parkway. To some extent, all the Mars-Wishing Star route alternatives would affect views for commuters on Loudoun County Parkway between Old Ok Road to the south and Evergreen Mills Road to the north. The required clearing for the Mars 230 kV Loop would result in a negligible change to the existing conditions and potential views traveling the roadway.

As discussed in Section 3.4, the following VSRs were identified for the study: Highways 606, 659, and 857; Arcola Mills Drive; Evergreen Mills Road; Loudoun County Parkway; and residences located on the north side of Evergreen Mills Road. Loudoun County Parkway/Highway 606 bisects the study area from north to south; all alternative routes for the Mars-Wishing Star Lines would cross Loudoun County Parkway. Carters School Road, serves as an access route to the large surface parking lots and data centers. The activities present along the roadway are representative of an activity with a low sensitivity to visual impacts. The residences north of Evergreen Mills Road would have views of Mars-Wishing Star Routes 1 through 6, with Routes 2 and 3 having the closest proximity to residences approximately between Belmont Ridge Road and Kinston Ferry Terrace, and Route 1 having the closest proximity to residences along Arcola Mills Drive would have views of all Mars-Wishing Star alternative routes northwest of the Arcola Mills Drive/Belmont Ridge Road/Briarfield Lane intersection.

4.4.1 Key Observation Points

In evaluating visual impacts for the Project, KOPs were identified in consultation with Dominion. KOP coordinates were loaded into a resource-grade global positioning system for data collection. Simulations were prepared for a representative selection of 10 KOPs providing future condition views of the planned transmission infrastructure along the various routes. The simulations were chosen to represent the following criteria or conditions:

- Illustrate visibility from specific VSRs.
- Illustrate representative views for different user groups.
- Illustrate the proposed new transmission infrastructure along the various route alternatives.
- Provide representative views of the proposed structures and associated vegetative clearing.

Information on each KOP is provided in Table 3.4-2.

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4.4.2 Visual Simulations

4.4.2.1 Visualization Tools Approach

Visual resources in both urban and rural environments are becoming increasingly important to the public. Often these impacts are perceived rather than actual. This analysis relies on visual simulations to accurately depict potential changes to the landscape due to construction and operation of the Project.

A visual simulation is a photorealistic computer representation of a proposed project based on site photography and engineered data. These types of simulations are routinely used to demonstrate before and after construction conditions, alternatives analyses, material/design comparisons, mitigation measures, and long-term maintenance and monitoring plans. Visual simulations explain visual changes to the environment within the context of a public viewshed.

4.4.2.2 Visual Simulation Methodology

Visual simulations of the proposed transmission infrastructure were developed according to the steps and conditions described below:

- Photographic imagery: Imagery was captured using the appropriate focal length to accurately represent the proposed technology.
- <u>Reference conditions</u>: The following conditions/information were documented to enhance rendering accuracy:
 - ✓ Date, time of day (hour/minutes): Determines color of sunlight, shadow location, and irradiance levels.
 - ✓ Atmospheric conditions: Haze and light diffusion have an impact on contrast at distance and amount of ambient light.
 - ✓ Lens length: Determines amount of parallax and depth of field between objects in view.
 - ✓ Available reference photography: Used to accurately represent color, saturation, and contrast.
- Three-dimensional existing conditions modeling: An existing conditions 3D model of the study area was created, including terrain, vegetation, and structures. The 3D model was geo-referenced and compiled with aerial imagery and available light detection and ranging (LiDAR) data to ensure spatial accuracy. Structures, vegetation clusters, and skylines were cross-referenced with LiDAR data and reference imagery to ensure accurate representation of scale and placement within the visual simulation.
- <u>Three-dimensional sun and atmospheric conditions</u>: Atmospheric data were imported into the 3D model to develop a sun and atmospheric system that matches the location-specific reference data.
- Three-dimensional project development: Based on computer-aided GIS and power line systems design data provided by Dominion, a 3D model of the Project was constructed. All information was imported into the 3D existing conditions model using the same geo-reference, and the projection was validated for accuracy. Three-dimensional materials and associated specular reflectance information was applied to the 3D information.
- <u>Visual simulation</u>: After all information was properly located in the 3D model, a photograph that best represents the targeted resource was aligned, atmospherics checked, and materials applied. The 3D information was then rendered using highly accurate raytraced render engines. Rendered elements

were separated into multiple passes including foreground and background layers to allow for precise compositing and fine-tuning using photo-editing software.

Photo-editing software: The use of photo-editing software was necessary to achieve realistic representation of referenced 3D components within the photograph. Atmospherics, grunge, and vegetation depicted in the 3D model were fine-tuned to match the existing conditions photo. Additional imagery was cross-referenced to ensure accurate depiction camera effects like chromatic aberration, noise, and depth of field.

The following sections provide an assessment of the existing conditions and potential changes that may occur from the Project at a representative selection of 10 KOPs. The narratives provide a description of the various conditions that may result from the Project with visual simulations from the KOPs provided in Appendix F, Visual Simulations.

4.4.3 Visual Simulation Results

Key Observation Point 1

Existing Conditions: KOP 1 faces northeast from the cul-de-sac terminus at the north end of Weathervane Place. The foreground is dominated by front lawns and residences along Weathervane Place. There are several small trees and shrubs within the grassy lawns in front of the houses, which are three stories tall with attached garages. Behind the residences are tall mature trees which limit further views of the area. There is a trail that runs behind the residences, in the trees, that could potentially be visible at certain times of year. No existing transmission features are visible from this KOP.

<u>Simulation Conditions</u>: The simulation illustrates the change in visual conditions at KOP 1 that would result from the installation of transmission structures and associated equipment for the Wishing Star Substation and Mars-Wishing Star Routes 1 through 6. Due to the density and height of the trees behind the residences, no Project feature would be visible from this KOP.

Based on existing user activities in the area, sensitivity to visual change would be medium. The change in landscape character that would result from the introduction of the new substation and transmission lines would have a negligible to low impact on scenic quality at the KOP, and the overall impact would be minimal. The reason the rating includes a potential for low impact, even though the simulation shows no visibility of the transmission infrastructure, is that the specific KOP location is representative of the neighborhood as a whole. From other locations in the neighborhood, the tops of the proposed structures could be visible from some vantage points.

Key Observation Point 1c

Existing Conditions: KOP 1c looks southeast from the cul-de-sac terminus at the eastern end of Marigold Mill Place in a residential neighborhood. An existing transmission right-of-way crosses the roadway in front of the viewer, running north-south. Two transmission structures are visible above the tree line on the north side of the roadway with several associated conductors present as well. The foreground shows the paved cul-de-sac of Marigold Mill Place and the eastern edges of grassy lawns for the residences to the north and south. A foreground landscape tree is visible on the right-side of the frame, representing several additional trees also present in the accompanying lawns. The view expands along the open grassy parcels. To the southeast is a gravel parking area with several picnic benches and a sign for the trail system that runs to the south towards Lenah Run. A community garden with animal fencing and a storage structure is visible on the east side of the cul-de-sac, in the foreground of the tree line, where existing transmission structures are visible. Dense, mature trees and shrubs frame the middleground of the scene obscuring further views to the south and east. Several lattice-structures along an existing Dominion right-of-way are visible over the trees in the middleground.

<u>Simulation Conditions</u>: The simulation illustrates the change in visual conditions at this KOP that would result from the removal of the two existing lattice structures and the installation of the transmission structures and associated equipment for the Wishing Star Substation and Mars-Wishing Star Routes 1 through 6 (each of which uses the same alignment in this area). The associated structures at the proposed Wishing Star Substation would rise above the mature tree line in the center of the view. The tops of these structures and the associated conductors would also be visible above the trees to the east.

