# Upper Oconee Supplemental Document: Water Stewardship Act and Water Conservation Measures

PREPARED FOR: Georgia Environmental Protection Division

PREPARED BY: CH2M HILL

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## Introduction

As part of the water planning process, the Georgia Environmental Protection Division (GAEPD) carried out a modeling and analysis exercise to determine if the readily available water resources could support current and future water needs based on the forecasted water demands for each Water Planning Region. The planning contractors and the regional councils were then tasked with developing and selecting a series of management practices (MP's) that would close the gaps found on the resource assessments. This TM summarizes the MPs applied to the nodes of interest in the Upper Oconee Region to address the resource availability gaps. For modeling purposes, the conservation measures were only applied to the municipal water demands to account for the implementation of the requirements established by the Water Stewardship Act (WSA) and additional conservation measures in cases where the gaps were persistent.

GAEPD and the Surface Water Availability Resource Assessment Team performed analysis of current and future resource assessments for the Upper Oconee (UO) Water Planning region with projected 2050 water use conditions, specifically the Oconee, Ocmulgee, and Altamaha (OOA) River Basin. The future water use values (including municipal, industrial, thermal energy, and agricultural) were provided by the water planning contractors between May and September 2010. The results of additional modeling scenarios, which included water conservation estimates and additional MPs to address gaps were provided in February 2011.

## Process

The planning process flowchart shown in Figure 1 places Gap Analysis as the basis for selecting suitable MPs for each Water Planning Region. The resource assessment analyses and water demand forecasts were used to provide a baseline assessment of the readily available water sources and their ability to provide sufficient water now and into the future. The modeling process was used to identify gaps at the Planning Nodes and to also model possible alternatives to close those gaps applying water conservation measures and MPs.

