

**Summary Report
State Advisory Committee
Submitted by the Fanning Institute
to the
Environmental Protection Division**

The State Advisory Committee was convened for the fifth time on November 6, 2006 at the Alcovy Conservation Center in Covington. The primary purposes of the meeting were: to discuss the proposed policy on surface storage and water quantity management; and to further explore the planning tool to help apply the proposed Consumptive Use Budget concept (CUB).

Following a review of the objectives for the day, the SAC reviewed a timeline (Appendix I) of their future work plan. Nap Caldwell highlighted EPD responses to a number of questions submitted by SAC members during the August 31 meeting. On three of the questions, EPD would like to see SAC members provide input via sub-groups. The sub-groups are to discuss these questions either through email or conference call and submit their response to the Fanning Institute by December 1. Sub-groups and responses received are included in Appendix II. The questions are:

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?
2. Will 7Q10 or some other measure underpin CUBs?
3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

Mr. Caldwell then introduced the proposed surface storage and water quantity management policy as distributed to SAC members prior to the meeting. Before beginning the sub-group exercise to discuss the proposed policy, the following comments and questions were raised.

- How do we move to working regionally? Will the state incentivize that? Bear Creek worked but what about others?
- How will decisions be made to protect sensitive areas from reservoir development?
- There will be a projected demand for sub-basins so how is the sub-basin determined?
 - The sub-basin is an artifact of this concept we have based upon the CUB, and the geographic area of the sub-basin will not have political boundaries but natural boundaries.
- When identifying sensitive areas, we should also identify areas that aren't so sensitive.
- Since different political jurisdictions having different planning horizons, should this be pushed from state level down instead of local government up?

- We should look at the previously created reservoir plan and consider how we could incentivize those projects.
- Need to determine how things will work within the water districts as it will be a shift in current thinking.
- We don't need to regress and create another boundary that pits district against district and how ever the sub-basins are drawn, there are other considerations as many counties are split between watersheds.
 - We are on the front end of thinking about those kinds of things.
- Within the context of surface storage, we need to look at: aggressive conservation measures; the use of current supply; evaluate impacts, both environmental and cumulative; and determine if all other options have been explored prior to reservoir construction.
- What are EPD's thoughts on finalizing an instream flow policy?
 - The interim ought to stay in place for making decisions on individual projects, but the interim needs to advance, and we need more data and information before we make it a permanent policy.
- For a CUB, we need some baseline flow and isn't that the instream flow?
 - No. It is a function of what is actually there now and what may be there in the future.
- Keeping in mind the balance we are meeting between human and ecological needs, the reservoir process, and how you locate them, does that argue in favor of maximizing the size of the sub-basin?
 - It could, but we haven't thought about that, but we want the SAC to help us with that and develop the thought and decision criteria on how to determine scale of sub-basins.
- Is it true to say that the flow at the node would be determined by the instream flow policy?
 - Not necessarily. The thought process that is involved in deciding what flow is used down here is different than the criteria used upstream and we don't know what the thought process will be at this point.

Proposed Surface Storage Policy

Following the conversation with Mr. Caldwell, each sub-group commented on the proposed policy statement for surface storage as well as the proposed considerations: demonstration of

need; localized considerations; and sub-basin wide considerations. A summary of the comments collected as well as questions that will require further explanation from EPD and recommendations for inclusion follow. The proposed policy and considerations provided by EPD are included in Appendix III.

Proposed Policy Statement

For the most part, reactions to the proposed policy statement were positive. SAC members expressed that consideration should be given to people and the economy. How would a reservoir meet the needs of the population and what would the economic benefits of reservoir construction be? If a community or sub-basin is considering constructing a reservoir that doesn't make economic sense, and without a prescribed purpose, it won't be constructed. It should also be considered if a reservoir is being constructed to meet current demand or future projections, and on what those future projections are based.

