

This Technical Memorandum #2 for the Washington County Thoroughfare Plan provides an understanding of socioeconomic conditions in rural Washington County, Tennessee. Included are discussions of population and employment over time and their relationship to infrastructure, especially the roadway system under the authority of the Washington County Highway Department.

Washington County Thoroughfare Plan

Technical Memorandum #2:
Socioeconomic Conditions

By:



For:



Project Planning Division
& Washington County, TN

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1.0 INTRODUCTION

This Technical Memorandum #2 for the Washington County Thoroughfare Plan provides an understanding of socioeconomic conditions in rural Washington County, Tennessee. Included are: population and demographics over time; employment; and, the relationship of these to infrastructure, such as water and sewer services. The study area includes roads under the jurisdiction of the Washington County Highway Department. Therefore, the study area is Washington County excluding areas within the city limits of Johnson City and Jonesborough. **Figure 1.1: Vicinity Map** shows Washington County in eastern Tennessee. **Figure 1.2: Study Area Map** shows the city limits of Johnson City and Jonesborough and state highway routes. It is notable that Johnson City includes a number of extensions out into the unincorporated county, sometimes using road right-of-way to connect to “islands” of growth.

The socio-economic data herein for the study area, also referred to as rural Washington County are drawn from the Johnson City Metropolitan Transportation Planning Organization (MTPO) *2040 Long Range Transportation Plan (LRTP)* to maintain consistency with that planning study.

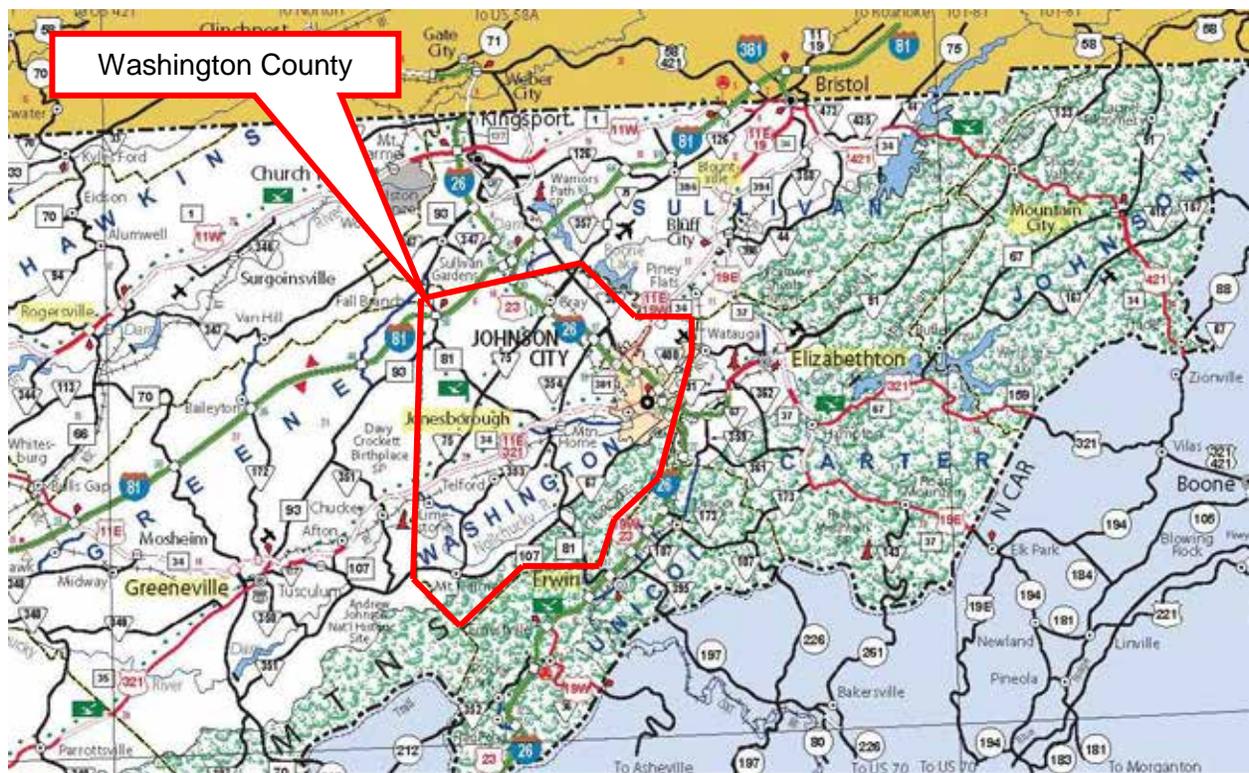


FIGURE 1.1: VICINITY MAP
Source: Official 2012 Transportation Map (Tennessee)

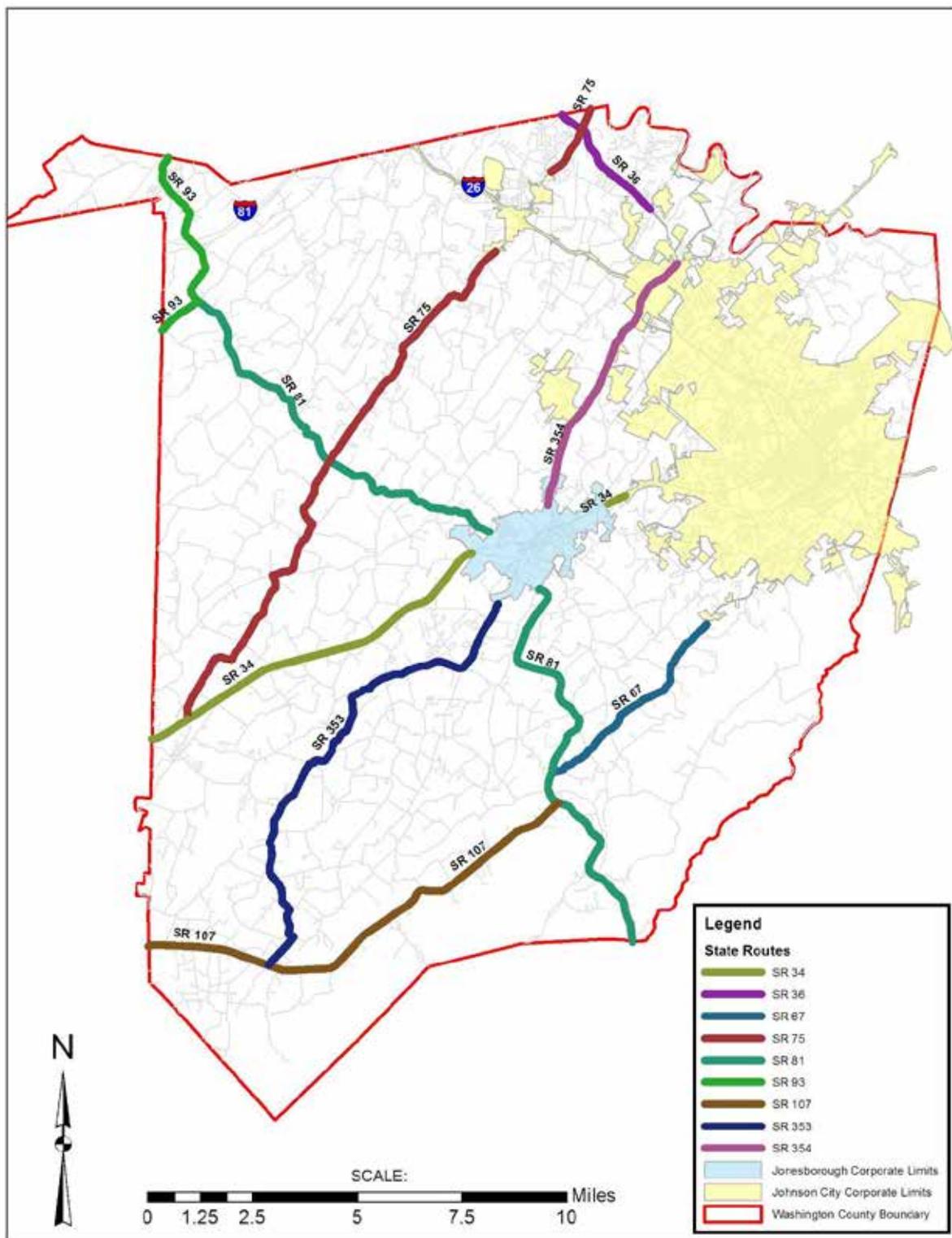


FIGURE 1.2: AREA MAP WITH JOHNSON CITY AND JONESBOROUGH CITY LIMITS
Source: Johnson City Metropolitan Transportation Planning Organization

The Washington County Thoroughfare Plan is a comprehensive transportation planning document for the rural portion of the county, outside the city limits of Johnson City and Jonesborough, including the analysis of the state and county maintained road systems. It provides short- and long-term plans for improvements to the roadway infrastructure of Washington County to complement the long range planning process of the Johnson City Metropolitan Transportation Planning Organization (JCMTPO) and the Kingsport Metropolitan Transportation Planning Organization (KMTPO). JCMTPO is responsible for planning for the urbanized portion of Washington and Carter Counties, as well as part of the Town of Unicoi. KMTPO covers a small portion of northern Washington County.