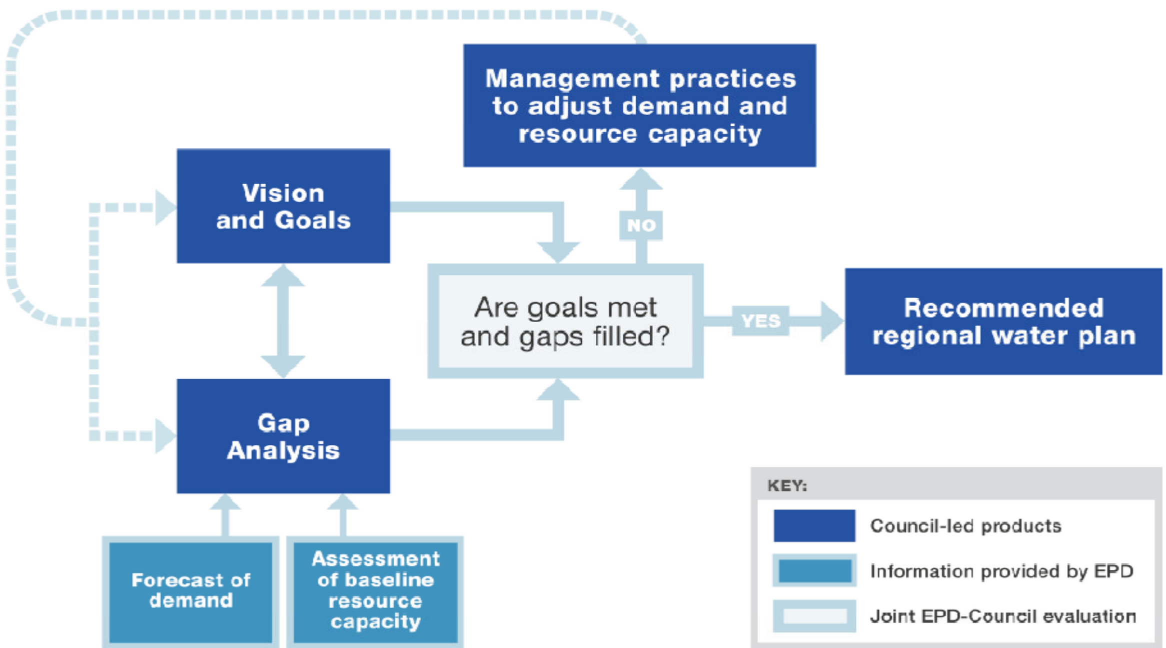


**FIGURE 1**
Planning Process Flowchart
Source: GAEPD, 2009

Figure 2 shows a schematic of a typical baseline modeling scenario in which the total forecasted water demand tends to increase throughout the planning horizon while the resource capacity stays constant unless additional storage or significant water transfers take place. Under those circumstances, the water demand is expected to surpass the available resources and the implementation of water management measures will be necessary to close the gap by reducing water demand or increasing the capacity of the available resources.

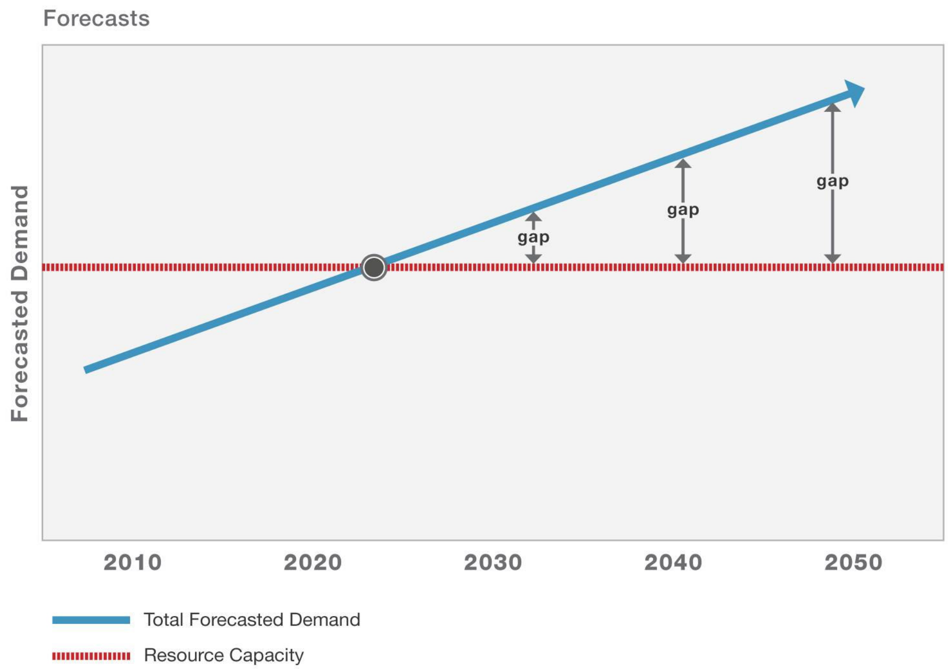


**FIGURE 2**
Typical Baseline Modeling Scenario
Source: GAEPD, 2009

Figure 3 shows an example of how the implementation of water conservation practices, such as WSA requirements, drought triggers, and other Tier 4 practices might reduce the water needs along the planning horizon. Reduction in water demand will extend the time at which the gaps start appear and also reduces the quantity of the gap.

