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# Population Estimates for the City of Williston

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## Introduction

Rapid expansion in the petroleum sector has led to unprecedented growth in the City of Williston. Employment opportunities in the oil and gas industry and other associated sectors (e.g., residential and commercial construction) has attracted thousands of workers fueling population growth, housing shortages and inflated housing costs. Further, rapid growth has strained existing infrastructure and the delivery of public services. Communities are struggling to manage the many challenges associated with rapid growth as well as plan for future delivery of public services and gauge response to demand for housing and infrastructure. One of the most basic metrics used to gauge response and guide planning processes is population projections. Accordingly, study objectives were to estimate the current service population of Williston and Williams County and develop a five-year service population projection. The service population includes long-term normal residents, others that may work in North Dakota and live elsewhere, and those that live in North Dakota temporarily.

## Model #1: Employment Model

Standard cohort demographic models and methods historically used to project population are inadequate due to the very rapid rate of change in western North Dakota and the unique nature of the workforce in the Williston Basin.

The U.S. Census reports normal resident population and does not count workers and others present in the state that are residents of other states. Existing demographic models lack the appropriate data to adjust birth rates, death rates and in- and out-migration rates. Further because of rapidly changing conditions, the lag associated with collection of necessary data would render projections immediately obsolete.

Because expansion in the oil and gas industry and associated employment is driving growth, a model based on oil field development was created to forecast regional employment, housing and population based on various oil and gas development scenarios. Scenarios were based on the rate (rig counts) and scope (number of wells) of oil field development. The consensus scenario used in this projection assumed economic conditions remain about the same as they were in 2012. The petroleum sector continues to grow for another 8-10 years after which employment declines. For a complete discussion of the employment model see Bangsund and Hodur (2012).

## Workforce Characteristics

Workforce characteristics vary by type of oilfield activity. The workforce for activities related to oil field services, maintenance and production are generally comprised of workers who are established permanent residents of North Dakota. They would be considered normal residents and included in U.S. Census figures.

Alternately, the workforce associated with oil field development activities such as drilling, hydraulic fracturing (fracing), construction and gathering systems construction (e.g. pipelines) often consist of workers who do not make

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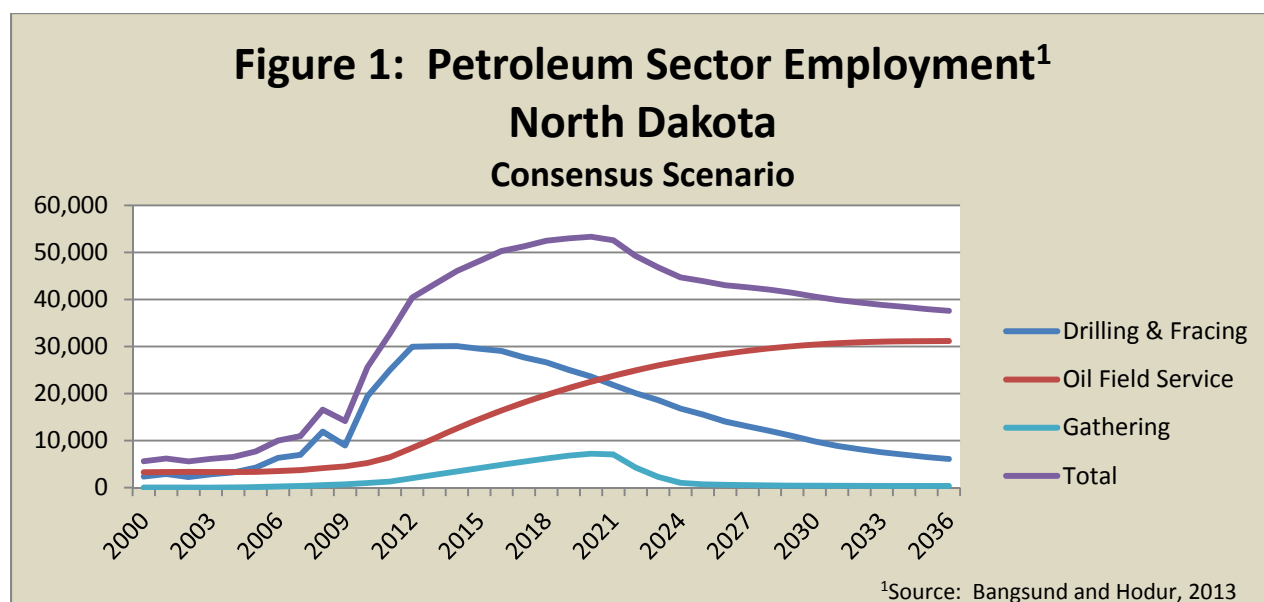
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North Dakota their permanent residence. Employment is often characterized by alternating working and non-working periods and during non-working periods workers return to their normal residence.

