DECEMBER 2020
REVISED DECEMBER 2022

Industrial Water Demand Forecast

FINAL REPORT

GEORGIA REGIONAL WATER PLANNING INDUSTRIAL STAKEHOLDERS

CDM Smith

Table of Contents

List of Figures

List of Tables

Appendices

This page intentionally left blank.

Memorandum

To: *Georgia Regional Water Planning Industrial Stakeholders*

cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *October 10, 2022*

Subject: *Water Demand Forecast for the Industrial Sector in Georgia*

This technical memorandum presents the water demand forecast for the industrial sector for Georgia's Regional Water Planning process.

Introduction and Background

An industrial sector water demand forecast was initially developed for the 2011 Regional Water Plans (RWPs) by the individual Regional Water Planning Councils through the support of the Georgia Environmental Protection Division (EPD). The water demand forecast was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. Reported water withdrawals were aggregated by county and North American Industry Classification System (NAICS) code. Industrial water discharges were also identified by county and NAICS code from EPD discharge permit data. At the time, the future industrial water withdrawals and discharges by county and NAICS code were estimated based upon statewide projected growth rates of future employment by NAICS code. When the Regional Water Plans were subsequently updated in 2017, the water demand forecast for the industrial sector was not updated.

This effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders. Industrial water demands are estimated for the 10 water planning regions outside of the Metropolitan North Georgia Water Planning District ("Metro District"). The Metro District's planning process incorporates estimated demands for all municipally-supplied industrial water use in the 15-County Metro District area. Those demands are therefore not included in the maps and tables included in this forecast report. Future industrial water demands were provided to Georgia EPD for industries that maintain their own water withdrawal or wastewater discharge permits within the Metro District. Those demands were then factored into the Resource Assessment modeling that informs the Regional Water Plans.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for Georgia does not address potential economic growth for which the timing, location and water requirements are currently unknown. However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. **Appendix A** lists the participants of the advisory group and their industry affiliation. The first meeting of the industrial advisory group was held on June 3, 2020.

Figure 1 illustrates statewide industrial employment, industrial gross domestic product (GDP), and reported industrial water withdrawals from 2000 to 2018. The average monthly employment for each year (blue columns) reflects the impact of the Great Recession on industrial employment from 2008 to 2010, with a steady increase in employment since 2010 that has yet to reach the pre-recession levels. Industrial GDP in real dollars (green line) is similar to the employment trend with a decrease from 2007 to 2009 followed by a steady increase that surpasses the pre-recession level. Conversely, reported industrial water withdrawals (red line) show a steady decline from 2006 to 2018. Thus, as statewide industrial employment and productivity have increased since 2010, industrial water withdrawals have continued to decline, suggesting greater water use efficiency and an inverse relationship with employment.

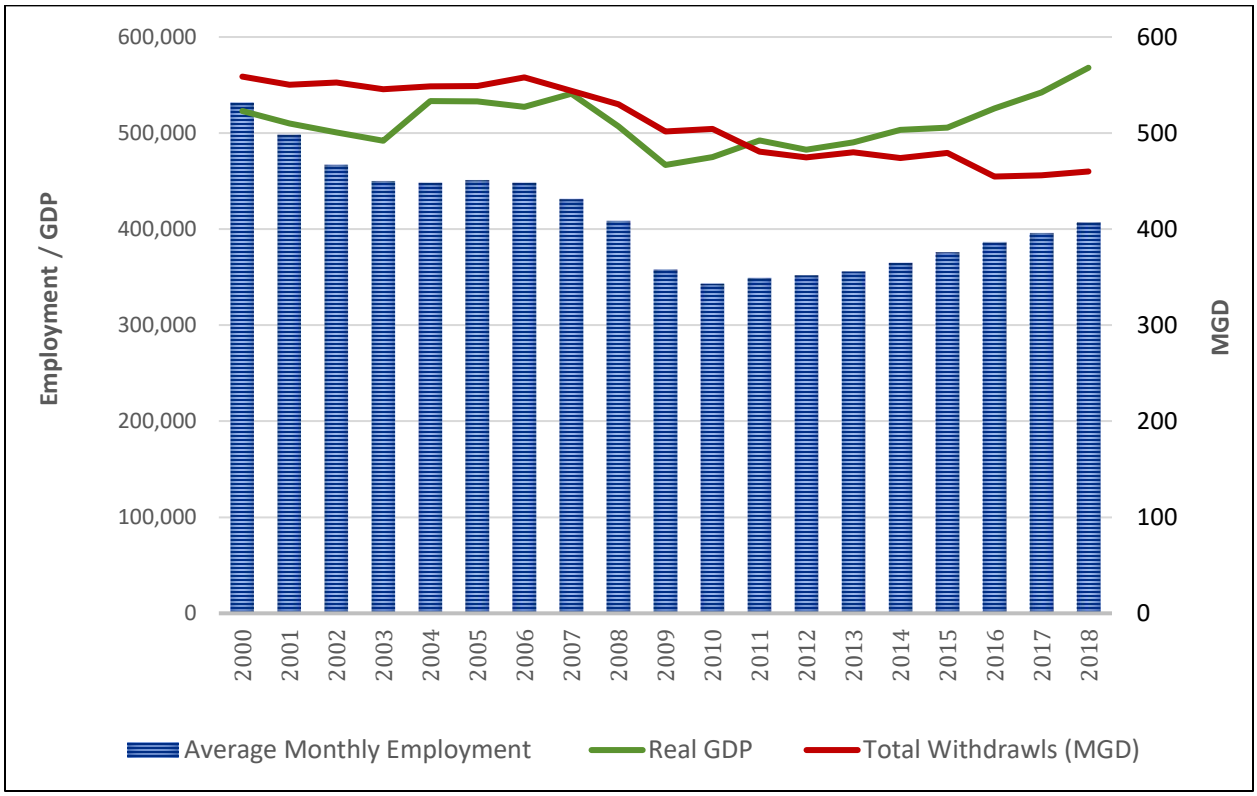

Figure 1. Industrial Employment, GDP, and Water Withdrawals in Georgia from 2000 to 2018
(*Sources: Georgia Dept of Labor, U.S. Bureau of Economic Activity, and EPD reported withdrawals*)

Reported water withdrawals for industries with EPD water withdrawal permits can be classified into four industrial sub-sectors. The statewide 10-year average annual reported withdrawals for paper and forest products, food processing, manufacturing, and mining are illustrated on **Figure 2**. Paper and forest products industries account for the majority (78 percent) of statewide industrial water withdrawals. Mining, manufacturing and food processing account for 11 percent, 9 percent and 2 percent respectively.

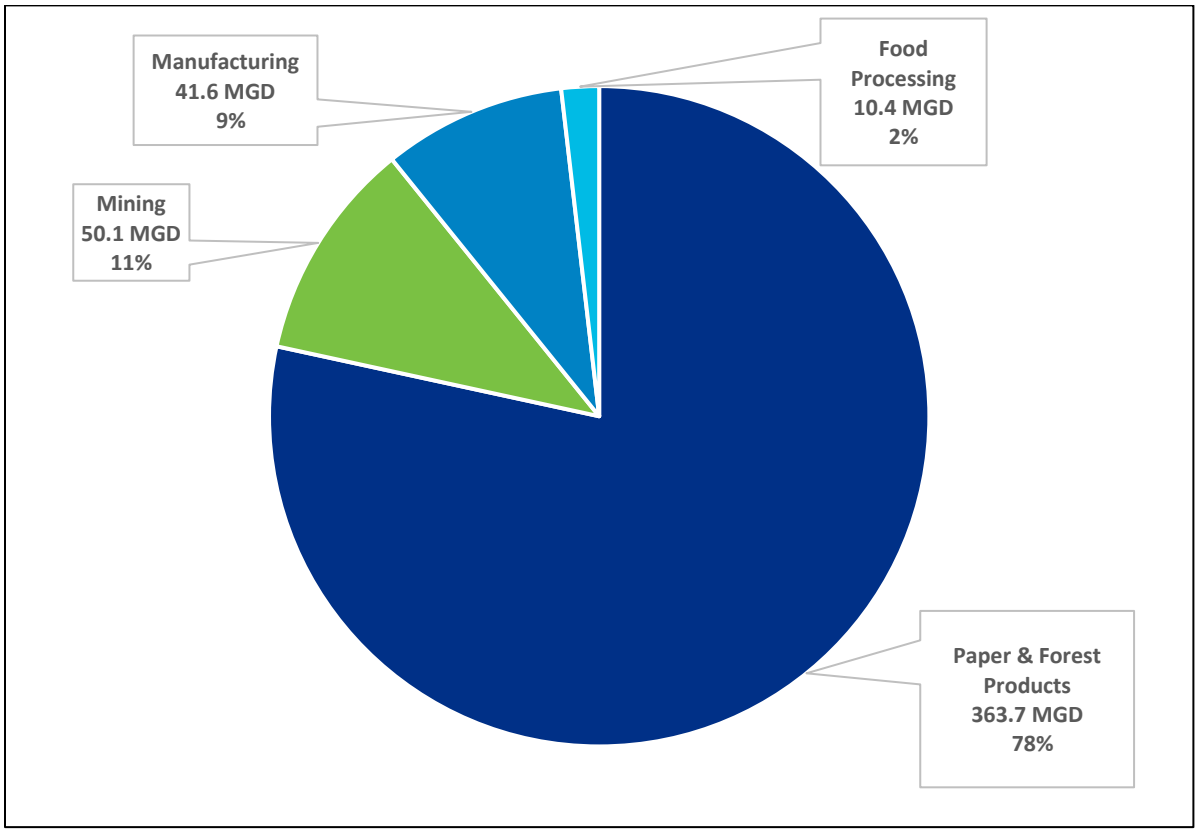

Figure 2. 10-Year Average Annual Permitted Industrial Water Withdrawals (MGD) in Georgia from 2010 to 2019
Source: EPD reported withdrawals

A consensus of the advisory group was that:

- Employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

- Separate industrial sub-sector groups should be formed to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing.

A separate advisory group was convened for each of these four sub-sectors. The sub-sector advisory groups worked concurrently over several months to identify the most reasonable approach for estimating future water withdrawals for their respective sectors.

The industrial water sector forecasting efforts include estimations of both water demands and water discharges. The water demand forecast is estimated based on the facilities' withdrawal

permits and known municipal water purchases. The water discharges are estimated based on the facilities' wastewater permits. The overall water discharge forecast is also broken down by the type of discharge: direct discharge, land application systems (LAS), or discharge to a municipal wastewater treatment system. The estimated water discharge forecast is a way for the planning regions to account for return flows to streams, rivers and other surface bodies.

Estimating Future Water Demand for Industries in Georgia

The industrial sub-sector advisory groups independently discussed various considerations for estimating future water demand. The four sub-sector advisory groups reached a number of common conclusions as well as conclusions specific to each sub-sector:

- While the planning horizon for the Regional Water Plans extends to the year 2060, it is difficult to predict what the water demand for industries in Georgia will be more than a few years into the future.
- Industries that are heavily reliant on water as part of their production process understand the value of protecting their water resources.
- While the Georgia Department of Economic Development (GDED) and others work to attract new industries to Georgia, or existing companies may expand in the future, it is difficult to predict when and where such development will occur, and the volume of water that will be required. Note that water availability is just one of many factors industries consider in deciding where to locate.
- EPD should re-evaluate industrial water demand in Georgia every 5 to 10 years to adjust for changing conditions.

Paper and Forest Products:

- Pulp and paper mills in Georgia frequently change product lines in response to market conditions, therefore water use at any one facility may change at any time.
- The market demand for paper products is not likely to decrease in the near future.
- While some pulp and paper mills withdraw large volumes of water from surface water, these facilities discharge 90 to 95 percent of water withdrawn back to surface water bodies.
- Pulp and paper companies in Georgia are heavily invested in sustainable practices including water use efficiency.
- For the current Regional Water Plan update, it is recommended that water use for the paper and forest products industry remain constant (i.e., zero growth rate) across the state, and use the most recent 10-year average (2010 to 2019) water withdrawals by location.

Mining:

- Kaolin production in the U.S. declined around the time of the recession (2008 – 2010) with relatively stable production since 2010. Georgia produces 90 percent of the kaolin in the U.S. The market for kaolin may increase over the next decade as new uses for kaolin are developed.

- Mining facilities in Georgia frequently change product lines in response to market conditions, therefore water use at any post-extraction processing facility may change at any time.

- The market demand for manufactured products is likely to increase in the near future, yet operations may reduce water use per product with further recycling and water use efficiency.

- Weather has a significant impact on water use because of the use of stormwater as process water. With more rain, more stormwater is available to use as process water, discharges increase and withdrawals from the source water are less. Conversely, in dry periods when less stormwater is available, discharges are less, and withdrawals increase[1].

- EPD will consult with the mining sub-sector advisory group when modeling water discharges to reasonably reflect the decrease in water discharges during dry periods.

- A survey was conducted of members of the Georgia Mining Association, focusing on those facilities using more than 0.2 MGD, which limited the number of respondents. A majority of respondents indicated they had no plans to expand operations or water use in the next 5 to 10 years, or that expansion would be balanced by water recycling resulting in no expected increase in water withdrawals. Municipal water use is minimal and only for domestic use at mining facilities.

- For the current Regional Water Plan update, it is recommended that water demand for the mining industry remain constant (i.e., zero growth rate) across the state, and reflect the 10-year average (2010 to 2019) water withdrawals by location.

Manufacturing:

- Manufacturing facilities in Georgia frequently change product lines in response to market conditions, therefore water use at any one facility may change at any time.

- The market demand for manufactured products is likely to increase in the near future, yet operations may reduce water use per product with further recycling and water use efficiency.

- The Georgia Association of Manufacturers surveyed its larger water-using members. Most respondents indicated no plans to increase water use in the next 5 to 10 years. Those

[1] Note that increases in water demand under dry hydrologic conditions are addressed in the Surface Water Availability Resource Assessment modeling that informs the Regional Water Plans.

anticipating an increase in production or number of facilities also anticipated water-use efficiency to offset any increase in water use.

- For the current Regional Water Plan update, it is recommended that water demand for the manufacturing industry remain constant (i.e., zero growth rate) across the state, and reflect the 10-year average (2010 to 2019) water withdrawals by location.

Food Processing:

- Growth in poultry processing and therefore water use is anticipated.
- Water use among non-poultry processing facilities is small and assumed to remain constant in the future.
- The majority of poultry producers desire to reduce water use. However, there are USDA minimum requirements for water use in poultry processing that must be met.
- The survey of members of the Georgia Poultry Federation resulted in the following guidelines for estimating future water use among poultry processors:
    - Growth rates provided by survey responses regarding projected increases in water use for the next 5 to 10 years were applied to county-level 2019 water use to project respective county-level water demand to the year 2025.
    - From 2025 to 2040, a 2 percent industry average annual growth in water use is anticipated.
    - After 2040, it is anticipated that water-saving technologies and strategies are likely to be implemented at poultry processing facilities that will offset higher growth in water use. From 2040 to 2050, a 1 percent annual growth rate in water use is anticipated. From 2050 to 2060, a 0.5 percent annual growth rate for water use is assumed.

Within the sub-sectors, data collected through trade association surveys were retained by the respective associations to preserve the confidentiality of responses. Summaries of water use by county and by source were provided to EPD and merged with EPD withdrawal data. The recommendations from the sub-sector advisory groups were used to develop the water withdrawals forecast by county and sub-sector. The proportion of water use by source, either groundwater, surface water or municipal water supply, is held constant for each county and industry sub-sector. The water demand forecasts for paper and forest products, manufacturing, mining, and food processing are provided in **Appendices B, C, D** and **E**, respectively.

For the majority of industrial facilities, the 10-year average water withdrawals from 2010 to 2019 is used as the basis for the projected water use. In some instances, such as data obtained through trade association surveys, the basis of the forecast of water demand by county may be a 5-year average from 2015 to 2019 or may be limited to 2019 reported water use.

Note that information was exchanged between the industrial forecast team and the municipal forecast team to make adjustments in both forecasts for industries that are supplied by municipal water systems. This exchange of information allowed the municipal forecast team to exclude large industrial users from the calculation of municipal water use per capita and from the municipal water demand forecast. For the industrial forecast team this exchange of information allowed municipally-supplied industrial water users to be accounted for in the industrial water demand forecast. As part of this information exchange, it was noted that the Macon Water Authority (Bibb County) anticipates manufacturing use supplied by its system to increase from 0.94 MGD in 2019 to 1.28 MGD in 2060. Thus, this forecast includes a slight increase in manufacturing and paper and forest products in the Middle Ocmulgee planning region over time.

Figure 3, Figure 4, Figure 5 and **Figure 6** illustrate the forecast estimated 2020 water demand by county for the paper and forecast products, manufacturing, mining, and food processing sub-sectors. The 2020 water demand is shown in MGD for each county.

The industrial water demand is expected to increase from 491 MGD in 2020 to 504 MGD in 2060. **Figure 7** compares the 2020 and 2060 industrial water demand by industry sub-sector. Note that the 2020 distribution of water demand by sub-sector is different from that shown in Figure 2, which is limited to reported permit withdrawals. Data for Figure 7 include industrial water use supplied by municipal water systems, which increases the volumes for each sub-sector. The additional 11 MGD of municipal water supply for the paper and forest product sector is primarily for domestic water use. Food processing uses 12 MGD and manufacturing uses 8 MGD of municipally-supplied water. In addition, the 2020 water demand estimate shown in Figure 7 represents only those that have active EPD withdrawal permits. Figure 2 reflects the 10-year average of statewide industrial EPD permittees over the 10-year period. Permitted water withdrawals for the mining sector have declined in recent years thus the 2020 mining water demand shown in Figure 7 is less than the 10-year average shown in Figure 2.
Figure 8 illustrates the 2060 industrial water demand by county for the 10 water planning regions outside of the Metro District. **Table 1** summarizes the industrial water demand forecast by planning region and industry sub-sector. **Table 2** summarizes the industrial water demand forecast by planning region and county. **Table 3** shows the industrial water demand forecast by water source. Note that some industries obtain their water from municipal water systems. **Table 4** shows that 59 percent of food processing facilities and 17 percent of manufacturing industries rely on municipal water systems. Mining and paper facilities may use a small amount of municipal water for employee use.

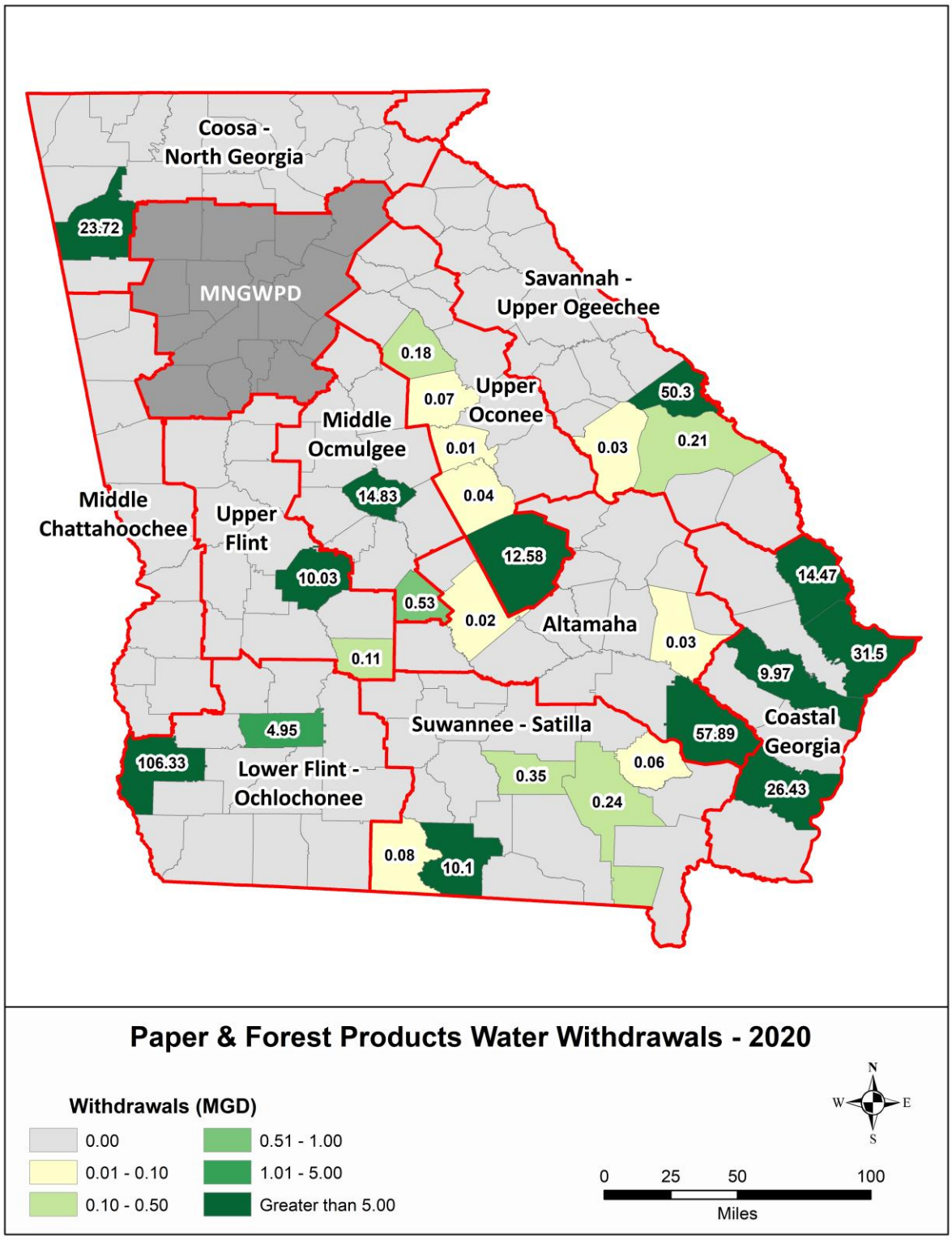

Figure 3. 2020 Paper and Forest Products Sub-Sector Water Demand by County in MGD