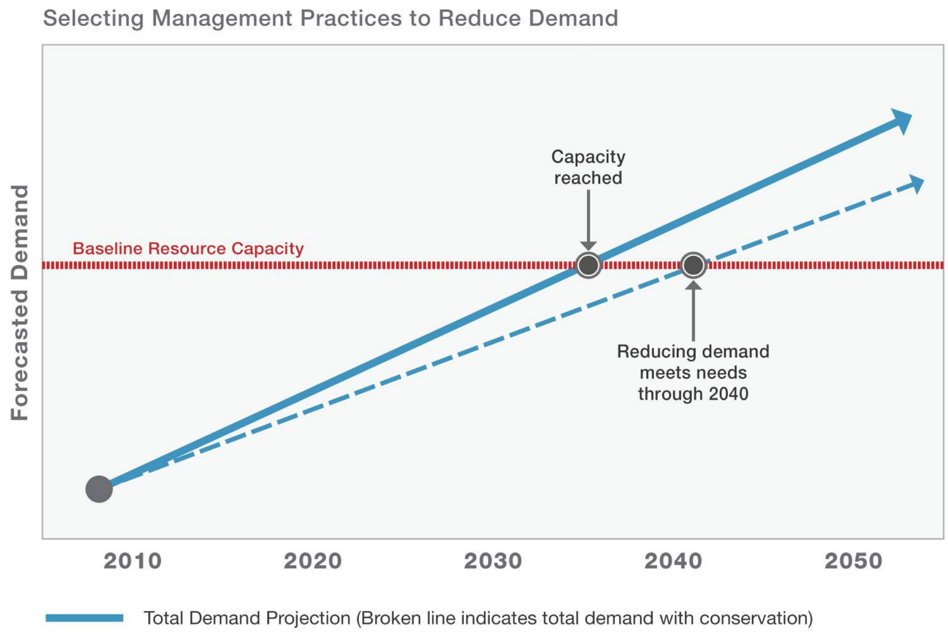


**FIGURE 3**
Schematic of Water Demand Reduction with the Application of Water Conservation Practices
Source: GAEPD, 2009

If the resource assessment model showed persistent gaps within the planning node, additional MPs were applied in addition to the WSA requirements, drought triggers, and the Tier 4 practices. Figure 4 shows how addition of storage capacity would increase the baseline resource capacity and a combination of water conservation practices and water MPs would minimize or close any gaps identified in the future.

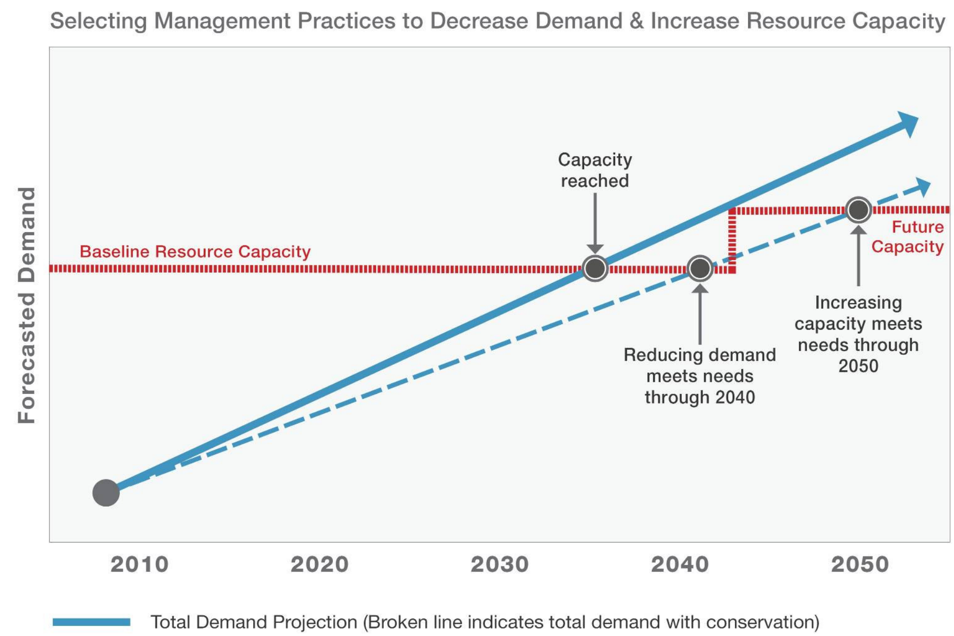


**FIGURE 4**
Schematic of Water Demand Reduction with the Application of Water Conservation Practices and Increase in Resource Capacity to Close Water Demand Gaps
Source: GAEPD, 2009

# Resource Assessment Background

The Baseline Surface Water Quantity Resource Assessment estimates the ability of surface water resources to meet current municipal, industrial, agricultural, and thermoelectric power water needs, as well as the needs of in-stream and downstream users. For each region, nodes are the finest spatial resolution in the planning models. Water withdrawal and discharge values do not reflect any individual facilities, existing or planned, but all components have been aggregated per node. Figure 5 shows the OOA River Basin divided into 9 Basic Nodes and its corresponding Local Drainage Areas.

