

SUBMITTED BY:  
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# I-270/I-495 HOT LANES INDEPENDENT ECONOMIC ASSESSMENT

FOR MARYLAND DEPARTMENT OF TRANSPORTATION | SEPTEMBER 2019

## TABLE OF CONTENTS

TABLE OF CONTENTS .....	2
LIST OF FIGURES.....	4
LIST OF TABLES .....	8
LIST OF ACRONYMS .....	1
Executive Summary .....	2
Introduction .....	3
Study Purpose.....	3
Study Context.....	4
Study Approach.....	5
Primary Market Area Definition .....	6
Assessment of Growth Trends.....	11
Historic Regional Growth Trends .....	11
Historic National Growth Trends .....	35
Amazon HQ2.....	41
Key Findings.....	48
Independent Analysis of Growth Trends.....	54
Cohort-Component Method.....	54
Shift-Share Analysis .....	58
Blended Forecasts .....	60
Population Forecasts.....	60
Employment Forecasts.....	68
Final Baseline Jurisdictional Control Totals.....	77

Suballocation .....	80
Demand Factors .....	80
Capacity .....	95
Demand Scores and TAZ Growth Estimates .....	96
Localized Adjustments .....	96
Allocation Results .....	97
Scenario Sensitivity Testing.....	132
Low Scenario.....	132
High Scenario.....	140
2060 Forecast .....	147

## LIST OF FIGURES

Figure 1   MWCOG/TPB Jurisdictions and Travel Model Area .....	4
Figure 2   Primary Market Area Definition .....	6
Figure 3   Primary Market Area's Key Activity Centers .....	8
Figure 4   MWCOG Region Employment by Job Type, 1969-2016 .....	14
Figure 5   Diversity of Ten Largest Traded Sector Job Clusters, 2005 .....	15
Figure 6   Diversity of Ten Largest Traded Sector Job Clusters, 2015 .....	16
Figure 7   Federal Employment by Jurisdiction, 2001-2016 .....	17
Figure 8   Number of Professional Services Jobs by Jurisdiction, 2001-2016 .....	18
Figure 9   Cost of Living Comparison .....	21
Figure 10   Regional Per Capita Income, 2005-2015 .....	22
Figure 11   Median Household Income, 2017 .....	23
Figure 12   Median Year Structure Built - Residential .....	24
Figure 13   Primary Market Area Jurisdiction Population Trends, 1969-2017 .....	26
Figure 14   Primary Market Area Jurisdiction Employment Trends, 1969-2017 .....	27
Figure 15   Development Intensity, 2016 .....	28
Figure 16   Land Cover – Percent Undeveloped and Unprotected .....	30
Figure 17   Average Office Lease Size by Class Type, 2004-2014 .....	32
Figure 18   Average Office Lease Size by Industry Type, 2004-2014 .....	33
Figure 19   Historic D.C. Regional and National Population, 1969-2016 .....	36
Figure 20   Year-to-Year Percent Change in National and D.C. Regional Population, 1970-2016 .....	37
Figure 21   Year-to-Year Percent Projected National Population Change, 2015-2040 .....	38
Figure 22   D.C. Regional and National Employment, 1969-2016 .....	39
Figure 23   Percent Change in D.C. Regional and National Employment, 1970-2016 .....	40
Figure 24   Amazon HQ2 Employment Timeline .....	41
Figure 25   Major Transit Projects in the Region .....	50
Figure 26   Regional Jurisdiction Tiers .....	51
Figure 27   Description of Regional Tiers .....	52
Figure 28   U.S. Fertility Rate Trend, 1940-2017 .....	55
Figure 29   Social Security Administration Life Expectancy Tables for the U.S., 1900-2100 .....	56
Figure 30   Components of Shift Share Analysis .....	58



Figure 31   Arlington County, VA Population Forecasts.....	61
Figure 32   City of Alexandria, VA Population Forecasts .....	62
Figure 33   District of Columbia Population Forecasts .....	63
Figure 34   Fairfax County, VA Population Forecasts .....	64
Figure 35   Montgomery County, MD Population Forecasts .....	65
Figure 36   Prince George’s County, MD Population Forecasts .....	66
Figure 37   Arlington County, VA Employment Forecasts.....	69
Figure 38   City of Alexandria, VA Employment Forecasts .....	70
Figure 39   District of Columbia Employment Forecasts .....	71
Figure 40   Fairfax County, VA Employment Forecasts .....	72
Figure 41   Montgomery County, MD Employment Forecasts .....	73
Figure 42   Prince George’s County, MD Employment Forecasts .....	74
Figure 43   Auto Accessibility to Jobs, 2019 .....	82
Figure 44   Auto Accessibility to Jobs, 2040 .....	83
Figure 45   Auto Accessibility to Population, 2019 .....	84
Figure 46   Auto Accessibility to Population, 2040 .....	85
Figure 47   Transit Accessibility to Jobs, 2019.....	86
Figure 48   Transit Accessibility to Jobs, 2040.....	87
Figure 49   Transit Accessibility to Population, 2019 .....	88
Figure 50   Transit Accessibility to Population, 2040 .....	89
Figure 51   Floating Point Activity Unit Density, 2015 .....	90
Figure 52   Land Cover - Percent Developed – High Intensity.....	91
Figure 53   Land Cover - Percent Developed – Medium Intensity .....	92
Figure 54   Existing Fixed Guideway Transit, 2017.....	93
Figure 55   Activity Centers.....	94
Figure 56   Renaissance Forecast Population Density, 2017 .....	102
Figure 57   Renaissance Forecast Employment Density, 2017 .....	103
Figure 58   Renaissance Forecast Activity Unit Density, 2017 .....	104
Figure 59   Renaissance Forecast Population Density, 2025 .....	105
Figure 60   Renaissance Forecast Employment Density, 2025 .....	106
Figure 61   Renaissance Forecast Activity Unit Density, 2025 .....	107
Figure 62   Renaissance Forecast Population Density, 2035 .....	108

Figure 63   Renaissance Forecast Employment Density, 2035 .....	109
Figure 64   Renaissance Forecast Activity Unit Density, 2035 .....	110
Figure 65   Renaissance Forecast Population Density, 2045 .....	111
Figure 66   Renaissance Forecast Employment Density, 2045 .....	112
Figure 67   Renaissance Forecast Activity Unit Density, 2045 .....	113
Figure 68   MWCOCG Population Density Growth, 2017-2045.....	114
Figure 69   Renaissance Population Density Growth, 2017-2045 .....	115
Figure 70   MWCOCG Employment Density Growth, 2017-2045.....	116
Figure 71   Renaissance Employment Density Growth, 2017-2045 .....	117
Figure 72   MWCOCG Activity Unit Density Growth, 2017-2045.....	118
Figure 73   Renaissance Activity Unit Density Growth, 2017-2045.....	119
Figure 74   MWCOCG Population Growth, 2017-2045.....	120
Figure 75   MWCOCG Employment Growth, 2017-2045.....	121
Figure 76   Renaissance Population Growth, 2017-2045 .....	122
Figure 77   Renaissance Employment Growth, 2017-2045 .....	123
Figure 78   Difference between Renaissance and MWCOCG Population, 2017.....	124
Figure 79   Difference between Renaissance and MWCOCG Employment, 2017.....	125
Figure 80   Difference between Renaissance and MWCOCG Population, 2025.....	126
Figure 81   Difference between Renaissance and MWCOCG Employment, 2025.....	127
Figure 82   Difference between Renaissance and MWCOCG Population, 2035.....	128
Figure 83   Difference between Renaissance and MWCOCG Employment, 2035.....	129
Figure 84   Difference between Renaissance and MWCOCG Population, 2045.....	130
Figure 85   Difference between Renaissance and MWCOCG Employment, 2045.....	131
Figure 86   Baseline and Low Forecast Comparison - Population, 2017-2045.....	134
Figure 87   Baseline and Low Forecast Comparison - Employment, 2017-2045.....	135
Figure 88   Low Scenario 2045 Population – Difference from Baseline.....	138
Figure 89   Low Scenario 2045 Employment – Difference from Baseline.....	139
Figure 90   Baseline and High Forecast Comparison – Population, 2017-2045 .....	141
Figure 91   Baseline and High Forecast Comparison – Employment, 2017-2045 .....	142
Figure 92   High Scenario 2045 Population – Difference from Baseline .....	145
Figure 93   High Scenario 2045 Employment – Difference from Baseline .....	146
Figure 94   2060 Population Density .....	148

Figure 95   Population Density Change, 2045-2060 .....	149
Figure 96   2060 Employment Density .....	150
Figure 97   Employment Density Change, 2045-2060 .....	151

## LIST OF TABLES

Table 1   Primary Market Area Key Activity Centers .....	9
Table 2   Washington Metro Area Jobs by Industry, 2018 .....	12
Table 3   Proportion of MWCOC Region Employment by Job Type, 1969 and 2016 .....	13
Table 4   Round 9.1 Job Forecasts for National Landing Combined Activity Centers .....	43
Table 5   Amazon HQ2 Direct Employment Growth Estimate.....	43
Table 6   State-Level Adjustment Factors .....	57
Table 7   2045 Population Forecast by Source and Jurisdiction .....	67
Table 8   2045 Employment Forecasts by Source and Jurisdiction .....	76
Table 9   Baseline Population Control Totals, 2017-2045.....	78
Table 10   Baseline Employment Control Totals, 2017-2045.....	79
Table 11   Demand Factors in Suballocation .....	81
Table 12   Notable Localized Adjustments in the Primary Market Area .....	98
Table 13   Baseline Forecast of Population and Employment by Jurisdiction, 2017-2045 .....	99
Table 14   MWCOC Cooperative Forecast Round 9.1.....	100
Table 15   Difference between Renaissance Baseline Forecast and MWCOC Cooperative Forecast Round 9.1 .....	101
Table 16   Low Scenario Forecast of Population and Employment by Jurisdiction, 2017-2045 .....	136
Table 17   Difference between Low and Baseline Scenario Forecasts of Population and Employment by Jurisdiction, 2017-2045...	137
Table 18   High Scenario Forecast of Population and Employment by Jurisdiction, 2017-2045.....	143
Table 19   Difference between High and Baseline Scenario Forecasts of Population and Employment by Jurisdiction, 2017-2045..	144



## LIST OF ACRONYMS

AAGR – Average Annual Growth Rate  
BEA – Bureau of Economic Analysis  
BLS – Bureau of Labor Statistics  
BRAC – Base Realignment and Closure  
BRT – Bus Rapid Transit  
CAGR – Compound Annual Growth Rate  
CBD – Central Business District  
HOV – High Occupancy Vehicle  
HQ2 – Amazon Second Headquarters  
LQ – Location Quotient  
MSA – Metropolitan Statistical Area  
MWCOG – Metropolitan Washington Council of Governments  
MPO – Metropolitan Planning Organization  
NAICS – North American Industry Classification System  
NAIOP – National Association of Industrial and Office Properties  
PMA – Primary Market Area  
SIC – Standard Industrial Classification  
TAZ – Transportation Analysis Zone  
TPB – Transportation Planning Board  
ULI – Urban Land Institute  
VAEDP – Virginia Economic Development Partnership  
WMATA – Washington Metropolitan Area Transit Authority

## EXECUTIVE SUMMARY

This report describes the independent economic analysis of the land use trends and forecasts affecting potential travel demand for I-270 and I-495 managed lanes projects, encompassing the portion of I-270 south of I-370 and the full extent of I-495 within Montgomery and Prince George's Counties (the Project). The study is prepared for input into travel demand forecasts using the travel model maintained by the Metropolitan Washington Council of Governments (MWCOC). The independent economic analysis therefore utilizes the data structure of the MWCOC travel demand model (TDM) in terms of traffic analysis zone (TAZ) forecasts for residential population and employment (jobs) in the region. The independent economic analysis uses both local and national data sources to develop a new set of TAZ forecasts for a series of near-term to long-term analysis years. The report describes both the process and key findings of the independent economic analysis. The key findings include:

- The I-270 and I-495 managed lane projects cast a sizeable influence on the region, with the Primary Market Area (PMA) incorporating not only Montgomery and Prince George's County, but also the District of Columbia and the city of Alexandria, Arlington County, and Fairfax County in Virginia.
- The Renaissance Planning Group (Renaissance) forecasts show about 58,000 more residents and 7,000 more jobs in 2017 than included in the MWCOC Round 9.1 forecasts, mostly within the PMA and largely a result of post-recession economic growth not reflected in the MWCOC 2017 estimates (prepared two to three years ago, depending upon the jurisdiction). By 2045, the Renaissance totals are about 120,000 residents and 25,000 jobs higher than MWCOC.
- The Renaissance forecasts generally reflect higher totals than MWCOC in the region's first-tier and second-tier jurisdictions, where walkable suburban activity centers are able to satisfy a sweet-spot that blends marketplace desires for urbanity and affordability.
- The single greatest jurisdictional difference between Renaissance and MWCOC forecast growth is in population for the District of Columbia, where the MWCOC forecasts show an average annual growth rate (AAGR) of 1.4% through 2045, yielding a 2045 population of about 984,000. The MWCOC growth rate is higher than any other core, first-tier, or second-tier jurisdiction. The Renaissance 2045 population forecast of about 890,000 reflects a 1.0% AAGR.
- The Renaissance forecasts allocate slightly less growth to the designated activity centers in the Primary Market Area, a function of both the suballocation process likelihood to recognize infill development opportunities, which are typically not explicitly identified in local jurisdiction planning processes.

# INTRODUCTION

Renaissance Planning Group (Renaissance) conducted this independent economic analysis of the validity of the socioeconomic data used with the Metropolitan Washington Transportation Planning Board travel demand model to forecast future travel demand in the Washington D.C. Metropolitan Area. The analysis includes a reasonability test of traffic analysis zone (TAZ) and countywide socioeconomic data relative to current economic conditions and trends, the availability of vacant and underutilized land, and the propensity for development and redevelopment.

Renaissance prepared countywide population and employment estimates for 2017, and forecasts for 2020, 2025, 2030, 2035 2040, 2045, and 2060 for the core and suburban jurisdictions within the Washington D.C. region as defined for the purposes of travel demand forecasting: Arlington, Clarke, Fairfax, Fauquier, King George, Loudoun, Prince William, Stafford, and Spotsylvania Counties and the Cities of Alexandria and Fredericksburg in Virginia; Anne Arundel, Calvert, Carroll, Charles, Frederick, Howard, Montgomery, Prince George's, and St. Mary's Counties in Maryland; the District of Columbia; and, Jefferson County in West Virginia. These forecasts were generated considering U.S. Census results, public and private forecasts from several sources, as well as Metropolitan Washington Council of Governments (MWCOG) Round 9.1 forecasts developed for the purposes of long-range regional land use and transportation planning. Additionally, a detailed evaluation of market conditions and socioeconomic forecasts was conducted for the Primary Market Area (PMA), comprising Arlington County, the City of Alexandria, the District of Columbia, Fairfax County, Montgomery County, and Prince George's County. This was accomplished by compiling and refining parcel-level data from various sources, deploying a land use allocation model, and identifying TAZs where our findings indicate revisions to the adopted forecasts may be warranted.

## Study Purpose

The Maryland State Highway Administration is conducting a series of traffic and revenue studies to examine the feasibility of proposed managed lanes on portions of I-495 (the Capital Beltway) and I-270, including sensitivity testing to consider conditions under several alternative land use and operational scenarios. The amount, location, and type of land development in the area affects person and vehicle trip generation, distribution, and assignment, so the land use inputs to the travel demand model are one element of the traffic and revenue forecasting process where sensitivity testing is desired, both to establish an independent assessment of baseline forecast land use totals as well as consider alternative scenarios to that baseline.

The purpose of this report is to document the analysis undertaken by Renaissance Planning Group and present the resulting jurisdictional- and TAZ-level adjustments to the Round 9.1 MWCOG Cooperative Forecasts for selected horizon years 2017, 2025,

2035, and 2045 (as well as a sensitivity test for 2060) to the adopted Round 9.1 population and employment forecasts for the Washington D.C. Metropolitan Area.

## Study Context

The Washington region has a variety of geographic definitions, depending on the charter and purpose of the defining agency. For the purposes of this report, the principal definition is that established by the Metropolitan Washington Council of Governments (MWCOCG). The National Capital Region Transportation Planning Board (TPB) is the federally designated metropolitan planning organization (MPO) for metropolitan Washington. Working with local, state, regional, and federal partners, the TPB coordinates future plans, provides data and analysis to decision makers, and coordinates regional programs to advance safety, land-use coordination, and more. The TPB is housed at and staffed by MWCOCG.

Figure 1, provided by MWCOCG, shows the relationship of the TPB member jurisdictions and the additional areas included in the current edition (Version 2.3) of the TPB travel demand model. The travel demand model area is larger than the TPB member jurisdictions to provide a buffer area between modeled external stations representing highways beyond the model area to recognize the importance of travel between the TPB region and adjacent jurisdictions. The term MWCOCG region is used throughout this report to describe the Version 2.3 model study area.

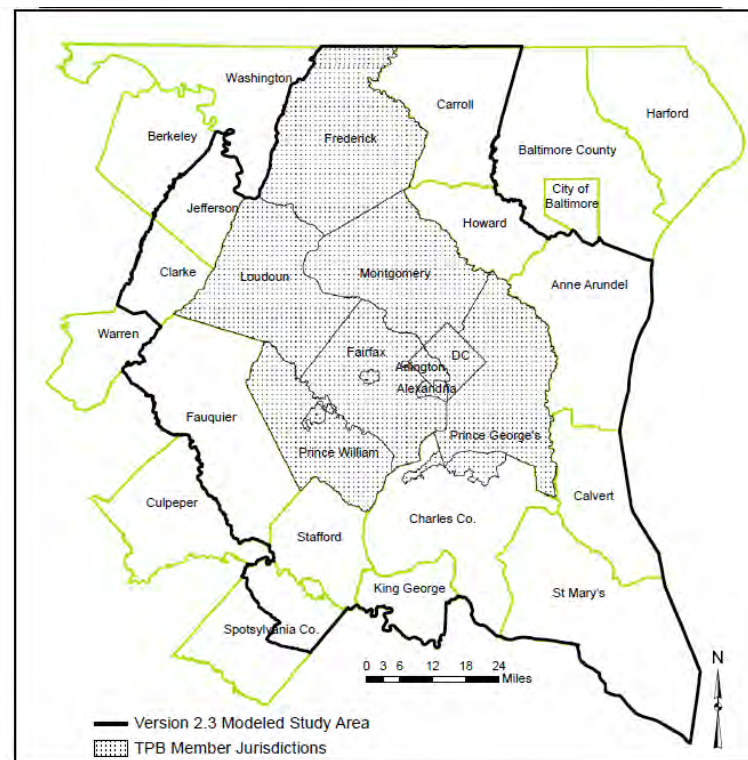


Figure 1 | MWCOCG/TPB Jurisdictions and Travel Model Area

MWCOCG is responsible for coordinating travel demand model inputs (principally land use and transportation networks) for their member jurisdictions and obtaining updated information for the non-member counties through their partner regional planning associations in Maryland, Virginia, and West Virginia. The MWCOCG Cooperative Forecasting Program provides regularly updated population, household, and employment forecasts for use in planning and modeling activities at MWCOCG and other state, regional, and local agencies. A report analyzing the round of the Cooperative Forecasts can be found here. Established in 1975, the program enables local, regional, and federal agencies to coordinate planning



activities using common assumptions about future growth and development. Each series of forecasts constitutes a “Round”, and each round covers a period of 20 to 30 years. The current set of forecasts, Round 9.1, were adopted in fall 2018.

## Study Approach

Renaissance assembled a project team of professional land use planners, development specialists, transportation planners, and geographic information systems analysts. The project team evaluated economic conditions, local market dynamics, land use patterns, land availability, and infrastructure investments that affect the long-term population and employment growth in the Washington DC Metropolitan Area. The Renaissance approach included:

- Definition of a Primary Market Area (PMA) for focused suballocation of economic growth
- A macroeconomic assessment of the opportunities for short- and long-term growth and an independent, quantitative evaluation of jurisdiction-level macroeconomics
- Testing and adjusting regionwide- and jurisdiction-level population and employment control totals to result in a blended set of forecast control totals
- Suballocation of Primary Market Area opportunities and constraints for residential and non-residential development, including a forecasting tool that integrates predictive variables to analyze and adjust forecasts at the TAZ-level for a baseline forecast for all horizon years
- Preparation of three sensitivity tests pivoting from the baseline forecast.

Each of these approach steps are described in the following pages.

## PRIMARY MARKET AREA DEFINITION

The development of TAZ-level forecasts reflects information and knowledge regarding localized planning, zoning, and market research affecting development patterns within the Primary Market Area. The PMA includes several key activity centers that are referenced throughout the report. The PMA is anticipated to both capture 85% of the trip origins and destinations for Project users and will also incorporate the National Landing sites for Amazon HQ2.

The result of an MWCOCG 2019 travel demand model run was used as the primary source to identify the PMA. The model analysis considered select-link analysis for all trips using any segment of the Study Area. These origins and destination points were mapped, and analyzed both by normalized density per acre, as well as total by TAZs. The PMA is defined by TAZ boundaries. TAZs with the highest concentration of both origins and destinations were manually selected to comprise the PMA. Wherever possible, TAZs were selected to form a cohesive study area, avoiding holes and rough edges. Prior analyses for other transportation facilities in the Washington region demonstrated that a cohesive study area boundary can usually be defined by a “travelshed” encompassing 85% of total facility origins and destinations (a threshold beyond which the remaining users are too dispersed to be cohesive). The selection process continued until the percent of total origins and destinations were both greater than 85%. The PMA and densities of origins and destinations by TAZ are depicted in Figure 2. The area includes portions of Arlington, Alexandria, Fairfax, Prince William, and D.C.

Figure 2 shows the TAZs color-coded to indicate which have the greatest total number of origins and destinations from the 2019 travel demand model using any single link of the managed lane project. The results demonstrate

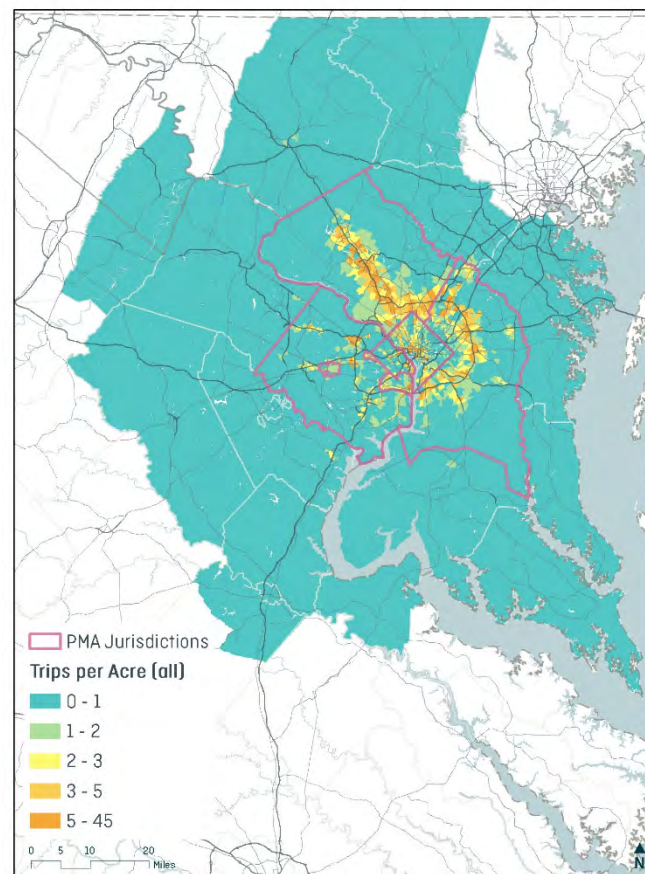


Figure 2 | Primary Market Area Definition

the role of the “gravity model” in influencing trip distribution; trips on I-270 and I-495 tend to be generated by nearby TAZs (of almost any size) or by large TAZs further away.

Information in Figure 2 helps demonstrate the derivation of the PMA boundary based on the TAZs that generate the top 85% of origins and destinations. In particular, the development patterns in the Washington region shape the I-270/I-495 PMA so that it encompasses not only Montgomery and Prince George’s Counties in which the project study segments are located, but also the District of Columbia as well as the City of Alexandria, Arlington County, and Fairfax County in Virginia.

The total number of trips identified using at least one link of the project is about 1.4 million. Since most trips on I-270 and I-495 travel for several exits, this total is about six times as high as the highest average daily traffic volumes along the study area interstates, but well below the sum of daily volumes for each study area segment. The study area is significantly sized and influential for regional traffic that some non-zero number of trips reach 3,688 different TAZs; the average number of trips per TAZ is 378. However, since most of the trips do begin and/or end relatively close to I-270 and I-495, half of the 1.4 million trips are generated by the 269 highest volume TAZs.

The TAZs have a wide range of size, reflecting their development contexts. Within the densely developed core jurisdictions, TAZs are generally about 10 to 30 acres in size, whereas in the rural portions TAZs generally cover several thousand acres. The intensity of trip generation is therefore best understood by normalizing the trip generation by TAZ size and expressing the result as trips per acre. The portion of the study area with the most intense trip generation on portions of I-270 and/or I-495 is, not surprisingly, located near the junction of I-270 and I-495, where decades of high-levels of highway accessibility have helped promote planned density and the two interstate highways serve origin-destination patterns in all directions.

The TAZ generating the highest number of trips on the study segments is TAZ 702, also described as Rock Spring Park, located in the area between I-270 and the I-270 Spur that form its junction with I-495. This TAZ is about 370 acres and generates 16,200 trips on the study area portions of I-495 and/or I-270, resulting in 44 trips per acre.

The TAZ generating the highest intensity of trips per acre is TAZ 662, one of three that make up the Bethesda Central Business District in Montgomery County. Bethesda is the most densely developed activity center in Montgomery County and is located about two miles south of the junction of I-270 and I-495; so, the TAZ is served by limited-access connectivity to the southwest and east via I-495 and to the northwest via I-270. The TAZ is only 170 acres, but its 7,600 trips generated using study area portions of I-495 and/or I-270 reflect a trip density of 45 trips per acre.

The total number of weekday trips using at least one study area segment is about 1.4 million; so, even TAZ 702 only generates about 1% of the total daily trips. The project is sufficiently large that nearly all of the 3,675 regional TAZs generate some small number of trips, yet only 700 TAZs (19%) generate at least two trips per acre, as indicated by the red shading in Figure 2. Those TAZs demonstrate the value of proximity to I-270 and I-495, as well as the regional importance of the facilities to providing at least a small linkage to the most-densely developed portions of the region in the core jurisdictions.

Figure 3 highlights the study segments of I-270 and I-495 within the PMA jurisdictions and identifies some key activity centers. Table 1 summarizes the relevance of those key activity centers; many have economic development catalyzed by significant federal employment anchors.

### MARYLAND I-495/I-270 | KEY ACTIVITY CENTERS

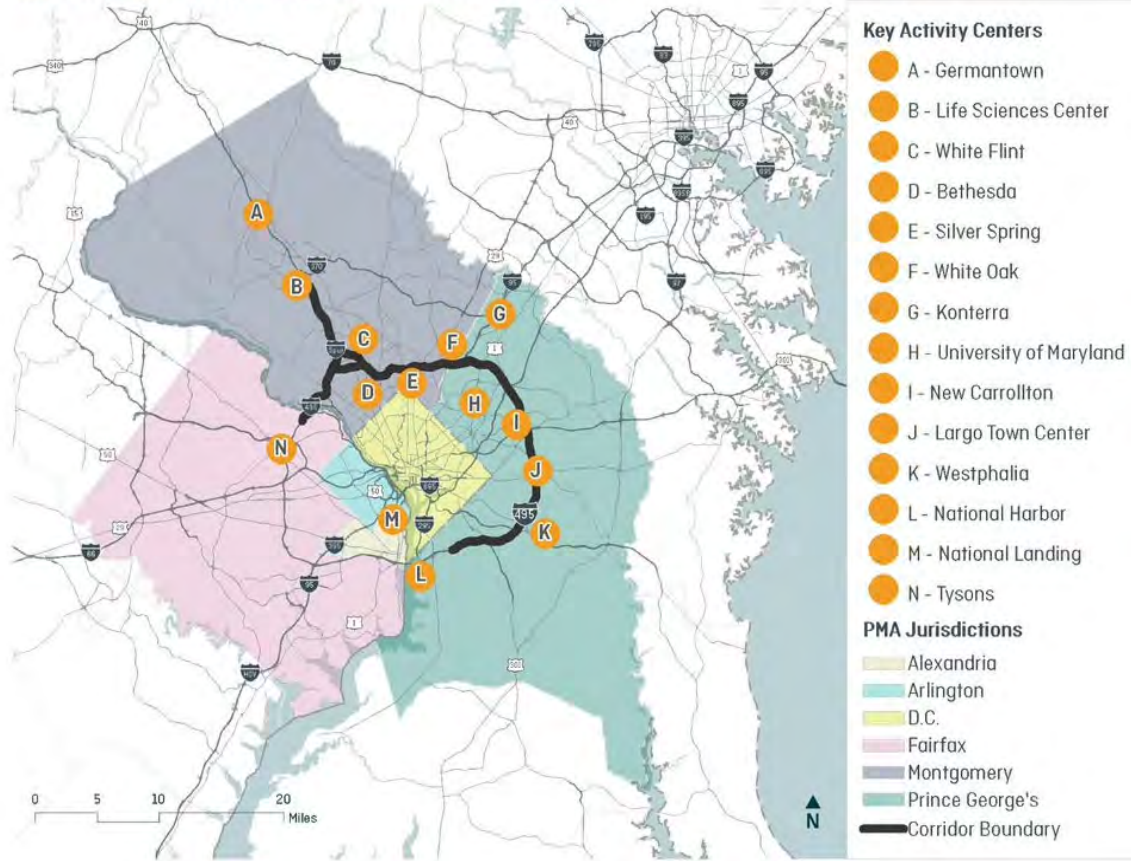


Figure 3 | Primary Market Area's Key Activity Centers



Table 1 | Primary Market Area Key Activity Centers

Activity Center	Notable Characteristics
A. Germantown	Emerging employment center containing some of the last greenfield sites in Montgomery County, anchored by Department of Energy administration complex.
B. Life Sciences Center	Montgomery County activity center west of I-270 at its junction with the Intercounty Connector. Developed as a planned employment center through County land acquisition and marketing. Proximate to both the independent cities of Gaithersburg and Rockville, with annexation occurring as part of mixed-use developments such as King Farm in Rockville and Crown Farm in Gaithersburg.
C. White Flint	An emerging activity center housing the Nuclear Regulatory Commission headquarters. The 2009 White Flint Sector Plan initiated a new intense mixed-use zone, and subsequent development included North Bethesda Market, the tallest building in Montgomery County.
D. Bethesda	The most intensely developed activity center within five miles of the study segments and expected to increase employment by about 25% and double population by 2045. The CBD is adjacent to the National Naval Medical Center and the National Institutes of Health campuses. The Rock Spring Park activity center is located nearby in the land formed by the junction of I-270, the I-270 Spur, and I-495.
E. Silver Spring	The second most intensely developed activity center within five miles of the study segment and is expected to increase employment by about 25% and population by about 40% by 2045. The National Oceanic and Atmospheric Administration headquarters are in the CBD.
F. White Oak	FDA Headquarters relocated to White Oak Campus in 2003, and its establishment and expansion served as the primary impetus for the White Oak Science Gateway Master Plan adopted by Montgomery County in 2014. The Washington Adventist Hospital moved from Takoma Park to White Oak in 2019.
G. Konterra	A planned activity center at the junction of I-95 and the Intercounty Connector. Originally planned around two regional mall sites intended for more than six million square feet of retail space, site development is now proceeding as a series of smaller, more mixed-use neighborhoods.
H. University of Maryland	The largest educational institution in the region, with a student enrollment of about 41,000. The institutional activities extend beyond campus boundaries, including the nearby M2 technology center in Riverdale.
I. New Carrollton	An intermodal hub at the junction of I-495 and US 50 served by Metrorail, MARC commuter rail, and Amtrak. Home to the Internal Revenue Service's financial services center, New Carrollton and several adjacent industrially-zoned properties are seeing new commercial construction in technology-oriented industries.
J. Largo Town Center	The Largo Town Center activity center is oriented around the Largo Town Center Metrorail station in 2004, the first extension to the original 103-mile Metrorail system. The University of Maryland Capitol

	Region Medical Center is under construction, with opening scheduled in 2021. Across I-495, FedEx Field is the current home to the NFL Redskins and other stadium events.
K. Westphalia	One of the largest remaining greenfields sites in the PMA, with residential construction underway in implementing the 2007 Westphalia Sector Plan. As of summer 2019, the Prince George's County Council approved zoning changes that would facilitate Amazon distribution activities as an allowed use.
L. National Harbor	A planned community on the eastern shore of the Potomac River at the junction of I-495 and I-295, anchored by the Gaylord National Resort and Convention Center opening in 2008. The MGM National Harbor casino opened in December 2016.
M. National Landing	The branding given to the Amazon HQ2 sites in Arlington County and the City of Alexandria, organized around the Pentagon City, Crystal City, and (future) Potomac Yard Metrorail stations. Additional information on Amazon HQ2 is provided in a separate section of this memorandum.
N. Tysons	An activity center located at the confluence of I-495 and the Dulles Toll Road, and often characterized as the downtown of Fairfax County. The 2010 Tysons amendment to the Fairfax County Comprehensive Plan set the stage for an ultimate buildout of 200,000 jobs and 100,000 residents; new high-rise construction is underway, catalyzed in part by the opening of four Silver Line Metrorail stations in 2014.

# ASSESSMENT OF GROWTH TRENDS

The Washington D.C. Metropolitan Area is unique due to its position as a national capital, which provides an employment base of federal agencies, complemented by the goods and services they attract. The relative consistency of federal government activities, as contrasted with private-sector economic cycles, helped the Washington region through the Great Recession of 2007-2009 with less volatility than many other regions. However, the economy weakened somewhat due to federal cutbacks, such as Base Realignment and Closure (BRAC) and sequestration, and subsequently a reduction in the federal workforce. This section summarizes demographic, economic, and real estate trends at the national, regional, and local levels likely to influence development in and around the PMA.

## Historic Regional Growth Trends

### Commercial Trends

Washington Metro's economy is dominated by two sectors: federal and private-sector professional and technical services. The location quotient provided by the Bureau of Labor Statistics (BLS) describes the degree to which a given type of occupation in a geographic area is over-represented ( $LQ > 1$ ) or under-represented ( $LQ < 1$ ) relative to the national average. The BLS notes that as of May 2018 the LQ for the Washington Metropolitan Statistical Area (MSA) the LQ for the Business and Financial Operations Occupations was 1.86 (the highest nationally for MSA's with more than 400,000 population).

Table 2 summarizes jobs by industry sector in 2018. The table shows how strongly the regional economy depends on a narrow band of knowledge-sector jobs. Professional, Scientific and Technical Services is the dominant industry, with fewer, high-paying jobs in other industries. Health Care and Social Assistance is the second largest sector and is largely a local sector rather than a traded sector. Overall, about two thirds of the jobs in the region are local sector jobs.

Table 3 summarizes the proportion of regional employment, organizing Woods and Poole data into the four industry groupings used in the MWCOG model in 1969 and 2016. The table shows that office jobs have become the dominant industry over the last 50 years, replacing "Other" (government, administrative, and support services). Additionally, the table demonstrates that retail and industrial sectors have been consistent in the past 50 years, despite some contrary narratives suggesting that both retail jobs and industrial jobs are in substantial decline. Figure 1 demonstrates the proportional change in employment by industry type over that same interval of time, further illustrating the growth of office jobs.

Table 2 | Washington Metro Area Jobs by Industry, 2018

	<b>Total Jobs</b>	<b>Private Sector Jobs</b>	<b>Public Sector Jobs</b>
<b>All NAICS Sectors</b>	2,817,767	2,491,163	326,604
Professional, Scientific, and Technical Services	515,777	515,045	732
Health Care and Social Assistance	324,106	315,730	8,376
Educational Services	292,629	94,852	197,777
Retail Trade	279,387	279,386	1
Accommodation and Food Services	276,107	276,107	-
Administrative/Support & Waste Management/Remediation Services	198,621	196,374	2,247
Other Services (except Public Administration)	175,131	174,131	1,000
Construction	156,226	154,272	1,954
Finance and Insurance	93,752	93,752	-
Public Administration	87,087	-	87,087
Information	77,858	75,148	2,710
Transportation and Warehousing	76,255	56,743	19,512
Wholesale Trade	59,278	59,278	-
Manufacturing	55,744	55,737	7
Real Estate and Rental and Leasing	53,279	53,278	1
Arts, Entertainment, and Recreation	42,410	39,612	2,798
Management of Companies and Enterprises	40,339	40,339	-
Utilities	10,459	8,055	2,404
Agriculture, Forestry, Fishing and Hunting	2,289	2,289	-
Mining, Quarrying, and Oil and Gas Extraction	975	975	-

Source: U.S. Census Longitudinal Employer-Household Dynamics (LEHD) 2018,  
Washington DC/VA/MD/WV MSA

Table 3 | Proportion of MWCOG Region Employment by Job Type, 1969 and 2016

<b>Job Type</b>	<b>Year</b>	
	<b>1969</b>	<b>2016</b>
<b>Retail</b>	15%	17%
<b>Industrial</b>	11%	8%
<b>Office</b>	25%	41%
<b>Other</b>	49%	34%

The Washington region is unusual in the degree to which the federal government and its supporting industries result in an unusually high proportion of local sector jobs as contrasted with traded sector jobs. Traded sector jobs are those in which the region provides goods and services with a national or international market. Local sector jobs are those which provide goods and services within the local economy. In most regions, economic sectors such as agriculture or manufacturing are traded sectors which have a wide geographic range of customers. In contrast, sectors such as primary/secondary education, health care, and business services are generally local sectors, selling goods and services to other local customers.

Figure 5 and Figure 6 are sourced from the U.S. Cluster Mapping Project for the Washington, D.C. Metropolitan Area. An economy heavily dependent on local clusters, with only 36% of jobs in the traded sector, has insulated the region from national economic and employment downward trends. Figure 5 displays the ten largest traded sectors in the region as a proportion of employment in 2005 with Figure 6 showing the same information for 2015. Business services and education grew substantially between 2005 and 2015, accounting for more than 60% of the top 10 largest clusters. In many regions, such homogeneity suggests a potential regional weakness that could create a risk for future growth. However, history shows that the Washington regional economy’s reliance on government administration and related business services (ranging from contractors who directly support government contracts to indirectly related groups such as those involved in research and advocacy) has helped it weather prior recessions, so this homogeneity is not considered a meaningful limitation in developing future projections.



Figure 4 | MWCOG Region Employment by Job Type, 1969-2016

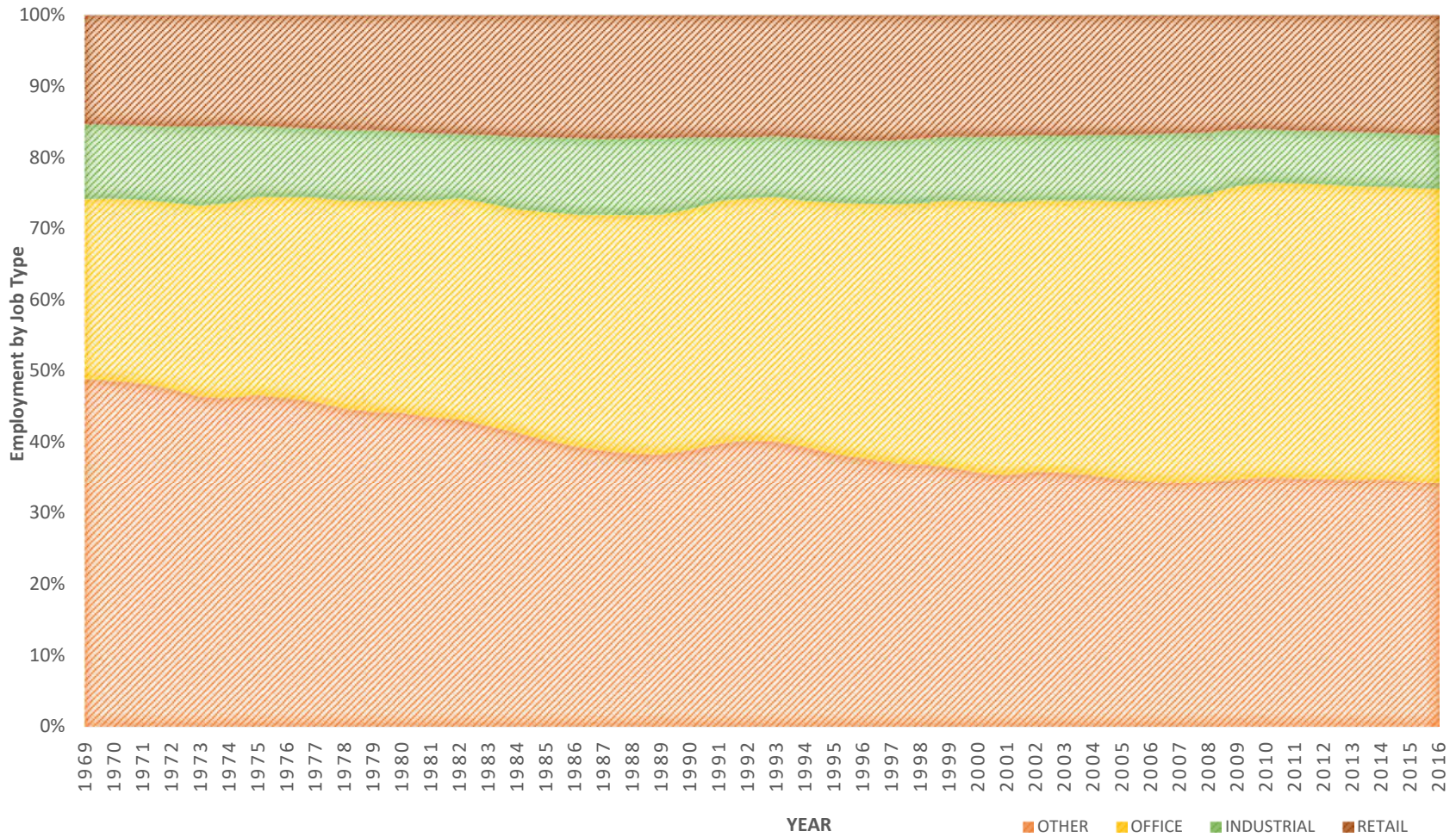


Figure 5 | Diversity of Ten Largest Traded Sector Job Clusters, 2005

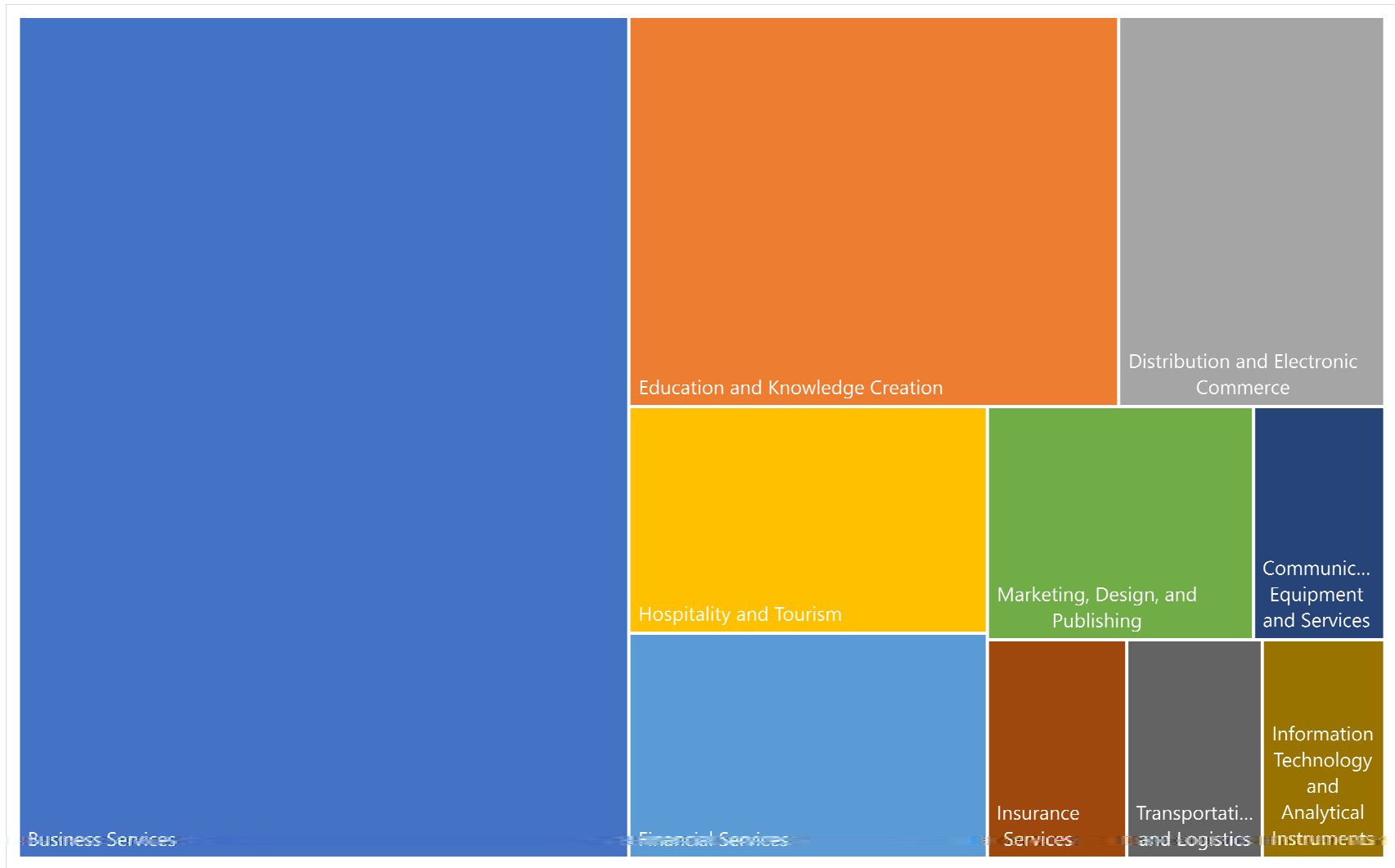
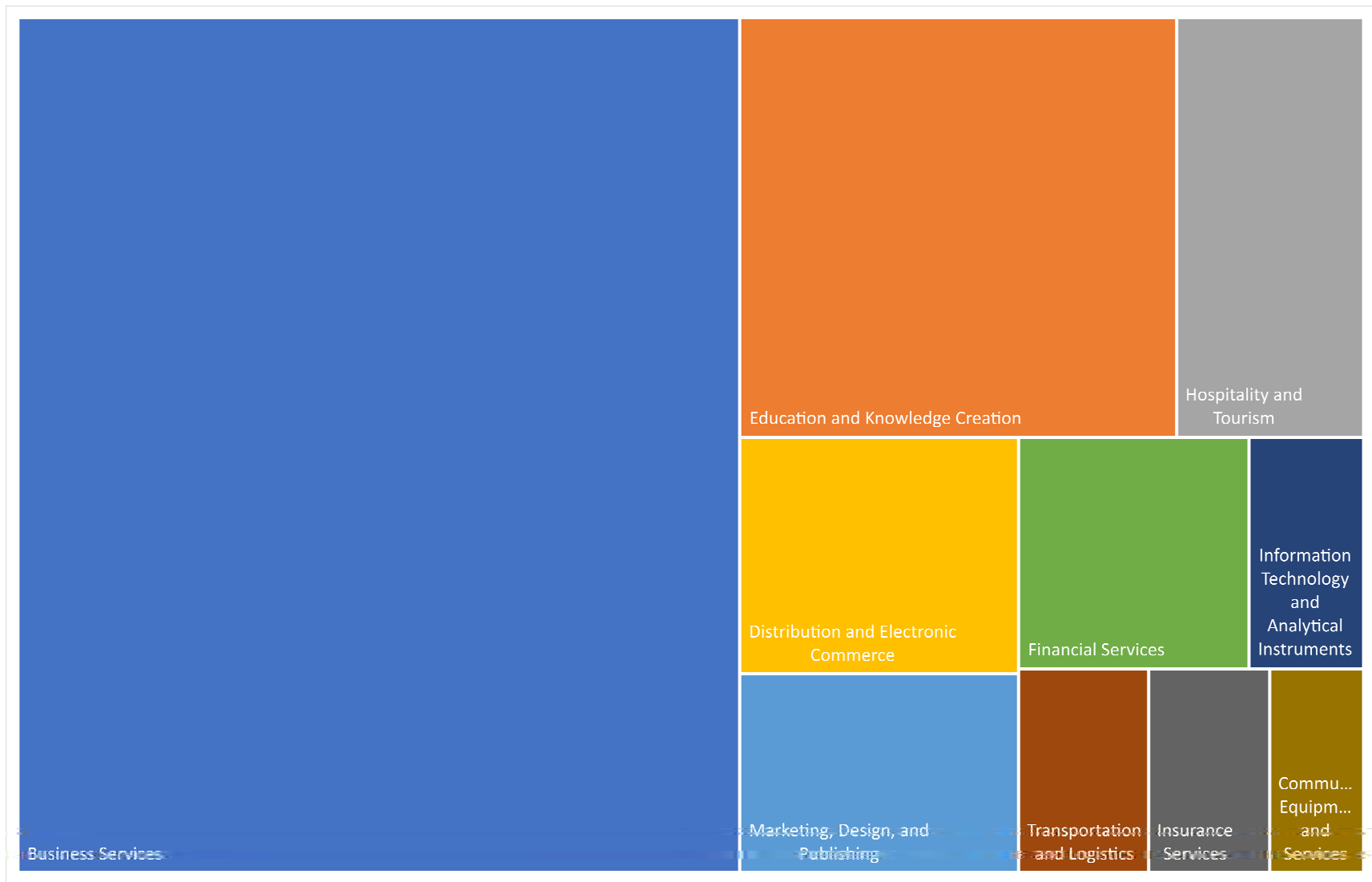
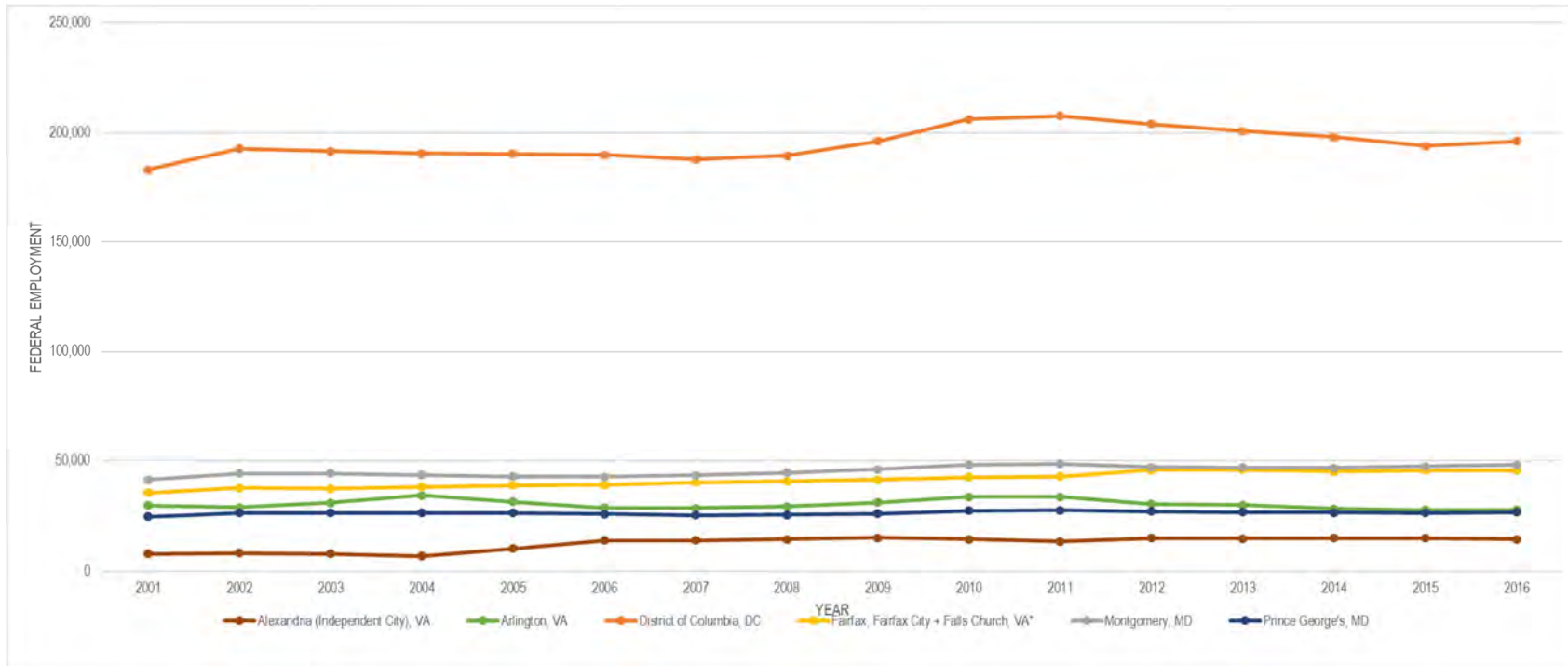


Figure 6 | Diversity of Ten Largest Traded Sector Job Clusters, 2015



Annual employment data provided by the U. S. Bureau of Labor Statistics since 2001 shows federal jobs, which are part of several industry sectors, had limited growth within the Primary Market Area in the past two decades, as seen in Figure 7. Federal jobs remain concentrated primarily in the District of Columbia, but all six jurisdictions contain some federal employment. The total number of federal jobs in the PMA increased from 331,022 in 2001 to 369,749 in 2016, a compound annual growth rate (CAGR) of 0.7%.

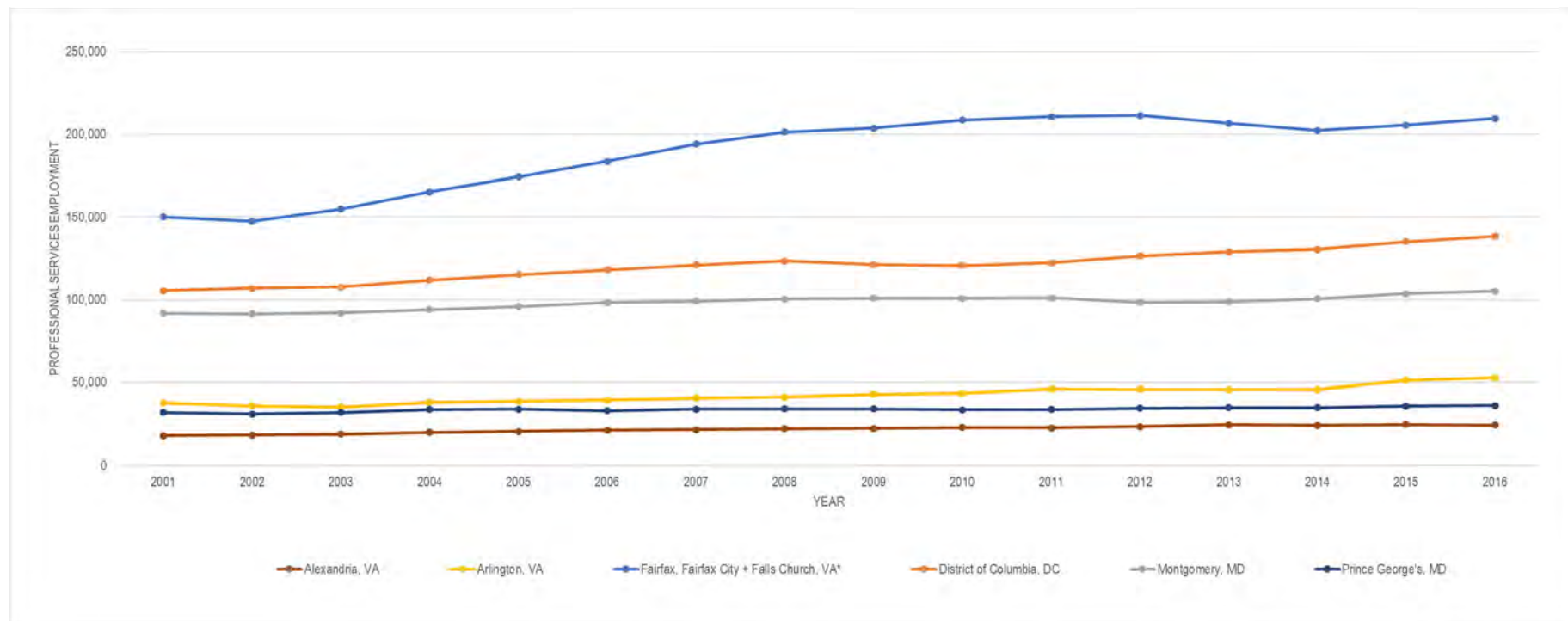
Figure 7 / Federal Employment by Jurisdiction, 2001-2016





Annual employment data provided by the U. S. Bureau of Labor Statistics since 2001 are shown for Professional, Scientific, and Technical Services in Figure 8. The professional services sector in each jurisdiction in the Primary Market Area has shown relatively steady growth through the recessionary period, reinforcing the resilience of the regional economy. The total number of professional services jobs in the PMA increased from 435,084 in 2001 to 566,419 in 2016, a compound annual growth rate (CAGR) of 1.8%.

Figure 8 / Number of Professional Services Jobs by Jurisdiction, 2001-2016



Overall, these trends describe a region that should continue its strong and resilient economic position, but expectations of robust growth should be balanced against the concern that a lack of employment heterogeneity does suggest potential long-term uncertainty.



## Residential Trends

Cost of living is a concern in the region and can have implications for short- and medium-term population projections. The U.S. Bureau of Economic Analysis (BEA) publishes state and regional cost of living comparison metrics, known as regional price parities for goods, services, and rents (a proxy for all housing costs), where the regional price parity number represents the percentile relative to the national average (i.e., 100 equals the national average and 110 equals 110% of the national average).

The state and regional data do not facilitate comparison of each of the regional jurisdictions, but a contrast of estimates for the District of Columbia to regionwide totals provides a useful indication of the degree to which regional centrality (as represented by the District of Columbia) affects cost of living.

Figure 9 shows the housing cost indexes for both the District and the region are more than twice the national average and have continued to increase<sup>1</sup>. Interestingly, while D.C. home values trend higher than regional home values, D.C. rents trend lower than regional rents. Meanwhile, the cost of goods and services in both areas stayed steady and similar, with D.C. goods and services costs trending slightly higher than the region, emphasizing that cost of living concerns are really cost of housing concerns. Confirming the BEA findings on rent, the real estate website Zillow reports that home values in the District are up 29 percent and rents are up 13 percent since 2011. A study by the U.S. Bureau of Labor Statistics found that the Washington, D.C. metro area had the highest average annual housing costs in the U.S. for 2011-2012 – even more than New York City and San Francisco – and they are still rising<sup>2</sup>.

Another aspect of the dynamic between price and population is median income and the age of the housing stock. Figure 11 shows the current median household income from the 2013-2017 American Community Survey. This figure demonstrates two related characteristics of the region, the “favored quarter” and the “east-west divide”. The favored quarter for the Washington region describes the areas of highest household income, generally oriented towards the quarter of the region emanating from the center and including the northwest quadrant of Washington, northern Arlington and Fairfax Counties, and western Montgomery County. The east-west divide extends the favored quarter concept more regionally, reflecting the preponderance of prosperity on the northwestern half of the region and the relative lack of prosperity along the southeastern portion of the region. These trends reflect centuries of land development patterns that are generally typical of urban areas along the eastern fall line, wherein topography and drainage

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<sup>1</sup> Regional Price Parities data, Bureau of Economic Analysis. District of Columbia (Metropolitan Portion) and Washington-Arlington-Alexandria, DC-VA-MD-WV MSA: <http://www.bea.gov/itable/iTable.cfm?ReqID=70&step=1#reqid=70&step=25&isuri=1&7022=101&7023=8&7024=non-industry&7001=8101&7029=101&7090=70>

<sup>2</sup> Wiener, Aaron. “D.C. Area Housing Costs Are the Highest in America.” *Washington CityPaper*. September 8, 2014. <http://www.washingtoncitypaper.com/blogs/housingcomplex/2014/09/08/d-c-housing-costs-are-the-highest-in-america>

patterns in the industrial age provided early advantages to areas with higher elevation and those advantages were perpetuated as policies and politics evolved subsequently. Figure 12 provides a demonstration of regional expansion outward from the historic cores of downtown Washington and Alexandria, where some of the oldest housing stock remains in use.