The purpose of this Thoroughfare Plan is to set forth a realistic set of multi-modal transportation improvements that take into account where growth is occurring and where it is expected to continue to occur, based on: general growth patterns, the anticipated expansion of water and sewer infrastructure, and the availability of developable land with good access. Together the availability of piped water, sanitary sewers, and good roads provide the opportunity for development. Combined with the population and employment data used to develop the MTPO's 2040 Plan, they shed light on both the location and magnitude of anticipated growth.

JCMTPO uses forecasts of population and employment for their transportation planning efforts. JCMTPO has updated its Long Range Transportation Plan (LRTP) to 2040. The computer modeling of traffic for the LRTP covers the entire county, though the LRTP only covers the portion of Washington County that falls within the MTPO planning area. The LRTP forecasting required socioeconomic data for the entire county for the base year of 2010 and the forecast horizon of 2040. The characterization of rural Washington County in this effort relies on the MTPO data.

2.0 POPULATION

Growth in Washington County from 2000 to 2010 outpaced that of Tennessee and the United States. Planning for the rural portion of Washington County must anticipate the continued growth of population.

Taken as a whole, Washington County is expected to have almost twice the population in 2040 that it had in 1970, as can be seen in **Table 2.1: Washington County and Study Area Population**. Growth was strongest in the decade between 1970 and 1980 at twenty percent (20%), and strong again in the two decades between 1990 and 2010 at sixteen percent (16%) and fifteen percent (15%), respectively. For the three decades between 2010 and 2040, population growth is anticipated by the JCMTPO to slow to seven percent (7%) per decade.

TABLE 2.1: WASHINGTON COUNTY AND STUDY AREA POPULATION
(Study Area = Washington County less Johnson City and Jonesborough)

	Washington County Population	% Growth from Previous Period	Study Area Population	% Growth from Previous Period	Washington County Households	% Growth from Previous Period	Washington County Persons/Household
1970	73,924	NA	NA	NA	22,614	NA	NA
1980	88,755	20%	NA	NA	31,200	38%	2.84
1990	92,315	4%	NA	NA	35,843	15%	2.58
2000	107,198	16%	NA	NA	44,300	24%	2.42
2010	122,979	15%	51,736	NA	73,892	67%	1.66
2040	150,611	22%	64,260	24%	92,395	25%	1.63

^a Based on 2040 LRTP Transportation Analysis Zone data (see text).
Sources: JCMTPO, US Census, Woods and Poole, Inc., and The Corradino Group.

The population of the study area, meaning Washington County outside Johnson City and Jonesborough, was based on today’s city boundaries and data from the LRTP transportation model. For the transportation modeling process, the JCMTPO allocates population and employment to Traffic Analysis Zones (TAZs), which are closely matched to US Census units, such as Census tracts and block groups. However, the TAZs boundaries do not conform to the political boundaries of Johnson City and Jonesborough due to the convolutions of the cities’ boundaries. For this Washington County Thoroughfare Plan, TAZs along the fringes of the two cities were examined individually to allocate the population of each TAZ between the part within a city’s boundaries and the part outside city boundaries (and therefore within the study area).

Because Johnson City has tended to annex commercial nodes at some distance from the core of the city, the annexation areas tend to represent commercial areas (jobs), more so than residential areas (population). So, the allocation process for population used different percentages than those used for employment. In some TAZs split by city boundaries, all the population in a TAZ is outside the city boundaries, but virtually all the employment is within the city limits. This process was used to estimate the 2010 and 2040 study area population. This analysis shows in **Table 2.1** that the study area will grow slightly faster than Washington County as a whole, twenty-four percent (24%) versus twenty-two percent (22%).

Because of the process used to tabulate the population, it was possible to differentiate between the TAZs partly within Johnson City or Jonesborough (called “fringe” TAZs), and those TAZs fully outside the boundaries of these two cities (and fully within the study area). **Table 2.2: Population Growth in Study Area vs. Fringe Areas** shows the result in terms of population.

TABLE 2.2: POPULATION GROWTH IN STUDY AREA VS. FRINGE AREAS

	2010 Population	2040 Population	Growth
Fringe TAZs	10,114	13,727	36%
Fully Rural TAZs	41,622	50,533	21%
Study Area Total	51,736	64,260	24%

Sources: JCMTPO and The Corradino Group.

This population allocation process shows that the fringe areas are forecast by the MTPO to grow at a higher rate than the fully rural portion of Washington County. This is reasonable as the urban areas expand.

Figure 2.1: Population Change 2010 to 2040 shows the increase in population anticipated between 2010 and 2040, with darker shading indicating the areas of greatest growth. The absolute numbers for each TAZ are also shown, so the reader can see whether the high growth in a TAZ truly reflects substantive growth, or merely a large percentage growth where there are few residents. It is clear that the fastest growing areas (greater than 50 percent [50%]) are north of Johnson City and between Johnson City and Jonesborough. Areas of moderate growth (twenty to fifty percent [20 to 50 %]) by 2040 ring the two cities. Two areas removed from the city fringes are in the southwest quadrant of I-81 and I-26 and in the south county along SR 107.

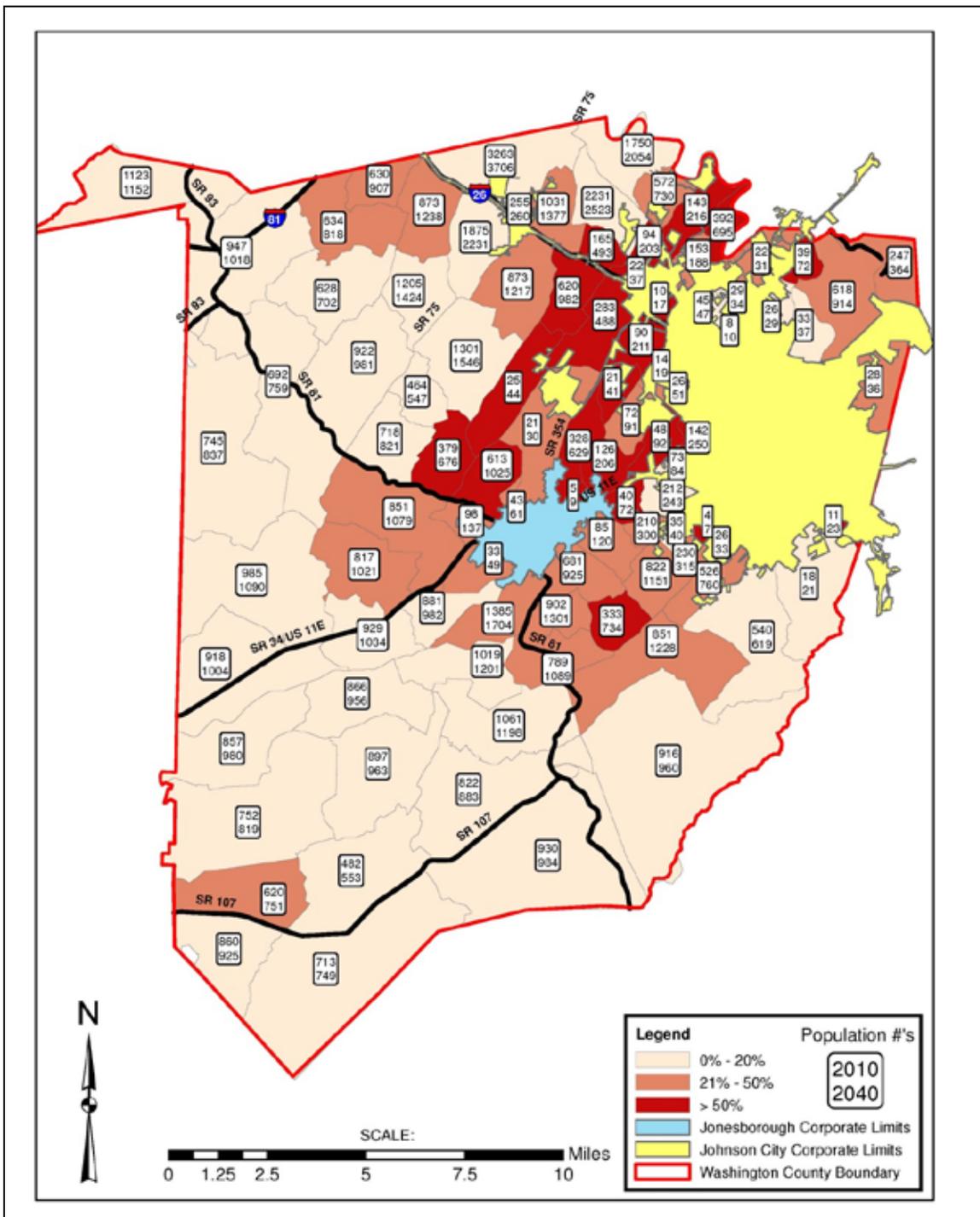


FIGURE 2.1: POPULATION CHANGE 2010 TO 2040

Sources: JCMTPO, US Census, Woods and Poole, Inc., and The Corradino Group

3.0 EMPLOYMENT

Table 3.1: Washington County and Study Area Employment shows employment data for all of Washington County and for the study area - the county exclusive of Johnson City and Jonesborough. As noted in the previous section, population and employment data were derived from the MPTPO's long range transportation plan model, specifically the input data for Transportation Analysis Zones (TAZs). One can see that employment growth in Washington County is projected by the JCMTPO to be robust. Whereas population is expected to increase in the county twenty-two percent (22%) between 2010 and 2040, employment is expected to grow at more than double that, forty-six percent (46%). Based on the proration of employment to either the cities or study area, the employment of the study area is projected to increase at a greater rate than the overall county, one-hundred-twenty-seven percent (127%). This strong increase in jobs is important as more jobs mean more work trips and more vehicles on the road.

