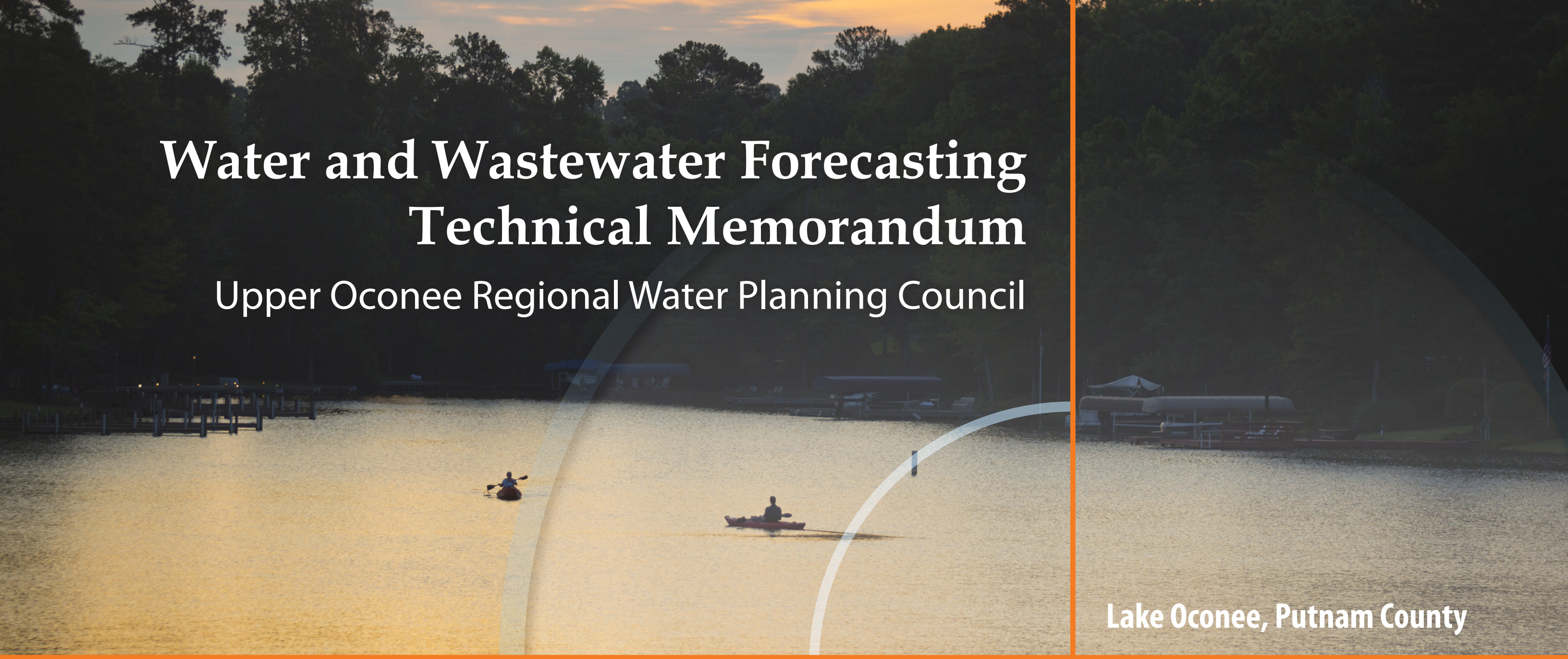
Water and Wastewater Forecasting Technical Memorandum

Upper Oconee Regional Water Planning Council



Lake Oconee, Putnam County

Supplemental Material

Upper Oconee Regional Water Plan

March 2017

CDM Smith

Lake Oconee, Putnam County
photo courtesy of the Georgia Department of Economic Development

Table of Contents

List of Figures

List of Tables

Section 1

Introduction

Municipal and Industrial Water and Wastewater Forecasts were originally developed for the Upper Oconee Regional Water Planning Council as part of the Georgia Comprehensive Statewide Water Management Plan (CSWMP) in 2011. Agricultural and Energy water needs were also identified and forecasted during the 2011 planning process. As part of the 5-year review and revision of that plan, all of these forecasts, except Industrial water and wastewater forecasts have been updated. This Technical Memorandum describes how the original forecasts have been updated to account for changes in population and water use that have occurred since the original forecasts were produced.

Throughout this report, the prior Regional Planning process that occurred in 2009 – 2011 is referred to as "Round 1." Thus, the current (2016) update is referred to as "Round 2".

The basic approach to updating the forecasts starts with the same methodology used in developing the original forecasts, which are described in various Technical Memoranda, which were included as supplemental materials to the 2011 Upper Oconee Regional Water Plan.[1] The purpose of this Technical Memorandum is to describe where modifications to the original forecast methodology were made and to provide the revised forecast values.

1.1 General Methodology

The basic methodology for forecasting water demand is to estimate demand separately for each major water use sector. For each sector, water demand is estimated using a 'driver' multiplied by the 'rate of use'. The driver is defined as a countable unit that can be projected in future years, such as number of people, number of employees in a business, acres irrigated or megawatts of power. The rate of use is defined as the quantity of water used by the driving unit per unit of time, such as gallons per person per day, gallons per day per acre, or gallons per megawatt produced.

The planning process examines and forecasts water demand for four major sectors:

- **Municipal** – this sector includes domestic, commercial, and low water use industries
- **Industrial** – this sector includes higher water use industries
- **Agricultural** – this sector includes major crops such as cotton, corn, peanuts, soybean, pecans, specialty crops, and nursery and horticulture; a snapshot of major livestock water use and golf course water use

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[1] See "Water and Wastewater Forecasting Technical Memorandum," dated May 2011 (available at http://www.upperoconee.org/documents/UOCMandIForecastFINAL09092010_000.pdf);

"Statewide Energy Sector Water Demand Forecast" Technical Memorandum, dated October 29, 2010 (available at http://www.georgiawaterplanning.org/pages/forecasting/energy_water_use.php);

and Agricultural Water Use forecast prepared by Dr. Jim Hook et al. (available at http://www.georgiawaterplanning.org/pages/forecasting/agricultural_water_use.php).

- **Energy** – this sector includes thermoelectric power generation

1.2 Population Update

State and County population projections are provided by the Governor's Office of Planning and Budget (OPB). These projections are used consistently throughout the state for multiple purposes such as transportation planning and allocation of education funds. The Georgia Environmental Protection Division (EPD) is required to use these population projections in statewide water planning. The 2010 Census statewide population count was lower than had been projected for 2010 in the Round 1 projections, although this trend of lower population than projected does not hold true for all counties. The prior forecast had the State's population growing at an annual rate of 1.69% while the new forecast grows at an annual rate of only 1.05 percent as shown in **Figure 1-1**.

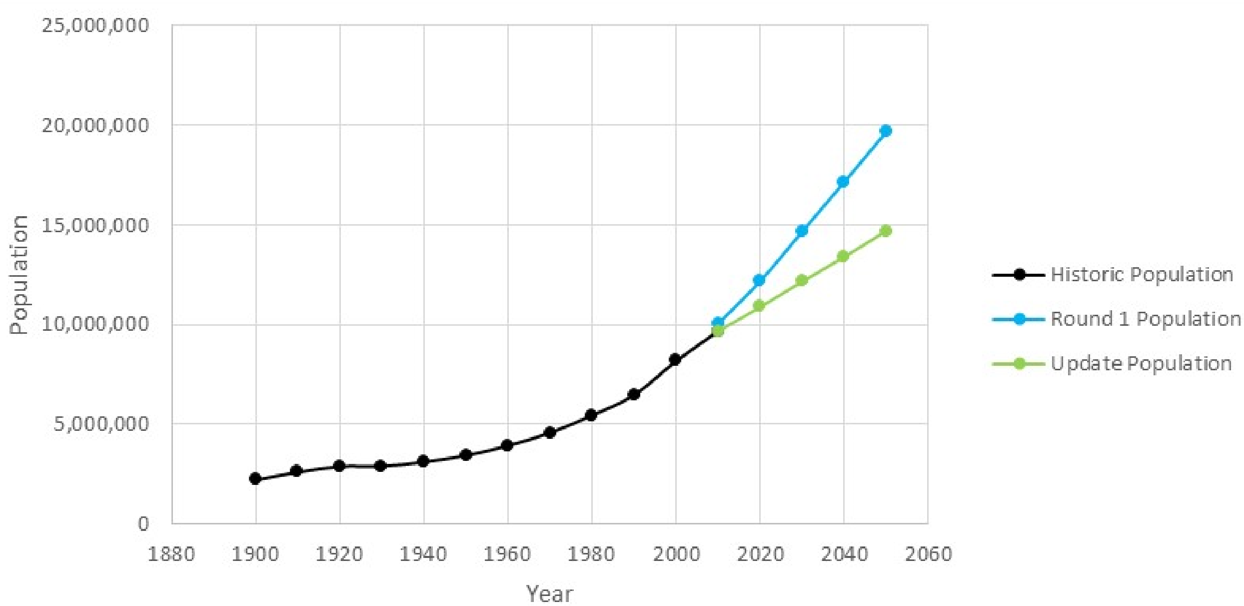


Figure 1-1
Georgia's Historic Population and Growth Projections

While the trend of a lower population in 2010 than projected was seen statewide, each County had its own individual trend. For the Region as a whole, the population obtained from the 2010 Census data was 4.7 percent lower than previously projected. Combined with lower growth rates moving forward the projected population in 2050 is 33 percent less than the previous estimate as shown in **Figure 1-2**. The new population projections (OPB, 2015) by County are shown in **Table 1-1**.

