A Concept on the Possible Structural Elements of a Water Allocation Formula for the Apalachicola-Chattahoochee-Flint (ACF) River Basin

08 April 2003

This concept is offered for consideration as an aid to the ongoing ACF Compact negotiations on a water allocation formula. It should be considered as a work in progress. Technical evaluations continue and refinements to this concept may occur.

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ACT/ACF River Basin Commissions
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April 8, 2003

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State Capitol
600 Dexter Avenue
Montgomery, Alabama 36130

Governor Jeb Bush
The Capitol
Tallahassee, Florida 32399-0001

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State Capitol Building
Atlanta, Georgia 30334

RE: Alabama-Coosa-Tallapoosa (ACT) River Basin Compact and Apalachicola-Chattahoochee-Flint (ACF) River Basin Compact

Dear Commissioners

On behalf of members of the federal interagency task force, I am pleased that you have scheduled ACT and ACF Commission meetings for April 21, 2003. In order to assure that these public sessions are as meaningful as possible for all, I believe that our respective technical staffs should gather together to discuss basinwide technical matters for each basin in advance of the April 21 session. Thus, I am encouraged to hear that there is already an ACT technical session April 11th in Atlanta.

We recognize that, over the past few weeks, the state technical staff have been analyzing ACF basin matters. During the same period, members of the federal interagency taskforce have reviewed their earlier "current impressions" of various draft ACF water allocation formulas advanced by the States. Building upon those impressions, these agencies have produced the outline of a technical concept and an accompanying preliminary model, which we would like to offer to the State technical teams as part of their consideration. Our team believes that the basic elements of the concept developed for the ACF would also be useful for the ACT and we would like to offer the ideas for that forum as well.

Of course, the concept is intended as an aid. Further studies may be appropriate and, in any event, further NEPA analysis lies ahead for any agreed upon formula reached

by the States under Article VIIa of the Compacts. The concept does not reflect final positions on behalf of the federal agencies and is not binding on the Office of the Federal Commissioner with respect to concurrence or non-concurrence.

With these factors in mind, I have enclosed the ACF concept outline. Members of our federal technical team will participate in this Friday's ACT technical session and look forward to discussing how this alternative concept could be of use in the ACT basin. Furthermore, I invite the States to make their staffs available for similar ACF technical discussions to explore this concept prior to the Commission Meeting on April 21st. To that end, I have been authorized by the task force agencies to offer the time and services of their employees at the States' convenience. In addition, I have asked our core agency technical staff to be available in Atlanta during the week of April 14 in the hope that the period would be workable for these ACF technical discussions.

I look forward to hearing from each of you about an ACF technical session by April 10th. As this is obviously a time sensitive matter and we want to do our utmost to assist the process, it would appear that email is the most expeditious manner for you to respond. Please respond to me (alec@seminerals.com) with copies provided to the Assistant to the Office of the Federal Commissioner, Heather Hallows, (hhallows@earthlink.net), and Jim Brookshire, my Department of Justice counsel (James.Brookshire@usdoj.gov). If there is anything you would like to discuss with me by phone, please do not hesitate to call me at (229) 243-5224. Thank you.

Sincerely,

Alec L. Poitevint II
ACF Federal Commissioner
ACT Alternate Federal Commissioner

Enclosure

Enclosure - April 8, 2003 letter from Federal Commissioner to State Commissioners

A Concept on the Possible Structural Elements of a Water Allocation Formula for the Apalachicola-Chattahoochee-Flint (ACF) River Basin

Introduction

By letter dated February 25, 2002, the Federal Commissioner to the ACF River Basin Compact transmitted to the State Alternate Commissioners the current impressions of the Federal agencies on the proposals for an ACF water allocation formula made by the States of Florida and Georgia in January, 2002. The Concept described herein takes those current impressions an additional step, to describe more fully the structural elements for a possible water allocation formula between the States. The intent of offering this Concept is to facilitate further dialogue among the State negotiating teams, the Federal agencies, and stakeholders and to contribute to successful negotiations. In developing this Concept, an effort has been made to take into account the principal objectives expressed in the January, 2002, proposals, but also, consistent with the "current impressions", to simplify the structural elements of a potential water allocation formula.