Based on collocation of the new line and substation with existing transmission infrastructure, along with existing user activities in this area, sensitivity to visual change would be medium. The proposed structures associated with the Wishing Star Substation would replace the two existing lattice structures shown in the existing conditions image. The proposed substation equipment is slightly larger than the equipment at the existing substation and therefore may have more contrast. The change in landscape character that would result from the introduction of the new substation and transmission line would have a negligible to low impact on scenic quality at this KOP, and the overall impact would be minimal.

Key Observation Point 3

Existing Conditions: KOP 3 looks northwest from the intersection of Arcola Mills Drive and Belmont Ridge Road (SR 659). The foreground shows the striped roadway of Belmont Ridge Road and grassy roadside conditions. Several road signs are visible in the northeast portion of the view. On the north side of the roadway is a distribution pole with a line running overhead to the south. A road sign is to the left of the pole. There is a large grassy/vegetated parcel in the midground with mature trees and shrubs forming a screen from Arcola Mills Drive to the northwest and other views to the north. Residences along Birnam Wood Place are visible to the north. The mature trees in the middleground to the north are part of the riparian zone for Broad Run. A dark band of mature trees are visible in the background to the north. There are multiple transmission lines and associated structures running through the middleground and background of the view associated with existing Dominion transmission lines (Lines #2183 and #2172). The existing transmission structures are partially sky-lined above the mature trees, with conductors visible running through vegetation as well as above the trees.

<u>Simulation conditions</u>: The simulation illustrates the change in visual conditions at KOP 3 that would result from the installation of transmission structures and conductors for the Wishing Star Substation and Mars-Wishing Star Routes 1 through 6 (each of which uses the same alignment in this area). The Project would add additional transmission structures and conductors to the view across the middleground at the rear of the open field, running east-west. These structures would be partially sky-lined above the mature trees.

Based on existing user activities in the area, sensitivity to visual change at this KOP would be low. The change in landscape character that would result from the introduction of the new transmission line would have a low impact on scenic quality at this KOP, and the overall impact would be minimal.

Key Observation Point 5

Existing conditions: KOP 5 faces south from the intersection of Evermont Trace Drive and Birnam Wood Place. The foreground is a flat grassy lawn/park space with transmission lines and structures running across the view. A line of deciduous trees/shrubs creates a middleground viewing barrier with the top of a higher, tree covered hill visible over several trees. The top portion of the existing transmission structures are sky-lined, adding industrial features to a more natural view. On the grassy area on the south side of Birnam Wood Place is a green transformer box and parking area. There is also a street sign in the view.

<u>Visual Simulation</u>: The simulation illustrates the change in visual conditions at this KOP that would result from the installation of the transmission structures and associated equipment along Routes 1 through 6 (each of which utilizes the same alignment in this area). The proposed transmission structures and

conductors run from west to east across the view, behind the existing transmission infrastructure. The new structures would be partially obscured by the existing tree line, but the remaining portion would be sky-lined. Conductors would be visible above the treeline impacting the natural view of the tree covered hill in the background.

Based on the presence of existing transmission infrastructure along with existing user activities in this area, sensitivity to visual change would be low. The change in landscape character that would result from the introduction of the new transmission line would have a low impact on scenic quality at this KOP, and the overall impact would be minimal.

Key Observation Point 13

Existing conditions: KOP 13 faces northeast from the east bound shoulder of Highway 606 (Old Ox Road), southwest of the Company's existing Cabin Run Substation, at the crossing of Cabin Branch. In the foreground is a guardrail on the south side of the road extending east, a vegetated shoulder leading to a black chain link fence, and dense mature trees bordering the roadway. The Company's existing right-of-way for Lines #2137 and #2213 follows along the grassy shoulder with multiple visible transmission structures running east into the background. The existing structures are sky-lined due to the low vegetation and gentle uphill grade of the roadway. There is a grassy median bisecting the roadway on the northern side of the view. There is also a vegetated shoulder on the north side of the roadway with a silver chain link fence that borders an impounded pond/water catchment system with mature trees on the north side of it. To the east is the Cabin Run Substation with sky-lined transmission structures and associated conductors running on the north side of the road into the horizon. There is a commercial business building behind the substation with a screening line of trees extending towards the roadway.

<u>Visual Simulation</u>: The simulation illustrates the change in visual conditions at this KOP that would result from the installation of transmission structures and associated conductors along Routes 1 through 6 (each of which utilizes the same alignment in this area). The proposed right-of-way crosses Cabin Branch diagonally running northwest-southeast across the roadway. The new transmission structures would be taller than the existing structures and sky-lined on both sides of the road, before being obscured by trees to the southeast.

Based on collocation of the Mars-Wishing Star line with existing transmission infrastructure, along with the existing user activities in this area, sensitivity to visual change would be low. The change in landscape character that would result from the introduction of the new transmission line would have a low impact on scenic quality at KOP 13, and the overall impact would be low.

Key Observation Point 14

Existing conditions: KOP 14 looks north from the cul-de-sac at the southern terminus of Carter School Road, which is a two-lane striped roadway running north to Highway 606 (Old Ox Road). Within this view, there are cars parked on both shoulders of the roadway. Distribution lines and associated poles (partially sky-lined) run on both sides of the road. There are shrubs lining the west side of the roadway shoulder blocking views further west. On the east side of the roadway shoulder is a silver chain link fence bordering a vegetated parcel with trees further to the north. The trees obscure views to the northeast.

<u>Visual Simulation</u>: The simulation illustrates the change in visual condition at KOP 14 that would result from the installation of the transmission structures and conductors at the Mars Substation, along the Mars 230 kV Loop, and along Mars-Wishing Star Routes 1 through 6 (which share a common alignment in this area). The Mars Substation dominates the view on the east side of the roadway with a tall, chain link, mesh fence and the new structures and conductors associated with the transmission lines. Behind the fence are several buildings and additional structures and conductors. The Mars 230 kV Loop runs north

along the east side of the roadway. All structures taller than the fence would be sky-lined. The trees to the northeast would be visible in gaps between the substation buildings.

Based on existing user activities in this area, sensitivity to visual change in this area would be high. The change in landscape character that would result from the introduction of the new substation and transmission lines would have a high impact on scenic quality at this KOP, and the overall impact would be medium.

Key Observation Point 16

Existing Conditions: KOP 16 faces southwest across Old Ox Road towards Carters School Road and several commercial buildings. The view is dominated by the structures and conductors along the Company's existing right-of-way for Lines #2095 and #2137, which parallel the south side of Old Ox Road, as well as distribution infrastructure. The Company's existing right-of-way along Old Ox Road is open and grassy. There is a multi-use path for pedestrians/bicyclists/recreationalists that runs between the roadway and utility structures. There is a grassy median between the east and westbound lanes along Old Ox Road. A chain link fence is visible on the south side of the road along with a few road signs. Several three-plus story data center complexes in the middleground of the image block views to the south. The eastern edge of the view is filled in with deciduous trees and partially sky-lined utility structures that fill in the background and create a horizon line in that direction.

<u>Simulation Conditions</u>: The simulation illustrates the change in visual conditions at KOP 16 that would result from the installation of the transmission structures and associated conductors along the Mars 230 kV Loop. The addition of the loop on the east side of the view would increase the density of conductors and associated structures, some of which would be partially sky-lined, at this location.

Based on the presence of existing transmission infrastructure along with expected user activities in this area, sensitivity to visual change would be low to medium. The change in landscape character that would result from the introduction of the new transmission line would have a low impact on scenic quality at this KOP, and the overall impact would be low.