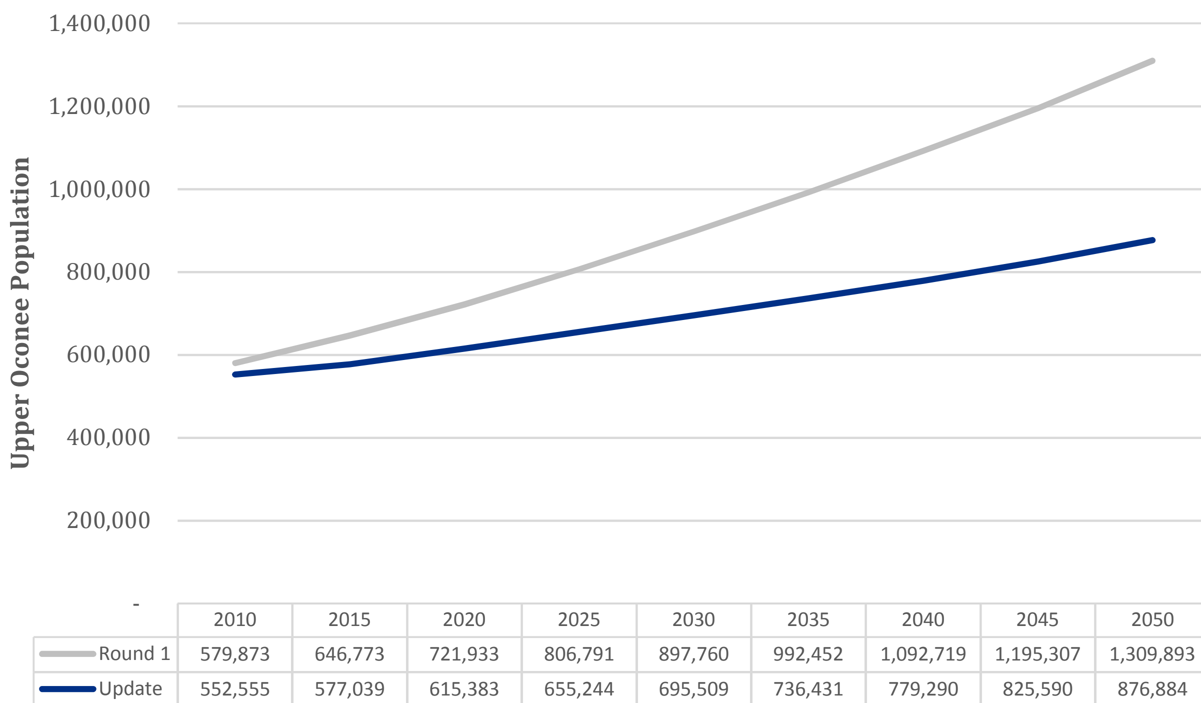


Figure 1-2
Upper Oconee Population Projections

Table 1-1 Population Projections per County

County	2015	2020	2025	2030	2035	2040	2045	2050
Baldwin	46,457	47,487	48,359	48,902	49,154	49,185	49,094	48,990
Barrow	75,869	87,355	100,036	114,081	129,633	146,904	166,160	187,785
Clarke	123,489	129,135	134,588	139,254	143,334	147,208	151,060	154,917
Greene	16,446	16,699	16,784	16,681	16,478	16,291	16,162	16,122
Hancock	8,630	8,003	7,359	6,706	6,065	5,455	4,913	4,477
Jackson	63,492	69,770	76,414	83,313	90,420	97,871	105,835	114,473
Laurens	48,543	49,830	50,904	51,702	52,249	52,653	53,014	53,410
Morgan	18,108	18,927	19,734	20,473	21,098	21,654	22,227	22,877
Oconee	35,265	38,483	42,056	45,904	49,846	53,795	57,865	62,289
Putnam	21,533	21,873	22,043	22,052	21,962	21,831	21,720	21,692
Walton	89,098	97,786	107,206	117,138	127,484	138,437	150,289	163,301
Washington	20,686	20,672	20,563	20,365	20,096	19,774	19,430	19,131
Wilkinson	9,423	9,363	9,199	8,938	8,612	8,231	7,820	7,420
Total	**577,039**	**615,383**	**655,244**	**695,509**	**736,431**	**779,290**	**825,590**	**876,884**

Section 2

Municipal Water Forecasting

This section describes the methodology and results of municipal water demand forecasts for the Upper Oconee Planning Region.

2.1 Methodology

The County level municipal water demand includes both public-supplied (i.e., utility) water demand and self-supplied (i.e., private well) water demand. The self-supplied water is associated with groundwater use, while the public-supply water is associated with either surface water or groundwater use as indicated by permit data. Each County has an average weighted per capita water use value that was derived from an analysis of all reporting utilities within each County, and then vetted through the regional councils in Round 1. The following sections describe updates to the previous methodology used to produce the revised forecasts.

2.1.1 Percent Change in Gallons per Capita per Day

The Georgia EPD reviewed withdrawal data and estimated population served data reported by permitted municipal water systems from the years 2010 through 2014. Georgia EPD then calculated adjustment factors for each County's public-supplied municipal per capita water use rate. For each County, a per capita value for each year 2010-2014 was calculated based on actual withdrawal and estimated population served data for that County. The percent rate of change was calculated for each year interval (2010 to 2011, 2011 to 2012, 2012 to 2013, 2013 to 2014), and the average of those four values was calculated as the per capita water use adjustment factor.

These adjustment factors were applied to the Gallons Per Capita per Day (GPCD) values used in Round 1 to derive the 2015 GPCD values for each County. If no data were available to Georgia EPD, the prior GPCD value was used as the 2015 value. Of the counties with available data, roughly two-thirds had a decrease in GPCD while approximately one third showed an increase in GPCD. Note that a decrease in GPCD could be due to conservation and water loss control efforts during this time period, or other factors such as an increase in population with less increase in water use, or a drop in water use (e.g., loss of industrial customer) with the same population. **Table 2-1** shows the GPCD adjustment factor applied to the Round 1 GPCD for each County in the region.

The self-supplied value of 75 GPCD for each County remains unchanged from Round 1.

Table 2-1 Per Capita Demand Values by County, GPCD

County	Round 1 Per Capita	2015 Adjustment Factor	Round 2 Adjusted Per Capita
Baldwin	140	-2.3%	137
Barrow	153	0.4%	153
Clarke	157	6.7%	167
Greene	153	4.5%	160
Hancock	125	-3.8%	120
Jackson	111	-1.4%	110
Laurens	157	-3.1%	153
Morgan	164	-0.3%	163
Oconee	142	-4.7%	136
Putnam	131	-1.1%	129
Walton	138	2.4%	142
Washington	195	-2.1%	191
Wilkinson	132	2.0%	135

2.1.2 Plumbing Code Adjustment Factor

In Round 1, the GPCD for each County was reduced over time due to the effects of plumbing codes based upon the age of housing stock in each County. Over time, as new houses are built with more efficiency fixtures, the County average GPCD will decrease. Previously a reduction (adjustment) was calculated for each County starting with zero in 2010 (the base year in Round 1) and increasing over time. For the update, these plumbing code adjustments were reset to zero in 2015 with the difference in the adjustment factor between 2010 and 2014 subtracted from the adjustment factor for all remaining years. The revised plumbing code adjustment was then applied to both public-supplied and self-supplied water demand. **Table 2-2** shows the municipal public-supplied GPCD value over time for each County.

Table 2-2 Adjusted Public-Supplied GPCD

County	2015	2020	2025	2030	2035	2040	2045	2050
Baldwin	136.7	135.4	134.2	133.0	131.7	130.5	129.3	128.0
Barrow	153.4	152.5	151.7	150.9	150.0	149.2	148.4	147.5
Clarke	167.2	166.0	164.8	163.7	162.5	161.3	160.1	158.9
Greene	160.3	159.2	158.2	157.2	156.1	155.1	154.0	153.0
Hancock	120.4	119.1	117.8	116.5	115.2	113.9	112.7	111.4
Jackson	109.5	108.6	107.7	106.8	105.9	105.0	104.0	103.1
Laurens	152.6	151.3	150.0	148.7	147.4	146.2	144.9	143.6
Morgan	163.5	162.4	161.3	160.2	159.1	158.0	156.9	155.8
Oconee	135.6	134.7	133.7	132.8	131.9	131.0	130.1	129.2
Putnam	129.2	128.2	127.3	126.3	125.3	124.4	123.4	122.4
Walton	141.8	140.9	140.1	139.2	138.4	137.5	136.7	135.8
Washington	190.7	189.4	188.1	186.8	185.4	184.1	182.8	181.5
Wilkinson	134.5	133.2	131.9	130.6	129.3	128.0	126.7	125.4

2.2 Municipal Water Forecasting Results

Table 2-3 shows the forecasted municipal water demand in millions of gallons per day (MGD) (public-supplied and self-supplied) by County in the Upper Oconee Region. The total regional demand is shown graphically in **Figure 2-1** along with a comparison of the Round 1 estimates. Region-wide the municipal forecast is lower than in Round 1 due to the combination of lower population projections and generally lower per capita water use values.

