

Georgia Environmental Protection Division
Upper Flint Council
Water Conservation Technical Memorandum

Section 1 – Introduction

The regional water planning councils were charged with incorporating management practices that included and promoted water conservation into their Regional Water Plans (Section 6). This technical memorandum describes the water conservation practices selected by the Council. Where data were available and reasonable assumptions could be made, anticipated water savings associated with the selected practices were quantified and are presented herein. Recognizing the challenge of selecting meaningful and measurable management practices; the Council also included recommendations to the state (Section 7) to collect better baseline water use data, to determine water conservation techniques already in use throughout the region, and to perform detailed analysis on water resources gaps on the basis of ecological and other scientific investigations.

To assist the Council's in selecting water conservation management practices appropriate for the region, the Georgia Environmental Protection Division (EPD) provided planning guidance. A detailed water conservation guidance document is available on the State Water Plan website.¹ The planning guidance categorizes conservation practices in the following categories:

Tier ONE: Basic water conservation activities and practices that are currently required or general mandates that will certainly be included in upcoming amended rules.

Tier TWO: Conservation activities and practices that will be addressed in upcoming amended rules, but for which detailed requirements are uncertain.

Tier THREE: Basic water conservation practices for all water users that may not be addressed in current or upcoming amended rules.

Tier FOUR: Additional water conservation practices that can be considered if a gap exists between current or future water supplies and the demands for the region.

Table 1 shows the current (2005) and forecast future (2050) water withdrawals in the region. Agriculture is the largest water use sector. Much of the Council's discussion focused on this sector, but other sectors were also discussed, and management practices were included in the plan to address all sectors.

¹ http://www.georgiawaterplanning.org/pages/technical_guidance/regional_planning_guidance.php

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| TABLE 1: Current Withdrawals in Upper Flint Region For 2005 and 2050 (MGD) | | | | |
|---|------------------------------|----------------------------|------------|---------------------------------|
| | Surface Water (2005, MGD) | Groundwater (2005, MGD) | TOTAL 2005 | TOTAL 2050 Forecast (MGD) |
| Agriculture | 44 | 112 | 156 | 192 |
| Energy Production | - | - | - | - |
| Industry | 12 | 4 | 16 | 30 |
| Municipal Water Supply | 16 | 13 | 29 | 48 |
| TOTAL | 72 | 129 | 201 | 270 |

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Section 2 – Selected Water Conservation Practices

The following table (adapted from Table 6-2) summarizes the demand management practices selected by the Council. Details regarding the selection of these practices are provided in the Management Practice Selection Technical Memorandum.

| Adapted from Table 6-1: Water Management Practices Selected for the Upper Flint Region | |
|---|---|
| Management Practice | Description/Definition of Action |
| DEMAND MANAGEMENT (DM) | |
| Issues Addressed | Surface water availability sustainability criteria; groundwater sustainable yields |
| Gaps Addressed | Surface water modeled shortfalls at Bainbridge (Flint) and Alapaha (Suwannee); groundwater modeled shortfalls in Upper Floridan (Dougherty Plain) and Claiborne |
| Council Goals Addressed | 1, 3, 4, 5, 6 |
| DM1: Improve the agricultural water withdrawal metering program **HIGH PRIORITY** MANAGEMENT PRACTICE | <ul style="list-style-type: none"> The Council recommends continued improvement in the implementation of the agricultural water metering program to ensure that the data collected is as comprehensive, accurate, and useful as possible. The Council recommends additional investment by the state in the metering program to ensure these outcomes. The Council also recommends that the program provide annual reporting to the public on collected data (while recognizing the confidentiality constraints on the use of the data). |
| DM2: Use irrigation suspension only through implementation of the Flint River Drought Protection Act, only by voluntary means, with notification to farmers before March 1 when possible, and only as a last resort when other options are not available to address severe flow depletions **HIGH PRIORITY** MANAGEMENT PRACTICE | <ul style="list-style-type: none"> The Council supports voluntary implementation of the Flint River Drought Protection Act (OCGA §12-5-40) by EPD through an irrigation suspension auction, when absolutely necessary in abnormally dry periods and when other options are not available to address severe flow depletions. When possible, EPD should provide notification of use of the Flint River Drought Protection Act before the March 1 deadline. Earlier notification to farmers would inform planting decisions and help reduce the cost to farmers and to the state for irrigation suspension. The Council acknowledges the need to improve drought prediction tools to support earlier notification and supports EPD efforts to develop better predictive tools. The Flint River Drought Protection Act has not had adequate funding in recent years, and a reliable source of funding is needed to support voluntary suspension. |