The basic elements of the Concept are:

1) minimum flow rates at state lines are linked to climatic indices;
2) maximum depletions to the surface waters of the basin are apportioned by functional reach and by state;
3) federal processes are used in implementing an allocation formula; and
4) adaptive management is addressed.

Specific rules for operating the ACF federal reservoirs have not been included as an explicit element of this Concept. Reservoir operations are instead viewed as a means towards maintaining the minimum flows and supplying the water for the depletions specified under Elements 1 and 2. Rules governing reservoir operations would emerge from federal processes following adoption of an allocation formula. These processes are described in Element 3. Such rules and other water management actions would likely need to change over time. Therefore, Element 4, adaptive management, addresses the process of verifying formula compliance and of monitoring, evaluating, and responding to changing conditions in the basin.

Some preliminary HEC5 and ACF Daily Stella models have been developed to investigate the practicability of Elements 1 and 2, minimum flows and maximum depletions, of the Concept. Both models simulate surface water conditions given the 1939 to 2001 unimpaired flow data set for the basin. These models are available for review and the Federal agency technical staffs are available for discussion and consultation.

Structural Element 1 -- Minimum Flow Rates at State Lines

The flow regime of the Chattahoochee River and the Apalachicola River at the boundaries between the three states is highly variable, with flow rates differing by orders of magnitude between months for a given year, and for a given month between years. This applies both to the historic observed record of flow, which is influenced by reservoir operations and water uses for various purposes, and to the synthesized unimpaired flow data set for the basin, which attempts to remove those influences from the record. Establishing minimum flow rates that are too high relative to the hydrologic record could impose a burden on upstream portions of the Basin to constrain water use and to augment river flow with releases from reservoir storage. Conversely, rates that are too low relative to the hydrologic record could expose downstream portions of the Basin to the stressful effects of the lowest-flow conditions. This Concept attempts to guide the balancing of these conflicting needs.

Because the flow regime of the ACF is so variable at the state lines, this Concept patterns the minimum flow rates after the flow regime. The watershed may be capable of meeting low minimum flow rates when the surface water yield of the watershed upstream of the state line is low, and higher rates may be possible when flow is high. For a given depletion amount and a given reservoir capacity, a minimum flow schedule matched to varying climatic conditions eases the upstream burden of maintaining minimum flow rates and lessens downstream alterations of the low end of the flow regime.

Minimum Flow Rates for the Apalachicola River at Chattahoochee, Florida

To reflect the high degree of intra- and inter-annual variability in flow rates into the Apalachicola River, the minimum flow rates specified in this Concept vary by month and by current climatic conditions. The Concept, which is patterned after in the States' January 2002 proposals, consists of a set of flow rates for January through December that apply when climatic indices for the previous month exceed specified values for dry conditions, and another set of flow rates that apply when the climatic indices do not exceed those values (Table 1).

Table 1. Monthly average minimum flow (cfs) for the Apalachicola River at Chattahoochee, Florida.

	Climatic indices for the previous month:	
	Exceed thresholds (normal or wet)	Do not exceed thresholds (dry)
January	12,000	7,000
February	14,000	10,000
March	19,000	12,500
April	18,000	10,500
May	12,000	8,000
June	9,000	5,000
July	9,000	5,000
August	8,000	5,000
September	7,000	5,000
October	6,000	5,000
November	6,000	5,000
December	9,000	6,500

