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United States Department of the Interior

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Northeast Region
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SEP 16 2015

**US Army Corps of
Engineers
Norfolk District
Regulatory Office
Received by: RLS
Date: Sept 21, 2015**

Ms. Lynette R. Rhodes
Mr. Randy Steffey
Norfolk District, US Army Corps of Engineers
ATTN: CENAO-WR-R
803 Front Street
Norfolk, VA 23510-1096

Re: Dominion Surry-Skiffes Creek-Whealton Transmission Line Consultation CENAO-WRR
NAO-2012-00080; 13-V0408 and Southern Virginia Regulatory Section NAO-2012-00080; 13-
V0408 (James River)

Dear Ms. Rhodes and Mr. Steffey:

In previous correspondence we committed to undertaking an analysis of visual impacts of the proposed Surry-Skiffes Creek-Whealton alternative and providing that to you in advance of the next consulting parties meeting. Please find a copy of this analysis enclosed.

In addition, we have requested time to provide an overview of the analysis at the next consulting parties meeting.

We would be happy to answer questions regarding the analysis. Please contact me at any time to make arrangements. Thank you.

Sincerely,


Frank R. Hays
Associate Regional Director
Resource Stewardship and Sciences

Enclosure

US Army Corps of
Engineers
Norfolk District
Regulatory Office
Received by: RLS
Date: Sept 21, 2015

Analysis of Visual Impacts to Historic Properties Proposed Dominion Surry-Skiffes Creek – Whealton Alternative

Prepared by:

National Park Service Chesapeake Bay Office
Northeast Region

September 15, 2015

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Introduction

This document presents the extent of predictable, quantifiable visual impacts to historic properties which would stem from construction of the proposed Surry-Skiffes-Whealton Creek transmission corridor project. The analysis is prepared by the National Park Service as information for the on-going review of the proposed project by the US Army Corps of Engineers (USACE) under section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

The National Park Service (NPS) is on record that this analysis of visual impacts to historic properties is only one of several analyses required to fully assess the potential effects of the proposed project and viable alternatives. The NPS stresses that a full Environmental Impact Statement (EIS) is required for the project in order to adequately evaluate alternatives and their impacts. In addition, the NPS asserts that analyses of impacts on visitor experience and cumulative impacts of the project must be conducted.

The Proposed Surry-Skiffes Creek-Whealton Alternative

The proposed Surry-Skiffes Creek-Whealton alternative would involve construction of a new 7.76 mile, 500kV aerial transmission corridor from Surry VA nuclear power plant, crossing the James River east of Jamestown Island, to a proposed Skiffes Creek switching station. The project requires state approval and a federal permit to cross a navigable waterway. The USACE is the federal permitting agency and responsible for conducting NHPA and NEPA compliance.

The proposed transmission corridor would make an approximately 4.1 mile crossing of the James River, requiring placement of 17 new towers (up to 295' high) and related infrastructure within and above the river bed. In addition, construction would involve the creation or modification of 27 land based towers where the height will be increased by greater than 10% or 20 feet more than what currently exists. These towers are located on either side of the James River.

Note that this proposed alternative also includes modifications to an existing corridor from the proposed Skiffes Creek switching station to Whealton. This spur line is not addressed in the analysis presented in this document.

The project's indirect Area of Potential Effect (APE) defined by the USACE includes an area of land and water totaling approximately 81,275 acres and extending from upstream of Jamestown Island approximately 26.56 miles downstream to the Pagan River (see figure 1).

Historic Properties Included in Analyses

The visual impact analyses presented here address the following historical properties in the vicinity of the proposed project (see also figure 2):

- Colonial National Historical Park, which includes Historic Jamestowne and Jamestown Island, the Colonial Parkway, and Yorktown Battlefield.
- Carter's Grove Plantation National Historic Landmark.
- Captain John Smith Chesapeake National Historic Trail (NHT) and associated 81,251 acre historic district recently determined eligible for the National Register of Historic Places (NRHP).¹
- NRHP listed sites identified by the American Battlefield Protection Program: Fort Huger, Fort Boykin and Fort Crafford.

The analyses do not currently address the Washington Rochambeau Revolutionary Route NHT due to insufficient available information.

For each of these NRHP listed or eligible properties setting, feeling and association are central to their significance and integrity. Thus, calculating visual impacts to these properties is appropriate and necessary.

Overview of Visual Impacts Analysis

Visual impacts analysis is a long-standing field of work in planning, landscape architecture, and compliance. Analysis traditionally focuses on either or both of two aspects:

1. Quantifying the extent and intensity of impacts
2. Modeling the appearance and characteristics of impacts

Advances in computer-assisted modeling, geographic information systems (GIS) and satellite imaging have made sophisticated computation of impacts more manageable for both aspects. However, these advances are particularly useful in quantifying impacts.

For analyzing the impacts of the proposed alternative (and other alternatives that should be assessed through an EIS), the NPS focuses on quantifying extent and intensity. The NPS reviewed relevant cases studies and literature prior to conducting the analyses to determine the most appropriate and accurate methodologies. The NPS separately conducted three distinct methodologies for comparison. One of these was dismissed due to significant concerns about its validity in calculating actual impacts.² The other two methods—which are

¹ See August 14 2015 letter from Stephanie Toothman, Keeper of the National Register of Historic Places, NPS to William T. Walker, Chief Regulatory Branch, USACE Norfolk District.

² The NPS examined and tested one methodology used in evaluating the Susquehanna-Roseland Project, a transmission corridor impacting several NPS administered properties. The methodology was developed by consultants for the Susquehanna-Roseland project proponents (Pennsylvania

variations of the same core computational approach—are described below and present the potential maximum and minimum range of visual impacts.

Visual Impacts of Proposed Surry-Skiffes Creek Alternative

Portion of Proposed Alternative Analyzed

The analysis below addresses the portion of the overall proposed Surry-Skiffes Creek-Whealton alternative between Surry nuclear power plant and a proposed Skiffes Creek switching station. This consists of a total of 44 transmission line towers; 17 of these are proposed for construction in the James River; 11 are proposed as land-based on the land-based Surry side of the project; 16 are proposed as land-based on the Skiffes Creek side of the project.

Methodology

This section describes the methodology used in this analysis. The analysis addresses the two key factors of visual impact: area (or extent) of impact and intensity of impact. The methods for calculating each factor and their resulting overall impact calculations are outlined below.

This analysis presents two overall impact calculations to provide a projected range of visual impact from bare minimum to absolute maximum (though not counting cumulative impacts). The reason for this is described below.

Calculation of Area of Impact

“Area of impact” means the geographic extent in which the proposed transmission towers would be visible. Area of impact is calculated using digital surface and elevation models, LiDAR data, and GIS data. This is done for two different scenarios: (1) the landscape with existing vegetation; and (2) the landscape without vegetation. These two calculations provide a range of projected impact from minimum (with vegetation) to maximum (without vegetation). The actual long-term visual impact is highly likely to be somewhere in between the two. Why would this be the case? There are several reasons. Vegetation which may screen portions of the proposed development from view is not all permanently protected; some of it can be altered by human actions. Furthermore, vegetation is highly subject to alteration by climatic changes. Storm damage, insect infestations due to climate change and

Power and Light Electric Utilities and Public Service Electric and Gas Company). However, the NPS found significant shortcomings associated with the methodology when applied to Surry-Skiffes Creek-Whealton. These include its inability to calculate actual area of visual impact and substantial limitations of the magnitude calculation methodology. For more information about the Susquehanna-Roseland method see: <http://www.pplreliablepower.com/NR/rdonlyres/836A0C89-9722-4A75-94A5-9D69F2D2A4AA/0/CMPCContributionmethodologyNPS7.pdf>.

importation of invasive species, and changing sea level can all have extreme effects on existing vegetation patterns. Thus, while a “no vegetation” scenario is unlikely, some loss of existing vegetation is quite likely.