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| Adapted from Table 6-1: Water Management Practices Selected for the Upper Flint Region | |
|---|---|
| Management Practice | Description/Definition of Action |
| <i>DM3: Implement Tier 1 and 2 non-farm water conservation practices in the region</i> | Tier 1 and 2 water conservation practices include those required by existing law or anticipated in upcoming state rule-making: <ul style="list-style-type: none"> • Submittal of water conservation plans by withdrawal permittees (DNR Rule 391-3-6-.07 and 391-3-2-.04(11)) • Landscape irrigation limits (4pm to 10am), as required by Water Stewardship Act of 2010, Section 4 (with exemptions) (OCGA §12-5-7) • Even-odd watering restrictions for non-irrigation outdoor water uses (DNR Rule 391-3-30) • Public car wash facility regulations, which require best management practices (DNR Rule 391-31) • Demonstration by water withdrawal permittees of progress toward water conservation goals or water efficiency standards (State Water Plan, Section 8) • International Water Association standards and practices required for drinking water providers (Water Stewardship Act, Section 3, OCGA §12-5-4.1) • Amendment of local building codes to require sub-metering in multi-tenant buildings, installation of high efficiency plumbing fixtures in all new construction, and installation of high-efficiency cooling towers in new construction (Water Stewardship Act, Sections 7, 8, and 9, OCGA §§ 12-5-180.1, 8-2-3, 8-2-23) |
| <i>DM4: Implement Tier 3 and 4 non-farm water conservation practices with the support of incentive programs</i> | <ul style="list-style-type: none"> • Utilize incentive programs to support the use of these practices. |
| <i>DM5: Implement Tier 1 and 2 agricultural water conservation practices in the region</i> | Tier 1 and 2 water conservation practices required by existing law or anticipated in upcoming state rule-making: <ul style="list-style-type: none"> • Implementation of conservation requirements under the Flint River Basin Water Development and Conservation Plan (2006) • Compliance with forthcoming requirement (established by Water Stewardship Act of 2010, OCGA §12-5-31) regarding active, inactive, and unused permits |
| <i>DM6: Implement Tier 3 and 4 agricultural water conservation practices in</i> | <ul style="list-style-type: none"> • Incentive funding is available from the Soil and Water Conservation Districts and the Georgia Soil and Water Conservation Commission. |

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| Adapted from Table 6-1: Water Management Practices Selected for the Upper Flint Region | |
|--|---|
| Management Practice | Description/Definition of Action |
| <i>the region with the support of incentive programs</i> | <ul style="list-style-type: none"> • The Council endorses the following benchmarks for this practice: <ul style="list-style-type: none"> <i>By January 2012, all new, and by January 2020, all existing agricultural irrigation systems will have application efficiencies of 80% or greater.</i> <i>By January 2050, all irrigation systems will have application efficiencies of 90% or greater.</i> <i>By January 2015, 25% of farmers using irrigation on their fields will adopt irrigation scheduling based on crop needs and available water supplies.</i> <i>By January 2020, 50% of farmers using irrigation on their fields will adopt irrigation scheduling based on crop needs and available water supplies.</i> • A focus on a desired performance outcome will support increased conservation while allowing farmers to select what practices and approach will work best for their own operations. • Practices that farmers can use to attain this benchmark include low-pressure/full-drop nozzle irrigation systems, Variable Rate Irrigation, conservation tillage, irrigation scheduling, drip irrigation, as well as other conservation measures not listed here that best suit an individual farmer's operation. |
| <i>DM7: Manage new agricultural water withdrawal permits in the region according to the 2006 Flint River Basin Water Development and Conservation Plan</i> | <p>The 2006 Flint River Basin Water Development and Conservation Plan limits new agricultural withdrawal permits based upon expected impact on nearby wells and streams.² Under the 2006 plan, the following requirements apply to new agricultural water withdrawal permits in the Flint River Basin:</p> <ul style="list-style-type: none"> • New permits require mandatory conservation measures, such as end-gun shut off switches and leak prevention and repair, as a condition of the permit • New surface water permits in Ichawaynochaway and Spring Creek sub-basins must suspend use when streamflow drops below 25% Average Annual Discharge instead of 7Q10 • New permits in the Flint River Basin have a \$250 application fee |

² The 2006 Flint River Basin Water Development and Conservation Plan is available as Supplemental Document 6 on the Upper Flint Council's website: http://www.upperflint.org/pages/our_plan/index.php

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| Adapted from Table 6-1: Water Management Practices Selected for the Upper Flint Region | |
|---|---|
| Management Practice | Description/Definition of Action |
| <i>DM8: Create an awards program to recognize agricultural irrigators for exemplary implementation of best management practices (BMPs) for water conservation</i> | <ul style="list-style-type: none"> • Program to be modeled after Georgia Forestry Commission awards program for BMP implementation. • This program should be coordinated with existing Georgia Soil and Water Conservation Commission programs. |

For agriculture, the process of considering tier 3 and 4 management practices by the Council focused primarily on the ability of agricultural water users to tailor their operations and efforts to local conditions and to be flexible enough to support innovation beyond a list of basic practices. It also included consideration of practices specific to drought periods.

Several of the conservation management practices listed in Table 6-1 have been evaluated to estimate their potential water savings. The practices and the assumptions made to determine estimated savings are detailed below.