The flow rates included in the normal/wet column of Table 1 are the 10th percentile values of the historic observed monthly average flows for the Apalachicola River at Chattahoochee, Florida, from 1929 through 2001, rounded down to the nearest 1,000 cubic foot per second (cfs). The rates in the dry column are the greater of 5,000 cfs or the lowest observed monthly average flows rounded down to the nearest 500 cfs. The climatic indices, described in the following section, have historically reported values less than the thresholds for dry conditions in about 10 percent of the months (75 months in the 756 months of the 1939 to 2001 record). Therefore, these minimum flow rates would maintain flow into the Apalachicola River not less than the dry values about 10 percent of the time, and maintain flow not less than the normal/wet values the rest of the time. During both dry and normal/wet months, the flow would ordinarily equal or exceed the corresponding minimums depending on the amount of the Chattahoochee and Flint Basins' surface water yield, reservoir operations for other authorized purposes, and depletions. Preliminary analysis indicates, however, that there may be instances in the future where an unusually low surface water yield together with maximum depletions specified in Element 2 could result in exhausting reservoir storage and could result in an inability to maintain these minimum flow rates. Further modeling of these flow rates and maximum depletions is needed to address the sustainability of this Concept.

Climatic indices

The flow regime derives from climatic conditions and is modified by water management actions such as reservoir operations, withdrawals, returns, and inter-basin transfers. Climatic indicators suggest whether rainfall and, therefore, inflow into the watershed, are above or below "normal". This Concept provides for shifting between higher and lower minimum flow rates in response to the climatic indicators and is intended to

respond to rainfall deficits and not man-made shortages. Several climatic indices published by the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center as possible predictors of surface water yield from the Chattahoochee and Flint Basins were investigated for inclusion in this Concept. These included the two indices (12-month Standard Precipitation Index and Palmer Hydrologic Drought Index) used in the States' January 2002 proposals. All of the various indices are compiled by climate zones, which do not correspond to the Chattahoochee and Flint Basin boundaries. Three zones in Alabama and seven zones in Georgia span the watershed upstream of the Apalachicola River at Chattahoochee, Florida. The procedure developed by the States of weighting the index values from the ten climate zones by the area of each zone within the basin to compute a single composite value is incorporated in this Concept. The historic record of the following ten basin-area-weighted indices was analyzed: the Palmer Drought Severity Index, Palmer Hydrologic Drought Severity Index, Palmer Z Index, and the Standard Precipitation Index computed for 1-, 2-, 3-, 4-, 5-, 6-, and 12-month time scales.

While each of these ten basin-area-weighted indices show a general positive relationship with the unimpaired flow of the Apalachicola in the following month, i.e., lower index values are associated with lower flows and higher values with higher flows, additional analysis was performed to improve reliability. No single index proved much more than 50 percent accurate in predicting when the lowest unimpaired flow values would occur in the following month, which is when it would be advantageous to shift to supporting lower minimum flow rates in a water management context. By stratifying the analysis by months, however, and by selecting the strongest predictor among the ten indicators for each month, the accuracy of the climatic indicators improves to about 75 percent. This aspect of the Concept for a water allocation formula warrants additional analytical effort on the part of the Federal and State technical teams. The Climatic Indicators and their corresponding threshold values are shown in the following Table.

Table 2. Chattahoochee and Flint Basin area-weighted monthly climatic index values for selecting dry or normal/wet minimum flow rates for the Apalachicola River at Chattahoochee, Florida

Month	Index name[1]	Threshold value[2]
January	SPI 12-month	-1.45
February	SPI 6-month	-1.42
March	SPI 4-month	-1.28
April	SPI 5-month	-1.45
May	PDSI	-2.31
June	PDSI	-2.55
July	SPI 12-month	-1.37
August	PDSI	-2.56
September	PDSI	-2.82
October	SPI 4-month	-1.23
November	SPI 4-month	-1.18
December	SPI 1-month	-2.20

[1] SPI = Standard Precipitation Index; PDSI = Palmer Drought Severity Index.
[2] The Table 1 normal/wet condition minimum flow rates apply in months following climatic index values greater than these thresholds; the dry condition rates apply in months following values less than or equal to these thresholds.

