UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board
G. Paul Bollwerk, III, Chairman
Nicholas G. Trikouros
Dr. James F. Jackson

In the Matter of	)	**Docket Nos. 52-025 COL and**
	)	**52-026-COL**
SOUTHERN NUCLEAR OPERATING CO.	)	
	)	**ASLPB No. 09-873-01-COL-BD01**
(Combined Operating License, Vogtle Electric	)	
Generating Plant, Units 3 and 4	)	**October 30, 2009**
	)	

PETITION OF VINCE DRESCHER, KENNETH WARD, JOHN C. HORN, JR., WILLIAM S. BASHLOR AND JAMES EDDIE PARTAIN TO INTERVENE AND ADMIT NEW CONTENTION

I. Introduction and Procedural Background

Pursuant to 50 C.F.R. § 2.309, Vince Drescher, Kenneth Ward, John C. Horn, Jr., William S. Bashlor and James Eddie Partain (collectively, "Petitioners") respectfully petition the Atomic Safety and Licensing Board ("ASLB") for leave to intervene as parties in this proceeding and admit a new contention.[1]

In this proceeding, Southern Nuclear Operating Company ("SNC") seeks a Combined License ("COL") for two new nuclear reactors ("Units 3 and 4") at the Vogtle Electric Generating Plant (the "Vogtle Plant" or "Vogtle"), which is located in Burke County, Georgia, on the Savannah River, approximately 25 miles southeast of Augusta. Notice of acceptance and docketing of the COL application was published on June 11, 2009, 73 Fed. Reg. 33118. A Notice of Hearing and Opportunity to Petition for Leave to

[1] This petition is timely because, as required by this Board's Order dated December 2, 2008 (n.6), it is filed within 30 days after the new information on which the contention is based became available.

Intervene was published in 73 Fed. Reg. 53446 (Sept. 16, 2008). In its order of March 3, 2009, the ASLB granted petitions to intervene and proposed contentions of the Atlanta Women's Action for New Directions, *et al.*

In June 2009, after an adjudicatory hearing on SNC's separate application for an early site permit ("ESP") for Units 3 and 4, a separate Licensing Board rejected environmental contentions raised by intervenors in that proceeding. *Southern Nuclear Operating Co. (Early Site Permit for Vogtle Site ESP),* ASLPB No. 07-850-01-ESP-BD01 (June 22, 2009)(*"Vogtle ESP First Partial Initial Decision"*). In a subsequent August 2009 decision, that Licensing Board resolved all remaining environmental issues and held that the Final Environmental Impact Statement for the ESP (the "ESP FEIS") satisfied the requirements of the National Environmental Policy Act, 42 U.S.C. §§ 4321 *et seq.* ("NEPA"). (*"Vogtle ESP Second and Final Partial Initial Decision"*). On August 26, 2009, the Commission issued an ESP and accompanying Limited Work Authorization for Vogtle Units 3 and 4. 74 Fed. Reg. 44879 (Aug. 31, 2009).

II. Description of Petitioners and Basis for Standing

Pursuant to 50 C.F.R. § 2.309(d)(1)(i), the names, addresses and telephone numbers for each petitioner are set forth in the Declarations accompanying this petition. These Declarations establish that each petitioner has standing to intervene as a party in this proceeding. First, Mr. Ward resides less than 50 miles from the Vogtle site. Accordingly, he has presumptive standing. *Diablo Canyon, supra,* 56 NRC at 426,27, citing *Florida Power & Light Co.* (Turkey Point Nuclear Generating Plant, Units 3 and 4), LPB01-06, 53 NRC 138, 146, *aff'd* CLI 01-17, 54 NRC 3 (2001). As stated in his Declaration, Mr. Bashlor resides less than 53 miles from the Vogtle Plant.

Moreover, each petitioner actively uses and enjoys the Savannah River for recreational purposes, including fishing and, in the case of Mr. Ward, boating and water skiing. Consequently, each of them has interests that stand to be directly injured if the potential impacts of proposed Units 3 and 4 on the Savannah River -- impacts to water quality, water quantity/flow and the river's fish and other natural resources -- are adversely affected or if those potential impacts are not adequately assessed by the NRC.

Accordingly, each petitioner has standing to intervene and raise appropriate NEPA-based contentions that the NRC's analysis ignores reasonably foreseeable conditions and thus understates the potential adverse impacts of Vogtle Units 3 and 4 on the Savannah River. Thus, (1) each petitioner has suffered or will suffer a distinct and palpable harm that constitutes injury-in-fact within the zone of interests protected by NEPA; (2) the injury can be fairly traced to the challenged action; and (3) the injury is likely to be redressed by a favorable decision. *In the Matter of Pacific Gas & Electric Co.* (Diablo Canyon Independent Spent Fuel Storage Installation), LPB-02-23, 56 NRC 413, 426 (2002)("Diablo Canyon"). *See also Southern Nuclear Operating Company* (Vogtle Electric Generating Plant), No. 52-11-ESP, Board Memorandum and Order (March 12, 2007) at 5-5 (ruling on Standing and Contentions).

III. Proposed Contention (10 C.F.R. § 2.309(f)(1)(i))

> NEPA-1. The potentially significant adverse impacts of Vogtle Units 3 and 4 on the Savannah River have not been fully or adequately evaluated in light of the proposal of the United States Army Corps of Engineers ("USACE") to reduce discharges from the Thurmond Dam to 3100 cubic feet per second ("cfs"), and as low as 2,600 cfs, from mid-September through mid-February in any future years when necessary to avoid Level 4 drought conditions in the Thurmond Reservoir. The cumulative impacts of such flow restrictions (and the assumed potentially recurrent Level 3 drought conditions that underly the USACE's proposal), combined with the proposed Vogtle Plant expansion, constitutes significant new

information not considered in the ESP FEIS, and could reduce river flows to levels that would adversely affect the river.

B. Brief Explanation of Bases for the Proposed Contention and Demonstration of a Genuine Dispute (§ 2.309(f)(1)(ii) and (vi))

The SNC contends that there are no new environmental issues pertaining to its COL application "that were not resolved" in the ESP licensing proceeding.[2] This assertion ignores the recent proposal of the USACE, announced, on October 2, 2009, to restrict discharges from the Thurmond Dam to 3100 cfs, and potentially as low as 2600 cfs, from mid-September through mid-February in the future when necessary to ensure a sufficient water supply in the Thurmond reservoir. The USACE's proposal constitutes significant new information that must be considered in connection with the ASLB's decision whether to approve the COL. As discussed below and in detail in the accompanying Declaration of Paula L. Feldman, P.E., the anticipated water use of proposed Vogtle Units 3 and 4, combined with the USACE's proposed plan to restrict discharges from Thurmond Dam, may have a significant adverse impact on the Savannah River River, and reduce flows to levels that are below those required by the state of Georgia to assurance protection of the river, its resources and beneficial uses.

C. The Contention is Within the Scope of the Hearing (§ 2.309(f)(1)(iii))

The contention raises an issue whether the NRC has complied with applicable NEPA requirements. The Licensing Board in the ESP proceeding stated that any significant new environmental information not considered in the FEIS for the ESP would be considered in a supplemental environmental impact statement prepared in this proceeding. *See Vogtle ESP First Initial Partial Decision, supra* at 152-53. SNC

[2] SNC VEGP Units 3 and 4 COLA ER Revision 0 at 4-1 (March 8, 2009).

acknowledges that "new and significant" environmental issues that "would alter the conclusions on a specific issue in the ESP EIS" are cognizable in this proceeding.[3]

D. Materiality of the Contention (10 C.F.R. § 2.309(f)(1)(iv))

NEPA requires federal agencies to take a "hard look" at the impacts of proposed actions. *Kleppe v. Sierra Club*, 427 U.S. 390, 410 n. 21 (1976); *Louisiana Energy Servs., L.P.* (Claiborne Enrichment Center), CL-98-3, 47 NRC 77, 87-88 (1998); *Vogtle ESP First Initial Partial Decision, supra,* at 13. While agencies need not address every possible impact, they must address significant impacts that are reasonably foreseeable. *Vogtle ESP First Initial Partial Decision, supra* at 13 [citing *Long Island Lighting Co.* (Shoreham Nuclear Power Station, Unit 1), ALAL-156, 6 AEC 831, 836 (1973)]. Further, agencies must consider direct, indirect, cumulative and short-term and long-term impacts. To the extent possible they must quantify all "reasonably foreseeable significant adverse impacts" and assess potential impacts "over the lifetime of the action . . . and beyond," including the impacts of "other past, proposed and reasonably foreseeable future actions that either have or might affect those [same] resources" by other federal or non-federal agencies and persons.[4] Cumulative impacts are defined as those which result

> from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency ... or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions . . . over a period of time

40 C.F.R. §1508.8.[5]

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[3] ER at 1-1 (emphasis added).

[4] *See* NRC, Environmental Review Guidance for Licensing Actions Associated With NMSS Programs, NUREG-1748 at § 4.2.5 (August 2003).

[5] The NRC has adopted certain definitions provided in Council on Environmental Quality regulations. See 50. C.F.RI § 51.14(b). Among those is 40 C.F.R. § 1508.25, which states that an EIS must consider direct, indirect and cumulative impacts of an action.