Section 3 – Water Savings Estimates

AGRICULTURAL WATER USE (DM1, DM2, DM5, DM6, DM7, DM8)

Estimating water savings for agricultural conservation practices began with an effort to calculate water savings from a basic water conservation package for irrigation. This effort preceded the identification of conservation tiers in the conservation guidance, and therefore, it overlaps the tier thresholds somewhat, but most of this basic package would be considered Tier 3 or 4 practices in agriculture. Existing regulatory requirements for end-gun shut-offs are an exception (i.e., these are a Tier 1 practice).

Irrigators in the region use a mix of surface and ground water which have varying degrees of impact on streamflow depending on location, source and time of the year. The amount of water that can be saved via conservation depends on the suite of practices implemented. As a point of reference, assume a field irrigated with a high pressure, impact sprinkler center pivot. These systems were common in the early days of irrigation and are assumed to be 70-80% efficient. With a full conservation package conversion to low pressure and full drop nozzles, efficiency is estimated to increase to 90-95%. The

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efficiency of an irrigation system is defined as the volume of irrigation water beneficially used/volume of irrigation water applied * 100. Efficiency estimates assume proper irrigation system design and management.³

During a dry August, these efficiency upgrades could save between 0.00027 and 0.00067 cfs per acre for surface water irrigation and between 0.00013 and 0.00032 cfs per acre for ground water.⁴ No concrete data exists on average age or efficiency levels of irrigation systems in Georgia. However, anecdotal evidence from regional irrigation suppliers and county extension agents suggests nearly half of the systems in use today already employ conservation measures in the form of low pressure, partial drop nozzles and end-gun shut-offs.⁵

If additional upgrades in conservation equipment could attain the savings estimated above on 50% of the acres (assuming that half of the systems already employ this equipment), then the following in-stream flow improvements could be attained at Bainbridge with 100% implementation of these measures on agricultural acreage⁶ that affects the Bainbridge node (including agricultural acreage in the Upper Flint, Lower Flint-Ochlockonee, and Middle Chattahoochee region)⁷:

Surface Water:

Lower Bound Estimate:

0.00027 cfs per acre X 141,791 acres X 50% = 19.1 cfs

Upper Bound Estimate:

0.00067 cfs per acre X 141,791 acres X 50% = 47.5 cfs

³ Vickers, A. 2001. *Handbook of water use and conservation: homes, landscapes, businesses, industries, farms*. WaterPlow Press. pg. 333.

⁴ The impact of groundwater withdrawals on surface water flows is estimated at 40% for all withdrawals. The Flint system model used by USGS and Dr. Wei Zeng uses a more precise estimation method that estimates the impact factor based on specific location of the withdrawal. The 40% factor is used here because the location specific factors were not available to us. 40% is the average impact calculated from summary information on groundwater withdrawals and groundwater impact inputs to the model presented by Dr. Zeng at the November 2009 council meetings.

⁵ The Council notes the hindrance created by a lack of baseline information on existing water conservation practices in the region in its plan. In Section 7.4 of the plan, the Council recommends the development of this data in order to support future planning.

⁶ Agricultural acreage affecting the Bainbridge node were provided in summary materials on the surface water availability resource assessment presented at November 2009 meetings of the regional water councils and at January 2010 joint regional water council meetings on the preliminary resource assessment results.

⁷ The Bainbridge node is the focus of this analysis because of the large gap identified by the surface water availability assessment at this node. Per acre savings estimates can be applied elsewhere in region.

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Groundwater:

Lower Bound Estimate:

0.00013 cfs per acre X 211,880 acres X 50% = 13.8 cfs

Upper Bound Estimate:

0.00032 cfs per acre X 211,880 acres⁸ X 50% = 33.9 cfs

Assumptions:

- Current implementation is 50%.
- Implementation increases to 100%.
- Impact of groundwater pumping on surface water is 40%. (See note 6.)

The distribution of agricultural acreage affecting the Bainbridge node is illustrated in Figure 1.⁹

In summary, the benefit from comprehensive implementation of conservation equipment on irrigation systems to streamflow at Bainbridge is estimated to be between 32.9 and 81.4 cfs. This benefit estimate assumes a baseline level of implementation of 50% for both surface water and groundwater supplied irrigation systems.

The Council used this information to determine the benefit of additional conservation practices (beyond baseline implementation) in the region. The Council noted the following important points:

- Implementation of some conservation practices in irrigation is already required under the Flint River Basin Water Development and Conservation Plan (2006) (These are Tier 1 Practices.)
- The new Water Stewardship Act of 2010 (adopted while the Council was working on this plan) will create new requirements regarding active, inactive, and unused permits. (These are Tier 2 Practices.)
- Other conservation practices might be employed to additional benefit, though the level of benefit is generally dependent on factors including topography, crop, soils, etc. For example, variable rate irrigation, conservation tillage,

⁸ Agricultural acreage affecting the Bainbridge node via groundwater withdrawals includes only acres physically located within the boundaries of the node. It is possible that some acres beyond the node affect the flows at Bainbridge, but this effect cannot be determined from available information, and the method used herein should provide a good estimate.