Figure 9 / Cost of Living Comparison

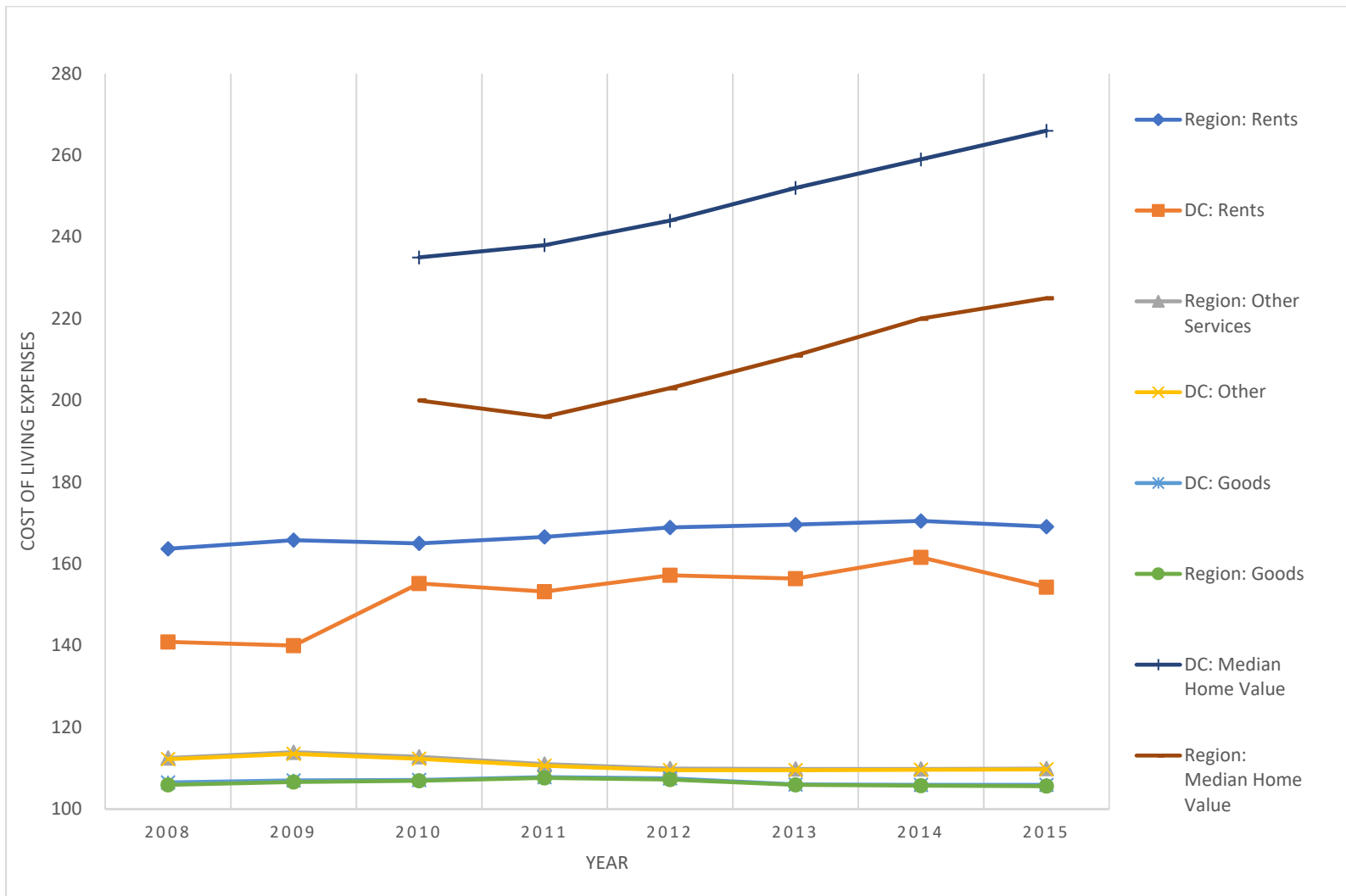


Figure 10 / Regional Per Capita Income, 2005-2015

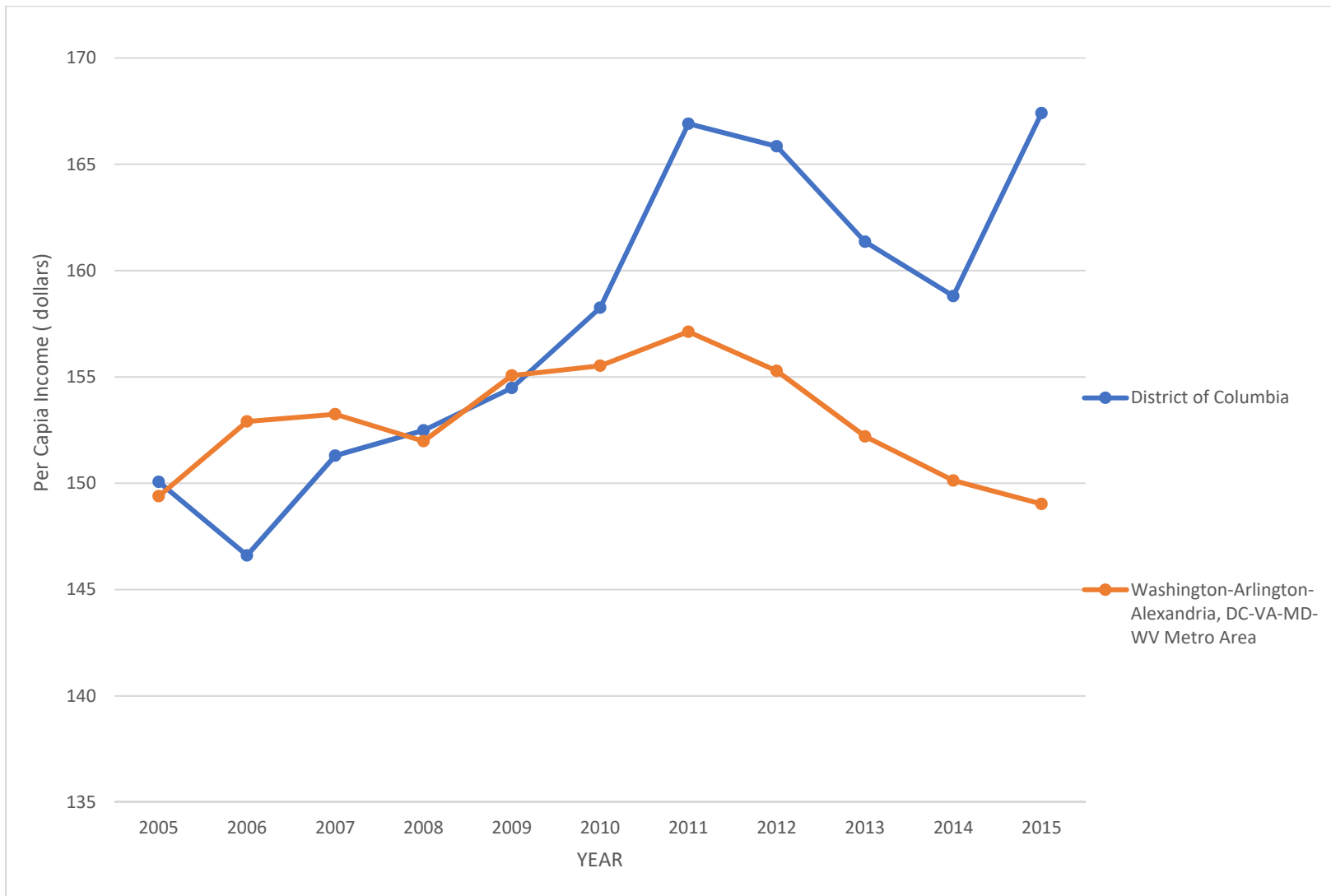


Figure 11 | Median Household Income, 2017

### MARYLAND I-495/I-270 | MEDIAN HOUSEHOLD INCOME - 2017

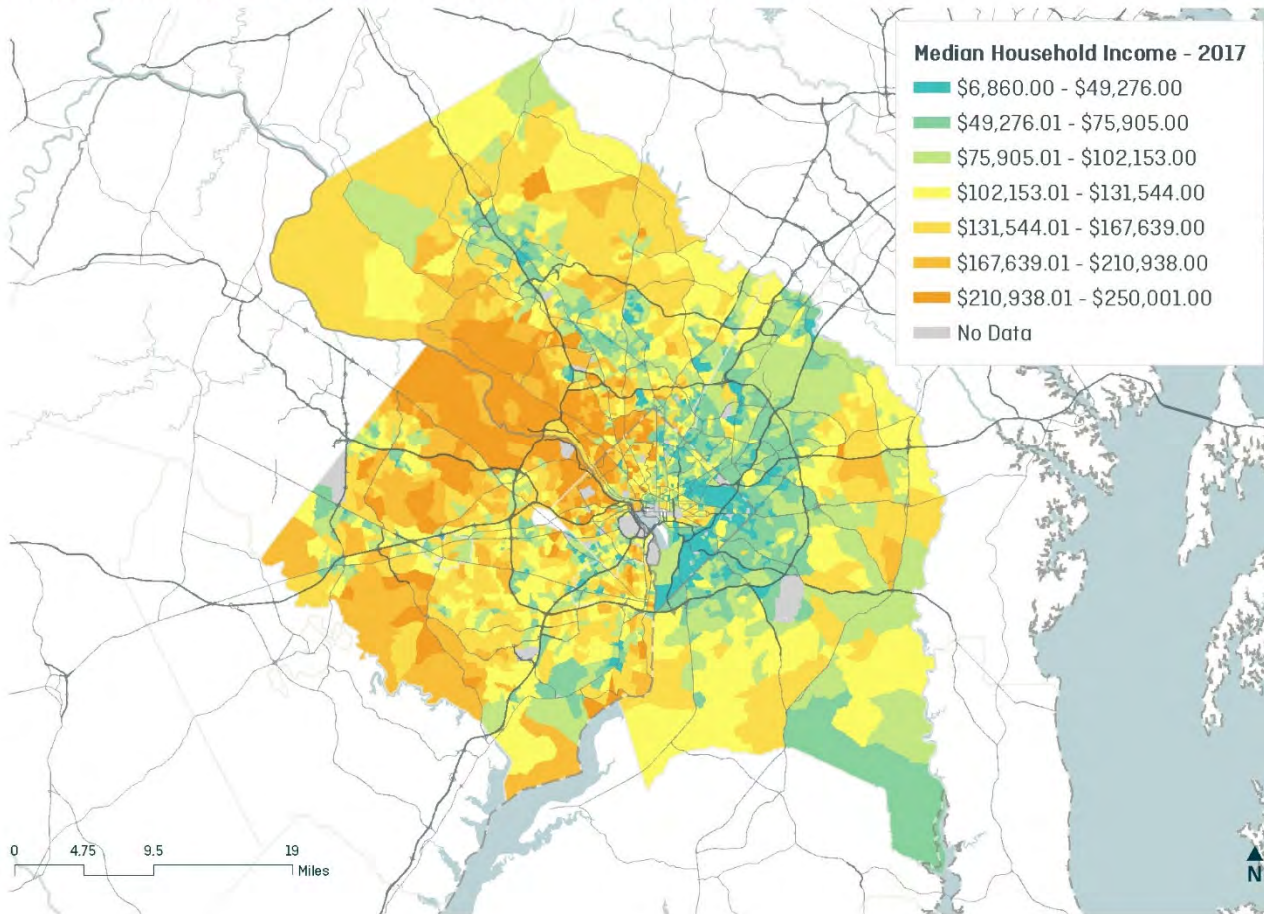
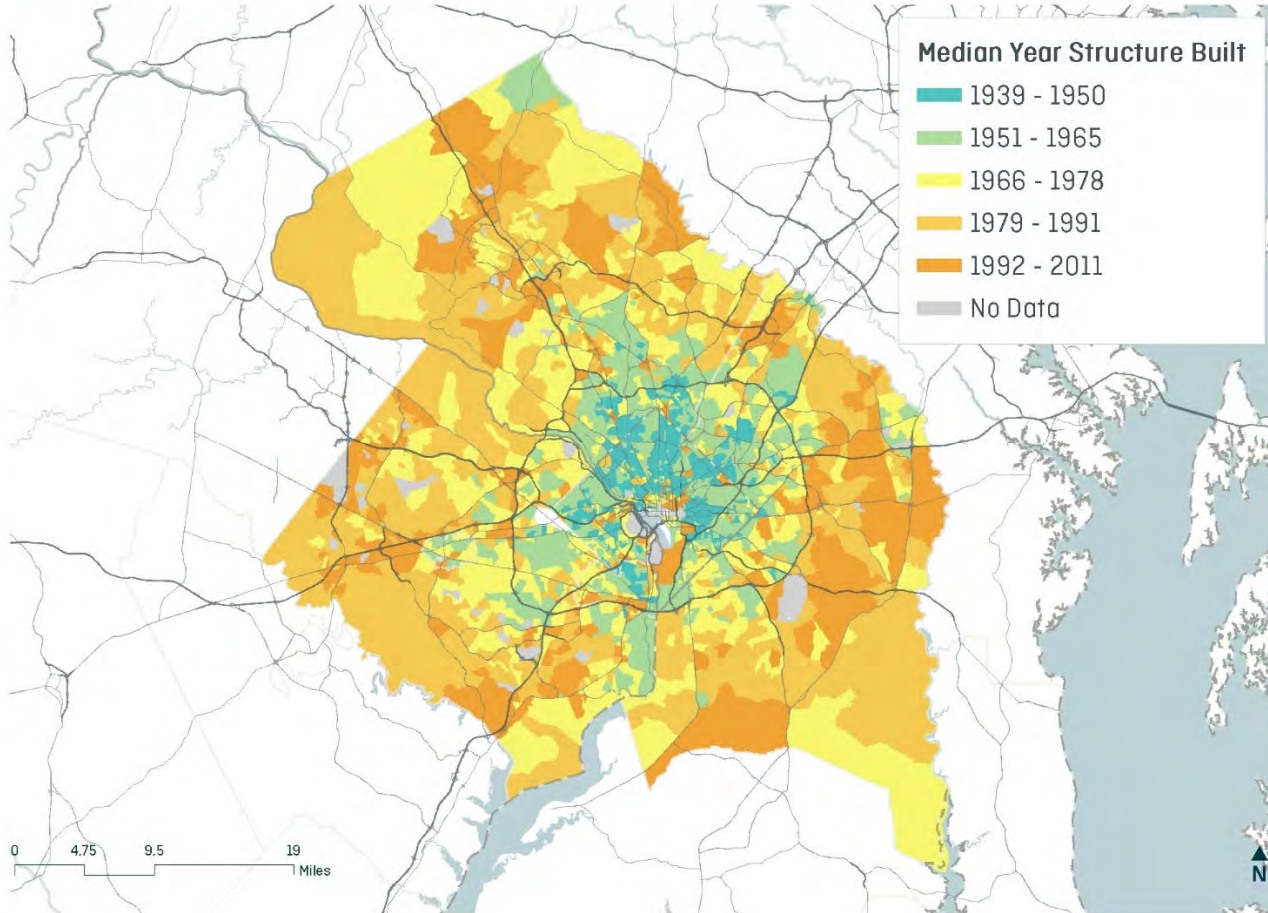




Figure 12 | Median Year Structure Built - Residential

### MARYLAND I-495/I-270 | MEDIAN YEAR STRUCTURE BUILT - RESIDENTIAL



### *Millennial Trends*

The Millennial generation is poised to have as much of an impact on economic and social trends as the Baby Boom generation did before it. Also known as Gen Y, it makes up one-fourth of the national population and is expected to further increase in size due to international immigration. Early thought on the emerging and future influence of this generation centered on its role in an urban renaissance, and the Urban Land Institute (ULI) commissioned two surveys in the past few years to evaluate its current and future housing and shopping preferences. The findings point to a more nuanced set of settlement patterns and preferences.

Contrary to the narrative of millennials greatly preferring downtown living, most millennials live on the urban fringe. Only 13% of millennials live in or near downtowns. Notably, in a recent ULI report nearly 2 in 5 surveyed described themselves as “city people”, so there appears to be a mismatch between locational preference and current living situation. This finding likely stems from several sources, but the most influential may be cost. A supporting survey noted in the ULI report indicates that the ‘cost of housing’ was the most important characteristic of any future residential choice by millennials, far surpassing features like safety, proximity to work, or quality of schools.<sup>3</sup>

### Primary Market Area Growth Trends

The Primary Market Area as a whole has experienced relatively consistent growth in population and jobs over the past five decades, although the individual jurisdictions have very different historical patterns of growth. These patterns are typical of older metropolitan areas in the northeastern US wherein population migrated from the central city and other core jurisdictions in the second half of the twentieth century. Figure 13 shows the historic population for each of the PMA jurisdictions, demonstrating the decline of Washington DC population (where the highest decennial census population total was 802,178 in 1950 and the lowest was 572,059 in 2000) through the 1970s and 1980s. In contrast, the second half of the twentieth century was a period of prolonged population growth in the first tier suburbs of Montgomery, Prince George’s and Fairfax Counties, as each jurisdiction experienced periods of growth that both utilized most of the planned greenfield acreage as well as began experiencing some higher density redevelopment in certain activity centers, a trend heightened by the opening of Metrorail in 1976 with subsequent system expansion. Figure 13 shows the historic employment totals for each of the PMA jurisdictions. The employment trends for each jurisdiction generally show more continuous jobs growth for all jurisdictions with some slowing of growth during recessions (most notably in the early 1990s). Fairfax County stands out from the other PMA jurisdictions with continually higher job growth rates influenced by the “favored quarter” dynamic previously described and the attractiveness of Dulles Airport.

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<sup>3</sup> [“Housing in the Evolving American Suburb”](#), Urban Land Institute, 2016

Figure 13 | Primary Market Area Jurisdiction Population Trends, 1969-2017

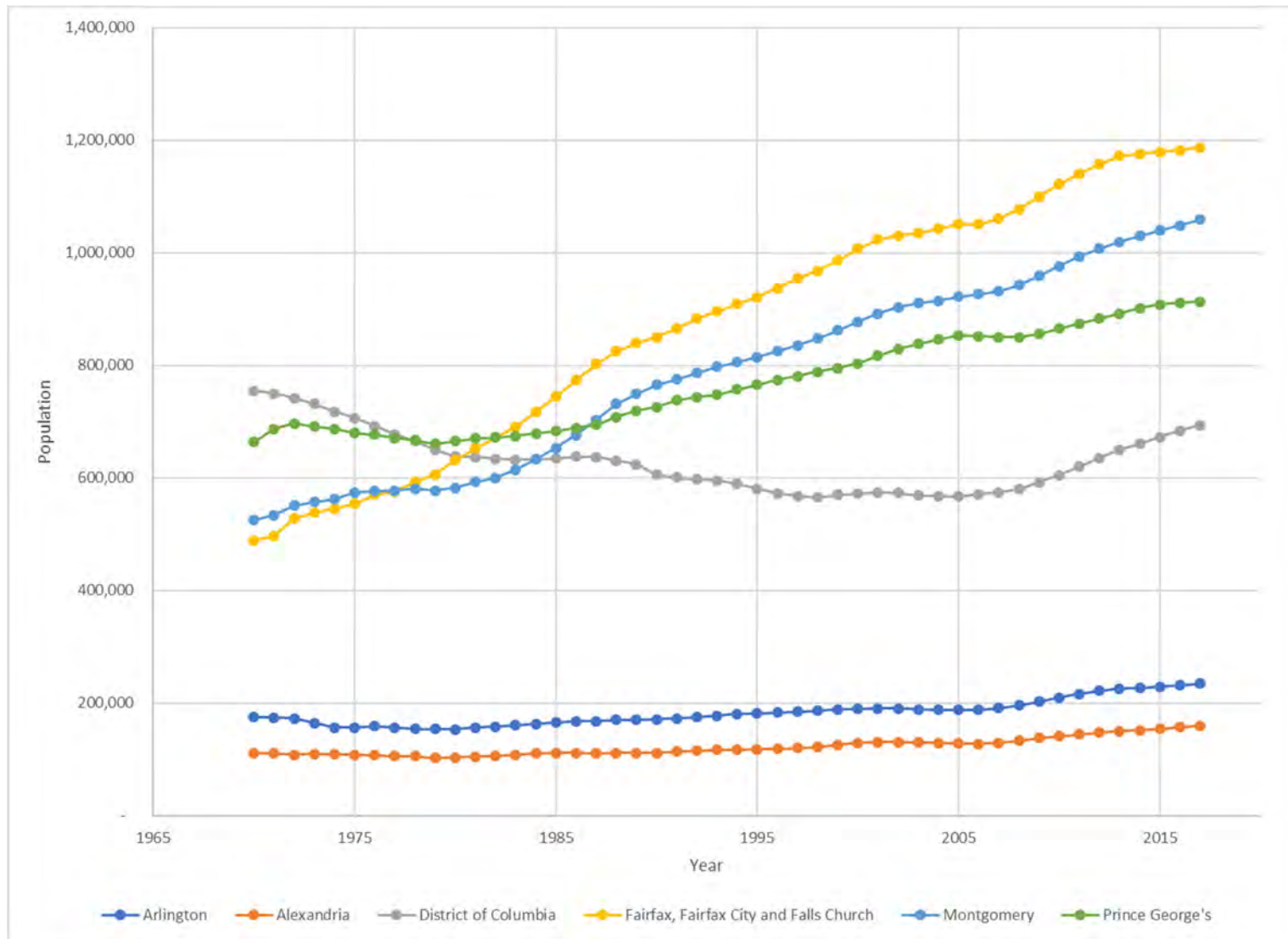
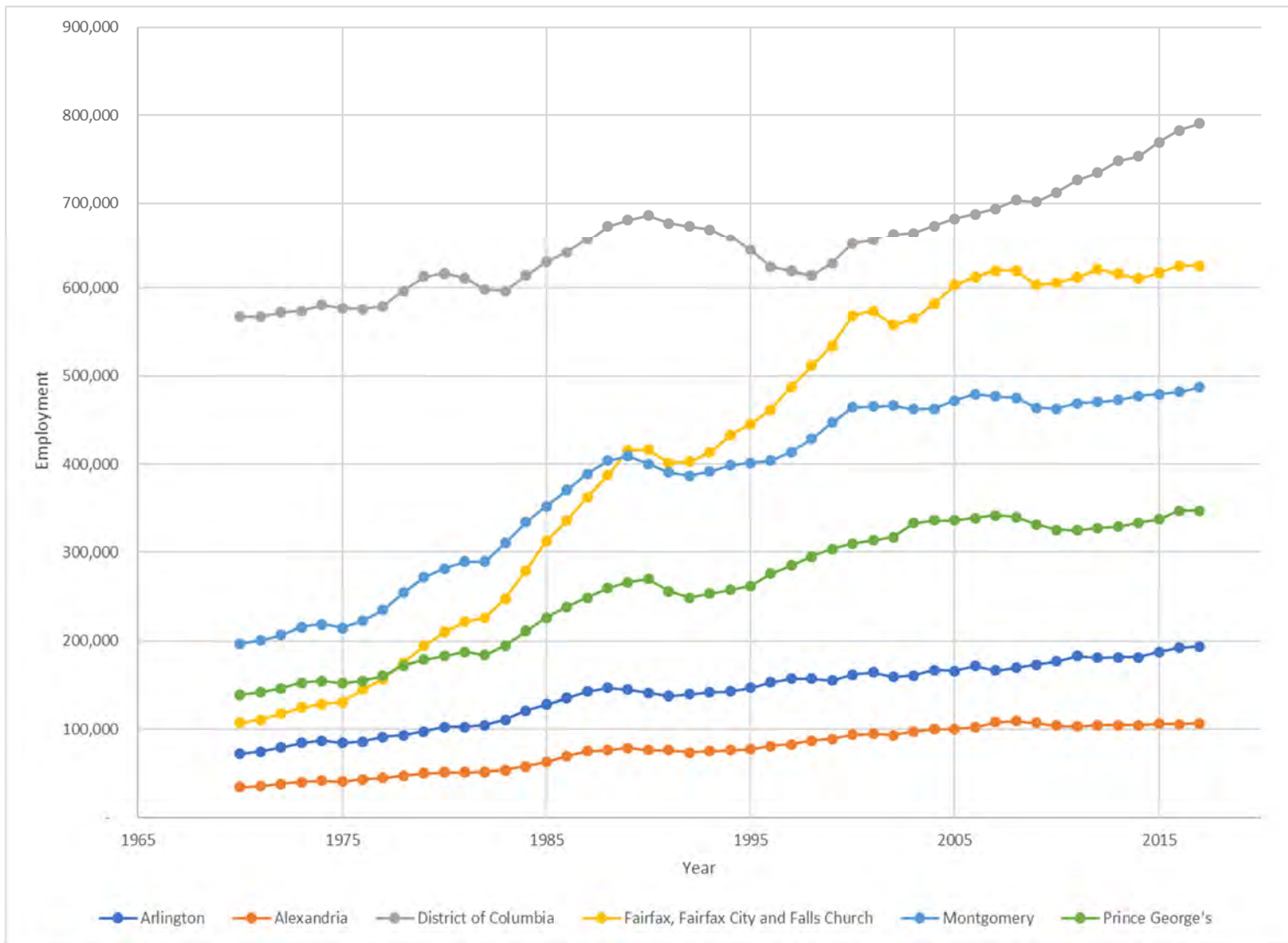


Figure 14 | Primary Market Area Jurisdiction Employment Trends, 1969-2017





## Place-Based Trends

### Suburban Growth

Suburban growth is dependent upon both supply of suburban land and demand for suburban residential and non-residential products. The region is not in danger of running out of either greenfield or infill development opportunities in the near-term. Figure 15 shows 2016 development intensity from the National Land Cover Database (NLCD); data from 2011 was used in analysis as 2016 data was not made available until mid-2019, after analysis was complete .

Areas of dark red are intensely-developed areas that have little room for infill, though could always accommodate increased density on already-developed land. Areas of light red are places with lower intensity development but with potential for infill. Areas shown in greens and yellows show where land development is low density, due to a combination of policies (i.e., parkland and zoning) and market forces. In the long-term, there is a potential supply problem for land in suburban counties.

Figure 15 | Development Intensity, 2016

### MARYLAND I-495/I-270 | LANDCOVER - DEVELOPMENT INTENSITY

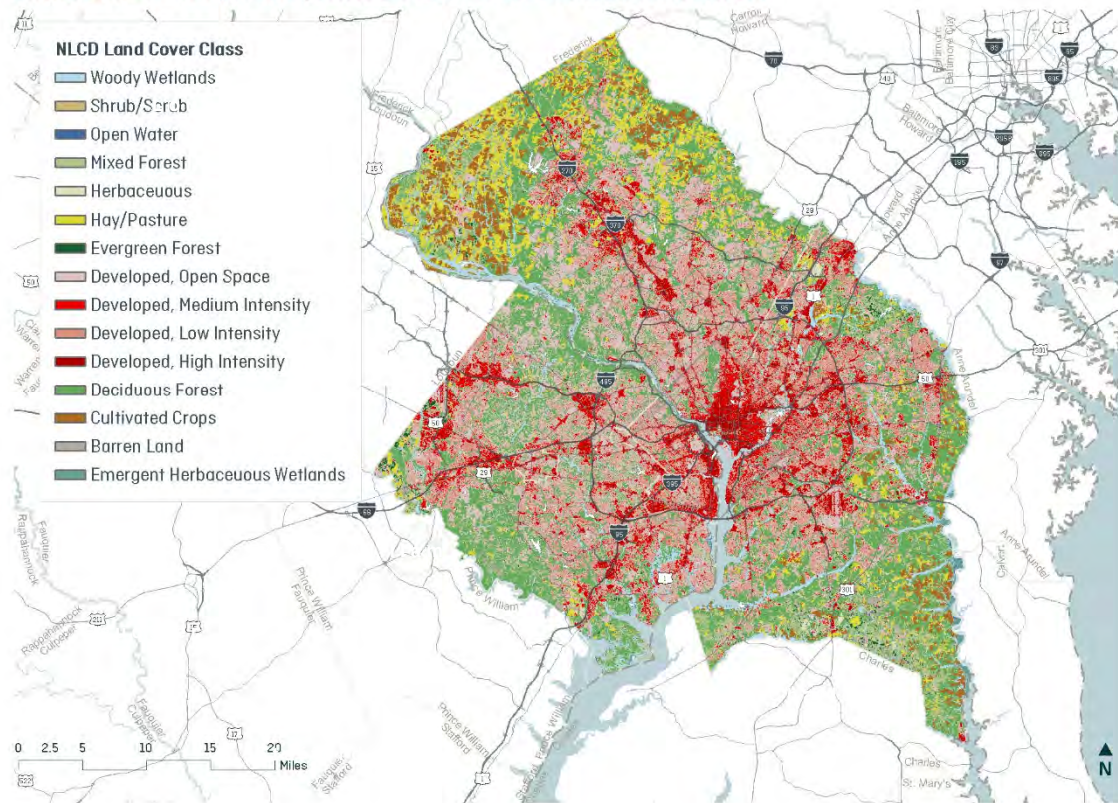
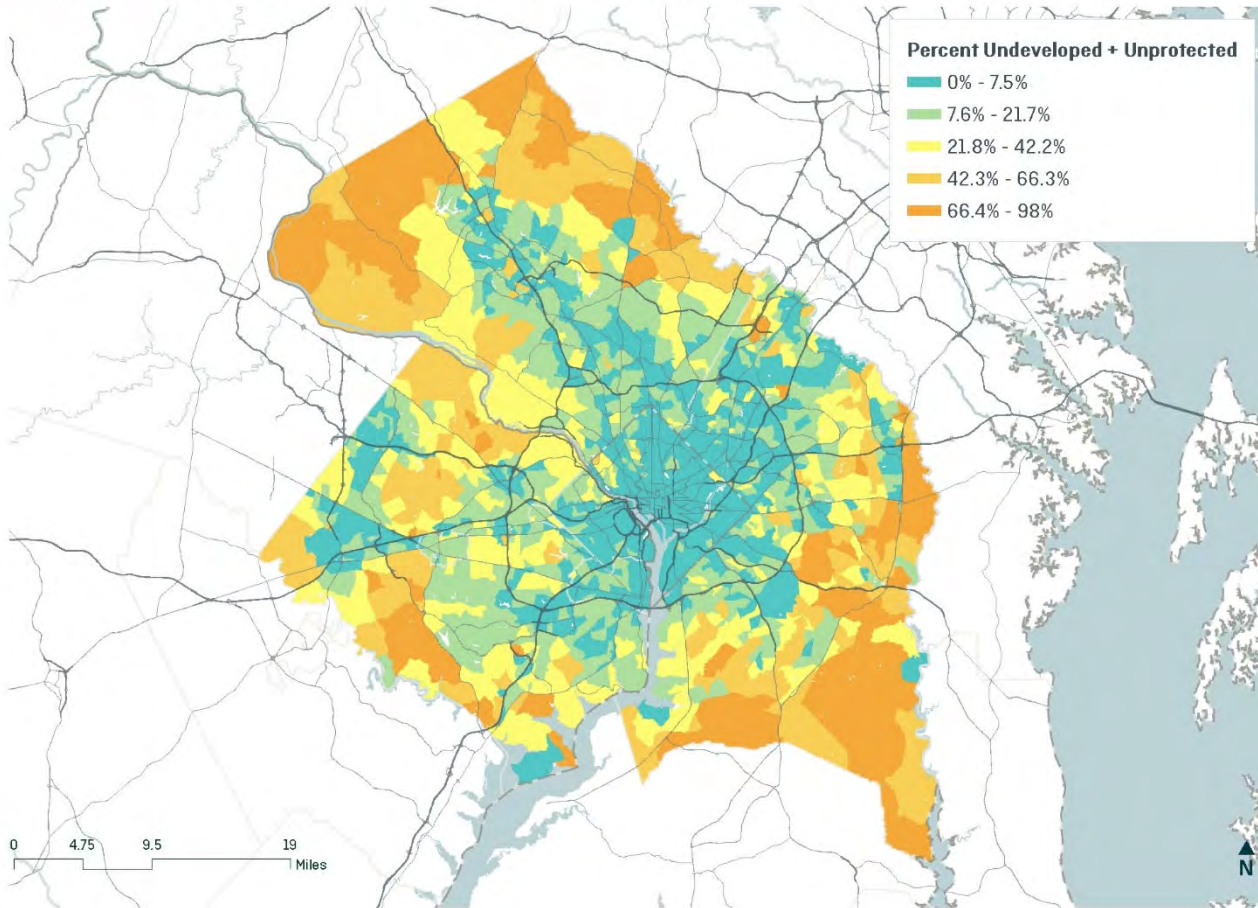


Figure 16 organizes the NLCD data into an index showing the degree to which regional TAZs are available for greenfield development, as indicated by the percentage that is either yet developed nor protected for parkland or as natural environmental resources. The areas of blue reflect TAZs where greenfields opportunities are low, as most of the TAZ acreage is either already developed or is protected from additional development. By contrast, the areas in orange have the highest amount of remaining land both available for development and unprotected. The outlying TAZs in the PMA hold greater capacity for development than those in the core of the PMA.



Figure 16 | Land Cover – Percent Undeveloped and Unprotected

### MARYLAND I-495/I-270 | LANDCOVER - PERCENT UNDEVELOPED AND UNPROTECTED



Population growth in the District of Columbia, combined with real estate demand and development in walkable centers around the region, suggests that urban and suburban activity centers that best emulate urban places are the future of regional growth. But the suburbs still have growth prospects and not all growth is likely to come from city-dwelling Millennials. In fact, new Census data suggests that suburbs and exurbs have both recently grown faster than the urban core. Census data for 2018 shows that for the approximately 50 metropolitan areas with a population of at least 1 million, the primary city saw slower population growth in the past year than its neighboring suburban areas. This slower growth rate for primary cities reversed prior trends in which center city growth outpaced suburban growth.<sup>4</sup> This trend is most pronounced in the smaller southern, southwestern, and midwestern regions; additionally, the D.C. region itself still has slightly higher population growth in the city (0.9%) than the suburbs (0.8%). Overall, these various findings suggest the need to consider increased suburban growth prospects, particularly as compared to the more urban portions of the region.

### *Office Space*

Suburban office markets affected by the recession are starting to bounce back.<sup>5</sup> This recovery is focused on the best locations, so many secondary and lower-tier suburban markets are not able to compete. The location and density of future employment in the region could be influenced by trends in office space usage. Specifically, the average square footage of building space per worker could influence firm location decisions.

The industry guide has been 200 or 250 square feet per office worker, but there have been several analysts in recent years estimating that corporate office space usage will decline significantly to 150 square feet or less per worker. Such a reduction in office space demand could affect build-out assumptions in some developing areas. In contrast, Professor Norm G. Miller of the University of San Diego found that the traditional rule of thumb is possibly underestimating the true amount of office space companies require per worker.<sup>6</sup> Miller argues that rather than 200 or 250 square feet per worker, the true figure may be more like 340 square feet per worker. From that adjusted starting point, Miller posits that most companies will not be able to dramatically reduce their office space usage.

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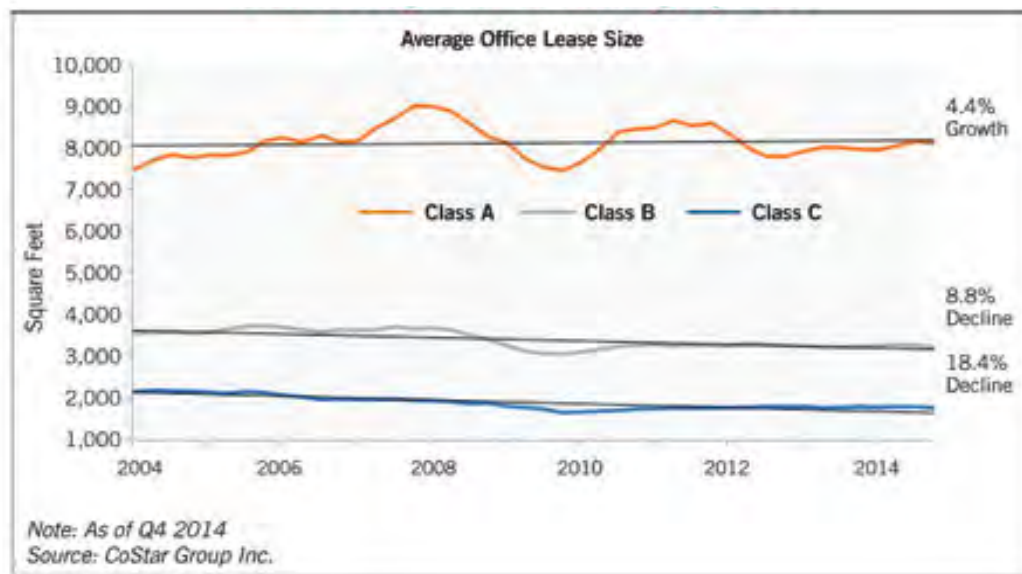
<sup>4</sup> [“Big City Growth Stalls Further as the Suburbs Make a Comeback”](#), Brookings Institute, May 24, 2019

<sup>5</sup> Drummer, Randy. “Once Left for Dead, Suburban Office Making a Comeback.” *CoStar News*. November 12, 2013. <http://www.costar.com/News/Article/Once-Left-for-Dead-Suburban-Office-Making-a-Comeback/154320>

<sup>6</sup> Miller, Norm G. “Estimating Office Space per Worker: Implications for Future Office Space Demand.” September 17, 2012. <http://www.costar.com/Webimages/Webinars/EstOfficeNMiller.pdf>

Demand for office space tends to vary by office class. Class A office space represents the newest, highest quality office space with state-of-the-art systems for elements such as energy efficiency and telecommunications. Class B office space is a step down, representing quality spaces generally at the regional average asking rates for rents. Class C spaces are the least desirable and lowest rent properties, generally in buildings more than two decades old and in need of some renovation. Figure 17 illustrates that square feet per employee in Class A office space has increased while space in Class B and C has dropped. Additionally, Figure 18 shows that office space changes are not consistent across all industry types. Interestingly, two of the larger industries in the Washington D.C. area are on opposite ends of this spectrum, with computer and data processing locations getting larger and government space getting smaller. The upshot is that current levels of square footage per employee remain relevant in forecasting the degree to which zoning constraints would limit growth.

Figure 17 / Average Office Lease Size by Class Type, 2004-2014



### Preferences for Cities and Walkability

To capitalize on the qualities of city living at more reasonable costs, many people are choosing non-downtown city neighborhoods or more-walkable suburbs. While many have a vision of younger people and retirees flooding back into cities, it may not actually be the urbanity that is pulling them in, but the accessibility that is offered in an urban location. Almost regardless of geographic preference for living- urban or suburban - what people value is the ability to be within walking distance of a variety of opportunities- restaurants, shops, jobs, parks, and more. Looking more specifically at the D.C. Metro region, ULI's 2015 'Millennials Inside the Beltway' report found that survey participants expressed a consistent interest in living in walkable places with good transit access. Over two-thirds of respondents said that walkability is the best attribute and 65% of respondents said Metro access is among their top three reasons for selecting or staying in their current location.

The walkability of urban areas and “urban-like” areas is seen as one of the key factors appealing to all demographic groups. A national survey found that 60% of respondents “favor a mix of houses and stores that are easy to walk to”.<sup>7</sup> Real estate analyst and longtime Washington, D.C. market observer Christopher Leinberger published research showing that the region leads the nation in major walkable centers, most of the region’s recent development happened in these centers, and real estate in these centers has a major price/value premium over other suburban development.<sup>8</sup> It appears that walkability is increasingly driving the commercial real estate market in the region, and most of the walkable places are in, or near, the urban core or along Metrorail lines. Of the region’s 43 walkable centers identified by Leinberger, 21 are in the District of Columbia.

Figure 18 | Average Office Lease Size by Industry Type, 2004-2014



Research published by the National Association of Industrial and Office Properties (NAIOP) found similar preferences by office tenants and higher values for walkable, mixed-use places. Across the U.S., “vibrant suburban centers” compete evenly with regional central business districts for office tenants, but they have beaten out conventional suburban locations.<sup>9</sup> ULI’s Emerging Trends in Real Estate 2016 report included walkable secondary markets in their list of Expected Best Bets for real estate investment. Overall, this suggests that much of the region will be a desirable place to live, as all counties in the region have elements of urbanity and walkability. Moreover, there are many different examples of urban, walkable places, increasing the potential attractiveness as a place to raise families and retire, thus supporting a wide range of both residential and commercial markets. These trends inform our findings that the first-tier

and second-tier suburbs remain the strongest markets for growth.

<sup>7</sup> National Association of Realtors, 2013 Community Preference Survey.

<sup>8</sup> Leinberger, Christopher B. *DC: The WalkUP Wake-Up Call*. The George Washington University School of Business. 2012.

<http://business.gwu.edu/dc-the-walkup-wake-up-call>

<sup>9</sup> Malizia, Emil. *Preferred Office Locations*. NAIOP Research Foundation. 2014. <http://www.naiop.org/preferredofficelocations>



## Retail Industry Trends

The retail industry is in flux due to the aftermath of the Great Recession, the continuing rise of e-commerce, the indirect effects of mobile technology, and Generation Y preferences beginning to supersede those of the Baby Boomers, which have driven the market for so long. Many analysts have weighed-in on this subject, which is complex because it reflects a wide-range of cultural and economic influences. While there are slight changes every year, recent years have seen a consistent set of key trends:

1. The national urban population increase has been outpacing the nation's overall growth rate for over a decade, and new construction in suburban areas is increasingly more urban in feel, with a mix of development types and transportation options located nearby.<sup>10</sup>
2. Washington D.C. real estate will continue to be bolstered by international investment. The national property market is the most stable and transparent in the world, making it a logical investment choice.
3. Dramatic shifts in the retail market are expected to continue. The "de-massification" of retail continues to occur; mass physical markets are disappearing and fragmenting, and along with that are many big malls, shopping centers, and retailers. The retail in demand now is either driven by experience (upscale) or need/convenience (downscale). The convenience and choice of online shopping fits with the desires of current shoppers, so getting them out to physical locations calls for prime locations and compelling experiences/products.<sup>11</sup> Major retailers are adjusting to online purchasing with mixed spaces (i.e., both virtual and physical space used by retailers) and "showroom" style spaces increasing in prominence. These types of spaces are well-suited to urban and denser suburban places, where space is at a premium.

Based on these trends, we find that the number and strength of walkable, mixed-use places in the region indicate a position at the leading edge in the evolution of the retail industry and the locations and real estate that it occupies. Combined with the emerging preference for urban living on the part of Millennials and the District population boom, the expansion of retail development following an expansion of population may slow or be redirected to more intensely developed centers than has been the case in the past.

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<sup>10</sup> Urban Land Institute. *Emerging Trends in Real Estate, United States and Canada*. 2016.

<sup>11</sup> Lewis, Robin. "The Great Retail Demassification, Part 1." *Forbes*. March 24, 2014. <http://www.forbes.com/sites/robinlewis/2014/03/24/the-great-retail-demassification-part-1>

## Summary of Regional Trends

### *Strengths*

The region has a competitive advantage compared to national averages as demonstrated by continued long-term positive trends in population, employment, and the economy. The population is growing, complemented by a high-quality job market and a strong, albeit consolidated, traded sector. Additionally, the individual jurisdictions with the region continue to “grow together”, as recent decades have created a more integrated set of markets that increasingly span jurisdictional boundaries. A continuation of this trend would require cooperation towards increased diversity and attractive as both a population and employment center.

### *Weaknesses*

Some of the elements that strengthen the region also expose it to economic volatility. Due to its attractiveness, the region has been characterized by a relatively high-cost of living that is commensurate with slow income growth. This slow income growth could be attributed to stagnating federal job growth, as federal jobs continue to be the dominant industry. In the long-term, the region is susceptible to changes in federal spending, but long-term federal job loss hasn't impeded regional growth to-date. Changes in federal jobs growth have direct and indirect impacts on employment in other sectors. Specifically, the private sector remains heavily dependent on public contracts and could feel the effects of stagnant federal jobs growth.

## Historic National Growth Trends

Figure 19 shows the Washington MSA population has outpaced national population growth and has been doing so more quickly in the past two decades. The national population continues to grow, yet is decelerating, indicated in Figure 20. The U.S. Census Bureau forecasts a continued deceleration in relative population increases, following the patterns of the last few decades, as illustrated in Figure 21. Historically, regional and national employment trends are in-sync, as demonstrated in Figure 22, although the region did not experience as much of an employment drop as the rest of the nation during the Great Recession. The influence of the federal jobs sector helped the region survive economic downturn, evidenced in Figure 23, but has also limited growth afterwards.



Figure 19 / Historic D.C. Regional and National Population, 1969-2016

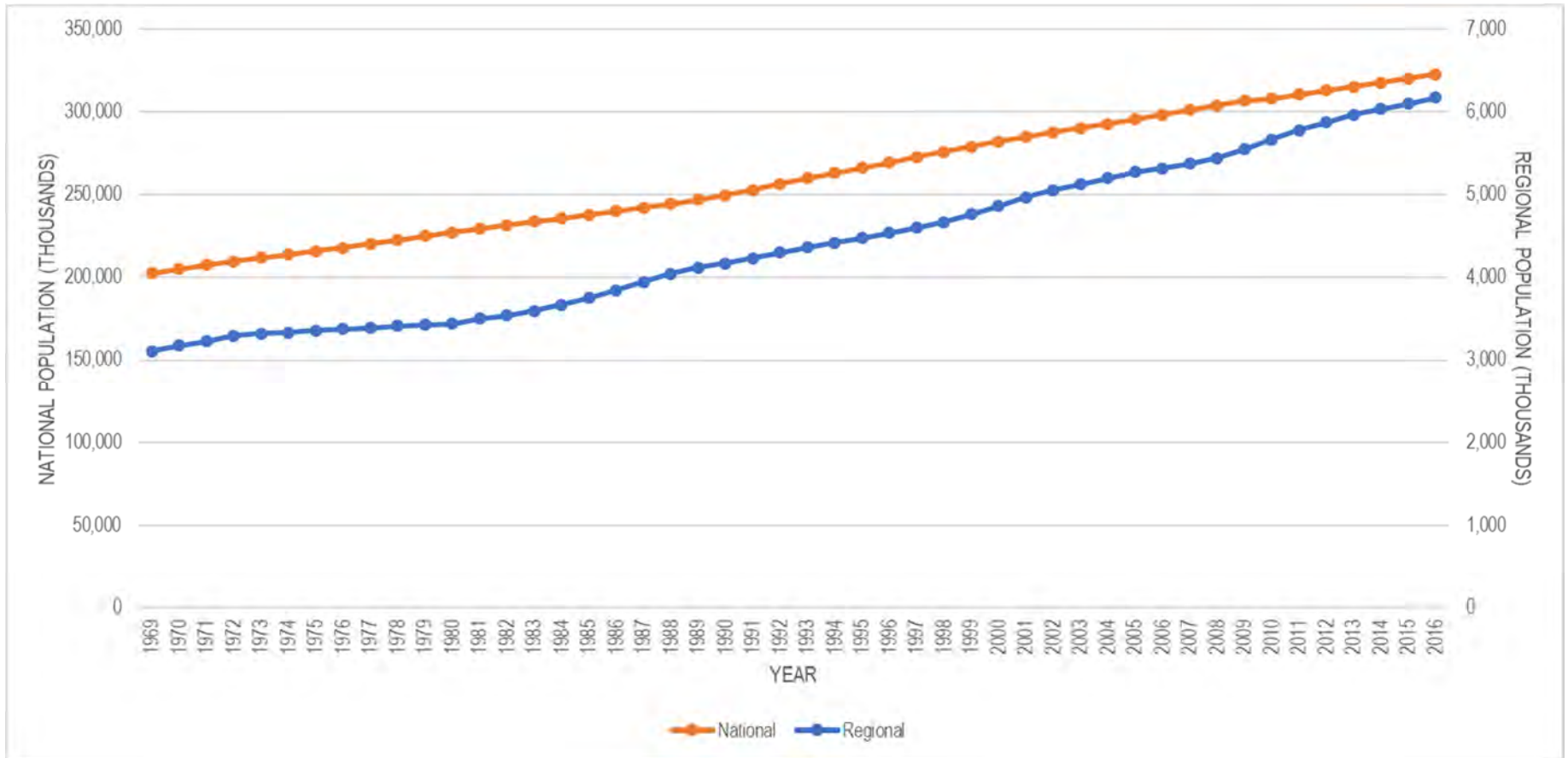


Figure 20 / Year-to-Year Percent Change in National and D.C. Regional Population, 1970-2016

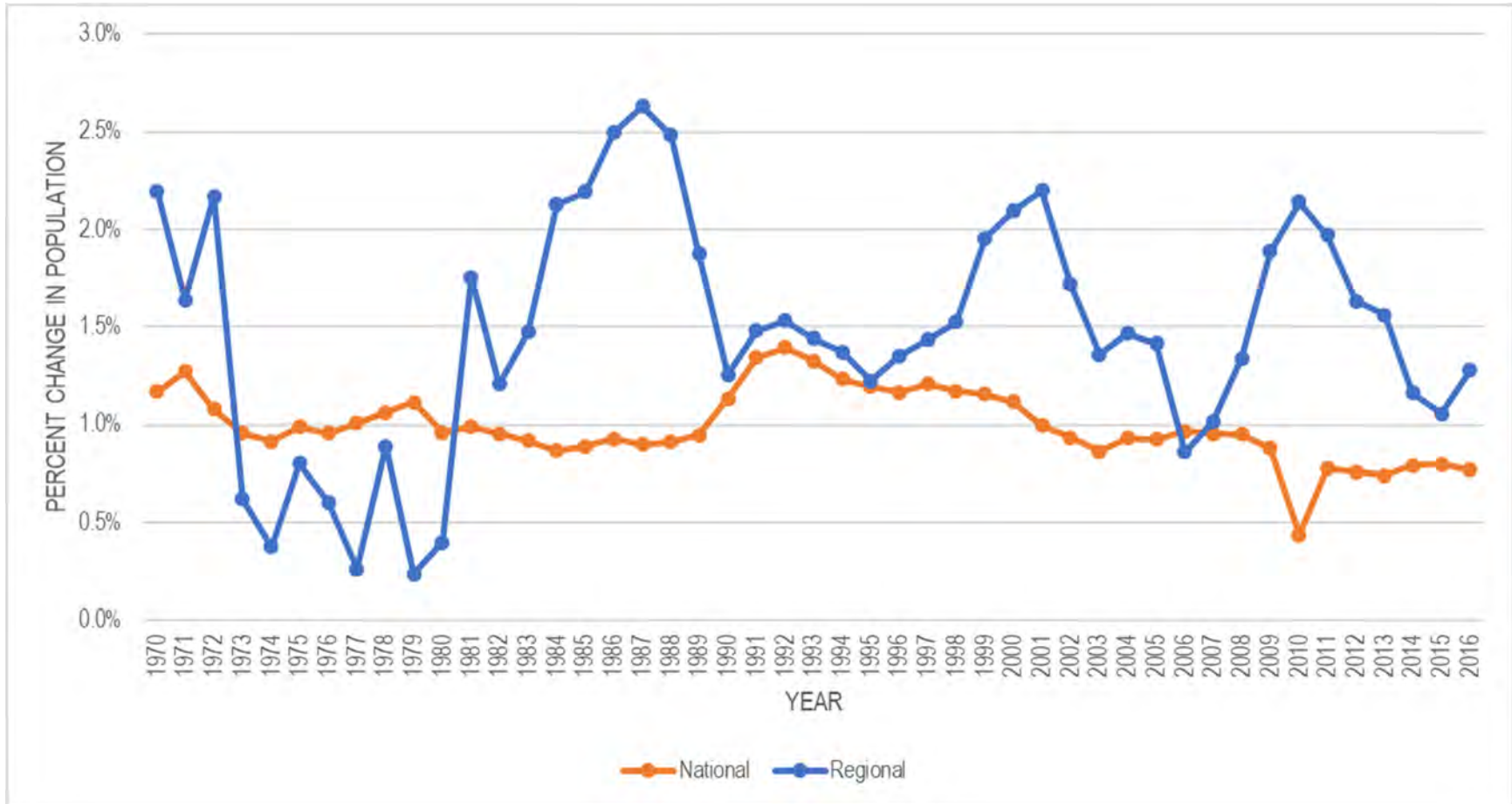


Figure 21 / Year-to-Year Percent Projected National Population Change, 2015-2040

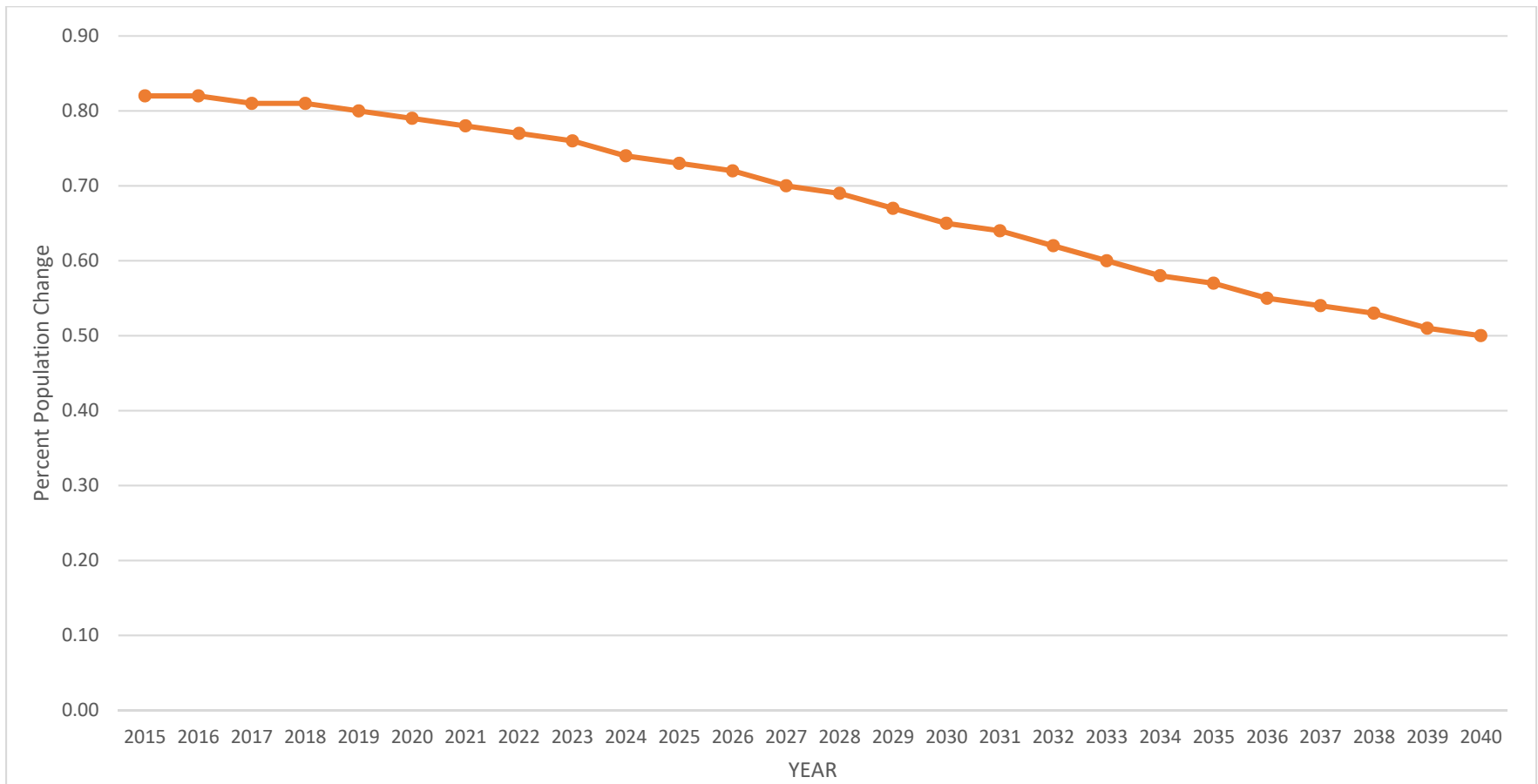


Figure 22 / D.C. Regional and National Employment, 1969-2016

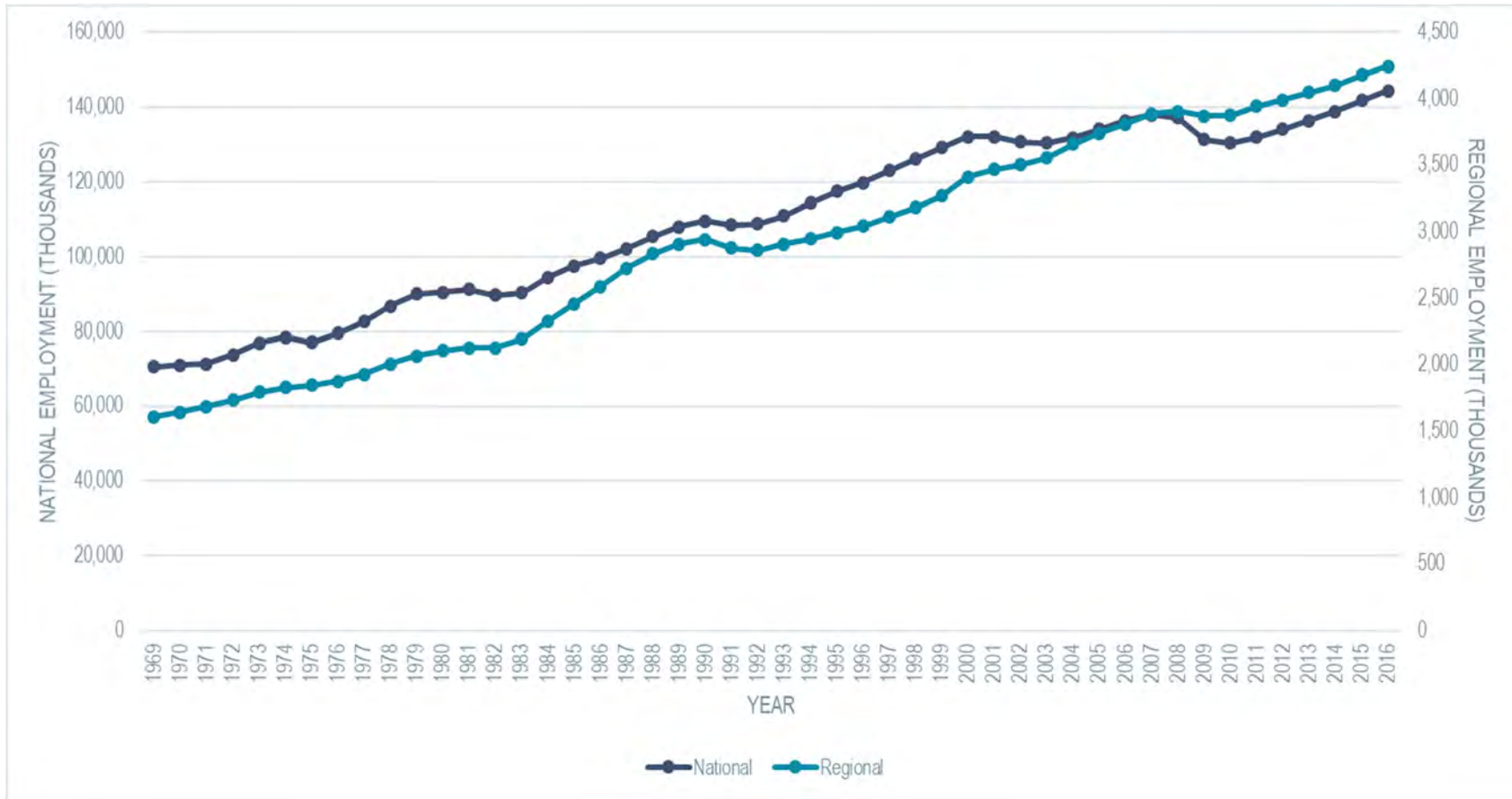
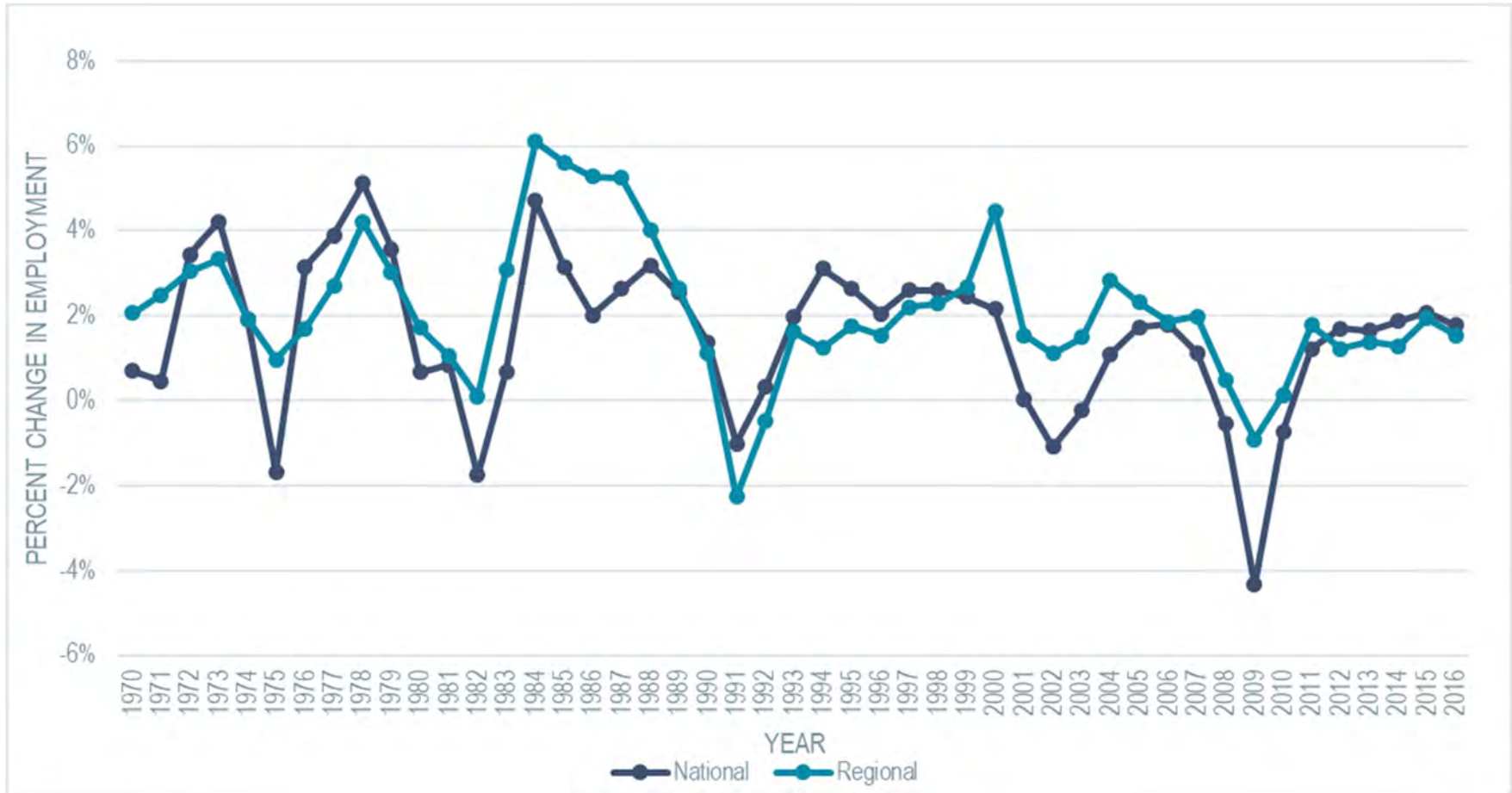


Figure 23 / Percent Change in D.C. Regional and National Employment, 1970-2016



## Amazon HQ2

### What is it?

A 150-acre site in Arlington County, Virginia, newly-branded as National Landing. Encompassing parts of Pentagon City and Crystal City in Arlington as well as Potomac Yard in Alexandria, National Landing is the product of a partnership involving Arlington, Alexandria, and property owner and developer JBG Smith.

