

Appendix G: Effects of Projects and Programs



This appendix presents details about the technical analyses the BRTB (through the efforts of BMC staff) has conducted during the development of *Maximize2040*. These analyses help the BRTB to evaluate and understand the potential effects of the proposed projects and programs of *Maximize2040* with respect to adopted regional transportation goals, including conserving and enhancing the environment, increasing mobility, and improving accessibility.

Analysis of Preferred Alternative – Air Quality Conformity

Chapter 1 describes the federal requirements each MPO must follow to make sure the projects in *Maximize2040* will not cause new air quality violations, worsen existing violations, or delay timely attainment of air quality standards.

To protect public health, the U.S. Environmental Protection Agency (EPA) sets the national ambient air quality standards (NAAQS) for “criteria pollutants.” The EPA then determines the areas that do not meet these standards.

The EPA has determined that the Baltimore region does not meet the national standard for ground-level ozone. As a result, the EPA has classified the region as a “nonattainment” area for ground-level ozone. The EPA also has classified the region as a “maintenance” area for carbon monoxide (CO) and fine particulate matter (PM_{2.5}).

What does this mean for the region? The State Implementation Plan (SIP) developed by the Maryland Department of the Environment determines how the region will reach the NAAQS. Part of this SIP includes motor vehicle emission budgets. The region must show that its transportation plans and programs conform to the air quality goals in the SIP and do not exceed the motor vehicle emission budgets.

This process is coordinated through the Interagency Consultation Group, a subcommittee of the BRTB. The Maryland Department of the Environment (MDE) submitted SIPs for 8-hour ozone, PM_{2.5}, and CO. The maintenance SIP for CO was approved in 2003. The “rate of further progress” budget for mobile sources from the 8-hour ozone SIP was deemed adequate by EPA in 2008. The maintenance SIP for PM_{2.5} was approved in 2014.

The results of the conformity analysis indicate that projected mobile source emissions are below the established budgets for years 2017, 2025, 2035, and 2040. Based on the conformity analysis, the BRTB, in its capacity as the MPO for the Baltimore region, has concluded that implementation of the projects in *Maximize2040* and the amended 2016-2019 Transportation Improvement Program will not worsen the region’s air quality or delay the timely attainment of national ambient air quality standards.

Air Quality Conformity – Final Emissions Results (in tons)				
	2017	2025	2035	2040
Daily Summer NOx				
Total Emissions Modeled	50.7	25.9	18.2	18.2
Motor Vehicle Emissions Budget	106.8	106.8	106.8	106.8
Conformity Result	Pass	Pass	Pass	Pass
Daily Summer VOC				
Total Emissions Modeled	26.5	18.2	12.0	11.6
Motor Vehicle Emissions Budget	41.2	41.2	41.2	41.2
Conformity Result	Pass	Pass	Pass	Pass
Daily Winter CO				
Total Emissions Modeled	381.0	271.1	197.1	194.9
Motor Vehicle Emissions Budget	1,689.8	1,689.8	1,689.8	1,689.8
Conformity Result	Pass	Pass	Pass	Pass
Annual Direct PM_{2.5}				
Total Emissions Modeled	887	538	448	441
Motor Vehicle Emissions Budget	1,218.60	1,051.39	1,051.39	1,051.39
Conformity Result	Pass	Pass	Pass	Pass
Annual NOx				
Total Emissions Modeled	19,294	10,002	7,742	7,344
Motor Vehicle Emissions Budget	29,892.01	21,594.96	21,594.96	21,594.96
Conformity Result	Pass	Pass	Pass	Pass

Analysis of Preferred Alternative – Travel Demand Model

The BMC staff applied performance measures to quantify the effects of simulated horizon year travel on the Baltimore region transportation network. Numerical data collected to quantify *Maximize2040* performance measures came from the Baltimore Region Travel Demand Model (Version 4.4a). Staff validated the travel demand model against 2010 reported observed conditions.

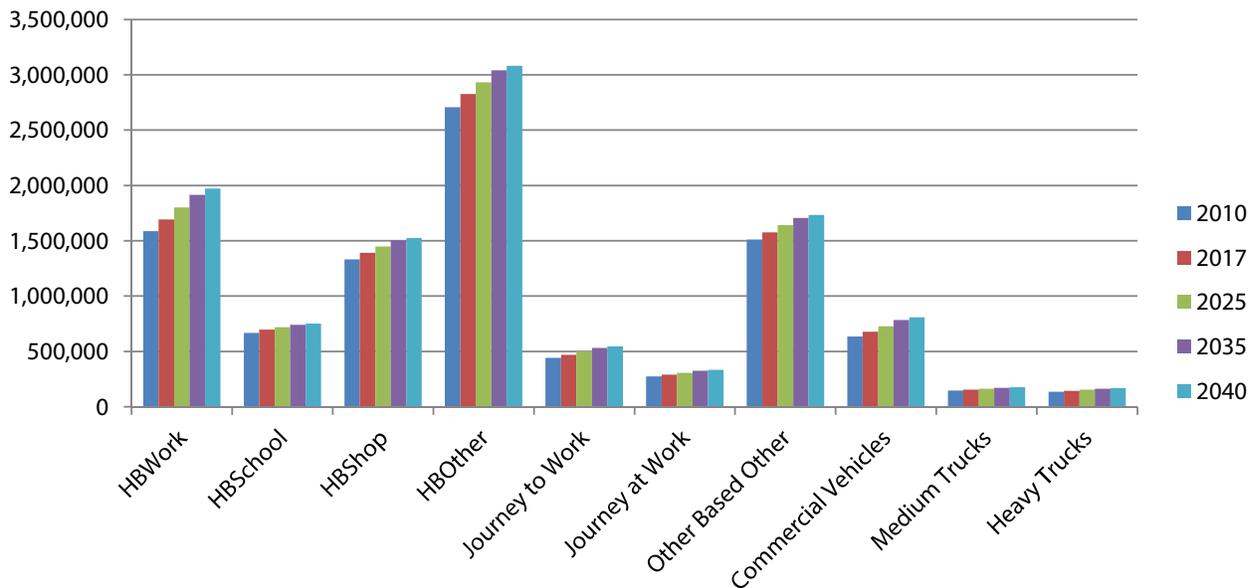
The Version 4.4a model includes seven person-level trip purposes: (1) Home-Based Work, (2) Home-Based School, (3) Home-Based Shopping, (4) Home-Based Other, (5) Journey to Work, (6) Journey to

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Work, (7) Other-Based Other. The model also includes three truck purposes: Commercial Vehicle, Medium Trucks, and Heavy Trucks. Staff used the Round 8-A socioeconomic forecasts to simulate household and non-household travel behavior choices.

The following figure illustrates model simulated travel for 2010, 2017, 2025, 2035, and 2040 conditions for an average Baltimore region weekday. Based on horizon year input assumptions, the model forecasts a 16.6% increase in total household person trips (motorized and non-motorized) from 2010 to 2040, resulting in a total of 9.94 million total person trips produced in 2040. The model forecasts an increase of 25.3% in non-household vehicle trips over this same period, resulting in 1.15 million commercial and truck vehicle trips. Trips for 2010 and 2040 are distributed throughout the region and the output vehicle trip tables from the mode choice module are assigned to the 2010 and 2040 transportation networks, respectively.

Simulated Household Person Trips and Non-Household Vehicle Trips



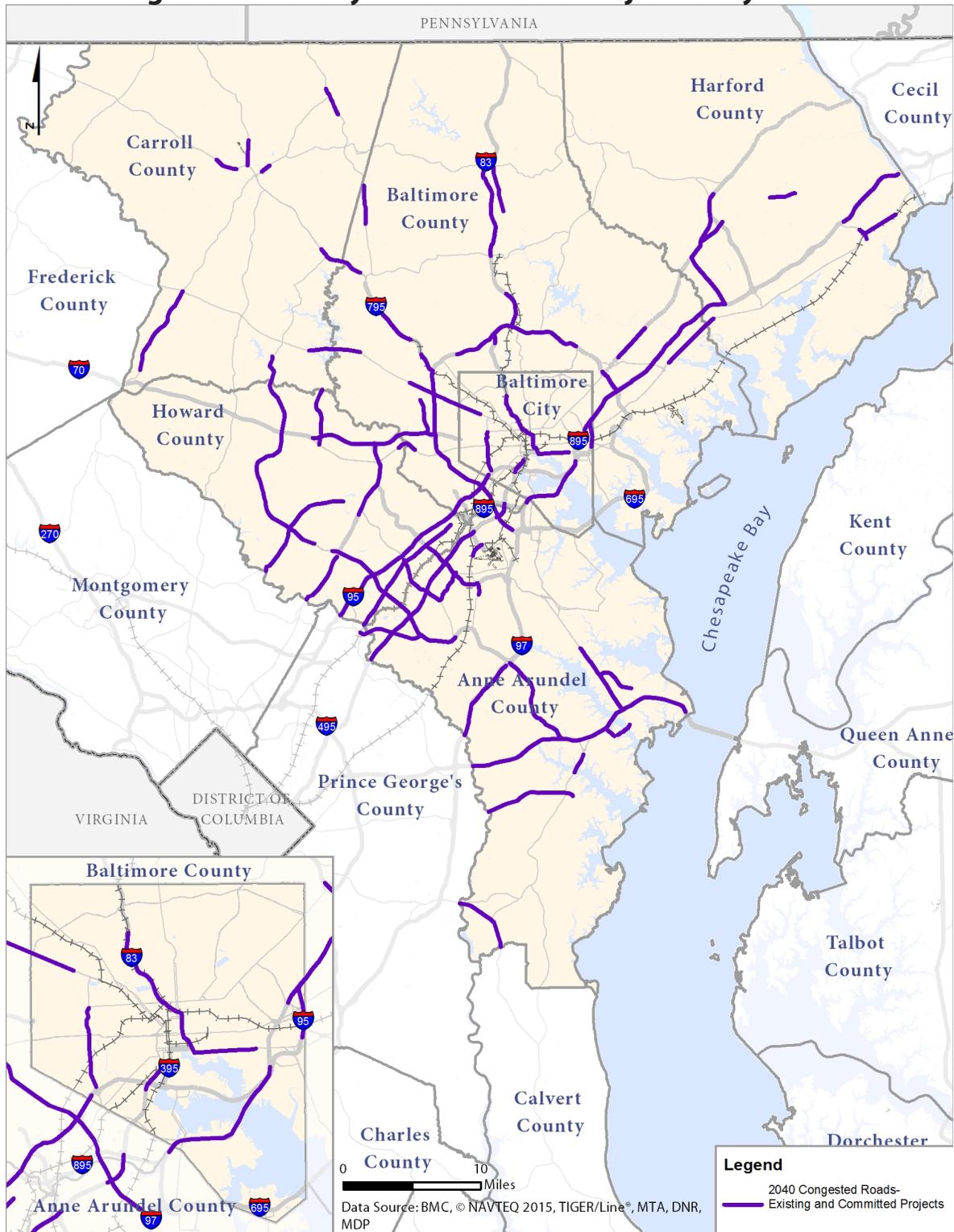
Performance measures have been developed to analyze simulation characteristics to show travel demand results. Performance measures were calculated for two simulations:

- 2019 Existing and Committed (E + C)¹,
- *Maximize2040* Preferred Alternative.

The E + C network illustrates the forecasted level of service that would result in year 2040 if only the projects currently built, or the limited group scheduled for construction by calendar year 2019, were completed. E + C, in this case, shows what is referred to as a “no-build” scenario, wherein all project planning terminates with the projects that are currently funded and scheduled.

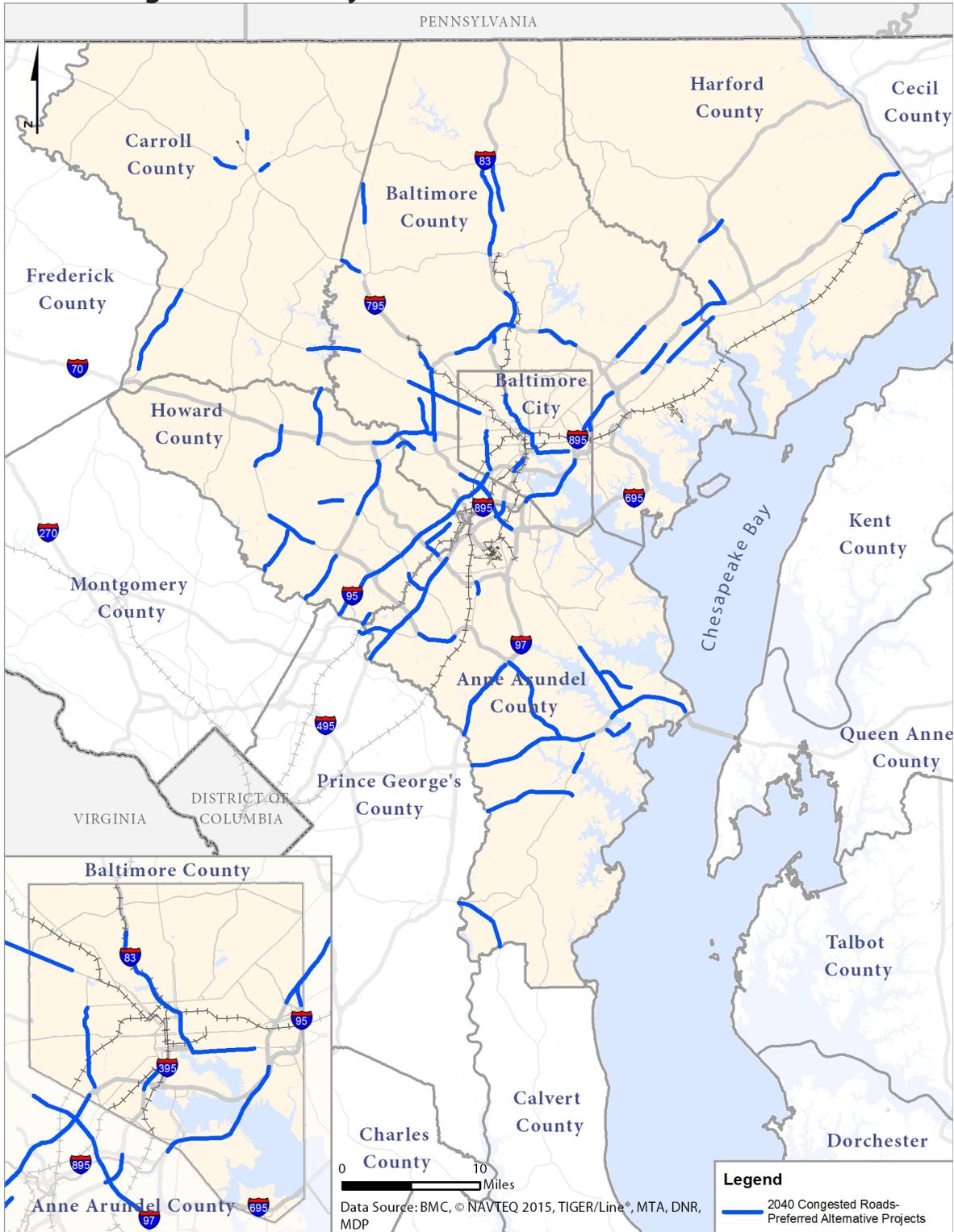
¹ This is the 2019 network (existing + committed projects), with 2040 population and employment projections.