For the baseline model, it was assumed no MPs had been implemented beyond those reflected in the Current Resource Assessments or by the 2050 Water Demand Forecasts. The amount of storage for each node remained the same as in the Current Resource Assessments and all the storage volume was aggregated at the node level. The storage information incorporated in the model did not reflect the site or size of any single reservoir.

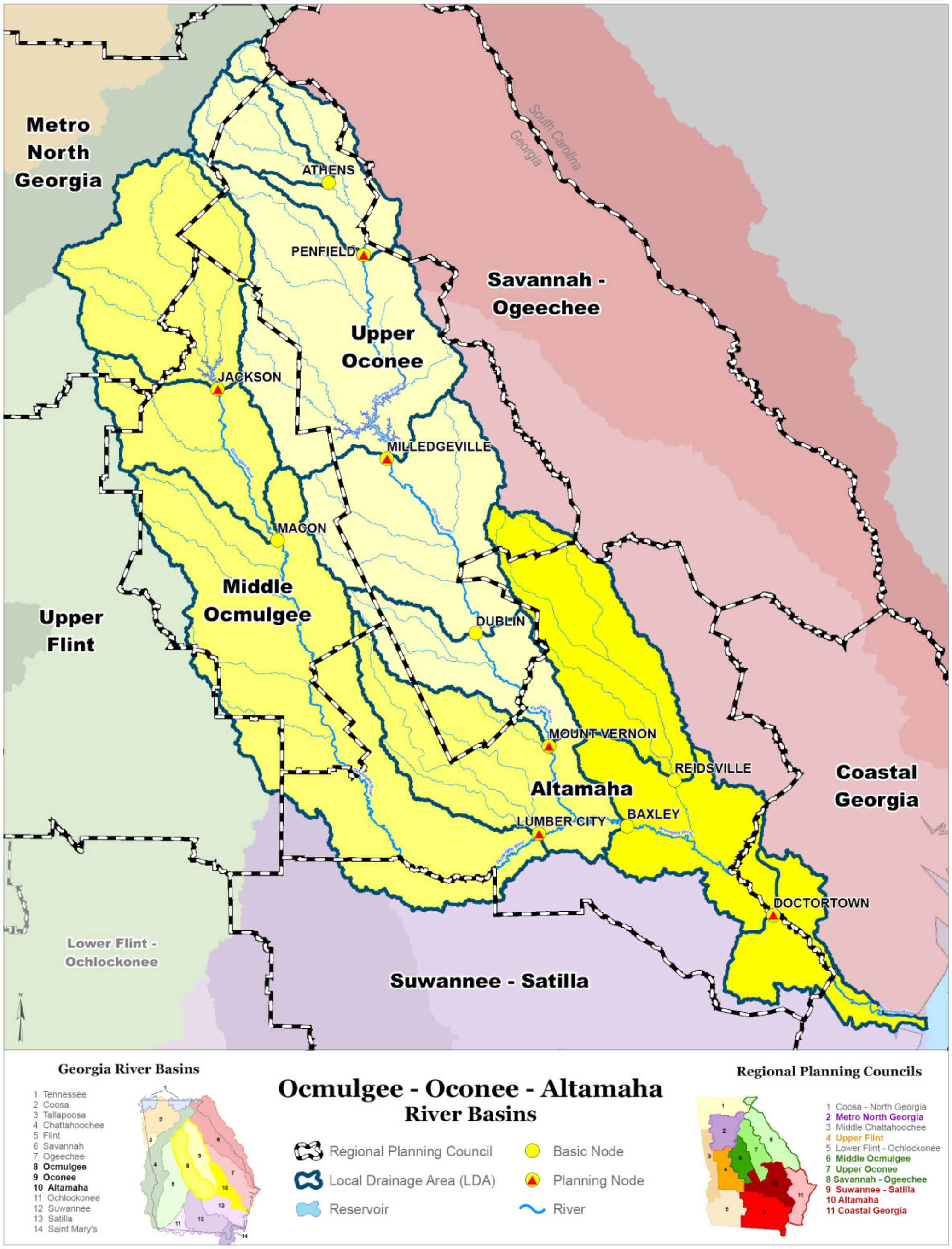


**FIGURE4**
Planning Nodes and Local Drainage Areas within the OOA River Basin
Source: GAEPD, 2009

## Nodes with Gaps

The Penfield Node was the only node within the Upper Oconee Region that showed gaps in the initial surface water availability model results.