### How many new employees?

Amazon already employs more than 8,500 in Virginia and 2,000 in the D.C. metro.<sup>12</sup> Amazon expects to fill 400 additional jobs in 2019, followed by 1,180 in 2020. By 2030, that number should be a minimum of 25,000 in total, with the potential to expand to 37,850 by 2038.<sup>13</sup> The final number of employees may change based on a recent decision not to build a second HQ2 in Long Island City, NY.<sup>14</sup> However, Amazon representatives assured elected officials that this decision will not affect the HQ2 project in Virginia, since the deal Amazon signed with Virginia permits the company to grow to 37,850 employees by 2038.<sup>15</sup>

The number of indirect (and/or induced) jobs varies, as multiple entities conducted studies to estimate the economic and fiscal impact of Amazon's new headquarters, including the National Association of Realtors, Virginia Chamber Foundation, and the Virginia Economic Development Partnership (VAEDP). Experts assumed that the jobs created by Amazon headquarters, direct and indirect/induced, are not incorporated into Round 9.1 projections. Amazon headquarters is thus presented as a catalyst to the region's economy and a generator of employment activity.

Crystal City Job Creation Timeline  
12-Year Ramp-Up

Year	Crystal City
2019	400
2020	1,180
2021	1,964
2022	1,439
2023	2,665
2024	2,352
2025	1,643
2026	2,207
2027	3,000
2028	3,000
2029	2,305
2030	2,845

Source: Memorandum of Understanding Major Headquarters Program, Nov. 12, 2018

Figure 24 | Amazon HQ2 Employment Timeline

<sup>12</sup> <https://www.northernvirginiamag.com/culture/culture-features/2018/12/20/everything-you-need-to-know-about-amazon-coming-to-northern-virginia/>

<sup>13</sup> [http://ngkf.com/Uploads/Amazons\\_HQ2\\_Decision\\_The\\_Impact\\_on\\_the\\_Washington\\_Commercial\\_Real\\_Estate\\_Market.pdf](http://ngkf.com/Uploads/Amazons_HQ2_Decision_The_Impact_on_the_Washington_Commercial_Real_Estate_Market.pdf)

<sup>14</sup> <https://blog.aboutamazon.com/company-news/update-on-plans-for-new-york-city-headquarters>

<sup>15</sup> <https://wamu.org/story/19/02/14/amazon-is-pulling-the-plug-on-its-nyc-campus-but-impact-on-crystal-city-remains-unclear/#.XG3K4uhKiUk>



The National Association of Realtors published a factsheet outlining the potential impacts that Amazon HQ2 could have on the real estate market. This analysis assumes that the size of the multiplier effect may be 2 additional jobs for each job that HQ2 creates. Considering the multiplier effect, about 5,000 additional jobs are expected to be added every year in the market (assuming 2,500 Amazon jobs added per year). If the multiplier effect is 2 jobs for every one Amazon job, then employment in the Washington region should increase 11% on average every year in the next ten years.<sup>16</sup> This assumption is a bit oversimplified and is not aligned with market expectations. It is more realistic to expect Amazon hiring will vary year to year, as indicated in the table above. Subsequently, indirect and induced jobs should also vary from year to year.

The Stephen S. Fuller Institute prepared a study on behalf of the VAEDP estimating the economic and fiscal impact of Amazon on Arlington County and the Commonwealth of Virginia on November 8, 2018, just days before the Amazon announcement of two headquarters. Therefore, the assumptions in their analysis are for one headquarters that would host 50,000 employees. When compared to Round 9.1 forecasts for Arlington County's growth over the 2019- 2039 period, Amazon's proposed workforce of up to 50,000 (plus 2,310 assumed indirect and induced jobs beyond supporting development already assumed in Round 9.1) substantially exceeds Round 9.1 forecasts. Without HQ2, the Fuller Institute estimates that the County is expected to add 34,312 jobs to the employment base over this period. However, with Amazon's potential addition of 52,310 jobs (including indirect and induced job growth), the County's employment base would increase by 86,622 jobs or by 44.4 percent rather than by the projected 34,312 jobs or 17.6 percent by 2039. This more than doubles the County's job growth over this period and assumes that the new Amazon jobs are not already included in the current forecasts. The study was reconfigured with the new assumptions (25,000 Amazon employees) and projects 22,000 indirect jobs will be created from Amazon's arrival.

The Virginia Chamber Foundation commissioned a study to assess the economic impact of Amazon HQ2 in Arlington County and Northern Virginia. The results indicate that the 25,000 direct hires will correlate to approximately 62,650 indirect and induced jobs in the Metropolitan Statistical Area (MSA). When added to the Round 9.1 forecast for Arlington County, the employment growth rate increases to 2.2%, to reach a total of 78,922, and when added to the Round 9.1 forecast for Northern Virginia, the growth rate increases to 1.3% (or a total of 346,159 new jobs).<sup>17</sup> This estimate from the Virginia chamber assumes all the new growth will occur in Arlington County, counter to the branding associated with the Potomac Yard Metrorail station (in the City of Alexandria). This analysis also appears to assume that all Amazon HQ2 jobs are new to the region (Figure 4.3 and 4.5 show exactly 25,000 jobs as the difference with and without HQ2) and that none of the indirect/induced demand of 37,850 are due to HQ2. This may be a simplifying assumption, but it suggests they have not examined which of these jobs are truly already "baked into" the adopted 9.1 forecasts.

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<sup>16</sup> [https://www.nar.realtor/infographics/infographic-amazons-hq2-impact-on-dc?om\\_rid=AACfJP&om\\_mid=Bb7d5ZB9uewccE&om\\_ntype=NARWeekly](https://www.nar.realtor/infographics/infographic-amazons-hq2-impact-on-dc?om_rid=AACfJP&om_mid=Bb7d5ZB9uewccE&om_ntype=NARWeekly)

<sup>17</sup> <https://www.vachamber.com/wp-content/uploads/2018/12/Final-Amazon-Study-120718.pdf>

The expected location for Amazon HQ2 is National Landing, which represents three activity centers: Crystal City, Pentagon City, and Potomac Yard. These three activity centers are projected in Round 9.1 to add 32,743 additional jobs by 2045. The composition of MWCOG Round 9.1 employment projections for this combined activity center is presented in the table below.

Table 4 | Round 9.1 Job Forecasts for National Landing Combined Activity Centers

	2017	2020	2025	2030	2035	2040	2045
<b>Office</b>	35,964	35,413	42,658	49,364	53,175	57,844	63,803
<b>Retail</b>	11,264	11,542	12,611	13,718	14,092	15,163	15,111
<b>Industrial</b>	1,666	1,678	1,877	2,089	2,281	2,452	2,515
<b>Other</b>	3,372	3,385	3,488	3,507	3,542	3,575	3,581
<b>TOTAL</b>	52,267	52,018	60,634	68,678	73,090	79,034	85,010
<b>MWCOG Projected Total Job Growth</b>	0	-249	8,367	16,411	20,823	26,767	32,743

Table 5 | Amazon HQ2 Direct Employment Growth Estimate<sup>18</sup>

	2017	2020	2025	2030	2035	2040	2045
<b>Direct Employment Growth Estimate</b>	400	1,580	11,643	25,000		37,850	

<sup>18</sup> Virginia Economic Development Partnership (VAEDP), S. Fuller Institute

The tables above demonstrate that some of the employment growth from Amazon HQ2 is already captured in the growth of Crystal City through 2020. However, from 2025 through 2045, the existing MWCOG forecast does not include the anticipated employment ramp-up from Amazon headquarters. This indicates the need to adjust the control totals in our independent assessment from 2025 through 2045 to capture the direct jobs created from HQ2.

Amazon's presence is likely to attract other like-minded companies and further diversify the area's economy away from dependence on the federal government. Experts estimated that Amazon HQ2 could create 22,000 indirect jobs in the region by 2040.<sup>19</sup> It is likely that these jobs will not be concentrated in the Crystal City activity center; in fact, it is more reasonable to assume that they will locate in surrounding activity centers, as well as Fairfax, Arlington, Loudoun, and Prince William counties.

### How could this affect the region?

The workers and their households will reside throughout the region. No single jurisdiction will house all the HQ2 employees, as these workers will have differing preferences and household types.<sup>20</sup> Additionally, no single jurisdiction will host all of the indirect and induced employment that the new headquarters will generate. The assumption that HQ2 employees locational choices will be dispersed throughout the region is supported by the fact that Crystal City is easily accessed by commuting, allowing Amazon HQ2 employees to consider living within commuting distance rather than necessarily near the workplace.<sup>21</sup> The Fuller Institute estimates that the largest share of new residents (nearly 25,000 in their initial estimates for a full HQ2 complement of 50,000 jobs) would move to Fairfax. Arlington would add 9,000 new households, and Loudoun, Prince William, and DC would each add at least 5,000 households each.<sup>22</sup>

One of the impacts of this major headquarters locating in Crystal City is the contribution to a widening gap between wealthy and poor households in the Washington, D.C. MSA. The average Amazon employee is expected to earn \$150,000, which is almost 50% higher than the median household income in Arlington (\$108,706 in 2016) and almost 100 percent greater than the median household income in D.C. (\$75,506 in 2016).<sup>23</sup> However, this income disparity may not translate to displacement of residents due to gentrification. A study from Metrostudy estimates that the demand for homes will increase in Arlington, Loudoun, Prince William, and Fairfax counties. The study suggests that there will be more listings and slightly higher prices, but this won't translate to a shift in

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<sup>19</sup> Virginia Economic Development Partnership (VAEDP), S. Fuller Institute

<sup>20</sup> <http://sfullerstitute.gmu.edu/2018/11/13/amazon-housing-impacts/>

<sup>21</sup> <<https://www.marketwatch.com/story/why-the-amazon-effect-on-house-prices-may-be-muted-in-the-chosen-hq2-cities-2018-11-07>>

<sup>22</sup> Greater Greater Washington <<https://ggwash.org/view/70036/washington-dc-region-housing-supply-is-tight-amazon-probably-wont-change-that-much>>

<sup>23</sup> <https://thehill.com/policy/technology/416524-five-ways-amazon-hq2-could-impact-the-dc-area>

the type and location of residential stock beyond what is already in the Round 9.1 forecasts. This is partly due to depressed price appreciation for the DC housing market, as well as the trend of baby boomers aging out of their housing. Metrostudy projects a growing resale market and suggests Amazon employees will not compete for these homes, opting for new construction instead.<sup>24</sup>

MWCOG analyzed the potential impact that Amazon could have on the housing market and estimates demand significantly outpaces the market's current pace of supply. For example, MWCOG estimates that the region needs an additional 235,000 housing units by 2025 to accommodate expected job growth. An additional 50,000 jobs (now 25,000) boosts that production target to 267,000 (now 251,000).<sup>25</sup> The housing market currently lags behind historic trends. If this pattern continues, housing prices may continue to rise faster than in the past relative to household growth, with or without HQ2. Builders may see HQ2 as an opportunity and increase production as a result.<sup>26</sup>

Finally, HQ2 could affect the broader employment base in Arlington County and surrounding jurisdictions. For example, in 2019 Arlington County is dominated by the Business Services cluster, an "Office" category in the MWCOG projections, and includes "Corporate Headquarters". Employees at Amazon HQ2 would likely fall under this category. Ancillary businesses and indirect jobs created from HQ2 could fall under "Retail" or "Other" job categories. These jobs induced by HQ2 could shift the composition of jobs in the county away from Business Services to other clusters, diversifying the employment base.<sup>27</sup>

### How is the region responding?

HQ2 direct hires and indirect/induced jobs will increase demand on transportation infrastructure, the regional job market, and real estate development. Significant transportation investments will be required to accommodate the additional demand on the system. Additionally, a larger pool of high-skilled candidates should be developed to meet the hiring needs of Amazon and related businesses. Finally, real estate development in and around Crystal City to support Amazon HQ2 and its employees should shift towards more condominiums, mixed-use, and Class A office space.

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<sup>24</sup> <https://www.metrostudy.com/amazon-effect-hq2-will-impact-nyc-dc-housing-markets/>>

<sup>25</sup> Urban Institute <https://apps.urban.org/features/amazon-hq2-washington-housing-charts/>>

<sup>26</sup> <http://fullerinstitute.gmu.edu/2018/11/13/amazon-housing-impacts/>

<sup>27</sup> <http://ngkf.com/Uploads/Amazons HQ2 Decision The Impact on the Washington Commercial Real Estate Market.pdf>

Washington Metropolitan Area Transit Authority's (WMATA) \$5.1 billion capital improvement plan and \$6.8 billion project to deliver rail service to Dulles International Airport are both key regional investments that support the Amazon HQ2 arrival. In addition, Virginia DOT is investing up to \$195 million in transportation projects, including additional entrances at two Metro stations near the headquarters. Finally, Arlington and Alexandria are investing \$570 million in transportation projects.<sup>28</sup> These investments represent a regional commitment to a transportation system that effectively serves the new activity being generated by HQ2.

In addition to regional transportation investments, universities across the state are investing in programs and assets that position their graduates for employment at Amazon or associated businesses. Virginia Tech is investing \$1 billion to develop an Innovation Campus near HQ2, with the aim of establishing a talent pipeline. Similarly, George Mason is investing \$250 million in an Institute for Digital Innovation on its Arlington campus – which currently occupies 700,000 sf and will grow to 1.2 million - in addition to expanding programs, all of which is designed to support HQ2.<sup>29</sup> New graduates will not be hired only by Amazon - some will be hired by companies who lose workers to Amazon, others will be hired by the federal government or government contractors, while some will start their own companies. This could lead to long-term job creation within high-wage fields, inducing additional jobs in the region's retail market.<sup>30</sup>

HQ2 is expected to expedite development in the Crystal City area, particularly for multi-family, office, and retail.<sup>31</sup> The following developments were highlighted by the research firm Newmark Knight Frank for their relationship to HQ2 and overall development footprint.

- Amazon is set to purchase land that was previously set aside for future developments called Pen Place and Metropolitan Park. The land has a potential density of up to 4.1 million square feet.
- Crystal Square JBG Smith has approvals to redevelop a 15-acre area called Crystal Square. The project will include 100,000 square feet of retail including an Alamo Drafthouse and a yet-to-be announced small format grocery store. The project also will include a two-story freestanding retail building above the future new Crystal City Metro station entrance.
- Metro Market Square 1750/1770 Crystal Drive will undergo renovations and a 22,000-square-foot expansion of the existing 250,000-square-foot office building. The project is projected to get underway during fourth quarter 2019. Amazon is planning on occupying the entire building upon its completion.

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<sup>28</sup> <https://www.smartcitiesdive.com/news/amazon-hq2-decision-transit-impact/542214/>

<sup>29</sup> <http://www.virginiabusiness.com/news/article/george-mason-launching-institute-for-digital-innovation-idea>

<sup>30</sup> [http://ngkf.com/Uploads/Amazons\\_HQ2\\_Decision\\_The\\_Impact\\_on\\_the\\_Washington\\_Commercial\\_Real\\_Estate\\_Market.pdf](http://ngkf.com/Uploads/Amazons_HQ2_Decision_The_Impact_on_the_Washington_Commercial_Real_Estate_Market.pdf)

<sup>31</sup> [http://ngkf.com/Uploads/Amazons\\_HQ2\\_Decision\\_The\\_Impact\\_on\\_the\\_Washington\\_Commercial\\_Real\\_Estate\\_Market.pdf](http://ngkf.com/Uploads/Amazons_HQ2_Decision_The_Impact_on_the_Washington_Commercial_Real_Estate_Market.pdf)



- Pentagon Centre Kimco Realty is adding to the existing Pentagon Centre with 440 apartment units and 7,000 square feet of retail above the Pentagon City Metro station in phase one, which is set to deliver in the second quarter of 2019. Phase two includes 253 units of multifamily housing and 25,000 square feet of retail.
- Potomac Yard (Arlington) One million square feet of office space and 41,325 square feet of retail space are approved for development on land owned by Lidl and Meridian Group. Praedium Group is constructing a 342-unit apartment building, while Erkelitian Development Co. is constructing a 360-unit apartment building.
- Potomac Yard Center (Alexandria) Redevelopment This site hosts a big-box shopping center that is slated to be redeveloped into 7.5 million square feet of mixed-use space. The first phase includes 732 multifamily housing units and 290,800 square feet of retail space. Phase one also would include either 115,000 square feet of office space or a 120-room hotel.
- 2351 Jefferson Davis Highway Lowe Enterprises has approval for a 302-unit multifamily housing project with an additional 20,000 square feet of retail space. The building will be above the existing Buffalo Wild Wings restaurant.
- Crystal House III Mack-Cali's multifamily housing arm called Roseland Residential Trust gained approval for a third building with 252 apartment units. When completed, Crystal House will have more than 800 multifamily housing units.
- 1900 Crystal Drive JBG Smith plans to start construction at 1900 Crystal Drive in 2019. The two building multifamily housing project will total 750 units.
- Altaire Phase II LCOR recently purchased almost an acre of land adjacent to its recently completed Altaire project. Phase two will include 280 multifamily housing units at a lower price point than the 451-unit phase one building. LCOR plans to break ground in early 2020.

It is reasonable to assume that demand will continue for multi-family housing and retail. Therefore, the projects highlighted above are just a sampling of the development activity that could be expected as the region responds to the arrival of HQ2.

### How does HQ2 affect our forecast?

Renaissance developed several simplifying assumptions to determine the effect that Amazon HQ2 would have on the jurisdictional control totals, prior to suballocation to TAZs. These assumptions are as follows:

- All Amazon HQ2 direct employment are classified as "Office"
- All direct employees will be located in the National Landing Activity Center (which is comprised of Crystal City, Pentagon City, and Potomac Yard).
- Majority of indirect employees will be located within a 5-mile service area (based on HERE network travel times) of the National Landing Activity Center; some small number of indirect employees will locate in National Landing
- Regional population growth will be proportional to regional jobs/population balance

- National Landing will demonstrate the following mixed-use pressures
  - o HQ2 will increase both job and housing costs
  - o HQ2 will influence a shift from residential to commercial for near term (opposite of the BRAC departure effect shift toward residential)
  - o Residential amounts do not drop; however, higher HQ2 salaries maintain current demand for residential, therefore our forecasts only explicitly reflect an increase in jobs
  - o There are no capacity constraints on height or floor-area ratios to prohibit construction of office space to accommodate HQ2 as all new construction if market demanded
- Growth by jurisdiction will be proportional to future office employment in activity centers

Deploying these assumptions, our analysis identified that MWCOG 9.1 employment projections for the National Landing Activity Center by 2045 already account for approximately 23,000 jobs of the anticipated 37,850 Amazon HQ2 direct hires. Thus, control totals in the National Landing Activity Center were adjusted by approximately 14,850 by 2045 to ensure Amazon HQ2 is reflected in this independent forecast.

## Key Findings

### Quality of life and international appeal spur continued population growth

Population growth can be attributed to two forces: natural increase and net-migration. As the number of places for full life-cycle living increase, and the population continues to live longer, births will exceed deaths, resulting in a natural population increase. Additionally, a robust regional economy, despite some concerning trends that are discussed below, will continue to attract migrants.

### Employment growth may be constrained by continued homogeneity

The region hosts a strong economy relative to the nation. Due to increased public spending, the D.C. region was able to weather the 2008 recession with minimal impact. However, the job market is heavily dependent on federal jobs and federal contracts, leaving the economy more susceptible to downturns than other large regions.

Federal job growth has slowed in the region, and federal spending has shifted from the public to private sector. Much of the local work contracted by the federal government is characterized as business services. Business services has historically been, and continues to be, the leading industry of the traded sector in the region. In fact, the region is a national leader in the provision of businesses services, which includes occupations such as computer services (data processing and hosting, computer systems design, programming), technical and professional consulting services, and corporate headquarters. These are generally high-wage

jobs with strong national growth forecasts. However, business services can increasingly be done remotely, which means that the D.C. region has no locational advantage to maintain these jobs. Additionally, a reliance on federal contracts leaves the region susceptible to shifts in federal funding availability.

### **Accessibility investments serve shifting market preferences**

There are signs of modest but consequential changes in development patterns across the region. Residential and commercial market preferences, large-scale infrastructure investments, and focused policy efforts point to changes in population and employment growth over time.

Increasingly, commercial and residential locational preferences are driven by two different factors: (1) the desire to locate in amenity-rich destinations for working, shopping, and living; and (2) a strong preference for cost savings. This is reflected in several regional and national trends.

For example, Class A office space and “high street” retail continue to command high prices and considerable demand in the primary activity centers of the region. Meanwhile, Class B and C office space moves to smaller, cheaper suburban locales while neighborhood retail struggles to compete with online sales and is shifting to service-based retail like restaurants and personal services. This leads to an increase in both diverse, higher-cost development in dense activity centers and in the continued sprawl of housing and employment in lower-cost areas of the region.

Some suburban jurisdictions are pursuing investments that would complement this anticipated shift by offering greater access to both jobs and amenities by car and transit. Many have made significant investments to improve their regional accessibility as illustrated in Figure 25. A few projects to highlight include toll and HOV lane system expansions on I-95, I-395, and I-66, in addition to the I-270

and I-495 managed lanes that are the subject of this study. Transit projects include the Silver Line Phase 2; the Potomac Yard Metrorail Station, the Purple Line and Corridor Cities Transitway; Rockville Pike, Veirs Mill Road and Richmond Highway BRT lines; D.C. Streetcar expansion; and systemwide station and/or service improvements. In addition to these regional accessibility initiatives, many jurisdictions have identified opportunities to increase local accessibility. This includes creating walkable street networks within redeveloping activity centers, such as Tysons, White Flint, and Richmond Highway corridor, as well as improving arterial system connections.

The drivers of change – full life-cycle quality of life, high-paying but homogenous jobs, regionwide infrastructure and policy investments, and predominant development trends influence change in the region in notably different ways. Generally, the region can be divided into tiers that share spatial and sociodemographic characteristics. These are shown in Figure 26 and described in Figure 27.

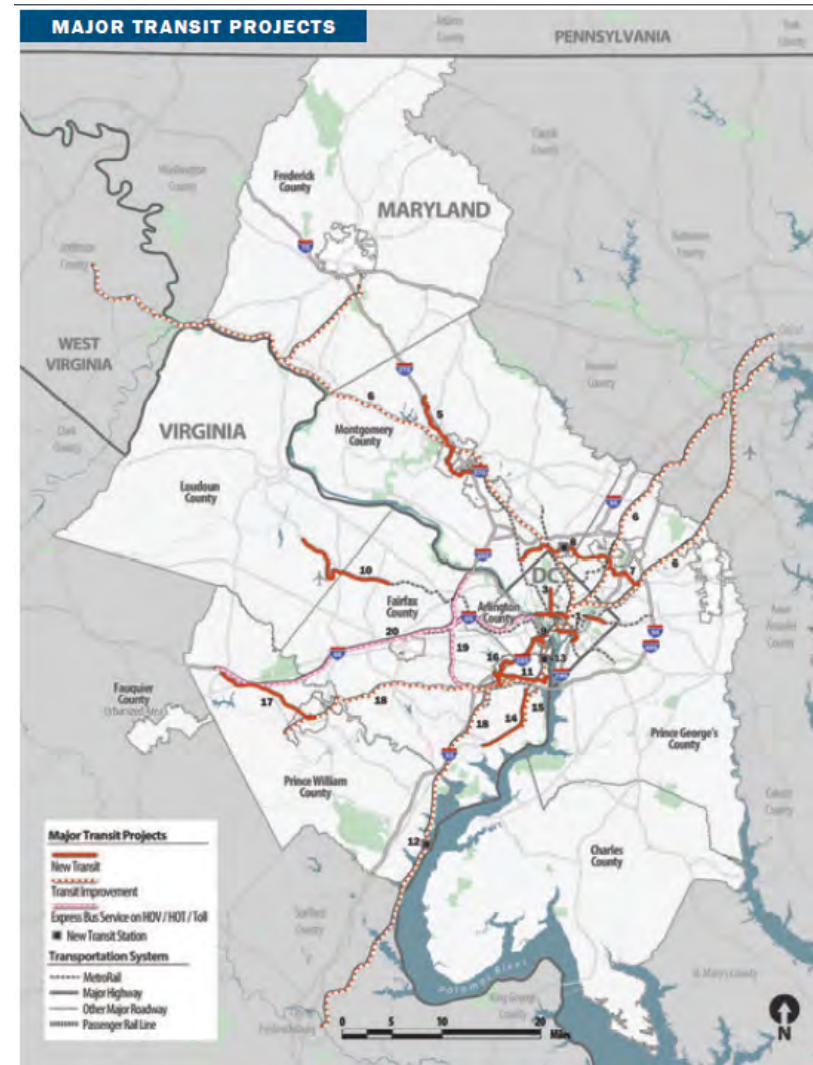


Figure 25 | Major Transit Projects in the Region

Figure 26 | Regional Jurisdiction Tiers

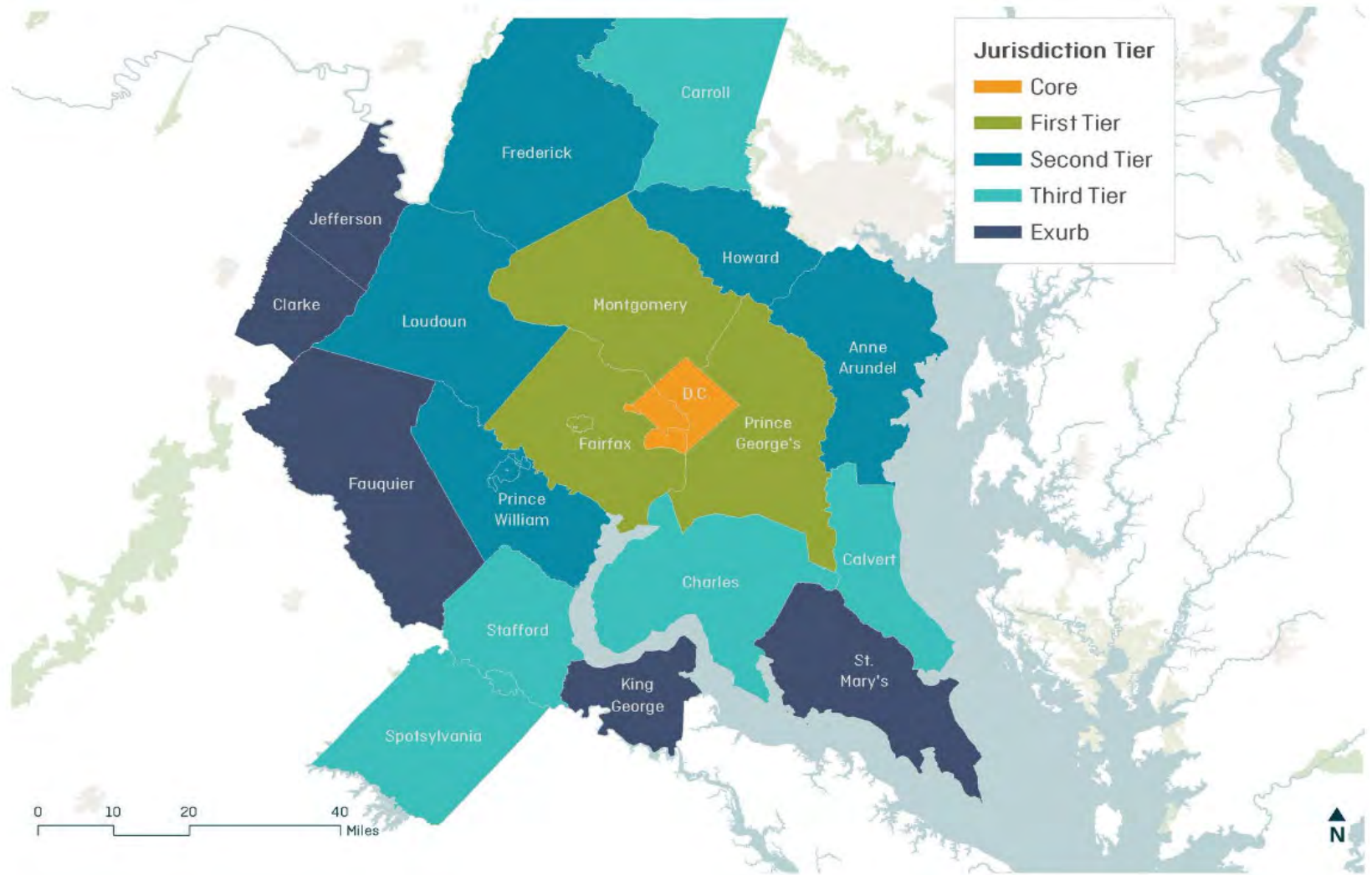




Figure 27 | Description of Regional Tiers

Tier	Jurisdictions	Description
Core	District of Columbia, Arlington County, and City of Alexandria	The historic hubs of the region.
First	Fairfax, Montgomery, and Prince George’s Counties	The first wave of expansion from the core created “bedroom communities” made accessible by historic infrastructure investment aimed at improved access to core jurisdictions which ultimately served to facilitate commercial growth over time.
Second	Anne Arundel, Howard, Frederick, Loudoun, and Prince William Counties	Experienced different drivers of change than first tier and, due to their geographic distance, are not as heavily influenced by the core of the region.
Third	Calvert, Carroll, Charles, Spotsylvania and Stafford Counties and City of Fredericksburg	Of smaller magnitude than first or second tier jurisdictions, but oriented around both the core and an outlying employment hub (e.g. Baltimore, Fredericksburg, or Annapolis).
Exurb	Clarke, Fauquier, Jefferson, King George, and St. Mary’s Counties	Population-heavy areas with limited economic connections to regional employment hubs by long-distance commuters.

The drivers of change lead to the following growth dynamics:

- A combination of opposite market forces pulling outwards toward sprawl and inwards toward compact development focuses growth generally into activity centers in the first and second tier jurisdictions as a new equilibrium for optimal cost, local amenities, and regional access, thus creating the region's most favorable growth conditions.
- A slight decline in the dominance of the core jurisdictions as recent population and employment growth centers. The exurban jurisdictions are generally less impacted by these forces and continue to grow while land is still available.
- A westward shift in the center of gravity for the "favored quarter", the western quadrant of the region, resulting from Dulles Airport's rising influence over employment activity. This is solidified by the rise of Tyson's Corner on the Silver Line as a major new hub of diverse, high-density activity.
- Continued improvements in the balance between jobs and housing at the jurisdictional level, where jobs-heavy places see marginal improvements in housing availability due to regional demand for activity centers, and population-heavy places see marginal improvements in jobs availability due to regional demand for low-cost land for Class B/C office and neighborhood-serving retail and personal services.

# INDEPENDENT ANALYSIS OF GROWTH TRENDS

Population and employment forecasts are commonly developed through a quantitative, data-driven evaluation of natural growth patterns. For this work, cohort-component and shift-share analyses were chosen. They were chosen because of their long track record as reasonable and empirically-validated methods. Details on each method follow.

## Cohort-Component Method

Cohort-component methodology for forecasting population revolves around the three key “components” that create population change: births, deaths, and migration. The cohort-component formula is as follows: Births – Deaths + Net Migration. Cohort-component forecasts are normally created in five-year increments, with new estimates for each component created for every forecasted increment.

### Births

This component focuses on the cohort of births that occur in the region during the forecast period. Longitudinal data exists on historical birth rates and trends at jurisdictional, regional, and national levels that can be used to estimate births in the future.

For this forecast, birth rates in Virginia jurisdictions were aggregated by Planning Districts, including: the Northern Shenandoah Valley Commission, Northern Virginia Commission, Rappahannock-Rapidan Commission, and the George Washington Regional Commission. Additionally, average birth rates were calculated at the state level for Maryland and West Virginia jurisdictions. We analyzed national, regional, and jurisdictional birth rate trends to inform forecasted birth rates for each jurisdiction, as there have been small but important differences in birth rates across the MWCOG region. A downward trend in national birth rates, as illustrated in Figure 28 below, was applied to jurisdictions through an adjustment factor to birth rates through 2045.

Figure 28 | U.S. Fertility Rate Trend, 1940-2017

### Trends in the U.S. Fertility Rate (births per 1,000 women ages 15-44): Selected Years, 1940-2017



Sources: Data for 1940-1965: U.S. Department of Health, Education, and Welfare. (1967). *Vital statistics of the United States, 1965* (Table I-6). Washington, DC: Author. Retrieved from [https://www.cdc.gov/nchs/data/vs/us/nat65\\_1.pdf](https://www.cdc.gov/nchs/data/vs/us/nat65_1.pdf). Data for 1970-1990: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics. (2002). *Health, United States, 2002, with chartbook on trends in the health of Americans* (Table 3). Hyattsville, MD: Author. Retrieved from <https://www.cdc.gov/nchs/data/hus/hus02.pdf>. Data for 1990-2016: Martin, J. A., Hamilton, B. E., Osterman, M. J. K., Driscoll, A. K., & Drake, P. (2018). *Births: Final data for 2016* (Tables 1, 5, 1-26). *National Vital Statistics Reports*, 67(1). Retrieved from [https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67\\_01.pdf](https://www.cdc.gov/nchs/data/nvsr/nvsr67/nvsr67_01.pdf). Data for 2016-2017 race/Hispanic origin estimates: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. (2018). *CDC WONDER* [Data tool]. Retrieved from <https://wonder.cdc.gov/controller/datarequest/D66>. Data for 2017: Martin, J. A., Hamilton, B. E., Osterman, M. J. K., Driscoll, A. K., & Drake, P. (2018). *Births: Final data for 2017* (Tables 1, 2). *National Vital Statistics Reports*, 67(8). Retrieved from

childtrends.org

### Deaths

Deaths are represented in terms of survival rates or the proportion of each 5-year age group that survives into the next 5-year group. Survival rates are provided for each year of life. In general, survival rates are highest from ages 1 through 20, and then begin to decline. Survival rates for each age cohort are then applied to current population to forecast the surviving local population 5 years from the year of analysis.

Historical survival rate data is available at the jurisdictional scale, but because of natural variability in survival rates for small jurisdictions, survival rates were aggregated to the state level, where there was less year-to-year variability.

For our cohort component method, jurisdictional survival rates from 2010-2040 were derived from a blend of the historical data and the Social Security Administration Life Tables, which provide forecasted survival rates through year 2100, illustrated in Figure 29 below. Historical national survival rates were found to be slightly different than evaluated jurisdictions, so a state-level adjustment factor was derived and applied to the Social Security Administration forecast. State-level adjustment factors, reflecting each state's death rate divided by the national death rate, are shown in Table 6. In general, survival rates in Virginia and Maryland are higher than the nation as a whole, while in the District of Columbia and West Virginia, survival rates are slightly worse.

Figure 29 / Social Security Administration Life Expectancy Tables for the U.S., 1900-2100

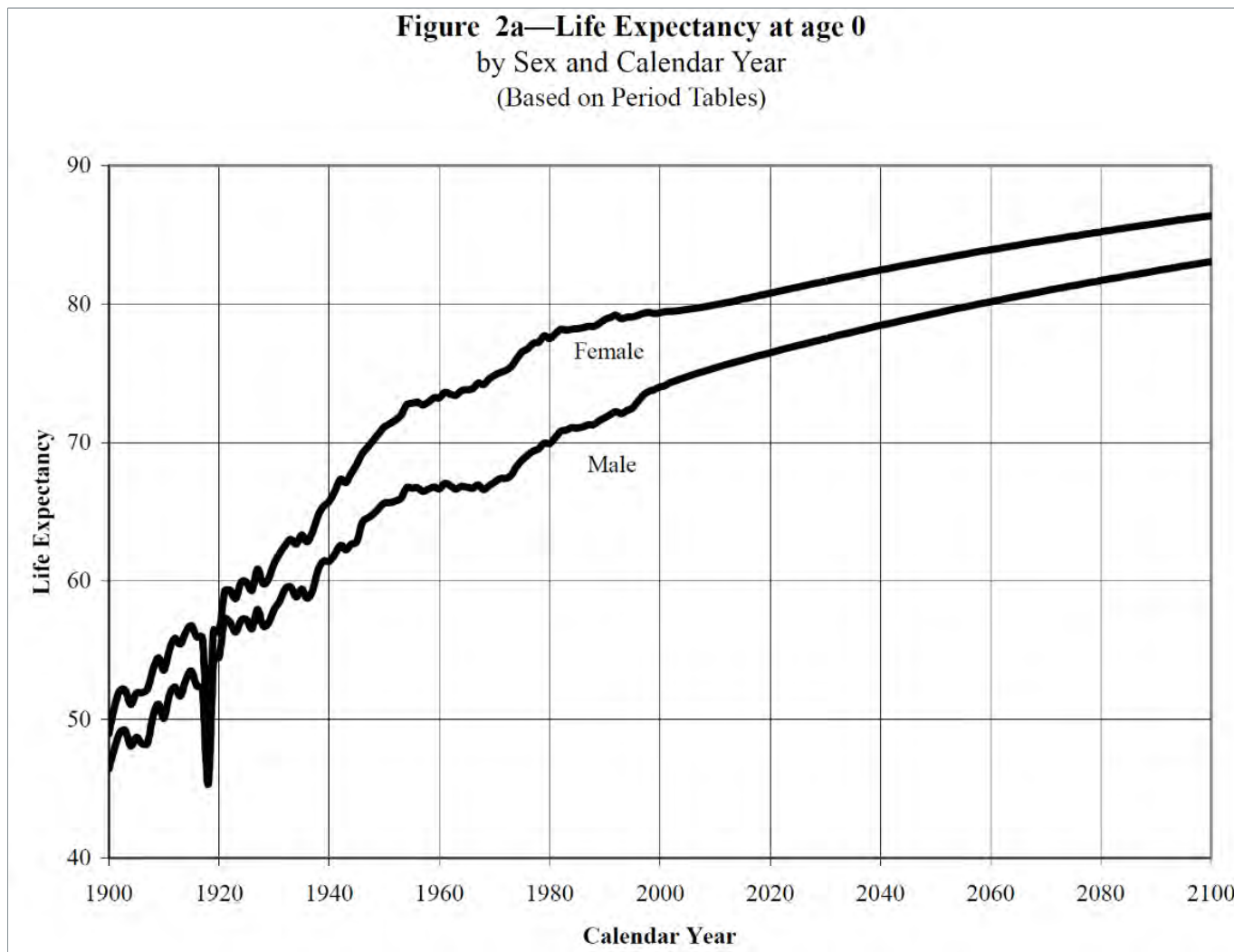




Table 6 | State-Level Adjustment Factors<sup>32</sup>

<b>Geography</b>	<b>Adjustment Factor</b>
District of Columbia	1.022
Maryland	0.843
Virginia	0.807
West Virginia	1.011

### **Net Migration**

Net migration, or the difference between in-migration and out-migration, is the final component of the cohort-component method. Net migration is difficult to track with precision, resulting in variability among estimators on annual net migration. For this forecast, net migration estimates for 1970s, 1980s, 1990s, and 2000s were collected from the University of Wisconsin - Madison.<sup>33</sup> A historical weighted average of net migration was developed for each age cohort and applied to the 2017 population estimate for each jurisdiction to arrive at a 5-year weighted estimate of net migration by age cohort.

<sup>32</sup> United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Compressed Mortality File (CMF) on CDC WONDER Online Database.

<sup>33</sup> Winkler, Richelle, Kenneth M. Johnson, Cheng Cheng, Jim Beaudoin, Paul R. Voss, and Katherine J. Curtis. Age-Specific Net Migration Estimates for US Counties, 1950-2010. Applied Population Laboratory, University of Wisconsin - Madison, 2013. Web. [January 2019] <https://netmigration.wisc.edu/>.

## Shift-Share Analysis

The shift-share analysis methodology for employment forecasting incorporates three trends that are presumed to influence local employment: national employment trends, industry-specific employment trends, and local industry trends. This method quantifies how much of historical employment growth is directly related to the three trends above. The local industry “competitiveness” can thus be ascertained, and used to help forecast growth in the future. National forecasts of growth by industry, combined with local competitiveness, can then be used to forecast jurisdictional growth. This approach synthesizes national, regional, and local forecasts within the four MWCOG travel model industry categories (office, retail, industrial and other) to develop an individual estimate of total jobs.

The differences in BEA data for each jurisdiction between 2001 and 2017 was assessed to establish past trends for national share, industry share, and local competitiveness in each of the four industry types used by the travel demand model: office, retail, industrial, and other. The projected national share estimate for 2045 was applied by assessing national forecast growth across all industries from Woods and Poole to the 2017 estimated job total for each of the four industry groups in each jurisdiction. The projected industry shares were attained by comparing estimates of national-level growth in each of the four industry types to assess the shift of national job growth within each industry. The local competitiveness elements were attained by comparing the Round 9.1 growth rates in each of the four industry types by jurisdiction against the national-level



Figure 30 | Components of Shift Share Analysis

industry growth rates. The estimates of each component are then aggregated into an independent estimate of jobs by category in each jurisdiction, with the total jurisdictional employment estimates consisting of the sum of the four industry groups. These results are presented in the following section on blended forecasts from all sources.

## BLENDING FORECASTS

Population and employment forecasts are developed by public agencies, including state demographic centers and MWCOC, as well as private entities, such as Moody's and Woods & Poole. Professional expertise in the trends of various forecasting agencies was the primary factor in developing a weighted average.

### Population Forecasts

The following outside forecasts for population were collected for weighted analysis: Woods & Poole, Moody's, Weldon Cooper (for Virginia jurisdictions), The figures below show population forecasts from Renaissance's Cohort Component methodology, MWCOC 9.1, Woods & Poole, Moody's, Weldon Cooper (as applicable) and Maryland State Data Center (as applicable) for each jurisdiction in the PMA.

Figure 31 | Arlington County, VA Population Forecasts

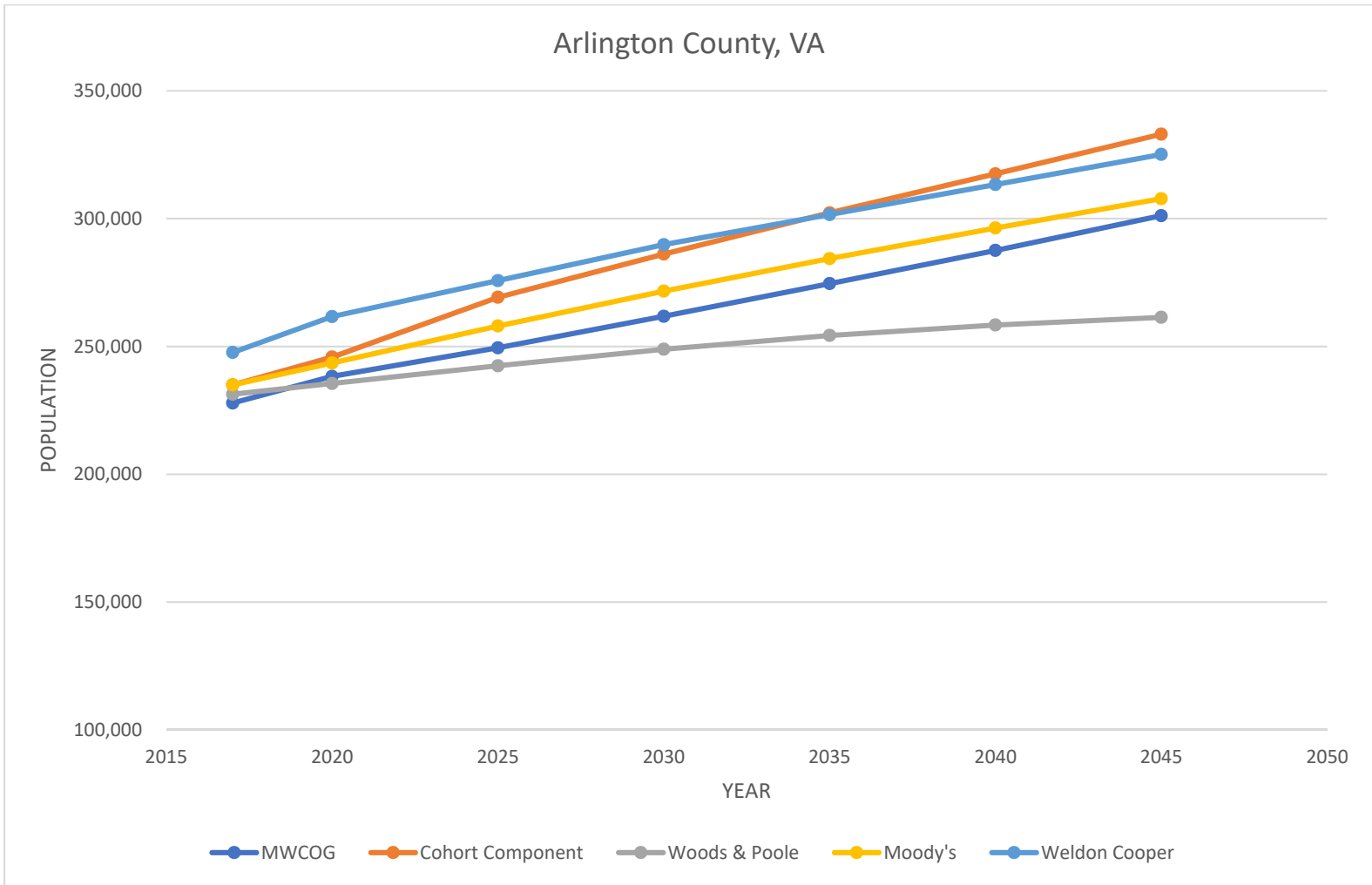


Figure 32 | City of Alexandria, VA Population Forecasts

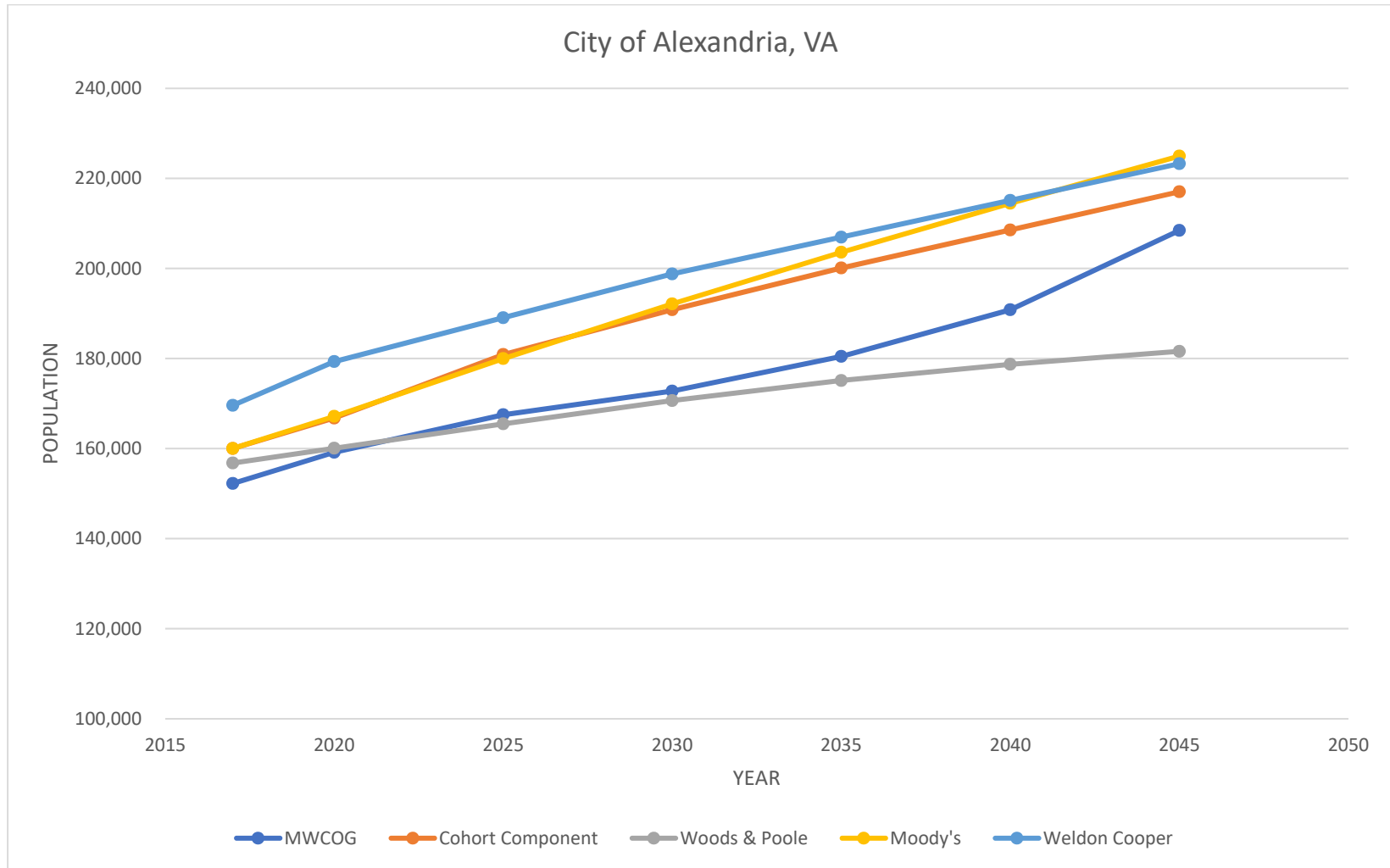




Figure 33 | District of Columbia Population Forecasts

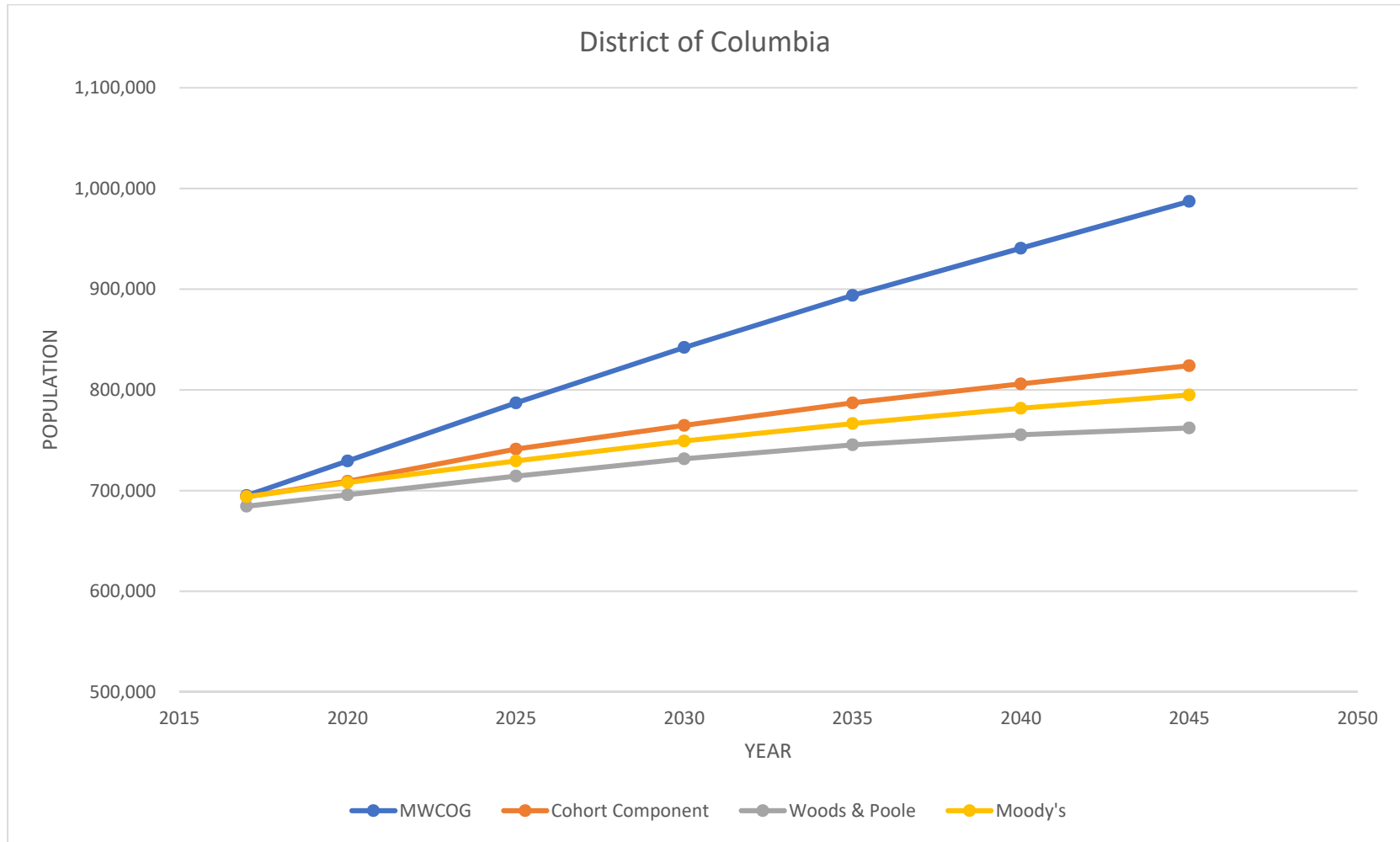


Figure 34 | Fairfax County, VA Population Forecasts

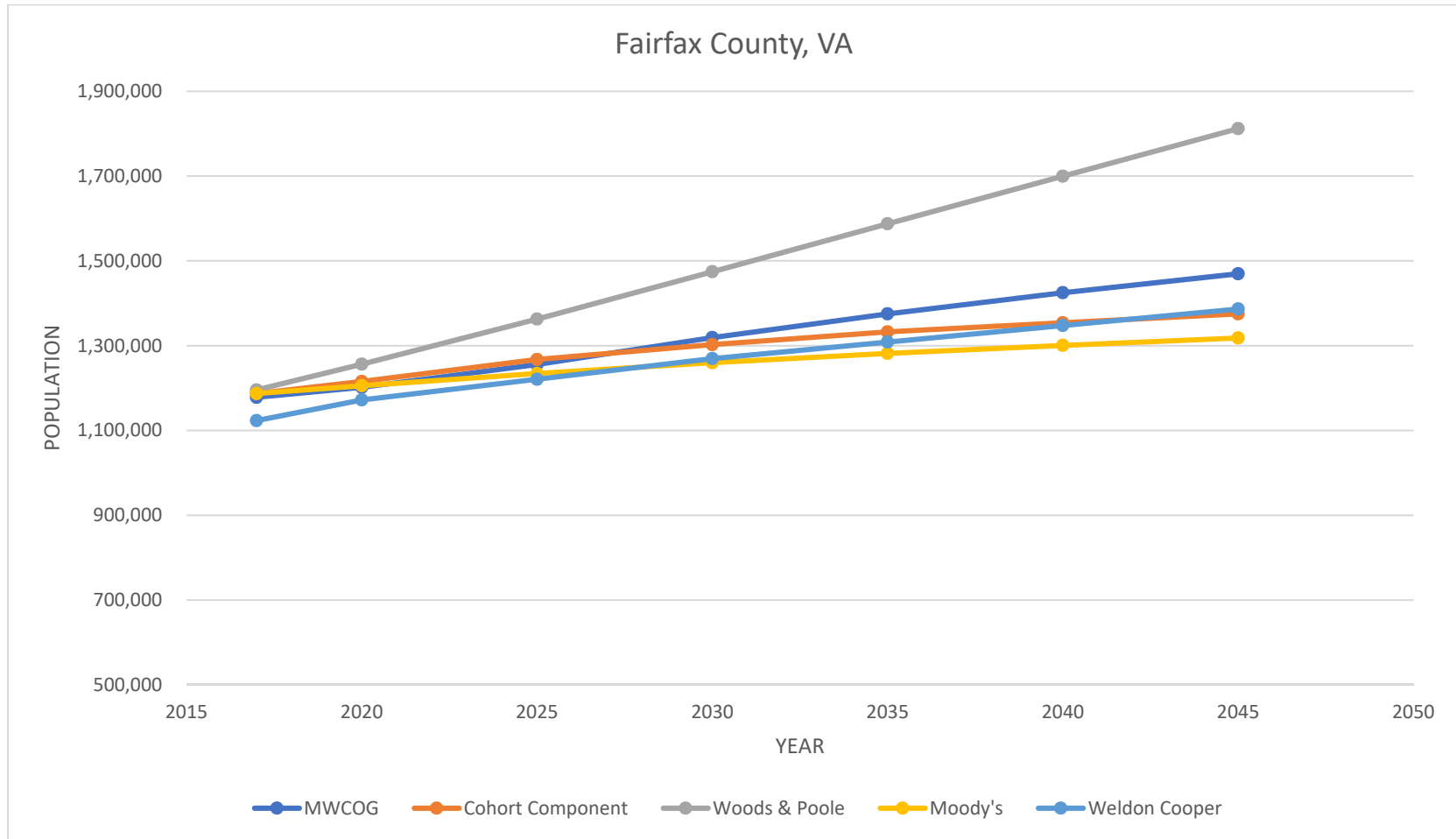


Figure 35 | Montgomery County, MD Population Forecasts

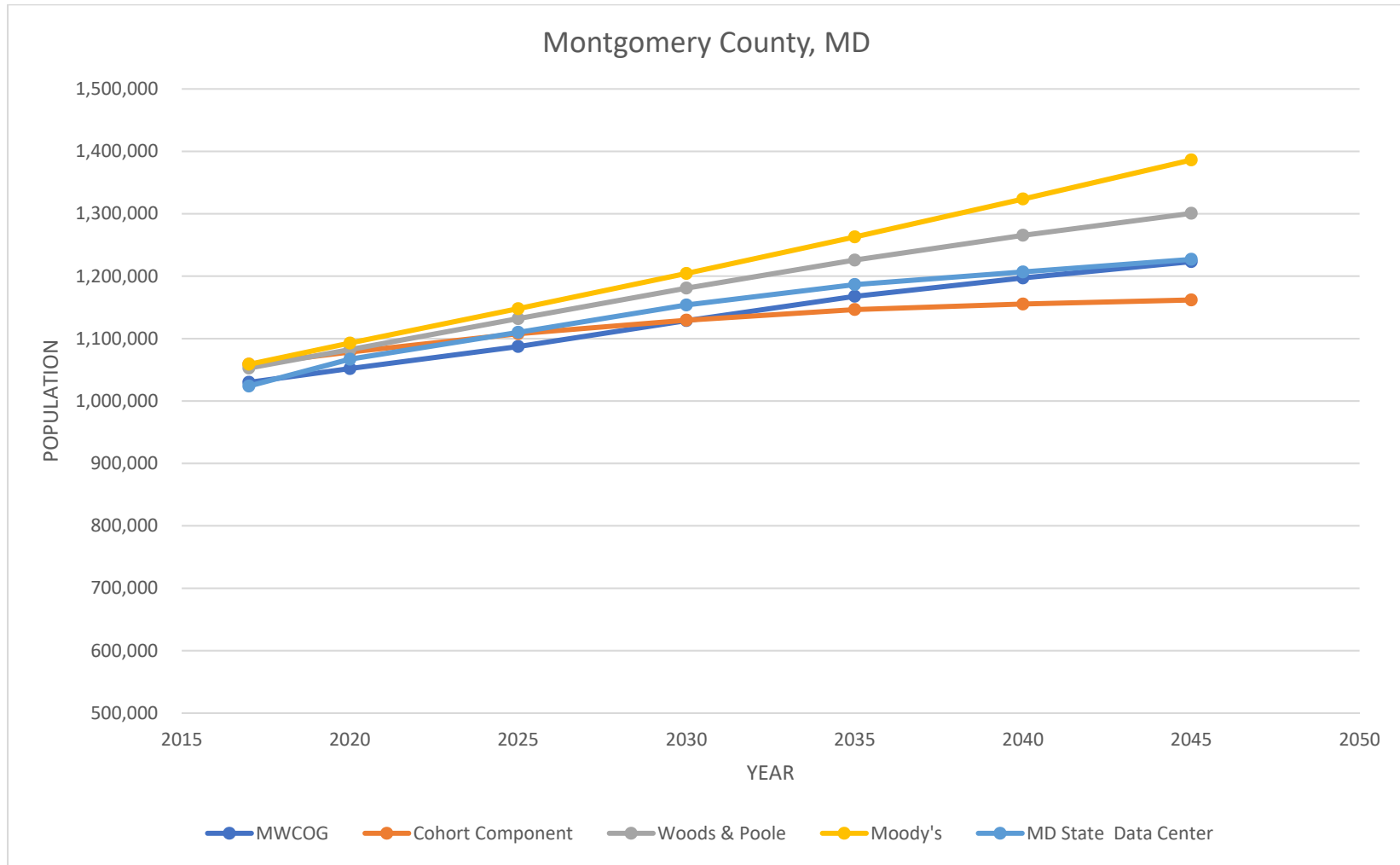
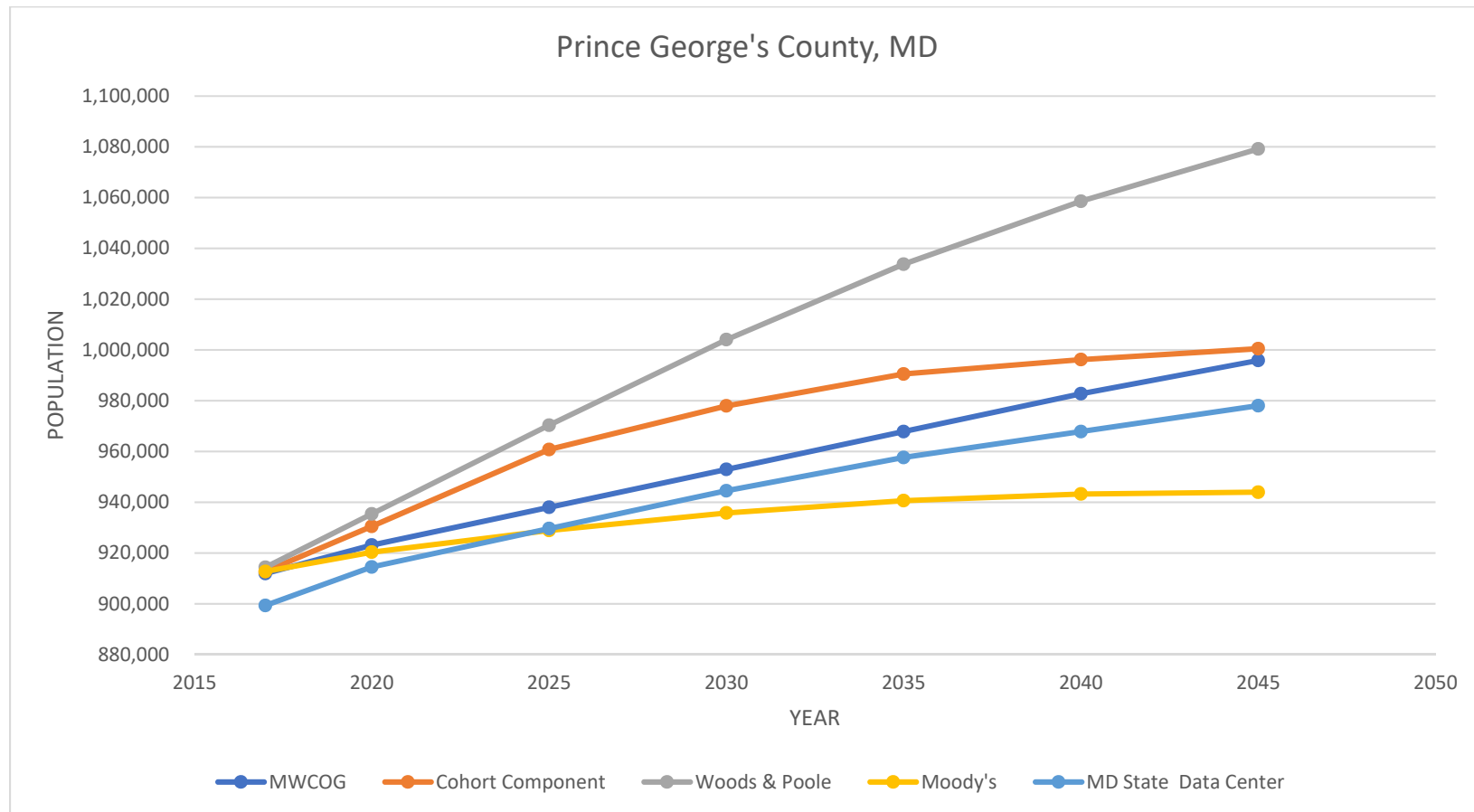


Figure 36 | Prince George's County, MD Population Forecasts



Professional judgement informed the weighting of each forecast at the jurisdictional level. Woods & Poole is more bullish in some core and second tier jurisdictions; these were weighted lower in comparison to the other forecast sources. In general, each forecast source was weighted equally. Table 7 below summarizes 2045 population forecasts from Renaissance's Cohort Component method, MWCOG 9.1, Woods & Poole, Moody's, Weldon Cooper, and Maryland State Data Center for all applicable jurisdictions in the study area.