Table 2-3 Average Annual Municipal Water Demand Forecast by County (MGD)

County	2015	2020	2025	2030	2035	2040	2045	2050	% Increase
Baldwin	6.3	6.4	6.5	6.5	6.4	6.4	6.3	6.2	-1%
Barrow	8.9	10.1	11.5	13.0	14.7	16.5	18.6	20.8	135%
Clarke	20.6	21.4	22.2	22.8	23.3	23.7	24.2	24.6	19%
Greene	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.1	-7%
Hancock	0.9	0.8	0.7	0.7	0.6	0.5	0.5	0.4	-53%
Jackson	6.8	7.5	8.1	8.7	9.4	10.1	10.8	11.6	70%
Laurens	5.7	5.7	5.8	5.8	5.8	5.8	5.8	5.7	2%
Morgan	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.5	18%
Oconee	3.9	4.2	4.6	5.0	5.4	5.7	6.1	6.5	67%
Putnam	2.3	2.3	2.3	2.3	2.3	2.2	2.2	2.2	-6%
Walton	9.9	10.8	11.7	12.7	13.7	14.8	15.9	17.2	74%
Washington	2.8	2.8	2.8	2.7	2.7	2.6	2.5	2.4	-14%
Wilkinson	1.1	1.1	1.0	1.0	1.0	0.9	0.8	0.8	-27%
Total	**73.6**	**77.7**	**81.8**	**85.8**	**89.8**	**93.9**	**98.3**	**103.2**	**40%**

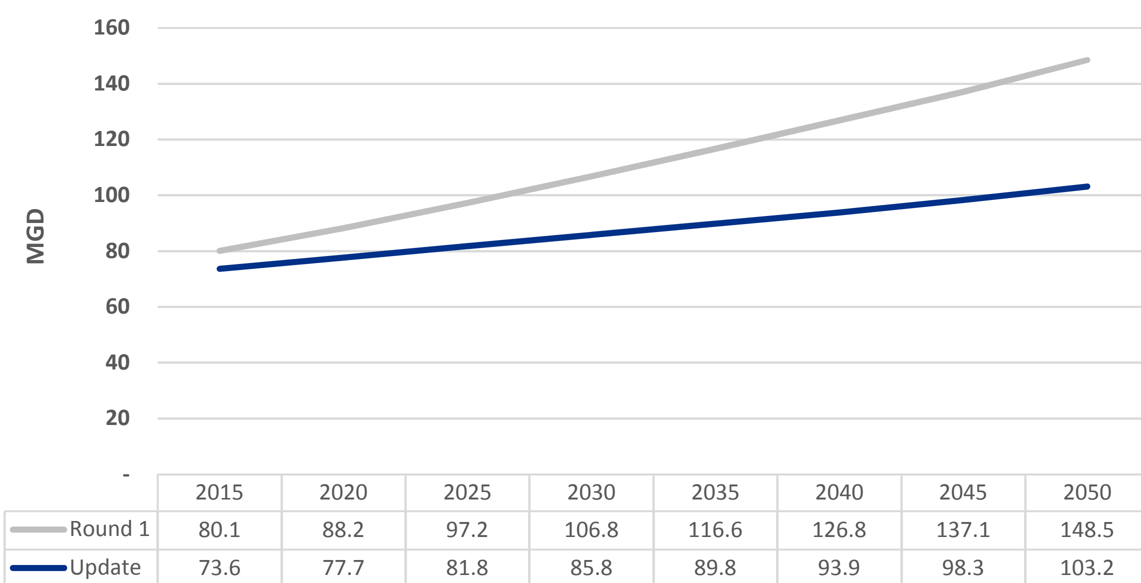


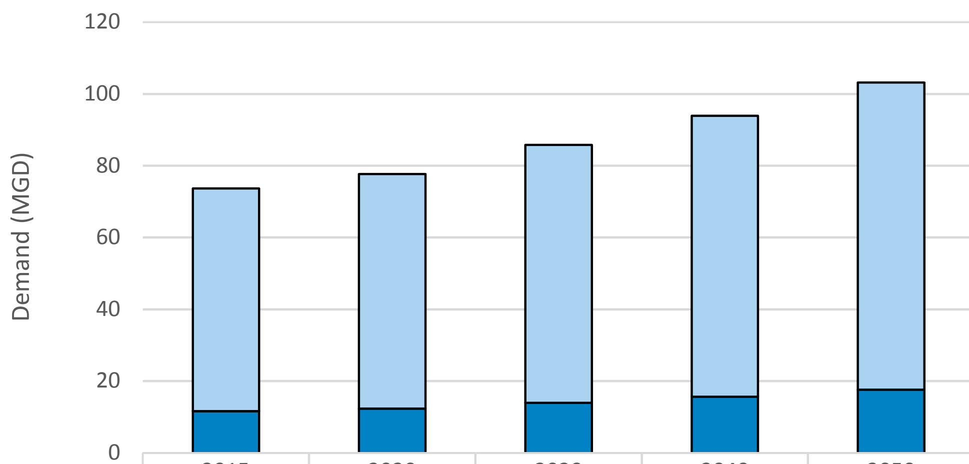
Figure 2-1
Forecasted Municipal Water Demand for Upper Oconee Planning Council

2.3 Municipal Water Forecast Allocations

As noted above, the municipal water demand for each County is the summation of the public-supplied and self-supplied water demand estimates for each County. The percent of County population that is public-supplied and self-supplied remains the same from Round 1. This split of County population was derived from United States Geological Survey (USGS) estimates, and was vetted through the Regional council review process. **Figure 2-2** shows the split between self-supply versus public-supply for the region.

As in Round 1, it is assumed that all self-supplied (i.e., domestic residential) water use is from groundwater. The allocation of public-supplied municipal water among surface water and groundwater sources was determined in Round 1 by an analysis of surface water and groundwater permitted water withdrawals for municipal use by County. The percent of County public-supply municipal water by surface water and groundwater are retained from Round 1 and used to allocate the updated County municipal water demand by sources. Furthermore, the allocation of surface water by stream node (for the surface water models) and groundwater by aquifer (for the groundwater models) maintains the same proportions as in Round 1.

Thus the updated County municipal water demand forecasts are allocated among surface water nodes and groundwater aquifers for analysis with other components of the state water plan update. For the Upper Oconee Region, the majority of municipal water is from surface water (76 percent), as shown in **Figure 2-3**.



	2015	2020	2030	2040	2050
Public Supply	62.0	65.3	71.9	78.3	85.5
Self-Supply	11.6	12.4	13.9	15.6	17.6

Figure 2-2
Self-Supply Versus Public-Supply of Municipal Water Demand

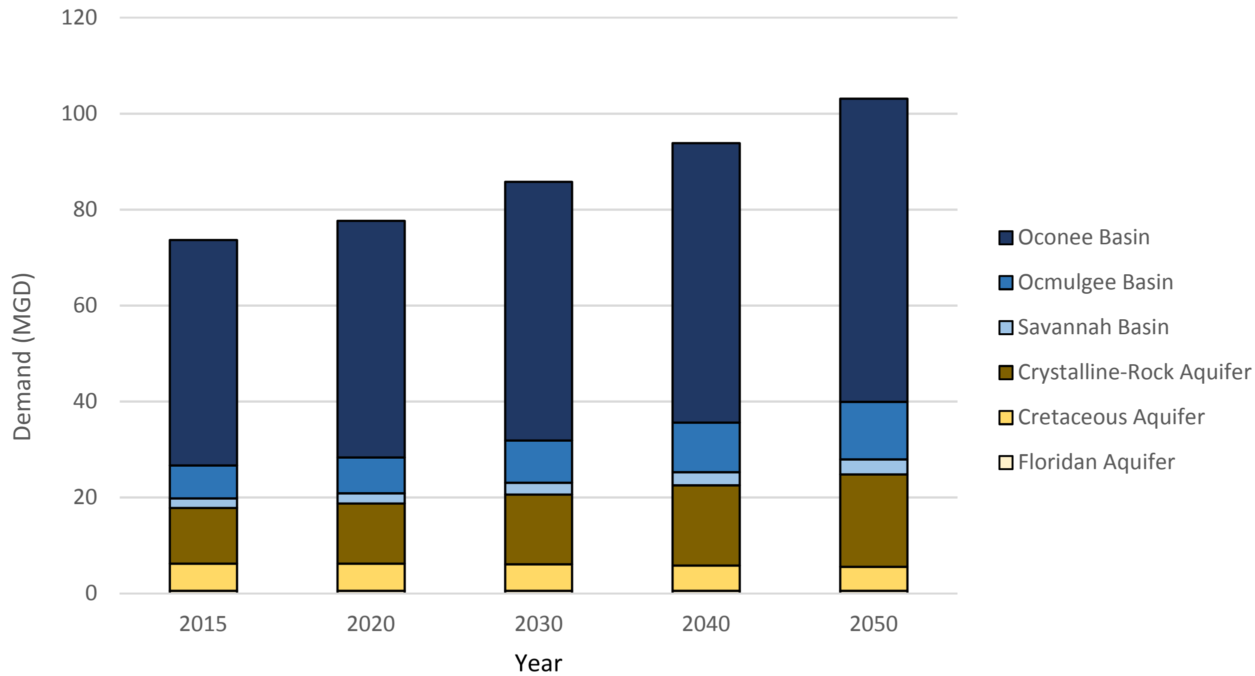


Figure 2-3
Municipal Water Demand for Upper Oconee Planning Council by Aquifer and Basin

Section 3

Municipal Wastewater Forecasting

This section describes the methodology and results of the update of the municipal wastewater demand forecasts for the Upper Oconee Planning Region.

3.1 Methodology

Within the previous analysis (i.e., Round 1), the municipal water demand served as the basis for estimating the municipal wastewater flows for each County with a portion of the water demand assumed to be indoor use that entered the centralized wastewater treatment system. While self-supplied water demand was assumed to go to a septic system, public-supplied water in each County had a proportion going to septic and a portion to centralized treatment. A percentage was then added to centralized flows for inflow and infiltration (I/I) that occurs on the way to the treatment facility. The centralized flow estimate was then allocated between point discharge (NPDES) and land application systems (LAS).

For the update, the Georgia EPD provided an analysis of 2014 NPDES permitted discharges by County and a recommended methodology for the municipal wastewater forecast update.

- The percent of County total wastewater flow that is septic is retained from Round 1. Any percentage change over time is from council member input in Round 1.
- Future septic flow by County is estimated from the Round 1 septic flow forecast times the percent change in County population between the Round 1 and Round 2 population projections for the County.
- Future septic flows are allocated to watersheds and stream nodes based on the same percent of County area in watersheds as in Round 1.
- The sum of annual average 2014 NPDES point discharges by County are adjusted by the change in percent of County that is septic/centralized over time (if applicable), and increased/decreased over time with the rate of change in the new County population projections to derive the new point discharge forecast for the County.
- The updated point discharge for the County is allocated to watersheds and stream nodes based on the permit locations of the 2014 NPDES flows in the County.
- The sum of annual average 2014 land application system (LAS) flows by County are adjusted by the change in percent of County that is septic/centralized over time (if applicable), combined with any 2014 subsurface flows (if any), and increased/decreased over time with the rate of change in the new County population projections to derive the new LAS and subsurface forecast for the County.