TABLE 3.1: WASHINGTON COUNTY AND STUDY AREA EMPLOYMENT
(Study Area = Washington County less Johnson City and Jonesborough)

	Washington County Employment	% Growth from Previous Period	Study Area Employment ^a	% Growth from Previous Period
1970	27,481	NA	NA	NA
1980	37,447	36%	NA	NA
1990	47,617	27%	NA	NA
2000	59,967	26%	NA	NA
2010	65,892	10%	4,467	NA
2040	96,013	46%	10,136	127%

^a Based on 2040 LRTP Transportation Analysis Zone data.
Sources: JCMTPO, US Census, Woods and Poole, Inc., and The Corradino Group.

The analysis of employment on a TAZ basis shows the strongest grow in the fringe areas around Johnson City and Jonesborough (**Table 3.2: Employment Growth in Study Area vs. Fringe Areas**). This is logical as jobs tend to concentrate in built-up areas. **Figure 3.1: Employment Change 2010 to 2040** show the relative growth of the TAZs in the study area. The shading shows growth in terms of percentages. Growth in terms of percentages is expected to be widespread. One must look at the number of jobs in the boxes to see where growth is concentrated in terms of the number of jobs. The growth in the number of jobs is anticipated to be strongest in Gray and along I-26, and in the TAZ southwest of Jonesborough that is home to the Washington County Industrial Park.

TABLE 3.2: EMPLOYMENT GROWTH IN STUDY AREA VS. FRINGE AREAS

	2010 Employment	2040 Employment	Growth
Fringe TAZs	1,362	3,980	192%
Fully Rural TAZs	3,105	6,156	98%
Study Area Total	4,467	10,136	127%

Sources: JCMTPO and The Corradino Group.

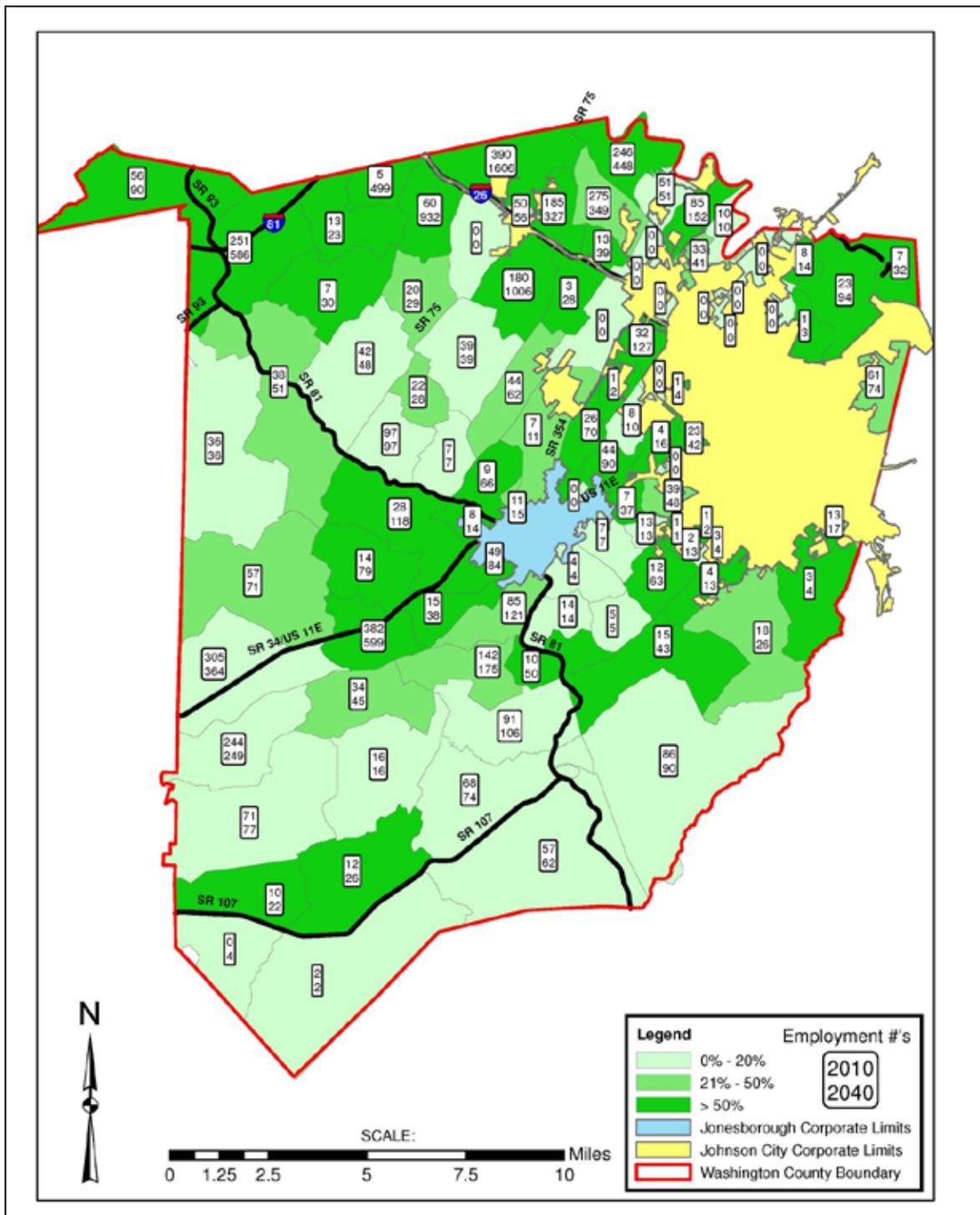


FIGURE 3.1: EMPLOYMENT CHANGE 2010 TO 2040

Sources: JCMTPO, US Census, Woods and Poole, Inc., and The Corradino Group

3.1 TRAFFIC GENERATORS IN THE STUDY AREA

The MTPO 2040 Plan finds that the trend in employment is towards service industries. These jobs in professional, technical, health, education, government and finance tend to cluster in urbanized areas. The effect of the trend to service jobs will be a stronger growth in Johnson City and Jonesborough, than outside those cities. The 2040 Plan listed the top ten employers in Washington County. All fall within one city or the other.

Primary and secondary schools are well distributed in the rural county and generate a high level of trips in their peak periods (**Figure 3.2: Study Area Traffic Generators**). Most elementary schools are removed from high travel areas in rural Washington County and have low enough student populations that congestion is well managed. Grandview Elementary School is somewhat unique as it is located on the north side of SR 34 (US11E); so trips to that school must navigate the high speed traffic on that rural principal arterial. Traffic projections for 2040 on SR 34 show an anticipated volume over 20,000 vehicles a day and a level of service of C.

David Crockett High School serves the southern part of Washington County, drawing from Jonesborough Middle School and the following elementary schools: Jonesborough, West View, Lamar, Grandview, and South Central. Enrollment is upwards of 1,200 students. The concentration of students means that congestion occurs daily at the start and end of school on the two-lane SR 353. According to the MTPO 2040 Long Range Plan there were 7,200 vehicles a day in 2010 on SR 353. That traffic is forecast to grow to 8,900 by 2040. Daily traffic does not always reflect the peak traffic conditions that occur at schools.

Daniel Boone High School, the other county high school, is located on SR 75 and serves the northern half of Washington County, with an enrollment upwards of 1,200. Its feeder schools are Sulphur Springs Middle School and the following elementary schools: Sulphur Springs, Boones Creek, Fall Branch, Gray, and Ridgeview. The high school fronts onto SR 75, which has a three-lane section to the east, but a two-lane section to the west. Daily traffic according to traffic modeling for the LRTP on SR 75 was 8,900 in 2010. Traffic is expected to grow to over 12,000 by 2040. The combination of high traffic volumes and poor sight distance west of the school have resulted in this roadway section being listed in Table 7-1 of the 2040 LRTP (VP-27), which calls for safety and geometric improvements from SR 34 (US11E) to Boonesboro Road.

The Washington County Industrial Park represents one growing center of employment outside the cities. It is on the north side of SR 34 (US11E) west of Leesburg Road. Businesses in the park are Koyo Corporation of the US, Nakatetsu Manufacturing Technologies, and Alo Tennessee, Inc. The first two make tapered roller bearings. Koyo has over 50 employees. Nakatetsu Machining Technologies has approximately 70 employees. Alo specializes in front loader equipment and has approximately 140 employees. Space remains at the Industrial Park for more businesses. The county recently expanded the park by purchasing an additional 65 acres of land. In the past, a southbound, right-turn deceleration lane was constructed on SR 34 (US11) to aid truck entry to Cherry Lane, the road serving the industrial park. Likewise, a southbound acceleration lane was added for vehicles turning right out of Cherry Lane onto SR 34 (US11). And, a northbound left-turn lane is provided on SR 34 (US11).