Table 7 | 2045 Population Forecast by Source and Jurisdiction

	Jurisdiction	Renaissance Population Control Total	Cohort Component	MWCOG 9.1	Woods & Poole	Moody's	Weldon Cooper	Maryland State Data Center	Renaissance Rank
Core	City of Alexandria, VA	214,532	217,038	208,451	181,600	224,951	223,281		4 of 6
	Arlington County, VA	307,838	333,037	301,167	261,371	307,817	325,124		4 of 6
	District of Columbia	889,846	824,058	987,213	762,192	794,998			2 of 5
First Tier	Fairfax County, VA	1,444,117	1,374,985	1,469,595	1,811,971	1,318,095	1,386,476		3 of 6
	Montgomery County, MD	1,274,850	1,161,934	1,223,345	1,300,694	1,386,168		1,227,000	3 of 6
	Prince George County, MD	1,001,916	1,000,493	995,874	1,079,205	943,976		978,050	2 of 6
Second Tier	Anne Arundel County, MD	665,830	659,420	638,133	730,178	653,415		637,900	2 of 6
	Frederick County, MD	345,075	329,869	344,138	364,384	332,770		348,400	3 of 6
	Howard County, MD	409,060	397,716	373,639	498,015	415,120		369,200	3 of 6
	Loudoun County, VA	609,222	583,445	507,398	800,353	701,667	755,869		4 of 6
	Prince William County, VA	715,344	694,433	652,038	815,204	703,920	729,137		3 of 6
Third Tier	Calvert County, MD	110,524	139,858	100,850	130,835	89,559		101,850	3 of 6
	Carroll County, MD	195,432	212,467	192,968	239,064	160,219		192,900	2 of 6
	Charles County, MD	222,803	228,621	236,479	231,575	185,598		229,400	5 of 6
	City of Fredericksburg, VA	40,182	60,049	36,189	56,576	44,599	40,944		5 of 6
	Stafford County, VA	242,012	234,501	267,925	270,825	210,100	222,554		3 of 6
	Spotsylvania County, VA	161,347	180,209	181,321	257,162	202,724	192,503		6 of 6
Exurb	Clarke County, VA	16,881	45,438	16,315	18,092	15,827	16,315		2 of 6
	Fauquier County, VA	97,768	110,396	97,881	110,365	81,841	88,330		4 of 6
	Jefferson County, WV	76,053	84,271	82,830	88,294	58,105			4 of 5
	King George County, VA	42,603	66,031	46,982	43,328	38,214	37,185		4 of 6
	St. Mary's County, MD	160,458	167,920	162,899	167,244	140,964		170,550	5 of 6
	<b>TOTAL</b>	9,243,692	9,106,189	9,123,630	10,218,527	9,010,646			

## Employment Forecasts

The following outside forecasts for employment were collected for weighted analysis: Woods & Poole, Moody's, Maryland State Data Center (for Maryland jurisdictions), and MWCOC Round 9.1 Cooperative Forecast.. Outside forecast sources may measure the number of jobs differently, resulting in greater variability. For instance, BLS estimates of jobs totals at a County level are based on unemployment insurance program data and the BEA estimates of jobs totals make adjustments for additional employment not covered by unemployment insurance, notably nonprofit and student/intern employment. Therefore, the contrast across data sources is focused more on the differences in growth over time rather than on the absolute value in any given year. The figures below show employment forecasts from Renaissance's Shift Share methodology, MWCOC 9.1, Woods & Poole, Moody's, and Maryland State Data Center (as applicable) for each jurisdiction in the Primary Market Area.



Figure 37 | Arlington County, VA Employment Forecasts

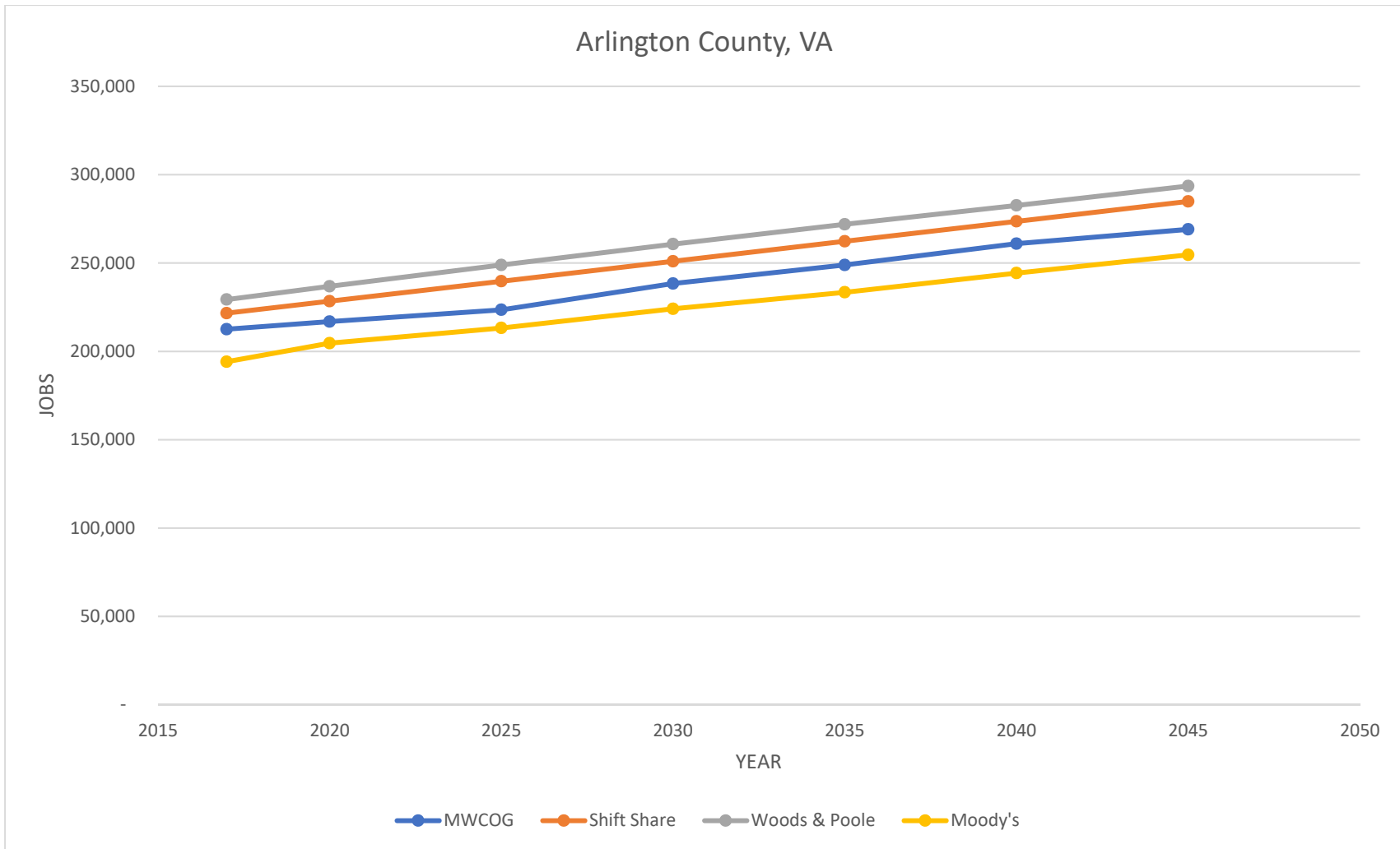


Figure 38 | City of Alexandria, VA Employment Forecasts

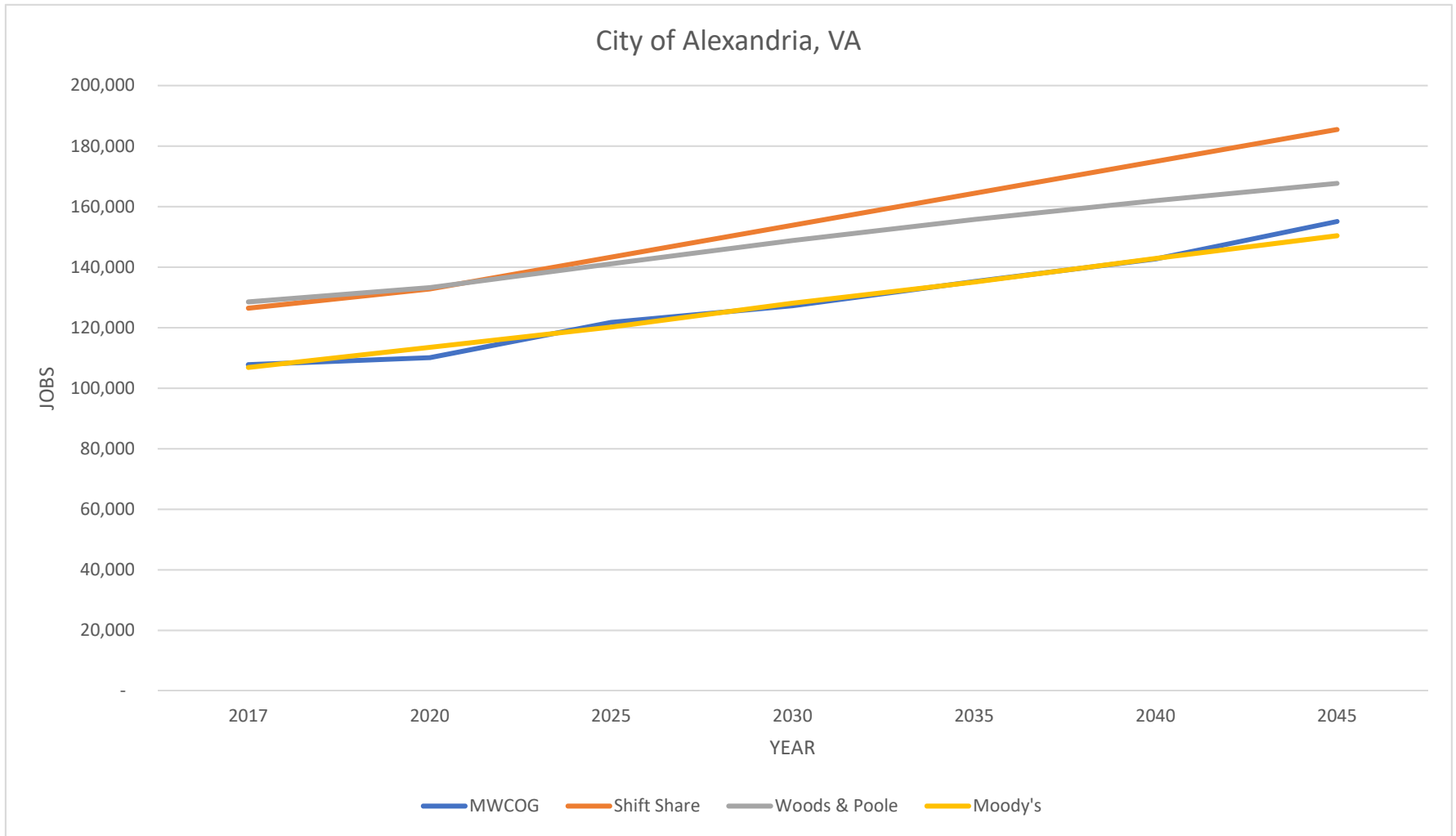


Figure 39 | District of Columbia Employment Forecasts

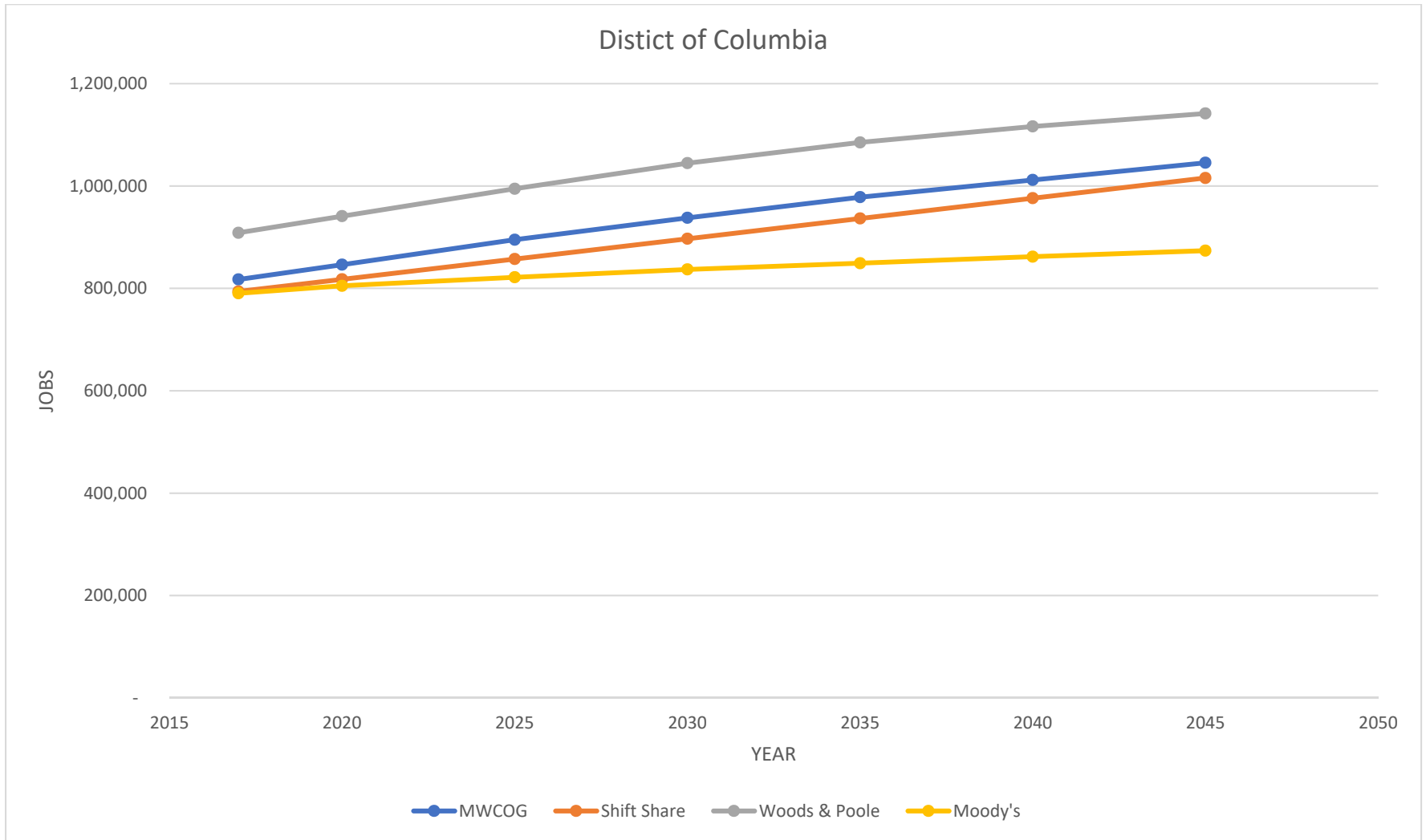


Figure 40 | Fairfax County, VA Employment Forecasts

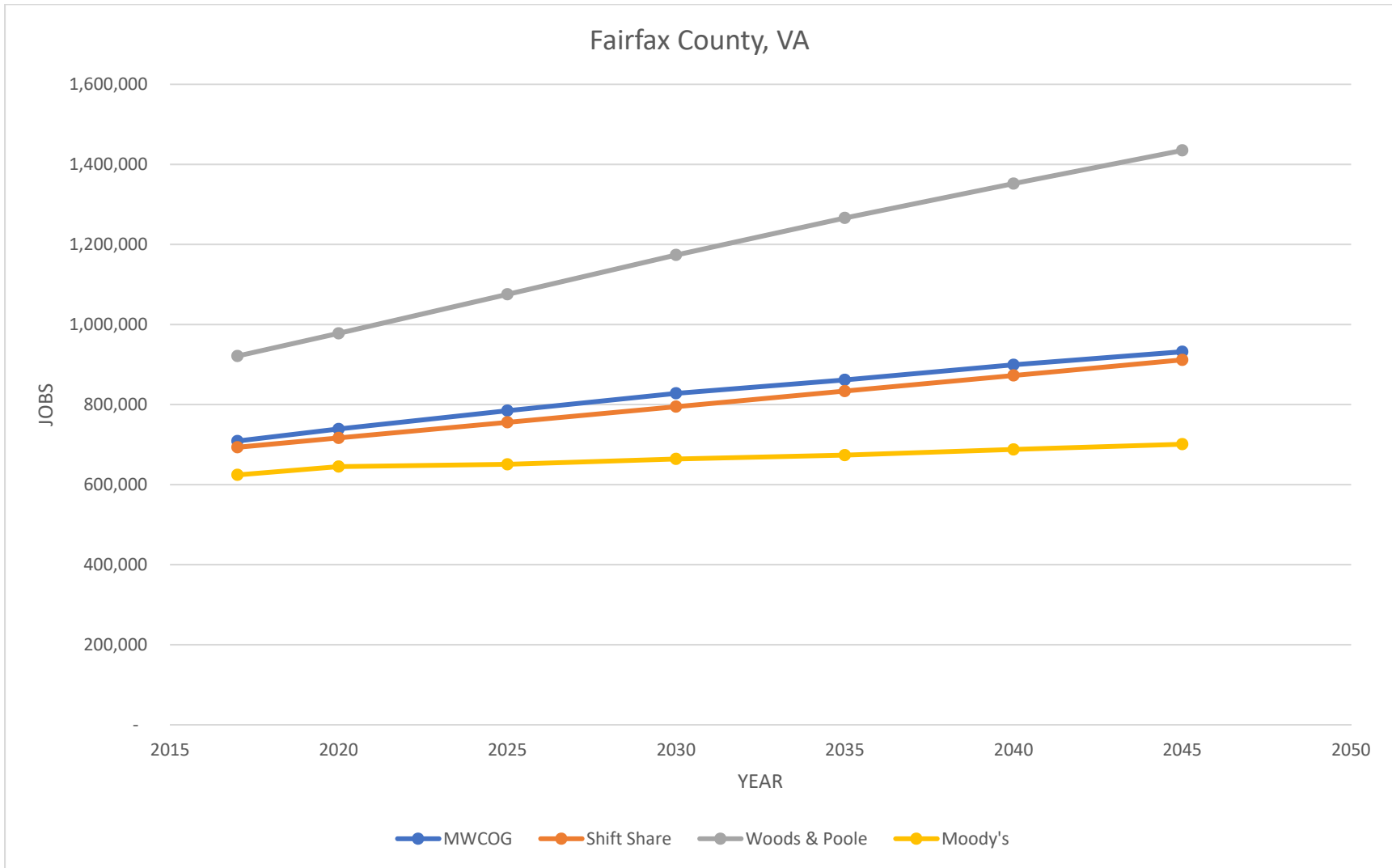


Figure 41 | Montgomery County, MD Employment Forecasts

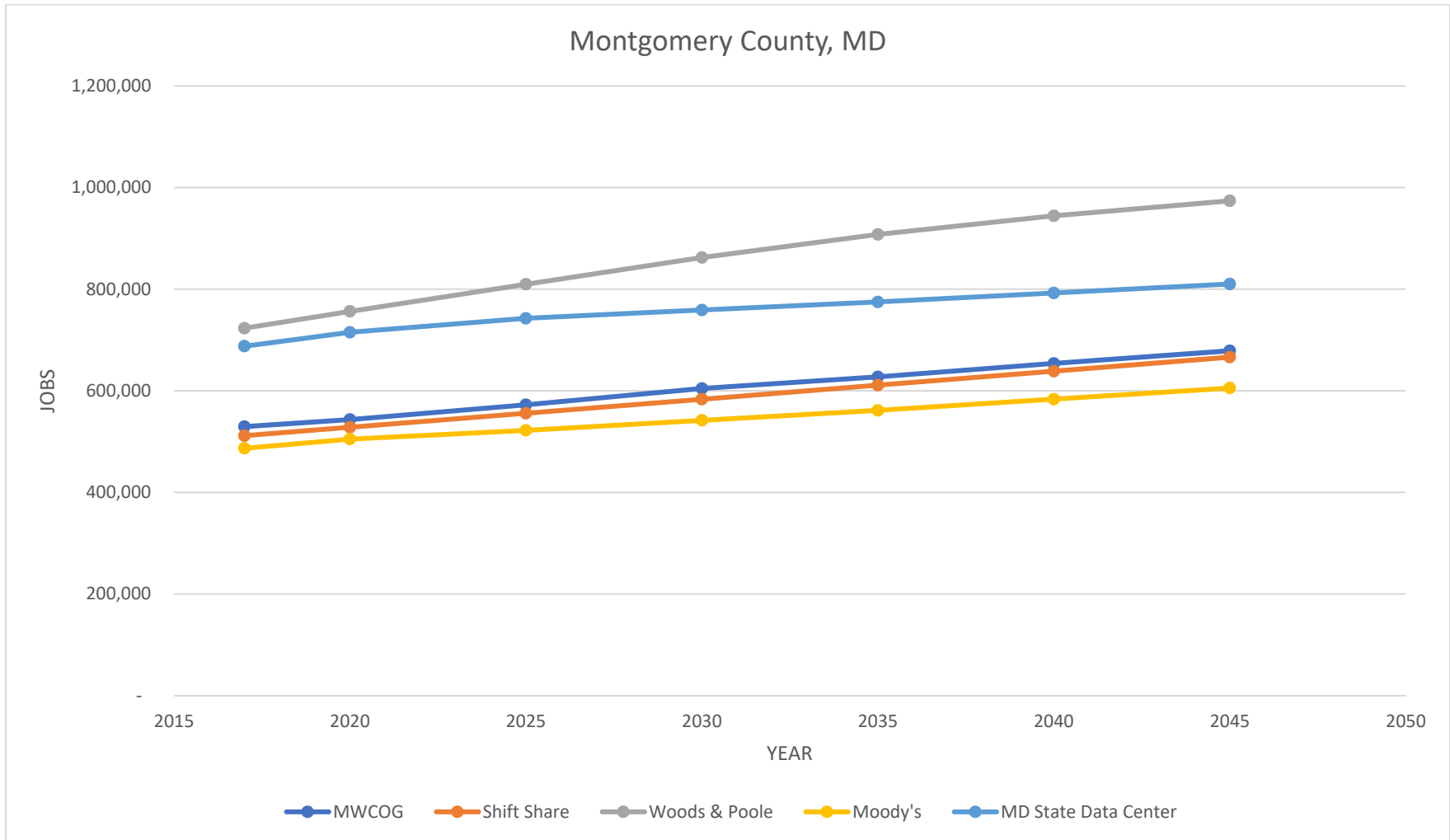
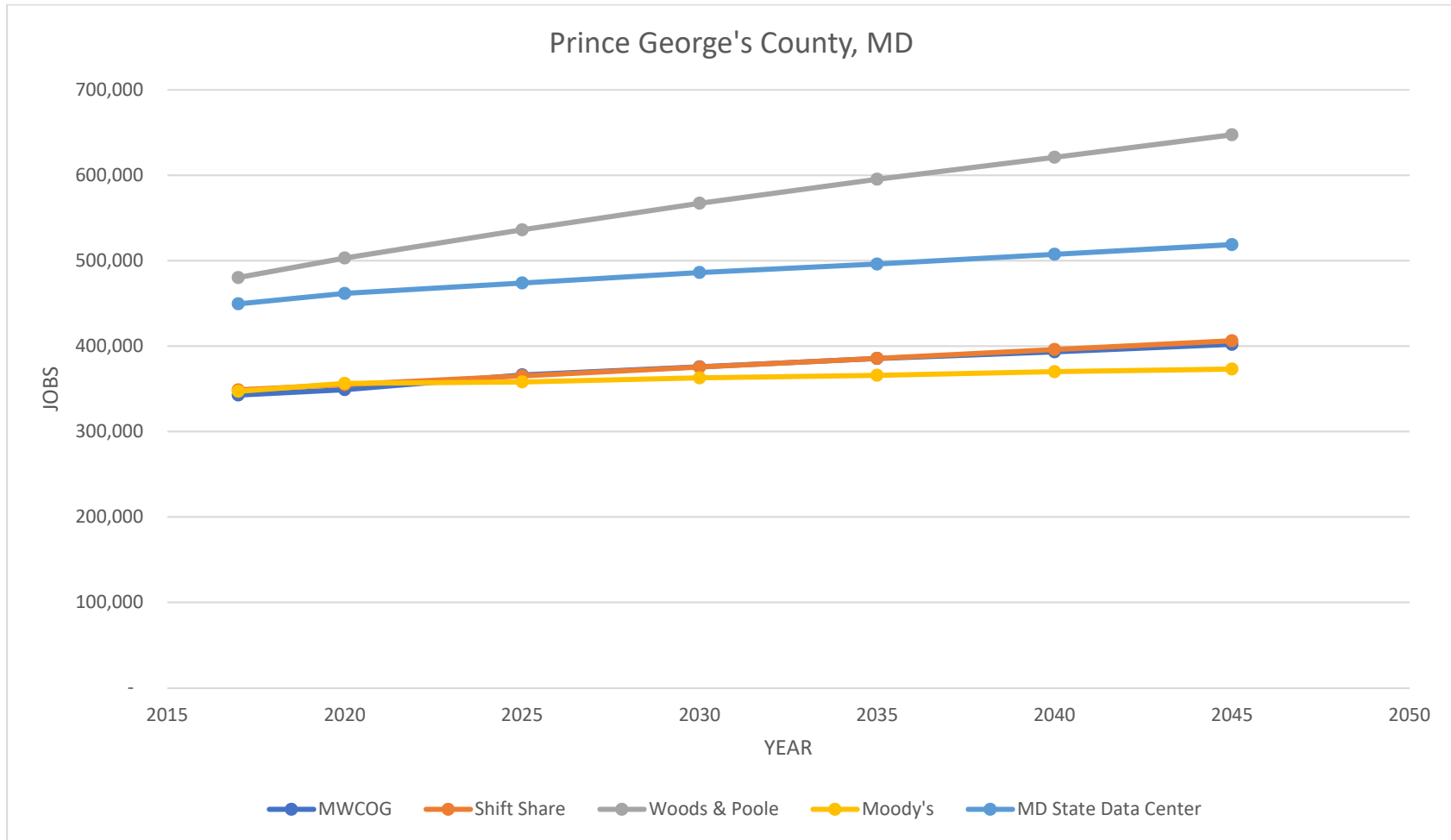


Figure 42 | Prince George's County, MD Employment Forecasts





Professional judgement informed the weighting of each forecast at the jurisdictional level. Woods & Poole forecasts greater employment growth in some core and exurban jurisdictions and was therefore weighted lower than other forecast sources. With a few exceptions, all forecast sources were weighted equally.

Table 8 summarizes 2045 employment forecasts from Renaissance's Shift Share methodology, MWCOC 9.1, Woods & Poole, Moody's, and Maryland State Data Center for all applicable jurisdictions in the study area.

Table 8 | 2045 Employment Forecasts by Source and Jurisdiction

	Jurisdiction	Renaissance Employment Control Total	Shift Share	MWCOG 9.1	Woods & Poole	Moody's	Maryland State Data Center	Renaissance Rank
Core	City of Alexandria, VA	150,812	185,464	155,095	167,680	150,385		4 of 5
	Arlington County, VA	275,401	284,877	269,064	293,602	254,631		3 of 5
	District of Columbia	1,011,767	1,015,764	1,045,390	1,141,655	873,686		4 of 5
First Tier	Fairfax County, VA	973,050	911,652	931,892	1,434,884	700,907		2 of 5
	Montgomery County, MD	672,168	666,225	678,753	973,887	605,444	810,200	4 of 6
	Prince George County, MD	396,421	406,295	402,145	647,453	373,127	518,900	5 of 6
Second Tier	Anne Arundel County, MD	414,064	415,960	407,101	568,149	364,854	488,800	4 of 6
	Frederick County, MD	149,089	136,978	145,526	214,724	131,828	176,200	3 of 6
	Howard County, MD	247,780	244,095	236,651	372,879	261,374	292,700	4 of 6
	Loudoun County, VA	315,704	301,864	291,165	470,825	321,722		3 of 5
	Prince William County, VA	278,990	258,688	293,261	379,970	231,031		3 of 5
Third Tier	Calvert County, MD	43,863	42,723	44,300	54,873	27,388	44,300	4 of 6
	Carroll County, MD	83,822	72,091	81,569	121,645	65,926	107,200	3 of 6
	Charles County, MD	61,487	80,641	61,505	96,840	58,420	82,800	5 of 6
	City of Fredericksburg, VA	55,304	76,817	57,981	28,978	17,955		3 of 5
	Stafford County, VA	90,138	89,324	91,156	115,444	69,036		3 of 5
	Spotsylvania County, VA	70,667	100,607	74,534	131,719	81,614		3 of 5
Exurb	Clarke County, VA	7,514	9,716	8,374	9,513	4,707		4 of 5
	Fauquier County, VA	41,615	49,622	40,984	58,996	29,087		4 of 5
	Jefferson County, WV	30,618	32,791	30,852	38,602	21,009		3 of 5
	King George County, VA	27,995	21,963	27,270	25,420	16,827		4 of 6
	St. Mary's County, MD	81,603	75,335	79,435	92,318	57,151	84,500	1 of 5
	<b>TOTAL</b>	5,499,274	5,479,494	5,454,003	7,440,056	4,718,109		

## Final Baseline Jurisdictional Control Totals

Control totals were developed for each jurisdiction by weighting each outside forecast to develop a forecast that was in-line with the macroeconomic assessment of the region. These control totals then serve as inputs to the allocation model. Tables with population and employment control totals for each jurisdiction and each interval year in the forecast period are presented below.

Table 9 | Baseline Population Control Totals, 2017-2045

		POPULATION (000s)						
	Jurisdiction	2017	2020	2025	2030	2035	2040	2045
Core	City of Alexandria	160.0	167.5	178.1	186.3	194.6	203.4	214.5
	Arlington County	235.0	245.5	258.8	271.9	284.1	296.0	307.8
	District of Columbia	694.0	718.2	759.2	796.6	830.9	861.0	889.8
First Tier	Fairfax County	1,187.1	1,220.6	1,272.9	1,323.2	1,367.1	1,406.6	1,444.1
	Montgomery County	1,058.8	1,088.9	1,131.9	1,174.8	1,213.5	1,245.1	1,274.8
	Prince George's County	913.1	927.7	948.5	965.9	980.8	992.3	1,001.9
Second Tier	Anne Arundel County	573.2	586.8	606.5	623.8	639.4	652.9	665.8
	Frederick County	252.0	264.5	283.4	299.5	315.4	330.2	345.1
	Howard County	321.1	334.8	354.8	371.1	385.3	397.3	409.1
	Loudoun County	398.1	433.8	486.4	525.0	558.0	585.6	609.2
	Prince William County	521.1	546.9	592.7	628.8	660.7	689.3	715.3
Third Tier	Calvert County	91.5	94.3	98.9	102.4	105.3	107.9	110.5
	Carroll County	167.8	171.5	177.3	182.3	186.8	191.1	195.4
	Charles County	159.7	168.7	181.1	192.6	202.8	212.2	222.8
	City of Fredericksburg	28.4	29.9	32.2	34.0	36.1	38.1	40.2
	Stafford County	146.8	158.2	176.6	193.1	209.3	225.5	242.0
	Spotsylvania County	109.1	116.9	128.8	139.2	146.9	154.2	161.3
Exurb	Clarke County	14.5	14.8	15.3	15.8	16.2	16.5	16.9
	Fauquier County	69.5	72.8	78.3	83.3	88.1	92.9	97.8
	Jefferson County	56.3	58.6	62.6	66.1	69.5	72.7	76.1
	King George County	26.3	28.5	31.6	34.5	37.2	39.9	42.6
	St. Mary's County	112.7	118.8	128.3	135.7	145.2	152.7	160.5
TOTAL		7,296.2	7,568.3	7,984.2	8,345.9	8,672.9	8,963.4	9,243.7

Table 10 | Baseline Employment Control Totals, 2017-2045

	Jurisdiction	JOBS (000s)						
		2017	2020	2025	2030	2035	2040	2045
Core	City of Alexandria	106.8	111.4	120.0	127.3	134.8	142.3	150.8
	Arlington County	214.2	221.5	231.1	243.4	254.0	265.2	275.4
	District of Columbia	815.7	840.9	881.6	918.5	952.6	982.6	1,011.8
First Tier	Fairfax County	713.9	745.7	794.7	843.6	887.5	931.5	973.0
	Montgomery County	529.4	548.7	576.0	602.5	626.0	649.8	672.2
	Prince George's County	346.2	354.8	365.1	373.7	381.3	388.9	396.4
Second Tier	Anne Arundel County	328.9	340.5	355.5	370.5	384.9	400.5	414.1
	Frederick County	114.0	118.8	125.3	131.5	137.6	143.6	149.1
	Howard County	178.1	187.1	199.8	212.6	224.4	236.1	247.8
	Loudoun County	178.4	194.2	218.2	243.3	267.3	291.5	315.7
	Prince William County	182.6	194.3	211.2	228.4	245.2	262.4	279.0
Third Tier	Calvert County	35.1	36.7	38.6	40.0	41.3	42.6	43.9
	Carroll County	69.1	71.4	74.3	76.8	79.2	81.5	83.8
	Charles County	46.8	48.5	51.1	53.7	56.3	59.0	61.5
	City of Fredericksburg	37.2	39.4	42.6	45.9	49.0	52.1	55.3
	Stafford County	55.0	58.8	64.5	70.7	77.0	83.5	90.1
	Spotsylvania County	46.7	49.4	53.2	57.1	61.6	66.1	70.7
Exurb	Clarke County	5.7	5.9	6.2	6.6	6.9	7.2	7.5
	Fauquier County	30.3	31.7	33.7	35.7	37.7	39.7	41.6
	Jefferson County	22.3	23.3	24.7	26.2	27.7	29.2	30.6
	King George County	18.4	19.5	21.1	22.8	24.5	26.2	28.0
	St. Mary's County	63.7	66.4	69.8	72.6	75.5	78.6	81.6
TOTAL		4,138.4	4,308.9	4,558.5	4,803.6	5,032.3	5,260.0	5,499.3

## SUBALLOCATION

The purpose of suballocation is to assign growth to each traffic analysis zone (TAZ) in the model area. In general terms, the process requires assigning demand potential, growth capacity, and then population and employment growth based on demand potential but constrained by capacity for each TAZ.

Growth potential is based on many factors that fall into four overarching categories:

- Activities – the existing prevalence of uses and the recent growth trends that contributed to that existing condition,
- Access – the multi-modal infrastructure that exists now or is expected to exist in the future that allow an area to reach - and be reached by – the larger region,
- Policy – public sector land use and infrastructure decisions that reflect growth management regulations, and
- Market – the view that the private sector has about a place, usually identified through indirect measures like cost.

A suballocation model was developed to identify and quantify these categories, using two dozen different demand factors to best reflect the multivariate components of growth potential. Each TAZ was scored in population and employment demand potential based on these factors. Jurisdictional growth forecasts were then applied to the demand potential scores - constrained by development capacity – to calculate TAZ level growth estimates.

### Demand Factors

The following tables and figures show the demand factors that were used for the suballocation methodology. Existing land cover, access to jobs and population, proximity to fixed guideway transit, and median household income were developed into factors that informed the suballocation process.



Table 11 summarizes factors used in the suballocation process.

Table 11 | Demand Factors in Suballocation

Name	Data Source	Comments
Prior 5-year interval growth in population and jobs by type	MWCOG Round 9.1 (2010-2015), Renaissance model in future years	Sum of TAZ growth plus 50% of growth in neighboring TAZs
Presence of fixed guideway transit	Center for Transit Oriented Development, Renaissance	Within ¼-mile of an existing, planned, or proposed fixed guideway transit stop. Existing fixed guideway is used in all forecast years, planned fixed guideway is used starting in 2030, and proposed fixed guideway is used starting in 2040
Regional job accessibility score	Renaissance, MWCOG Round 9.1	Total time-decayed jobs reachable within a 45-minute drive. Updated activity units used every 5-year interval, but 2010 road network used through 2025, then 2040 road network from MWCOG Round 9.1 used after 2025
Retail job accessibility score	Renaissance, MWCOG Round 9.1	Total time-decayed retail jobs reachable within a 45-minute drive. Updated activity units used every 5-year interval, but 2010 road network used through 2025, then 2040 road network from MWCOG Round 9.1 used after 2025
Customer accessibility score	Renaissance, MWCOG Round 9.1	Total time-decayed population reachable within a 45-minute drive. Updated activity units used every 5-year interval, but 2010 road network used through 2025, then 2040 road network from MWCOG Round 9.1 used after 2025
Existing activity unit density	Renaissance calculation	(Population + jobs) / developed acres
Land cover	Renaissance calculation	Prior interval medium and high density development and remaining greenfield acres – (forecasted activity units / existing activity unit density * proportion of greenfield capacity relative to infill capacity)
Activity Center	MWCOG	Defined by local jurisdictions in coordination with MWCOG
Activity Center neighbor	MWCOG, Renaissance	Any TAZ that borders an activity center but is not itself in an activity center
Population and Employment Policy Damper	Renaissance	Known policy or market condition that prevents population or employment growth in a TAZ.

