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Lutz, FL 33549

November 13, 2017

Mr. Steve Davis
Director of Advanced Projects
The Boring Company
1030 15th Street, NW, Suite 220 E
Washington, D.C. 20005

Subject: **Preliminary Geologic Review of Southern Extension**
Zero Emission Subterranean Transportation Tunnel
Baltimore-Washington Parkway Right-of-way
Anne Arundel and Prince George's Counties, Maryland
PACSCON Project No. 2017-1086

Dear Mr. Davis:

Pursuant to your request, **Poole & Associates Consulting Solutions, Inc (PACSCON)** is pleased to provide this Preliminary Geologic Review of the Southern Extension of the subject tunnel project to **The Boring Company (TBC)**, hereinafter referred to as the Client. The following sections are provided to discuss the geologic setting with regards to the anticipated subsurface conditions to be encountered along the proposed tunnel alignment during this project. The location of the proposed tunnel alignment is presented on Figure 1 attached hereto.

PROJECT LOCATION AND PHYSIOGRAPHIC SETTING

The proposed southern alignment of the tunnel corridor stretches a distance of approximately 18 miles from just north of the intersection of the Baltimore-Washington Parkway (State Route 295) and Jessup Road (State Route 175), and travelling south-southeast along the Baltimore-Washington Parkway to its intersection with New York Avenue NE (US Route 50). Figure 2, attached hereto, is a map showing the proposed southern extension of the tunnel alignment presented on a portion of the Physiographic Province Map of Maryland.

This proposed tunnel alignment is entirely situated within the Atlantic Coastal Plain geomorphic province as it traverses Anne Arundel and Prince George's Counties. This province generally consists of a seaward-sloping plain that extends from Cape Cod to the north to the southern tip of Florida. Locally, the Atlantic Coastal Plain consists of fairly flat to moderately rolling upland areas and flatter lowland areas. As this portion of the tunnel alignment travels south towards the District of Columbia, it comes within approximately one mile southeast of the eastern edge of the Fall Zone Region as it enters the southern portion of Anne Arundel County, and is up to 4 miles southeast of the Fall Zone Region through Prince George's County (see Figure 2). The Fall Zone Region is the area where the sediments of the Atlantic Coastal Plain province transition to crystalline rock of the Piedmont Plateau province.

The Atlantic Coastal Plain is further divided into progressively smaller areas by a number of sections, regions, districts, and areas. The proposed tunnel alignment lies primarily within the Glen Burnie Rolling Upland District of the Western Shore Uplands Region of the Embayed Section of the Atlantic Coastal Plain. The Embayed Section is generally characterized by estuaries and embayments attributed to the drowning of river mouths and the formation of barrier islands associated with the post-glacial rise of sea level. The Western Shore Uplands Region is further characterized as a flat to rolling upland surface underlain by Cretaceous (145 to 66 million years ago [mya]) to Pliocene (5.33 to 2.58 mya) aged sediments. The Glen Burnie Rolling Upland District is then further characterized as an undulating upland with slopes generally less than eight degrees. In the areas of the Patuxent River and Little Patuxent River at and near the boundary between Anne Arundel County and Prince George's County, the proposed tunnel alignment passes below the Upper Patuxent Valley Area, in which these rivers flow in well-defined flood plains and exhibit numerous and convoluted meanders. The southern terminus of the proposed tunnel alignment enters into the Anacostia Valley Area, which consists of a pronounced valley cut into the upland surface of southern Maryland, and includes Quaternary (2.58 mya to the present) aged alluvium and Tertiary (65 to 2.58 mya) aged terraces adjacent to the main channel of the Anacostia River.

GEOLOGIC SETTING

The surficial geologic setting for the proposed tunnel alignment as it traverses Anne Arundel and Prince George's Counties, traveling from the northeast to the southwest, is summarized in the following sections.

ANNE ARUNDEL COUNTY

Beginning at the northern point of the proposed tunnel (SR 175) and moving southward, the proposed alignment begins in the lower Cretaceous silt-clay facies of the Potomac Group (Kpc).