Key Observation Point 21

Existing Conditions: KOP 21 faces north along Loudoun County Parkway from the multi-use path along the east side of the road. The eastern foreground is a vegetated area with a water catchment system in place for runoff from the road and a culvert to funnel the water into Broad Run. An existing transmission structure within the Company's right-of-way for Lines #2137 and #2213 sits just behind a low, vegetated hill. A dense wall of trees frames the eastern side of the image obscuring views outside of the immediate foreground and to the east of the roadway. Loudoun County Parkway is bounded by multi-use paved trails on either side of the roadway with a grassy median separating the north and south lanes of the roadway across Broad Run. The bridge is not visible to the east side due to viewer location. The western side of the view shows the continuation of the existing transmission lines (#2137 and #2213) across a grassy field, with dense riparian corridor on the southern end of Broad Run. Looking north along the roadway, several apartments/commercial structures are visible in the background, obstructing views further north.

<u>Simulation Conditions for Routes 1 and 3</u>: This simulation illustrates the change in visual conditions at KOP 21 that would result from installation of new transmission structures and conductors along Routes 1 and 3, which share a common alignment in this area. In the image, the proposed transmission structures and conductors run from west to east across the view, behind the existing riparian corridor along Broad Run. The new structures would be partially obscured by the existing tree line with structures visible east

of the roadway and associated water catchment area. Conductors would be visible over the roadway in the middleground looking towards the northeast.

Based on existing user activities in this area, sensitivity to visual change would be low. The change in landscape character that would result from the introduction of the new transmission facilities would have a low impact on scenic quality at this KOP, and the overall impact would be minimal.

Simulation Conditions for Routes 2, 4, 5, and 6: This simulation illustrates the change in visual conditions at KOP 21 that would result from installation of the new transmission structures and conductors along Routes 2, 4, 5, and 6, which share a common alignment in this area. In the image, the proposed transmission structures and conductors run from west to east across the view, behind the Company's existing right-of-way for Lines #2137 and #2213. The proposed new right-of-way would require clearing of vegetation and trees on the south side of the Broad Run riparian area. A new three-pole transmission structure would be introduced on the east side of the image with additional conductors in the foreground of the view.

Based on existing user activities in this area, sensitivity to visual change would be low. The change in landscape character that would result from the introduction of the new transmission facilities would have a low impact on scenic quality at this KOP, and the overall impact would be minimal.

Key Observation Point 24

Existing Conditions: KOP 24 faces south from a residential neighborhood on the north side of Evergreen Mills Road. The view is partially obscured by the young trees planted on the low hill and landscaping in the foreground, on the south side of Cypress Glen Square. There are flowers, low grasses, and shrubs planted in the landscaped area as well. There is a fence visible on the southeast side of the view, east of the low hill. The hill and fence block most views of Evergreen Mills Road, which can only be seen through a gap in the vegetation to the southwest. In the middleground of the image is a dense line of mature trees running east to west blocking views further to the south. These mature trees are the beginning of the northern side of the riparian zone for Broad Run. The pedestrian path visible in the lower right corner of the image leads to a tunnel under Evergreen Mills Road.

<u>Simulation Conditions</u>: The simulation illustrates the change in visual conditions at KOP 24 that would result from the installation of the new transmission structures and conductors along Routes 1 and 3, and 2 and 4, which share a common alignment in this area. The proposed new right-of-way would run from west to east across the middleground, adding conductors to the view. New transmission structures could potentially be visible from or near this KOP where not obscured by background vegetation in the Broad Run riparian zone.

Based on existing user activities in this area, sensitivity to visual change would be high. The change in landscape character that would result from the introduction of the new transmission line and associated conductors would have a medium impact on scenic quality at this KOP, but the overall impact would be low.

Key Observation Point 26

Existing Conditions: KOP 26 faces south from the multi-use path on the south side of Evergreen Mills Road between Richland Grove Drive to the west and Kinston Ferry Terrace to the east. The foreground is filled with a grassy field to the south, framed by trees and shrubs to the west and a low hill denoting the edge of an impounded pond. The dense line of mature trees marking the north end of the riparian zone for Broad Run limits the background of the view. Several transmission structures are visible above the treeline to the south for the Company's existing right-of-way for Lines #2213 and #2137 on the south side of Broad Run.

<u>Simulation Conditions for Routes 1 and 2</u>: The simulations illustrate the change in visual conditions at KOP 26 that would result from the installation of the new transmission structures and conductors along Routes 1 and 2. The structures would be partially sky-lined at the southern end of the open field at the east side of the view, and conductors would be visible above the treeline. There are also structures partially obscured by trees on the west side of the view.

Based on existing user activities in this area, sensitivity to visual change would be medium. The change in landscape character that would result from the introduction of the new transmission line and associated conductors would have a low impact on scenic quality at this KOP, and the overall impact would be low.

<u>Simulation Conditions for Routes 3 and 4</u>: The simulations illustrate the change in visual conditions at KOP 26 that would result from the installation of the new transmission structures and conductors along Routes 3 and 4. The structures would be partially sky-lined at the southern end of the open field at the east side of the view, and conductors would be visible above the treeline. Structures are also partially obscured by trees on the west side of the view.

Based on existing user activities in this area, sensitivity to visual change would be medium. The change in landscape character that would result from the introduction of the new transmission line and associated conductors would have a low impact on scenic quality at this KOP, and the overall impact would be low.

Simulation Conditions for Routes 5 and 6: The simulations illustrate the change in visual conditions at KOP 26 that would result from the installation of the new transmission structures and conductors along Routes 5 and 6. The proposed new right-of-way would run from west to east across the background, behind the edge of the Broad Run riparian zone. Structures would be partially sky-lined and conductors would be visible above the treeline. The structures are grouped at the east side of the view and are partially obscured by trees on the west side of the view.

Based on existing user activities in this area, sensitivity to visual change would be medium. The change in landscape character that would result from the introduction of the new transmission line and associated conductors would have a low impact on scenic quality at this KOP, and the overall impact would be low.

4.4.4 Impact Assessment for Visually Sensitive Resources

An assessment of impacts on VSRs along the route alternatives is presented in Table 4.4-1. The table discusses the potential impact from each route on VSRs based on review of the representative visual simulations and the field reconnaissance completed in August 2022.

VSR Number	VSR Name	Representative KOP(s)	Description of Impact	Potential Impact Rating
Scenic R	esources			
No resour	ces present			
Recreatio	onal Resources			
1	Stream Valley Park and Broad Run Stream Valley Trail	24, 26	Mars-Wishing Star Route 1 crosses Stream Valley Park approximately between MPs 1.5 and 1.8 south of Evergreen Mills Road and west of Loudoun County Parkway. The route would require clearing for the new right-of-way along the norther border of the park, just south of Evergreen Mills Road. The route crosses the trail	Medium to high (Routes 1 through 6)

Table 4.4-1: Visually Sensitive Resource Assessment

VSR Number	VSR Name	Representative KOP(s)	Description of Impact	Potential Impact Rating
			network associated with the park in nine locations.	• • •
			Mars-Wishing Star Route 2 crosses Stream Valley Park approximately between MPs 1.6 and 1.9 in the area between Broad Run to the north and the Company's existing right-of-way for Lines #2183 and #2172 to the south. The route would require clearing to expand the width of the existing right-of-way along the southern park boundary. The route crosses the trail network associated with the park in eight locations.	
			Mars-Wishing Star Route 3 crosses Stream Valley Park approximately between MPs 1.5 and 1.8 along an identical alignment as Route 1. The route crosses the trail network associated with the park in five locations.	
			Mars-Wishing Star Route 4 crosses Stream Valley Park approximately between MPs 1.6 and 1.9 along an identical alignment as Route 2. The route crosses the trail network associated with the park in four locations.	
			Mars-Wishing Star Route 5 crosses Stream Valley Park approximately between MPs 1.5 and 1.8 in the area between Broad Run to the north and the Company's existing right-of-way for Lines #2183 and #2172 to the south (similar to Routes 2 and 4). The route would require clearing to expand the width of the existing right- of-way along the southern park boundary. The route avoids crossing the trail network associated with the park.	
			Mars-Wishing Star Route 6 crosses Stream Valley Park approximately between MPs 1.5 and 1.8 along an identical alignment as Route 5. The route avoids crossing the trail network associated with the park.	
			See Appendix F for an aerial representation of alternative routes relative to the trail network.	

