



WATER CONTINGENCY PLANNING TASK FORCE

FINDINGS AND RECOMMENDATIONS

21 December 2009

ACKNOWLEDGEMENTS

The Task Force acknowledges the dedication of the co-chairs:

- John Brock Chairman and CEO, Coca-Cola Enterprises
- Tim Lowe CEO, Lowe Engineers

A special thanks to Technical Advisors who donated their time and resources to the Task Force effort.

- AECOM
- Arcadis
- Brown and Caldwell
- CH₂M Hill
- Golder & Associates
- Jordan Jones and Goulding
- MACTEC Engineering in partnership with Tanner and Associates, Tommy Craig, Schnabel Engineering and B&E Jackson Engineers
- Post Buckley Shue & Jernigan
- University of North Carolina, Environmental Finance Center

and

- The Boston Consulting Group (Atlanta office) for coordination of Technical Advisor Teams and overall process facilitation

TABLE OF CONTENTS

	<u>Page</u>
1 Executive Summary	4
2 Introduction	5
2.1 Background.....	5
2.2 Limitations on scope of study.....	7
3 Recommendations: supporting Policies and Actions.....	8
3.1 Policy Recommendations to pursue now	9
3.2 Policy Recommendations in case of “Contingency Plan” requirements.....	12
3.3 Additional policies for consideration.....	14
4 Recommended Contingency Solutions.....	14
4.1 Description of 2012 option portfolio	16
4.2 2015 contingency portfolio	20
4.3 Recommended 2020 portfolio of options	21
5 Methodology	23
5.1 Task Force solution development process	23
5.2 Primary’ and ‘Alternate’ 2020 portfolios	25
6 Summary Of Task Force Feedback	29
6.1 Summary of Task Force feedback on principles	29
6.2 ‘Summary of Task Force feedback on portfolios.....	30
6.3 ‘No-regret’ and ‘contingency’ options	31
6.4 Alternative views on key types of options	32
7 Topics Pending Further Evaluation	34
7.1 Determination of downstream flow impact	34
7.2 Additional options requiring more detailed evaluation	35
7.3 Regional governance model.....	38
8. Conclusion.....	38

DEFINITION OF KEY TERMS

APPENDIX

- I. List of Task Force Members
- II. Fact base: water situation, facts on usage
- III. Complete set of options evaluated with rationale, cost, yield, implementation feasibility
- IV. Technical assumptions used in option evaluation
- V. Task Force member survey results
- VI. Comments and submissions provided to Task Force

TABLE OF FIGURES

	<u>Page</u>
Figure 1: Projected water shortfall in 2012 under Judge Magnuson’s ruling	6
Figure 2: Aggressive implementation of conservation options insufficient to address 2012 gap	17
Figure 3: Overall District water usage levels	18
Figure 4: List of options available by 2012.....	19
Figure 5: List of options in recommended 2015 portfolio.....	20
Figure 6: Indirect potable reuse infrastructure requirement.....	21
Figure 7: List of options in recommended 2020 portfolio.....	22
Figure 8: Task Force solution development process.....	23
Figure 9: Options key feasibility considerations	25
Figure 10: Defining the ‘primary’ and ‘alternate’ 2020 portfolios	25
Figure 11: List of options in the cost optimal 2020 portfolio	26
Figure 12: List of options in the ‘primary’ 2020 portfolio.....	27
Figure 13: List of options in the ‘alternate’ 2020 portfolio and comparison with ‘primary’	28
Figure 14: Assessment of ‘no-regret’ and ‘contingency’ options through TF survey results	32
Figure 15: Distribution of Task Force response on support for key prioritization principles.....	29
Figure 16: Level of support for key prioritization principles by various sub-groups	30

1 EXECUTIVE SUMMARY

The Water Contingency Planning Task Force was created to analyze the potential water shortfall in Georgia in light of Judge Magnuson's July 2009 ruling, and to develop a contingency plan containing a prioritized set of recommendations on water conservation and supply options. The Task Force evaluation reaffirms that Lake Lanier is by far the best water supply source for the metro region. If the recommended contingency options were required instead, these options would impose significant incremental economic costs and environmental impact the region does not currently face.

The Task Force does not foresee the ability of the metro region to meet the potential water shortfall in 2012, when Judge Magnuson's ruling could take effect, even with extremely aggressive mandated conservation. Within this timeframe, no new supply options could offer significant yield. By 2015, there is a potential contingency solution, consisting primarily of an indirect potable reuse project, along with a set of conservation measures and isolated groundwater options. The 2015 solution would, however, require significant upfront capital of approximately \$3 billion and supply water at an average incremental unit cost of \$890 per million gallons (MG). By 2020, a broader set of more cost-effective options exists, as reservoirs and transfers could be implemented. In that regard, the Task Force recommends a 2020 contingency solution that considers cost efficiency, environmental impact, and implementation feasibility criteria. This solution includes conservation measures and groundwater options that could be available the 2015 solution, but replaces the relatively expensive indirect reuse project with more cost effective reservoir expansions (Tusahaw Creek, Dog River), and a new reservoir (Richland Creek). The 2020 contingency solution would require a lower upfront capital requirement of ~\$1.7B and would have an incremental unit cost of \$460/MG, which is nearly half the 2015 solution cost.

While the supply options for 2015 and 2020 are identified as *contingencies*, the Task Force recommends that enhanced conservation, implemented through incentive-based programs, should be pursued regardless of the outcome of Lake Lanier reauthorization. This program of enhanced conservation is the basis for a set of Task Force recommendations on "no regrets" options to implement immediately, along with a supporting set of policy considerations (detailed in Section 3.1). There are three broad areas of additional conservation improvements that build on the Metro Atlanta's significant conservation progress to date, and are reflected in these recommended policies:

1. Institute mandatory data collection and reporting of key metrics to inform future planning efforts. For instance, utilities would have to conduct standardized water loss audits.
2. Adopt higher water efficiency standards and incentive measures to increase conservation effectiveness. (e.g., increasing incentives for fixture and soil meter retrofits.)
3. Link progress on conservation efforts to funding eligibility, low-interest loan qualifications, and permitting applications to ensure implementation of measures.

The *Contingency* solutions recommended by the Task Force should only be pursued if they are deemed to be absolutely essential, based on the outlook of tri-state negotiations, Lake Lanier

reauthorization efforts, and the appeal of Judge Magnuson's order. Preference should be given to the 2020 contingency solution, if possible, and only if this action is required. In conjunction with the 2020 contingency solution, the Task Force also identified a set of policies that could support the implementation of mandate-based conservation measures envisioned within that contingency solution (detailed in Section 3.2), also to be considered only if necessary to support a contingency solution. However, the Task Force notes that the ability to implement either a 2015 or 2020 solution in their stated timeframes would also be contingent on initiating the necessary technical studies and permitting process swiftly, and implementation within these timeframes would not accommodate any unforeseen delays.

2 INTRODUCTION

2.1 Background

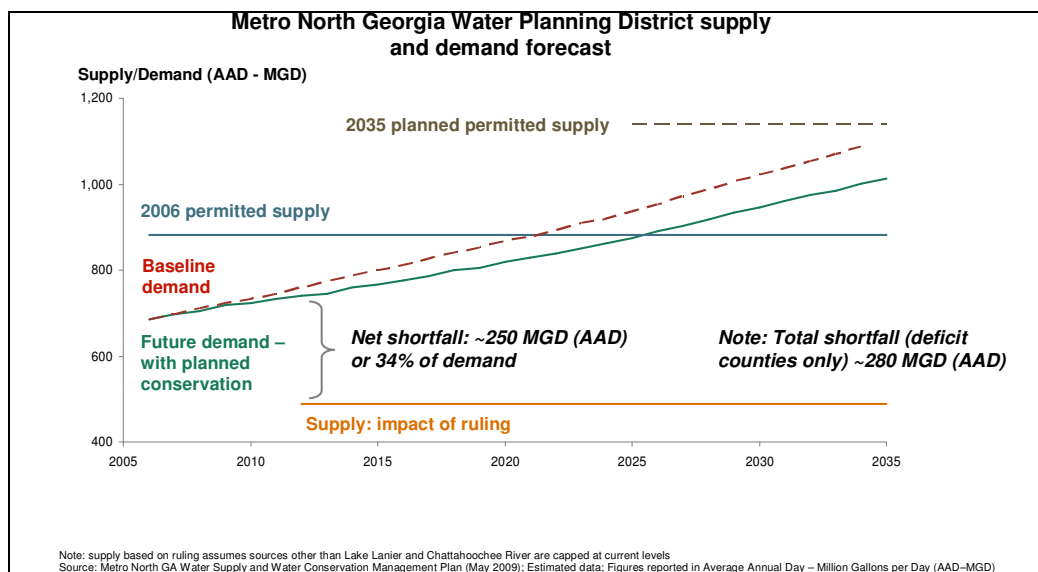
On July 17 2009, U.S. District Judge Paul Magnuson issued a ruling holding that water supply was not an authorized purpose of Lake Lanier. Additionally, Judge Magnuson determined that the US Army Corps of Engineers' (hereafter referred to as the Corps) operation of Lake Lanier for water supply exceeded its authority under the Water Supply Act of 1958. Judge Magnuson concluded that, absent further Congressional authorization, water supply operations at Lake Lanier must cease by mid-July 2012. That is, except for certain limited withdrawals that predate construction of the reservoir, all withdrawals directly from Lake Lanier will be prohibited, and releases from Buford Dam to meet downstream water needs will be severely curtailed.

In response to the ruling, the Governor outlined a 4-pronged strategy which consisted of (a) appealing the ruling in court, (b) negotiating a mutually agreeable water allocation scheme with Alabama and Florida, (c) pursuing Congressional reauthorization of Lake Lanier for water supply and (d) developing a contingency plan, to be implemented if the Judge's ruling were to take effect. The Water Contingency Planning Task Force was created to evaluate various options for a contingency plan and make recommendations to the Governor.

Absent Congressional action or reversal on appeal of Judge Magnuson's order, that order will create a water supply shortfall for North Georgia in July 2012. The part of Judge Magnuson's order that would go into effect in July 2012 does not directly limit withdrawals from the river. That element of the order, however, does enjoin the Corps' operation of Buford Dam such that the reliable supply of water available from the river will be severely curtailed. Although it is not currently possible to predict with specificity how much water would actually be available for withdrawal from the river under the operations required by the Judge's order, the order did state that such operations in the 1970s yielded 230 Million Gallons per Day (MGD). The range of possible yields from the required operations is wide, but 230 MGD appears to fall well within that range, and accordingly was used as the assumed amount of available water for purposes of calculating the water supply shortfall.

Given this assumption, a net water shortfall was calculated to be approximately 250 MGD (on an annual average basis) in the metro region (15 county region served by Metropolitan North Georgia Water Planning District, hereafter referred to as Metro Water District) in 2012. This shortfall is estimated by taking the difference between projected 2012 water demand, as published in the Metro Water District's Water Supply and Water Conservation Management Plan (published in May 2009, hereafter referred to as the Metro Water Plan), and projected 2012 water supply under the scenario that could occur should Judge Magnuson's ruling take effect. This is illustrated graphically in Figure 1. The projected shortfall of 250 MGD is a net shortfall across the entire metro region, subtracting from the total shortfall the amount of estimated surplus in counties with excess water from other sources. Relying on one possible interpretation of how the ruling would impact downstream communities, the total shortfall for counties in deficit (while ignoring the counties with surplus) was estimated to be approximately 280 MGD in 2012. This shortfall estimate of 280 MGD was used by the Water Contingency Planning Task Force (hereafter referred to as the Task Force) for planning purposes, out of conservatism. Using a similar approach and assuming that demand continued to grow as outlined in the Metro Water Plan, the corresponding water shortfall in 2015 and 2020 were estimated to be approximately 310 MGD and 350 MGD respectively. Clearly, the Judge's ruling has a very significant impact on water supply to the metro region.