Minimum Flow Rates for the Chattahoochee River at Columbus, Georgia

At this time the Concept does not consider alternatives to the States' proposal for a weekly average minimum flow of 1,850 cfs at Columbus when the elevation of West Point Reservoir exceeds 621.6 ft. When the elevation is less than 621.6, the minimum flow in this Concept is 1,200 cfs.

Minimum Flow Rates for the Chattahoochee River at Atlanta, Georgia

Although this Concept does not specify a minimum flow on the Chattahoochee River at Peachtree Creek, modeling of the Concept reflects a year-round minimum flow rate of 750 cfs at this location.

Element 2 -- Maximum Depletions

It is recognized that not all surface water withdrawn from the ACF Basin is returned within the basin, thereby resulting in a net depletion of the interstate resource. Depletions are important to the following Federal authorities and processes:

- Reallocation of Storage from Federal Reservoirs. If water use is to be supported using storage in federal reservoirs, that use would be quantified for purposes of determining the storage to be reallocated from other authorized purposes and appropriate compensation for lost federal benefits.

- Minimum Flow Requirements. If minimum flow is to be supported using storage in federal reservoirs, depletions upstream of the minimum flow location would be estimated for purposes of determining the storage to be reallocated from other authorized purposes and the appropriate compensation for lost federal benefits.

- Biological Integrity. The frequency and duration of low-flow events, which affect water quality, threatened and endangered species, inter-jurisdictional fisheries, and other water-dependent resources protected under federal law, are strongly influenced by depletions. Depletions upstream of these resources influence how federal reservoirs and other federal programs (e.g., administration of the Clean Water Act) upstream of these resources would operate in order to comply with federal law.

Given the importance of quantifying depletions to these Federal authorities and processes, net depletion resulting from new reservoir evaporation, municipal, industrial,

agricultural, thermal, and other withdrawals in the Alabama, Florida, and Georgia portions of the ACF Basin is included as an explicit element in this Concept.

The depletions specified in this Concept are based on various forecasts of water demands for the 2030 to 2050 time frame used by the States in hydrologic models of their January 2002 proposals. For the limited purposes of this concept, the net depletions associated with these demand forecasts are specified as tentative expressions of each State's allocated portion of the shared water resource. These depletion levels were developed based on the following forecasts:

- Georgia's estimated 2030 Municipal and Industrial (M&I) and Thermal demands for the Chattahoochee basin upstream of Whitesburg, Georgia, distributed according to Georgia's, "Proposed metro Atlanta ratio" which is intended to normalize water withdrawals and wastewater returns on a seasonal basis.

- ACT/ACF Comprehensive Study 2050 M&I and Thermal demands for all other portions of the basin.

- Agricultural demands were based on the following parameters:
  - 621,000 acres irrigated in all years
  - Water demand per acre varies from average amounts per acre per month according to the Palmer Z index:
    - Palmer Z > 1.85 (wet months); demand = average demand * 0.5
    - Palmer Z < -1.77 (dry months); demand = average demand * 1.7

These M&I demand forecasts are consistent with what the States have used in modeling their water allocation formula proposals. With respect to agricultural demands, it appears that some proposal models have been based on 922,000 irrigated acres in wet and normal years, and 821,000 acres in dry years, with that acreage being reduced by implementation of Georgia's Flint River Drought Protection Act. Other proposal models have been based on 621,000 irrigated acres in all years, which is consistent with an estimate of irrigated acreage developed in the ACT/ACF Comprehensive Study. A more recent study (Litts, T., A. Thomas, and R. Welch. 2001. Mapping irrigated lands in southwest Georgia. Final report to the GA Dept. of Natural Resources, Agreement No. 649-990205. Dept. of Geography, University of Georgia, Athens, GA, 30602-2503. 51 pp) using remote sensing measured 475,779 irrigated acres in Southwest Georgia. The irrigated acreage utilized in this Concept as the basis of depletions associated with agriculture is 621,000 acres.

