



Agribusiness & Applied Economics Report 742

● May 2015

# Service Population Estimates for City of Williston

Nancy M. Hodur ● Dean A. Bangsund



**NDSU** AGRIBUSINESS AND  
APPLIED ECONOMICS

North Dakota State University Fargo, ND 58108

NDSU is an EO/AA university

## Acknowledgments

Much of the data used for this research effort came from city administrators and others with knowledge of the petroleum sector in the state. Special thanks to everyone who contributed information and insight to this study.

Special thanks are extended to:

Brad Bekkedahl, Commissioner, City of Williston  
John Kautzman, Auditor, City of Williston  
Kent Jarcik, Director Planning and Zoning, City of Williston  
Rachel Ressler, Staff Planner, City of Williston  
Donald Kress, Staff Planner, City of Williston  
Darcy Anderson, Assessor, Williams County  
Katie Lima, Building Official, Williams County  
Kylene Murphy, Staff Planner, Williams County  
Taylor Corbett, Staff Planner, Williams County  
Amy Kruger, Director, Williston Convention and Visitors Bureau

Financial support was provided by the City of Williston. We express our appreciation for its support.

Thanks are extended to Karen Olson, Center for Social Research, North Dakota State University for assistance with U.S. Census data. Thanks are extended to Norma Ackerson for preparation of document materials and Edie Nelson for her work with graphics and document preparation.

The authors assume responsibility for any errors of omission, logic, or otherwise. Any opinions, findings, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the view of the Department of Agribusiness and Applied Economics, North Dakota State University, or the study sponsors.

North Dakota State University does not discriminate on the basis of age, color, disability, gender expression/identity, genetic information, marital status, national origin, public assistance status, race, religion, sex, sexual orientation, or status as a U.S. veteran. This publication is available electronically at this web site: <http://agecon.lib.umn.edu/>. Please address your inquiries regarding this publication to: Department of Agribusiness & Applied Economics, P.O. Box 6050, Fargo, ND 58108-6050, Phone: 701-231-7441, Fax: 701-231-7400, Email: [ndsu.agribusiness@ndsu.edu](mailto:ndsu.agribusiness@ndsu.edu).

NDSU is an equal opportunity institution.

Copyright © by Hodur and Bangsund. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided this copyright notice appears on all such copies.

## TABLE OF CONTENTS

	<u>Page</u>
List of Tables .....	ii
Executive Summary.....	iii
Introduction .....	1
Objectives.....	1
Rational for Service Population Estimate .....	2
Methodology Housing Build-out Model .....	3
Service Population Estimates, 2014.....	5
Adjustments to 2012 Estimates of Service Population.....	8
Change in Service Population, 2012-2014 .....	9
Service Population Potential Projections.....	10
Sensitivity Analysis .....	11
Key Assumptions of Build-out Model .....	14
Conclusions, Implications and Need for Further Study .....	14
References .....	16

**List of Tables**

<u>Title</u>	<u>Page</u>
1 Total Resident Population, 2011-2014 Estimated Population, City of Williston, Select Williams County Townships and Williams County, North Dakota.....	3
2 Person’s Per Household Occupancy Rates, Williston and Williams County, 2014.....	4
3 Service Population Estimate, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2014.....	7
4 Adjustments to 2012 Service Population Williston, Six Surrounding Townships and Williams County .....	9
5 Percentage Change 2012 Adjusted Service Population to 2014 Service Population Estimates, Williston, Six Surrounding Townships, and Williams County, 2014.....	10
6 Comparison of 2012 Service Population Estimates and 2014 Service Population Estimates, Williston, Six Surrounding Townships and Williams County, 2014.....	10
7 Potential Housing Unit Build Out, Housing Model, City of Williston, Six Surrounding Townships and Williams County .....	11
8 Service Population Potential, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2014.....	12
9 Service Population Estimate, Housing Model, City of Williston, Six Surrounding Townships and Williams County, Sensitivity Analysis Based on Reduction in Occupied Units, 2014 .....	13

## Executive Summary

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) have 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.

Study objectives were to estimate the current service population of Williston and Williams County and develop a five-year service population potential. 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. A similar effort was undertaken in 2012 and this research updates the previous estimates of the service population in Williston and Williams County (Hodur and Bangsund 2013, Hodur and Bangsund 2013a).

Models, methodologies and strategies used in the past to assess changes in the economy were not well-suited to model the effects of the rapid growth in the petroleum sector. The unique nature of the circumstances in western North Dakota renders many of the tools traditionally used to model economic, demographic, and fiscal impacts ineffective. Traditional models do not accurately reflect the effects of rapid and wide-spread expansion of regional employment that has occurred in the Williston Basin. Accordingly, a new model based on an inventory of traditional and non-traditional housing was developed to estimate current and projected service population potential. Service population was defined as the sum of the resident population obtained from the U.S. Census Bureau and the population that works in the Williston area but maintains a residence elsewhere. The housing build-out model used a combination of information from the U.S. Census Bureau, informal lodging arrangements, and housing completions since the 2010 Census. Anticipated housing build-out rates were used to estimate near-term population potential.