Where, as here, a COL application references an early site permit under Part 52, NRC staff must prepare a supplement to the ESP FEIS. 50 C.F.R. § 51.92(b). The supplement must address "new and significant circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." *Id.* § 51.92(a)(2). The NRC has announced that it will prepare a supplemental EIS for the proposed Vogtle expansion. *See* 74 Fed. Reg. 49407 (Sept. 28, 2009). For the reasons discussed below, the recent proposal of the USACE to restrict discharges from the Thurmond Dam constitute "new and significant information" that must be considered in connection with the COL application and are material to the findings that the NRC must make in determining whether to issue the COL. *Accord,* 10 C.F.R. § 52.39(c) (contentions may be litigated in a COL proceeding regarding "any issue involving the impacts of construction and operation of the facility that was resolved in the early site permit proceeding for which significant new information has been identified."); *Vogtle ESP First Initial Partial Decision, supra* at 6 n.6 (stating that after an early site permit is issued, NRC staff will address significant new information in a supplemental EIS in the COL proceeding). This motion is timely under the ASLB's initial prehearing order in this proceeding, which directs potential petitioners/intervenors to file motions to admit contentions within thirty days of the date upon which the information that is the basis of the motion becomes available to the petitioner/intervenor. *See Southern Nuclear Operating Co.* (Vogtle Electric Generating Plant, Units 3 and 4), Docket No. 52-025-COL and 52-026-COL, Initial Prehearing Order (Dec. 2, 2008) (slip op. at 6 n.6). The USACE publicly announced its proposal on October 2, 2009, less than 30 days ago. *See* Attachment A hereto.

E. Facts and Expert Opinions Supporting the Proposed Contention (10 C.F.R. § 2.309(f)(1)(v)

The facts and opinions supporting the proposed contention are set forth in detail in the accompanying Declaration of Paula L. Feldman, P.E. ("Feldman Decl."), incorporated herein by reference and are summarized here.

On October 2, 2009, after the ESP FEIS was upheld by the ESP Licensing Board, the USACE announced a proposal to restrict discharges from Thurmond Dam, which lies upstream of Vogtle, during Level 3 drought conditions to ensure sufficient water levels in the reservoir. Discharges from the dam would be reduced to 3100 cfs -- and as low as 2600 cfs -- from mid-September through mid-February in any future year as necessary for this purposes. *See* Attachment B hereto. The Corps prepared an Environmental Assessment ("EA") for this proposed action. *See* Attachment C hereto.

Although the Corps says it is "uncertain" whether drought conditions will recur in the future so as to require implementation of its proposed plan, it is at least reasonably foreseeable that recent drought conditions that prompted the preparation of the plan will recur in the future, triggering the proposed restrictions. Feldman Decl, ¶¶ 9-11. Indeed, why else would the Corps have seen fit to develop its proposed plan? Moreover, widely accepted climate change models and projections suggest that such conditions are not only reasonably foreseeable, but reasonably likely to occur over the next several decades while Vogtle Units 3 and 4 are operational. *Id.* and sources cited therein.

The consumptive water use of proposed Vogtle Units 3 and 4, coupled with the Corps' proposed restrictions on releases from Thurmond Dam, could well have a significant adverse impact on the Savannah River. In the ESP licensing proceedings, NRC witnesses asserted (and the ESP Licensing Board concluded) that an in-stream flow

of 3800 cfs in the vicinity of the Vogtle plant is the appropriate benchmark for NEPA analysis. Second and Final Partial Initial Decision, ¶ 4.18. The NRC's analysis and projections of in-stream flow rates focused on the assumption that releases from Thurmond Dam would be about 3800 cfs, which is consistent with the USACE's contingency plan then in effect which called for releases to be reduced to 3800 cfs during Level 3 drought conditions. ESP FEIS at 5-7. Although some data were presented concerning impacts when flows fall to 3000 cfs and lower, this information was presented merely for "context" rather than as a comprehensive "hard look" analysis, and the Licensing Board agreed with staff that assumed flows at such low levels were "extremely unlikely" and should not provide the basis for a NEPA analysis. Second and Final Partial Initial Decision, ¶ 4.32.[6] NRC witnesses concluded that the impacts of proposed Units 3 and 4 on the river would be SMALL because, *inter alia*, their consumptive water use would constitute only 1.7 percent of the assumed low flow of 3800 cfs. Feldman Decl., ¶ 10.

However, in light of the USACE's most recent proposal, it is not "extremely unlikely" that flows will drop to 3100 cfs or less, and such lower flows should be the basis for a NEPA analysis of the potential cumulative impacts of Vogtle Units 3 and 4. Moreover, those potential impacts cannot be determined based on the percent of river water they withdraw. To determine those impacts, one needs to know the minimum in-stream flow levels *that are necessary to protect the river. Id.*, ¶ 11. At the Vogtle location, the flow level required to protect downstream uses and resources is not 3800 cfs; it is 4070 cfs. Id., ¶ 14. Thus, even if river flow at Vogtle remain at 3800 cfs under

[6] In fact, NRC staff asserted that the Level 3 drought conditions which had caused the USACE briefly to decrease dam releases to about 3100 cfs for a few weeks in the winter of 2009 are unlikely to recur -- a premise recently belied by the USACE's October 2nd proposal. See Attachment D hereto.

the combined influence of Units 3 and 4 and the USACE's restrictions on releases from Thurmond Dam, resulting in-stream flows according to the NRC staff's own analysis, can be expected to be at or less than 3800 cfs -- which is nearly 300 cfs less than what is necessary to protect the river. *Id.*

Further, even if an in-stream flow of 3800 cfs were an appropriate benchmark, by definition, the NRC staff's previous analysis did not take full account of the USACE's recent proposal because the potential impacts of reducing dam discharges to as low as 2600 cfs, as proposed by the USACE, were not systematically assessed or used as the basis for the NEPA analysis. And even at a dam release rate of 3100 cfs, there is no information or analysis from which one could conclude that future, protracted restrictions of dam releases to 3100 cfs five months each year would ensure in-stream flows of 3800 cfs near Vogtle. Feldman Decl., ¶ 15.

The potential cumulative impacts of Vogtle Units 3 and 4, combined with the USACE's proposed flow reduction plan, will potentially be felt far downstream of the Vogtle plant. These impacts could include reducing dissolved oxygen concentrations below the levels required to support the river's fish; adversely affecting the City of Savannah's water supply by increasing chloride concentrations to unacceptable levels; and adversely affecting the water supplies for other downstream users of the river. Feldman Decl., ¶¶ 16-20.

The proposed contention is also timely as a new contention under 10 C.F.R. § 2.309(f)(2). The contention raises new data and conclusions that differ significantly from those of SNC and the NRC; was not previously available; is materially different from information previously available; and has been timely submitted. Assuming,

counterfactually, that this petition is untimely, it satisfies the requirements of 10 C.F.R. § 2.309(c). The USACE's proposal was announced very recently, after issuance of the ESP; petitioners clearly have standing and have demonstrated a direct and significant interest that would be adversely affected if the NRC fails to consider the new information; granting the petition clearly will not delay the proceedings; their participation will contribute to the development of a sound record; no other parties have raised the foregoing issues in this proceeding; and there are no other means by which petitioners may protect their interests in ensuring that the potential cumulative impacts of Vogtle Units 3 and 4 are fully considered before they are approved.

CONCLUSION

For all the foregoing reasons, the instant petition should be granted.

Dated: October 30, 2009

Respectfully submitted,
/original signed by Barry S. Neuman/

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Counsel for Petitioners Vince Drescher, Kenneth Ward, John C. Horn, Jr., William S. Bashlor and James Eddie Partain

ATTACHMENT A

DEPARTMENT OF THE ARMY
SAVANNAH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 889
SAVANNAH, GEORGIA 31402-0889

REPLY TO
ATTENTION OF:

Mobile/Savannah
Planning Center

JOINT PUBLIC NOTICE
US Army Corps of Engineers, Savannah District,
and the
Georgia Department of Natural Resources, Coastal Resources Division,
and the
South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

TO WHOM IT MAY CONCERN:

SUBJECT: Notice of Availability of a Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for a temporary deviation to the US Army Corps of Engineers' Savannah River Basin Drought Contingency Plan on the Savannah River in Georgia and South Carolina, in response to the continued drought conditions.

Notice of the following is hereby given:

a. Pursuant to the National Environmental Policy Act of 1969, notice is hereby given that the US Army Corps of Engineers, Savannah District proposes a temporary deviation to the March 1989 Savannah River Basin Drought Contingency Plan, as revised.

b. The Savannah District announces the availability to the public of a Draft EA and Draft FONSI concerning the action. Copies of the Draft EA and unsigned FONSI can be obtained from the following website: www.sas.usace.army.mil, by emailing Mr. William Bailey at following address: william.g.bailey@usace.army.mil.

c. Written statements regarding the Draft EA and FONSI for the proposed action will be received at the Savannah District Office until

12 O'CLOCK NOON, OCTOBER 31, 2009

from those interested in the activity and whose interests may be affected by the proposed action.

PROJECT DESCRIPTION: The proposed action is a temporary revision to the US Army Corps of Engineers (Corps) 1989 Savannah River Basin Drought Contingency Plan. The revision would be a reduction in the minimum daily average discharge from the J. Strom Thurmond reservoir from 3,600 to 3,100 cubic feet per second (cfs) during the fall/winter months for the duration of the present drought. The reduction would begin in the fall (mid-September) when dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers' Depot (#0219897730). The reduction in flow would continue until one of the following conditions occurred:

1. arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2. water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after February 1.