Figure 1: Projected water shortfall in 2012 under Judge Magnuson's ruling



In response to this potential significant problem, the Task Force had two key objectives. First, to develop a fact-base to educate business and community leaders on Georgia's water situation and the implications of Judge Magnuson's ruling. Second, to define a time-driven action plan that prioritized

specific options and recommendations for conservation, supply enhancement, and water policy to address the potential shortfall.

The Task Force, in order to fulfill its mission and scope, was directed by the Governor's office to work with a set of key operating assumptions:

- Options were to be defined assuming that Judge Magnuson's ruling remains in effect. Thus, interbasin transfer options could not assume use of Lake Lanier to store incremental water supply, as withdrawals from the lake would be restricted under the ruling
- All types of options were to be considered for evaluation, without regard to legal or political implementation challenges.
- The geographic scope to be evaluated was focused on only those areas affected by the ruling. Specifically, the scope was to be limited to only the ACF (Apalachicola Chattahoochee Flint) basin, with a primary focus on the metro Atlanta region as the area most severely affected
- Long-range water planning was to be outside the scope of the Task Force effort and instead was to be addressed by the Comprehensive Statewide Water Management Plan and to be the responsibility of existing Regional Water Planning Councils.
- Existing long-range water supply and conservation plans and underlying data were to form the Task Force's baseline. The potential water supply shortfall was to be defined by incorporating already planned conservation savings. Therefore, Task Force conservation savings were to be incremental to what is in the May 2009 Metro Water District Plan
- The Task Force was to identify the timeframe by when the potential water shortfall could be addressed, and the means to do so, *i.e.*, with what supporting set of options. On the basis of the Judge's ruling and option evaluation, three relevant time horizons emerged - 2012: the year when withdrawals from Lake Lanier end and the Corps' operation of Buford Dam changes, 2015: the earliest possible timeline when potential shortfall could be addressed (based on option availability), and 2020: timeframe by which the shortfall could be addressed with a broad suite of potential options (including reservoir and transfers). Note that these timelines are based on the assumption that there are no significant delays to implementation of options (e.g., permitting, technical studies, etc), and presume that decisions to implement are made in a timely fashion.

2.2 Limitations on scope of study

The limitations of this study should be clearly understood. A thorough analysis of the shortfall and potential solutions will require many months, perhaps years, to complete. Given the urgency created by Judge Magnuson's order, however, the Governor directed the Task Force to deliver this report within six weeks. This time frame was essential in the event that action would need to be taken in the 2010 session of the General Assembly.

Accordingly, the contents of this report should be taken as initial findings and recommendations that will provide a basis for further study and analysis. All yield and cost estimates are preliminary and are likely to change with further analysis. Furthermore, projects have been studied on an individual basis

without considering the interaction between different projects; the yield of certain projects may not be additive to others because of interactions not fully evaluated. Projects have also been assessed without considering the logistics or cost of making water transfers within the metro region, and to places where it may be the most needed. The Task Force focused exclusively on the total water supply potentially available to the Metro Water District without addressing issues related to the distribution or allocation of water within the District, or the impact of any alternatives on the use or ownership of existing water resources infrastructure. These issues are significant for many reasons—logistical, equitable, legal, and political—and could in many cases be the decisive factor in determining whether to pursue a project. The Task Force also did not presume to suggest how costs for these projects, including conservation projects, should be allocated. These issues are substantial and would require further study to provide for a more complete solution.

It should also be reiterated that the Task Force analyses focus only on the incremental gain over and above existing water supply and conservation plans prepared by the Metro Water District, which already provide for the implementation of aggressive water conservation measures.

3 RECOMMENDATIONS: SUPPORTING POLICIES AND ACTIONS

The Task Force defines supply and demand contingency options and also recommends a set of policies and actions for consideration by the Governor and State Assembly. These recommendations are divided into a set of policies to consider immediately (Section 3.1), and a set of potential policies to consider as contingency measures (Section 3.2). The recommended policies to consider immediately are solely conservation focused, because there are no supply-based contingency options that require immediate policy action, although other near term implementation steps may be required. Task Force recommendations are based upon those options evaluated and where appropriate the Task Force provides general policy guidance. The Task Force does not intend to provide prescriptive policy language. Note, as well, that all Task Force recommendations are set in the context of the ruling, which creates a potential shortfall only in the Metro Water District. Under certain considerations, these recommendations could have broader application and could be considered for application outside the region. Section 3.2 contains additional policies identified through the Task Force process, that may be worthy of consideration, but were not based upon the Task Force's evaluation of specific options.

Several state and local agencies would play key roles in implementing these policies. The office of the Governor, Georgia General Assembly, the Georgia Department of Natural Resources/EPD, GEFA, the Metro Water District (including local governments and water utilities), and other executive agencies such as the Georgia Soil and Water Conservation Commission, the Department of Community Affairs, and the Georgia Forestry Commission, all would have active and critical roles in implementing policies and in enforcement and oversight. The Regional Water Planning Councils

should also consider the recommendations and policies outlined in this report as relevant to their regions and the state water plan.

3.1 Policy Recommendations to pursue now

The Task Force recommends a set of “no regret” conservation options which should be implemented immediately, regardless of the ultimate outcome of the Lake Lanier ruling. These demand management programs are generally cost-effective, and promote both short and long-term water management goals. Specifically, the Task Force recommends that the Metro Water District pursue more aggressive incentive-driven conservation programs and adopt more aggressive conservation-pricing schemes, *even if* Lake Lanier is reauthorized for water supply use.

A detailed set of policies and actions are provided for each of the recommended conservation options, categorized into the following sections:

- General conservation principles
- Enhanced efficiency programs (both residential and commercial, including programs for toilets, showerheads, faucets, washing machines, spray rinse valves, and cooling towers)
- New outdoor water usage policies (watering restrictions and rain sensor irrigation systems)
- More multi-family sub-metering
- Improved information for loss reduction programs
- More aggressive conservation pricing
- Renewed water education

These policy recommendations support entirely incentive-driven implementation plans. Again, focus is on the Metro Water District but these recommendations could be considered for wider application across the state.

General conservation principles

With respect to those general principles which help foster a culture of conservation, the Task Force proposes that statutes be considered that reinforce certain principles:

- Require minimum implementation of water conservation measures by embedding water conservation implementation requirements in state permits, with active enforcement via periodic reporting
- Require adoption of real-time data collection for all water withdrawals, adoption of compatible online data management systems and reporting practices, and publication of water statistics for all users and use categories
- Tie state investment in water supply and other types of funding to minimum levels of water conservation implementation

- Increase state financial support grants and low interest loans for water and wastewater infrastructure
- Recommend that the state develop guidance or technical assistance programs for water utilities, e.g. education on cost benefit analysis, conservation evaluation (i.e. AWE's conservation tracking software)

Enhanced efficiency programs

The Task Force recommends that state and local governments and water utilities consider new rebate programs or enhanced existing rebate and tax credit programs that would provide greater financial incentives for individual water users to install and retrofit efficient fixtures and convert to water-saving appliances. Specifically, the Task Force recommends that:

- State and local government appropriate funds for residential retrofit rebate programs for toilets, showerheads and faucet aerators
- State and local governments and water utilities establish diverse rebate and tax credit programs
 - Expand rebate programs to all residential Water Sense appliances (e.g., washing machines, dishwashers, etc)
 - Expand rebate programs to include commercial spray rinse valves used in commercial kitchens and restaurants, and commercial cooling towers

New outdoor water usage policies

To address discretionary outdoor watering demands, the Task Force recommends that state and local governments appropriate funds for rebate programs to retrofit existing residential and commercial landscaping irrigation systems with rain sensors

More multi-family sub-metering

To encourage better accountability of personal water usage in multi-family complexes, the Task Force proposes that statutes be considered that requires state and local governments and water utilities to provide rebate incentives to existing non-sub-metered multi-family complexes to install sub-meters.

Improved information for loss reduction programs

The Task Force recommends several policies related to general water loss data management and leak abatement programs to minimize loss of Georgia's water resources. These actions should be implemented regardless of whether Lake Lanier is reauthorized or not. The goal of these policies is not to set specific water loss targets, especially given the data quality in this area, but to prepare local governments and water utilities for future evaluations of leak abatement programs and targets. Specifically, the Task Force recommends that:

- Every water utility conduct water loss assessments to IWA/AWWA (International Water Association / American Water Works Association) standards.

- Audits to improve consistency of non-revenue loss data and terminology, and enable better comparison of this benchmark across utilities and over time to assess progress
 - The utilization of standardized audits can be phased in with larger utilities complying within 3 years
- A funding program be developed provide financial assistance to water utilities for capital-intensive projects related to decreasing water loss
 - Direct GEFA to prioritize use of Clean Water and Drinking Water State Revolving Funds for projects that reduce water loss
- State and local government and industry associations assist in developing technical assistance program to provide guidance to water utilities for leak abatement programs
 - Technical guidance should be developed and water utilities given time to create and implement a program based on utility size or service population
- Every water utility develop a “real water loss” reduction program such as leak abatement options to address *actual* water leaks (i.e. not billing or metering problems)
 - Program can include leak detection and repair, valve exercising, and pressure management
- Every water utility develop a lost revenue recovery program
 - Program to include metering techniques such as meter testing and replacement (for all utility-owned meters including system and customer meters)
 - Utility should commit personnel to maintain meter system to accurately capture real versus apparent losses

More aggressive conservation pricing

To ensure the most effective conservation-based pricing rate structures, the Task Force recommends that:

- Every water utility conduct a detailed rate study, informed by accurate demand data, to be used as the basis for setting effective rates on utility-level basis. Every water utility should:
 - Identify key customer classes such as single family residential, multi-family residential, and commercial users
 - Maintain demand data for each customer class, such as (i) total number of customers in each class, (ii) total number of customers with irrigation meters in each class, (iii) total number of customers, total water volume sold and total billed charges for water and sewer at each 1,000 gallon per month consumption increment (For example, the total number of customers, total water volume sold and total billed charges for users consuming between 5K - 6K gallons per month, and similarly between 6K - 7K gallons per month, etc.), for each month.
- Effective residential conservation rate policies be implemented while providing sufficient flexibility to water utilities to set rates that meet individual requirements (such as sufficient funding, fair and equitable rates for local customers, bond requirements).

- Price per 1000 gallons at key consumption levels (5K, 10K, 15K gallons per month) for every water utility in the Metro Water District to be comparable to the price charged by other utilities in the rest of the Metro Water District (no less than 10% of metro average price), while accounting for customer affordability. Data from the GEFA rate study may be used for benchmarking. Utilities must assess the feasibility of implementing the necessary change within 1 – 3 years.
- Volumetric tier endpoints should be consistent with consumer consumption pattern; Minimum of three tiers with base tier addressing average winter use, Tier 1 allowing 1 day of irrigation per week, Tier 2 addressing all usage above Tier 1
- Price differential across tiers should be significant; Tier 1 price at least 50% above base tier price, Tier 2 price at least 250% of base tier price
- Every water utility educate consumers about conservation in their monthly bill
 - Historical usage to be presented with comparison to average usage of population served by the utility
 - Water utilities to report water usage figures in gallons, to make reports more intuitive and relevant to customers
- Every water utility conduct a pricing audit to measure key performance indicators, at minimum every 5 years, but recommended every 2 -3 years
 - Comparison of absolute prices at key consumption levels with rest of metro area, volumetric tier endpoints compared to consumer demand levels, degree of price change across each tier

Enhanced water conservation education

Successful conservation efforts have robust education and public outreach programs. Therefore, the Task Force recommends appropriate allocation of funding and resources to support existing programs and create new programs in order to foster greater understanding of Georgia’s water resources. Specifically the Task Force recommends that:

- State and local governments provide funding to support state-wide water conservation campaigns and public outreach programs
- State and local government, in conjunction with water utilities and industry associations, establish partnerships with local businesses to develop, fund and deliver conservation education and communications programs.