VSR Number	VSR Name	Representative KOP(s)	Description of Impact	Potential Impact Rating
Cultural I	Resources		•	
No resour	ces present			
Road Co	rridors			
2	Highway 606 (Old Ox Road)	13, 16	Mars-Wishing Star Routes 1 through 6 each cross Old Ox Road in the area east of the Company's existing Cabin Run Substation and north of a large open air parking lot on the south side of the road. The crossing is adjacent to the Company's existing right-of- way for Lines #2137 and #2213. The land on the north side of the road is mostly open. To the south, the route crosses the parking lot, though some limited tree clearing in this area would be required.	Low (Routes 1 through 6)
3	Highway 659 (Belmont Ridge Road)	5	Mars-Wishing Star Routes 1 through 6 run perpendicular to Belmont Ridge Road crossing the road south of the Arcola Volunteer Fire Department campus. This is also south of the intersection of Belmont Ridge and Evergreen Mills Roads where Belmont Ridge Road merges from four lanes to the north to two lanes to the south. The crossing of Belmont Ridge Road is adjacent to the Company's existing right-of-way for Lines #2172 and #2183.	Low (Routes 1 through 6)
4	Route 857 (Carters School Road)	14, 16	Mars-Wishing Star Routes 1 through 6 each terminate at the proposed Mars Substation along Carters School Road. The route splits into separate rights-of-way for the proposed 500 kV line, which enters the substation site from the west, and the 230 kV line, which enters the substation from the south. Land cover in this area is developed or open. The Mars 230 kV Loop parallels the east side of Carters School Road between Old Ox Road to the north and the Mars Substation site to the	Low (Routes 1 through 6) Low (Mars 230 kV Loop)
5	Arcola Mills Drive	3	of Carters School Road is largely forested. Mars-Wishing Star Routes 1 through 6 each cross Arcola Mills Road south of Broad Run near the Company's existing right-of-way for Lines #2172 and #2183. The clearing associated	Low to Medium (Routes 1 through 6)

VSR Number	VSR Name	Representative KOP(s)	Description of Impact	Potential Impact Rating
			but is not out of character with the existing landscape.	
6	Evergreen Mills Road (and accompanying multi-use paths)	24, 26	Mars-Wishing Star Routes 1 through 6 each pass south of Evergreen Mills Road in the area approximately between Belmont Ridge Road to the west and Loudoun County Parkway to the east. Routes 1 and 3 pass nearest to Evergreen Mills Road between approximate MPs 1.5 and 1.8, where the routes are parallel and adjacent to the road. The right-of-way clearing and new structures installed along these alternatives would be more apparent/visible from Evergreen Mill Road than for the other alternatives. Clearing and new structures installed along Routes 2 and 4 would be less visible from Evergreen Mill Road as these routes are farther south. Clearing and new structures installed along Routes 5 and 6 would be least visible as these routes are farthest from the road. New transmission structures would be visible from these routes but hard to discern as they intermingle with the tops of existing vegetation and the existing transmission structures. Proposed future developments along the southern side of Evergreen Mills Road would limit the visibility of the Broad Run area; therefore, much of the visual impact to Evergreen Mills Road from the alternative routes would be mitigated in the future.	Low to Medium (Routes 1 through 6)
7	Loudoun County Parkway	21	Mars-Wishing Star Routes 1 and 3 each cross Loudoun County Parkway to the north near its intersection with Evergreen Mills Road. These routes would introduce right-of-way clearing and new transmission structures into the view from the parkway. Mars-Wishing Star Routes 2, 4, 5, and 6 each cross Loudon County Parkway at the southern edge of the Broad Run area, adjacent to the Company's existing right-of-way for Lines #2213 and #2137. Collocation with the existing transmission lines would minimize the visual impacts from these routes at the crossing of the parkway.	Low (Routes 1 through 6)

Areas of High Public Concentration

ENVIRONMENTAL ROUTING STUDY

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 Project

VSR Number	VSR Name	Representative KOP(s)	Description of Impact	Potential Impact Rating
8	Evergreen Mills Road area residents	5, 24, 26	See the analysis presented for VSR 6 above.	Medium (Routes 1 through 6)
			The impact rating for VSR 8 is higher than VSR 6 due to the difference in user groups and activities associated with these resources. Compared to driving or being a passenger within a car, the more static activities undertaken while at home are more sensitive to changes in the surrounding landscape.	

4.4.5 Impact Assessment by Route

The impact of changes in visual conditions is a function of both the nature of the change (i.e., the presence of new Project structures and rights-of-way, where no such development currently exists) as well as the sensitivity of user groups to such changes. User group/viewer sensitivity is inherently subjective, and each user group has their own opinion of what constitutes a positive or negative change in visual conditions within the landscape. However, as discussed in Section 3.4, Visual Conditions, specific user groups have a preset interaction with visual changes to the landscape.

This analysis identifies VSRs within the study area, identifies corresponding user groups and their associated sensitivity to visual changes in the landscape, and provides visual simulations to demonstrate various representative views that would be experienced from selected VSRs and throughout the study area as a whole. This analysis indicates that overall visual impacts from the Project would vary from low to high depending on route; however, the impacts would not likely be perceived as a fundamental change in landscape conditions within the study area. Visibility of the proposed transmission structures for the route alternatives due to vegetative clearing at the ten KOPs evaluated above is broadly representative of views and potential Project impacts within the study area (Table 4.4). Based on the identified VSRs, potential user groups, and visual simulations, Mars-Wishing Star Routes 5 and 6 have the least predicted visual impact on identified VSRs and the study area as a whole, with Route 5 having slightly less impact than Route 6.

Route 5 has the least predicted visual impact for the following reasons: greater collocation with existing transmission lines; greater distance from Evergreen Mills Road and nearby residences; and no crossings of Stream Valley Park trails. Route 6 shares much of the same characteristics as Route 5. The main difference is the proximity to the trail network where Route 6 remains on the northern side of the Company's existing transmission right-of-way for Lines #2137 and #2213.

The Mars 230 kV Loop has a low predicted visual impact on VSRs and user groups associated with areas of potential visibility. Carters School Road has a very low sensitivity to visual change and would not be impacted by the installation of new transmission structures and associated clearing.

The number of affected KOPs, number of road crossings, and impact potential for all routes are summarized and compiled in Table 4.4-2.