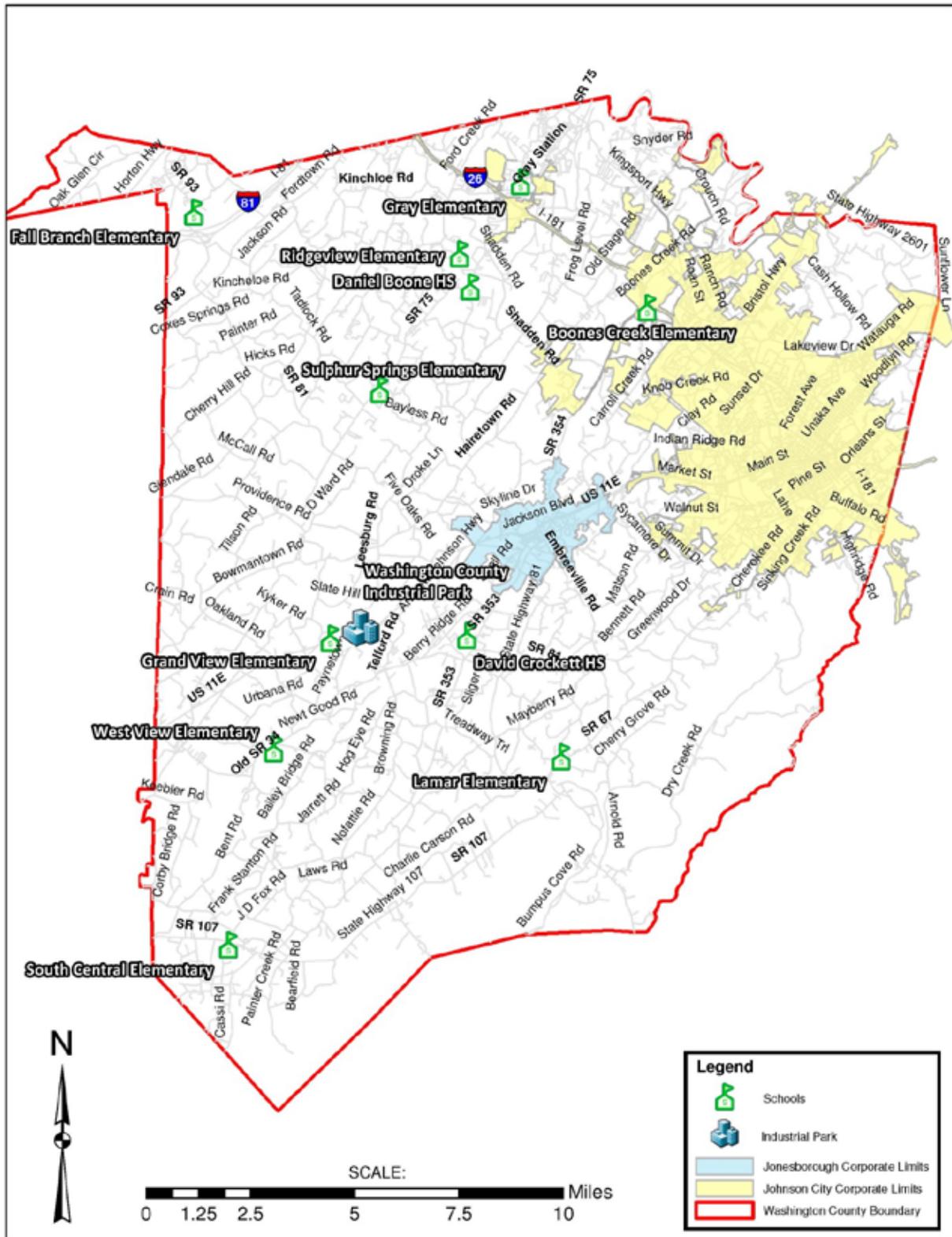


FIGURE 3.2: STUDY AREA TRAFFIC GENERATORS
Source: The Corradino Group

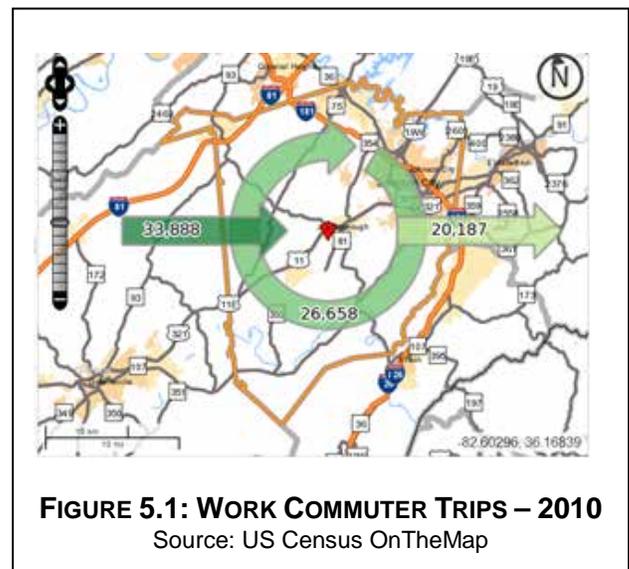
4.0 MEDIAN INCOME

Median income can be an indicator of travel habits. It can serve as a surrogate for the number of vehicles owned and disposable income for travel. Data from the American Community Survey (Census) indicates that the median income per household for all of Washington County was \$42,104 (years 2007-2011). That value was slightly higher in Jonesboro at \$43,833, but substantially lower in Johnson City at \$37,284. The median income for the study area is estimated to be \$47,866, higher than the values for the entire county, Johnson City and Jonesborough. This appears to support the potential for more frequent and longer trips for residents of the study area.

5.0 COMMUTER TRAFFIC PATTERNS

Commuter patterns can be understood by reviewing data and graphics from the “OnTheMap” service of the US Census. It provides a web-based mapping and reporting application that shows where workers are employed and where they live.

The screenshot to the right from OnTheMap shows that more workers in 2010 came into Washington County for work (33,888) than left their homes in Washington County to go out of the county for work (20,187). (Note that the arrows do not indicate an actual direction, only the number of trips into and out of the county.) Also, more workers come into the county (33,888) than both live and work in the county (26,658), indicating the strength of Washington County’s job market.



Travel directional patterns are revealed for work travel in Washington County by additional information from OnTheMap. **Figure 5.2: Home to Work Directional Pattern - 2010** shows home census tracts of workers. The larger the dot, the more workers living in that census tract. The “Radar Chart” in the upper right is limited to those workers who reside in Washington County. It shows the direction of travel from those home census tracts in Washington County to all work places. For workers who reside in the Washington County, fifty-six percent (56%) travel ten (10) or fewer miles to work. Twenty-eight percent (28%) travel ten to fourteen (10-14) miles. This latter group, in particular, tends to travel to the northwest, north, and northeast to go to work inside or outside the county. Workers who live in Washington County may travel a long distance to work. Thirteen percent (13%) travel to the west and southwest on I-81 more than 50 miles.

As noted above, Washington County is a net importer of jobs. That is why the Radar Chart in **Figure 5.3: Work to Home Directional Pattern - 2010** shows more trips than are expressed in the Radar Chart in **Figure 5.2**. The trip home from jobs in Washington County favors the Kingsport area for trips of ten to twenty-four (10 to 24) miles. Longer trips tend to be west on I-26 and southwest on I-81.