Findings quantified the current and projected service population in Williston and Williams County. The housing model estimated Williston's current service population to be just over 31,000. When the six surrounding townships were included in the estimate, Williston's service population was estimated to be just over 42,000. The percentage change in service population from the previous estimate made in 2012 was substantial. The service population in Williston grew from nearly 26,000 in 2012 to 31,000 in 2014, a 20 percent increase. The service

population estimate is consistent with observed water flows in the city's waste water treatment plant.

A comparison of the 2012 service population projections for 2014 and 2014 service population estimates found the two estimates strikingly similar and well within an acceptable range. The 2012 projection for 2014 service population for Williston was 32,692 and the 2014 service population estimate was 31,143, a 5 percent overestimate. The 2012 estimate for Williston and the six surrounding townships underestimated the 2014 service population by about 5 percent. On a county wide level, the numbers were nearly identical. 2012 projections for 2014 service population was estimated to be 53,262 and 2014 service population was estimated to be 52,778, an approximately 1 percent difference.

To assess the potential implications of a reduction in occupied units on 2014 service population estimates, a sensitivity analysis was completed. Sensitivity analysis suggests that even with reduced utilization of non-traditional housing, the service population has grown substantially. Assuming reduced utilization of permitted capacity to 70 percent for crew camps and special and conditional use permits, 60 percent for RVs and 90 percent for traditional housing, service population estimates for Williston was reduced by 5 percent to approximately 29,000, which still represents a substantial 14 percent increase in two years.

Population potential associated with the build-out of known housing developments resulted in an estimated increase in service population over the five year study period of 17,931 for an estimated 2019 service population potential for the City of Williston of 49,074. Population potential from build out of approved housing developments for the six surrounding townships of Williston, Judson, Missouri Ridge, Pherrin, Stony Creek and Trenton could be expected to lead to an increase in population of 793 over the five year study period for an estimated 2019 service population of approximately 12,000. The estimated build-out for the remainder of Williams County (not including potential build out in other incorporated areas) could be expected to result in an increase in population of nearly 1,029 for a total estimated 2019 service population of approximately 11,000. Projected 2019 service population potential for Williams County was 72,000 (does not included population potential from build out in other incorporated areas).

The estimates of current service population and projected increases suggest continued high demand for and strain on infrastructure and public services. Even with the recent slowdown in drilling activities, the major economic driver of change, the oil and gas industry is still expanding, albeit at a slower rate. The recent slowdown in drilling activities has not eliminated the need for a substantial workforce for maintenance and operations of existing new wells. Although a portion of the service population related to the temporary workforce will ultimately

move to another job site, they will use and require housing, infrastructure and public services while working and living in North Dakota.

# **Service Population Estimates for the City of Williston**

Nancy M. Hodur and Dean A. Bangsund<sup>1</sup>

## **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) have 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. Models, methodologies and strategies used in the past to assess changes in the economy were not well-suited to model the effects of the rapid growth in the petroleum sector. The unique nature of the circumstances in western North Dakota renders many of the tools traditionally used to model economic, demographic, and fiscal impacts ineffective. Traditional models do not accurately reflect the effects of rapid and wide-spread expansion of regional employment that has occurred in the Williston Basin. The time lag associated with Census Bureau's population estimates often makes the data of little value. Estimates of current population are complicated by how the U.S. Census defines residency and the nature of the oil and gas industry workforce. U.S. Census Bureau estimates do not include non-resident workers or those that may be in the state temporarily. An alternative methodology and population definition was needed to gauge current population and population potential in Williston and Williams County.

## **Objectives**

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 work in North Dakota and live elsewhere, and those that live in North Dakota temporarily. A similar effort was undertaken in 2012 and this effort updates the previous estimates of the service population in Williston and Williams County (Hodur and Bangsund 2013, Hodur and Bangsund 2013a).

---

<sup>1</sup> Research assistant professor and research scientist, respectively, Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.

## **Rationale for Service Population Estimate**

The oil and gas industry workforce consists of both resident and non-resident workers. The substantial non-local workforce is a function of the nature of the work tasks and workforce characteristics. For example, much of the workforce associated with oil field development activities such as drilling, hydraulic fracturing (fracing), construction and gathering systems construction (e.g., pipelines) and other specialized construction (e.g. refining and processing construction) often consist of workers who do not make North Dakota their permanent residence. For those workers, 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 or processing facilities construction provides a good example. When their job on the pipeline or processing facility is complete, the worker moves to the next job site. Other jobs may be characterized by high turnover. Non-resident workers and workers who reside in North Dakota only temporarily while they work in North Dakota are not included in the decennial census or in population estimates provided by the U.S. Census Bureau. The U.S. Census Bureau reports resident population only and does not count workers and others present in the state that are residents of other states. Lack of available housing and cost of housing may also contribute to the large non-resident workforce in North Dakota.