3.2 Policy Recommendations in case of “Contingency Plan” requirements

In the event that Lake Lanier is not available for future water supply, the Task Force believes that incentive based conservation would be insufficient to meet shortfalls and that mandate-driven conservation measures could likely be a necessary component of contingency plans. The Task Force provides a set of policies and actions for that eventuality, in conjunction with the recommended contingency options. These policies are categorized into the following initiatives:

- Mandatory efficiency programs (both residential and commercial, including programs for toilets, showerheads, faucets, rain sensors, spray rinse valves, cooling towers)
- Mandatory multi-family sub-metering/or fixture conversion
- Mandated limits on outdoor water usage

The Task Force recommends that these alternative and more aggressive implementation approaches - mandated options - be considered only if Lake Lanier is not authorized for water supply.

Mandatory efficiency programs

Of all the contingency options, mandated efficiency programs, such as direct installation of efficient fixtures and retrofit on resale, appear to be the most effective and received the highest support of by the Task Force. The Task Force would endorse mandated efficiency programs, if necessary, for contingency planning because of increased water savings, as compared to the incentive-based programs. Specifically, under the conditions of the contingency plan, the Task Force would recommend that statutes be considered that:

- Updates plumbing code mandating HET toilets (1.28 gpf), low-flow showerheads and faucet aerators in all new residential construction
- Mandates water utilities to provide direct installations (water utility providers contract with plumbing contractors to directly replace fixtures in all customer residences and businesses) for all residential and commercial retrofits of:
 - High-efficiency toilets (1.28 gpf)
 - Low-flow showerheads and faucet aerators
 - Rain sensors on irrigation systems on residential and commercial premises
 - Spray rinse valves in commercial kitchens and restaurants
- Requires residential retrofit on resale (mandatory retrofit with low-flow fixtures on all properties at change of ownership)
- Mandates higher standards for cooling towers, increasing their water efficiency from 2 to 5 cycles of concentration (which can result in ~40% water savings).

Mandatory multi-family sub-metering

If necessary, the Task Force recommends the “required” usage of sub-meters in multi-family complexes, but provides alternative options where sub-metering retrofits are not cost-effective. Specifically, the Task Force would recommend that statutes be considered to require all existing non-sub-metered multi-family complex owners to either install sub-meters or pursue and demonstrate conversion to efficient fixtures and appliances, if more cost-effective

Mandated limits outdoor water usage policies

Under the contingency options, the Task Force would recommend that policies be considered to limit discretionary outdoor watering demands. Specifically the Task Force would endorse consideration of statutes to mandate 'no day-time watering' restrictions, possibly defined as no watering between 10am – 4pm, for all residential and commercial landscape usages

3.3 Additional policies for consideration

In addition to those policy recommendations to pursue immediately, and those that would be reserved only for contingency purposes, the Task Force also outlines a set of additional policies to consider. The Task Force believes that these suggestions should be further evaluated, and an assessment made of their merits for individual local governments and water utilities. The Task Force suggests consideration of:

Greater general conservation program linking

Water utilities evaluate coupling water efficiency conservation programs and energy efficiency conservation programs, potentially through partnerships with power utilities

More industrial and commercial efficiency programs

The State consider mandating industrial and commercial facilities to use performance-based contracts for the operation of cooling tower and boilers

Further enhancement of local outdoor water usage policies

- Local communities be empowered with the ability to manage their own drought response programs, if more stringent than state requirements, based on local water conditions
- Statute that requires in-service training and continued education of irrigation professionals under national industry best practices and standards
- Local government and water utility provide financial incentives for residence and businesses to adopt drought-tolerant landscaping and Xeriscaping
- Statute that mandates more efficient irrigation systems (e.g., rain sensors, moisture sensors) for all commercial/residential landscape users

Enhanced water audits

Statute that requires commercial water audits for all businesses; and residential water audits for high-use water customers (as defined by each water utility)

Consideration of voluntary inter-basin transfers into Metro District

Consider defining exceptions to current IBT prohibitions to enable sale (mutually acceptable transfers) of surplus water from systems outside Metro District, where these are currently prohibited by IBT ban

Additional water withdrawal authority

Statute to provide Georgia EPD with authority to regulate all surface and ground water withdrawals between 10,000-100,000 gallons per day during droughts

4 RECOMMENDED CONTINGENCY SOLUTIONS

The Task Force contingency plan began with a focus on demand management, through conservation. Conservation measures are environmentally friendly and often highly cost-effective, and are playing a major role in the metro region today. These options should be an integral part of any contingency solution. The range of potential water savings from additional conservation suggests that these conservative programs are necessary *but not sufficient* in addressing the potential water shortfall.

Conservation measures are, however, the only options available by 2012, primarily because supply-focused options such as reservoirs and transfers require time, both in pre-work (eg, permitting, environmental impact studies) and in actual construction. Conservation options also require time to yield savings, as they rely on consumer adoption and behavioral changes. However, the Task Force believes that even if the Metro Water District were to pursue an extremely aggressive conservation implementation approach through mandates that targeted the 2012 timeframe, the estimated yield (~80 MGD) would still be insufficient to meet the projected shortfall (~280 MGD). Accordingly, the Task Force believes that the Metro Water District does not have the ability to address a potential water shortfall by 2012. This 2012 portfolio, were it to be pursued, would consist of water fixture retrofits, conservation pricing, and a more comprehensive leak abatement program. The full detailed set of these 2012 options is listed in Section 4.1.

There is a potential contingency solution that is available to address the 2015 shortfall, although it would be very expensive and potentially very difficult to implement. Consequently, the Task Force believes that this solution should not be pursued unless it is absolutely required. In addition to the conservation options within the 2012 plan, the additional options available by 2015 include a number of small, isolated groundwater systems (contributing ~15% of the portfolio's yield). But more importantly, it would feature a major reliance on an indirect potable reuse project (which contributes ~75% of the overall portfolio yield). Indirect potable reuse would involve recapturing treated wastewater downstream from its original point of discharge, after dilution via sufficient contact with naturally occurring water, such as lakes or rivers. It would then be pumped back to upstream communities to replenish water supplies. This option is described further in Section 4.2.

This potential 2015 solution would require significant upfront capital of approximately \$3 billion. It would supply water at an average unit cost of \$890/MG, which is twice as costly as a potential 2020 solution. Another way to gauge the cost of contingency solutions is to consider the impact on the retail price of water. If one assumes that the incremental cost is borne (directly or indirectly) by water providers, retail water costs across the Metro Water District would have to increase by approximately 55% for the 2015 portfolio, versus ~32% for the 2020 portfolio. Clearly, the solution could pose a significant near-term economic burden on water consumers.

By 2020, a broader set of more cost-effective potential solutions exists, and the Task Force believes that such a portfolio is worthy of consideration, if required for contingency planning. These components include supply enhancement options such as existing reservoir expansions and new reservoir development, projects which require an estimated 8-12 years to come online. Because there are a larger set of options available by 2020, there are also many ways one could prioritize options to

create potential water supply portfolios. One such portfolio could be based on cost efficiency alone. Applying this method, the most cost-efficient portfolio could address the 350 MGD 2020 shortfall through an upfront investment of approximately \$2.3 billion, and an average unit cost of \$410/MG.

Using this most cost-efficient portfolio as a starting point, the Task Force incorporated environmental impact concerns and feasibility considerations to arrive at a recommended 2020 portfolio to address the shortfall. With an average unit cost of \$460/MG and an upfront capital requirement of approximately \$1.7 billion, this portfolio would consist primarily of the conservation measures and groundwater systems previously mentioned, plus four existing reservoir expansions and one new reservoir build. Full details of options included can be found in Section 4.3, while the process of developing this solution is discussed further in Section 5.2.

Table 1 summarizes key metrics such as yield and cost for the 2015 and 2020 contingency portfolio of options. Note that there is no possible solution by 2012, and that the 2015 solution is nearly twice as expensive as the 2020 solution. Also of note, the shortfall shown for 2015 is 310 MGD and for 2020, 350 MGD. These shortfall values assume Metro District demand follows long-term projections as per the existing water plan. Implicitly, this assumes the region would not face demand reduction as a result of the ruling.

Table 1: Summary of Potential 2015 and 2020 Solutions

	2015 solution	2020 solution
Yield (MGD)	~340 (2015 shortfall is ~310)	~360 (2020 shortfall is ~350)
Capital Cost (\$ million)	~3,060	~1,660
Cost efficiency (\$/MG)	~890	~460
Total 50 year cost (\$ million)	~5,035	~2,940
Potential impact on Metro District weighted average retail water rates (assuming costs borne directly/indirectly by utilities)	~55% increase (assuming ~\$5/kgallons base rate)	~32% increase

4.1 Description of 2012 option portfolio

When considering the challenge posed by Judge Magnuson's ruling, the first question to evaluate was whether potential water shortfall in July 2012 can be addressed. As mentioned, the Task Force does not believe that the Metro Water District can meet the potential supply gap by 2012, even with extremely aggressive conservation measures, including drought-response level, full outdoor watering bans.

Only conservation options would likely provide yield only by 2012, as they do not require the planning and construction time of infrastructure-based options. Many conservation options, however, still require ramp-up time, and could only yield a fraction of their potential savings by 2012. For example, options such as conservation pricing, sub-metering, and use of more efficient fixtures would require consumers to adopt the option and/or change their behavior, which could take several years. Capture and control options, such as reservoirs, require significant pre-work, such as permitting, technical design and environmental impact studies, which often take 3-4 years prior to start of construction. Because of these significant lead times, most of these capture and control options would not be available until 2020, except a small ground water project.

Figure 2: Aggressive implementation of conservation options insufficient to address 2012 gap

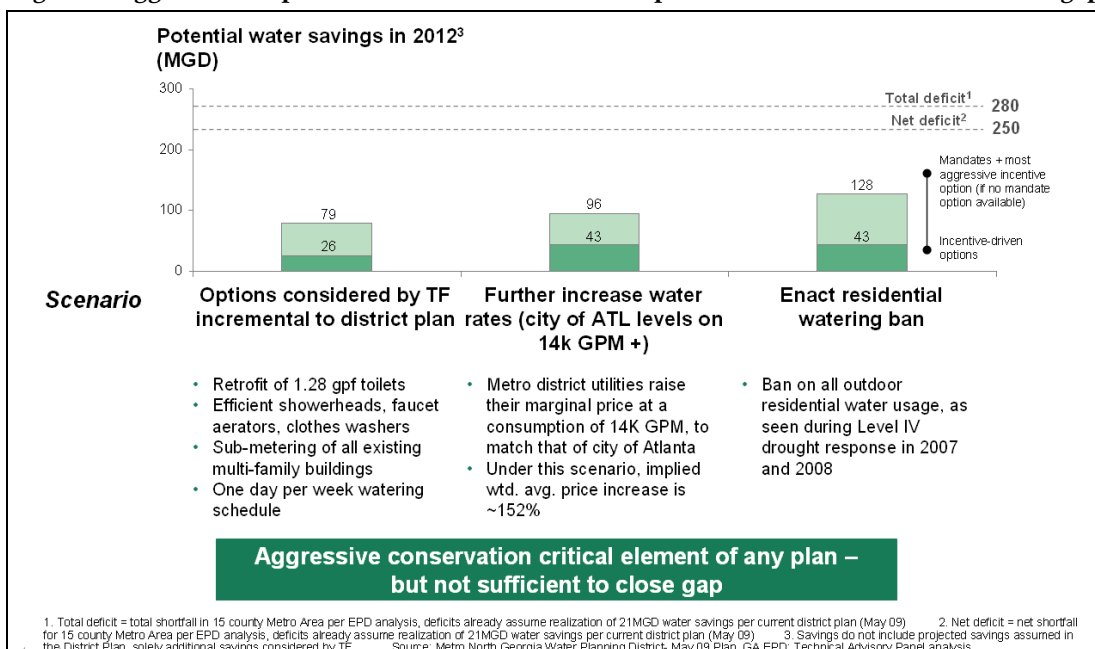
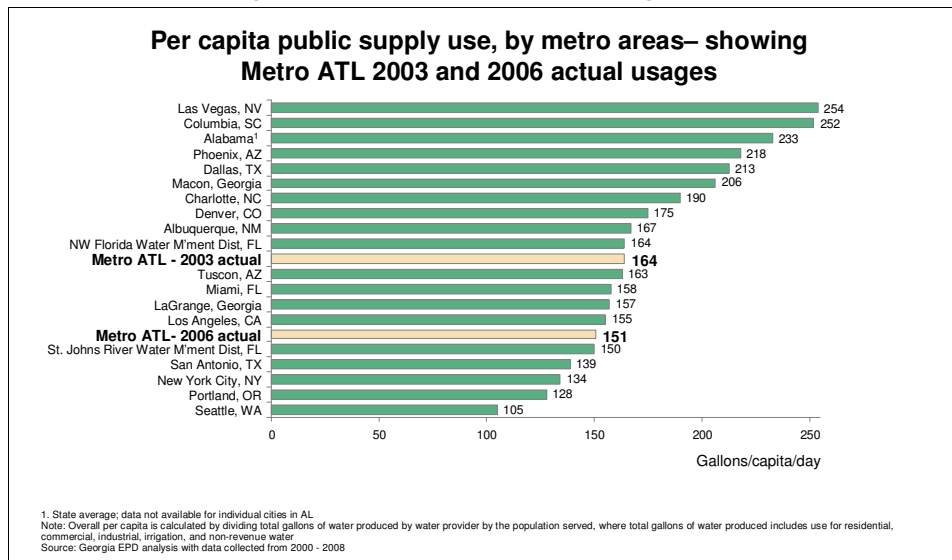