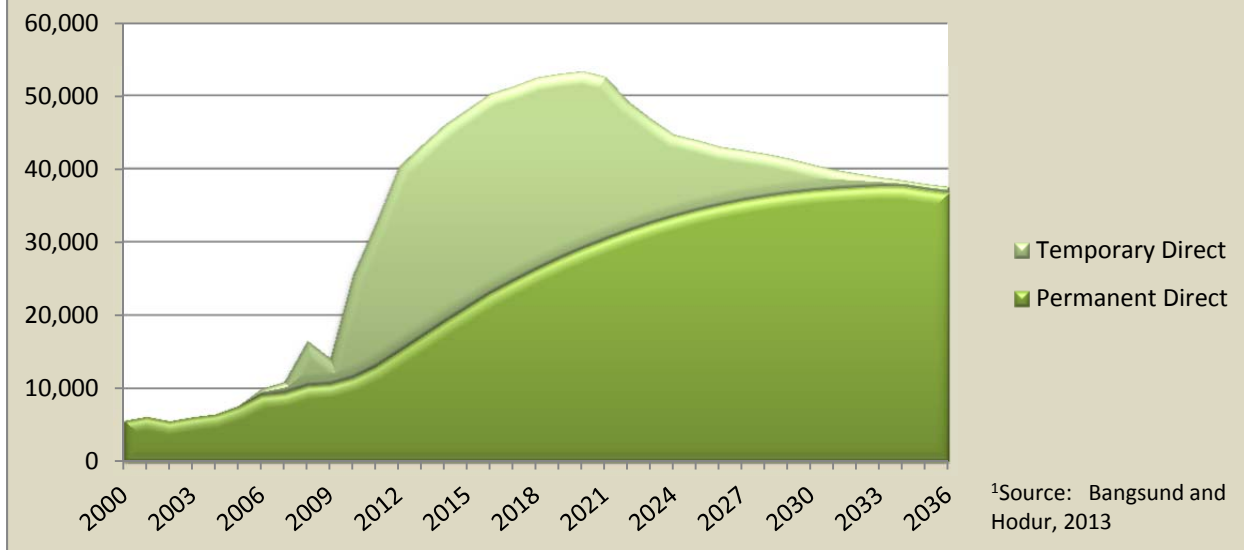
Other workers associated with oilfield development may only temporarily make their residence in North Dakota. The workforce related to pipeline construction provides a good example. When the pipeline is done, the worker moves on to the next job site. Even though workers that live in North Dakota before moving on to the next job site may be in the state for extended periods, they are viewed as temporary workers relative to the lifecycle of the oil field. Non-resident workers and

workers that live in North Dakota temporarily while they work in North Dakota are included in the service population and would not be included in the U.S. Census population.

Figure 1 illustrates employment estimates for the petroleum sector in North Dakota for the various types of activities and Figure 2 illustrates total petroleum sector employment with delineations for temporary and permanent workforce. Figure 2 illustrates the surge in temporary employment in the early years of oil field exploration and development and the steady growth in long-term permanent employment associated with oil field maintenance and service.



**Figure 2: Petroleum Sector Employment  
North Dakota  
Consensus Scenario**



#### *Employment to Housing to Population Estimates*

Employment in Williston and western North Dakota has increased demand for housing. Despite a surge in building over the past two years, housing supply is still less than demand. The employment model was used to estimate housing demand in the Williston Basin over the study period. In the near term, the model assumes one additional job equals demand for one additional housing unit. Over time, this assumption was relaxed to account for housing supply catching up with housing demand. Housing demand was used to estimate population potential based on historic occupancy rates for various housing types.

Williston trade area housing demand was allocated by county based on the historic distribution of housing. Two types of housing demand were estimated: demand for permanent housing based on permanent employment projections and total housing demand based on permanent and temporary

employment estimates. Housing demand was then converted to estimates of population potential using historic occupancy rates and emerging trends for various types of housing. The result was two population estimates, one estimate for permanent population and another for the service population which consists of both permanent and temporary population.