Even though some workers are not considered “residents” they still require public and private goods and services, such as housing, access to health care, public services such as police and fire protection, access to schools, and retail and entertainment options. An understanding of the size of the service population is critical for public policy makers, economic developers and business and investors as they plan for and make decisions regarding the delivery of current and future public and private goods and services. Because of the shortcomings of U.S. Census Bureau estimates, an alternative definition of population that includes the substantial non-resident population was needed. The term “service population” was coined and is defined as the sum of the resident population and others who work or reside in Williston but do not meet the residency criteria as defined by the U.S. Census Bureau. This includes non-resident workers that maintain residency elsewhere or others who reside in Williston or Williams County temporarily.

The U.S. Census Bureau estimates the resident population for Williams County as of July 2014 at just over 32,000 (U.S. Census Bureau, 2015). The most recent estimates for Williams County subdivisions are for 2013. Census estimates for Williston for 2013 were nearly 21,000 (U.S. Census Bureau, 2013). It is widely acknowledged that these numbers do not accurately represent the actual conditions in Williston and regionally. By definition, the U.S. Census

Bureau does not account for the substantial non-resident workforce present in North Dakota. Census Bureau population estimates for Williams County, Williston and the six surrounding townships are detailed in Table 1.

<b>Table 1. Total Resident Population, 2010, 2011- 2014 Estimated Population, City of Williston, Select Williams County Townships and Williams County, North Dakota.</b>					
<b>County Subdivision</b>	<b>2010 Census Population<sup>1</sup></b>	<b>2011 Population Estimate</b>	<b>2012 Population Estimate</b>	<b>2013 Population Estimate</b>	<b>2014 Population Estimate</b>
Williams County	22,398	24,379	26,686	29,563	32,130
City of Williston	14,716	16,205	18,310	20,850	NA
Williston Township	1,307	1,327	1,357	1,413	NA
Judson Township	130	139	143	149	NA
Missouri Ridge Township	496	531	538	560	NA
Pherrin Township	276	286	279	270	NA
Stony Creek Township	558	596	604	628	NA
Trenton Township	541	576	585	608	NA
<sup>1</sup> U.S. Census Bureau, 2015. American FactFinder <i>2010 Census</i> . <sup>2</sup> U.S. Census Bureau, 2015. Annual Estimates of the Resident Population. <sup>3</sup> Not available.					

### **Methodology Housing Build-out Model**

Because of rapid expansion in the oil and gas industry and the unique nature of the regional workforce, a model based on housing inventory was developed to make an estimate of the service population in Williston and Williams County. The service population is defined as the sum of the resident population (census population), and others that work in North Dakota but maintain their residence elsewhere, or are only in the state temporarily. Service population was calculated based on an inventory of housing, both traditional (e.g., single family homes, apartments) and non-traditional (e.g., crew camps, RV parks) housing that has been added since 2010. Person per household occupancy rates units were applied to the inventory of housing added since 2010 and added to the 2010 Census population, which served as the baseline population.

Primary data were collected from multiple sources to inventory non-traditional housing, such as hotels, crew camps, RV camps and housing permitted via conditional and special use permits. The model also estimated the number of new housing units constructed since 2010 and the five year housing build-out potential. The number of new housing units constructed was estimated using building permit data collected from Williston and Williams County. Population potential was estimated by inventorying new housing developments and estimating potential future build out of approved developments. Housing data were collected for the city of Williston, the six surrounding townships of Williston, Judson, Missouri Ridge, Pherrin, Stony Creek , and

Trenton, and the remainder of Williams County. Other incorporated cities in Williams County were not included in the estimate of service population potential. Population of other incorporated areas is included in the baseline (2010) population. 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 the City of Williston and Williams County as reported by the U.S. Census Bureau’s American Community Survey (U.S. Census, 2015) were applied to the total number of traditional housing units (single family homes, apartments, mobile homes)(Table 2). Occupancy rates for various types of non-traditional housing (e.g., hotels, RVs, crew camps) were based on observed data and personal conversations with local officials and applied to the inventory of non-traditional housing stock. Persons per room were estimated to be 1.2 persons for hotels (Bangsund and Hodur 2012, Kruger, 2014) and RV camps were assumed to have 1.5 persons per unit (Bangsund et. al, 2012 and Murphy 2014). The percentage of hotel rooms used as workforce housing and annual occupancy rates were based on a survey of local hotel operators. Number of housing units for RVs parks, and special and conditional use permits was based on number of permitted beds for conditional use permits and crew camps and number of permitted sites for RV camps. Occupancy rate assumptions related to number of permitted housing units and persons per household are consistent with the previous estimate of service population.

