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Environmental Engineers & Scientists

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From:
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Date:
October 31, 2010

Project No.:
50006-000-001

Subject:
Technical Memorandum 1 – Population and Wastewater Flow Projections
Wastewater Treatment Capacity and Effluent Disposal Study
Murfreesboro Water and Sewer Department

The primary objective of Technical Memorandum No. 1 is to describe the geographical distribution of baseline and projected wastewater flows based on current and projected population projections. This technical memorandum (TM) also includes an analysis of dry- and wet- weather flows and peaking factors for maximum month and peak day flows. This TM also includes an introduction and background to the study, as this document is the first of a series of technical memoranda.

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Tables

Figures

Attachments

1. Introduction and Background

The City of Murfreesboro Water & Sewer Department (MWSD) commissioned Hazen and Sawyer to develop a *Wastewater Treatment Capacity and Effluent Disposal Study*. As part of this study, Hazen and Sawyer evaluated potential wastewater disposal and treatment alternatives that are cost-effective, meet regulatory requirements, and fulfill capacity needs as identified in the population and flow projections. One of the main objectives was to make recommendations of whether to expand the Sinking Creek Wastewater Treatment Plant (SCWWTP) and its collection system or to build a decentralized system with satellite wastewater treatment facilities to meet local demands.

Wastewater flow over the past 10 years to the SCWWTP have been rapidly increasing due to both population growth in the existing city limits and a rise in demands for service inside the City's urban growth boundary areas. As the SCWWTP is already operating above 80 percent capacity, this study must result in recommendations for immediate capacity needs while also becoming a planning tool over a minimum 20-year capital and operation and maintenance (O&M) investment horizon. The following major objectives were established for this study is as follows:

- Compile and perform a comprehensive review of previous reports, projects, and data.
- Develop a geographic distribution of population and wastewater flow projection estimates for 5-year increments through a 20-year planning period.
- Outline recent discussions with the Tennessee Department of Environment and Conservation (TDEC) regarding system expansion and prioritize disposal alternatives through the evaluation of the feasibility of regulatory approval.
- Review existing systems associated with collection, treatment, and discharge of wastewater; recent system improvements and plant recommendations in the *Preliminary Engineering Report, Sinking Creek Wastewater Treatment Plant Phase 4C Expansion* (SSR, 2008).
- Evaluate options for meeting discharge and disposal capacity requirements, including seasonal discharge permits, opportunities to maximize treated water reuse, and zero discharge and reuse options to determine feasibility and cost-effectiveness.
- Evaluate centralized and decentralized treatment alternatives through the analysis of hydraulic capacity, nutrient removal capability, biosolids treatment and disposal, MBR systems, repurification system, and collection system improvements, and financial information.
- Develop available options for system improvements and ensure all existing assets are being leveraged to support the needs identified and projected future growth.
- Work with MWSD to evaluate options for funding of major capital improvements recommended in the study.

2. Service Area Population

In order to facilitate the determination of baseline and projected service area populations, MWSD's service area (current and potential) was previously divided into approximately 123 sanitary sewer districts as displayed in Figure 2-1. These districts represent local wastewater drainage sub-basins, pump station service areas, and/or planning boundaries. Hazen and Sawyer has retained the use of these sewer districts; however, following our Team's review of the gravity sewer and the force mains within the sewer districts, the boundaries were adjusted slightly to better reflect the areas served and extents of existing infrastructure.

Baseline total population values for each sewer district were determined using GIS data and were based on a categorization of each sewer district, as follows:

- For districts in which the entire area is served by MWSD sewer as judged by the distribution of MWSD and Consolidated Utility District (CUD) water meters and sewer cleanouts identified in GIS, baseline populations were calculated using the number of residential meters multiplied by an assumed 2.7 persons per meter. To account for multi-family housing, the number of duplexes was multiplied by an assumed 2.7 persons per duplex (with two meters identified per duplex) and the number of apartments or other multi-family residential units multiplied by an assumed 1.5 persons per apartment. A list of multi-family housing units was provided by MWSD.
- Partially-served districts included the same baseline population calculation for the completely-served districts (i.e., a meter count) plus an estimate for households without sewer service that was calculated through a building count. The building count was completed in GIS by overlaying zoning, building, and meter layers to determine the number of houses without service. This household count was multiplied by the unit value of 2.7 persons per house and added to the sewered baseline population for each district.
- Populations for districts without any sewer service were determined by completing the same type of building count as described for partially served districts. Apartments known to be in those districts were added using the number of apartments multiplied by 1.5 persons per apartment.

As MWSD does not provide sewer service to all of the residents within the service area, it was necessary to establish both the total population and the actual population served within each district. The population served was determined by estimating a service percentage for each sewer district based on the number of residences that have an MWSD meter or a sewer cleanout compared to those with service. This service percentage was then multiplied by the total population to estimate the population served by sewer. Using this method allows the service percentage to be increased in future years to account for the increase in population served for districts in which sewer extensions have been proposed. The population served calculation is described in the following equation:

Sanitary District Population Served = (Sanitary District Total Population) x (District Service Percentage)

To validate estimated service area populations, an analysis was completed on each individual sewer district in which the following factors were taken into account:

- Area available for future growth within each district.
- Current zoning classifications within the service area as shown in Figure 2-2.
- Active subdivisions, as indicated in the City's GIS and identified through discussions with the Murfreesboro Planning Department. These major subdivisions are shown in Figure 2-3.

Based on this criteria, the growth potential for each sewer district was designated as None (0.0 percent annual growth rate or AGR), Minimal (1.5 percent AGR), Standard (3.0 percent AGR), or Aggressive (5.0 percent AGR). This method allows an accounting of districts that appear to already be built-out versus those where new subdivisions are planned. The "standard" AGR rate of 3.0 percent was defined based on an evaluation of the City's historical population growth. The "aggressive" rate was based on an evaluation of historical growth during the high expansion years of 2000 to 2006.

The increase in district service percentage, as defined previously, for each 5-year increment in the 20-year planning period was estimated for each sewer district using the proposed sewer expansions described by the Wastewater Facilities Plan (2002). Infrastructure improvements labeled as "mid-term" in the 2002 Facilities Plan were assumed to be completed by 2030.

The resulting distributions of total population by sewer district are shown in Figure 2-4 (current baseline of 2010), Figure 2-5 (projected year 2020), and Figure 2-6 (projected year 2030). The population served values for the sewer districts are displayed in Figure 2-7 (baseline of 2010), Figure 2-8 (year 2020), and Figure 2-9 (year 2030). Figures A1-1 and A1-2, provided in Attachment A, illustrate the change in total population by sewer district between 2010 and 2020 and 2020 and 2030, respectively. As can be seen in these figures, the highest growth potential is in the south-west regions of the service area (west of I-24) and in the area immediately northeast of Murfreesboro's city center. The total projected service area populations for the study area (i.e., the sum of all of the sewer districts) are shown in Table 2-1 and displayed by district in Table A1-1.

Figure 2-10 displays the historical populations for the City of Murfreesboro and Rutherford County as determined from census data. The projected total population and population served over the study time frame are also shown.

Table 2-1: Summary of Population Projections

Year	Total Service Area Population	Total Population Served	Total Population Average Annual Growth Rate [1]	Population Served Average Annual Growth Rate [1]
2010	179,981	109,641	-	-
2015	204,727	122,766	2.61%	2.29%
2020	234,296	138,840	2.73%	2.49%
2025	269,775	158,623	2.86%	2.70%
2030	312,521	183,910	2.99%	3.00%

[1] *The population values in this table represent the sum of the individual sewer district populations, each of which is estimated using different growth rates based on the methodology described in the text. The average annual growth rates in this column were back-calculated based on the totals shown in this table and are displayed for reference only.*

Miles
0 1.25 2.5 5

N

Legend

Interceptors
- Connection To WWTP PS
- Bradville Rd
- Bushman Creek
- Lower Lytle-2
- Northeast
- Overall Creek
- Puckett Creek
- Samsonite Relief
- Sinking Creek
- Southwest
- Stones River
- Upper Lytle
- VA

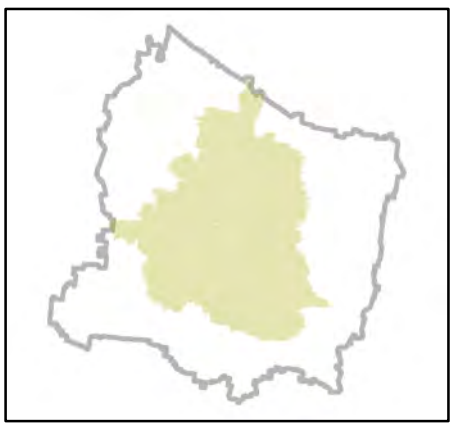
- Interceptor Force Main
- Forcemain
- Pipes
- Interceptor Pump Stations
- Pump Stations
- WWTP
- Sewer Districts
- Rutherford County Boundary
- Murfreesboro Urban Growth Boundary
- Murfreesboro City Limits
- Roads

Figure 2-1
Sewer Districts

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department

Miles
0 1.25 2.5 5

N



Legend

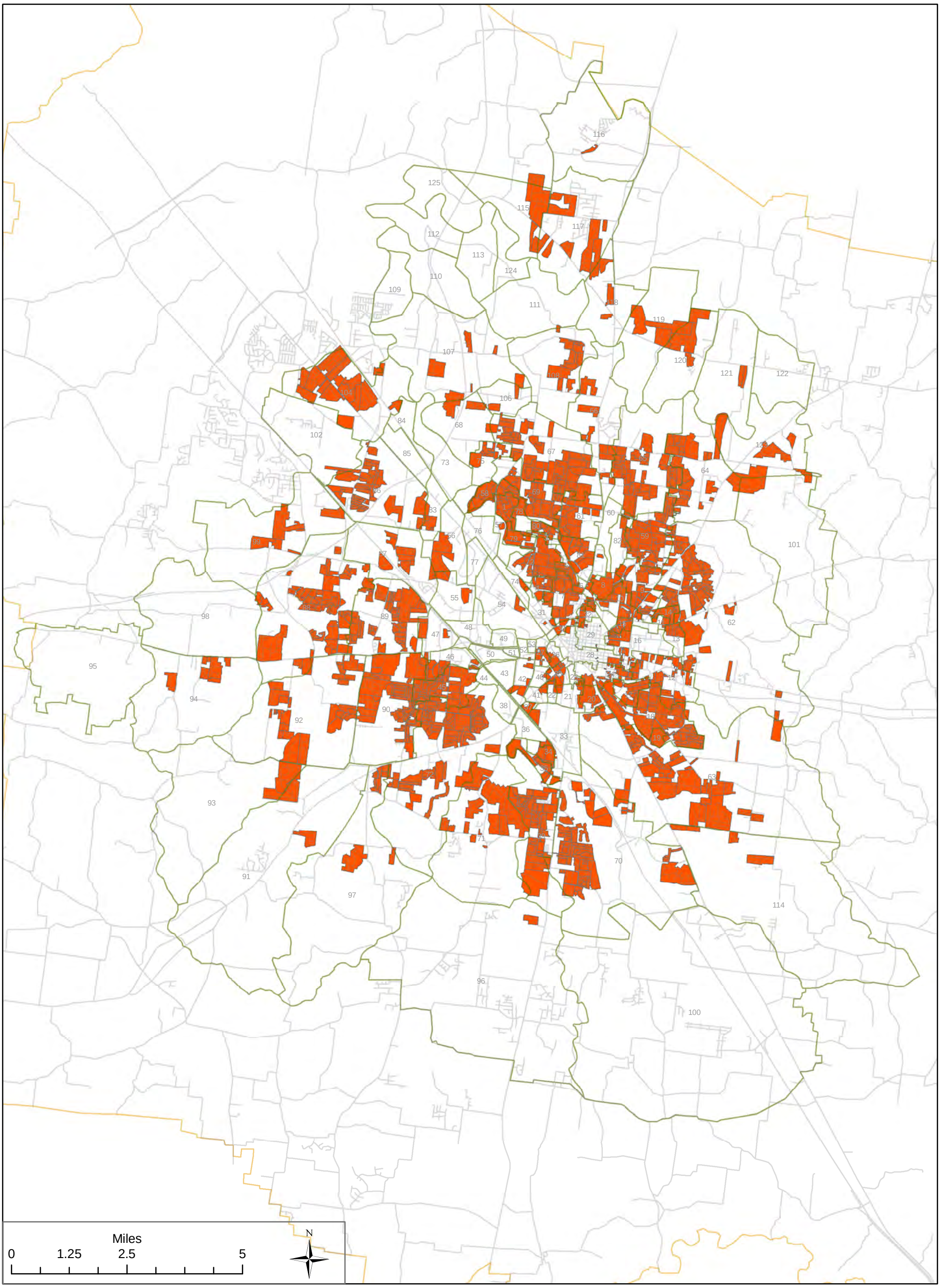
Current Zoning Classifications

- Central Business District
- Commercial District
- Business Residential
- College and University District
- Industrial
- Planned Residential District
- Single Family Residential District
- Planned Commercial District
- Planned Indiustrial District
- Planned Unit Development
- Mobile Home district
- Duplex Residential District
- Multi Family Residential District
- Park