- Consideration should be given to indirect and cumulative impacts of the reservoir construction and operation in addition to direct impacts.
- An instream flow policy should be finalized before this policy and the State Water Management Plan are put into place.
- The current management and operation of existing reservoirs and potential changes that might nullify the need for additional storage should be considered. Can existing reservoirs be enlarged to create additional storage in lieu of new construction?
- A "Responsible Use Doctrine" that prioritizes water use could be included in the policy statement.
- Reservoir planning should be included in overall land use planning. It should not be reactionary but should consider implications on functions of natural systems and impacts on quantity and quality.

Demonstration of Need

In demonstrating the need for new storage, communities should consider current conditions of existing infrastructure. Are water losses minimized to the greatest extent possible? Are aggressive conservation measures and conservation pricing in place to balance current supply and demand; how will EPD evaluate this? Would an interbasin transfer be a less disruptive alternative to reservoir construction? Are stormwater management policies in place to augment current supplies?

- Demonstration of need should explicitly recognize regional economy, but historic growth ought not to prescribe the economic future.
- A uniform set of criteria should be in place to assure that water demand projections are not overstated.

- Permitted withdrawals that are unused or only partially used, should be changed to more accurately reflect use so that the “additional” unused water is made available in the basin for other users.

Localized Considerations

Many of the comments concerned the current lack of knowledge surrounding water withdrawals of less than 100,000 gallons per day. A database should be created to track all water withdrawals to have a better accounting for what is available within a sub-basin. Several questions arose: Who will define “high quality habitat” and what is the hierarchy of decision making – local vs. state?

- A review of pending permits is needed to better assess the current demand level.
- A state-level tool should be created to require hook-up to a public water system if that is available. Such a mechanism would increase the knowledge of available supply and demand.
- Consideration across the policy should look at recreational use and how reservoir construction or the alteration of flows would impact those uses.
- Economic impacts of reservoirs should also be a local consideration.
- The impacts to private property owners must be considered in terms of eminent domain and buffer requirements.

Sub-Basin Wide

On the sub-basin level, a sound assessment of existing and future needs should be in place. Both the economic and ecological impacts of one large versus several small reservoirs should be considered. One major concern is how will the decision be made on who gets what – how much water to each water system? Upstream impacts of storage should also be considered as should water quality impacts. Additional considerations, besides desired flows, should be alterations to temperature, sedimentation, and nutrient loads.

Overview of CUB Concept

Nap Caldwell presented a review of the CUB concept, reiterating that is predicated on the notion that we can define what the required flow regimes are at the bottom of each connected watershed to meet the needs of downstream users. Given that, the modeling of the CUB also incorporates the following:

- Total amount of water that a watershed produces is some given amount;
- Instream needs are some given amount;
- Demand is superimposed on that amount;
- Lines reflect those consumptive uses and the withdrawals and discharges; and
- Reflects what consumptive use might do if we do nothing to try and manage those uses.

Mr. Caldwell reiterated that there are things that can be done to supplement the CUB. Those include:

- More time for effective use of that resource
- Provide storage
- Import water

Demonstrating with the Chattahoochee system, where we currently have the most data and information, Dr. Georgakakos has modeled examples that show the river under various conditions. It is the concept that the SAC is currently focusing on, not the numbers. The results of his examples, which are posted online, only demonstrate the concept, and not what EPD is saying will be the CUB for the Chattahoochee River.¹ Several comments were made by SAC members:

- This gets confusing because it seems that it is a mixture of data gathering with these policies, and it is confusing the way you have fused together the data gathering with the policy so that you can develop the data as if there were no human impacts instead of having the policies as part of the data.
- We need to start with some sort of data gathering and then start establishing policies.
- Maybe we need to figure out if there is a way to separate those pieces out.
- Taking flows that we see expressing themselves and removing the impacts of man and developing unimpaired flow regimes seems to artificially create some condition that does not exist.

Mr. Caldwell responded that we do not want this to be a political process and by looking at it as if there were no human impact will help start a non-political process. The modeling work done by Dr. Georgakakos should be fairly close to that.

Dr. Georgakakos's presentation, *An Integrated Water Resources Planning Concept and Tool for Georgia*, covered the following: General Planning Issues, Principles and Steps; Flow Regime Requirements; Consumptive Use Budgets; Impact of Basin Storage and Basin Transfer; and the Application/Demonstration Examples using the Chattahoochee River. Examples of flows under various conditions were modeled and discussed by the SAC. The following questions were raised:

Q: The model run had four flow regimes. Is the intention to use all four or pick one?