	<b>Williams County</b>	<b>Williston</b>
Single Family Home	2.50	2.40
Multi-family 1-3 units	1.49	1.52
Multi-family 4 or more units	1.93	1.98
Mobile	2.27	2.33
All	2.34	2.26

<sup>1</sup>Source: U.S. Census Bureau, 2009-2013 American Community Survey (ACS) 5-Year Estimates, Tables B25024, B25032, and B25033

Historical occupancy rates were applied to the number of traditional housing units (e.g. single family home, apartments) in approved and platted housing developments to estimate future population potential in Williston and Williams County. Housing developments in other incorporated areas were not included in the estimate of service population potential for Williams County. Data on type and size of housing developments was provided by City and County Planning Departments. Build out times were based on discussions with City of Williston planning department staff familiar with the planned development (Jarcik, Ressler, Kress, 2014). Most developments with the exception of those that were nearly complete were assumed to have a five year build out. Other developments were assigned a one, two or three year build out based on the percentage completed and planning department staff’s personal knowledge

of construction plans. This is consistent with the assessment done in 2012 (Hodur and Bangsund, 2013, Hodur and Bangsund 2013a).

An estimate of future service population based on non-traditional housing is difficult. Exactly how inventories of non-traditional housing may change in the future is unknown. The large non-resident workforce, continued high cost of traditional housing stock and seasonal variability (e.g., season construction) in workforce mean non-traditional housing will remain an important component in housing supply in at least the near term. 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. This is consistent with the previous assessment (Hodur and Bangsund, 2013, Hodur and Bangsund 2013a). While the downturn in crude oil prices has resulted in a slowdown in the oil and gas industry drilling activity in late 2014, drilling and development activities are ongoing, albeit at a slower pace than in 2012, 2013, and 2014. Even with the recent slowdown, housing and demand for affordable housing is still a major issue. While housing stocks are not as constrained as in 2012, it is assumed that building activities and demand for housing will continue to be strong.

Unemployment rates are still low indicating a tight labor market. Considerable infrastructure and construction activities remain and the 12,000 wells that have been drilled in the past five years all require a workforce to maintain and operate. Substantial construction activities are planned for the near future as communities continue to play “catch up” after the industry’s rapid expansion. Assuming prices recover over time, oil and gas drilling activities could quickly ramp up to levels similar to those seen in the last few years. For the purpose of this study, the build out assumptions remain the same as the 2012 study and assume continued strong demand for housing.

#### **Service Population Estimates, 2014**

The 2014 service population for Williston was estimated to be 31,143. Population associated with housing units constructed since 2010 was estimated to be just over 12,000 with population of nearly 4,200 associated with non-traditional housing; namely motels, crew camps and housing permitted with conditional and special use permits (Table 3).

The 2014 service population for the six surrounding townships (Williston, Judson, Missouri Ridge, Pherrin, Stony Creek and Trenton) was estimated to be just over 11,000. A substantial amount of temporary housing is permitted in the six surrounding townships. Service population associated with RV camps, crew camps and conditional use permits was estimated to be approximately 5,800. Service population associated with newly constructed traditional housing was estimated to be just over 2,100. The service population in the six surrounding townships and Williston was estimated to be 42,363 (Table 3).

The service population estimate for 2014 is consistent with estimates made by the Williston City Public Work Department. Average waste water flow is estimated to be 80 gallons per

person per day (Hanson, 2014). Accordingly, a service population of 31,000 would be expected to use approximately 2.5 million gallons per day. Average daily water flows through the City's waste water treatment plant in 2014 averaged 2.39 million gallons per day ranging from a low of 2.22 million gallons per day in February 2014 to a high of 2.51 in October and November 2014 (Hanson, 2014). Using average annual flow data to calculate service population would result in an estimated service population of 29,875 (2,390,000 gallons/80 gallons per person per day). While flow data may not be the most precise measure of service population, the flow data supports the service population estimate made using the housing model.

The 2014 service population for the remainder of Williams County was estimated to be just over 10,400. Like the six surrounding townships, a substantial portion of Williams County service population is associated with RV camps, crew camps, and conditional use permits. Crew camps, RV parks, special use permits in other incorporated areas were not included in the service population estimate for Williams County. Population associated with non-traditional housing in Williams County was estimated to be 4,483. Total Williams County service population, including the city of Williston, and the six surrounding township was estimated to be just over 52,700. Service population estimates for Williams County do not include service population in other incorporated areas. Service population estimates associated with the build out model are detailed in Table 3.

**Table 3. Service Population Estimate, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2014.**

<b>Williston</b>	----- service population -----				
2010 Census Population				14,716	
Hotels					
Workforce Service Population	536				
Regular Travel Service Population	<u>1,565</u>				
Total Hotel Service Population	<u>2,101</u>		2,101		
Crew Camps, Permitted Housing		<u>1,231</u>			
Crew Camps, Permitted Housing-Previously in Williams County		858			
Total Crew Camps, Permitted Housing		<u>2,089</u>	<u>2,089</u>		
Total Hotels, Crew Camps, Permitted Housing/Hotels			<u>4,190</u>	4,190	
New Housing 2010-2014				<u>12,237</u>	
<b>Estimated Service Population Williston</b>				<u>31,143</u>	31,143
<b>Surrounding Townships<sup>1</sup></b>					
2010 Census Population		3,308			
Permitted RV camps	333				
Crew Camps, Conditional Use Permits	<u>5,469</u>				
Total RVs, Crew Camps, Conditional Use Permits	<u>5,802</u>	5,802			
New Housing 2010-2014		<u>2,110</u>			
Estimated Service Population Six Surrounding Townships		<u>11,220</u>			<u>11,220</u>
<b>Estimated Service Population Williston and Surrounding Townships</b>					<u>42,363</u> 42,363
<b>Remainder of Williams County</b>					
2010 Census Population		4,374			
Permitted RV camps	567				
Crew Camps, Permitted Housing (Permitted Beds) <sup>2</sup>	<u>3,916</u>				
Total RV Camps, Crew Camps, Permitted Housing	<u>4,483</u>	4,483			
Building Permits 2010-2014		<u>1,558</u>			
Estimated Service Population Remainder of Williams County		<u>10,415</u>			<u>10,415</u>
<b>Estimated Service Population Williams County</b>					<u>52,778</u>