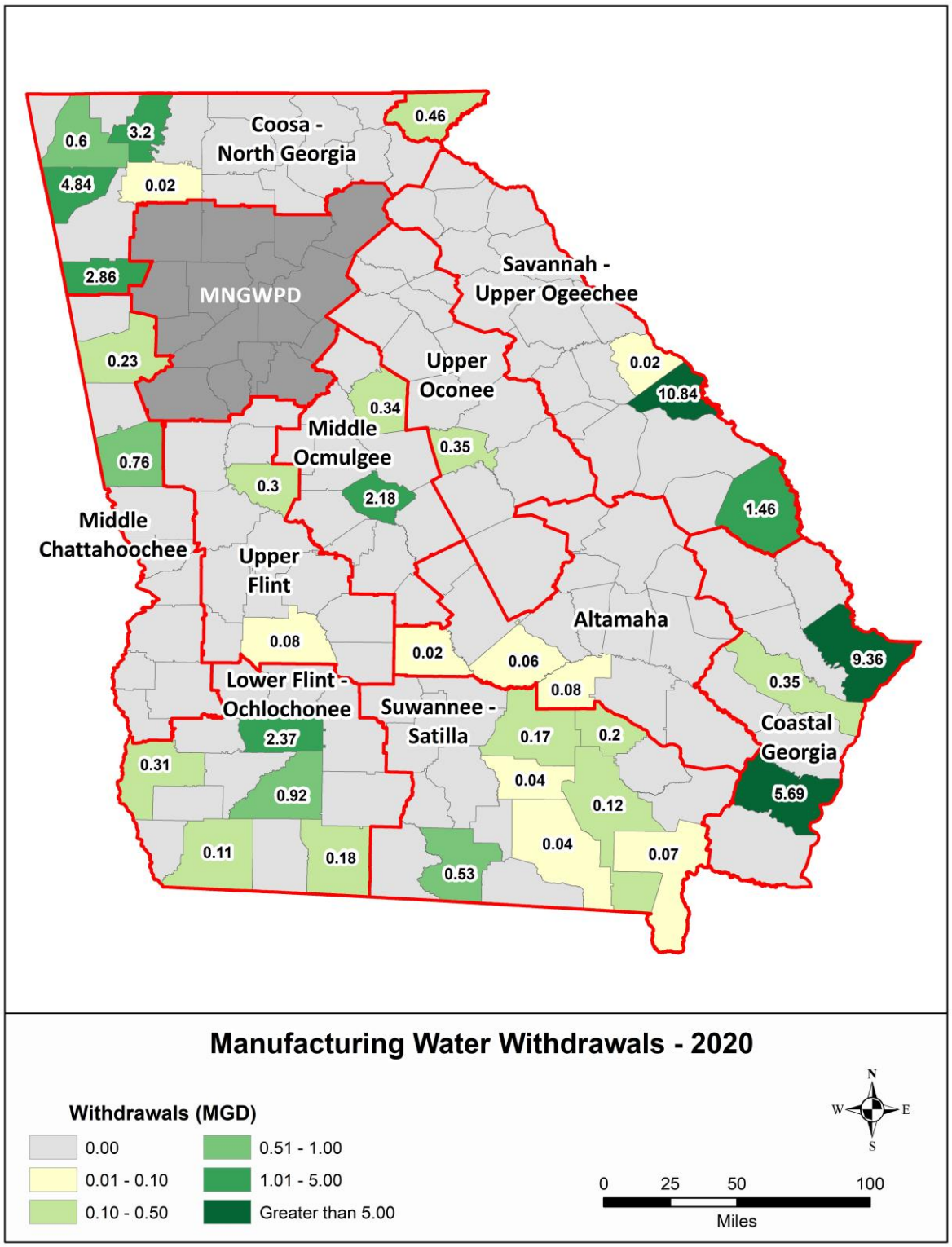

Figure 4. 2020 Manufacturing Sub-sector Water Demand by County in MGD

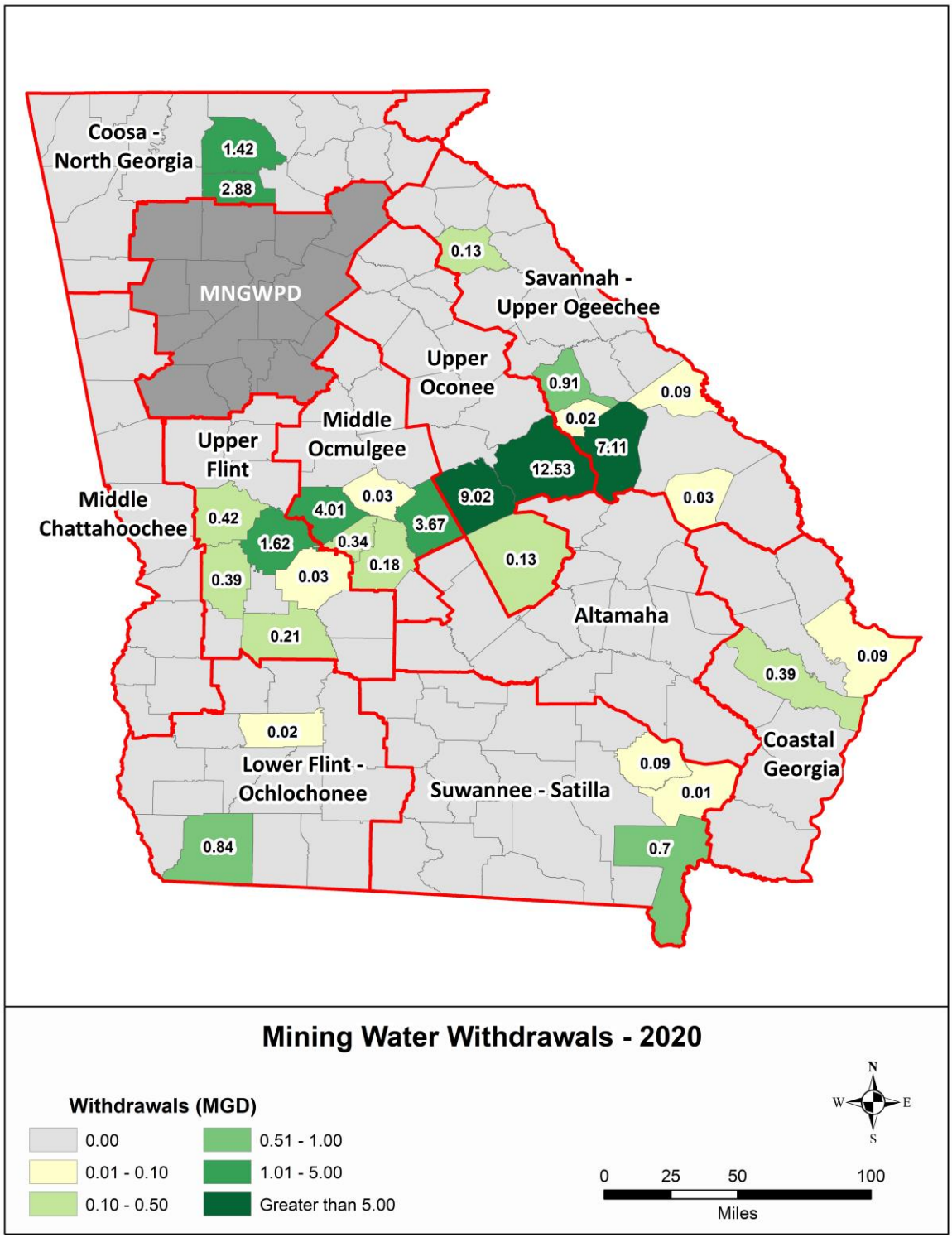

Figure 5. 2020 Mining Sub-sector Water Demand by County in MGD

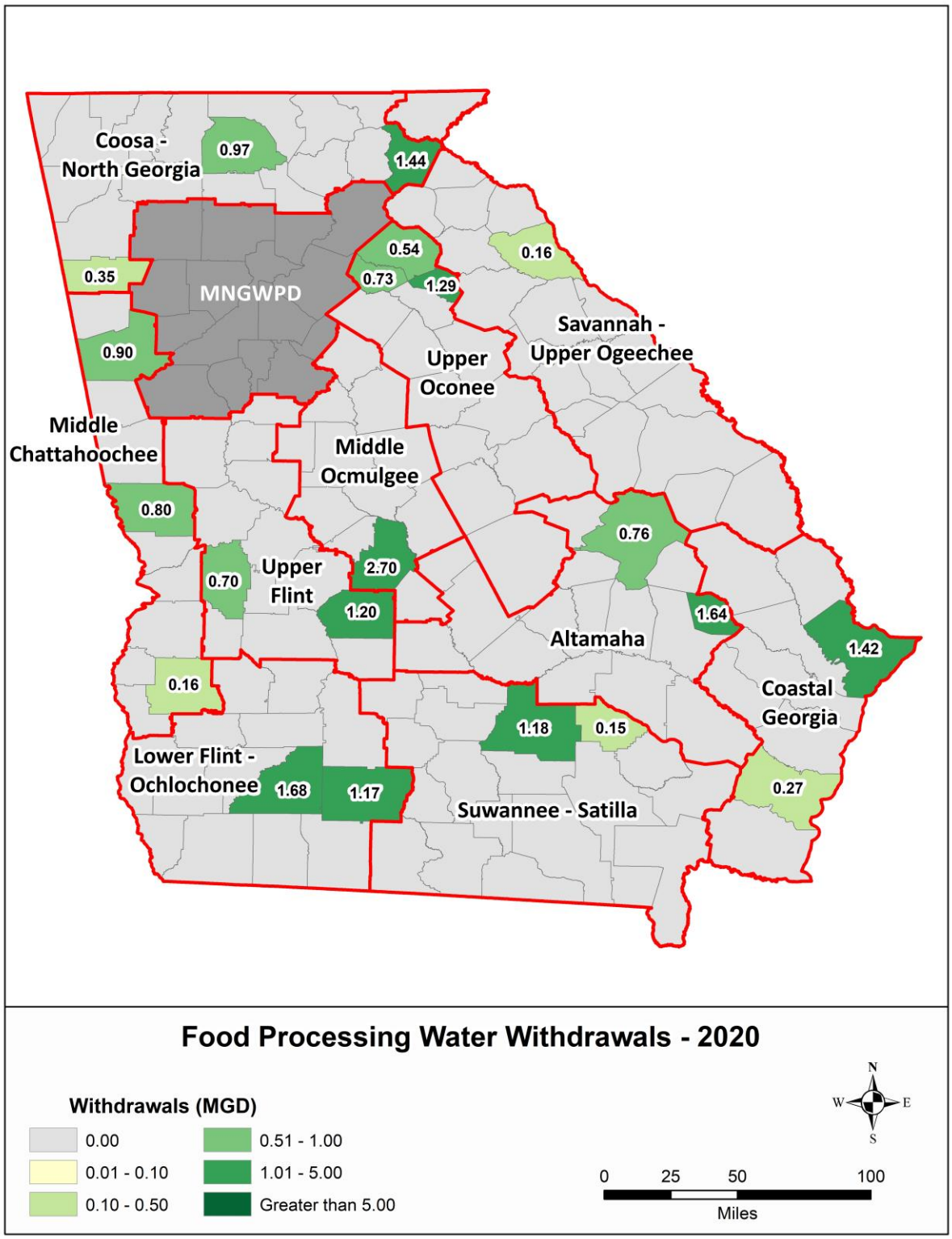

Figure 6. 2020 Food Processing Sub-Sector Water Demand by County in MGD

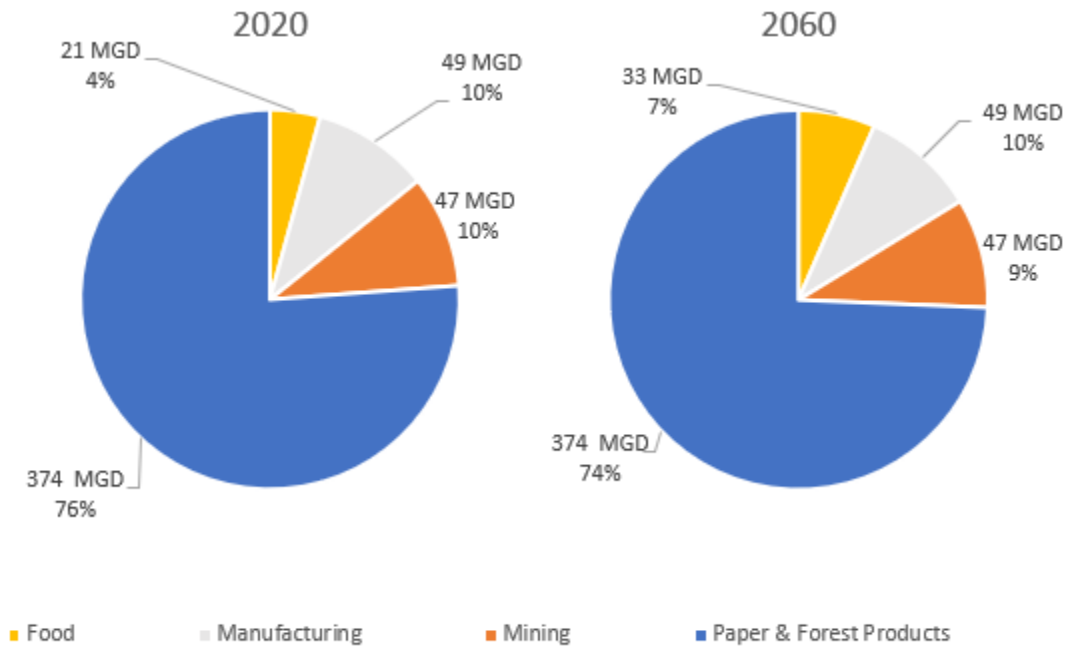

Figure 7. 2020 and 2060 Industrial Water Demand in the 10 Planning Regions in MGD

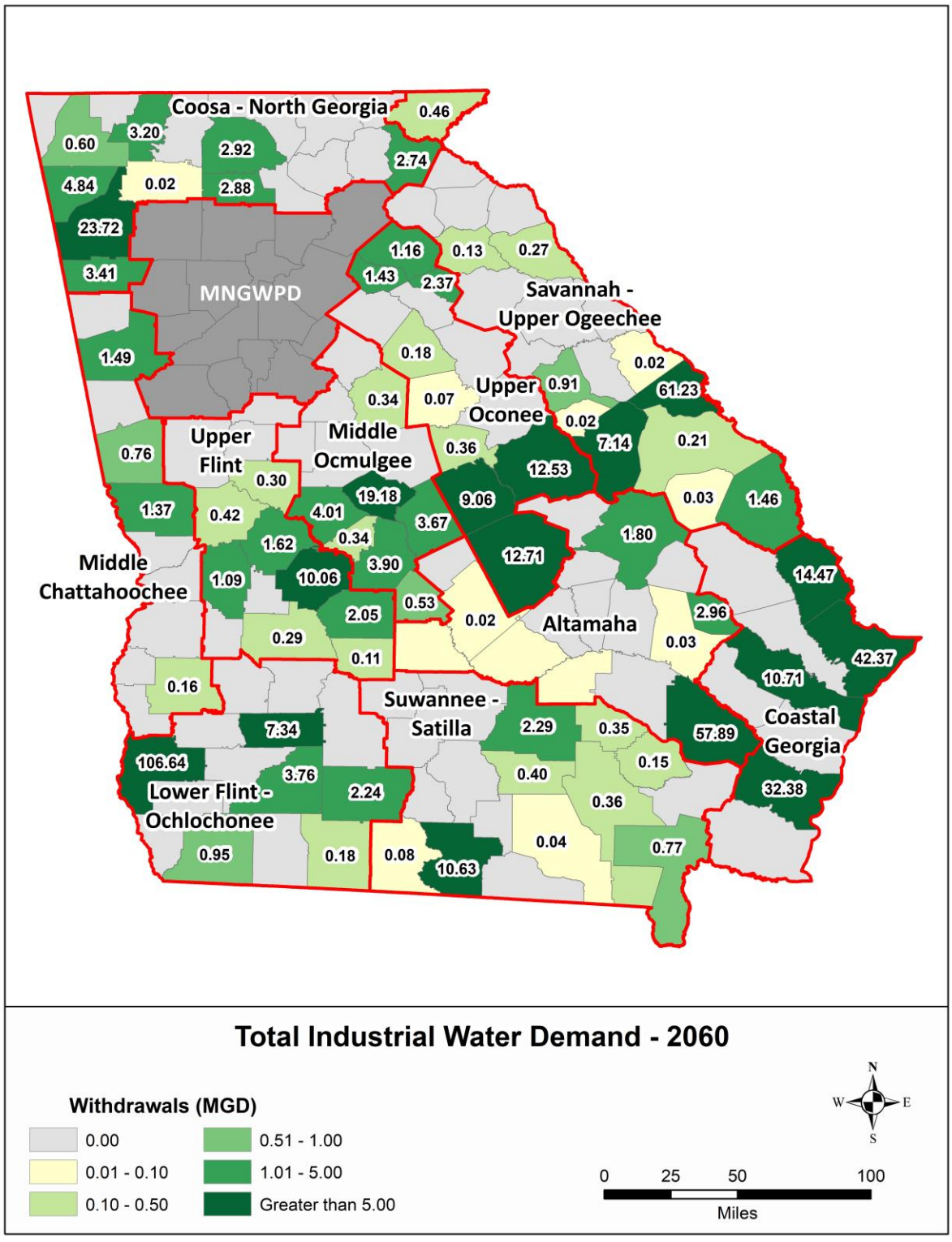

Figure 8. 2060 Industrial Water Demand Forecast in Georgia by County in MGD

Table 1. Industrial Water Demand Forecast by Planning Region and Industry Sub-sector in MGD

Planning Region	Sub-sector	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Altamaha	Food	2.80	3.42	4.12	4.53	4.76
	Manufacturing	0.16	0.16	0.16	0.16	0.16
	Paper	57.94	57.94	57.94	57.94	57.94
	Total	**60.90**	**61.51**	**62.22**	**62.63**	**62.86**
Coastal Georgia	Food	1.69	1.69	1.69	1.69	1.69
	Manufacturing	15.39	15.38	15.38	15.38	15.38
	Mining	0.48	0.48	0.48	0.48	0.48
	Paper	81.13	79.82	79.82	79.82	79.82
	Total	**98.70**	**97.38**	**97.38**	**97.38**	**97.38**
Coosa - North Georgia	Food	2.94	3.43	4.14	4.55	4.79
	Manufacturing	11.52	11.52	11.52	11.52	11.52
	Mining	4.30	4.30	4.30	4.30	4.30
	Paper	23.72	23.72	23.72	23.72	23.72
	Total	**42.48**	**42.97**	**43.68**	**44.09**	**44.32**
Lower Flint - Ochlockonee	Food	2.94	3.64	4.40	4.84	5.08
	Manufacturing	3.89	3.89	3.89	3.89	3.89
	Mining	0.86	0.86	0.86	0.86	0.86
	Paper	111.29	111.29	111.29	111.29	111.29
	Total	**119.03**	**119.68**	**120.44**	**120.87**	**121.12**
Middle Chattahoochee	Food	1.84	2.05	2.44	2.67	2.80
	Manufacturing	0.99	0.99	0.99	0.99	0.99
	Total	**2.83**	**3.04**	**3.43**	**3.66**	**3.78**
Middle Ocmulgee	Food	2.19	2.67	3.22	3.54	3.72
	Manufacturing	2.52	2.61	2.69	2.78	2.86
	Mining	8.22	8.22	8.22	8.22	8.22
	Paper	15.36	15.81	16.26	16.71	17.16
	Total	**28.29**	**29.31**	**30.40**	**31.25**	**31.97**
Savannah - Upper Ogeechee	Food	0.16	0.20	0.24	0.26	0.27
	Manufacturing	12.78	12.78	12.78	12.78	12.78
	Mining	8.29	8.29	8.29	8.29	8.29
	Paper	50.55	50.55	50.55	50.55	50.55
	Total	**71.78**	**71.81**	**71.85**	**71.88**	**71.89**

Planning Region	Sub-sector	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Suwannee - Satilla	Food	1.45	1.67	1.99	2.17	2.28
	Manufacturing	1.17	1.17	1.17	1.17	1.17
	Mining	0.80	0.80	0.80	0.80	0.80
	Paper	10.82	10.82	10.82	10.82	10.82
	Total	**14.24**	**14.46**	**14.78**	**14.96**	**15.06**
Upper Flint	Food	2.12	2.17	2.48	2.65	2.75
	Manufacturing	0.37	0.37	0.37	0.37	0.37
	Mining	2.68	2.68	2.68	2.68	2.68
	Paper	10.14	10.14	10.14	10.14	10.14
	Total	**15.31**	**15.36**	**15.67**	**15.85**	**15.95**
Upper Oconee	Food	2.61	3.56	4.30	4.72	4.96
	Manufacturing	0.35	0.35	0.35	0.35	0.35
	Mining	21.69	21.69	21.69	21.69	21.69
	Paper	12.87	12.87	12.87	12.87	12.87
	Total	**37.52**	**38.47**	**39.20**	**39.63**	**39.87**
Total	Food	20.79	24.50	29.02	31.63	33.11
	Manufacturing	49.14	49.22	49.31	49.39	49.48
	Mining	47.31	47.31	47.31	47.31	47.31
	Paper	373.82	372.96	373.41	373.86	374.31
	Total	**491.07**	**494.00**	**499.05**	**502.20**	**504.21**

Note that demand shown as 0.00 may be less than 0.005 MGD.