- Sewer Districts
- Roads

Figure 2-2
Current Zoning Classifications in Service Area

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department

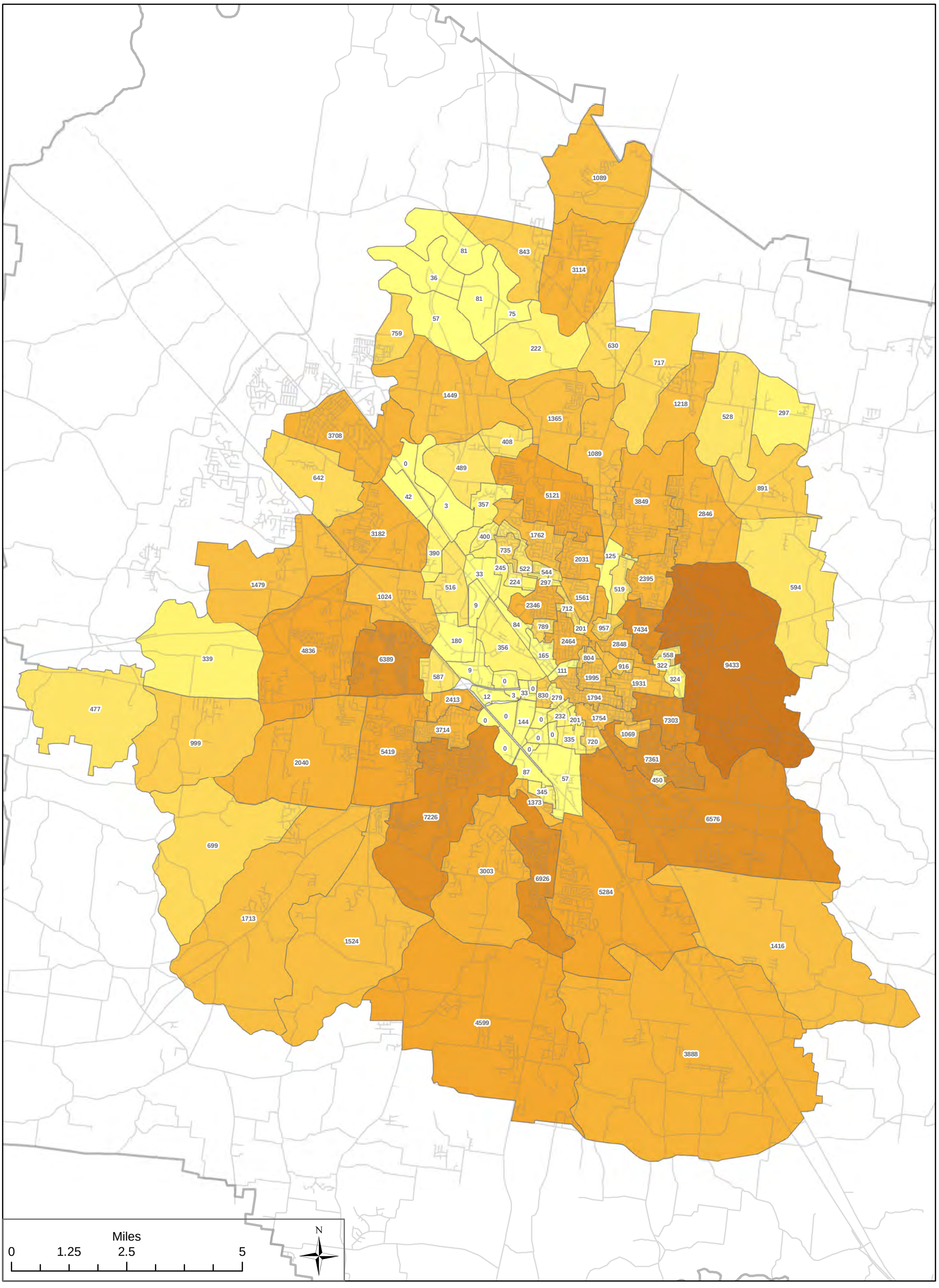


Legend

- Active Subdivisions
- Sewer Districts
- Rutherford County Boundary
- Roads

Figure 2-3
Active Subdivisions as in Indicated in City GIS

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department



Legend

2010 Total Population by Sewer District

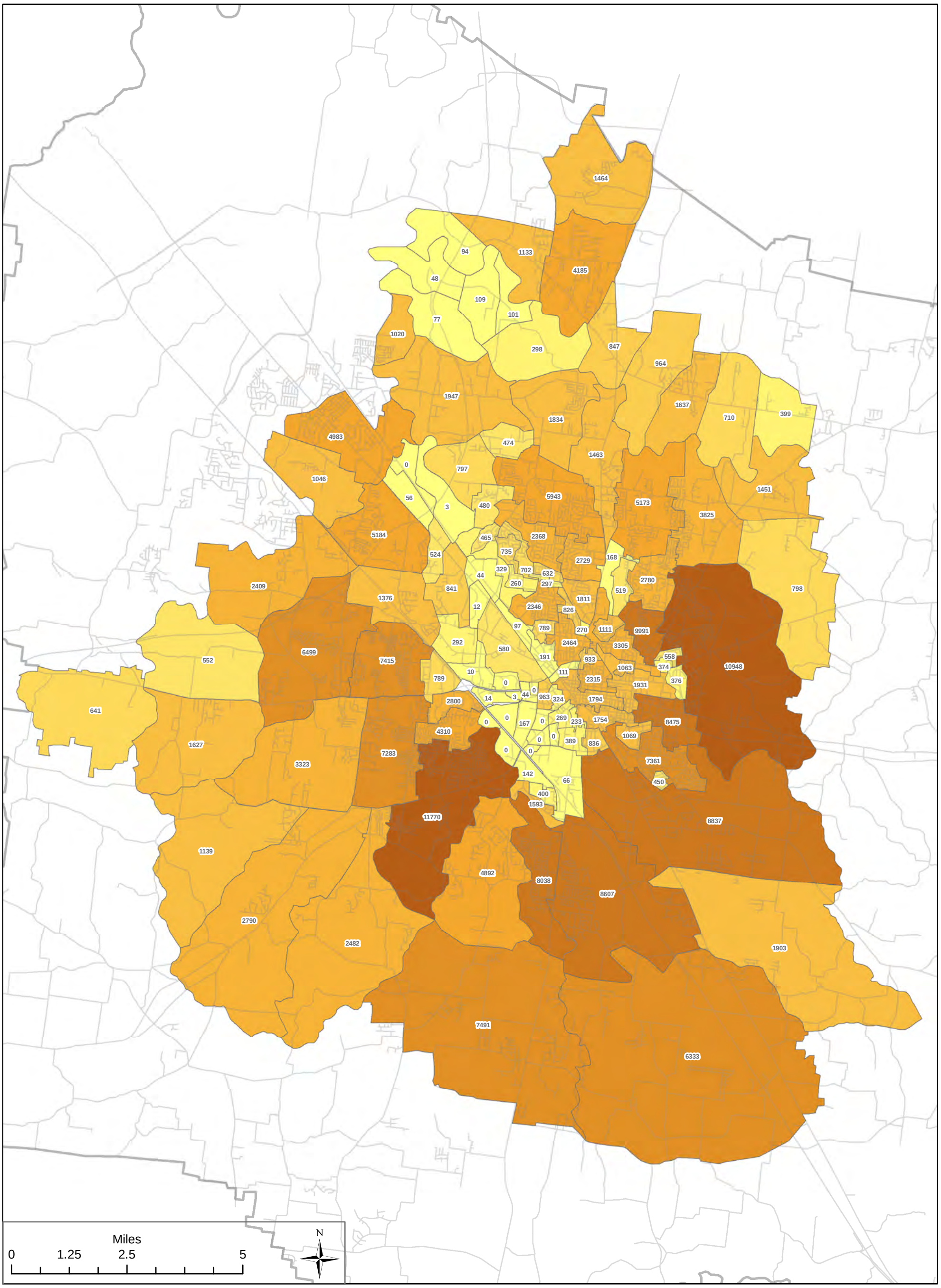
- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000
- 8001 - 10000
- 10001 - 12000
- 12001 - 14000
- 14001 - 16000
- 16001 - 18000
- 18001 - 20000

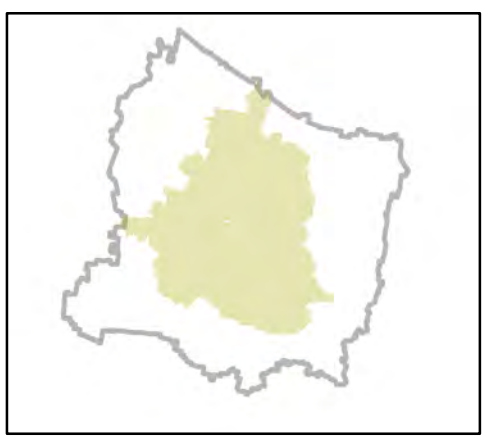
Rutherford County Boundary

Roads

Figure 2-4
Year 2010 Total Population by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department





Legend

2020 Total Population by Sewer District

- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000
- 8001 - 10000
- 10001 - 12000
- 12001 - 14000
- 14001 - 16000
- 16001 - 18000
- 18001 - 20000

Rutherford County Boundary

Roads

Figure 2-5
Year 2020 Total Population by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department

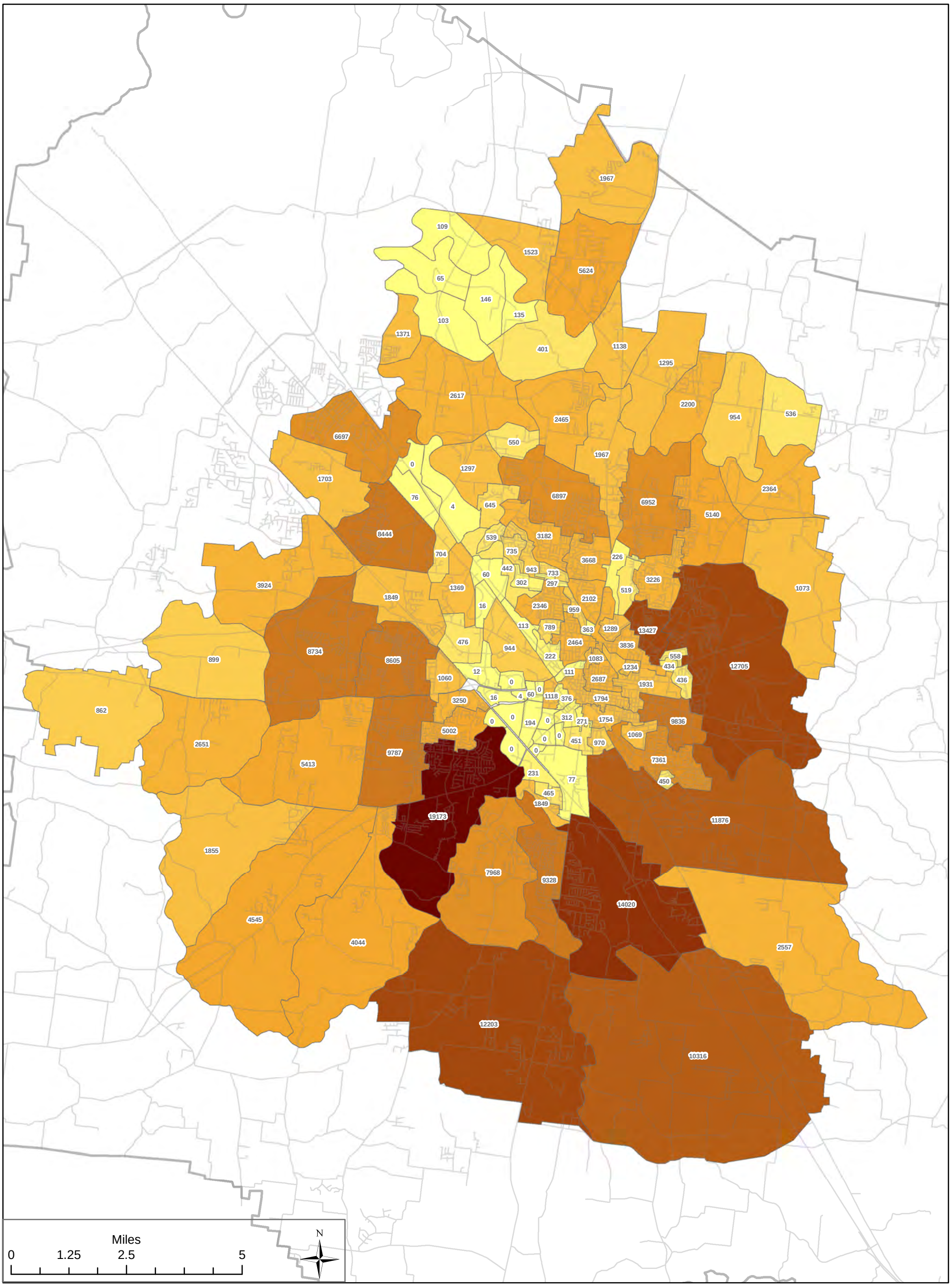
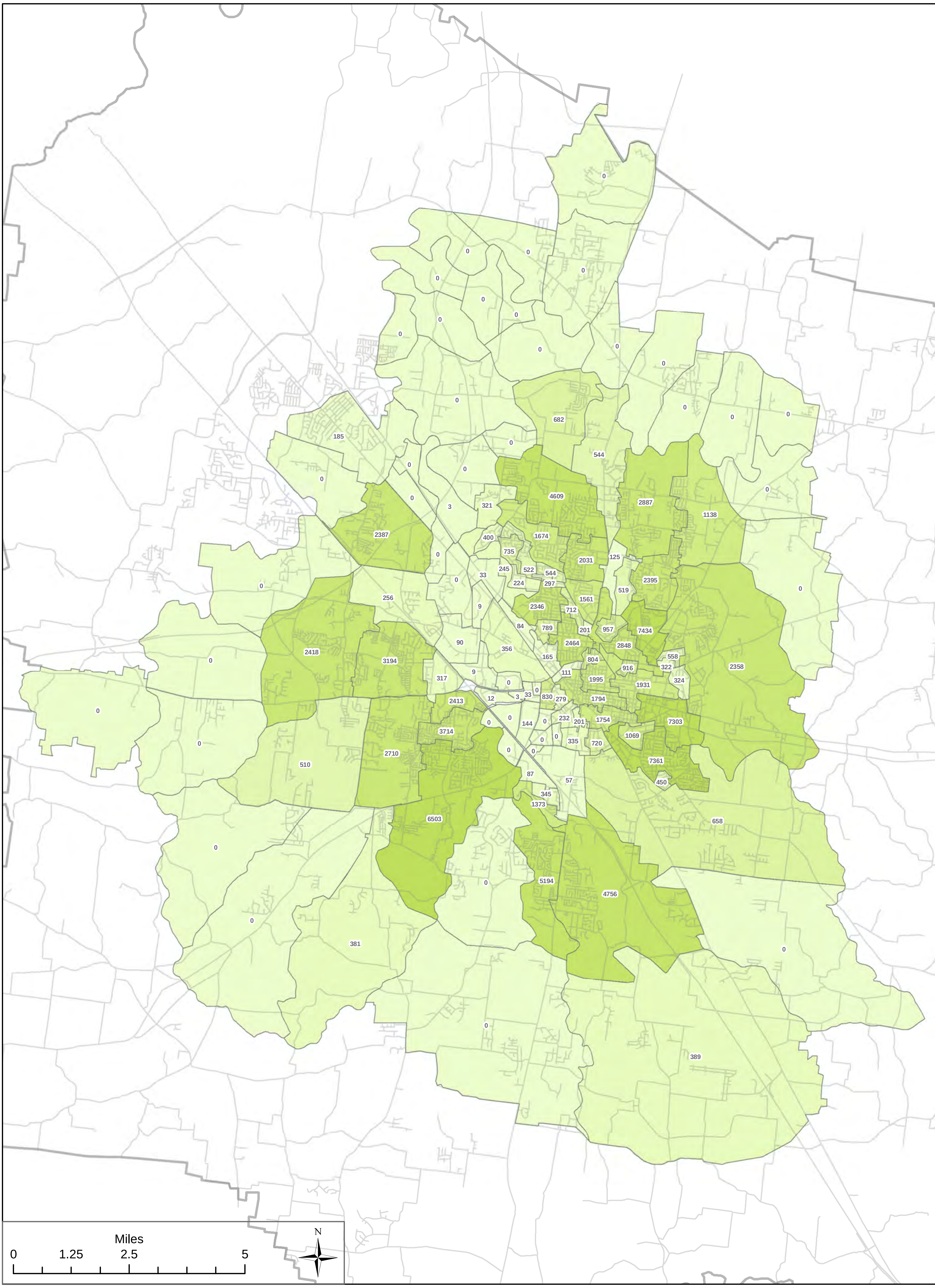