This change would preserve water in the Corps reservoirs and delay the time at which those reservoirs would reach the bottom of their conservation storage. The Corps would restore the discharges from the Thurmond reservoir up to the present 3,600 cfs per day daily average if requested by either the State of Georgia or South Carolina.

The US Army Corps of Engineers operates its three multi-purpose projects on the Savannah River (Hartwell, Richard B. Russell, and J. Strom Thurmond) as a three-lake system. The most recent drought has reduced the volume of conservation storage in those three lakes. As a result of declines in the conservation storage and concerns that Level 4 drought conditions may be reached if the drought continues, Savannah District is considering reducing discharges from the Thurmond Reservoir during the fall/winter months when the projects are in a Level 3 drought condition. Alternatives considered included the following:

(A) No Action,

(B) Reducing discharges during the fall/winter months from 3,600 to 3,100 cubic feet per second (cfs) (Alternative 1), and

(C) Reducing discharges during the fall/winter months from 3,600 to 2,600 cfs (Alternative 2). The tentatively recommended plan is Alternative 1.

AUTHORIZATION REQUIRED FROM THE STATE OF GEORGIA:

Coastal Zone Consistency: Savannah District has evaluated the proposed project and believes it is consistent with the Georgia Coastal Zone Management Program to the maximum extent practicable. The District will submit its evaluation to the Georgia Department of Natural Resources, Coastal Resources Division in Brunswick, Georgia, who administers that program. The State will review the proposed action and determine whether it concurs that the proposed project is consistent with the State's Coastal Zone Management Program to the maximum extent practicable. Any person who desires to comment or object to Georgia Coastal Zone Management Consistency Certification must do so in writing within 10 days of the date of this notice to the Federal Consistency Coordinator, Georgia Department of Natural Resources, Coastal Resources Division, Suite 300, One Conservation Way, Brunswick, Georgia 31520-8687 and state the reasons or basis for the objections.

AUTHORIZATION REQUIRED FROM THE STATE OF SOUTH CAROLINA:

Coastal Zone Consistency: Savannah District has evaluated the proposed project and believes it is consistent with the South Carolina Coastal Zone Management Program to the maximum extent practicable. The District will submit its evaluation to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management in Charleston, South Carolina, who administers that program. The State will review the proposed action and determine whether it concurs that the proposed project is consistent with the State's Coastal Zone Management Program to the maximum extent practicable. Any person who desires to comment or object to South Carolina Coastal Zone Management Consistency Certification must do so in writing within 10 days of the date of this notice to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management; 1362 McMillan Avenue; Suite 400, Charleston, South Carolina 29405 and state the reasons or basis for the objections.

DEPARTMENT OF THE ARMY EVALUATION:

Environmental Assessment: Savannah District has prepared a Draft Environmental Assessment (EA) and found that an Environmental Impact Statement will not be required for this action. The Draft EA is being coordinated concurrently with this Notice to Federal and State natural resource agencies for review and comment. No wetlands would be filled, but riparian wetlands could be temporarily impacted by reduced river flows. No discharge of dredge or fill material into waters of the US is included in the proposed action, so no evaluation is required under Section 404 of the Clean Water Act.

Threatened and Endangered Species: The District reviewed the most recent information on Federally-listed endangered or threatened species and determined that the proposed action may effect, but is not likely to affect shortnose sturgeon, manatee, and wood stork. This proposed action is being coordinated with the US Fish and Wildlife Service and the National Marine Fisheries Service under Section 7 of the Endangered Species Act.

Cultural Resources: In accordance with the National Historic Preservation Act (P.L. 89-655, as amended) and 36 CFR, Part 800, Savannah District has evaluated the proposed action's potential effect upon historic properties. The District has determined the proposed action will have no adverse effect upon historic properties and has initiated consultation with the Georgia and South Carolina State Historic Preservation Officers and eighteen Native American Tribes.

Essential Fish Habitat: Savannah District evaluated the proposal's potential effects on Essential Fish Habitat. The project's effects would be of relatively short duration. As a result, the District believes the proposed action would not produce long term effects on these valuable coastal habitats that warrant mitigation. The District is coordinating the proposed action with the National Marine Fisheries Service under the Magnuson-Stevens Fishery Conservation and Management Act.

Coastal Zone Consistency: Savannah District evaluated compliance of the proposed action with both the Georgia and South Carolina Coastal Management Programs (CMP). The District believes that the proposed action is consistent with the CMPs to the maximum extent practicable. The District will submit the EA to the Georgia Department of Natural Resources, Coastal Resources Division in Brunswick, Georgia and to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management in Charleston, South Carolina.

Public Interest Review: The decision whether to proceed with the project as proposed will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both the protection and use of important resources. The benefits which reasonably may be expected to accrue from the proposal will be balanced against its reasonably foreseeable detriments. All factors that may be relevant to the proposal will be considered, including the cumulative effects thereof. Among these are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife, flood hazards, flood plains, land use, navigation, shoreline erosion/accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership, environmental justice, and, in general, the needs and welfare of the people.

Consideration of Public Comments: The US Army Corps of Engineers is soliciting comments from the public; Federal, State, and local agencies and officials; Native American Tribes; and other interested parties in order to consider and evaluate the impacts of the proposed activity. Any comments received will be considered by the US Army Corps of Engineers in its deliberations on this action. To make this decision, comments are used to assess impacts to endangered species, wetlands, historic properties, water quality, general environmental effects, socioeconomic effects, and the other public interest factors listed above. Comments are used in the preparation of the Environmental Assessment pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

Comment Period: Anyone wishing to comment to the Corps on this proposed action should submit comments no later than the end of the comment period shown in this notice, in writing, to the US Army Corps of Engineers, Savannah District, Savannah Planning Unit, ATTN: Mr. William Bailey, Post Office Box 889, Savannah, Georgia 31402-0889, by FAX to 912-652-5787, or by emailing the comments to the following address: william.g.bailey@usace.army.mil.

Any person who desires to comment or object to Georgia Coastal Zone Management Consistency Certification must do so in writing to the Georgia Department of Natural Resources, Coastal Resources Division, Federal Consistency Coordinator, Suite 300, One Conservation Way, Brunswick, Georgia 31520-8687.

Any person who desires to comment or object to South Carolina Coastal Zone Management Consistency Certification must do so in writing to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management; 1362 McMillan Avenue; Suite 400, Charleston, South Carolina 29405.

William G. Bailey
Chief, Savannah Planning Unit

ATTACHMENT B

NEWS RELEASE

U.S. ARMY CORPS OF ENGINEERS **BUILDING STRONG®**

For Immediate Release:
October 2, 2009
News Release No. 09-54

Contact:
Billy Birdwell, Public Affairs Officer, 912.652.5014/5279
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Comment period opens on temporary changes to drought plan

SAVANNAH, GEORGIA – The Savannah District of the Army Corps of Engineers proposes to make a temporary revision to the 1989 Savannah River Basin Drought Contingency Plan and is soliciting comments from the public on the change. The revision in the plan would reduce the minimum daily average discharge of water from the J. Strom Thurmond Dam and Lake from 3,600 to 3,100 cubic feet per second (cfs) in the fall and winter months for the reminder of the present drought, if conditions warrant the reduction.

The change would preserve water in the three Savannah River reservoirs and delay the time at which those reservoirs would reach the bottom of their conversation storage pools. The Corps of Engineers would restore the discharges from the Thurmond reservoir to the present 3,600 cfs per day daily average if requested by either the states of Georgia or South Carolina.

A more detailed description of the proposed action is contained in the draft Environmental Assessment and Appendices. The comment period, described in the Joint Public Notice, is open until October 31.

– 30 –

ATTACHMENT C

DRAFT
ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

FALL/WINTER FLOW REDUCTION
SAVANNAH RIVER BASIN

US ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

September 2009

TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS (continued)

LIST OF TABLES

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF APPENDICES

TABLE OF CONTENTS (continued)

Page No.

ACRONYMS

CFR ---------- Code of Federal Regulations
cfs ---------- cubic feet per second
DHEC ---------- Department of Health and Environmental Control
DNR ---------- Department of Natural Resources
DO ---------- Dissolved Oxygen
EA---------- Environmental Assessment
EFM ---------- Ecosystems Function Model
EPA ---------- Environmental Protection Agency
EPD ---------- Environmental Protection Division
HEC---------- US Army Corps of Engineers Hydrologic Engineering Center
JST ---------- J. Strom Thurmond
msl ---------- mean sea level
NAA ---------- No Action Alternative
NEPA ---------- National Environmental Policy Act of 1969
NOAA ---------- National Oceanic and Atmospheric Administration
NSBL&D-------- New Savannah Bluff Lock and Dam
NWR---------- National Wildlife Refuge
PDT ---------- Project Delivery Team
RBR---------- Richard B. Russell
SEPA ---------- Southeastern Power Administration
SHPO ---------- State Historic Preservation Officer
SRBDCP -------- Savannah River Basin Drought Contingency Plan
USFWS---------- United States Fish and Wildlife Service
USGS ---------- United States Geologic Survey
WY---------- Water Year

FINDING OF NO SIGNIFICANT IMPACT

Name of Action: Drought Contingency Plan Temporary Deviation for the Savannah River Basin

1. Description of the Proposed Action

The proposed action consists of reducing discharges from J. Strom Thurmond Dam from 3,600 to 3,100 cubic feet per second (cfs) during the fall/winter (mid-September through mid-February) when the Corps' reservoirs on the Savannah River are in Level 3 drought conditions. The action would retain the major components of the 1989 Savannah River Basin Drought Contingency Plan (SRBDCP) and adjust one feature (discharge during fall/winter) for the duration of the present drought. This change would preserve water in the US Army Corps of Engineers reservoirs and delay the time at which those reservoirs would reach the bottom of their conservation storage. The Corps would restore the discharge from Thurmond Dam up to the 3,600 cfs per day daily average at any time during the fall/winter if requested by either the State of Georgia or South Carolina.