Route	Potentially Impacted VSRs	Description of Impact	Potential Impact Rating
Wishing Star to	Mars Alternatives		
Route 1	1–8 Total 8	Road crossings: Total–5	Low
		Trail crossings: Total–9	High
		Sensitive VSRs: Stream Valley Park and Trails Evergreen Mills Road, paths and residents Loudoun County Parkway	High
		Impacted User Groups: Local residents/workers Recreationalists/tourists	High
		Total:	High

Table 4.4-2: Visually Sensitive Resource Impact Results

Route 2	1–8 Total 8	Road crossings: Total–5	Low
		Trail crossings: Total–8	High
		Sensitive VSRs: Stream Valley Park and Trails Evergreen Mills Road, paths and residents	Medium to high
		Impacted User Groups: Local residents/workers Recreationalists/tourists	Medium
		Total:	Medium to high

Route 3	1–8 Total 8	8 Road crossings: Total–5	
		Trail crossings: Total–5	Medium
		Sensitive VSRs: Stream Valley Park and Trails Evergreen Mills Road, paths and residents Loudoun County Parkway	Medium to high

Route	Potentially Impacted VSRs	Description of Impact	Potential Impact Rating
		Impacted User Groups: Local residents/workers Recreationalists/tourists	Medium to high
		Total:	Medium to high

Route 4	1–8 Total 8	Road crossings: Total–5	Low
		Trail crossings: Total–4	Medium
		Sensitive VSRs: Stream Valley Park and Trails Evergreen Mills Road, paths and residents	Medium
		Impacted User Groups: Local residents/workers Recreationalists/tourists	Low to medium
		Total:	Medium

Route 5	1–8 Total 8	Road crossings: Total–5	Low
		Trail crossings: Total–0	Negligible
		Sensitive VSRs: Stream Valley Park and Trails	low
		Impacted User Groups: Local residents/workers Recreationalists/tourists	Low
		Total:	Low

Route 6 1–8 Total 8		Road crossings: Total–5	Low
		Trail crossings: Total–0	Negligible
		Sensitive VSRs: Stream Valley Park and Trails	Low to medium

ENVIRONMENTAL ROUTING STUDY

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 Project

Route	Potentially Impacted VSRs	Description of Impact	Potential Impact Rating
		Impacted User Groups: Local residents/workers Recreationalists/tourists	Low to medium
		Total:	Low to medium

Mars 230 kV Loop	2, 4 Total 2	Road crossings: Total–0	Negligible
		Trail crossings: Total–NA	Negligible
		Sensitive VSRs: Carters School Road	Low
		Impacted User Groups: Local residents/workers	Low
		Total:	Negligible to low

NA = not applicable

4.5 Cultural Resources

Impacts on cultural resources relevant to each Mars-Wishing Star route alternative, the 230 kV Mars Loop, and the proposed substations are discussed below. The full Pre-Application Analysis Report for the Project is included in Appendix G, Stage I Pre-Application Analysis of Cultural Resources.

4.5.1 Archaeology Findings

Eight previously recorded archaeological sites are located within the right-of-way of one or more of the Mars-Wishing Star route alternatives, Mars 230 kV Loop, or substation sites, as follows:

- Site 44LD0167 is crossed by Mars-Wishing Star Routes 1 and 2.
- Site 44LD0168 is crossed by all Mars-Wishing Star routes.
- Site 44LD0173 is crossed by Mars-Wishing Star Routes 2, 4, 5, and 6.
- Site 44LD0174 is crossed by Mars-Wishing Star Routes 5 and 6.
- Site 44LD0609 is crossed by Mars-Wishing Star Routes 5 and 6.
- Site 44LD0970 is crossed by Mars-Wishing Star Routes 2, 4, 5, and 6.
- Site 44LD1742 is crossed by the Mars 230 kV Loop.
- Site 44LD1280 is located within the footprint of the proposed Wishing Star Substation site.

Each of these sites is discussed below. The discussion provides both the current NRHP status and desktop reconnaissance-level information about each site's condition.

No previously recorded archaeological sites are within the footprint of the proposed Mars Substation.

Site 44LD0167

44LD0167 is a Pre-Contact temporary camp site, consisting of one quartz shallow side-notched point. The site has not been formally evaluated to determine its eligibility for listing in the NRHP, and the overall integrity of the site is unknown. Mars-Wishing Star Routes 1 and 2 extend across the length of 44LD0167 (approximately 719 feet). Construction along either route would include clearing of the right-of-way and the installation of a single planned structure within the boundary of the site. Because the resource has not been formally evaluated, field survey would be needed to assess the site's eligibility for listing in the NRHP. If the site is found to be eligible, the route or location of the structure may need to be adjusted to avoid impacts on the site.

Site 44LD0168

Mars-Wishing Star Routes 1 through 6 cross the southwestern half of 44LD0168, which is a Pre-Contact temporary camp, primarily consisting of a quartz lithic scatter. The site was previously determined not eligible for listing in the NRHP.

Site 44LD0173

44LD0173 consists of a Pre-Contact temporary camp and lithic scatter that included a quartzite late-stage biface fragment, a quartz early to middle stage biface fragment, quartz flakes, rhyolite flakes, a quartz cobble fragment, a stoneware sherd, and a glass shard. Mars-Wishing Star Routes 2, 4, 5, and 6 intersect the northern part of 44LD0173's boundary. The current design of these routes would include the placement of a single transmission structure within the site; however, the site was previously determined not eligible for listing in the NRHP.

Site 44LD0174

44LD0174 is a Pre-Contact temporary camp containing a lithic scatter with two stemmed points suggesting a Late Archaic component. The rights-of-way for Mars-Wishing Star Routes 5 and 6 cross a very small portion of the northern boundary of the site; however, the site was previously determined not eligible for listing in the NRHP.

Site 44LD0609

44LD0609 is an Early Woodland base camp consisting of a Susquehanna projectile point, a chert bifacial tool, a grit-tempered Marcey Creek variant ceramic sherd, and five quartz flakes. The integrity of 44LD0609 is unknown, and the site has not been evaluated to assess its eligibility for listing in the NRHP. The rights-of-way for Mars-Wishing Star Routes 5 and 6 abut the northern boundary of 44LD0609. Clearing of the right-of-way and associated construction activities along either route could impact the site. Because the resource has not been formally evaluated, field survey would be needed to assess the eligibility of the site for listing in the NRHP.

Site 44LD0970

44LD0970 is a Late Archaic period lithic scatter consisting of two quartz flakes, a quartzite projectile point fragment, two rhyolite flakes, and a chert flake. While the site is previously disturbed, it has not been formally evaluated to determine its eligibility for listing in the NRHP. The southern half of the right-of-way along a common segment of Mars-Wishing Star Routes 2, 4, 5, and 6 crosses 44LD0970. Clearing of the right-of-way and associated construction activities could impact the site; however, because the site has been previously disturbed from the construction of an existing Dominion transmission line (#2137 and

#2213), construction along Routes 2, 4, 5, or 6 would be unlikely to impact intact cultural deposits within this resource.

Site 44LD1280

One archaeological site lies within the footprint of the proposed Wishing Star Substation: 44LD1280, an historic railroad bed. The site is approximately 1.7 miles long and consists of cuts and berms associated with the proposed Loudoun Branch of the Manassas Gap Rail Company. Construction of the railroad began in 1853 but was abandoned prior to the Civil War and never completed. The northern portion of the proposed Wishing Star Substation site encompasses an approximately 0.21-mile-long segment of the railroad; however, the site has been determined not eligible for listing in the NRHP.

Site 44LD1742

One archaeological site lies within the right-of-way for the proposed Mars 230 kV Loop. 44LD1742, the Carter Schoolhouse, consists of the burned remains of the school building, which was built ca. 1920 and closed between 1936 and 1939. The remains consist of a stone rubble foundation and brick chimney fall. A total of 385 artifacts are reported from previous investigations of the site, including porcelain, whiteware, glass fragments, metal nails, and a decorative plate. The right-of-way for the Mars 230 kV Loop crosses the site; however, the site has been determined not eligible for listing in the NRHP.