Population estimates for the city of Williston were based on the historic distribution of the percentage of Williams County population that resides in the city of Williston, 65.7 percent. A second estimate assumed that six Williams County townships (Williston, Judson, Missouri, Pherrin, Strony Creek and Trenton) were functionally part of the city of Williston and may in the future be annexed and become part of the city. The city of Williston and the 6 surrounding townships make up 80.5 percent of the population of Williams County. See Table 1 for historic population distributions for Williston and the six surrounding townships.

**Table 1. 2010 U.S. Census Population, City of Williston, Select Williams County Townships and Williams County, North Dakota**

County Subdivision	Population		% of Williams County
Williams County	22,398		100.0
City of Williston	14,716	14,716	65.7
Williston Township		1,307	
Judson Township		130	
Missouri Ridge Township		496	
Pherrin Township		276	
Stony Creek Township		558	
Trenton Township		541	
Subtotal, Williston and Six Surrounding Townships		18,024	80.4

The 2010 U.S. Census population for the city of Williston was 14,716 and for Williams County was 22,398 (Table 2). Using the employment model, the 2012 estimated *permanent* population in Williston and Williams County was 17,792 and 27,081, respectively. The 2012 *service* population for Williston and Williams County was estimated to be 33,547 and 51,061, respectively. Projected 2017 permanent population for Williston and Williams County was 28,658 and 43,619, respectively. Projected service population in 2017 for Williston and Williams County was 43,993 and 66,960, respectively, a 134 percent increase.

When the six surrounding townships were included in the estimate of Williston, the projections naturally increase. The 2010 Census population for Williston and the six surrounding townships was 18,030. The 2012 estimated

*permanent* population for Williston and the six surrounding townships was 21,800 and the *service* population was estimated to be 41,104. The 2017 estimated permanent population for Williston and the six surrounding townships was 35,113 and the service population was estimated to be 53,903.

The increases in population for both the permanent and service population were substantial. Permanent population change from 2010 to 2012 was estimated to be approximately 21 percent, while the change in 2012 estimated service population compared to 2010 Census population was nearly 128 percent. In 2017 permanent and service population was projected to increase by 61 percent and nearly 134 percent over 2012 estimates, respectively. Employment model population estimates are detailed in Table 2.

**Table 2. Population Estimates, Employment Model, Consensus Scenario, Williams County, City of Williston and Six Surrounding Townships.**

	Williams County		City of Williston <sup>1</sup>		City of Williston and 6 surrounding townships <sup>2</sup>	
Item	Permanent Population <sup>3</sup>	Service Population (permanent and temporary) <sup>4</sup>	Permanent Population <sup>3</sup>	Service Population (permanent and temporary) <sup>4</sup>	Permanent Population <sup>3</sup>	Service Population (permanent and temporary) <sup>4</sup>
2010	22,398 <sup>5</sup>	22,398	14,715 <sup>5</sup>	14,715	18,030 <sup>5</sup>	18,030
2012	27,081	51,061	17,792	33,547	21,800	41,104
Change 2010-2012	4,683	28,663	3,077	18,832	3,770	23,074
Percent Change 2010-2012	20.9%	127.9%	20.9%	127.9%	20.9%	127.9%
2017	43,619	66,960	28,658	43,993	35,113	53,903
Change 2012-2017	16,538	15,899	10,866	10,446	13,313	12,799
Percent Change 2012-2017	61.0%	31.0%	61.0%	31.0%	61.0%	31.0%
<sup>1</sup> City of Williston is 65.7% of the population of Williams County.						
<sup>2</sup> City of Williston and 6 surrounding townships is 80.5% of the population of Williams County.						
<sup>3</sup> Population associated with permanent workforce.						
<sup>4</sup> Population associated with permanent and temporary workforce.						
<sup>5</sup> Source: 2010 Census. No estimate for service population in 2010. Census population only.						

#### *Key Assumptions: Employment Model*

Employment model population estimates represent population potential. The estimates for Williston and Williams County were based on housing demand and the model assumes that the demand for housing is met. The model also assumes historic population distributions remain valid. However, it is possible that the distribution of housing may change over time, (e.g., the city of Williston may have a greater or lesser proportion of county population). Housing distribution may change depending on where housing demand is met. The petroleum industry workforce is mobile and may not live in the same place as their job. The workforce will live where housing is available.