2. Other Alternatives Considered

Alternatives to the Proposed Action were developed as part of the planning process. The alternatives that were considered were as follows:

a. No Action Alternative (Continue with the 1989 Savannah River Basin Drought Contingency Plan (SRBDCP) as updated in 2006 to include a 3,600 cfs discharge from J. Strom Thurmond Dam during Level 3 drought conditions.)

b. Alternative 1 (Selected Alternative): Retain the major components of the 1989 SRBDCP and temporarily adjust one feature. When Level 3 drought conditions exist, the minimum daily average release at Thurmond Dam would be adjusted from 3,600 to 3,100 cfs for the period mid-September through mid-February, for the duration of the present drought. The flow reduction would be implemented in a 2-step process, with flows dropping to 3,300 cfs for one week, followed by the remaining reduction to 3,100 cfs. The reduction would begin in the fall as soon as dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers' Depot (#0219897730). The reduction in flow would continue until one of the following conditions occurred:

1. arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2. water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after 1 February.

The first Shortnose sturgeon have recently been observed at the New Savannah Bluff Lock and Dam around 15 February.

c. Alternative 2: Adjust the minimum daily average release at Thurmond Dam from 3,600 to 2,600 cfs for the period mid-September through mid-February while in Level 3 drought conditions. Alternative 2 is essentially the same as the Alternative 1 except that the minimum daily average release at Thurmond Dam would be lower -- 2,600 cfs.

3. Coordination

Savannah District coordinated this action with Federal, State and local agencies and issued a Notice of Availability to solicit comments from the public on the Draft Environmental Assessment.

NOAA-Fisheries Service stated that they agree with our determination that the proposed flow reduction is not likely to adversely affect Shortnose sturgeon if flows are restored to 3,600 cfs beginning 15 February or upon the arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam. The Corps will continue to coordinate with NOAA Fisheries and would extend the flow reduction past the mid-February date if new information indicates that Shortnose sturgeon spawning would not be measurably adversely affected by continuing the reduced discharges. The Corps would need to obtain separate approval from NOAA Fisheries to extend the flow reduction past the documented arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam.

4. Conclusions

Based on a review of the information contained in this Environmental Assessment (EA), I have determined that the preferred alternative is the best course of action. I have also determined that the proposed action is a temporary deviation from the Drought Contingency Plan for the Savannah River Basin and is not a major Federal action within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, preparation of an Environmental Impact Statement is not required. My determination was made considering the following factors discussed in the EA to which this document is attached:

a. The proposed action would not adversely affect any threatened or endangered species (may affect, but not likely to adversely affect shortnose sturgeon, manatee, and wood stork).

b. The proposed action would not adversely impact cultural resources.

c. The proposed action would not adversely impact air quality.

d. The proposed action complies with Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.”

e. The proposed action would not cause any significant long term adverse impacts to wetlands.

f. No unacceptable adverse cumulative or secondary impacts would result from the implementation of the proposed action.

5. Findings

The proposed action to temporarily reduce discharges from J. Strom Thurmond Dam from 3,600 to 3,100 cfs during the fall/winter would result in no significant environmental impacts and is the alternative that represents sound natural resource management practices and environmental standards.

Date

Edward J. Kertis
Colonel, US Army
Commanding

DRAFT
ENVIRONMENTAL ASSESSMENT

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1. INTRODUCTION

1.1.1. History

The Savannah River Basin experienced a severe drought that began in early 2006. Rainfall and resulting stream flow was particularly low, causing the reservoirs to drop faster than any previous drought on record. This latest drought has become the new drought-of-record for the basin. Hartwell and Russell Lakes experienced their lowest pool elevations since they were initially filled. The region experienced more normal rainfalls in 2009, but the three Corps reservoirs have not refilled to their Guide Curves and they remain in a drought status.

The Corps manages these three impoundments on the Savannah River as a system and uses a Water Control Manual to describe how it will operate those projects. The Drought Contingency Plan is a component of that Manual and was developed (1) to address the effects of the Corps' operation on those impoundments and the downstream portion of the river, and (2) to assist the States of Georgia and South Carolina in drought contingency planning in their water management responsibilities for the Savannah River Basin.

The Corps' 1989 Drought Contingency Plan (DCP) and a 2006 Environmental Assessment (EA) describe activities that would be conducted during four stages of a continuing drought. Those four stages correspond to different reservoir pool levels. When the reservoirs reach the Level 1 trigger elevation, the Corps issues a public safety advisory concerning recreational use of the reservoirs. The Corps also reduces discharges from the reservoirs when Levels 1-3 are reached. When Level 4 is reached, the conservation pools are empty. If drought conditions persist after Level 4 is reached, a discharge of 3600 cfs would be maintained for a period and then further reduced to the point where the outflow from the lakes equals the net inflow.

The actions the Corps would take surrounding the Level 4 trigger were never evaluated in detail when the plan was originally developed or during the 2006 Update. The Reservoir System Simulation modeling conducted to analyze the effects of the various operational scenarios during development of the 1989 DCP and its 2006 EA for the DCP Update always indicated that the lakes would not reach the bottom of conservation pool. This modeling was conducted using inflows that were the drought of record at that time. Sensitivity analyses revealed that the drought would need to extend three additional years to reach Level 4. Therefore, detailed consideration was never given for the best way to operate once that trigger was reached. Savannah District is presently evaluating how it should operate while in Level 4. It is coordinating with the States on alternative operational scenarios. When the District has

completed more of its evaluations, it will coordinate a NEPA document with the public that describes in more detail how it would operate the three-reservoir system when the conservation pools are empty.

It should be noted that when a new drought of record occurs, the Corps' operational objective is to avoid reaching the bottom of the conservation pool. This requires a constant evaluation of the current operations and an update of the drought of record. Since this present drought became the drought of record, additional measures that were not included in the previous Manual or Drought Contingency Plan must be considered and evaluated to achieve this objective.

In 1986, the Savannah District developed a Short-Range Drought Water Management Strategy to address the worsening water shortage conditions in the Savannah River Basin. That document served as a guide for using the remaining storage in the Corps operated Savannah River impoundments for the duration of the drought. The short-range strategy also served as a prelude to the development of a long-term drought strategy, the Savannah River Basin Drought Contingency Plan (SRBDCP) of March 1989. That plan was modified in 2006 by the revision of actions that would occur at the various drought trigger levels. The intent of those modifications was to act earlier in a drought to preserve additional water in the lakes, thereby delaying the time when the conservation pools would be depleted and outflows would reflect only the inflows that the lakes received. The severity of the latest drought created conditions that stressed the traditional management concepts which Savannah District followed to regulate the individual Corps impoundments and the integrated water management of the three lakes. Concerns and conflicts over competing water issues intensified as drought conditions became more severe and lake levels continued to fall.

In October 2007, the Federal and State natural resource agencies agreed with Savannah District's request to temporarily reduce the minimum daily average discharge from Thurmond Dam from the 3,800 cfs level specified in the 2006 EA for the DCP Update back to the 3,600 cfs level that was in the original DCP. The Corps' South Atlantic Division office approved that temporary deviation to the DCP that same month. This action was taken in response to the continued drought to preserve water in the lakes and delay the time when the conservation pools would be depleted. As a result, downstream resources experienced slightly more impacts than would have occurred with strict adherence to the Drought Contingency Plan.

As the latest drought in the southeastern U.S. completed its third year, the Savannah River reservoir system operated by the Army Corps of Engineers (hereafter referred to as the Savannah System) experienced extreme pressure and difficulties. In December 2008, the system had less than 25% of its conservation storage remaining. Hartwell Lake had about 33% of its conservation storage left, and Thurmond had only 10% of its conservation storage remaining.

Arrival of the spring 2009 recharge season brought an easing of the drought conditions. Lake levels and conservation storage began to return to near normal levels but they were not completely restored. Since the pools did not refill to their Guide Curves, the District continues to operate under the procedures defined in the Drought Contingency Plan and the active deviations From that plan. With the uncertainties that surround the subject of weather and rainfall forecasting, the District is uncertain whether the drought will worsen and we will again reach

Level 3 conditions before the pools refill. This EA was developed so that the District would be prepared to conserve water in the reservoirs again in the fall/winter should the system again reach Level 3 conditions.

1.1.2 Requirement for Environmental Documentation

An Environmental Assessment (EA) is prepared following the procedures established by the National Environmental Policy Act of 1969 (NEPA) to identify impacts expected to result from implementation of a proposed action. The assessment ensures that the decision-maker is aware of the environmental impacts of the action prior to the decision to proceed with its implementation. This Act requires the consideration of environmental impacts of a "Proposed Action" and its alternatives prior to implementing the action. This EA addresses proposed temporary revisions to the SRB Drought Contingency Plan.