### Penfield Planning Node

Model results showed a very small gap in instream flow at the Penfield Node, located north in the Upper Oconee Region. Table 1 summarizes the gap results for the Penfield Node. For the entire period of record, there is an average gap of 42 MGD (65 cfs) in the flow regime for 0.1 percent of the time. This gap in 2050, in comparison to no gap under current conditions, was attributed by the modelers to an increase in consumptive water use in this sub-basin.

**TABLE 1**
2050 Initial and Modified Model Results for the Flow Regime within the Penfield Node

| Scenario | Length of Gap | Average Gap (MGD) | Long-Term Average Flow (MGD) | Maximum Gap (MGD) | Corresponding Flow regime (MGD) |
|---|---|---|---|---|---|
| 2050 Forecasted Consumptive Demand | 0.1% | 42 | 753 | 45 | 299 |

Even though the Penfield Node was the only node identified within the Upper Oconee Region to have a deficit under future demand conditions, the MPs identified to eliminate the gap were applied and modeled for the demand users in the Athens and the Penfield Nodes. The Athens Node is located upstream the Penfield Node; therefore, its water demands and consumption directly affect the flows downstream into the Penfield Node.

# Management Practices

The regional planning guidance describes MPs as any activity that would adjust the water demand, wastewater flow, or the resource capacity to sustainably meet current and future water needs. The guidance also specified water conservation as a priority MP and each Council were expected to include them in their plan. To assist in the selection process a *Worksheet of Tiered Conservation Practices* was developed by GAEPD to describe various practices and establish a tiered hierarchy from required to voluntary measures.

## Water Stewardship Act

The WSA activities are considered Tier 1 water conservation practices because their implementation is required by law. The WSA was signed by the Governor of Georgia in June 2010 and includes incentives for increasing water conservation in addition to required conservation practices[1]. Beginning in July 2012, the legislation requires:

1. High efficient water fixtures in all new residential and commercial construction statewide. The maximum flush rate was lowered from 1.6 gpf (gallon per flush)to 1.28 gpf (High Efficiency Toilet or HET) and required that after July 1, 2012, all new residential construction include HETs in addition to the progressive replacement of an older, higher-flush toilets through a plumbing code requirement.

[1] http://www.georgia.gov/00/press/detail/0,2668,78006749_160096907_160096913,00.html

2. The installation of efficient cooling towers in new commercial and industrial construction; and,
3. Sub-metering for all new residential and commercial multi-unit projects that each unit will receive consumption reports and have incentive to practice conservation measures.

The legislation also instructs GAEPD agencies to consider grants and loan programs to develop incentive criteria that would encourage retrofit programs on existing construction and to set standards for water loss and leak detection for all medium and large public water systems. The final piece of the legislation extends the voluntary agriculture monitoring program to include surface water withdrawals. Extending this program to surface water withdrawals is expected to provide critical data to update the Georgia's water inventory of sources and uses.

The methodology for estimating water demand projections after applying the plumbing code were calculated as follows:

1. Estimated the number of toilets by flush volume based on the U.S. Census Age of Housing Units information and the following timeline:
    a. Toilets made prior to 1980 use an average of 5 gpf
    b. Toilets made between 1980 and 1992 use an average of 3.5 gpf
    c. Toilets made after 1992 use 1.6 gpf (ULFT)
    d. Toilets made after 2012 use 1.28 gpf (HET)
2. Estimated the amount of toilet replacement that has already taken place, typically 5 percent.
3. Estimated the natural replacement rate of the remaining toilets installed prior to 2010 over the 40-year planning horizon. This replacement is 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.
4. Used the estimated natural replacement rate and estimated the water savings that will occur (i.e., the plumbing code adjustment).
5. Applied the plumbing code adjustment as a reduction to the municipal water demand projections for each county over the planning period.