2040 Congested Roadway Forecast – E + C Projects Only



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2040 Congested Roadway Forecast – E + C and Preferred Alternative



The following table displays 2010, 2019 E + C, and 2040 Preferred Alternative performance measures for the 24-hour period:

Travel Demand Performance Measures for Baltimore Region				
	Indicator of Travel Demand	2010	2019 E + C	2040 Preferred Alternative
Vehicle Miles Traveled (VMT)	Interstates	31,257,000	37,701,000	39,425,000
	Arterials	25,202,000	32,745,000	32,116,000
	Collectors	5,307,000	7,443,000	7,043,000
	All Roads	61,767,000	77,889,000	78,584,000
Congested VMT (LOS E and F)	Interstates	8,473,000	14,215,000	14,650,000
	Arterials	6,962,000	13,974,000	12,394,000
	Collectors	1,495,000	3,491,000	3,035,000
	All Roads	16,930,000	31,680,000	30,080,000
Percentage of Congested VMT (LOS E and F)	Interstates	27.1%	37.7%	37.2%
	Arterials	27.6%	42.7%	38.6%
	Collectors	28.2%	46.9%	43.1%
	All Roads	27.4%	40.7%	38.3%
	Total Transit Ridership (Linked Trips)	302,885	317,145	323,213
	Travel Characteristics			
Auto Occupancy Ratio	Home-Based Work Trips	1.09	1.09	1.09
	Home-Based Non-Work Trips (Shop/Other)	1.53	1.53	1.53
	All Home-Based Trips	1.41	1.40	1.40
	Home-Based Transit Mode Share	4.7%	4.3%	4.3%
	Performance			
Congested Speed (mph) for AM Peak Period	Interstates	48.2	39.9	42.8
	Freeways	47.2	35.6	36.5
	Principal Arterials	32.9	27.8	29.1
	Minor Arterials	30.5	26.0	26.8
	Collectors	30.4	25.3	26.2
	All Roads	37.3	30.5	32.1
	Vehicle Hours of Delay (AM Peak Period)	75,656	388,398	304,725
	Vehicle Hours of Delay (24-Hour Period)	233,513	1,078,030	918,973

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Following are some significant observations related to the travel demand model data as presented in the table:

- The Baltimore region on an average weekday is projected to have a 27 percent growth in VMT from a 2010 total of 61.7 million to a 2040 Preferred Alternative projection of 78.3 million.
- Congested VMT (Level of Service E and F) is projected to increase 77 percent from 17.0 million in 2010 to 29.5 million in the 2040 Preferred Alternative. The congested VMT in the 2040 Preferred Alternative accounts for nearly 38.3 percent of total VMT in the region while the 2019 E + C shows a 40.7 percent level compared to the 2010 network at 27.6 percent.
- Transit ridership shows an increase of 6.0 percent from 2010 to 2040, but the transit mode share for all trips decreases.
- Vehicle hours of delay for the 2040 Preferred Alternative are almost four times greater than the hours of delay for 2010 because of increased traffic congestion.
- Vehicle hours of delay for the 2040 Preferred Alternative are projected to decrease by 17.3 percent from 2019 E + C.
- Average speed for all roads under the 2040 Preferred Alternative shows a decrease of 13.9 percent between 2010 and 2040 due to increased traffic congestion.

Analysis of Preferred Alternative – Environmental Justice

Background

Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” requires the U.S. Department of Transportation to make EJ analysis part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, programs, and activities on minority populations and/or low-income populations (collectively “EJ populations”). In grant agreements where the BRTB is a recipient of FHWA/FTA funds, there is a requirement to facilitate compliance with Executive Order 12898 and DOT’s Implementing Order 5610.2, “Environmental Justice in Minority Populations and Low-Income Populations.” This is accomplished by incorporating environmental justice principles into every stage of the transportation decision-making process.

Building from the framework of Title VI of the Civil Rights Act of 1964, which ensures nondiscrimination in federal programs, EJ directives address how low-income and minority populations are affected by the actions of the federal government (i.e., funding to MPOs). In its publication, *An Overview of Transportation and Environmental Justice*, the U.S. Department of Transportation (U.S. DOT) outlines the three main objectives stemming from this mandate:

- To avoid, minimize, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations;
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process; and
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

Definitions from FTA Circular 4703.1 – Identification of Minority and Low-Income Populations

The EJ analysis utilized U.S. Department of Transportation (U.S. DOT) definitions of minority and low-income populations to identify concentrations of minority and low-income populations and to determine any disproportionate benefits and burdens of transportation decisions. Specifically, these terms are defined as follows:

A minority population means any readily identifiable group or groups of minority persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed or transient persons (such as migrant workers or Native Americans), who will be similarly impacted by a proposed DOT program, policy, or activity. The U.S. Department of Transportation Order on Environmental Justice, issued to comply with Executive Order 12898, defines minority as a person who is a member of one of these groups:

- Black (a person having origins in any of the black racial groups of Africa)
- Hispanic (a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race)
- Asian American (a person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands)
- American Indian and Alaskan Native (a person having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition).

A low-income population means any readily identifiable group of persons whose median household income is at or below the Department of Health and Human Services' poverty guidelines who live in geographic proximity, and, if circumstances warrant, geographically dispersed or transient persons, who will be similarly impacted by a proposed DOT program, policy, or activity. According to data from the U.S. Census Bureau, the 2014 poverty threshold for a family of four is \$24,418.¹ The U.S. Census Bureau updates poverty thresholds each year using the change in the average annual Consumer Price Index for All Urban Consumers (CPI-U).

An adverse effect means "the totality of significant individual or cumulative human health or environmental effects, including interrelated social and economic effects, which may include, but are not limited to: bodily impairment, infirmity, illness, or death; air, noise, and water pollution and soil contamination; destruction or disruption of man-made or natural resources; destruction or diminution of aesthetic values; destruction or disruption of community cohesion or a community's economic vitality; destruction or disruption of the availability of public and private facilities and services; vibration; adverse employment effects; displacement of persons, businesses, farms, or non-profit organizations; increased traffic congestion, isolation, or exclusion or separation of individuals within a given community or from the broader community; and the denial of, reduction in, or significant delay in the receipt of benefits of DOT programs, policies or activities."

A disproportionately high and adverse effect on minority and low-income populations is defined as "an adverse effect that: (1) is predominantly borne by a minority and/or a low-income population or (2) will be suffered by the minority and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population."

¹ <https://www.census.gov/hhes/www/poverty/data/threshld/>

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Methodology

Following the outline as laid out in FTA Circular 4703.1, an EJ analysis involves three fundamental steps.

1. Determine whether there are any EJ populations potentially affected by the activity.
2. Once it has been determined that one or more EJ populations are present, consider the potential effects of the activity on the EJ populations.
3. The analysis in Step 2 should provide the information to determine benefits or burdens.

To identify how the burdens and benefits of the transportation planning process and transportation improvements are distributed within the region, BMC staff completed a series of analyses. Following are the steps used to complete these analyses:

Step 1: Determine whether there are any EJ populations potentially impacted by the activity—in this case, the Preferred Alternative investment outlined in *Maximize2040*.

A Geographic Information System (GIS) was utilized to view and tabulate demographic information and analyze this information in relation to the proposed *Maximize2040* projects. Spatial and demographic data from the 2010 U.S. Census data were analyzed at the census tract and block group level, relative to Transportation Analysis Zones (TAZs).

Data from the American Community Survey five-year estimates for 2006-2010 were used for minority (persons other than non-white Hispanics). These data were available at the TAZ level. A total of 1,387 TAZs make up the Baltimore modeling area.

To determine threshold minority and low-income levels, the regional average of minority population and households below the poverty level were calculated for the metropolitan planning area. Those block groups where the minority or low-income population was greater than the regional average were identified as communities where EJ issues should be analyzed.

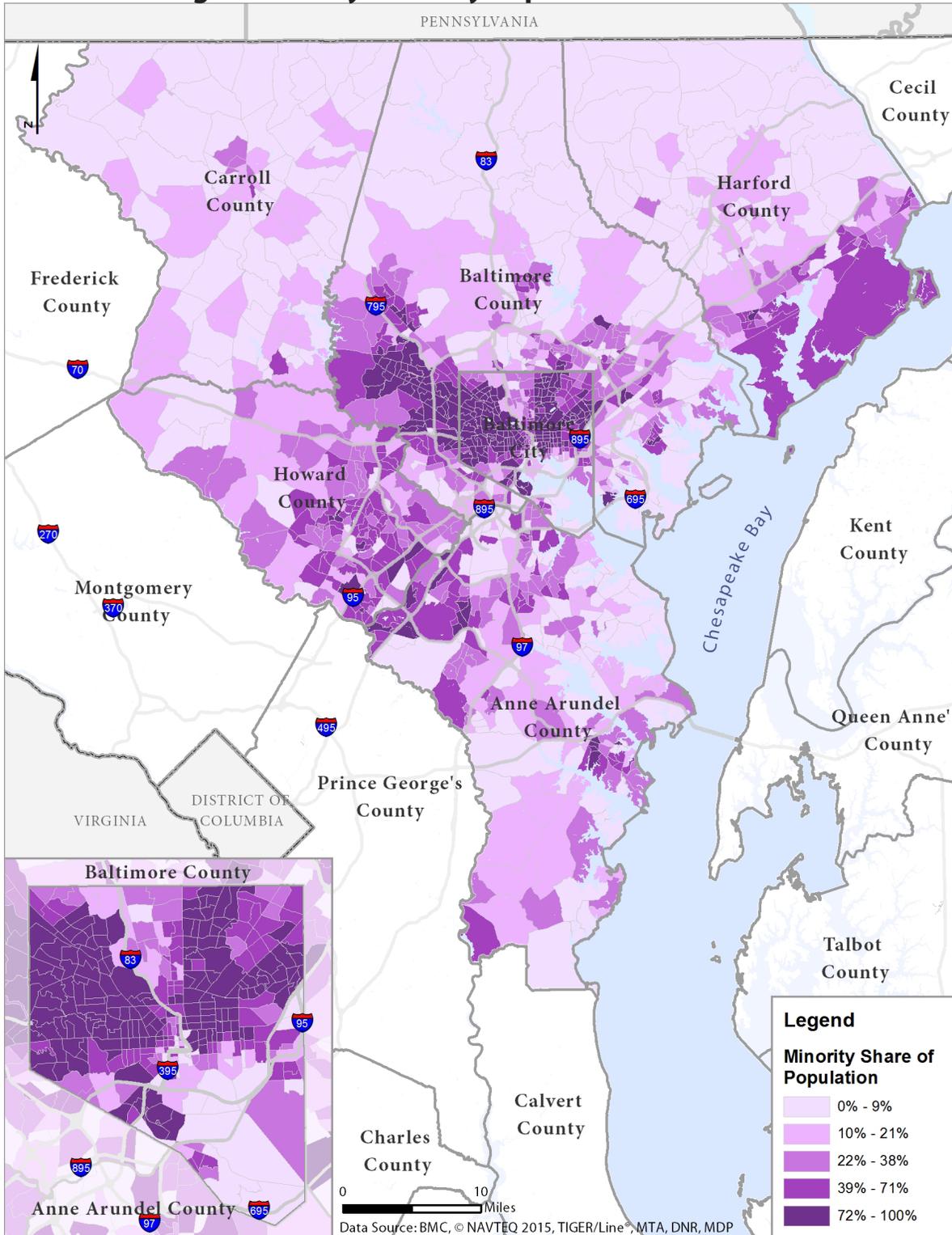
Step 2: Consider the potential effects of the activity on the EJ populations.

According to the U.S. DOT definitions of minority and low-income, staff determined that more than 35 percent of all residents in the region are minorities, and 11.5 percent of the households in the region meet the federal definition of low-income in 2010. By comparing census block group data on minority populations across the region, the analysis enabled BMC staff to identify areas with percentages of minority residents greater than the regional average. Staff completed a similar assessment for low-income households. In many cases, where there is an overlap of low-income and minority populations, maps were generated to identify all minority populations as well as low-income populations.

Step 3: Use information from Step 2 to determine benefits or burdens.