Table 2. Industrial Water Demand Forecast Planning Region and County in MGD

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Altamaha	Dodge	0.02	0.02	0.02	0.02	0.02
	Emanuel	1.06	1.29	1.56	1.71	1.80
	Evans	1.74	2.13	2.57	2.82	2.96
	Jeff Davis	0.08	0.08	0.08	0.08	0.08
	Tattnall	0.03	0.03	0.03	0.03	0.03
	Telfair	0.06	0.06	0.06	0.06	0.06
	Wayne	57.89	57.89	57.89	57.89	57.89
	Wilcox	0.02	0.02	0.02	0.02	0.02
	Total	**60.90**	**61.51**	**62.22**	**62.63**	**62.86**
Coastal Georgia	Chatham	41.14	39.82	39.82	39.82	39.82
	Effingham	14.47	14.47	14.47	14.47	14.47
	Glynn	32.38	32.38	32.38	32.38	32.38
	Liberty	10.71	10.71	10.71	10.71	10.71
	Total	**98.70**	**97.38**	**97.38**	**97.38**	**97.38**
Coosa - North Georgia	Chattooga	4.84	4.84	4.84	4.84	4.84
	Floyd	23.72	23.72	23.72	23.72	23.72
	Gilmer	2.42	2.50	2.72	2.85	2.92
	Gordon	0.02	0.02	0.02	0.02	0.02
	Habersham	1.61	1.96	2.37	2.60	2.74
	Pickens	2.88	2.88	2.88	2.88	2.88
	Polk	3.18	3.25	3.33	3.38	3.41
	Walker	0.60	0.60	0.60	0.60	0.60
	Whitfield	3.20	3.20	3.20	3.20	3.20
	Total	**42.48**	**42.97**	**43.68**	**44.09**	**44.32**
Lower Flint - Ochlockonee	Colquitt	1.32	1.61	1.94	2.13	2.24
	Decatur	0.95	0.95	0.95	0.95	0.95
	Dougherty	7.34	7.34	7.34	7.34	7.34
	Early	106.64	106.64	106.64	106.64	106.64
	Mitchell	2.59	2.96	3.38	3.62	3.76
	Thomas	0.18	0.18	0.18	0.18	0.18
	Total	**119.03**	**119.68**	**120.44**	**120.87**	**121.12**
Middle Chattahoochee	Carroll	1.10	1.13	1.32	1.42	1.49
	Harris	0.81	0.98	1.19	1.31	1.37
	Randolph	0.16	0.16	0.16	0.16	0.16
	Troup	0.76	0.76	0.76	0.76	0.76
	Total	**2.83**	**3.04**	**3.43**	**3.66**	**3.78**

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Middle Ocmulgee	Bibb	17.04	17.58	18.11	18.65	19.18
	Crawford	4.01	4.01	4.01	4.01	4.01
	Houston	2.37	2.85	3.40	3.72	3.90
	Jasper	0.34	0.34	0.34	0.34	0.34
	Peach	0.34	0.34	0.34	0.34	0.34
	Pulaski	0.53	0.53	0.53	0.53	0.53
	Twiggs	3.67	3.67	3.67	3.67	3.67
	Total	**28.29**	**29.31**	**30.40**	**31.25**	**31.97**
Savannah - Upper Ogeechee	Burke	0.21	0.21	0.21	0.21	0.21
	Columbia	0.02	0.02	0.02	0.02	0.02
	Elbert	0.16	0.20	0.24	0.26	0.27
	Glascock	0.02	0.02	0.02	0.02	0.02
	Jefferson	7.14	7.14	7.14	7.14	7.14
	Jenkins	0.03	0.03	0.03	0.03	0.03
	Madison	0.13	0.13	0.13	0.13	0.13
	Rabun	0.46	0.46	0.46	0.46	0.46
	Richmond	61.23	61.23	61.23	61.23	61.23
	Screven	1.46	1.46	1.46	1.46	1.46
	Warren	0.91	0.91	0.91	0.91	0.91
	Total	**71.78**	**71.81**	**71.85**	**71.88**	**71.89**
Suwannee - Satilla	Atkinson	0.40	0.40	0.40	0.40	0.40
	Bacon	0.35	0.35	0.35	0.35	0.35
	Brantley	0.00	0.00	0.00	0.00	0.00
	Brooks	0.08	0.08	0.08	0.08	0.08
	Charlton	0.77	0.77	0.77	0.77	0.77
	Clinch	0.04	0.04	0.04	0.04	0.04
	Coffee	1.47	1.69	2.01	2.19	2.29
	Lowndes	10.63	10.63	10.63	10.63	10.63
	Pierce	0.15	0.15	0.15	0.15	0.15
	Ware	0.36	0.36	0.36	0.36	0.36
	Total	**14.24**	**14.46**	**14.78**	**14.96**	**15.06**

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Upper Flint	Crisp	0.11	0.11	0.11	0.11	0.11
	Dooly	1.42	1.47	1.78	1.95	2.05
	Macon	10.06	10.06	10.06	10.06	10.06
	Marion	1.09	1.09	1.09	1.09	1.09
	Sumter	0.29	0.29	0.29	0.29	0.29
	Talbot	0.42	0.42	0.42	0.42	0.42
	Taylor	1.62	1.62	1.62	1.62	1.62
	Upson	0.30	0.30	0.30	0.30	0.30
	Total	**15.31**	**15.36**	**15.67**	**15.85**	**15.95**
Upper Oconee	Baldwin	0.36	0.36	0.36	0.36	0.36
	Barrow	0.65	1.03	1.24	1.36	1.43
	Clarke	1.39	1.70	2.05	2.26	2.37
	Jackson	0.57	0.83	1.00	1.10	1.16
	Laurens	12.71	12.71	12.71	12.71	12.71
	Morgan	0.18	0.18	0.18	0.18	0.18
	Putnam	0.07	0.07	0.07	0.07	0.07
	Washington	12.53	12.53	12.53	12.53	12.53
	Wilkinson	9.06	9.06	9.06	9.06	9.06
	Total	**37.52**	**38.47**	**39.20**	**39.63**	**39.87**
Total		**491.06**	**494.00**	**499.05**	**502.19**	**504.20**

Note that demand shown as 0.00 may be less than 0.005 MGD.

Table 3. Industrial Water Demand Forecast by Source in MGD

Source	2020	2030	2040	2050	2060	%
Surface Water	269.12	269.12	269.12	269.12	269.12	54%
Groundwater	190.04	190.60	192.50	193.60	194.22	39%
Municipal System	31.91	34.27	37.41	39.46	40.85	7%
Total	491.07	493.99	499.04	502.18	504.20	100%

Table 4. Industrial Water Demand Forecast by Sub-sector and Source

Subsector	SW	GW	Municipal	Total
Food	0%	41%	59%	100%
Manufacturing	45%	39%	17%	100%
Mining	25%	74%	1%	100%
Paper	63%	34%	3%	100%
Overall	55%	39%	6%	100%

Comparing the 2011 and 2020 Industrial Water Demand Forecasts

The industrial sector water demand forecast developed for the 2011 Regional Water Plans was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. The future industrial water withdrawals and discharges by county and NAICS code were estimated based upon statewide projected growth rates of future employment by NAICS code.

Figure 9 compares the 2011 statewide industrial water demand forecast with the 2020 industrial water demand forecast for the 10 water planning regions. The 2011 forecast was based on 2005 withdrawals and increases over time as per industrial employment projections that were developed prior to the Great Recession (2008 – 2010). However:

- Industrial water withdrawals decreased from 2005 to 2010, as illustrated in Figure 1.
- The current 2020 forecast is based on the 10-year average withdrawals from 2010 to 2019, which is a lower "starting point" than the 2011 forecast.
- The growth of the current 2020 forecast is based on the opinions of relevant industry trade groups within the state and is disassociated from employment projections.

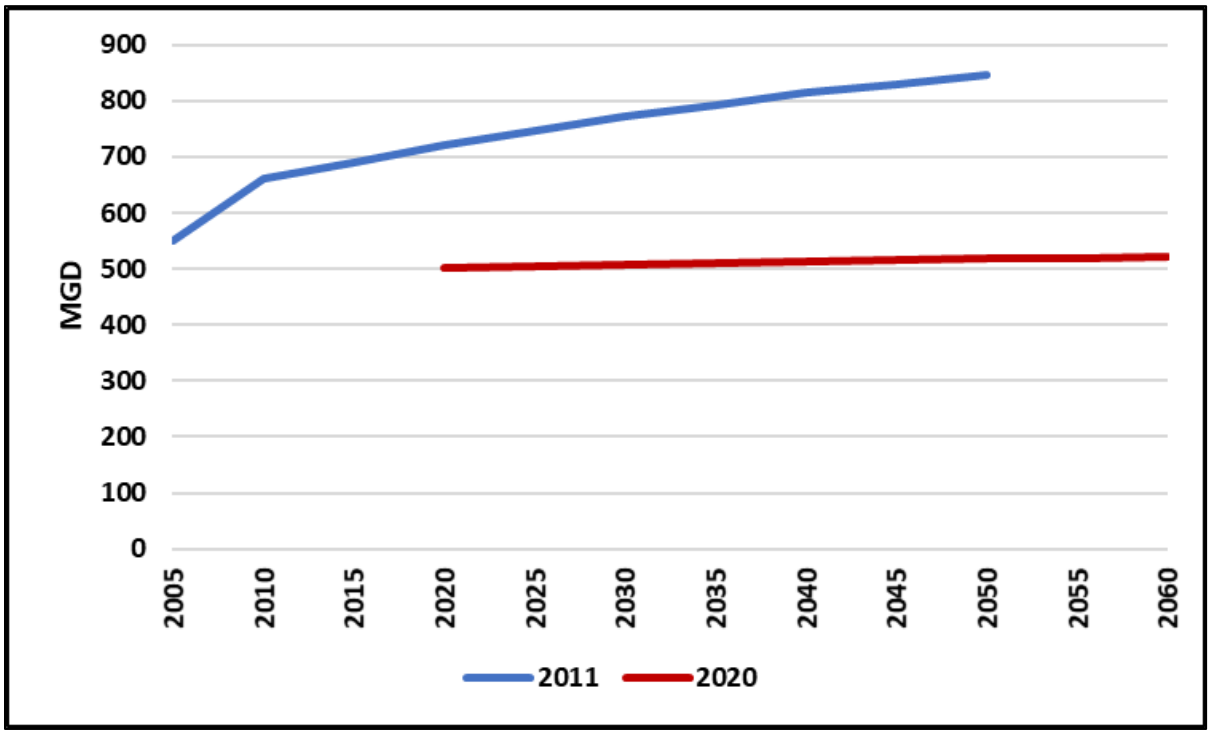

Figure 9. 2011 and 2020 Industrial Water Demand Forecast in MGD

Estimating Future Water Discharges by Industries in Georgia

For some industrial facilities, water discharges may include stormwater runoff as well as the discharge of wastewater. Thus, permitted discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. It is important to note, however, that the Regional Water Planning water resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, for this analysis it is assumed that water discharges do not exceed water withdrawals at each facility.

Many pulp and paper facilities cover large areas and thus have significant volumes of stormwater discharges. In mining operations, discharges from stormwater or from groundwater seepage are more frequently used as "recycled" water in processing. Thus, when more stormwater or groundwater seepage is available to use as process water, discharges increase and withdrawals from source water decrease. Conversely, in dry periods when less stormwater is available, discharges decrease, and withdrawals increase.

The industrial water discharges are estimated based on the facilities' wastewater permits reported discharge from 2015–2019. In a few instances, industrial discharges by county obtained from trade association surveys may be limited to 2019 data. The overall industrial discharge forecast is broken down by the type of discharge: direct discharge or LAS. The estimated water discharge forecast is a

way for the planning regions to account for return flows to streams, rivers and other surface water bodies. Water discharged to LAS is assumed to not return to streams or rivers in the resource assessment modeling process, which is a conservation assumption. Some information on industrial discharges to municipal wastewater treatment systems was obtained from the sub-sector surveys and is included in the industrial water discharge by county where known. The proportion of discharges to municipal systems, land application and direct discharges is assumed to remain the same throughout the forecast period within each county.

Water discharges by manufacturing, mining, and paper and forest product facilities are assumed to remain constant over time as are the water demand forecasts for these sub-sectors. The water discharges for the food processing industries are assumed to follow the same growth patterns as the water demand forecast over the forecast period for each county as developed by the food processing sub-sector advisory group.

Figure 10 illustrates the 2060 industrial water discharge forecast by county for the 10 water planning regions outside of the Metro District. **Table 5** summarizes the projected water discharges by planning region and sub-sector. **Table 6** summarizes the projected water discharges by planning region and county. **Table 7** shows the industrial discharges by sub-sector and discharge type. **Table 8** shows the percent of sub-sector discharge by type. More than one-third of food processing discharge goes to a municipal wastewater treatment system and 42 percent goes to LAS. All of mining discharges are direct discharges as are 94 percent of manufacturing and paper discharges. Details of the water discharge forecasts for paper and forest products, manufacturing, mining, and food processing are provided in **Appendices B, C, D** and **E**, respectively.

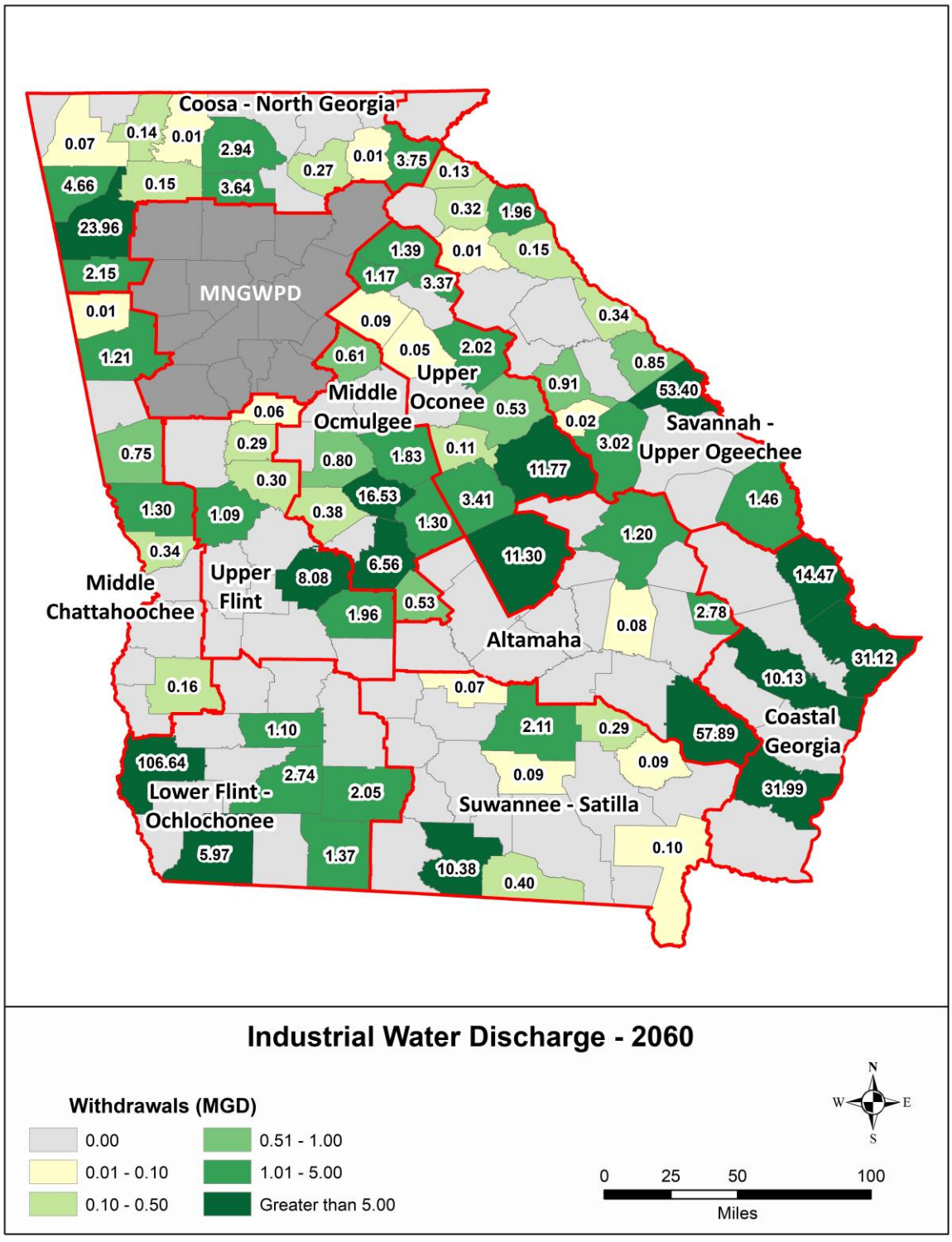

Figure 10. 2060 Industrial Water Discharge Forecast in Georgia by County in MGD

Table 5. Industrial Water Discharge Forecast by Planning Region and by Sub-sector in MGD

Planning Region	Sub-sector	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Altamaha	Food	2.43	2.94	3.53	3.87	4.07
	Manufacturing	0.00	0.00	0.00	0.00	0.00
	Mining	0.00	0.00	0.00	0.00	0.00
	Paper	57.89	57.89	57.89	57.89	57.89
	Total	**60.31**	**60.83**	**61.42**	**61.76**	**61.95**
Coastal Georgia	Food	0.63	0.63	0.63	0.63	0.63
	Manufacturing	10.22	10.22	10.22	10.22	10.22
	Mining	2.56	2.56	2.56	2.56	2.56
	Paper	74.30	74.30	74.30	74.30	74.30
	Total	**87.71**	**87.71**	**87.71**	**87.71**	**87.71**
Coosa - North Georgia	Food	2.82	3.29	3.97	4.36	4.58
	Manufacturing	6.79	6.79	6.79	6.79	6.79
	Mining	7.12	7.12	7.12	7.12	7.12
	Paper	23.25	23.25	23.25	23.25	23.25
	Total	**39.99**	**40.46**	**41.14**	**41.53**	**41.75**
Lower Flint - Ochlockonee	Food	2.72	3.31	4.00	4.39	4.62
	Manufacturing	1.72	1.72	1.72	1.72	1.72
	Mining	7.20	7.20	7.20	7.20	7.20
	Paper	106.33	106.33	106.33	106.33	106.33
	Total	**117.97**	**118.57**	**119.25**	**119.65**	**119.87**
Middle Chattahoochee	Food	1.70	1.89	2.25	2.46	2.58
	Manufacturing	0.04	0.04	0.04	0.04	0.04
	Mining	1.16	1.16	1.16	1.16	1.16
	Total	**2.90**	**3.09**	**3.45**	**3.66**	**3.77**
Middle Ocmulgee	Food	4.42	5.04	5.74	6.15	6.38
	Manufacturing	1.94	1.94	1.94	1.94	2.14
	Mining	5.08	5.08	5.08	5.08	5.08
	Paper	13.66	13.66	13.66	13.66	14.92
	Total	**25.10**	**25.72**	**26.42**	**26.83**	**28.53**
Savannah - Upper Ogeechee	Food	0.19	0.21	0.24	0.25	0.26
	Manufacturing	4.02	4.02	4.02	4.02	4.02
	Mining	7.98	7.98	7.98	7.98	7.98
	Paper	50.30	50.30	50.30	50.30	50.30
	Total	**62.49**	**62.51**	**62.53**	**62.55**	**62.55**

Planning Region	Sub-sector	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Suwannee - Satilla	Food	1.83	2.05	2.36	2.55	2.65
	Manufacturing	0.54	0.54	0.54	0.54	0.54
	Mining	0.15	0.15	0.15	0.15	0.15
	Paper	10.15	10.15	10.15	10.15	10.15
	Total	**12.67**	**12.89**	**13.20**	**13.39**	**13.49**
Upper Flint	Food	1.36	1.41	1.70	1.87	1.97
	Manufacturing	0.59	0.59	0.59	0.59	0.59
	Mining	1.15	1.15	1.15	1.15	1.15
	Paper	8.08	8.08	8.08	8.08	8.08
	Total	**11.17**	**11.23**	**11.52**	**11.69**	**11.78**
Upper Oconee	Food	2.42	3.23	3.90	4.28	4.50
	Mining	19.50	19.50	19.50	19.50	19.50
	Paper	11.20	11.20	11.20	11.20	11.20
	Total	**33.11**	**33.93**	**34.60**	**34.98**	**35.20**
Total	Food	22.77	26.90	31.82	34.66	36.27
	Manufacturing	28.44	28.49	28.54	28.59	28.64
	Mining	73.77	73.77	73.77	73.77	73.77
	Paper	355.17	355.48	355.80	356.11	356.43
	Total	**480.14**	**484.64**	**489.92**	**493.13**	**495.10**

Note that discharges shown as 0.00 may be less than 0.005 MGD.

Table 6. Industrial Discharge Forecast by Planning Region and County in MGD

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Altamaha	Dodge	0.00	0.00	0.00	0.00	0.00
	Emanuel	0.71	0.86	1.04	1.14	1.20
	Evans	1.64	2.00	2.41	2.65	2.78
	Jeff Davis	0.00	0.00	0.00	0.00	0.00
	Tattnall	0.00	0.00	0.00	0.00	0.00
	Telfair	0.00	0.00	0.00	0.00	0.00
	Toombs	0.08	0.08	0.08	0.08	0.08
	Wayne	57.89	57.89	57.89	57.89	57.89
	Wilcox	0.00	0.00	0.00	0.00	0.00
	Total	**60.31**	**60.83**	**61.42**	**61.76**	**61.95**
Coastal Georgia	Chatham	31.12	31.12	31.12	31.12	31.12
	Effingham	14.47	14.47	14.47	14.47	14.47
	Glynn	31.99	31.99	31.99	31.99	31.99
	Liberty	10.13	10.13	10.13	10.13	10.13
	McIntosh	0.00	0.00	0.00	0.00	0.00
	Total	**87.71**	**87.71**	**87.71**	**87.71**	**87.71**
Coosa - North Georgia	Catoosa	0.00	0.00	0.00	0.00	0.00
	Chattooga	4.66	4.66	4.66	4.66	4.66
	Floyd	23.96	23.96	23.96	23.96	23.96
	Gilmer	2.44	2.51	2.74	2.87	2.94
	Gordon	0.15	0.15	0.15	0.15	0.15
	Habersham	2.68	3.01	3.40	3.62	3.75
	Lumpkin	0.27	0.27	0.27	0.27	0.27
	Murray	0.01	0.01	0.01	0.01	0.01
	Pickens	3.64	3.64	3.64	3.64	3.64
	Polk	1.96	2.02	2.09	2.12	2.15
	Union	0.00	0.00	0.00	0.00	0.00
	Walker	0.07	0.07	0.07	0.07	0.07
	White	0.01	0.01	0.01	0.01	0.01
	Whitfield	0.14	0.14	0.14	0.14	0.14
	Total	**39.99**	**40.46**	**41.14**	**41.53**	**41.75**

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Lower Flint - Ochlockonee	Colquitt	1.21	1.47	1.77	1.95	2.05
	Decatur	5.97	5.97	5.97	5.97	5.97
	Dougherty	1.10	1.10	1.10	1.10	1.10
	Early	106.64	106.64	106.64	106.64	106.65
	Grady	0.00	0.00	0.00	0.00	0.00
	Mitchell	1.68	2.01	2.39	2.61	2.74
	Thomas	1.37	1.37	1.37	1.37	1.37
	Total	**117.97**	**118.57**	**119.25**	**119.65**	**119.87**
Middle Chattahoochee	Carroll	0.85	0.88	1.06	1.16	1.21
	Haralson	0.01	0.01	0.01	0.01	0.01
	Harris	0.79	0.95	1.13	1.24	1.30
	Heard	0.00	0.00	0.00	0.00	0.00
	Muscogee	0.34	0.34	0.34	0.34	0.34
	Randolph	0.16	0.16	0.16	0.16	0.16
	Troup	0.75	0.75	0.75	0.75	0.75
	Total	**2.90**	**3.09**	**3.45**	**3.66**	**3.77**
Middle Ocmulgee	Bibb	15.07	15.44	15.80	16.17	16.53
	Crawford	0.38	0.38	0.38	0.38	0.38
	Houston	4.60	5.21	5.92	6.33	6.56
	Jones	1.83	1.83	1.83	1.83	1.83
	Lamar	0.00	0.00	0.00	0.00	0.00
	Monroe	0.80	0.80	0.80	0.80	0.80
	Newton	0.61	0.61	0.61	0.61	0.61
	Peach	0.00	0.00	0.00	0.00	0.00
	Pulaski	0.53	0.53	0.53	0.53	0.53
	Twiggs	1.30	1.30	1.30	1.30	1.30
	Total	**25.10**	**26.08**	**27.15**	**27.93**	**28.53**