4.5.2 Aboveground Historic Properties

Three previously recorded historic architectural resources fall within the VDHR study tiers for the Mars-Wishing Star route alternatives. A comparison of the number of resources that would be impacted and the degree of impact on these resources for each Mars-Wishing Star route alternative, the Mars 230 kV Loop, and the proposed substations are presented in Table 4.5-1.

Based on desktop analysis and visual simulations (see Appendix G, Stage I Pre-Application Analysis of Cultural Resources), ERM recommends that construction and operation of the new transmission lines along each of the Mars-Wishing Star alternative routes would result in a finding of no impact on two resources (053-0982 and 053-0984) and a minimal impact on one (053-0008). ERM additionally recommends that construction and operation of the proposed Wishing Star Substation would result in a finding of no impact for one resource (053-0982), while construction and operation of the Mars Substation would result in finding of minimal impact on one resource (053-0008). There are no resources along the proposed Mars 230 kV Loop.

The specific resources affected by each route alternative and substation are discussed below.

Table 4.5-1: Comparison of Impacts on Historic Resources in the Study Area for the Mars-Wishing Star routes, Mars 230 kV Loop route, and Mars and Wishing Star Substations

Route/Project Facility	Numbe	Number of Considered Resources in Each Impact Category					
	No Impact	Minimal Impact	Moderate Impact	Severe Impact	Total		
Mars-Wishing Star Route 1	2	1	0	0	3		
Mars-Wishing Star Route 2	2	1	0	0	3		
Mars-Wishing Star Route 3	2	1	0	0	3		
Mars-Wishing Star Route 4	2	1	0	0	3		
Mars-Wishing Star Route 5	2	1	0	0	3		

Route/Project Facility	Number	Number of Considered Resources in Each Impact Category					
Mars-Wishing Star Route 6	2	1	0	0	3		
Mars 230 kV Loop	0	0	0	0	0		
Wishing Star Substation	1	0	0	0	1		
Mars Substation	0	1	0	0	1		

4.5.2.1 Mars-Wishing Star Lines, Routes 1, 2, 3, 4, 5, and 6

Three previously recorded architectural resources fall within the VDHR study tiers for Mars-Wishing Star Routes 1 through 6 (Table 4.5-2). Construction and operation of the new facilities associated with these routes would have no impact on two resources, Arcola Elementary School (053-0982) and Arcola Slave Quarters (053-0984) and a minimal impact on one resource, Dulles International Airport Historic District (053-0008).

Arcola Elementary School (053-0982) is a one-story, circa 1939, rectangular brick school with a hipped roof and projecting central pavilion. The school was the fifth Public Works Administration construction project in Loudoun County and the first all-white school with individual classrooms for the various grades. Prior to its opening, most of the schools in the area had been one-room schoolhouses. The site is located approximately 0.66 mile to the south of Routes 1, 2, and 6, and 0.64 mile to the south-southwest of Routes 3, 4, and 5. Arcola Slave Quarters (053-0984) is a circa 1880 slave structure that is listed as an embodiment of distinctive characteristics of both early Virginia architecture and methods of slave quarter construction. It is a rare example of a stone slave quarters in Virginia. 053-0984 is located approximately 0.71 mile to the south of Route 1, 0.64 mile to the southwest of Route 2, 0.55 mile to the south of Routes 3, 4, and 5, and 0.57 mile to the south of Route 6. Neither resource would have a view to transmission infrastructure installed along any of the routes due to distance and intervening vegetation.

The Dulles Airport was designed by Eero Saarinen and is considered one of his most significant works. It represents the first airport designed for jet travel. The goal was to move people to planes, starting with their approach to the terminal, with the construction of a dedicated access road, through the onboarding and deplaning/baggage claim processes. The airport opened in 1962, and as of 1989, included the following contributing elements: 13 structures, 18 mobile lounges, the landscaping plan, and approach road. The district is located approximately 0.38 mile to the south of the 500/230 kV split along Mars-Wishing Star Routes 1 through 6 where the routes enter the Mars Substation site along a shared, common alignment.

The area between Dulles International Airport Historic District and the alternative routes is densely wooded. Only the tops of new structures installed along the routes would be visible above the tree line from the runway, and likely only during leaf-off seasons. The recorded boundary for the resource encompasses 1,726.60 acres, only a small portion of which (less than 10 acres) lies within the half-mile study tier for the routes. Additional mitigating factors include mature, tall trees surrounding the district, which would block visibility of the transmission line structures from most vantage points within the airport. For these reasons, ERM recommends that each of the proposed Mars-Wishing Star alternative routes would have a minimal impact on the Dulles International Airport Historic District.

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Table 4.5-2: Impacts to Historic Resources in the VDHR Study Tiers for Routes 1through 6

Buffer (miles)	Resource Category	Resource Number	Description	Impact
1.0 to 1.5	National Historic Landmarks	NA	NA	NA
0.5 to 1.0	National Register Properties	053-0982	Arcola Elementary School	None
	(listed)	053-0984	Arcola Slave Quarters	None
0.0 to 0.5	National Register-eligible	053-0008	Dulles International Airport Historic District	Minimal
0.0 (within ROW)	National Historic Landmarks, National Register Properties (listed and eligible)	NA	NA	NA

NA = not applicable; ROW = right-of-way; VDHR = Virginia Department of Historic Resources

4.5.2.2 Mars 230 kV Loop

There are no previously recorded architectural resources within the VDHR study tiers for the Mars 230 kV Loop.

4.5.2.3 Wishing Star Substation

One previously recorded architectural resource (053-0982) was identified within the VDHR study tiers for the Wishing Star Substation (Table 4.5-3). Construction and operation of the new substation would have no impact on this resource.

Arcola Elementary School (053-0982) is located approximately 0.83 mile to the southeast of the proposed Wishing Star Substation. Due to intervening forested land, residential development, and distance, the substation would not be visible from this resource.

Table 4.5-3: Impacts on Historic Resources in the VDHR Study Tiers for Wishing Star Substation

Buffer (miles)	Resource Category	Resource Number	Description	Impact
1.0 to 1.5	National Historic Landmarks	NA	NA	NA
0.5 to 1.0	National Register Properties (listed)	053-0982	Arcola Elementary School	None
0.0 to 0.5	National Register—eligible	NA	NA	NA
0.0 (within ROW)	National Historic Landmarks, National Register Properties (listed, eligible)	NA	NA	NA

NA = not applicable; ROW = right-of-way; VDHR = Virginia Department of Historic Resources

4.5.2.4 Mars Substation

One previously recorded architectural resource (053-0008) was identified within the VDHR study tiers for the Mars Substation (Table 4.5-4). Construction and operation of the new substation would have a minimal impact on this resource.

053-0008 is located approximately 0.42 mile south of the proposed Mars Substation site. The area between the resource and the substation is densely wooded, so the substation would not be visible from
the resource. However, as the Mars Substation would be built in conjunction with the Mars-Wishing Star routes and Mars 230 kV Loop route, both the substation and the routes are included in the analysis of viewshed impacts in this analysis. The Mars-Wishing Star routes are the same in the area surrounding the substation; thus, impacts from the substation and transmission line collectively are reviewed here.

The Mars-Wishing Star routes and Mars 230 kV Loop route all present equal, albeit minimal, potential for viewshed impacts. While all of the alternative routes would be visible from the runway, only the tops of the structures would be visible from above the tree line in the area between the district and the substation. Moreover, the structures are only likely to be visible only during leaf-off seasons. The recorded boundary for the resource encompasses 1,726.60 acres, only a small portion of which is located in the half-mile study tier for the routes. Further mitigating visual impacts are mature, tall trees surrounding the district that block visibility of the transmission line structures from most vantage points. ERM recommends that the proposed Mars Substation and any associated transmission lines under consideration would have a minimal impact on the Dulles International Airport Historic District.