Note again that this analysis does not take into account cumulative effects that may result from implementation of this alternative. Cumulative effects analysis could identify additional visual impacts to historic properties.

No Vegetation Scenario

The no vegetation scenario uses a digital elevation model (DEM)³ to calculate area of impact. Each tower was run individually with a unique OFFSETA to account for the tower’s given height (115 ft avg on land and specific individual heights for each river crossing tower, based on data in the USACE permit request) as well as an OFFSETB of 6 ft to account for the height of a viewer and a RADIUS2 of 15 miles. A factor for curvature of the earth was also taken into account. The resultant viewsheds were then added in raster calculator to show the total combined impact that the towers would have if developed.

Existing Vegetation Scenario

The existing vegetation scenario uses a digital surface model (DSM) to calculate area of impact. The DSM is based on LiDAR data⁴ that was first grouped into a dataset of tiles covering the area and then converted to raster using the ESRI LAS dataset to raster tool. The data was converted based on elevation values binned using the maximum return and filled using a linear method.

Once the DSM was created the area of the direct APE was clipped out and filled in using the DEM from the previous model to simulate the cleared corridor in which the towers would reside.

The viewshed analysis was performed using the ESRI viewshed tool. Each tower was run individually with a unique OFFSETA to account for the towers given height (115ft avg on land and individual heights for each river crossing tower, based on data in the USACE permit request). Each tower was also run for a radius of 15 miles taking into account the curvature of the earth and an above ground layer(AGL) was produced.

With all of the tower viewsheds completed each individual AGL was then manipulated in the raster calculator to find all the locations in which the difference between the AGL and the DEM was 6ft or less. This was done to simulate the view of a person at any height within 0-6ft. The AGL’s adjusted areas where trees were located were removed by taking out data points to eliminate viewpoints residing on tree cover. The forest layer was created by using an nDSM created with our DSM and

³ DEM, USGS NED, nationalmap.gov, 1/3 arc-seconds

⁴ LiDAR downloaded from VALiDAR.com originating from USGS, 01/2011, 3.5ft Horizontal Accuracy

DEM from earlier and an 8-bit Normalized Difference Vegetation Index(NDVI) layer created from National Agricultural Imagery Program(NAIP) imagery. Forest cover was defined as anywhere the DSM-DEM was greater than 6ft and the NDVI value was greater than 109. The individual viewsheds were then added in the raster calculator to show the total impact of all the towers over the area.

Calculation of Intensity of Impact

Where the area of impact methodology above maps the geographic extent of visibility, calculating the “intensity of impact” accounts for variation in impact due to: (1) distance from a viewing location to the proposed development; and (2) the amount of the development viewed. This analysis uses the terms “distance decay” for the former and “magnitude” for the latter.

Distance Decay

Distance decay refers to the decline in visibility of an object as the distance between that object and the viewer increases. The literature on visual analysis includes a variety of calculations of distance decay. For the purposes of this analysis, distance decay generally follows a model used in an analysis of the Susquehanna-Roseland project.⁵ This sets out categories or zones of distance from an object (the proposed transmission towers in this case) to the landscape from which the object is viewed. For each of these zones a distance decay function is applied. This function is based on the estimated percentage of visibility diminishment for the distance.

Applying the distance decay model to the James River and the Indirect APE requires some modifications because of substantial differences in landscape type and topography. Examples of projects studying visibility across open water conditions, such as wind turbine visibility, were reviewed. Research showed that observed facilities “were judged to be a major focus of visual attention at distances up to 10 miles, were noticeable to casual observers at distances of almost 18 miles and were visible with extended or concentrated viewing at distances beyond 25 miles.”⁶ In open water conditions, the distance decay was greatly reduced due to the nature of increased, uninterrupted sight distances across the water. Based on these circumstances, the distance decay function values for the proposed Surry-Skiffes Creek alternative were adjusted upward slightly from the baseline Susquehanna-Roseland distance decay values. The distance decay zones and functions used in this analysis are set out in table 1 below.

⁵ This aspect of the Susquehanna-Roseland analysis was based on Fisher, P. F. (1994). Probable and fuzzy models of the viewshed operation. Innovations in GIS: selected papers from the First National Conference on GIS Research UK. M. F. Worboys. London, UK, Taylor and Francis: 161-175.

⁶ Robert G. Sullivan, Leslie B. Kirchler, Jackson Cothren, Snow L. Winters. 2013. “Offshore Wind Turbine Visibility and Visual Impact Threshold Distances.” Environmental Practice. Available at: <http://visualimpact.anl.gov/offshorevitd/docs/OffshoreVITD.pdf>

Table 1. Distance Decay		
Distance Zone	Distance Range	Distance Decay Function
Immediate Foreground	0 feet to 1/2 mi.	1.00
Foreground	1/2 mi. to 1 mi.	0.75
Mid-ground	1 mi. to 2 mi.	0.50
Background	2 mi. to 4 mi.	0.25
Near Horizon	4 to 7 mi.	0.10
Distant Horizon	7 to 13 mi.	0.05

The distance zones are mapped using GIS (see figure 3). Note that the distance zones are identical for both the vegetation and no vegetation scenarios as this calculation is independent of vegetation.

Magnitude

Magnitude refers to the amount of an object visible, in this case the proposed transmission corridor. This analysis uses the number of transmission towers visible as a reasonable and easily quantifiable method for calculating magnitude. The maximum number towers is 44, which—as described previously—includes both the proposed 17 towers in the James River and 27 land-based towers on either side of the river. The magnitude rating is expressed as a simple ratio:

$$\frac{\text{Maximum number of towers visible from a particular historic property}}{\text{total number of towers}}$$

The calculation of the number of towers visible from a historic property is based on a qualitative analysis of the viewshed data. This involved graphing the number of towers visible in a particular raster cell by the number of raster cells in which that value is present. These graphs show definitive areas where the bulk of cells occur. We use the tower number value representative of the peak of this area. This eliminates outliers both high and low and is a good representation of the number of visible towers from a historic property.

The calculated magnitude results will differ in the two scenarios analyzed, as magnitude is influenced by vegetation.

Impact intensity Rating

An impact intensity rating is calculated for each distance zone by multiplying the distance decay factor by the magnitude:

$$\text{distance decay factor} \times \text{magnitude} = \text{impact intensity rating}$$

Overall Impact Calculation

The overall visual impact calculation for a scenario is a product of the area of impact and the impact intensity rating:

$$\text{area of impact (acres)} \times \text{impact intensity rating} = \text{overall visual impact calculation}$$

Note that this approach to calculating overall impact does not differentiate between varying levels of significance of different viewing or vantage points. All are treated equally in this analysis.

*Results – No Vegetation Scenario**Area of Impact*

The area of impact for the no vegetation scenario is depicted in figure 4. Also shown on this map is an overlay of the distance zones.

Table 2 presents the area of impact acreages in each distance zone for each historic property. This data is further grouped by three landscape categories: Waterfront Land (0 to 400' from shoreline), Inland (land beyond 400' from shoreline), and Open Water.