Variability in agricultural water demand per acre between wet and dry conditions is also a critical variable in estimating depletions. Use of different parameters will result in differences of several hundred cfs in peak depletion rates. Some proposal models multiply the average agricultural demand amounts by factors of 0.5 in wet years and 1.4 in dry years, thereby indicating increases or decreases from "normal" irrigation rates. The latter multiplier is consistent with a Natural Resources Conservation Service

(NRCS) analysis that concluded that ACF agricultural demands would increase by a factor of 1.3 to 1.5 about 20 percent of the time. For less frequent but drier conditions NRCS indicates that agricultural demand could increase by a factor up to, but not exceeding, 1.7. NRCS finds that a dry-year multiplier of 2.2 exceeds the amount of water that crops could consume. For purposes of quantifying a *maximum* depletion allocation, the agricultural demand estimates included in this Concept are based on a multiplier of 1.7 applied to the driest 15 percent of the months.

Rather than assigning entire years to wet, normal, and dry categories, the depletion estimates for agricultural demand specified in this Concept are based on the historic record of the Palmer Z index in the principal agricultural portions of the ACF, weighting the data from each climate zone in the same fashion as described for the indices applied to the minimum flow rates. The Palmer Z index measures short-term drought, and is the monthly analog of the Palmer Crop Moisture Index, which is computed on a weekly scale and is used to quantify drought's impacts on agriculture. For modeling purposes, individual months were categorized as wet, normal, or dry.

Based on the parameters described above together with the agricultural demand data spread sheets that were developed from the ACT/ACF Comprehensive Study, an estimate was developed of the maximum annual and monthly depletions associated with each hydrologic reach of the Basin (Table 3). Some of these reaches are shared between states and additional analysis is on-going to apportion the reach depletions between states by returning to the county-level inputs to the demand data spread sheets.

Table 3. Annual maximum and monthly maximum depletions apportioned by reaches of the ACF Basin.

State(s)	Basin Reach	Annual maximum depletion (cfs)	Monthly maximum depletion (cfs)
GA	Upper Chattahoochee River[1]	415	483
AL, GA	Middle Chattahoochee River[2]	376	682
GA	Flint River[3]	272	1,078
AL, FL, GA	Chattahoochee/Flint Confluence[4]	177	767
FL	Apalachicola River	103	198
	All reaches	1,343	3,009

[1] Upstream of Whitesburg, GA
[2] Whitesburg, GA to George Andrews Lock and Dam
[3] Upstream of Bainbridge, GA
[4] Downstream of George Andrews Lock and Dam and Bainbridge, GA, to Jim Woodruff Lock and Dam

Element 3 -- Federal Processes in Implementing an Allocation Formula

This Concept recognizes that the Federal agencies will implement the allocation formula to the extent required by the Compact and consistent with the requirements of Federal law. Further, this Concept recognizes that full or incremental implementation of the allocation formula agreement may be subject to completion of appropriate studies in accordance with applicable Federal laws and policy, receipt of Congressional authority for reallocation of reservoir storage to water supply, or changes in authorized project purposes. Finally, this Concept recognizes that reallocations or other elements of the allocation formula could be phased in over time.