 Table 4.5-4: Impacts on Historic Resources in the VDHR Study Tiers for Mars

 Substation

Buffer (miles)	Resource Category	Resource Number	Description	Impact
1.0 to 1.5	National Historic Landmarks	NA	NA	NA
0.5 to 1.0	National Register Properties (Listed)	NA	NA	NA
0.0 to 0.5	National Register—eligible	053-0008	Dulles International Airport Historic District	Minimal
0.0 (within ROW)	National Historic Landmarks, National Register Properties (Listed, eligible)	NA	NA	NA

NA = not applicable; ROW = right-of-way; VDHR = Virginia Department of Historic Resources

4.6 Geological Constraints

There are no active mineral operations located within 0.25 mile of the Project. As such, the Project would not impact any identified mineral resources.

4.7 **Collocation Opportunities**

ERM identified potential routing opportunities (i.e., existing linear corridor features) within the study area by reviewing recent digital aerial photography and data on Dominion's existing transmission system. A summary of the use of routing opportunities by route is as follows:

Route 1:

- 0.22 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.35 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137
- Total collocation: 0.57 mile (16 percent of the route)

Route 2:

- 0.22 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.74 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137

Total collocation: 0.96 mile (26 percent of the route)

Route 3:

- 0.60 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.35 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137
- Total collocation: 0.95 mile (26 percent of the route)

Route 4:

- 0.60 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.74 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137
- Total collocation: 1.34 mile (37 percent of the route)

Route 5:

- 0.92 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.81 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137
- Total collocation: 1.73 mile (49 percent of the route)

Route 6:

- 0.92 mile adjacent to the right-of-way for Dominion's existing Lines #2172 and #2183
- 0.91 mile adjacent to the right-of-way for Dominion's existing Lines #2213 and #2137
- Total collocation: 1.73 mile (49 percent of the route)

Mars 230 kV Loop:

The Mars 230 kV Loop route runs 0.47 mile adjacent to Carters School Road (82 percent of the route).

5. ANALYSIS OF ROUTE ALTERNATIVES

This section of the routing study provides a comparative analysis of the Mars-Wishing Star route alternatives. This analysis highlights the key constraints and opportunities relevant to selecting a preferred route alternative for the Mars-Wishing Star Lines. Because the Mars 230 kV Loop route is the only alignment between the Mars Substation and the Company's existing 230 kV Cabin Run-Shellhorn Road (#2095) and 230 kV Poland Road-Shellhorn Road (#2137) lines, it is not discussed below. The potential environmental impacts associated with each Mars-Wishing Star route alternative (inclusive of the Wishing Star and Mars Substation sites) are quantified in Table 4-1 (Environmental Feature Crossing Tables).

Route Length and Construction Footprint

Route lengths vary by less than 0.1 mile. Routes 5 and 6 are the shortest alternatives (at 3.55 miles and 3.56 miles, respectively), while Routes 1, 2, 3, and 4 range between 3.62 miles and 3.64 miles in length. Despite being the shortest alternatives, Routes 5 and 6 would have larger construction footprints than the other alternatives to accommodate the expanded, 200-foot-wide, right-of-way segment needed to span Broad Run at its confluence with North Fork Broad Run. Route 6 would require the most right-of-way at 93.88 acres and Route 2 the least at 91.68 acres (a difference in range of only 2.20 acres).

Routing Opportunities

According to SCC Guideline #1 (that existing rights-of-way should be given priority when adding additional facilities), ERM aligned portions of the Mars-Wishing Star route alternatives along existing transmission line rights-of-way to the extent practicable. Approximately 49 percent of Routes 5 and 6 (1.73 miles each) are collocated with existing transmission line rights-of-way. The other alternatives range from a low of 0.57 mile (16 percent) for Route 1 to a high of 1.33 miles (37 percent) for Route 4, all less than Routes 5 and 6.

Land Use/Land Cover

Land use/land cover types along and within the alternative routes and associated facilities (i.e., developed land, open space, forested land, agricultural land, and open water) are quantified in Table 4-1, Environmental Features Crossing Table. Installation of the transmission lines would not substantively alter existing land uses or cover types in developed lands and open space areas; therefore, potential impacts in these areas would not meaningfully differentiate the alternative routes. In forested areas, installation of the transmission lines would result in a permanent change in existing conditions (from forested lands to open space) within the maintained right-of-way. Installation of the Wishing Star and Mars Substations would permanently convert existing land uses (currently forested, developed, and/or open space) to developed land within the maintained facility site.

Forested lands are highly valued for the benefits they provide, including watershed and riparian buffers, wildlife habitat, enhanced biodiversity, carbon sequestration, water filtration, flood control/protection, and aesthetic appeal. Of the six Mars-Wishing Star route alternatives, Route 1 would have less impact on forested lands at 33.98 acres than all other alternatives, which range from a low of 34.96 acres for Route 2 to 42.96 acres for Route 6. Routes 1 and 2 cross mostly open land along the upland portions of the Brambleton Shreveport South parcel parallel to a stormwater pond, which is lightly forested. In contrast, Routes 3, 4, 5, and 6 pass further to the south of Evergreen Mills Road within the heavily forested Broad Run riparian corridor. This largely accounts for the difference in forested impacts along the routes.

Qualitatively, the type and location of forest impacts is a significant factor to consider when comparing routes. As discussed above, the routes impact varying amounts of forested wetlands that may be

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 Project

considered higher value forest and provide different ecological functions than upland forest. Also present along Broad Run are old growth deciduous hardwood trees, including several oak tree specimens surveyed in conjunction with the Birchwood at Brambleton development planning approval process. Additionally, crossings of the Broad Run riparian area result in varying degrees of forest fragmentation, leaving pockets of forest surrounded by cleared transmission line rights-of-way.

Qualitative impacts are difficult to assess because weighing the value of each is subjective and sometimes contradictory. To gain better insight into forest impacts around Broad Run, ERM consulted with Loudoun County Natural Resources Department staff and solicited input from participants of the Loudoun Reliability Engagement Group⁸ (LREG) meetings and public open house attendees to discuss impacts to forests along the Broad Run corridor. County Natural Resources staff provided input consistent with land use planning and transmission line routing principles, including minimizing forest impacts and fragmentation as much as possible; maximizing collocation along roads, transmission lines, and other linear infrastructure; and avoiding forested wetlands and old growth hardwood tree stands. Similarly, comments from open house attendees and conservationist members of the LREG stressed the value of the Broad Run forests for both their ecological and recreational assets.

The key takeaway from the conversations with county staff and LREG and open house participants was that a purely quantitative interpretation of forest impacts by acres would not account for the qualitative differences in forest quality between the routes. When considering forest impacts in the context of habitat fragmentation, forested wetland conversion, and impacts to the Stream Valley Park and Trails, Routes 5 and 6 were viewed as preferable to Routes 1 through 4, which have less collocation with existing transmission rights-of-way.

Residences

There is no difference in the number of residences within 100 feet, 250 feet, and 500 feet of each route alternative.

Environmental Justice

ERM's EJ analysis found that none of the alternative routes are expected to result in disproportionate adverse impacts on EJ populations.