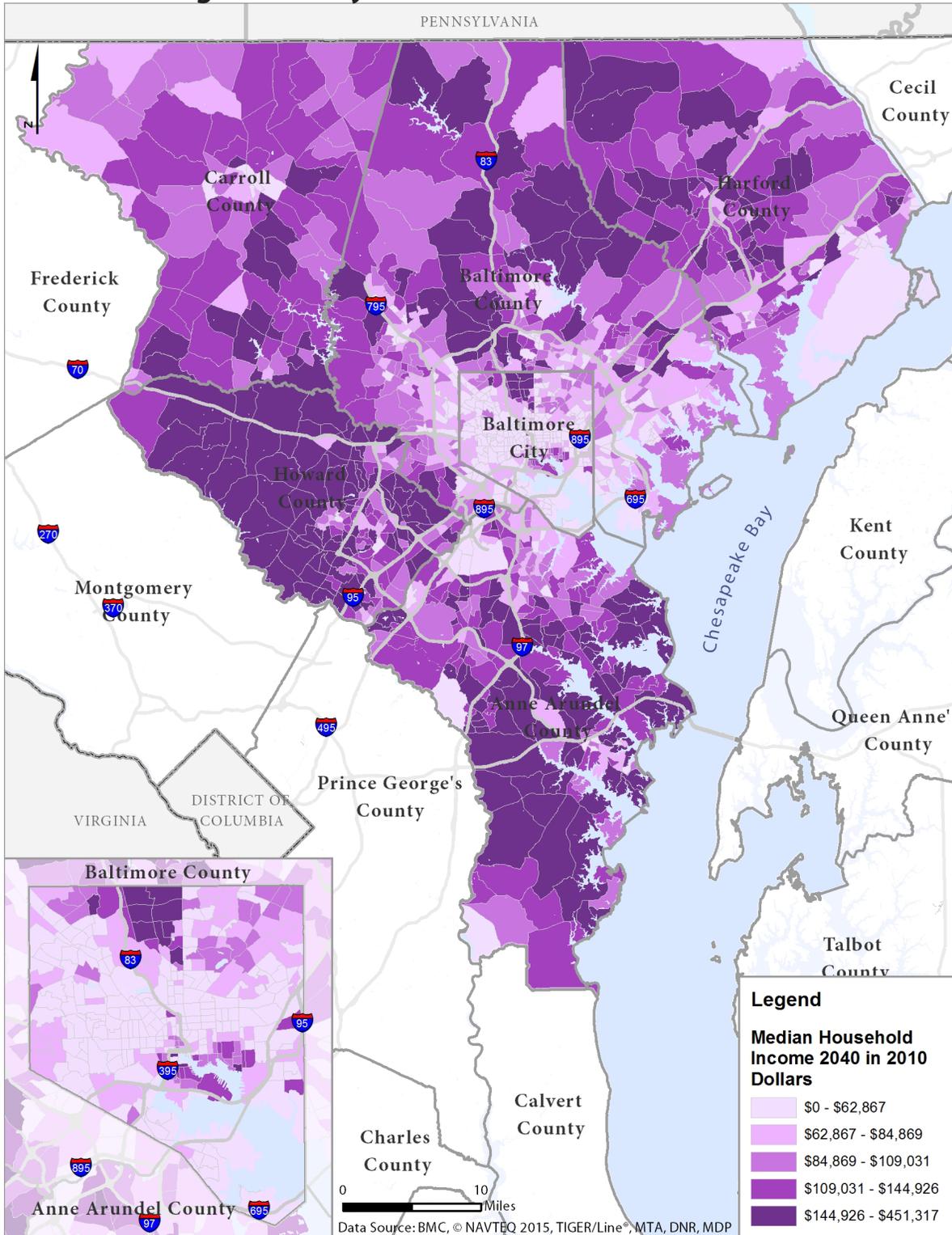
The benefits of the transportation projects in *Maximize2040*, when evaluated on the basis of their spatial distribution, do not disproportionately benefit EJ or non-EJ communities. Most individuals will not see a significant change in travel times from one area of the region to another (home to work, school, retail centers, hospitals, etc.), mostly due to the allocation of approximately 77% of available resources to system preservation and system operations. Also, the remaining expansion projects will have a negligible impact on overall travel time. Low-income and minority populations are not disproportionately affected and are beneficiaries of the improvements to the transportation network.

Baltimore Region TAZs by Minority Population



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Baltimore Region TAZs by Income



Estimating Accessibility for Environmental Justice Populations

The BMC staff conducted analyses to estimate accessibility by Environmental Justice populations in the region with respect to home-based work (HBW) and home-based non-work (HBNW) trips. Zones are grouped by their appropriate population concentration and compared. Comparisons are also made between the 2040 existing and committed projects (E + C) network (no new projects beyond what is currently in place or in the TIP) and the Preferred Alternative. The methodology is similar to that employed for the 2011 long-range transportation plan update, with some modifications.

Staff identified Baltimore region zones by the share of minority population, based on 2010 Census data. This process differs from the 2011 process in that it considers a total minority population, rather than include separate analyses for each racial/ethnic group (Asian, black, Hispanic, other, and white). Break-points were set so that approximately one-fifth of the 2010 regional population is in each category. The following table shows the share breakpoints for the different categories.

Racial Categorization of Zones (Percent)	
Category	Minority Share
1 (Lowest)	0.09
2	0.21
3	0.38
4	0.71
5 (Highest)	1.00

The analysis also considers income. HBW, home-based shop (HBS), and home-based other trips are broken down into four income categories in the model, so these categories were carried into the EJ analysis. Home-based school (SCH) trips are not broken down by income level, so these trips were excluded from the income analysis, although they are included in the racial minority analysis.

Staff then examined transportation accessibility using a 30-minute highway time and a 60-minute transit time. HBW analysis is based on congested travel times used by the model; the HBNW review assumes uncongested travel times.

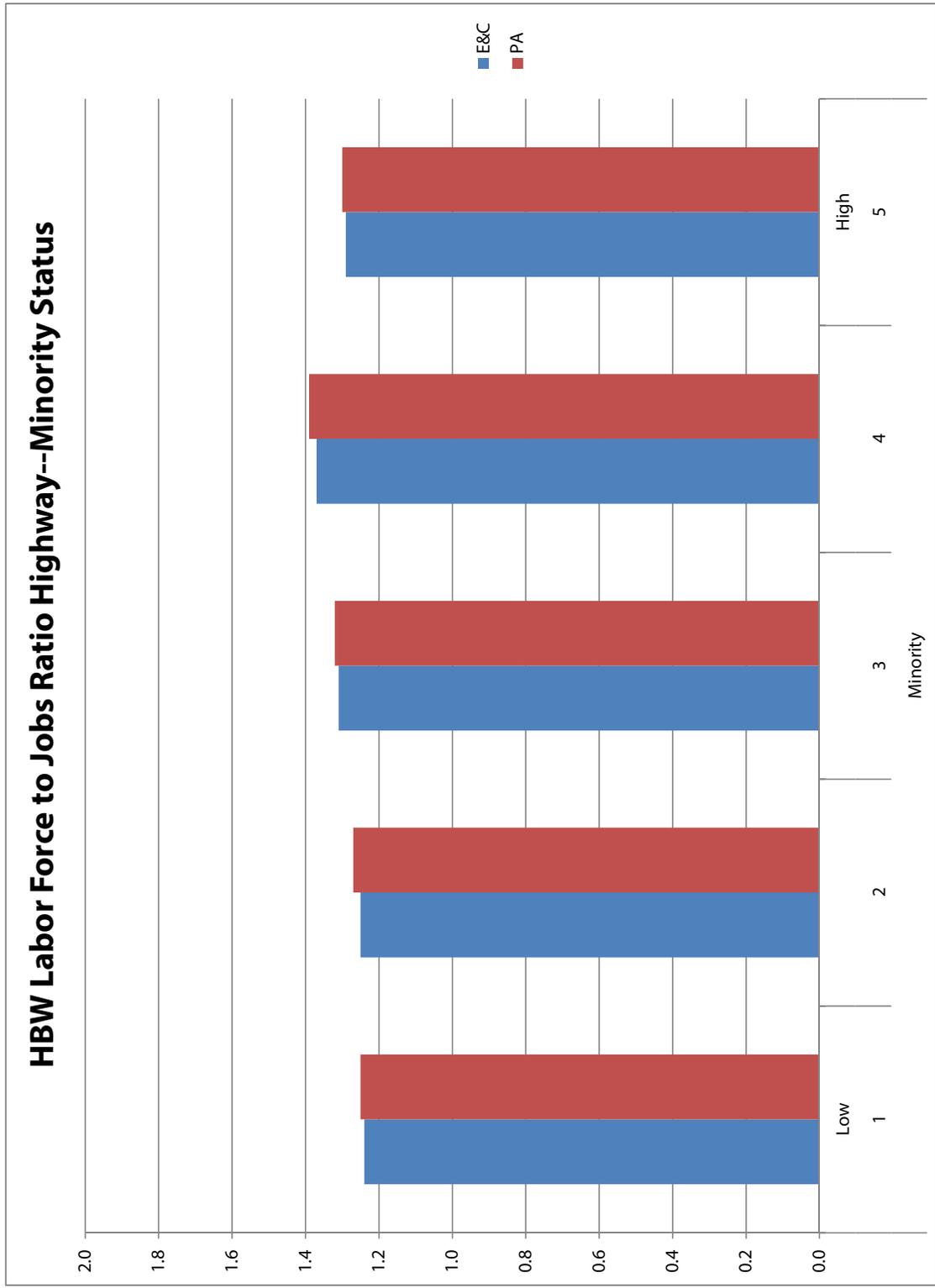
The HBW analysis for the minority share considers employment (jobs) and the competing labor force for those jobs. Within the given time radius of each zone, the number of jobs and the labor force are summed and the ratio taken. The time includes highway terminal time (for highway access) and walk and wait time (for transit access). Highway and transit accessibility are considered separately. HBNW trips are considered by summing the population and number of HBNW attractions within the given radius to get attractions per person.

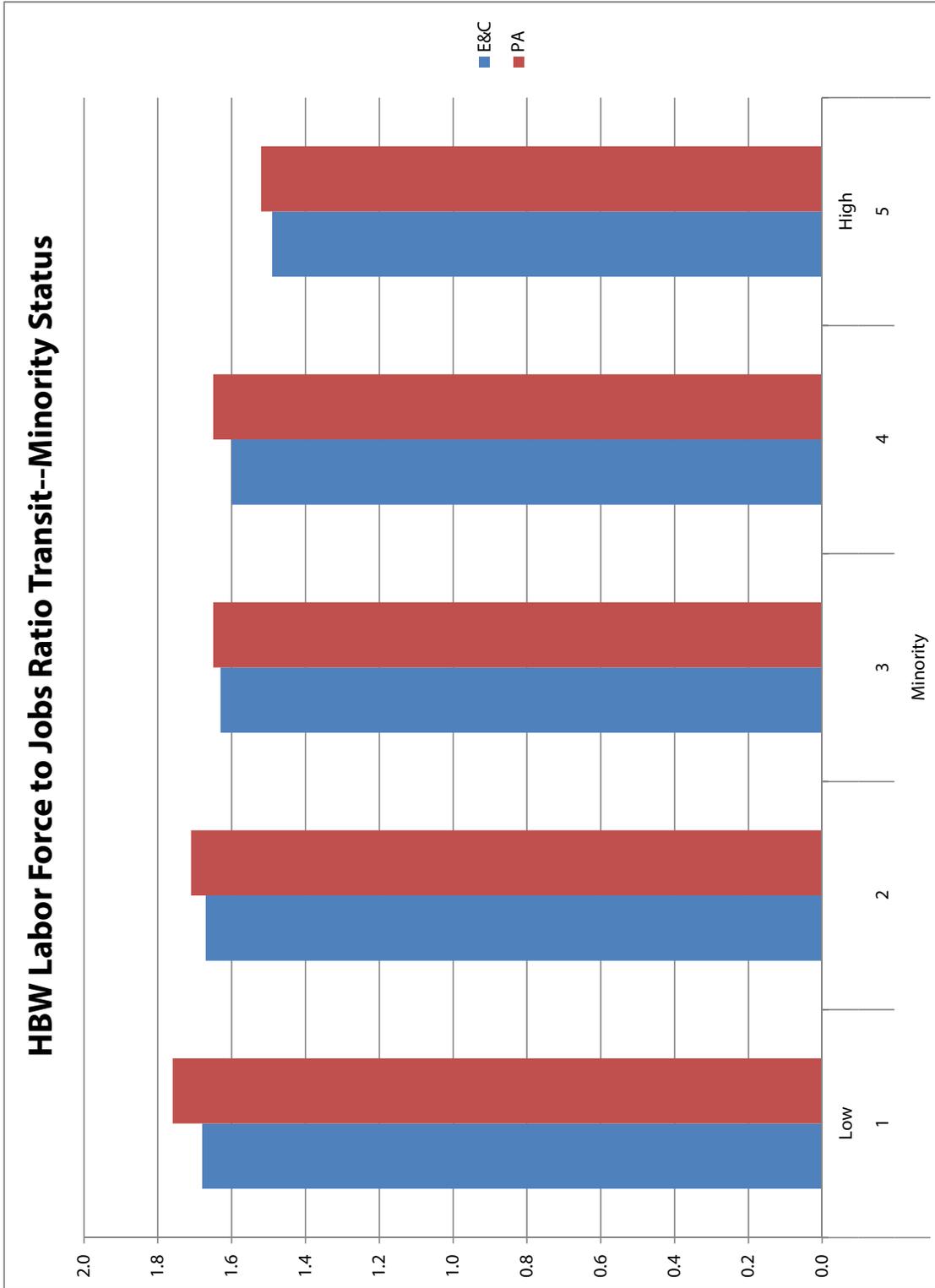
For the income analysis, productions and attractions are summed for trips in each income category within each time radius and compared for both HBW and HBNW (excluding SCH) trips. In addition to producing labor force, job, population, production, and attraction statistics, the process includes calculating the jobs/labor force, attractions/population, or attraction/production ratios. Also determined is the average (weighted by employment or attractions) travel time.