1.1.3 General Objectives

The objectives of the Proposed Action are:

> Savannah River Basin – Reduce discharges from the Corps' reservoirs on the Savannah River Basin to ensure the conservation pool remains as full as possible until we are certain the drought is over. This would delay the time when drought Level 4 conditions would occur in the Corps reservoirs. This approach would preserve water supply for as many users as possible and minimize negative impacts to other users adversely affected by this action. Implementation of the proposed action would aid in the recovery of the system reservoirs by allowing more storage to be captured during this cooler weather period.
>
> Environmental Compliance - comply with all applicable environmental laws, regulations, and policies

1.2 PURPOSE AND NEED

The Savannah River Basin experienced a severe drought beginning in early 2006. Rainfall and resulting stream flow had been particularly low, causing the reservoirs to drop faster than during previous droughts. The SRBDCP is intended to be a dynamic document which can be changed as new drought periods occur. The purpose for the temporary reduction in flow from Thurmond to as low as 2,600 cfs during the months of mid-September through mid-February is to preserve additional conservation storage within the Savannah system, thereby delaying the point at which the conservation pools would be empty, and to decrease the recovery time to refill the reservoirs.

1.3. SCOPE

The scope of this EA is limited to assessing the potential environmental and socio-economic effects resulting from implementing the Proposed Action and the No Action Alternative (NAA). After eliminating alternatives that are not considered feasible or effective, the potential environmental impacts associated with the NAA are compared to the Proposed Action.

1.4. STUDY METHODOLOGY

Water managers in Georgia and South Carolina jointly performed a volume analysis of the storage remaining within the conservation pools of the three Corps-managed reservoirs on the

Savannah River back in 2007. They considered several different drought inflow and outflow scenarios, and then performed computer modeling that focused on how long the conservation storage could be preserved within the three-lake system.

The States initially considered several hydrologic and operating scenarios. Among other factors, those scenarios reflected the range of potential inflow amounts that could be expected in the basin. Those alternatives and hydrologic conditions were refined after more data became available from the National Weather Service and lake levels declined over the 2008 summer months. The hydrologic conditions they ultimately chose as inputs for the analysis were based on the 2007 inflows with a 10% reduction.

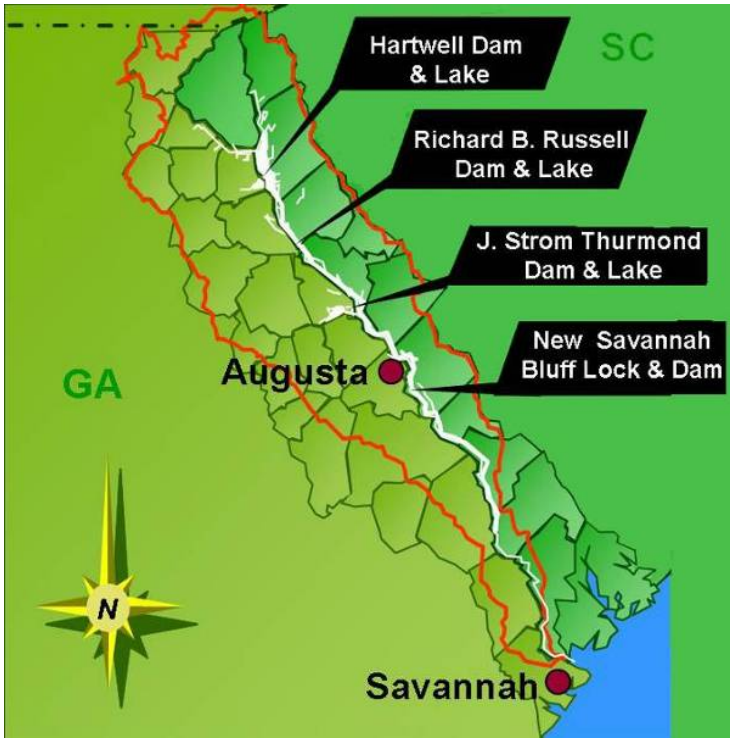
The goal of the alternatives analysis was to identify an operating approach that would allow the conservation storage within the lakes to decline at a slower rate, while still balancing the authorized project purposes of water supply, water quality, fish and wildlife, and hydropower. If such an alternative could be found, the point at which the conservation storage within the lakes would be depleted would be postponed, delaying Level 4 conditions.

Once the inflow set was chosen, several analyses were performed to identify the impacts of the outflow scenarios on the various project purposes. The proposed alternative consists of a targeted release of 3,100 cfs from Thurmond Dam for the cooler months of October through February when the lakes are in Drought Level 3. This release would be a temporary change to the Savannah River Basin Drought Contingency Plan. The States proposed a flow reduction starting on 1 October, but they did not submit the request to the Corps in time that allowed for evaluation and public comment. The proposal in this Draft EA is to begin the flow reduction around mid-September which is earlier than the November date included in the November 2008 Temporary Deviation Drought Contingency Plan Environmental Assessment..

The No Action Alternative follows the water release procedures described in the previously-approved Savannah River Basin Drought Contingency Plan, including previously-approved deviations.

2.0 AFFECTED ENVIRONMENT

2.1. DESCRIPTION OF THE SAVANNAH RIVER BASIN



The Savannah River basin has a surface area of approximately 10,580 square miles, of which 5,821 square miles are in Georgia, 4,581 square miles are in South Carolina and 175 square miles are in North Carolina. The basin includes portions of 27 counties in Georgia, 13 counties in South Carolina and four counties in North Carolina. Although the basin is predominantly rural, metropolitan areas are experiencing significant growth and development pressures. The growth is occurring primarily in the areas of Augusta and Savannah, Georgia, although many smaller cities and towns are also growing. The study area drains portions of three physiographic provinces: the Blue Ridge Mountains, the Piedmont and the Coastal Plain. In its middle and upper reaches the river flow is regulated by several reservoirs, including three large multipurpose Corps projects (Hartwell Lake, Richard B. Russell (RBR) Lake and J. Strom Thurmond (JST) Lake) and two large private power reservoirs (Lakes Keowee and Jocassee). Other structures include the New Savannah Bluff Lock and Dam, the Stevens Creek Dam and the Old Lock and Dam at the Augusta Canal.

Water discharge in the Savannah River varies considerably both seasonally and annually, even though it is largely controlled by releases from the Corps' JST Dam located about 20 miles northwest of Augusta, Georgia. Discharge is typically high in winter and early spring and low in summer and fall, but regulation by upstream reservoirs has reduced natural flow variations. At the New Savannah Bluff Lock and Dam located 12 miles downstream of Augusta, average annual discharge is about 10,000 cfs. The range over the last 10 years was from a minimum of 3,310 to a maximum of 30,700 cfs. Average discharge at Clyo (Effingham County, Georgia) is 12,040 cfs, ranging over the last 10 years from a minimum of 4,110 cfs to a maximum of 39,600 cfs. Tidal effects extend upstream to approximately river mile 45 (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999).

2.2. DESCRIPTION OF CORPS PROJECTS

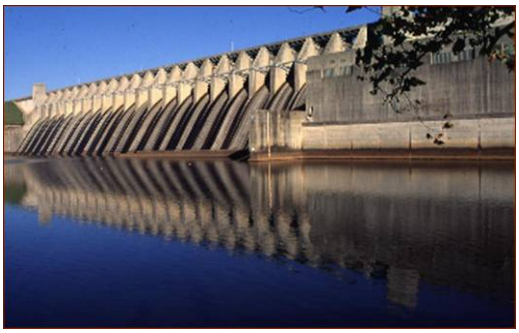
The Corps maintains and operates three large multipurpose projects in the basin. Hartwell Dam and Lake (55,950 acre summer pool) is located 89 miles upstream of Augusta and was filled in 1962. R.B. Russell Dam and Lake (26,650 acre summer pool) is located 59 miles upstream of Augusta and was filled in 1984. J.S. Thurmond Dam and Lake (70,000-acre summer pool) is located 22 miles upstream of Augusta and was filled in 1954.


Hartwell Lake and Dam

The authorized project for the Savannah River between Augusta and Savannah, Georgia, provides for a navigation channel 9 feet deep and 90 feet wide from the upper end of Savannah Harbor (mile 21.3) to the head of navigation just below the 13th Street bridge in Augusta (mile 202.2). This is a distance of 180.9 miles. The project also includes the lock and dam at New Savannah Bluff, located about 12 miles downstream from Augusta. Channel modifications, including deepening, widening, snagging, construction of bend cutoffs, and construction of pile dikes, were made on the river to provide the 9-foot depth. However, by 1980, shipping on the river had virtually ceased, and channel maintenance was discontinued.


R. B. Russell Lake and Dam

The existing authorized Savannah Harbor Navigation Project provides a channel 44 feet deep and 600 feet wide across the ocean bar; 42 feet deep and 500 to 600 feet wide to the vicinity of Kings Island Turning Basin; and 30 feet deep and 200 feet wide to a point l,500 feet downstream of the Houlihan Bridge (US Highway 17). The terminus of the deep-draft channel in Savannah Harbor is at approximately river mile 21. The project provides turning basins for vessels at various locations in the harbor (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999).


