



Draft Technical Memorandum

Prepared For: Savannah-Upper Ogeechee Water Planning Council and Georgia Environmental Protection Division

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Subject: **Agricultural Water Use Forecasts**
Section 4 Supplemental Document
Savannah-Upper Ogeechee Regional Water Plan

Introduction

The Georgia Comprehensive State-wide Water Management Plan requires development of long-range forecasts of agricultural water demand for 10, 20, 30, and 40-year planning horizons. These forecasts were prepared by the University of Georgia's (UGA) College of Agricultural and Environmental Sciences under contract with Georgia Environmental Protection Division (EPD). This document summarizes the forecasting results for the Savannah-Upper Ogeechee Water Planning Region and supplements Section 4 of the Savannah-Upper Ogeechee Water Development and Conservation Plan (Regional Water Plan). Detailed forecast methodology and data can be found on the following website: <http://www.nespal.org/SIRP/waterinfo/State/AWD/AgWaterDemand.htm>.

For the Savannah-Upper Ogeechee Region, the bulk of existing agricultural water use is located in the southern part of the region in Burke, Jefferson, Jenkins, and Screven counties. Groundwater is the primary source for agricultural irrigation. In 2005, the Savannah-Upper Ogeechee Region withdrew approximately 59 million gallons per day (MGD) for agricultural use based on data provided in "*Water Use in Georgia by County for 2005; and Water-Use Trends, 1980-2005*" (U.S. Geological Survey).

Agricultural Water Demand Forecasts

UGA prepared agricultural water demand forecasts for the entire state in the following categories, by region and by county:

- *Crop Demand:* This category includes irrigation water demand for cover row and orchard crops, as well as vegetable and specialty crops. These crops currently cover more than 95 percent of Georgia's irrigated land.
- *Non-Crop Demand:* This category includes water uses for agricultural practices other than irrigation, such as livestock and other animal-related operations, nurseries, greenhouses, and

golf course irrigation. These operations generally fall below the 100,000 gallons per day (gpd) regulatory threshold and do not require a water withdrawal permit (therefore sometimes termed “non-permitted” demand). (State regulations require that farmers who withdraw more than 100,000 gpd from streams and aquifers obtain a permit from the EPD.)

Crop Demand

Crop demand includes irrigation water demand for major crops and for vegetable and specialty crops. Agricultural irrigation water demand for crop production was projected for the years 2011 (assumed to be equivalent to 2010), 2020, 2030, 2040, and 2050. Three scenarios, including wet, median and dry years were projected to simulate a range of weather conditions. Water withdrawal quantities were estimated based on the projected irrigated area for a crop (in acres) and the predicted monthly irrigation application rate (application depth in inches). The water sources (groundwater or surface water) for future demands are assumed, based on water sources identified in existing permits and the location of the irrigated area.

The current irrigated areas were measured using 2007-2008 aerial imagery; visible irrigated field areas were delineated and labeled by location using standard Geographical Information System (GIS) tools. The proportion of existing irrigated area of each major rotation crop was taken from the 2008 UGA Cooperative Extension Irrigation Survey to ensure that the irrigated crop types were consistent with those observed in 2008. The projected annual growth rate for each crop was based on the arithmetic average of projections from three economics-based models developed by UGA. The models predicted the total production area for each crop based on data gathered in Georgia, the Southeast Region, and the United States. Five major crops, including corn, cotton, peanut, soybean, and pecan, were included in these three models because they make up 85 percent of Georgia's irrigated crop area.

Because there is insufficient long-term water use data for vegetables, specialty crops, and ornamental nurseries, irrigated area for these crops was assumed to remain constant through the planning horizon; the growth rates were assumed to equal the aggregate growth rate of the five major crops.

A range of agricultural irrigation demand scenarios was considered to address the potential climate extremes, including the 10th, 25th, 50th, 75th, and 90th percentiles. The 50th percentile value represents the average rainfall conditions and the median water demand, while the 75th percentile represents the dry-year conditions when higher irrigation demands are expected. For this planning process, the 50th percentile values have been used for the Savannah-Upper Ogeechee Region in Section 4 of the Regional Water Plan. For Groundwater and Surface Water Resource Assessments, both the 50th and 75th percentile values have been evaluated for gap analysis. In addition, UGA developed an estimated monthly irrigation demand distribution to highlight the difference in water needs between growing and non-growing seasons during wet, average, and dry-year conditions. Table 1 summarizes the median-year crop demand forecast for each county.