A: You can pick one or use any combination. These are just examples, as we are waiting for the planning process to determine what flow regime to use.

Q: Is the requirement being imposed an environmental requirement?

A: No, it is really a flow regime requirement. It reflects back to all of the policy options that you might use.

¹ The presentation given by Dr. Aris Georgakakos can be found by selecting "CUB Concept Presentation" under November 2006 at http://www.gadnr.org/gswp/Documents/sac_discussion.html.

Q: In general with Georgia rivers, could you say which one of those four is the most restrictive?

A: It is about preserving the statistic and the more of the curve you impact the more restrictive the criteria.

Q: This surcharge, how you generate the value that represents the total at the lower basin as compared to how you determine flows in the basins individually?

A: There could be a deficit. It is not always a surcharge.

Q: With Environmental Flow Regime requirements, how do you find a CUB?

A: You have both total flows and the local flows and with that, depending upon the scale you are looking at, you have defined the CUB.

Q: Why aren't you sharing the surcharge?

A: The model does that through returns to system.

Q: How much of the local flows can be used to meet the CUB and the environmental flow regime requirements? Is there no volume that you can count on having 100% of the time?

A: To meet the flow regime, this tells you that there will be some period of time where you won't meet it and you would have to put in storage and /or transfers.

Q: With the issue of returns, is the assumption being made that the returns are at the same purity that the withdrawn water ways at?

A: Returns should be treated to some level that allows the down stream to take. For a reliability target, something has to be selected, and it depends on the type of water use: urban use might want a high reliability; and for industrial or other uses it could be different.

Q: What is the record that you are using to assess?

A: You can select a drought or a whole period.

Q: How can the contributions be the same?

A: It has its own inputs, and they have similar 7Q10 requirements.

Q: Should all of the scales start at zero for clarity?

A: Good point, but it is difficult when the scales are so different.

Q: What are you assuming for conservation?

A: Whatever the 2000 data provides; whatever returns and then withdrawals that came back with conservation being implicit in return and withdrawal.

Following Dr. Georgakakos's presentation, and questions from SAC members, the sub-groups created their own scenarios to be modeled at a later date. Those scenarios have been submitted to Dr. Georgakakos.

Next Steps

The next meeting of the SAC will be on January 11, 2007 in Atlanta. Members were asked to volunteer to help EPD translate the CUB concept for more general audiences. That meeting will

be organized by EPD and anyone willing to participate should contact Gail Cowie. The groups were also reminded that a meeting with Dr. Georgakakos for further exploration of his modeling work will be set up for early to mid-December. Those interested were asked via email to let Leigh Askew know if they would like to participate.

With no further comments or questions, and no public comment, the fifth meeting of the State Advisory Committee was adjourned.

Appendix I

**Georgia Statewide Water Management Planning
Statewide Advisory Committee**

Draft Timeline

<u>Dates</u>	<u>Topics Covered</u>
Nov. 6, 2006	<i>SAC Meeting</i> - Surface Storage; Modeling Applications of CUB Concept
Nov. 7 – Dec. 1, 2006	<i>Small Working Groups</i> – Between Meeting Discussion (via e-mail or conference call) on CUB Margins of Safety; Sub-Basin Boundaries
Week of Jan. 8, 2007	<i>SAC Meeting</i> – Water Quality; Integration of Four Management Objectives; Working List of Questions
Jan. 12 – Feb. 10, 2007	<i>Small Working Groups</i> – Between Meeting Discussion (via e-mail or conference call) on Group Questions
March, 2007	<i>SAC Meeting</i> – Sub-State Planning; Working List of Questions
March – March, 2007	<i>Small Working Groups</i> – Between Meeting Discussion (via e-mail or conference call) on Group Questions
April, 2007	<i>SAC Meeting</i> – Sub-State Planning; Working List of Questions

Appendix II

SAC Sub-Groups

Sub-groups of the SAC were created to provide a diversity of interests for discussions to take place both during the scheduled SAC meetings and to provide further input to EPD on specific questions or issues between SAC meetings.