Table 2. Area of Impact (in Acres) -- No Vegetation Scenario					
Property	Distance Zone	Waterfront (ac.)	Inland (ac.)	Open Water (ac.)	Total (ac.)
Colonial NHP	0-0.5 mi.	0.00	0.00	0.00	0.00
	0.5 to 1 mi.	0.00	0.00	0.00	0.00
	1 mi. to 2 mi.	0.00	0.00	0.00	0.00
	2 mi. to 4 mi.	52.67	54.46	0.00	107.13
	4 mi. to 7 mi.	348.99	5002.67	0.00	5351.66
	7 mi. to 13 mi.	47.06	391.8	0.00	438.86
	Area Subtotal	448.72	5448.93	0.00	
	Aggregate				5897.65

Carter's Grove NHL	0-0.5 mi.	0.00	2.5	0.00	2.5
	0.5 to 1 mi.	21.65	260.79	0.00	282.44
	1 mi. to 2 mi.	28.38	68.04	0.00	96.42
	2 mi. to 4 mi.	0.00	0.00	0.00	0.00
	4 mi. to 7 mi.	0.00	0.00	0.00	0.00
	7 mi. to 13 mi.	0.00	0.00	0.00	0.00
	Area Subtotal	50.03	331.33	0.00	
	Aggregate				381.36
Captain John Smith Chesapeake NHT & NRHP Eligible Historic District	0-0.5 mi.	171.3	2855.42	2376.6	5403.32
	0.5 to 1 mi.	173.13	1756	2616.23	4545.36
	1 mi. to 2 mi.	344.87	2162.33	6805.9	9313.1
	2 mi. to 4 mi.	492.24	2131.37	10060.24	12683.85
	4 mi. to 7 mi.	928.98	6462.72	14263.03	21654.73
	7 mi. to 13 mi.	604.94	2546.02	17502.76	20653.72
	Area Subtotal	2715.46	17913.86	53624.76	
	Aggregate				74254.08
ABPP - Fort Crafford	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	0	9.21	0	9.21
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	0	0	0	0
	Area Subtotal	0	9.21	0	
	Aggregate				9.21
ABPP - Fort Boykin	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	0	0	0	0
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	9.03	3.32	0	12.35
	Area Subtotal	9.03	3.32	0	
	Aggregate				12.35
ABPP - Fort Huger	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	6.23	11.53	0	17.86
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	0	0	0	0
	Area Subtotal	6.23	11.53	0	
	Aggregate				17.86

Impact intensity

Figure 5 breaks out the area of impact by colors depicting the number of towers visible from any given location. This analysis provides the basis for the magnitude rating. In the no vegetation scenario each of the historic properties has the same number for the highest number of towers visible: 44. The magnitude rating is thus the same for each: $44/44 = 1.00$ (see table 3). It is unsurprising that all towers would be visible from all historic properties in the no vegetation scenario. In a landscape with relatively low topography, vegetation is the primary screening factor.

Table 3. Magnitude Rating -- No Vegetation Scenario						
	Colonial NHP	Carter's Grove NHL	CJSNHT-Historic District	Fort Huger	Fort Crafford	Fort Boykin
Total visible towers	44	44	44	44	44	44
Total possible towers	44	44	44	44	44	44
Magnitude rating	1.00	1.00	1.00	1.00	1.00	1.00

The magnitude rating allows for calculation of the impact intensity ratings as shown in table 4. Because all historic properties have the same magnitude the impact intensity ratings in table 4 apply to all.

Table 4. Impact Intensity Rating			
Distance Zone	Distance Decay	Magnitude Rating	Impact Intensity Rating
0-0.5 mi.	1.00	1.00	1.00
0.5 to 1 mi.	0.75	1.00	0.75
1 mi. to 2 mi.	0.50	1.00	0.50
2 mi. to 3.5 mi.	0.25	1.00	0.25
3.5 mi. to 7 mi.	0.10	1.00	0.10
7 mi. to 13 mi.	0.05	1.00	0.05

Overall Impact Calculation

Table 5 presents the overall impact calculations for the no vegetation scenario (ie. area of impact (acres) X impact intensity rating = overall visual impact calculation). As described previously, this represents a high end of potential visual impacts not counting impacts stemming from cumulative effects.

Table 5. Overall Impact Calculation (in Acres) -- No Vegetation Scenario								
Property	Distance Zone	Impact Intensity Rating	Waterfront Area of Impact (ac.)	Overall Water-front Impact (ac.)	Inland Area of Impact (ac.)	Overall Inland Impact (ac.)	Open Water Area of Impact (ac.)	Overall Open Water Impact (ac.)
Colonial NHP	0-0.5 mi.	1.00	0	0	0	0	0	0
	0.5 to 1 mi.	0.75	0	0	0	0	0	0
	1 mi. to 2 mi.	0.50	0	0	0	0	0	0
	2 mi. to 4 mi.	0.25	52.67	13.17	54.46	13.62	0	0
	4 mi. to 7 mi.	0.10	348.99	34.90	5002.67	500.27	0	0
	7 mi. to 13 mi.	0.05	47.06	2.353	391.8	19.59	0	0
	Area Subtotal		448.72	50.42	5448.93	533.47	0.00	0.00
Carter's Grove NHL	0-0.5 mi.	1.00	0	0	2.5	2.5	0	0
	0.5 to 1 mi.	0.75	21.65	16.24	260.79	195.59	0	0
	1 mi. to 2 mi.	0.50	28.38	14.19	68.04	34.02	0	0
	2 mi. to 4 mi.	0.25	0	0	0	0	0	0
	4 mi. to 7 mi.	0.10	0	0	0	0	0	0
	7 mi. to 13 mi.	0.05	0	0	0	0	0	0
	Area Subtotal		50.03	30.43	331.33	232.11	0.00	0.00
Captain John Smith Chesapeake NHT & NRHP Eligible Historic District	0-0.5 mi.	1.00	171.3	171.3	2855.42	2855.42	2376.6	2376.6
	0.5 to 1 mi.	0.75	173.13	129.85	1756	1317	2616.23	1962.17
	1 mi. to 2 mi.	0.50	344.87	172.44	2162.33	1081.17	6805.90	3402.95
	2 mi. to 4 mi.	0.25	492.24	123.06	2131.37	532.84	10060.24	2515.06
	4 mi. to 7 mi.	0.10	928.98	92.90	6462.72	646.27	14263.03	1426.30
	7 mi. to 13 mi.	0.05	604.94	30.25	2546.02	127.30	17502.76	875.14
	Area Subtotal		2715.46	719.79	17913.86	6560.00	53624.76	12558.22
ABPP - Fort Crafford	0-0.5 mi.	1.00	0	0	0	0	0	0
	0.5 to 1 mi.	0.75	0	0	0	0	0	0
	1 mi. to 2 mi.	0.50	0	0	0	0	0	0
	2 mi. to 4 mi.	0.25	0	0	9.21	2.30	0	0
	4 mi. to 7 mi.	0.10	0	0	0	0	0	0
	7 mi. to 13 mi.	0.05	0	0	0	0	0	0
	Area Subtotal		0.00	0.00	9.21	2.30	0.00	0.00
ABPP - Fort Boykin	0-0.5 mi.	1.00	0	0	0	0	0	0
	0.5 to 1 mi.	0.75	0	0	0	0	0	0
	1 mi. to 2 mi.	0.50	0	0	0	0	0	0
	2 mi. to 4 mi.	0.25	0	0	0	0	0	0
	4 mi. to 7 mi.	0.10	0	0	0	0	0	0
	7 mi. to 13 mi.	0.05	9.03	0.45	3.32	0.17	0	0
	Area Subtotal		9.03	0.45	3.32	0.17	0.00	0.00

ABPP - Fort Huger	0-0.5 mi.	1.00	0	0	0	0	0	0
	0.5 to 1 mi.	0.75	0	0	0	0	0	0
	1 mi. to 2 mi.	0.50	0	0	0	0	0	0
	2 mi. to 4 mi.	0.25	6.23	1.56	11.53	2.88	0	0
	4 mi. to 7 mi.	0.10	0	0	0	0	0	0
	7 mi. to 13 mi.	0.05	0	0	0	0	0	0
	Area Subtotal		6.23	1.56	11.53	2.88	0.00	0.00

Results – Existing Vegetation Scenario

Area of Impact

The area of impact for the vegetation scenario is depicted in figure 6. Also shown on this map is an overlay of the distance zones.

