

## Woodford County Forecasts: Population Households Employment 2015-2040

Prepared for the  
Versailles-Midway-Woodford County Planning Commission

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### *County Population*

Population projections are forecasts of the population in future time periods. The most common population projection model used by demographers – the cohort component model – was used to generate the county projections in this report. The cohort-component model is based on the balancing equation of population growth:

$$N_{t+5} = N_t + B_{t,t+5} - D_{t,t+5} + NM_{t,t+5}$$

where  $N_t$  is the total population at time  $t$  (the start of the forecast period),  $B_{t,t+5}$  is the number of births between time  $t$  and time  $t+5$ ,  $D_{t,t+5}$  is the number of deaths between time  $t$  and time  $t+5$ , and  $NM_{t,t+5}$  is net migration between time  $t$  and  $t+5$ . The output from this equation,  $N_{t+5}$ , represents the total population forecast at time  $t+5$ .  $B_{t,t+5}$ ,  $D_{t,t+5}$ , and  $NM_{t,t+5}$  are derived by applying recent fertility, mortality, and migration rates to the population by 5-year age group at time  $t$ . The model was carried out over five year periods from 2015 to 2040. Population counts by gender and 5-year age groups from the U.S. Census Bureau’s 2016 Population Estimates served as the base population.

Age-specific fertility rates were calculated using confidential birth data provided by the Kentucky Cabinet for Health and Family Services. Future fertility rates were adjusted by applying a linear extrapolation of the state-level fertility trend at each age group – this adjustment has little effect in Woodford County. Age-specific survival rates were calculated for each county using confidential death data provided by the Kentucky Cabinet for Health and Family Services. Future survival rates were adjusted by applying a linear extrapolation of the state-level survival trend at each age group. Age specific net migration rates were generated using a residual method, in which any population at the end of the base forecast period that was unaccounted for by the applied fertility and mortality rates was attributed to migration. Future net migration rates were held constant over the projection period.

### *Sub-County Populations*

The cohort-component model is a poor choice for the sub-county populations, as demographic rates for these areas are unlikely to be stable. Although total population counts are available for the cities of Versailles and Midway in the 2000 and 2010 Decennial Censuses and the 2015 Census Population Estimates, these latter figures are not stratified by gender or age. In addition, no estimates exist for the “non-standard” geographies of the urban service boundaries (USB). Forecasts for these sub-county geographies thus require several steps.

First, within the USBs, areal interpolation is used to estimate the population by age and gender in the base years of 2000 and 2010. The areal interpolation proceeds by assigning block populations for census blocks fully within a USB boundary in each year to the appropriate USB count. Populations for blocks that cross a USB boundary are allotted to the appropriate USB count according to the percentage of developed land within the block that falls within the USB boundary (based on the 2001 or 2011 National Land Cover Database). This procedure requires an assumption that the population in a census block that crosses a USB boundary is evenly distributed across the developed land in the block. However, the small size of census blocks and the general absence of very high density spaces in the county make this assumption quite tenable.

Next, annual population counts by age and gender are derived for the USB areas by interpolating the 2000 and 2010 estimates, and then extrapolating this line through 2015. A similar process is carried out for the cities of Versailles and Midway, except that the 2015 population estimates are used as an additional control in the extrapolation. The creation of these annual population counts assumes that the household population is increasing linearly through the 2000 to 2015 period.

Upon creation of this annual series of estimates, the city-level forecasts for 2020-2040 are derived using separate linear regression models in which the year and the total Woodford County population are used as explanatory variables for the city populations. The coefficients from these regression equations are then applied to the future year and Woodford County populations to generate forecasts for the independent cities. The use of linear regression assumes that population change over time and the pattern of change observed in Woodford County are good indicators of population change in the cities. This is also a tenable assumption.

For the city of Versailles, the regression covers the full period 2000-2015. For the city of Midway, the regression is truncated to cover only the period 2006-2015, the prior 10 years. This change was incorporated into the model to better account for the observed shift in the population trend (from negative growth to positive growth) in the city of Midway during this period. The population forecasts for the USB areas are derived in a similar manner, except that the population of the encompassed city is used as an additional explanatory variable in the regression model. This addition ensures that any population change within a given city is incorporated into the forecast of the USB area for that city.