- *The silt-clay facies of the Potomac Group generally consist of clay, silt, and subordinate fine- to medium-grained muddy sand. This facies is generally massive thick-bedded, compact, and "tough." It includes sandy clay, laminated slit-clay, and nearly pure, plastic kaolinite clay. Sand lenses are typically composed of poorly-sorted quartz sand with interstitial silt-clay. Sand can be cross-bedded, flat bedded, or massive. It is pebbly in places, with common anastomosing ironstone layers and sideritic concretions. The thickness of this unit ranges from 50 to 1,600 feet thick.*

Advancing south, the proposed tunnel alignment runs approximately one mile before transitioning into Quaternary Patuxent River Terraces (Qtp) for approximately 1.5 miles as the corridor approaches the Little Patuxent River.

- *Patuxent River Terraces consist of interbedded sand and gravel, lesser amounts of silt-clay, and gravel concentrated in the lower portions. This gravel is predominantly quartzose, but also contains cobbles and boulders up to 4 feet in diameter of mostly mafic (a silicate mineral or igneous rock that is rich in magnesium and iron and dark in color) rock. Limonite-cemented conglomerate ledges are locally common, and sand is glauconitic (a greenish micaceous mineral consisting essentially of a hydrous silicate of potassium, aluminum, and iron and occurring in greensand, clays, etc.) in places. Silt clay beds are thin and discontinuous. Sand is predominantly clean and fairly well-sorted, but becomes clays in the upper portions of the terraces. The thickness of this unit ranges from 3 to 60 feet thick.*

For approximately ¼-mile on either side of the Little Patuxent River (approximately ½-mile total), the proposed tunnel alignment runs beneath Quaternary alluvium (Qal) within the floodplain of this river.

- *Quaternary alluvium consists interbedded sand, silt-clay, and subordinate gravel. These are very heterogenous sediments with poorly-sorted muddy sand and silt. Organic matter, including peat in places, is a common component. The thickness of this unit ranges from 3 to 15 feet thick.*

Upon exiting the southern floodplain of the Little Patuxent River, the proposed tunnel alignment enters back into the lower Cretaceous silt-clay facies of the Potomac Group (Kpc) for approximately three miles as it heads southwest towards the Patuxent River. Approximately 0.4-mile from reaching the river bank, the proposed tunnel alignment enters back into Quaternary Patuxent River Terraces (Qtp) for approximately 0.2-mile and Quaternary alluvium (Qal) for approximately 0.2-mile before crossing beneath the Patuxent River and into Prince George's County.

PRINCE GEORGE'S COUNTY

Continuing at the boundary with Prince George's County and exiting beneath the Patuxent River, the proposed tunnel alignment continues through (or beneath) Quaternary alluvium (Qal) for approximately 0.4-mile, and exits the Patuxent River Valley into alternating sequences of the lower Cretaceous silt-clay (Kpc) and sand-gravel (Kps) facies of the Potomac Group.

- *The sand-gravel facies of the Potomac Group underlies the silt-clay facies, and generally consists of interbedded quartz sand, pebbly sand, gravel, and subordinate silt-clay. The lithology is essentially fine- to coarse-grained sand, grading to pebbly sand and gravel that is coarse to very coarse in places, and arranged in thin to very thick lenticular beds. Conspicuous cross-bedding is common, as are clay clasts, channel fills, and upward-fining sequences. Interbedded with these coarser clastics are scattered thin lenticular bodies of tough massive silt-clay. Typical of fluvial sediments, few beds are laterally continuous for any great distance and therefore great variability in outcrop lithology is expected.*

The proposed tunnel alignment then stays within this alternating Kpc/Kps sequence though the majority of Prince George's County, with several locations crossing beneath limited areas of Quaternary alluvium (Qal) as the tunnel passes beneath many tributary streams ultimately leading to Indian Creek and the Anacostia River.

Approximately 0.6-mile from the southern terminus of the proposed tunnel alignment, the corridor crosses into (or beneath) Quaternary terrace deposits (Qt) for approximately 0.1-mile.

- *Quaternary terrace deposits generally consist of interbedded sand, gravel, and silt-clay. This includes heterogeneous lithologies such as medium to coarse sand, pebbly sand, and subordinate silt-clay. These sediments are contained in a series of disjunct bodies flanking the major streams in Prince George's County. A few such deposits are as thick as 50 feet, but the average thickness is much less. Bedding within these deposits is mostly lenticular, but can be massive and unstructured. These terrace deposits are the product of stream erosion during the early Quaternary time, and are now isolated on the valley walls above the modern floodplain by renewed downcutting.*

The final approximate ½-mile of the proposed tunnel alignment lies beneath Quaternary alluvium (Qal) sediment within the Anacostia River valley and floodplain.