- The updated LAS and subsurface flow forecast for the County is allocated to watersheds and stream nodes based on the permit locations of the 2014 (LAS and subsurface) flows in the County.
- County centralized flow is the sum of the point source discharges and LAS and subsurface discharges.
- County total wastewater flow is the sum of the centralized and septic flows.

3.2 Results

Table 3-1 shows the forecasted municipal wastewater generated per County in the Upper Oconee region. The total regional wastewater generated is then shown graphically in **Figure 3-1** broken down between septic treatment and centralized treatment that is discharged via a point source or land application. **Figure 3-2** gives a snapshot of the how the generated wastewater is discharged per watershed for 2015 located in the Region.

Table 3-1 Total Wastewater Generated in Upper Oconee Planning Region per County (MGD)

County	2015	2020	2030	2040	2050	% Change 2015 to 2050
Baldwin	6.8	7.0	7.1	7.1	7.0	3%
Barrow	7.6	8.9	11.7	14.9	18.6	144%
Clarke	18.2	18.9	20.1	20.9	21.8	20%
Greene	1.7	1.7	1.7	1.7	1.6	-4%
Hancock	1.3	1.2	1.0	0.8	0.6	-51%
Jackson	5.8	6.4	7.5	8.6	9.9	70%
Laurens	6.5	6.6	6.8	6.9	6.9	7%
Morgan	2.1	2.2	2.5	2.7	2.9	36%
Oconee	3.6	3.9	4.4	5.1	5.9	64%
Putnam	2.0	2.1	2.1	2.1	2.1	5%
Walton	10.3	12.3	16.1	19.6	23.2	126%
Washington	1.9	1.9	1.9	1.8	1.7	-10%
Wilkinson	1.1	1.1	1.0	0.9	0.8	-25%
Total	**69.0**	**74.2**	**83.9**	**93.2**	**103.2**	**50%**

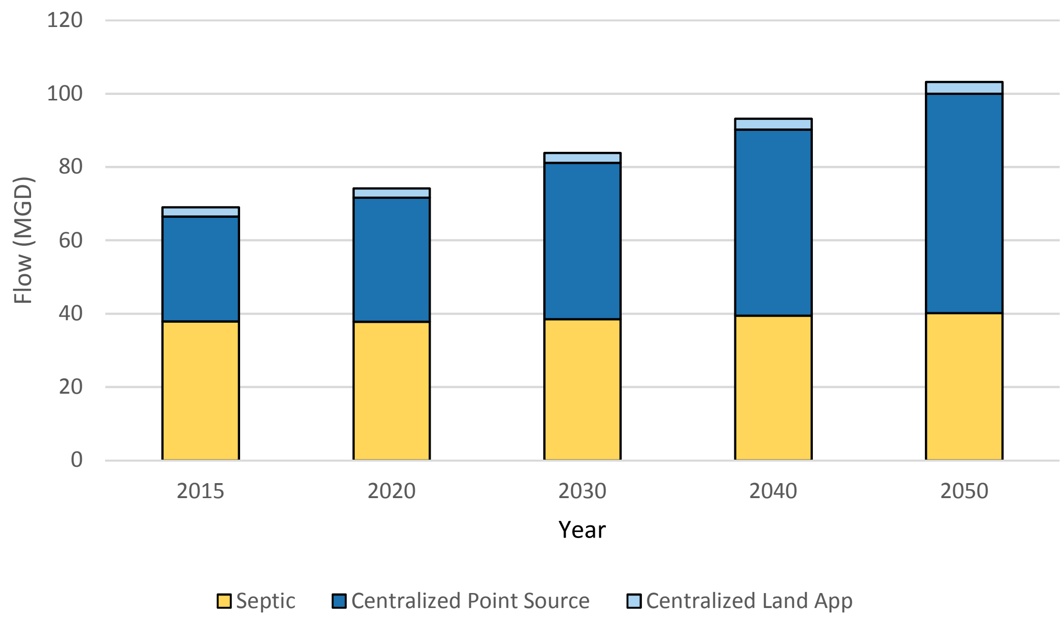


Figure 3-1
Total Wastewater Generated Upper Oconee Planning Region by Type

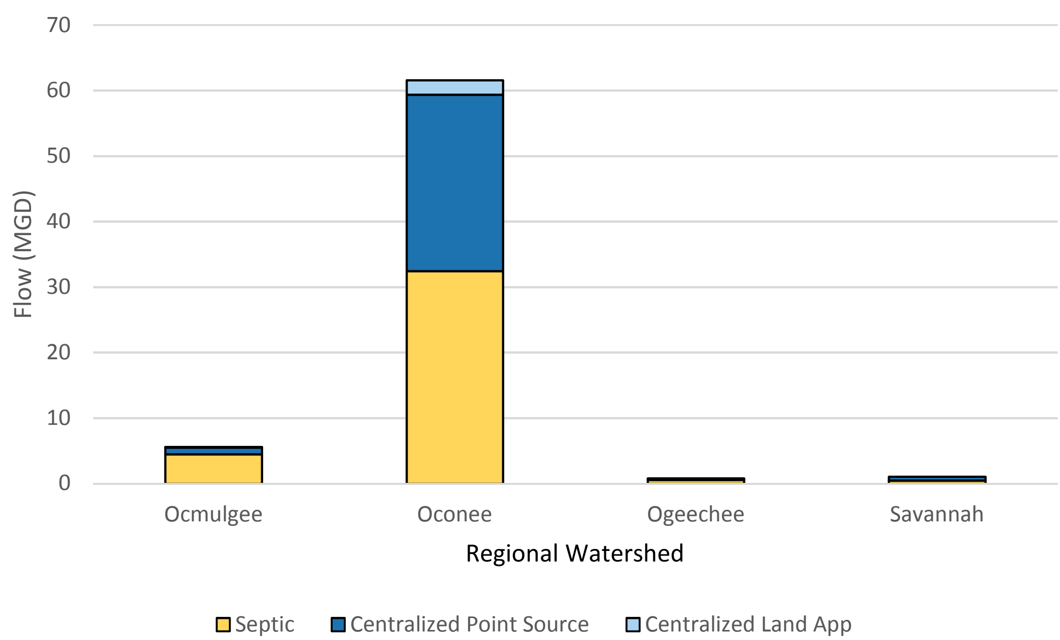


Figure 3-2
2015 Snapshot of Wastewater Discharge Type per Watershed

Section 4

Industrial Forecasting

This section describes the methodology and results of industrial water and wastewater demand forecasts for the Upper Oconee Planning Region.

4.1 Methodology

The industrial water and wastewater forecasts were not updated from those produced in Round 1 other than any significant issues or changes that individual Planning Councils believed should be incorporated. For the Upper Oconee Planning Council, no changes were decided to be incorporated at this time.

The original methodology forecasted industrial water demand based on employment projections per industry with the 2010 water use multiplied by the expected employment growth rate into the future for that type of industry. The industrial wastewater flow was then estimated from a wastewater to water ratio developed for each industrial category.

4.2 Results

Table 4-1 shows the (Round 1) industrial water demand by industry. The majority of industrial water demand in the Upper Oconee Region is from the mining and paper industrial classification categories. Currently, 66 percent of the industrial water demand in the Region comes from groundwater. The percentage is projected to increase slightly in the future as a greater ratio of future demand continues to come from groundwater as shown in **Figure 4-1**.

Table 4-2 provides the forecast of industrial wastewater generated per industry. The forecasted wastewater is higher than the forecasted water demand since the mining and stone and clay industries includes stormwater drainage from the facility sites. The vast majority (greater than 99.9 percent) of the industrial wastewater in the Planning Region is discharged via permitted point sources for the industrial facilities. A very small percentage is discharged via land application.

Table 4-1 Industrial Water Demand Forecast per Industry (MGD)

Industry	2015	2020	2030	2040	2050
Mining	38.77	41.60	47.32	53.05	58.77
Food	4.31	4.43	4.60	4.78	5.00
Textiles	2.52	2.74	3.17	3.47	3.78
Apparel	-	-	-	-	-
Paper	15.52	15.79	16.37	17.02	17.78
Chemicals	0.36	0.41	0.49	0.57	0.65
Petroleum and Coal	-	-	-	-	-
Plastic and Rubber	0.05	0.05	0.05	0.05	0.05
Stone and Clay	-	-	-	-	-
Primary Metals	-	-	-	-	-
Fabricated Metal Products	-	-	-	-	-
Electrical Machinery	-	-	-	-	-
Automotive Manufacturing	-	-	-	-	-
Other	0.47	0.51	0.60	0.72	0.86
TOTAL	**62.0**	**65.5**	**72.6**	**79.6**	**86.9**