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Savannah - Upper Ogeechee	Burke	0.00	0.00	0.00	0.00	0.00
	Columbia	0.85	0.85	0.85	0.85	0.85
	Elbert	0.09	0.11	0.13	0.14	0.15
	Franklin	0.32	0.32	0.32	0.32	0.32
	Glascock	0.02	0.02	0.02	0.02	0.02
	Hart	1.96	1.96	1.96	1.96	1.96
	Jefferson	3.02	3.02	3.02	3.02	3.02
	Lincoln	0.34	0.34	0.34	0.34	0.34
	Madison	0.01	0.01	0.01	0.01	0.01
	Rabun	0.00	0.00	0.00	0.00	0.00
	Richmond	53.40	53.40	53.40	53.40	53.40
	Screven	1.46	1.46	1.46	1.46	1.46
	Stephens	0.13	0.13	0.13	0.13	0.13
	Warren	0.91	0.91	0.91	0.91	0.91
	Total	**62.49**	**62.51**	**62.53**	**62.55**	**62.55**
Suwannee - Satilla	Atkinson	0.10	0.10	0.10	0.10	0.10
	Bacon	0.29	0.29	0.29	0.29	0.29
	Ben Hill	0.07	0.07	0.07	0.07	0.07
	Brooks	0.00	0.00	0.00	0.00	0.00
	Charlton	0.05	0.05	0.05	0.05	0.05
	Clinch	0.00	0.00	0.00	0.00	0.00
	Coffee	1.29	1.51	1.82	2.00	2.11
	Echols	0.40	0.40	0.40	0.40	0.40
	Lowndes	10.38	10.38	10.38	10.38	10.38
	Pierce	0.09	0.09	0.09	0.09	0.09
	Ware	0.00	0.00	0.00	0.00	0.00
	Total	**12.67**	**12.89**	**13.20**	**13.39**	**13.49**
Upper Flint	Crisp	0.00	0.00	0.00	0.00	0.00
	Dooly	1.36	1.41	1.70	1.87	1.96
	Macon	8.08	8.08	8.08	8.08	8.08
	Marion	0.00	0.00	0.00	0.00	0.00
	Spalding	0.06	0.06	0.06	0.06	0.06
	Sumter	0.00	0.00	0.00	0.00	0.00
	Talbot	1.09	1.09	1.09	1.09	1.09
	Upson	0.30	0.30	0.30	0.30	0.30
	Pike	0.29	0.29	0.29	0.29	0.29
	Total	**11.17**	**11.23**	**11.52**	**11.69**	**11.78**

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Upper Oconee	Baldwin	0.11	0.11	0.11	0.11	0.11
	Barrow	0.66	0.91	1.05	1.13	1.17
	Clarke	2.41	2.71	3.06	3.26	3.37
	Greene	2.02	2.02	2.02	2.02	2.02
	Hancock	0.53	0.53	0.53	0.53	0.53
	Jackson	0.80	1.06	1.23	1.33	1.39
	Laurens	11.26	11.27	11.29	11.29	11.30
	Morgan	0.05	0.05	0.05	0.05	0.05
	Putnam	0.00	0.00	0.00	0.00	0.00
	Walton	0.09	0.09	0.09	0.09	0.09
	Washington	11.77	11.77	11.77	11.77	11.77
	Wilkinson	3.41	3.41	3.41	3.41	3.41
	Total	**33.11**	**33.93**	**34.60**	**34.98**	**35.20**
Total		**480.14**	**484.64**	**489.92**	**493.13**	**495.10**

Note that EPD is validating those counties that have discharge permits with no reported discharge.
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Table 7. Industrial Discharge by Sub-sector and Type in MGD

Subsector	Direct	LAS	Municipal System	Total
Food	5.68	9.46	7.63	22.77
Manufacturing	26.83	0.59	1.02	28.44
Mining	34.47	-	-	34.47
Paper	335.63	10.10	9.44	355.17
Total	402.61	20.15	18.09	440.85

Table 8. Percent of Industrial Discharge by Sub-sector and Type

Subsector	Direct	LAS	Municipal System	Total
Food	25%	42%	34%	100%
Manufacturing	94%	2%	4%	100%
Mining	100%	0%	0%	100%
Paper	94%	3%	3%	100%
Overall	91%	5%	4%	100%

Summary

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial stakeholder water demand forecast advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. Appendix A lists the participants of the advisory group and their industry affiliation. The first meeting of the industrial advisory group was held on June 3, 2020. A consensus of the advisory group was that:

- Employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

- Separate industrial sub-sector groups should be formed to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing. A separate advisory group was convened for each of these four sub-sectors.

The sub-sector advisory groups worked concurrently over the next several months to identify the most reasonable approach for estimating future water withdrawals for their respective sectors.

The industrial water sector forecasting efforts include estimations of both water demands and water discharges. The water demand forecast is estimated based on the permitted facilities' reported withdrawal and known municipal water purchases. The water discharges are estimated based on the permitted facilities' reported wastewater and known discharges to municipal treatment facilities. The overall water discharge forecast is also broken down by the type of

discharge: direct discharge, LAS or municipal system. The estimated wastewater forecast is a way for the planning regions to account for return flows to streams, rivers and other surface water bodies.

Water demand by source, either surface water, groundwater, or municipal water is assumed to remain proportional throughout the forecast period for each sub-sector in each county. Discharges are assumed to remain proportional to the water demand for each county. The proportion of discharge to municipal systems, land application and direct discharge remains constant over time for each county.

For this analysis, it is assumed that water discharges do not exceed water withdrawals at the facility level because the Regional Water Planning resource assessment models account for stormwater runoff separately through the incorporation of rainfall events. Thus, for some industrial facilities the annual average discharge is capped at the corresponding withdrawal volume.

The estimated water demand by paper and forest products industries represent 75 percent of the total industrial water demand in the 10 planning regions in 2020. Almost two-thirds of the water for paper and forest products facilities is from surface water sources with one-third from groundwater sources. Discharges by paper and forest products industries often exceed the volume of withdrawals due to the inclusion of stormwater runoff in discharges. However, for this analysis an effort is made to exclude stormwater from discharges by limiting discharges to facility withdrawals wherever possible. Nearly all discharges from paper and forest products facilities are direct permitted discharges to streams and rivers.

Water demand for mining facilities represent about 9 percent of the total industrial water demand in the 10 planning regions throughout the entire planning period. Almost three-fourths of the mining demands is from groundwater sources with one-fourth from surface water sources. Discharges by mining facilities often exceed the volume of withdrawals due to the inclusion of stormwater runoff in the discharges. For this analysis an effort is made to exclude stormwater from discharges by limiting discharges to facility withdrawals wherever possible. All manufacturing discharges are direct permitted discharges to streams and rivers.

Water demand for manufacturing facilities represent 10 percent of the total industrial water demand in the 10 planning regions throughout the entire planning period. Surface water supplies 45 percent of water used in manufacturing, groundwater provides 39 percent, and municipal water supply provides 17 percent. Nearly all manufacturing discharges are direct permitted discharges to streams and rivers.

Water demand for food processing industries represent about 4 percent of the total industrial water demand in the 10 planning regions in 2020. The demand for water in the food processing sector is expected to increase and is estimated to account for 7 percent of total industrial water demand in 2060. The permitted withdrawals of ground water supply 41 percent of the water demand for food processing. In addition, 59 percent of the water used in food processing comes from municipal water. Food processing facilities do not use surface water (except where the municipal water supply is surface water). One-third of wastewater discharges from food processing

facilities are discharged to municipal wastewater treatment facilities, 42 percent are discharged to LAS, and 22 percent are discharged directly to receiving water bodies after the necessary treatment.

This 10 planning region effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for the 10 planning regions does not address potential economic growth for which the timing, location and water requirements are currently unknown. However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

This page intentionally left blank.

Appendix A

List of the Industrial Stakeholder Advisory Group

Food Processing Sub-Sector Advisory Group:

Mike Giles, Georgia Poultry Federation
Alexander Samoylov, Georgia Tech Research Institute
Doug Britton, Georgia Tech Research Institute
Olga Kemenova, Georgia Tech Research Institute

Mining Sub-Sector Advisory Group

Lee Lemke, Georgia Mining Association
Cody Hale, Nutter & Associates on behalf of Georgia Mining Association
Michele Oxlade, Covia
Kevin Willoughby, Covia
Ken McKinzie, Covia
Adam Beatty, Covia
Derick Kopp, BASF
Scott Brandenburg, BASF
Kent Moles, BASF
Gil Rowland, KaMin LLC
Ashley Morris Varnum, Georgia Department of Economic Development

Paper and Forest Products Sub-Sector Advisory Group

Brittney Hull, Packaging Corporation of America also representing Georgia Paper and Forest Products Association
Michelle Liotta, Georgia Pacific
Brian Mooney, Rayonier Performance Fibers
Tony Owens, International Paper
Brian Solheim, Irving Consumer Products
Ashley Morris Varnum, GA Dept of Economic Development

Manufacturing Sub-Sector Advisory Group

Clay Jones, Georgia Association of Manufacturers
Jeremy Lawrence, Gerdau Steel
Lee Slusher, Milliken
Rebecca Bolden, Mohawk Industries
Shanon Seals, Toyo Tires
Shellee Pyron, Kia Motors Manufacturing
Chip Wildes, SAFT America
Wes Robinson, Georgia Chemistry Council
Ashley Morris Varnum, GA Dept of Economic Development

This page intentionally left blank.

Appendix B

Water Demand Forecast for the Paper and Forest Products Sub-Sector in Georgia

Memorandum

To: *Georgia Regional Water Planning Industrial Stakeholders – Paper and Forest Products Sub-Sector*

cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *December 22, 2020*[1]

Subject: *Water Demand Forecast for Industrial Paper & Forest Products Sector in Georgia*

This technical memorandum presents the preliminary water demand forecast for the paper and forest products sector of the industrial water demand forecast for Georgia's Regional Water Planning process.

Introduction and Background

An industrial sector water demand forecast was initially developed for the 2011 Regional Water Plans (RWPs) by the individual Regional Water Planning Councils through the support of the Georgia Environmental Protection Division (EPD). The water demand forecast was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. Reported water withdrawals were aggregated by county and North American Industry Classification System (NAICS) code. Industrial water discharges were also identified by county and NAICS code from EPD discharge permit data. At the time, the future industrial water withdrawals and discharges by county and NAICS code were estimated based upon projected growth rates of future employment by NAICS code. When the Regional Water Plans were subsequently updated in 2017, the water demand forecast for the industrial sector was not updated.

This statewide effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for Georgia does not address potential economic growth for which the timing, location and water requirements are currently unknown.

---

[1] Revised May 31, 2022

However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. The first meeting of the industrial advisory group was held on June 3, 2020. A consensus of the advisory group was that employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

Figure 1 illustrates statewide industrial employment, industrial gross domestic product (GDP), and permitted industrial water withdrawals from 2000 to 2018. The average monthly employment for each year (blue columns) reflects the impact of the Great Recession on industrial employment from 2008 to 2010, with a steady increase in employment since 2010 that has yet to reach the pre-recession levels. Industrial GDP in real dollars (green line) is similar to the employment trend with a decrease from 2007 to 2009 followed by a steady increase that surpasses the pre-recession level. Conversely, reported industrial water withdrawals (red line) show a steady decline from 2006 to 2018. Thus, as statewide industrial employment and productivity have increased since 2010, industrial water withdrawals have continued to decline, suggesting greater water use efficiency and an inverse relationship with employment.

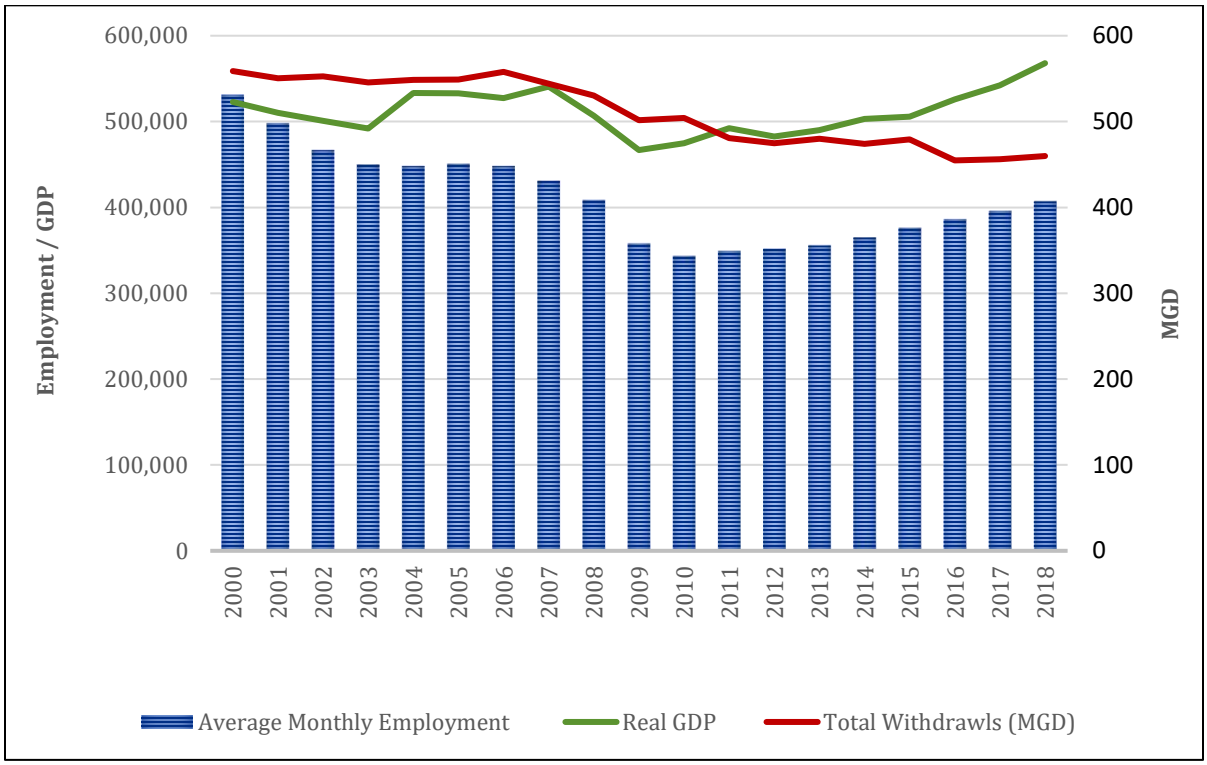

Figure 1. Industrial Employment, GDP, and Water Withdrawals in Georgia from 2000 to 2018
(*Sources: Georgia Dept of Labor, U.S. Bureau of Economic Activity, and EPD permitted withdrawals*)

The industrial advisory group recommended the formation of separate industrial sub-sector groups to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing. A separate advisory group was convened for each of these four sub-sectors. The sub-sector advisory groups worked concurrently to identify and gain consensus on the most reasonable approach for estimating future water withdrawals for their respective sectors. **Appendix A** lists the participants of the paper and forest products sub-sector advisory group and their industry affiliation.

Trends in Paper and Forest Products in Georgia

In 2001, Ellis et al. reported that the forest products (pulp and paper) industry is the largest industrial process water user in the United States (Ellis et al., 2001). In Georgia, forest products account for 78 percent of permitted industrial water withdrawals over the last 10 years. The 10-year average annual permitted withdrawals for paper and forest products, mining, manufacturing, and food processing are illustrated on **Figure 2**. It is important to note that while the paper and forest products industry withdraws large volumes of water from surface water and groundwater sources, about 90 to 95 percent of the water is discharged or returned to surface water bodies.

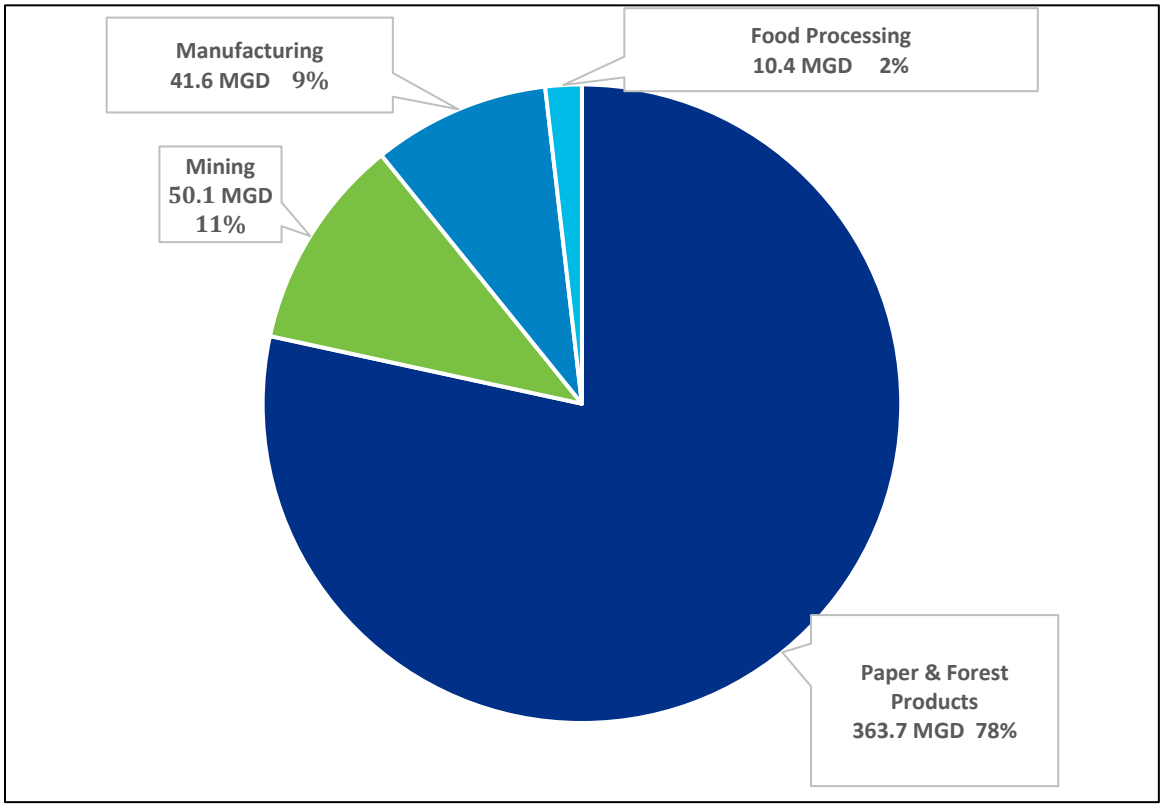

Figure 2. 10-Year Average Annual Permitted Industrial Water Withdrawals (MGD) in Georgia from 2010 to 2019

(Source: Georgia EPD permitted withdrawals)

Figure 3 shows the total annual average water withdrawals from 2010 to 2019 for permittees that are in the paper and forest products sector. Also shown on Figure 3 is the number of reporting permittees per year. The total volume of water withdrawn has decreased slightly over the 10-year period, as has the number of reporting permittees.

Average annual water use among the reporting permittees ranges from less than 0.01 million gallons per day (MGD) to over 100 MGD as shown on **Figure 4**. The 10 largest water-using paper and forest products sector permittees account for 86 percent of withdrawals. However, the volume of water used per unit of production varies with the number of products being produced.

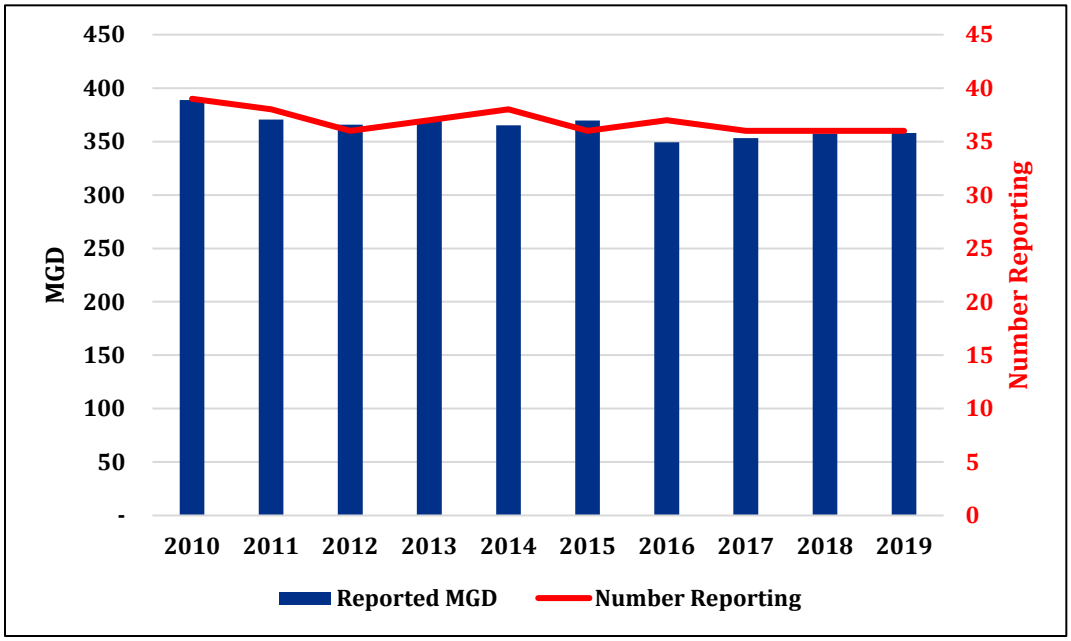

Figure 3. Annual Water Withdrawals by Paper Sector Permittees from 2010 to 2019

(*Sources: Georgia EPD permitted withdrawals*)

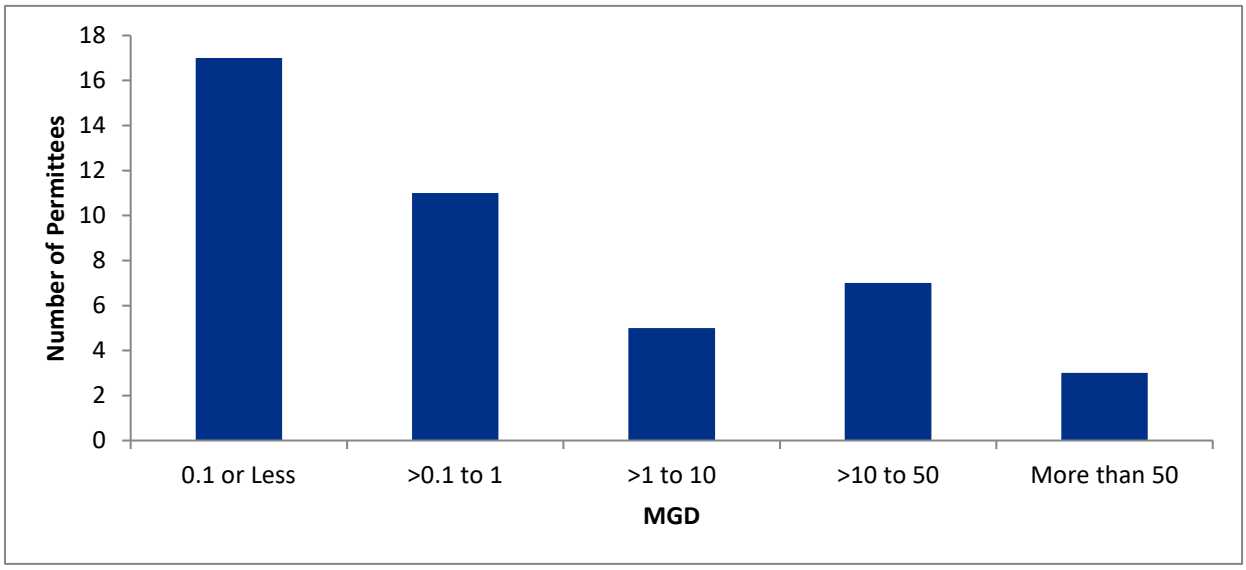

Figure 4. Range of Average Annual Water Withdrawals by Paper Sector Permittees

(*Source: Georgia EPD permitted withdrawals*)

Ellis et al. (2001) report findings from a 1996 survey of 663 U.S. and Canadian paper mills showed that water use per ton of product varies by the type of mill and product (see **Table 1**). While these water use factors may be outdated, the variation in water use is applicable. Water use in pulp and paper facilities in Georgia can and will change as product lines change in response to market conditions.