Available published geologic cross sections that intersect the proposed southern extension of the tunnel are available for the corridor approximately 1.5 miles south of its intersection with Interstate I-495 in Prince Georges County. At this point, the anticipated lithology is expected to consist of interbedded silt-clay and sand-gravel facies of the Potomac Group to a depth exceeding 200 feet below grade (or an elevation of 100 feet below sea level). Crystalline basement rock may

be encountered at depths approaching 300 feet below grade at this point. It is anticipated that the tunnel will generally stay within the Kpc/Kps facies of the Potomac Group and pass beneath the encountered rivers and associated Quaternary sediments without significant conflict. However, this cannot be confirmed without detailed borehole or lithological data in the immediate areas of these features.

HYDROGEOLOGIC SETTING

The southern corridor extension is situated almost entirely within the outcrop of the Lower Patapsco aquifer system. This aquifer system consists of multiple water-bearing sands of varying thickness and permeabilities, and is most likely underlain by the Arundel Clay confining unit followed by the Patuxent aquifer system before reaching pre-Cretaceous basement rock.

CLOSURE

Please note that the information provided herein is based on the research and review of readily-available surficial geological maps and Open File Reports (OFRs) maintained by the Maryland Geological Survey (MGS) and the United States Geological Survey (USGS). As such, surficial geological data may not be representative of strata encountered at the depths of the proposed tunnel, and the boundary between sedimentary deposits and hard rock may not be accurately determined without specific subsurface data at known points along the proposed tunnel alignment. The primary sources utilized for this review include the *Physiographic Province Map of Maryland* (MGS, 2008), *Geologic Map of Anne Arundel County* (MGS, 1976), *Geologic Map of Prince George's County, Maryland* (MGS, 2003), and *Maryland Coastal Plain Aquifer Information System: Hydrogeologic Framework* (MGS, 2013).

We thank you for the opportunity to provide this preliminary geological review and look forward to continuing to work with you on this exciting and significant transportation infrastructure project! Please do not hesitate to contact us if you have any questions.

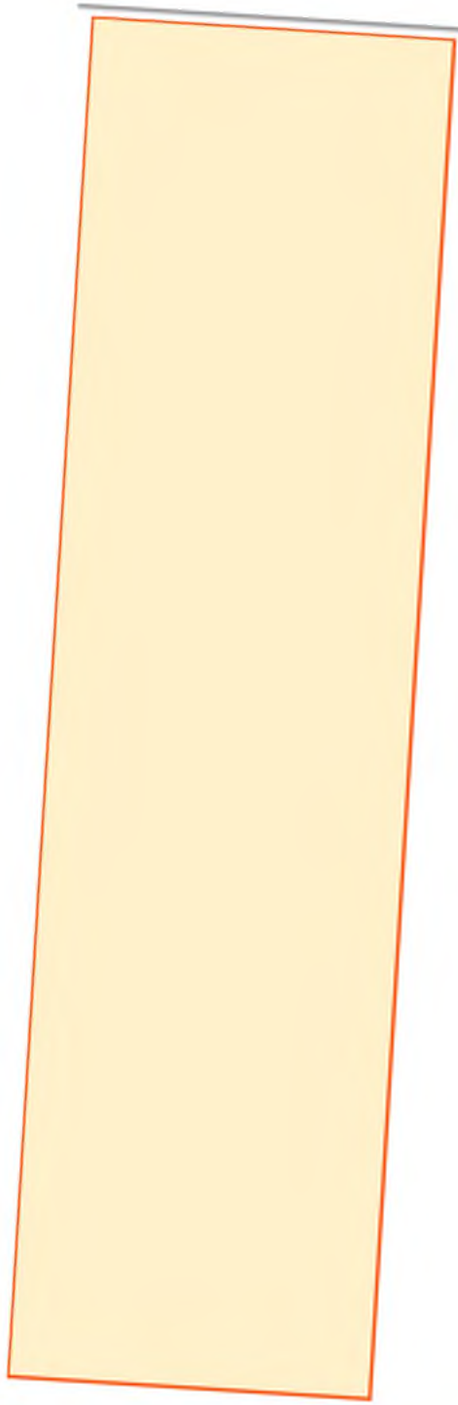
Sincerely,
PACSCON

Daniel C. Grossman, PG
Senior Geologist | Project Manager

Christopher B. Poole, PG, CPG
President | Principal

DG/CP

Attachments: Figure 1: Proposed Tunnel Alignment Aerial Photograph
Figure 2: Proposed Tunnel Alignment Physiographic Location Map