Group 1

Ross King – Local governments
April Ingle – environmental NGO
Jon Huffmaster - Agriculture
Reggie Prime - Industry
Tim Williams – Home Builders (Bettie Sleeth substituting)
Brad Curry – At-Large
James McClatchey - Industry
Denise Wood - Industry

Group 2

Terry Christie – Local Government
Jamie Higgins – River Recreation (Dan MacIntyre substituting)
Bryan Tolar - Agriculture
Lee Lemke - Industry
Charles Hood - Industry
Glenn Dowling – Environmental NGO (Sarah Barmeyer substituting)
Hunter Hopkins - Business
Charles Manning – Industry

Group 3

Tom Gehl – Local governments
Tavia McCuen – Environmental NGO
Andy Hull – Green Industry
John Cardosa - Industry
Lindsey Thomas – Industry
Steve McWilliams - Forestry
Jack Dozier – Water Systems
Mel Garber - Agriculture

Group 4

David Kubala – Local government
Jim Stokes – Environmental NGO
Aaron McWhorter – Green Industry
Jerry Cook - Industry
Cullen Larson - Business
Pat Stevens – At-Large
Donnie Smith - Agriculture
Berry Collett – Golf Course Association
Charles Huling - Industry

**SAC Member Responses to Questions
from August 31, 2006**

The following responses were submitted by Chuck Huling, Georgia Power.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

Flexibility in establishing sub-state boundaries should be the goal. Consider avoiding the establishment of boundaries during this phase of the process. It would be helpful if Georgia could self-identify sub-basin areas and come together voluntarily to manage their water future. Otherwise, local governments, water providers and others might consider the framework to have been imposed on them. At a minimum, the Water Council could recommend sub-basins with a public input process. Limiting the number of sub-basins will maximize flexibility. As we obtain better information and understanding, the basins could be increased, if needed.

An alternate approach might be establishing some near-term priority areas to use “pilot sub-basins”. Some areas (Metro N. Georgia, SW Georgia, Coastal Georgia) already have studies and plans in place. If these remain priority areas in EPD’s judgment, it would be helpful to have more information regarding how these plans might be improved or changed under the CUB approach. Questions that should be considered include: where these plans fall short, what needs to be done, what wasn’t done, or what don’t we know that we need to know?

2. Will 7Q10 or some other measure underpin CUBs?

The underpinning of any model or policy must be a balance as the legislative directive states to “support the state’s economy, to protect public health and natural systems, and to enhance the quality of life for all citizens.”

As proposed, a CUB (what’s available for humans and the economy) is essentially the "remainder term" (i.e., “what’s left”) in a water-balance equation where water for environmental instream flow (whether it is 7Q10 or something else) is considered first. The future water demands of the sub-basin at issue, “to support the state’s economy...protect public health and ... enhance the quality of life for all citizens,” are not considered in setting (or underpinning) the CUB. This approach to CUBs is substantially “instream-flow driven.”

An alternative approach would be a demand-based approach, with forecast water demands (minus returns) as water-balance input terms. If a resulting instream flow regime is deemed insufficient by EPD there would then be an effort *led by EPD* to allow additional water sources (e.g., reservoirs, IBTs) to augment instream flows as needed. This is more demand driven.

A more balanced approach considers both demand and instream needs in the beginning and uses the toolkit to evaluate what management is necessary to meet the CUB (i.e., what tool in the toolkit – conservation, IBT, etc.). This approach would be periodically revised based on updated population growth and water-demand projections.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

Certainly, with variable data and estimates of impact, demand, etc. – the CUB could be presented as a range as opposed to a set value. A margin of safety (MOS) implies an understanding of the “uncertainty” in the data used to establish the information (such as demand, instream flow, etc.). The MOS could be calculated as an acceptable level of uncertainty of the data. Why should a MOS apply only to environmental concerns and not consumptive concerns as important as public water supply? EPD is asking stakeholders which instream flow regimes and how margins of safety should be set and there is little scientific consensus on how much instream flow is enough.