Table 6 presents the area of impact acreages in each distance zone for each historic property. This data is further grouped by the three landscape categories: Waterfront Land (0 to 400' from shoreline), Inland (land beyond 400' from shoreline), and Open Water.

Table 6. Area of Impact (in Acres) -- Existing Vegetation Scenario					
Property	Distance Zone	Waterfront	Inland (ac.)	Open Water	Total (ac.)
Colonial NHP	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	47.5	30.55	0	78.05
	4 mi. to 7 mi.	198.75	812.18	0	1010.93
	7 mi. to 13 mi.	10.4	93.33	0	103.73
	Area Subtotal	256.65	936.06	0	
	Aggregate				1192.71
Carter's Grove NHL	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	8.02	92.08	0	100.1
	1 mi. to 2 mi.	10.78	13.14	0	23.92
	2 mi. to 4 mi.	0	0	0	0
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	0	0	0	0
	Area Subtotal	18.80	105.22	0	
	Aggregate				124.02

Captain John Smith Chesapeake NHT & NRHP Eligible Historic District	0-0.5 mi.	105.62	1356.08	2376.5	3838.2
	0.5 to 1 mi.	60.17	985.55	2319.97	3365.69
	1 mi. to 2 mi.	211.54	918.28	5841.27	6971.09
	2 mi. to 4 mi.	311.34	787.24	9829.50	10928.08
	4 mi. to 7 mi.	383.95	1717.73	13032.17	15133.85
	7 mi. to 13 mi.	242.14	521.65	12831.86	13595.65
	Area Subtotal	1314.76	6286.53	46231.27	
	Aggregate				53832.56
ABPP - Fort Crafford	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	0	1.26	0	1.26
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	0	0	0	0
	Area Subtotal	0	1.26	0	
	Aggregate				1.26
ABPP - Fort Boykin	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	0	0	0	0
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	3.82	4.67	0	8.49
	Area Subtotal	3.82	4.67	0	
	Aggregate				8.49
ABPP - Fort Huger	0-0.5 mi.	0	0	0	0
	0.5 to 1 mi.	0	0	0	0
	1 mi. to 2 mi.	0	0	0	0
	2 mi. to 4 mi.	2.06	0.46	0	2.52
	4 mi. to 7 mi.	0	0	0	0
	7 mi. to 13 mi.	0	0	0	0
	Area Subtotal	0.46	0.46	0	
	Aggregate				2.52

Impact intensity

Figure 7 breaks out the area of impact by colors depicting the number of towers visible from any given location. This analysis provides the basis for the magnitude rating. Unlike the no vegetation scenario each of the historic properties has a different number for the highest number of towers visible. This, and the resulting magnitude rating, is presented in table 7.

Table 7. Magnitude Rating -- Existing Vegetation Scenario						
	Colonial NHP	Carter's Grove NHL	CJSNHT-Historic District	Fort Huger	Fort Crafford	Fort Boykin
Total visible towers	22	25	29	28	12	19
Total possible towers	44	44	44	44	44	44
Magnitude rating	0.50	0.57	0.66	0.64	0.27	0.43

The magnitude rating allows for calculation of the impact intensity ratings as shown in table 8.

Table 8. Impact Intensity Ratings				
Property	Distance Zone	Distance Decay	Magnitude Rating	Impact Intensity Rating
Colonial NHP	0-0.5 mi.	1.00	0.50	0.50
	0.5 to 1 mi.	0.75	0.50	0.38
	1 mi. to 2 mi.	0.50	0.50	0.25
	2 mi. to 3.5 mi.	0.25	0.50	0.13
	3.5 mi. to 7 mi.	0.10	0.50	0.05
	7 mi. to 13 mi.	0.05	0.50	0.03
Carter's Grove NHL	0-0.5 mi.	1.00	0.57	0.57
	0.5 to 1 mi.	0.75	0.57	0.43
	1 mi. to 2 mi.	0.50	0.57	0.29
	2 mi. to 3.5 mi.	0.25	0.57	0.14
	3.5 mi. to 7 mi.	0.10	0.57	0.06
	7 mi. to 13 mi.	0.05	0.57	0.03
Capt. John Smith Chesapeake NHT & NRHP eligible Historic District	0-0.5 mi.	1.00	0.66	0.66
	0.5 to 1 mi.	0.75	0.66	0.50
	1 mi. to 2 mi.	0.50	0.66	0.33
	2 mi. to 3.5 mi.	0.25	0.66	0.17
	3.5 mi. to 7 mi.	0.10	0.66	0.07
	7 mi. to 13 mi.	0.05	0.66	0.03
ABPP site Fort Huger	0-0.5 mi.	1.00	0.64	0.64
	0.5 to 1 mi.	0.75	0.64	0.48
	1 mi. to 2 mi.	0.50	0.64	0.32
	2 mi. to 3.5 mi.	0.25	0.64	0.16
	3.5 mi. to 7 mi.	0.10	0.64	0.06
	7 mi. to 13 mi.	0.05	0.64	0.03
ABPP site Fort Crafford	0-0.5 mi.	1.00	0.27	0.27
	0.5 to 1 mi.	0.75	0.27	0.20
	1 mi. to 2 mi.	0.50	0.27	0.14
	2 mi. to 3.5 mi.	0.25	0.27	0.07
	3.5 mi. to 7 mi.	0.10	0.27	0.03
	7 mi. to 13 mi.	0.05	0.27	0.01

ABPP site Fort Boykin	0-0.5 mi.	1.00	0.43	0.43
	0.5 to 1 mi.	0.75	0.43	0.32
	1 mi. to 2 mi.	0.50	0.43	0.22
	2 mi. to 3.5 mi.	0.25	0.43	0.11
	3.5 mi. to 7 mi.	0.10	0.43	0.04
	7 mi. to 13 mi.	0.05	0.43	0.02

Overall Impact Calculation

Table 9 presents the overall impact calculations for the vegetation scenario. As described previously, this represents a low end of potential visual impacts not counting impacts stemming from cumulative effects.