Environmental Justice Charts

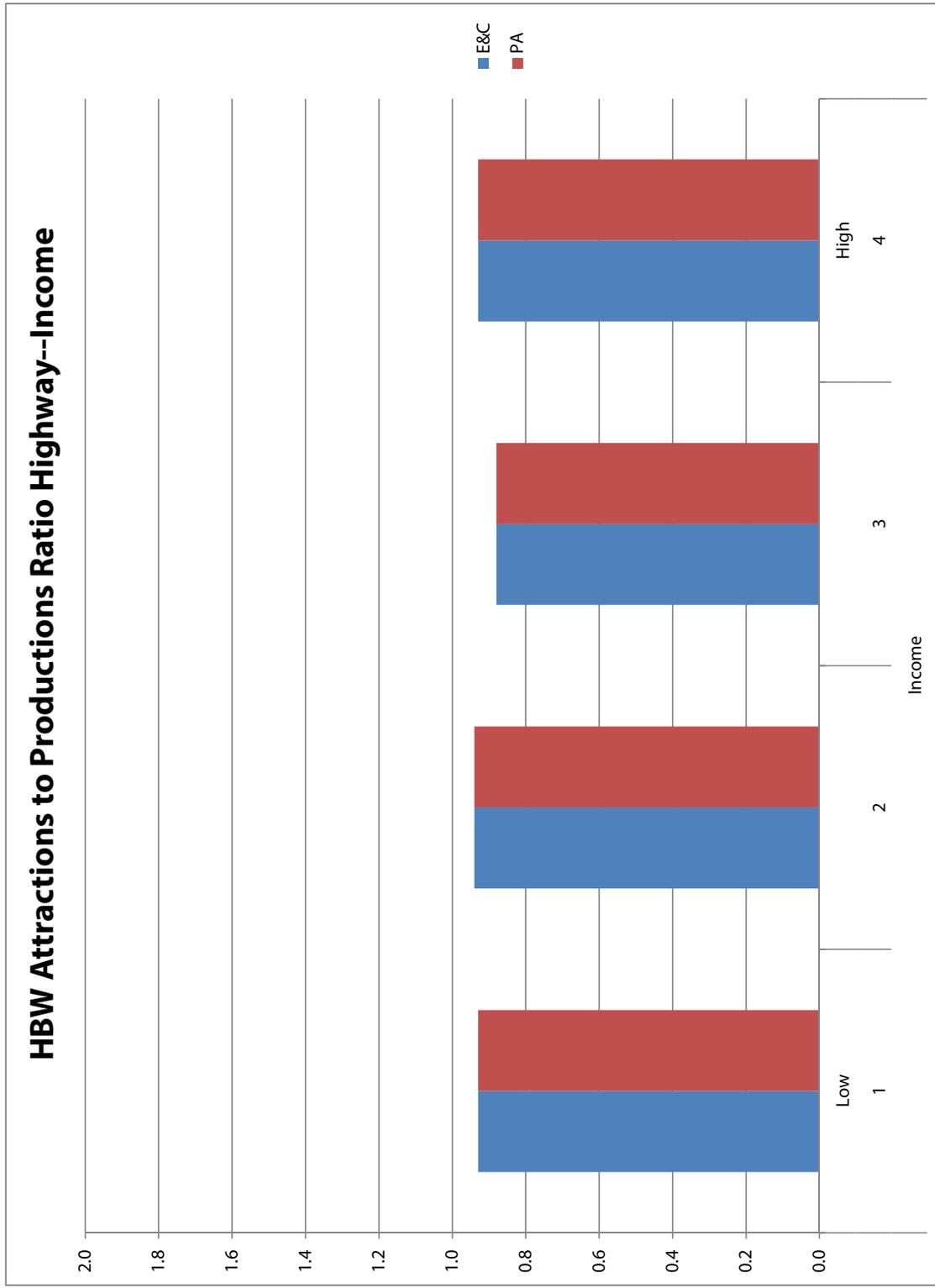
The following charts show the concentrations of attractions for each level of population share. For example, E + C Category 1 refers to the first level of population share. "E + C" refers to existing and committed projects; "PA" refers to preferred alternative projects.

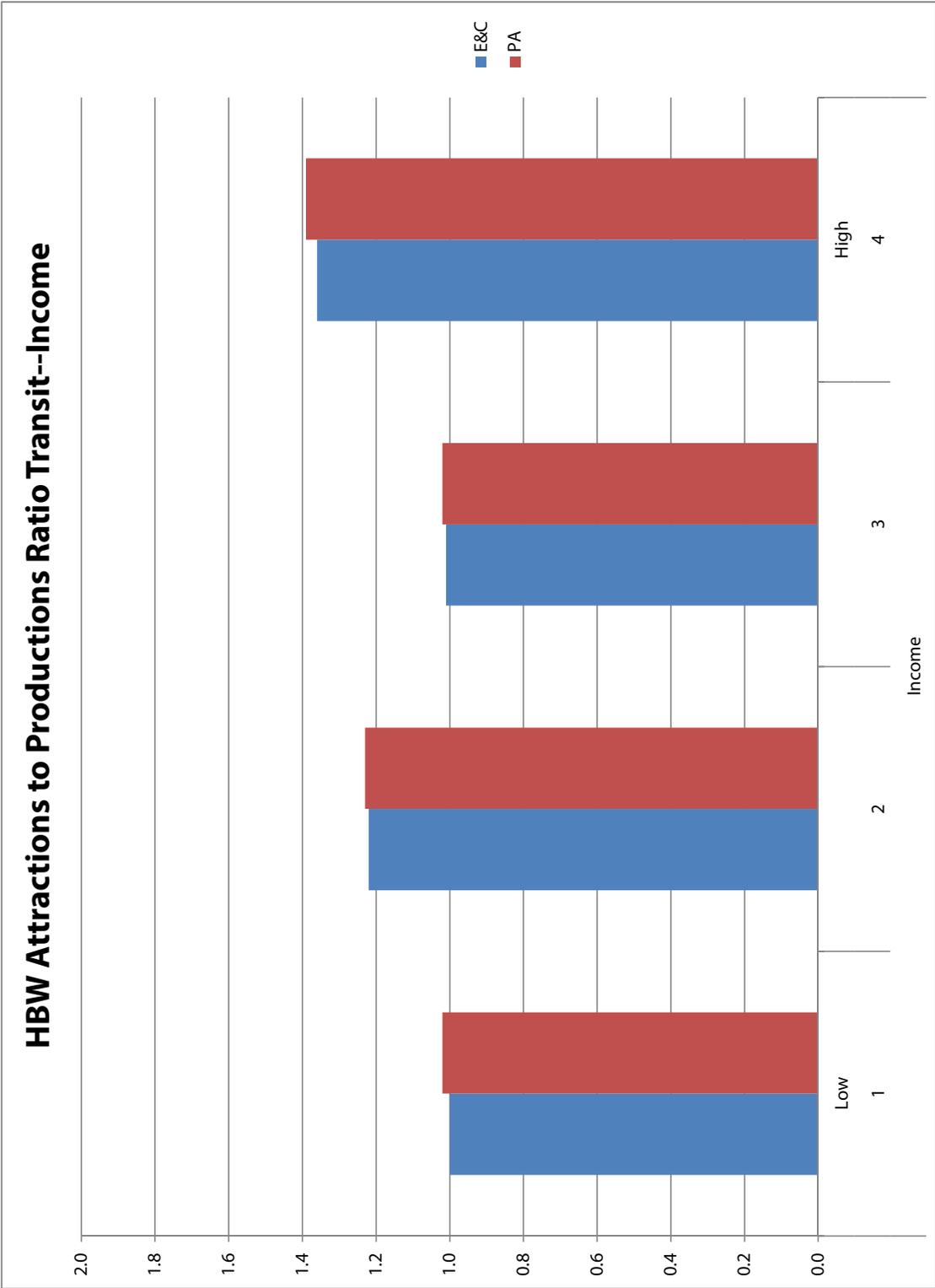
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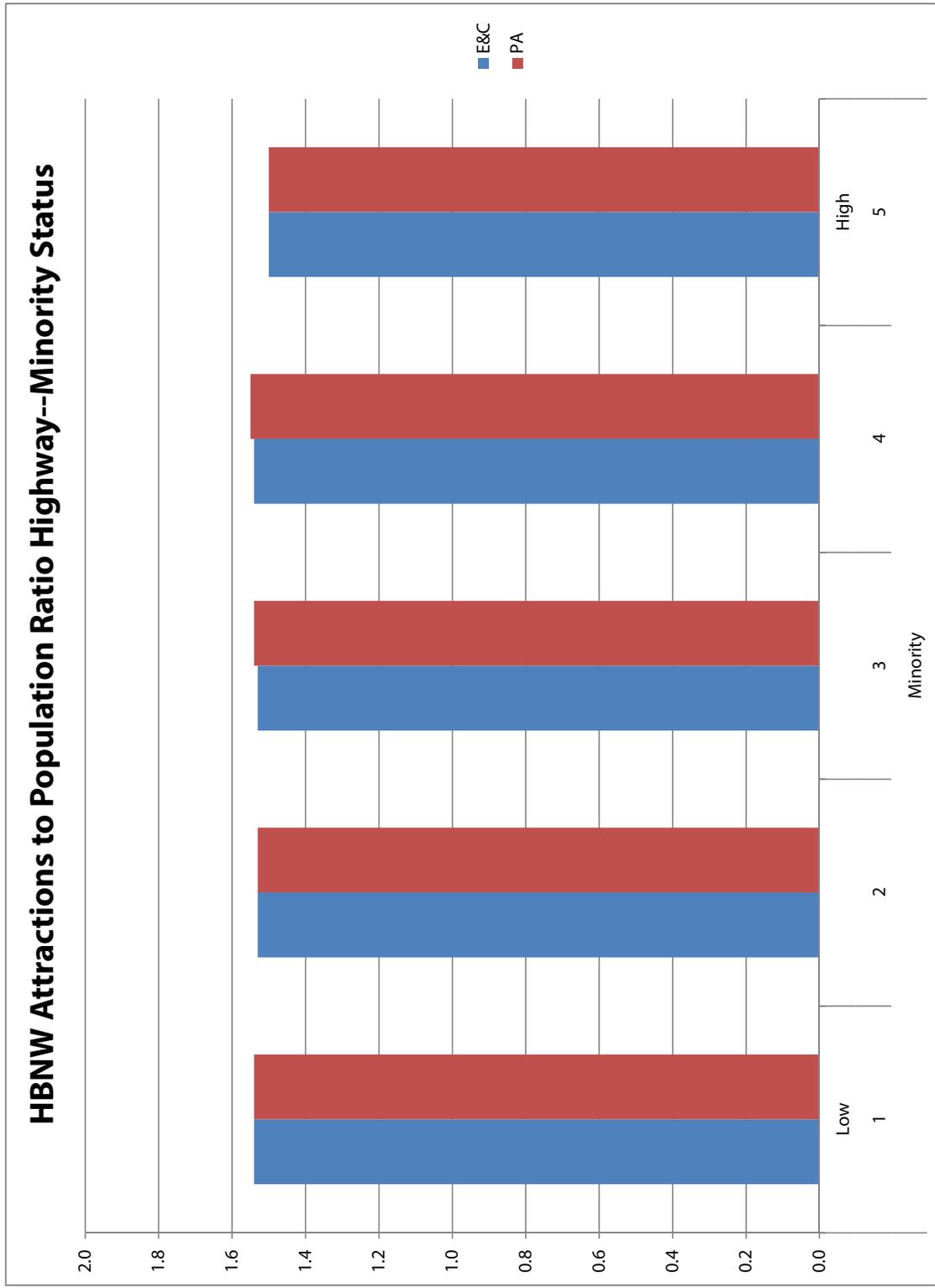


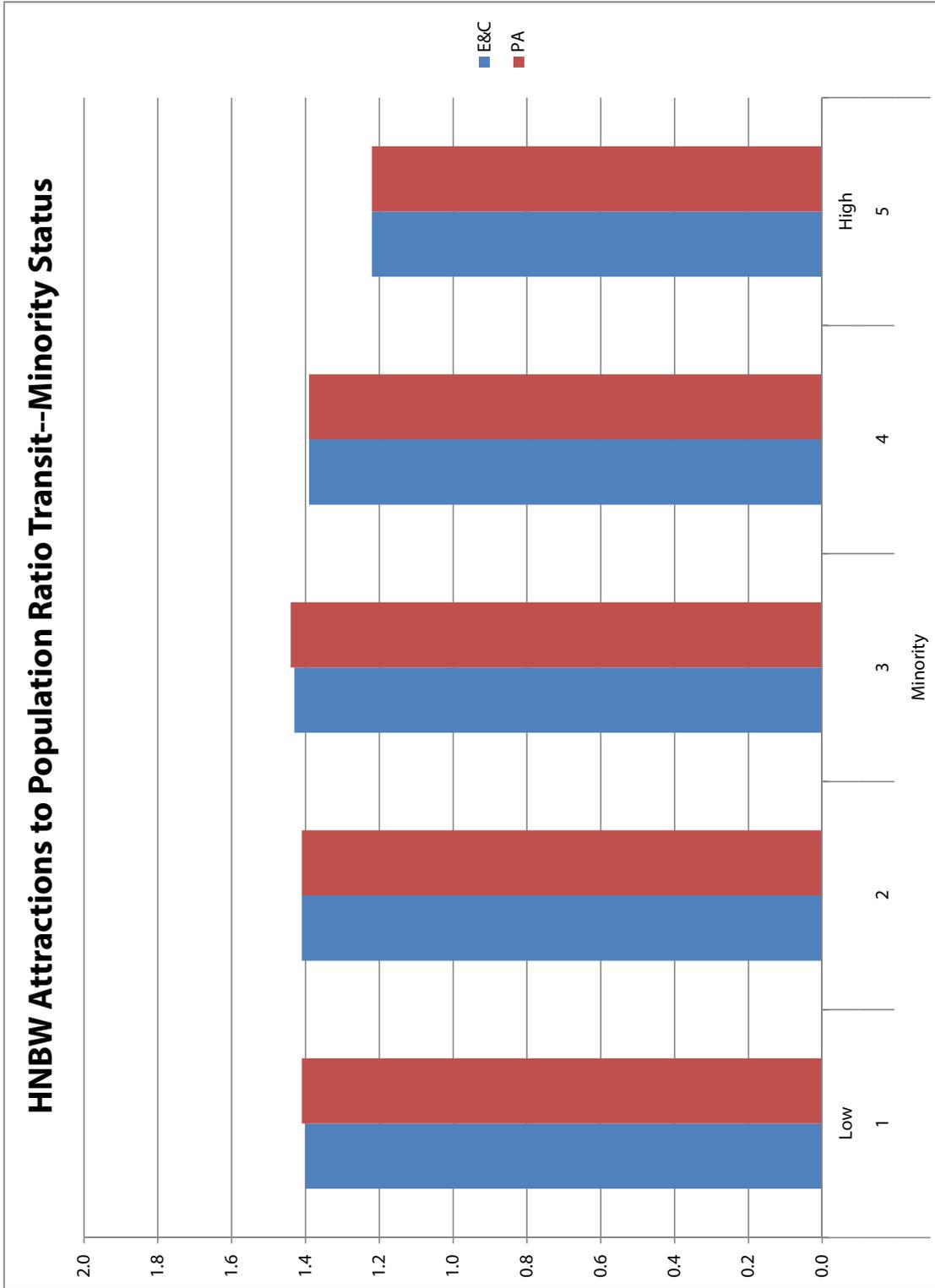
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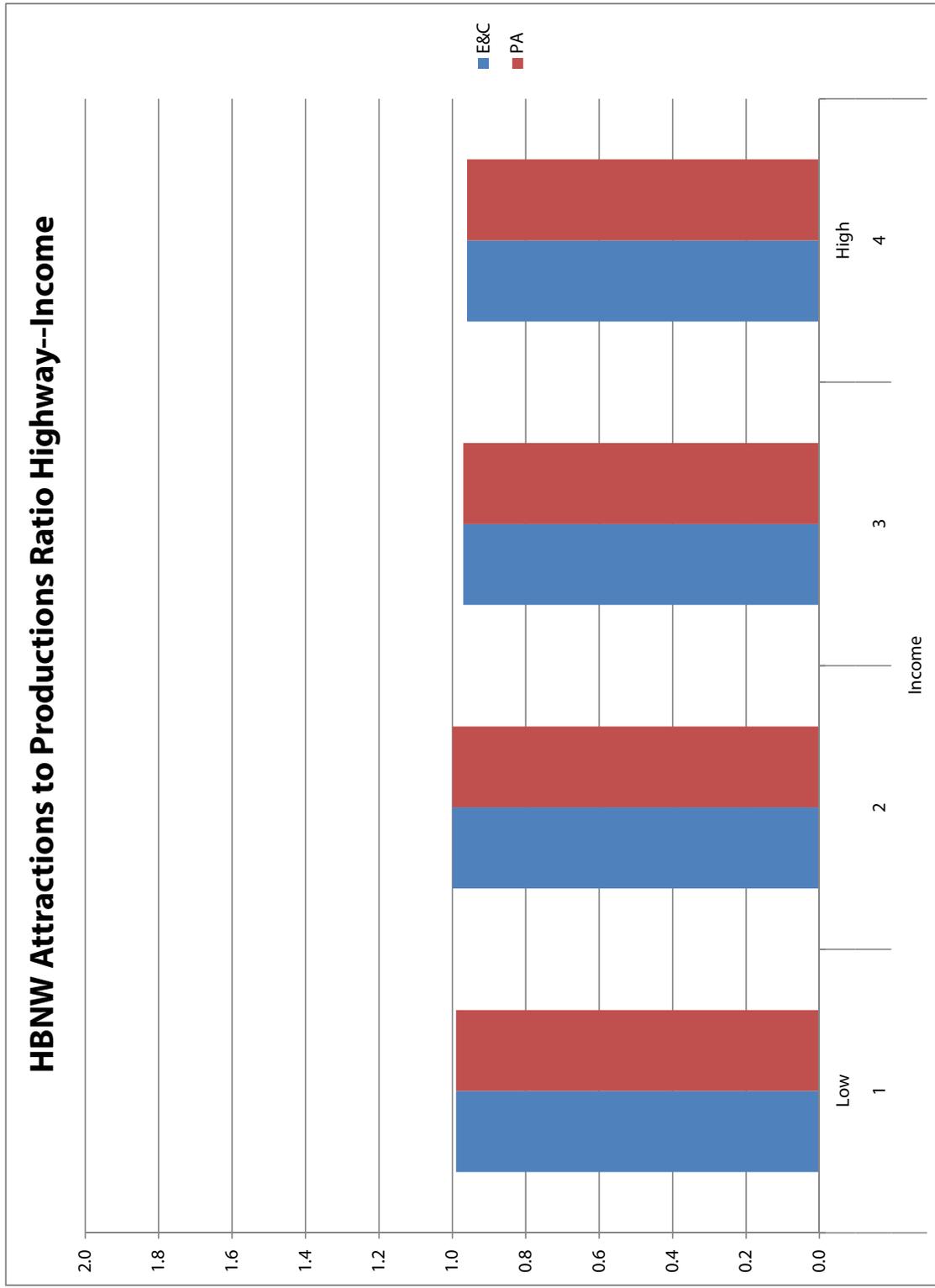