Figure 2-6
Year 2030 Total Population by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department



Legend

2010 Population Served by Sewer District

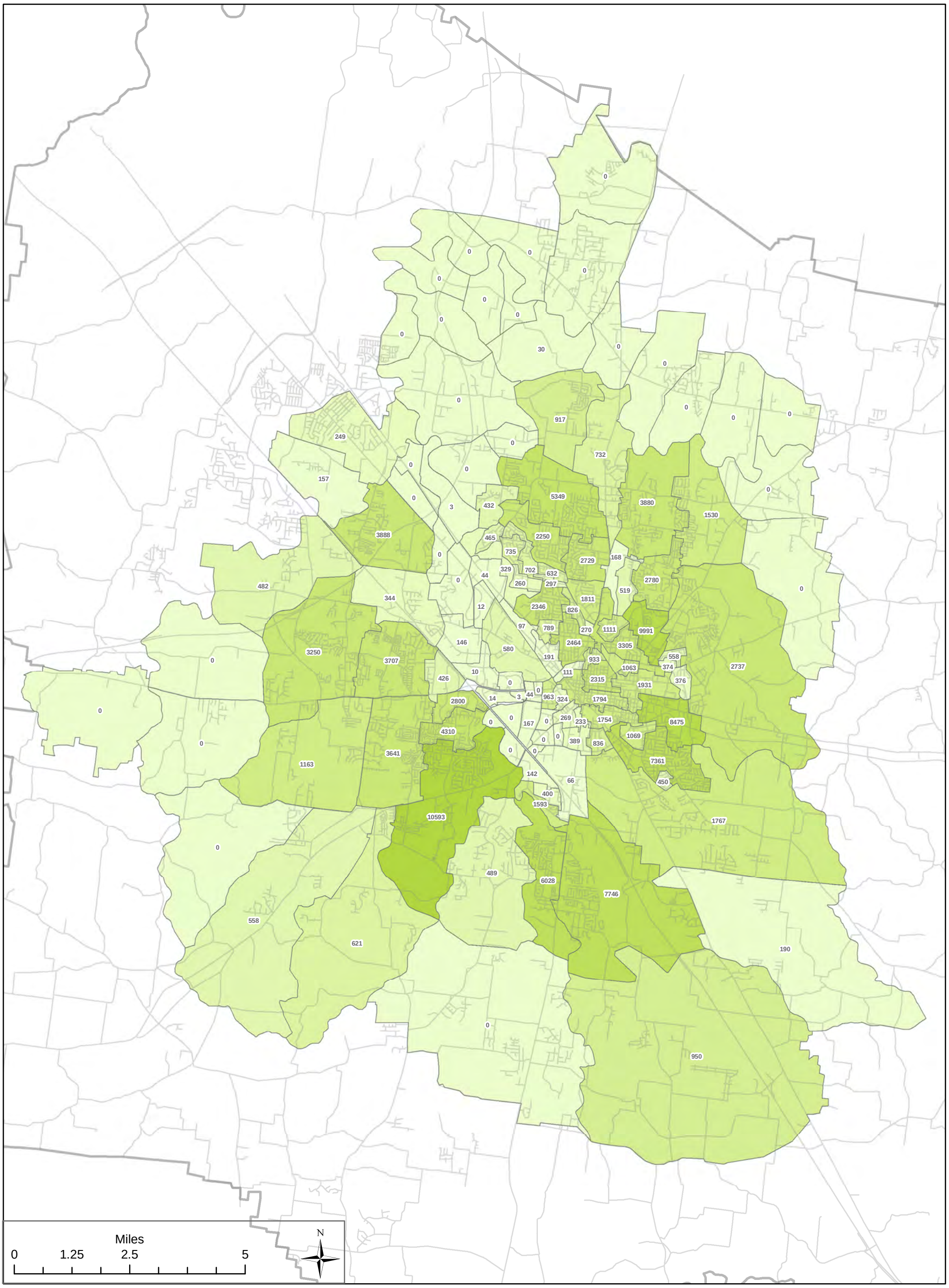
- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000
- 8001 - 10000
- 10001 - 12000
- 12001 - 14000
- 14001 - 16000
- 16001 - 18000

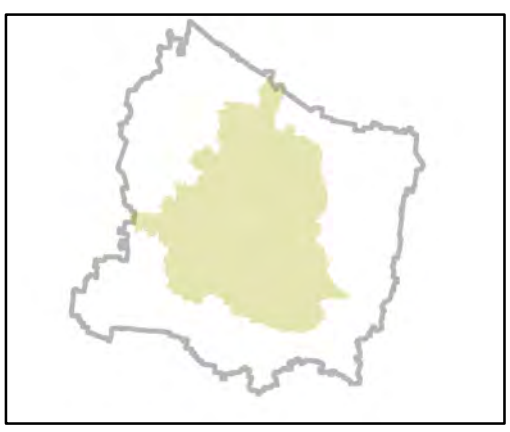
Rutherford County Boundary

Roads

Figure 2-7
Year 2010 Population Served by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department





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2020 Population Served by Sewer District

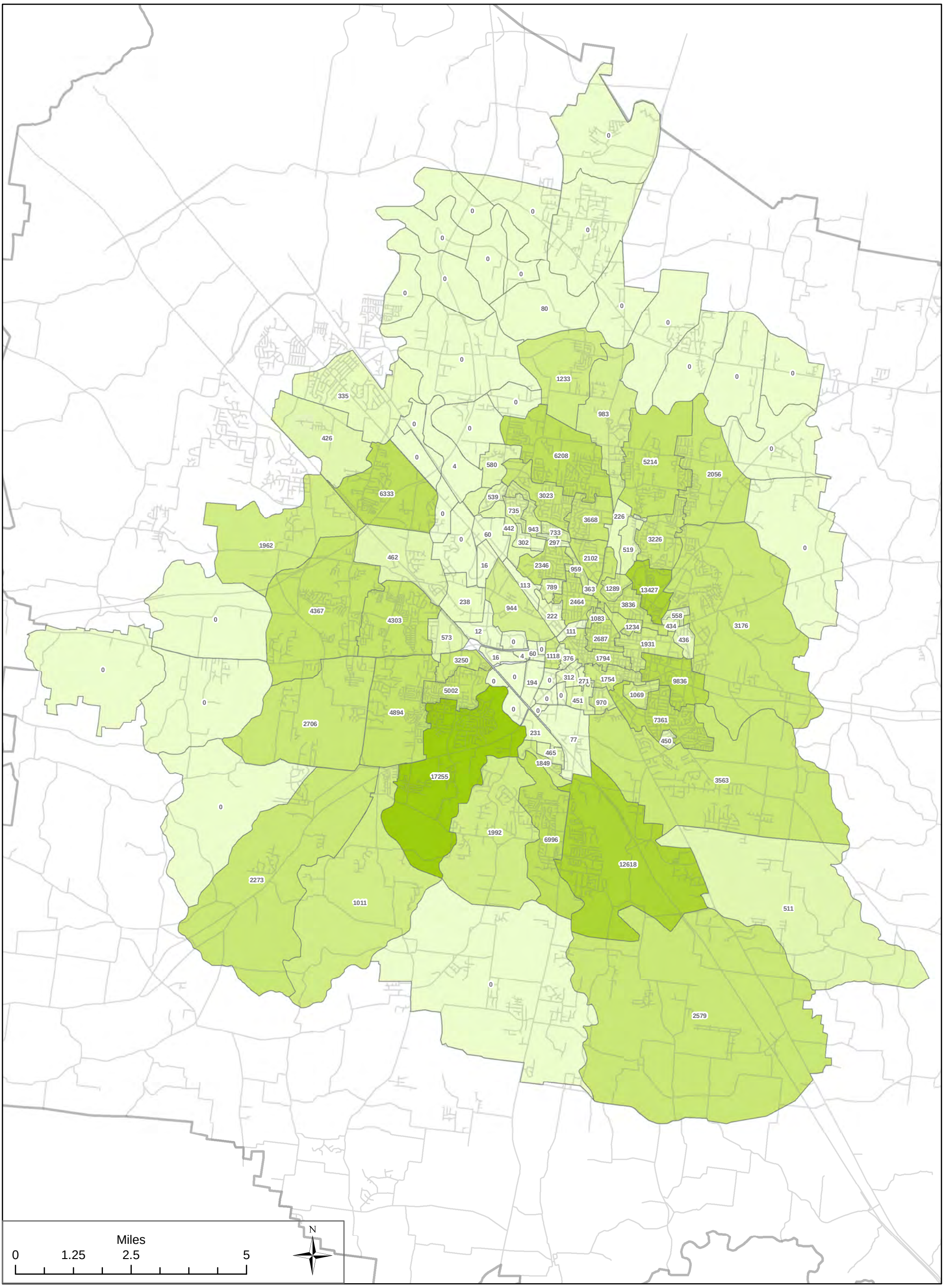
- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000
- 8001 - 10000
- 10001 - 12000
- 12001 - 14000
- 14001 - 16000
- 16001 - 18000

Rutherford County Boundary

Roads

Figure 2-8
Year 2020 Population Served by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department



Legend

2030 Population Served by Sewer District

- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000
- 8001 - 10000
- 10001 - 12000
- 12001 - 14000
- 14001 - 1600
- 1601 - 18000

Rutherford County Boundary

Roads

Figure 2-9
Year 2030 Population Served by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department

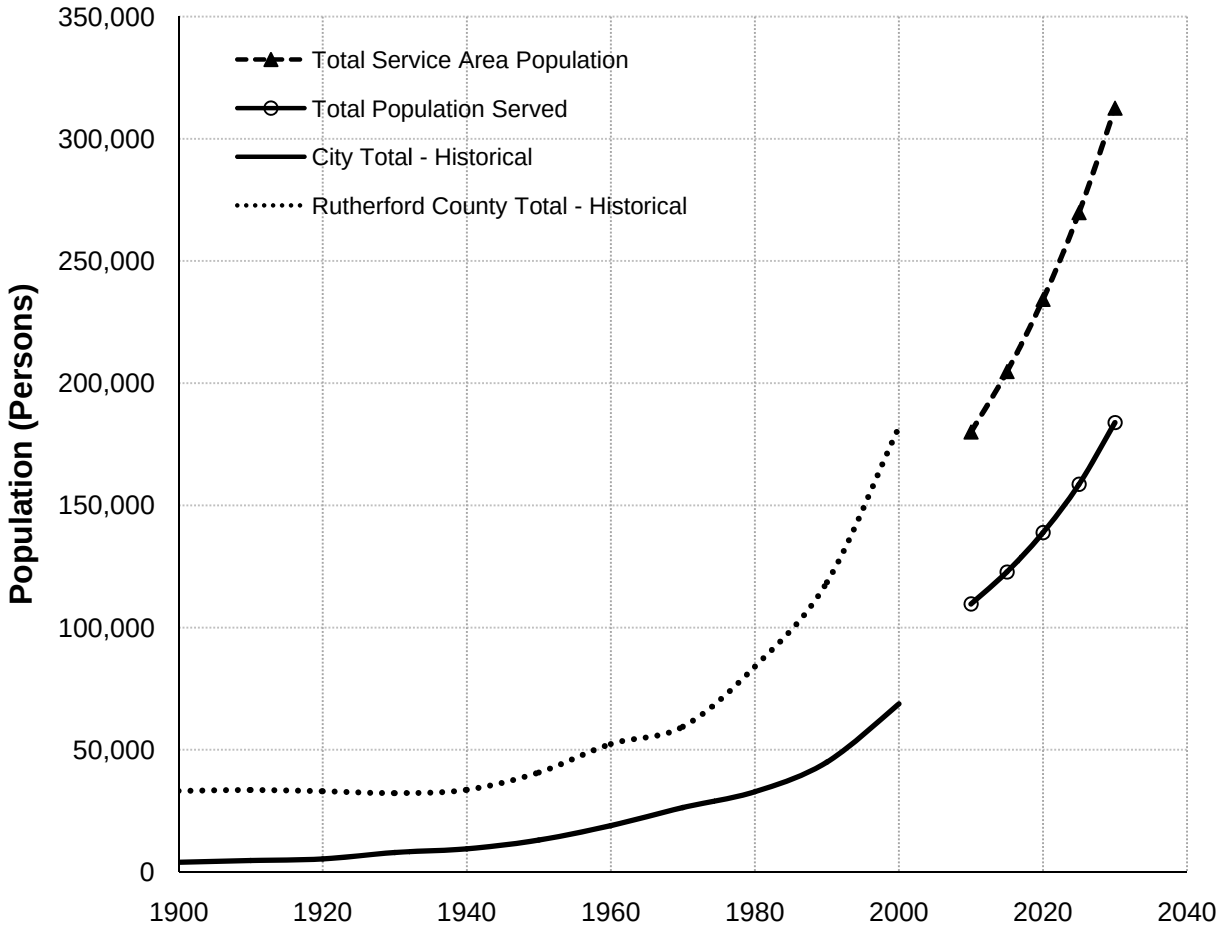


Figure 2-10: Historic and Projected Total Population and Population Served

3. Wastewater Flow Analysis

The population projections described in the previous sections form the basis for development of wastewater flow projections throughout the current and proposed service areas. To determine the short-term and long-term needs of the City of Murfreesboro's wastewater treatment system, wastewater flow projections were developed for the following planning periods:

- Current baseline wastewater flow (year 2010).
- 5-Year planning period (year 2015).
- 10-Year planning period (year 2020).
- 15-Year planning period (year 2025).
- 20-Year planning period (year 2030).