Household populations by age and gender are calculated within the cohort-component model used to create the county-level projection. These counts are used to apportion the total population within each sub-county area into the household population (e.g., the population that lives in households) and the group quarters population. This is accomplished by calculating for the whole county the household population age and gender percentage changes over successive 5-year periods between 2010 and 2040, and then applying these successive percentage changes to the sub-county household populations in 2010.

Although Woodford County has a fairly small group quarters population overall, it is quite a large portion of the population in Midway and the Midway USB. The group quarters population within the county is allowed to grow moderately over the 2015-2040 period, from 337 to 362. Because this is a relatively negligible number, the majority of this 25 person change was applied to the group quarters counts in the city of Midway. Note that these group quarters forecasts assume that the residential population of Midway University will not grow (or shrink) in any substantial way over the forecast period.

Finally, the household population forecasts and the group quarters forecasts are aggregated to ensure that these two figures sum to the corresponding total population. In cases where these sums are not the same, the household population forecast is adjusted upward or downward as appropriate, as the total population forecasts are considered the more reliable of the forecasts.

## Forecasts of Population

	2010	2015	2020	2025	2030	2035	2040
<b>Total Population</b>							
<b>Woodford County</b>	24,939	25,876	26,699	27,552	28,386	29,125	29,696
<b>City of Versailles</b>	8,568	9,146	9,562	9,954	10,337	10,676	10,935
<b>USB of Versailles</b>	14,758	15,464	16,160	16,832	17,500	18,289	18,990
<b>City of Midway</b>	1,641	1,701	1,698	1,719	1,738	1,750	1,750
<b>USB of Midway</b>	1,698	1,716	1,732	1,751	1,767	1,783	1,798
<b>As % of County:</b>							
<b>City of Versailles</b>	35.5%	35.3%	35.8%	36.1%	36.4%	36.7%	36.8%
<b>USB of Versailles</b>	60.1%	58.9%	60.5%	61.1%	61.7%	62.8%	63.9%
<b>City of Midway</b>	6.6%	6.6%	6.4%	6.2%	6.1%	6.0%	5.9%
<b>USB of Midway</b>	6.8%	6.6%	6.5%	6.4%	6.2%	6.1%	6.1%

Note: Counts for 2010 are from the Decennial Census. Woodford County count for 2015 is from the Census Bureau's 2016 Population Estimates. Other counts for 2015 are from the Census Bureau's 2015 Population Estimates. Counts for 2020-2040 are KSDC population forecasts.

## Forecasts of Vital Statistics

	2010-2015	2015-2020	2020-2025	2025-2030	2030-2035	2035-2040
<b>Births</b>	1,370	1,509	1,605	1,667	1,665	1,639
<b>Deaths</b>	1,096	1,243	1,367	1,527	1,688	1,817
<b>Natural Increase</b>	274	266	238	140	-23	-178
<b>Net Migrants</b>	*507	557	615	694	761	748

\* Birth and death counts for 2010-2015 are from Kentucky Department of Health and Family Services records. Net migrants in the 2010-2015 period is the mean number of net migrants over four periods: 1) 2004-2009, 2) 2005-2010, 3) 2009-2014, and 4) 2010-2015. All counts 2015-2040 are from the KSDC population forecasts.

## Forecasts of Population in Households

	2010	2015	2020	2025	2030	2035	2040
<b>Woodford County</b>	24,610	25,539	26,357	27,205	28,034	28,768	29,334
<b>City of Versailles</b>	8,501	9,074	9,487	9,876	10,256	10,593	10,849
<b>USB of Versailles</b>	14,643	15,343	16,034	16,700	17,363	18,146	18,842
<b>City of Midway</b>	1,460	1,513	1,511	1,529	1,546	1,557	1,557
<b>USB of Midway</b>	1,511	1,527	1,541	1,558	1,572	1,586	1,600

Note: Counts for 2010 are from the Decennial Census. Counts for 2015-2040 are KSDC population forecasts.