The employment model assumes that historic occupancy rates are valid. Anecdotal evidence suggests historic occupancy rates may, in some cases, underrepresent current conditions (e.g., double ups and multiple families sharing

housing due to high cost of living). In other cases, historic occupancy rates may overstate current conditions as some workers are unaccompanied by spouses and dependents. It also is possible that due to acute housing shortages and expensive housing costs, unaccompanied workers may double up and share housing to help alleviate high housing costs. With no information available to suggest to what degree historic occupancy rates may have appreciably changed, historic occupancy rates were used and assumed to remain valid.

The employment model also assumes that the temporary workforce has similar characteristics as the permanent workforce, (e.g. occupancy rates, demographics). In some cases, this assumption may overestimate service population as some workers are only present in the state during work periods and are unaccompanied by their families. Alternately, some of the temporary workforce has similar characteristics as the permanent population

because some workers relocate to North Dakota for extended periods, ranging from several months to several years. Reports from community leaders and industry experts support the premise that at least some portion of the temporary population has characteristics similar to the permanent population (Personal Conversations, 2012). No data on workforce characteristics were available to suggest to what degree demographic characteristics of the service population may be different or the same as the historic permanent population.

The model is sensitive to changes in key variables. For example, small changes in occupancy rates result in substantial changes in projections. The model also lacks a good baseline. The model's baseline is the 2010 census which did not capture the substantial service population already present in the region in 2010. There was no estimate of the service population for 2010. Accordingly, the percentage change in estimated 2012 service population compared to the 2010 Census is very large. The actual percentage change is likely less due to the lack of a 2010 service population estimate that included the service population already present in Williston.

#### Model #2: Build-out Model

Data were collected from multiple sources to inventory non-traditional housing, such as hotels, crew camps, RV camps and housing permitted via conditional use permits. The model also estimated the number of new housing units constructed since 2010 and estimated the 5-year housing build-out potential by inventorying new housing developments and estimating the number of housing units for each development. Housing data were collected for Williston and Williams County. Other incorporated cities in Williams County were not included in the assessment. Most of the data collected for the build-out model were primary data provided by the city of Williston and Williams County.

Upon completion of an inventory of the various types of housing units, occupancy rates were applied to the total number of each type of housing unit. Historic occupancy rates for traditional housing units, (single family homes, apartments, mobile homes) were applied to the total number of units built since 2010 to estimate the 2012 permanent population. The 2012 service population was estimated by applying appropriate occupancy rates for various types of non-traditional housing (e.g., hotels, RVs, crew camps) and summing with permanent population estimates. Occupancy rates for hotels were assumed to be 1.2 persons per room (Bangsund and Hodur 2012) and RV camps were assumed to have 1.5 persons per unit (Bangsund et al, 2012). Number of permitted beds was used to estimate service population for housing permitted under conditional use permits and crew camps.

Historical occupancy rates were applied to the number of housing units in approved and platted housing developments and likely residential annexations to estimate future population potential. Because no data exist to suggest whether population associated with non-traditional housing will increase or decrease, the model assumes there would be no change. Considering it is likely that economic activity will remain at current levels for the next 6-8 years (consistent with employment model assumptions), it is reasonable to assume that the use of non-traditional housing will remain at current levels. Non-traditional housing will remain an important component in meeting the demand for temporary housing for the temporary workforce. The same assumption was applied to future levels of non-traditional housing in Williams County.

The 2012 service population for Williston was estimated to be 25,349. Population associated with housing units constructed since 2010 was estimated to be just over 7,000 with another nearly 3,600 associated with non-traditional housing; hotels, crew camps and housing

permitted with conditional use permits.  
Population potential associated with the build-out of known housing developments resulted in

an estimated increase in service population of 14,000 for an estimated 2017 service population for the City of Williston of 39,679.