⁹ Note that the map is based on subarea 4 withdrawals. Model inputs are based on a slightly different database, but for illustrative purposes, the map is a good approximation of the distribution of groundwater withdrawals in the region.

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irrigation scheduling, and drip irrigation, can provide water savings benefits. (These are Tier 3 and 4 practices.)

- Incentive funding is available for conservation practices for irrigation from the Soil and Water Conservation Districts and the Georgia Soil and Water Conservation Commission.
- Specifying which practices should be used is not desirable due to variability of conditions. Practices are not one-size-fits-all. A focus on a desired performance outcome will support increased conservation while allowing farmers to select what practices and approach will work best for their own operations.
- Conservation implementation in the region is already widespread; the lack of baseline information is a barrier to better planning.
- Conservation for irrigation will continue to improve in the future as new innovations in technology and management are realized through research and development.
- Agricultural acreage in all three planning regions affects the flows measured at the Bainbridge node.

The Council decided to suggest a benchmark to guide the implementation of Tier 3 and 4 practices for agriculture in the region. This approach was preferred to specifying practices to be adopted for the reasons noted above. The following benchmarks were selected and adapted from Georgia's Water Conservation Implementation Plan¹⁰:

By January 2012, all new, and by January 2020, all existing agricultural irrigation systems will have application efficiencies of 80% or greater.

By January 2050, all irrigation systems will have application efficiencies of 90% or greater.

By January 2015, 25% of farmers using irrigation on their fields will adopt irrigation scheduling based on crop needs and available water supplies.

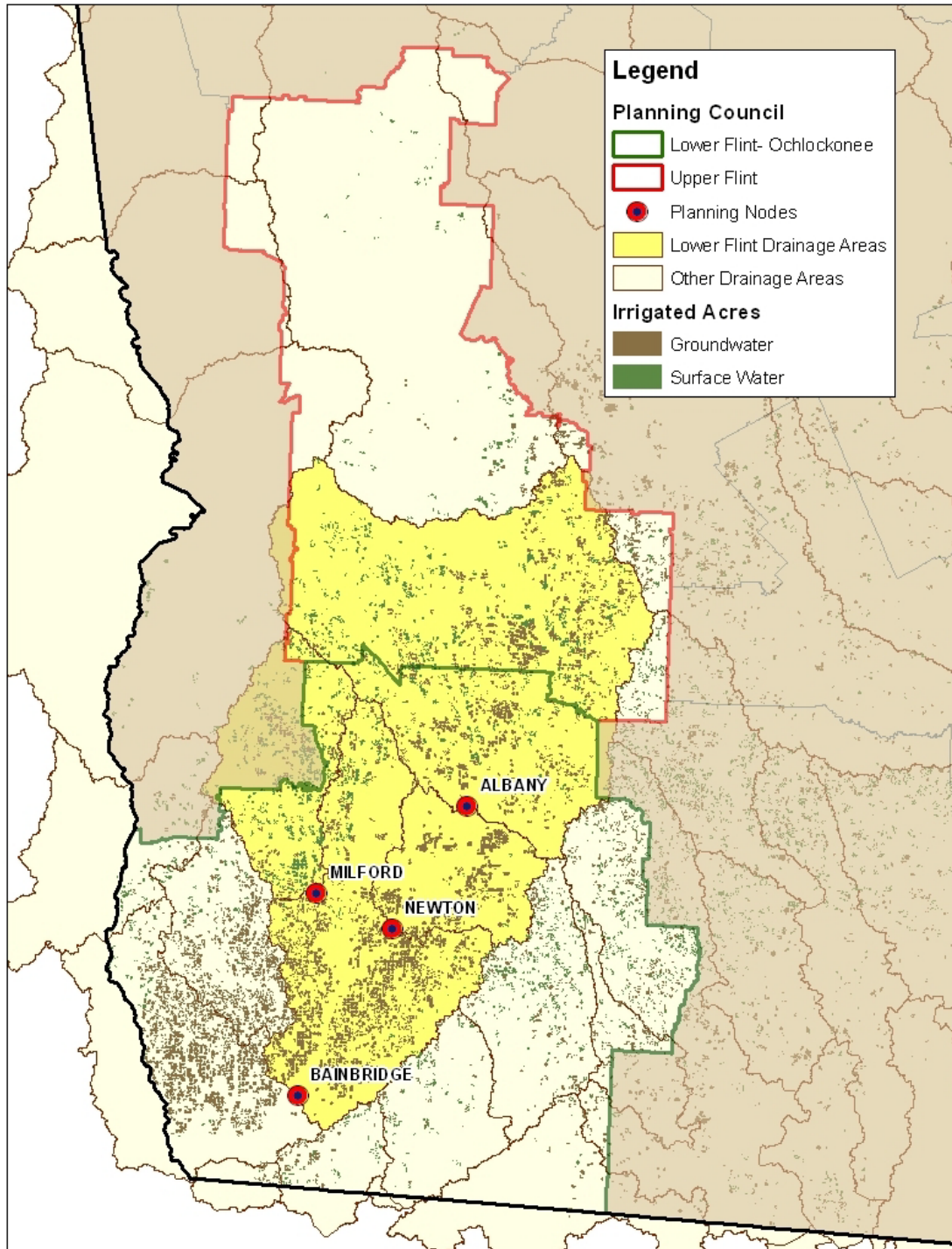
By January 2020, 50% of farmers using irrigation on their fields will adopt irrigation scheduling based on crop needs and available water supplies.