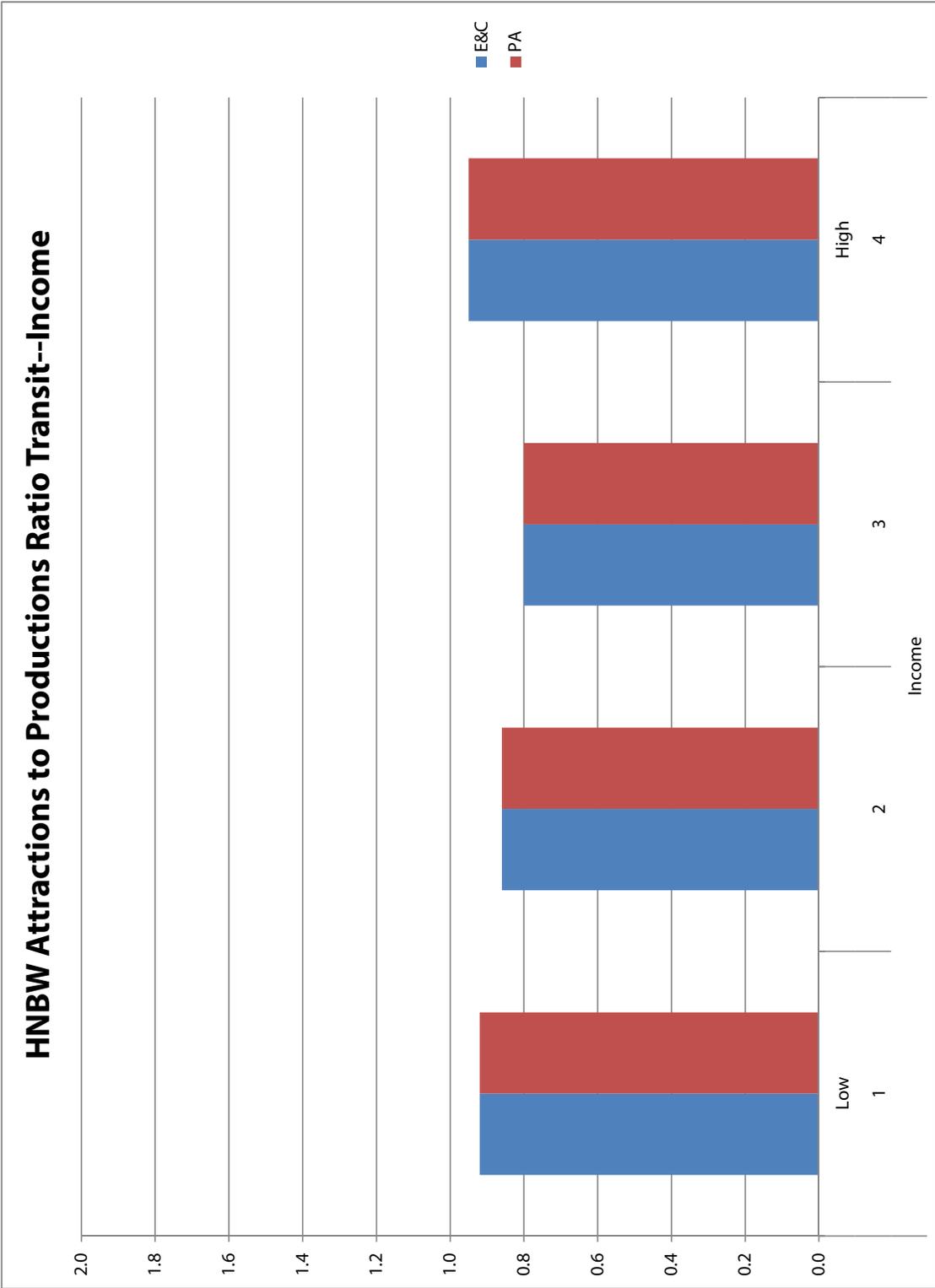
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Results of Environmental Justice Analyses

Generally, the HBW analysis for racial minorities shows a slight or no improvement in the jobs to labor force ratio for the highway travel time, although the fourth highest minority share shows a slight decrease. Transit travel time shows a minor across-the-board improvement.

For HBW income analysis, there is virtually no difference in the attractions/productions ratio for highway trips, and a slight improvement in three of the income categories for transit trips.

Differences between the two scenarios (E + C projects versus E + C and Preferred Alternative projects) for HBNW trips are virtually nonexistent. Since HBNW trips utilize the uncongested travel times, it appears that the network changes in and of themselves have little effect on accessibility; it is the reduction in congestion that makes the difference, which shows up when the congested travel times are used for HBW trips.

** Overall, the analysis shows virtually no change or only a slight improvement in accessibility based on the construction of the Preferred Alternative projects. High-minority and low-income communities do not find themselves disadvantaged by the projects in Maximize2040.*

Analysis of Preferred Alternative – Natural and Cultural Resources

When agencies collaborate in their planning for the natural, cultural, and community context of the transportation system, it can lead to better results. Collaboration can lead to the avoidance or minimization of effects to important resources, improved procedures for mitigation on a regional basis, fewer project delays and re-do loops, added trust among stakeholders, and, ultimately, better transportation solutions and environmental outcomes.

MAP-21 includes legal requirements for coordination with resource agencies during planning. These requirements state that planning agencies (such as MPOs) consult with federal, state, and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation as part of the development of the long-range transportation plan. These consultations are expected to involve a comparison of transportation plans with conservation plans, maps, and inventories of natural, cultural, and historic resources. Additionally, MAP-21 requires MPO plans to include a discussion of potential environmental mitigation activities and potential areas to carry out mitigation activities based on this resource agency consultation.

The Baltimore Regional Transportation Board (BRTB) understands the potential benefits of effective coordination with resource agencies during planning. For *Maximize2040*, the BRTB has built on the previous consultation process performed for the 2011 long-range plan (known as *Plan It 2035*). For *Maximize2040*, the environmental coordination process involved greater mapping capabilities and additional communication. The goals of this coordination are to:

1. determine potential mitigation areas and types and
2. enhance the linkage between long-range transportation planning and the NEPA process.

The BRTB continues to be involved in the Interagency Review meetings, hosted by SHA and involving the resource and regulatory agencies, in order to understand and discuss potential effects of projects that are at all stages of planning. These meetings provide an opportunity for the BRTB to share projects that are very early in the planning stages with the resource and regulatory agencies. As agencies are exposed to the location and magnitude of proposed projects, an appropriate strategy can be developed that provides benefits beyond the effects of an individual activity.

Consultation to Improve Environmental Impact Mitigation

In developing this plan, the BRTB has consulted with federal, state, and local agencies responsible for land use management, natural resources, environmental protection, conservation, and historic preservation. During this consultation process, involved agencies were provided opportunities for coordination at two SHA-led interagency review meetings in the summer of 2015, as well as communications through phone calls, emails, and the online interactive mapping application. The online interactive mapping application was created to conduct a broad analysis comparing proposed projects with resources in the area. The following resources have been mapped with the proposed projects and shared with coordinating agencies:

- Maryland Department of Natural Resources Protected Lands (Maryland Agricultural Land Preservation Foundation Districts, Rural Legacy Areas, Maryland Environmental Trust Easements, Forest Legacy Easements, DNR Lands, County Parks, Federal Lands, Private Conservation Properties)
- Greenways
- Maryland Green Infrastructure Network
- Chesapeake Bay Critical Area
- Impaired Watersheds
- National Register of Historic Places
- Maryland Inventory of Historic Properties
- Maryland Department of Planning Land Use / Land Cover Data
- Sensitive Species Project Review Areas
- Wetlands of Special State Concern
- Sea Level Rise

Through these comparisons, and ongoing conversations with resource/regulatory agencies, this environmental consultation process creates the opportunity to bring issues to light in advance of project planning. Analysis of natural and historic resources becomes very detailed at the short-range project planning level, so it is important to provide an opportunity during long-range transportation planning for broad-based discussions of resources that consider all proposed projects.

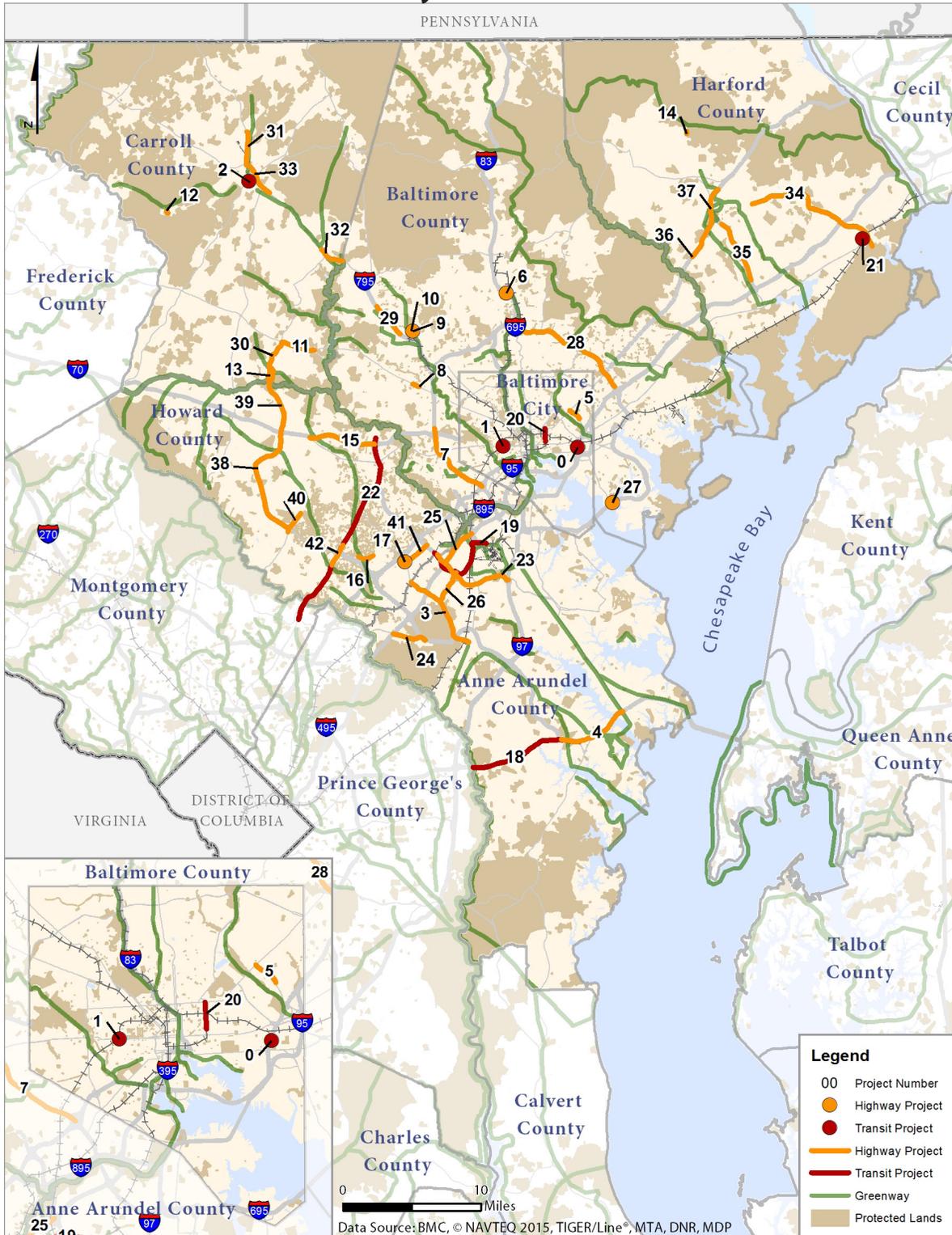
In addition to the mapping information listed above, the U.S. Fish and Wildlife Service (FWS) provides a website: Information for Planning and Conservation (IPaC). IPaC is a tool designed to streamline the FWS review process. It can provide an initial project scoping of threatened or endangered species, critical habitat, migratory birds, or other natural resources. Staff will explore this service further in the future with regard to long-range transportation planning. Staff also will explore in the future the possibility of mapping the National Wetlands Inventory with plan projects.