<sup>1</sup>Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships. <sup>2</sup>Does not included other incorporated areas in Williams County

## **Adjustments to 2012 Estimates of Service Population**

Adjustments to the 2012 estimates of service population (Hodur and Bangsund, 2013, Hodur and Bangsund 2013a) were required to estimate change in service population since 2012 and enable a comparison of 2012 projections for 2014 and 2014 estimates of service population. Both county conditional use permits and city special use permits are periodically renewed and re-issued. Since the last service population estimates in 2012, both Williams County and the City of Williston have reviewed and did not renew permits for beds that were not built under the previously issued permit (Corbert, 2015, Kress, 2014). For example, some crew camps were permitted but never built, or others were permitted but not built to the maximum number of permitted beds.

In order to make a comparison of changes from 2012 to 2014, it was necessary to adjust 2012 estimates to reflect excess permitted capacity for crew camps and other permitted housing that was never constructed. No adjustments were made for camps that were operational in 2012 but since then closed, had their permits not renewed or were otherwise no longer operational. 2012 service population estimates also were adjusted to reflect city annexations since 2012. For example, some camps were not under the jurisdiction of the City of Williston in 2012 but, as a result of the annexations are now under the jurisdiction of the City of Williston. Without adjusting the 2012 service population, an estimate of change from 2012 service population estimates to 2014 would be misleading. Not adjusting 2012 service population estimates would suggest little change in the service population in Williston and Williams County, which was not the case.

Updated lists of conditional and special use permits, RV camps and hotel properties were compared to 2012 data to identify excess permitted capacity. The same occupancy assumptions for the various types of non-traditional housing were used to adjust over permitted beds into adjusted service populations for 2012. The adjustments were more substantial in the six surrounding townships and the remainder of Williams County, with adjustments of 11.5 and 38.1 percent, respectively. This is function of the substantially larger number of special permitted beds outside Williston city limits in Williams County. Annexations explain the substantial increase in crew camps and permitted housing in the City of Williston. Table 4 details the adjusted 2012 service population estimates.

<b>Table 4. Adjustments to 2012 Service Population, Williston, Six Surrounding Townships and Williams County, 2014.</b>			
	<b>2012 Service Population</b>	<b>2012 Adjusted Service Population</b>	<b>Change</b>
<b>Adjustments:</b>			
<b>Williston</b>			
Hotels	2,149	1,689	-21.4%
Crew Camps, Permitted Housing Service Population	<u>1,443</u>	<u>2,469</u>	71.1%
<b>Total Hotels, Crew Camps, Permitted Housing, Hotels<sup>2</sup></b>	<u>3,592</u>	<u>4,158</u>	15.8%
<b>Six Surrounding Townships<sup>1</sup></b>			
Permitted RVs	750	333	-55.6%
Crew Camps, Conditional Use Permits	<u>6,484</u>	<u>5,569</u>	-14.2%
<b>Total Permitted RVs, Crew Camps, Conditional Use Permits<sup>2</sup></b>	<u>7,234</u>	<u>5,902</u>	-18.4%
<b>Remainder of Williams County</b>			
Permitted RVs <sup>3</sup>	567	567	0.0%
Crew Camps, Conditional Use Permits <sup>3</sup>	5,496	3,185	-42.0%
<b>Total Permitted RVs, Crew Camps, Conditional Use Permits, Remainder of Williams County 2010-2014<sup>2</sup></b>	<u>6,063</u>	<u>3,752</u>	-38.1%
<b>Service Population:</b>			
<b>Williston and Six Surrounding Townships</b>	25,349	25,915	2.2%
<b>Williams County<sup>3</sup></b>	11,599	10,267	11.5%
<b>Williams County<sup>3</sup></b>	<u>10,437</u>	<u>8,126</u>	-28.4%
<b>Total<sup>2</sup></b>	<u>47,385</u>	<u>44,308</u>	7.0%
<sup>1</sup> Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships.			
<sup>2</sup> Does not include U.S. Census Bureau 2010 baseline population.			
<sup>3</sup> Does not included other incorporated areas in Williams County.			