Table 1. Water Use in Different Categories of Pulp and Paper Mills

Mill Type	Mean Water Use (gal/ton-product)	Median Water Use (gal/ton-product)
Integrated Bleached	23,400	22,900
Integrated Unbleached	11,400	10,100
Paper Mill>100 Air-dried tons (ADT)/day	8,000	3,600
Bleached Market Kraft Pulp	22,400	23,000
Newsprint (mechanical pulp)	10,400	9,700
Corrugating Medium (neutral sulfite semi-chemical)	6,400	4,500
Newsprint (mechanical and high-yield chemical)	19,700	15,500
Deinked Secondary Fibers	9,700	9,500
Dissolving Pulp	51,000	41,400
Paper Mill<100 ADT/day	18,000	12,000
Market Non-kraft	18,000	4,500

Source: Ellis et al. 2001, Bryant et al. 1996.

Estimating Future Water Demand for the Paper and Forest Products Industry in Georgia

The industrial advisory paper and forest products sub-group discussed various considerations for future water demand. Conclusions reached by the sub-group included:

- While the planning horizon for the Regional Water Plans extends to the year 2060, it is difficult to predict what the water demand of the paper and forest products industry in Georgia will be more than a few years into the future.
- Pulp and paper mills in Georgia frequently change product lines in response to market conditions, therefore water use at any one facility may change at any time.
- The market demand for paper products is not likely to decrease in the near future.
- While some pulp and paper mills withdraw large volumes of water from surface water, these facilities discharge 90 to 95 percent of water withdrawn back to surface water bodies.
- Pulp and paper companies in Georgia are heavily invested in sustainable practices including water use efficiency.
- Industries that are heavily reliant on water as part of their production process understand the value of protecting their water resources.
- While the Georgia Department of Economic Development (GDED) and others work to attract new pulp and paper industries to Georgia, or existing pulp and paper companies may expand in

the future, it is difficult to predict when and where such development will occur other than to say that it will occur in the "wood basket" of Georgia and "near a river."

- For the current Regional Water Plan update, it is recommended that water use for the paper and forest products industry remain constant (i.e., zero growth rate) across the state, and use the most recent 10-year average (2010 to 2019) water withdrawals by location.
- Changes or growth in water demand for the paper and forest products industry in Georgia is not likely to be a gradual rate of increase over time, but rather a "step-up" in water demand at a given location at a given point in time.
- EPD should re-evaluate water demand for the paper and forest products industry in Georgia every 5–10 years to adjust for changing conditions.

Given this feedback from the industrial advisory paper and forest products sub-group, the water demand forecast for water withdrawals by the self-supplied (permitted) paper facilities will remain constant throughout the forecast period. The current 10-year average for each facility is assumed to continue to the year 2060.

Georgia EPD has implemented reductions in permitted industrial groundwater withdrawals from the Floridan aquifer through 2025 in the Red and Yellow Zones of Chatham, Effingham, Bryan, and Liberty Counties. These reductions are based on concerns regarding saltwater intrusion into the Floridan aquifer and are consistent with Georgia EPD's *Coastal Georgia Water and Wastewater Permitting Plan for Managing Saltwater Intrusion*. These lower permit limits impact one paper and forest products facility in Chatham County with an imposed reduction of 1.23 MGD in 2020, and 2.54 MGD in 2025 from its current (10-year average) groundwater demand. As outlined in a prior study (100 Miles, 2018, page 24), this facility plans to address these reductions by implementing water conservation and efficiency measures. The lower permit limits for this facility are incorporated into the water demand forecast.

Note that information was exchanged between the industrial forecast team and the municipal forecast team to make adjustments in both forecasts for industries that are supplied by municipal water systems. This exchange of information allowed the municipal forecast team to exclude large industrial users from the calculation of municipal water use per capita and the municipal water demand forecast. For the industrial forecast team this exchange of information allowed municipally-supplied industrial water users to be accounted for in the industrial water demand forecast.

The current 10-year average water withdrawals by planning region and county are summarized in **Table 2**. For the majority of facilities, the 10-year average water withdrawals from 2010 to 2019 is used as the basis for the projected water use. In some instances, such as data obtained through trade association surveys, the basis of the forecast of water demand by county may be a 5-year average from 2015 to 2019 or may be limited to 2019 reported water use.

Data for Table 2 include industrial water use supplied by municipal water systems. The additional 11 MGD of municipal water supply for the paper and forest product sector is primarily for domestic water use. Thus, water withdrawals by source may be either surface water (SW), groundwater (GW) or

municipally-supplied water (MW). The allocation of water demand by source is assumed to remain the same throughout the forecast period.

Estimating Future Water Discharges for the Paper and Forest Products Industry in Georgia

For some industrial facilities, water discharges may include stormwater runoff as well as the discharge of wastewater. Many paper and forest products facilities cover large areas and thus have significant volumes of stormwater discharges. Thus, permitted water discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. It is important to note, however, that the EPD water resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, for this analysis it is assumed that water discharges do not exceed water withdrawals.

EPD permitted discharge data from 2015–2019 are used to derive the 5-year annual average discharge for paper and forest products facilities with EPD water withdrawal permits. **Table 3** lists the 5-year average annual water discharges from pulp and paper facilities by planning region and county. As noted, the discharges by an individual permittee may be limited to the withdrawal volume for that permittee. As with the water demand forecast, the water discharges for the paper industries in Georgia are assumed to be constant over the forecast period.

In most instances (94 percent), discharges from paper and forest products facilities have direct discharge permits. A few are known to discharge to land application systems or municipal wastewater treatment facilities. The proportion of water discharges to municipal systems, land application and direct discharges is assumed to remain the same throughout the forecast period within each county.

Table 2. Paper and Forest Products: 10-year Average Reported Withdrawals by Source for 2019

Planning Region	County	GW MGD	SW MGD	MW MGD	Total MGD
Altamaha	Dodge	0.02	0.00	0.00	0.02
	Tattnall	0.03	0.00	0.00	0.03
	Wayne	57.89	0.00	0.00	57.89
Coastal Georgia	Chatham[2]	14.70	8.79	8.02	31.50
	Effingham	0.84	13.63	0.00	14.47
	Glynn	26.43	0.00	0.00	26.43
	Liberty	9.97	0.00	0.00	9.97
Coosa - North Georgia	Floyd	0.00	23.72	0.00	23.72
Lower Flint - Ochlockonee	Colquitt	0.00	0.00	0.00	0.00
	Dougherty	4.95	0.00	0.00	4.95
	Early	0.07	106.26	0.00	106.33
Middle Ocmulgee	Bibb	0.54	11.49	2.80	14.83
	Pulaski	0.53	0.00	0.00	0.53

[2] Groundwater withdrawals in Chatham County are reduced by 1.23 MGD in 2020 and 2.54 MGD in 2025 from current withdrawals by Red Zone limits.

Planning Region	County	GW MGD	SW MGD	MW MGD	Total MGD
Savannah - Upper Ogeechee	Burke	0.21	0.00	0.00	0.21
	Jefferson	0.03	0.00	0.00	0.03
	Richmond	0.00	50.30	0.00	50.30
	Screven	0.00	0.00	0.00	0.00
Suwannee - Satilla	Atkinson	0.35	0.00	0.00	0.35
	Brooks	0.08	0.00	0.00	0.08
	Lowndes	10.10	0.00	0.00	10.10
	Pierce	0.06	0.00	0.00	0.06
	Ware	0.24	0.00	0.00	0.24
Upper Flint	Crisp	0.11	0.00	0.00	0.11
	Macon	0.52	9.51	0.00	10.03
Upper Oconee	Baldwin	0.01	0.00	0.00	0.01
	Laurens	1.15	11.43	0.00	12.58
	Morgan	0.05	0.00	0.13	0.18
	Putnam	0.07	0.00	0.00	0.07
	Wilkinson	0.04	0.00	0.00	0.04
Total		**128.98**	**235.13**	**10.95**	**375.05**

Source: Georgia EPD permitted withdrawals.
Note that demand shown as 0.00 may be less than 0.005 MGD.
GW = Groundwater; SW = Surface Water; and MW = Municipal Water.

Table 3. Paper and Forest Products: 5-year Average Reported Water Discharges by County

Planning Region	County	Wastewater Annual Discharge in MGD			
		Direct	Land	Municipal	Total
Altamaha	Wayne	57.89			57.89
Coastal Georgia	Chatham	23.46			23.46
	Effingham	14.47			14.47
	Glynn	26.40			26.40
	Liberty	9.97			9.97
Coosa - North Georgia	Floyd	23.25			23.25
Lower Flint - Ochlockonee	Early	106.33			106.33
Middle Ocmulgee	Bibb	3.69		9.44	13.13
	Pulaski	0.53			0.53
Savannah - Upper Ogeechee	Richmond	50.30			50.30
Suwannee - Satilla	Atkinson	0.05			0.05
	Lowndes		10.10		10.10
Upper Flint	Macon	8.08			8.08
Upper Oconee	Laurens	11.20			11.20
Total:		**335.63**	**10.10**	**9.44**	**355.17**

Source: Georgia EPD permitted discharges
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Summary

Water withdrawals by paper and forest products industries in the 10 planning regions represent a significant portion of the total industrial water withdrawals. Almost two-thirds of the withdrawals are from surface water sources with one-third from groundwater sources. Water discharges by paper and forest products industries often exceed the volume of withdrawals due to the inclusion of stormwater runoff in discharges. However, the EPD water resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, water discharges are limited to known withdrawals where data are available.

A stakeholder advisory group of paper and forest products sub-sector representatives was convened to discuss recent trends in water use by the industry and a reasonable approach to estimating future water withdrawals by the industry across the state. Given feedback from the paper and forest products advisory group, the water demand forecast for water withdrawals by these facilities will remain constant at the current 10-year average for each facility throughout the forecast period. Thus, the 10-year average water withdrawals by planning region and county, and by source, either surface water or groundwater, are assumed to remain constant throughout the forecast period.

References

100 Miles, Industrial Water Use: A Study of Managing for Efficiency in Southeast Georgia. 2018.

Bryant, Patrick S., Clark P. Woitkovich, and Earl W. Malcolm. 1996. "Pulp and Paper Mill Water Use in North America." In Proceedings of the TAPPI 1996 International Environmental Conference and Exhibits, 451-60. Atlanta, Ga.: Technical Association of the Pulp and Paper Industry.

Ellis, M., Energetics, Incorporated, S. Dillich, U.S. Department of Energy-Office of Industrial Technologies, and N. Margolis, Energetics, Incorporated. *Industrial Water Use and its Energy Implications,* ACEEE, 2001.
https://www.aceee.org/files/proceedings/2001/data/papers/SS01_Panel1_Paper03.pdf

List of the Industrial Stakeholder Advisory Group for Paper and Forest Products

- Brittney Hull, Packaging Corporation of America also representing Georgia Paper and Forest Products Association
- Michelle Liotta, Georgia Pacific
- Brian Mooney, Rayonier Performance Fibers
- Tony Owens, International Paper
- Brian Solheim, Irving Consumer Products
- Ashley Morris Varnum, GA Dept of Economic Development

This page intentionally left blank.

Appendix D

Water Demand Forecast for the Mining Sub-Sector in Georgia

Memorandum

To: *Georgia Regional Water Planning Industrial Stakeholders – Mining Sub-Sector*

cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *December 22, 2020*[1]

Subject: *Water Demand Forecast for Industrial Mining Sector in Georgia*

This technical memorandum presents the preliminary water demand forecast for the mining sector of the industrial water demand forecast for Georgia's Regional Water Planning process.

Introduction and Background

An industrial sector water demand forecast was initially developed for the 2011 Regional Water Plans (RWPs) by the individual Regional Water Planning Councils through the support of the Georgia Environmental Protection Division (EPD). The water demand forecast was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. Reported water withdrawals were aggregated by county and North American Industry Classification System (NAICS) code. Industrial water discharges were also identified by county and NAICS code from EPD discharge permit data. At the time, the future industrial water withdrawals and discharges by county and NAICS code were estimated based upon statewide projected growth rates of future employment by NAICS code. When the Regional Water Plans were subsequently updated in 2017, the water demand forecast for the industrial sector was not updated.

This statewide effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for Georgia does not address potential economic growth for which the timing, location and water requirements are currently unknown. However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

[11] Revised May 31, 2022.

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. The first meeting of the industrial advisory group was held on June 3, 2020. A consensus of the advisory group was that employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

Figure 1 illustrates statewide industrial employment, industrial gross domestic product (GDP), and permitted industrial water withdrawals from 2000 to 2018. The average monthly employment for each year (blue columns) reflects the impact of the Great Recession on industrial employment from 2008 to 2010, with a steady increase in employment since 2010 that has yet to reach the pre-recession levels. Industrial GDP in real dollars (green line) is similar to the employment trend with a decrease from 2007 to 2009 followed by a steady increase that surpasses the pre-recession level. Conversely, reported industrial water withdrawals (red line) show a steady decline from 2006 to 2018. Thus, as statewide industrial employment and productivity have increased since 2010, industrial water withdrawals have continued to decline, suggesting greater water use efficiency and an inverse relationship with employment.

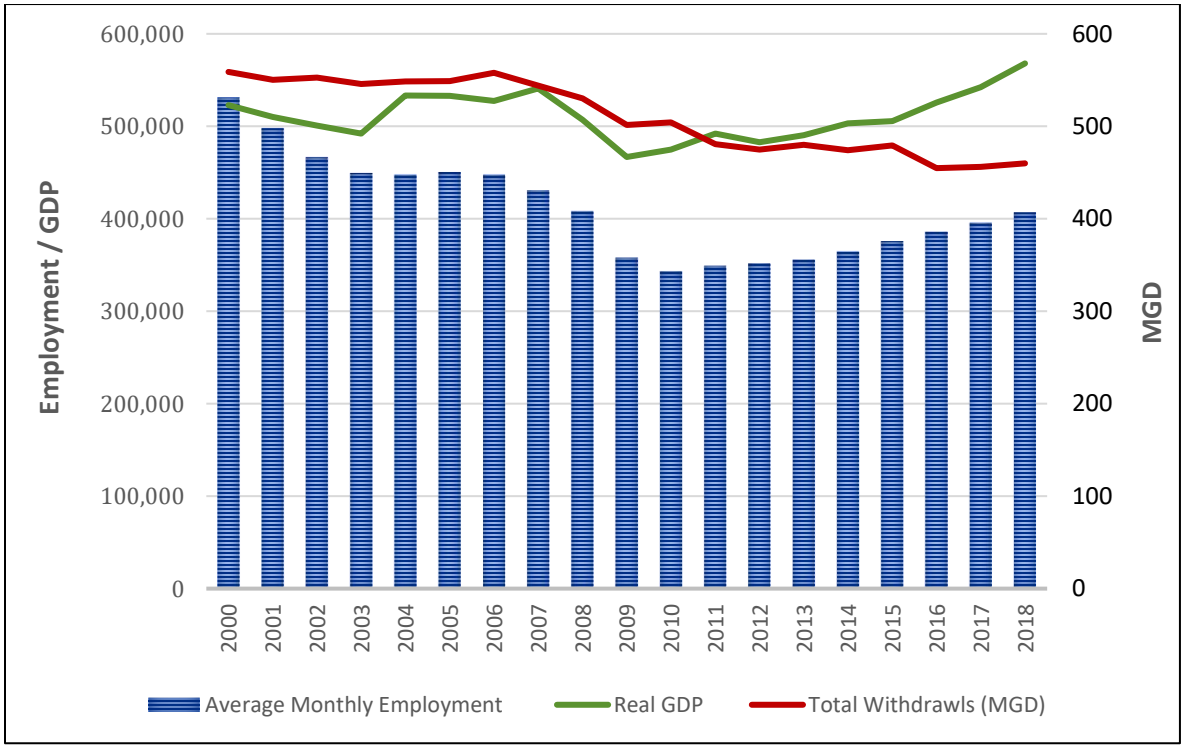

Figure 1. Industrial Employment, GDP, and Water Withdrawals in Georgia from 2000 to 2018

(*Sources: Georgia Dept of Labor, U.S. Bureau of Economic Activity, and EPD permitted withdrawals*)

The industrial advisory group recommended the formation of separate industrial sub-sector groups to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing. A separate advisory group was convened for each of these four sub-sectors. The sub-sector advisory groups worked concurrently to identify and gain consensus on the most reasonable approach for estimating future water withdrawals for their respective sectors. **Appendix A** lists the participants of the mining sub-sector advisory group and their industry affiliation.

Trends in Mining in Georgia

In Georgia, mining accounts for approximately 11 percent of permitted industrial water withdrawals over the last 10 years. The 10-year average annual permitted withdrawals for paper and forest products, mining, manufacturing, and food processing are illustrated on **Figure 2**.

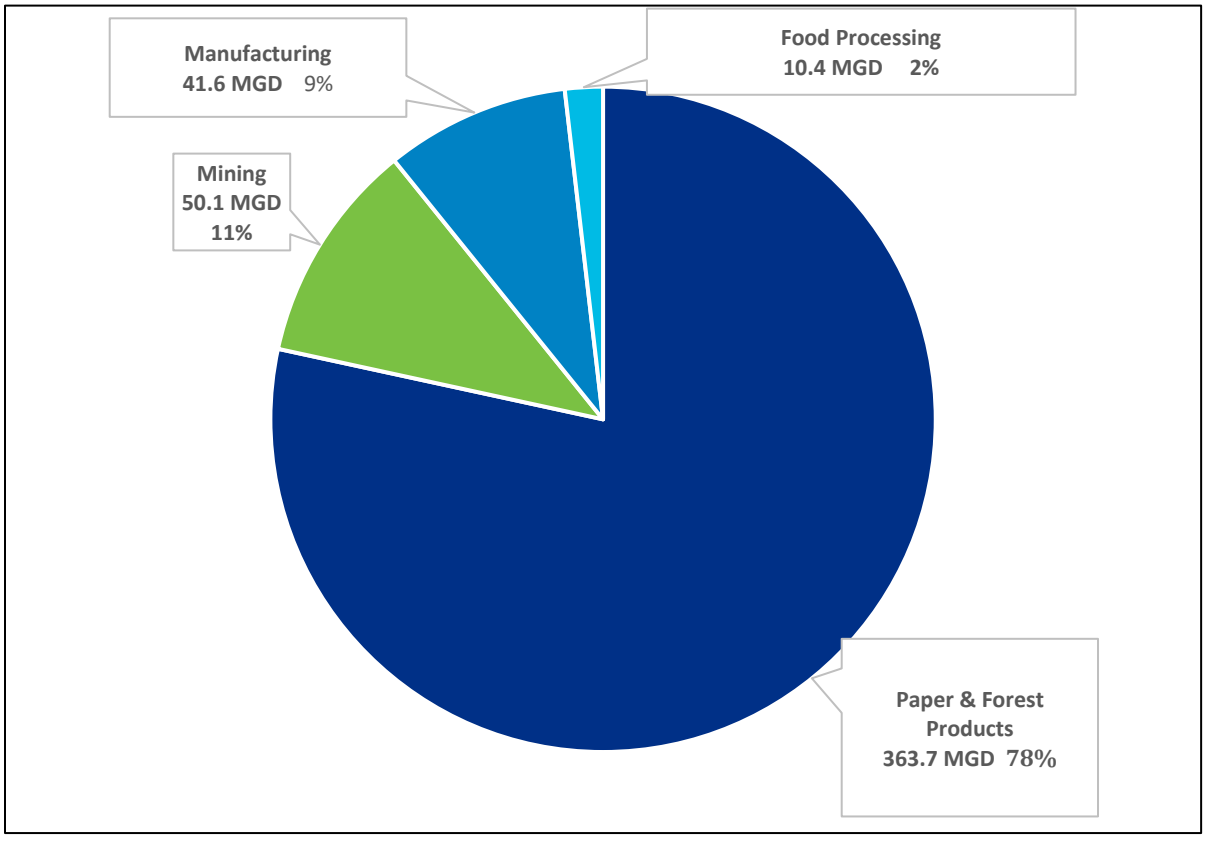

Figure 2. 10-Year Average Annual Permitted Industrial Water Withdrawals (MGD) in Georgia from 2010 to 2019
Source: EPD permitted withdrawals

Figure 3 shows the total annual average water withdrawals from 2010 to 2019 for permittees that are in the mining sector. Also shown on Figure 3 is the number of reporting permittees per year. The total volume of water withdrawn has varied over the 10-year period as has the number of reporting permittees.