Figure 2 illustrates alternative conservation approaches, and demonstrates that conservation alone, even under extremely aggressive scenarios, would be insufficient to meet the potential 2012 water shortfall. The vertical axis represents potential savings in 2012 (MGD), with the dark green designating incentive-driven water savings and the light green highlighting the additional yield available through mandated conservation options. The first scenario on the left shows the estimated impact from the range of conservation options identified by the Task Force; 26-79 MGD of water savings by 2012. The hypothetical, middle scenario shows what one could achieve if one were to increase marginal water prices on discretionary outdoor use (above 14,000 gallons per month) to existing city of Atlanta levels. While the estimated water savings would increase, it would still not be enough to close the gap. On the right is another hypothetical scenario, representing savings if residential watering bans were enacted. Even under this mandatory conservation scenario, the

realized savings would not be sufficient to address the shortfall. Moreover, even if conservation options could offset the shortfall in totals, actual conservation savings tend to be diffused across the entire metro region. So, even that amount of conservation would not guarantee that shortfalls in critically affected areas could be met. It is clear, however, that conservation efforts across all counties of the metro region are critical to establish an overall culture of conservation, to demonstrate good stewardship of a limited resource, and to benefit downstream users.

As stated in the introduction, conservation savings evaluated by the Task Force should be considered as incremental to existing plans. Incremental conservation savings are somewhat limited because of the degree of progress the Metro District has made and continue to makes. As shown in Figure 3, Metro Atlanta (the 15-county area) has decreased per-capita usage 13 gallons/capita/day (or 8%) between 2003 and 2006, to a level below that of many other metro areas.

Figure 3: Overall District water usage levels



Considering the cost-effective and environmentally friendly nature of conservation options, the real choice with conservation is not whether to include it in the solution, but rather, by what means to implement it, namely via incentives or via mandates. For example, consumers might be provided with tax incentives to replace their high flow toilets, or the state might mandate that all high flow toilets in the Metro Water District are to be replaced in two years. Overall, an estimated additional 26 MGD can be saved by 2012 through incentives-based conservation.

In comparison, an additional 36MGD can be saved by pursuing mandated programs. There are two key reasons for mandated programs having a higher yield. First, the estimated yield for incentive-based conservation programs, as evaluated by the Task Force, does not include what is already outlined in existing water plans. Key incentive-based conservation programs such as toilet retrofits,

showerheads and faucets, multi-family sub-metering etc. have already been set into motion by the Metro Water Plan, thereby decreasing the size of the incremental opportunity. Second, significantly higher market penetrations for conservation programs are likely to be achieved only through mandates. For example, in case of multi-family sub-metering, a mandate is the only means to ensure that 100% of multi-family buildings in the area opt for sub-meters; an incentive based approach would generate lower levels of adoption. Figure 4 lists the conservation options available through conservation 2012, under an incentive based approach. Detailed descriptions of these conservation options considered may be found in Appendix III. (Note: based on their estimated cost efficiencies, grey water reuse and pipeline replacement options, with cost efficiencies in excess of \$15,000/MG, were not included 2012 solution portfolio).

In addition, an effective and robust set of education and public outreach programs are essential to fully realize the potential water savings through conservation. A key requirement for a public education and awareness program is sufficient funding. The estimated cost of public education is approximately \$1 per person, or ~\$4 million for the Metro Atlanta District in a 3-year effort to reach the entire population. Even with this additional \$4 million expenditure on education, which is equivalent to additional cost over and above the cost of conservation programs, of \$50-\$100/MG water saved, they are still highly cost effective.

Figure 4: Options available by 2012

Option	Cost Efficiency (\$/MG)	Capital Cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	5
Rain sensors (retrofit 25% existing systems)	60	6	5
Spray rinse valves (rebate program)	115	1	0.7
Conservation pricing	125	14	6
Multi family sub-metering (retrofit 50% existing homes)	165	6	2
Cooling towers (rebate program)	170	6	3
Showerheads and faucets (increased rebate program)	300	8	3
Toilet retrofits (increased rebate program)	375	25	2
Residential clothes washers	1,050	14	0.2
Leak abatement	1,200	17	9
	Wtd. Avg. ~410	~100	~35

Source: Technical Advisor Panel estimates
Note: Expected 2012 yield shown for conservation options

4.2 2015 contingency portfolio

The potential water shortfall in 2015 arising from Judge Magnuson’s ruling could be addressed only by a contingency solution that supplies water at an incremental average cost of approximately \$890/MG. The options that would constitute this relatively expensive solution are shown in Figure 5. This contingency portfolio would consist primarily of isolated groundwater systems and a large relatively expensive, indirect potable reuse project. As previously noted, the indirect potable reuse option drives the majority of the cost of the 2015 portfolio, and there is little flexibility in the 2015 contingency portfolio solution, since indirect potable reuse is the only significant option that is available in this timeframe. It is important to note that indirect potable reuse would not be part of the lowest cost 2020 portfolio, if the Metro water district had more time to respond.

Figure 5: Options in 2015 contingency portfolio

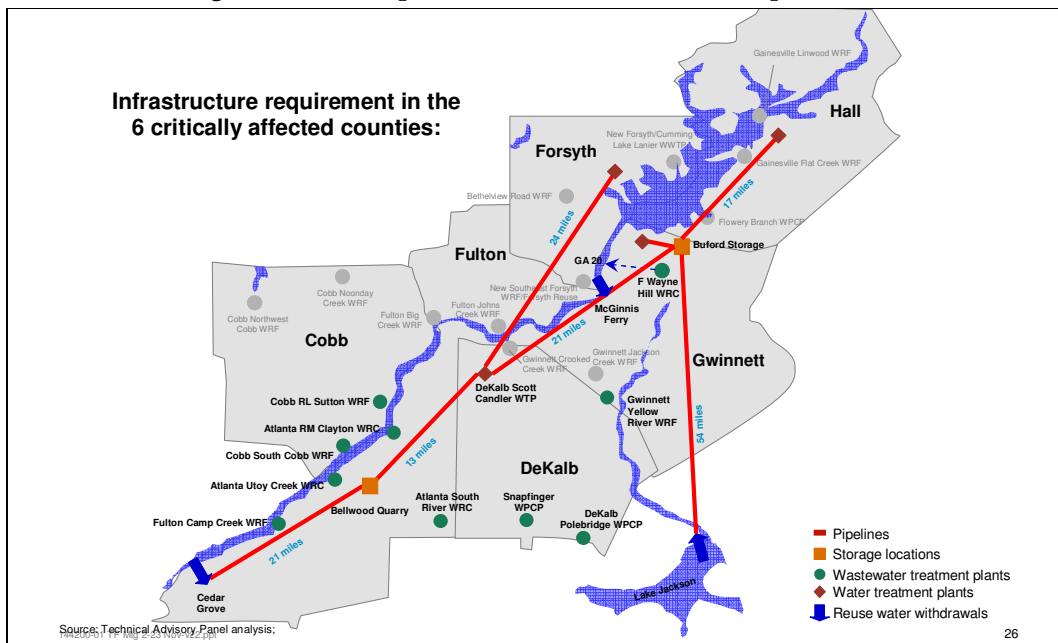
Option	Cost Efficiency (\$/MG)	Capital Cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	6
Rain sensors (retrofit 25% existing systems)	60	6	4
Spray rinse valves (rebate program)	115	1	0.5
Conservation pricing	125	14	6
GW for non-potable use	155	8	15
Multi family sub-metering (retrofit 50% existing homes)	165	6	2
Cooling towers (rebate program)	170	6	3
Lawrenceville GW system	300	5	6
Showerheads and faucets (increased rebate program)	300	8	2
Spalding county GW system	325	7	6
Bartow county GW system	345	11	7
Suwanee GW system	375	10	5
Palmetto GW system	375	3	2
Toilet retrofits (increased rebate program)	375	25	2
Lawrenceville ASR	900	19	4
Small Quarry	1,010	95	8
Residential clothes washers	1,050	14	0.4
Indirect potable reuse (6 county)	1,070	2,800	252
	Wtd. Avg. ~890	~3,060	~340

Source: Technical Advisor Panel estimates
Note: Expected 2015 yield shown for conservation options

But because the indirect potable reuse option is central to the 2015 portfolio, it is worth denoting exactly what this option entails. Indirect potable reuse recaptures wastewater that has been diluted with natural water from rivers and lakes, to provide water for drinking purposes. It is currently practiced in the Metro District in both planned and incidental forms. But the 2015 solution would rely on a dramatic expansion of this option by building an extensive network of pipes, and pumping the water to upstream communities critically affected by the ruling. The map in Figure 6 provides an overview of the pipe and pump infrastructure required to implement this indirect potable reuse option. There would be three water intake points where wastewater that would have been mixed with natural water would be withdrawn: Cedar Grove, Lake Jackson, and McGinnis Ferry. Cedar Grove – the major water intake location – would be chosen 5 miles downstream of the further downstream wastewater discharge location to allow for sufficient contact with natural water and thus ensure

sufficiently high wastewater quality. The pipes help deliver the pumped water back upstream to the critically affected communities, where this water would enter existing water treatment facilities to replenish the drinking water supply. These pipes across the various counties drive the high cost of this option.

Figure 6: Indirect potable reuse infrastructure requirement



The Indirect Potable Reuse project would also raise a number of concerns about implementation feasibility. First, there would be risks concerning implementation timing, due to the need for extensive technical design, permitting, processes of obtaining easements, and other factors. While this option could possibly be implemented by 2015, any delay in these activities could jeopardize the ability to implement this solution in a timely manner. Second, there would be significant funding challenges to be addressed. The solution would have a high upfront capital need of approximately \$2.8 billion, and would include multiple entities in the Metro Water District. It would also be a challenge to specify the necessary contracts and to establish a suitable governance structure to manage the project. The option would also have the potential for significant environmental impact, such as change in water quality levels and temperatures, which could necessitate additional mitigation costs. Further, there would be questions about the degree to which consumers would embrace the concept of reusing water for potable purposes. Clearly, there would be significant non-financial considerations to be taken into account if this option were to be implemented.