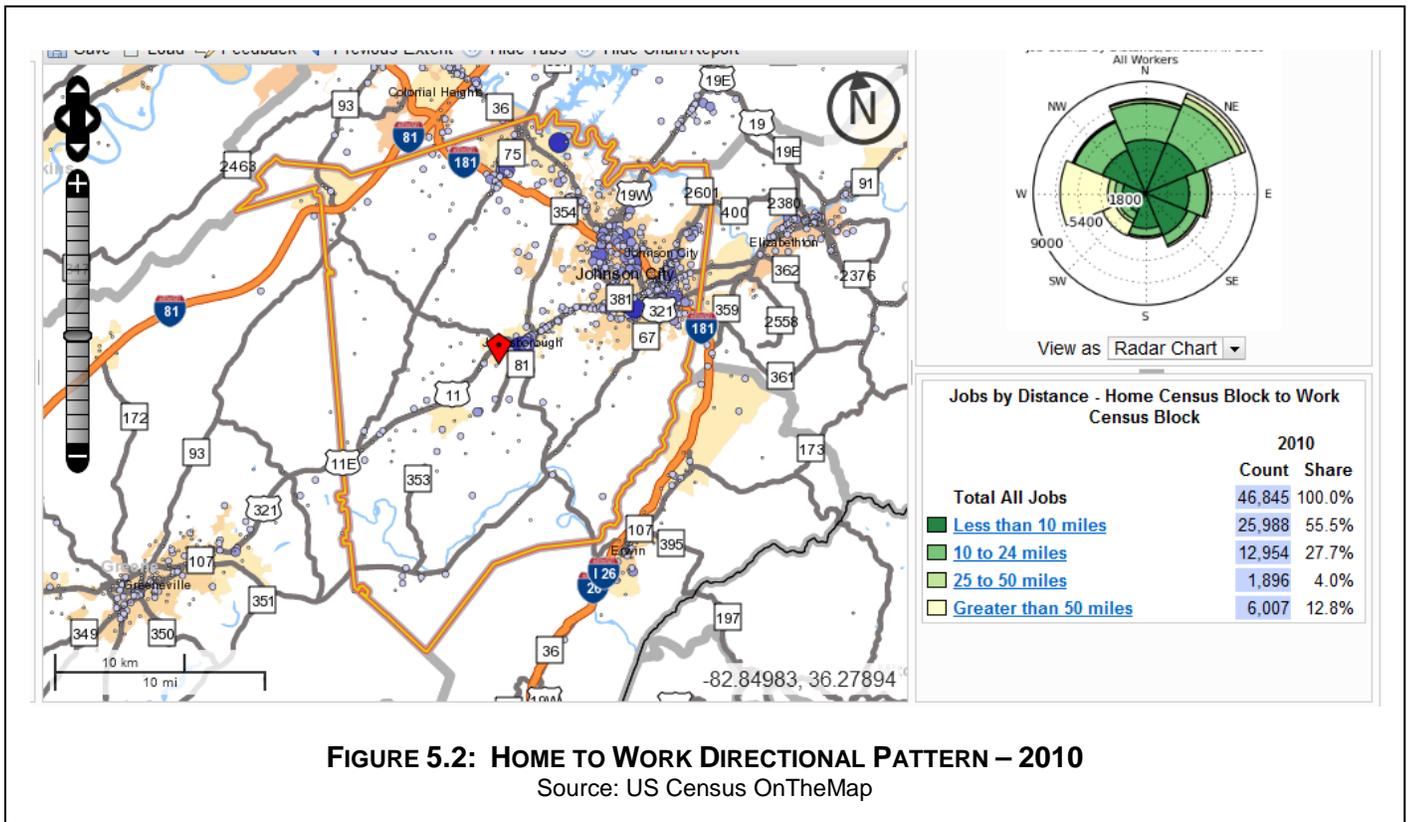


FIGURE 5.2: HOME TO WORK DIRECTIONAL PATTERN – 2010

Source: US Census OnTheMap

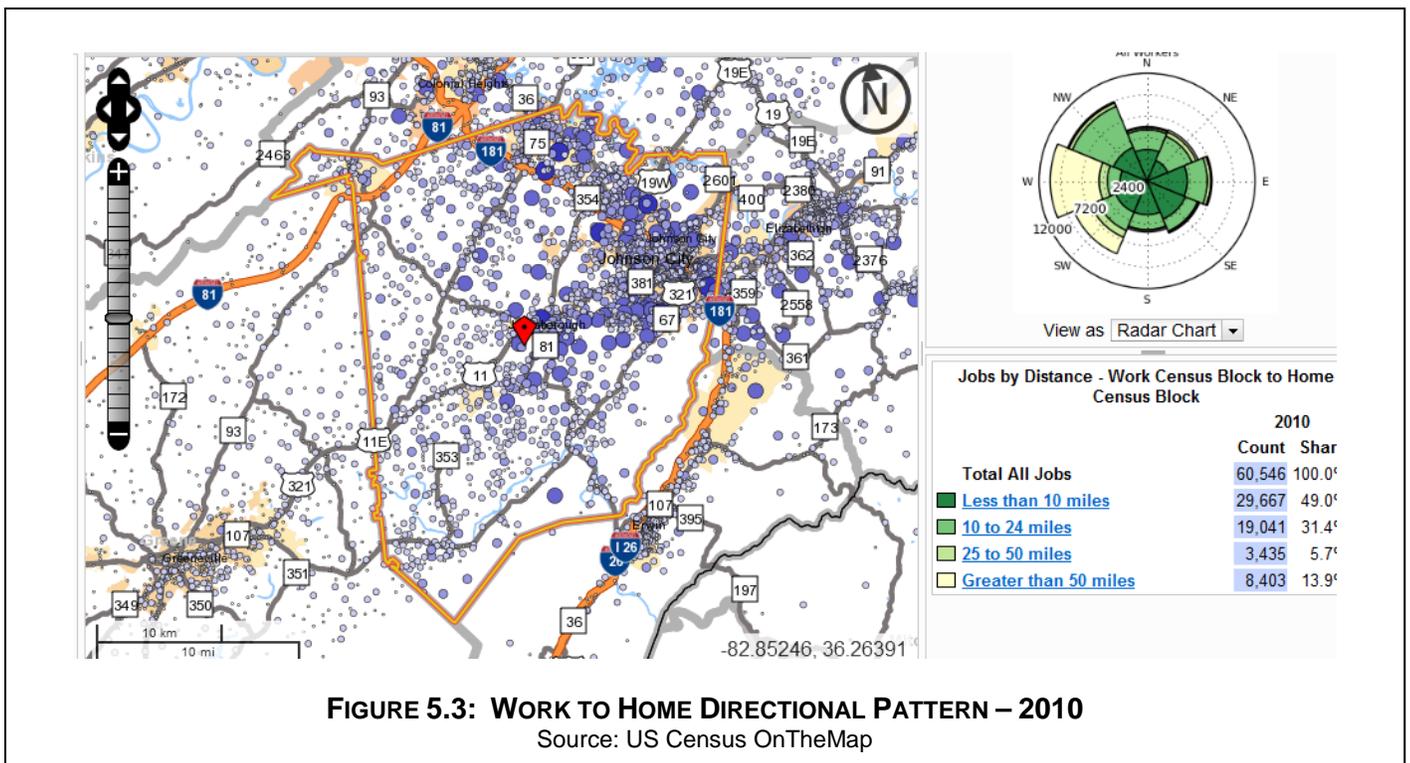


FIGURE 5.3: WORK TO HOME DIRECTIONAL PATTERN – 2010

Source: US Census OnTheMap

6.0 LAND USE AND ZONING

Land use in Washington County outside Johnson City and Jonesborough is overwhelmingly agricultural, or, in the south portion of the county, forest in the Cherokee National Forest (**Figure 6.1: Washington County Land Use**). Washington County's Zoning Atlas assigns agricultural zoning to most of the non-urbanized county. With the exception of widely-spread, single-family homes and subdivisions, notable exceptions to this agricultural pattern (listed generally north to south) are:

- The business district in Fall Branch.
- Land west of Eastern Star Road zoned for manufacturing.
- A business node at the intersection of SR 81 and Fordtown Road.
- Several business parcels along SR 75 north of Gray Station Road.
- Several business parcels near SR 81 in the vicinity of Cherry Hill Road.
- A business node at the intersection of SR 81 and SR 75.
- Business zoning along SR 75 in Sulphur Springs.
- Business zoning north of Jonesborough along SR 354.
- Intermittent business zoning along SR 34 (US11E).
- Business and manufacturing parcels between Jonesborough and Johnson City along SR 34 (US11E).
- Several business parcels at the curve in Summit Drive south of its intersection with Antioch Road.
- Business parcels north of Jonesborough and east of SR 34 (US 11E).
- The Washington County Industrial Park on SR 34 (US11E) in Telford.
- A manufacturing site in east Telford.
- Business parcels east of David Crockett High School on SR 353.
- Business parcels at the intersection of SR 81 with SR 107 south of the Nolichucky River.

The locations listed above would be expected to grow incrementally except, potentially, developments along SR 34 (US11E), in particular at the Washington County Industrial Park. There is greater potential for a larger employer to move into that area. It is that growth, along with regional growth, that will result in declining levels of travel service on SR 34 (US11E), as noted in Technical Memorandum #1.

Certain areas of the county are not suitable for construction due to steep grades. These are depicted in **Figure 6.2: Slope Map**. Most of the steep slopes are in the south county within the Cherokee National Forest.