FIGURES

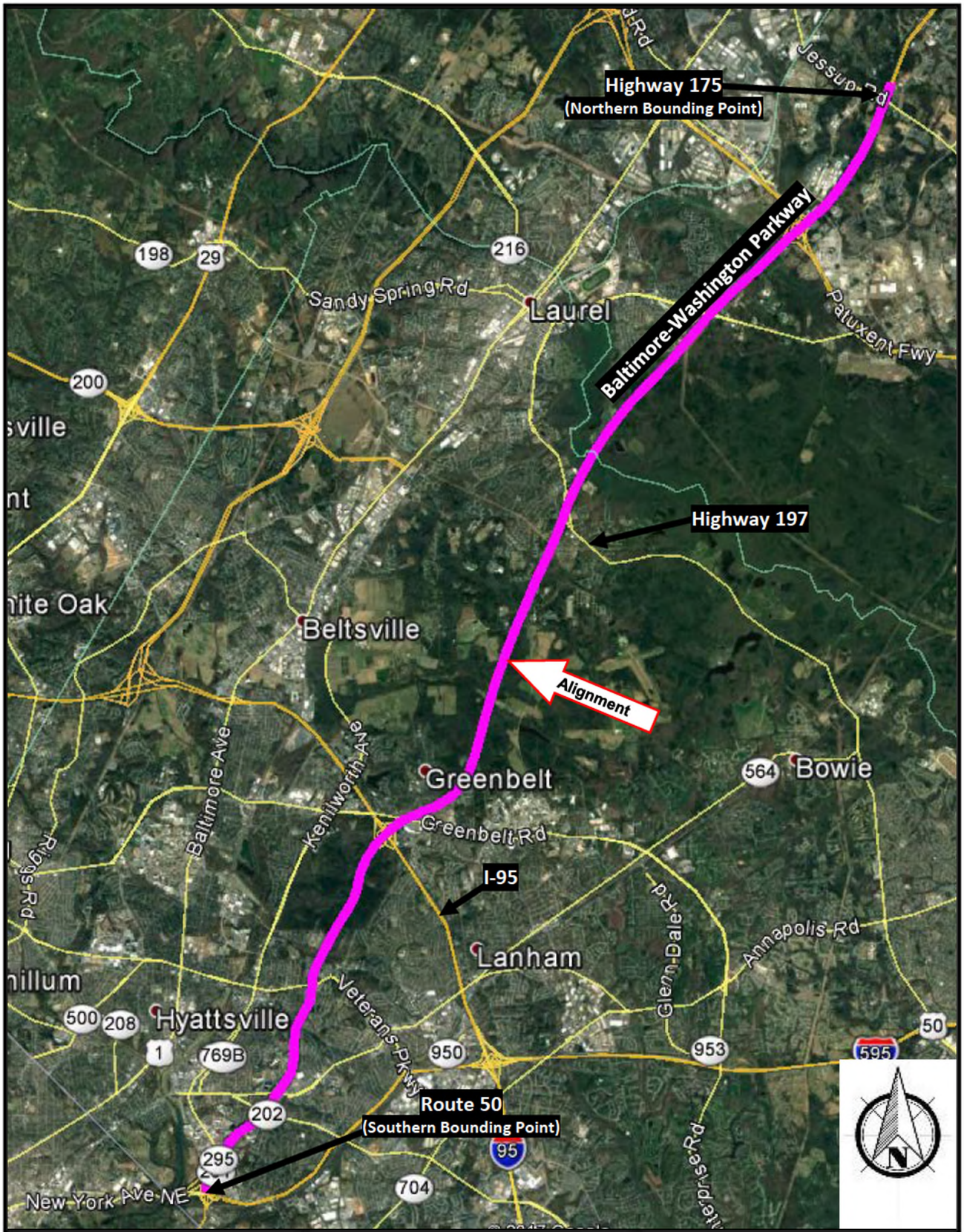


FIGURE 1
Proposed Tunnel Alignment
Aerial Photograph
Google Earth Pro, dated February 17, 2017
APPROXIMATE SCALE:
2 Miles