Analysis of the current (2010) baseline wastewater flow incorporated the three methodologies are as follows:

- Review of recent wastewater flow influent to the SCWWTP using the plant's monthly operating reports.
- Review of recent wastewater flows at each of the permanent flow monitors within the system using the City's online flow monitoring portal
- Geographical distribution of flow based on population projections by sewer district.

The baseline flow calculated from the 2010 population estimate utilized the baseline population in each sewer district (provided in Table A1-1), an assumed average daily flow per capita of 130 gallons per person per day (gpcd), and non-residential flow estimated as a percentage of the total residential flow based on the ratio of non-residential meters to residential meters identified in GIS. Historical flow data from the collection system flow monitors was used to assess the dry- and wet-weather flow and peak conditions. Population projections were then used to estimate wastewater flows throughout the planning period.

3.1 Historic Wastewater Flow

Wastewater flow rates for a public utility are typically considered for several flow conditions and defined as follows:

- Annual Average (Daily) Flow – The total wastewater flow generated in one year divided by the number of days in the year.
- Maximum Month Flow – The largest amount of wastewater flow expressed as a daily flow rate generated in one calendar month over a one-year period.

- Maximum Instantaneous (Hourly) Peak Flow – The maximum instantaneous (or hourly) quantity of wastewater flow expressed as a daily flow rate generated over a one year period. Peak Day Flow, the largest amount of wastewater flow generated in one day over a one-year period, may also be evaluated.

3.1.1 Annual Average Flow

Monthly operating reports for the SCWWTP were provided by MWSD for the period from January 2007 to June 2010. These reports include the daily average and maximum flow rates for each day of the month. For the year ending June 2010, the annual average daily flow for the treatment plant was 16.20 mgd and the annual average daily discharge to West Fork was 12.56 mgd. The SCWWTP average daily flow rates for this period are shown in Table A1-2.

3.1.2 Maximum Month Flow

From July 2009 to June 2010, the maximum month flow for the SCWWTP was 21.9 mgd, which occurred in February 2010. The maximum month-to-annual average flow ratio for the period from July 2009 to June 2010 was 1.35 (21.90 mgd / 16.20 mgd). Maximum month flows normally occur during periods of high rainfall and are typically used for treatment facility sizing because NPDES discharge permit effluent limits are based on monthly average values.

3.1.3 Peak Flow

Peaking factors were calculated for each sewer district using flow data from July 2009 to June 2010 at all permanent flow monitors. This data was downloaded from MWSD's online portal maintained by ADS Environmental Services. Ratios of maximum month and peak day to average annual daily flow were calculated for each flow monitor. After review of the ratios (or peaking factors) determined them to be abnormally high, the data for the May 2010 rain event, the near 1,000-yr storm that caused significant flooding in middle Tennessee, was removed and peaking factors were recalculated. The resulting peaking factors for each flow monitor are shown in Table 3-1.

Figure 3-1 illustrates the basins associated with each flow monitor. Peaking factors were assigned to each sewer district based on the corresponding flow monitor fed by each sewer district. For districts not served by a flow monitor, a maximum month-to-annual average daily flow factor of 1.1 and a peak day-to-average annual daily flow factor of 2.5 were assigned.

Table 3-1: Peaking Factors by Flow Monitoring Basin for July 2009 to June 2010

Flow Meter ID [1]	Annual Average Daily Flow (mgd)	Maximum Month Flow (mgd)	Peak Day Flow (mgd)	Max Month-to-Annual Average Peaking Factor	Peak Day-to-Annual Average Peaking Factor [2]
MF01	8.58	10.92	17.47	1.29	2.50
MF02	4.67	6.59	10.47	1.41	2.50
MF03	1.22	1.75	3.81	1.44	3.13
MF04	1.10	1.71	2.65	1.56	2.50
MF05	2.36	3.56	5.39	1.51	2.50
MF06	3.10	4.08	6.77	1.32	2.50
MF07	0.94	1.44	2.53	1.53	2.68
MF08	1.16	1.54	2.50	1.33	2.50
MF09A	0.60	0.87	2.04	1.46	3.39
MF09B	1.06	1.65	3.26	1.56	3.09
MF10	0.40	0.79	2.09	1.97	5.19
MF11	1.97	2.79	3.77	1.41	2.50
MF12	1.08	1.43	2.85	1.33	2.64
MF13	1.17	1.56	2.84	1.34	2.50
MF13A	0.88	1.40	5.17	1.59	5.90
MF13B	0.30	0.49	1.63	1.67	5.51
MF14	0.06	0.09	0.42	1.48	6.59
OVFL10-4	0.47	0.76	1.28	1.61	2.72

[1] *The severe rain event of May 2010 was removed from data prior to calculations.*
[2] *A minimum value of 2.5 was set for the peak day-to-average annual daily flow peaking factor.*

3.2 Wastewater Flow Components

Wastewater flows in the collection system are derived from two main sources: (1) the fraction of the water consumption from different categories of customers of MWSD's and CUD's water system that is discharged to the wastewater collection system and (2) extraneous water from groundwater or surface water runoff that enters the collection system through openings in manholes or pipelines. This extraneous water is referred to as infiltration and inflow (I/I). Although a detailed discussion of I/I is beyond the scope of this Technical Memorandum, it should be noted that flow from I/I is included within the previously shown peaking factors. In addition, MWSD is aggressively working on I/I issues throughout the service area to lower these peaking factors.

3.3 Wastewater Flow Projections

The projected annual average flows for the study area were developed based on the population projections and the water use demand categories within the study area. Figures 3-2, 3-3, and 3-4 provide the total annual average daily wastewater flow rate by sewer district for the years 2010, 2020, and 2030, respectively. Table 3-2 presents the baseline 2010 wastewater flow rates by sewer district.

Residential wastewater flow was projected based on the estimated values for "population served" in each district for each planning year as shown in Table A1-1. These population values were multiplied by a residential per capita wastewater flow rate of 130 gpcd, which was selected based on input from MWSD. This residential per capita value was checked by a calculation using the average annual daily flow (AADF) from July 2009 to June 2010, the ratio of residential MWSD and CUD meters to non-residential meters in GIS, and the estimated 2010 baseline population. This calculation resulted in a comparable value of 136 gpcd.

Baseline non-residential wastewater flow was derived from the number of non-residential meters in each sewer district multiplied by a calculated unit flow per non-residential meter. This unit flow was determined assuming the total non-residential flow to be equal to 8.3 percent (based on the ratio of non-residential meters to residential meters in GIS) of the total AADF (16.20 mgd) and dividing this value by the number of non-residential meters. Non-residential flow projections were determined using baseline non-residential flows for each sewer district and the corresponding sewer district growth potential established during population projection analysis.

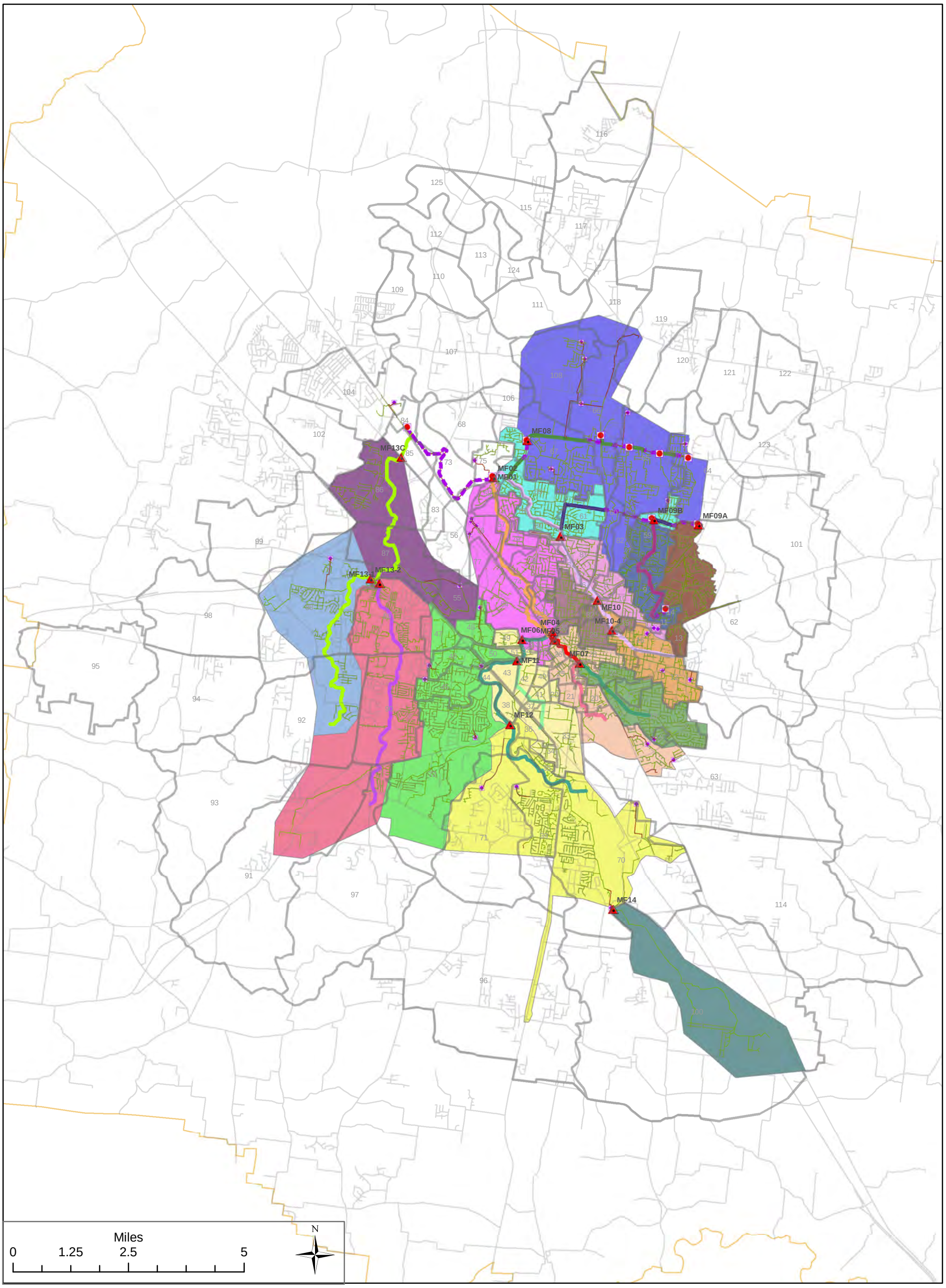
General Mills is one of the largest non-residential wastewater producers in the service area, so its projected flow rates were segregated from the other non-residential sources. A total 2010 baseline flow of 350,000 gpd was assumed as the output from all General Mills meters and subtracted from the total baseline non-residential flow of 8.3 percent of the AADF. This updated total non-residential flow was divided by the total non-residential meters excluding all General Mills meters. The General Mills baseline flow was then added to the baseline flow of the sewer district in which it resides. General Mills has proposed an expansion in wastewater production from 350,000 to 500,000 gpd. This increase was incorporated into the year 2015 projection.

Projected maximum month flow was determined for each sewer district based on the corresponding maximum month to annual average flow ratios described previously. The individual maximum month flows were then summed to determine the total maximum month flows for each year. Maximum month wastewater flow projections are presented in Table 3-3.

Projected peak daily flow was determined for each sewer district based on the corresponding peak day to annual average flow ratios described previously. The individual peak daily flows were then summed to determine the total peak day flow. Peak day wastewater flow projections are presented in Table 3-3.

3.4 Water Conservation and Reuse

For this study, it is assumed that future planned reuse will not affect the wastewater flow projections because reuse water is derived from wastewater effluent and is generally used for purposes that do not result in return to the wastewater collection system, i.e., irrigation, industrial cooling water, etc. MWSD's repurification system will be discussed in detail in Technical Memorandum 4. Water demand reductions due to water conservation may result in reductions of wastewater flows by reducing the volume of water used for clothes washing, dishwashing, toilet flushing, and other uses. Reductions in maximum month wastewater flow due to conservation would also be assumed to be at least as high as annual average reductions for the same planning period. If MWSD has estimates of the impact of local water conservation efforts on water demand, adjustments should be made to the flow per capita to reduce the wastewater flow projections. However, beyond an aggressive conservation plan, it will be assumed for the purposes of this study that water conservation will not significantly impact wastewater generation rates.