Table 1: Median-Year Crop Demand for 2010 and 2050 (AAD-MGD)

| County | Groundwater | | Surface Water | | Total | |
|--------------|--------------|--------------|---------------|--------------|--------------|--------------|
| | 2010 | 2050 | 2010 | 2050 | Total 2010 | Total 2050 |
| Banks | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Burke | 11.51 | 12.20 | 3.76 | 3.88 | 15.27 | 16.08 |
| Columbia | 0.08 | 0.09 | 0.06 | 0.06 | 0.14 | 0.15 |
| Elbert | 0.22 | 0.21 | 0.07 | 0.07 | 0.29 | 0.28 |
| Franklin | 0.00 | 0.00 | 0.07 | 0.08 | 0.07 | 0.08 |
| Glascok | 0.00 | 0.00 | 0.03 | 0.04 | 0.03 | 0.04 |
| Hart | 0.21 | 0.24 | 0.54 | 0.58 | 0.75 | 0.82 |
| Jefferson | 8.42 | 8.67 | 3.02 | 3.18 | 11.44 | 11.85 |
| Jenkins | 3.84 | 4.24 | 1.53 | 1.72 | 5.37 | 5.96 |
| Lincoln | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Madison | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| McDuffie | 3.16 | 3.63 | 0.27 | 0.31 | 3.43 | 3.94 |
| Oglethorpe | 0.22 | 0.25 | 0.05 | 0.06 | 0.27 | 0.31 |
| Rabun | 0.01 | 0.02 | 0.00 | 0.00 | 0.01 | 0.02 |
| Richmond | 0.12 | 0.14 | 0.00 | 0.00 | 0.12 | 0.14 |
| Screven | 12.25 | 12.93 | 3.27 | 3.50 | 15.52 | 16.43 |
| Stephens | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Taliaferro | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Warren | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Wilkes | 0.05 | 0.06 | 0.01 | 0.02 | 0.06 | 0.08 |
| Total | 40.09 | 42.68 | 12.68 | 13.50 | 52.77 | 56.18 |

Source: UGA Agricultural Demand Forecasts (April 2010)

Non-Crop Demand

For planning purposes, the non-crop demand includes forecasts for the following:

- Livestock and other animal-related operations;
- Nurseries and greenhouse; and
- Golf course irrigation.

With input from the respective industry associations, EPD developed a “snap shot” of current (at or around 2008) water usage for the three types of non-crop demand listed above; however, future water demand forecasts were not developed because of lack of available data. Table 2 summarizes the total annual average non-crop demand. For the purpose of this plan, the current non-crop demand was assumed to remain constant throughout the 40-year planning horizon.

Table 2 – Estimated Non-Crop Demand for 2010-2050 (AAD-MGD)

| County | Nursery | Golf | Livestock | Total |
|--------------|--------------|-------------|-------------|--------------|
| Banks | 0.15 | 0.00 | 0.58 | 0.74 |
| Burke | 0.20 | 0.00 | 0.69 | 0.89 |
| Columbia | 0.34 | 0.58 | 0.04 | 0.95 |
| Elbert | 0.14 | 0.09 | 0.36 | 0.59 |
| Franklin | 0.05 | 0.21 | 1.23 | 1.50 |
| Glascocock | 0.00 | 0.00 | 0.09 | 0.09 |
| Hart | 1.55 | 0.17 | 1.00 | 2.72 |
| Jefferson | 0.54 | 0.03 | 0.44 | 1.01 |
| Jenkins | 0.00 | 0.00 | 0.15 | 0.15 |
| Lincoln | 0.00 | 0.00 | 0.07 | 0.07 |
| Madison | 0.27 | 0.19 | 0.79 | 1.25 |
| McDuffie | 5.59 | 0.25 | 0.18 | 6.02 |
| Oglethorpe | 0.09 | 0.00 | 1.35 | 1.43 |
| Rabun | 0.70 | 0.21 | 0.06 | 0.96 |
| Richmond | 0.33 | 0.48 | 0.05 | 0.86 |
| Screven | 0.07 | 0.08 | 0.14 | 0.29 |
| Stephens | 0.02 | 1.46 | 0.28 | 1.76 |
| Taliaferro | 0.00 | 0.00 | 0.10 | 0.10 |
| Warren | 0.05 | 0.00 | 0.26 | 0.31 |
| Wilkes | 0.10 | 0.00 | 1.42 | 1.52 |
| Total | 10.21 | 3.75 | 9.26 | 23.21 |

Source: UGA Agricultural Demand Forecasts (April 2010)

Note: Assumed to remain constant at 2008 values through planning period

Table 3 summarizes the six major categories of livestock water use based on best available data gathered by industry associations in 2008.

Table 3: Estimated Livestock Water Use 2010-2050 (AAD-MGD)