J. S. Thurmond Lake and Dam


New Savannah Bluff Lock and Dam

2.3. RECREATION

The lakes of the Savannah River Basin provide excellent opportunities for water resource-based recreation. However, in times of drought, when the lake levels of Hartwell and JST Lake drop 4 feet below summer pool, drought information sheets are disseminated to the public. These sheets instruct the public to only use marked navigation channels, since unmarked hazards become more prevalent increasing

risks of boating accidents outside the channel. In addition, at 6 feet below summer pool, designated swimming areas become dry. Adverse impacts initially become noticeable at designated swimming areas when lake levels drop 3 feet below summer full pool.

According to the Savannah River Basin Water Use Data Collection Presentation of Findings, June 2004, conduct by Zapata Engineering. P.A., for the US Army Corps of Engineers, Savannah District, during periods of low water, approximately 39 percent of the recreational users surveyed said that they would make a water-based recreational trip to the same lake, 41 percent would make a water-based recreation trip elsewhere, and 20 percent would not make a water-based recreation trip. Therefore, during periods of drought, 61 percent of non-drought visitors do not make a water resource-based recreation trip to Hartwell and JST Lakes. Respondents of this survey also indicated that their recreational activities are seriously impacted when lake levels drop an average of 7.5 feet below full pool. According to some lake managers, water recreation is more difficult and less convenient during periods of drought because recreationists may have to travel further distances to a useable ramp for access to the lake, they may consider the lake aesthetically unpleasing and they may recognize the increased risk of damaging their boat and person.

2.3.1 Public Boat-Launching Ramps and Private Docks

Public boat-launching ramps and private docks provide recreational access to the lakes of the Savannah River Basin. The following paragraphs discuss the facilities that exist on the three Corps reservoirs.

Hartwell Lake

There are 95 public boat-launching ramps and marinas located on Hartwell Lake. From lake elevation 660 to 658.01 feet mean sea level (msl) all ramps are useable. At and below lake level 658 feet msl, the first 6 boat-launching ramps become unusable. At and below lake level 657 feet msl, 6 more or a total of 12 boat-launching ramps become unusable. At and below lake level 656 feet msl, one more or a total of 13 boat-launching ramps become unusable. At and below lake level 655 feet msl, 3 more or a total of 16 boat-launching ramps become unusable. At and below lake level 654 feet msl, 1 more or a total of 17 boat-launching ramps become unusable. At and below lake level 653 feet msl, 6 more or a total of 23 (24.2 percent) public boat ramps become unusable, but 72 (75.8 percent) remain serviceable. When lake levels drop to 646 feet msl, 43 (45.2 percent) boat-launching ramps become unusable. If lake levels were to ever drop to 638 feet msl, all the ramps become unusable. Table 1 on the following two pages shows the elevations of the various public boat ramps on Hartwell Lake.

In December 2008, Lake Hartwell reached a record low. As a result of the low water, Savannah District closed all of its boat ramps on Hartwell Lake on October 25, 2008. The District's policy is that three feet of water should be present at the end of a ramp for the safe launching of recreational boats. Gravel was placed at the end of five ramps to allow their continued use. However, such use is at the boat owner's risk. Those ramps are: Green Pond and Hatton's Ford in Anderson County; Martin Creek in Oconee County; and Big Oaks and Crawford's Ferry in Hart County, Georgia. Water levels began to rise in March 2009 and all ramps are operational at this time.

Table 1: Hartwell Lake Public Boat Ramps

Hartwell Lake

Boat Ramp Bottom Elevations - Revised March 2009

Notice: The information on this page may contain errors. Use this information as an approximation only. Launching ability will also depend on type of vehicle, boat and trailer. In addition, ramps with siltation buildup or damage may be unusable much earlier. Always use caution when launching or retrieving a boat, especially when lake levels are lower than normal. The full pool elevation of Hartwell Lake is 660 feet above mean sea level (ft-msl). The elevations below are listed in ft-msl. Some ramps may be closed due to seasonal closures or low water closures; go to www.sas.usace.army.mil/lakes/hartwell/boating for the boat ramp closure list. References to "left lane" and "right lane" are if you are standing on land, facing the water.

Name	Bottom of Ramp	Approx. Lake Elevation When Ramp Becomes Unusable	Comments
Apple Island	649.50	651.50	
Asbury	640.00	643.00	
Big Oaks (left lane)	649.50	652.50	
Big Oaks (right lane)	640.00	643.00	
Broyles (east ramp)	649.30	651.30	
Broyles (middle ramp)	638.85	642.00	
Broyles (west ramp)	648.50	650.50	
Camp Creek	641.00	644.00	
Carters Ferry	641.70	645.00	
Choestoea	640.70	644.00	
Cleveland	647.50	649.50	
Coneross	641.00	644.00	
Crawfords Ferry	640.30	643.30	
Denver	640.00	643.00	
Double Springs	640.80	644.00	
Duncan Branch	640.60	644.00	
Durham	652.70	655.70	
Eighteen Mile Creek	640.00	643.00	
Elrod Ferry	640.00	643.00	Prone to siltation
Fairplay (left lane)	644.00	647.00	
Fairplay (right lane)	641.39	644.00	
Friendship (left lane)	648.00	651.00	
Friendship (right lane)	641.39	644.00	
Glenn Ferry	640.50	644.00	
Green Pond	640.60	644.00	
Gum Branch	641.00	644.00	
Hattons Ford	640.60	644.00	
Honea Path	645.50	648.50	
Jarrett	647.00	650.00	
Jenkins Ferry	639.84	643.00	
Lawrence Bridge	648.00	651.00	
Long Point	640.60	644.00	
Martin Creek	640.00	643.00	
Mary Ann Branch	640.00	643.00	
Milltown Campground	642.36	645.36	
Mullins Ford	640.00	643.00	
New Prospect	641.00	644.00	
Oconee Point Campground	640.00	643.00	
Paynes Creek Campground (inside campground) - left lane	650.60	652.60	

Paynes Creek Campground (inside campground) - right lane	650.60	652.60
Paynes Creek (outside of campground)	640.00	643.00 (prone to siltation)
Poplar Springs (left lane)	649.50	651.50
Poplar Spring (right lane)	640.60	643.60
Powder Bag Creek	640.00	643.00
Richland Creek	640.00	643.00
River Fork (left lane)	640.00	643.00
River Fork (right lane)	648.00	651.00
Rock Springs	641.00	644.00
Singing Pines	640.00	643.00
Spring Branch	646.00	649.00
Springfield Campground	640.60	643.60
Stephens County	649.50	651.50
Tabor	650.50	652.50
Townville	650.30	652.30
Twelve Mile (left lane)	643.77	647.00
Twelve Mile (right lane)	643.77	647.00
Twin Lakes (right lane)	645.00	648.00
Twin Lakes(left lane)	645.00	648.00
Walker Creek	654.00	657.00
Watsadler Campground	642.00	645.00
Weldon Island	640.00	643.00

There are approximately 10,500 private boat dock permits issued on Hartwell Lake. This number is almost double of what was reported in the March 1989 SRBDCP. In that report, it was roughly estimated that about 50 percent of the docks were unusable below lake level 652 feet msl and about 90 percent were unusable at 643 feet msl. Even with the ability and willingness to chase the water, the percentage of docks now unusable at 652 feet msl would likely be greater than 50 percent, since more developments are located adjacent to shallow cove areas. Water levels rose above 652 feet in April 2009.

Richard B. Russell Lake

There are approximately 30 public boat-launching ramps on RBR Lake. All of these ramps are useable until lake levels reach 466 feet msl. Lake levels at RBR Lake do not drop more than five feet below full pool. Therefore, public boat-launching ramps on RBR Lake were not adversely impacted during the drought of record.

J. Strom Thurmond Lake

There are 84 public boat-launching ramps and marinas located on JST Lake. Above lake elevation 326 feet msl to 330 feet msl all ramps are useable and allow for the launching of boats with up to 3 feet of draft. At and below lake level 326 feet msl, the first boat-launching ramp becomes unusable. At and below lake level 325 feet msl, 4 more or a total of 5 boat-launching

ramps become unusable. At and below lake level 324 feet msl, 7 more or a total of 12 boat-launching ramps become unusable. At and below lake level 323 feet msl, 5 more or a total of 17 (20 percent) boat-launching ramps become unusable while 67 (80 percent) remain useable. At and below lake level 317 feet msl, 33 (39 percent) boat-launching ramps become unusable. At and below lake level 315 feet msl, 46 (55 percent) boat-launching ramps become unusable. All boat-launching ramps would become unusable at 306 feet msl. Table 2 on the following page shows the elevations of the various public boat ramps on Thurmond Lake.

There are approximately 1,851 private boat docks on the JST Lake. This is a 25 percent increase from the SRBDCP report. In that report, at 322 feet msl, about 50 percent of the docks were considered unusable. At 313 feet msl, 95 percent of the private docks were considered as unusable. Even with the ability and willingness to chase the water, the percentage of docks now unusable at 322 feet msl would likely be greater than 50 percent, since newer developments are located in shallower coves. Water levels rose above 326 feet in April 2009.

2.3.3. Swimming

Swimming areas on the Corps reservoirs are mainly used from May through September. The following paragraphs discuss the facilities that exist on the three Corps reservoirs.