Legend

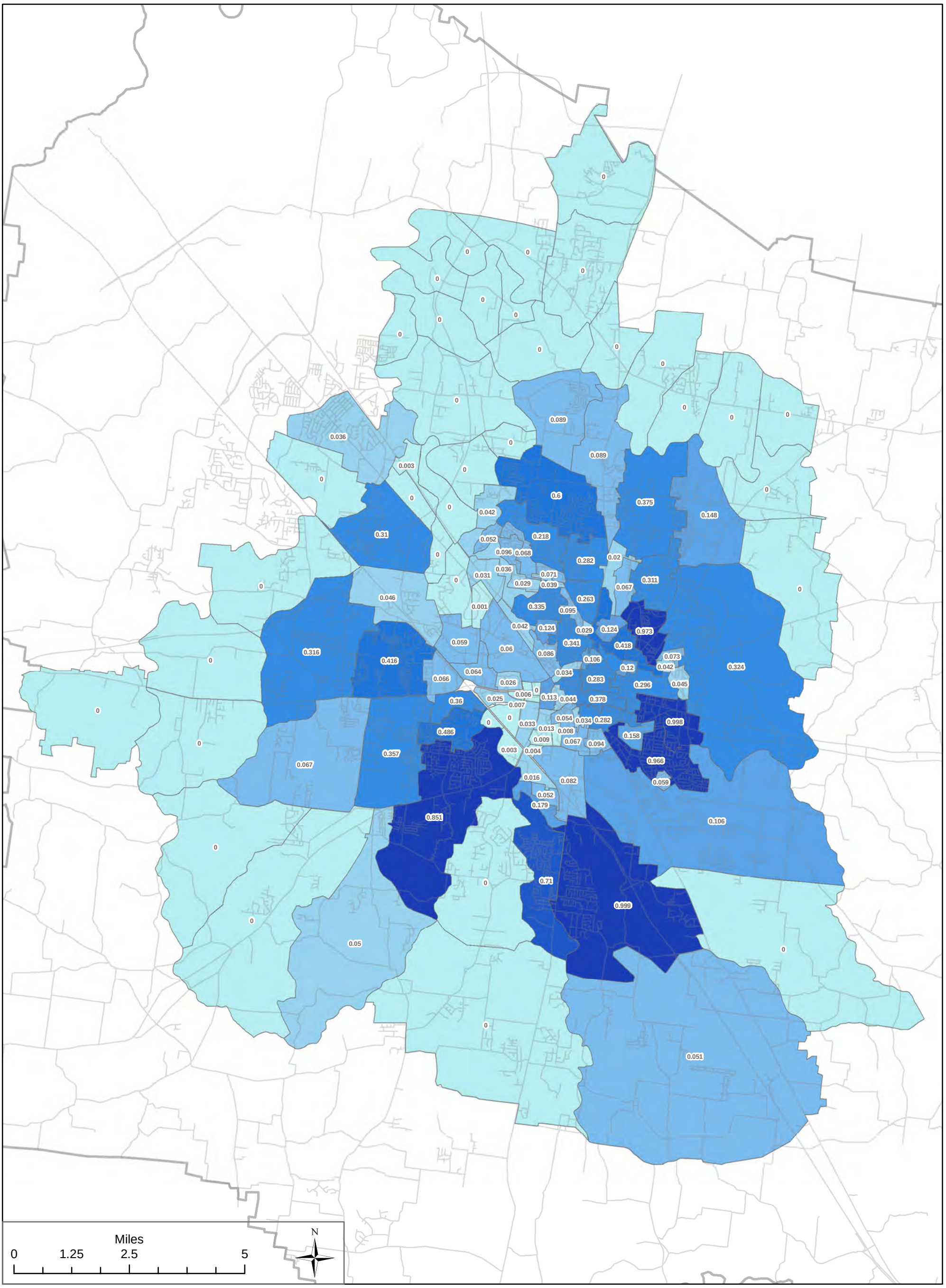
Flow Monitoring Basins
- MF01
- MF02
- MF03
- MF04
- MF05
- MF06
- MF07
- MF08
- MF09A
- MF09B
- MF10
- MF11
- MF12
- MF13
- MF13A
- MF13B
- MF14

Interceptors
- Connection to WWTP PS
- Bradville Rd
- Bushman Creek
- Lower Lytle-2
- Northeast
- Overall Creek
- Puckett Creek
- Samsonite Relief
- Sinking Creek
- Southwest
- Stones River
- Upper Lytle
- VA

- Rutherford County Boundary
- Sewer Districts
- Roads
- Interceptor Force Main
- Existing Gravity Sewer
- Exisiting Forcemain
- Existing Pump Stations
- Interceptor Pump Stations
- Flow Monitors
- Wastewater Treatment Plant

Figure 3-1
Flow Monitoring Basins

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department



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2010 Average Daily Wastewater Flow Rate (MGD) by District

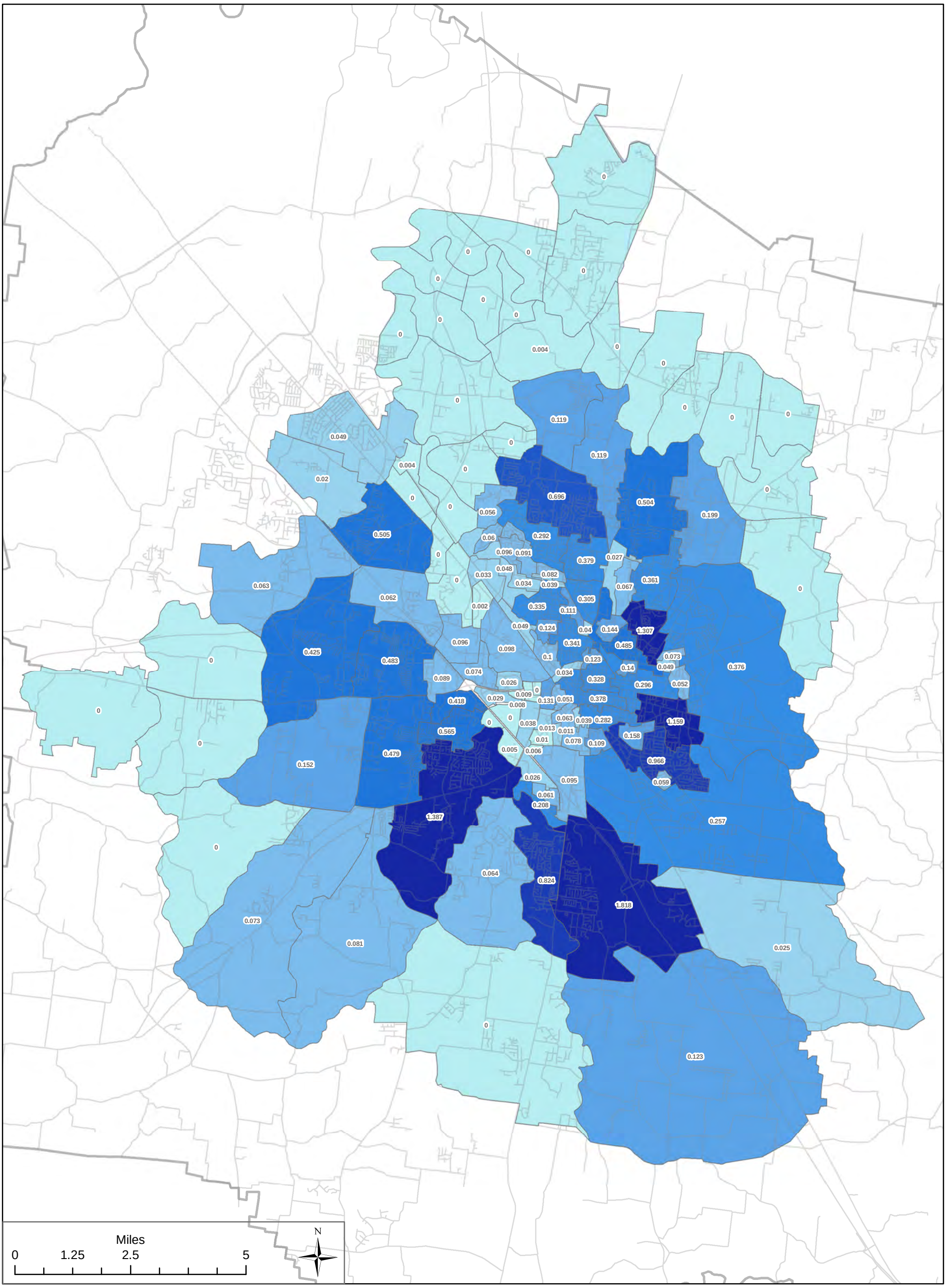
- 0.000 - 0.010
- 0.011 - 0.050
- 0.051 - 0.100
- 0.101 - 0.200
- 0.201 - 0.400
- 0.401 - 0.600
- 0.601 - 0.800
- 0.801 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000

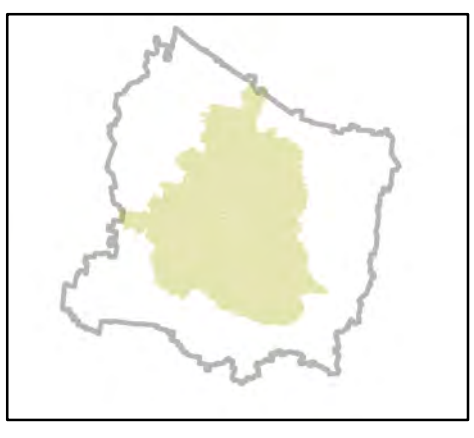
Rutherford County Boundary

Roads

Figure 3-2
2010 Total Average Daily Wastewater Flow Rate (MGD)
by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department





Legend

2020 Average Daily Wastewater Flow Rate (MGD) by District

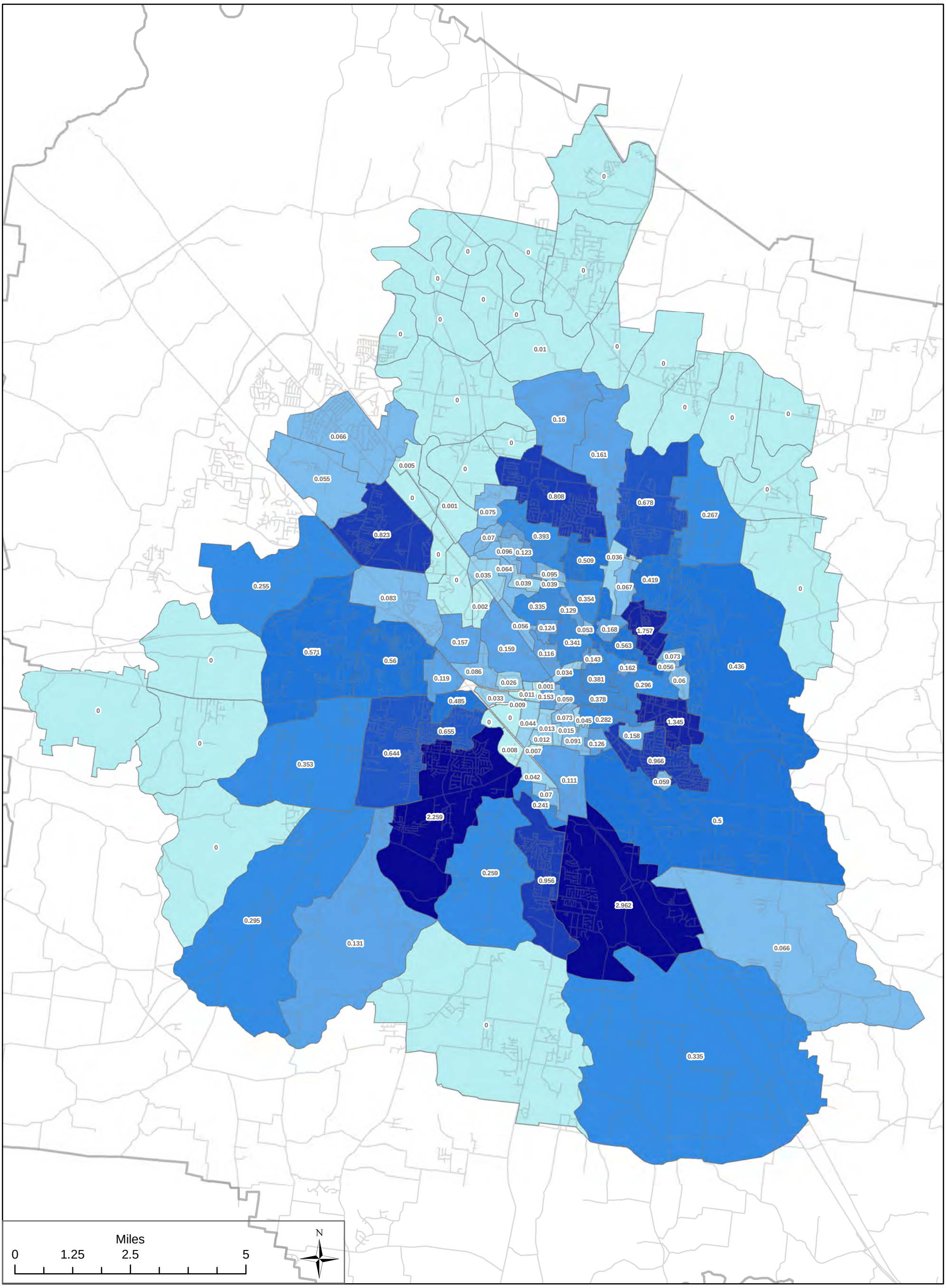
- 0.000 - 0.010
- 0.011 - 0.050
- 0.051 - 0.100
- 0.101 - 0.200
- 0.201 - 0.400
- 0.401 - 0.600
- 0.601 - 0.800
- 0.801 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000

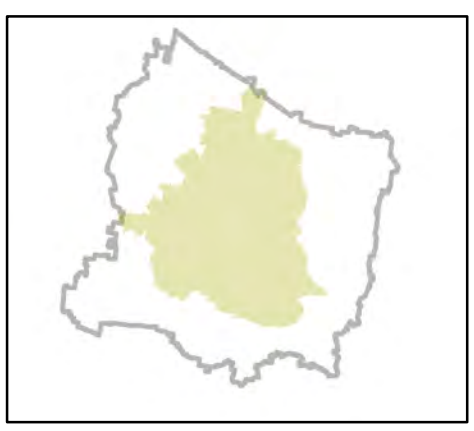
Rutherford County Boundary

Roads

Figure 3-3
2020 Total Average Daily Wastewater Flow Rate (MGD)
by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department





Legend

2030 Average Daily Wastewater Flow Rate (MGD) by District

- 0.000 - 0.010
- 0.011 - 0.050
- 0.051 - 0.100
- 0.101 - 0.200
- 0.201 - 0.400
- 0.401 - 0.600
- 0.601 - 0.800
- 0.801 - 1.000
- 1.001 - 2.000
- 2.001 - 3.000