#### **Change in Service Population, 2012-2014**

A comparison of 2012 adjusted service population and estimated service population for 2014 revealed a substantial increase in the service population in the City of Williston and Williams County. Williston's estimated service population of just over 31,000 represents a 20 percent increase since 2012. Increases were similar when including the six surrounding townships. The estimated service population grew from just over 36,000 to over 42,000 in Williston and the six surrounding townships, a 17 percent increase. Williams County service population increased from approximately 44,000 to 52,700 in 2014, a 19 percent increase (Table 5).

<b>Table 5. Percentage Change 2012 Adjusted Service Population to 2014 Service Population Estimates, Williston, Six Surrounding Townships, and Williams County, 2014</b>			
	<b>2012 Adjusted Service Population</b>	<b>2014 Service Population Estimate</b>	<b>Percent Change</b>
Williston	25,915	31,143	20.2
Williston and Six Surrounding Townships <sup>1</sup>	36,182	42,363	17.1
Total Williams County <sup>2</sup>	44,308	52,778	19.1
<sup>1</sup> Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships.			
<sup>2</sup> Does not included other incorporated areas in Williams County.			

A comparison of the 2012 service population projections and 2014 service population estimates found the two estimates strikingly similar and well within an acceptable range. The 2012 projection for 2014 service population for Williston was 32,692 and the 2014 service population estimate was 31,143, a 5 percent overestimate. The 2012 estimate for Williston and the six surround township underestimated 2014 service population by about 5 percent. On a county-wide level, the numbers were nearly identical. 2012 projections for 2014 service population was estimated to be 53,262 and 2014 service population was estimated to be 52,778, an approximately 1 percent difference. A comparison of 2012 service population projections for 2014 and 2014 service population estimates are detailed in Table 6.

<b>Table 6. Comparison of 2012 Service Population Estimates and 2014 Service Population Estimates, Williston, Six Surrounding Townships and Williams County, 2014.</b>			
	<b>2014 Service Population Estimate</b>	<b>2012 Projections of 2014 Service Population</b>	<b>Percent Difference</b>
Williston	31,143	32,692	4.9
Six Surrounding Townships <sup>1</sup>	11,220	10,674	-5.0
Remainder of Williams County <sup>2</sup>	10,415	9,896	-5.1
Total Williams County	52,778	53,262	-0.9
<sup>1</sup> Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships.			
<sup>2</sup> Does not included other incorporated areas in Williams County.			

### **Service Population Potential Projections**

Population projections represent population potential based on the number of housing units approved for development. An inventory of approved housing developments and assumptions on build out rates provided by county and city officials were the basis for population potential based on projected housing built out. Based on the number of approved housing developments and assumed build out rates, approximately 3,000 housing units could be added in 2015, nearly all in the City of Williston. The potential number of additional housing units decreased in each of the following years (Table 7). Because there is no way to estimate future proposed developments, housing unit projections are based only on known and approved housing developments.

<b>Table 7. Potential Housing Unit Build Out, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2014.</b>						
	Housing Units Added 2010-2014	Potential Housing Units Added				
		2015	2016	2017	2018	2019
Williston	7,431	2,803	2,204	1,916	976	976
Six Surrounding Townships <sup>1</sup>	912	125	119	99	55	55
Remainder of Williams County	<u>724</u>	179	173	142	100	100
Total Williams County	<u>9,067</u>	<u>3,107</u>	<u>2,496</u>	<u>2,156</u>	<u>1,132</u>	<u>1,132</u>
<sup>1</sup> Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships. <sup>2</sup> Does not included other incorporated areas in Williams County.						

Population potential associated with the build out of known housing developments resulted in an estimated increase in service population over the five-year study period of 17,931 for an estimated 2019 service population for the City of Williston of 49,074 (Table 8). The estimated build out for the six surrounding townships of Williston, Judson, Missouri Ridge, Pherrin, Stony Creek and Trenton could be expected to lead to an increase in population of 793 over the five-year study period for an estimated 2019 service population of approximately 12,000. The estimated build out for the remainder of Williams County (not including other incorporated areas) could be expected to result in an increase in population of nearly 1,029 for a total estimated 2019 service population of approximately 11,000. Combined, the 2019 service population for the study area was estimated to be approximately 72,000. Service population potential estimates associated with the build out model are detailed in Table 8.

<b>Table 8. Service Population Potential, Housing Model, City of Williston, Six Surrounding Townships and Williams County, 2014.</b>						
	Estimated Service Population 2014	Service Population Potential				
		2015	2016	2017	2018	2019
Williston	31,143	36,685	41,126	40,005	47,040	49,074
Six Surrounding Townships <sup>1</sup>	11,220	11,435	11,636	11,833	11,923	12,013
Remainder of Williams County <sup>2</sup>	<u>10,415</u>	10,772	11,012	11,225	11,335	11,444
Total Williams County	<u>52,778</u>	<u>58,842</u>	<u>63,774</u>	<u>68,064</u>	<u>70,297</u>	<u>72,531</u>
<sup>1</sup> Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships. <sup>2</sup> Does not included other incorporated areas in Williams County.						