Hartwell Lake
At Hartwell Lake, there are 22 Corps of Engineers' operated swimming beach areas located in 13 recreation areas. When lake levels reach 654 feet msl, all designated swimming areas are dry. However, when the lake level drops below 657 feet msl, swimming areas become less desirable due to the reduced water area available for swimming. When this happens, swimming occurs outside the designated swimming area, increasing the risk of fatalities. During the 1986 drought, when swimming beaches were unusable, recreation fatalities for swimming activities increased from three to nine. They fell to zero when the beaches were back in service in 1987. Water levels rose back above 657 feet in May 2009.

Richard B. Russell Lake
At RBR, there are no Corps of Engineers' operated designated swimming areas.

J. Strom Thurmond Lake
At JST Lake, there are 18 Corps of Engineers' operated swimming beach areas. When lake levels reach 324 feet msl, the designated swimming areas are dry. However, when the lake level drops below 327 feet msl, swimming areas beaches become less desirable due to the reduced water area available for swimming. When this happens, swimming occurs outside the designated swimming area, increasing the risk of fatalities. Water levels rose above 324 feet in April 2009.

Table 1: J. Strom Thurmond Public Boat Ramps

To report a buoy, hazard or obstruction
Call
1-800-533-3478

Thurmond Lake
Boat Ramp Elevations

*** NOTE - Looking down at multiple lane ramps, ramp lanes are numbered left to right**

Area Name	Lane No.	Bottom of Ramp	Approximate lake elevation when launching becomes difficult
Amity Recreation Area	3	311.8	313.8
Amity Recreation Area	2	312.3	314.3
Amity Recreation Area	1	315.9	317.9
Baker Creek State Park	1	312	314
Big Hart Recreation Area	1	311.8	313.8
Bobby Brown State Park	1, 2	313	315
Broad River Campground	1	323	325
Bussey Point	1	319	321
Calhoun Falls Ramp	1	323	325
Catfish Ramp	1	323.5	325.5
Chamberlain Ferry Ramp	1	316.33	318.33
Cherokee Recreation Area	1	312.6	314.6
Cherokee Recreation Area	2	316	318
Cherokee Recreation Area	3	316.71	318.71
Cherokee Recreation Area	4	319	321
Cherokee Recreation Area	5	322.7	324.7
Clarks Hill Park	1	311.5	313.5
Clay Hill Campground	1	321.5	323.5
Dordon Creek Ramp	1	314.2	316.2
Dorn	3,4	306.4	308.4
Dorn	1,2,5,6	312.4	314.4
Double Branches Ramp	1	316.1	318.1
Elijah Clark State Park	1, 2, 3	314	316
Fishing Creek/Hwy 79 Ramp	1	318.7	320.7
Ft. Gordon Recreation Area	1, 2	313	315
Gill Point Ramp	1	312.8	314.8
Hamilton Branch State Park	1, 2	312	314
Hawe Creek Campground	1	311.5	313.5
Hesters Ferry Campground	1	310.9	312.9
Hickory Knob State Park	1	314.2	316.2
Holiday Park	1	313.6	315.6
Hwy 28 Access Ramp	1	324	326
Keg Creek Ramp	1	307	309
Lake Springs Park	1, 2, 3	306.7	308.7
Landam Creek Ramp	1	314.2	316.2
Leathersville Ramp	1	304.3	306.3
Leroys Ferry Campground	1	317.5	319.5
Little River Marina	2	309.3	311.3
Little River Marina	1	312	314
Little River Quarry Ramp	1	322	324
Little River/Hwy 378	1	312.5	314.5
Long Cane Creek Ramp	1	323.7	325.7
Mistletoe State Park	1, 2	322.2	324.2

2.4. WATER SUPPLY

Hartwell Lake

There are 8 water supply users on Hartwell Lake. The highest intake elevation is 638.33 feet msl, while the lowest is 610.00 (SRBDCP, March 1989).

Richard B. Russell Lake

There are 6 water supply users on RBR. The highest intake elevation is 468.8 feet msl, while the lowest is 454.75 (SRBDCP, March 1989).

J. Strom Thurmond Lake

There are 8 water supply users on JST Lake. The highest intake elevation is 318.0 feet msl, while the lowest is 307.0 (SRBDCP, March 1989).

Downstream of J. Strom Thurmond Lake

Sixteen major water supply users exist downstream of Thurmond Dam. The major municipal users occur at Augusta and near the coast. The City of Augusta operates and withdraws water from the Augusta Canal. The City of North Augusta withdraws water from the pool upstream of the New Savannah Bluff Lock and Dam (roughly river mile 187.5). The Beaufort-Jasper County Water Supply Authority withdraws water at river mile 39.3, while the City of Savannah's M&I Plant is located on Abercorn Creek, approximately at river mile 29. The other municipal users consist of Columbia County and Edgefield County.

Industrial users with intakes in the New Savannah Bluff Lock and Dam (NSBL&D) pool include North Augusta, Mason's Sod, Kimberly Clark, Urquhart Station, PCS Nitrogen, DSM Chemical and General Chemical, and South Carolina Electric and Gas. Users below NSBL&D include International Paper, Savannah River Site, Plant Vogtle, Savannah Electric – Plant McIntosh, Georgia-Pacific, and the Savannah National Wildlife Refuge.

2.5. HYDROPOWER AND PUMPED STORAGE

The Southeastern Power Administration (SEPA) markets hydropower generated at Hartwell, RBR and JST lakes and dams. SEPA markets the energy through contracts negotiated between SEPA and certain preference customers. There are ten hydropower facilities included in the contract that provide the energy and capacity requirements of the contract. These projects are located in the Savannah, Alabama-Coosa, and Apalachicola-Chattahoochee-Flint Basins. Under normal conditions, if a certain basin or portion of a basin is unable to meet the demands expected, then that shortage can usually be transferred to, or "made up" in, another basin. However, a drought of record situation that adversely impacts all three basins affects SEPA's ability to meet the minimum contract requirements. SEPA may purchase replacement energy for the system generation when the Corps does not generate enough power to meet the requirements of SEPA's contract. They purchased substantial amounts of power in 2007, 2008 and 2009 to meet their contract requirements.

The RBR Pumped Storage Project began commercial operation in July 2002. Current operation of the four pumped storage units includes several operational restrictions to minimize fish entrainment and fishery habitat impacts. These operational restrictions include:

- Pumped storage operations will occur only during the hours beginning one hour after official sunset to one hour before official sunrise.
- Pumped storage operations will include a maximum of one unit operation in March and May and no pumped storage operations in April (not applicable to Drought Level 2 and below).
- Pumped storage operations will include a maximum of one unit operation from May 1 to May 15; a maximum of one unit operation from May 16 to May 31, except when a Level I drought is declared in accordance with this plan, during which time a maximum of two pumped storage units may be used. There shall be no spring-time pumped storage operational restrictions when a Level 2 drought or below is declared in accordance with this plan.
- From May 16 to May 31, the District will conduct a minimum of six unit hours of generation, of not less than 60 megawatts, within the twelve hours preceding any two unit pumped storage operation when in drought Levels 1, 2, or 3. From June 1 to September 30, the District will conduct a minimum of six unit hours of generation, of not less than 60 megawatts, within the twelve hours preceding any pumped storage operation.

In addition to the restrictions above, all other operational and monitoring restrictions outlined in the August 1999, Final Environmental Assessment and FONSI for the Richard B. Russell Dam and Lake Project, Pumped Storage, will remain in effect.

2.6. WATER QUALITY IN THE LAKES

Generally, water quality in the lakes is at or above State Water Quality Standards. However, like most deep reservoirs in the southeastern United States, they experience thermal stratification. This natural phenomenon results from the difference in densities between the surface and subsurface water caused by the temperature variation in the water column. As the tributary and surface waters warm, the difference in density between the surface and bottom waters begins to restrict vertical circulation of the lake. The result of this restriction of circulation is the development of three layers of water: the epilimnion, the well-mixed surface layer which receives oxygen from interaction with the atmosphere; the hypolimnion, the bottom strata which is essentially stagnant water in which the dissolved oxygen (DO) is slowly depleted by the respiration and decomposition of organic matter; and the thermocline, which is the transition between the upper and lower strata and which exhibits the maximum temperature gradient.

The stability of the lake during stratification increases throughout the summer months as the density gradient intensifies. As winter approaches, cooling of the surface waters causes them to become denser. When temperatures are sufficiently reduced, these waters fall below the thermocline, thereby breaking the stratification. After the fall "overturn," the lake becomes

isothermal, with free circulation of water throughout the lake (Hartwell Major Rehabilitation Program Evaluation Report, US Army Corps of Engineers, Savannah District, 1995).

For example, thermal stratification begins in Hartwell Lake in late April and early May of each year. The thermocline is established at a depth of about 30 feet and is maintained at that depth through early August. The thermocline moves to a depth of about 40 feet in late August/early September and to about 50 feet in late September/early October. In late October/early November, as the lake "overturns," the thermocline moves to a depth of about 70 feet and the lake becomes isothermal by early December.

The hypolimnion is typically below the euphotic zone and, lacking free circulation with surface waters, has no potential to renew DO concentrations which are gradually exhausted through respiration and decomposition. As the DO concentrations decrease, a maximum DO gradient develops in the area of the thermocline.