These benchmarks are incorporated into Demand Management practice #6 (DM6) in the regional water plan. Related management practices that developed from this discussion include DM1 (improve agricultural withdrawal metering program), DM5 (Tier 1 and 2 practices for agriculture), DM7 (continued implementation of 2006 Flint Plan), and DM8 (agricultural efficiency awards program).

¹⁰ <http://www.conservewatergeorgia.net/documents/wcip.html>

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Figure 6-1: Irrigated Agricultural Acreage Affecting the Bainbridge Node



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Next, the Council considered drought management practices. It started with consideration of the existing Flint River Drought Protection Act. To understand the potential impact on flow of reduction in irrigation withdrawals during drought, the impact of irrigation suspension on flow at Bainbridge was estimated across a range from 10% to 100% suspension. A broad range was considered to provide an understanding of potential impact. The Council did not advocate for 100% suspension; instead this calculation was made to understand the relative impact on flow as modeled in the resource assessment of various levels of suspension.

The following estimates the average amount of streamflow reduction from an acre of irrigated land in August (the month when agriculture water demand is highest) during a drought year.

Surface water – 0.0027 cfs
 Ground water – 0.0013 cfs¹¹

The tables below (Tables 2 and 3) use these estimates to project potential benefits to streamflow at Bainbridge given various levels of irrigation suspension. Given that the impact estimates are based on assumption of dry-year, August (high agricultural demand) conditions, the projections in the tables are high end estimates of the potential benefit of irrigation suspension.

| Table 2: Surface Water Irrigation Suspension Impacts on Bainbridge Flows, Dry-Year August Estimates | | | |
|--|---|---|--|
| % of Acreage Suspended | Acres Affecting Bainbridge Flows (in LFO & UF regions) | Estimated Impact per Acre Suspended (cfs/acre) | Flow Improvement Estimate (cfs) |
| 10% | 141,791 | 0.0027 | 38.3 |
| 20% | 141,791 | 0.0027 | 76.6 |
| 25% | 141,791 | 0.0027 | 95.7 |
| 50% | 141,791 | 0.0027 | 191.4 |
| 75% | 141,791 | 0.0027 | 287.1 |
| 100% | 141,791 | 0.0027 | 382.8 |

¹¹ Assumptions used to calculate streamflow impact are consistent with those presented by Dr. Wei Zeng at Council Meeting 4. Average use numbers for August, 1.90 acre inches for surface water and 2.25 acre inches for ground water, are consistent with data published by Dr. Jim Hook (UGA, Ag Water Pumping – 2005). In this analysis, it was assumed that only ground water pumping from the Upper Floridan aquifer within Sub Area 4 of the Dougherty Plain had any impact on streamflow. The percentage impact to the stream from ground water pumping varies across the region but was assumed to be 40% for this calculation.

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| Table 3: Groundwater Irrigation Suspension Impacts on Bainbridge Flows, Dry-Year August Estimates | | | |
|--|---|---|--|
| % of Acreage Suspended | Acres Affecting Bainbridge Flows (in LFO & UF regions) | Estimated Impact per Acre Suspended (cfs/acre) | Flow Improvement Estimate (cfs) |
| 10% | 211,880 | 0.0013 | 27.5 |
| 20% | 211,880 | 0.0013 | 55.1 |
| 25% | 211,880 | 0.0013 | 68.9 |
| 50% | 211,880 | 0.0013 | 137.7 |
| 75% | 211,880 | 0.0013 | 206.6 |
| 100% | 211,880 | 0.0013 | 275.4 |

In summary, the benefit to streamflow that could be attained with *complete* irrigation suspension is 658.2 cfs. This benefit estimate assumes 100% suspension of irrigation, which would be a severe policy measure, especially if implemented post-planting. The regional economic impact would be dramatic. Voluntary suspension using the Flint River Drought Protection Act (FRDPA) would have very high public costs. Implementation of the FRDPA in 2001 and 2002 had costs of \$4.5 million and \$5.2 million, respectively. Less than 15% of irrigation was suspended at that time. Recent changes in the FRDPA are expected to increase costs due to new targeting provisions in the revised implementing rules, and as a result, the public costs of voluntary suspension will be substantially higher.¹² Involuntary suspension would create very high levels of financial hardship for agricultural producers and the regional economy. The economic impact of irrigation suspension, voluntary or involuntary, would extend far beyond agricultural producers and have a severe negative impact on the regional economy. The magnitude of this impact should not be understated; it would be devastating to the region.¹³

However, from this analysis, it was clear that addressing the modeled flow shortfall completely, full suspension of irrigation would be required in a dry year, unless augmentation were developed to offset use. This occurs because, with the sustainability target used in the assessment model, consumptive use creates a shortfall in dry periods. The Council questions this evaluation method in its plan. See Sections 6.2 and 7.4 of the plan for further discussion. The Council notes that the sustainability criteria are not clearly associated with any known adverse impacts on the environment or downstream users.