4.3 Recommended 2020 portfolio of options

If required, the Task Force recommends a portfolio of options to address the water shortfall by 2020. This portfolio would better balance cost-effectiveness and feasibility considerations than the 2015

portfolio. The primary difference between this portfolio and the 2015 contingency portfolio would be the expansion of four existing reservoirs (Tusahaw Creek, Dog River, Big Haynes Creek, and Etowah River Dam 1) and development of one new reservoir (Richland Creek). These more cost effective options would take the place of the indirect potable reuse project. Figure 7 summarizes the options that would comprise this portfolio, along with their associated cost and yield estimates.

Figure 7: Options in recommended 2020 portfolio

Option	Cost efficiency (\$/MG)	Capital cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	7
Rain sensors (retrofit 50% existing systems)	70	6	6
Spray rinse valves (direct install program)	110	1	2
Conservation pricing	125	14	6
GW for non-potable use (parks, golf courses, etc)	155	8	15
Multi family sub-metering (retrofit 100% existing units)	170	6	3
Cooling towers (required standards)	170	6	5
Tusahaw Creek reservoir expansion	260	64	20
Lawrenceville GW system	300	5	6
Dog river reservoir expansion	300	230	48
Showerheads and faucets (direct install program)	250	8	10
Spalding county GW system	325	7	6
Bartow county GW system	345	11	7
Suwanee GW system	375	10	5
Palmetto GW system	375	3	2
Toilet retrofits (direct install program)	350	25	15
Big Haynes Creek reservoir expansion	390	270	47
Richland creek reservoir (larger)	580	620	80
Etowah River Dam No. 1 reservoir expansion	615	350	41
Leak abatement	1,200	17	27
	Wtd. Avg. ~460	~1,660	~360

Note: Expected 2020 yield is shown for conservation options
Source: Technical Advisor Panel estimates

The recommended 2020 portfolio would feature aggressive implementation of retrofit and efficiency programs. Specifically, toilet retrofits, showerhead and faucet retrofits, multi-family sub-metering, and spray rinse valve retrofits would be included, and implemented through a direct installation program, rather than relying solely on incentives to encourage adoption. Rain sensor and cooling tower programs would be included under a more aggressive, but incentive-based implementation approach. The 2020 portfolio would also include critical reservoir expansion options (~156 MGD), based on their relatively higher cost-efficiency and relatively lower environmental impact concerns (as compared to new reservoirs).

The Task Force believes that an incentive-based conservation approach could be readily implemented, independent of the potential impact of Judge Magnuson's ruling. And the Task Force would endorse a mandate-based approach only as a contingency solution. More detail regarding Task Force deliberations on these options can be found in Section 6.1.

Note that no interbasin transfer options are recommended as part of the 2020 contingency portfolio. This is primarily a result of their high relative cost, as well as due to Task Force member input on

preferred solutions, and an assessment of implementation feasibility. Their non-inclusion does not imply that transfers are never warranted, or that a transfer option could not address a different situation. But, for purposes of the 2020 portfolio, based on both cost efficiency and feasibility, there were superior alternatives to interbasin transfers. It is also possible that some other future transfer options, not explicitly evaluated by the Task Force (e.g., sale of surplus water), may prove cost-effective and worthy of consideration.

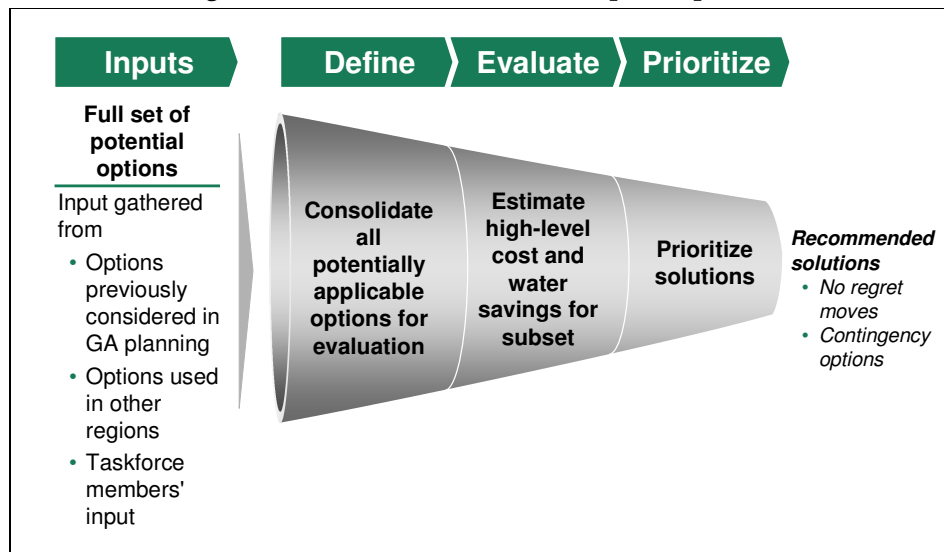
5 METHODOLOGY

The Task Force employed a systematic option prioritization process in order to develop the recommended contingency solutions. This enabled on initial, broad assessment of many options, followed by increasingly detailed evaluation of a subset of preferred options. Through this process, key options and potential solution portfolios were first identified. Task Force member input was collected through specific surveys, to gage support for alternative portfolios and to converge on recommended solutions. This section describes the methodology relied upon to generate the ‘primary’ and ‘alternative’ 2020 solutions. The following section describes the feedback received from the Task Force on principles, and on portfolios and options, and the implications for the 2020 contingency solution recommended.

5.1 Task Force solution development process

The Task Force followed a three step process to define, evaluate, and prioritize options, as shown in Figure 8.

Figure 8: Task Force solution development process



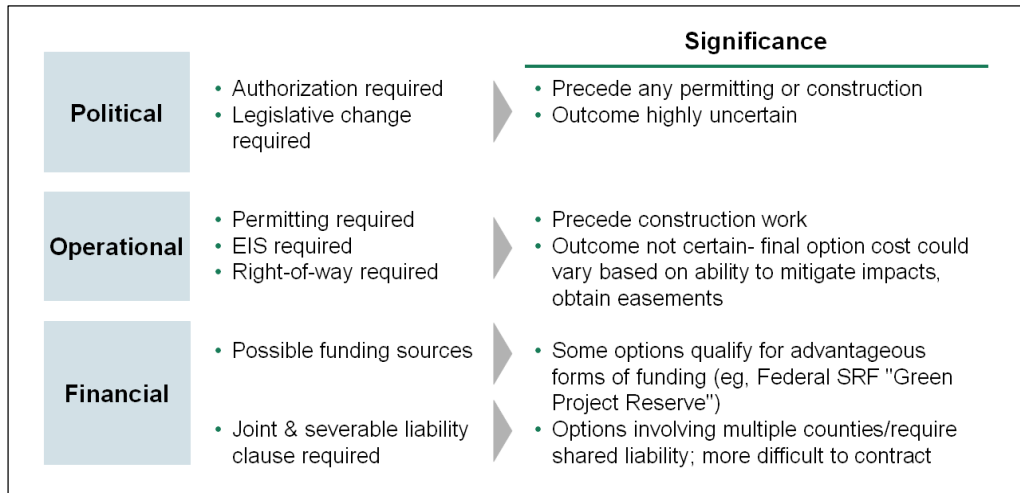
In the first step, the full set of potential options were defined from existing water plans, options considered by other regions, input from Task Force members, technical advisors, and various groups. The Task Force considered these options in three broad categories. The first was existing programs or options that could be more quickly or broadly implemented. For example, this could mean phasing out high-flush toilets in the Metro Area within the next 5 years, instead of according to a 10-year plan. The second broad category was previously-identified but not implemented options. These ideas may have been passed over for implementation previously because they were not necessary, though they could potentially be valid in the context of Judge Magnuson's ruling and its consequences (e.g., options deemed to be too costly before could prove to be cost-effective under assumptions that reflect the impact of the ruling). The third broad category was new ideas that were not previously assessed. These ideas were sourced from best practices followed by other regions' and input from the Task Force members. Examples of such ideas include use of non-potable ground water for outdoor watering in select location and desalination.

In the second step these options were evaluated. This involved making estimates of high-level costs and yields for a subset of these options. Because the scope and compressed timeline of the Task Force effort, it is important to recognize that these estimates of cost and yield include a range of uncertainty. A precise assessment would have required many months of detailed technical design, and hydrology studies that were outside the Task Force scope. However, the estimates are comparable across options, are based upon the use of common estimation methodologies and standard input assumptions, where appropriate, across options. For example, all options employed standard methodologies for reservoir yield determinations, water transport costs and treatment costs (refer to Appendix IV for details).

For all options, initial capital costs (construction, installation, program rollout, etc) and ongoing operating expenses were estimated. Where possible, capital and operating costs were defined per 'phase' or 'process'- for example, for Aquifer Storage and Recovery (ASR) options, costs were estimated for initial treatment, injection, extraction, and re-treatment phases. Cost scale factors were applied where appropriate, (eg, water treatment, pipeline costs) to adjust unit costs for option size. Project lifetimes were assumed based upon the duration of the option (generally 50-year lifetimes were assumed) and total costs over project lifetimes were summed in 2010 dollar terms (ie, present value). These total costs were applied against total expected lifetime yields (in Average Annual Day terms- AAD) to obtain the \$/MG cost efficiency metric. This cost metric enables comparison across different types of options, with different cost profiles (upfront capital cost loaded versus steady operating costs every year)

Figure 9 provides a summary of the key feasibility considerations used to evaluate options (details on how each option fares against these criteria can be found in the Appendix III.) Additionally, options were also classified as "no regrets" (i.e., pursue irrespective of the ruling) or "contingency options" (i.e., those to pursue only if the judge's ruling were to take effect), based on Task Force member survey input. Details on these options are presented in Section 6.2.

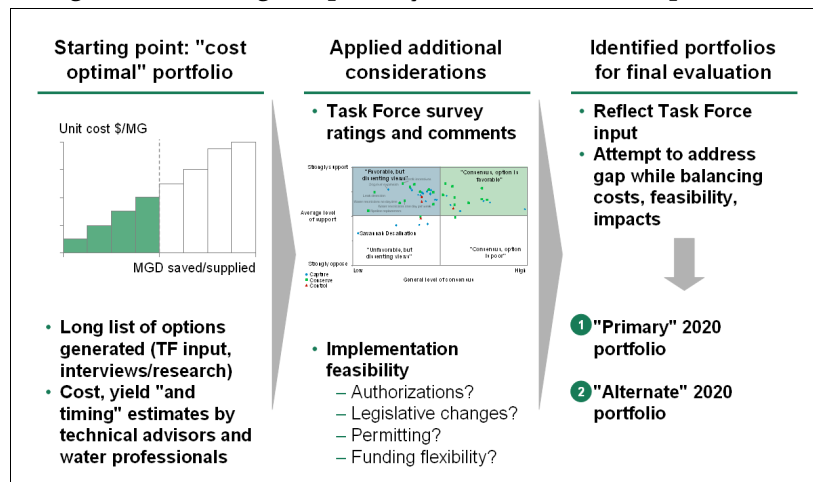
Figure 9: Options key feasibility considerations



5.2 Primary' and 'Alternate' 2020 portfolios

The Task Force also relied on a similar prioritization process, which as depicted in Figure 10, to identify 'Primary' and 'Alternate' portfolios. This practically pertains only to the 2020 contingency solution, as there were not multiple viable options to address the water shortfall prior to this. By 2020, however, there should be a broad set of potential contingency options available, requiring prioritization of specific options. The Task Force believed it was important to consider various 2020 alternatives, in part because of key uncertainties in terms of implementation feasibility.

Figure 10: Defining the 'primary' and 'alternate' 2020 portfolios



The starting point for these alternatives was the 2020 lowest cost option portfolio. This portfolio was determined by a simple ranking of the cost efficiency of all options evaluated (See Figure 11). Cost, yield, and timing estimates were generated by technical advisors and validated with local water professionals. The lowest cost options that filled the gap were selected in sequence. Note that this portfolio contains the Lake Burton interbasin transfer option, based on its estimated cost efficiency.