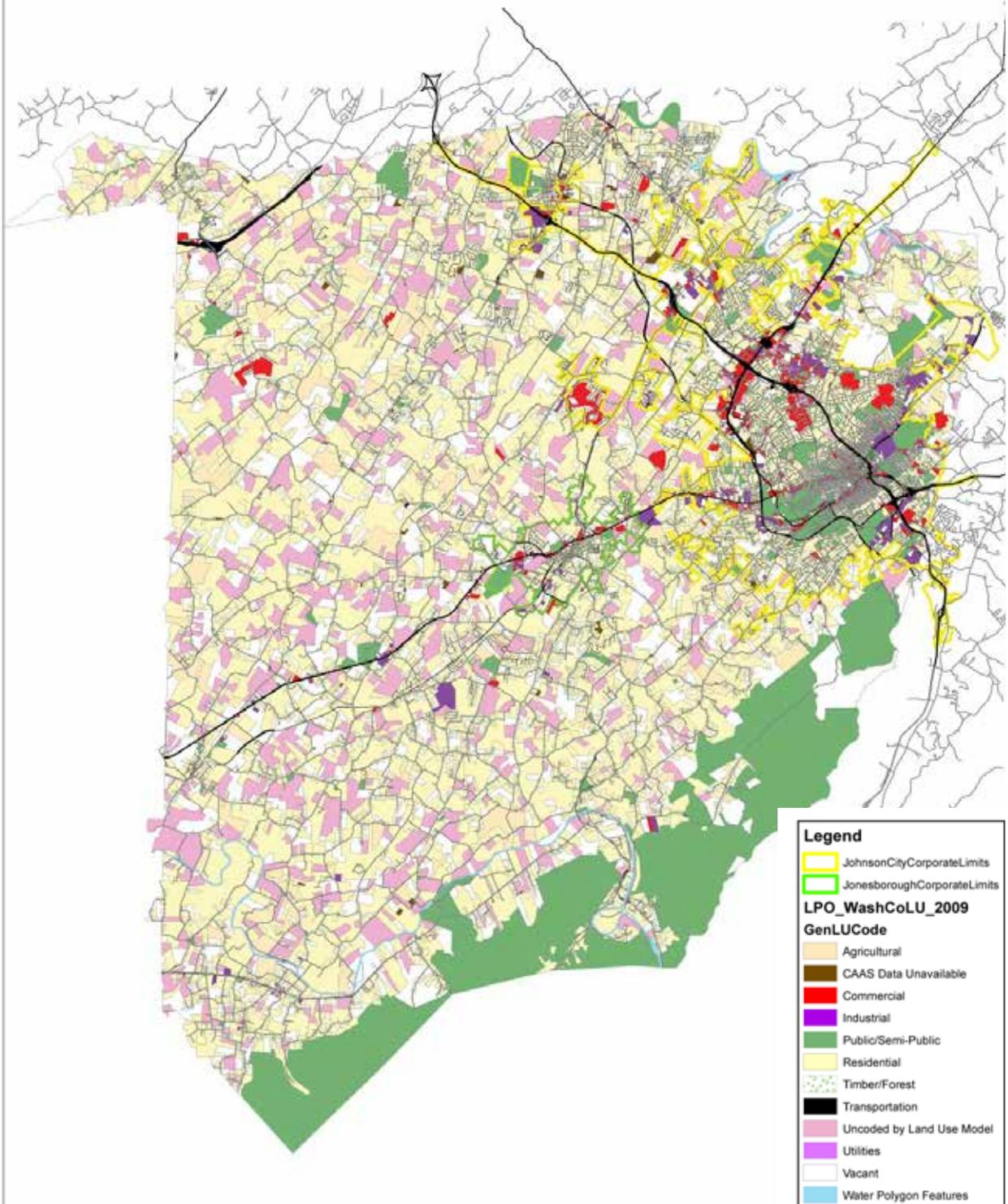
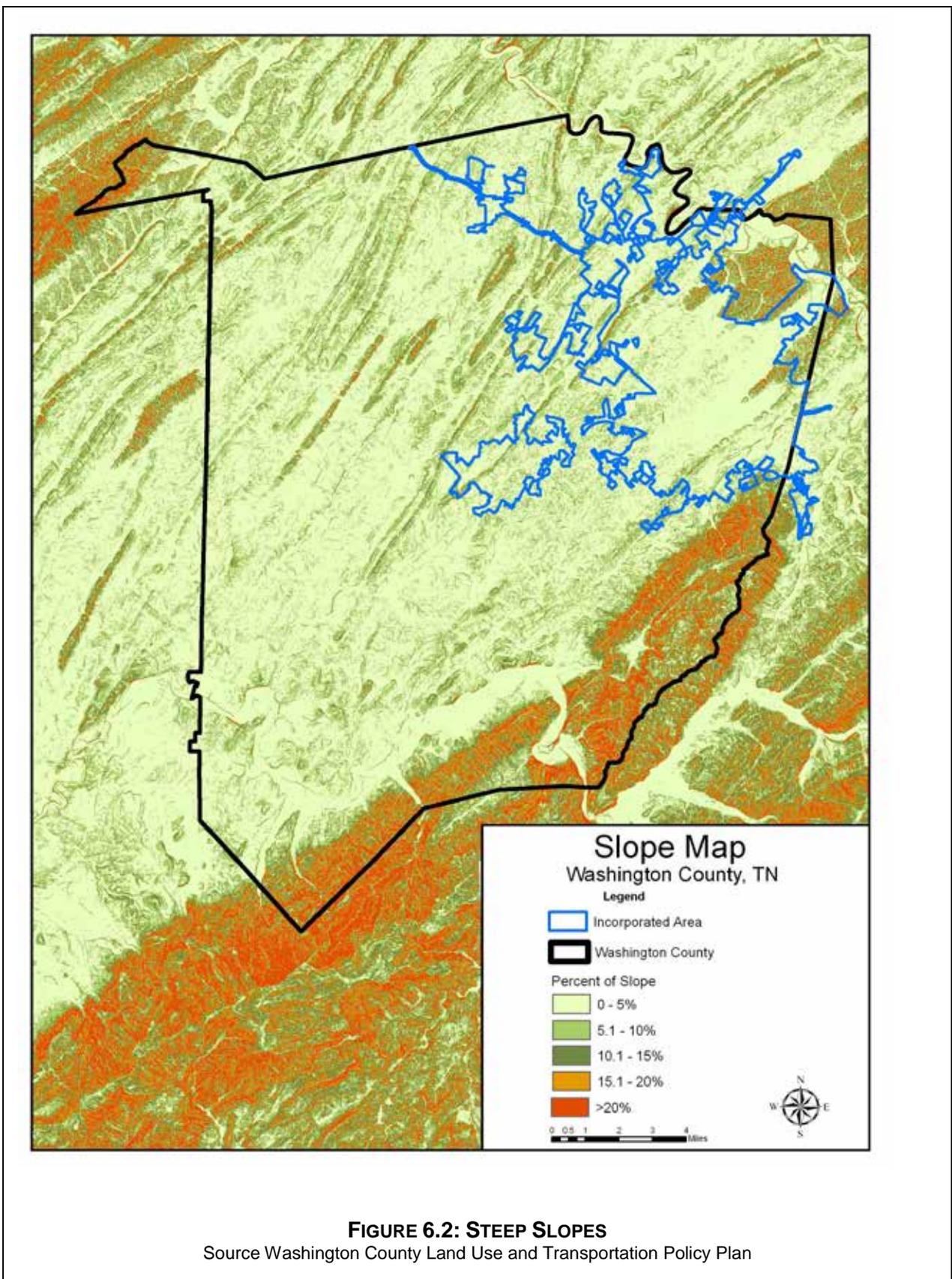


FIGURE 6.1: WASHINGTON COUNTY LAND USE – 2010
Source: Washington County



7.0 OTHER CONSIDERATIONS

This section covers cultural resources, scenic highways, floodplains, wetlands and water and sewer service areas.

7.1 CULTURAL RESOURCES AND PARKS

Washington County has a long and rich history. There are many notable historic sites and many are listed on the *National Register of Historic Places*. Sites on or eligible for listing on the Register are subject to protection under the law. So, care must be taken when transportation projects are developed to avoid direct or indirect impacts to such resources. Most of the historic sites are within Jonesborough or Johnson City. A number are located in the south county; three others are located in mid-county (**Figure 7.1: Historic Sites in Study Area**).

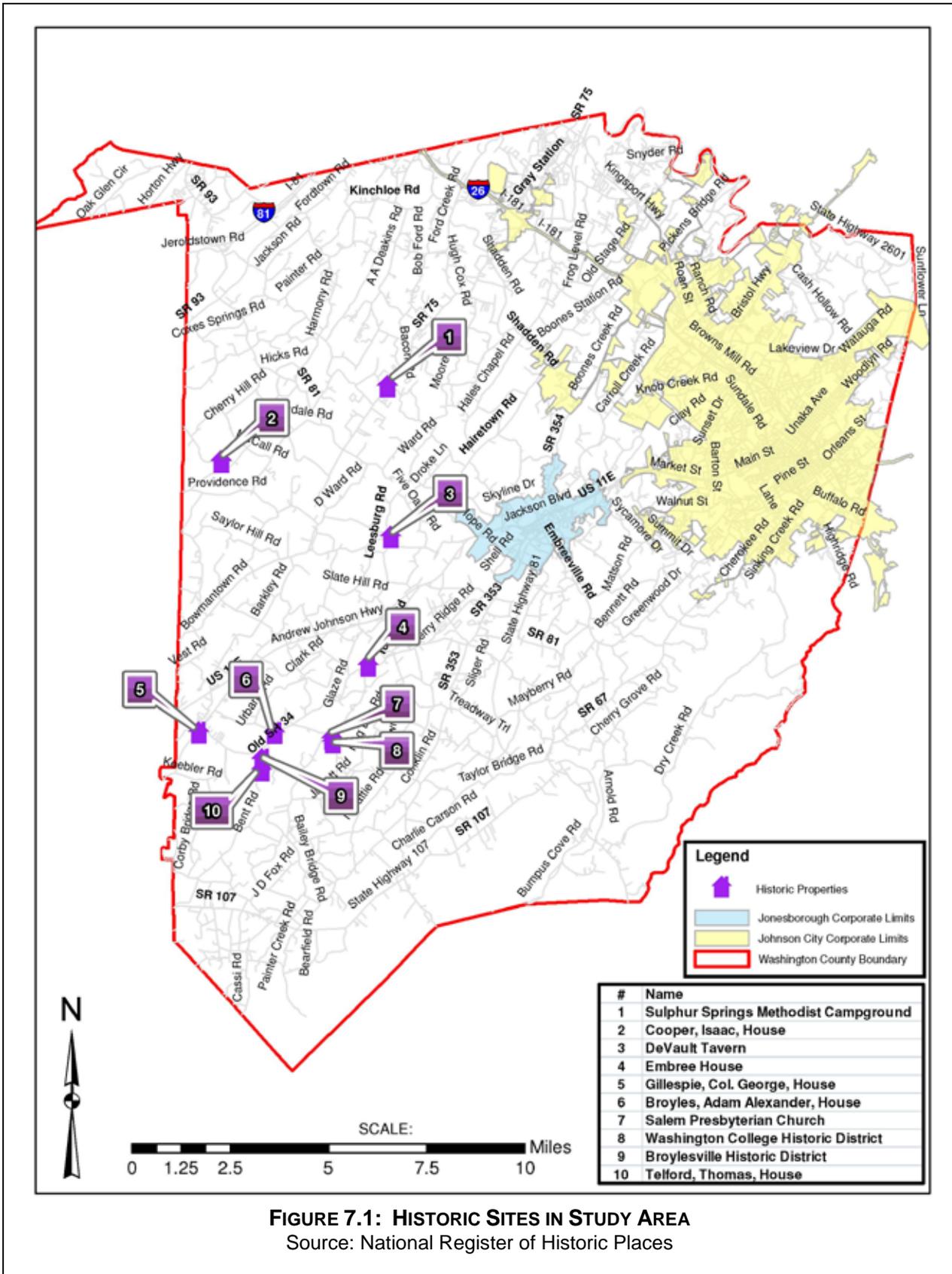


FIGURE 7.1: HISTORIC SITES IN STUDY AREA
Source: National Register of Historic Places

Washington County has no designated parks. The County Fairgrounds is located north of I-26, west of Gray, and adjacent to the National Guard Armory (**Figure 7.2: Washington County Fairgrounds**).