The following responses were submitted by Jim Stokes, Georgia Conservancy.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

The sub-basin boundaries should be determined by joint decision by the heads of the Environmental Protection Division (EPD), the Wildlife Resources Division (WRD), and the Coastal Resources Division (CRD). This group of agency leaders ought to use the hydrologic unit codes (HUC 8) as the starting point for sub-basin boundaries and should combine these HUCs where appropriate. These agency leaders should also come together to assist with establishing decision criteria on how to combine different HUCs. These criteria ought to include, but should not be limited to, habitat, endangered species, flow, shared resources within separate political jurisdictions (e.g. stormwater utility), and recreation.

2. Will 7Q10 or some other measure underpin CUBs?

First, it is important to consistently use the full instream flow terminology so we are sure that we are all talking about the same flow standard: either *monthly* 7Q10 or *annual* 7Q10. The monthly 7Q10 is included in the interim instream flow policy and is the minimum flow needed to be even marginally protective of our river resources. In 1995, WRD published a paper that determined that the *annual* 7Q10 is *not* protective of species. We do not support the use of *annual* 7Q10.

Second, EPD should consult with WRD and CRD to review the issues that were discussed when the interim instream flow policy was created. For example, components missing from the interim policy include the recognition that flows vary between years with flood flows and droughts and how water quality is affected by flow. Freshwater inflows to our estuaries and the resultant salinity gradients create transient habitats throughout the lower river distributaries for a multitude of organisms. The recent collapse of Georgia's blue crab fishery highlights the fragility of our coastal systems and the need for us to better understand the implications of flow policy on these systems.

Third, EPD should provide a summary of the results from the EPD convened target flow regime Technical Advisory Committee (TAC) to the SAC. Additionally, the summary of the findings from this TAC ought to guide the SAC in their discussions on instream flow guidelines and sub-basin boundaries.

Finally, the instream flow standard for the CUB nodes must take into account the magnitude, timing, duration, frequency, and rate of change of streamflow passing a CUB node to ensure that the streamflow standard at the CUB node is protective of all downstream uses. Critical concepts associated with these criteria include: (1) variability; (2) connectivity; (3) water quality; and (4) regional, sub-basin planning.

Natural flow variability is one of the most important components of any healthy stream and instream flow policy because it is the variability throughout the seasons, months, and even days that supports species habitat. In addition, the presence high and low flow pulses are important indicators of the health of an aquatic community. Creating a flow policy that preserves or restores natural variability is crucial. We should be careful not to have an instream flow policy that flatlines the natural flow variability.

Ensuring that our streams and rivers have uninterrupted streamflow or connectivity is critical to supporting our wildlife, fisheries, and recreation. Dams interrupt river flows and create reservoirs that produce a lake-like habitat that is unable to support native species. Dams should only be created as a last resort, and releases from dams should mimic natural flows as much as possible.

Ensuring that our instream flow policy protects water quality is critical because reduced flows in rivers concentrate pollution, including stormwater, one of the largest pollutants in the state. The quantity of flow in any stream or river should therefore be based in part on the impact of waste assimilation and stormwater pollution.

Ideally, all new instream flow standards should be determined by focused, scientific, regional/sub-basin studies designed to evaluate aquatic habitat and water demands specific to each region. Flow requirements vary throughout the state and should not be treated uniformly. Although sub-basin studies are ideal, this approach cannot be met within the current statewide water planning timeframe. Therefore, EPD must come up with a uniform system on setting instream flow standards at the CUB nodes *now* that can be adapted once sub-basin studies are completed.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

First, an initial comment is that it is difficult to have a conversation on the how the margin of safety (MOS) should fit into the CUB model without knowing what the instream flow standard at the CUB nodes is. Any instream flow standard and MOS have to include consideration of Total Maximum Daily Loads (TMDLs).

Second, the MOS must be science based and must address the level of risk or uncertainty to the quantity, quality, and timing of streamflow in addition to the health of the aquatic habitat. EPD ought to convene a technical advisory committee to help develop the necessary decision criteria (e.g. quantity and quality of observed data, TMDLs, and model sensitivity to parameters) in establishing an MOS for the CUBs.