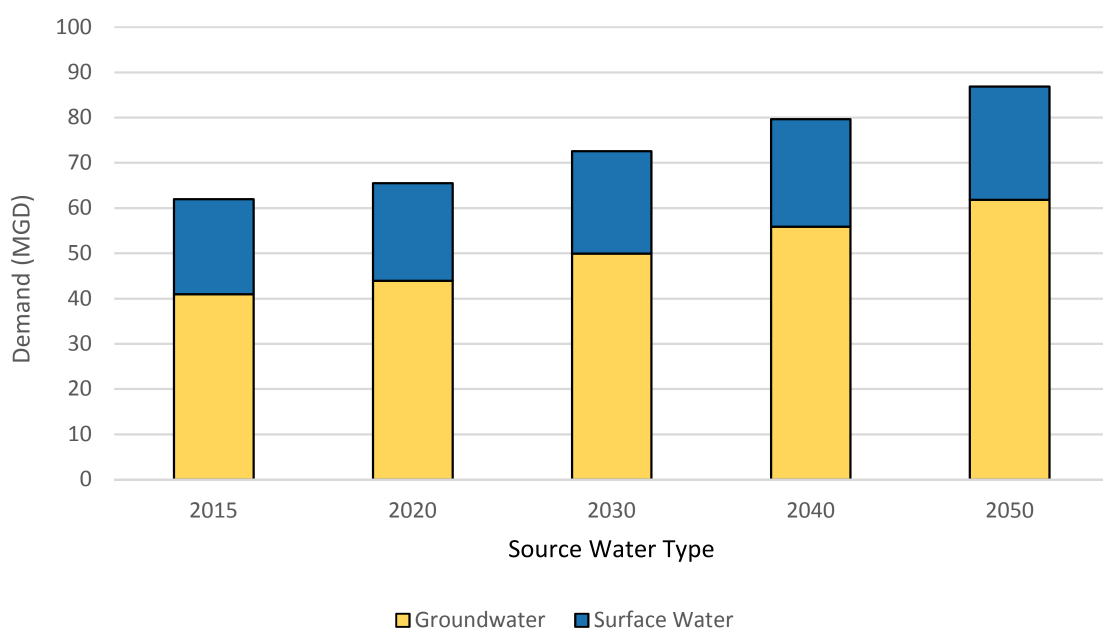


Figure 4-1
Industrial Water Demand by Source Water Type

Table 4-3 Industrial Wastewater Generation Forecast per Industry (MGD)

Industry	2015	2020	2030	2040	2050
Mining	50.02	53.66	61.04	68.43	75.81
Food	3.88	3.98	4.14	4.30	4.50
Textiles	1.89	2.05	2.38	2.60	2.83
Apparel	-	-	-	-	-
Paper	15.20	15.47	16.04	16.67	17.41
Chemicals	0.34	0.38	0.45	0.53	0.60
Petroleum and Coal	-	-	-	-	-
Plastic and Rubber	0.01	0.01	0.01	0.01	0.01
Stone and Clay	-	-	-	-	-
Primary Metals	-	-	-	-	-
Fabricated Metal Products	-	-	-	-	-
Electrical Machinery	-	-	-	-	-
Automotive Manufacturing	-	-	-	-	-
Other	0.28	0.30	0.36	0.43	0.52
TOTAL	**71.6**	**75.9**	**84.4**	**93.0**	**101.7**

Section 5

Agricultural Water Forecasting

This section describes the methodology and results of agricultural water demand forecasting for the Upper Oconee Planning Region.

5.1 Methodology

Agricultural water demand forecasts were originally developed, and recently updated, by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences. GWPPC was contracted by Georgia EPD to prepare estimates of current and future use of water by the agricultural sector in Georgia. The basic methodology involved estimating the projected irrigated area for each crop type and multiplying that area by the predicted monthly irrigation need in inches per each crop type. The proportion of irrigation water derived from different water source types was also considered. The projections cover row and orchard crops as well as most vegetable and specialty crops accounting for more than 95 percent of Georgia's irrigated land. Additionally, estimates of current use are made for animal agriculture, horticultural nurseries and greenhouses, as well as golf courses.

Metered observations were utilized from the 2010-2013 growing seasons and then projected into the future demand years using methods consistent with Round 1. To address potential climate extremes, a range of agricultural demand scenarios were considered. The 75th percentile of water demand was selected to represent dry year conditions when higher irrigation demands are expected. For planning purposes, GWPPC used the 75th percentile values for each Region to represent a more conservative scenario than the median value. It is the 75th percentile demands that are presented in this report.

5.2 Results

Table 5-1 shows the forecasted agricultural water needs by County in the Upper Oconee Region. The Region as a whole is expected to see an increase of 16 percent in agricultural water demand by 2050. **Figure 5-1** shows the agricultural demands split by basin for surface water and aquifer for groundwater with the same data also provided in **Table 5-2**. Currently 78 percent of the agricultural demand in the Upper Oconee Region is met from groundwater.

Table 5-1 Upper Oconee Agricultural Demand Forecast by County (MGD)

County	2015	2020	2030	2040	2050	Percent Increase 2015 to 2050
Baldwin	0	0	0	0	0	0%
Barrow	0	0	0	0	0	0%
Clarke	0.27	0.28	0.29	0.30	0.31	15%
Greene	0	0	0	0	0	0%
Hancock	0.08	0.08	0.08	0.08	0.08	6%
Jackson	0.05	0.05	0.05	0.05	0.06	16%
Laurens	9.1	9.3	9.7	10.0	10.2	12%
Morgan	2.2	2.3	2.4	2.5	2.6	15%
Oconee	3.3	3.4	3.5	3.6	3.8	14%
Putnam	0.25	0.25	0.25	0.24	0.23	-7%
Walton	3.8	3.9	4.1	4.3	4.4	15%
Washington	10.8	11.2	11.9	12.6	13.2	22%
Wilkinson	0.21	0.21	0.21	0.20	0.19	-7%
Total	30.1	30.9	32.5	33.8	35.1	16%

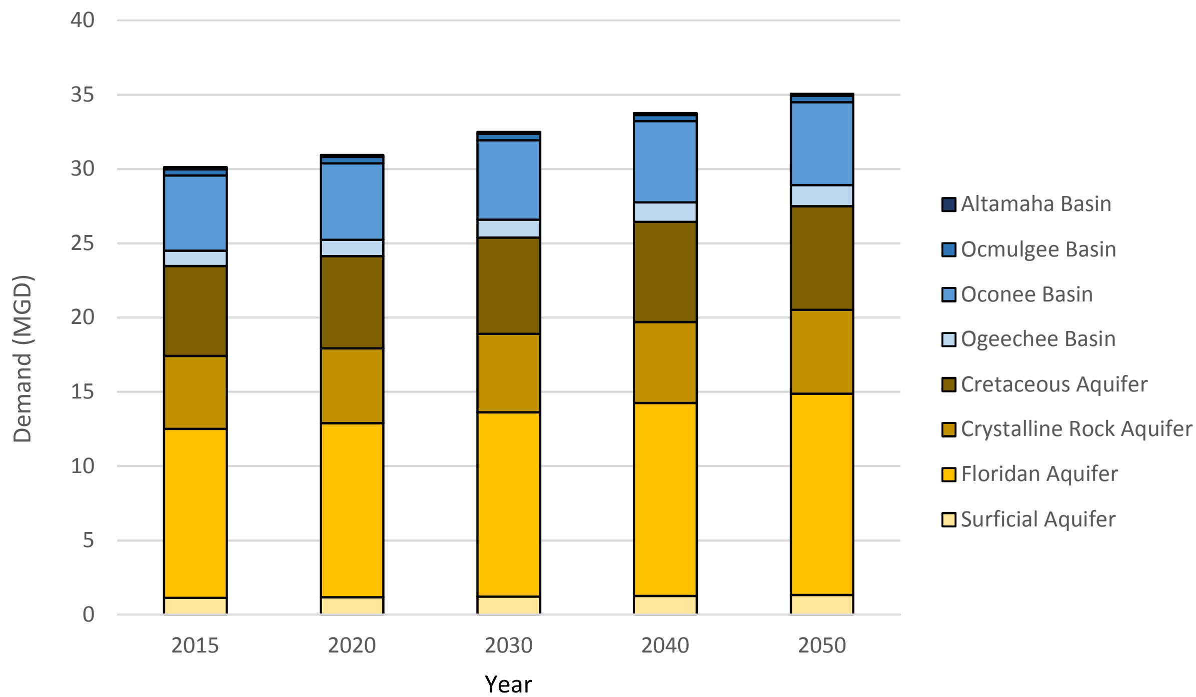


Figure 5-1
Agricultural Water Demand by Source Water Type

Table 5-2 Upper Oconee Agricultural Demand Forecast per Source (MGD)

Source Water Type	Basin/Aquifer	2015	2020	2030	2040	2050	Percent Increase 2015 to 2050
Surface Water	Altamaha	0.14	0.14	0.14	0.13	0.13	-7%
	Ocmulgee	0.41	0.41	0.42	0.42	0.43	4%
	Oconee	5.06	5.17	5.33	5.46	5.59	10%
	Ogeechee	1.04	1.10	1.21	1.31	1.42	36%
	Sub Total	**6.66**	**6.82**	**7.10**	**7.33**	**7.56**	**14%**
Groundwater	Cretaceous	6.05	6.20	6.50	6.73	6.97	15%
	Crystalline Rock	4.91	5.03	5.26	5.46	5.66	15%
	Floridan	11.37	11.73	12.41	12.98	13.55	19%
	Surficial	1.14	1.17	1.23	1.27	1.32	16%
	Sub Total	**23.47**	**24.13**	**25.39**	**26.45**	**27.50**	**17%**
	Total	**30.1**	**30.9**	**32.5**	**33.8**	**35.1**	**16%**

Section 6

Energy Water Forecasting

This section describes the methodology and results of energy sector water demand for the Upper Oconee Planning Region.

6.1 Methodology

Demands forecasted in this section are associated with future energy sector utilities (NAICS 22) power generation. Water demands associated with power generation by facilities with other industry codes are captured as part of the municipal and industrial water demand forecasts discussed in previous sections.

The analysis covers both water withdrawal requirements and water consumption associated with energy generation. Information related to water withdrawals is an important consideration in planning for the water needed for energy production. However, water consumption is the more important element when assessing future resources because a large volume of water is typically returned to the environment following the energy production process.