The forecasts of total population and population in households show robust growth across the county throughout the forecast period. Woodford County is expected to add 3,820 residents between 2015 and 2040, a nearly 15% increase over these 25 years. This growth is expected to occur predominantly in the city of Versailles and its immediate environs, with the population of Versailles increasing by almost 20% and the population of the Versailles USB increasing by approximately 23% during this time. As such, the percentage of the county's population living in the Versailles area will steadily increase.

The table of vital statistics forecasts reveals that growth within the county is largely the result of large positive net migration. Although natural increase (i.e., births minus deaths) is currently positive, the rate of natural increase will decrease over time. By 2030, when individuals in the Baby Boomer generation are between the approximate ages of 66 and 84, deaths will outnumber births in the county. However, strong patterns of net migration will allow the county to maintain overall positive population change.

Because the group quarters population in Woodford County is relatively small, trends in the growth of the household population are quite similar to those of the total population. As noted above, the group quarters population is expected to grow by a small number (25) between 2015 and 2040.

One notable detail in these population figures is the small loss of population forecast for the city of Midway between 2015 and 2020. Although this city has shown relatively strong population growth since 2012, it has exhibited sporadic growth and decline since 2000. The 2015 Midway population estimate of 1,701 is remarkably higher than the estimate in 2014, and may prove to be an anomaly in the population trend. Rather than adjust the forecasts upwards to account for this potentially inconsistent estimate, the observed linear trend was maintained, which explains the discrepancy between the 2015 estimate and the 2016 (and later) forecasts. When 2016 population estimates for cities are released later this year, the KSDC will adjust the Midway projections if the 2016 estimate proves to be higher than anticipated.

Full population and household population forecasts by sex and 5-year age group for each geographic area are provided in spreadsheet appendices.

### *Households and Household Size*

To determine the total number of households in Woodford County and the sub-county areas, the headship rate method is used. The proportion of the household population in the 2010 Decennial Census that was classified as the head of household within each 10-year age group (age 15+) is calculated for the county and the cities of Versailles and Midway. This proportion is then applied to the corresponding age group in the household population forecasts to generate a forecast of the number of households. For the USB areas, the headship rates within the encompassing city are used. This method naturally assumes that the headship rates remain constant over time. The projected mean household size is calculated as the forecast of the population in households divided by the forecast of the number of households.

## Forecasts of Households

	2010	2015	2020	2025	2030	2035	2040
<b>Woodford County</b>	9,806	10,296	10,866	11,336	11,739	12,049	12,288
<b>City of Versailles</b>	3,542	3,844	4,119	4,348	4,556	4,736	4,874
<b>USB of Versailles</b>	6,050	6,499	6,961	7,353	7,713	8,113	8,466
<b>City of Midway</b>	643	675	689	710	726	738	747
<b>USB of Midway</b>	658	681	702	723	738	752	767

Note: Counts for 2010 are from the Decennial Census. Counts for 2015-2040 are based on 2010 Decennial Census headship rates applied to the KSDC household population forecasts.

## Forecasts of Household Size

	2010	2015	2020	2025	2030	2035	2040
<b>Woodford County</b>	2.51	2.48	2.43	2.40	2.39	2.39	2.39
<b>City of Versailles</b>	2.40	2.36	2.30	2.27	2.25	2.24	2.23
<b>USB of Versailles</b>	2.42	2.36	2.30	2.27	2.25	2.24	2.23
<b>City of Midway</b>	2.27	2.24	2.19	2.15	2.13	2.11	2.08
<b>USB of Midway</b>	2.30	2.24	2.20	2.15	2.13	2.11	2.09

Note: Calculations for 2010 are from the Decennial Census. Calculations for 2015-2040 are based on the KSDC household and household population forecasts.

The number of households in Woodford County is expected to increase at a slightly faster rate than the total population living in households – this is true for the county as a whole and the sub-county geographies within each 5-year forecast period. As a result, the mean household size is forecast to continue declining, although at a slowing rate. By 2040, mean household sizes across the county are likely to reach their minimum, based on current demographic rates of change. Woodford County has the higher mean household size than do the independent cities, possibly the result of the larger size of rural families. The city of Midway has the smallest mean household size, likely due to the presence of the university and the number of single-person households it draws.