Figure 43 | Auto Accessibility to Jobs, 2019

### MARYLAND I-495/I-270 | AUTO ACCESSIBILITY TO JOBS - 2019

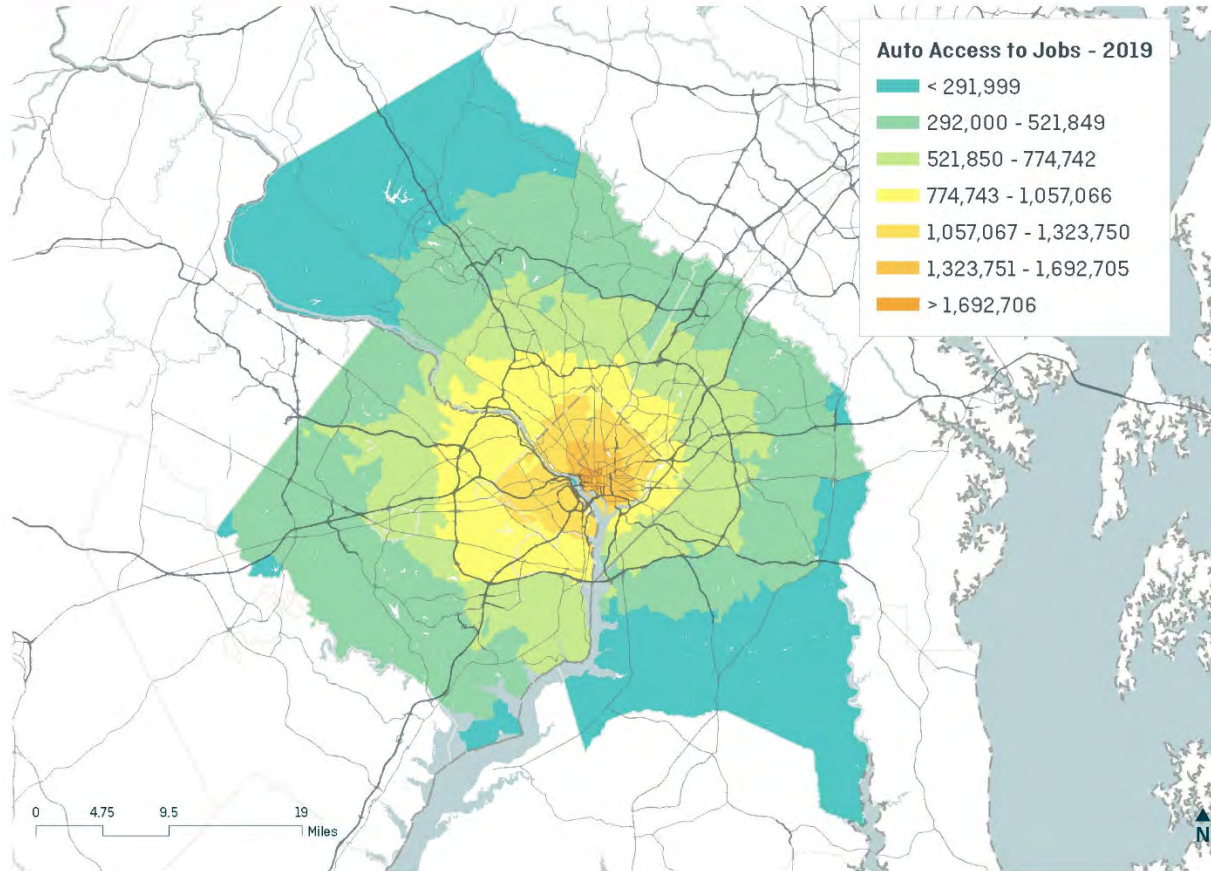


Figure 44 | Auto Accessibility to Jobs, 2040

### MARYLAND I-495/I-270 | AUTO ACCESSIBILITY TO JOBS - 2040

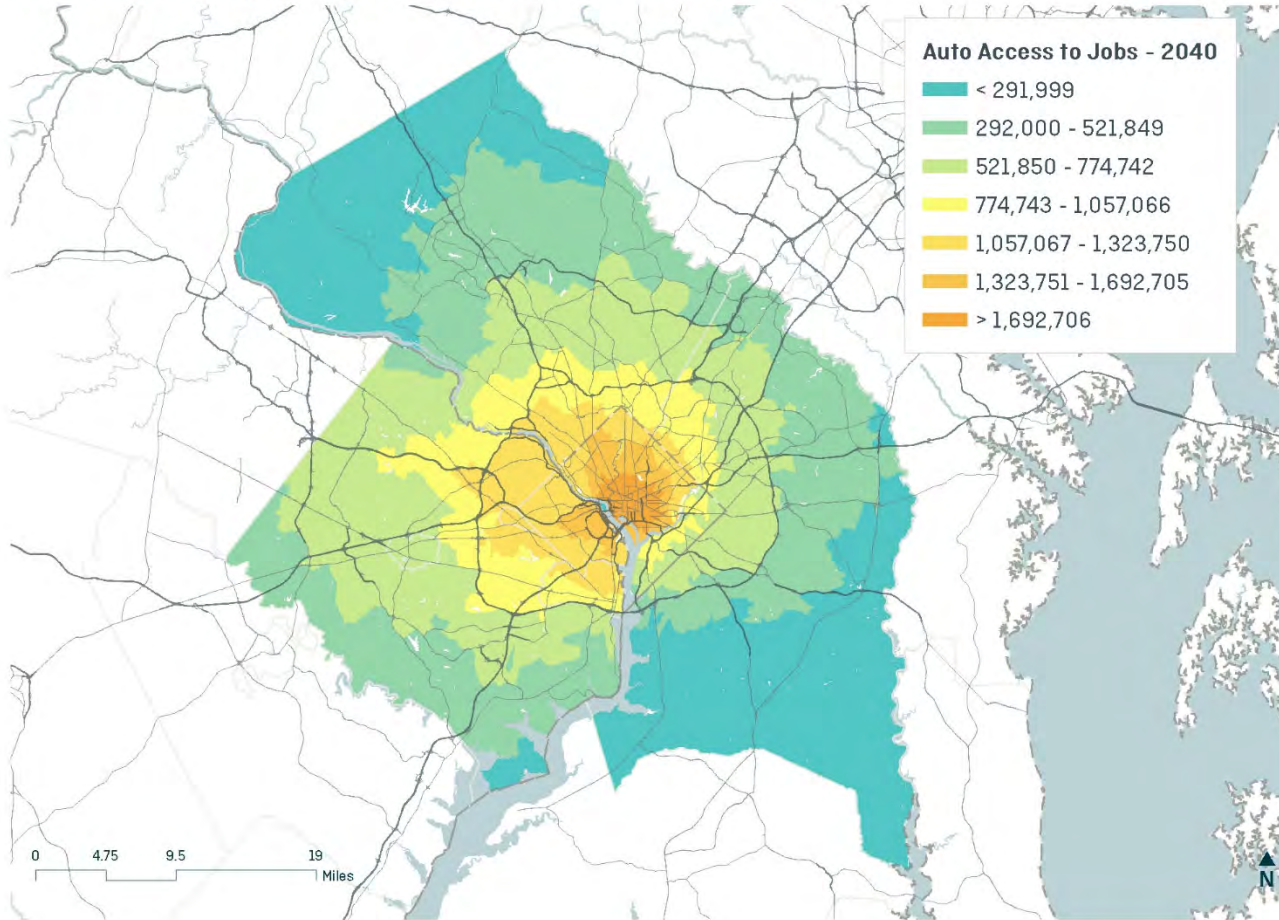




Figure 45 | Auto Accessibility to Population, 2019

### MARYLAND I-495/I-270 | AUTO ACCESSIBILITY TO POPULATION - 2019

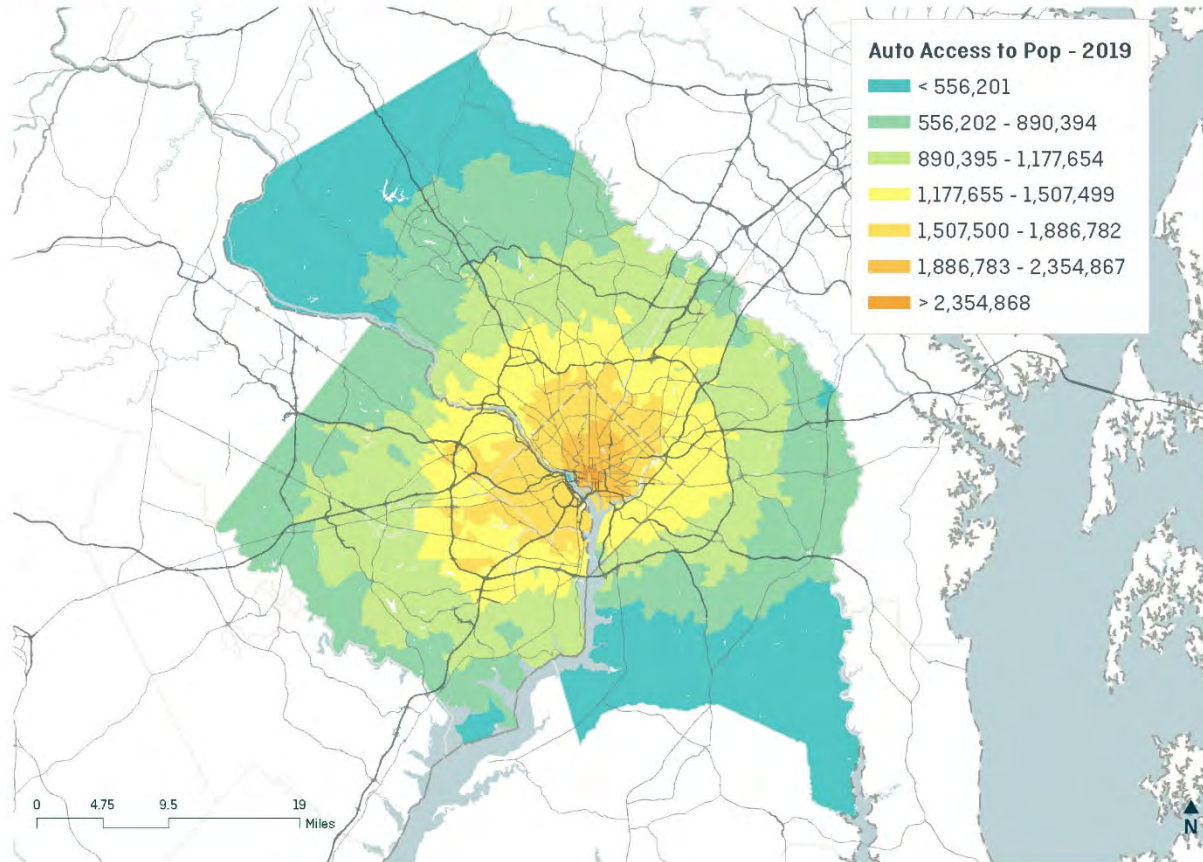


Figure 46 | Auto Accessibility to Population, 2040

### MARYLAND I-495/I-270 | AUTO ACCESSIBILITY TO POPULATION - 2040

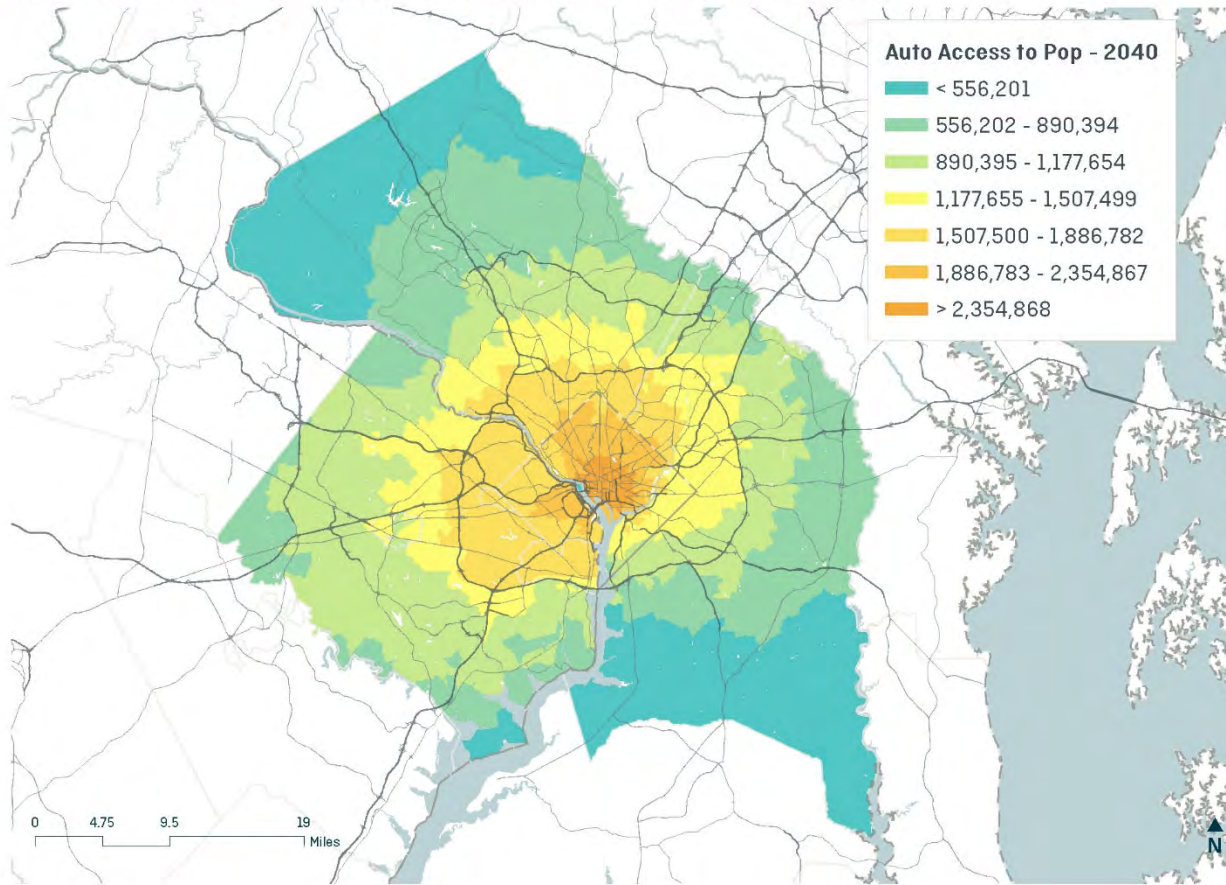


Figure 47 | Transit Accessibility to Jobs, 2019

### MARYLAND I-495/I-270 | TRANSIT ACCESSIBILITY TO JOBS - 2019

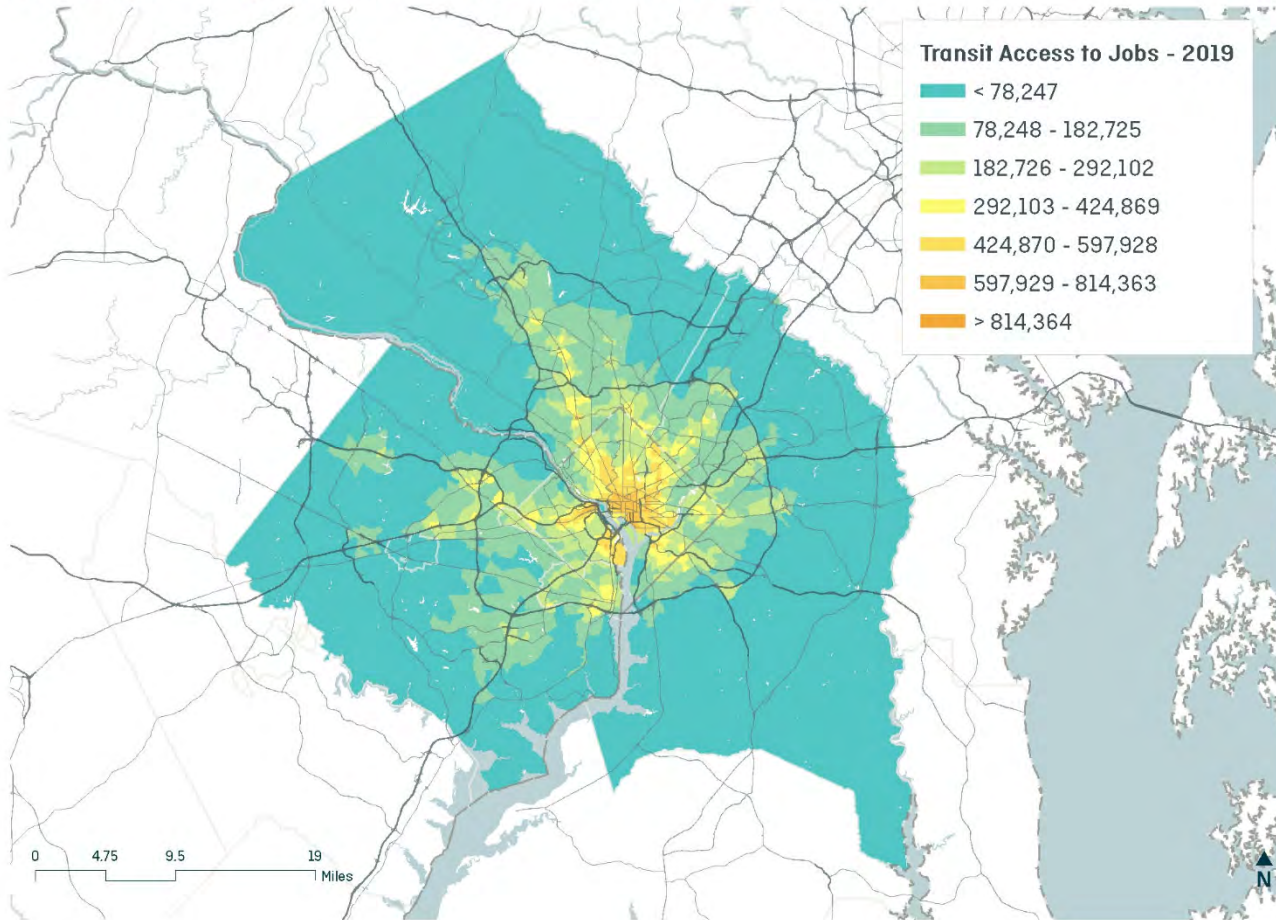




Figure 48 | Transit Accessibility to Jobs, 2040

### MARYLAND I-495/I-270 | TRANSIT ACCESSIBILITY TO JOBS - 2040

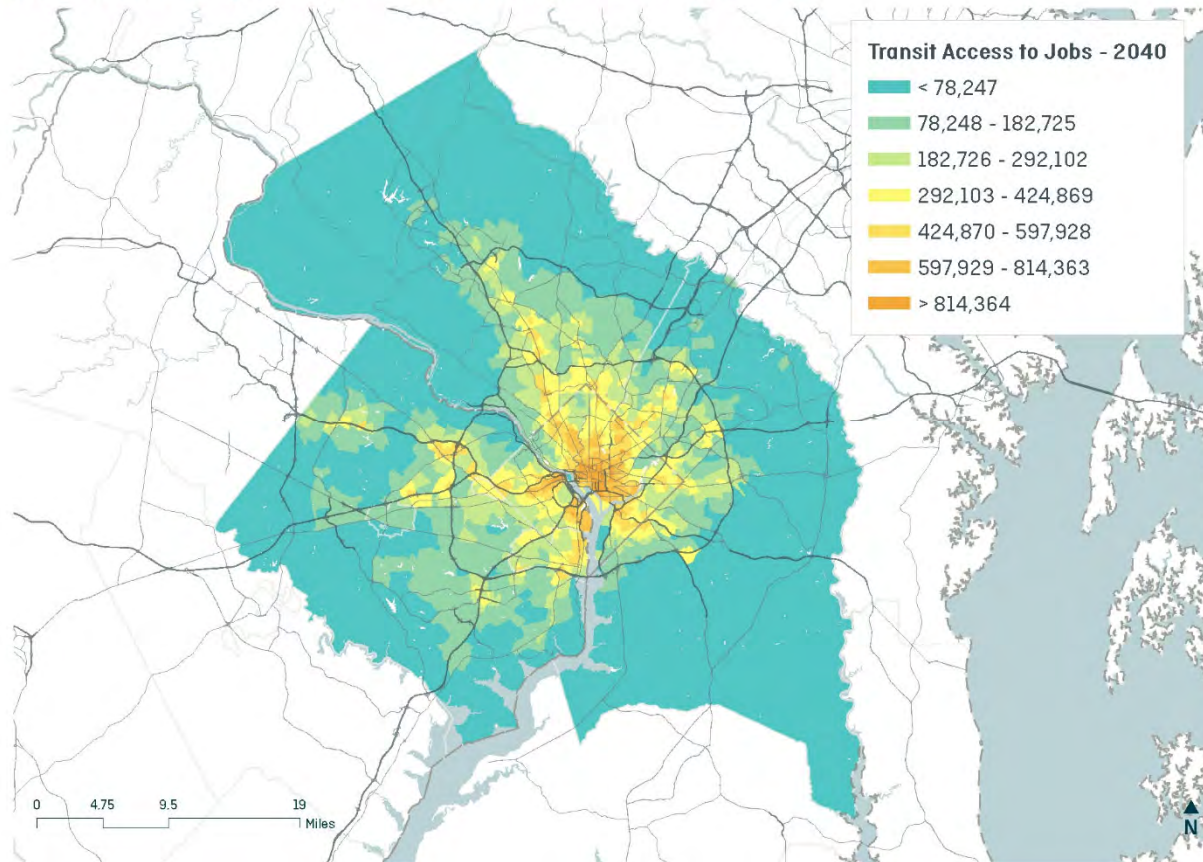


Figure 49 | Transit Accessibility to Population, 2019

### MARYLAND I-495/I-270 | TRANSIT ACCESSIBILITY TO POPULATION - 2019

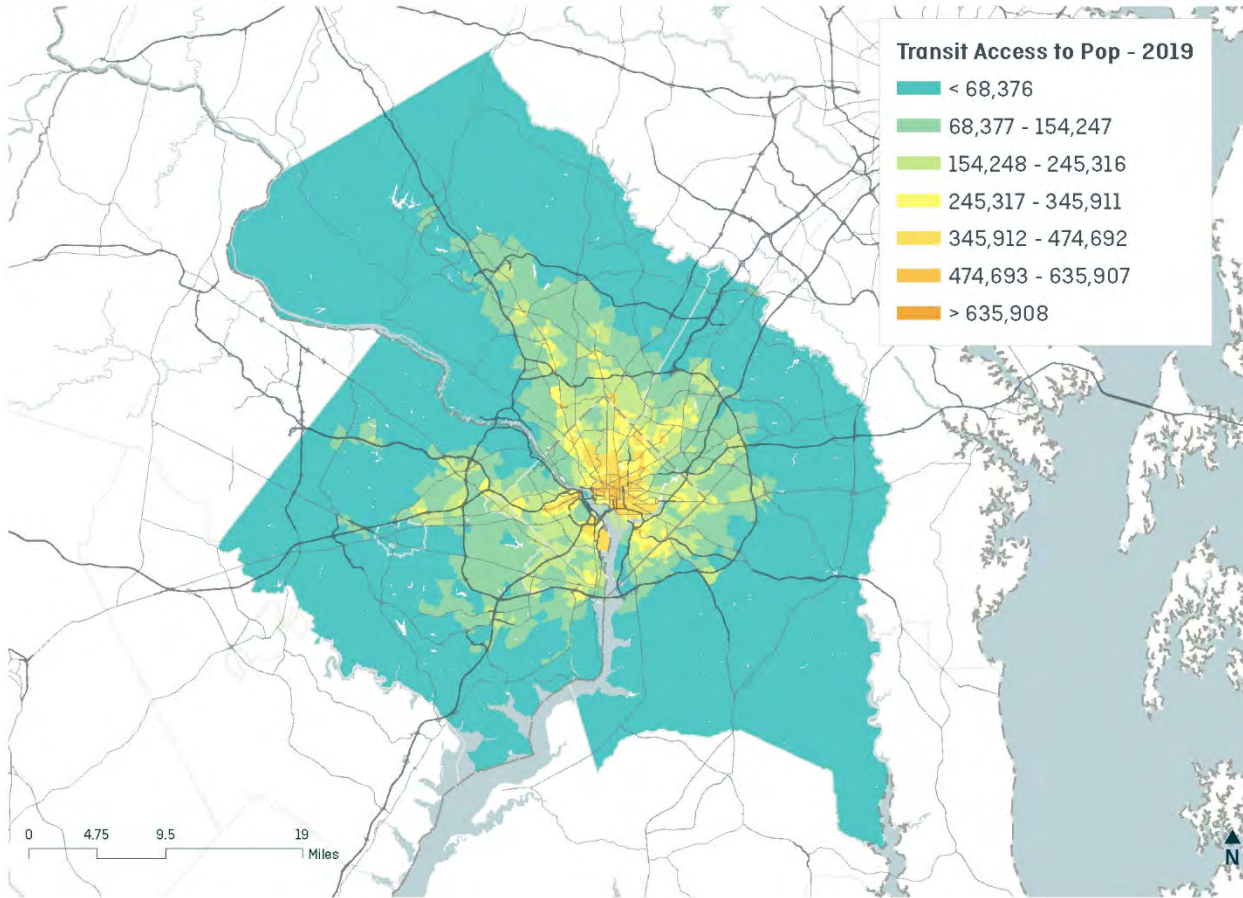


Figure 50 | Transit Accessibility to Population, 2040

### MARYLAND I-495/I-270 | TRANSIT ACCESSIBILITY TO POPULATION - 2040

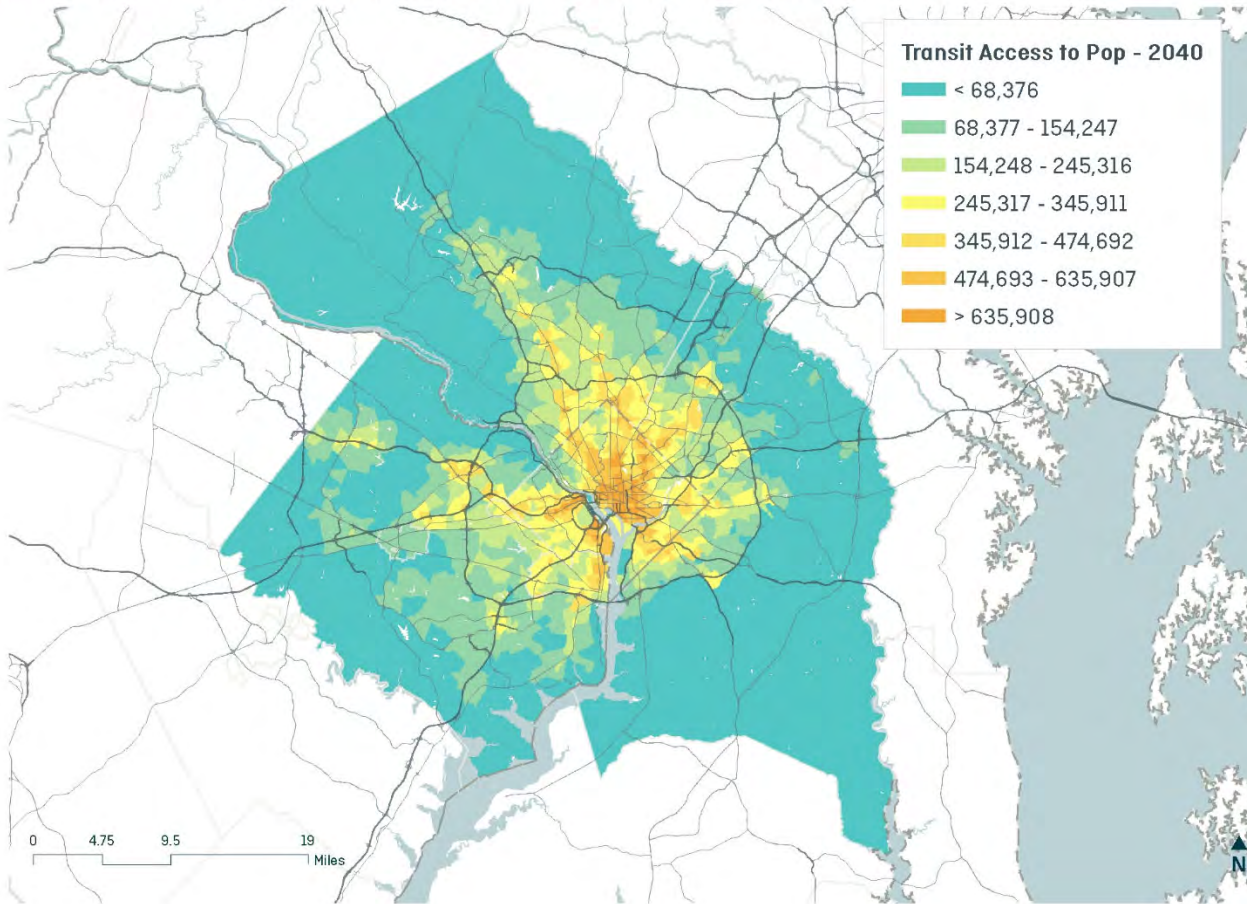




Figure 51 | Floating Point Activity Unit Density, 2015

### MARYLAND I-495/I-270 | FLOATING POINT ACTIVITY UNIT DENSITY - 2015

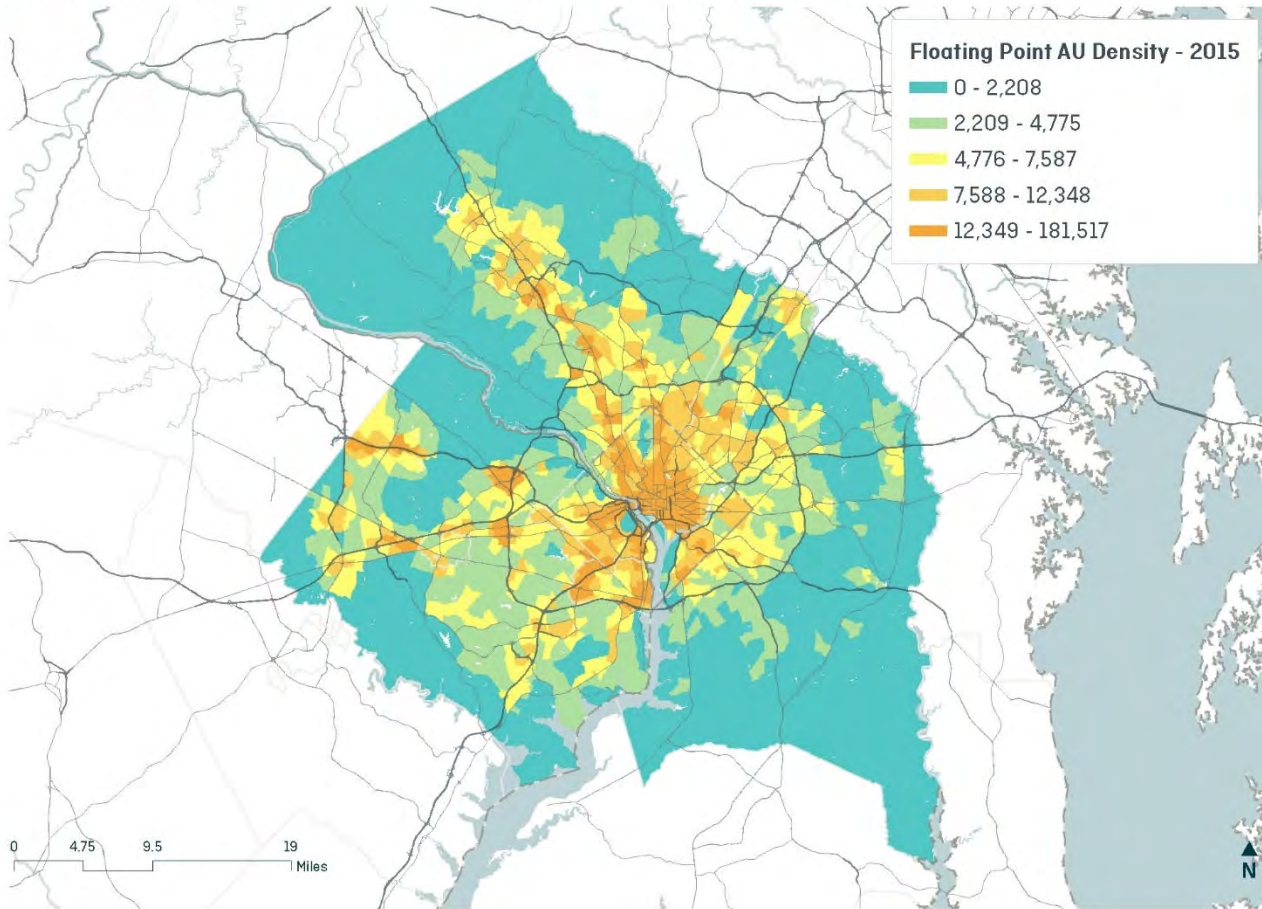


Figure 52 | Land Cover - Percent Developed – High Intensity

### MARYLAND I-495/I-270 | LANDCOVER - PERCENT DEVELOPED - HIGH INTENSITY

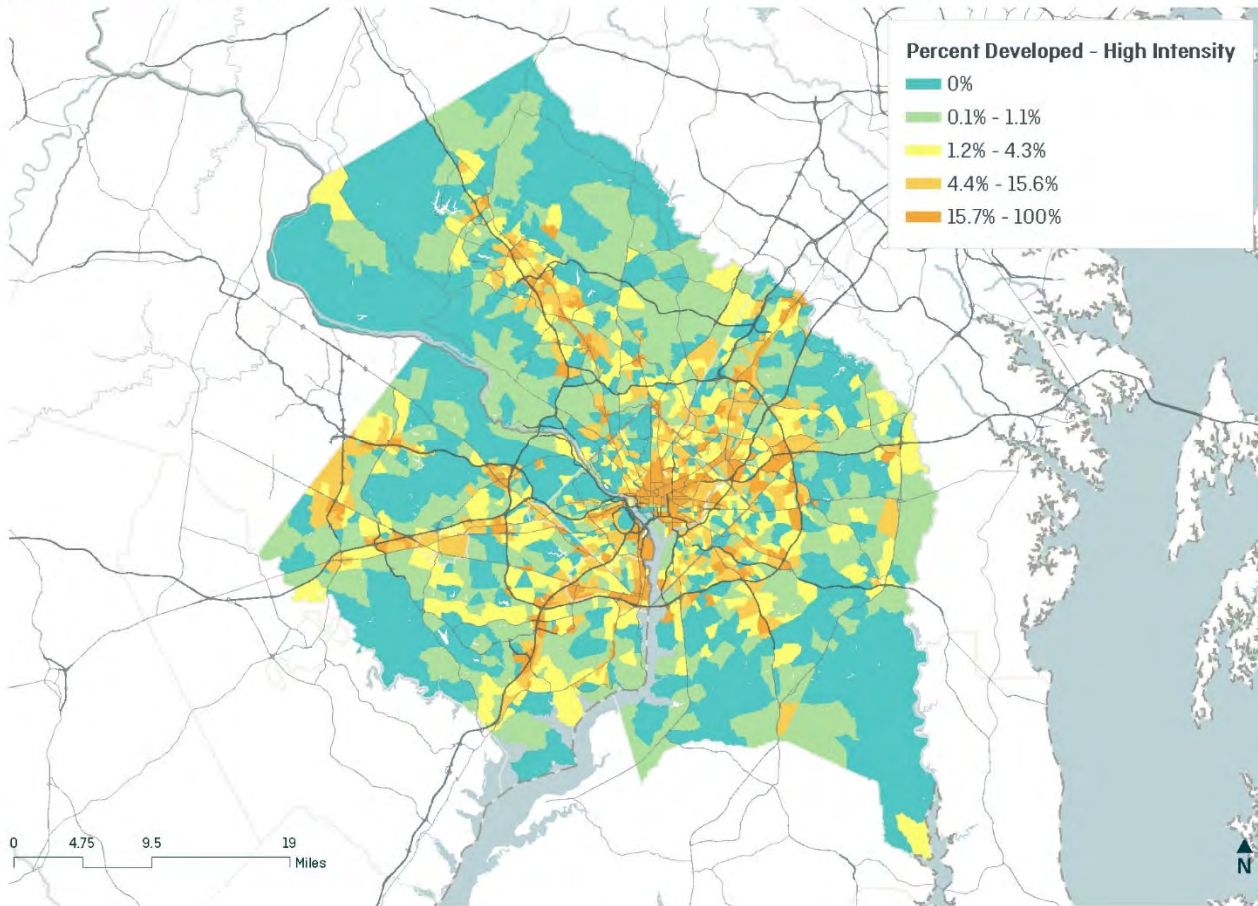


Figure 53 | Land Cover - Percent Developed – Medium Intensity

**MARYLAND I-495/I-270 | LANDCOVER - PERCENT DEVELOPED - MEDIUM INTENSITY**

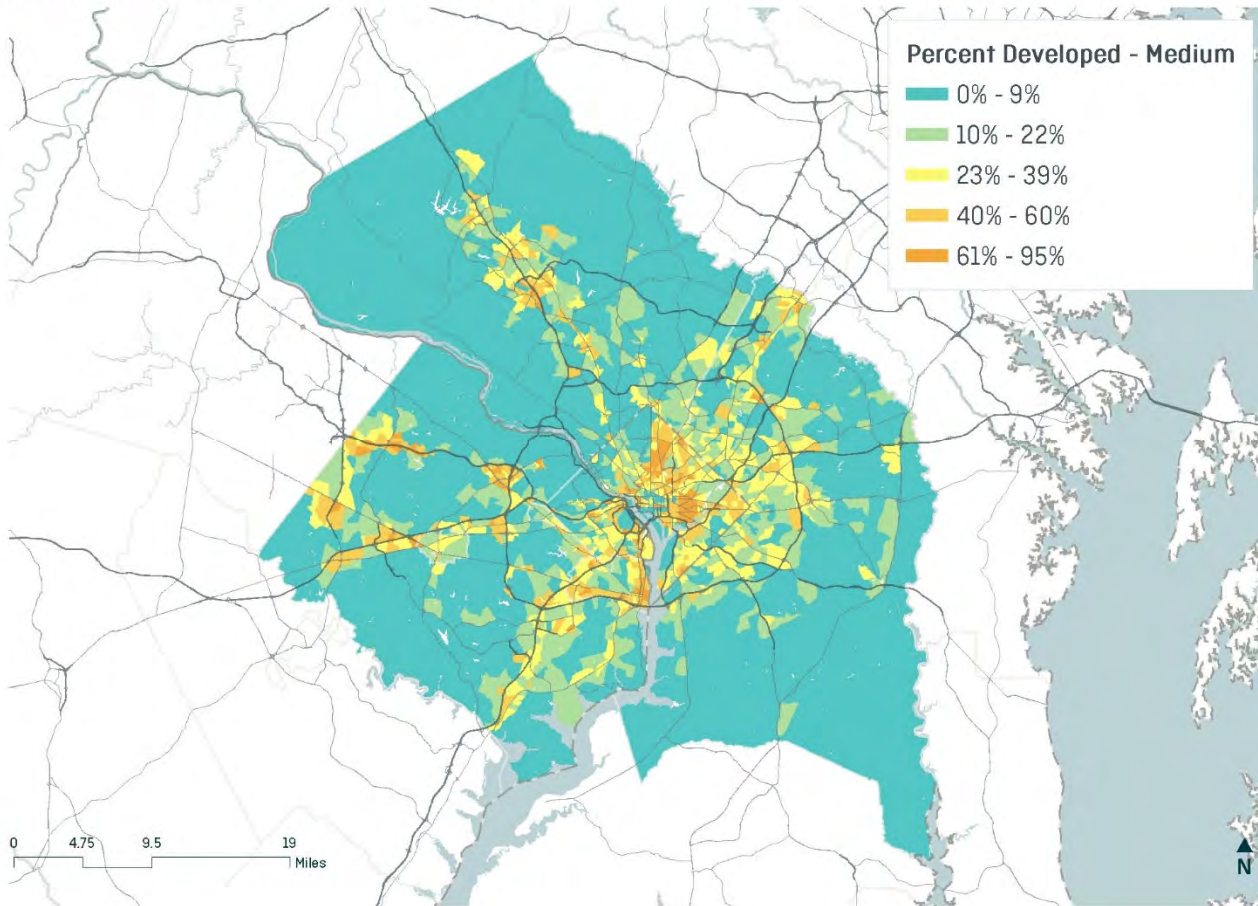




Figure 54 | Existing Fixed Guideway Transit, 2017

### MARYLAND I-495/I-270 | FIXED GUIDEWAY TRANSIT PRESENCE - 2017

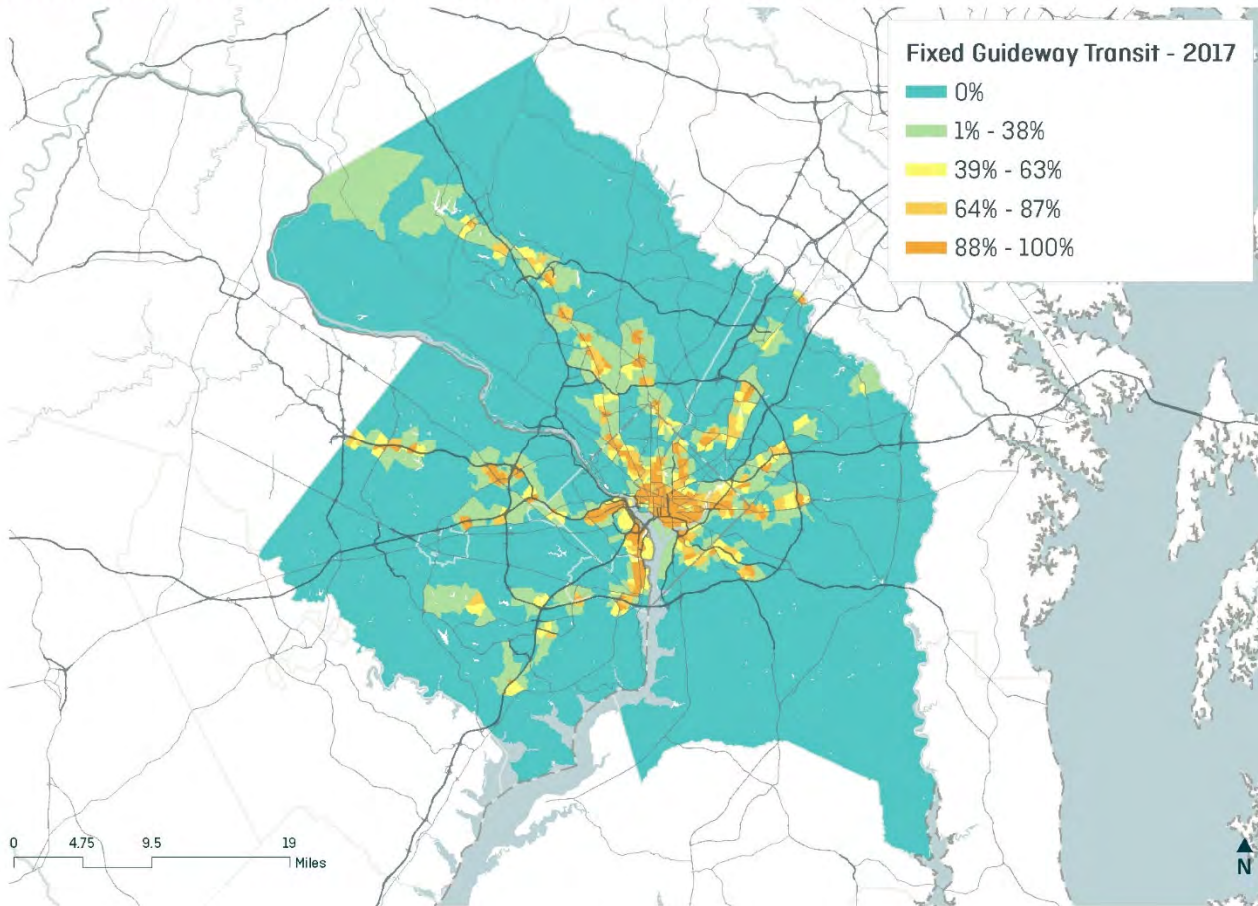
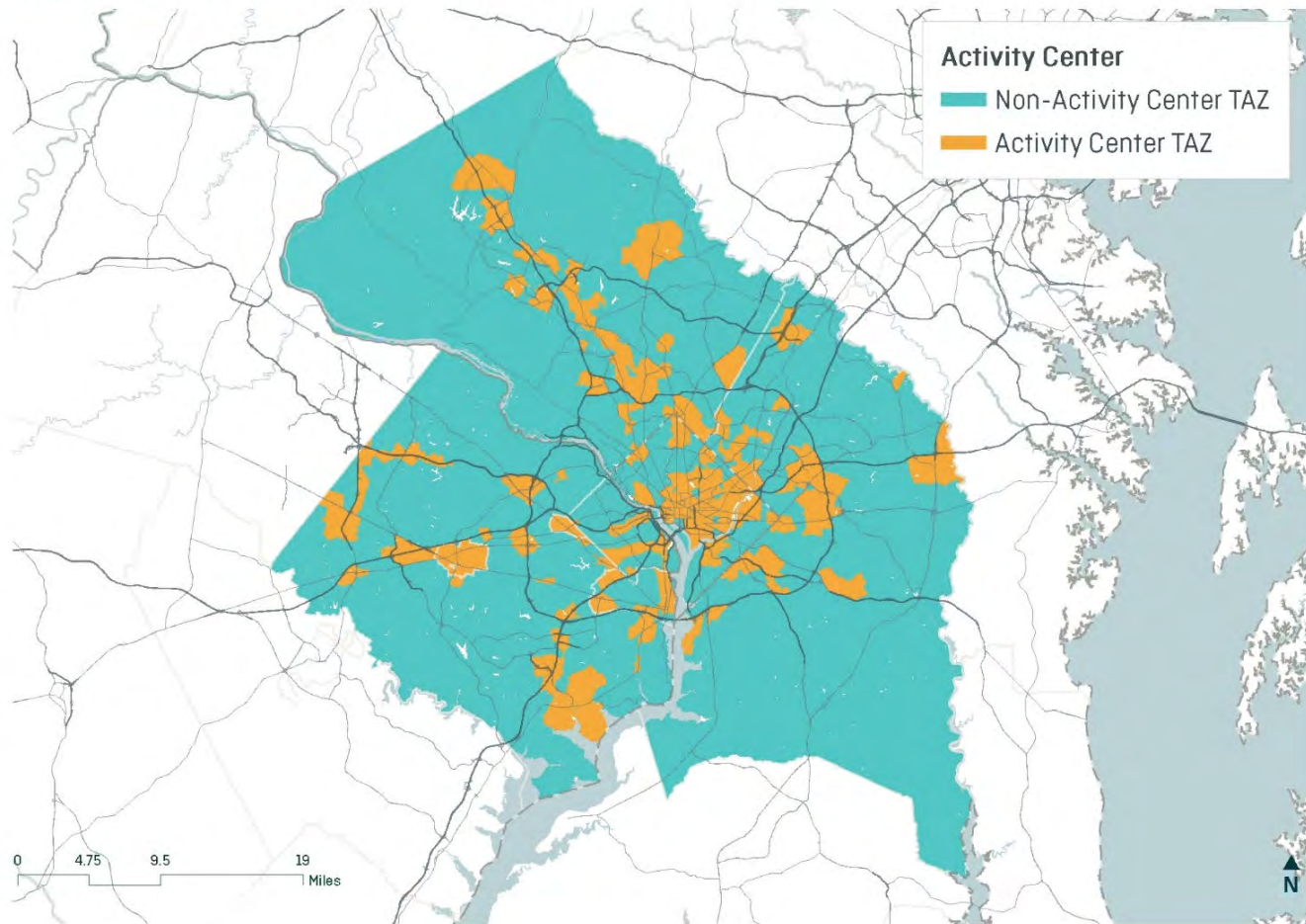




Figure 55 | Activity Centers

### MARYLAND I-495/I-270 | ACTIVITY CENTERS



Weights for each factor were determined through a two-step process. First, 2010-2020 growth, as forecasted by MWCOCG, was evaluated in a linear regression model to determine correlation between demand factors and growth. This data was used to provide guidance on the relative weights of factors. The regression analysis pointed to activity unit density, existing proportions, fixed guideway transit, and the airport as major influencers of growth. Professional judgement was then applied as step two to create weights by activity type. Considerable thought was put into the final weights in an attempt to ensure that no factor or set of factors had undue impact on the forecast. This was done through simple scenario analyses where factor weights were adjusted to evaluate forecasted changes.

## Capacity

Development capacity comes from two sources: available undeveloped land, and currently developed land that might be redeveloped. No data source was identified that provided the level of detail needed for the determination of capacity at the TAZ level, so capacity needed to be derived.

The capacity derivation used National Land Cover Database (NLCD) data from 2011 to categorize land as either undeveloped, developed, or undevelopable. Using MWCOCG data from 2010 and 2015, estimates of available undeveloped acres and prevailing activity unit density of developed acres were both derived. These two data points were then used to forecast growth capacity at the TAZ level, defined as:

*[Existing activity unit density \* available undeveloped land \* 2] + [existing activity unit density \* developed land acres \* (1 - proportion of activities that are population)]*

In other words, capacity is presumed to be a reflection of available land, existing activity unit density, and the how much of existing development is housing. Places with high existing activity density and available land will have high capacity for growth, while places with limited available land and a predominance of housing will have low capacity for growth.

An exception for the capacity process is made for TAZs where both market forces and local policies demonstrate redevelopment potential that exceeds the traditional capacity measure; these are generally the activity centers identified by local jurisdictions such as Tysons and White Flint, where growth is directed towards transit-oriented development with new higher density development replacing existing development.

## Demand Scores and TAZ Growth Estimates

The raw data for each demand factor were normalized to the jurisdictional maximum, so that all factors were scored on a scale from -1 to +1. These scores were then multiplied by the weight assigned that factor for each of the five development types, then summed by development across all factors. The result was a demand “score” for each development type for each TAZ. Scores were then converted into a preliminary growth estimate using the following calculation:

$$[\text{Demand Score} / \text{Sum of Jurisdiction's Demand Score} * \text{5-Year Growth Forecast}]$$

In other words, the preliminary growth estimate assumes that each TAZ receives growth proportional to the TAZ’s percent of its jurisdiction’s growth.

Preliminary growth estimates were then compared to activity unit capacity. If growth is less than capacity, the TAZ receives the full amount of preliminary growth. If growth is higher than capacity, the TAZ receives the amount of growth equal to available capacity. The remaining growth increment is then re-allocated to the rest of the TAZs in the jurisdiction that have been identified as having additional capacity. This set of calculations is done for each 5-year growth increment until all forecasted growth has been allocated.

## Localized Adjustments

Renaissance conducts research on notable development project status to identify specific areas where TAZ-level adjustments are warranted, particularly in developing base year estimates, to reflect best estimates of local conditions. The Renaissance forecasts include TAZ-specific revisions to the MWCOG Round 9.1 forecasts throughout the Primary Market Area. The balancing of macroeconomic forces, localized quantitative factors that influence development suitability and market response, as well as site-specific or property concerns results in some notable adjustments at the TAZ-level within the Primary Market Area.

While the Round 9.1 forecasts were adopted by MWCOG in fall 2018, the process of forecast development, testing, and adoption is roughly a two-year process; so, for most jurisdictions, the Round 9.1 forecasts reflect conditions known in roughly the middle of 2016. Further, not all jurisdictions choose to participate in each potential round of updates. Within the PMA, the District of Columbia, the City of Alexandria, the City of Gaithersburg (reflected in the Montgomery County jurisdiction reports for MWCOG) and Prince George’s County chose not to participate in Round 9.1 so their values reflect Round 9.0 values (adopted by MWCOG in 2016 and reflect a similar two-year gestation period). Renaissance focused on adjustments to substantial developments with a focus on changes to construction and, where known, occupancy, dates to adjust 2017 and 2020 TAZ values. reviewed current, pending, and recently-approved development applications to identify significant applications (greater than 100,000 gross square feet of commercial space or 100 dwelling units) and assess the status of developments as of July 1, 2017.

Within Montgomery and Prince George’s County, where the subject managed lane projects are located, Renaissance reviewed all development applications. In the remainder of the PMA, Renaissance focused on newsworthy applications through publications and other media sources including the Washington Business Journal, Washington Post, WTOP radio, individual jurisdiction economic development agency or property development company press releases, and the Greater Greater Washington blog site (to identify candidate sites then confirmed through authoritative sources). Staff made TAZ-specific adjustments to both jobs and housing units where the preponderance of the evidence linked individual development status to a meaningful change in the MWCOG Round 9.1 estimates for a given TAZ or neighborhood of TAZs. Throughout the region, the MWCOG 2017 population forecasts were subsequently adjusted on a proportional basis to match the published July 1, 2017 US Census estimates at a jurisdictional level.

In general, the comparison of Renaissance forecasts to MWCOG Round 9.1 forecasts indicate the following:

- The Renaissance forecasts show about 58,000 more residents and 7,000 more jobs in 2017, mostly within the PMA and largely a result of post-recession economic growth not reflected in the MWCOG 2017 estimates (prepared two to three years ago depending upon the jurisdiction). By 2045, the Renaissance totals are about 120,000 residents and 25,000 jobs higher than MWCOG
- The Renaissance forecasts generally reflect higher totals than MWCOG in the region’s first-tier and second-tier jurisdictions
- The single greatest jurisdictional difference between Renaissance and MWCOG forecast growth is in population for the District of Columbia, where the MWCOG forecasts show an AAGR of 1.4% through 2045, yielding a 2045 population of about 984,000. The MWCOG growth rate is higher than any other core, first-tier, or second-tier jurisdiction. The Renaissance 2045 population forecast of about 890,000 reflects a 1.0% AAGR.

## Allocation Results

Table 12 summarizes the notable localized adjustment in the PMA. Table 13 provides the results of the allocation methodology, represented as the “baseline forecast” for population and employment for each jurisdiction and for each tier from 2017 through 2045, in the following interval years: 2017, 2020, 2025, 2030, 2035, 2040, and 2045. The table also presents the average annual growth rate (AAGR). The following tables provide the MWCOG Cooperative Forecast Round 9.1 and the difference between the Baseline forecast and the Round 9.1 forecast

Table 12 | Notable Localized Adjustments in the Primary Market Area

Jurisdiction	Adjustments
Alexandria City	<ul style="list-style-type: none"> <li>Deferred National Science Foundation move from Arlington to Alexandria from 2017</li> </ul>
Arlington County	<ul style="list-style-type: none"> <li>Adjusted Pentagon jobs data based on Arlington County data and past experience</li> <li>Held 1901 North Moore Street (tallest building in northern Virginia when constructed in 2014 but vacant until 2018) vacant in 2017</li> </ul>
District of Columbia	<ul style="list-style-type: none"> <li>Deferred Capitol Crossing (under construction in 2018), District Wharf (opened in late 2017) and 655 New York Avenue (occupancy mid 2019) from 2017</li> </ul>
Fairfax County	<ul style="list-style-type: none"> <li>Deferred Inova Health complex from 2017</li> </ul>
Montgomery County	<ul style="list-style-type: none"> <li>In Gaithersburg vicinity, deferred Lerner Black Hill site, Bloom Montgomery Village, and Milestone development from 2017</li> <li>In Silver Spring vicinity, reflect turnover between 2017 and 2025 for Discovery Communications departure and JBG site retrofit</li> </ul>
Prince George's County	<ul style="list-style-type: none"> <li>In University of Maryland vicinity, defer Studio 3807, U MD Hotel, 5801 University Research Center and Kaiser Permanente, accelerated U2 site to half occupancy in 2017</li> <li>In Konterra vicinity, defer portion of Brick Yard Station from 2017</li> <li>In Prince George's Plaza vicinity, add Bowie Market Place retail employment in 2017, defer Melford residential site</li> <li>In Westphalia vicinity, defer portion of Richie Station Marketplace from 2017</li> <li>In National Harbor vicinity, accelerate full employment at MGM Casino (opened December 2016)</li> </ul>



Table 13 | Baseline Forecast of Population and Employment by Jurisdiction, 2017-2045

Renaissance (Version 15)																	
POPULATION										JOBS							
Jurisdiction	2017	2020	2025	2030	2035	2040	2045 AAGR			2017	2020	2025	2030	2035	2040	2045 AAGR	
<b>Core</b>																	
City of Alexandria	160,037	167,517	178,058	186,308	194,599	203,437	214,529	1.2%		106,812	111,440	119,997	127,278	134,804	142,298	150,791	1.4%
Arlington County	234,967	245,523	258,842	271,895	284,072	295,968	307,839	1.1%		214,180	221,542	230,863	243,088	253,677	264,942	275,109	1.0%
District of Columbia	693,977	718,172	759,251	796,587	830,893	861,012	889,859	1.0%		815,714	841,156	881,525	918,388	952,606	982,732	1,011,989	0.8%
<b>First Tier</b>																	
Fairfax County	1,187,109	1,220,562	1,272,950	1,323,152	1,367,072	1,406,613	1,444,122	0.7%		713,901	745,645	794,739	843,649	887,486	931,532	973,048	1.3%
Montgomery County	1,058,813	1,088,910	1,131,888	1,174,806	1,213,457	1,245,126	1,274,859	0.7%		529,424	548,669	575,988	602,489	625,969	649,776	672,156	0.9%
Prince George's County	913,117	927,728	948,465	965,927	980,828	992,314	1,001,925	0.3%		346,156	354,671	364,952	373,633	381,187	388,804	396,365	0.5%
<b>Second Tier</b>																	
Anne Arundel County	573,243	586,808	606,459	623,846	639,370	652,852	665,833	0.6%		328,887	340,412	355,491	370,478	384,906	400,488	414,064	0.9%
Frederick County	252,022	264,501	283,360	299,533	315,385	330,185	345,073	1.3%		113,963	118,752	125,317	131,449	137,634	143,590	149,071	1.1%
Howard County	321,111	334,817	354,787	371,132	385,326	397,311	409,054	0.9%		178,099	187,128	199,835	212,608	224,421	236,088	247,787	1.3%
Loudoun County	398,090	433,767	486,419	524,989	558,005	585,560	609,216	1.8%		178,355	194,243	218,257	243,373	267,288	291,475	315,698	2.7%
Prince William County	521,087	546,883	592,647	628,738	660,641	689,245	715,334	1.3%		182,612	194,370	211,220	228,450	245,228	262,373	278,993	1.8%
<b>Third Tier</b>																	
Calvert County	91,500	94,346	98,930	102,412	105,345	107,936	110,526	0.7%		35,118	36,688	38,592	40,041	41,279	42,588	43,874	0.9%
Carroll County	167,783	171,530	177,277	182,340	186,767	191,117	195,430	0.6%		69,090	71,452	74,273	76,799	79,203	81,524	83,826	0.7%
Charles County	159,701	168,672	181,148	192,594	202,847	212,168	222,801	1.4%		46,756	48,506	51,067	53,688	56,265	58,935	61,500	1.1%
City of Fredericksburg	28,360	29,939	32,188	34,005	36,086	38,141	40,184	1.4%		37,182	39,401	42,629	45,881	48,990	52,138	55,304	1.7%
Stafford County	146,781	158,271	176,746	193,295	209,484	225,706	242,272	2.2%		54,983	58,743	64,500	70,745	77,010	83,513	90,158	2.2%
Spotsylvania County	109,149	116,898	128,835	139,243	146,916	154,198	161,349	1.6%		46,740	49,374	53,155	57,093	61,601	66,139	70,676	1.8%
<b>Exurb</b>																	
Clarke County	14,508	14,783	15,283	15,765	16,160	16,530	16,882	0.6%		5,701	5,883	6,220	6,558	6,884	7,208	7,514	1.1%
Fauquier County	69,465	72,811	78,305	83,275	88,084	92,871	97,767	1.4%		30,323	31,692	33,664	35,722	37,677	39,652	41,606	1.3%
Jefferson County	56,337	58,557	62,603	66,079	69,462	72,725	76,053	1.2%		22,282	23,271	24,751	26,218	27,692	29,146	30,617	1.3%
King George County	26,341	28,542	31,637	34,461	37,203	39,907	42,602	2.1%		18,431	19,517	21,126	22,784	24,470	26,200	27,999	1.8%
St. Mary's County	112,669	118,840	128,299	135,743	145,162	152,730	160,458	1.5%		63,689	66,339	69,824	72,577	75,509	78,543	81,603	1.0%
<b>TOTAL</b>	<b>7,296,167</b>	<b>7,568,377</b>	<b>7,984,377</b>	<b>8,346,125</b>	<b>8,673,164</b>	<b>8,963,652</b>	<b>9,243,967</b>	<b>0.9%</b>		<b>4,138,398</b>	<b>4,308,894</b>	<b>4,557,985</b>	<b>4,802,989</b>	<b>5,031,786</b>	<b>5,259,684</b>	<b>5,479,748</b>	<b>1.1%</b>

POPULATION										JOBS							
Subtotals by Tiers	2017	2020	2025	2030	2035	2040	2045 AAGR			2017	2020	2025	2030	2035	2040	2045 AAGR	
<b>PMA</b>																	
Core	1,088,981	1,131,212	1,196,151	1,254,790	1,309,564	1,360,417	1,412,227	1.0%		1,136,706	1,174,138	1,232,385	1,288,754	1,341,087	1,389,972	1,437,889	0.9%
First Tier	3,159,039	3,237,200	3,353,303	3,463,885	3,561,357	3,644,053	3,720,906	0.6%		1,589,481	1,648,985	1,735,679	1,819,771	1,894,642	1,970,112	2,041,569	1.0%
<b>Non-PMA</b>																	
Second Tier	2,065,553	2,166,776	2,323,672	2,448,238	2,558,727	2,655,153	2,744,510	1.1%		981,916	1,034,905	1,110,120	1,186,358	1,259,477	1,334,014	1,405,613	1.5%
Third Tier	703,274	739,656	795,124	843,889	887,445	929,266	972,562	1.3%		289,869	304,164	324,216	344,247	364,348	384,837	405,338	1.4%
Exurb	279,320	293,533	316,127	335,323	356,071	374,763	393,762	1.4%		140,426	146,702	155,585	163,859	172,232	180,749	189,339	1.2%
<b>Totals</b>																	
SUBTOTAL - PMA	4,248,020	4,368,412	4,549,454	4,718,675	4,870,921	5,004,470	5,133,133	0.7%		2,726,187	2,823,123	2,968,064	3,108,525	3,235,729	3,360,084	3,479,458	1.0%
SUBTOTAL- Non-PMA	3,048,147	3,199,965	3,434,923	3,627,450	3,802,243	3,959,182	4,110,834	1.2%		1,412,211	1,485,771	1,589,921	1,694,464	1,796,057	1,899,600	2,000,290	1.4%
<b>TOTAL</b>	<b>7,296,167</b>	<b>7,568,377</b>	<b>7,984,377</b>	<b>8,346,125</b>	<b>8,673,164</b>	<b>8,963,652</b>	<b>9,243,967</b>	<b>0.9%</b>		<b>4,138,398</b>	<b>4,308,894</b>	<b>4,557,985</b>	<b>4,802,989</b>	<b>5,031,786</b>	<b>5,259,684</b>	<b>5,479,748</b>	<b>1.1%</b>

Table 14 | MWCOG Cooperative Forecast Round 9.1

**MWCOG (Round 9.1)**

	POPULATION								JOBS							
	2017	2020	2025	2030	2035	2040	2045	AAGR	2017	2020	2025	2030	2035	2040	2045	AAGR
<b>Core</b>																
Jurisdiction																
City of Alexandria	152,260	159,169	167,515	172,781	180,463	190,824	208,451	1.3%	107,792	110,119	121,772	127,266	135,254	142,735	155,095	1.5%
Arlington County	227,860	238,295	249,462	261,792	274,563	287,563	301,167	1.1%	212,552	216,874	223,539	238,379	248,902	260,975	269,064	0.9%
District of Columbia	695,135	729,501	787,116	842,154	893,898	940,687	987,213	1.4%	817,462	846,280	895,120	937,854	978,223	1,011,806	1,045,390	1.0%
<b>First Tier</b>																
Fairfax County	1,178,155	1,201,565	1,255,535	1,319,169	1,374,998	1,424,946	1,469,595	0.9%	708,912	738,884	784,676	827,977	861,586	899,356	931,892	1.1%
Montgomery County	1,029,947	1,051,989	1,087,292	1,128,792	1,167,704	1,197,147	1,223,345	0.6%	529,480	543,467	572,497	604,516	627,351	653,865	678,753	1.0%
Prince George's County	911,915	923,144	938,023	952,955	967,842	982,767	995,874	0.3%	342,747	349,048	366,326	375,746	385,542	393,335	402,145	0.6%
<b>Second Tier</b>																
Anne Arundel County	567,770	580,006	593,594	606,688	618,176	628,047	638,133	0.4%	328,902	340,015	353,530	367,845	380,691	398,615	407,101	0.8%
Frederick County	255,011	267,782	288,690	303,583	319,361	332,151	344,138	1.2%	114,013	117,300	123,176	128,627	135,345	141,075	145,526	1.0%
Howard County	321,520	337,051	354,149	363,674	369,603	371,621	373,639	0.6%	178,097	186,021	199,221	212,422	221,513	229,082	236,651	1.1%
Loudoun County	390,766	423,952	459,579	480,173	494,369	502,398	507,398	1.0%	178,354	195,198	219,395	243,375	262,221	277,790	291,165	2.2%
Prince William County	511,999	527,587	564,961	592,938	616,256	635,785	652,038	0.9%	182,622	196,408	217,578	237,589	257,083	276,260	293,261	2.1%
<b>Third Tier</b>																
Calvert County	92,230	94,600	97,350	99,200	100,050	100,450	100,850	0.3%	35,120	36,800	39,500	40,900	41,900	43,100	44,300	0.9%
Carrroll County	172,687	175,900	179,437	183,258	186,180	189,574	192,968	0.4%	69,096	70,790	72,936	75,225	77,184	79,376	81,569	0.6%
Charles County	157,290	167,036	178,238	194,671	207,519	218,575	236,479	1.7%	46,759	46,988	49,227	52,196	55,378	58,762	61,505	1.1%
City of Fredericksburg	26,925	28,203	30,327	30,787	32,588	34,389	36,189	1.2%	37,189	39,585	43,590	47,314	50,868	54,425	57,981	1.9%
Stafford County	151,992	166,405	190,375	210,142	229,403	248,664	267,925	2.6%	54,998	58,506	64,337	70,768	77,573	84,366	91,156	2.3%
Spotsylvania County	109,149	121,892	143,106	161,672	168,221	174,770	181,321	2.3%	46,739	48,811	52,229	55,768	62,029	68,269	74,534	2.1%
<b>Exurb</b>																
Clarke County	14,258	14,337	14,801	15,266	15,615	15,965	16,315	0.5%	5,698	5,785	6,277	6,768	7,301	7,838	8,374	1.6%
Fauquier County	69,832	72,838	77,845	82,853	87,862	92,871	97,881	1.4%	30,334	31,481	33,377	35,278	37,182	39,080	40,984	1.2%
Jefferson County	59,810	62,688	67,071	71,203	75,300	79,065	82,830	1.3%	22,282	23,351	24,995	26,521	28,050	29,449	30,852	1.3%
King George County	26,413	29,134	33,653	37,086	40,383	43,680	46,982	2.7%	18,430	19,371	20,917	22,506	24,092	25,678	27,270	1.7%
St. Mary's County	115,378	120,149	129,199	140,749	148,149	155,349	162,899	1.4%	63,703	66,180	69,844	71,917	74,369	76,907	79,435	0.9%
<b>TOTAL</b>	<b>7,238,302</b>	<b>7,493,223</b>	<b>7,887,318</b>	<b>8,251,586</b>	<b>8,568,503</b>	<b>8,847,288</b>	<b>9,123,630</b>	<b>0.9%</b>	<b>4,131,281</b>	<b>4,287,262</b>	<b>4,554,059</b>	<b>4,806,757</b>	<b>5,029,637</b>	<b>5,252,144</b>	<b>5,454,003</b>	<b>1.1%</b>

	POPULATION								JOBS							
	2017	2020	2025	2030	2035	2040	2045	AAGR	2017	2020	2025	2030	2035	2040	2045	AAGR
<b>Subtotals by Tiers</b>																
<b>PMA</b>																
Core	1,075,255	1,126,965	1,204,093	1,276,727	1,348,924	1,419,074	1,496,831	1.4%	1,137,806	1,173,273	1,240,431	1,303,499	1,362,379	1,415,516	1,469,549	1.0%
First Tier	3,120,017	3,176,698	3,280,850	3,400,916	3,510,544	3,604,860	3,688,814	0.6%	1,581,139	1,631,399	1,723,499	1,808,239	1,874,479	1,946,556	2,012,790	0.9%
<b>Non-PMA</b>																
Second Tier	2,047,066	2,136,378	2,260,973	2,347,056	2,417,765	2,470,002	2,515,346	0.8%	981,988	1,034,942	1,112,900	1,189,858	1,256,853	1,322,822	1,373,704	1.4%
Third Tier	710,273	754,036	818,833	879,730	923,961	966,422	1,015,732	1.5%	289,901	301,480	321,819	342,171	364,932	388,298	411,045	1.4%
Exurb	285,691	299,146	322,569	347,157	367,309	386,930	406,907	1.5%	140,447	146,168	155,410	162,990	170,994	178,952	186,915	1.1%
<b>Totals</b>																
SUBTOTAL- PMA	4,195,272	4,303,663	4,484,943	4,677,643	4,859,468	5,023,934	5,185,645	0.8%	2,718,945	2,804,672	2,963,930	3,111,738	3,236,858	3,362,072	3,482,339	1.0%
SUBTOTAL- Non-PMA	3,043,030	3,189,560	3,402,375	3,573,943	3,709,035	3,823,354	3,937,985	1.0%	1,412,336	1,482,590	1,590,129	1,695,019	1,792,779	1,890,072	1,971,664	1.4%
<b>TOTAL</b>	<b>7,238,302</b>	<b>7,493,223</b>	<b>7,887,318</b>	<b>8,251,586</b>	<b>8,568,503</b>	<b>8,847,288</b>	<b>9,123,630</b>	<b>0.9%</b>	<b>4,131,281</b>	<b>4,287,262</b>	<b>4,554,059</b>	<b>4,806,757</b>	<b>5,029,637</b>	<b>5,252,144</b>	<b>5,454,003</b>	<b>1.1%</b>



Table 15 | Difference between Renaissance Baseline Forecast and MWCOG Cooperative Forecast Round 9.1

Renaissance - MWCOG															
	POPULATION							JOBS							
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
<b>Core</b>															
Jurisdiction	7,777	8,348	10,543	13,527	14,136	12,613	6,078	(980)	1,321	(1,775)	12	(450)	(437)	(4,304)	
City of Alexandria	7,107	7,228	9,380	10,103	9,509	8,405	6,672	1,628	4,668	7,324	4,709	4,775	3,967	6,045	
Arlington County	(1,158)	(11,329)	(27,865)	(45,567)	(63,005)	(79,675)	(97,354)	(1,748)	(5,124)	(13,595)	(19,466)	(25,617)	(29,074)	(33,401)	
District of Columbia	8,954	18,997	17,415	3,983	(7,926)	(18,333)	(25,473)	4,989	6,761	10,063	15,672	25,900	32,176	41,156	
Fairfax County	28,866	36,921	44,596	46,014	45,753	47,979	51,514	(56)	5,202	3,491	(2,027)	(1,382)	(4,089)	(6,597)	
Montgomery County	1,202	4,584	10,442	12,972	12,986	9,547	6,051	3,409	5,623	(1,374)	(2,113)	(4,355)	(4,531)	(5,780)	
Prince George's County	5,473	6,802	12,865	17,158	21,194	24,805	27,700	(15)	397	1,961	2,633	4,215	1,873	6,963	
Anne Arundel County	(2,989)	(3,281)	(5,330)	(4,050)	(3,976)	(1,966)	935	(50)	1,452	2,141	2,822	2,289	2,515	3,545	
Frederick County	(409)	(2,234)	638	7,458	15,723	25,690	35,415	2	1,107	614	186	2,908	7,006	11,136	
Howard County	7,324	9,815	26,840	44,816	63,636	83,162	101,818	1	(955)	(1,138)	(2)	5,067	13,685	24,533	
Loudoun County	9,088	19,296	27,686	35,800	44,385	53,460	63,296	(10)	(2,038)	(6,358)	(9,139)	(11,855)	(13,887)	(14,268)	
Prince William County	(730)	(254)	1,580	3,212	5,295	7,486	9,676	(2)	(112)	(908)	(859)	(621)	(512)	(426)	
Calvert County	(4,904)	(4,370)	(2,160)	(918)	587	1,543	2,462	(6)	662	1,337	1,574	2,019	2,148	2,257	
Carroll County	2,411	1,636	2,910	(2,077)	(4,672)	(6,407)	(13,678)	(3)	1,518	1,840	1,492	887	173	(5)	
Charles County	1,435	1,736	1,861	3,218	3,498	3,752	3,995	(7)	(184)	(961)	(1,433)	(1,878)	(2,287)	(2,677)	
City of Fredericksburg	(5,211)	(8,134)	(13,629)	(16,847)	(19,919)	(22,958)	(25,653)	(15)	237	163	(23)	(563)	(853)	(998)	
Stafford County	-	(4,994)	(14,274)	(22,429)	(21,305)	(20,572)	(19,972)	1	563	926	1,325	(428)	(2,130)	(3,858)	
Spotsylvania County	250	446	482	499	545	565	567	3	98	(57)	(210)	(417)	(630)	(860)	
Clarke County	(367)	(27)	460	422	222	-	(114)	(11)	211	287	444	495	572	622	
Fauquier County	(3,473)	(4,131)	(4,468)	(5,124)	(5,838)	(6,340)	(6,777)	-	(80)	(244)	(303)	(358)	(303)	(235)	
Jefferson County	(72)	(592)	(2,016)	(2,625)	(3,180)	(3,773)	(4,380)	1	146	209	278	378	522	729	
King George County	(2,709)	(1,309)	(900)	(5,006)	(2,987)	(2,619)	(2,441)	(14)	159	(20)	660	1,140	1,636	2,168	
St. Mary's County	57,865	75,154	97,059	94,539	104,661	116,364	120,337	7,117	21,632	3,926	(3,768)	2,149	7,540	25,745	
TOTAL															

	POPULATION							JOBS							
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
<b>PMA</b>															
Subtotals by Tiers	13,726	4,247	(7,942)	(21,937)	(39,360)	(58,657)	(84,604)	(1,100)	865	(8,046)	(14,745)	(21,292)	(25,544)	(31,660)	
Core	39,022	60,502	72,453	62,969	50,813	39,193	32,092	8,342	17,586	12,180	11,532	20,163	23,556	28,779	
First Tier	18,487	30,398	62,699	101,182	140,962	185,151	229,164	(72)	(37)	(2,780)	(3,500)	2,624	11,192	31,909	
Second Tier	(6,999)	(14,380)	(23,709)	(35,841)	(36,516)	(37,156)	(43,170)	(32)	2,684	2,397	2,076	(584)	(3,461)	(5,707)	
Third Tier	(6,371)	(5,613)	(6,442)	(11,834)	(11,238)	(12,167)	(13,145)	(21)	534	175	869	1,238	1,797	2,424	
Exurb	52,748	64,749	64,511	41,032	11,453	(19,464)	(52,512)	7,242	18,451	4,134	(3,213)	(1,129)	(1,988)	(2,881)	
Non-PMA	5,117	10,405	32,548	53,507	93,208	135,828	172,849	(125)	3,181	(208)	(555)	3,278	9,528	28,626	
Totals	57,865	75,154	97,059	94,539	104,661	116,364	120,337	7,117	21,632	3,926	(3,768)	2,149	7,540	25,745	
SUBTOTAL - PMA															
SUBTOTAL - Non-PMA															
TOTAL															

The figures below illustrate the results of the allocation and the MWCOG Round 9.1 Cooperative Forecast, specifically population and employment density for interval years 2017, 2025, 2035, and 2045; population and employment density change from 2017 to 2045; population and employment growth from 2017 to 2045; and the difference between the Renaissance forecast and the MWCOG forecast for both population and employment for interval years 2017, 2025, 2035, and 2045.