Water requirements for thermoelectric power generation facilities are estimated based on future energy demands along with the water requirements and consumption rates in gallons per megawatt-hour (MWh) for different power generating configurations. For a full discussion of the original forecast methodology see the 2010 Technical Memorandum "Statewide Energy Sector Water Demand Forecast" or the "Update of GA Energy Needs & Generating Facilities" Memorandum. The following updates to the original methodology were incorporated into the current estimates:

- Projections of the statewide energy demand were updated using the new population projections with the relationship between population and energy demand the same as previously estimated.
- The list of existing facilities, facilities under construction, and planned and permitted new facilities was updated. In addition, some prior facilities were retired from service or converted from one generating configuration to another configuration.
- The same water withdrawal and consumptive use factors (gallons per MWh) by generating configuration were maintained as previously developed.
- To meet the future energy demand, the energy generation of existing facilities is increased over time to a predetermined maximum sustainable generating capacity based on the generation configuration. As additional capacity is needed in the future, "new" capacity is added to the most likely to be developed generating configurations, but the "new" generating capacity is not assigned geographically to any specific Region within the state.

- The estimated future generating capacity of existing facilities, and associated water requirements, is allocated to regions based on the location of the existing facilities.

6.2 Results

The energy facilities within the Upper Oconee Regional Water Planning Council include AL Sandersville, Washington County Power, and Blue Ridge Energy Development. The GA Power Plant Harlee Branch is assumed retired in the forecasts following 2015. **Table 6-1** shows the projected expected scenario average annual daily withdrawal and consumption at the facilities over the planning horizon which is met via groundwater.

Table 6-1 Upper Oconee Forecasted Energy Sector Demands (MGD)

Demand Type	2015	2020	2030	2040	2050
Withdrawals	669	0.58	0.66	0.75	0.81
Consumption	0.46	0.49	0.56	0.63	0.69

Within the previous statewide analysis, the generating capacity of the existing and planned facilities was not able to meet the projected statewide power needs through 2050 and additional generating capacity was assumed to be developed beyond 2020. Additional generating capacity may be needed to meet the statewide power need estimate. However, the water requirements associated with the potential new capacity are minimal; less than 20 MGD withdrawals and less than 10 MGD consumption, statewide. Thus, no future water demands for currently unassigned power generation facilities have been added to the estimates for the Upper Oconee Region within this update. Projections for the need of new energy capacity are less than estimated previously because: (a) population projections are lower, (b) high water-using facilities have been retired, and (c) the types of generating facilities likely to be constructed in the future to meet the additional need have lower water use requirements.

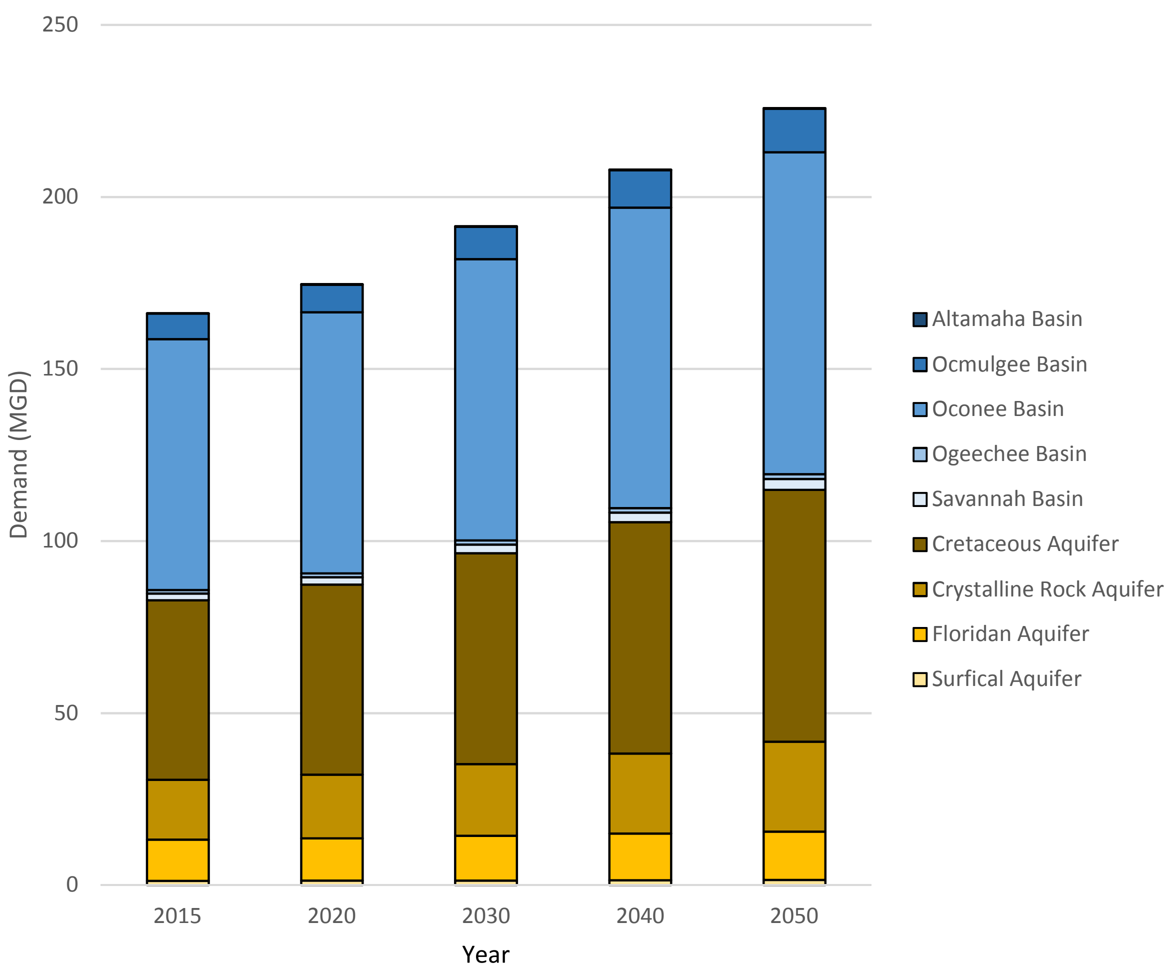
Section 7

Regional Summary

This section summarizes the water and wastewater forecasts within the Region for all the sectors combined.

7.1 Water Demand Summary

The full regional water demand including municipal, industrial, agricultural and energy uses are summarized in the figures and tables of this section. **Figure 7-1** shows the regional water demand per basin for surface water withdrawals and per aquifer for groundwater withdrawals, while **Figure 7-2** shows the regional water demand per sector. **Table 7-1** provides a breakdown of the demand types and withdrawal locations per County.



Note: Consumptive demand rather than total withdrawals from the energy sector included