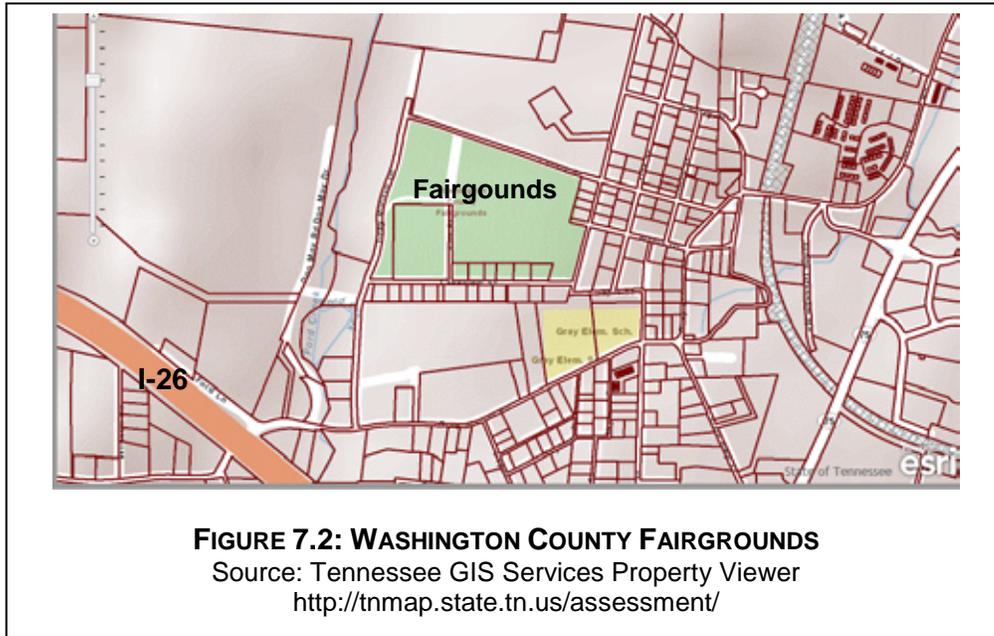


FIGURE 7.2: WASHINGTON COUNTY FAIRGROUNDS
Source: Tennessee GIS Services Property Viewer
<http://tnmap.state.tn.us/assessment/>

7.2 SCENIC HIGHWAYS

Demonstrating the natural beauty of the county, SR 81, SR 75 and SR 34 (US11E) are included on TDOT’s Parkways and Scenic Highways map. See **Figure 7.3: Scenic Highways**.

7.3 FLOODPLAINS AND WETLANDS

Johnson City occupies much of the flat land in the county that is subject to flooding. Generally, floodplains and floodways are very limited due to the ridge and valley topography of this section of the Appalachian Mountains. There are isolated locations where state and county roads are in close proximity to streams. Any project development effort will have to address these on a localized, case-by-case basis.

The topography likewise limits the extent of wetlands. Wetlands are either manmade, such as ponds, or associated with watercourses.

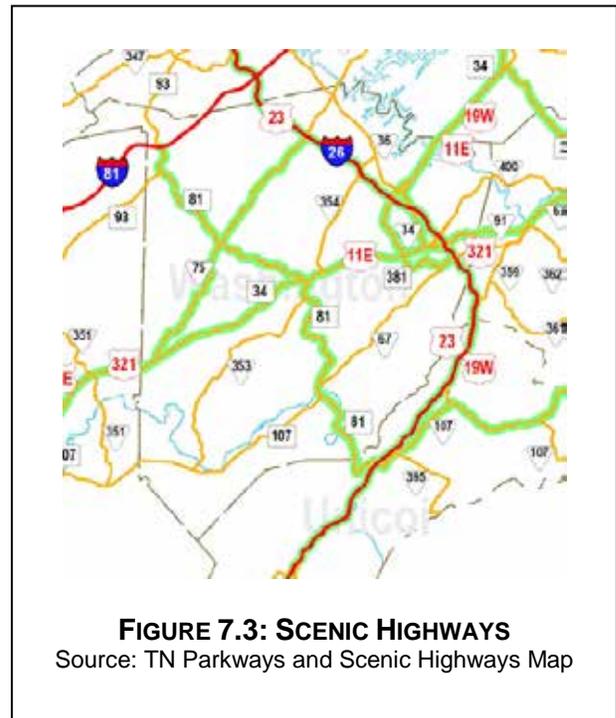


FIGURE 7.3: SCENIC HIGHWAYS
Source: TN Parkways and Scenic Highways Map

7.4 WATER AND SEWER SERVICE

The county's topography and low population density act as constraints for expanding water and sewer services, especially the latter. **Figure 7.4: Water and Sewer Lines** shows the extent of current service in the county (except that the Chuckey Utility District serves a small portion of the southwest county). Generally, sewer service is limited to the incorporated areas where there is a requirement that services be provided within a specified time after annexation, and one can see in **Figure 7.4** that the sewer and water lines generally conform to the city limits of Johnson City and Jonesborough. Jonesborough has a policy regarding water main extensions and cost sharing. Also, any proposed individual water supply and/or sewage disposal system must be approved by the State of Tennessee and appropriate permits must be secured.

Water mains operate under pressure, so it is common to construct them up and down the county's ridges, as long as service pressures can be practically maintained using a combination of pumping and storage facilities. Centralized sewage collection systems, are commonly gravity-based, although pressurized systems are an option. Centralized sewage collection systems in areas with variable terrains and low population density are costly to construct and operate. Lift stations are needed to convey sewage collected at low topographical points and conveyed to higher elevations. For conventional gravity-based, centralized sewage collection systems, lift stations can cost on the order of \$100,000 to \$200,000 each. Given the cost of centralized sewers, along with the availability of suitable on-site sewage treatment and disposal system alternatives, expansion of sewer systems usually trails expansion of "city" water, and in some cases never occurs. Laying water pipes may actually cost more than sewers, \$50/linear foot, versus sewer pipe costs on the order of \$40/foot, but the lift stations and treatment cost for centralized sewer management add significant cost.