Table 9. Overall Impact Calculation (in Acres) -- Existing Vegetation Scenario								
Property	Distance Zone	Impact Intensity Rating	Waterfront Area of Impact (ac.)	Overall Water-front Impact (ac.)	Inland Area of Impact (ac.)	Overall Inland Impact (ac.)	Open Water Area of Impact (ac.)	Overall Open Water Impact (ac.)
Colonial NHP	0-0.5 mi.	0.50	0	0.00	0	0.00	0	0.00
	0.5 to 1 mi.	0.38	0	0.00	0	0.00	0	0.00
	1 mi. to 2 mi.	0.25	0	0.00	0	0.00	0	0.00
	2 mi. to 4 mi.	0.13	47.5	6.18	30.55	3.97	0	0.00
	4 mi. to 7 mi.	0.05	198.75	9.94	812.18	40.61	0	0.00
	7 mi. to 13 mi.	0.03	10.4	0.31	93.33	2.80	0	0.00
	Area Subtotal		256.65	16.42	936.06	47.38	0.00	0.00
Carter's Grove NHL	0-0.5 mi.	0.57	0	0.00	0	0.00	0.00	0.00
	0.5 to 1 mi.	0.43	8.02	3.45	92.08	39.59	0.00	0.00
	1 mi. to 2 mi.	0.29	10.78	3.13	13.14	3.81	0.00	0.00
	2 mi. to 4 mi.	0.14	0	0.00	0	0.00	0.00	0.00
	4 mi. to 7 mi.	0.06	0	0.00	0	0.00	0.00	0.00
	7 mi. to 13 mi.	0.03	0	0.00	0	0.00	0.00	0.00
	Area Subtotal		18.80	6.57	105.22	43.41	0.00	0.00
Captain John Smith Chesapeake NHT & NRHP Eligible Historic District	0-0.5 mi.	0.66	105.62	69.71	1356.08	895.01	2376.5	1568.49
	0.5 to 1 mi.	0.50	60.17	30.09	985.55	492.78	2319.97	1159.99
	1 mi. to 2 mi.	0.33	211.54	69.81	918.28	303.03	5841.27	1927.62
	2 mi. to 4 mi.	0.17	311.34	52.93	787.24	133.83	9829.5	1671.02
	4 mi. to 7 mi.	0.07	383.95	26.88	1717.73	120.24	13032.17	912.25
	7 mi. to 13 mi.	0.03	242.14	7.26	521.65	15.65	12831.86	384.96
	Area Subtotal		1314.76	256.67	6286.53	1960.54	46231.27	7624.32

ABPP - Fort Crafford	0-0.5 mi.	0.27	0.00	0.00	0	0.00	0.00	0.00
	0.5 to 1 mi.	0.20	0.00	0.00	0	0.00	0.00	0.00
	1 mi. to 2 mi.	0.14	0.00	0.00	0	0.00	0.00	0.00
	2 mi. to 4 mi.	0.07	0.00	0.00	1.26	0.09	0.00	0.00
	4 mi. to 7 mi.	0.03	0.00	0.00	0	0.00	0.00	0.00
	7 mi. to 13 mi.	0.01	0.00	0.00	0	0.00	0.00	0.00
	Area Subtotal		0.00	0.00	1.26	0.09	0.00	0.00
ABPP - Fort Boykin	0-0.5 mi.	0.43	0	0.00	0	0.00	0.00	0.00
	0.5 to 1 mi.	0.32	0	0.00	0	0.00	0.00	0.00
	1 mi. to 2 mi.	0.22	0	0.00	0	0.00	0.00	0.00
	2 mi. to 4 mi.	0.11	0	0.00	0	0.00	0.00	0.00
	4 mi. to 7 mi.	0.04	0	0.00	0	0.00	0.00	0.00
	7 mi. to 13 mi.	0.02	3.82	0.08	4.67	0.09	0.00	0.00
	Area Subtotal		3.82	0.08	4.67	0.09	0.00	0.00
ABPP - Fort Huger	0-0.5 mi.	0.64	0	0.00	0	0.00	0.00	0.00
	0.5 to 1 mi.	0.48	0	0.00	0	0.00	0.00	0.00
	1 mi. to 2 mi.	0.32	0	0.00	0	0.00	0.00	0.00
	2 mi. to 4 mi.	0.16	2.06	0.33	0.46	0.07	0.00	0.00
	4 mi. to 7 mi.	0.06	0	0.00	0	0.00	0.00	0.00
	7 mi. to 13 mi.	0.03	0	0.00	0	0.00	0.00	0.00
	Area Subtotal		2.06	0.33	0.46	0.07	0.00	0.00

Comparison of Impact Scenarios

Table 10 provides a comparison of the overall impact calculations for the no vegetation and existing vegetation scenarios. This depicts the aggregate impact in acres (as modified by intensity) of all historic properties combined for each scenario.

Table 10. Aggregate Impacts of Scenarios (in acres)				
	Aggregate Waterfront Impact	Aggregate Inland Impact	Aggregate Open Water Impact	Aggregate Total Impact
No Vegetation Scenario (HIGH END)	802.65	7330.93	12558.22	20691.80
Existing Vegetation Scenario (LOW END)	280.07	2051.58	7624.32	9955.97

These represent a high end and low end of projected impacts from the Surry-Skiffes alternative. The precise long-term impact cannot be accurately predicted though it will lie within this range. Factors such as incomplete control of existing vegetation,

storm damage, insect infestations due to climate change and importation of invasive species, and changing sea level can all have extreme effects on existing vegetation patterns. Each of these can modify extent, location, size and type of vegetation. The likelihood of modification over time is high, though its precise nature is not currently calculable. Thus, it is logical to assume an impact value somewhere between the high and low ends.

Limitations and Use of this Analysis – Further Analysis Required

The impact scenarios described above represent quantitative measurements of visual impacts for one alternative. Such measurements are best used for comparing the level of impacts among different alternatives.

The quantitative measurements presented here have limitations. For example, they do not account for varying degrees of significance of different viewing or vantage points within historic properties. Some viewing points have greater significance than others, but all (within the same distance zone) are treated equally in the analysis presented in this document.

Further, as stated previously, the results presented above do not factor in additional visual impacts stemming from cumulative effects of the proposed alternative. Cumulative effects can result from: additional development facilitated over time by the project; placement of other features in a newly established corridor; the creation of additional corridors of some type that might result from the precedent set by issuance of a permit for this alternative; and more. Analysis of such effects is quite feasible and is required in section 106 and NEPA compliance procedures. However, only a full EIS can ensure analysis of the full range of cumulative effects. Such analysis is fully called for given the magnitude of this project.

There are also additional likely effects of alternatives on other values that can only be evaluated in the context of an EIS, including effects on visitor experience, tourism and associated economic impacts.

Figure 1: Area of Potential Effect (APE)