Figure 7-1
Regional Water Demand by Basin and Aquifer

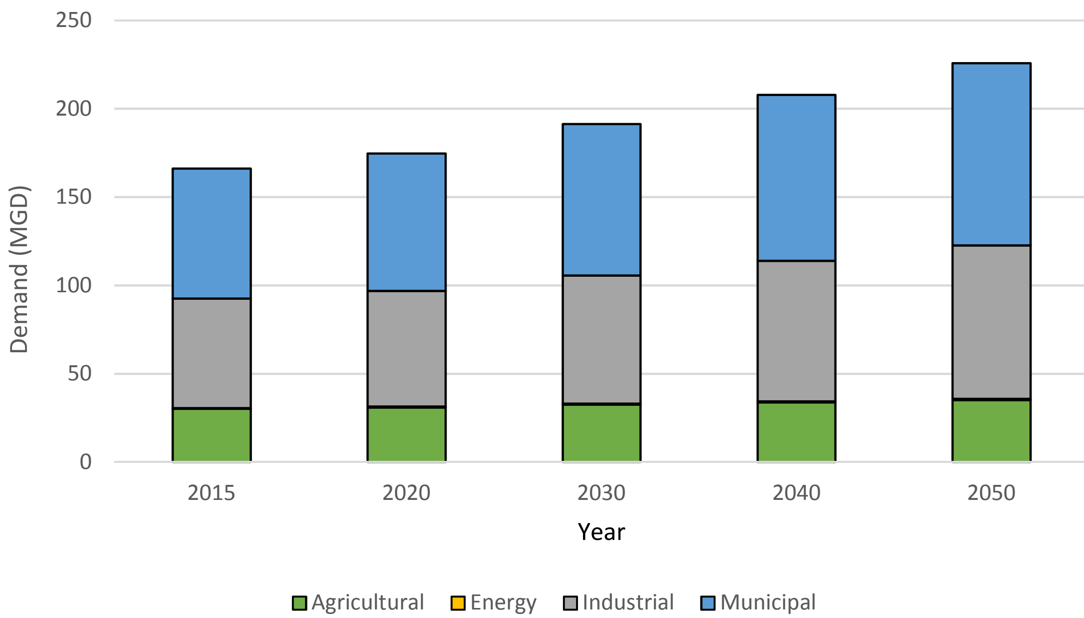


Figure 7-2
Regional Water Demand by Sector

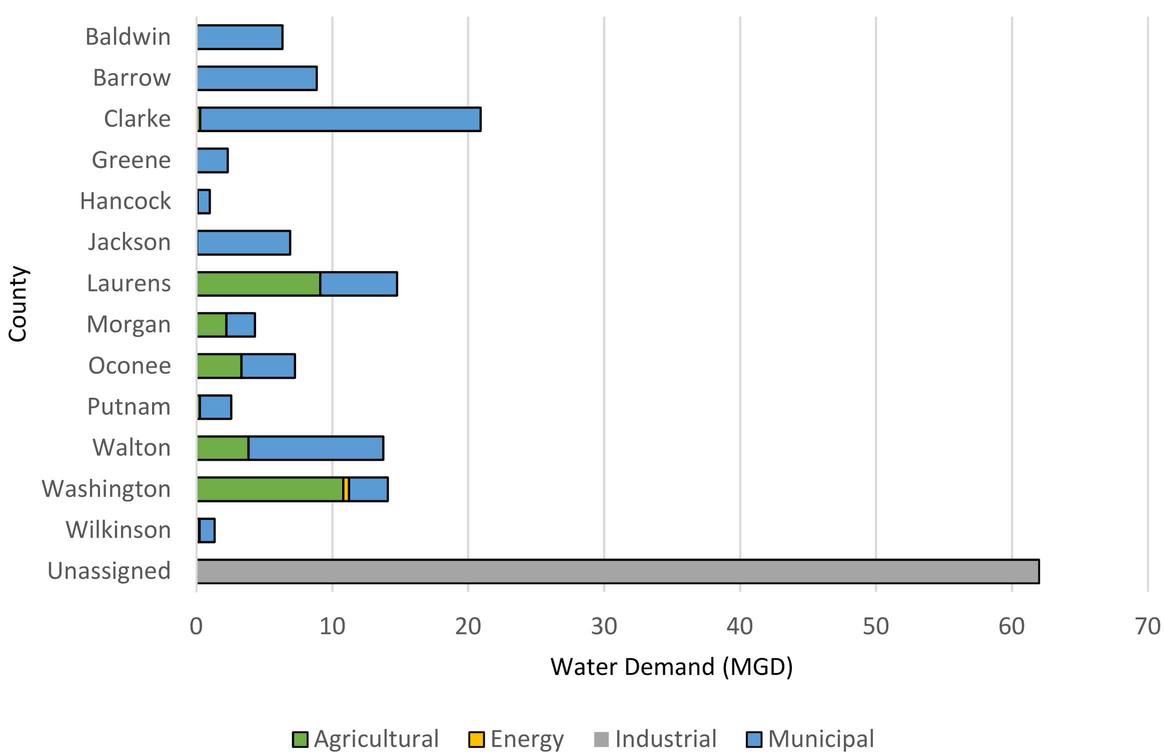


Figure 7-3
County Water Demand by Sector for 2015

Table 7-1 Summary of Water Demand per County (MGD)

County	Sector	Aquifer/Node	2015	2020	2030	2040	2050
Baldwin	GW Municipal Self Supply	Crystalline Rock	0.04	0.04	0.04	0.04	0.03
	SW Municipal Public Supply	Milledgeville	6.28	6.36	6.43	6.35	6.21
	Total		**6.32**	**6.40**	**6.47**	**6.39**	**6.24**
Barrow	GW Municipal Public Supply	Crystalline Rock	0.56	0.64	0.82	1.05	1.33
	GW Municipal Self Supply	Crystalline Rock	2.66	3.03	3.87	4.87	6.08
	Groundwater Total		3.22	3.67	4.70	5.92	7.41
	SW Municipal Public Supply	Athens	5.45	6.24	8.06	10.26	12.97
	SW Municipal Public Supply	Penfield	0.19	0.21	0.27	0.35	0.44
	Surface Water Total		5.63	6.45	8.33	10.61	13.41
	Total		**8.85**	**10.12**	**13.03**	**16.53**	**20.81**
Clarke	GW Agricultural	Crystalline Rock	0.14	0.14	0.15	0.15	0.16
	GW Municipal Public Supply	Crystalline Rock	0.21	0.21	0.23	0.24	0.25
	GW Municipal Self Supply	Crystalline Rock	0.02	0.02	0.02	0.02	0.02
	Groundwater Total		0.36	0.37	0.39	0.41	0.42
	SW Agricultural	Penfield	0.14	0.14	0.15	0.15	0.16
	SW Municipal Public Supply	Athens	13.39	13.91	14.78	15.40	15.97
	SW Municipal Public Supply	Penfield	7.01	7.27	7.73	8.06	8.35
	Surface Water Total		20.54	21.32	22.66	23.61	24.48
	Total		**20.90**	**21.70**	**23.06**	**24.02**	**24.90**
Greene	GW Municipal Public Supply	Crystalline Rock	0.50	0.50	0.50	0.48	0.47
	GW Municipal Self Supply	Crystalline Rock	0.30	0.30	0.29	0.28	0.27
	Groundwater Total		0.80	0.81	0.79	0.76	0.73
	SW Municipal Public Supply	Milledgeville	1.22	1.23	1.22	1.17	1.14
	SW Municipal Public Supply	Thurmond Reservoir	0.27	0.27	0.27	0.26	0.25
	Surface Water Total		1.49	1.51	1.49	1.43	1.40
	Total		**2.29**	**2.31**	**2.27**	**2.19**	**2.13**
Hancock	GW Agricultural	Crystalline Rock	0.05	0.05	0.05	0.06	0.06
	GW Municipal Self Supply	Crystalline Rock	0.24	0.22	0.17	0.14	0.11
	Groundwater Total		0.29	0.27	0.23	0.19	0.16
	SW Agricultural	Eden	0.02	0.02	0.02	0.02	0.02
	SW Municipal Public Supply	Milledgeville	0.66	0.60	0.50	0.39	0.32
	Surface Water Total		0.68	0.63	0.52	0.42	0.34
	Total		**0.97**	**0.90**	**0.75**	**0.61**	**0.50**

Table 7-1 Summary of Water Demand per County (MGD)

County	Sector	Aquifer/Node	2015	2020	2030	2040	2050
Jackson	GW Municipal Public Supply	Crystalline Rock	0.66	0.72	0.84	0.97	1.12
	GW Municipal Self Supply	Crystalline Rock	0.24	0.27	0.31	0.35	0.40
	Groundwater Total		0.90	0.98	1.15	1.33	1.52
	SW Agricultural	Athens	0.05	0.05	0.05	0.05	0.06
	SW Municipal Public Supply	Athens	3.17	3.45	4.05	4.68	5.38
	SW Municipal Public Supply	Bell	1.72	1.87	2.19	2.53	2.91
	SW Municipal Public Supply	Penfield	1.06	1.15	1.35	1.56	1.79
	Surface Water Total		5.99	6.52	7.65	8.83	10.14
	Total		**6.89**	**7.50**	**8.80**	**10.15**	**11.66**
Laurens	GW Agricultural	Floridan, Cretaceous	7.69	7.87	8.23	8.49	8.75
	GW Municipal Public Supply	Cretaceous	0.63	0.64	0.66	0.66	0.66
	GW Municipal Self Supply	Cretaceous	1.14	1.15	1.15	1.13	1.10
	GW Municipal Self Supply	Floridan	0.56	0.57	0.57	0.56	0.54
	Groundwater Total		10.02	10.23	10.60	10.83	11.05
	SW Agricultural	Mount Vernon, Dublin, Basley	1.42	1.43	1.46	1.46	1.47
	SW Municipal Public Supply	Dublin	3.32	3.38	3.45	3.45	3.44
	Surface Water Total		4.74	4.81	4.91	4.92	4.91
	Total		**14.76**	**15.04**	**15.51**	**15.75**	**15.96**
Morgan	GW Municipal Self Supply	Crystalline Rock	0.73	0.76	0.79	0.81	0.83
	SW Agricultural	Milledgeville	2.22	2.28	2.38	2.47	2.55
	SW Municipal Public Supply	Milledgeville	1.36	1.41	1.51	1.57	1.64
	Surface Water Total		3.58	3.69	3.89	4.04	4.19
	Total		**4.31**	**4.45**	**4.68**	**4.85**	**5.03**
Oconee	GW Agricultural	Crystalline Rock	2.05	2.10	2.19	2.28	2.36
	GW Municipal Public Supply	Crystalline Rock	0.34	0.37	0.44	0.51	0.58
	GW Municipal Self Supply	Crystalline Rock	1.06	1.14	1.33	1.52	1.71
	Groundwater Total		3.45	3.61	3.96	4.30	4.65
	SW Agricultural	Milledgeville	1.26	1.29	1.33	1.37	1.41
	SW Municipal Public Supply	Athens	2.52	2.74	3.22	3.72	4.25
	Surface Water Total		3.79	4.02	4.55	5.09	5.66
	Total		**7.24**	**7.63**	**8.51**	**9.39**	**10.31**
Putnam	GW Municipal Public Supply	Crystalline Rock	0.32	0.32	0.32	0.31	0.31
	GW Municipal Self Supply	Crystalline Rock	0.64	0.64	0.63	0.61	0.59
	Groundwater Total		0.96	0.97	0.96	0.92	0.90
	SW Agricultural	Milledgeville	0.25	0.25	0.25	0.24	0.23
	SW Municipal Public Supply	Milledgeville	1.35	1.36	1.35	1.32	1.29
	Surface Water Total		1.60	1.62	1.60	1.56	1.52
	Total		**2.57**	**2.59**	**2.56**	**2.48**	**2.42**
Walton	GW Agricultural	Crystalline Rock,	3.81	3.91	4.09	4.25	4.41

Table 7-1 Summary of Water Demand per County (MGD)