The following maps have been created for this analysis process. The maps, as shown here, display a comparison of highway and transit projects in the Preferred Alternative with resource data.

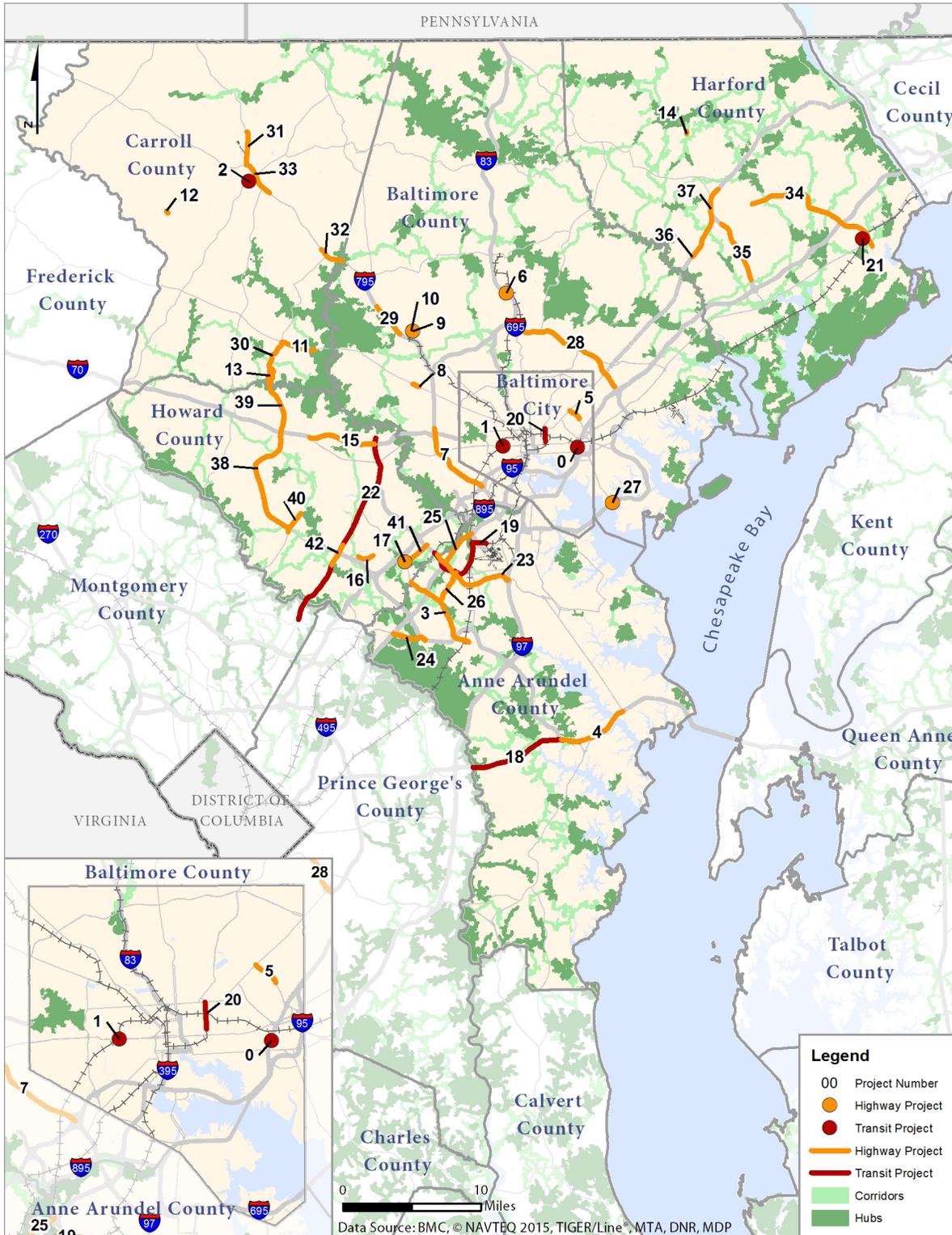


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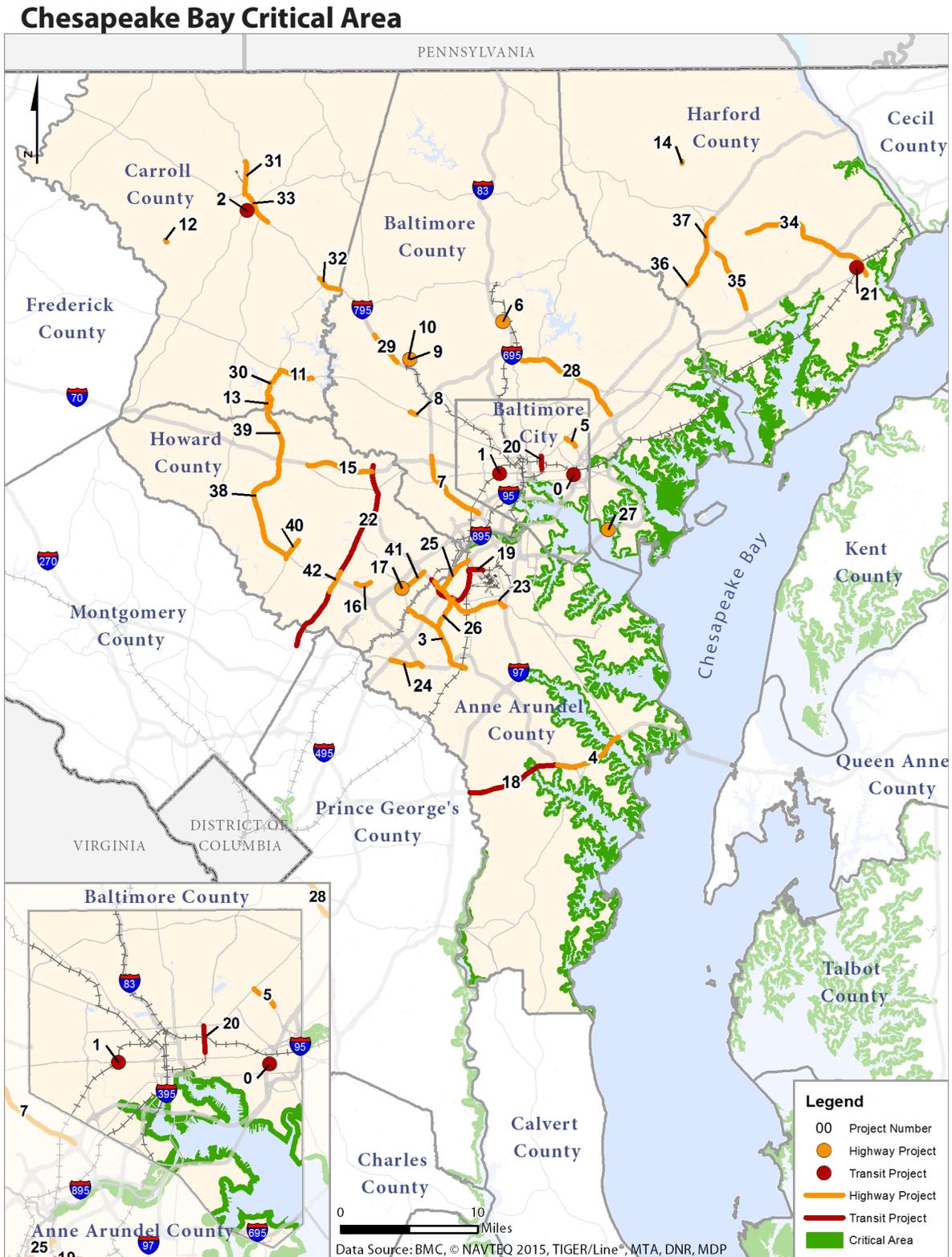
Protected Lands and Greenways