¹² Rule 391-3-28.05(a).

¹³ Litigation over irrigation suspension at this scale might also be an expected outcome.

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The Council does not support drastic suspension of irrigation to completely close flow shortfalls identified by the model, but the Council recognizes that irrigation suspension could be a tool needed to sustain in-stream flows in particularly dry periods. The Council made the following recommendation regarding the use of irrigation suspension:

DM2: Use irrigation suspension only through implementation of the Flint River Drought Protection Act, only by voluntary means, with notification to farmers before March 1 when possible, and only as a last resort when other options are not available to address severe flow depletions

The Council included the following to the description for this management practice:

- The Council supports voluntary implementation of the Flint River Drought Protection Act (OCGA §12-5-40) by EPD through an irrigation suspension auction, when absolutely necessary in abnormally dry periods and when other options are not available to address severe flow depletions.
- When possible, EPD should provide notification of use of the Flint River Drought Protection Act before the March 1 deadline. Earlier notification to farmers would inform planting decisions and help reduce the cost to farmers and to the state for irrigation suspension. The Council acknowledges the need to improve drought prediction tools to support earlier notification and supports EPD efforts to develop better predictive tools.
- The Flint River Drought Protection Act has not had adequate funding in recent years, and a reliable source of funding is needed to support voluntary suspension.

The Council's other high priority demand practice, DM1, was to improve the agricultural water withdrawal metering program. The Council recommends continued improvement in the implementation of the agricultural water metering program to ensure that the data collected is as comprehensive, accurate, and useful as possible. The Council also recommends additional investment by the state in the metering program to ensure these outcomes. The Council also recommends that the program provide annual reporting to the public on collected data (while recognizing the confidentiality constraints on the use of the data).

To address concerns about the implementation of current demand management tools, the Council suggested in DM8 the creation of an awards program to recognize agricultural irrigators for exemplary implementation of best management practices (BMPs) for water conservation. This Program is to be modeled after Georgia Forestry Commission awards

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program for BMP implementation. The Council suggested this program should be coordinated with existing Georgia Soil and Water Conservation Commission programs.

NON-FARM WATER USE

Plumbing code adjustments for replacement of old toilet fixtures with higher efficiency models were embedded within the municipal water forecasts as part of this planning effort (see Supplemental Document 13 - Municipal and Industrial Water and Wastewater Forecasting Memorandum).¹⁴ The Water Stewardship Act, passed after completing the initial round of forecasting, further reduced the flush volume of toilet fixtures from 1.60 gallons per flush to 1.28 gallons per flush on all new and renovation construction after July 1, 2012. The initial plumbing code water efficiency adjustment estimated the effect of the plumbing code requirement due to toilet replacement over the period of 2010-2050. This analysis was further refined taking into account the increased efficiency associated with the Water Stewardship Act.

The steps to estimate the water use reduction due to the plumbing code and the Water Stewardship Act are described below.

Step 1. Estimate the current mix and number of toilets for each county by flush volume based on the US Census Age and number of Housing Units information. An assumed two toilets per household was utilized in the analysis. The estimate for flow volumes was based on the following timeline for different flush volume toilets in the Georgia.

- Toilets installed prior to 1980 use an average of 5 gallons per flush
- Toilets installed between 1980 and 1992 use an average of 3.5 gallons per flush
- Toilets installed after 1992 use 1.6 gallons per flush
- Water Stewardship Act: toilets installed after July 1, 2012 use 1.28 gallons per flush (ULFTs)

Step 2. Estimate the water savings when higher volume per flush toilets are replaced with ultra low flush toilets (ULFTs) based on an estimate of the natural replacement rate of the remaining toilets installed prior to 1992 over the 40-year planning period. This replacement rate was assumed to be 2 percent per year, which corresponds to a life of 50 years per toilet, and is consistent with other regional water planning efforts in Georgia (Metropolitan North Georgia Water Planning District).

In order to generate an actual volume of water an estimated two toilets per household was assumed. The mix of toilets (by flush volume) was estimated as previously discussed. A

¹⁴ Available on Council website: http://www.upperflint.org/pages/our_plan/index.php

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baseline value of annual water use was then calculated assuming 5.1 flushes per person per day. This factor is derived from the Residential End Uses of Water study sponsored by the American Water Works Association Research Foundation (AWWARF, 1999).

Step 3. Apply the plumbing code adjustment as a reduction to the calculated per capita water use rate for each county over the planning period. This was accomplished by determining the change in annual water use associated with toilet flushing over the planning horizon as compared to the base year. For each time step the calculated number of ULFT's increased while higher volume toilets decreased. Holding the 5.1 flushes per person per day assumption constant resulted in a measurable savings as the mix of toilets changed. This savings was normalized by the population to generate savings on a per capita basis.