Figure 11: Options in the lowest cost 2020 portfolio

Option	Cost Efficiency (\$/MG)	Capital Cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	7
Rain sensors (retrofit 25% existing systems)	60	6	3
Spray rinse valves (rebate program)	115	1	0.3
Conservation pricing	125	14	6
GW for non-potable use	155	8	15
Multi family sub-metering (retrofit 50% existing homes)	165	6	2
Cooling towers (rebate program)	170	6	3
Tussehaw Creek reservoir expansion	260	64	20
Lawrenceville GW system	300	5	6
Dog river reservoir expansion	300	230	48
Showerheads and faucets (increased rebate program)	300	8	1
Spalding county GW system	325	7	6
Bartow county GW system	345	11	7
Suwanee GW system	375	10	5
Palmetto GW system	375	3	2
Toilet retrofits (increased rebate program)	375	25	1
Big Haynes Creek reservoir expansion	390	270	47
Lake Burton transfer	417	362	50
New reservoir NW of Forsyth	510	660	88
Richland creek reservoir (larger)	580	620	80
	Wtd. Avg. ~410	~2,300	~400

Note: Expected 2020 yield is shown for conservation options
Source: Technical Advisor Panel estimates

At this point in the process, Task Force members were asked to provide ratings through a survey (described in Section 6), and to summarize implementation feasibility considerations (as described in Figure 9), and to apply them to these options. Task Force members were asked their level of support (through a 5- point scale) for the options, as well as whether they would continue to support the option even in the event Lake Lanier were reauthorized.

Two resulting portfolios emerged from these qualitative considerations, termed ‘primary’ and ‘alternate’ 2020 portfolios. These alternatives differ primarily on the mode of conservation (i.e. the desired extent of incentive-driven options vs. mandates), and the mix of reservoir expansions vs. new builds. The recommended 2020 portfolio of options was then designed based on Task Force feedback on these ‘primary’ and ‘alternate’ portfolios.

The set of options that make up the primary 2020 portfolio are shown in Figure 12. There are two key changes relative to the lowest cost portfolio of options: First, the Lake Burton interbasin transfer option was removed as it was deemed to pose significant implementation challenges. Second, a leak abatement option was included despite its high cost, as it received very high support from Task Force members. As a result of these changes, the ‘primary’ portfolio which the Task Force recommends

would address the 2020 water shortfall at an average unit cost of approximately \$470/MG, with an upfront capital requirement of around \$2 billion.

Figure 12: Options in the ‘primary’ 2020 portfolio

Option	Cost efficiency (\$/MG)	Capital cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	7
Rain sensors (retrofit 25% existing systems)	60	6	3
Spray rinse valves (rebate program)	115	1	0.3
Conservation pricing	125	14	6
GW for non-potable use (parks, golf courses, etc)	155	8	15
Multi family sub-metering (retrofit 50% existing homes)	165	6	2
Cooling towers (rebate program)	170	6	3
Tussehaw Creek reservoir expansion	260	64	20
Lawrenceville GW system	300	5	6
Dog river reservoir expansion	300	230	48
Showerheads and faucets (increased rebate program)	300	8	1
Spalding county GW system	325	7	6
Bartow county GW system	345	11	7
Suwanee GW system	375	10	5
Palmetto GW system	375	3	2
Toilet retrofits (increased rebate program)	375	25	1
Big Haynes Creek reservoir expansion	390	270	47
New reservoir NW of Forsyth	510	660	88
Richland creek reservoir (larger)	580	620	80
Leak abatement	1,200	17	27
	Wtd. Avg. ~470	~1,970	~370

Note: Expected 2020 yield is shown for conservation options
Source: Technical Advisor Panel estimates

The logic underlying ‘alternate’ portfolio, shown in Figure 13, would be to further enhance implementation feasibility and minimize environmental impact. Specifically, the portfolio would achieve this by incorporating more aggressive (mandated) retrofit programs (~28 MGD incremental yield) and increased incentives for rain sensor retrofits (3 MGD) and by prioritizing reservoir expansions over new reservoirs. Thus, the option of building a new reservoir NW of Forsyth would be excluded in favor of the Etowah River Dam No. 1 expansion project. The resulting cost-efficiency of this portfolio would be approximately \$460/MG. This portfolio would marginally more cost-efficient than the ‘primary’ portfolio, because the more aggressive conservation options are more cost-effective relative to capture options, and provide greater yield.

Figure 13: Options in the 'alternate' 2020 portfolio and comparison with primary

Option	Cost efficiency (\$/MG)	Capital cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	7
Rain sensors (retrofit 50% existing systems)	70	6	6
Spray rinse valves (direct install program)	110	1	2
Conservation pricing	125	14	6
GW for non-potable use (parks, golf courses, etc)	155	8	15
Multi family sub-metering (retrofit 100% existing units)	170	6	3
Cooling towers (required standards)	170	6	5
Tussehaw Creek reservoir expansion	260	64	20
Lawrenceville GW system	300	5	6
Dog river reservoir expansion	300	230	48
Showerheads and faucets (direct install program)	250	8	10
Spalding county GW system	325	7	6
Bartow county GW system	345	11	7
Suwanee GW system	375	10	5
Palmetto GW system	375	3	2
Toilet retrofits (direct install program)	350	25	15
Big Haynes Creek reservoir expansion	390	270	47
Richland creek reservoir (larger)	580	620	80
Etowah River Dam No. 1 reservoir expansion	615	350	41
Leak abatement	1,200	17	27
Wtd. Avg. ~460	~1,660	~360	

Note: Expected 2020 yield is shown for conservation options
Source: Technical Advisor Panel estimates

Primary 2020 Portfolio				Alternate 2020 portfolio			
Option	Cost efficiency (\$/MG)	Capital cost (\$M)	Yield (MGD)	Option	Cost efficiency (\$/MG)	Capital cost (\$M)	Yield (MGD)
Water restrictions (no daytime watering)	10	0	7	Water restrictions (no daytime watering)	10	0	7
Rain sensors (retrofit 25% existing systems)	60	6	3	Rain sensors (retrofit 50% existing systems)	70	6	6
Spray rinse valves (rebate program)	115	1	0.3	Spray rinse valves (direct install program)	110	1	2
Conservation pricing	125	14	6	Conservation pricing	125	14	6
GW for non-potable use (parks, golf courses, etc)	155	8	15	GW for non-potable use (parks, golf courses, etc)	155	8	15
Multi family sub-metering (retrofit 50% existing homes)	165	6	2	Multi family sub-metering (retrofit 100% existing units)	170	6	3
Cooling towers (rebate program)	170	6	3	Cooling towers (required standards)	170	6	5
Tussehaw Creek reservoir expansion	260	64	20	Tussehaw Creek reservoir expansion	260	64	20
Lawrenceville GW system	300	5	6	Lawrenceville GW system	300	5	6
Dog river reservoir expansion	300	230	48	Dog river reservoir expansion	300	230	48
Showerheads and faucets (increased rebate program)	300	8	1	Showerheads and faucets (direct install program)	250	8	10
Spalding county GW system	325	7	6	Spalding county GW system	325	7	6
Bartow county GW system	345	11	7	Bartow county GW system	345	11	7
Suwanee GW system	375	10	5	Suwanee GW system	375	10	5
Palmetto GW system	375	3	2	Palmetto GW system	375	3	2
Toilet retrofits (increased rebate program)	375	25	1	Toilet retrofits (direct install program)	350	25	15
Big Haynes Creek reservoir expansion	390	270	47	Big Haynes Creek reservoir expansion	390	270	47
New reservoir NW of Forsyth	510	660	88	Etowah River Dam No. 1 expansion	615	350	41
Richland creek reservoir (larger)	580	620	80	Richland creek reservoir (larger)	580	620	80
Leak abatement	1,200	17	27	Leak abatement	1,200	17	27
Wtd. Avg. ~470	~1,970	~370		Wtd. Avg. ~460	~1,660	~360	

Note: Changes from "primary" to alternate" portfolio include:
1) Most aggressive retrofit/efficiency program implementation, and
2) Etowah River Dam 1 expansion instead of New Reservoir NW of Forsyth

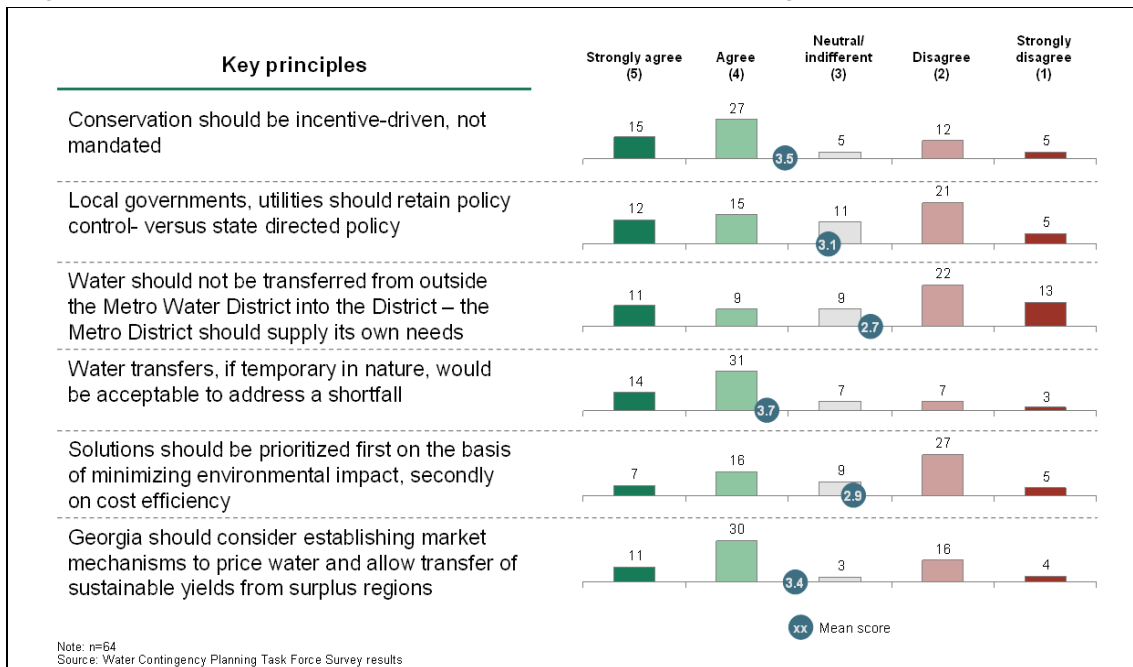
6 SUMMARY OF TASK FORCE FEEDBACK

Feedback was collected from Task Force members throughout the process, on many levels, and it directly informed the development of these recommendations. The following section summarizes Task Force feedback on principles of prioritization, solution portfolios, and individual options.

6.1 Summary of Task Force feedback on principles

Task Force members were surveyed on their level of support for set of principles that could be used for option prioritization, before they were asked about any individual options. This was done to clarify the underlying logic that Task Force members, as individuals and as sub-groups (business, elected officials, conservation, etc) would prefer to be used to evaluate and prioritize solutions. Figure illustrates the of Task Force responses on each principle.