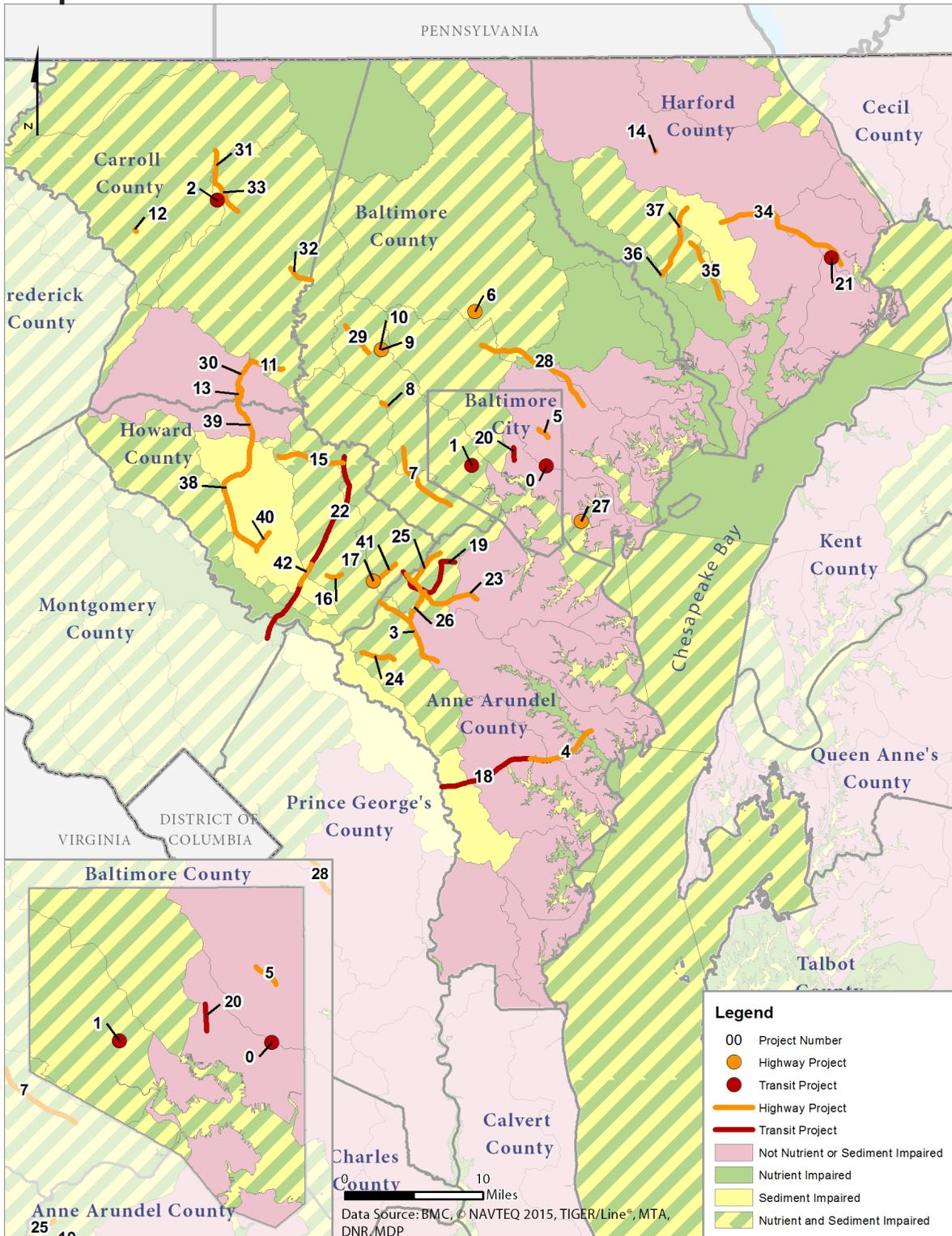
Green Infrastructure Network



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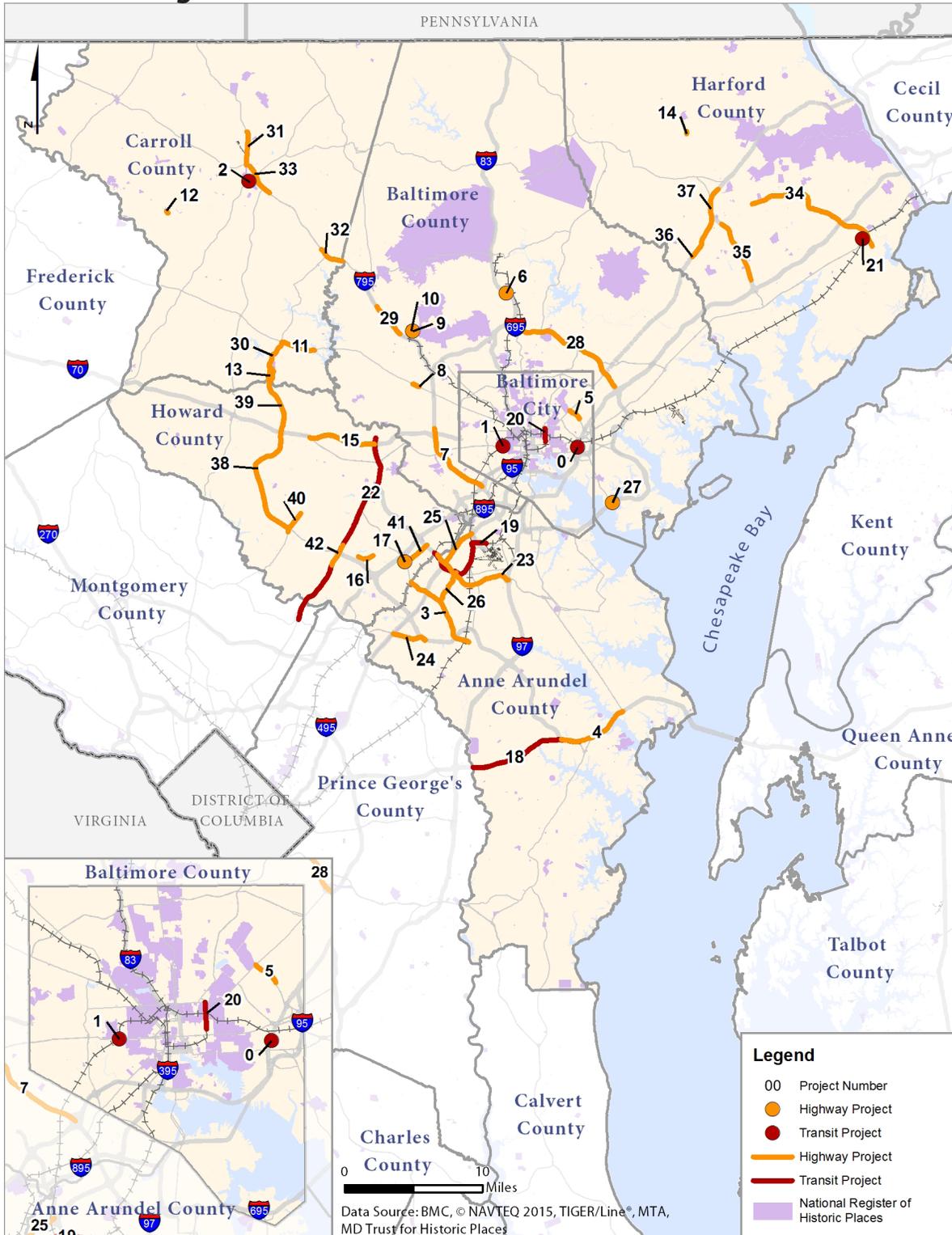


Impaired Watersheds

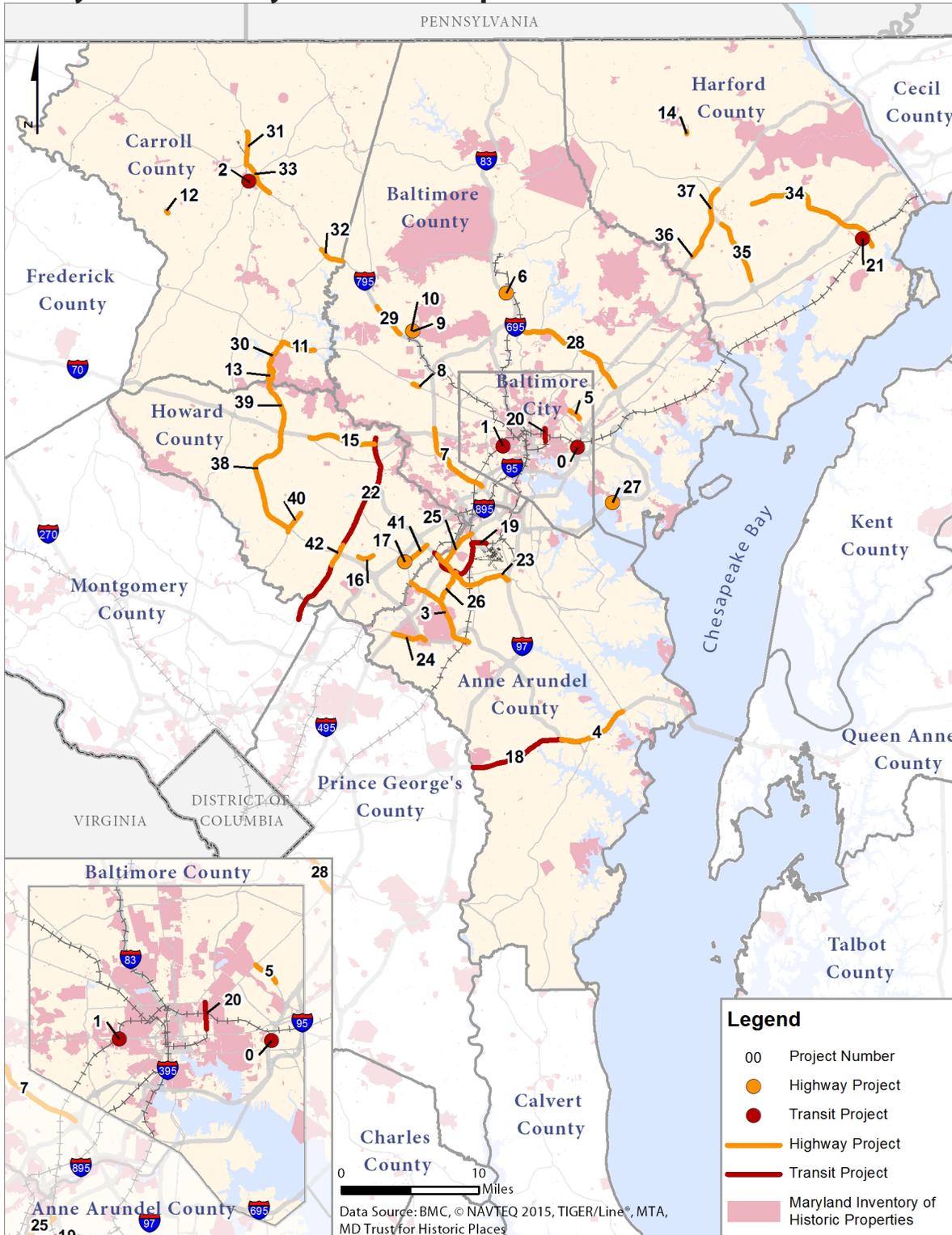


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National Register of Historic Places