This adjustment to the water use rate was made prior to forecasting wastewater generation. The effects of the plumbing code adjustment on regional per capita values are summarized in Table 4. Demand scenario 1 reflects the initial adjusted 2050 per capita values used to generate forecasted demands as presented in Section 4. Demand scenario 2 reflects the adjusted per capita values with additional efficiency associated with the Water Stewardship Act incorporated.

The total regional municipal water demand forecasts are illustrated in Figure 2 for three scenarios: baseline per capita without plumbing code adjustment, plumbing code adjustment with 1.60 gallon per flush toilet replacement, and plumbing code adjustment with 1.28 gallon per flush toilet replacement. The estimated reduction in total regional water use from baseline to demand scenario 2 (includes requirements associated with Water Stewardship Act) is approximately 4 million gallons per day on an annual average basis.

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Table 4:

Comparative Reduction in Per Capita Demand Resulting from Toilet Fixture Replacement at Variable Flush Rates (values in gallons per capita per day)

| County | Municipally-Supplied Demand | | | Self-Supplied Demand | | |
|-------------------|-----------------------------|--|--|----------------------------|--|--|
| | Baseline Per Capita Demand | 2050 Per Capita Demand - Scenario 1 (1.60 gallons per flush) | 2050 Per Capita Demand - Scenario 2 (1.28 gallons per flush) | Baseline Per Capita Demand | 2050 Per Capita Demand - Scenario 1 (1.60 gallons per flush) | 2050 Per Capita Demand - Scenario 2 (1.28 gallons per flush) |
| Crisp County | 122 | 114 | 112 | 75 | 67 | 64 |
| Dooly County | 163 | 156 | 153 | 75 | 67 | 64 |
| Macon County | 162 | 154 | 151 | 75 | 67 | 64 |
| Marion County | 191 | 185 | 182 | 75 | 69 | 66 |
| Meriwether County | 143 | 135 | 133 | 75 | 68 | 65 |
| Pike County | 142 | 137 | 134 | 75 | 70 | 67 |
| Schley County | 183 | 175 | 172 | 75 | 67 | 65 |
| Spalding County | 163 | 155 | 152 | 75 | 67 | 65 |
| Sumter County | 143 | 135 | 132 | 75 | 67 | 64 |
| Talbot County | 132 | 124 | 122 | 75 | 68 | 65 |
| Taylor County | 166 | 158 | 155 | 75 | 67 | 65 |
| Upson County | 233 | 225 | 222 | 75 | 67 | 64 |
| Webster County | 137 | 129 | 127 | 75 | 67 | 64 |
| AVERAGE | 160 | 153 | 150 | 75 | 68 | 65 |

The true impact of water savings associated with fixture replacement on regional water resources is further dependent upon how fast the resultant wastewater is released back to those resources. The wastewater generated and discharged via a point source directly to a surface water course is representative of non-consumptive water use. The variables and assumptions utilized to develop the point source discharges for the region are detailed in Supplemental Document 13 - Municipal and Industrial Water and Wastewater Forecasting Memorandum. For this analysis, the municipal wastewater forecasts for the three scenarios presented in Figure 2 were determined. The estimated point source discharge quantities were deducted from the total water use estimates to calculate the consumptive water demand in each case. The resulting reduction in regional consumptive water use for the municipal sector is estimated to be approximately 3 million gallons per day on an annual average basis. This reduction in consumptive demand represents the

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actual benefit for this particular practice to the regional water resources and is illustrated in Figure 3.

Figure 2: Forecasted Regional Municipal Water Demand Resulting from Toilet Replacement at Variable Flush Rates