Wetlands and Waterbodies

As discussed in Section 4.3.1, Wetlands, permanent wetland impacts for each route include vegetative clearing (i.e., conversion of PFO wetland to PSS or PEM wetland due to maintenance of the right-of-way).⁹ Forested wetlands provide a wide range of crucial functions, including peak flood flow reduction, nutrient and sediment capture, filtration of pollutants to adjacent waterbodies, and habitat diversity. PFO wetlands are of especially high value in protecting adjacent waterbodies such as Broad Run. The results of ERM's analysis indicate that Route 5 would have substantially less impact on PFO wetlands than the other route alternatives. Route 5 would impact 6.50 acres of PFO wetland, whereas Routes 1, 2, 3, 4, and 6 would impact between 7.71 acres (Route 6) and 11.05 acres (Route 1) of PFO wetlands.

Routes 1, 2, 3, and 4 cross Broad Run via perpendicular paths, while Routes 5 and 6 cross and parallel the waterbody such that approximately 0.3 mile of Broad Run would be within the rights-of-way for these alternatives. Routes 1, 2, 3, and 4 would have lower riparian buffer impacts immediately adjacent to

⁸ Loudoun Reliability Engagement Group is a group of 20 volunteers participating in an ongoing series of meetings to hear updates on the Project and provide input and feedback on behalf of their respective organizations.

⁹ Wetland impacts are based on ERM's desktop wetland study, which is provided in Appendix D, Wetland and Waterbody Desktop Summary.

Broad Run but would fragment contiguous forest north of the waterbody. Routes 5 and 6 would have a higher impact on the riparian buffer adjacent to the stream, but forested impacts would be limited to the area immediately adjacent to the Company's existing right-of-way for Lines #2172 and #2183. This would limit the fragmentation of contiguous forested areas north of Broad Run.

Recreation Areas

The Mars-Wishing Star route alternatives all cross Stream Valley Park and segments of the Stream Valley Park Trail System. The Stream Valley Trails extend beyond the Birchwood Community Association's open space proffer and onto a sizable portion of the Brambleton Shreveport South property. Crossing lengths and impacts to the Stream Valley Parks are similar between the routes, ranging from 0.22 mile to 0.36 mile of parkland crossed and from 4.84 acres to 5.14 acres of parkland affected. Although the crossing lengths and acreages are similar for the six routes, the alignment of the routes across the park would result in substantively different impacts on park facilities and users.

Routes 1 and 3 both cross Stream Valley Park along a common alignment to the north, adjacent to Evergreen Mills Road. This crossing would be visually impactful to park visitors because it occurs in an upland portion of the park with areas of open land where views of the transmission structures would not be concealed by forest in the foreground. Routes 1 and 3 are also within 70 feet of the community greenhouse and garden, which would impact the visual character of the park and these amenities in particular. In contrast, Routes 2, 4, 5, and 6 avoid the greenhouse and frontage along Evergreen Mills Road thereby mitigating visual impacts on park visitors in this area. Routes 5 and 6, and to a lesser degree Routes 2 and 4, collocate with the existing transmission right-of-way south of Broad Run, which would help mitigate visual impacts and retain the park's natural character.

Crossings of the Stream Valley Trail segments vary widely across routes. Routes 5 and 6 do not cross directly over any trail segments, whereas Routes 1, 2, 3, and 4 cross trail segments in nine, eight, five, and four locations, respectively. Routes 1 and 2 parallel a trail segment along the south side of the Brambleton Shreveport South stormwater pond resulting in almost 0.25 mile of trail within the right-of-way for these routes.

To further evaluate impacts to trail users, ERM calculated the distance of trail within the rights-of-way along each alternative route. Where a route right-of-way and trail intersect, trees and vegetation growing over 10 feet in height would be removed and subject to ongoing right-of-way maintenance during Project operations. Routes 1 and 2 intersect the most trail with 0.50 mile and 0.45 mile, respectively, of trail within the rights-of-way for these alternatives. Routes 3 and 4 intersect the second greatest amount of trail at 0.20 mile and 0.16 mile, respectively. The rights-of-way for Routes 5 and 6 would only intersect 0.04 mile of trail. Although clearing would take place adjacent to the trail and along the existing transmission corridor, Routes 5 and 6 would both have the least impact on trail-users and would mitigate visual impacts by collocating the Mars-Wishing Star line with the Company's existing transmission line along the southern boundary of Stream Valley Park.

Planned Developments

The Mars-Wishing Star route alternatives cross multiple planned developments in varying stages of conceptual design, county review and approval, and construction. Among them, two planned developments have the greatest potential for land use conflict with the Project: Brambleton Shreveport South and Brambleton South Industrial (Black Chamber Group Data Center). As discussed in Section 4.1.6, Planned Developments, Dominion consulted with the property owners, developers, and NOVEC to discuss the Project and collect information to anticipate and avoid land use conflicts between the developments and new transmission rights-of-way. After review of the route alternatives, representatives of the respective planned developments expressed their support for Route 5.

Cultural Resources

The Mars-Wishing Star alternative routes cross between 1 (Route 3) and 5 (Routes 5 and 6) previously recorded archaeological sites. Most of the sites have been determined not eligible for listing in the NRHP. Regardless of the route selected for the Project, field investigation would be needed to evaluate the significance of the archaeological deposits at previously recorded sites and to survey for as-yet unrecorded sites.

With regard to historic architectural resources, Mars-Washing Star Routes 1 through 6 each pass near three previously recorded resources: 053-0982 (Arcola Elementary School), 053-0984 (Arcola Slave Quarters), and Dulles International Airport Historic District (053-008). Each route would result in no impact on 053-0982 and 053-0984 and a minimal impact on 053-0008.

Visual Impacts

A detailed account of the visual impact analysis for Project is found in Section 4.4, Visual Assessment. The assessment concludes that Route 5 has the least predicted visual impact on visual resources compared to the other alternatives for the following reasons: greater collocation with existing transmission lines; greater distance from Evergreen Mills Road and nearby residences; and no overhead crossings of Stream Valley Park trails.

6. CONCLUSIONS AND RECOMMENDATIONS

On behalf of Dominion, ERM identified, assessed, and compared six transmission line route alternatives for the Mars-Wishing Star Lines. The Mars 230 KV Loop route is the only alignment between the Mars Substation and the existing 230 kV Cabin Run-Shellhorn Road Line (#2095) and 230 kV Poland Road-Shellhorn Road Line (#2137); no other alternatives were identified for this component of the Project.

Based on a comparison of the advantages and disadvantages of Mars-Wishing Star Routes 1 through 6 as discussed in Section 5, Analysis of Route Alternatives, Dominion concluded that Route 5 would reasonably minimize adverse impacts on scenic assets, historic and cultural resources, planned developments, the environment, namely forested wetlands, and recreation areas, while providing the greatest amount of collocation possible. This study therefore recommends Route 5 as the preferred alternative but recommends Routes 1–4 and 6 also be provided for public notice and Commission consideration. This conclusion is based on the following:

- Route 5 would utilize more existing Dominion transmission rights-of-way (1.73 miles) than all other route alternatives except for Route 6 (also 1.73 miles).
- Route 5 would have less impact on recreation areas (Stream Valley Park and Trail System) than the other route alternatives. Trail intersections with Route 5 are adjacent to existing Dominion transmission rights-of-way. In contrast, the other route alternatives require multiple trail crossings and/or parallel longer stretches of trails where vegetation and trees would be cleared for the new right-of-way. Furthermore, Route 5 avoids the Birchwood greenhouse and other recreational amenities near Evergreen Mills Road.
- Route 5 would affect less forested wetland (6.50 acres) than the other alternatives (range of 7.71 to 11.05 acres).
- Route 5 avoids land use conflicts with planned developments and is supported by landowners and developers with whom Dominion worked cooperatively.
- Route 5 (along with Route 6) has the least predicted visual impacts, primarily due to greater collocation with existing transmission lines.

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APPENDIX A FIGURES






























