The following responses were submitted by April Ingle, Georgia River Network.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

The sub-basin boundaries should be determined by EPD, WRD and CRD working together. They should be based on the hydrologic unit codes (HUC 8) and then combined where appropriate, considering issues such as endangered species, recreation, flow, habitat, shared resources, etc.

2. Will 7Q10 or some other measure underpin CUBs?

We need to be specific when we talk about 7Q10 and specify if we mean an annual 7Q10 or a monthly 7Q10. We do not support the use of annual 7Q10. WRD published a paper in 1995 which determined that the annual 7Q10 is not protective of species. A monthly 7Q10 is the *minimum* flow needed to be even marginally protective of our river resources.

EPD should present the SAC with all information regarding instream flow created by the Instream Flow TAC and use it to inform the creation of the instream flow guideline at the nodes. EPD should also work with WRD and CRD to draft instream flow guidelines, as they did when creating the interim instream flow policy.

Ultimately the policy should address the following principles:

Flatlining: Flatlining streams is one of the greatest threats to species in our rivers and streams, creating poor habitat and water quality. Flatlining is essentially removing the flow and variability of a river, and reducing it to a low, constant drought flow. All flow policies should be designed to avoid flatlining.

Variability: Natural flow variability is one of the most important components of any healthy stream and instream flow policy. It is not only the amount of water in a stream, but also the variability of that quantity throughout the seasons, months and even days that supports species habitat. In addition, the presence of high and low flow pulses are important indicators of the health of an aquatic community. Creating a flow policy that preserves or restores natural variability is crucial.

Connectivity: Dams interrupt river flows and create reservoirs that drown productive streamside vegetation and wildlife habitat, and fragment free-flowing stream habitat. Dams should only be created as a last resort, and releases from dams should mimic natural flows as much as possible.

Water Quality: Reduced flows in rivers concentrate pollution, including stormwater, one of the largest polluters in the state. The flow in any stream or river should therefore be based in part on the impact of waste assimilation and stormwater pollution.

Regional, sub-basin planning: Ideally, all new instream flow standards should be determined by focused, scientific, sub-basin studies designed to evaluate aquatic habitat and water demands specific to each region. Flow requirements vary throughout the state and should not be treated uniformly.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

It will be difficult to determine a margin of safety until an instream flow parameter is set. If the instream flow policy incorporates a protective margin of safety, then the margin of safety will be less critical in the CUB. However, if the instream flow policy does not incorporate a protective margin of safety, then it will be extremely important to make sure a protective margin of safety is built in into the CUB.

Additionally, what “Margin of Safety” means in the context of the Statewide Water Plan must be defined. The margin of safety should address not only water availability, but water quality, quantity and aquatic habitat as well, and also have a scientific underpinning.

The following responses were submitted by Brad Currey, SAC Member-at-Large.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

Determined by EPD. As to the Chattahoochee Flint River Basin and the Coosa River Basin, each sub-basin should include one reservoir. Sub-basin boundaries should be at the fall line as to other rivers rising in North Georgia. Ecological considerations should include identification of sensitive areas where endangered species need special protection.

2. Will 7Q10 or some other measure underpin CUBs?

7Q10 until and unless we know it can't protect species.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

Margin of safety needs to be sufficient to protect both human needs (the economy) and the environment. Margins should be at least as large as the amount of reduction in consumptive use that was seen when emergency restrictions were applied during our most severe drought year.

The following responses were submitted by Tavia McCuean, The Nature Conservancy.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

The sub-basin boundaries should be determined in an objective process for each basin using the CUB model. There are several factors that will affect the decision, such as amount of available water and number of permitted entities. The model can show trade-offs of different sized sub-basins for the site-specific conditions. The basin interests should determine what works best for them from this exercise. If possible, the boundaries should be set as ‘draft’ or ‘interim’ for some period of time (e.g., 3 years) until they can be tested to see how they actually work. The ecological considerations should include the ability for the CUB to ensure that the ecological flow regime is maintained within the sub-basin as well as for downstream needs. Again, the model should be utilized to explore this issue objectively. The optimal size of the sub-basin will allow human and ecological needs to be met within the area as well as meeting downstream needs.