This Concept envisions that the U. S. Army Corps of Engineers (Corps) will operate the Federal reservoirs in the ACF Basin in a manner necessary to comply with the maximum depletions and minimum flow requirements specified herein together with the other authorized project purposes. The Corps, following Congressional authorization of full or incremental implementation measures, would develop and adopt a Water Control Plan, which would include a Drought Contingency Plan as required by Corps regulations, for the full or incremental implementation of the terms of a water allocation formula and for the operation of Federal reservoirs consistent with the formula and as authorized by Congress. The Water Control Plans would be developed in full consultation with the States and the ACF Commission and in accordance with applicable Corps regulations and policies. Under this Concept the Water Control Plans would provide for the maximum production of hydropower consistent with meeting the depletion and minimum flow requirements and would be periodically revised to account for incremental implementation of the water allocation agreement or any other changes required to improve compliance with the provisions of the allocation formula. The Drought Contingency Plan developed as part of the Water Control Plans would be coordinated with any Drought Plan that might be developed by the ACF Commission to ensure consistency. In carrying out the ACF water allocation formula, the Corps would periodically modify the Water Control Plans (with appropriate compliance with Corps regulations pertaining to obtaining public participation and with all environmental requirements) in consultation with the ACF Basin Commission to meet the allocation formula operating criteria, in full or to achieve incremental implementation of the formula, to the extent required by the Compact and consistent with Federal law, including Congressional authorizations of any Federal multi-purpose project.

Element 4 -- Adaptive Management

The two basic goals of this concept for an ACF water allocation formula are to maintain the schedule of minimum flow rates, which is linked to climatic indices (Element 1), and to support the States' use of water consistent with the maximum depletion rates (Element 2). It is the States' purview, subject to Federal concurrence, to agree whether these goals represent "an allocation formula for equitably apportioning the surface waters of the ACF Basin among the states while protecting the water quality, ecology,

and biodiversity of the ACF, as provided in … applicable federal laws" (ACF Compact Article VII). Although verifying compliance with a schedule of minimum flow rates is a relatively simple matter, verifying compliance with maximum depletion rates presents some special monitoring and research challenges. Verifying compliance with the Compact's language about "protecting the water quality, ecology, and biodiversity of the ACF" presents yet additional monitoring and research challenges. While these challenges complicate compliance verification, they are unavoidable, because depletions, water quality, ecology, and biodiversity are each of critical importance in managing the surface waters of the basin. To answer these challenges, a process of adaptive management is proposed as the fourth and final element of this allocation Concept that would: 1) compile information relevant to formula compliance; and 2) use that information to improve water management in the Basin in response to changing conditions.

Compliance with the formula as framed in this concept necessarily involves monitoring and research activity in the following areas: 1) flow rates; 2) climatic indices; 3) depletion rates; and, 4) water quality, ecology, and biodiversity. Monitoring flow rates at the state lines and other locations throughout the ACF Basin is a well-established and ongoing activity, and to a lesser degree, so is water quality monitoring. Climatic data collection is also well established, but is not specifically tailored to serve the needs of an ACF allocation formula, e.g., indicators that are strong predictors of basin yield as described in the minimum flows element. Depletion monitoring is relatively complete in the basin for large M&I and thermal users, but is limited in the agricultural demand sector, where depletions resulting from ground water withdrawals substantially complicate the picture. Ecology and biodiversity studies have been conducted occasionally in various portions of the basin, but only a few have been designed to examine relationships with minimum flow rates, depletions, or other factors relevant to water allocation. All of these areas of monitoring and research in the ACF Basin could be enhanced to some extent to better answer the questions raised by a basin-wide water allocation. Coordination among the various State, Federal, and private entities that are engaged in these four general types of monitoring and research is, therefore, a principal role of the adaptive management process under this formula Concept.

The States have proposed various institutional arrangements under the ACF Commission for receiving some aspects of a monitoring and research responsibility, e.g., an ACF Committee and a Scientific Advisory Panel. Regardless of how it may be administratively organized, this Concept envisions a body appointed by the Commission that would have the diversity of expertise necessary to address all research and monitoring data relevant to compliance with the allocation formula. This body would make that data available to all Compact parties and to the public. It would regularly seek public input and report to the Commission on formula compliance (flows and depletions) and on water management issues relating to compliance such as reservoir operations, water conservation, drought response measures, water-based recreation, and the status of water-dependent resources in the basin.