Table 2 summarizes the water demand projections over the planning period in the nodes of interest after applying the plumbing code adjustment.

**TABLE 2**
Water Demands in MGD Before and After Applying the Plumbing Code Adjustment in the Penfield and Athens Nodes in the Upper Oconee Region over the Planning Horizon

| | Plumbing Code = 1.6 gpf | | | | | Plumbing Code = 1.28 gpf | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Node | 2010 | 2020 | 2030 | 2040 | 2050 | 2010 | 2020 | 2030 | 2040 | 2050 |
| Athens | 23.8 | 32.1 | 42.8 | 54.8 | 68. 2 | 23.8 | 32.1 | 42.7 | 54.5 | 67.7 |
| Penfield | 7.6 | 8.7 | 10.2 | 11.8 | 13. 8 | 7.6 | 8.7 | 10.1 | 11.8 | 13.7 |

The methodology for estimating water demand projections after applying cooling tower adjustment for commercial buildings only was calculated cumulatively after applying the plumbing code as follows:

1. Savings were applied only to the new demand, per the WSA.
2. Estimated the percent of the water demand used by commercial buildings; the value used for planning purposes was 20 percent.
3. Estimated the amount water that is used by cooling towers account for approximately 50 percent of the water used by large commercial buildings.
4. Applied the expected water reduction, typically water use in a cooling tower can be reduced by 20 percent by increasing cooling tower cycles[2].
5. Applied the cooling tower adjustment as a reduction to the municipal water demand projections for each county over the planning period.

Table 3 summarizes the water demand projections expected from the cooling tower adjustment over the planning period in the nodes of interest.

**TABLE 3**
Water Demands in MGD After Applying the Cooling Tower Adjustment in the Penfield and Athens Nodes in the Upper Oconee Region over the Planning Horizon

| Node | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| Athens | 23.8 | 31.9 | 42.5 | 54.3 | 67.4 |
| Penfield | 7.5 | 8.7 | 10.1 | 11.7 | 13.6 |

Water use reduction on the municipal water demand projections after applying the submetering requirements to new multiunit buildings was calculated as follows:

1. Savings were applied only to the new demand, per the WSA.
2. Estimated the percent of the water demand used by commercial and residential multiunit buildings; the value used for planning purposes was 10 percent.
3. Estimated the expected decrease in water demand, typically the installation and billing of individual units actual water use can reduce water usage by approximately 15 percent[2].
4. Apply the submetering water savings to the municipal water demand projections for each county.

Table 4 summarizes the estimated demand projections after applying the submetering adjustment cumulatively after applying the plumbing code and cooling tower savings over the planning period in the nodes of interest.

**TABLE 4**
Water Demands in MGD After Applying the Multiunit Submetering Adjustment in the Penfield and Athens Nodes in the Upper Oconee Region over the Planning Horizon

| Node | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|

[2] GAEPD. 2010. EPD Guidance for Evaluating Management Practices to Manage Water Demand.

**TABLE 4**
Water Demands in MGD After Applying the Multiunit Submetering Adjustment in the Penfield and Athens Nodes in the Upper Oconee Region over the Planning Horizon

| Node | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| Athens | 23.8 | 31.8 | 42.3 | 54.1 | 67.2 |
| Penfield | 7.5 | 8.7 | 10.1 | 11.7 | 13.6 |

The WSA requirements were applied to the 2050 Future Resource Assessment models when a gap was identified within a planning node. The use of the HET plumbing code adjustment was accounted for in the initial model runs. Table 5 summarizes the model input for the expected water demands and saving for 2050 once the WSA requirements were applied. A potential 1 percent decrease in water demand could be expected from the application of the WSA requirements.