County	Sector	Aquifer/Node	2015	2020	2030	2040	2050
		Surficial					
	GW Municipal Self Supply	Crystalline Rock	3.07	3.34	3.90	4.51	5.19
	Groundwater Total		6.89	7.24	7.99	8.76	9.60
	SW Agricultural	Milledgeville, Jackson	0.03	0.03	0.03	0.03	0.03
	SW Municipal Public Supply	Jackson	6.82	7.44	8.81	10.28	11.98
	Surface Water Total		6.85	7.47	8.84	10.31	12.01
	Total		**13.74**	**14.71**	**16.83**	**19.07**	**21.61**
Washington	GW Agricultural	Floridan, Cretaceous	9.55	9.88	10.50	11.05	11.60
	GW Energy	Cretaceous	0.30	0.32	0.37	0.42	0.45
	GW Energy	Cretaceous	0.13	0.14	0.16	0.18	0.20
	GW Municipal Public Supply	Cretaceous	2.12	2.11	2.05	1.96	1.87
	GW Municipal Self Supply	Cretaceous	0.72	0.70	0.67	0.62	0.58
	Groundwater Total		12.83	13.16	13.75	14.23	14.70
	SW Agricultural	Eden, Reidsville, Dublin	1.24	1.30	1.40	1.50	1.60
	Total		**14.07**	**14.46**	**15.15**	**15.74**	**16.30**
Wilkinson	GW Agricultural	Floridan, Cretaceous	0.18	0.18	0.18	0.17	0.17
	GW Energy	Cretaceous	0.03	0.03	0.03	0.03	0.03
	GW Municipal Public Supply	Cretaceous	0.88	0.87	0.81	0.73	0.65
	GW Municipal Self Supply	Cretaceous	0.22	0.21	0.19	0.17	0.15
	Groundwater Total		1.30	1.28	1.21	1.11	1.00
	SW Agricultural	Dublin, Mount Vernon	0.03	0.03	0.03	0.03	0.03
	Total		**1.33**	**1.31**	**1.24**	**1.14**	**1.02**
Unassigned	GW Industrial		40.97	43.94	49.94	55.88	61.84
	SW Industrial		21.03	21.57	22.66	23.76	25.04
Planning Region Total Groundwater Demand			**82.8**	**87.3**	**96.5**	**105.5**	**114.9**
Planning Region Total Surface Water Demand			**83.5**	**87.3**	**95.0**	**102.4**	**110.9**
Planning Region Total Demand			**166.2**	**174.6**	**191.5**	**207.9**	**225.8**

7.2 Wastewater Summary

The full regional wastewater forecasts including municipal and industrial discharges are summarized in the figures and tables of this section. **Figure 7-4** shows the wastewater discharges per basin while **Figure 7-5** shows the forecasted discharge per method. **Table 7-2** provides a summary of the discharge type per watershed model node.

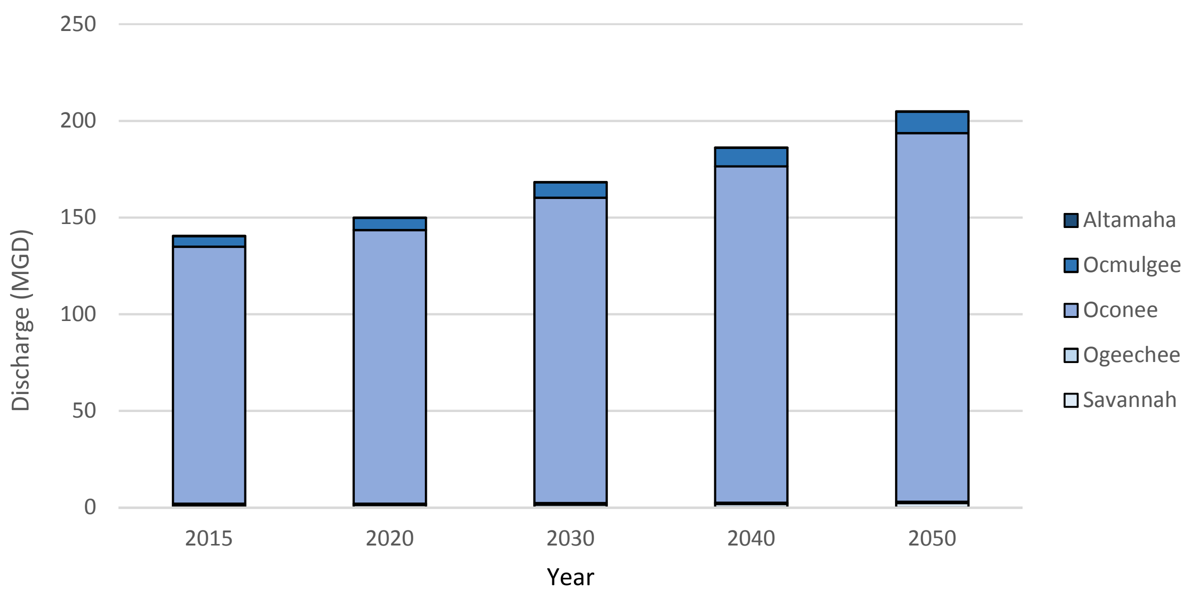


Figure 7-4
Regional Wastewater Discharge per Basin

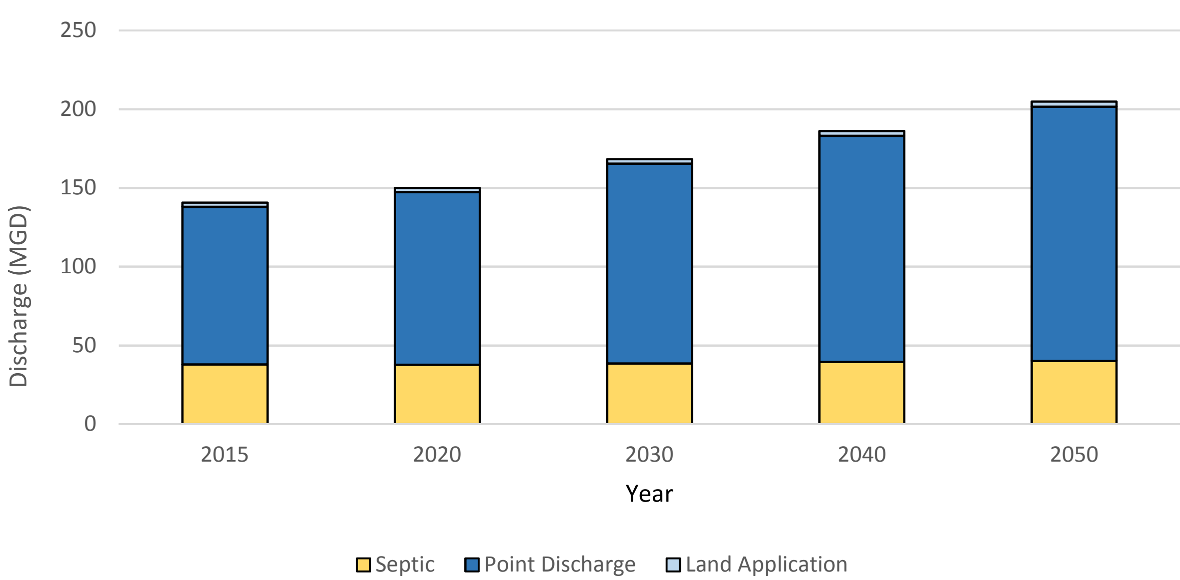


Figure 7-5
Regional Wastewater Discharge per Method

Table 7-2 Summary of Regional Wastewater Flows at Applicable Nodes (MGD)

Node	Discharge Type	2015	2020	2030	2040	2050
Athens	Land Application	2.36	3.10	5.02	7.60	11.03
	Point Discharge	5.98	6.14	6.59	6.73	6.50
	Septic	0.20	0.22	0.27	0.31	0.37
	Total	8.54	9.46	11.88	14.63	17.89
Baxley	Land Application	0.02	0.02	0.02	0.02	0.02
	Point Discharge	0.63	0.64	0.65	0.64	0.63
	Septic	-	-	-	-	-
	Total	0.65	0.66	0.67	0.66	0.66
Bell	Land Application	0.61	0.73	1.04	1.43	1.93
	Point Discharge	0.44	0.40	0.38	0.34	0.28
	Septic	-	-	-	-	-
	Total	1.05	1.13	1.42	1.76	2.21
Dublin	Land Application	42.81	45.70	51.44	56.98	62.49
	Point Discharge	4.03	4.03	3.96	3.81	3.63
	Septic	-	-	-	-	-
	Total	46.83	49.73	55.40	60.78	66.12
Eden	Land Application	0.07	0.07	0.06	0.06	0.05
	Point Discharge	0.54	0.53	0.48	0.43	0.38
	Septic	0.19	0.19	0.19	0.19	0.18
	Total	0.81	0.79	0.73	0.67	0.62
Jackson	Land Application	1.03	1.68	2.69	3.51	4.23
	Point Discharge	3.82	3.95	4.48	5.16	6.04
	Septic	0.07	0.08	0.10	0.11	0.13
	Total	4.92	5.71	7.27	8.79	10.41
Milledgeville	Land Application	18.59	20.97	25.32	29.43	33.51
	Point Discharge	11.81	12.20	12.84	13.81	14.84
	Septic	0.97	1.06	1.21	1.38	1.60
	Total	31.37	34.23	39.37	44.61	49.96
Mount Vernon	Land Application	18.29	18.67	19.38	20.09	20.89
	Point Discharge	1.58	1.60	1.61	1.59	1.56
	Septic	0.76	0.72	0.66	0.59	0.53
	Total	20.63	20.99	21.65	22.26	22.99
Penfield	Land Application	16.45	18.68	22.01	24.57	27.33
	Point Discharge	8.73	8.00	7.20	6.71	6.01
	Septic	0.31	0.34	0.39	0.39	0.40
	Total	25.49	27.01	29.61	31.68	33.74

Table 7-2 Summary of Regional Wastewater Flows at Applicable Nodes (MGD)

Node	Discharge Type	2015	2020	2030	2040	2050
Reidsville	Land Application	0.03	0.03	0.03	0.03	0.03
	Point Discharge	0.17	0.17	0.16	0.15	0.15
	Septic	-	-	-	-	-
	Total	0.20	0.20	0.19	0.18	0.17
Thurmond Reservoir	Land Application	-	-	-	-	-
	Point Discharge	0.12	0.12	0.12	0.12	0.11
	Septic	-	-	-	-	-
	Total	0.12	0.12	0.12	0.12	0.11
Grand Total		**140.6**	**150.0**	**168.3**	**186.2**	**204.9**

Section 8

References

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CH2MHILL. 2011. Upper Oconee Supplemental Document: Municipal and Industrial Water and Wastewater Forecast. Middle Ocmulgee Regional Water Plan. February 2011 http://www.upperoconee.org/documents/UOCMandIForecastFINAL09092010_000.pdf

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