Figure 56 | Renaissance Forecast Population Density, 2017

### MARYLAND I-495/I-270 | 2017 POPULATION DENSITY

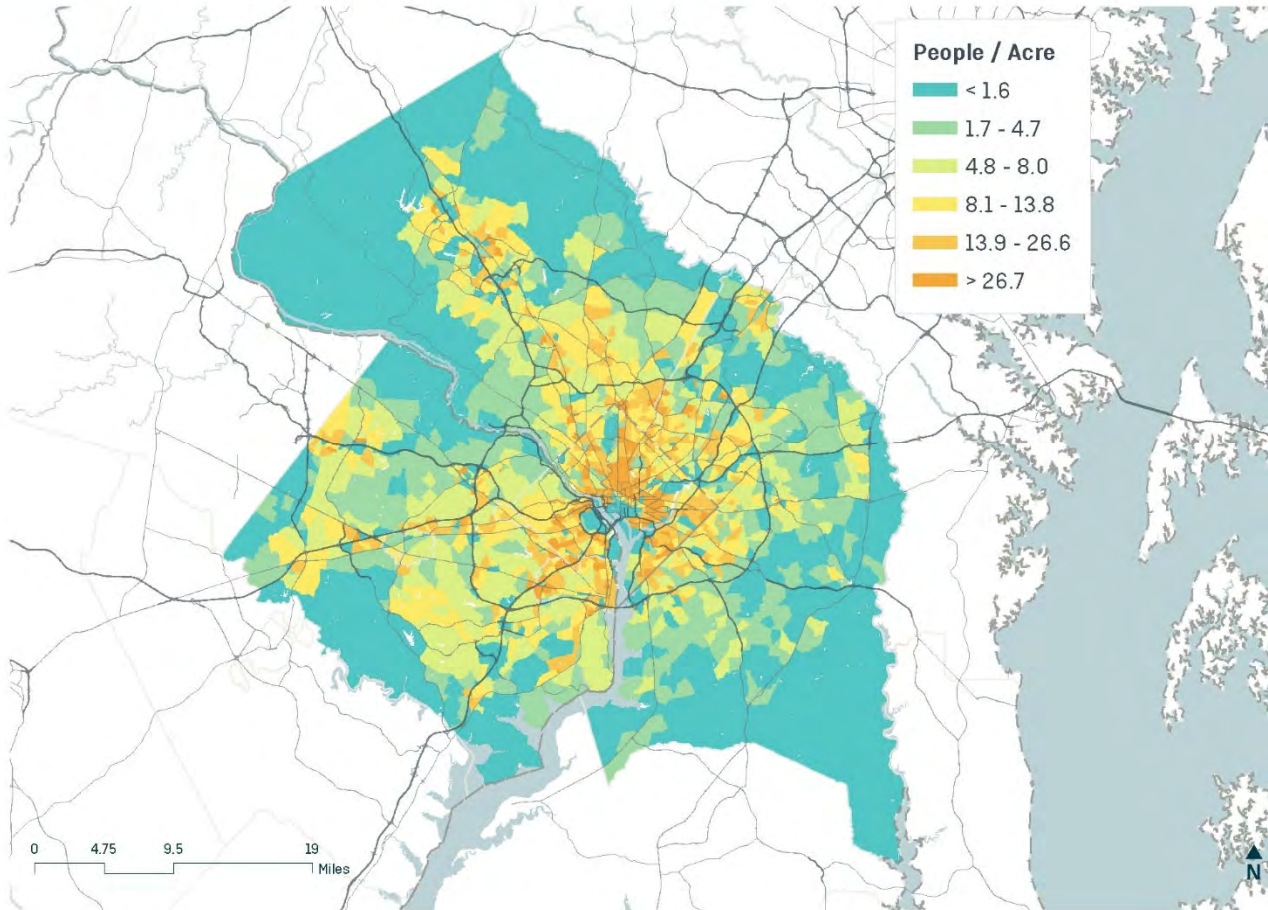


Figure 57 | Renaissance Forecast Employment Density, 2017

### MARYLAND I-495/I-270 | 2017 EMPLOYMENT DENSITY

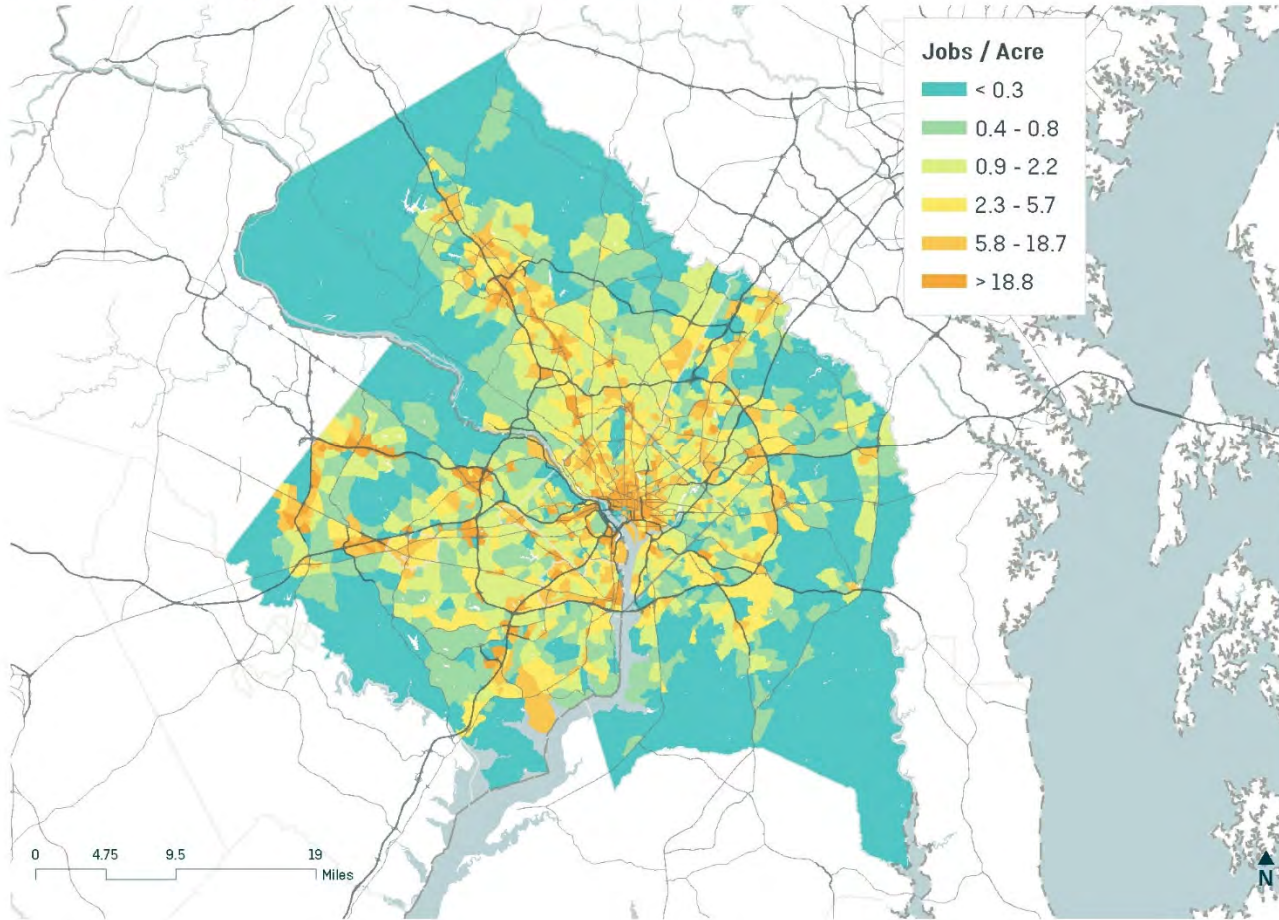




Figure 58 | Renaissance Forecast Activity Unit Density, 2017

### MARYLAND I-495/I-270 | 2017 ACTIVITY UNIT DENSITY

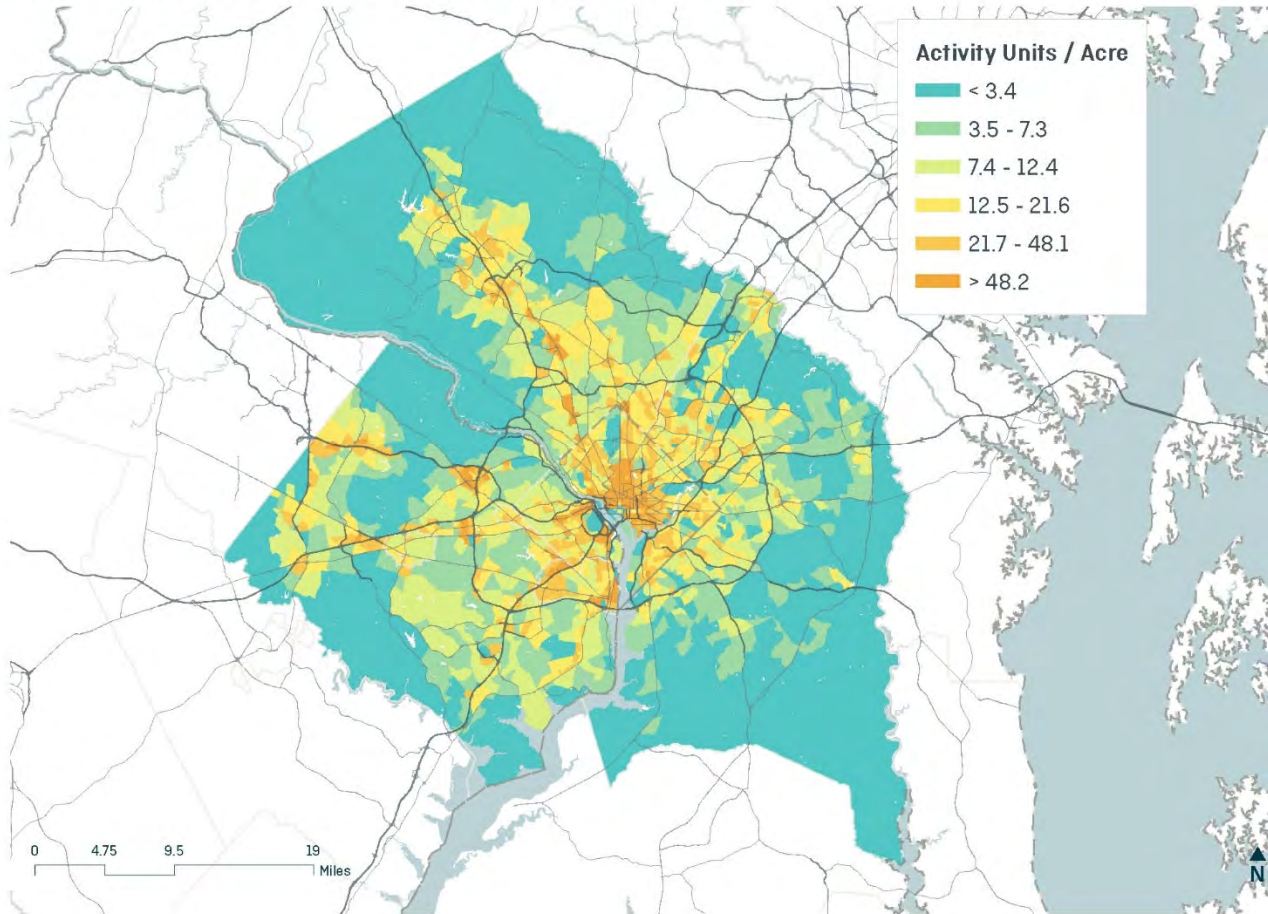


Figure 59 | Renaissance Forecast Population Density, 2025

### MARYLAND I-495/I-270 | 2025 POPULATION DENSITY

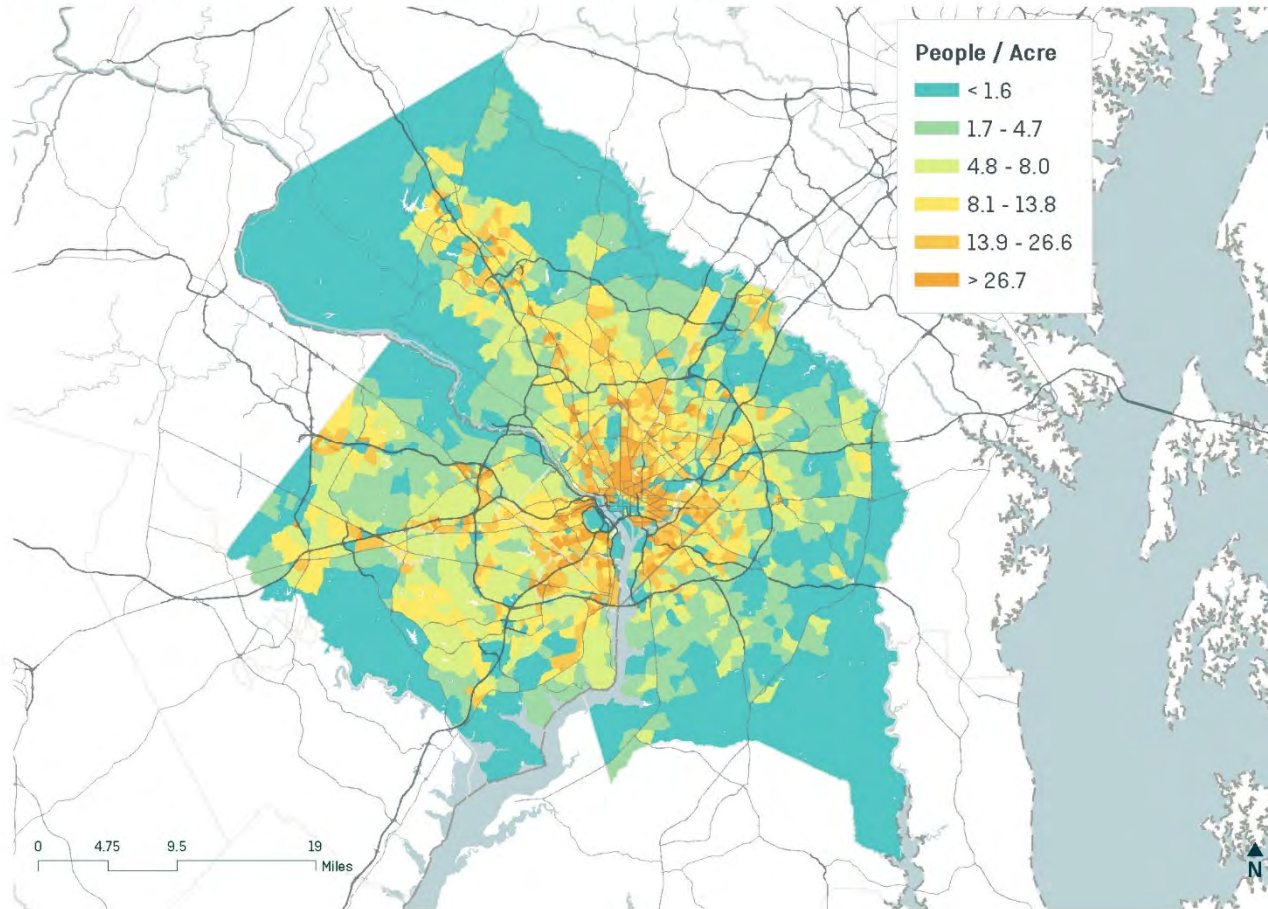


Figure 60 | Renaissance Forecast Employment Density, 2025

### MARYLAND I-495/I-270 | 2025 EMPLOYMENT DENSITY

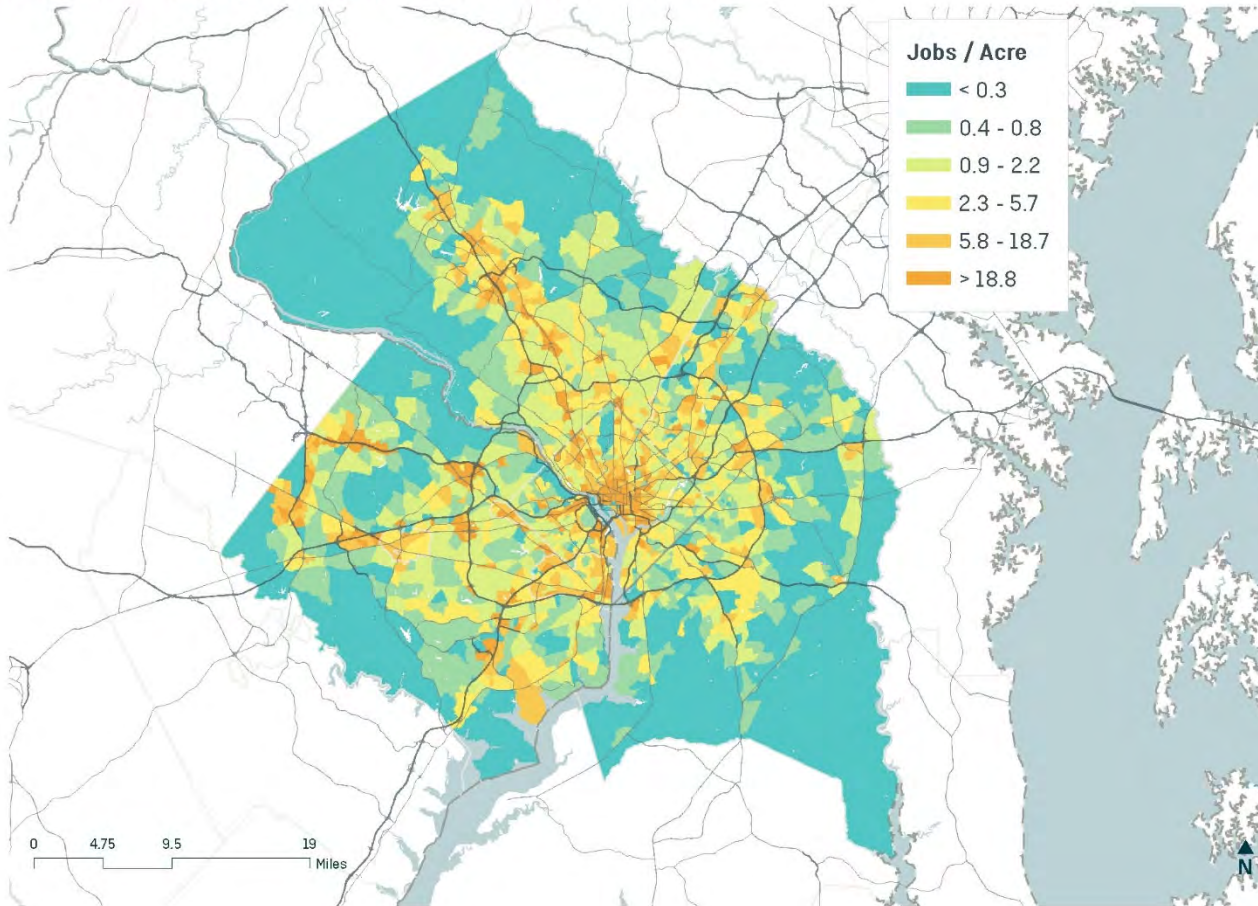




Figure 61 | Renaissance Forecast Activity Unit Density, 2025

### MARYLAND I-495/I-270 | 2025 ACTIVITY UNIT DENSITY

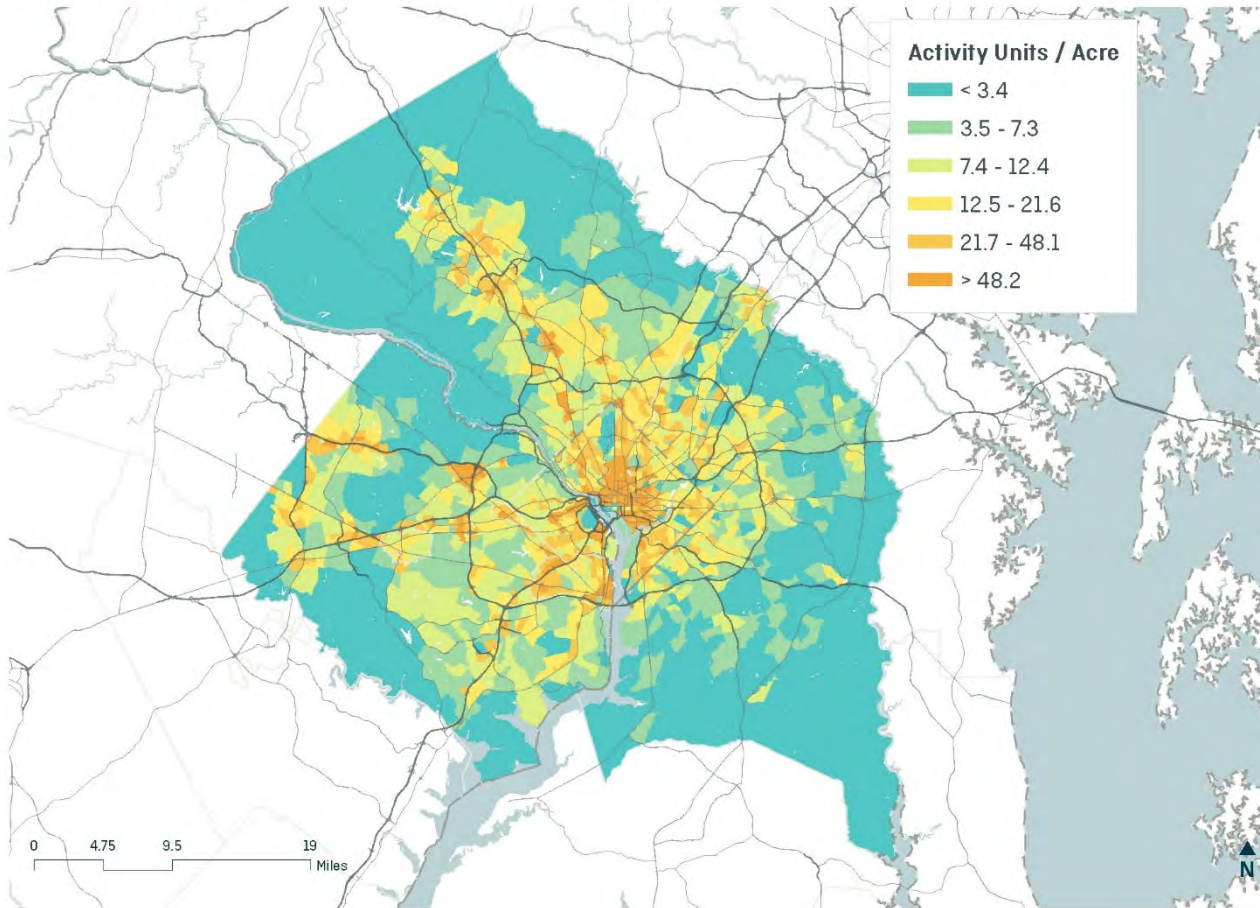


Figure 62 | Renaissance Forecast Population Density, 2035

### MARYLAND I-495/I-270 | 2035 POPULATION DENSITY

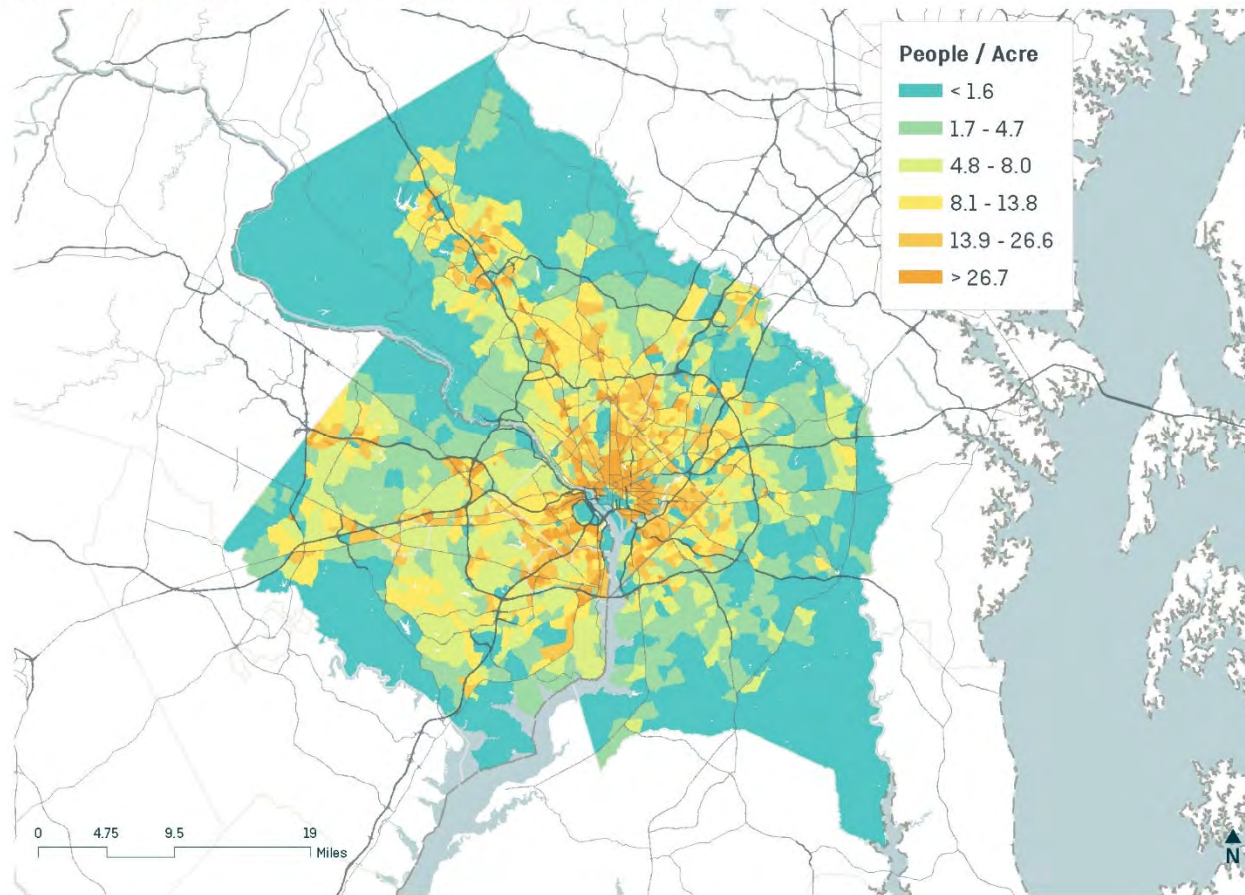


Figure 63 | Renaissance Forecast Employment Density, 2035

### MARYLAND I-495/I-270 | 2035 EMPLOYMENT DENSITY

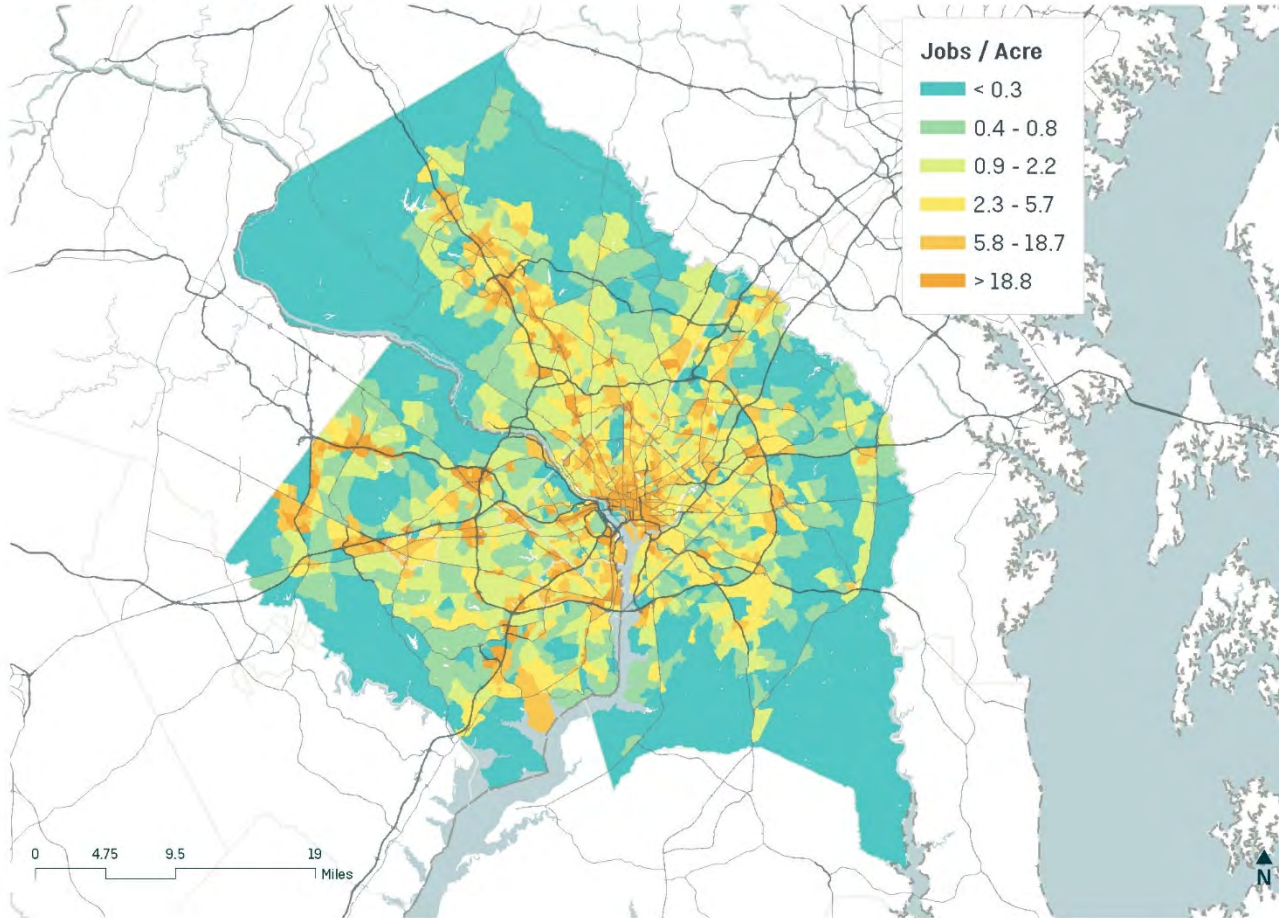




Figure 64 | Renaissance Forecast Activity Unit Density, 2035

### MARYLAND I-495/I-270 | 2035 ACTIVITY UNIT DENSITY

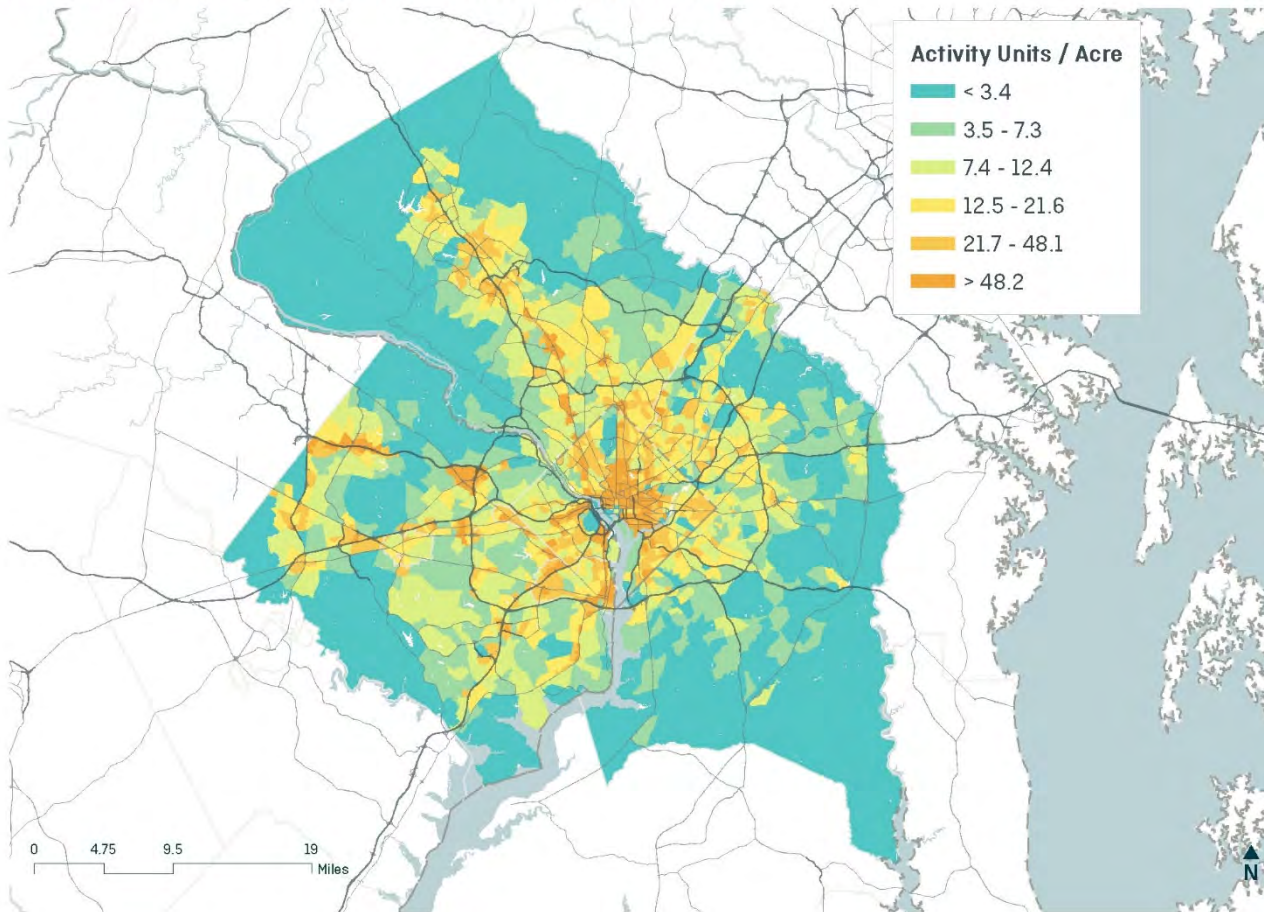


Figure 65 | Renaissance Forecast Population Density, 2045

### MARYLAND I-495/I-270 | 2045 POPULATION DENSITY

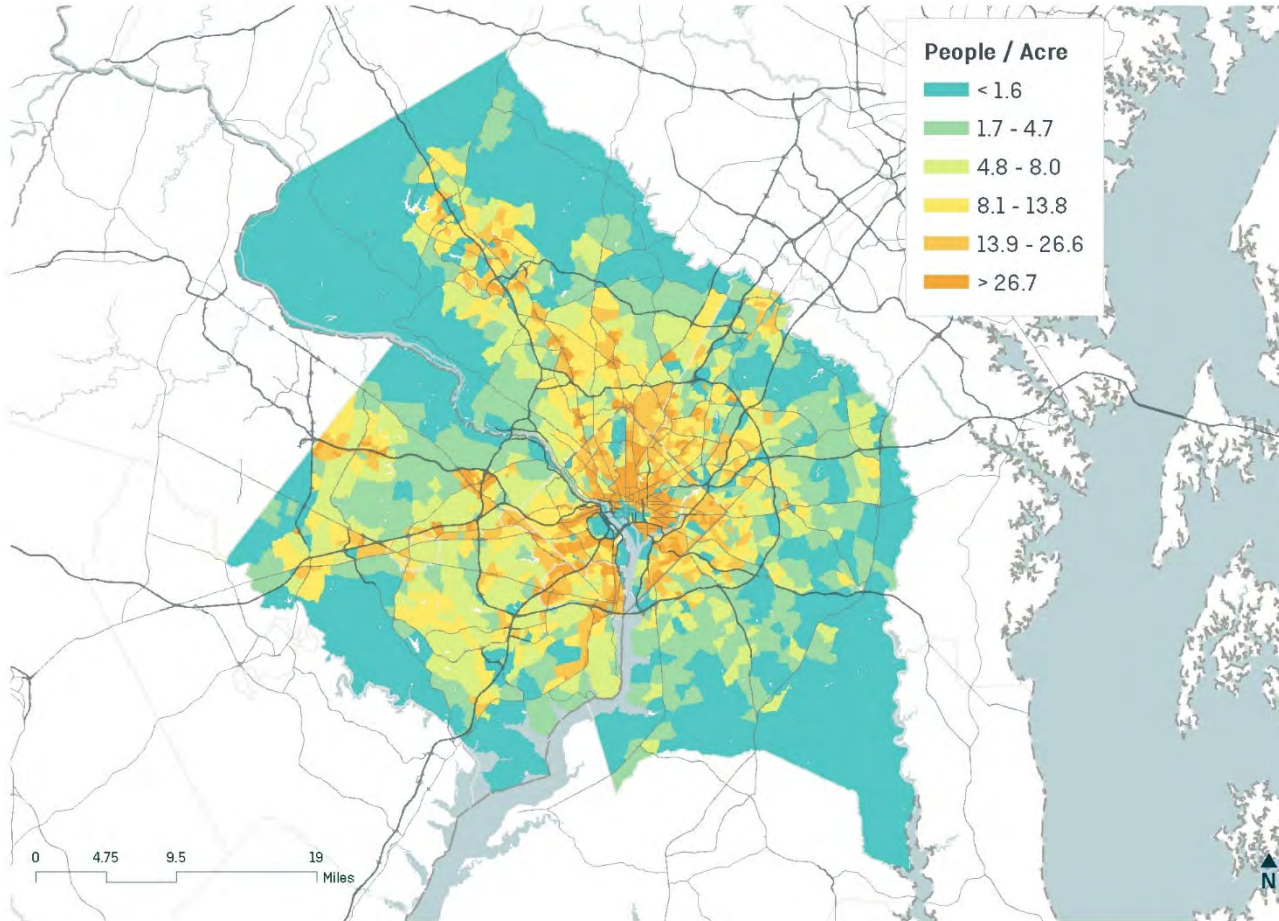




Figure 66 | Renaissance Forecast Employment Density, 2045

### MARYLAND I-495/I-270 | 2045 EMPLOYMENT DENSITY

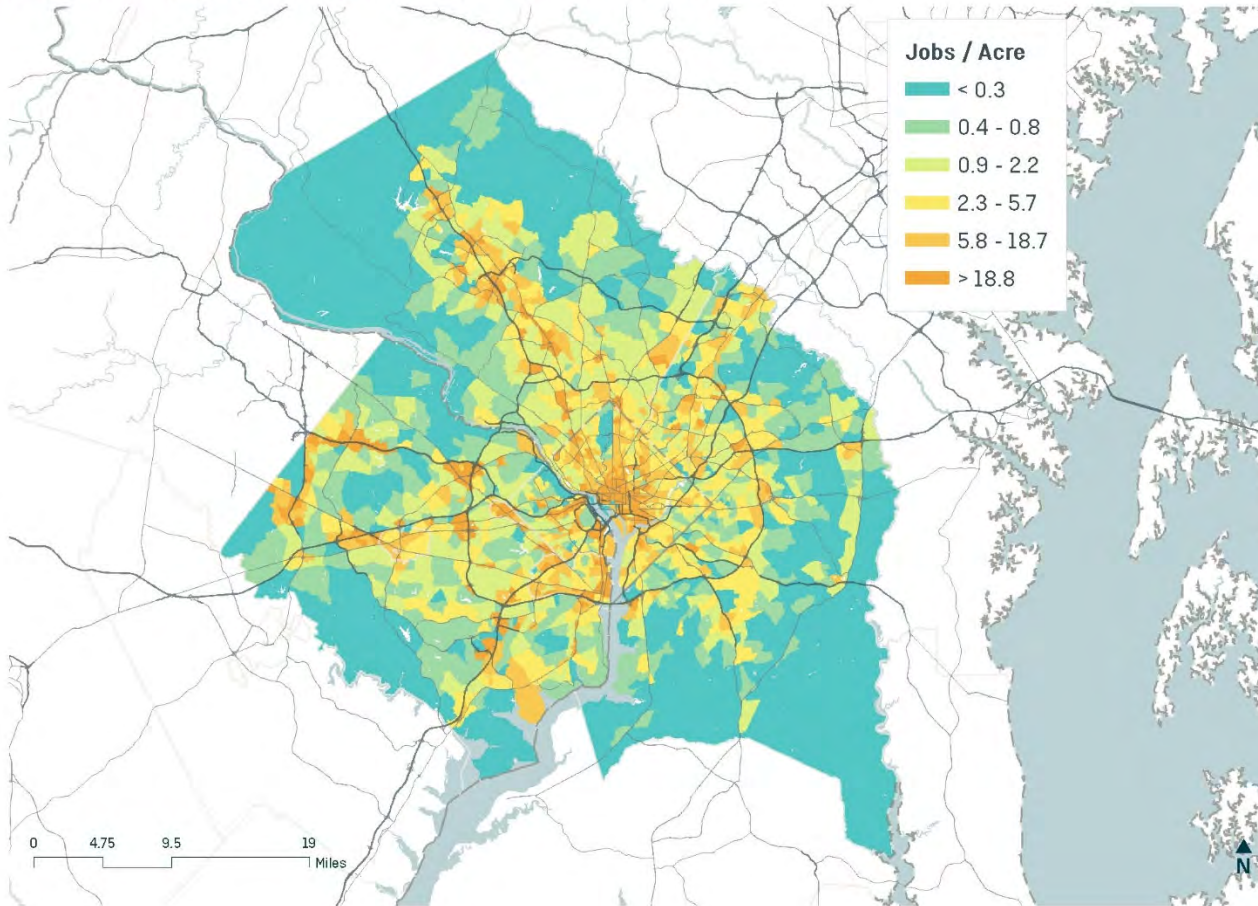


Figure 67 | Renaissance Forecast Activity Unit Density, 2045

### MARYLAND I-495/I-270 | 2045 ACTIVITY UNIT DENSITY

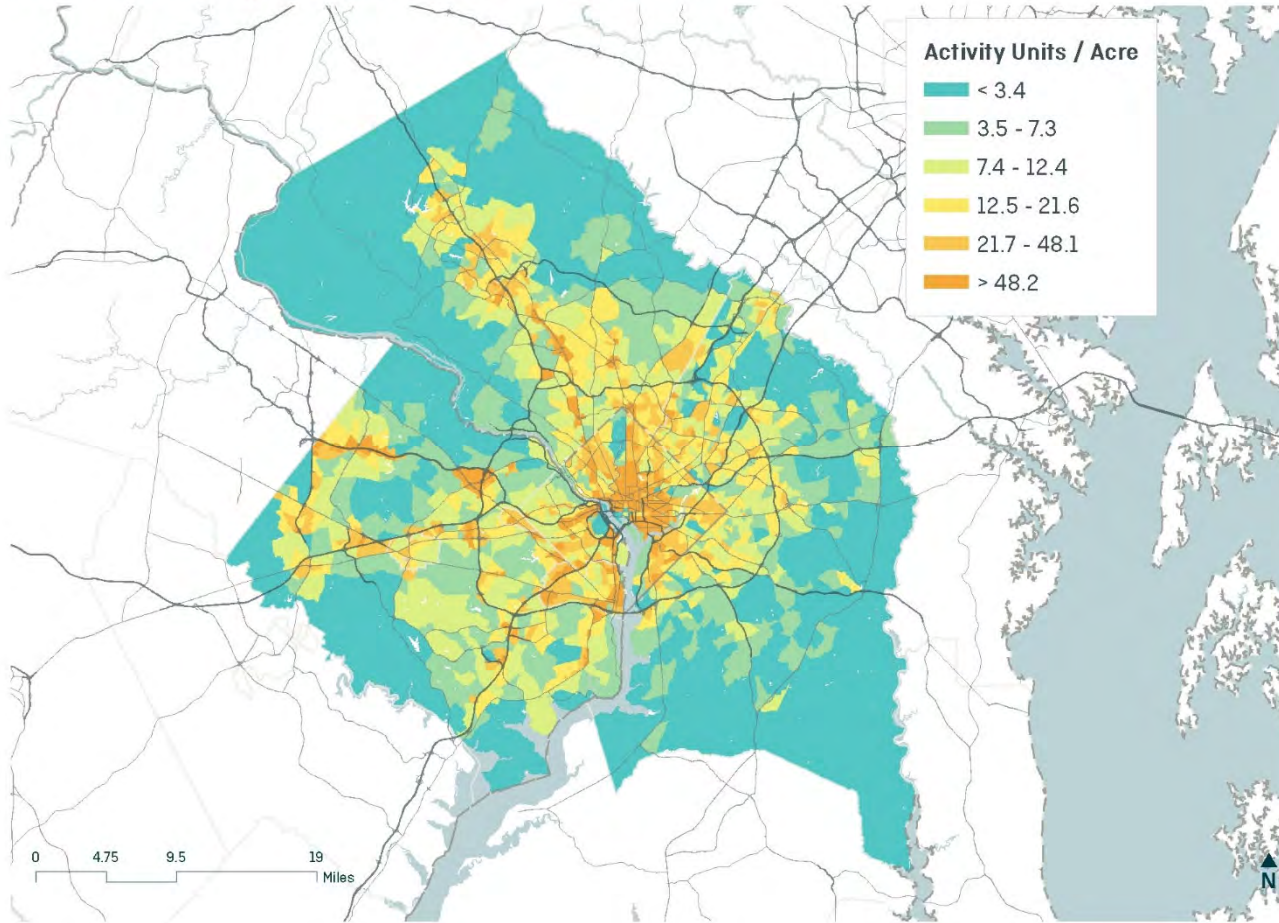




Figure 68 | MWCOG Population Density Growth, 2017-2045

### MARYLAND I-495/I-270 | MWCOG 2017-2045 POPULATION DENSITY GROWTH

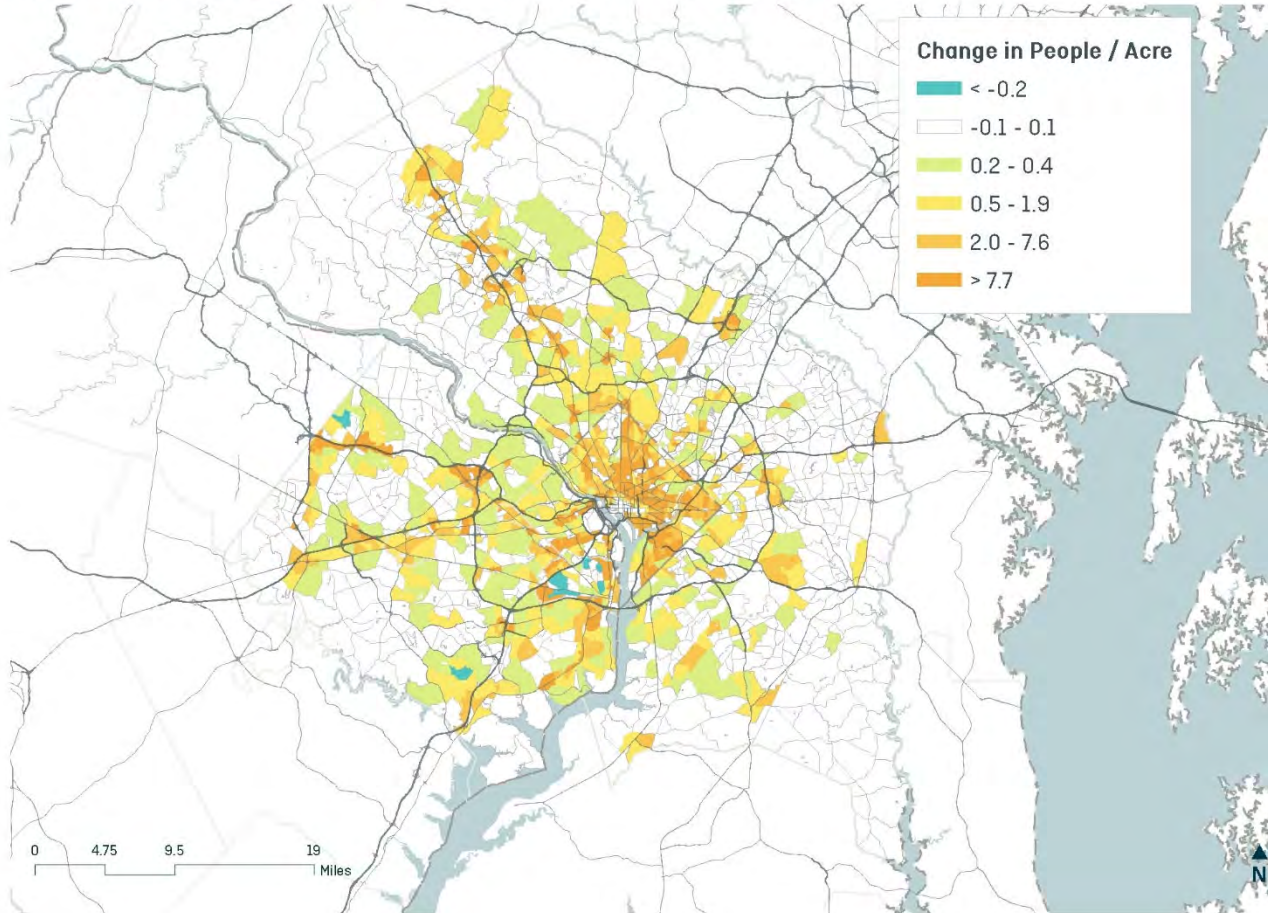


Figure 69 | Renaissance Population Density Growth, 2017-2045

### MARYLAND I-495/I-270 | 2017-2045 POPULATION DENSITY GROWTH

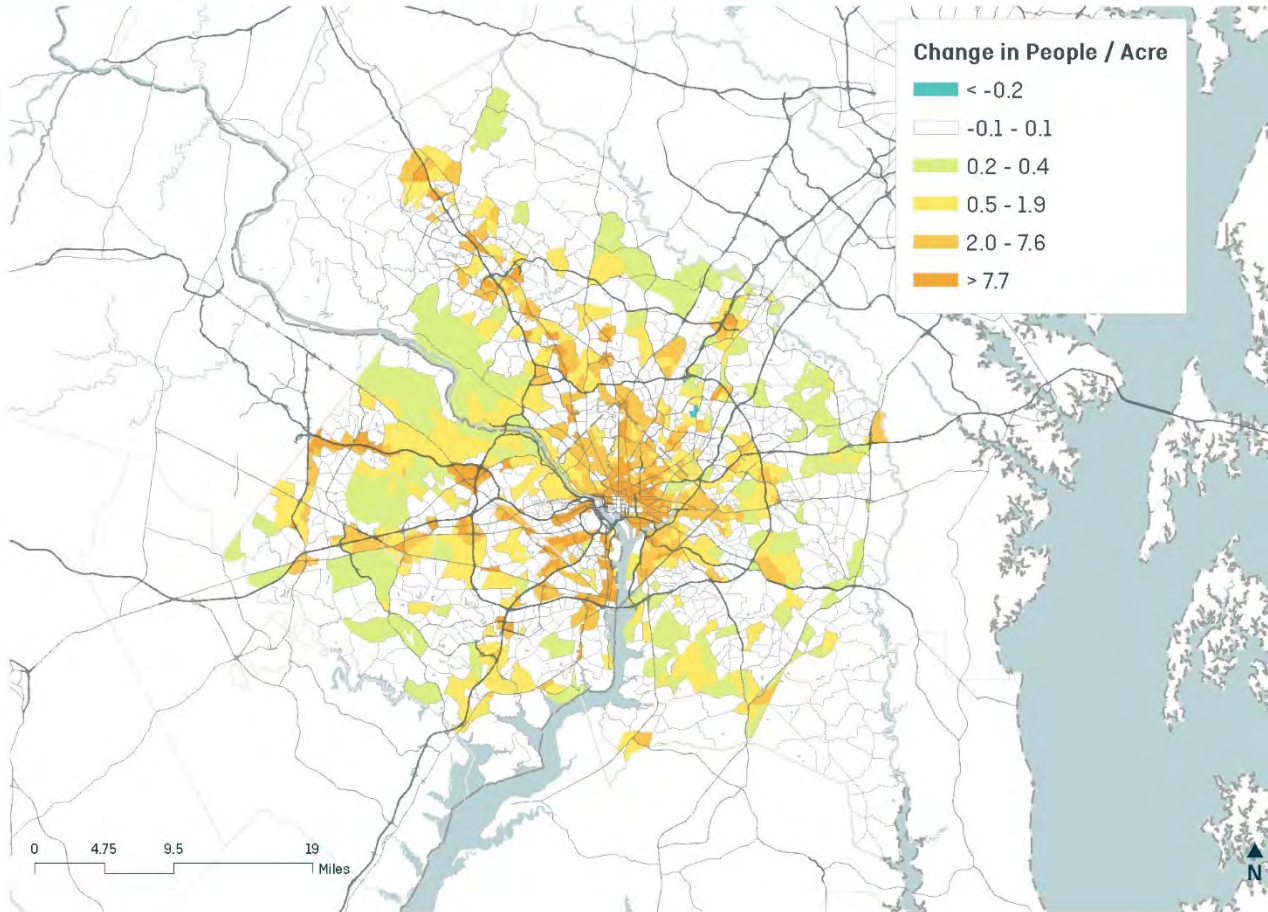


Figure 70 | MWCOC Employment Density Growth, 2017-2045

### MARYLAND I-495/I-270 | MWCOC 2017-2045 EMPLOYMENT DENSITY GROWTH

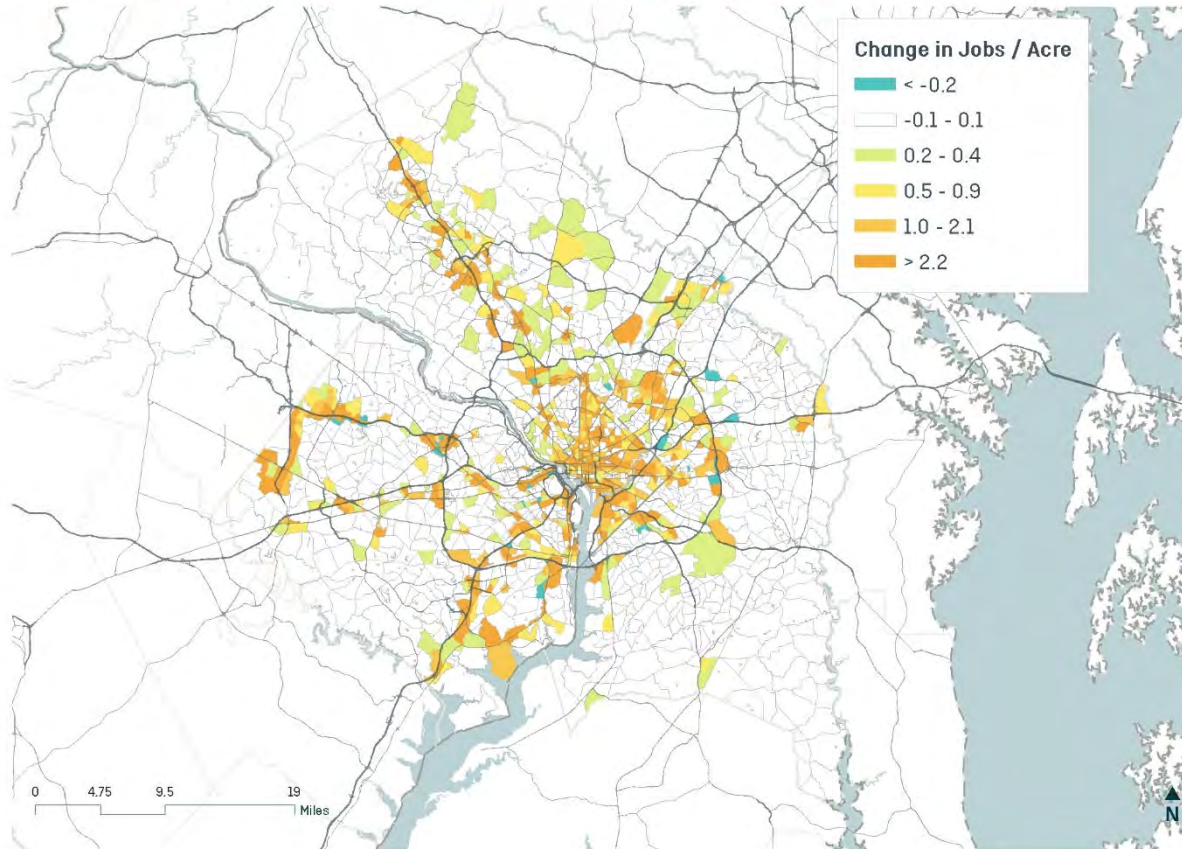




Figure 71 | Renaissance Employment Density Growth, 2017-2045

### MARYLAND I-495/I-270 | 2017-2045 EMPLOYMENT DENSITY GROWTH

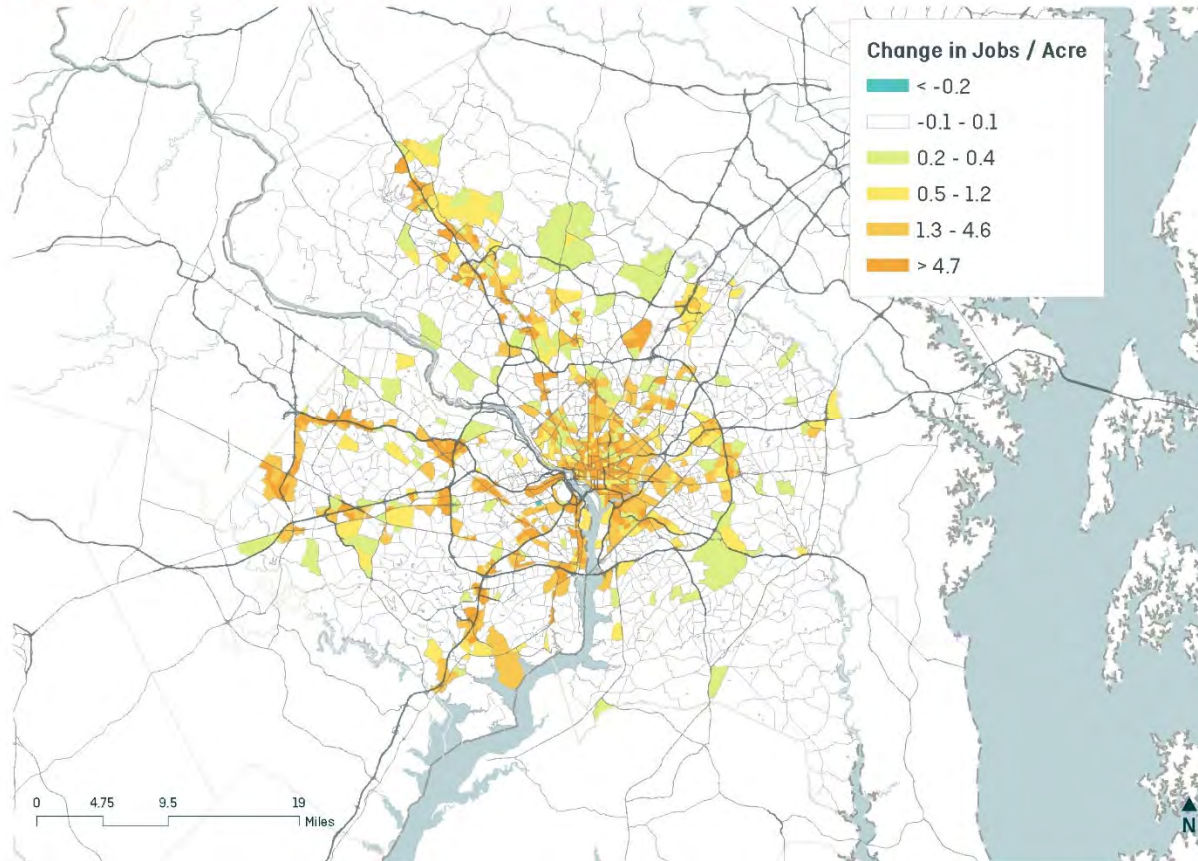


Figure 72 | MWCOC Activity Unit Density Growth, 2017-2045

### MARYLAND I-495/I-270 | MWCOC 2017-2045 ACTIVITY UNIT DENSITY GROWTH

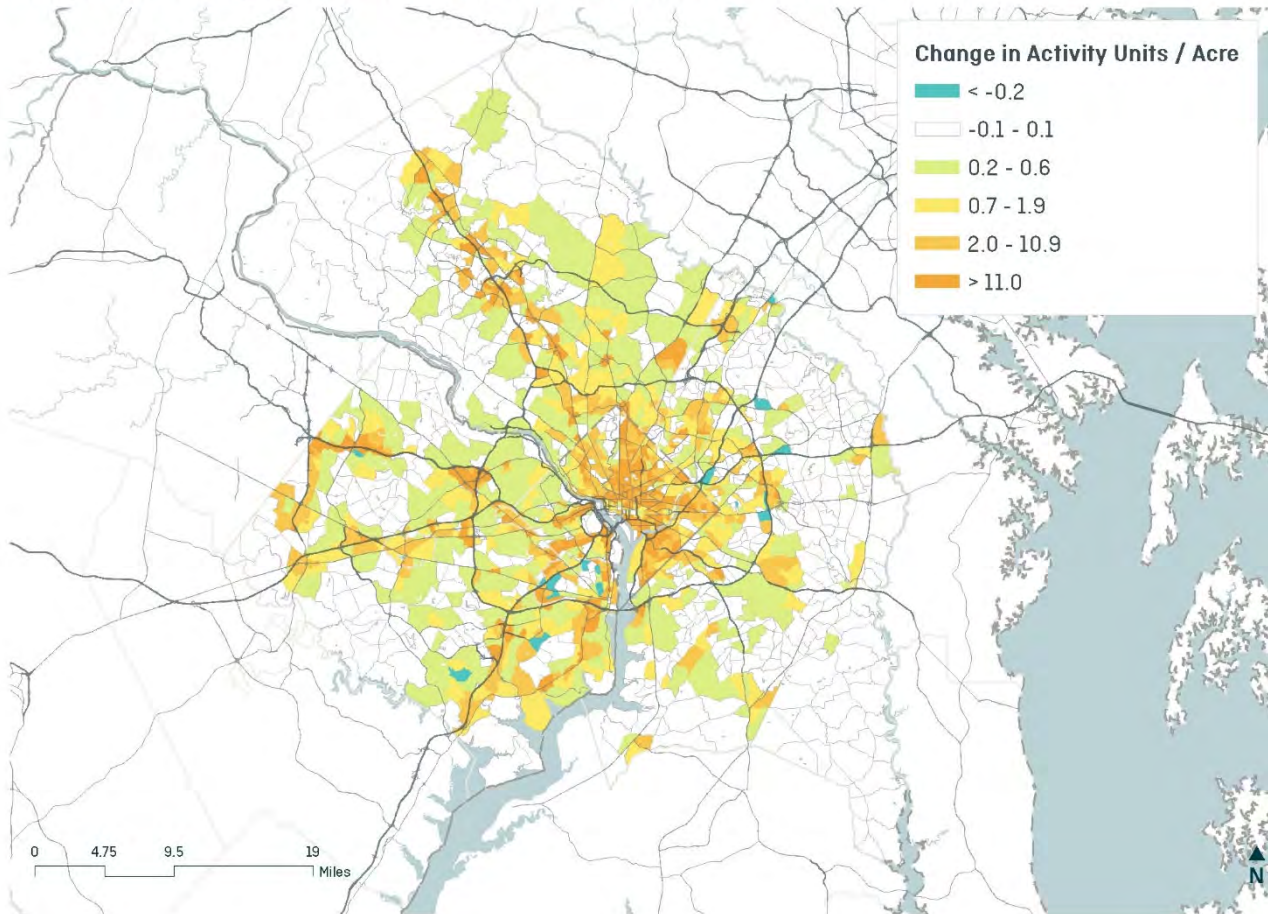


Figure 73 | Renaissance Activity Unit Density Growth, 2017-2045

### MARYLAND I-495/I-270 | 2017-2045 ACTIVITY UNIT DENSITY GROWTH

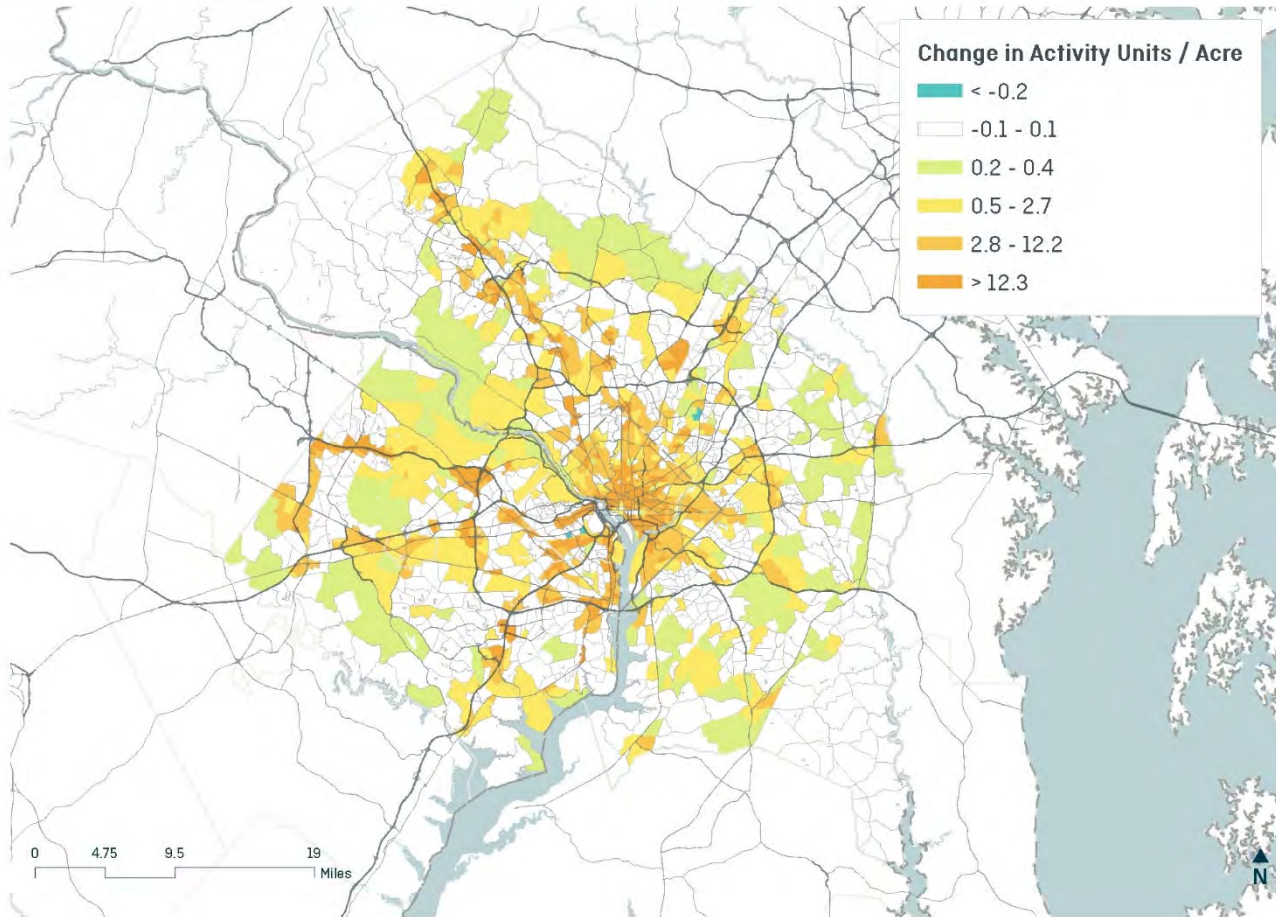




Figure 74 | MWCOG Population Growth, 2017-2045

### MARYLAND I-495/I-270 | MWCOG 2017-2045 POPULATION CHANGE

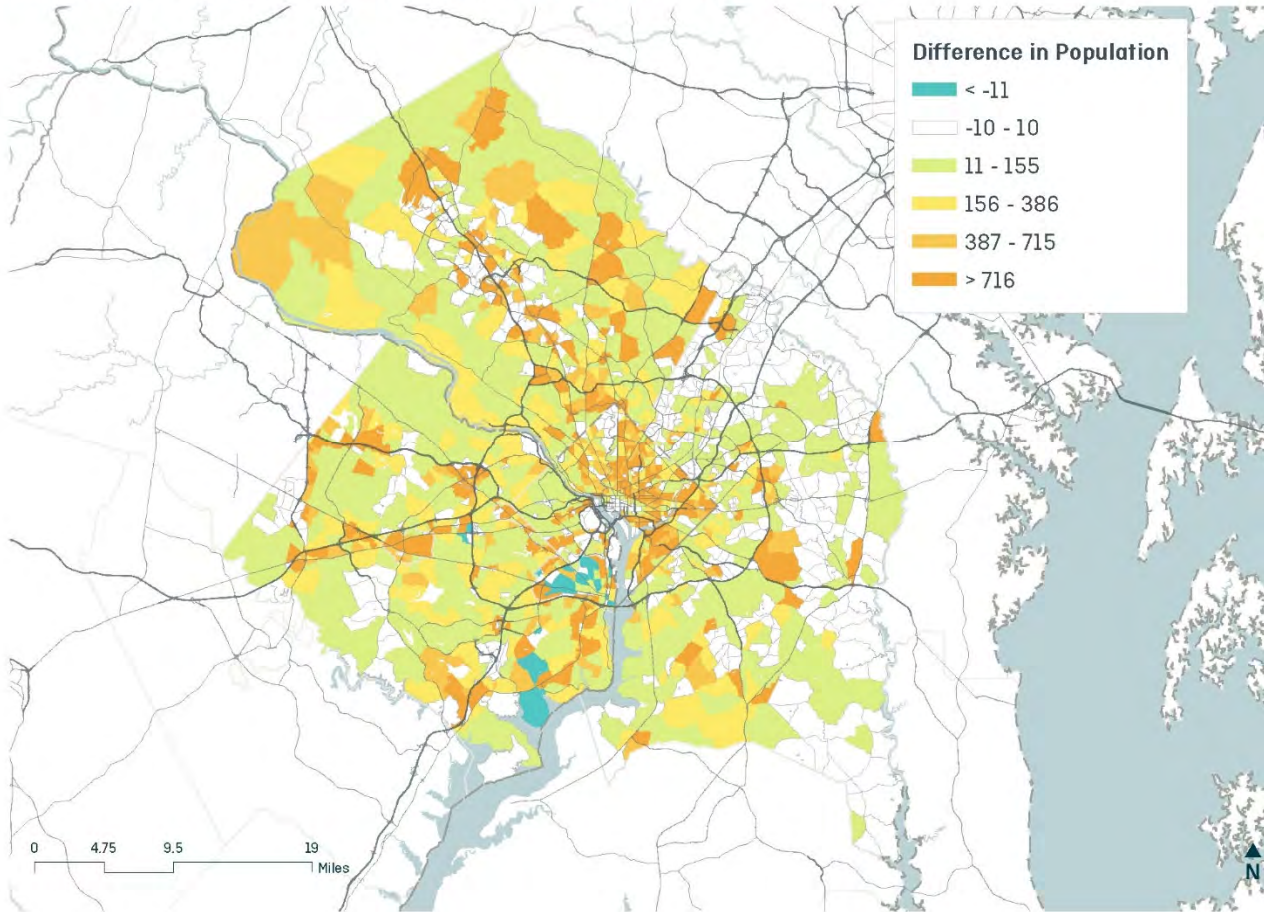


Figure 75 | MWCOG Employment Growth, 2017-2045

### MARYLAND I-495/I-270 | MWCOG 2017-2045 EMPLOYMENT CHANGE

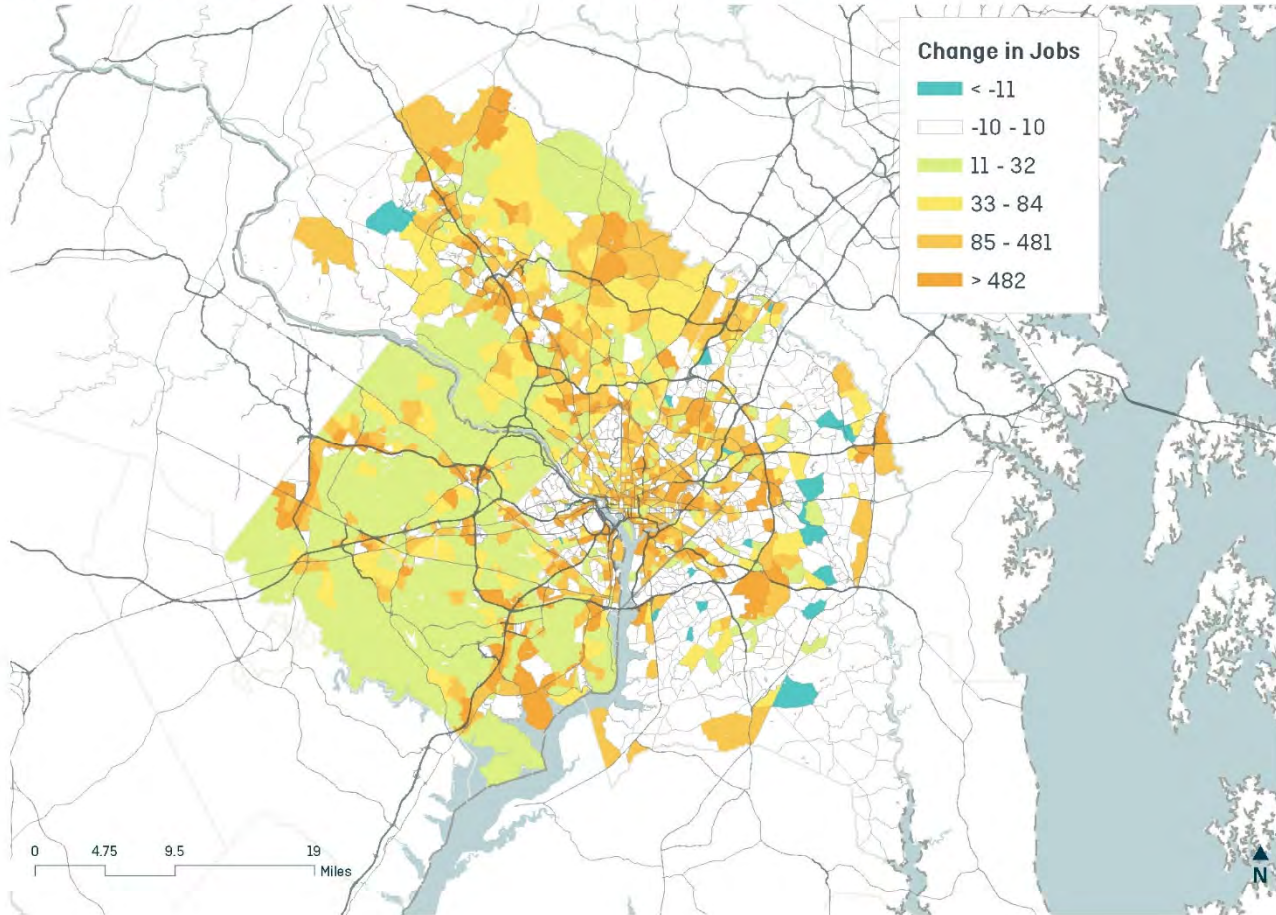




Figure 76 | Renaissance Population Growth, 2017-2045

### MARYLAND I-495/I-270 | 2017-2045 POPULATION CHANGE

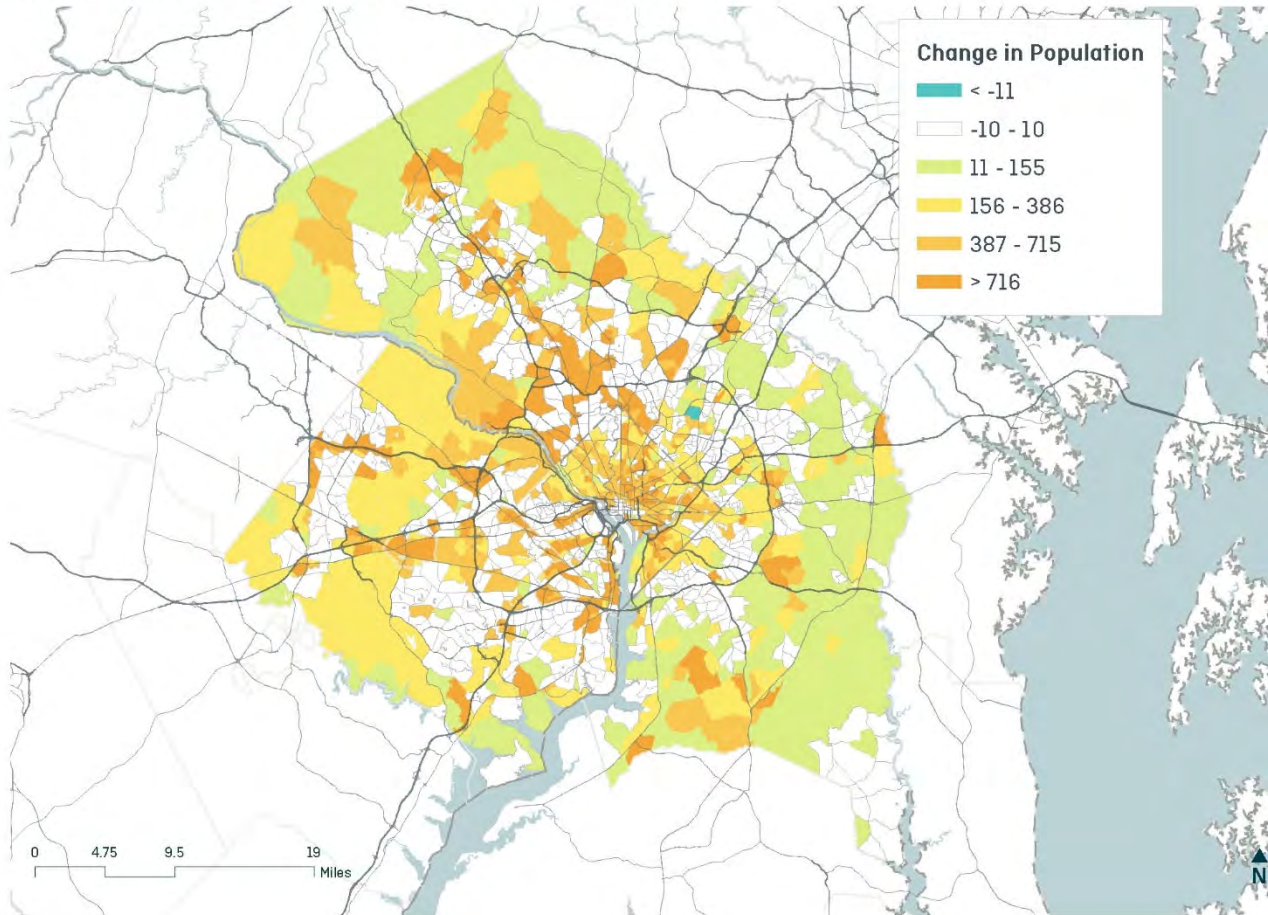


Figure 77 | Renaissance Employment Growth, 2017-2045

### MARYLAND I-495/I-270 | 2017-2045 EMPLOYMENT CHANGE

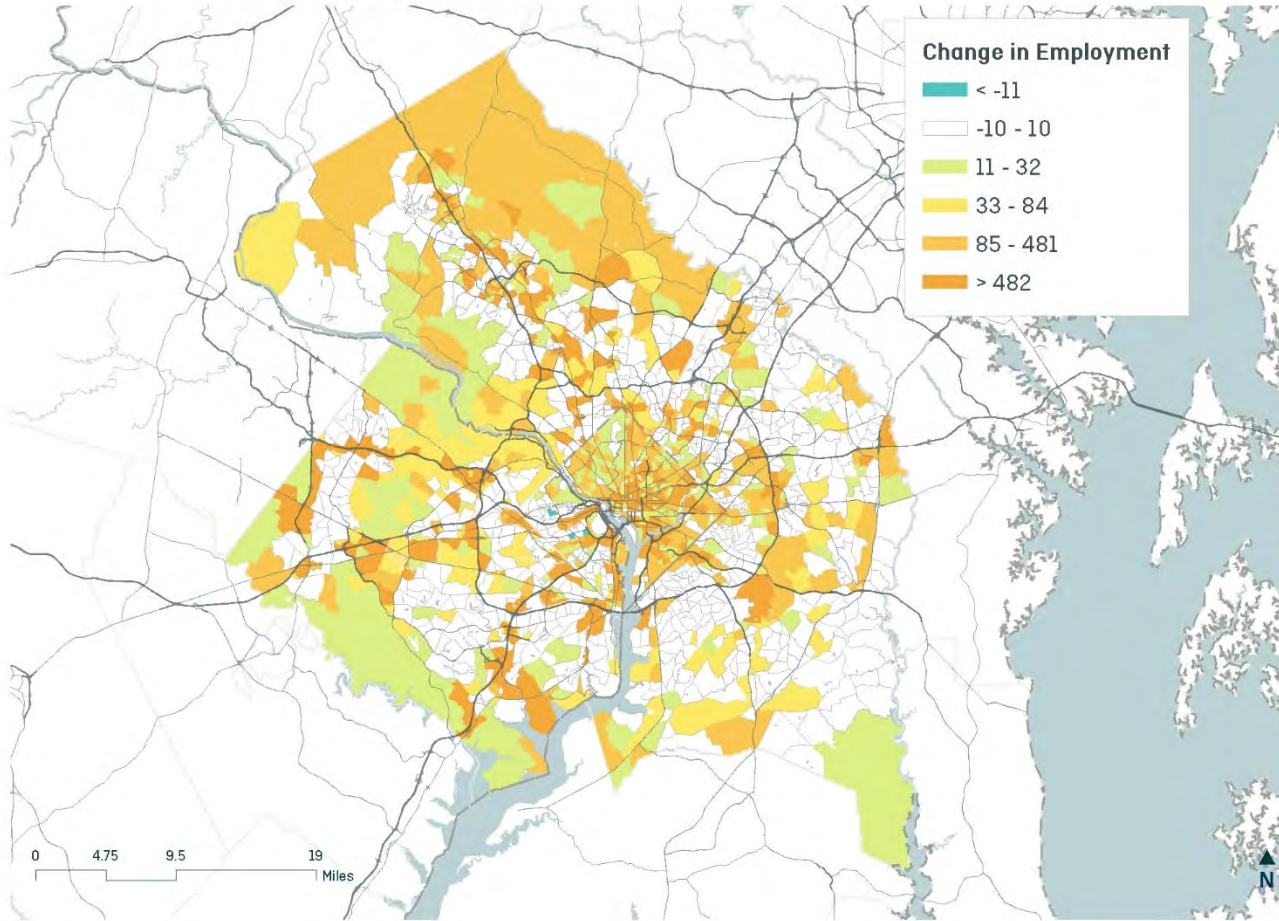




Figure 78 | Difference between Renaissance and MWCOG Population, 2017

### MARYLAND I-495/I-270 | 2017 POPULATION DIFFERENCE FROM MWCOG

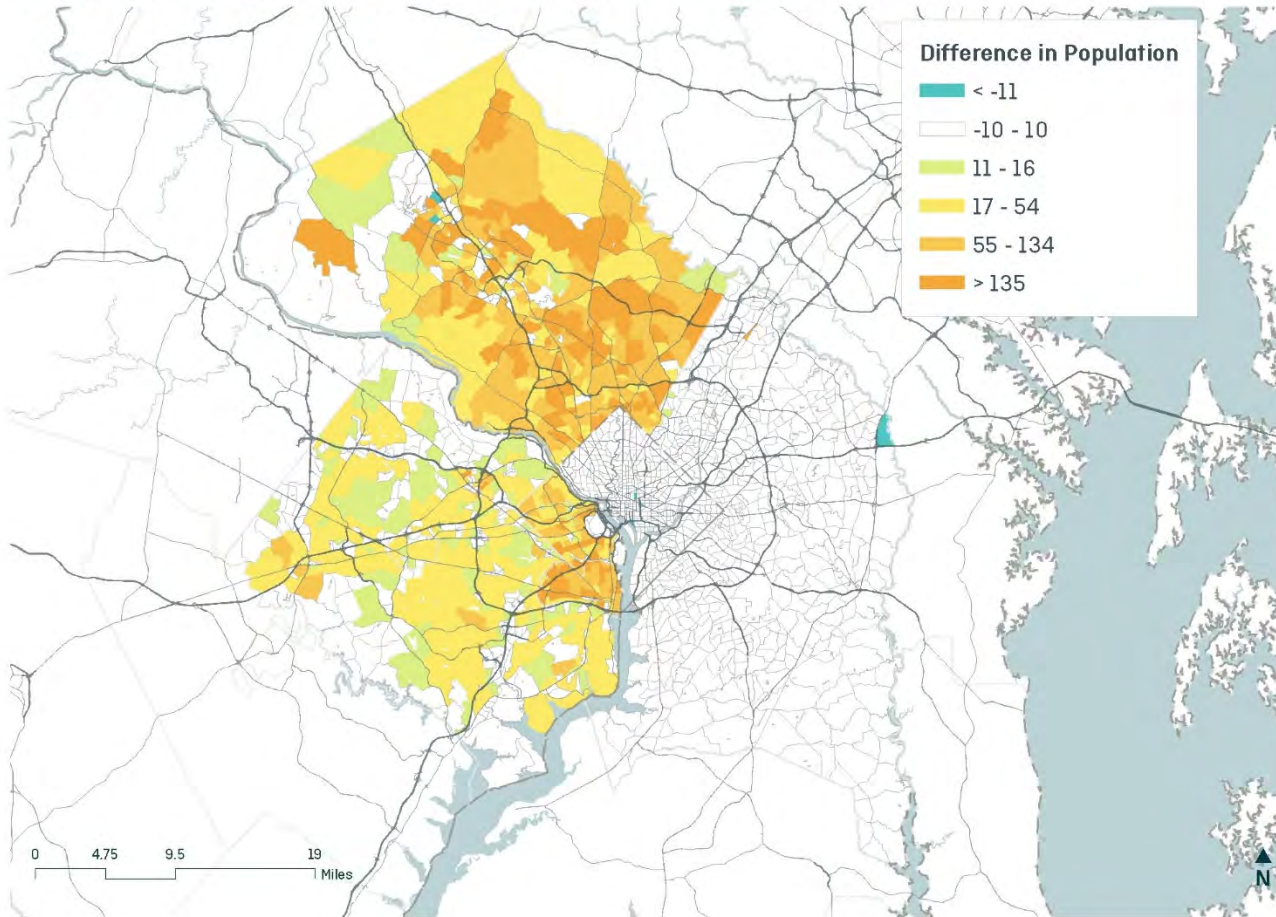


Figure 79 | Difference between Renaissance and MWCOG Employment, 2017