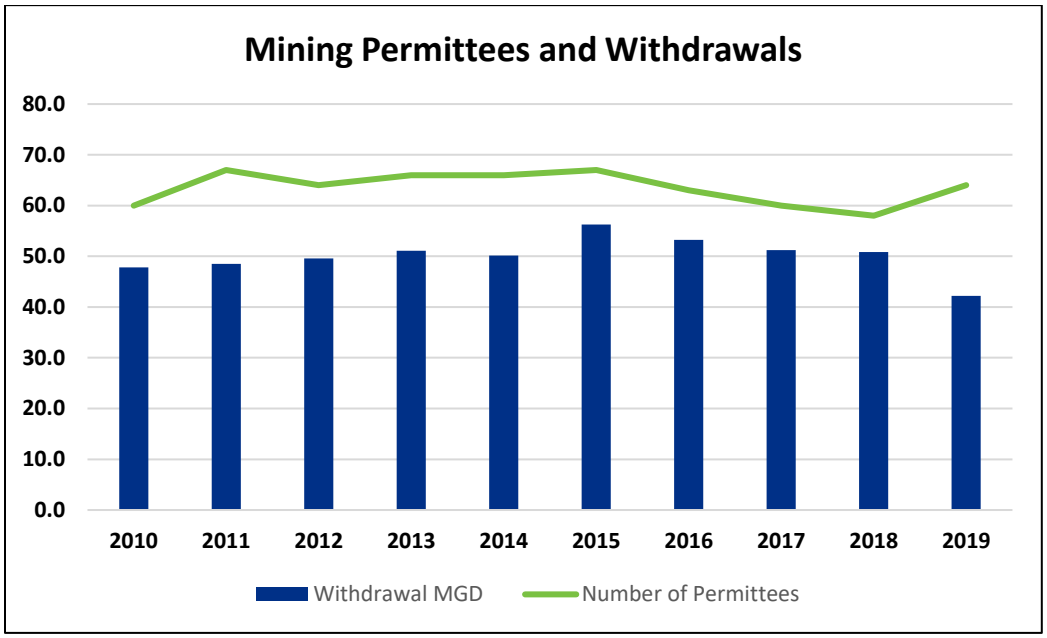

Figure 3. Annual Average Water Withdrawals by Mining Sector Permittees from 2010 to 2019
(*Source: Georgia EPD permitted withdrawals*)

Average annual water use among the reporting permittees ranges from less than 0.001 million gallons per day (MGD) to 10.0 MGD as shown on **Figure 4**. Roughly one-quarter of the mining permittees use less than 0.1 MGD per year on an annual average basis (29 percent), between 0.2 and 0.5 MGD per year (24 percent), and between 1 and 5 MGD per year (24 percent). The 10 largest water-using mining sector permittees account for 62 percent of statewide withdrawals from this sector.

It should be noted that the volume of water used per unit of production varies with the type of process and product being produced. For example, wet processing of kaolin clay generally uses more water per ton produced than other mineral or aggregate products produced in Georgia. The use of "pit water" and captured stormwater for processing reduces the need for water withdrawals as does water recycling throughout the process when these opportunities are available. In addition, some facilities use water to convey slurried materials to processing operations. Water use in post-extraction processing varies with the product being produced. Some kaolin products require a minimum water content; for example, domestic products may have up to 30 percent water content while international products may have only one percent water content. Water use in post-extraction processing facilities in Georgia can and will change as product lines change in response to market conditions.

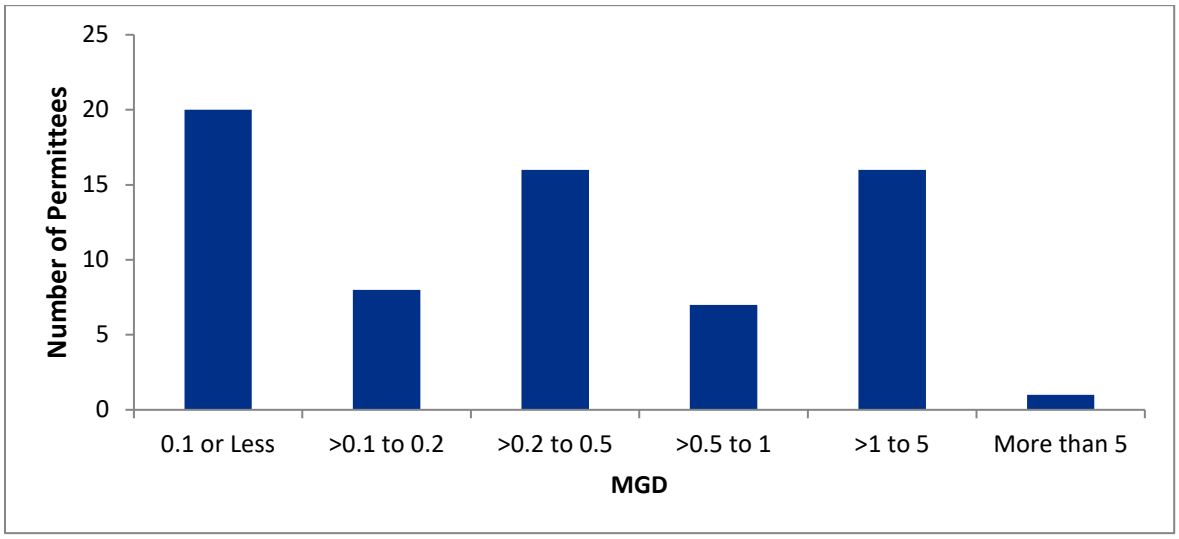

Figure 4. Range of Annual Average Water Withdrawals by Mining Sector Permittees
(*Source: Georgia EPD permitted withdrawals*)

Estimating Future Water Demand for the Mining Industry in Georgia

The mining sub-sector advisory group discussed various considerations for future water demand. Conclusions reached by the group included:

- While the planning horizon for the Regional Water Plans extends to the year 2060, it is difficult to predict what the water demand of the mining sector in Georgia will be more than a few years into the future.
- Mining facilities in Georgia frequently change product lines in response to market conditions, therefore water use at any post-extraction processing facility may change at any time.
- The market demand for manufactured products is likely to increase in the near future, yet operations may reduce water use per product with further recycling and water use efficiency.
- Mining companies that are heavily reliant on water as part of their production process understand the value of protecting their water resources.
- Kaolin production in the U.S. declined around the time of the recession (2008 – 2010) with relatively stable production since 2010. Georgia produces 90 percent of the kaolin in the U.S.
- Stakeholders believe the market for kaolin may increase over the next decade as new uses for kaolin are developed.

- Weather has a significant impact on water use because of the use of stormwater as process water. With more rain, more stormwater is available to use as process water, discharges increase and withdrawals from the source water are less. Conversely, in dry periods when less stormwater is available, discharges are less, and withdrawals may increase[2].

- A survey was conducted of members of the Georgia Mining Association, focusing on those facilities using more than 0.2 MGD, which limited the number of respondents. A majority of respondents indicated they had no plans to expand operations or water use in the next 5 to 10 years, or that expansion would be balanced by water recycling resulting in no expected increase in water withdrawals. Municipal water use is minimal and only for domestic use at facilities.

- For the current Regional Water Plan update, it is recommended that water demand for the mining industry remain constant (i.e., zero growth rate) across the state, and reflect the 10-year average (2010 to 2019) water withdrawals by location except where permittees have indicated recent changes that reflect a more representative value through the survey process.

- EPD should re-evaluate water demand for the mining industry in Georgia every 5 to 10 years to adjust for changing conditions.

Given this feedback from the mining sub-sector advisory group, the water demand forecast for facility-level water withdrawals for mining facilities will remain constant throughout the forecast period. The current 10-year average for each facility is assumed to continue to the year 2060.

Note that information was exchanged between the industrial forecast team and the municipal forecast team to make adjustments in both forecasts for industries that are supplied by municipal water systems. This exchange of information allowed the municipal forecast team to exclude large industrial users from the calculation of municipal water use per capita and the municipal water demand forecast. For the industrial forecast team this exchange of information allowed municipally-supplied industrial water users to be accounted for in the industrial water demand forecast.

The current 10-year average water withdrawals by planning region and county are summarized in **Table 1**. For the majority of facilities, the 10-year average water withdrawals from 2010 to 2019 is used as the basis for the projected water use. In some instances, such as data obtained through trade association surveys, the basis of the forecast of water demand by county may be a 5-year average from 2015 to 2019 or may be limited to 2019 reported water use.

[2] Note that increases in water demand under dry hydrologic conditions are addressed in the Surface Water Availability Resource Assessment models that inform the Regional Water Plans.

Also shown are the withdrawals by source, either surface water (SW), groundwater (GW), or municipal water supply (MW)[3]. Across the 10 planning regions, nearly 70 percent of mining water use is from groundwater, 30 percent is from surface water, and less than one percent is purchased from municipal systems. The allocation of water demand by source is assumed to remain the same throughout the forecast period within each county.

Table 1. Mining: 10-year Average Reported Withdrawals by Source

Planning Region	County	GW MGD	SW MGD	MW MGD	Total MGD
Coastal Georgia	Chatham	0.09			0.09
	Liberty		0.39		0.39
	Total	0.09	0.39		0.48
Coosa - North Georgia	Gilmer	1.42			1.42
	Pickens	2.88			2.88
	Total	4.30			4.30
Lower Flint - Ochlockonee	Decatur	0.17	0.66		0.84
	Dougherty	0.02			0.02
	Total	0.19	0.66		0.86
Middle Ocmulgee	Bibb		0.03		0.03
	Crawford		4.01		4.01
	Houston	0.18			0.18
	Peach	0.34			0.34
	Twiggs	3.67			3.67
	Total	4.18	4.04		8.22
Savannah - Upper Ogeechee	Glascock	0.02			0.02
	Jefferson	4.33	2.78		7.11
	Jenkins	0.03			0.03
	Madison		0.13		0.13
	Richmond	0.09			0.09
	Warren	0.43	0.48		0.91
	Total	4.90	3.39		8.29
Suwannee - Satilla	Brantley		0.00		0.00
	Charlton		0.70		0.70
	Pierce	0.09			0.09
	Total	0.09	0.70		0.80

[3] Note that a groundwater permit is required for "dewatering" an underground mine.

Planning Region	County	GW MGD	SW MGD	MW MGD	Total MGD
Upper Flint	Macon	0.03			0.03
	Marion		0.39		0.39
	Sumter	0.21			0.21
	Talbot		0.42		0.42
	Taylor		1.62		1.62
	Total	0.24	2.44		2.68
Upper Oconee	Laurens	0.13			0.13
	Washington	12.53			12.53
	Wilkinson	8.19	0.42	0.41	9.02
	Total	20.86	0.42	0.41	21.69
Total		34.85	12.04	0.41	47.3

Source: Georgia EPD permitted withdrawals.
GW = Groundwater; SW = Surface Water; and MW = Municipal Water.
In some Counties, the 10-year average withdrawal from permitted mining facilities is less than 0.005.

Estimating Future Water Discharges for the Mining Industry in Georgia

For mining facilities, water discharges often co-mingle stormwater with the discharge of wastewater. Thus, permitted discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. In mining operations, collected stormwater and groundwater seepage are frequently used as "recycled" water in processing. Thus, when more stormwater or groundwater seepage is available, water discharges may increase and withdrawals from source water may decrease. Conversely, in dry periods when less stormwater is available, water discharges generally decrease, and withdrawals generally increase.

It is important to note, however, that the Regional Water Planning resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, for this water demand forecasting analysis, designated stormwater discharge permit data is omitted, and it is assumed that water discharges do not exceed water withdrawals at each facility.

Reported discharge data from 2015–2019, available from EPD, are used to derive the 5-year annual average discharges for mining facilities with EPD water withdrawal permits[4]. **Table 2** lists the 5-year annual average water discharges from mining facilities by planning region and county. All identified discharges from mining are permitted direct discharges. Note that discharges by an individual permittee may be limited to the withdrawal amount for that permittee. As with the water demand forecast, the water discharges for the mining industries are assumed to be constant over the forecast period.

[4] Note that an NPDES discharge permit is required to discharge water off property or into state waters. Also, many facilities recycle water from certain wastestreams prior to or in place of discharging.

Table 2. Mining: 5-year Average Reported Discharges by County

Planning Region	County	Discharges in MGD	
		Direct	Total
Altamaha		-	-
Coastal Georgia	Chatham	2.56	2.56
Coosa - North Georgia	Gilmer	0.01	0.01
	Habersham	1.04	1.04
	Pickens	1.59	1.59
	White	0.01	0.01
	Total	2.66	2.66
Lower Flint - Ochlockonee	Decatur	0.66	0.66
Middle Chattahoochee	Haralson	0.01	0.01
	Heard	0.00	0.00
	Troup	0.72	0.72
	Total	0.73	0.73
Middle Ocmulgee	Houston	0.18	0.18
	Jones	0.18	0.18
	Monroe	0.07	0.07
	Twiggs	1.30	1.30
	Total	1.72	1.72
Savannah - Upper Ogeechee	Columbia	0.48	0.48
	Glascock	0.02	0.02
	Hart	1.96	1.96
	Jefferson	3.02	3.02
	Lincoln	0.34	0.34
	Richmond	0.56	0.56
	Warren	0.91	0.91
	Total	7.29	7.29
Suwannee - Satilla	Charlton	0.05	0.05
	Pierce	0.09	0.09
	Total	0.15	0.15
Upper Oconee	Clarke	1.03	1.03
	Hancock	0.53	0.53
	Washington	11.77	11.77
	Wilkinson	3.41	3.41
	Total	16.74	16.74
Total		32.51	32.51

Source: Reported discharge flow data, Georgia EPD.
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Summary

Water withdrawals for mining facilities in the ten planning regions represent about 11 percent of the total industrial water withdrawals. Among the ten planning regions three-quarters of the withdrawals are from groundwater sources and one-quarter from surface water sources. Water discharges by mining facilities often exceed the volume of withdrawals due to the inclusion of stormwater runoff in the discharges, however, stormwater discharges are not included in this analysis. A stakeholder advisory group of mining industry representatives was convened to discuss recent trends in water use for this sector and a reasonable approach to estimating future water withdrawals by this sector across the state. A survey was conducted by the Georgia Mining Association to inform the stakeholder process.

Given feedback from the mining sub-sector advisory group, the water demand forecast for water withdrawals by these facilities will remain steady at the current 10-year average for each facility throughout the forecast period. Thus, the 10-year average water withdrawals by planning region and county, and by source (surface water, groundwater, or municipal water), are assumed to remain constant throughout the forecast period.

Similarly, water discharges by mining operations are assumed to remain steady at the current 5-year average discharge rate. However, because the Regional Water Planning resource assessment modeling process accounts for stormwater runoff through the incorporation of rainfall events, for this analysis stormwater discharges are not included, and it is assumed that water discharges do not exceed water withdrawals. Thus, for some mining facilities the discharge is capped at the corresponding withdrawal volume.

List of the Industrial Stakeholder Advisory Group for the Mining Sub-Sector Advisory Group

- Lee Lemke, Georgia Mining Association
- Cody Hale, Nutter & Associates on behalf of Georgia Mining Association
- Michele Oxlade, Covia
- Kevin Willoughby, Covia
- Ken McKinzie, Covia
- Adam Beatty, Covia
- Derick Kopp, BASF
- Scott Brandenburg, BASF
- Kent Moles, BASF
- Gil Rowland, KaMin LLC
- Ashley Morris Varnum, Georgia Department of Economic Development

This page intentionally left blank.

Appendix C

Water Demand Forecast for the Manufacturing Sub-Sector in Georgia

Memorandum

To: *Georgia Regional Water Planning Industrial Stakeholders – Manufacturing Sub-Sector*

cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *December 22, 2020*[1]

Subject: *Water Demand Forecast for Industrial Manufacturing Sector in Georgia*

This technical memorandum presents the preliminary water demand forecast for the manufacturing sector of the industrial water demand forecast for Georgia's Regional Water Planning process.

Introduction and Background

An industrial sector water demand forecast was initially developed for the 2011 Regional Water Plans (RWPs) by the individual Regional Water Planning Councils through the support of the Georgia Environmental Protection Division (EPD). The water demand forecast was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. Reported water withdrawals were aggregated by county and North American Industry Classification System (NAICS) code. Industrial water discharges were also identified by county and NAICS code from EPD discharge permit data. At the time, the future industrial water withdrawals and discharges by county and NAICS code were estimated based upon statewide projected growth rates of future employment by NAICS code. When the Regional Water Plans were subsequently updated in 2017, the water demand forecast for the industrial sector was not updated.

This statewide effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for Georgia does not address potential economic growth for which the timing, location and water requirements are currently unknown. However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

---

[1] Revised May 31, 2022

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. The first meeting of the industrial advisory group was held on June 3, 2020. A consensus of the advisory group was that employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

Figure 1 illustrates statewide industrial employment, industrial gross domestic product (GDP), and permitted industrial water withdrawals from 2000 to 2018. The average monthly employment for each year (blue columns) reflects the impact of the Great Recession on industrial employment from 2008 to 2010, with a steady increase in employment since 2010 that has yet to reach the pre-recession levels. Industrial GDP in real dollars (green line) is similar to the employment trend with a decrease from 2007 to 2009 followed by a steady increase that surpasses the pre-recession level. Conversely, reported industrial water withdrawals (red line) show a steady decline from 2006 to 2018. Thus, as statewide industrial employment and productivity have increased since 2010, industrial water withdrawals have continued to decline, suggesting greater water use efficiency and an inverse relationship with employment.

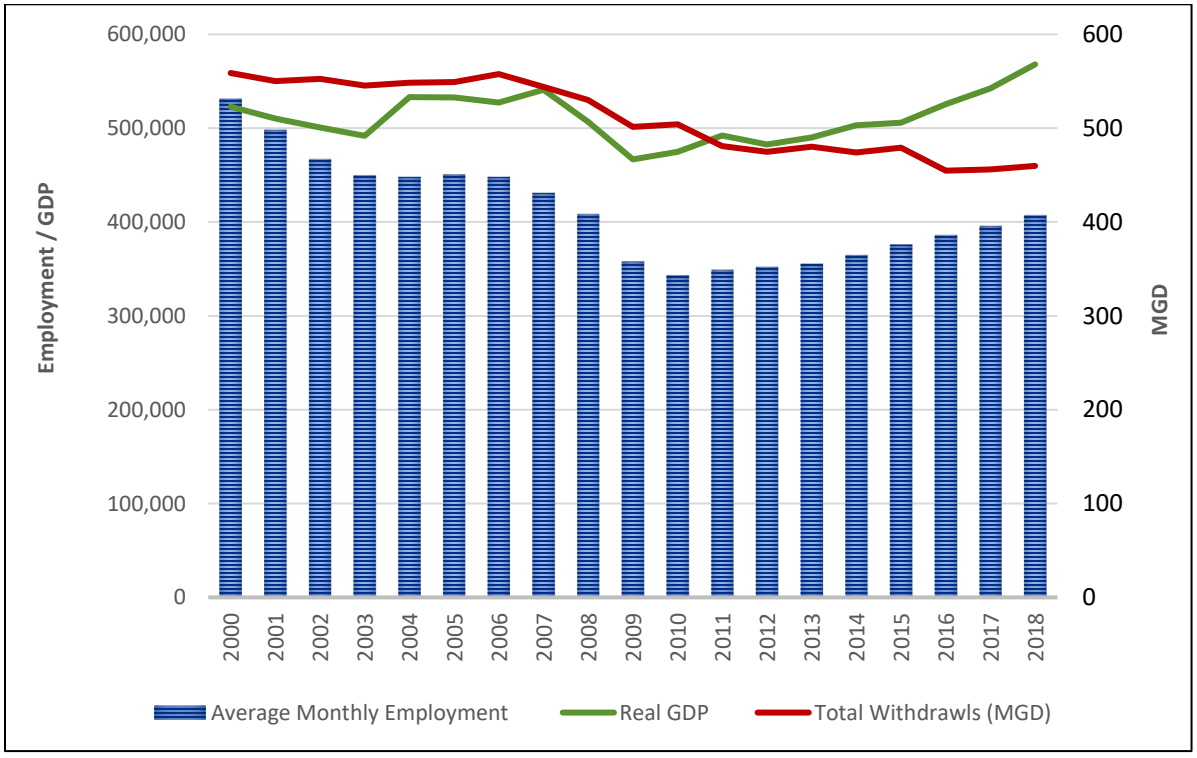

Figure 1. Industrial Employment, GDP, and Water Withdrawals in Georgia from 2000 to 2018

(*Sources: Georgia Dept of Labor, U.S. Bureau of Economic Activity, and EPD permitted withdrawals*)

The industrial advisory group recommended the formation of separate industrial sub-sector groups to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing. A separate advisory group was convened for each of these four sub-sectors. The sub-sector advisory groups worked concurrently to identify and gain consensus on the most reasonable approach for estimating future water withdrawals for their respective sectors. **Appendix A** lists the participants of the manufacturing sub-sector advisory group and their industry affiliation.

Trends in Manufacturing in Georgia

In Georgia, manufacturing accounts for approximately 9 percent of permitted industrial water withdrawals over the last 10 years. The 10-year average annual permitted withdrawals for paper and forest products, mining, manufacturing, and food processing are illustrated on **Figure 2**.

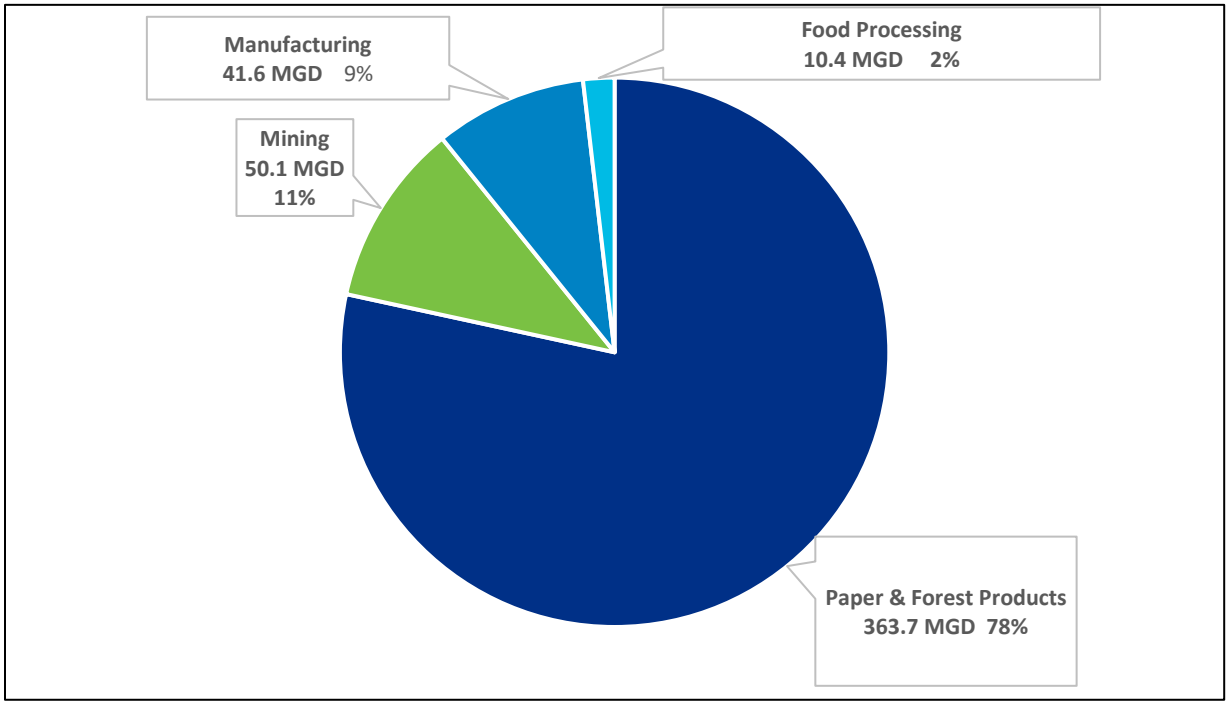

Figure 2. 10-Year Average Annual Permitted Industrial Water Withdrawals (MGD) in Georgia from 2010 to 2019
Source: EPD permitted withdrawals

Figure 3 shows the total annual average water withdrawals from 2010 to 2019 for permittees that are in the manufacturing sector and hold their own water withdrawal permit (vs. relying upon municipal water supply). Also shown on Figure 3 is the number of reporting permittees per year. The total volume of water withdrawn has decreased over the 10-year period (25 percent), as has the number of reporting permittees (28 percent).