Figure 14: Distribution of Task Force responses on support for key prioritization principles

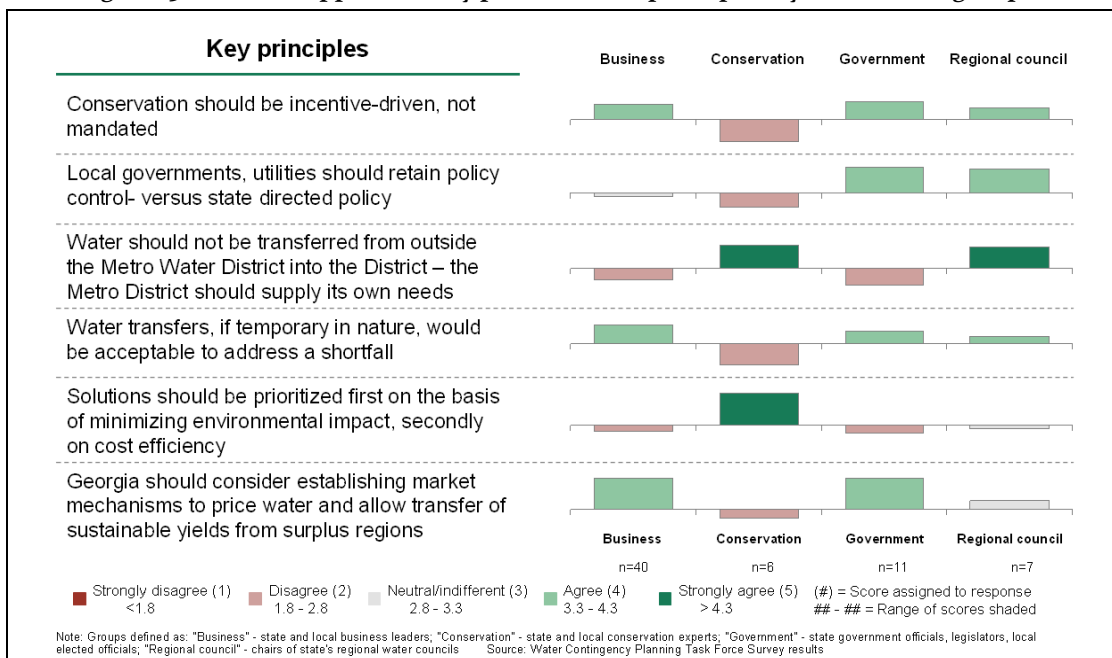


The Task Force was in fairly strong agreement that if given the choice, conservation measures should be implemented via incentives rather than mandates. There was also consensus on the principle that both cost effectiveness and environmental impact should be balanced when arriving at a recommended portfolio of options. Further, to address the immediate shortfall situation, most Task Force members felt that temporary transfers to an affected area would be acceptable. However, temporary transfers only apply to system interconnections, or specific reservoirs which could enable

sharing water from an area which currently has a surplus. Large, infrastructure-intensive interbasin transfers cannot be temporary because they would not be economically feasible. There were, however, several principles on which opinions diverged. For example, there were considerable differences within the Task Force on whether policy control should rest at the local or state level, and whether or not long-term inter-basin transfers should be allowed.

Figure 15 shows a different summary of Task Force feedback on principles. It summarizes the degree to which, Task Force members affiliated with different groups, tended to support the key prioritization principles. In general, there was consensus across most groups, although the conservation group affiliated members often expressed opinions differing from other groups. It is useful to understand the degree of endorsement for various prioritization principles by different groups, as well as the potentially divergent viewpoints that could be encountered about key options, both within the Task Force and more broadly. These viewpoints also underscore the key tradeoffs that should be considered when choosing to implement various options.

Figure 15: Level of support for key prioritization principles by various sub-groups



6.2 Summary of Task Force feedback on portfolios

Task Force members also provided feedback through additional surveys, on the various portfolios of options previously described. In general, the Task Force indicated high levels of support for both the 'primary' and 'alternate' 2020 portfolios. There was also a consensus among Task Force members that

more could be done via conservation measures, although differences in opinion did emerge over the method of implementation (i.e., incentives versus mandates).

When asked directly to choose one portfolio to endorse as a 2020 contingency solution, Task Force members leaned toward the “alternate” portfolio, with mandated conservation measures, at a slightly higher rate than toward “primary” portfolio (the margin of difference was 4 responses from a total of 58). Additional comments indicate that while almost all Task Force members recognized the need for, and are willing to endorse mandates in a truly “dire” situation, most feel strongly that *initial* implementation should be incentive-based. Furthermore, most Task Force members recognized that an optimal approach includes a blend of mandates and incentives for specific options, rather than an “all or nothing” approach.

When asked about the conditions necessary to secure their endorsement for specific portfolio solution, most Task Force members cited the need for further, detailed analyses of potential impact to downstream resources. Additionally, many encouraged follow-on evaluation of the potential cost-benefit of developing additional reregulation capacity on the Chattahoochee River below Buford Dam (e.g. dredging Morgan Falls reservoir). These items are discussed in more detail in Section 7 of this report.

In terms of the 2015 portfolio of contingency options (dominated by the indirect potable reuse option), Task Force support was very mixed. These options that could potentially address the gap by 2015 were generally viewed as costly and impractical. A comment from one Task Force member summarized the overall thoughts on this potential solution portfolio; “Indirect potable reuse is a very expensive way to do what we're already doing – drawing water out of the ACF and putting it back after using and treating it”. The Task Force supports this portfolio only as an absolute contingency if required to meet timing constraints.

6.3 ‘No-regret’ and ‘contingency’ options

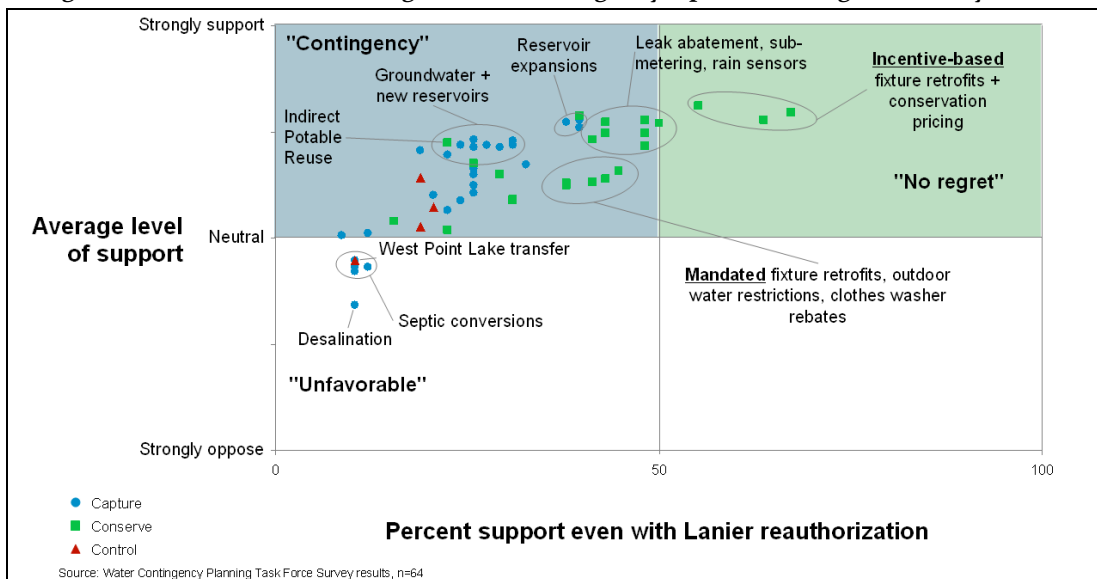
In addition to a survey of Task Force preferences on alternative 2020 portfolios, Task Force members were also surveyed on their views on specific options. As summarized in Section 5.1, the Task Force relied on survey results to identify ‘no-regret’ and ‘contingency’ options. On the chart in Figure 16, each option is plotted based on two attributes: 1) the option's average level of support (as indicated by respondents' rating), and 2) the option's average level of support even assuming Lake Lanier reauthorization (as indicated by the percent of respondents who chose “implement even with Lanier reauthorization” on the survey).

Through this lens, the Task Force identified those options in the upper right portion of the chart as ‘No-regrets’ (i.e. they earn relatively high support and most Task Force members would support them even with reauthorization). Options in the top left quadrant are generally well-supported, but only in

the event that Lake Lanier is not reauthorized. These are classified as ‘contingency’ options. Any options falling below the horizontal line are generally viewed as unfavorable.

Clearly, incentive-driven conservation measures stand out as ‘no-regret’ options. These include toilet retrofits, showerhead and faucet retrofits, cooling tower programs, and conservation pricing. Reservoir expansions have the highest support among contingency options, followed by new reservoirs, groundwater systems and, then, indirect Potable Reuse. It is also noteworthy that additional conservation measures, including leak abatement and mandated retrofits, have relatively high support. In the case of leak abatement, the recommended actions on mandatory data collection and reporting and utility plan development were endorsed as ‘no-regret’ options for immediate consideration.

Figure 16: Assessment of ‘no-regret’ and ‘contingency’ options through TF survey results



6.4 Alternative views on key types of options

As one might expect, for many issues there was not complete alignment among Task Force members’ views. A key role of the Task Force is to highlight those areas of differences and summarize alternative perspectives for consideration by policy-makers. This section presents alternative viewpoints on the major sub-sets of options. This is a considerably distilled summary. The compendium of Task Force members’ comments and submissions is in the Appendix VI.

Conservation efficiency programs:

Conservation efficiency programs include options such as toilet retrofits, showerheads and faucets, outdoor watering restrictions, etc. A full list of conservation efficiency programs evaluated can be found in Appendix III. For these measures, there is a consensus that they should be integral to the overall solution. However, there are diverging viewpoints on whether these options should be implemented via mandates or incentives. As an example, discretionary outdoor water use can be controlled via tiered pricing as a form of incentive, or be completely banned as was done during the drought. Proponents of a mandate-based implementation cite the opportunity to realize higher yields with minimal environmental impact as the key rationale. On the other hand, those supporting an incentive-based implementation place more weight on the higher quality-of-life associated with incentive based solutions.

In addition, some proponents of conservation advocate that all potential demand-management options should be considered before any supply options, including those conservation options with potentially low yields and/or high unit costs. For example, residential greywater recycling could reduce potable water use (20-25 MGD) but it is not included in the recommended portfolio due to its estimated unit cost (~\$15,000/MG). Some Task Force members still feel that this option is worth considering. Further, there are a number of lower yield potential options, (e.g., air-cooled ice-machines, x-ray machine upgrades) which were identified by some Task Force members but not investigated in detail. Other Task Force members cite the need to optimize scarce resources (i.e., funding, enforcement personnel, etc) and therefore suggest pursuing *only* those conservation options with the highest potential return.

Conservation pricing:

There is general support for the conservation pricing option, as being a cost effective and relatively easy to implement conservation measure. However, there are some Task Force concerns around the overall degree of price change that is feasible without severe consumer backlash. Furthermore, some Task Force members point out that any price change would need to preserve the affordability of water for consumers, since it is fundamental to quality of life. There were also some concerns regarding the timeframe for implementation. A significant price increase may need to be implemented over multiple years in small price increments, depending on the appetite that consumers have for price increases in any given year. This could potentially lead to delays in realizing water savings.

Indirect Potable Reuse:

Reactions to the Indirect Potable Reuse option are mixed. On the one hand, some Task Force members believe it is the only available option that can address the shortfall by 2015. Further, some point out that it is currently practiced in the Metro Water District and the proposed option is just an expansion of existing practice. However, there are also substantial concerns among many other Task Force members over the high cost of implementation and implementation feasibility, as discussed in Section 4.2.

Reservoir creation and expansion:

Capture options such as new reservoirs and reservoir expansion receive broad support as contingency options. Those supporting these options tend to argue that they lend themselves to providing long-term water supply stability to the region in addition to resolving contingency issues, which in turn helps economic development. Additionally, most of these options are regarded as relatively cost-effective. There is another school of thought within the Task Forces, however, that these options should only be considered to be “last resort” measures, owing to the associated environmental impact. However, there is general agreement that reservoir expansions would have lower environmental impact, when compared to new reservoir builds. Additionally, there are concerns that reservoirs would adversely impact the amount of water that would be available for downstream communities. At minimum, the Georgia EPD in-stream flow requirements would need to be met by each proposed reservoir option.

Interbasin transfers:

There are substantial differences of views on the long-term interbasin transfer options that were evaluated by the Task Force. Some Task Force members envision a regional water-planning model where water supply would be managed for the entire system as a whole, as opposed to localized regions. Interbasin transfer options become a key ingredient of this vision. Other Task Force members oppose these options, and cite the significant implementation challenges that they pose, such as the need for legislative change, the degree of environmental impact etc. Additionally, interbasin transfers could benefit some users at the expense of others. The specific impact, of course, would depend on the degree of return flows that are mandated under the implementation regime and their precise location.