In order for the CUB model to be able to assess ecological impacts of various alternatives, additional output needs to be generated that compares modeled flow regimes with reference flows – preferably the ‘unimpaired’ flows now being used in the CUB model. This can be done by linking the CUB output with the Index of Hydrologic Alteration (IHA) software or by comparing flow-duration curves. The alternative with the minimum departure from reference flow regimes would indicate the least ecological impact.

2. Will 7Q10 or some other measure underpin CUBs?

The SAC has not received sufficient information to answer this question. There are many ways to define protective instream flow criteria and it is not clear which is optimal for meeting human and ecological needs in the CUB framework. Even flow experts cannot answer this question without more information.

As a suggestion for question #1, the CUB model linked with a means to assess impacts to reference flow regimes needs to be used to objectively explore this question. The CUB model can run several water management scenarios using a variety of instream flow criteria (e.g., annual and monthly 7Q10, 30-60-40 mean annual flow, percent of flow, with and without drought management plans, etc.) to see which combination meets human needs and minimizes impacts on the flow regime.

Since conditions will vary from basin to basin, the decision of which instream flow criteria should be specified may need to be left up to basin interests. “One-size fits all” may not be protective. General guidance can be provided on the state level to ensure that protection of instream flow regimes is maintained with local decisions.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

We should not assume that even an objective process to determine CUB’s and instream flow criteria will necessarily result in protected instream flow regimes. There are likely to be many factors that reveal themselves as we move into an implementation phase of the water management plan. The margin of safety should be an allowance for these unforeseen influences.

Again, exploration of this issue using the CUB model gives the state an objective way to test alternatives to this issue.

The following responses were submitted by Sarah Barmeyer, representing Glenn Dowling, Georgia Wildlife Federation.

1. How should the sub-basin boundaries be determined? By whom? What ecological considerations should be considered in determining the boundaries?

Determining the sub-basin boundaries is a critical part of the CUB model. The sub-basin boundaries should be determined by EPD, WRD, and CRD because of the various types of expertise within each division. The boundaries should be based on the hydrological unit codes (HUC 8) and then should be combined where appropriate through the consideration of factors such as endangered species, recreation, flow, habitat, shared resources, etc.

2. Will 7Q10 or some other measure underpin CUBs?

We believe that it is important to clearly state *monthly* 7Q10 to avoid confusion with the *annual* 7Q10, which a 1995 WRD paper determined is not protective of species. The monthly 7Q10 is included in the interim instream flow policy and is the minimum flow needed to be even marginally protective of our river resources. We do not support the use of an *annual* 7Q10.

SAC members should be provided with a summary of results from the target flow regime Technical Advisory Committee to help guide our answers to this question. Scientific and technical expertise is critical to determining instream flow guidelines as well as sub-basin boundaries.

In addition, EPD should consult with WRD and CRD to review the issues that were discussed when the interim instream flow policy was created and determine ways to address missing components, such as flow variability.

The instream flow standard must take into account the magnitude, timing, duration, frequency, and rate of change of streamflow passing a CUB node to ensure the protection of downstream uses. Incorporating the following principles will help protect downstream uses and dependent aquatic species:

Flatlining: Flatlining streams is one of the greatest threats to species in our rivers and streams, creating poor habitat and water quality. Flatlining is essentially removing the flow and variability of a river, and reducing it to a low, constant drought flow. All flow policies should be designed to avoid flatlining.

Variability: Natural flow variability is one of the most important components of any healthy stream and instream flow policy. It is not only the amount of water in a stream, but also the variability of that quantity throughout the seasons, months and even days that supports species habitat. In addition, the presence of high and low flow pulses are important indicators of the health

of an aquatic community. Creating a flow policy that preserves or restores natural variability is crucial.