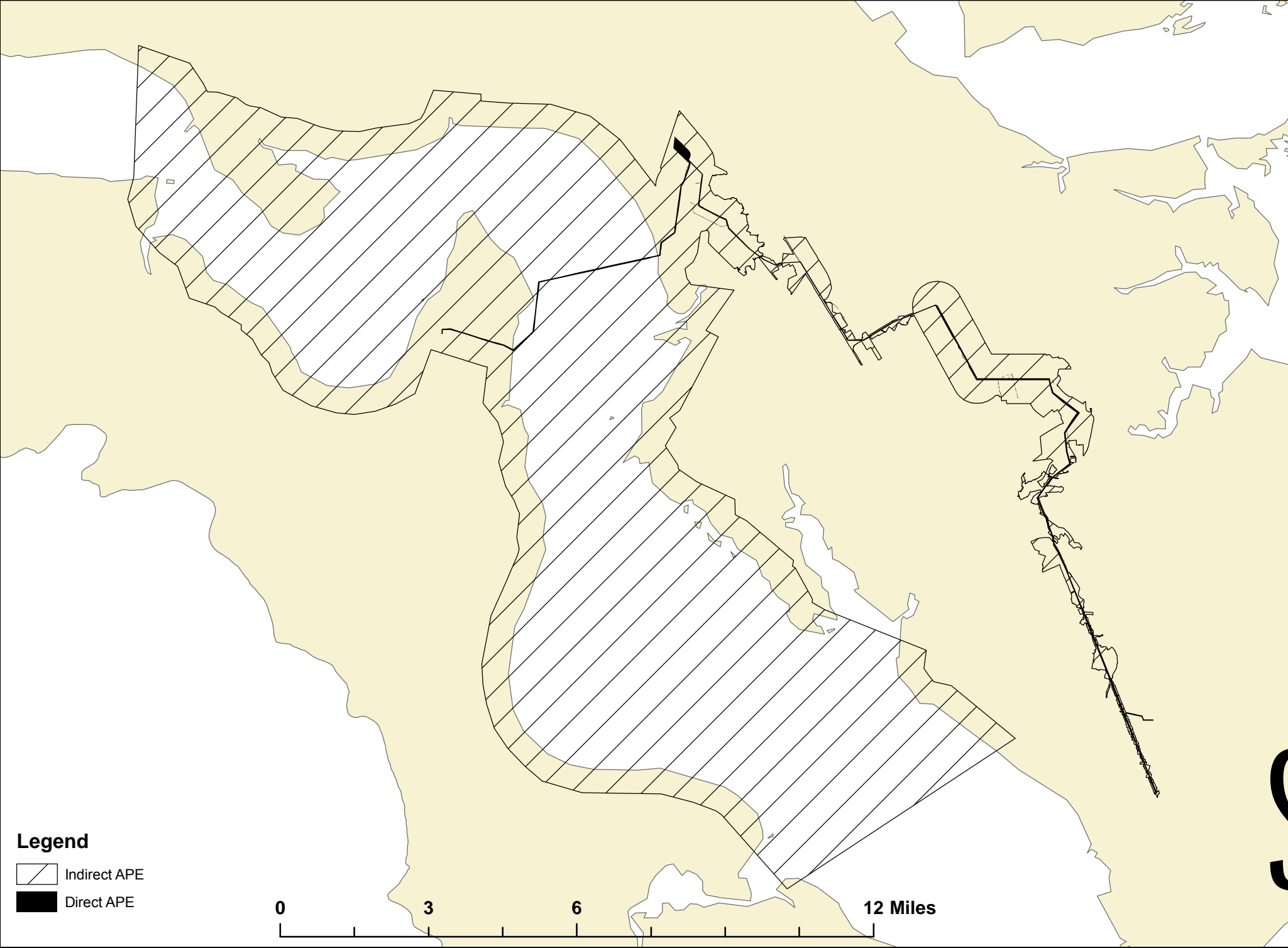


Figure 2: Overview Map with Historic Properties

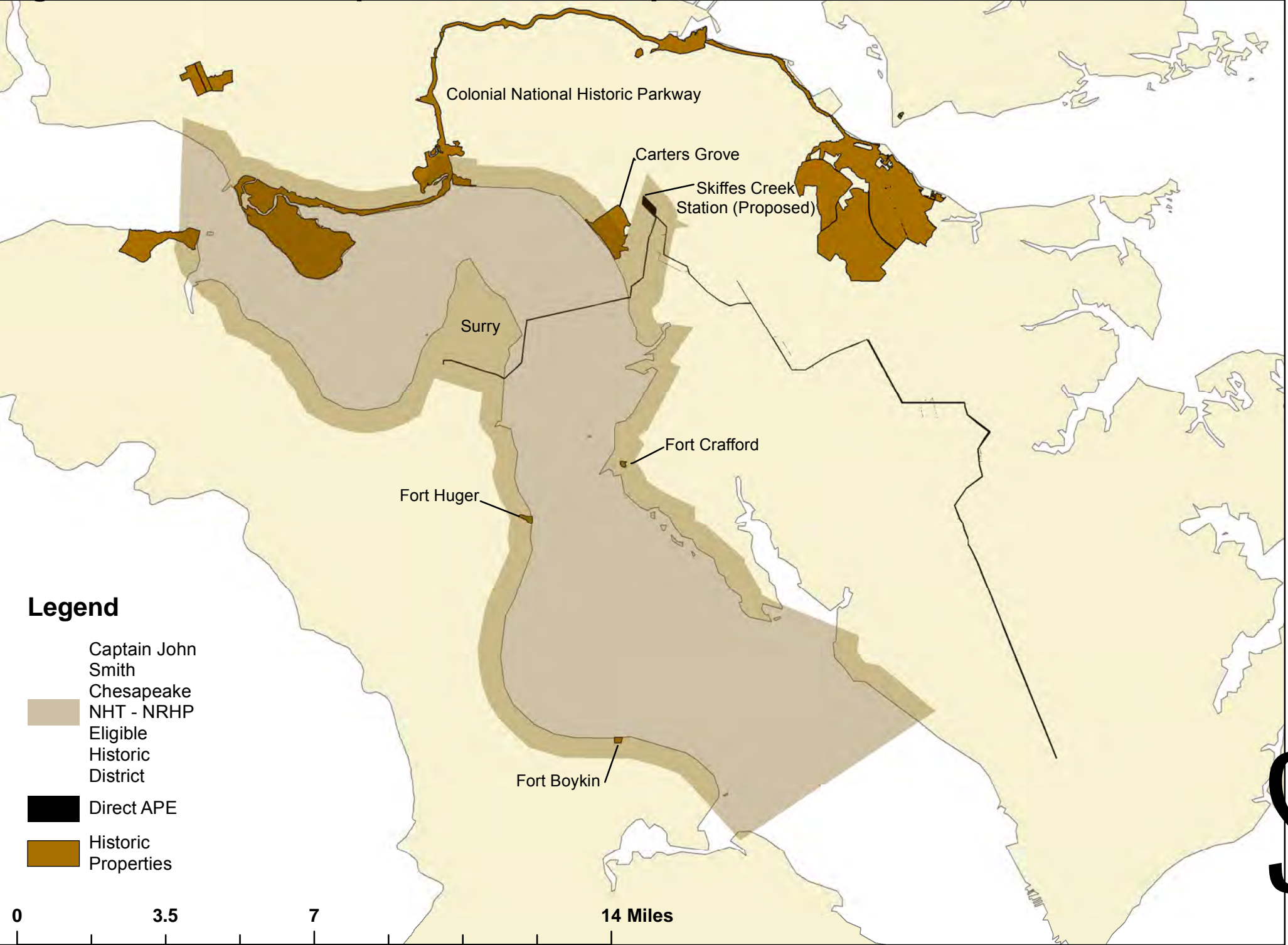


Figure 3: Distance Zones

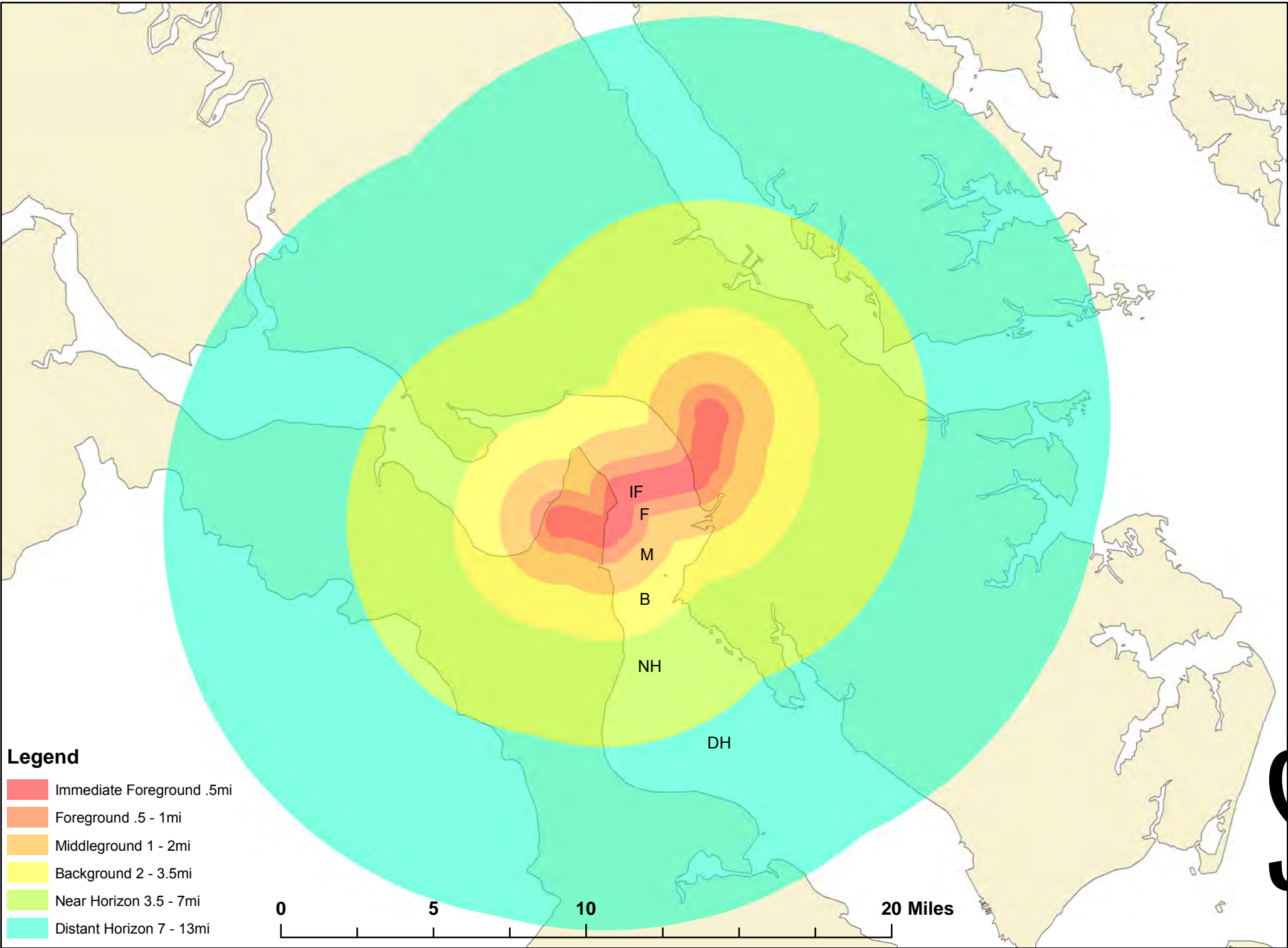