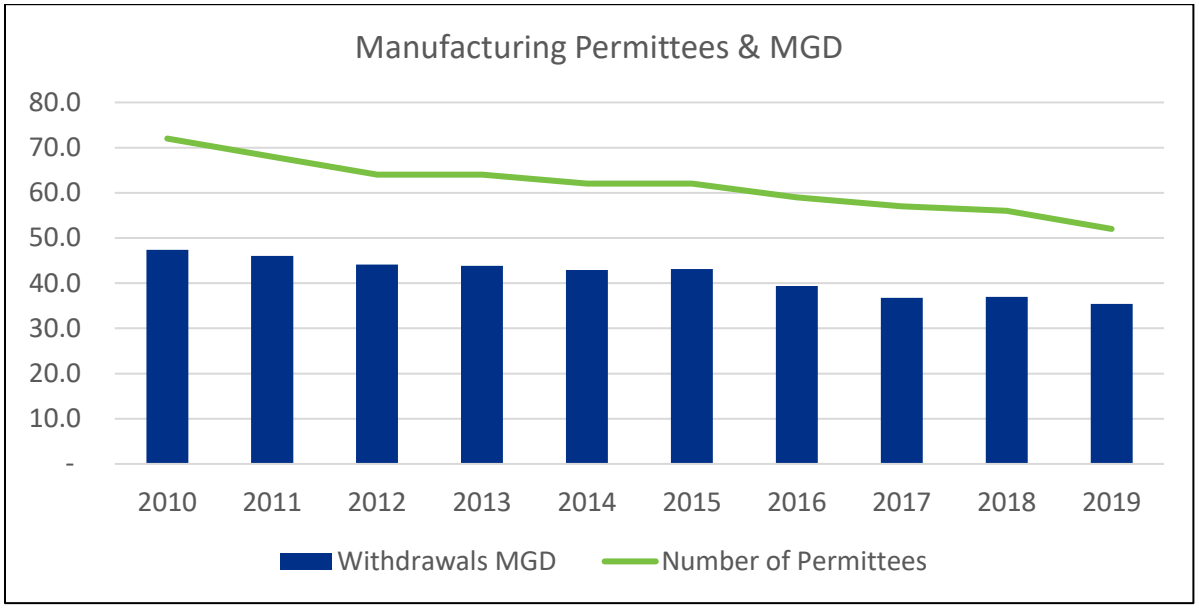

Figure 3. Annual Water Withdrawals by Manufacturing Sector Permittees from 2010 to 2019
(*Sources: Georgia EPD permitted withdrawals*)

Average annual water use among the reporting permittees ranges from less than 0.001 million gallons per day (MGD) to 6.4 MGD as shown on **Figure 4**. Half of the manufacturing permittees use 0.125 MGD per year or less on an annual average basis. The 10 largest water-using manufacturing sector permittees account for 75 percent of statewide withdrawals from this sector.

It should be noted that the volume of water used per unit of production varies with the type of product and the number of different products being produced. Examples include gallons per automobile assembled, gallons per tire produced, gallons per yard of fabric, and gallons per ton of fertilizer. Many of the published studies on water use factors per unit of production are outdated as manufacturers have incorporated water saving practices and recycling of process water into their operations to be more sustainable and reduce costs. Water use in manufacturing facilities in Georgia can and will change as product lines change in response to market conditions.

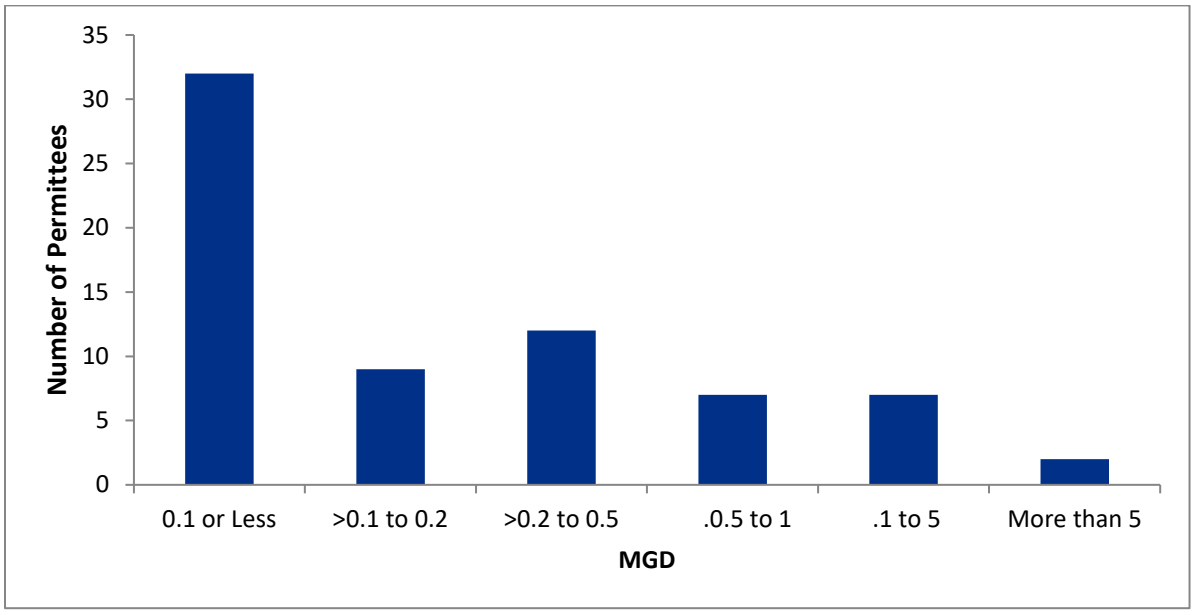

Figure 4. Range of Annual Average Water Withdrawals by Manufacturing Sector Permittees
(*Source: Georgia EPD permitted withdrawals*)

Estimating Future Water Demand for the Manufacturing Industry in Georgia

The manufacturing sub-sector advisory group discussed various considerations for future water demand. Conclusions reached by the sub-group included:

- While the planning horizon for the Regional Water Plans extends to the year 2060, it is difficult to predict what the water demand of the manufacturing sector in Georgia will be more than a few years into the future.
- Manufacturing facilities in Georgia frequently change product lines in response to market conditions, therefore water use at any one facility may change at any time.
- The market demand for manufactured products is likely to increase in the near future, yet operations may reduce water use per product with further recycling and water use efficiency.
- Manufacturers that are heavily reliant on water as part of their production process understand the value of protecting their water resources.
- While the Georgia Department of Economic Development (GDED) and others work to attract new manufacturers to Georgia, such as aerospace and automobile assembly facilities, it is difficult to predict when and where such development will occur. Water availability is just one of many factors that businesses consider in deciding where to locate.
- The Georgia Association of Manufacturers surveyed its larger water-using members. Most respondents indicated no plans to increase water use in the next 5 to 10 years. Those

anticipating an increase in production or number of facilities also anticipated water-use efficiency to offset any increase in water use.

- For the current Regional Water Plan update, it is recommended that water demand for the manufacturing industry remain constant (i.e., zero growth rate) across the state, and reflect the most recent 10-year average (2010 to 2019) water withdrawals by location.
- EPD should re-evaluate water demand for the manufacturing industry in Georgia every 5 to 10 years to adjust for changing conditions.

Given this feedback from the manufacturing sub-sector advisory group, the water demand forecast for facility-level water withdrawals and large municipal water use for manufacturing facilities will remain constant throughout the forecast period. The current 10-year average for each facility is assumed to continue to the year 2060[2].

Groundwater withdrawals have lower permit limits imposed in 2020 and 2025 for permittees in the Red and Yellow Zones of Chatham, Effingham, Bryan, and Liberty Counties in the Coastal Georgia Water Planning Region. These lower permit limits impact one manufacturer in Chatham County with an imposed reduction of 0.01 MGD from its current groundwater demand beginning in 2025. It is assumed that the facility will address the reduction by implementing water conservation and efficiency measures rather than purchasing municipally-supplied water.

Note that information was exchanged between the industrial forecast team and the municipal forecast team to make adjustments in both forecasts for industries that are supplied by municipal water systems. This exchange of information allowed the municipal forecast team to exclude large industrial users from the calculation of municipal water use per capita and the municipal water demand forecast. For the industrial forecast team this exchange of information allowed municipally-supplied industrial water users to be accounted for in the industrial water demand forecast. Through this exchange of information, it was learned that the Macon Water Authority in Bibb County anticipates large manufacturing use to increase from 0.94 MGD to 1.28 MGD in 2060.

The current 10-year annual average water withdrawals by planning region and county are summarized in **Table 1** for those permittees still active in 2019. For the majority of facilities, the 10-year average water withdrawals from 2010 to 2019 is used as the basis for the projected water use. In some instances, such as data obtained through trade association surveys, the basis of the forecast of water demand by county may be a 5-year average from 2015 to 2019 or may be limited to 2019 reported water use.

[2] Apart from the manufacturing sub-sector advisory group's input, the Macon Water Authority in Bibb County indicated that it anticipates manufacturing use supplied by its system to increase from 0.94 MGD to 1.28 MGD in 2060. That information has been factored into this forecast.

Also shown are the withdrawals by source, either surface water (SW), groundwater (GW), or municipal water supply (MW). Statewide, 39 percent of manufacturing water use is from groundwater, 45 percent is from surface water, and 17 percent is purchased from municipal water supply systems. The allocation of water demand by source is assumed to remain the same throughout the forecast period within each county.

Table 1. Manufacturing: 10-year Average Reported Withdrawals by Source

Planning Region	County	GW (MGD)	SW (MGD)	MW (MGD)	Total MGD
Altamaha	Jeff Davis	0.08			0.08
	Telfair	0.06			0.06
	Wilcox	0.02			0.02
	Total	0.16			0.16
Coastal Georgia	Chatham[3]	2.53	6.36	0.47	9.36
	Glynn	5.69			5.69
	Liberty			0.35	0.35
	Total	8.21	6.36	0.82	15.39
Coosa - North Georgia	Chattooga		4.84		4.84
	Gordon	0.02			0.02
	Polk	1.66		1.20	2.86
	Walker		0.60		0.60
	Whitfield			3.20	3.20
	Total	1.68	5.44	4.40	11.52
Lower Flint - Ochlockonee	Decatur	0.11			0.11
	Dougherty	2.37			2.37
	Early	0.31			0.31
	Mitchell	0.92			0.92
	Thomas	0.18			0.18
	Total	3.89			3.89
Middle Chattahoochee	Carroll		0.01	0.21	0.23
	Troup			0.76	0.76
	Total		0.01	0.97	0.99
Middle Ocmulgee	Bibb	1.24		0.94	2.18
	Jasper		0.34		0.34
	Total	1.24	0.34	0.94	2.52

[3] Groundwater withdrawals in Chatham County are reduced by 0.01 MGD in 2025 by Red Zone limits.

Planning Region	County	GW (MGD)	SW (MGD)	MW (MGD)	Total MGD
Savannah - Upper Ogeechee	Columbia	0.02			0.02
	Rabun	0.09		0.37	0.46
	Richmond	1.01	9.51	0.33	10.84
	Screven	1.46			1.46
	Total	2.58	9.51	0.70	12.78
Suwannee - Satilla	Atkinson	0.04			0.04
	Bacon	0.20			0.20
	Charlton	0.07			0.07
	Clinch	0.04			0.04
	Coffee	0.17			0.17
	Lowndes	0.53			0.53
	Ware	0.12			0.12
	Total	1.17			1.17
Upper Flint	Sumter	0.08			0.08
	Upson		0.30		0.30
	Total	0.08	0.30		0.37
Upper Oconee	Baldwin			0.35	0.35
Total		**19.00**	**21.95**	**8.18**	**49.14**

Source: Georgia EPD permitted withdrawals.
Note that demand shown as 0.00 may be less than 0.005 MGD
*Macon Water Authority in Bibb County anticipates large manufacturing use to increase from 0.94 MGD to 1.28 MGD in 2060.

Estimating Future Water Discharges for the Manufacturing Industry in Georgia

For some industrial facilities, water discharges may include stormwater runoff as well as the discharge of wastewater. Thus, permitted discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. It is important to note, however, that the Regional Water Planning water resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, for this water demand forecasting analysis it is assumed that water discharges do not exceed water withdrawals at each facility.

Reported discharge data from 2015–2019, available from EPD, are used to derive the 5-year annual average discharges for manufacturing facilities with EPD water withdrawal permits. **Table 2** lists the 5-year annual average discharges from manufacturing facilities by planning region and county. Note that discharges by an individual permittee may be limited to the withdrawal amount for that permittee. As with the water demand forecast, the water discharges for the manufacturing industries in Georgia are assumed to be constant over the forecast period.

Overall, most (95 percent) of manufacturing water discharges are direct permitted discharges to streams, rivers or other surface water bodies. The percentage of discharges that are direct, LAS and municipal are held constant for each county.

Table 2. Manufacturing 5-year Average Reported Discharges by County

Planning Region	County	Annual Average Water Discharge in MGD			
		Direct	Land	Municipal	Total
Coastal Georgia	Chatham	4.51			4.51
	Glynn	5.55			5.55
	Liberty	0.16			0.16
	Total	10.22			10.22
Coosa - North Georgia	Chattooga	4.66			4.66
	Gordon	0.15			0.15
	Habersham	0.10			0.10
	Polk	1.68			1.68
	Walker	0.07			0.07
	Whitfield	0.14			0.14
	Total	6.79			6.79
Lower Flint - Ochlockonee	Decatur	0.01			0.01
	Dougherty	1.10			1.10
	Early	0.31			0.31
	Mitchell	0.17			0.17
	Thomas	0.13			0.13
	Total	1.72			1.72
Middle Chattahoochee	Carroll	0.01			0.01
	Troup	0.03			0.03
	Total	0.04			0.04
Middle Ocmulgee	Bibb	1.24		0.70	1.94
Savannah - Upper Ogeechee	Richmond	2.53			2.53
	Screven	1.46			1.46
	Stephens	0.03			0.03
	Total	4.02			4.02
Suwannee - Satilla	Atkinson	0.04			0.04
	Bacon	0.15			0.15
	Ben Hill	0.07			0.07
	Charlton	0.05			0.05
	Lowndes	0.28			0.28
	Total	0.59			0.59
Upper Flint	Crisp	0.00			0.00
	Pike		0.29		0.29
	Upson		0.30		0.30
	Total	0.00	0.59		0.59
Total		**24.63**	**0.59**	**0.70**	**25.86**

Source: Georgia EPD permitted discharges.
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Summary

Water withdrawals for manufacturing facilities in the 10 planning regions represent nine percent of the total industrial water withdrawals. Surface water sources provide 40 percent of manufacturing water use, groundwater provides 44 percent, and municipal supply provides 16 percent.

A stakeholder advisory group of manufacturing representatives was convened to discuss recent trends in water use by the industry and a reasonable approach to estimating future water withdrawals by the industry across the state. The Georgia Association of Manufacturers conducted a survey of its largest water-using members. Given feedback from the manufacturing advisory sub-group, the water demand forecast for water withdrawals by manufacturing facilities will remain constant at the current 10-year average for each facility throughout the forecast period. Thus, the 10-year annual average water withdrawals by planning region and county, and by source, either surface water or groundwater, are assumed to remain constant throughout the forecast period. Similarly, water discharges from permitted manufacturers are assumed to remain constant by county.

References

Ellis, M., Energetics, Incorporated, S. Dillich, U.S. Department of Energy-Office of Industrial Technologies, and N. Margolis, Energetics, Incorporated. *Industrial Water Use and its Energy Implications,* ACEEE, 2001.
https://www.aceee.org/files/proceedings/2001/data/papers/SS01_Panel1_Paper03.pdf

List of the Industrial Stakeholder Advisory Group for Manufacturing Sub-Sector Advisory Group

- Clay Jones, Georgia Association of Manufacturers
- Jeremy Lawrence, Gerdau Steel
- Lee Slusher, Milliken
- Rebecca Bolden, Mohawk Industries
- Shanon Seals, Toyo Tires
- Shellee Pyron, Kia Motors Manufacturing
- Chip Wildes, SAFT America
- Wes Robinson, Georgia Chemistry Council
- Ashley Morris Varnum, GA Dept of Economic Development

This page intentionally left blank.

Appendix E

Water Demand Forecast for the Food Processing Sub-Sector in Georgia

Memorandum

To: *Georgia Regional Water Planning Industrial Stakeholders – Food Processing Sub-Sector*

cc: *Jennifer Welte, Georgia Environmental Protection Division (EPD)*

From: *CDM Smith*

Date: *December 22, 2020*[1]

Subject: *Water Demand Forecast for Industrial Food Processing Sector in Georgia*

This technical memorandum presents the preliminary water demand forecast for the food processing sector of the industrial water demand forecast for Georgia's Regional Water Planning process.

Introduction and Background

An industrial sector water demand forecast was initially developed for the 2011 Regional Water Plans (RWPs) by the individual Regional Water Planning Councils through the support of the Georgia Environmental Protection Division (EPD). The water demand forecast was based upon 2005 EPD groundwater and surface water permit data for industrial permittees in the state, as compiled in a 2005 USGS report on water use in Georgia. Reported water withdrawals were aggregated by county and North American Industry Classification System (NAICS) code. Industrial water discharges were also identified by county and NAICS code from EPD discharge permit data. At the time, the future industrial water withdrawals and discharges by county and NAICS code were estimated based upon statewide projected growth rates of future employment by NAICS code. When the Regional Water Plans were subsequently updated in 2017, the water demand forecast for the industrial sector was not updated.

This statewide effort to estimate future industrial water demand is based on direct input from industry leaders across the state and unlike the 2011 industrial forecast does not rely upon industrial employment projections. This updated forecast does not include future industrial growth and increasing water demand except where recommended by industry leaders.

EPD will re-evaluate water demands for industry in Georgia every 5–10 years to adjust for changing conditions. This 2020 update of industrial water demand for Georgia does not address potential economic growth for which the timing, location and water requirements are currently unknown.

[1] Revised May 31, 2022

However, the individual Regional Water Planning Councils may choose to develop an alternative management scenario if there is local knowledge of planned industrial growth.

In early 2020, EPD identified industrial representatives throughout the State of Georgia to form an industrial water demand forecast stakeholder advisory group consisting of representatives from the state's thirteen largest industrial water use sectors. The first meeting of the industrial advisory group was held on June 3, 2020. A consensus of the advisory group was that employment projections were not a valid basis for estimating the future water requirements of industries. Industrial water requirements are a function of production, and automation has reduced the number of employees per unit of production and has changed the relationship between employment and water use. In addition, most industries have modified production technology to maximize water use efficiency to reduce costs while minimizing the environmental impacts of production.

Figure 1 illustrates statewide industrial employment, industrial gross domestic product (GDP), and permitted industrial water withdrawals from 2000 to 2018. The average monthly employment for each year (blue columns) reflects the impact of the Great Recession on industrial employment from 2008 to 2010, with a steady increase in employment since 2010 that has yet to reach the pre-recession levels. Industrial GDP in real dollars (green line) is similar to the employment trend with a decrease from 2007 to 2009 followed by a steady increase that surpasses the pre-recession level. Conversely, reported industrial water withdrawals (red line) show a steady decline from 2006 to 2018. Thus, as statewide industrial employment and productivity have increased since 2010, industrial water withdrawals have continued to decline, suggesting greater water use efficiency and an inverse relationship with employment.

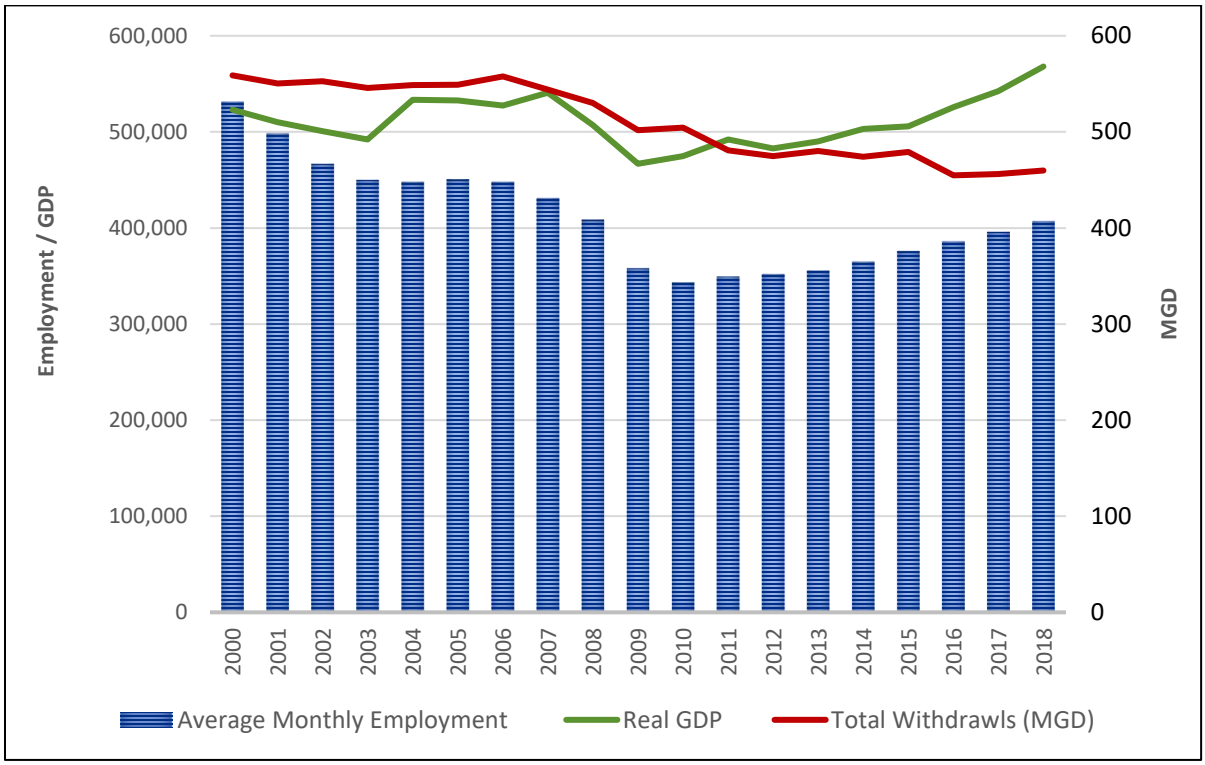

Figure 1. Industrial Employment, GDP, and Water Withdrawals in Georgia from 2000 to 2018
(*Sources: Georgia Dept of Labor, U.S. Bureau of Economic Activity, and EPD permitted withdrawals*)

The industrial advisory group recommended the formation of separate industrial sub-sector groups to examine trends in water use for the following sub-sectors in Georgia: food processing; paper and forest products; mining; and manufacturing. A separate advisory group was convened for each of these four sub-sectors. The sub-sector advisory groups worked concurrently to identify and gain consensus on the most reasonable approach for estimating future water withdrawals for their respective sectors. **Appendix A** lists the participants of the food processing sub-sector advisory group and their industry affiliation.