Rutherford County Boundary

Roads

Figure 3-4
2030 Total Average Daily Wastewater Flow Rate (MGD)
by Sewer District

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department

Table 3-2: Year 2010 Wastewater Flow Projections by Sewer District

Sewer District	2010											
	Population Served	Residential Flow per Capita (gpcd)	Residential Flow (gpd)	Non-Residential Meters in District	Flow per Non-Residential Meter (gpd/meter)	Non-Residential Flow (gpd)	Total Flow, ADF (gpd)	Total Flow, ADF (MGD)	Max Month: ADF Ratio	Total Flow Max Month (MGD)	Peak Day: ADF Ratio (Peaking Factor)	Total Flow Peak Day (MGD)
1	735	130	95,550	0	412	0	95,550	0.096	1.29	0.124	2.50	0.239
2	2,346	130	304,980	72	412	29,689	334,669	0.335	1.29	0.433	2.50	0.837
3	297	130	38,610	0	412	0	38,610	0.039	1.44	0.056	3.13	0.121
4	789	130	102,570	51	412	21,030	123,600	0.124	1.29	0.160	2.50	0.309
5	712	130	92,560	7	412	2,886	95,446	0.095	1.44	0.137	3.13	0.299
6	201	130	26,130	8	412	3,299	29,429	0.029	1.44	0.042	3.13	0.092
7	2,464	130	320,320	49	412	20,205	340,525	0.341	1.56	0.530	2.50	0.851
8	957	130	124,410	0	412	0	124,410	0.124	1.44	0.179	3.13	0.390
9	7,434	130	966,420	15	412	6,185	972,605	0.973	1.56	1.516	3.09	3.004
10	2,848	130	370,240	116	412	47,833	418,073	0.418	1.44	0.601	3.13	1.310
11	322	130	41,860	0	412	0	41,860	0.042	1.56	0.065	3.09	0.129
12	7,303	130	949,390	119	412	49,070	998,460	0.998	1.97	1.969	5.19	5.182
13	324	130	42,120	6	412	2,474	44,594	0.045	1.46	0.065	3.39	0.151
14	558	130	72,540	0	412	0	72,540	0.073	1.56	0.113	3.09	0.224
15	916	130	119,080	3	412	1,237	120,317	0.120	1.56	0.187	2.50	0.301
16	1,931	130	251,030	109	412	44,946	295,976	0.296	1.97	0.584	5.19	1.536
17	1,069	130	138,970	47	412	19,380	158,350	0.158	1.53	0.242	2.68	0.425
18	7,361	130	956,930	22	412	9,072	966,002	0.966	1.53	1.475	2.68	2.593
19	450	130	58,500	0	412	0	58,500	0.059	1.53	0.089	2.68	0.157
20	720	130	93,600	0	412	0	93,600	0.094	1.51	0.141	2.50	0.234
21	335	130	43,550	58	412	23,916	67,466	0.067	1.51	0.102	2.50	0.169
22	0	130	0	20	412	8,247	8,247	0.008	1.32	0.011	2.50	0.021
23	201	130	26,130	18	412	7,422	33,552	0.034	1.51	0.051	2.50	0.084
24	1,754	130	228,020	130	412	53,606	281,626	0.282	1.53	0.430	2.68	0.756
25	232	130	30,160	59	412	24,329	54,489	0.054	1.51	0.082	2.50	0.136
26	279	130	36,270	18	412	7,422	43,692	0.044	1.51	0.0659	2.50	0.109
27	830	130	107,900	13	412	5,361	113,261	0.113	1.29	0.146	2.50	0.283
28	1,794	130	233,220	351	412	144,735	377,955	0.378	1.51	0.570	2.50	0.945
29	1,995	130	259,350	57	412	23,504	282,854	0.283	1.56	0.440	2.50	0.707
30	111	130	14,430	48	412	19,793	34,223	0.034	1.56	0.053	2.50	0.086
31	165	130	21,450	157	412	64,739	86,189	0.086	1.29	0.111	2.50	0.215
32	804	130	104,520	4	412	1,649	106,169	0.106	1.56	0.165	2.50	0.265
33	57	130	7,410	181	412	74,635	82,045	0.082	1.32	0.108	2.50	0.205
34	345	130	44,850	18	412	7,422	52,272	0.052	1.32	0.069	2.50	0.131
35	1,373	130	178,490	1	412	412	178,902	0.179	1.33	0.237	2.64	0.471
36	87	130	11,310	11	412	4,536	15,846	0.016	1.32	0.021	2.50	0.040
37	0	130	0	10	412	4,124	4,124	0.004	1.32	0.005	2.50	0.010
38	0	130	0	7	412	2,886	2,886	0.003	1.32	0.004	2.50	0.007
39	5,195	130	675,285	84	412	34,637	709,922	0.710	1.33	0.942	2.64	1.871
40	0	130	0	32	412	13,195	13,195	0.013	1.32	0.017	2.50	0.033
41	0	130	0	21	412	8,659	8,659	0.009	1.32	0.011	2.50	0.022
42	144	130	18,720	34	412	14,020	32,740	0.033	1.32	0.043	2.50	0.082
43	0	130	0	0	412	0	0	0	1.32	0	2.50	0
44	0	130	0	0	412	0	0	0	1.32	0	2.50	0
45	3,714	130	482,762	9	412	3,711	486,473	0.486	1.41	0.687	2.50	1.216
46	2,413	130	313,690	112	412	46,183	359,873	0.360	1.41	0.508	2.50	0.900
47	317	130	41,214	60	412	24,741	65,955	0.066	1.41	0.093	2.50	0.165
48	9	130	1,170	152	412	62,677	63,847	0.064	1.41	0.090	2.50	0.160
49	0	130	0	64	412	26,390	26,390	0.026	1.32	0.035	2.50	0.066
50	12	130	1,560	56	412	23,092	24,652	0.025	1.41	0.035	2.50	0.062
51	3	130	390	15	412	6,185	6,575	0.007	1.32	0.009	2.50	0.016
52	33	130	4,290	5	412	2,062	6,352	0.006	1.32	0.008	2.50	0.016
53	0	130	0	1	412	412	412	0.000	1.29	0.001	2.50	0.001
54	356	130	46,274	33	412	13,608	59,881	0.060	1.29	0.077	2.50	0.150
55	90	130	11,671	115	412	47,420	59,091	0.059	1.34	0.079	2.50	0.148
56	0	130	0	0	412	0	0	0	1.10	0	2.50	0
57	245	130	31,850	9	412	3,711	35,561	0.036	1.29	0.0460	2.50	0.089
58	400	130	52,046	0	412	0	52,046	0.052	1.29	0.0673	2.50	0.130
59	2,395	130	311,389	0	412	0	311,389	0.311	1.56	0.4855	3.09	0.962
60	125	130	16,244	9	412	3,711	19,955	0.020	1.29	0.0257	2.50	0.050
61	2,031	130	264,017	43	412	17,731	281,748	0.282	1.41	0.3975	2.50	0.704
62	2,358	130	306,587	42	412	17,319	323,906	0.324	1.46	0.4719	3.39	1.099
63	658	130	85,484	50	412	20,618	106,102	0.106	1.51	0.1601	2.50	0.265
64	1,138	130	147,992	0	412	0	147,992	0.148	1.29	0.1906	2.50	0.370
65	2,887	130	375,278	0	412	0	375,278	0.375	1.29	0.4833	2.50	0.938
66	544	130	70,775	44	412	18,143	88,919	0.089	1.29	0.1145	2.50	0.222
66-VA	0	130	0	0	412	0	0	0	1.10	0	2.50	0
67	4,609	130	599,157	2	412	825	599,982	0.600	1.29	0.773	2.50	1.500
68	0	130	0	0	412	0	0	0	1.10	0	2.50	0
69	1,674	130	217,613	0	412	0	217,613	0.218	1.41	0.307	2.50	0.544
70	4,756	130	618,228	74	412	380,514	998,742	0.999	1.33	1.325	2.64	2.632
71	0	130	0	0	412	0	0	0	1.33	0	2.64	0
72	6,503	130	845,442	14	412	5,773	851,215	0.851	1.41	1.202	2.50	2.128
73	3	130	390	0	412	0	390	0.000	1.10	0.000	2.50	0.001
74	84	130	10,920	75	412	30,926	41,846	0.042	1.29	0.054	2.50	0.105
75 (WWTP)	321	130	41,769	0	412	0	41,769	0.042	1.10	0.046	2.50	0.104
76	33	130	4,290	0	412	0	4,290	0.004	1.29	0.006	2.50	0.011
77 (SRBF)	9	130	1,170	0	412	0	1,170	0.001	1.29	0.002	2.50	0.003
78	522	130	67,860	0	412	0	67,860	0.068	1.41	0.096	2.50	0.170
79	224	130	29,153	0	412	0	29,153	0.029	1.29	0.038	2.50	0.073
80	545	130	70,785	0	412	0	70,785	0.071	1.41	0.100	2.50	0.177
81	1,561	130	202,898	145	412	59,791	262,688	0.263	1.44	0.378	3.13	0.823
82	519	130	67,470	0	412	0	67,470	0.067	1.29	0.087	2.50	0.169
83	0	130	0	0	412	0	0	0	1.10	0	2.50	0
84	0	130	0	7	412	2,886	2,886	0.003	1.10	0.003	2.50	0.007
85 (AIRPORT)	0	130	0	0	412	0	0	0	1.10	0	2.50	0
86	2,387	130	310,284	0	412	0	310,284	0.310	1.34	0.415	2.50	0.776
87	256	130	33,272	31	412	12,783	46,055	0.046	1.34	0.062	2.50	0.115
88	2,418	130	314,340	4	412	1,649	315,989	0.316	1.67	0.528	5.51	1.740
89	3,195	130	415,285	2	412	825	416,110	0.416	1.59	0.663	5.90	2.453
90	2,710	130	352,235	11	412	4,536	356,771	0.357	1.59	0.568	5.90	2.103
91	0	130	0	0	412	0	0	0	1.59	0	5.90	0
92	510	130	66,300	1	412	412	66,712	0.067	1.67	0.111	5.51	0.367
93	0	130	0	0	412	0	0	0	1.67	0	5.51	0
94	0	130	0	0	412	0	0	0	1.67	0	5.51	0
95	0	130	0	0	412	0	0	0	1.67	0	5.51	0
96	0	130	0	0	412	0	0	0	1.33	0	2.64	0
97	381	130	49,530	0	412	0	49,530	0.050	1.59	0.079	5.90	0.292

Table 3-2: Year 2010 Wastewater Flow Projections by Sewer District

Sewer District	2010											
	Population Served	Residential Flow per Capita (gpcd)	Residential Flow (gpd)	Non-Residential Meters in District	Flow per Non-Residential Meter (gpd/meter)	Non-Residential Flow (gpd)	Total Flow, ADF (gpd)	Total Flow, ADF (MGD)	Max Month: ADF Ratio	Total Flow Max Month (MGD)	Peak Day: ADF Ratio (Peaking Factor)	Total Flow Peak Day (MGD)
98	0	130	0	0	412	0	0	0	1.67	0	5.51	0
99	0	130	0	0	412	0	0	0	1.34	0	2.50	0
100	389	130	50,544	0	412	0	50,544	0.051	1.48	0.075	6.59	0.333
101	0	130	0	0	412	0	0	0	1.29	0	2.50	0
102	0	130	0	0	412	0	0	0	1.34	0	2.50	0
103	0	130	0	0	412	0	0	0	1.10	0	2.50	0
104	185	130	24,102	30	412	12,371	36,473	0.036	1.34	0.049	2.50	0.091
105	0	130	0	0	412	0	0	0	1.10	0	2.50	0
106	0	130	0	0	412	0	0	0	1.10	0	2.50	0
107	0	130	0	0	412	0	0	0	1.10	0	2.50	0
108	683	130	88,725	0	412	0	88,725	0.089	1.29	0.114	2.50	0.222
109	0	130	0	0	412	0	0	0	1.10	0	2.50	0
110	0	130	0	0	412	0	0	0	1.10	0	2.50	0
111	0	130	0	0	412	0	0	0	1.29	0	2.50	0
112	0	130	0	0	412	0	0	0	1.10	0	2.50	0
113	0	130	0	0	412	0	0	0	1.10	0	2.50	0
114	0	130	0	0	412	0	0	0	1.51	0	2.50	0
115	0	130	0	0	412	0	0	0	1.10	0	2.50	0
116	0	130	0	0	412	0	0	0	1.10	0	2.50	0
117	0	130	0	0	412	0	0	0	1.10	0	2.50	0
118	0	130	0	0	412	0	0	0	1.29	0	2.50	0
119	0	130	0	0	412	0	0	0	1.29	0	2.50	0
120	0	130	0	0	412	0	0	0	1.29	0	2.50	0
121	0	130	0	0	412	0	0	0	1.29	0	2.50	0
122	0	130	0	0	412	0	0	0	1.29	0	2.50	0
123	0	130	0	0	412	0	0	0	1.29	0	2.50	0
124	0	130	0	0	412	0	0	0	1.10	0	2.50	0
125	0	130	0	0	412	0	0	0	1.10	0	2.50	0
Totals	109,641		14,253,317	3,236		1,684,365	15,937,682	15.94		23.57		49.77

3.5 Summary of Total Service Area Projections

The wastewater flows projected within individual sewer districts were summed to calculate total service area projections. Total wastewater flow projections for the planning periods are presented in Table 3-3 and graphically illustrated on Figure 3-5.