Those Task Force opinions were also informed by a rich variety of official comment and submissions to the Task Forces, a compendium of all official comments and submissions to the Task Force is available in Appendix VI.

7 TOPICS PENDING FURTHER EVALUATION

There are three main areas where the Task Force felt that additional evaluation and analysis were required to reach conclusions but these analyses were beyond the scope and timeline of the Task Force effort. The first is a more quantitative assessment of the net downstream flow impacts from pursuing sets of contingency options, an issue raised by several Task Force members. The second is a more thorough determination of cost and yield for certain options, where the Task Force’s high-level assessments may not prove adequate and an objective assessment of these topics would require detailed technical analyses that would require significant time. And the third area relates to the suggestions the Task Force received to consider the creation of a regional water authority.

7.1 Determination of downstream flow impact

The set of options evaluated by the Task Force would have varying degree of impact on the amount of water available to downstream users. For example, while conservation programs may have no impact

or even a positive downstream impact, capture measures would result in reduced downstream flow (the degree of reduction is very case specific), and transfer options could benefit a set of downstream users at the expense of others, depending on the specific location and amount of return flows. Given the scope and expedited time from the Task Force effort, only basic steps were taken to account for downstream impact in the option evaluation process. For example, technical advisors incorporated existing standards, such as the Georgia EPD minimum in-stream flow requirement, to ensure that adequate water flow is preserved. Further, the yield and cost estimates for various options included provisions for environmental mitigation.

However, prior to implementing major capture or transfer options it would also be necessary to perform a detailed due-diligence evaluation that takes into account the net impact of implementing multiple options, accounting for all minimum flow requirements, and the impact of Judge Magnuson's ruling on the Corps operating regime. This analysis would need to be done by the relevant Regional Water Planning Council in association with Georgia EPD, prior to implementing any option. Further, applying a standard minimum in-stream flow requirement to all existing reservoirs could change total potential yield available, as well potentially impacting the net downstream flows.

7.2 Additional options requiring more detailed evaluation

In general, an objective assessment of certain options would require detailed technical analyses that would require significant time and were beyond the scope of the Task Force. For example, modeling the hydrology of the Chattahoochee River, downstream of Buford Dam, is essential to assess the net downstream flow impact of implementing options, and to estimate the yield of certain supply options (Morgan Falls dredging, increasing supply through better water treatment standards). In addition, this assessment could require key data that is currently unavailable. For example, the implication of Judge Magnuson's ruling on (a) future Corps operation of the Buford Dam (essential for developing the hydrology model), and (b) permitted river withdrawals for counties downstream of the dam (necessary to assess the potential for transferring surplus water, if available, between counties), was information unavailable to the Task Force.

Morgan Falls Dredging

The Task Force recommends further detailed analysis, beyond the scope of this preliminary study, to determine the potential benefit, and associated cost efficiency, which could be realized by dredging the reservoir behind Morgan Falls Dam (Bull Sluice Lake). Precise levels of possible incremental yield depend largely on a number of factors, including underlying assumptions regarding Corps operating procedures with respect to peak hydropower releases. Initial indications suggest that dredging ~1,000 acre feet of sediment *could potentially* create significant incremental yield, anywhere from 0 to 130 MGD depending on many other factors. Fully understanding the potential benefit of this option, and how it compares to other options evaluated, requires a detailed analysis to include items such as (1) modeling hydrology of the Chattahoochee River below Buford Dam given an understanding of future Corps operating policies, (2) validation or update of historically reported cost estimates, and (3)

determination of expected duration of benefits achieved (i.e. lifetime of option). There are also substantial feasibility challenges and environmental risks that would also need to be addressed before proceeding further.

Increased water treatment levels and potential supply implications

The minimum flow requirement at Peachtree Creek is dictated by a set of constraints such as dissolved oxygen levels. If the binding constraint to the minimum flow requirement is determined, water treatment plants could be upgraded to treat water to a standard that alleviates the constraint, thereby lowering the minimum flow requirement and creating additional supply. The cost associated with the upgrade depends on what constraint is being addressed. In theory, this process can be repeated to alleviate a set of constraints up to the point where cost efficiency no longer available. A detailed evaluation of this option would require a modeling effort by Georgia EPD to simulate the hydrology of the Chattahoochee River below Buford Dam, would be based on assumptions of how the Corps would operate the dam, and would function in existing water treatment standards.

System interconnections/Purchase of surplus water

Surplus water available in counties within and surrounding the Metro Water District could potentially be purchased by counties facing a water shortfall, if system interconnections facilitate the transfer. On the basis of inputs received by the Task Force, it is unclear at this point as to (1) which counties would have surplus water, and (2) how much surplus water would be available in 2012. The availability of surplus water would depend on future growth potential for each county as well as the possible implications of Judge Magnuson's ruling on permitted river withdrawals. Further, this water would likely be available only on the basis of short-term contracts. Additionally, there are challenges in transferring any available surplus water to counties in need. In some instances, the existing infrastructure may be unsuitable for large scale transfer of water. There are also issues relating to water chemistry and water treatment compatibility that might need to be addressed. Even though these options are unlikely to be long-term solutions, however, they could be evaluated further to satisfy short-term needs for water.

Commercial user focused conservation programs

While the many efficiency programs were evaluated for residential users, commercial conservation program potential was not evaluated as fully. The primary limitation is the lack of robust commercial water use data by user and usage categories. This data gap complicates rigorous opportunity sizing. Moreover, given the larger scale of commercial facilities, it is possible that options which appear cost inefficient in residences (eg, greywater reuse) to be viable in some commercial settings. There is potentially an opportunity to validate the cost efficiency of such programs and define targeted incentives.

Likewise, there could potentially be an opportunity to tailor conservation pricing to commercial accounts as a means to motivate conservation and process improvements. One potential concept is 'budget-based' account pricing where marginal rate structures would be tailored to specific commercial accounts, based on account-specific historical usage levels. The latter opportunity could require enhanced water utility billing capabilities, requiring a more informed cost/benefit assessment

Stormwater Reuse

Stormwater reuse refers to the practice of storing stormwater runoff in large surface ponds and subsequently using that as a source of water for non-potable use, typically irrigation. The capture of stormwater was partially addressed through the reservoir pump storage options evaluated by the Task Force. The pump storage options envisioned river water being pumped at high flows (typically during and after storm events) for storage and subsequent use. However, Metro Water District, regional water planning council and/or Georgia EPD could consider conducting a more complete cost/benefit analysis that accounts for the benefits of reducing urban water runoff. Findings from a Stormwater Reuse study commissioned by Texas Water Development Board (<http://www.twdb.state.tx.us/iwt/reuse/projects/stormwater.html>; due Dec 09/Jan 10) could potentially be leveraged.

Rainwater Harvesting

Rainwater harvesting involves localized capture and storage of rainwater for irrigation and non-potable indoor uses. Preliminary analysis suggests that residential application of this concept is potentially expensive, with cost efficiency in excess of \$10,000/MG (accounting for upfront installation cost as well as periodic refurbishment and operating cost over a 50 year life; detailed cost and yield assumptions can be found in Appendix III). However, there could be potential to apply this concept at commercial establishments, with more cost effective applications. The cost and yield for commercial use is highly site specific. Metro Water District, Regional Water Planning Councils, and/or Georgia EPD could consider a more detailed analysis that evaluates the true potential for this option, based on the pattern of rainfall in the metro region. The following issues could also be given consideration: (1) minimum water quality guidelines and standards for rainwater use (2) treatment methods for indoor use of rainwater (3) appropriate cross-connection safeguards for indoor use of rainwater in conjunction with existing municipal water supply, and (4) minimum requirements for the option to be a viable alternative. For example, the Texas Water Development Board recommends this option only for facilities with 10,000 square feet or greater in roof area.

7.3 Regional governance model

Third, there was some input to the Task Force suggesting that a feasibility study should be conducted to assess the merits of establishing a Regional Water Entity, which could consolidate some or all service delivery functions of all water utilities in the Metro District. Such an entity could facilitate funding and implementation of regional infrastructure projects, for example. It was also suggested that Regional Water Planning Councils explore the establishment of county consortium to facilitate the sale of surplus water from surface and groundwater resources in their regions. This evaluation was not in the scope of the Task Force effort, since it addresses a broader issue of governance in the context of state wide water planning efforts, and was not directly linked to developing a contingency plan to address potential water shortfall in the region.

8. Conclusion

The key objective for the Task Force was to define a time-driven action plan prioritizing specific options and recommendations for conservation, supply enhancement. To that end, the Task Force is recommending a set of policies for immediate consideration as well as a set of policies and contingency options to be considered only if absolutely essential.

Policies for immediate consideration include three broad areas of additional conservation improvements: Instituting mandatory data collection and reporting of key metrics to inform future planning efforts (eg, utilities would have to conduct standardized water loss audits), adopting higher water efficiency standards and incentive measures to increase conservation effectiveness. (e.g., more aggressive conservation pricing, increased incentives for fixture retrofits.), and linking progress on conservation efforts to funding eligibility, low-interest loan qualifications, and permitting

applications to ensure implementation of measures. These actions help reinforce the culture of conservation in Georgia and would continue the outstanding progress made in the last several years.

Policies for consideration as contingency measures include mandated conservation program (eg, direct install programs for fixture upgrades, time of day watering restrictions, retrofit on resale). The Task Force also identified contingency solutions for 2015 and 2020 timeframes, based upon the expected availability of varying options. A large indirect potable reuse project defines the 2015 contingency solution, whereas the 2020 solution incorporates more cost effective reservoir expansions and while both contingency solutions are capital intensive and pose significant incremental costs, the 2020 solution is roughly half as costly per gallon of yield. Based on this significant cost difference, if a contingency plan is required, the Task Force recommends pursuing the 2020 solution if possible.

Going forward, the contingency plan will be evaluated in context of the Governor's overall 4-prongs strategy to identify whether and when to begin implementation. The near-term policy recommendations should be considered for incorporation into the state's general water management plan.

All Task Force analyses demonstrate clearly that replacing Lake Lanier as a water source would pose significant *incremental* economic burdens and environmental impacts. All else equal, water rates would rise to reflect the higher wholesale cost of water, quality of life would decline thru economic impacts in addition to increased watering restrictions, and new supply sources would pose some environmental impacts on existing ecosystems. In summary, Lake Lanier is clearly the most economically sensible and environmentally friendly water supply source for the metro Atlanta region.

DEFINITION OF KEY TERMS

Conserve: A broad category of options evaluated by the Task Force that aim to reduce water demand by consumers. Examples of conserve options include toilet retrofits, pricing, leak abatement etc. A complete list of conserve options evaluated by the Task Force can be found in Appendix III.

Capture: A broad category of options evaluated by the Task Force that aim to enhance future water supply through new sources or by expanding existing sources. Examples of capture options include new reservoirs, groundwater, Aquifer Storage and Recovery (ASR) etc. A complete list of capture options evaluated by the Task Force can be found in Appendix III.

Control: A broad category of options evaluated by the Task Force that aim to optimize management of supply through policy and/or process changes. A complete list of control options evaluated by the Task Force can be found in Appendix III.

Yield: The amount of water saved (in case of conserve options) or supplied (in case of capture and control options) by an option, expressed in Millions of Gallons per Day (MGD)

Cost Efficiency: The ratio of the Net Present Value (NPV) of all costs associated with an option (expressed in 2010 dollars) to the total yield of the option, across the estimated life of the option. This is expressed in dollars per Million Gallons (\$/MG).

APPENDIX

- I. List of Task Force Members
- II. Fact base: water situation, facts on usage
- III. Complete set of options evaluated with rationale, cost, yield, implementation feasibility
- IV. Technical assumptions used in option evaluation
- V. Task Force member survey results
- VI. Comments and submissions to Task Force