<b>Table 3. Service Population Estimates, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2012 and 2017.</b>							
Item	Service Population Estimate <sup>1</sup> 2012			Service Population Projection <sup>1</sup> 2017			
<b>Williston:</b>							
Census Population , 2010	14,716						
Hotels, Crew Camps, Condition Use Permits	3,592						
Estimated Housing Units Constructed 2010-2012	<u>7,041</u>						
Estimated Service Population, 2012	<u>25,349</u>	25,349		25,349			
5-year housing build-out				<u>14,330</u>			
Estimates Service Population, City of Williston, 2017				<u>39,679</u>	39,679		
<b>Surrounding Townships<sup>2</sup>:</b>							
Census Population , 2010	3,308						
Hotels, Crew Camps, Condition Use Permits	7,234						
Estimated Housing Units Constructed 2010-2012	<u>1,057</u>						
Estimated Service Population, Surrounding Townships, 2012	<u>11,599</u>	<u>11,599</u>		11,599			
Estimated Service Population, Williston and Surrounding Townships, 2012		<u>36,948</u>	36,948				
5-year Housing Build-out Surrounding Townships				<u>2,035</u>			
Estimated Service Population, Surrounding Townships, 2017				<u>13,634</u>	<u>13,634</u>		
Estimated Service Population, City of Williston and Surrounding Townships, 2017					<u>53,313</u>	53,313	
<b>Williams County:</b>							
2010 Census Population, Williams County (excluding Williston and Surrounding Townships)	4,374						
Hotels, Crew Camps, Conditional Use Permits	6,063						
Estimated Housing Units Constructed 2010-2012	<u>0</u>						
Estimated Service Population, Williams County (excluding Williston and Surrounding Townships)	<u>10,437</u>		<u>10,437</u>			10,437	
Total Estimated Service Population, Williams County (including Williston and Surrounding Townships), 2012			<u>47,385</u>				
5-year housing build-out						4,426	
Total Estimated Service Population, Williams County (excluding Williston and Surrounding Townships), 2017						<u>14,863</u>	<u>14,863</u>
Total Estimated Service Population, Williams County (including Williston and Surrounding Townships), 2017							<u>68,176</u>
<sup>1</sup> Population associated with permanent and temporary workforce.							
<sup>2</sup> Williston, Judson, Missouri, Pherrin, Stony Creek, and Trenton Townships.							

The 2012 service population for Williston was estimated to be 25,349. When the service population in the six surrounding townships and additional housing constructed since 2010 in the six surrounding townships was included, the 2012 service population for Williston was estimated to be 37,000. The 2012 service population for Williams County, including the city of Williston, was estimated to be just over 47,000. Population associated with non-traditional housing, specifically hotels, crew camps and housing units permitted with conditional use permits in Williams was estimated to be over 13,000 with 54 percent (7,234) located in the six surrounding townships.

The estimated build-out for Williston could be expected to lead to an increase in population of 13,600. An additional 2,000 population increase was estimated as a result of potential build-out in the six surrounding counties for an estimated 2017 service population of over 53,000 for Williston and the six surrounding townships.

The estimated build-out for Williams County (not including Williston) could be expected to result in an increase in population of over 4,000 for a total estimated 2017 service population for Williams County (including Williston) of 68,176. Service population estimates associated with the build-out model are detailed in Table 3.

*Key Assumptions: Build-out Model.*

Like the employment model, the build-out model represents population potential based on the assumption that housing in approved developments and likely annexations will be constructed. Build-out time was based on data provided by Williston and Williams County. For developments that have not yet started construction, and there was no estimate of planned rate of development, the build-out time was assumed to be five years.

The build-out model, like the housing model, assumes occupancy rates for traditional housing units were the same as historic rates. As was the case with the employment model, data were not available to suggest otherwise. Barring the availability of additional data, the use of historic occupancy rates will remain the only available option.

*Model Comparison*

A comparison of the two models reveals that at the county level, the two estimates are remarkably similar, with only a seven percent difference in the estimate of the 2012 service population and a two percent difference in the 2017 population estimate. The employment and housing models estimated the 2012 Williams County service population to be about 51,000 and 47,000, respectively (Table 4).

Alternately, an initial comparison of the two models for Williston suggests substantial disparity in the projections. The housing model suggests a 2012 estimated service population of just over 25,000 compared to the employment model estimate of over 33,000, a 28 percent difference. The two estimates of the 2017 service population were more closely aligned. The housing model projects 2017 service population for Williston of over 39,000 while the employment model suggested a projected population of 44,000, a 10 percent difference (Table 4).