Table 3-3: Projected Wastewater Flows for the Total Service Area

Year	Total Flow ADF (mgd)	Total Flow Max Month (mgd)	Total Flow Peak Day (mgd)
2010	15.94	23.57	49.77
2015	17.99	26.52	56.12
2020	20.37	29.94	63.67
2025	23.29	34.14	73.06
2030	27.00	39.48	85.10

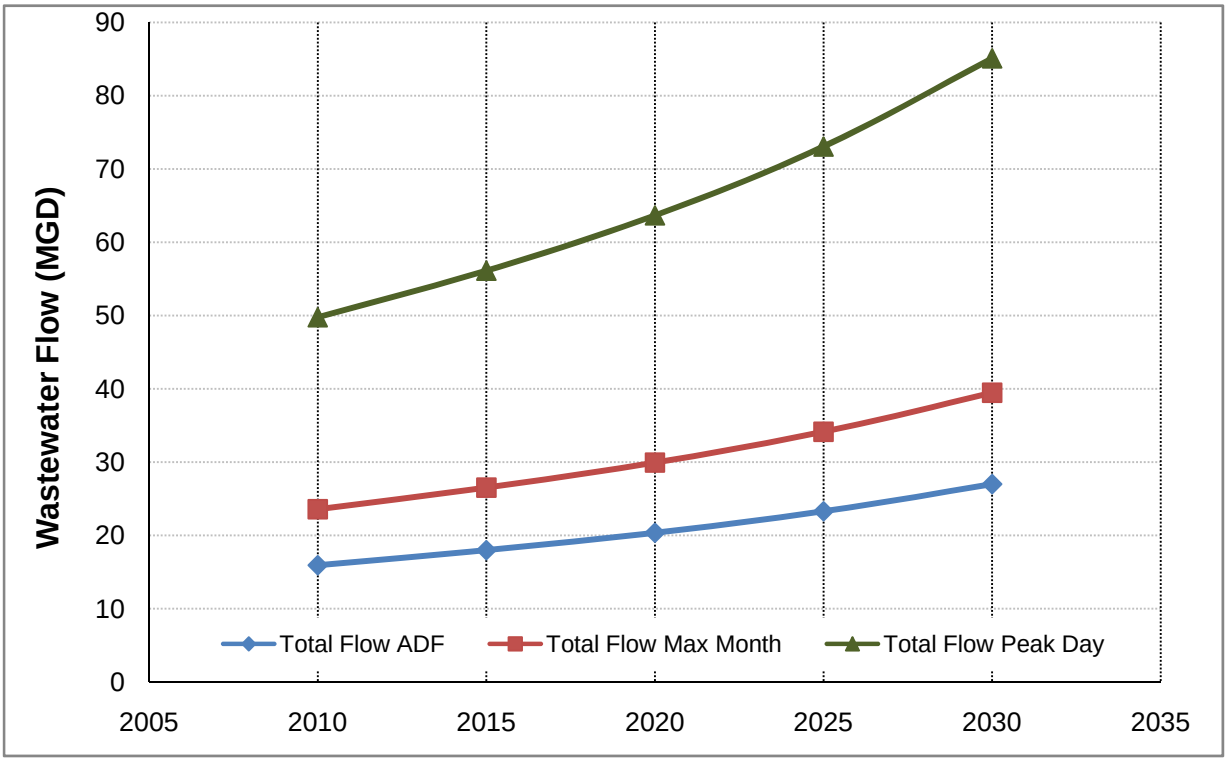


Figure 3-5: Projected Wastewater Flows for the Total Service Area

4. Conclusions

In the analysis described in Technical Memorandum No. 1, baseline and projected wastewater flows were calculated and geographically distributed based on anticipated population growth. Population (and therefore wastewater) growth was shown to be greatest southwest of I-24 and northeast of Murfreesboro center-city. This distribution of wastewater flows will be used as a foundation for future technical memoranda in completing the following:

- Evaluating the potential of decentralized treatment versus an expansion of the SCWWTP.
- Determining the most advantageous locations of future land application sites.
- Estimating capital investment for future collection system improvements.

Actual future growth, the areas within which this growth occurs, and the corresponding generation of wastewater may change as a function of the economy and the location and scale of near-term infrastructure development including roads, interchanges, and water and sewer piping. Thus, recommendations for wastewater treatment and disposal alternatives should offer flexibility in meeting the changing needs within the City of Murfreesboro and MWSD's service area. Further, the population and flow projections should be reexamined on a regular basis such that this data can continue to serve as a tool for planning of future infrastructure improvements.

ATTACHMENTS

Table A1-1: Service Area Population by Sewer District

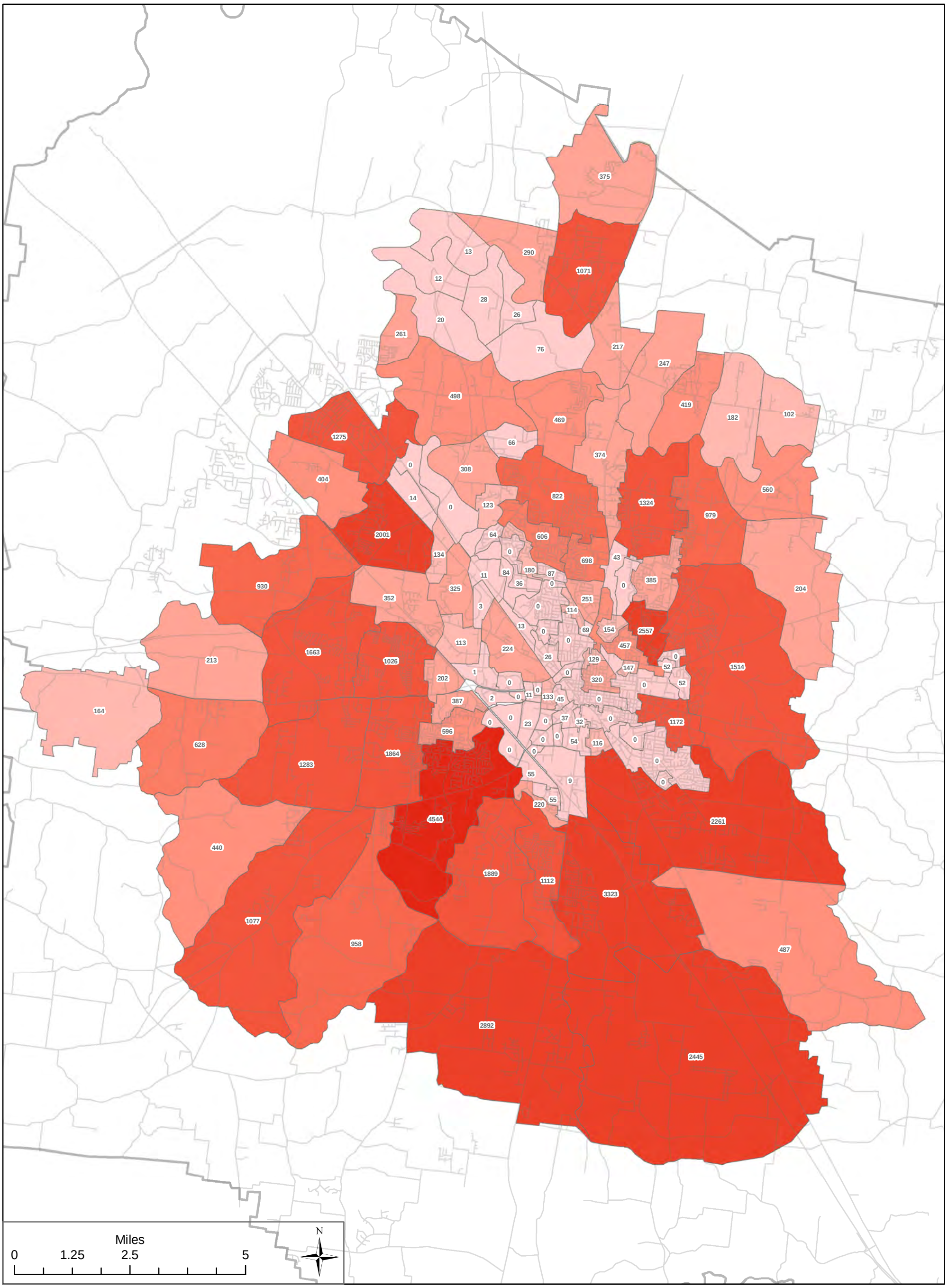
Sewer District	2010		2015		2020		2025		2030	
	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**
1	735	**735**	735	**735**	735	**735**	735	**735**	735	**735**
2	2,346	**2,346**	2,346	**2,346**	2,346	**2,346**	2,346	**2,346**	2,346	**2,346**
3	297	**297**	297	**297**	297	**297**	297	**297**	297	**297**
4	789	**789**	789	**789**	789	**789**	789	**789**	789	**789**
5	712	**712**	767	**767**	826	**826**	890	**890**	959	**959**
6	201	**201**	233	**233**	270	**270**	313	**313**	363	**363**
7	2,464	**2,464**	2,464	**2,464**	2,464	**2,464**	2,464	**2,464**	2,464	**2,464**
8	957	**957**	1,031	**1,031**	1,111	**1,111**	1,196	**1,196**	1,289	**1,289**
9	7,434	**7,434**	8,618	**8,618**	9,991	**9,991**	11,582	**11,582**	13,427	**13,427**
10	2,848	**2,848**	3,068	**3,068**	3,305	**3,305**	3,561	**3,561**	3,836	**3,836**
11	322	**322**	347	**347**	374	**374**	403	**403**	434	**434**
12	7,303	**7,303**	7,867	**7,867**	8,475	**8,475**	9,130	**9,130**	9,836	**9,836**
13	324	**324**	349	**349**	376	**376**	405	**405**	436	**436**
14	558	**558**	558	**558**	558	**558**	558	**558**	558	**558**
15	916	**916**	987	**987**	1,063	**1,063**	1,145	**1,145**	1,234	**1,234**
16	1,931	**1,931**	1,931	**1,931**	1,931	**1,931**	1,931	**1,931**	1,931	**1,931**
17	1,069	**1,069**	1,069	**1,069**	1,069	**1,069**	1,069	**1,069**	1,069	**1,069**
18	7,361	**7,361**	7,361	**7,361**	7,361	**7,361**	7,361	**7,361**	7,361	**7,361**
19	450	**450**	450	**450**	450	**450**	450	**450**	450	**450**
20	720	**720**	776	**776**	836	**836**	900	**900**	970	**970**
21	335	**335**	361	**361**	389	**389**	419	**419**	451	**451**
22	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
23	201	**201**	217	**217**	233	**233**	251	**251**	271	**271**
24	1,754	**1,754**	1,754	**1,754**	1,754	**1,754**	1,754	**1,754**	1,754	**1,754**
25	232	**232**	250	**250**	269	**269**	290	**290**	312	**312**
26	279	**279**	301	**301**	324	**324**	349	**349**	376	**376**
27	830	**830**	894	**894**	963	**963**	1,038	**1,038**	1,118	**1,118**
28	1,794	**1,794**	1,794	**1,794**	1,794	**1,794**	1,794	**1,794**	1,794	**1,794**
29	1,995	**1,995**	2,149	**2,149**	2,315	**2,315**	2,494	**2,494**	2,687	**2,687**
30	111	**111**	111	**111**	111	**111**	111	**111**	111	**111**
31	165	**165**	178	**178**	191	**191**	206	**206**	222	**222**
32	804	**804**	866	**866**	933	**933**	1,005	**1,005**	1,083	**1,083**
33	57	**57**	61	**61**	66	**66**	71	**71**	77	**77**
34	345	**345**	372	**372**	400	**400**	431	**431**	465	**465**
35	1,373	**1,373**	1,479	**1,479**	1,593	**1,593**	1,717	**1,717**	1,849	**1,849**
36	87	**87**	111	**111**	142	**142**	181	**181**	231	**231**
37	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
38	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
39	6,926	**5,195**	7,461	**5,596**	8,038	**6,028**	8,659	**6,494**	9,328	**6,996**
40	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
41	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
42	144	**144**	155	**155**	167	**167**	180	**180**	194	**194**
43	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
44	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
45	3,714	**3,714**	4,001	**4,001**	4,310	**4,310**	4,643	**4,643**	5,002	**5,002**
46	2,413	**2,413**	2,599	**2,599**	2,800	**2,800**	3,017	**3,017**	3,250	**3,250**
47	587	**317**	681	**368**	789	**426**	915	**494**	1,060	**573**
48	9	**9**	10	**10**	10	**10**	11	**11**	12	**12**
49	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
50	12	**12**	13	**13**	14	**14**	15	**15**	16	**16**
51	3	**3**	3	**3**	3	**3**	4	**4**	4	**4**
52	33	**33**	38	**38**	44	**44**	51	**51**	60	**60**
53	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
54	356	**356**	454	**454**	580	**580**	740	**740**	944	**944**
55	180	**90**	229	**115**	292	**146**	373	**187**	476	**238**
56	516	**0**	659	**0**	841	**0**	1,073	**0**	1,369	**0**
57	245	**245**	284	**284**	329	**329**	382	**382**	442	**442**
58	400	**400**	431	**431**	465	**465**	501	**501**	539	**539**
59	2,395	**2,395**	2,580	**2,580**	2,780	**2,780**	2,995	**2,995**	3,226	**3,226**
60	125	**125**	145	**145**	168	**168**	195	**195**	226	**226**
61	2,031	**2,031**	2,354	**2,354**	2,729	**2,729**	3,164	**3,164**	3,668	**3,668**
62	9,433	**2,358**	10,163	**2,541**	10,948	**2,737**	11,794	**2,949**	12,705	**3,176**
63	6,576	**658**	7,623	**1,143**	8,837	**1,767**	10,245	**2,561**	11,876	**3,563**
64	2,846	**1,138**	3,299	**1,320**	3,825	**1,530**	4,434	**1,774**	5,140	**2,056**
65	3,849	**2,887**	4,462	**3,347**	5,173	**3,880**	5,997	**4,497**	6,952	**5,214**
66	1,089	**544**	1,262	**631**	1,463	**732**	1,696	**848**	1,967	**983**
66-VA	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
67	5,121	**4,609**	5,517	**4,965**	5,943	**5,349**	6,402	**5,762**	6,897	**6,208**
68	489	**0**	624	**0**	797	**0**	1,017	**0**	1,297	**0**
69	1,762	**1,674**	2,043	**1,941**	2,368	**2,250**	2,745	**2,608**	3,182	**3,023**
70	5,284	**4,756**	6,744	**6,069**	8,607	**7,746**	10,985	**9,887**	14,020	**12,618**
71	3,003	**0**	3,833	**192**	4,892	**489**	6,243	**936**	7,968	**1,992**
72	7,226	**6,503**	9,222	**8,300**	11,770	**10,593**	15,022	**13,520**	19,173	**17,255**
73	3	**3**	3	**3**	3	**3**	4	**4**	4	**4**
74	84	**84**	90	**90**	97	**97**	105	**105**	113	**113**
75 (WWTP)	357	**321**	414	**372**	480	**432**	556	**501**	645	**580**
76	33	**33**	38	**38**	44	**44**	51	**51**	60	**60**
77 (SRBF)	9	**9**	10	**10**	12	**12**	14	**14**	16	**16**
78	522	**522**	605	**605**	702	**702**	813	**813**	943	**943**
79	224	**224**	242	**242**	260	**260**	280	**280**	302	**302**
80	545	**545**	587	**587**	632	**632**	681	**681**	733	**733**
81	1,561	**1,561**	1,681	**1,681**	1,811	**1,811**	1,951	**1,951**	2,102	**2,102**
82	519	**519**	519	**519**	519	**519**	519	**519**	519	**519**
83	390	**0**	452	**0**	524	**0**	608	**0**	704	**0**
84	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
85 (AIRPORT)	42	**0**	49	**0**	56	**0**	65	**0**	76	**0**
86	3,182	**2,387**	4,062	**3,046**	5,184	**3,888**	6,616	**4,962**	8,444	**6,333**
87	1,024	**256**	1,187	**297**	1,376	**344**	1,595	**399**	1,849	**462**
88	4,836	**2,418**	5,606	**2,803**	6,499	**3,250**	7,534	**3,767**	8,734	**4,367**
89	6,389	**3,195**	6,883	**3,441**	7,415	**3,707**	7,988	**3,994**	8,605	**4,303**
90	5,419	**2,710**	6,282	**3,141**	7,283	**3,641**	8,443	**4,221**	9,787	**4,894**
91	1,713	**0**	2,186	**219**	2,790	**558**	3,561	**1,068**	4,545	**2,273**
92	2,040	**510**	2,604	**781**	3,323	**1,163**	4,241	**1,908**	5,413	**2,706**
93	699	**0**	892	**0**	1,139	**0**	1,453	**0**	1,855	**0**
94	999	**0**	1,275	**0**	1,627	**0**	2,077	**0**	2,651	**0**
95	477	**0**	553	**0**	641	**0**	743	**0**	862	**0**
96	4,599	**0**	5,870	**0**	7,491	**0**	9,561	**0**	12,203	**0**
97	1,524	**381**	1,945	**486**	2,482	**621**	3,168	**792**	4,044	**1,011**
98	339	**0**	433	**0**	552	**0**	705	**0**	899	**0**
99	1,479	**0**	1,888	**189**	2,409	**482**	3,075	**922**	3,924	**1,962**
100	3,888	**389**	4,962	**496**	6,333	**950**	8,083	**1,617**	10,316	**2,579**