### *Employment (Jobs)*

Two separate employment forecasts are made here: A forecast of the number of jobs in Woodford County (filled by workers who may live anywhere) and a forecast of the number of workers who live in Woodford County (and who may work anywhere). These employment forecasts are carried out in a similar manner, although they rely on different data sources.

The forecast of the jobs located in Woodford County relies on 2001-2015 data from the Bureau of Economic Analysis (BEA). The BEA data is the highest quality employment data available for the place of employment. This data is available annually by industry for 20 top-level North

American Industry Classification System (NAICS) codes, although the industry-specific job counts are sometimes undisclosed for confidentiality reasons. For these forecasts, counts that are missing for any industry in any year are estimated based on the number of jobs in that industry in preceding or subsequent years and the total number of jobs in the county (which is always known). These estimates are made using simple linear regressions of the number of jobs in a specific industry on the year and the total number of jobs in that year, with the resulting coefficients used to calculate the undisclosed values in that industry.

Two exceptions to this procedure are the Management (NAICS 55) and Administrative (NAICS 56) industries, which did not have BEA data available for any of the years 2001-2015. For these two industries, Census LODES data – also available for the place of work – are used to generate the approximate number of jobs in the industry. Unlike BEA data, which includes all jobs, the Census LODES data is based only on those jobs in which job-holders pay into unemployment insurance. This excludes many contract workers and proprietors; however, the LODES data is preferred to other sources – such as the American Community Survey (ACS) – due to its coverage (annual vs. a 5-year average in the ACS) and its overall accuracy (administrative records vs. survey data).

Once the industry-specific job counts were derived, the total of these counts was compared to the total jobs in the county from the BEA. In cases where these totals are not the same, the industry-specific counts are adjusted upward or downward proportionally to achieve the appropriate total job count.

Forecasts of the total number of full and part-time jobs located in Woodford County in each year between 2016 and 2030 are made using a linear regression model in which the year and the total future Woodford County population are used as predictor variables for the future number of jobs. This model uses as its base period only the years 2012-2015, to circumvent the exceptional job losses during the Great Recession. The coefficients from this regression model are then applied to the future year and Woodford County populations to generate forecasts of the number of jobs in the county. The use of linear regression assumes that job change over this early period, along with the observed population change in Woodford County are good indicators of future job growth.

The calculation of the industry-specific number of jobs is grounded in the assumption that the trend in the *percentage* of total jobs that are in a specific industry is linearly increasing or decreasing. For example, if 10% of all jobs are in the construction industry in 2000 and 9.8% of all jobs are in the construction industry in 2010, 9.6% of all jobs will be forecast to be in the construction industry in 2020. This procedure will ensure that the sum of the industry-specific jobs will correspond with the total jobs forecast above.

Two exceptions to the above technique are made for manufacturing jobs. The manufacturing component of this comprehensive plan document indicates that 832 additional manufacturing jobs are expected to come online in the county in the coming years. Given the observed decline in the manufacturing sector over the 2001-2015 period, an unadjusted forecast of the number of manufacturing jobs will not inherently include this number. To account for this expected change, the manufacturing industry forecast is increased by approximately 55 jobs each year thru

2030. In addition, the trend in the percentage of total jobs that are in the manufacturing industry is measured starting in 2004 – rather than 2001 – to avoid incorporating into the future trend an exceptional and precipitous decline in manufacturing industry jobs in the early 2000’s.

### Forecasts of Employment – *Jobs Located in Woodford County*

	2001	2010	2015	2020	2025	2030
Agriculture/Forestry (11)	2,970	2,664	2,908	2,681	2,650	2,612
Mining (21)	21	10	44	40	48	56
Utilities (22)	48	44	44	38	36	33
Construction (23)	808	663	656	541	455	366
Manufacturing (31-33)	3,484	1,842	1,753	1,520	1,374	1,195
Wholesale Trade (42)	339	327	362	382	400	417
Retail Trade (44-45)	1,195	1,280	1,286	1,374	1,463	1,547
Transportation/Warehousing (48-49)	108	231	251	291	333	376
Information (51)	111	106	102	81	70	60
Finance/Insurance (52)	371	483	432	554	618	682
Real Estate/Rental/Leasing (53)	288	500	603	735	862	991
Professional/Technical/Scientific (54)	788	966	902	1,022	1,093	1,164
Management (55)	4	5	15	14	16	20
Administrative Support (56)	367	574	300	404	390	373
Educational Services (61)	264	595	724	908	1,097	1,288
Health Care/Social Assistance (62)	722	832	863	948	1,012	1,076
Arts/Entertainment/Recreation (71)	453	474	461	386	343	299
Accommodation/Food Services (72)	454	573	799	805	912	1,020
Other Services (81)	648	613	744	742	779	815
Public Administration (92)	1,127	1,655	1,620	1,975	2,176	2,378
<b>Total – All Industries</b>	14,570	14,437	14,869	15,447	16,129	16,768