Figure 4: Area of Impact - No Vegetation Scenario

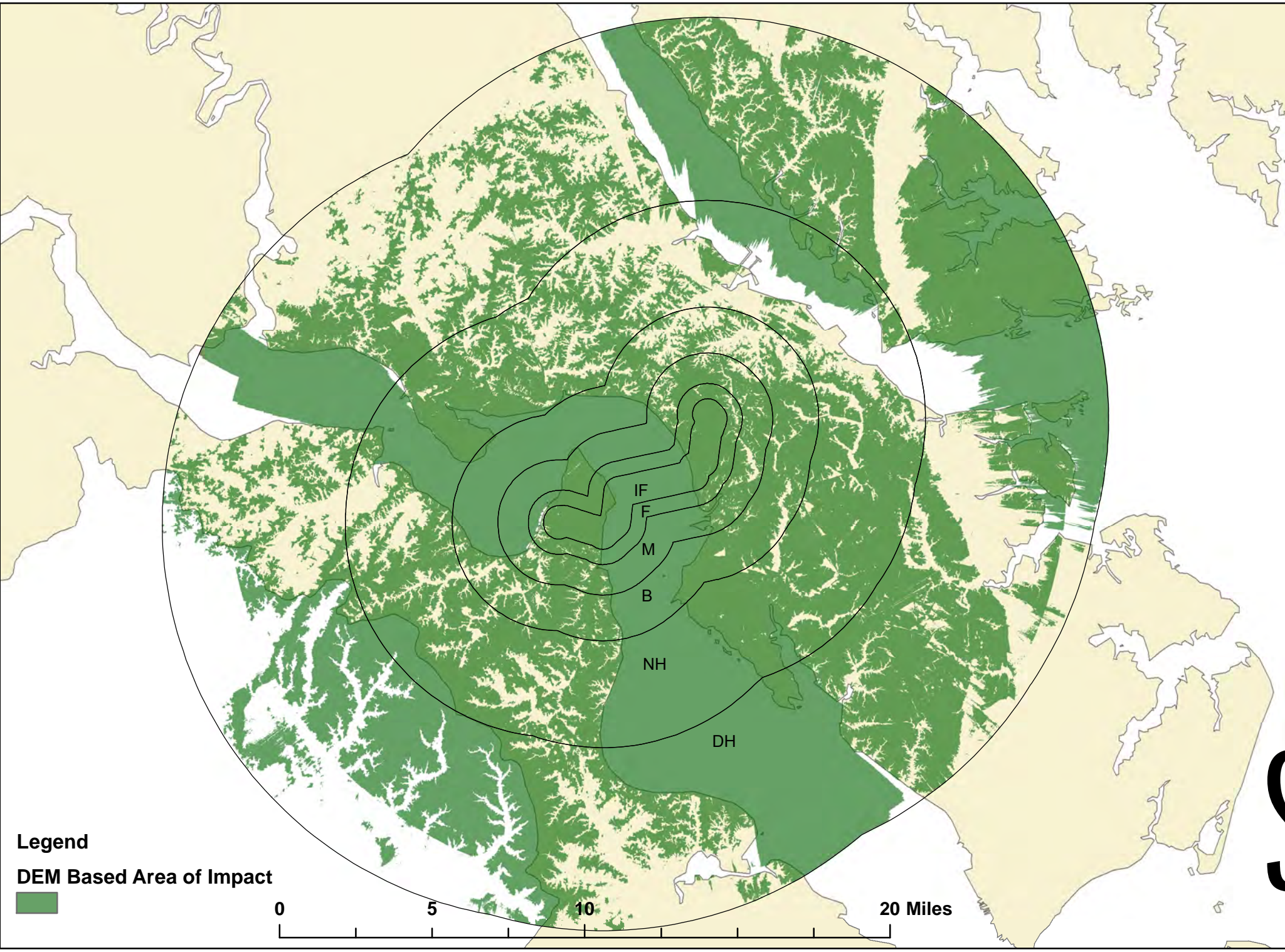


Figure 5: Area of Impact with Magnitude - No Vegetation Scenario

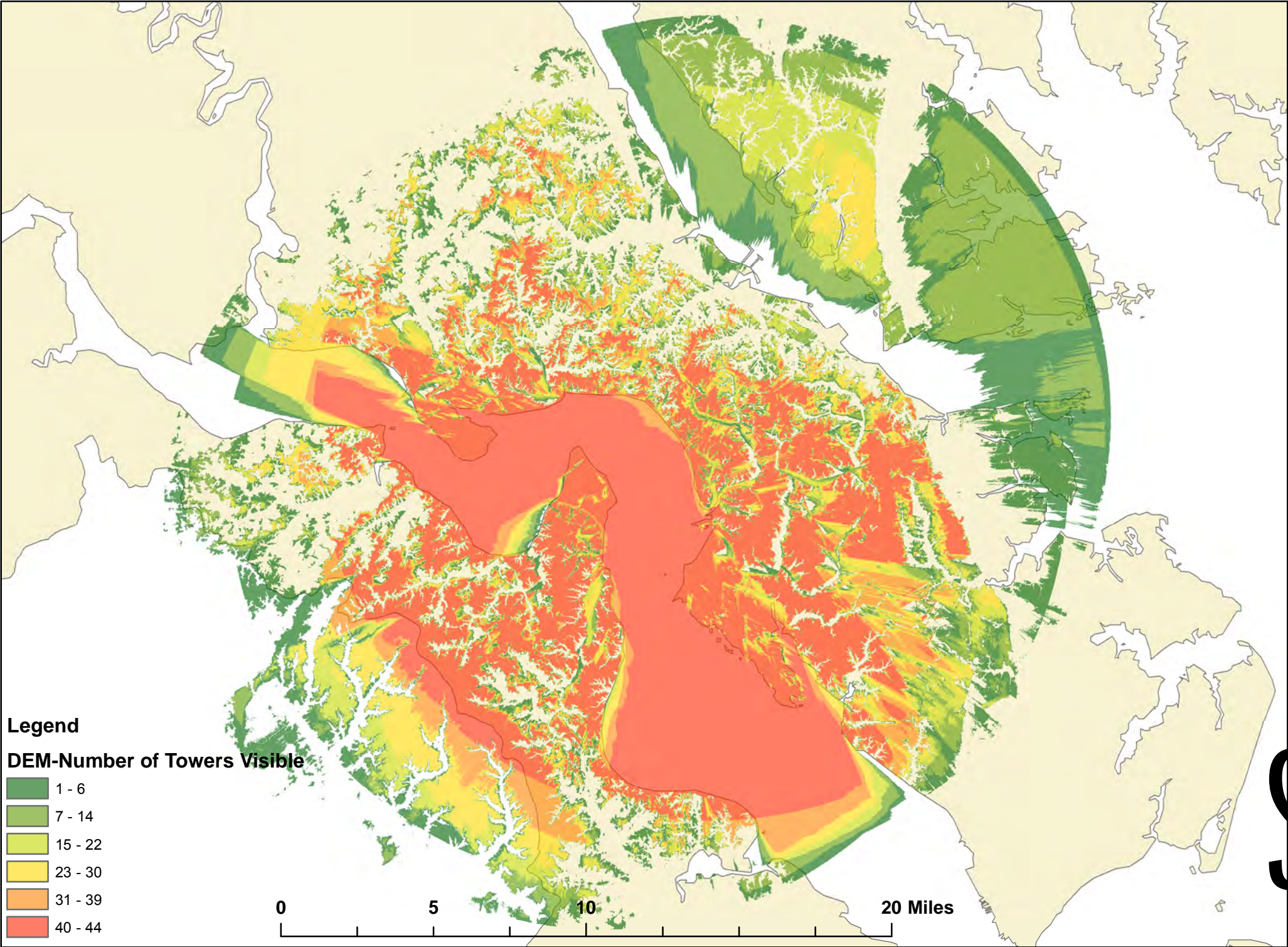