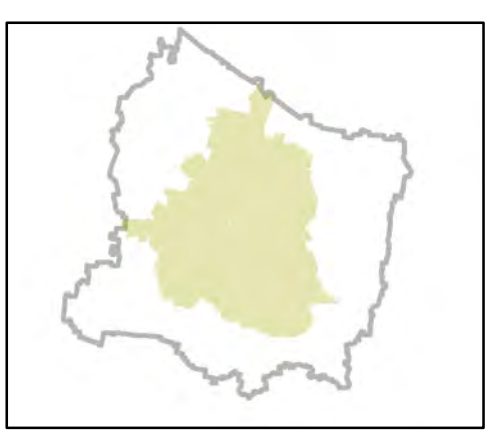
Table A1-1: Service Area Population by Sewer District

Sewer District	2010		2015		2020		2025		2030	
	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**	Total Service Area Population	**Population Served**
101	594	**0**	689	**0**	798	**0**	925	**0**	1,073	**0**
102	642	**0**	819	**82**	1,046	**157**	1,335	**267**	1,703	**426**
103	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
104	3,708	**185**	4,299	**215**	4,983	**249**	5,777	**289**	6,697	**335**
105	0	**0**	0	**0**	0	**0**	0	**0**	0	**0**
106	408	**0**	440	**0**	474	**0**	510	**0**	550	**0**
107	1,449	**0**	1,680	**0**	1,947	**0**	2,257	**0**	2,617	**0**
108	1,365	**683**	1,582	**791**	1,834	**917**	2,127	**1,063**	2,465	**1,233**
109	759	**0**	880	**0**	1,020	**0**	1,182	**0**	1,371	**0**
110	57	**0**	66	**0**	77	**0**	89	**0**	103	**0**
111	222	**0**	257	**13**	298	**30**	346	**52**	401	**80**
112	36	**0**	42	**0**	48	**0**	56	**0**	65	**0**
113	81	**0**	94	**0**	109	**0**	126	**0**	146	**0**
114	1,416	**0**	1,642	**82**	1,903	**190**	2,206	**331**	2,557	**511**
115	843	**0**	977	**0**	1,133	**0**	1,313	**0**	1,523	**0**
116	1,089	**0**	1,262	**0**	1,464	**0**	1,697	**0**	1,967	**0**
117	3,114	**0**	3,610	**0**	4,185	**0**	4,852	**0**	5,624	**0**
118	630	**0**	730	**0**	847	**0**	982	**0**	1,138	**0**
119	717	**0**	831	**0**	964	**0**	1,117	**0**	1,295	**0**
120	1,218	**0**	1,412	**0**	1,637	**0**	1,898	**0**	2,200	**0**
121	528	**0**	612	**0**	710	**0**	823	**0**	954	**0**
122	297	**0**	344	**0**	399	**0**	463	**0**	536	**0**
123	891	**0**	1,137	**0**	1,451	**0**	1,852	**0**	2,364	**0**
124	75	**0**	87	**0**	101	**0**	117	**0**	135	**0**
125	81	**0**	87	**0**	94	**0**	101	**0**	109	**0**
Totals	179,981	109,641	204,727	122,766	234,296	138,840	269,775	158,623	312,521	183,910

Table A1-2: SCWWTP Average Daily Flows July 2009 to June 2010

SCWWTP Average Influent Daily Flows (mgd) July 2009 to June 2010												
Day	July 09	Aug 09	Sept 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	March 10	April 10	May 10	June 10
1	11.6	14.4	11.4	15.6	23.1	13.8	15.2	21.3	14	15.5	22.7	17.1
2	11.2	15.4	11.4	15.1	20.2	16.6	14.9	22.8	14.1	14.3	35.7	17.3
3	10.4	14.9	11.5	14.3	18.7	14.3	14.6	25.6	14.1	13.4	35.6	17.1
4	9.7	14.5	11.1	14.2	18.1	15.4	14.6	23.9	13.7	14.4	33.3	16.4
5	12.8	16.6	10.8	16.2	18.1	14	14.2	34	13.5	13.9	32.4	16.5
6	13.3	15	10.8	14.4	16.9	14.3	14	35	12.9	14.1	31.8	14.2
7	13.7	14.1	11.1	15.6	15.4	14.9	13.7	32.9	12.5	14.6	30.9	12.7
8	13.4	13.1	11.6	15.5	15.1	14.9	13.6	29	12.6	15	26.5	13.4
9	12.9	12.9	11.6	15.2	15	24.6	13.3	31.8	13	13.3	22.7	13.8
10	12.3	13	12	14.8	15.2	24.4	13.3	33.2	12.9	12.2	21.5	15.6
11	12	13.2	11.8	14.7	14.4	20.4	13	27.8	13.5	12.9	23.1	14.7
12	12.5	13	11.4	14.7	14.5	18.7	14.5	24.1	18.2	13.5	19.9	14.1
13	15.7	12.8	11	15.3	14.3	29.6	13.3	21.7	19.6	13.6	19.9	14.5
14	14.7	11.9	11.2	18	13.5	27.6	13.1	20	17.9	12.9	21	15
15	14.2	11.4	13.8	23.1	13.5	24.1	12.9	19.5	17.3	13.1	19.7	14.9
16	14.3	11.4	15.3	22.9	14	21.5	12.6	18.9	16.7	12	21.3	14.3
17	13.5	11.9	21.1	19.3	14.2	19.7	27.6	18	16.1	13.2	21.2	16.8
18	12.4	12.3	24.9	18.2	14	19.2	29.8	17.7	15.6	13.4	19.7	15.9
19	12.1	12.7	18.7	17.3	13.8	19.9	24.1	16.8	15.1	12.6	18.3	13.5
20	12.8	12.6	18.3	16.5	12.4	18.6	22.6	16.3	14.2	13.2	19.4	13.8
21	12.9	11.8	18.3	15.1	12.9	17.9	27.5	15.6	14.8	13.5	19.1	14
22	13.1	11.1	19.4	14.7	13	16.9	30.4	16.7	17.5	13.4	17.9	13.8
23	13	11	19.3	14.1	13.1	16.3	25.4	16.3	16.2	13.1	17.7	13.7
24	12.7	11.4	18.4	14.2	12.8	15.4	25.5	16.2	15.7	15.5	15.9	14.8
25	11.8	11.6	16.8	13.8	12.2	17.1	28.2	15.7	16.8	16.6	16.6	17.7
26	12.4	11.4	19.1	14.8	11.1	16.8	27.7	15.1	19.7	15.8	17.2	16.2
27	13	11.2	20.4	15.1	11.4	16	24.6	14.5	17.8	14.5	16.7	15.3
28	14.5	11.2	18.6	16	12.1	16.1	21.6	14.1	19.6	14.1	16.5	15
29	15.5	11.4	17.5	15.5	11.9	15.7	19.9		19.9	13.6	15.1	15.7
30	17.4	11.2	16.5	15.6	13.8	15.1	21.5		18.4	12.7	14.7	14.9
31	15.7	11.4		25.3		15.7	21.6		17.9		15.9	





Legend

Change in District Population from 2010 to 2020

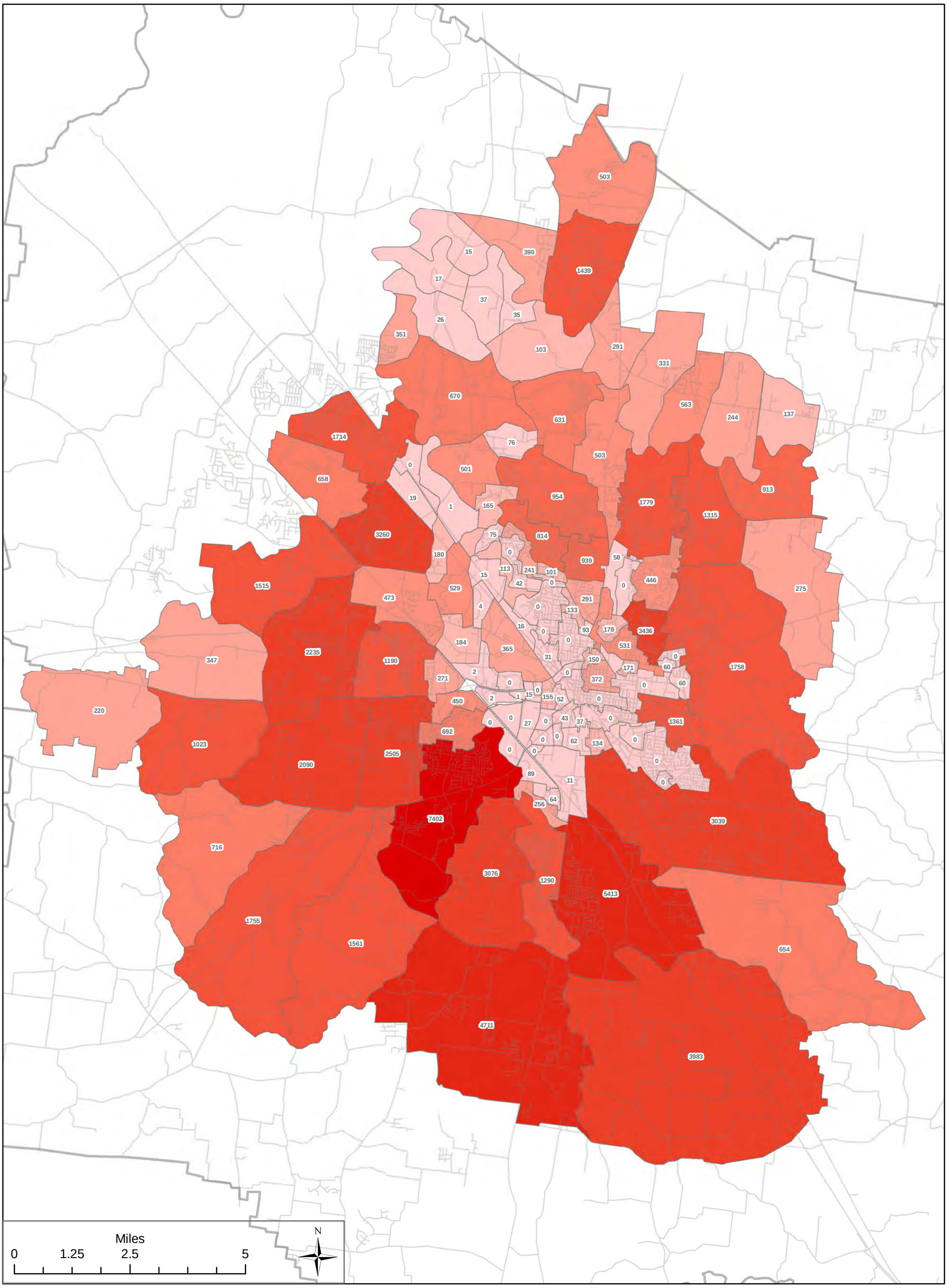
- 0 - 100
- 101 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 8000

Rutherford County Boundary

Roads

Figure A1-1
Change in Total Population by Sewer District from 2010 to 2020

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department



Legend

Change in District Population from 2020 to 2030

- 0 - 100
- 101 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1000
- 1001 - 2000
- 2001 - 4000
- 4001 - 6000
- 6001 - 80000

Rutherford County Boundary

Roads

Figure A1-2
Change in Total Population by Sewer District from 2020 to 2030

Wastewater Treatment Capacity and
Effluent Disposal Study
Murfreesboro Water and Sewer Department