### Sensitivity Analysis

Even prior to the recent slowdown in drilling activity as a result of lower crude oil prices, there was anecdotal evidence that the percentage of occupied units at some crew camps had fallen below the “at or near” 100 percent rate that was prevalent during the 2012 study. To assess the potential implications of a reduction in occupied units on 2014 service population estimates, a sensitivity analysis was completed. An effort was made to model current conditions to the degree data on occupied units were

available. Neither the City of Williston nor Williams County track the number of occupied permitted units or beds. Assumptions on occupied units were made based on input from city officials and others knowledgeable about conditions in late 2014.

No change in persons per room assumptions or occupancy rates for hotels was made for the sensitivity analysis as those variables were based on actual data provided by the Williston Convention and Visitors Bureau (Kruger, 2014). A windshield tour of a major RV camp approximated 60 of the available slots were occupied and local officials confirmed that rate was representative of other RV camps in the City of Williston and Williams County (Murphy, 2014). Several special use permit holders, both open commercial camps and closed employee only camps, were contacted by city officials to inquire about their current occupancy rates (Kress, 2014). A weighted average of percentage of occupied beds of responding camps was estimated to be 70 percent and used as a proxy for occupancy rates at commercial crew camps, conditional use permitted housing and special use permitted housing. Occupied units for existing traditional housing and housing added since 2010 were assumed to be 90 percent.

The reduction in occupied units had little effect on service population estimates in the City of Williston. Estimated service population in Williston dropped by 1,700 from just over 31,000 to 29,400, a 5 percent reduction (Table 9). Percentage reduction in the service population in the six surrounding townships and the remainder of Williams County was larger due to the greater prevalence of non-traditional housing. The service population estimate declined by 1,652 or 14.7 percent in the six surrounding townships. When Williston and the six surrounding townships were considered together, service population only declined by 3,365 or 8 percent. Again the percentage reduction was greater in the remainder of Williams County due to the greater percentage of non-traditional housing and much less additional traditional housing being added to the mix of housing available. The remainder of Williams County service population declined by 2,585 or 24.8 percent based on reduction in occupied units assumptions. Overall, service population for Williston, the six surrounding townships and the remainder of Williams County declined by 5,951 or 11.2 percent based on reduction in occupied units assumptions.

Overall reduction in occupied units had a relatively small effect on overall service population estimates. It also was noted by several crew camp operators and city and county officials that there is substantial seasonality associated with occupied units for crew camps, conditional use and special use permitted beds with a larger percentage of occupied units in non-winter months. Service population based on reduction in occupied units detailed in Table 9.

**Table 9. Service Population Estimate, Housing Model, City of Williston, Six Surrounding Townships and Williams County, Sensitivity Analysis Based on Reduction in Occupied Units, 2014.**

<b>Williston</b>	----- population number -----				
2010 Census Population				14,716	
Hotels <sup>1</sup>					
Workforce Service Population	536				
Regular Travel Service Population	<u>1,565</u>				
Total Hotel Service Population	<u>2,101</u>		2,101		
Crew Camps, Permitted Housing		981			
Crew Camps, Permitted Housing-Previously in Williams County		<u>611</u>			
Total Crew Camps, Permitted Housing <sup>3</sup>		<u>1,592</u>	<u>1,592</u>		
Total Hotels, Crew Camps, Permitted Housing			<u>3,693</u>	3,693	
New Housing 2010-2014				<u>11,021</u>	
<b>Estimated Service Population Williston</b>				<u>29,430</u>	29,430
<b>Surrounding Townships<sup>2</sup></b>					
2010 Census Population		3,308			
Permitted RV camps <sup>3</sup>	200				
Crew Camps, Conditional Use Permits <sup>4</sup>	<u>4,161</u>				
Total RVS, Crew Camps, Conditional Use Permits	<u>4,361</u>	4,361			
New Housing 2010-2014		<u>1,899</u>			
Estimated Service Population Six Surrounding Townships		<u>9,568</u>			<u>9,568</u>
<b>Estimated Service Population Williston and Surrounding Townships</b>					<u>38,998</u> 38,998
<b>Remainder of Williams County</b>					
2010 Census Population		4,374			
Permitted RV camps <sup>3,5</sup>	340				
Crew Camps, Permitted Housing (Permitted Beds) <sup>4,5</sup>	<u>1,713</u>				
Total RV Camps, Crew Camps, Conditional Use Permits	<u>2,053</u>	2,053			
Building Permits 2010-2014 <sup>5</sup>		<u>1,402</u>			
Estimated Service Population Remainder of Williams County		<u>7,830</u>			<u>7,830</u>
<b>Estimated Service Population Williams Co.</b>					<u>46,827</u>

<sup>1</sup>No change in assumptions for hotels.

<sup>2</sup>Williston, Judson, Missouri Ridge, Pherrin, Stony Creek, Trenton Townships.

<sup>3</sup>RV camps 60 percent occupied.

<sup>4</sup>Crew camps, conditional use permitted housing and special use housing 70 percent occupied.

<sup>5</sup>Does not include other incorporated areas in Williams County.