Figure 6: Area of Impact - Existing Vegetation Scenario

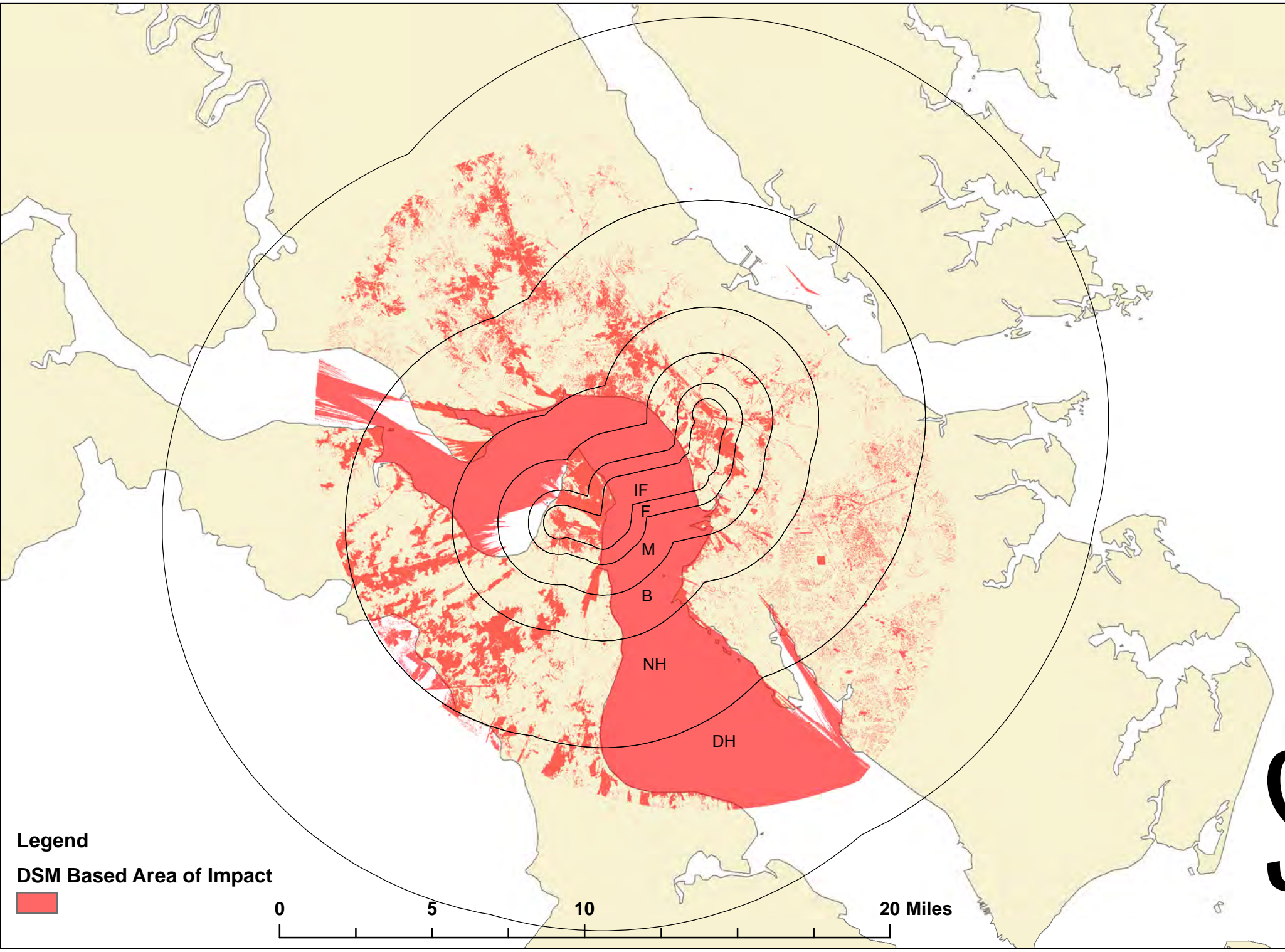


Figure 7: Area of Impact with Magnitude - Existing Vegetation Scenario