### MARYLAND I-495/I-270 | 2017 EMPLOYMENT DIFFERENCE FROM MWCOG

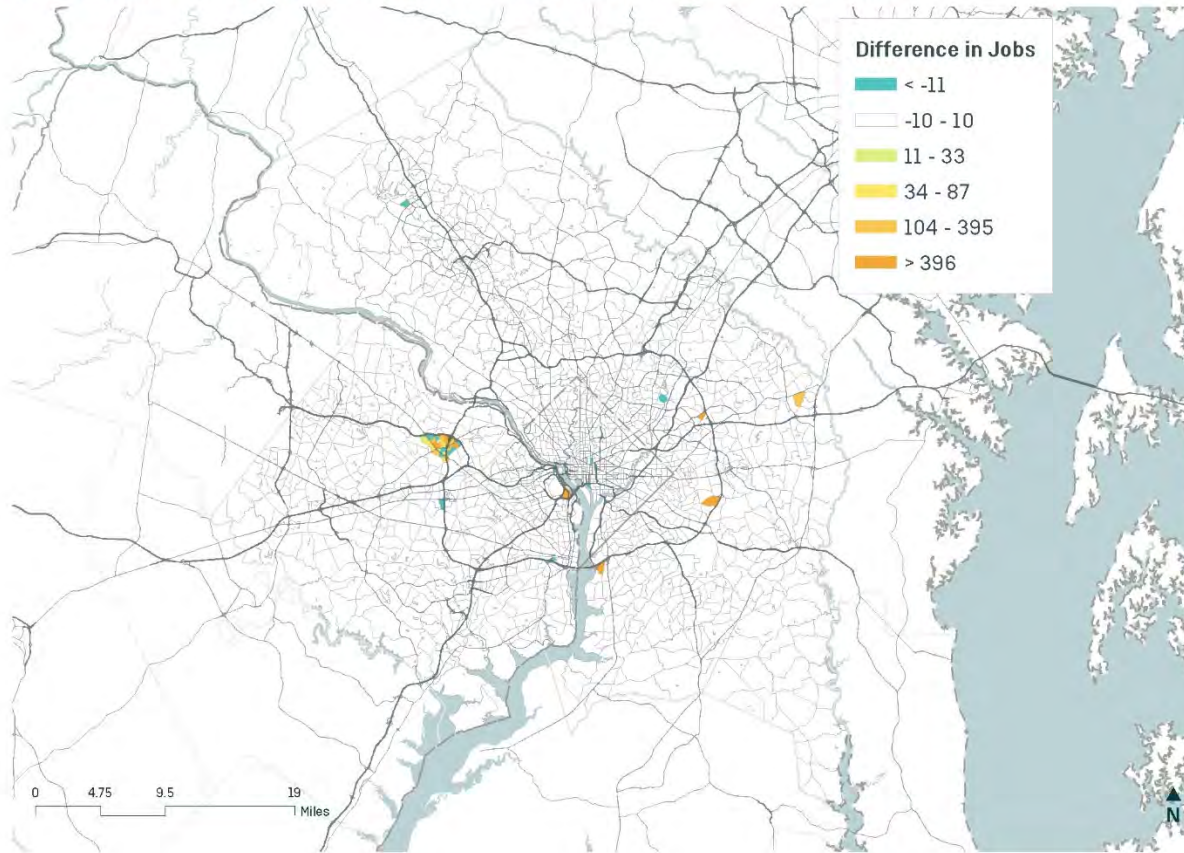


Figure 80 | Difference between Renaissance and MWCOG Population, 2025

**MARYLAND I-495/I-270 | 2025 POPULATION DIFFERENCE FROM MWCOG**

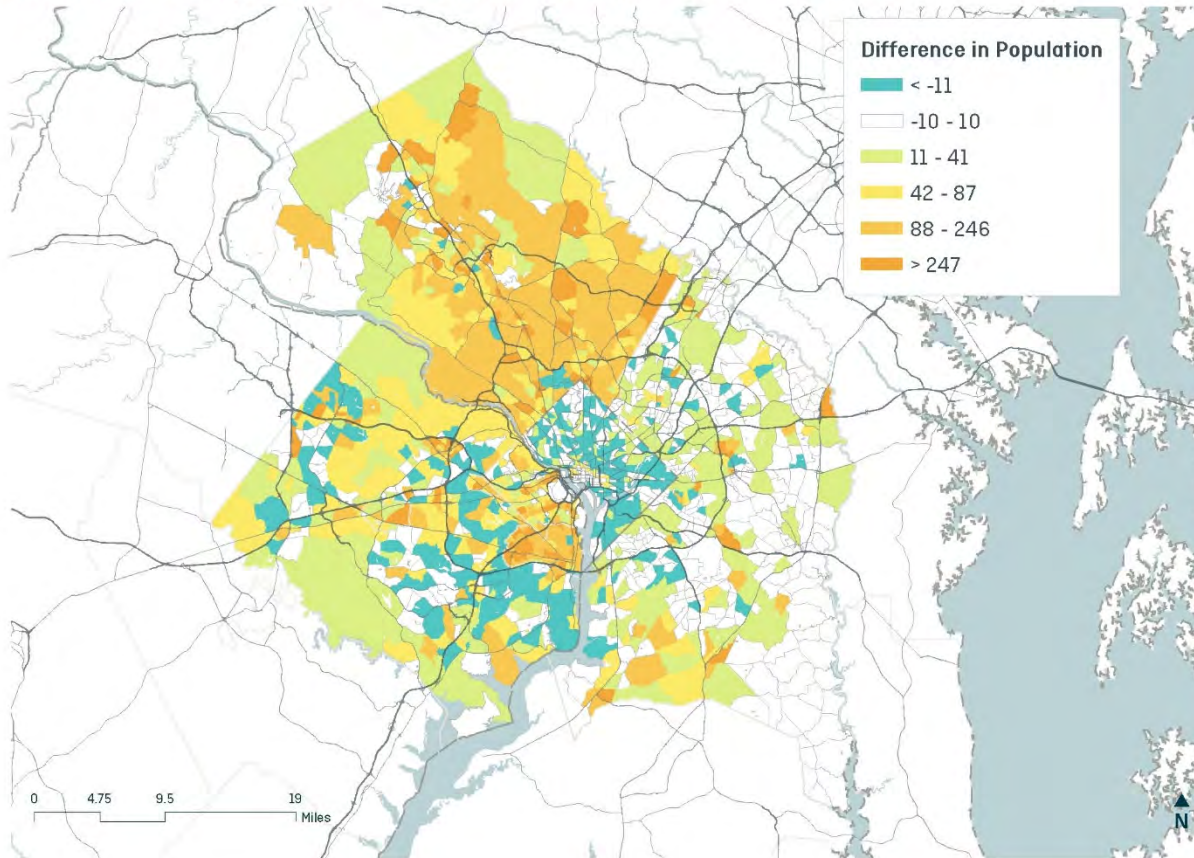




Figure 81 | Difference between Renaissance and MWCOG Employment, 2025

### MARYLAND I-495/I-270 | 2025 EMPLOYMENT DIFFERENCE FROM MWCOG

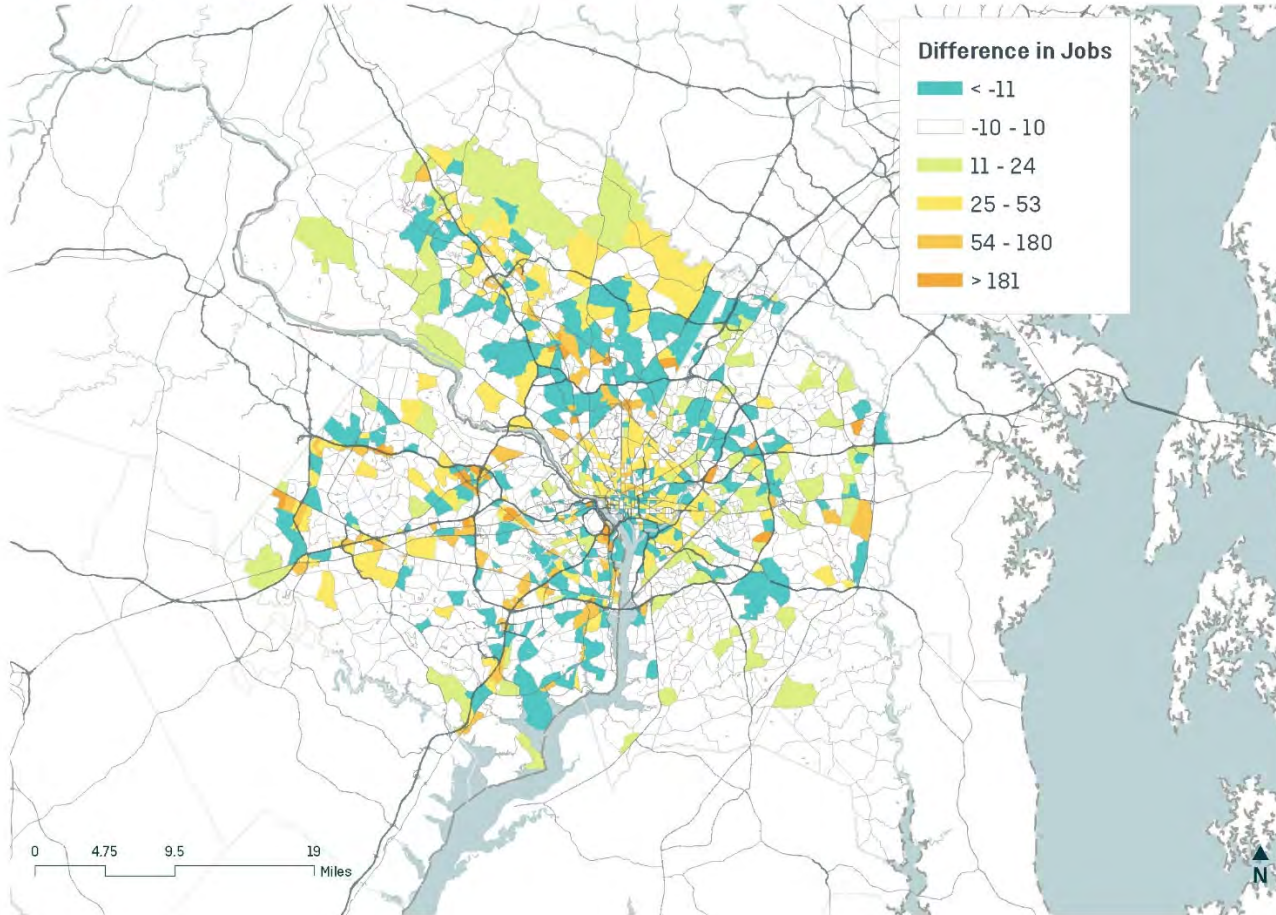


Figure 82 | Difference between Renaissance and MWCOG Population, 2035

### MARYLAND I-495/I-270 | 2035 POPULATION DIFFERENCE FROM MWCOG

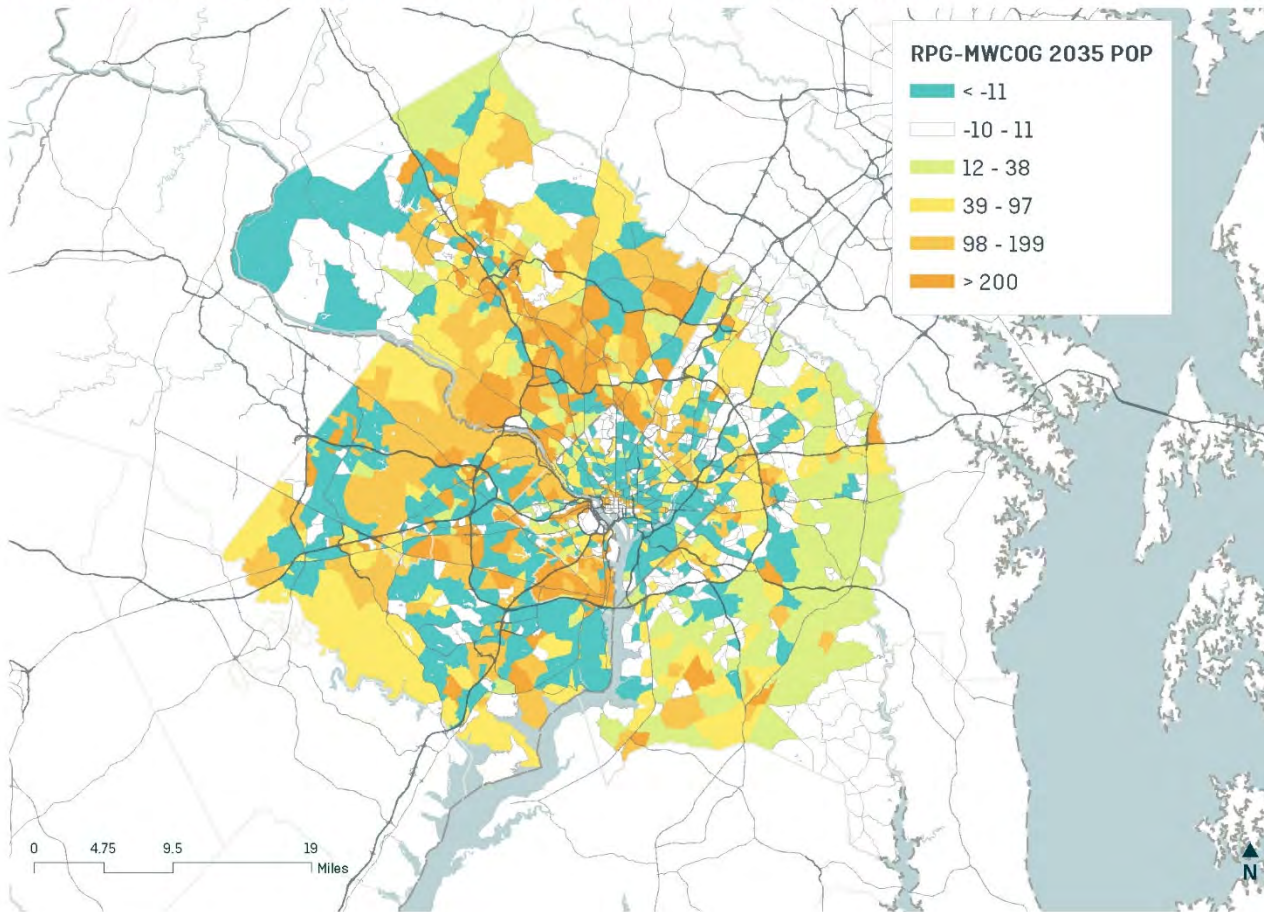




Figure 83 | Difference between Renaissance and MWCOG Employment, 2035

### MARYLAND I-495/I-270 | 2035 EMPLOYMENT DIFFERENCE FROM MWCOG

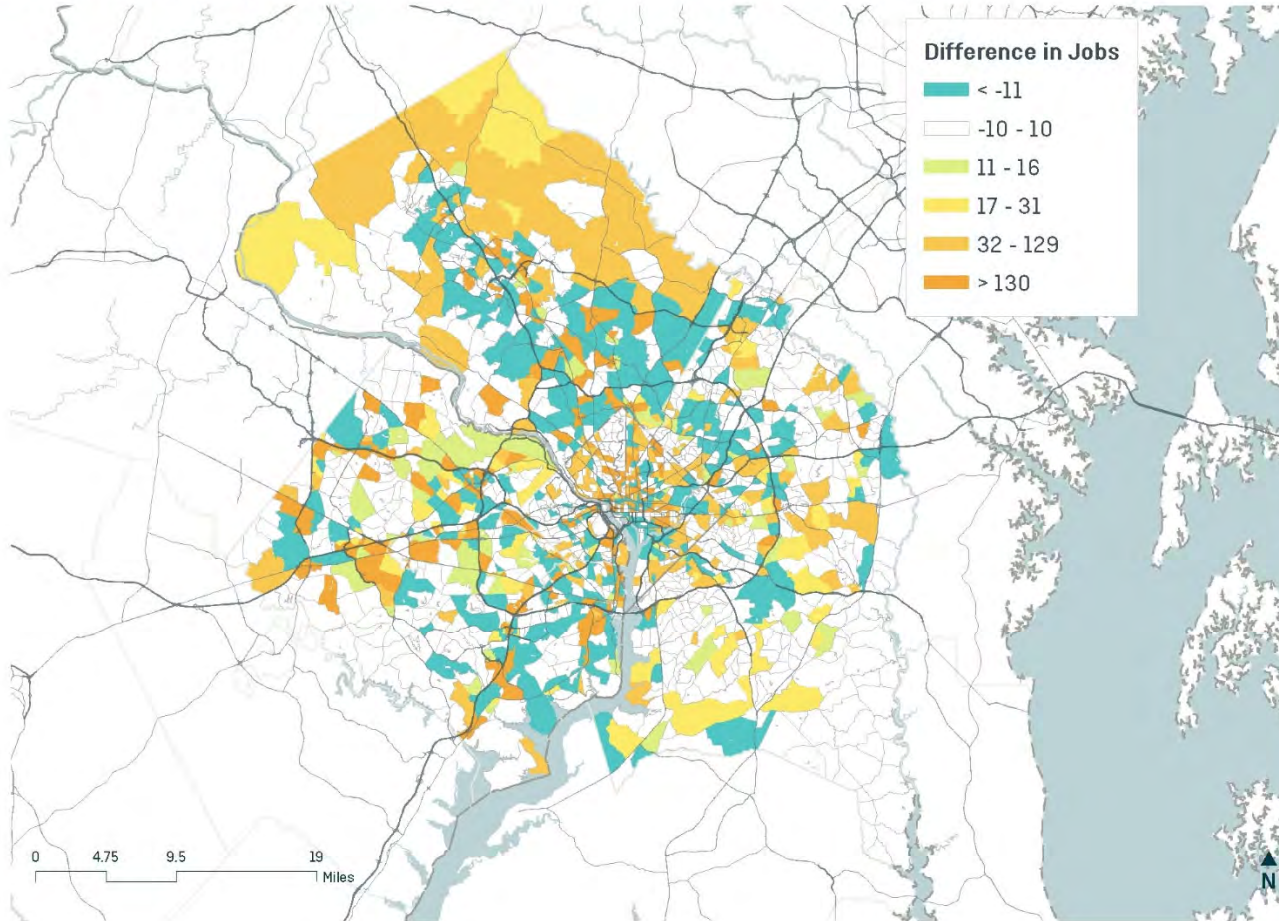


Figure 84 | Difference between Renaissance and MWCOG Population, 2045

### MARYLAND I-495/I-270 | 2045 POPULATION DIFFERENCE FROM MWCOG

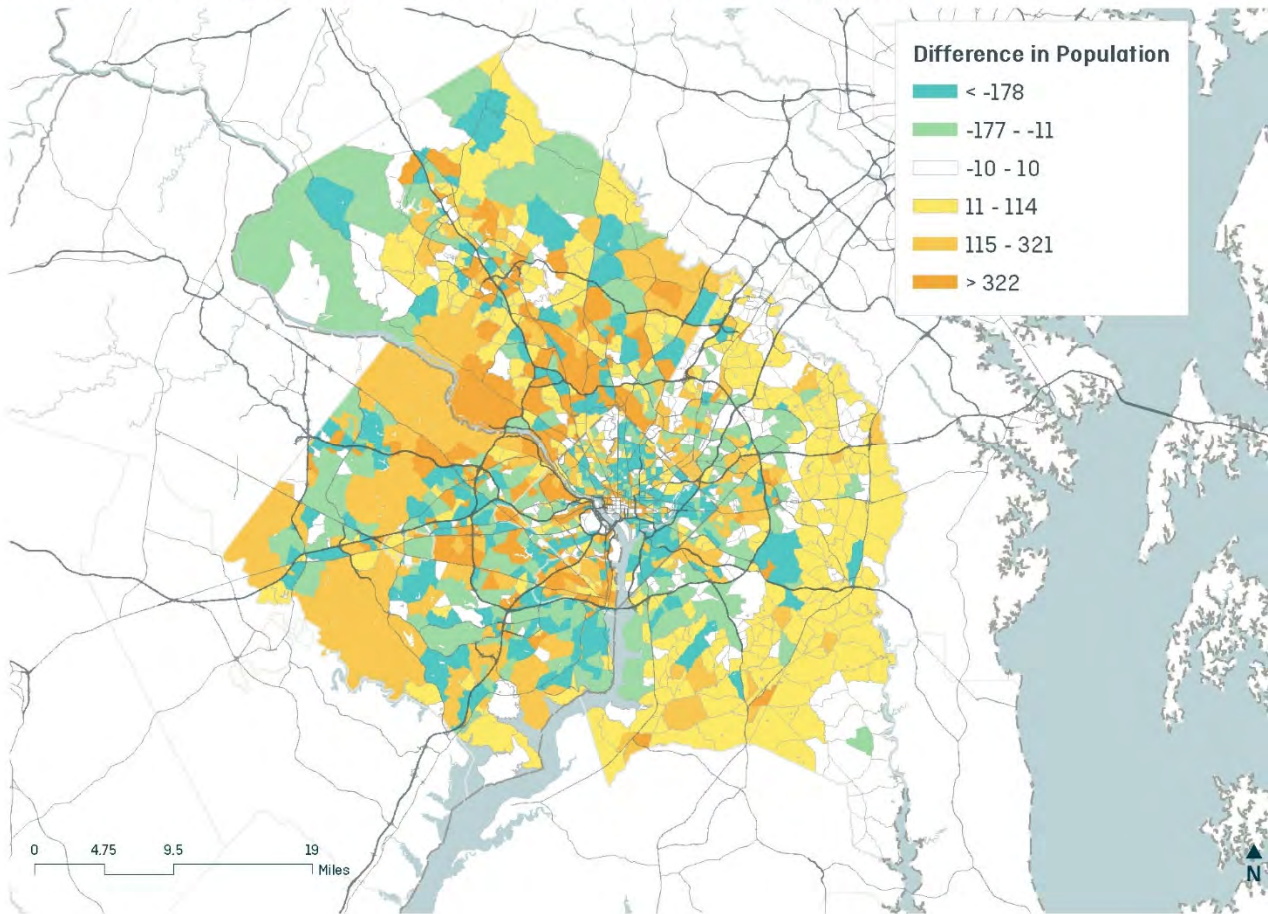
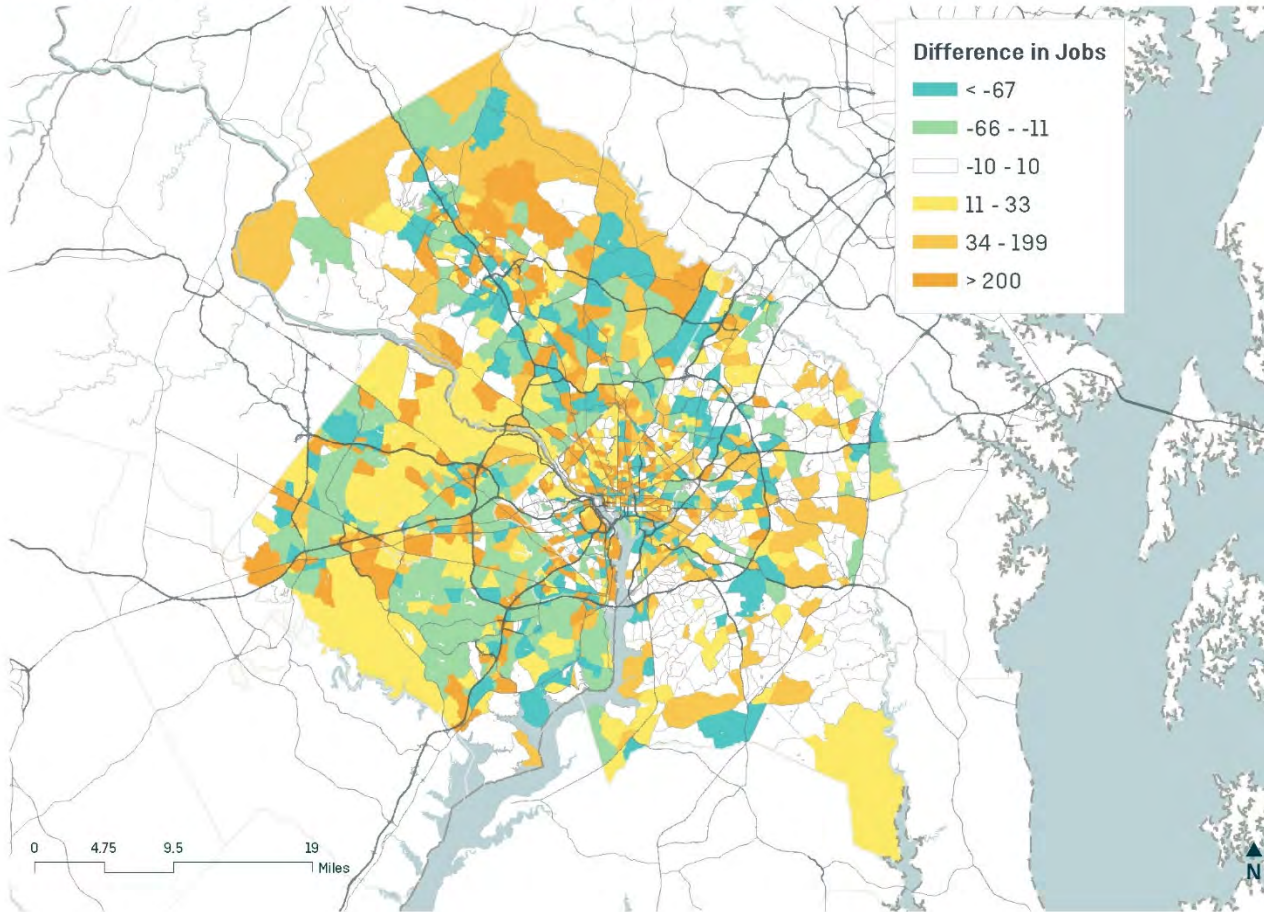




Figure 85 | Difference between Renaissance and MWCOG Employment, 2045

### MARYLAND I-495/I-270 | 2045 EMPLOYMENT DIFFERENCE FROM MWCOG





## SCENARIO SENSITIVITY TESTING

We developed two alternative growth scenarios that pivot from the baseline forecasts, one low scenario and one high scenario.

### Low Scenario

The low growth scenario development process began with an evaluation of historical regional recessions in 1980-83, 1990-91, and 2007-09, and identified three key findings:

1. Recessions generally resulted in employment declines from trend growth for a few years about once every 10-20 years and are followed by a rebound period. We have examined the variability in AAGR rates for rolling five-year growth periods on an annual basis and assumed recessions that have five-year cycles to be synchronized with the five-year periods in the baseline forecasts from 2020 through 2045.
2. Population losses have historically been less pronounced than employment losses and occurred more in the subsequent five-year period. In other words, population loss followed after employment loss.
3. Historical industrial and retail employment losses appear slightly more susceptible to loss in recession periods than office employment losses, although the differences are so slight as to be within the noise of the model, as demonstrated visually by the proportion of jobs in each of the four job categories shown previously in Figure 4.

With these findings in mind, and recognizing the increased reliance on office uses forecasted in the baseline condition, a low growth scenario was developed that fits within the bounds of historical patterns, but uses the following assumptions:

- Future recessions will occur in the 2020-2025 and 2040-2045 timeframes, with a single rebound occurring in 2025-2030. Other years are forecast to have the same net growth as baseline forecasts.
- The recessions will affect office jobs and non-office jobs equally.
- Population dips will see a slight latency relative to employment, so that the 2020-2025 recession affects population to a minor degree in 2020-2025 and to a larger degree in 2025-2030.
- Population impacts are felt more heavily in exurban regions where there is more homogeneity in housing options, and in the core where previous recessions have led to larger population impacts.

The charts below show baseline, and low scenario growth for primary market area population and employment, respectively. The tables that follow show low forecast jurisdictional totals in each interval year for population and employment, respectively, as well as the difference between the low scenario and the baseline scenario. Lastly, the figures below show the difference between the baseline and the low scenario for 2045 for population and employment.