Note: Annual counts for 2001-2015 are from the Bureau of Economic Analysis, with undisclosed numbers (indicated by \*) interpolated based on counts in preceding or succeeding years. Counts for 2020-2030 are KSDC employment forecasts. Numbers may not sum exactly due to rounding. Full NAICS categories: (11) Agriculture, Forestry, Fishing and Hunting, (21) Mining, Quarrying, and Oil and Gas Extraction, (22) Utilities, (23) Construction, (31-33) Manufacturing, (42) Wholesale Trade, (44-45) Retail Trade, (48-49) Transportation and Warehousing, (51) Information, (52) Finance and Insurance, (53) Real Estate and Rental and Leasing, (54) Professional, Scientific, and Technical Services, (55) Management of Companies and Enterprises, (56) Administrative Support, Waste Management and Remediation, (61) Educational Services, (62) Health Care and Social Assistance, (71) Arts, Entertainment, and Recreation, (72) Accommodation and Food Services, (81) Other Services (excluding Public Administration), (92) Public Administration.

The number of jobs located within Woodford County is forecast to increase by nearly 13% between 2015 and 2040, with growth occurring within a large number of individual industries. In general, the goods-producing industries (Agriculture and Forestry, Mining, Construction, and Manufacturing) are expected to shed jobs during this period, even after accounting for the new



manufacturing jobs that have been proposed. There are several hundred new jobs forecast in the Finance, Real Estate, and Professional sectors, as well as moderately strong growth in Transportation and Warehousing. As they are nationwide, the Education and Health Care industries are expected to continue gaining jobs. Finally, the Public Administration workforce – which includes local, state, and federal workers – is forecast to overtake Manufacturing as the county’s second largest industry (after Agriculture and Forestry).

These employment figures may not align with those from prior plans because these numbers are based on the place of work, rather than the place of residence. Place of residence jobs are discussed in the next section.

### *Employment (Workers)*

Although the BEA data are the preferred data to use in employment forecasts, the BEA does not produce employment estimates of the workers *residing* in a given county. For the forecasts of workers residing in Woodford County, the Census Bureau’s LODES data is used. As noted above, this data does not include individuals not covered by unemployment insurance, but is favored over other resident employee data sources.

For these forecasts, the number of workers in Woodford County is conceptualized as a function of temporal changes in the labor force participation rate (LFPR), as well as the size of the available labor force at a given point in time. First, the county’s LFPR in each year 2002-2014 (the available range of the LODES data) is calculated as the number of primary jobs over the population age 15 or higher. Using primary jobs in this calculation – rather than all jobs – ensures that individuals who hold multiple jobs are only counted once. The trend in the LFPR is extrapolated forward through the year 2030, and the total number of jobs in each year is forecast as the LFPR multiplied by the forecast labor force population in that year. These total job counts are used to control the industry-specific jobs discussed next.

The number of Woodford County workers within each specific industry is derived from a linear regression of the industry-specific employment 2002-2014 on the year, the LFPR in that year, and the number of jobs available in Woodford County in that industry. There is no expectation that all jobs in the county are filled by county residents; however, it is expected that greater job growth in a given industry will attract more residents employed in that industry to the county. The relationships identified in this regression model are applied to the future LFPRs and Woodford County jobs to generate forecasts of the number of county residents employed in each industry. No special adjustments are made to these forecasts.

The above framework for generating the industry-specific forecasts does not constrain the sum of the industry-specific forecasts to the total employment forecasts. Because the total employment forecasts are expected to be the more accurate series, the industry-specific worker forecasts are proportionally adjusted upward or downward to correspond with the total worker forecasts.