| County | Beef | Dairy | Goat/Sheep | Horse | Swine | Poultry | Total |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Banks | 0.165 | 0.000 | 0.010 | 0.013 | 0.025 | 0.367 | 0.581 |
| Burke | 0.184 | 0.495 | 0.003 | 0.002 | 0.001 | 0.000 | 0.686 |
| Columbia | 0.025 | 0.009 | 0.001 | 0.004 | 0.000 | 0.000 | 0.039 |
| Elbert | 0.169 | 0.024 | 0.003 | 0.005 | 0.000 | 0.155 | 0.355 |
| Franklin | 0.225 | 0.000 | 0.002 | 0.005 | 0.001 | 0.997 | 1.230 |
| Glascock | 0.078 | 0.000 | 0.002 | 0.005 | 0.004 | 0.000 | 0.088 |
| Hart | 0.306 | 0.113 | 0.002 | 0.001 | 0.000 | 0.577 | 1.000 |
| Jefferson | 0.076 | 0.361 | 0.002 | 0.001 | 0.000 | 0.000 | 0.440 |
| Jenkins | 0.067 | 0.069 | 0.001 | 0.000 | 0.008 | 0.000 | 0.146 |
| Lincoln | 0.063 | 0.000 | 0.002 | 0.004 | 0.000 | 0.000 | 0.068 |
| Madison | 0.291 | 0.020 | 0.006 | 0.008 | 0.004 | 0.462 | 0.792 |
| McDuffie | 0.082 | 0.079 | 0.001 | 0.013 | 0.000 | 0.000 | 0.175 |
| Oglethorpe | 0.244 | 0.204 | 0.002 | 0.002 | 0.375 | 0.518 | 1.345 |
| Rabun | 0.033 | 0.000 | 0.001 | 0.001 | 0.000 | 0.020 | 0.055 |
| Richmond | 0.043 | 0.000 | 0.001 | 0.004 | 0.000 | 0.000 | 0.049 |
| Screven | 0.120 | 0.015 | 0.006 | 0.002 | 0.001 | 0.000 | 0.144 |
| Stephens | 0.193 | 0.000 | 0.002 | 0.002 | 0.001 | 0.077 | 0.276 |
| Taliaferro | 0.000 | 0.103 | 0.000 | 0.000 | 0.000 | 0.000 | 0.103 |
| Warren | 0.117 | 0.107 | 0.006 | 0.018 | 0.015 | 0.000 | 0.263 |
| Wilkes | 0.307 | 0.298 | 0.000 | 0.002 | 0.720 | 0.089 | 1.416 |
| Total | 2.789 | 1.898 | 0.054 | 0.093 | 1.154 | 3.264 | 9.251 |

Source: UGA Agricultural Demand Forecasts (Nov 2009)

Note: Assumed to remain constant at 2008 values through planning period

Summary

Total agricultural demand for the planning period is summarized in Table 4. For the Savannah-Upper Ogeechee Region, crop irrigation in the southern part of the region will continue to be a significant water use. In 2050, it is projected that 71 percent of the agricultural water demand will be used for crop irrigation and 29 percent for other non-crop agricultural practices. Burke, Jefferson, Jenkins and Screven counties have the highest crop irrigation water demand. Non-crop demand represents the majority of agricultural water demand in the following counties in the northern and central parts of the region: Banks, Columbia, Elbert, Franklin, Glascock, Hart, Lincoln, McDuffie, Madison, Oglethorpe, Rabun, Richmond, Stephens, Taliaferro, Warren and Wilkes. Note that the non-crop demands may be the majority of agricultural water demand in these counties but may represent minimal water demands.

Table 4: Agricultural Water Forecasts by County (in AAD-MGD)

| County | Median-Year Crop Demand | | | | | Non-Crop Demand |
|--------------|-------------------------|--------------|--------------|--------------|--------------|-----------------|
| | 2010 | 2020 | 2030 | 2040 | 2050 | 2010-2050 |
| Banks | 0 | 0 | 0 | 0 | 0 | 0.74 |
| Burke | 15.27 | 15.39 | 15.59 | 15.82 | 16.08 | 0.89 |
| Columbia | 0.14 | 0.14 | 0.15 | 0.15 | 0.15 | 0.95 |
| Elbert | 0.29 | 0.29 | 0.29 | 0.29 | 0.28 | 0.59 |
| Franklin | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 1.50 |
| Glascocock | 0.03 | 0.03 | 0.04 | 0.04 | 0.04 | 0.09 |
| Hart | 0.75 | 0.76 | 0.78 | 0.8 | 0.82 | 2.72 |
| Jefferson | 11.44 | 11.49 | 11.6 | 11.72 | 11.85 | 1.01 |
| Jenkins | 5.37 | 5.48 | 5.62 | 5.78 | 5.96 | 0.15 |
| Lincoln | 0 | 0 | 0 | 0 | 0 | 0.07 |
| McDuffie | 0 | 0 | 0 | 0 | 0 | 1.25 |
| Madison | 3.43 | 3.53 | 3.65 | 3.79 | 3.94 | 6.02 |
| Oglethorpe | 0.27 | 0.28 | 0.29 | 0.3 | 0.31 | 1.43 |
| Rabun | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.96 |
| Richmond | 0.12 | 0.13 | 0.13 | 0.13 | 0.14 | 0.86 |
| Screven | 15.52 | 15.66 | 15.9 | 16.15 | 16.43 | 0.29 |
| Stephens | 0 | 0 | 0 | 0 | 0 | 1.76 |
| Taliaferro | 0 | 0 | 0 | 0 | 0 | 0.10 |
| Warren | 0 | 0 | 0 | 0 | 0 | 0.31 |
| Wilkes | 0.06 | 0.07 | 0.07 | 0.07 | 0.08 | 1.52 |
| Total | 52.77 | 53.33 | 54.19 | 55.13 | 56.18 | 23.21 |

Source: UGA Agricultural Demand Forecasts (April 2010)