Trends in Food processing in Georgia

In Georgia, food processing accounts for approximately 2 percent of permitted industrial water withdrawals over the last 10 years. The 10-year average annual permitted withdrawals for paper and forest products, food processing, manufacturing, and mining are illustrated on **Figure 2**.

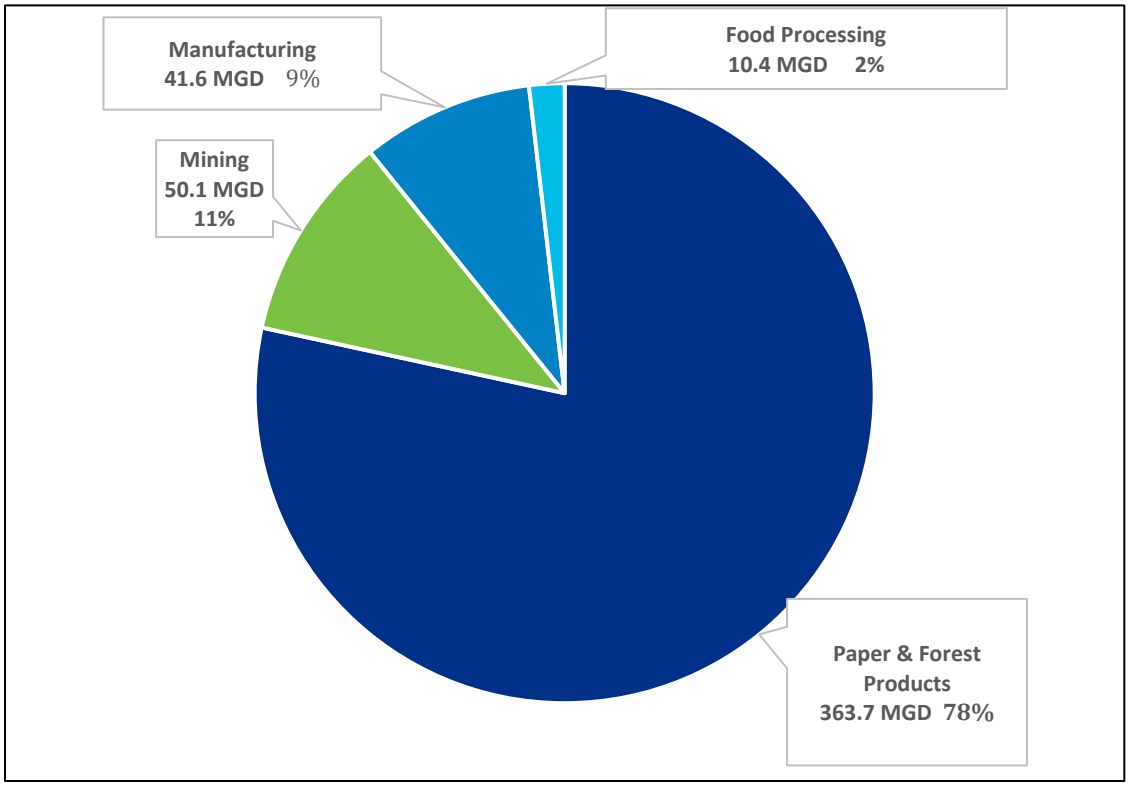

Figure 2. 10-Year Average Annual Permitted Industrial Water Withdrawals (MGD) in Georgia from 2010 to 2019

Source: EPD permitted withdrawals

Figure 3 shows the total annual average water withdrawals from 2010 to 2019 for permittees that are in the food processing sector and are not served by a municipal water supply. Also shown on Figure 3 is the number of reporting permittees per year. The total volume of water withdrawn has varied over the 10-year period as has the number of reporting permittees. Note that the food processing facilities with water withdrawal permits represent only a portion of food processors in Georgia as many food processors are on municipal water supply. All food processors with withdrawal permits use groundwater as the source of water.

Average annual water use among the reporting permittees ranges from 0.001 million gallons per day (MGD) to 2.9 MGD with an average of 0.54 MGD. Note that these permittees include a pork processor, two rendering facilities, two seafood processors and a sugar refinery. The remainder of the permittees are poultry processors.

There are many poultry processors throughout the state that are served by municipal water supply. To support the forecasting effort, the Georgia Poultry Federation conducted a survey of its members regarding water use, water sources and water discharges. The survey found that poultry processors use an annual average of 19.5 MGD of municipally-supplied water across the state.

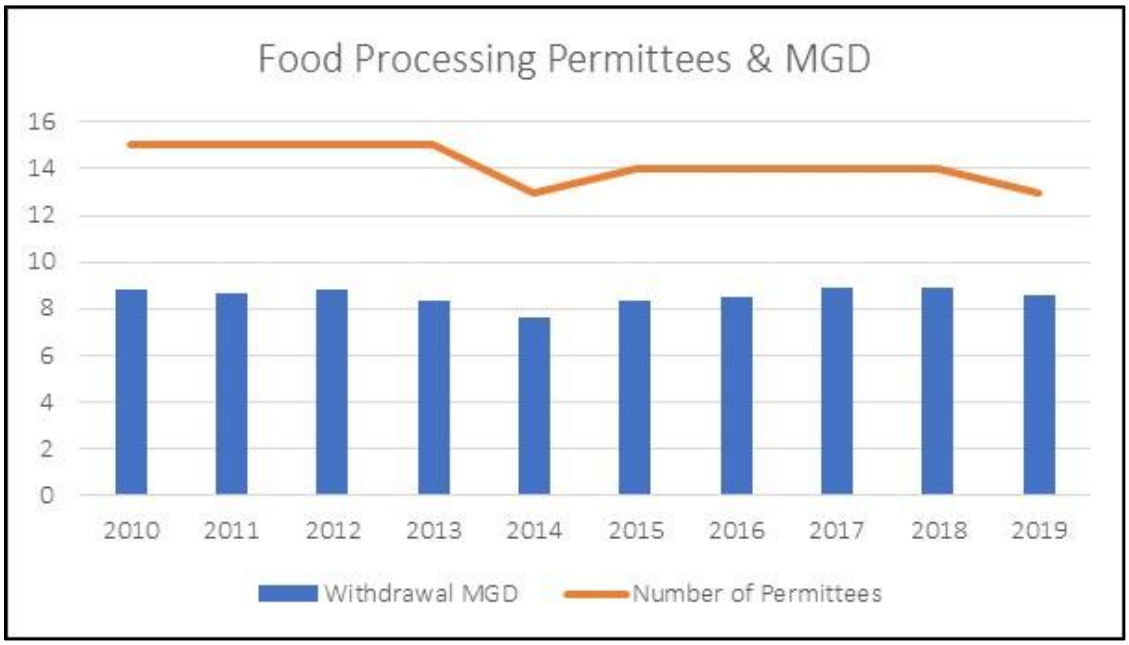

Figure 3. Annual Water Withdrawals by Food processing Sector Permittees from 2010 to 2019
(*Sources: Georgia EPD permitted withdrawals*)

Estimating Future Water Demand for the Food processing Industry in Georgia

The food processing sub-sector advisory group discussed various considerations for future water demand. Conclusions reached by the group included:

- While the planning horizon for the Regional Water Plans extends to the year 2060, it is difficult to predict what the water demand for food processing in Georgia will be more than a few years into the future.
- A growth in poultry processing and water use is anticipated.
- The majority of poultry producers desire to reduce water use. However, there are USDA minimum requirements for water use in poultry processing that must be met.
- The survey of members of the Georgia Poultry Federation resulted in the following guidelines for estimating future water use among poultry processors:
    - Growth rates provided by survey responses regarding projected increases in water use for the next 5 to 10 years were applied to county-level 2019 water use to project respective county-level water demand to the year 2025.
    - From 2025 to 2040, a 2 percent industry average annual growth in water use is anticipated.

- After 2040, it is anticipated that water-saving technologies and strategies are likely to be implemented at poultry processing facilities that will offset higher growth in water use. From 2040 to 2050, a 1 percent annual growth rate in water use is anticipated. From 2050 – 2060, a 0.5 percent annual growth rate for water use is assumed.

- EPD should re-evaluate water demand for the food processing industry in Georgia every 5 to 10 years to adjust for changing conditions.

The current 10-year average water demand for food processing is summarized in **Table 1** by planning region and county. Also shown is the water use by source, either groundwater (GW) or municipal water supply (MW). None of the food processing facilities were identified as using surface water unless it had gone through a municipal treatment process. Statewide, 59 percent of food processing water use is provided by municipal systems and 41 percent is served through groundwater sources. The allocation of water demand by source is assumed to remain the same throughout the forecast period within each county.

Note that information was exchanged between the industrial forecast team and the municipal forecast team to make adjustments in both forecasts for industries that are supplied by municipal water systems. This exchange of information allowed the municipal forecast team to exclude large industrial users from the calculation of municipal water use per capita and from the municipal water demand forecast. For the industrial forecast team this exchange of information allowed municipally-supplied industrial water users to be accounted for in the industrial water demand forecast.

Table 1. Food Processing: Average Annual Water Use by Planning Region, County and Source in MGD

Planning Region	County	GW MGD	MW MGD	Total MGD
Altamaha	Emanuel	0.76		0.76
	Evans	1.64		1.64
	Total	2.40		2.40
Coastal Georgia	Chatham	0.55	0.87	1.42
	Glynn	0.27		0.27
	Total	0.82	0.87	1.69
Coosa - North Georgia	Gilmer		0.97	0.97
	Habersham		1.44	1.44
	Polk		0.35	0.35
	Total		2.76	2.76
Lower Flint - Ochlockonee	Colquitt	1.17		1.17
	Mitchell		1.68	1.68
	Total	1.17	1.68	2.85

Planning Region	County	GW MGD	MW MGD	Total MGD
Middle Chattahoochee	Carroll		0.90	0.90
	Harris		0.80	0.80
	Randolph	0.16		0.16
	Total	0.16	1.70	1.86
Middle Ocmulgee	Houston	2.70		2.70
Savannah - Upper Ogeechee	Elbert		0.16	0.16
Suwannee - Satilla	Bacon	0.15		0.15
	Coffee		1.18	1.18
	Total	0.15	1.18	1.33
Upper Flint	Dooly		1.20	1.20
	Marion		0.70	0.70
	Total		1.90	1.90
Upper Oconee	Barrow	0.42	0.32	0.73
	Clarke		1.29	1.29
	Jackson	0.52	0.01	0.54
	Total	0.94	1.61	2.56
Total:		**8.35**	**11.86**	**20.21**

Sources: Georgia EPD permitted withdrawals and Georgia Poultry Federation data.
Note that demand shown as 0.00 may be less than 0.005 MGD.

The guidelines for growth in poultry processing from the food processing sub-sector advisory group are applied to the water demand forecast for poultry processing facilities by county. Water demands for the remaining food processing facilities (pork, seafood, and sugar) remain constant at the 10-year average water withdrawal from 2010 to 2019 throughout the forecast period. **Table 2** summarizes the water demand forecast for food processors by planning region and county. The growth in water demand varies by county. The growth in water demand for poultry processing derived from the Georgia Poultry Federation survey was applied by county for 2020 to 2040. Thus, each of these counties has a unique initial growth rate. The 2020 estimated water demand is higher than the 2010 to 2019 10-year average county average by almost 4 percent for poultry processing counties as water use has increased in recent years. Counties with only non-poultry food processing are assumed to have no growth. Overall, the water demand for food processing across the 10 planning regions increases at a rate of 12 percent per year from 2020 to 2060.

Table 2. Food Processing Water Demand Forecast by Planning Region and County in MGD

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Altamaha	Emanuel	1.06	1.29	1.56	1.71	1.80
	Evans	1.74	2.13	2.57	2.82	2.96
	Total	2.80	3.42	4.12	4.53	4.76
Coastal Georgia	Chatham	1.42	1.42	1.42	1.42	1.42
	Glynn	0.27	0.27	0.27	0.27	0.27
	Total	1.69	1.69	1.69	1.69	1.69

Planning Region	County	2020 MGD	2030 MGD	2040 MGD	2050 MGD	2060 MGD
Coosa - North Georgia	Gilmer	1.01	1.08	1.30	1.43	1.50
	Habersham	1.61	1.96	2.37	2.60	2.74
	Polk	0.32	0.39	0.47	0.52	0.55
	Total	2.94	3.43	4.14	4.55	4.79
Lower Flint - Ochlockonee	Colquitt	1.32	1.61	1.94	2.13	2.24
	Mitchell	1.67	2.04	2.46	2.70	2.84
	Total	2.99	3.64	4.40	4.84	5.08
Middle Chattahoochee	Carroll	0.87	0.90	1.09	1.20	1.26
	Harris	0.81	0.98	1.19	1.31	1.37
	Randolph	0.16	0.16	0.16	0.16	0.16
	Total	1.84	2.05	2.44	2.67	2.80
Middle Ocmulgee	Houston	2.19	2.67	3.22	3.54	3.72
Savannah - Upper Ogeechee	Elbert	0.16	0.20	0.24	0.26	0.27
Suwannee - Satilla	Bacon	0.15	0.15	0.15	0.15	0.15
	Coffee	1.30	1.52	1.84	2.02	2.13
	Total	1.45	1.67	1.99	2.17	2.28
Upper Flint	Dooly	1.42	1.47	1.78	1.95	2.05
	Marion	0.70	0.70	0.70	0.70	0.70
	Total	2.12	2.17	2.48	2.65	2.75
Upper Oconee	Barrow	0.65	1.03	1.24	1.36	1.43
	Clarke	1.39	1.70	2.05	2.26	2.37
	Jackson	0.57	0.83	1.00	1.10	1.16
	Total	2.61	3.56	4.30	4.72	4.96
Total		**20.80**	**24.50**	**29.02**	**31.62**	**33.11**

Sources: Georgia EPD permitted withdrawals and Georgia Poultry Federation data.
Note that demand shown as 0.00 may be less than 0.005 MGD.

Estimating Future Water Discharges for the Food Processing Industry in Georgia

For some food processing facilities, water discharges may include stormwater runoff as well as the discharge of wastewater. Thus, permitted discharges may be a greater volume than permitted withdrawals, and reported discharges may vary with weather conditions from year to year. It is important to note, however, that the Regional Water Planning water resource assessment modeling process otherwise accounts for stormwater runoff through the incorporation of rainfall events. Thus, for this analysis it is assumed that water discharges do not exceed water withdrawals at each facility.

EPD permitted discharge data from 2015–2019 for food processing facilities and responses to the Georgia Poultry Federation survey are used to derive the 5-year annual average discharges for food processing facilities listed in

Table 3 by planning region and county. Note that discharges by an individual permittee may be limited to the withdrawal amount for that permittee. About one-third of water discharges (32

percent) from food processing facilities are discharged to municipal wastewater treatment facilities, 46 percent are discharged to land application systems, and 22 percent are discharged directly to receiving water bodies after the necessary treatment. The proportion of discharges to municipal systems, land application and direct discharges is assumed to remain the same throughout the forecast period within each county.

The water discharges for the food processing industries are assumed to follow the same growth patterns as the water demand forecast over the forecast period for each county. **Table 4** summarizes the projected water discharges by planning region and county.

Table 3. Food Processing 5-year Average Annual Discharges by County in MGD

Planning Region	County	Wastewater Annual Discharge in MGD			
		Direct	Land	Municipal	Total
Altamaha	Emanuel		0.71		0.71
	Evans		1.64		1.64
	Toombs		0.08		0.08
	Total		2.43		2.43
Coastal Georgia	Chatham	0.59			0.59
	Glynn	0.04			0.04
	McIntosh	0.00			0.00
	Total	0.63			0.63
Coosa - North Georgia	Gilmer			1.01	1.01
	Habersham			1.53	1.53
	Polk			0.27	0.27
	Total			2.82	2.82
Lower Flint - Ochlockonee	Colquitt		1.21		1.21
	Early		0.00		0.00
	Mitchell		1.51		1.51
	Total		2.72		2.72
Middle Chattahoochee	Carroll			0.81	0.81
	Harris	0.73			0.73
	Randolph		0.16		0.16
	Total	0.73	0.16	0.89	1.70
Middle Ocmulgee	Houston	2.80	1.62		4.42
Savannah - Upper Ogeechee	Elbert			0.09	0.09
	Madison	0.01			0.01
	Stephens		0.10		0.10
	Total	0.01	0.10	0.09	0.20
Suwannee - Satilla	Bacon		0.00	0.14	0.14
	Coffee			1.29	1.29
	Echols		0.40		0.40
	Total		0.40	1.43	1.83

Planning Region	County	Wastewater Annual Discharge in MGD			
		Direct	Land	Municipal	Total
Upper Flint	Dooly		1.36		1.36
	Macon		0.00		0.00
	Total		1.36		1.36
Upper Oconee	Barrow		0.43		0.43
	Clarke			1.37	1.37
	Jackson	0.38	0.18		0.56
	Laurens		0.06		0.06
	Total	0.38	0.67	1.37	2.42
Total		**4.55**	**9.45**	**6.51**	**20.51**

Sources: Georgia EPD permitted discharges and Georgia Poultry Federation data.
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Table 4. Forecasted Food Processing Discharges by Planning Region and County in MGD

Planning Region	County	2020	2030	2040	2050	2060
		MGD	MGD	MGD	MGD	MGD
Altamaha	Emanuel	0.71	0.86	1.04	1.14	1.20
	Evans	1.64	2.00	2.41	2.65	2.78
	Toombs	0.08	0.08	0.08	0.08	0.08
	Total	2.43	2.94	3.53	3.87	4.07
Coastal Georgia	Chatham	0.59	0.59	0.59	0.59	0.59
	Glynn	0.04	0.04	0.04	0.04	0.04
	McIntosh	0.00	0.00	0.00	0.00	0.00
	Total	0.63	0.63	0.63	0.63	0.63
Coosa - North Georgia	Gilmer	1.01	1.09	1.31	1.44	1.51
	Habersham	1.53	1.87	2.26	2.48	2.61
	Polk	0.27	0.33	0.40	0.44	0.46
	Total	2.82	3.29	3.97	4.36	4.58
Lower Flint - Ochlockonee	Colquitt	1.21	1.47	1.77	1.95	2.05
	Early	0.00	0.01	0.01	0.01	0.01
	Mitchell	1.51	1.84	2.22	2.44	2.56
	Total	2.72	3.31	4.00	4.39	4.62
Middle Chattahoochee	Carroll	0.81	0.85	1.02	1.12	1.18
	Harris	0.73	0.88	1.07	1.17	1.23
	Randolph	0.16	0.16	0.16	0.16	0.16
	Total	1.70	1.89	2.25	2.46	2.58
Middle Ocmulgee	Houston	4.42	5.04	5.74	6.15	6.38

Planning Region	County	2020	2030	2040	2050	2060
		MGD	MGD	MGD	MGD	MGD
Savannah - Upper Ogeechee	Elbert	0.09	0.11	0.13	0.14	0.15
	Madison	0.01	0.01	0.01	0.01	0.01
	Stephens	0.10	0.10	0.10	0.10	0.10
	Total	0.19	0.21	0.24	0.25	0.26
Suwannee - Satilla	Bacon	0.14	0.14	0.14	0.14	0.14
	Coffee	1.29	1.51	1.82	2.00	2.11
	Echols	0.40	0.40	0.40	0.40	0.40
	Total	1.83	2.05	2.36	2.55	2.65
Upper Flint	Dooly	1.36	1.41	1.70	1.87	1.96
	Macon	0.00	0.00	0.00	0.00	0.00
	Total	1.36	1.41	1.70	1.87	1.97
Upper Oconee	Barrow	0.43	0.67	0.81	0.89	0.94
	Clarke	1.37	1.67	2.01	2.21	2.32
	Jackson	0.56	0.82	0.99	1.09	1.15
	Laurens	0.06	0.07	0.09	0.09	0.10
	Total	2.42	3.23	3.90	4.28	4.50
Total		**20.51**	**24.00**	**28.32**	**30.82**	**32.23**

Note that EPD is validating those counties that have discharge permits with no reported discharge.
Note that discharges shown as 0.00 may be less than 0.005 MGD.

Summary

Reported water withdrawals for food processing industries in the 10 planning regions represent about 2 percent of the total permitted industrial water withdrawals. These permitted withdrawals for food processing are from groundwater sources. In addition, 59 percent of the water used in food processing comes from municipal water. About one-third of water discharges (32 percent) from food processing facilities are discharged to municipal water treatment facilities, 46 percent are discharged to land application systems, and 22 percent are discharged directly to receiving water bodies after the necessary treatment. A stakeholder advisory group of food processing industry representatives was convened to discuss recent trends in water use by the industry and a reasonable approach to estimating future water withdrawals by the industry across the state.

A survey was conducted by the Georgia Poultry Federation to inform the stakeholder process and provide guidance for estimating future water demand for poultry processors by county. Water demand for the non-poultry food processors remain steady throughout the forecast period at the current 10-year average for each county. Thus, the water demand by county may be a combination of poultry processors with growth over time and non-poultry processors that remain constant over time. The water demand by source, either municipal water or groundwater is assumed to remain proportional throughout the forecast period.

Water discharges by poultry and non-poultry facilities by county are assumed to follow the corresponding growth rates in water demand for poultry and non-poultry processors by county. Thus, the water discharges remain proportional to the water demand for each county. The proportion of water discharge to municipal systems, land application and direct discharge remains constant over time for each county.

For this analysis, it is assumed that water discharges do not exceed water withdrawals because the Regional Water Planning resource assessment models account for stormwater runoff separately through the incorporation of rainfall events. Thus, for some processing facilities the annual average discharge is capped at the corresponding withdrawal volume.

List of the Industrial Stakeholder Advisory Group for the Food Processing Sub-Sector Advisory Group

- Mike Giles, Georgia Poultry Federation
- Alexander Samoylov, Georgia Tech Research Institute
- Doug Britton, Georgia Tech Research Institute
- Olga Kemenova, Georgia Tech Research Institute

This page intentionally left blank.

CDM Smith®

cdmsmith.com