**TABLE 5**
2050 Water Demands in MGD from the WSA for the Penfield and Athens Nodes in the Upper Oconee Region

| | 2050 Water Demand | | | |
|---|---|---|---|---|
| **Node** | **Baseline[a]** | **Plumbing Code[b]** | **Cooling Towers[c]** | **Submetering[c]** |
| Athens | 68.2 | 67.7 | 67.4 | 67.2 |
| Penfield | 13.8 | 13.7 | 13.6 | 13.6 |

[a] The baseline values represent the water demands previous to the application of the plumbing code (toilets with 1.6 gallons per flush).
[b] The plumbing code values represent the water demands for 2050 once the plumbing code was applied (toilets with 1.28 gallons per flush)
[c] Cooling towers and submetering was applied only to the municipal water demand values, which also includes commercial, because the expected ground on the municipal water use category was found to be more limited.

Wastewater returns were also estimated for each node to account for the decrease in water use. Wastewater reductions were calculated by multiplying the water demand percent reduction by the forecasted point discharge flows and by the indoor percent use within each node.

## Drought Management Plan

A drought management plan was recommended in addition to the WSA requirements for the Penfield Node due to the nature of the gaps that showed a rapid depletion of the storage volume, especially during the summer months. The initial resource assessment model runs did not consider or apply demand reductions during drought periods.

Various municipalities were contacted to obtain their drought contingency plans. The Emergency Drought/ Water Shortage Management Plan (EDWSMP) provided by Athens-Clarke County (ACC) was selected because this municipality is located within the node of interest and it offered the most applicable scenarios for this node. ACC's EDWSMP established trigger limits based on the storage depletion. For modeling purposes this scenario was expanded to set trigger limits for the existing aggregated storage capacity within the Penfield Node. Once the available aggregated storage was determined, the trigger limits described in Table 6 were applied following the ACC guidance.

**TABLE 6**
Drought Trigger Variables Based on the Remaining Available Storage for the Penfield Node

| Reservoir Level | Reduction in Original Withdrawals |
|---|---|
| 80% | 5% |
| 70% | 10% |
| 60% | 20% |
| 50% | 30% |

## Additional Storage

In case the gaps persisted at the Penfield Node, the modeling of planned storage was suggested in addition to the WSA requirements and the drought reductions because this area has two planned storage facilities that were not modeled as part of the baseline model. The first is additional storage of 12 MGD (18.6 cfs) allocated from Hard Labor Creek Reservoir to Oconee County in the Penfield Node. The recently approved Hard Labor Creek Reservoir and water treatment plant are currently under construction and are located in the Milledgeville Node and were not modeled previously as part of the Penfield Node.

In addition to the water transfer from Hard Labor Creek Reservoir, Barrow County recently proposed the construction of a new reservoir in Rocky Creek, located in the Athens Node. Table 7 summarizes the additional storage capacity that will be available once these reservoirs are in operation.

**TABLE 7**
Proposed additional storage based on planned projects

| Additional Storage (ac-ft) | Reservoir Location | Demand storage allocation (ac-ft) | Description |
|---|---|---|---|
| 36,829 | Hard Labor Creek Reservoir (Milledgeville Node) | 10,649 | Water from Walton Co. to Oconee Co. |
| 7,740 | Rocky Creek Reservoir (Athens Node) | 6,192 | Mulberry River Basin (Barrow Co.) |

The Surface Water Availability Resource Assessment Team was instructed to add water conservation practices and/or storage capacity, in addition to the WSA requirements, drought riggers, and already proposed reservoirs in order to address persistent gaps.

## Water Conservation

Additional Tier 4 Water Conservation Practices were recommended for the nodes that showed gaps after considering WSA requirements, drought triggers and additional storage. Tier 4 water conservation practices are considered “beyond basic” activities that needed to be considered when gaps were identified. The water conservation practices were only applied to the municipal water demands following the guidance from the Georgia Water Use and Conservation Profiles Study[3].

The Georgia Water Use and Conservation Profiles Study selected various communities in Georgia, outside the metro area, and attempted to characterize water use and identify cost-effective conservation measures. The communities were selected based on size, water source, geographic location, and major water use type. Historic water use data was analyzed and then summarized before the water conservation measures were implemented. The water conservation measures were evaluated to 100 percent of market penetration at the end of the implementation period. The savings were calculated based on a 5-year program and assuming a steady increase in implementation annually.