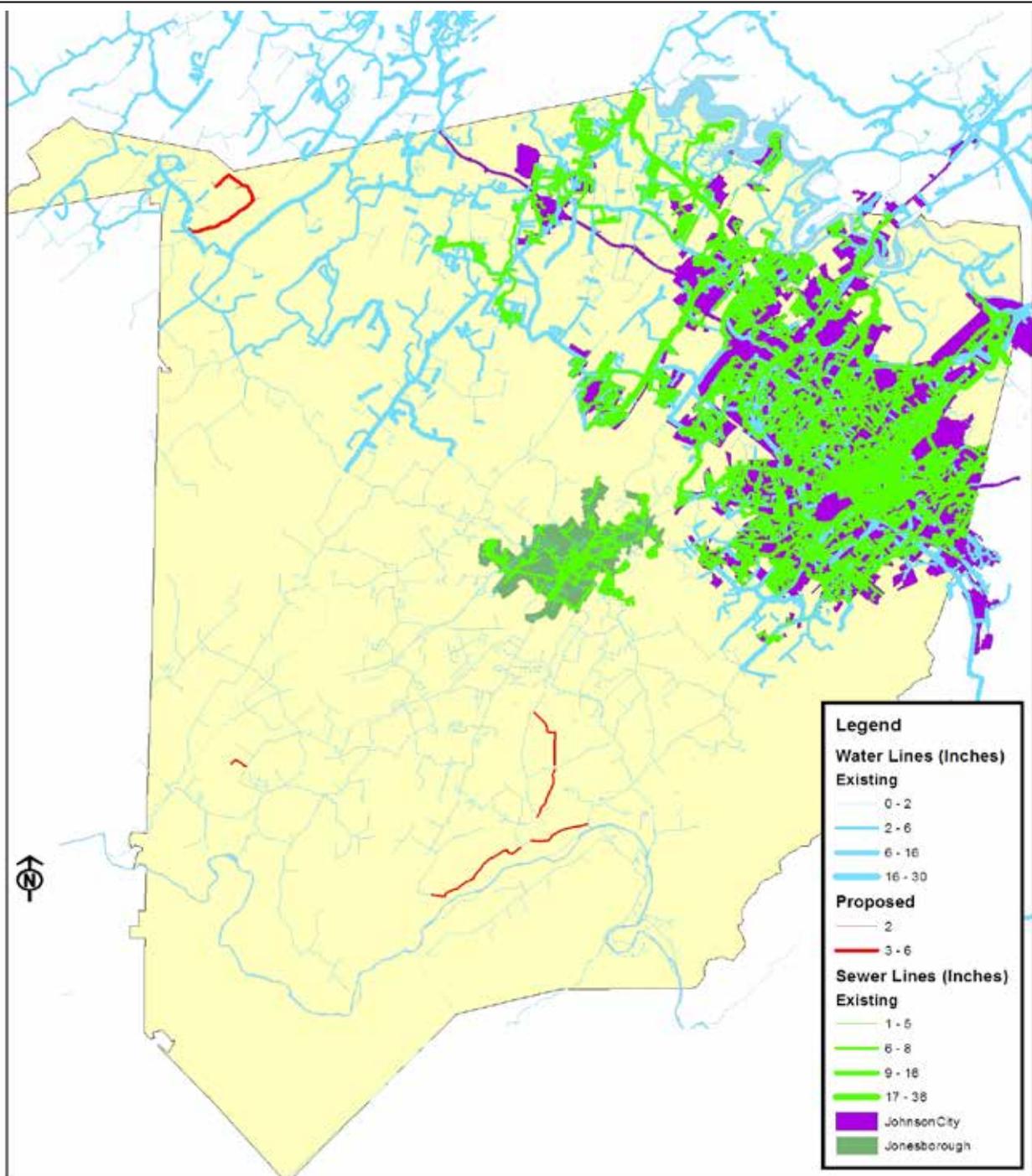


FIGURE 7.4: WATER AND SEWER LINES
Source: Johnson City Water & Sewer Services and
The Town of Jonesborough Sewer & Water Department

As a point of explanation, because of the terrain, Jonesborough’s wastewater system has on the order of 30 lift stations operating to serve its 4,000+ customers.

Normally sewers are extended as demand warrants. As sufficient development occurs, sewers are extended incrementally until capacity of the main lines is reached. The costs of extensions are normally recouped over time through the connection fees paid by the new users. Sewers can also be extended based on the expectation of adding new customers. For example, a sewer main was extended west on SR 34 (US11E) to serve, among other sites, the Washington County Industrial Park and the new Grandview Elementary School. And, the Regional Wastewater Treatment Plant in Gray was paid for by Johnson City bonds.

Water quality standards and US Environmental Protection Agency regulations can also drive wastewater treatment decisions. Septic systems are adequate and cost-effective from the standpoint of water quality, if properly operated and maintained. Septic tank requirements fall under the control of the Washington County Planning Commission through their zoning control. Presently, the rural county relies upon septic systems as is indicated in the following excerpt from the Washington County Subdivision Regulations.

Washington County Subdivision Regulations 8/2/2010
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- a. For residential lots, the maximum fire hydrant spacing shall be 1000’ as measured along an improved road and the center of any improved, approved, or recorded lot shall be within 500’ of a hydrant.
- b. For multifamily structures, the maximum fire hydrant spacing shall be 500’ as measured along an improved road and any building shall be within 300’ of a hydrant.
- c. For commercial or industrial uses, the maximum fire hydrant spacing shall be 300’ as measured along an improved road and any building shall be within 300’ of a hydrant.
- d. Hydrants shall be located at intersections whenever possible.

If the pressure and flow for public water mains are not sufficient to meet State regulations for fire hydrant installation, the water system shall provide sufficient main size per State regulations for fire hydrants and provide tees and valves for future fire hydrant installation. The location of the tees and valves for future fire hydrant installation shall be shown and labeled on the construction plans.

8. Sanitary Sewers

Where lots cannot be economically connected to a sanitary sewer system, they must contain adequate area for the installation of an approved septic tank and disposal fields and must be approved in writing by the State of Tennessee.

A greater density of development is allowed if public sewers are present. For example, in agriculturally zoned areas the number of dwelling units allowed by the zoning code is one per acre without sewers and three (3) per acre with sewers. In areas zoned R1, lots must be 15,000 square feet, but if sewers are present (R1a), the lot size can be reduced to 12,000 square feet.

Septic system drain fields require a certain depth of soil and should not be constructed on steep slopes. The shallow soils and steep slopes in certain parts of the county act as limitations. The presence of rock near the surface limits the installation of both septic systems and sewer lines.

An example of the cost of running sewers is provided along SR 81 over the 11 miles between the north limit of Jonesborough and the Fall Branch area at I-81 (**Figure 7.5: Example Sewer Line along SR 81 and Topography**). With construction costs of \$40/linear foot and an estimated eight (8) lift stations, the cost to run an interceptor type sewer would likely be upwards of \$4 million. Lateral lines to service development would increase the cost. These costs could inflate significantly where rock excavation would be needed to advance the lines and maintain grades¹. If sewage were treated at the low point in the line, east of SR 75, fewer lift stations would be needed and more gravity line used, but sewage treatment would have to be provided at that point, at a substantially increased cost.

As a comparison, if an average home septic system cost \$5,000; the \$4 million could cover 800 homes. With sewers there is a monthly bill. With a septic system, the tank has to emptied every few years.

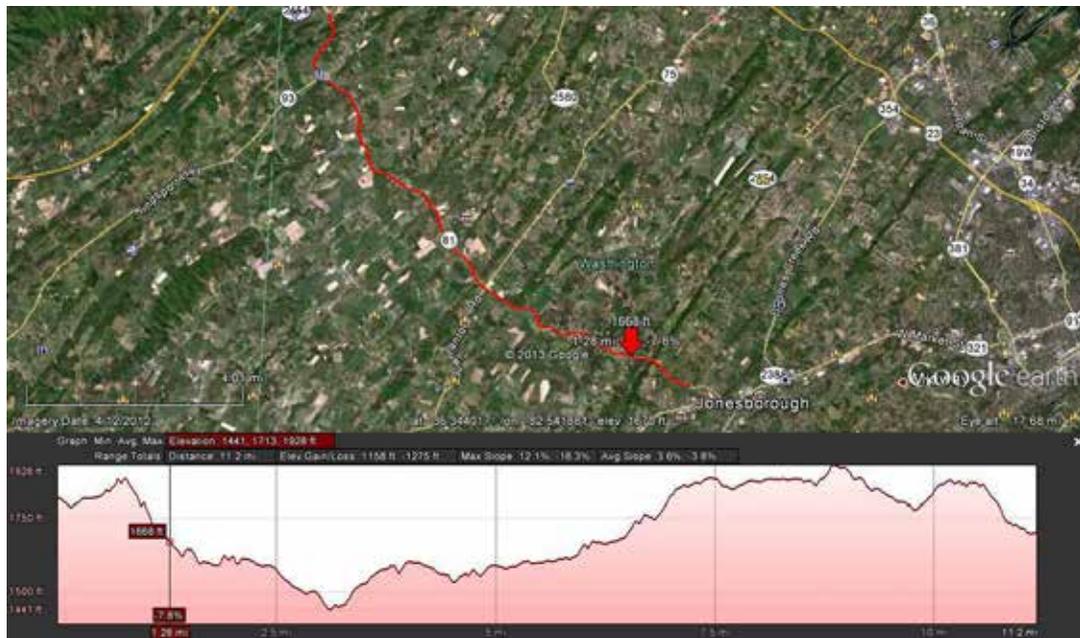


FIGURE 7.5: EXAMPLE SEWER LINE ALONG SR 81 AND TOPOGRAPHY
(profile at bottom is east to west)
Source: Google Earth

¹ The cost data noted assume installation in mostly open areas with no trenching deeper than 10 feet.

Another example would be running a sewer along SR 75 from the vicinity of the Daniel Boone High School to SR 81. Such a line would be half as long (5+ miles), but, importantly, be able to use gravity flow over most of its length, if it followed the valley and natural drainage to the southwest. But, at some point, a treatment plant would have to be constructed, unless flow were forced back to the Jonesborough or Johnson City systems with pump stations. Such a gravity flow sewer, without a treatment plant or pump stations, and with flow to a low point at SR 81 could cost on the order of \$1.5 million.

These examples, and the practical experience of the last 40 years since the passage of the Clean Water Act, indicate that, where housing remains dispersed and areas are unincorporated, onsite sewage treatment and disposal systems have and will provide a preferred way to address home generated sewage. Where subdivisions develop, septic systems can be constructed for individual homes or linked into a cluster or community system.

8.0 IMPLICATIONS OF SOCIO-ECONOMIC FACTORS ON TRANSPORTATION

The transportation Level of Service (LOS) analysis in Technical Memorandum #1 indicates that the roads outside the city limits of Johnson City and Jonesborough, on a lane-mile basis, will operate at the high level of service in the horizon year of 2040. Where that is not the case, improvements will be recommended. The transportation model that generated the LOS data is based on forecast socio-economic data. Those data take into account all forecast growth. The small area planning efforts that go into building the model and assessing the quality of the input data include reviews of city boundaries and the availability of services such as water and sewer.

This Technical Memorandum #2 does not find any evidence to modify the conclusions reached by examining the data output from the model. Therefore, this technical memorandum confirms the findings of Technical Memorandum #1.