Assumptions about how Williston is defined affect model results. If the service population of the six surrounding townships is included in Williston's population estimates, the estimates were more closely aligned. When the six surrounding townships were included, the 2012 estimated service population for Williston was 37,000 compared to 41,000 for the employment model, a 10 percent difference. An estimated service population of approximately 13,000 reside in non-traditional housing units in Williams County, of which over 7,000 reside in non-traditional housing in the six surrounding townships. Including the service

population that lives just outside city limits in the six surrounding townships in the estimate of the city of Williston brings the two estimates more in line with each other. Including the six

surrounding townships in the 2012 and 2017 estimated service population brings the estimates from the two models to within 10 percent and less than 1 percent (Table 5).

**Table 4. Comparison of Estimated Service Population, Employment Model and Housing Model, City of Williston and Williams County, 2012 and 2017**

Item	Estimated Service Population		Estimated Service Population	
	2012		2017	
	Employment Model	Housing Model	Employment Model	Housing Model
Williston	33,547 <sup>1</sup>	25,349 <sup>2</sup>	43,993 <sup>1</sup>	39,679 <sup>2</sup>
Percent Difference	27.8%		10.3%	
Williams County (excluding Williston)	17,514	22,036	22,697	28,497
Percent Difference	22.8%		22.6%	
Total	51,061	47,385	66,690	68,176
Percent Difference	7.5%		2.2%	
<sup>1</sup> Assumes City of Williston is 65.7 percent of Williams County population.				
<sup>2</sup> City of Williston only.				

**Table 5. Comparison of Estimated Service Population, Employment Model and Housing Model, City of Williston Including 6 Surrounding Townships and Williams County, 2012 and 2017**

Item	Estimated Service Population		Estimated Service Population	
	2012		2017	
	Employment Model	Housing Model	Employment Model	Housing Model
Williston	41,104 <sup>1</sup>	36,948 <sup>2</sup>	53,903 <sup>1</sup>	53,313 <sup>2</sup>
Percent Difference	10.6%		>1%	
Williams County (excluding Williston and 6 surrounding townships)	9,957	10,437	12,787	14,863
Percent Difference	4.7%		15.0%	
Total	51,061	47,385	66,690	68,176
Percent Difference	7.4%		2.2%	
<sup>1</sup> Assumes City of Williston is 80.5 percent of Williams County population.				
<sup>2</sup> City of Williston and six surrounding townships.				

### Conclusions, Implications, and Need for Study

Because of the unique circumstances present in western North Dakota, traditional population modeling tools were not appropriate for estimating the current or future service population in the city of Williston. Two methods were used to estimate the current and future service population of the City of Williston and Williams County. Both methods resulted in similar results which enhances confidence in the estimates.

Findings quantified the current and projected service population in Williston using two distinct models, based on different metrics; employment and housing. The housing model and the employment model estimated Williston's current service population to be 25,000 and 33,000, respectively. When the six surrounding townships were included in the estimate, the housing model and the employment model estimated Williston's current service population to be 37,000 and 41,000, respectively.

Both models project that the permanent and service population in Williston is likely to continue to grow at a high rate in the near term. The housing model projected the 2017 service population for Williston to increase to just under 40,000 and the employment model projected the 2017 service population for Williston to increase to 44,000. When the six surrounding townships were included in the projected service population, the housing model and the employment model projected the 2017 Williston service populations to be 53,000 and 54,000, respectively.

The estimates of current service population and projected increases suggest continued high demand for and strain on infrastructure and public services. Although a portion of the service population related to the temporary

workforce will ultimately move on to the next job site, they will use and require housing, infrastructure and public services while working and living in North Dakota. Even if only permanent population growth is considered, the employment model projects a 60 percent permanent population increase in Williston of nearly 10,000 (not including six surrounding townships) to just over 13,000 (including six surrounding townships), in just 5 years.

Findings would suggest that housing development in Williston appear to be in line with industry expectations for future employment growth and demand for housing associated with that growth. Based on model projections, it does not appear that Williston is in danger of overbuilding in the near term. Projections for continued increase in service population also underscore the continued need for temporary housing to meet the housing needs of the service population associated with transient employment.

Models should be updated and the data base of housing development maintained to track new annexations and zoning, platting and permitting of new housing developments. If housing build-out is constantly monitored, the housing model can easily be updated to reflect the dynamic conditions present in Williston and Williams County.

Further study is needed to refine the understanding of workforce characteristics. A better understanding of workforce characteristics would enable model refinements and improved estimates of both future permanent and service (temporary and permanent) populations.

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