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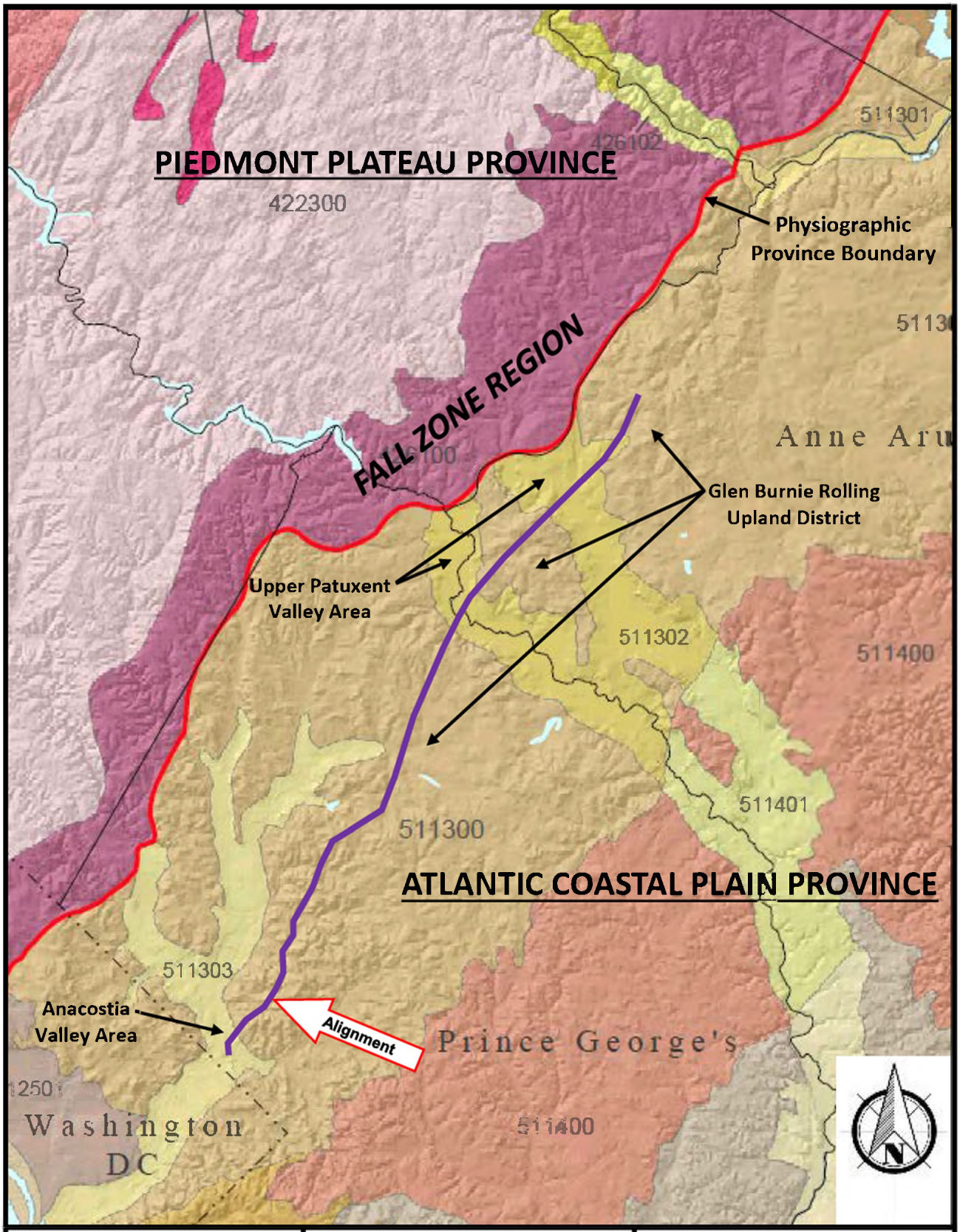

FIGURE 2
Proposed Tunnel Alignment
Physiographic Location Map
Physiographic Map of Maryland, dated 2008
APPROXIMATE SCALE:
5 Miles

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