Figure 86 | Baseline and Low Forecast Comparison - Population, 2017-2045

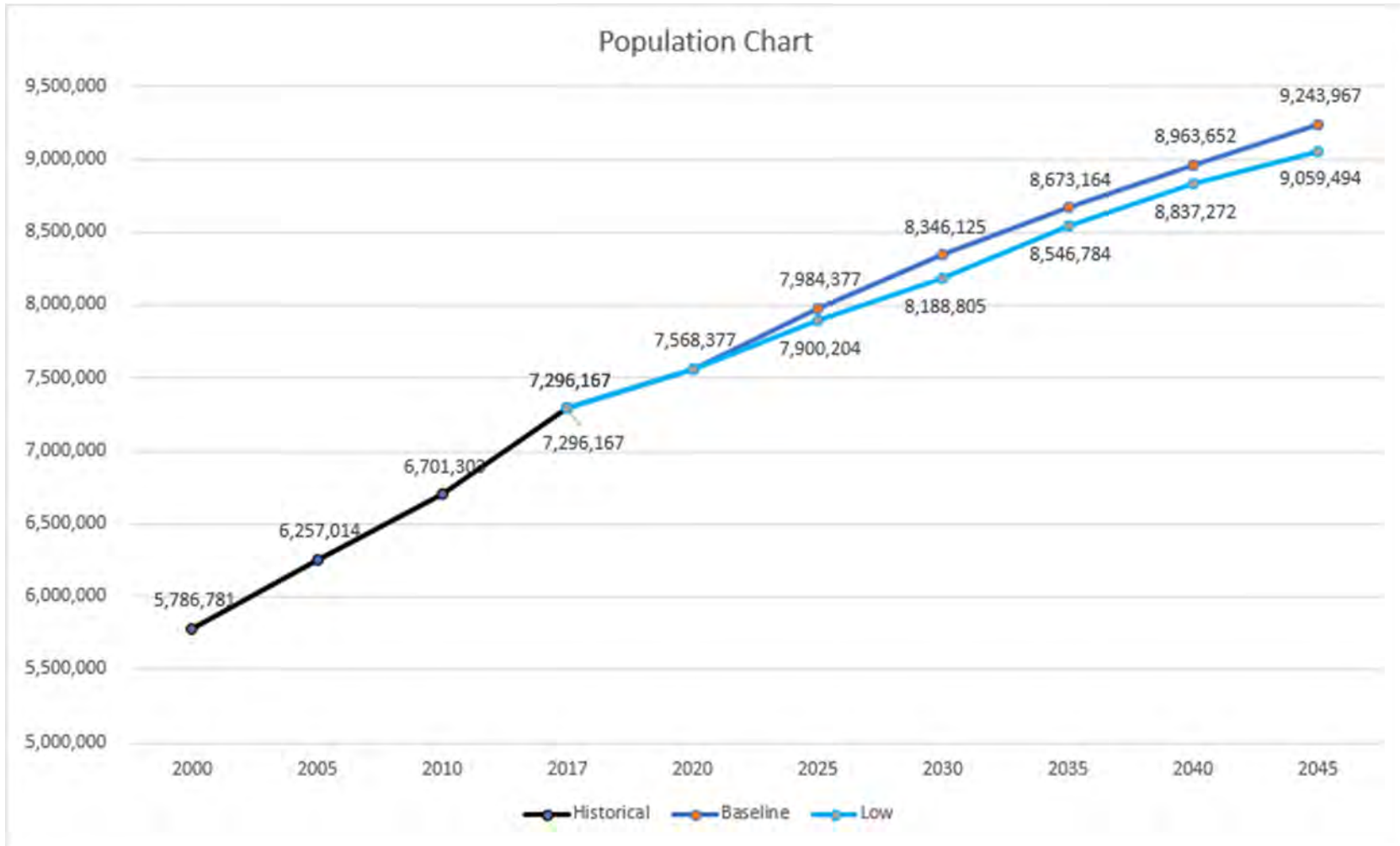


Figure 87 | Baseline and Low Forecast Comparison - Employment, 2017-2045

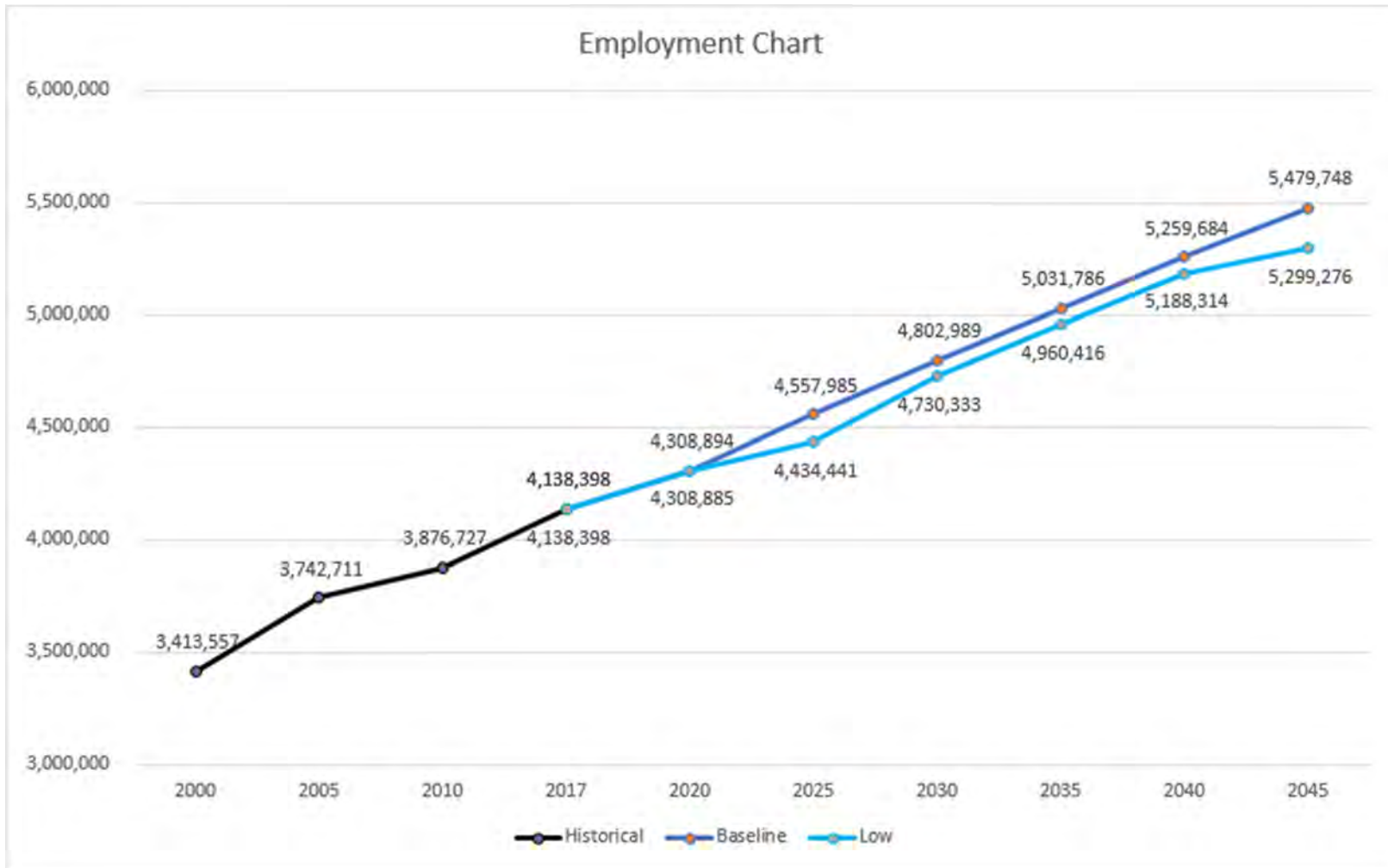


Table 16 | Low Scenario Forecast of Population and Employment by Jurisdiction, 2017-2045

Renaissance (Low Version)																	
	POPULATION							JOBS									
	Jurisdiction	2017	2020	2025	2030	2035	2040	2045 AAGR	2017	2020	2025	2030	2035	2040	2045 AAGR		
Core	City of Alexandria	160,037	167,517	175,950	182,550	191,670	200,508	209,382	1.1%	106,812	111,440	115,719	124,456	131,982	139,476	143,722	1.2%
	Arlington County	234,967	245,523	256,178	266,621	280,015	291,911	301,408	1.0%	214,180	221,542	226,203	240,873	251,462	262,727	267,810	0.9%
	District of Columbia	693,977	718,172	751,035	780,904	818,641	848,760	871,837	0.9%	815,714	841,156	861,341	905,576	939,794	969,920	984,549	0.7%
First Tier	Fairfax County	1,187,109	1,220,562	1,264,568	1,306,738	1,357,465	1,397,006	1,428,514	0.7%	713,901	745,645	771,419	833,046	879,075	923,121	944,917	1.1%
	Montgomery County	1,058,813	1,088,910	1,125,012	1,161,063	1,205,705	1,237,374	1,262,349	0.7%	529,424	548,669	563,011	596,403	621,057	644,864	656,613	0.8%
	Prince George's County	913,117	927,728	943,903	957,523	973,505	984,991	992,487	0.3%	346,156	354,671	359,683	369,840	377,205	384,822	388,508	0.4%
Second Tier	Anne Arundel County	573,243	586,808	602,136	615,698	632,347	645,829	655,954	0.5%	328,887	340,412	347,763	365,298	379,365	394,947	401,565	0.8%
	Frederick County	252,022	264,501	279,211	291,826	308,827	323,627	335,240	1.1%	113,963	118,752	121,952	129,127	135,157	141,113	143,785	0.9%
	Howard County	321,111	334,817	350,394	363,143	378,366	390,351	399,510	0.8%	178,099	187,128	193,323	208,267	219,785	231,452	237,155	1.1%
	Loudoun County	398,090	433,767	477,995	510,393	548,527	576,082	595,953	1.7%	178,355	194,243	206,850	238,497	263,607	287,794	300,511	2.4%
Third Tier	Prince William County	521,087	546,883	585,325	615,641	652,489	681,093	703,008	1.2%	182,612	194,370	203,216	224,926	242,543	259,688	268,413	1.6%
	Calvert County	91,500	94,346	97,646	100,154	103,057	105,648	107,513	0.6%	35,118	36,688	37,545	39,110	40,224	41,533	42,112	0.7%
	Carroll County	167,783	171,530	175,668	179,313	183,696	188,046	191,151	0.5%	69,090	71,452	72,721	75,450	77,613	79,934	80,970	0.6%
	Charles County	159,701	168,672	177,655	185,896	196,046	205,367	213,023	1.2%	46,756	48,506	49,658	52,489	54,808	57,478	58,633	0.9%
	City of Fredericksburg	28,360	29,939	31,558	32,867	34,927	36,982	38,453	1.2%	37,182	39,401	40,854	44,366	47,164	50,312	51,737	1.3%
	Stafford County	146,781	158,271	171,573	183,488	199,515	215,737	227,665	1.9%	54,983	58,743	61,334	68,078	73,717	80,220	83,210	1.8%
	Spotsylvania County	109,149	116,898	125,493	132,986	140,583	147,865	153,013	1.4%	46,740	49,374	51,075	55,328	59,386	63,924	65,965	1.4%
	Clarke County	14,508	14,783	15,123	15,451	15,820	16,190	16,429	0.5%	5,701	5,883	6,026	6,371	6,648	6,972	7,102	0.8%
	Fauquier County	69,465	72,811	76,547	79,927	84,423	89,210	92,539	1.1%	30,323	31,692	32,530	34,629	36,291	38,266	39,096	1.0%
	Exurb	Jefferson County	56,337	58,557	61,308	63,672	66,835	70,098	72,361	1.0%	22,282	23,271	23,900	25,396	26,649	28,103	28,728
King George County		26,341	28,542	30,647	32,567	35,131	37,835	39,667	1.7%	18,431	19,517	20,201	21,892	23,325	25,055	25,820	1.4%
St. Mary's County		112,669	118,840	125,272	130,334	139,141	146,709	151,964	1.2%	63,689	66,339	67,820	70,628	73,120	76,154	77,455	0.7%
TOTAL	7,296,167	7,568,377	7,900,195	8,188,753	8,546,730	8,837,218	9,059,422	0.8%	4,138,398	4,308,894	4,434,145	4,730,045	4,959,977	5,187,875	5,298,377	1.0%	

	POPULATION							JOBS									
	Subtotals by Tiers	2017	2020	2025	2030	2035	2040	2045 AAGR	2017	2020	2025	2030	2035	2040	2045 AAGR		
PMA	Core	1,088,981	1,131,212	1,183,163	1,230,074	1,290,326	1,341,179	1,382,627	0.9%	1,136,706	1,174,138	1,203,262	1,270,904	1,323,237	1,372,122	1,396,081	0.8%
	First Tier	3,159,039	3,237,200	3,333,482	3,425,323	3,536,674	3,619,370	3,683,350	0.6%	1,589,481	1,648,985	1,694,114	1,799,288	1,877,336	1,952,806	1,990,038	0.9%
Non-PMA	Second Tier	2,065,553	2,166,776	2,295,060	2,396,701	2,520,556	2,616,982	2,689,665	1.0%	981,916	1,034,905	1,073,105	1,166,114	1,240,457	1,314,994	1,351,430	1.3%
	Third Tier	703,274	739,656	779,593	814,704	857,824	899,645	930,818	1.1%	289,869	304,164	313,187	334,821	352,912	373,401	382,626	1.1%
	Exurb	279,320	293,533	308,897	321,950	341,350	360,042	372,961	1.2%	140,426	146,702	150,477	158,917	166,034	174,551	178,202	0.9%
Totals	SUBTOTAL - PMA	4,248,020	4,368,412	4,516,646	4,655,398	4,827,000	4,960,549	5,065,977	0.7%	2,726,187	2,823,123	2,897,375	3,070,193	3,200,574	3,324,929	3,386,119	0.8%
	SUBTOTAL- Non-PMA	3,048,147	3,199,965	3,383,550	3,533,355	3,719,730	3,876,669	3,993,445	1.1%	1,412,211	1,485,771	1,536,769	1,659,852	1,759,403	1,862,946	1,912,258	1.2%
	TOTAL	7,296,167	7,568,377	7,900,195	8,188,753	8,546,730	8,837,218	9,059,422	0.8%	4,138,398	4,308,894	4,434,145	4,730,045	4,959,977	5,187,875	5,298,377	1.0%



Table 17 | Difference between Low and Baseline Scenario Forecasts of Population and Employment by Jurisdiction, 2017-2045

Renaissance Low - Baseline															
Jurisdiction	POPULATION							JOBS							
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
City of Alexandria	-	-	(2,108)	(3,758)	(2,929)	(2,929)	(5,148)	-	-	(4,279)	(2,822)	(2,822)	(2,822)	(7,069)	
Arlington County	-	-	(2,664)	(5,274)	(4,057)	(4,057)	(6,431)	-	-	(4,661)	(2,216)	(2,216)	(2,216)	(7,299)	
District of Columbia	-	-	(8,216)	(15,683)	(12,252)	(12,252)	(18,022)	-	-	(20,185)	(12,812)	(12,812)	(12,812)	(27,440)	
Fairfax County	-	-	(8,382)	(16,414)	(9,607)	(9,607)	(15,608)	-	-	(23,320)	(10,603)	(8,411)	(8,411)	(28,131)	
Montgomery County	-	-	(6,876)	(13,743)	(7,752)	(7,752)	(12,510)	-	-	(12,977)	(6,086)	(4,912)	(4,912)	(15,543)	
Prince George's County	-	-	(4,562)	(8,404)	(7,323)	(7,323)	(9,438)	-	-	(5,269)	(3,793)	(3,982)	(3,982)	(7,857)	
Anne Arundel County	-	-	(4,323)	(8,148)	(7,023)	(7,023)	(9,879)	-	-	(7,728)	(5,180)	(5,541)	(5,541)	(12,499)	
Frederick County	-	-	(4,149)	(7,707)	(6,558)	(6,558)	(9,833)	-	-	(3,365)	(2,322)	(2,477)	(2,477)	(5,286)	
Howard County	-	-	(4,393)	(7,989)	(6,960)	(6,960)	(9,544)	-	-	(6,512)	(4,341)	(4,636)	(4,636)	(10,632)	
Loudoun County	-	-	(8,424)	(14,596)	(9,478)	(9,478)	(13,263)	-	-	(11,407)	(4,876)	(3,681)	(3,681)	(15,187)	
Prince William County	-	-	(7,322)	(13,097)	(8,152)	(8,152)	(12,326)	-	-	(8,004)	(3,524)	(2,685)	(2,685)	(10,580)	
Calvert County	-	-	(1,284)	(2,258)	(2,288)	(2,288)	(3,013)	-	-	(1,047)	(931)	(1,055)	(1,055)	(1,762)	
Carroll County	-	-	(1,609)	(3,027)	(3,071)	(3,071)	(4,279)	-	-	(1,552)	(1,349)	(1,590)	(1,590)	(2,856)	
Charles County	-	-	(3,493)	(6,698)	(6,801)	(6,801)	(9,778)	-	-	(1,409)	(1,199)	(1,457)	(1,457)	(2,867)	
City of Fredericksburg	-	-	(630)	(1,138)	(1,159)	(1,159)	(1,731)	-	-	(1,775)	(1,515)	(1,826)	(1,826)	(3,567)	
Stafford County	-	-	(5,173)	(9,807)	(9,969)	(9,969)	(14,607)	-	-	(3,166)	(2,667)	(3,293)	(3,293)	(6,948)	
Spotsylvania County	-	-	(3,342)	(6,257)	(6,333)	(6,333)	(8,336)	-	-	(2,080)	(1,765)	(2,215)	(2,215)	(4,711)	
Clarke County	-	-	(160)	(314)	(340)	(340)	(453)	-	-	(194)	(187)	(236)	(236)	(412)	
Fauquier County	-	-	(1,758)	(3,348)	(3,661)	(3,661)	(5,228)	-	-	(1,134)	(1,093)	(1,386)	(1,386)	(2,510)	
Jefferson County	-	-	(1,295)	(2,407)	(2,627)	(2,627)	(3,692)	-	-	(851)	(822)	(1,043)	(1,043)	(1,889)	
King George County	-	-	(990)	(1,894)	(2,072)	(2,072)	(2,935)	-	-	(925)	(892)	(1,145)	(1,145)	(2,179)	
St. Mary's County	-	-	(3,027)	(5,409)	(6,021)	(6,021)	(8,494)	-	-	(2,004)	(1,949)	(2,389)	(2,389)	(4,148)	
TOTAL	-	-	(84,182)	(157,372)	(126,434)	(126,434)	(184,545)	-	-	(123,840)	(72,944)	(71,809)	(71,809)	(181,371)	

Subtotals by Tiers	POPULATION							JOBS							
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
Core	-	-	(12,988)	(24,716)	(19,238)	(19,238)	(29,600)	-	-	(29,124)	(17,850)	(17,850)	(17,850)	(41,808)	
First Tier	-	-	(19,821)	(38,562)	(24,683)	(24,683)	(37,556)	-	-	(41,565)	(20,483)	(17,306)	(17,306)	(51,531)	
Second Tier	-	-	(28,612)	(51,537)	(38,171)	(38,171)	(54,845)	-	-	(37,015)	(20,244)	(19,020)	(19,020)	(54,183)	
Third Tier	-	-	(15,531)	(29,185)	(29,621)	(29,621)	(41,744)	-	-	(11,029)	(9,426)	(11,436)	(11,436)	(22,712)	
Exurb	-	-	(7,230)	(13,373)	(14,721)	(14,721)	(20,801)	-	-	(5,108)	(4,942)	(6,198)	(6,198)	(11,137)	
SUBTOTAL - PMA	-	-	(32,809)	(63,277)	(43,921)	(43,921)	(67,156)	-	-	(70,689)	(38,332)	(35,155)	(35,155)	(93,339)	
SUBTOTAL- Non-PMA	-	-	(51,373)	(94,095)	(82,513)	(82,513)	(117,389)	-	-	(53,152)	(34,612)	(36,654)	(36,654)	(88,032)	
TOTAL	-	-	(84,182)	(157,372)	(126,434)	(126,434)	(184,545)	-	-	(123,840)	(72,944)	(71,809)	(71,809)	(181,371)	

Figure 88 | Low Scenario 2045 Population – Difference from Baseline

### MARYLAND I-495/I-270 | LOW SCENARIO 2045 POPULATION - DIFFERENCE FROM BASELINE

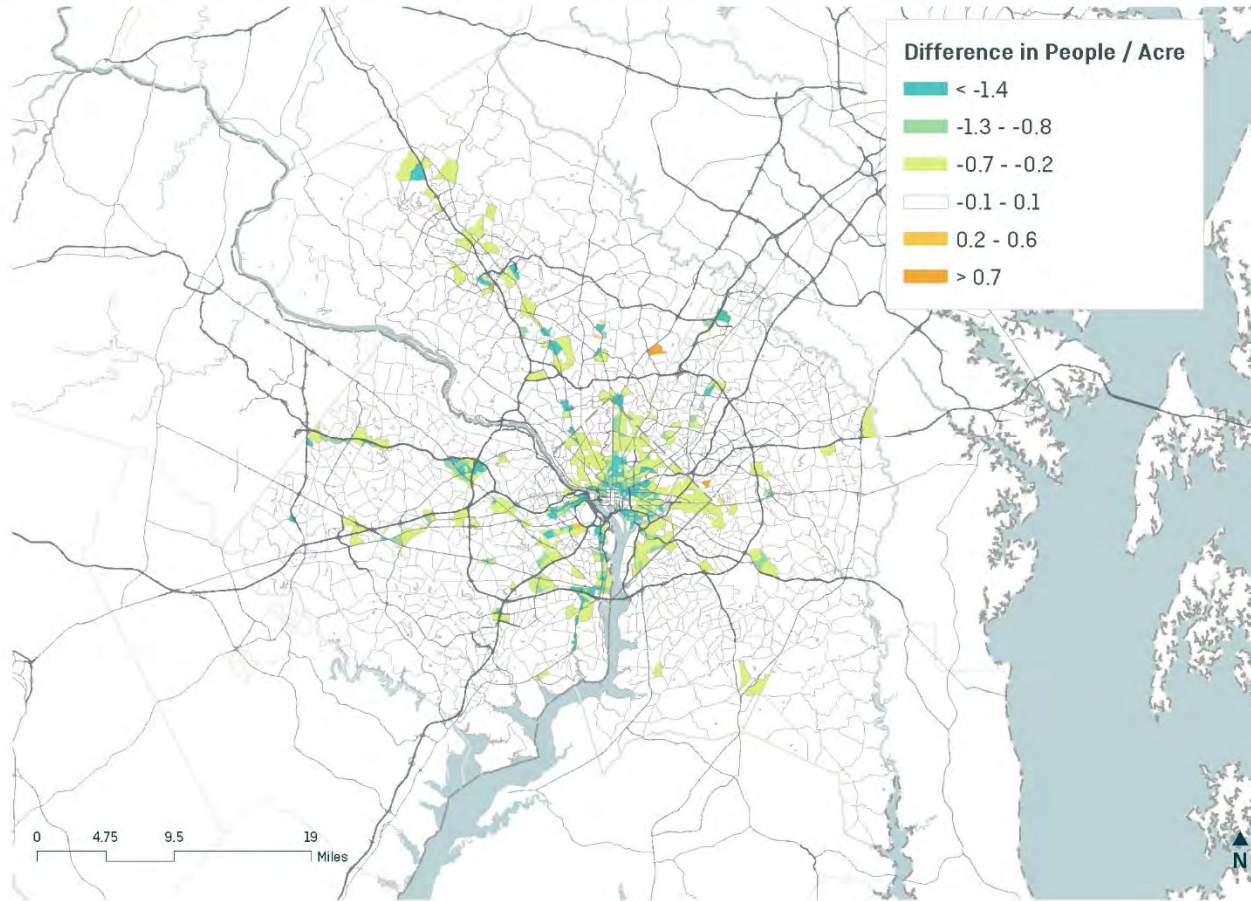
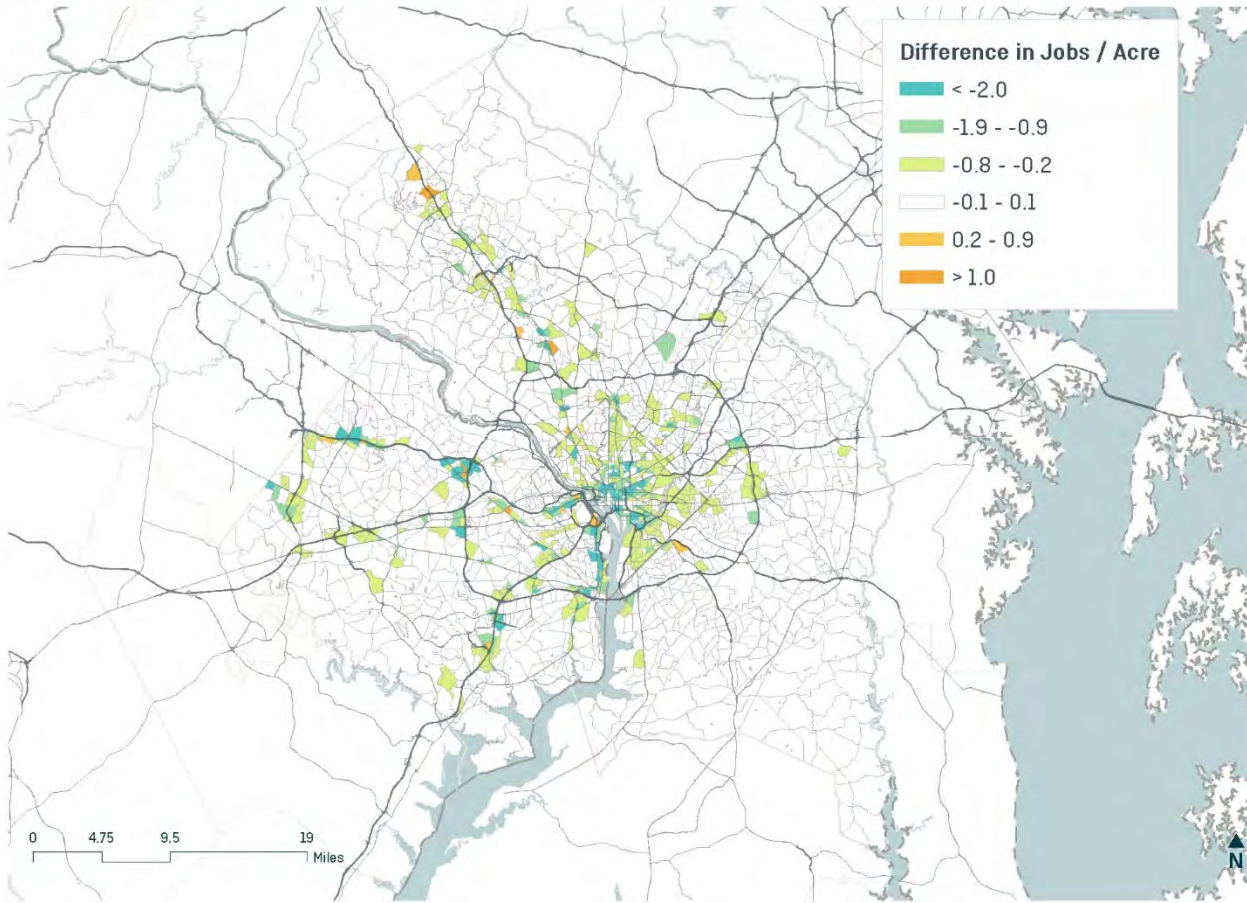




Figure 89 | Low Scenario 2045 Employment – Difference from Baseline

### MARYLAND I-495/I-270 | LOW SCENARIO 2045 EMPLOYMENT - DIFFERENCE FROM BASELINE



## High Scenario

The high scenario assumes that the growth rates forecast in the Renaissance baseline scenario increase by 25 percent. This increase was distributed in two sets: first among PMA jurisdictions and second among non-PMA jurisdictions based on the range of growth rates identified in the macroeconomic assessment. Therefore, the high scenario has 25% greater growth in both population and jobs across the sum of all PMA jurisdictions and 25% greater growth in both population and jobs across the sum of all non-PMA jurisdictions, but each jurisdiction's growth rate is allowed to vary. New control totals were developed to reflect the added growth.

The charts below show baseline, and high scenario growth for PMA population and employment, respectively. The tables that follow show high forecast jurisdictional totals in each interval year for population and employment, respectively, as well as the difference between the baseline scenario and the high scenario. Lastly, the figures below show the difference between the baseline and the high scenario for 2045 for population and employment.

Figure 90 | Baseline and High Forecast Comparison – Population, 2017-2045

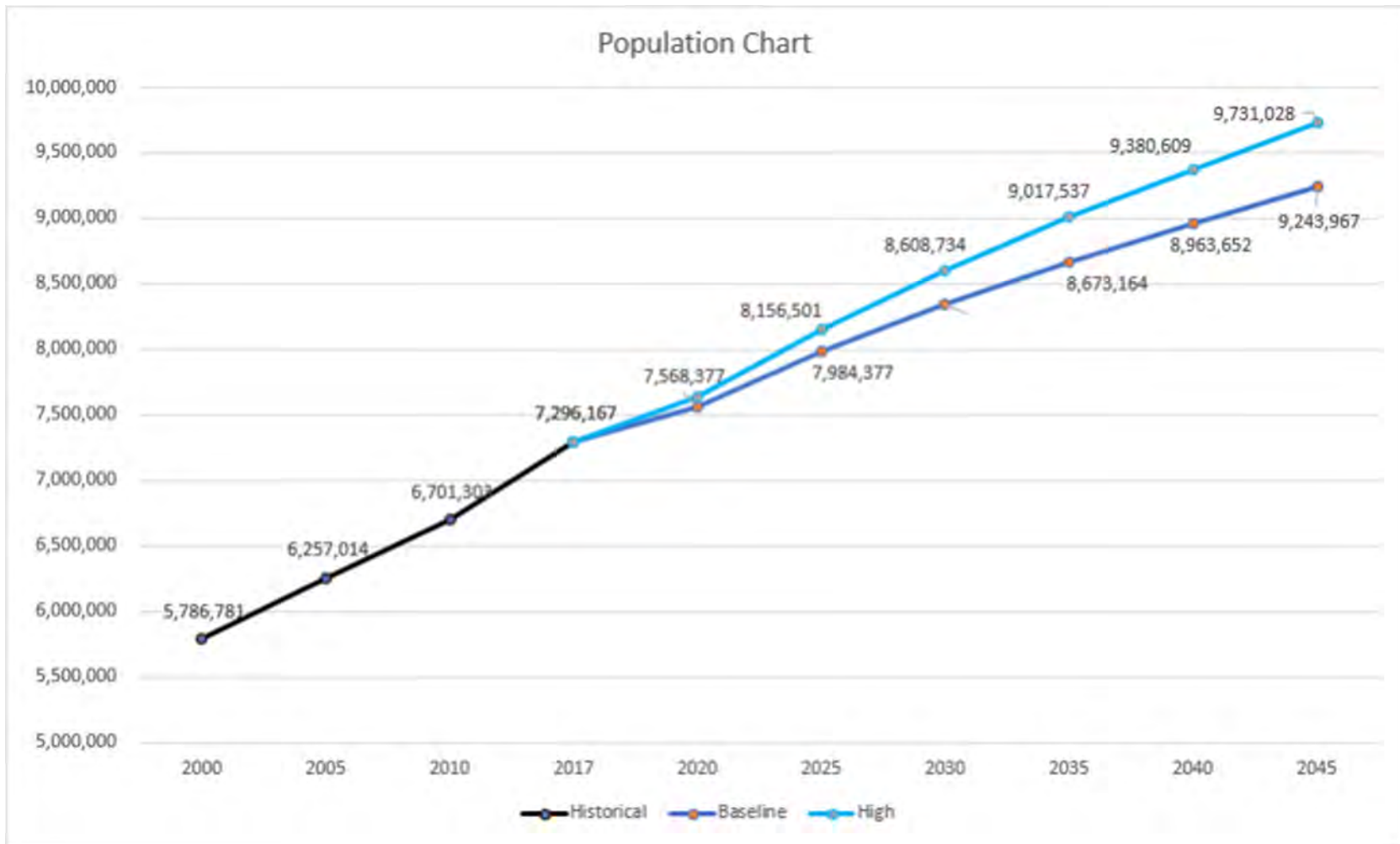




Figure 91 | Baseline and High Forecast Comparison – Employment, 2017-2045

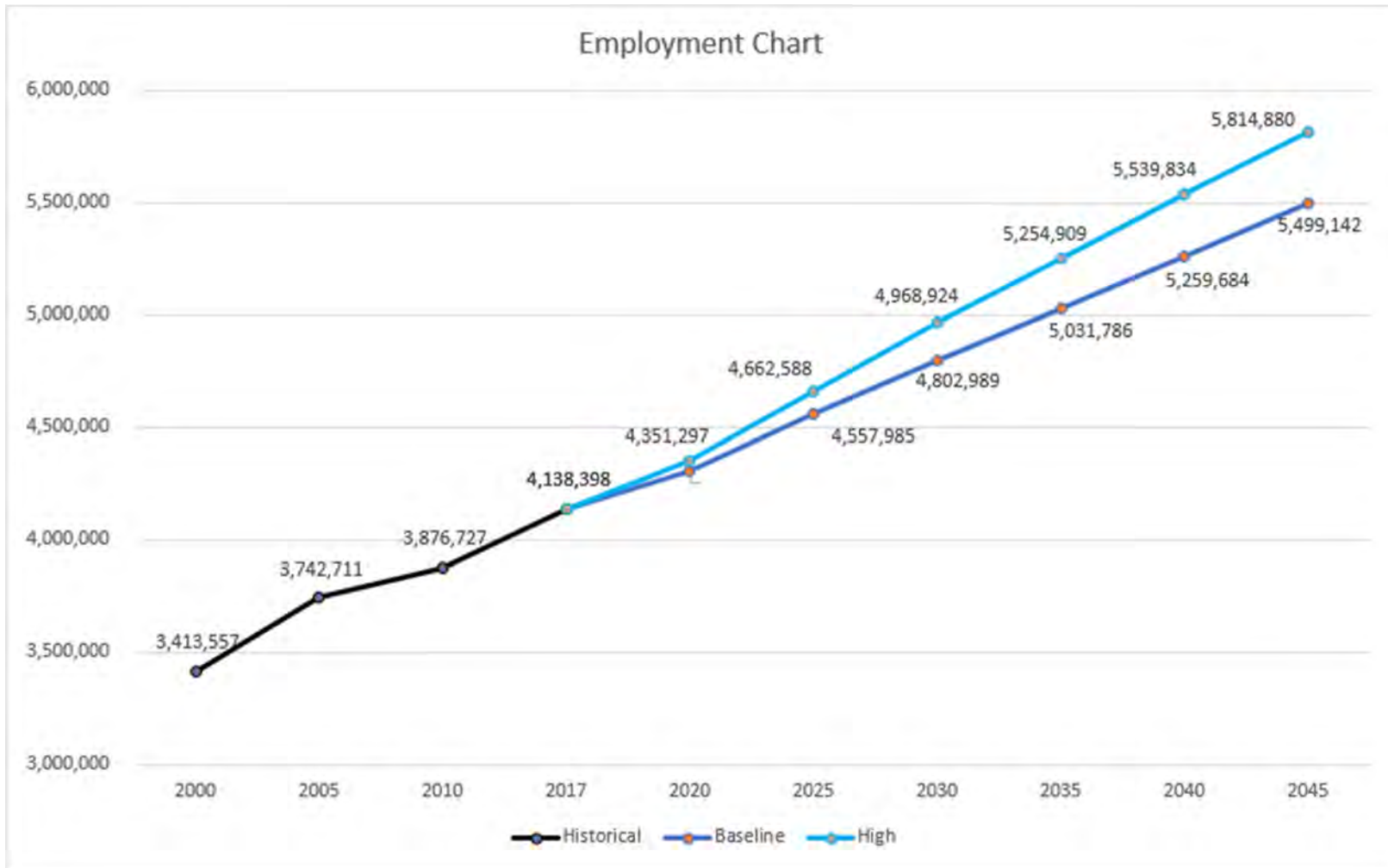


Table 18 | High Scenario Forecast of Population and Employment by Jurisdiction, 2017-2045

Renaissance (High Version)																	
POPULATION										JOBS							
	Jurisdiction	2017	2020	2025	2030	2035	2040	2045 AAGR		2017	2020	2025	2030	2035	2040	2045 AAGR	
Core	City of Alexandria	160,037	168,920	180,760	190,807	200,413	209,934	220,752	1.3%	106,812	117,583	127,709	136,446	145,334	154,208	164,116	1.8%
	Arlington County	234,967	248,538	265,088	280,111	293,910	306,900	319,735	1.2%	214,180	222,735	234,842	249,157	261,698	275,053	287,335	1.2%
	District of Columbia	693,977	724,848	769,620	810,472	847,690	880,107	911,119	1.1%	815,714	844,748	895,309	941,071	982,545	1,019,711	1,055,125	1.0%
First Tier	Fairfax County	1,187,109	1,227,797	1,298,106	1,366,342	1,428,035	1,484,746	1,539,785	1.0%	713,901	748,498	802,756	857,560	907,171	957,652	1,005,862	1.4%
	Montgomery County	1,058,813	1,090,159	1,143,376	1,195,570	1,242,274	1,280,916	1,317,648	0.8%	529,424	552,863	588,992	625,336	657,503	689,300	718,959	1.2%
	Prince George's County	913,117	938,246	967,866	993,060	1,014,354	1,030,969	1,045,386	0.5%	346,156	360,780	378,680	394,349	408,743	422,551	436,306	0.9%
Second Tier	Anne Arundel County	573,243	589,916	618,902	640,713	659,041	673,880	687,101	0.7%	328,887	343,513	363,738	383,620	402,405	421,376	439,050	1.2%
	Frederick County	252,022	267,227	289,670	308,383	325,801	341,370	356,277	1.4%	113,963	120,802	129,905	138,347	146,436	154,054	160,674	1.4%
	Howard County	321,111	336,020	362,056	383,997	404,066	422,257	439,654	1.3%	178,099	189,862	205,356	221,049	236,025	251,251	266,186	1.7%
	Loudoun County	398,090	441,323	501,569	547,497	586,169	618,854	647,103	2.2%	178,355	195,855	222,419	251,092	279,462	309,289	339,564	3.1%
	Prince William County	521,087	559,622	615,083	665,683	712,335	756,747	799,604	1.8%	182,612	196,325	216,584	237,220	257,280	277,876	297,511	2.2%
Third Tier	Calvert County	91,500	95,799	103,733	109,436	114,500	119,130	123,801	1.2%	35,118	37,403	40,319	42,605	44,562	46,607	48,558	1.3%
	Carroll County	167,783	173,759	184,179	192,438	199,706	206,450	213,004	0.9%	69,090	72,827	77,460	81,586	85,419	89,047	92,543	1.2%
	Charles County	159,701	170,299	184,525	198,635	210,454	220,702	233,359	1.6%	46,756	49,478	53,030	56,439	59,676	63,010	66,212	1.4%
	City of Fredericksburg	28,360	30,446	34,093	36,579	39,127	41,539	43,876	1.9%	37,182	39,840	43,862	47,875	51,729	55,636	59,458	2.1%
	Stafford County	146,781	158,993	180,764	199,615	218,245	236,844	255,799	2.6%	54,983	59,416	66,286	73,705	81,351	89,302	97,464	2.7%
	Spotsylvania County	109,149	117,303	130,325	140,984	148,561	155,481	162,086	1.7%	46,740	50,038	54,746	59,611	64,569	69,604	74,534	2.1%
	Clarke County	14,508	14,902	15,585	16,155	16,599	16,987	17,326	0.7%	5,701	5,967	6,417	6,873	7,306	7,732	8,124	1.5%
Exurb	Fauquier County	69,465	73,480	81,137	87,302	93,306	99,205	105,306	1.8%	30,323	32,116	34,822	37,594	40,234	42,878	45,411	1.7%
	Jefferson County	56,337	59,136	64,431	68,785	73,028	77,136	81,374	1.5%	22,282	23,516	25,390	27,299	29,197	31,138	33,101	1.7%
	King George County	26,341	28,617	32,252	35,275	38,160	40,951	43,690	2.3%	18,431	19,635	21,474	23,397	25,323	27,311	29,331	2.0%
	St. Mary's County	112,669	121,146	133,381	140,895	151,763	159,504	167,243	1.7%	63,689	67,497	72,492	76,693	80,941	85,248	89,456	1.4%
	TOTAL	7,296,167	7,636,496	8,156,501	8,608,734	9,017,537	9,380,609	9,731,028	1.2%	4,138,398	4,351,297	4,662,588	4,968,924	5,254,909	5,539,834	5,814,880	1.4%

POPULATION										JOBS							
	Subtotals by Tiers	2017	2020	2025	2030	2035	2040	2045 AAGR		2017	2020	2025	2030	2035	2040	2045 AAGR	
PMA	Core	1,088,981	1,142,306	1,215,468	1,281,390	1,342,013	1,396,941	1,451,606	1.1%	1,136,706	1,185,066	1,257,860	1,326,674	1,389,577	1,448,972	1,506,576	1.1%
	First Tier	3,159,039	3,256,202	3,409,348	3,554,972	3,684,663	3,796,631	3,902,819	0.8%	1,589,481	1,662,141	1,770,428	1,877,245	1,973,417	2,069,503	2,161,127	1.2%
	Second Tier	2,065,553	2,194,108	2,387,280	2,546,273	2,687,412	2,813,108	2,929,739	1.4%	981,916	1,046,357	1,138,002	1,231,328	1,321,608	1,413,846	1,502,985	1.8%
Non-PMA	Third Tier	703,274	746,599	817,619	877,687	930,593	980,146	1,031,925	1.6%	289,869	309,002	335,703	361,821	387,306	413,206	438,769	1.8%
	Exurb	279,320	297,281	326,786	348,412	372,856	393,783	414,939	1.7%	140,426	148,731	160,595	171,856	183,001	194,307	205,423	1.6%
Totals	SUBTOTAL - PMA	4,248,020	4,398,508	4,624,816	4,836,362	5,026,676	5,193,572	5,354,425	0.9%	2,726,187	2,847,207	3,028,288	3,203,919	3,362,994	3,518,475	3,667,703	1.2%
	SUBTOTAL - Non-PMA	3,048,147	3,237,988	3,531,685	3,772,372	3,990,861	4,187,037	4,376,603	1.5%	1,412,211	1,504,090	1,634,300	1,765,005	1,891,915	2,021,359	2,147,177	1.8%
	TOTAL	7,296,167	7,636,496	8,156,501	8,608,734	9,017,537	9,380,609	9,731,028	1.2%	4,138,398	4,351,297	4,662,588	4,968,924	5,254,909	5,539,834	5,814,880	1.4%

Table 19 | Difference between High and Baseline Scenario Forecasts of Population and Employment by Jurisdiction, 2017-2045

Renaissance High - Baseline															
POPULATION															
Jurisdiction	2017	2020	2025	2030	2035	2040	2045	JOBS							
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
<b>Core</b>															
City of Alexandria	-	1,403	2,702	4,499	5,814	6,497	6,223	-	6,143	7,712	9,168	10,530	11,910	13,325	
Arlington County	-	3,015	6,246	8,216	9,838	10,932	11,896	-	1,193	3,979	6,069	8,021	10,111	12,226	
District of Columbia	-	6,676	10,369	13,885	16,797	19,095	21,260	-	3,592	13,784	22,683	29,939	36,979	43,136	
<b>First Tier</b>															
Fairfax County	-	7,235	25,156	43,190	60,963	78,133	95,663	-	2,853	8,017	13,911	19,685	26,120	32,814	
Montgomery County	-	1,249	11,488	20,764	28,817	35,790	42,789	-	4,194	13,004	22,847	31,534	39,524	46,803	
Prince George's County	-	10,518	19,401	27,133	33,526	38,655	43,461	-	6,109	13,728	20,716	27,556	33,747	39,941	
<b>Second Tier</b>															
Anne Arundel County	-	3,108	12,443	16,867	19,671	21,028	21,268	-	3,101	8,247	13,142	17,499	20,888	24,986	
Frederick County	-	2,726	6,310	8,850	10,416	11,185	11,204	-	2,050	4,588	6,898	8,802	10,464	11,603	
Howard County	-	1,203	7,269	12,865	18,740	24,946	30,600	-	2,734	5,521	8,441	11,604	15,163	18,399	
Loudoun County	-	7,556	15,150	22,508	28,164	33,294	37,887	-	1,612	4,162	7,719	12,174	17,814	23,866	
Prince William County	-	12,739	22,436	36,945	51,694	67,502	84,270	-	1,955	5,364	8,770	12,052	15,503	18,518	
<b>Third Tier</b>															
Calvert County	-	1,453	4,803	7,024	9,155	11,194	13,275	-	715	1,727	2,564	3,283	4,019	4,684	
Carroll County	-	2,229	6,902	10,098	12,939	15,333	17,574	-	1,375	3,187	4,787	6,216	7,523	8,717	
Charles County	-	1,627	3,377	6,041	7,607	8,534	10,558	-	972	1,963	2,751	3,411	4,075	4,712	
City of Fredericksburg	-	507	1,905	2,574	3,041	3,398	3,692	-	439	1,233	1,994	2,739	3,498	4,154	
Stafford County	-	722	4,018	6,320	8,761	11,138	13,527	-	673	1,786	2,960	4,341	5,789	7,306	
Spotsylvania County	-	405	1,490	1,741	1,645	1,283	737	-	664	1,591	2,518	2,968	3,465	3,858	
<b>Exurb</b>															
Clarke County	-	119	302	390	439	457	444	-	84	197	315	422	524	610	
Fauquier County	-	669	2,832	4,027	5,222	6,334	7,539	-	424	1,158	1,872	2,557	3,226	3,805	
Jefferson County	-	579	1,828	2,706	3,566	4,411	5,321	-	245	639	1,081	1,505	1,992	2,484	
King George County	-	75	615	814	957	1,044	1,088	-	118	348	613	853	1,111	1,332	
St. Mary's County	-	2,306	5,082	5,152	6,601	6,774	6,785	-	1,158	2,668	4,116	5,432	6,705	7,853	
<b>TOTAL</b>	-	<b>68,119</b>	<b>172,124</b>	<b>262,609</b>	<b>344,373</b>	<b>416,957</b>	<b>487,061</b>	-	<b>42,403</b>	<b>104,603</b>	<b>165,935</b>	<b>223,123</b>	<b>280,150</b>	<b>335,132</b>	

POPULATION															
JOBS															
Subtotals by Tiers	2017	2020	2025	2030	2035	2040	2045								
	2017	2020	2025	2030	2035	2040	2045	2017	2020	2025	2030	2035	2040	2045	
<b>PMA</b>															
Core	-	11,094	19,317	26,600	32,449	36,524	39,379	-	10,928	25,475	37,920	48,490	59,000	68,687	
First Tier	-	19,002	56,045	91,087	123,306	152,578	181,913	-	13,156	34,749	57,474	78,775	99,391	119,558	
Second Tier	-	27,332	63,608	98,035	128,685	157,955	185,229	-	11,452	27,882	44,970	62,131	79,832	97,372	
<b>Non-PMA</b>															
Third Tier	-	6,943	22,495	33,798	43,148	50,880	59,363	-	4,838	11,487	17,574	22,958	28,369	33,431	
Exurb	-	3,748	10,659	13,089	16,785	19,020	21,177	-	2,029	5,010	7,997	10,769	13,558	16,084	
<b>Totals</b>															
SUBTOTAL - PMA	-	30,096	75,362	117,687	155,755	189,102	221,292	-	24,084	60,224	95,394	127,265	158,391	188,245	
SUBTOTAL - Non-PMA	-	38,023	96,762	144,922	188,618	227,855	265,769	-	18,319	44,379	70,541	95,858	121,759	146,887	
<b>TOTAL</b>	-	<b>68,119</b>	<b>172,124</b>	<b>262,609</b>	<b>344,373</b>	<b>416,957</b>	<b>487,061</b>	-	<b>42,403</b>	<b>104,603</b>	<b>165,935</b>	<b>223,123</b>	<b>280,150</b>	<b>335,132</b>	



Figure 92 | High Scenario 2045 Population – Difference from Baseline

### MARYLAND I-495/I-270 | HIGH SCENARIO 2045 POPULATION - DIFFERENCE FROM BASELINE

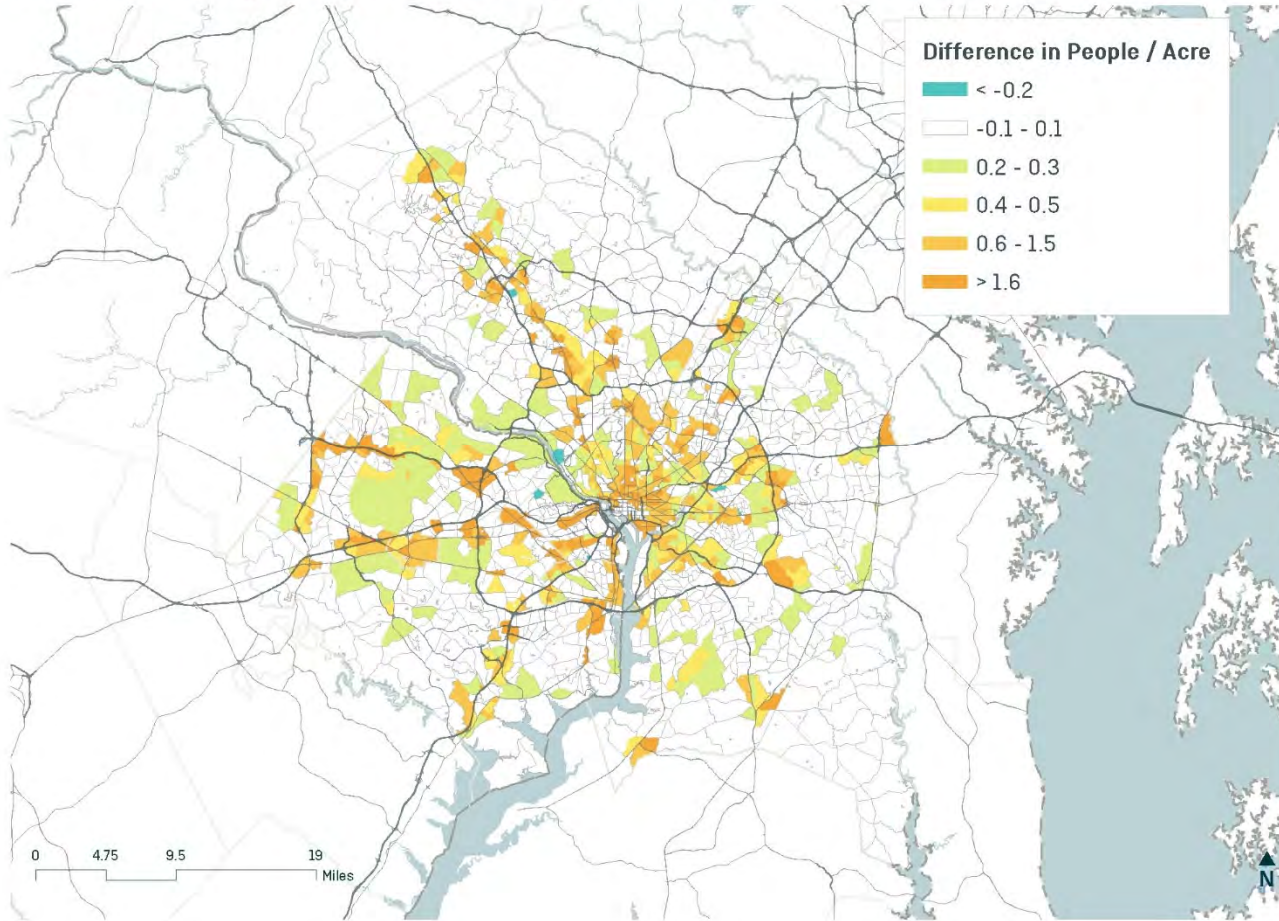
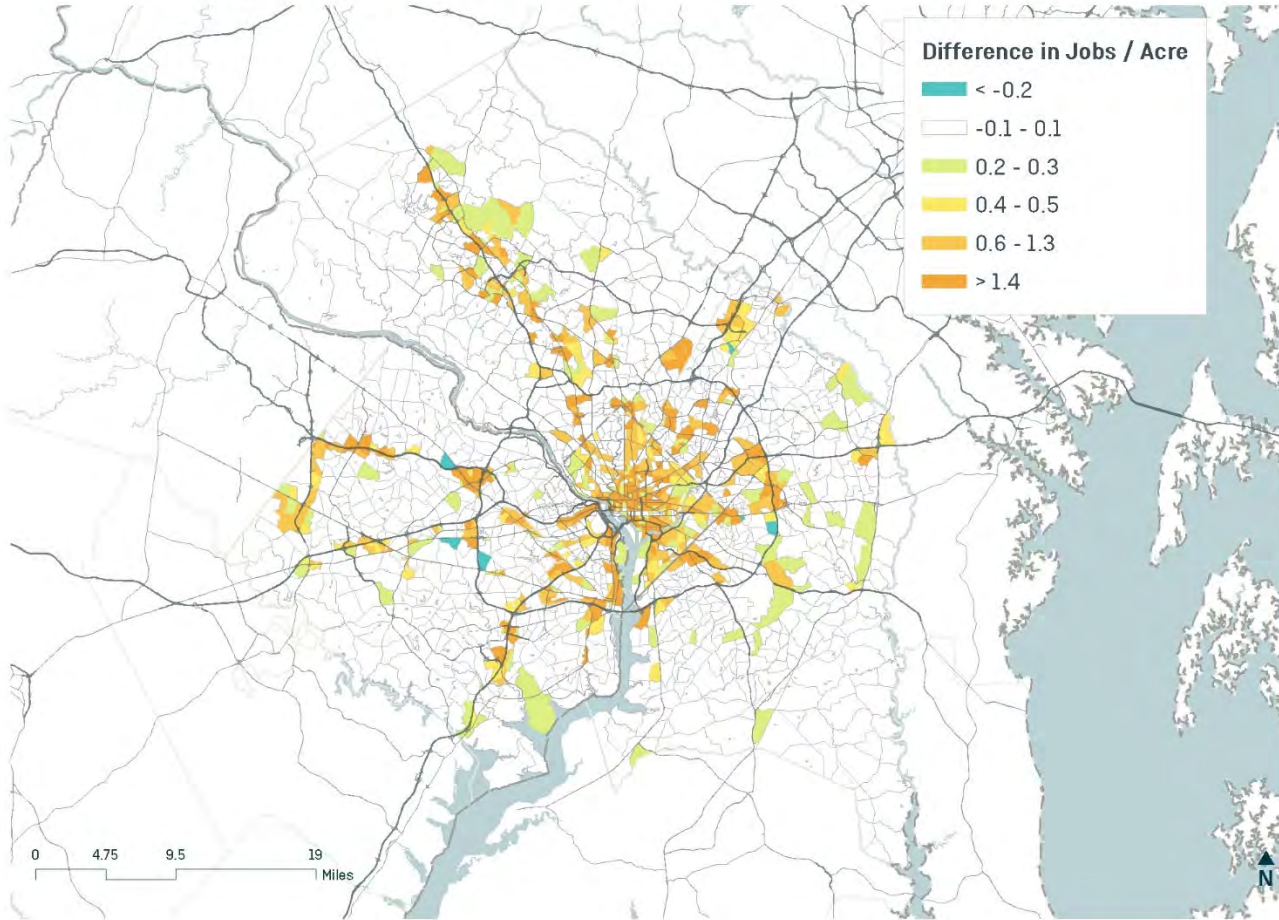


Figure 93 | High Scenario 2045 Employment – Difference from Baseline

**MARYLAND I-495/I-270 | HIGH SCENARIO 2045 EMPLOYMENT - DIFFERENCE FROM BASELINE**





## 2060 Forecast

The development of a land use forecast for a 2060 horizon year provides an opportunity to consider a different type of “high growth” scenario in which growth continues beyond the conventional 25-year forecast typical of traffic and revenue studies. For the 2060 scenario, Renaissance assumed a continuation of baseline scenario growth rate trends for three consecutive five-year periods beyond 2045. In other words, the rate at which each jurisdiction’s 5-year CAGRs decrease in successive horizon years was extended through 2060.

The figures below represent the employment and population density in the 2060 forecast, as well as the growth in employment and population density from 2045 to 2060.

Figure 94 | 2060 Population Density

### MARYLAND I-495/I-270 | 2060 POPULATION DENSITY

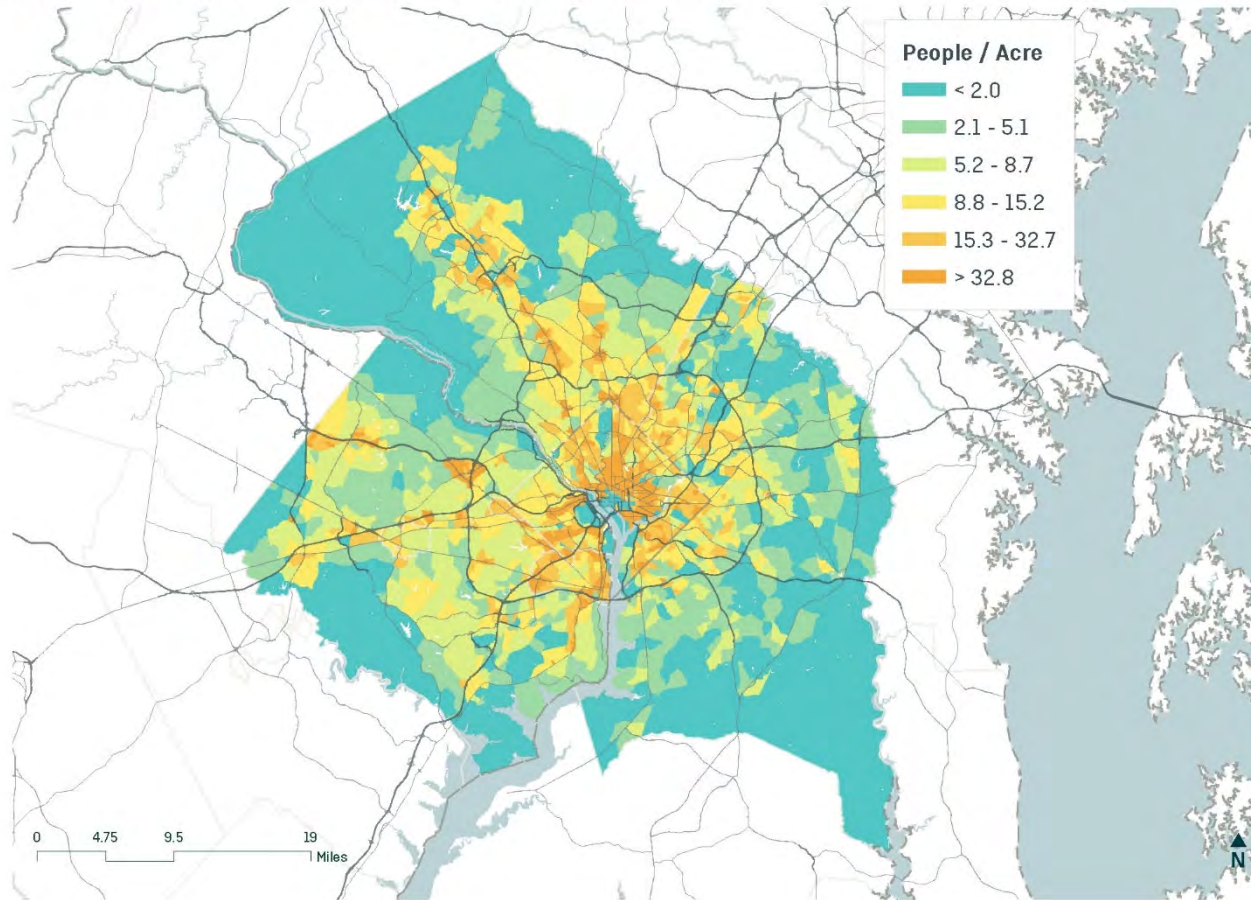


Figure 95 | Population Density Change, 2045-2060

### MARYLAND I-495/I-270 | POPULATION DENSITY CHANGE - 2045-2060

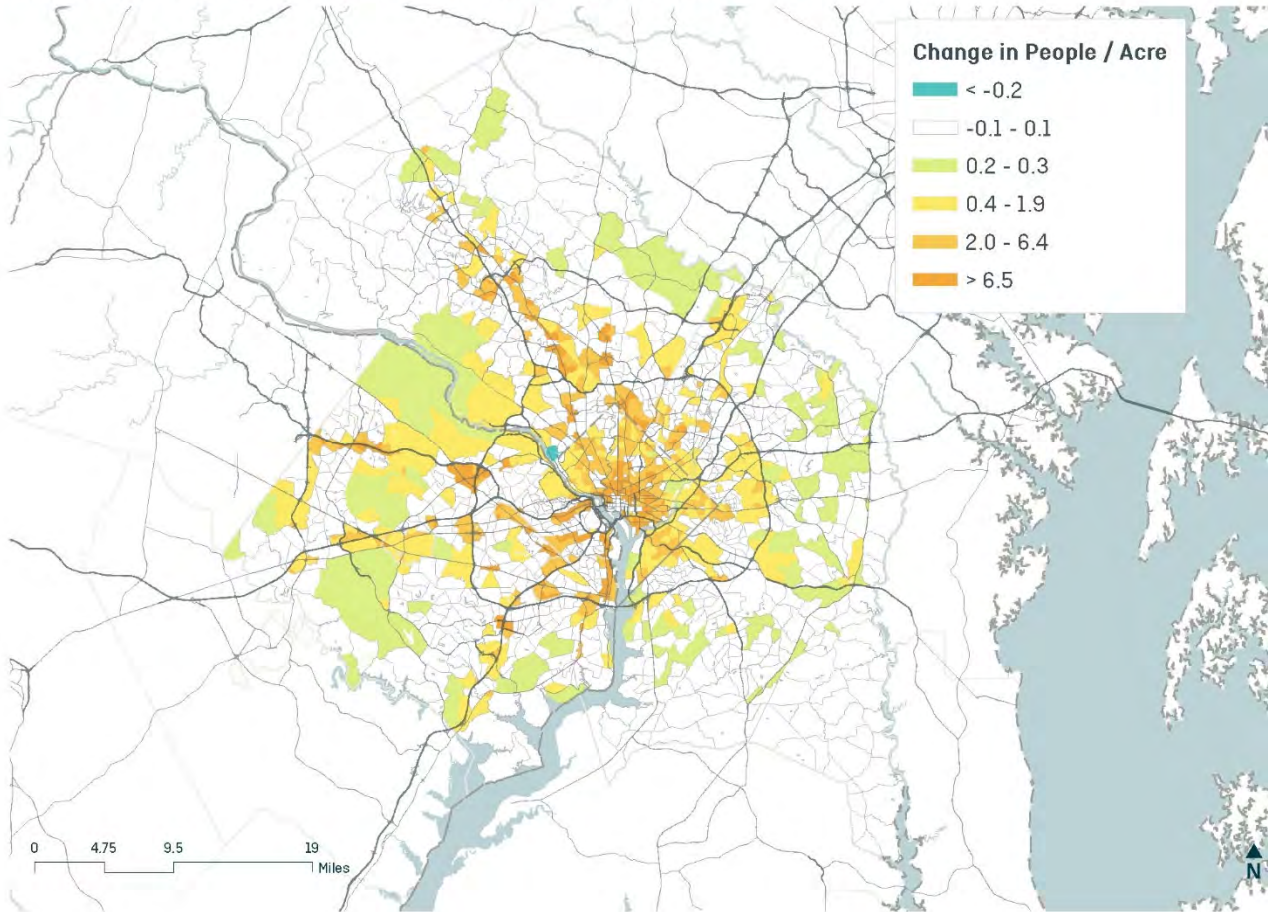




Figure 96 | 2060 Employment Density

### MARYLAND I-495/I-270 | 2060 EMPLOYMENT DENSITY

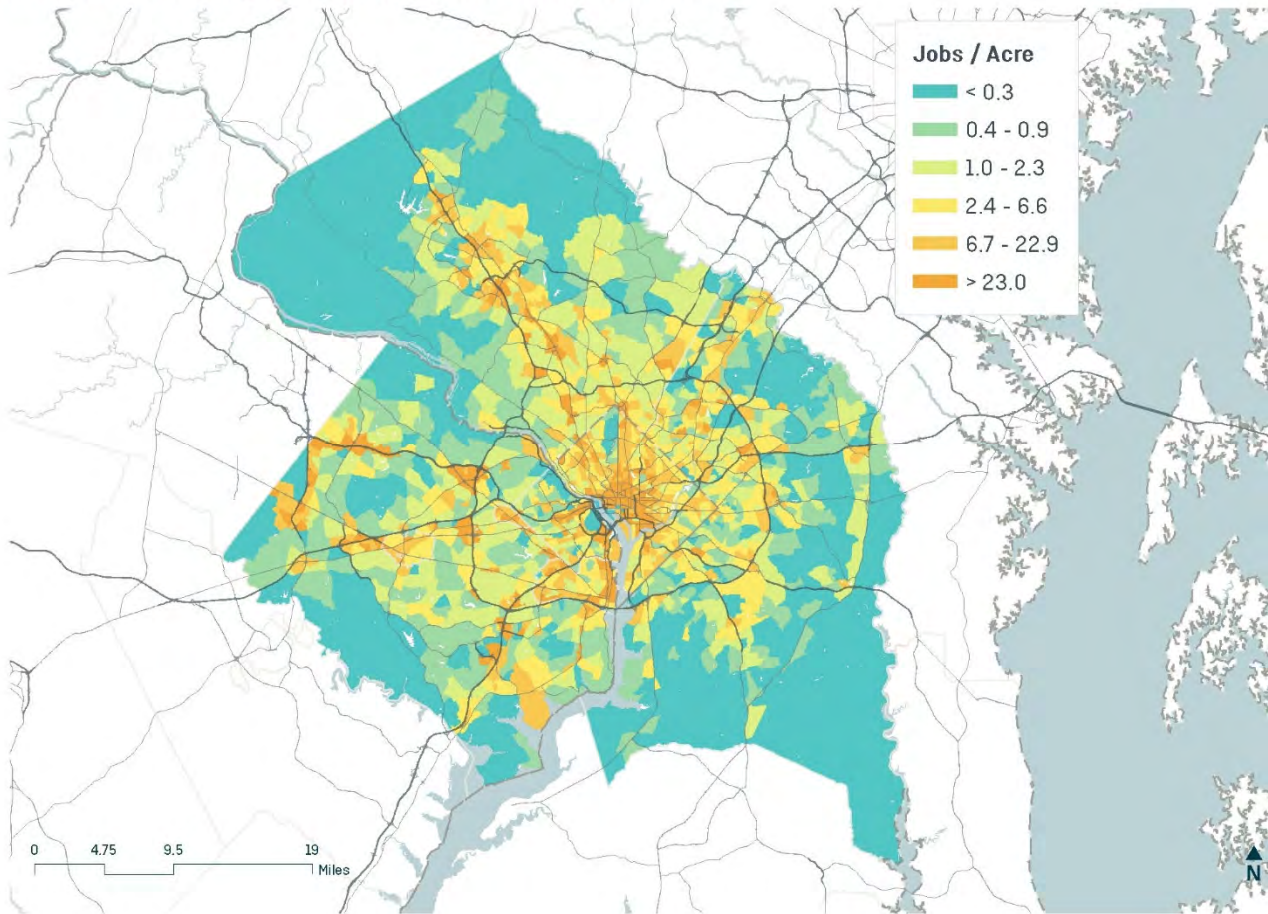


Figure 97 | Employment Density Change, 2045-2060

### MARYLAND I-495/I-270 | EMPLOYMENT DENSITY CHANGE - 2045-2060