Tier 4 water conservation practices selected for modeling purposes as follows: spray rinse valves, rains sensors, and the distribution of water conservation kits. These were also analyzed as part of the Georgia Water Use and Conservation Profiles Study; therefore, the results from the study were extrapolated to calculate the adjustment in water demand per county for the Penfield Node.

Table 8 summarizes the water conservation savings potential for the counties within the node of interest and references the counties selected from the Georgia Water Use and Conservation Profiles Study to serve as guidance. Once the county reductions were estimated, the total demand was aggregated per node.

**TABLE 8**
Water Conservation Savings Potential (%) for the Counties within the Nodes of Interest

| | Percent Reduction (%) | | | | |
|---|---|---|---|---|---|
| **County** | **Spray Rinse Valves** | **Rain Sensors** | **Conservation Kits** | **Total Reduction** | **Indoor Reduction** |
| Barrow[a] | 0 | 1 | 2 | 3 | 2 |
| Clarke[b] | 1 | 1 | 3 | 5 | 4 |
| Jackson[c] | 0 | 1 | 3 | 4 | 3 |
| Oconee[c] | 0 | 1 | 3 | 4 | 3 |

[a] Potential saving derived from Pickens County data
[b] Potential saving derived from LaGrange County data
[c] Potential saving derived from Leary County data

Table 9 shows the result of applying the water conservation practices to municipal water demands.

**TABLE 9**
Water Demands in MGD after Applying the WSA and Selected Tier 4 Water Conservation Practices

| | Future Water Demand | | | | |
|---|---|---|---|---|---|
| **Node** | **2010** | **2020** | **2030** | **2040** | **2050** |
| Athens | 23.3 | 27.5 | 34.3 | 42.0 | 50.9 |

3 CH2M HILL, 2008.

**TABLE 9**
Water Demands in MGD after Applying the WSA and Selected Tier 4 Water Conservation Practices

| | Future Water Demand | | | | |
|---|---|---|---|---|---|
| Node | 2010 | 2020 | 2030 | 2040 | 2050 |
| Penfield | 7.5 | 8.3 | 9.6 | 11.2 | 13.0 |

Wastewater returns for both nodes were calculated by multiplying the forecasted wastewater returns per by the water conservation percent reduction, the indoor percent reduction due to the application of water conservation practices, and by the indoor percent water use.

# Model Results

The proposed MPs described above were submitted to GAEPD and the Surface Water Availability Resource Assessment Team. The model runs determined that in order to eliminate the gaps under the 2050 demand scenario at the Penfield Node, a combination of WSA requirements, drought trigger conservation measures, and a portion of the planned additional storage capacity were needed. Annual demands were reduced for the Athens and Penfield Nodes as described in the WSA section of this TM and the drought triggers were also applied. In addition, model results indicate that an increase of approximately 1,544 ac-ft of storage in addition to the existing storage was necessary to close the gap in the Penfield Node. Table 10 shows the flow regime results for the initial model run and the model results after the MPs were applied.

**TABLE 10**
2050 Initial and Modified Model Results for the Flow Regime within the Penfield Node

| Scenario | Length of Gap | Average Gap (cfs) | Long-Term Average Flow (cfs) | Maximum Gap (cfs) | Corresponding Flow regime (cfs) |
|---|---|---|---|---|---|
| Initial Model | 0.1% | 65 | 1,165 | 71 | 463 |
| Modified Model[1] | 0% | 0 | 1,149 | 0 | - |

[1]This modeling scenario includes the implementation of WSA requirements, a drought trigger, and additional storage.

# Conclusion

The expected water savings described in this TM are appropriate for planning purposes and provide a good estimate of the decrease in water demand over the planning horizon. The WSA requirements and water conservation measures were able to reduce water demands at least by 5 percent. The addition of storage capacity eliminated the gaps identified during the initial modeling run. The planned additional storage from Hard Labor Creek and Rocky Creek reservoirs will fulfill the anticipated storage needs in 2050. It is important to note this combination of MPs may not be unique and different mixes of MPs could provide comparable results.