## **Key Assumptions of Build-out Model**

The build-out model represents population potential based on the assumption that housing in approved developments will be constructed and occupied. Build-out time was based on data provided by the City of 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 actual rate of construction is unknown but the estimate of population potential provides a reasonable estimate of maximum population potential. The estimates use the same occupancy assumptions as the previous study (Hodur and Bangsund 2013, Hodur and Bangsund 2013a). Occupancy rates for traditional housing units were assumed to be the same as historic rates. While some anecdotal evidence suggests occupancy rates may be higher as people attempt to defray the high cost of living by sharing accommodations, data are not available to suggest what those occupancy rates would be. Barring the availability of additional data, the use of historic occupancy rates will remain the only available option.

The model is sensitive to changes in some key variables. For example, small changes in person per household occupancy rates result in substantial changes in projections. The model is less sensitive to changes in occupied units. 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 2014 service population compared to the 2010 Census is 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.

## **Conclusions, Implications, and Need for Further 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. Findings quantified the current and projected service population in Williston using data collected from the City of Williston and Williams County and based on an inventory of both traditional (single family home, apartment, etc.) and non-traditional (RVs, crew camps, etc.) accommodations to make an estimate of the current service population.

The model estimates Williston's current service population to be approximately 31,000. Waste water treatment plant average daily flows are consistent with a service population of that size which lends validation to the estimate. When the six surrounding townships were included in the estimate of the City's population, the housing model suggests the current service population to be approximately 42,000. Williams County service population (excluding service population from non-traditional housing in other incorporated areas other than Williston,) was estimated to be nearly 53,000. The estimates for service population were based on actual data collected from the City of Williston and Williams County. The estimates are based on maximum population potential; however, the results are not sensitive to changes in assumptions regarding number of occupied units. A sensitivity analysis suggests that even with reduced utilization of non-traditional housing, the service population has still grown substantially. Even assuming reduced utilization of permitted capacity to 70 percent for crew camps and special and conditional use permits, 60 percent for RV camps and 90 percent for traditional housing, service

population estimates for Williston was reduced only by 5 percent to approximately 29,000, which represents a substantial 14 percent increase in two years. Planning professionals suggest that a 1.5 to 2.0 percent annual population increase to be a healthy and sustainable rate (Jarcik, 2014).

The estimates of current service population and projected increases suggest continued high demand for and strain on infrastructure and public services. Even with the recent slowdown in drilling activities, the major economic driver of change, the oil and gas industry is still expanding, albeit at a slower rate. Wells added in the last two years still require a substantial workforce for maintenance and operations. Although a portion of the service population related to the temporary workforce will ultimately move to the next job site, they will use and require housing, infrastructure and public services while working and living in North Dakota.

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 be updated to reflect the dynamic conditions present in the City of 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.

## References

- Bangsund, Dean A. and Nancy M. Hodur. 2012. "Modeling Direct and Secondary Employment in the Petroleum Sector in North Dakota". Agribusiness and Applied Economics Report 694. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Bangsund, Dean A. and Nancy M. Hodur. 2013. "Williston Basin 2012: Projections of Future Employment and Population in North Dakota". Agribusiness and Applied Economics Report 704. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Bangsund, Dean A., Nancy M. Hodur, Richard Rathge and Karen Olson. 2012. "Modeling Employment, Housing, and Population in Western North Dakota: The Case of Dickinson". Agribusiness and Applied Economics Report 695. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Corbert, Taylor. 2015. Personal Conversation with Williams County Staff Planner.
- Hanson, Bob. 2014. Personal correspondence with Hanson, Williston City Engineer and City of Williston historic waste water treatment flows.
- Hodur, Nancy M. and Dean A. Bangsund. 2013. *Population Estimates for City of Williston*. Agribusiness and Applied Economics Report No. 707. Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Hodur, Nancy M. and Dean A. Bangsund. 2013<sup>a</sup>. *Population Estimates for City of Williston*. Agribusiness and Applied Economics Report No. 707-S (Summary). Department of Agribusiness and Applied Economics, North Dakota State University, Fargo.
- Jarcik, Kent. 2014. Personal Conversation with Jarcik, Williston City Planner.
- Kautzman, John. 2014. Personal Conversation Kautzman, Williston City Auditor.
- Kress, Donald. 2014. Personal conversations with Kress, Williston Staff Planner.
- Kruger, Amy. 2014. Personal Conversation with Kruger, Director of Williston Visitors' and Convention Bureau.
- Murphy, Kylene, 2014. Personal Conversation with Murphy, Williams County Staff Planner.
- Ressler, Rachel. 2014. Personal Conversation with Ressler, Williston Staff Planner.
- U.S. Census Bureau, 2015. U.S. Census Bureau, 2015. Population Division, Annual Estimates of the Resident Population.
- U.S. Census Bureau, 2015a. 2009-2013 American Community Survey (ACS) 5-Year Estimates, Tables B25024, B25032, and B25033.



**NDSU** AGRIBUSINESS AND  
APPLIED ECONOMICS