Connectivity: Dams interrupt river flows and create reservoirs that drown productive streamside vegetation and wildlife habitat, and fragment free-flowing stream habitat. Dams should only be created as a last resort, and releases from dams should mimic natural flows as much as possible.

Water Quality: Reduced flows in rivers concentrate pollution, including stormwater, one of the largest polluters in the state. The flow in any stream or river should therefore be based in part on the impact of waste assimilation and stormwater pollution.

Regional, sub-basin planning: Ideally, all new instream flow standards should be determined by focused, scientific, sub-basin studies designed to evaluate aquatic habitat and water demands specific to each region. Flow requirements vary throughout the state and should not be treated uniformly.

3. How should the margin of safety fit into CUBs? (Environmental concerns as opposed to a consumptive concern)

It is difficult to determine a margin of safety without knowing what instream flow policy will be used. If the instream flow policy incorporates a protective margin of safety, then the margin of safety will be less critical in the CUB. However, if the instream flow policy does not incorporate a protective margin of safety, then it will be extremely important to make sure a protective margin of safety is built in into the CUB.

The margin of safety must be science-based and must address the level of risk or uncertainty to the water quantity, water quality, and timing of streamflow in addition to the health of the aquatic habitat. A technical advisory committee should be convened to assist with answering this question.

Appendix III

Proposed Surface Storage Policy Statement

- Water supply reservoirs are an important part of Georgia's water resource infrastructure and additional surface water storage may be critical in reliably meeting water supply needs in certain parts of the state.
- Reservoirs can have a variety of impacts and the viability of available reservoir sites is limited by a number of factors.
- Given these considerations, it is the policy of the State of Georgia to ensure that new water supply reservoirs are planned, designed, sited, and operated in order to optimize use of the state's water resources and minimize harm to the environment and to current and future water users.
- Consistency with this policy to be evaluated with the following factors, among others:
 - consideration of water supply alternatives prior to reservoir planning,
 - site election to minimize environmental impacts,
 - impacts on water available for consumptive use in the affected sub-basin, and
 - impacts on flows in downstream sub-basins.
- Implement this policy through two processes that would supplement existing oversight processes:
 - Sub-state planning to assess water supply needs, evaluate water supply alternatives, and identify areas where additional storage may be a reasonable alternative to meet water supply needs
 - State-level screening of the feasibility of potential projects identified through sub-state planning. Feasibility screening to include consideration of benefits and impacts from a sub-basin perspective (e.g., the overall projected demand for the sub-basin, potential service areas, and the total storage potential available in the sub-basin).
- Design and operate individual reservoirs to provide the volume and timing of flows necessary to meet instream flow needs in segments immediately downstream of the water supply reservoir:
 - Continue to use the current instream flow criteria while building the information base required to adapt these requirements to specific instream flow needs in different regions of the state.

Proposed considerations and decision criteria to be used in evaluating feasibility of potential projects and/or permit applications for specific reservoir projects:

Demonstration of need

- Water demand projections following sub-state planning guidance.
- Assessment of water supply alternatives following sub-state planning guidance:
 - Implementation of water conservation and reuse practices; and
 - Utilization of alternate sources, including purchase of water from adjacent utilities or water providers, use of groundwater (including excess capacity in existing wells), and use of existing surface storage, among others

Localized considerations

- Site selection to minimize environmental impacts:
 - Avoidance of streams or sites that currently provide high quality habitat for aquatic biota;
 - Siting on tributaries or smaller streams (with use of pumped storage as needed); and
 - Minimal contribution to fragmentation of the stream system.
- Provision of flows to meet instream needs immediately downstream.
- Water quality protection.
- Impacts on critical species or habitats in the reservoir pool area and immediately downstream.

Sub-basin wide considerations

- Impacts on desired flows at downstream node(s) (i.e., the nodes for which CUBs are defined);
- Impacts on water available for consumptive use:
 - The extent to which the project contributes to increasing the CUB for the affected sub-basin (i.e., contribution of the project to optimization of storage for the sub-basin); and
 - The extent to which the project is expected to contribute to future increases in consumptive use.
- Service to multiple jurisdictions or source replacement for jurisdictions that rely on sources that are approaching their CUB.