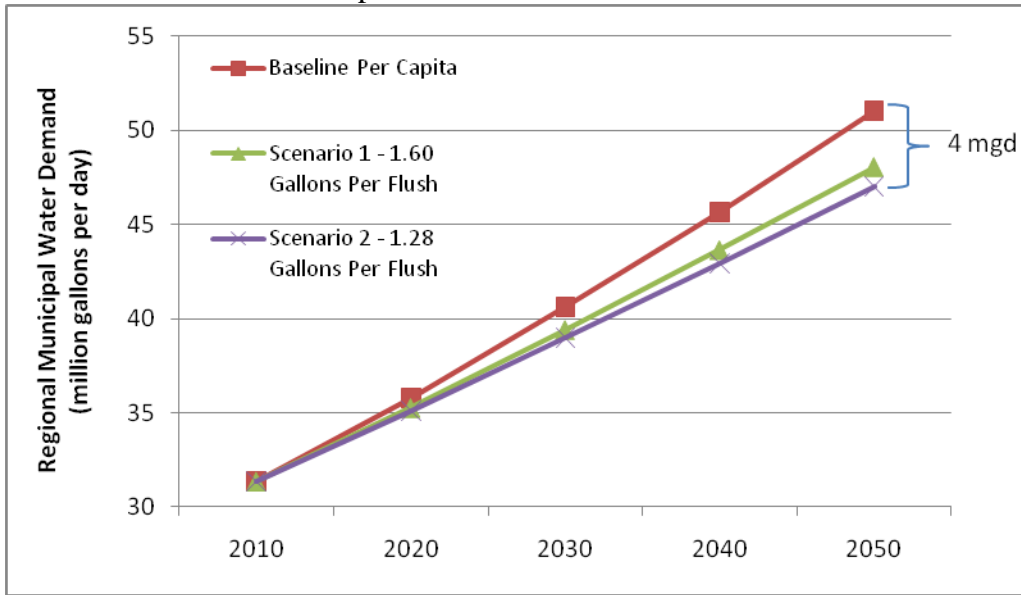
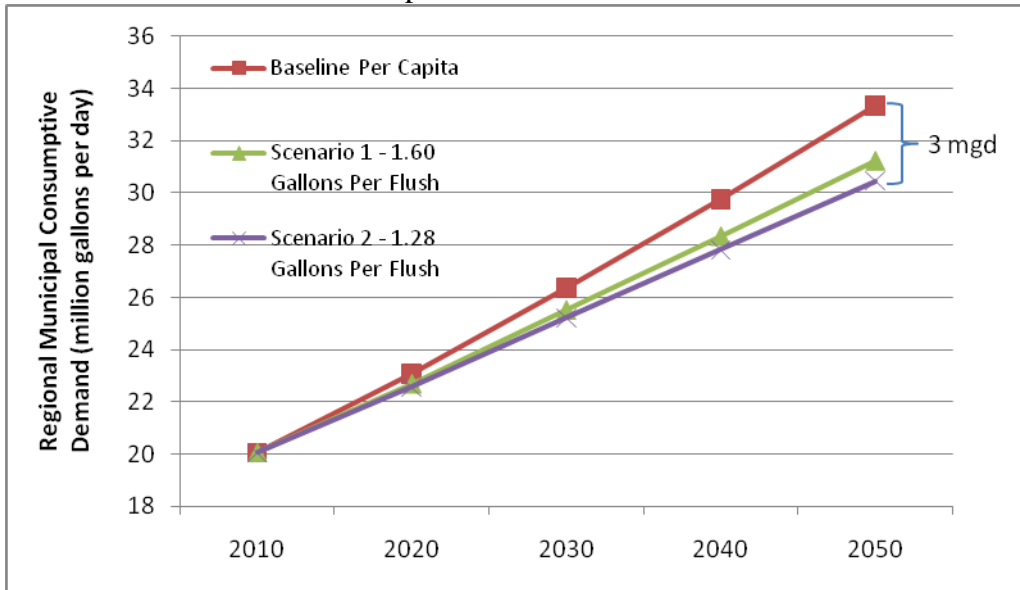


Figure 3: Forecasted Regional Municipal Consumptive Demand Resulting from Toilet Replacement at Variable Flush Rates



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Other water savings information on non-farm conservation practices was discussed by the Council. The following points were noted:

- Water users have already invested in and implemented a substantial portfolio of conservation practices in the region.
- Conservation addressing consumptive water uses can have a greater impact on flows than that addressing nonconsumptive water uses.
- Conservation in non-farm water uses has less impact on flows due to the relative share of these uses and returns to the system from these practices.
- Large water-using industries in the region (including energy production) generally already implement good conservation programs. They have in-house expertise on specific practices for their operations.
- The Council generally prefers encouraging Tier 3 and 4 practices with incentives to a regulatory approach.

Therefore, the Council recommended the following conservation management practices for non-farm water uses:

DM2: Implement Tier 1 and 2 non-farm water conservation practices in the region.

DM3: Implement Tier 3 and 4 non-farm water conservation practices in the region with the support of incentive programs.

See Section 2 for more detailed descriptions of these management practices

The Council also included the following water policy recommendation concerning conservation in Section 7.4 of the plan:

- The Council recommends that EPD and other agencies with water policy responsibilities should design water conservation policy and regulations to recognize and credit water users for conservation practices that they have already implemented. Conservation policies and regulations should prioritize addressing consumptive over nonconsumptive uses. Additionally, conservation policy and regulations should be designed with an emphasis on cost-effectiveness as a key criterion.

Section 4 – Conclusions

Georgia Environmental Protection Division
Upper Flint Council
Water Conservation Technical Memorandum

This memo summarizes the information that the Council evaluated in selecting conservation management practices. The Council recognized the priority importance of conservation as an important tool in its plan. Conservation practices will help to address shortfalls identified by the resource assessment models for surface water and groundwater availability. They will also support attainment of the Council's vision and goals. The Council discusses and questions the current criteria by which flows are evaluated in the resource assessment model. The "gap" identified by the model at Bainbridge could not be completely closed without complete cessation of water use in dry periods or offsetting storage or augmentation. Moreover, violating those criteria is not clearly connecting to impacts on downstream users and in-stream habitat. Therefore, the Council calls for a better information base for future planning. Furthermore, the Council emphasized the need for increased storage in the Flint River Basin to address flow concerns.