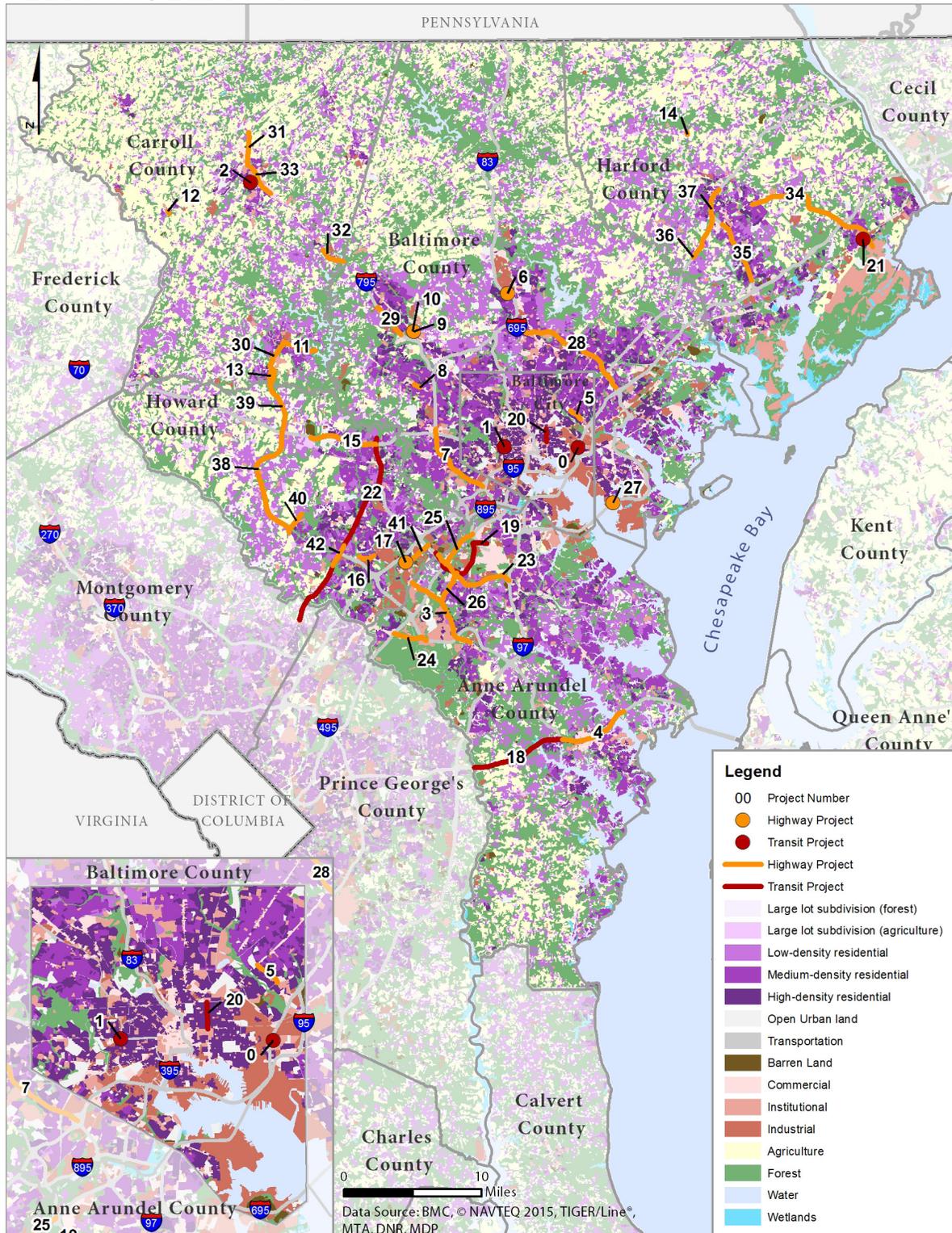


Maryland Inventory of Historic Properties

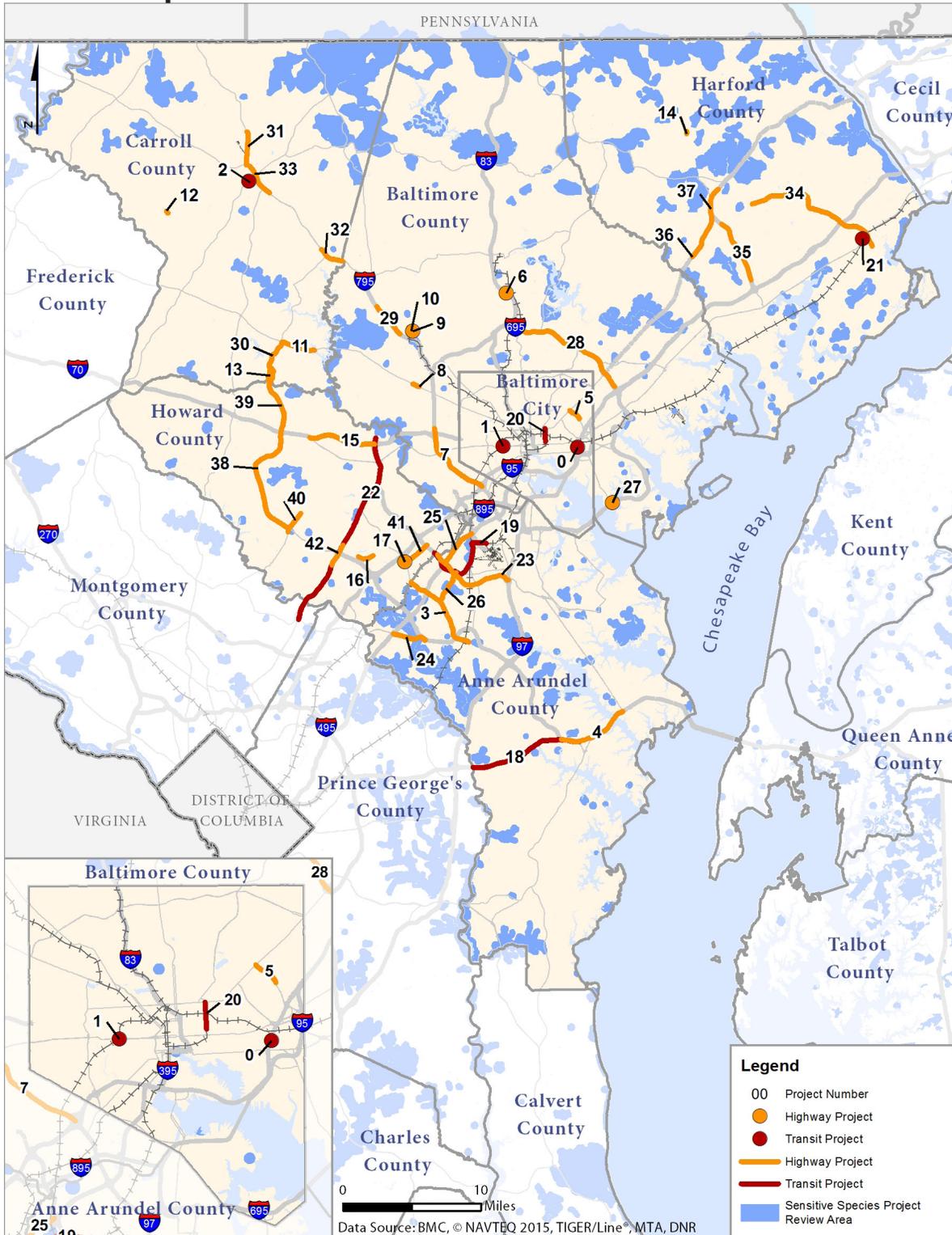


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Land Use / Land Cover

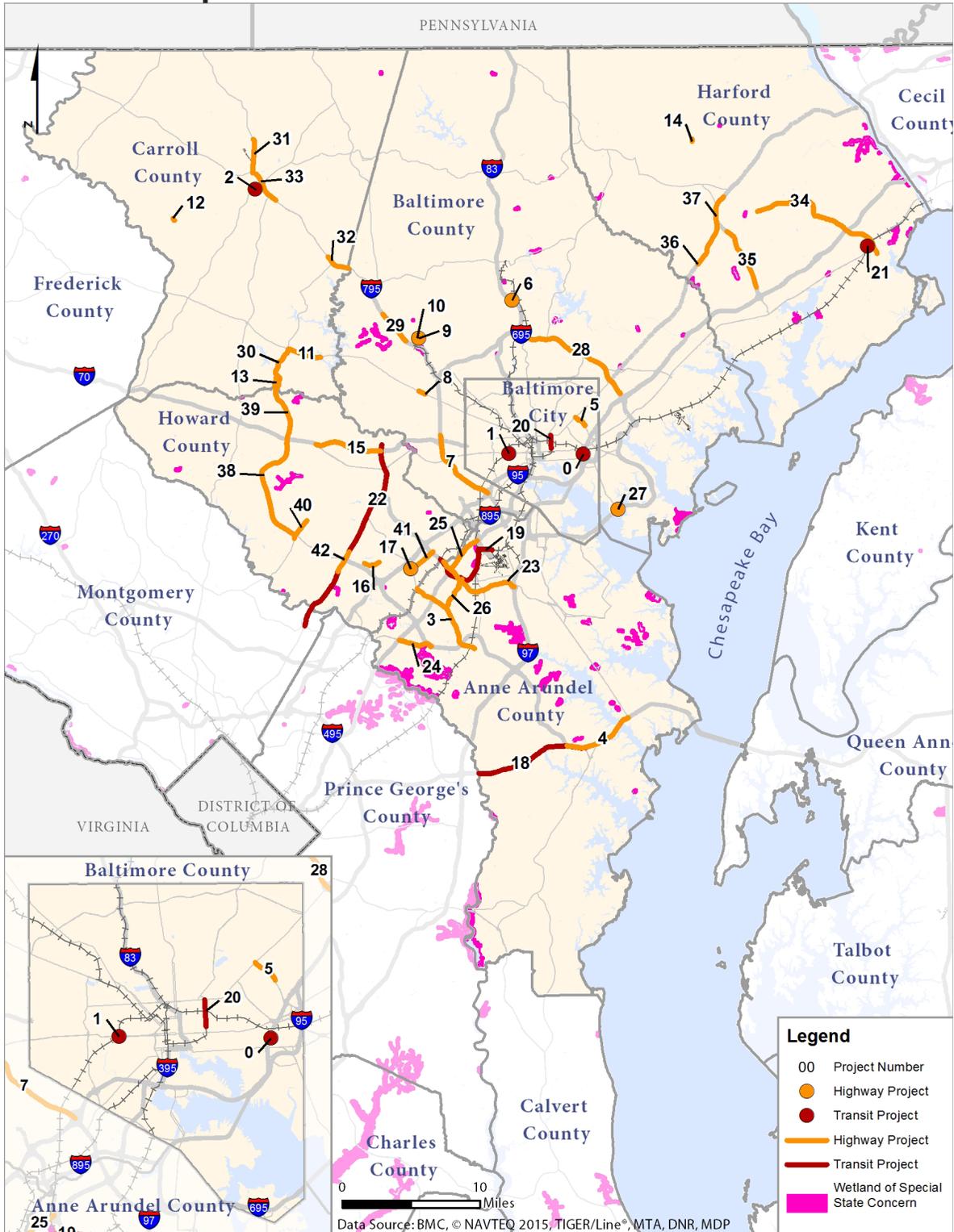


Sensitive Species

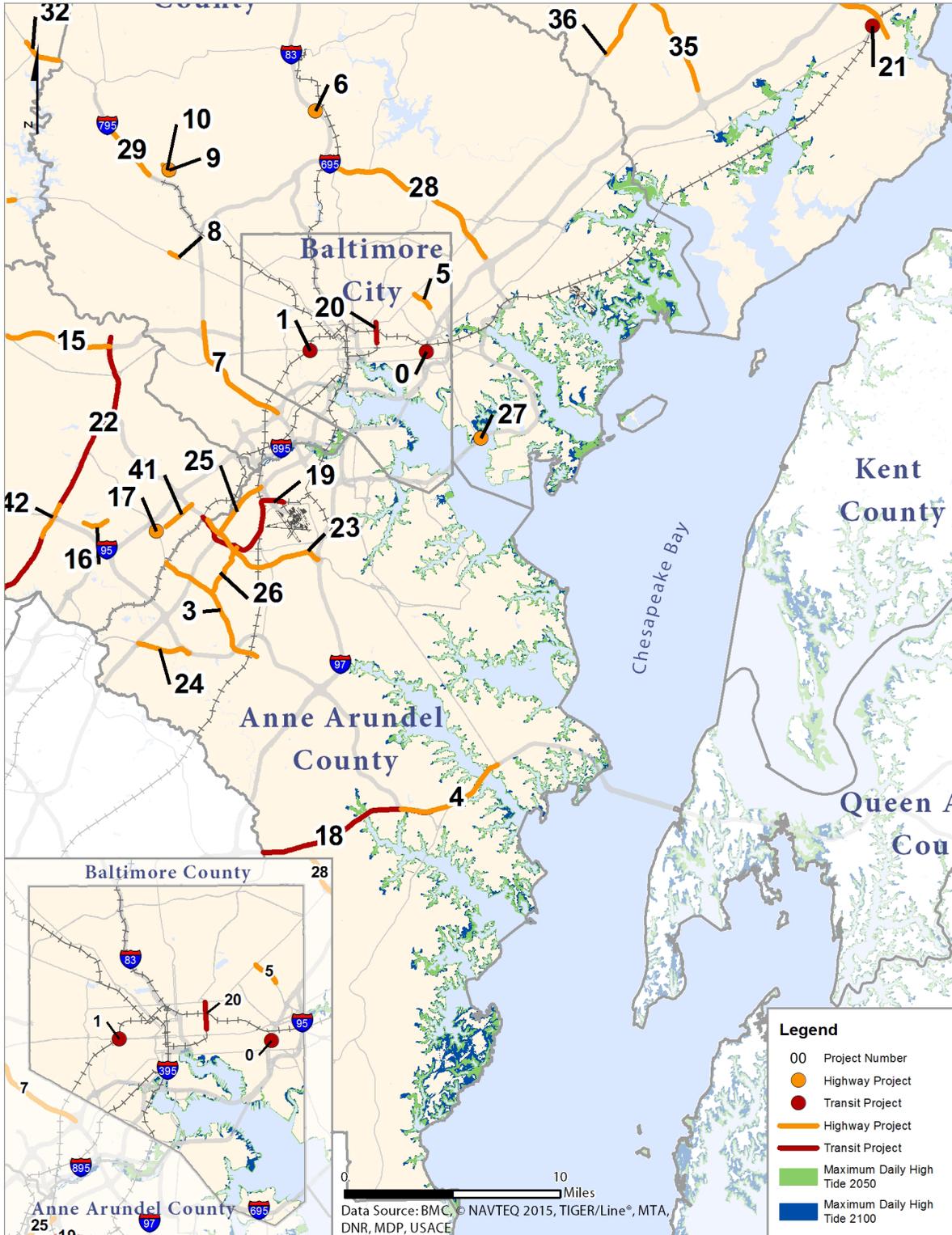


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Wetlands of Special State Concern



Sea Level Rise – Coastal Areas



Appendix G: Effects of Projects and Programs

The project planning process, which involves NEPA, is heavily detailed and time consuming. Performing coordination and discussing regional mitigation opportunities ahead of time is meant to improve process efficiency and identify any regional mitigation goals. The environmental coordination process will continue through the partnerships that have been made during this analysis process. Bringing together environmental concerns and regional mitigation planning into the long-range planning process is the ultimate goal.

Specific Impact Mitigation Strategies and Measures

The purpose of considering mitigation early in the long-range planning process is to focus attention on regional level conservation and restoration needs. This focus provides a context into which later decisions on specific mitigation concepts and strategies can be developed during the later project development process. The table below displays resource types along with corresponding legislation that provides protection and possible mitigation strategies and measures that could be applied during later project development.

Examples of Mitigation Measures		
Resource	Examples of Mitigation Measures	Regulation
Parks and Recreation Areas	For publicly-owned parks, replace land with land of equivalent value and equivalent location; Replace impacted facilities; Restore and landscape disturbed area	Section 4(f) of the U.S. Department of Transportation Act
Wildlife and Waterfowl Refuges	For publicly owned refuges, replace land with land of equivalent value and equivalent location; Incorporate habitat features	Section 4(f) of the U.S. Department of Transportation Act
Cultural Resources	Vegetative buffer screening; Measures to preserve a site's historic integrity; Project review/Memorandum of Agreement with Maryland's State Historic Preservation Office; Ensure compatibility with Certified Heritage Area management plans	Section 4(f) of the U.S. Department of Transportation Act; Section 106 of the National Historic Preservation Act
Water Resources and Wetlands	Mitigation for wetland and waterway impacts includes creation, restoration, preservation, enhancement, or monetary compensation. Site-specific stormwater management plans; use low-impact development (LID) stormwater design; BMP tracking; stormwater discharge monitoring; design of stormwater management capacity for new impervious surfaces, as well as existing; water quality banking program with MDE; sediment control during construction	Rivers and Harbors Act of 1899; Clean Water Act; COMAR Title 08.05, Water Resources Administration, Nontidal Wetlands; COMAR Title 9, Wetlands and Riparian Rights (Tidal Wetlands); 2000 Maryland Stormwater Design Manual (with 2009 Environmental Site Design Revisions); Maryland Phase II Watershed Implementation Plan for the Chesapeake Bay TMDL

Examples of Mitigation Measures

Resource	Examples of Mitigation Measures	Regulation
Endangered and Threatened Species	Mitigation may include placing conservation easements on properties occupied by the species, expanding/linking habitat areas through habitat creation areas, or enhancing low quality habitat	Endangered Species Act
Forests	Forest replacement on a 1:1 basis, for construction activities.	Maryland Reforestation Law, Forest Conservation Act
Chesapeake and Atlantic Coastal Bays Critical Area	Replace forests in the Critical Area on not less than an equal area basis. Mitigation typically includes installation of native shrub and tree species prioritizing on-site locations before moving off-site (within the same impacted watershed and county.) Techniques must be used to reduce stormwater runoff pollutant loading. The techniques must be capable of reducing pollutant loads generated from a developed site to a level at least 10% below the loads generated at the same site prior to development.	Critical Area Act (1984); COMAR 27.01.02.04
Nontidal Wetlands of Special State Concern	Mitigation for wetland impacts includes creation, restoration, preservation, enhancement, or monetary compensation. Acreage replacement ratios vary depending on wetland and mitigation type.	COMAR 26.23.06.01-.02
Prime Farmland Soils	A farmland conversion impact rating form is completed for major capital projects. The resulting score is intended for use as an indicator for the project sponsor to consider alternative sites if the potential adverse impacts on the farmland exceed the recommended allowable level.	Farmland Protection Policy Act

Mitigation of Natural Resource Impacts

When SHA is issued authorizations from the Maryland Department of the Environment (MDE) and the U.S. Army Corps of Engineers (COE) for activities which will cause unavoidable losses of wetlands, those impacts must be compensated for through wetland mitigation. Wetland mitigation is the creation, restoration, enhancement, and preservation of wetlands lost due to regulated maintenance and construction project activities. In order to meet the “no net loss” goals of MDE and the COE, SHA generally mitigates at a 2:1 ratio for shrub/scrub and forested wetlands, and at a 1:1 ratio for emergent wetlands for most impacts to wetlands by highway projects.

The COE compensatory mitigation rule was approved in 2008. The rule establishes a preference hierarchy for mitigation options (i.e., mitigation bank credits, in-lieu fee program credits, and

Appendix G: Effects of Projects and Programs

permittee-responsible mitigation projects). The permittee may use any of these three options to mitigate for project impacts. However, the COE preference is the use of mitigation banks.

Meeting the Chesapeake Bay TMDL

The U.S. EPA has issued a “pollution diet” or Total Maximum Daily Load (TMDL) for water going into the Chesapeake Bay. With the TMDL, and the resulting Maryland Watershed Implementation Plan (WIP), caps are set on levels of phosphorus, nitrogen, and sediment going into watershed segments of the Bay. As just one part of the Phase I WIP developed by the state of Maryland, SHA is required to treat water pollution from 20 to 30 percent of impervious surfaces that were constructed prior to 1985 by 2017. This level of required treatment is significant, and is expected to result in a dramatic level of new stormwater treatment in the state and the Baltimore region. Other transportation modal administrations in the state, such as MDTA and MTA, are to provide a certain level of treatment as well.

Ongoing and Future SHA Mitigation Strategies

Moving forward, SHA is working closely with the state and federal review agencies, local planning groups, the business community, environmental organizations, the general public, and other stakeholders, engaging in several other wetland and stream mitigation strategies. The watershed approach, wetland banking, and advanced mitigation (mitigation constructed in advance of the highway improvements) are just a few examples of what is anticipated. With the new mitigation rules in place, mitigation will be pursued earlier in the project development process, through a watershed approach, utilizing new tools such as the Watershed Resources Registry found at www.watershedresourcesregistry.com. The watershed approach is described below.

The watershed approach to compensatory mitigation is a flexible approach that encourages various partnerships between all state and federal review agencies, local planning and regional planning organizations, as well as the general public. This approach involves assessing the needs of the watershed in a comprehensive manner that allows planners and review agencies to determine the improvements that are most needed with a particular watershed and sub-watersheds. Areas targeted for improvement may include water quality and quantity, stormwater runoff, riparian buffer, stream restoration, wetland creation and restoration, wildlife habitat creation and restoration, fish passage, reforestation, etc. The watershed approach balances the needs of the watershed by often using out-of-kind mitigation strategies that would be most beneficial based upon those identified needs. By identifying the most needed improvements within a given watershed, SHA and its partners can create a priority list of mitigation strategies that can serve as a long-term plan for the overall improvement to the watershed. SHA uses the Watershed Resources Registry to assess the improvement needs of the watersheds potentially impacted by highway projects. This registry includes DNR’s Green Infrastructure Network and is consistent with FHWA’s Eco-logical Approach.

Although these projects are not in the Baltimore region of Maryland, SHA used the watershed approach on such large and complex projects as the InterCounty Connector (ICC) in Montgomery and Prince George’s counties and the U.S. 301 Transportation Study in Charles County. SHA also employs similar watershed approaches to mitigation on smaller projects in its design and construction program.