## Forecasts of Employment – *Workers Living in Woodford County*

	2002	2010	2015	2020	2025	2030
Agriculture (11)	409	494	559	606	638	664
Mining (21)	13	15	13	11	7	5
Utilities (22)	39	40	34	27	22	18
Construction (23)	352	354	384	344	319	292
Manufacturing (31-33)	1,838	1,404	1,348	1,174	1,023	869
Wholesale Trade (42)	365	388	415	417	416	412
Retail Trade (44-45)	990	1,082	1,145	1,152	1,152	1,142
Transportation/Warehousing (48-49)	214	261	325	364	399	429
Information (51)	166	195	207	207	213	216
Finance/Insurance (52)	286	330	329	359	365	368
Real Estate/Rental/Leasing (53)	81	104	98	113	122	132
Professional/Technical/Scientific (54)	432	549	558	621	654	679
Management (55)	50	88	90	100	109	117
Administrative Support (56)	302	429	521	563	602	634
Educational Services (61)	1,091	1,318	1,440	1,534	1,611	1,670
Health Care/Social Assistance (62)	914	1,258	1,491	1,679	1,833	1,962
Arts/Entertainment/Recreation (71)	172	191	223	210	198	184
Accommodation/Food Services (72)	572	696	933	964	1,057	1,137
Other Services (81)	204	251	272	284	295	302
Public Administration (92)	843	898	917	945	959	966
<b>Total – All Industries</b>	9,333	10,345	11,301	11,674	11,993	12,197

Note: Counts for 2002-2010 are from the Census Bureau LODES data. Although this data is likely the best available for temporal analysis of worker locations, it does not enumerate workers not covered by unemployment insurance. Counts for 2015-2030 are KSDC employment forecasts. Full NAICS categories: (11) Agriculture, Forestry, Fishing and Hunting, (21) Mining, Quarrying, and Oil and Gas Extraction, (22) Utilities, (23) Construction, (31-33) Manufacturing, (42) Wholesale Trade, (44-45) Retail Trade, (48-49) Transportation and Warehousing, (51) Information, (52) Finance and Insurance, (53) Real Estate and Rental and Leasing, (54) Professional, Scientific, and Technical Services, (55) Management of Companies and Enterprises, (56) Administrative Support, Waste Management and Remediation, (61) Educational Services, (62) Health Care and Social Assistance, (71) Arts, Entertainment, and Recreation, (72) Accommodation and Food Services, (81) Other Services (excluding Public Administration), (92) Public Administration.\

Forecasts of the number of workers living in Woodford County include workers who may hold jobs in other counties. These forecasts show the number of workers living in Woodford County increasing by approximately 13% between 2015 and 2030, a growth rate that is comparable to (albeit a little smaller) than growth in total population. Since worker growth is largely a consequence of labor force growth, this relationship is naturally expected to hold true. Employment trends in the individual industries are largely consistent with patterns occurring across the whole U.S. For example, Bureau of Labor Statistics (BLS) national employment forecasts for the 2014-2024 period show similar job losses in the Manufacturing, Information,

and Utilities sectors. The fastest growing industry in the BLS forecasts – Health Care and Social Assistance – is the 2<sup>nd</sup> fastest growing industry in the Woodford County forecasts. And BLS forecasts indicate continued growth in the Public Administration industry, with future job loss in the federal sector more than counterbalanced by future job growth in the local and state sectors.

One area in which there is significant deviation between the BLS forecasts and those presented above is in the Construction industry. The BLS predicts strong growth nationally in construction jobs, while the Woodford County figures show moderate job loss. This discrepancy is likely the result of the nature of the construction industry and the data sources used in the forecasts. The construction industry has a relatively high number of self-employed (contractor) workers and sole-proprietorships. As noted above, these workers are not counted in the LODES data used in the Woodford County projections; however, they are counted in the Current Population Survey data used to generate the BLS projections. Although this is a significant limitation of the LODES data, it is outweighed by the benefits of this data in making county-level forecasts. Nevertheless, caution should be exercised in interpreting the employment forecasts of workers living in Woodford County, particularly in those industries in which self-employment is expected to be high.