The DO of the top layer remains relatively constant, about 7 mg/l, as the DO of the bottom layer decreases. The level of the maximum DO concentration gradient is established at a depth of about 30 feet in July, moves to a depth of about 40 feet in August, and to 55 or 60 feet in late September. By the first of August, there is usually a 3 mg/l difference between the DO in the upper and lower layers; and by the middle of September, the DO in the lower layer can range between 0 and 2 mg/l. The water quality of the lower layer continues to deteriorate until the fall "overturn" occurs. As "overturn" occurs, the level of the maximum DO concentration gradient falls to 80 feet in October and near the lake bottom in early December, after which the DO concentration is nearly the same at all levels until the following spring (Hartwell Major Rehabilitation Program Evaluation Report, US Army Corps of Engineers, Savannah District, 1995).

The Corps uses a hypolimnetic DO system in RBR Lake to maintain DO discharges from that dam at or above 5 mg/l throughout the year. Because water released through Hartwell Dam for hydropower comes from the low DO layer, negative effects on the aquatic environment in the Hartwell tailwater area can result. The Corps has installed modifications, referred to as “turbine venting”, that allow air to be diffused into the water as it flows past the turbines during generation. The result is a much needed increase of at least 2 mg/l in dissolved oxygen levels in the tailwater. DO concentrations of the release waters from Hartwell can be expected to be below 5 mg/l from late summer through early fall, with the lowest readings from August through September.

The turbines at Thurmond Dam were recently replaced during a major rehabilitation effort that began with new turbines being installed from 2002-2007. The new turbines include a self-aspirating design that is a form of turbine venting. The new turbines now add as much as 3 mg/l of DO to the waters as they pass through the dam. Since the rehabilitation was complete, discharges from Thurmond Dam possess at least 3 mg/l of DO throughout the year. Construction of an oxygen injection system is underway at Thurmond Lake. Operation of this system will increase the DO of waters within the lake, as well as those which pass through the dam to flow downstream. When the DO injection system becomes operational in 2011, the

release waters from Thurmond can be expected to possess at least 5 mg/l of DO throughout the year.

2.7. WATER QUALITY IN THE SAVANNAH RIVER

The Savannah River below JST Dam is classified as "Freshwater" by the South Carolina Department of Health and Environmental Control (DHEC) (Savannah Watershed Water Quality Assessment 2003). This designation is defined as:

> "Freshwaters suitable for primary and secondary contact recreation and as a source for drinking water supply after conventional treatment in accordance with the requirements of the Department. These waters are suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora. This class is also suitable for industrial and agricultural uses."

The Georgia Environmental Protection Division (EPD) of the Georgia Department of Natural Resources (DNR) has classified the designated use of the main river as "Fishing" waters. The water quality standards for dissolved oxygen, as stated in Georgia's Rules and Regulations for Water Quality Control (GA EPD, 2004), Chapter 391-3-6-.03(6)(c)(i), that this classification requires are:

> "A daily average of 5.0 mg/L and no less than 4.0 mg/L at all times for waters supporting warm water species of fish".

Aquatic life and recreational uses are not fully supported along the main length of the Savannah River. Both South Carolina and Georgia have at least portions of the Savannah River (Thurmond Dam to Interstate 95) on their 2009 Section 303(d) List of Impaired Waters.

SC states that aquatic life is impaired due to levels of zinc, while fishing is impaired due to levels of mercury. South Carolina DHEC issued a fish consumption advisory in 1996 for the main Savannah River (Thurmond Dam to Interstate 95) because of concerns about mercury, Cesium-137, and Strontium-90. The advisory also states that some fish also contain cesium-137 and strontium-90. The levels of these radioisotopes in fish are low and have decreased over time.

The GA Section 303(d) list states that drinking water is impaired from J. Strom Thurmond Dam to the Stevens Creek Dam due to low levels of dissolved oxygen, most likely as a result of releases from the dam. Savannah District expects to complete installation of a DO injection system within Thurmond Lake in 2010. When this system becomes operational, discharges from Thurmond Dam are expected to contain at least 5 ppm of DO throughout the year. That level would meet both the Georgia and South Carolina standard for DO levels for those waters.

The GA Section 303(d) List includes numerous tributaries as not meeting the designated use of Fishing for a variety of reasons, including primarily low DO or high levels of fecal coliform. GA lists the main river (Stevens Creek Dam to Tidegate) as meeting its designated uses of

Drinking Water, Fishing, or Coastal Fishing. It states that Coastal Fishing is impaired from GA Highway 25 (Houlihan Bridge) to Elba Island Cut (roughly RM 4) due to low levels of DO.

Environmental Protection Agency (EPA) has established Total Maximum Daily Loads (TMDLs) for the following portions of the Savannah River:

- Fecal coliform – Savannah River in Richmond County
- Lead – Savannah River between Butler & McBean Creeks
- Dissolved Oxygen – Savannah River from the Seaboard Coastline Railroad Bridge (RM 27.4 to the coast)

South Carolina DHEC classifies the estuarine portion of the river as SB: "Tidal saltwaters". This designation is defined as:

> "… suitable primarily for primary and secondary contact recreation, crabbing and fishing. These waters are not protected for harvesting of clams, mussels, or oysters for market purposes or human consumption. The waters are suitable for fishing and the survival and propagation of a balanced indigenous aquatic community of marine fauna and flora."

The Georgia DNR-EPD has classified the designated use of the estuarine portion of the river as "Coastal Fishing."

Seasonal DO sags occur in the summer months in the estuarine portion of the river. EPA's TMDL for dissolved oxygen calls for zero discharge of oxygen-depleting substances from Augusta to the coast. The states are presently working with EPA to implement this requirement.

The State of South Carolina uses the current drought plan Level 3 flow of 3,600 cfs (Larry Turner, South Carolina DHEC) at the Savannah River Augusta gage for the permitting of point source discharges in the Augusta area and this flow is adjusted upward to account for tributary input as one moves down the river. The State of Georgia uses the 7Q10 values of 3,800 cfs at the Augusta gage, 4,160 cfs further downstream at the Millhaven gage and 4,710 cfs at the Clyo gage in its decisions on the permitting of point source discharges (Paul Lamarre, Georgia DNR-EPD).

2.8. BIOTIC COMMUNITIES AT THE LAKES

2.8.1. Fishery Resources at Hartwell Lake

Hartwell Lake and its tailrace provide a vast habitat for both warmwater and coldwater fisheries. The lake area supports a large warmwater fishery including such species as white and striped bass, hybrid bass, largemouth bass, bluegill, pumpkinseed, redear sunfish, yellow perch, sauger, walleye, and catfish. Nongame species found within the lake include blueback herring, threadfin shad, carp, longnose gar, redhorse and spotted sucker. The GADNR and SCDNR both actively stock, on average, 500,000 to 1,000,000 striped bass and hybrid bass in Hartwell Lake.

The Hartwell tailrace supports a coldwater put and take trout fishery that is supported by stocking from both States. The State of Georgia DNR-EPD classifies the Savannah River in Hart County (which includes the Hartwell tailrace) as Secondary Trout Waters. These waters are described as those waters in which there is no evidence of natural trout reproduction, but they are capable of supporting trout throughout the year. Striped bass are also found in this coldwater fishery.

Study findings indicate that blueback herring habitat becomes quite restricted during lake stratification due to the DO and temperature requirements of the fish. The results of these stratification conditions are the congregation of herring in the penstock area and fish kills from entrainment (Alexander, et.al., 1991). Operational procedures are followed by Savannah District to minimize this entrainment.

2.8.2 Fishery Resources at RBR Lake

The fishery resources of RBR have been extensively studied. Savannah District and the Georgia Cooperative Fish and Wildlife Research Unit (GA COOP) located at the University of Georgia, began baseline studies of fishery resources in RBR Lake in 1990. These studies included cove rotenone sampling, gill net sampling, electrofishing, and telemetry. Savannah District has also conducted hydroacoustic surveys of the fishery resources in the RBR tailrace since 1986, and lake-wide hydroacoustic surveys of RBR Lake in 1997. South Carolina DNR has conducted fisherman creel surveys on RBR since 1991. Georgia DNR has conducted fisherman creel surveys in the RBR tailrace since 1988.

RBR Lake supports a wide variety of fish species. The more common species include; largemouth bass, spotted bass, redeye bass, threadfin shad, gizzard shad, blueback herring, bluegill, redear sunfish, channel catfish, brown bullhead, black crappie, yellow perch, white perch, spotted sucker and common carp. Small numbers of hybrid bass (striped bass x white bass) and striped bass are caught each year in RBR Lake.

2.8.3. Fishery Resources at JST Lake

The fishery resources of JST have been extensively studied. Savannah District and the GA COOP began baseline studies of fishery resources in JST Lake in 1986. These studies included cove rotenone sampling, gill net sampling, electrofishing, and telemetry. The SC Cooperative Fish and Wildlife Research Unit (SC COOP) located at Clemson University conducted a commercial creel estimate and a population estimate of blueback herring. Savannah District has conducted lakewide hydroacoustic surveys of the forage fish populations in 1996. South Carolina DNR has conducted fisherman creel surveys on JST since 1991.

The more common fish species in JST Lake include; largemouth bass, bluegill, redear sunfish, hybrid bass, striped bass, black crappie, brown bullhead, channel catfish, flathead catfish, white perch, yellow perch, threadfin shad, gizzard shad, and blueback herring. South Carolina DNR and Georgia DNR both actively stock hybrid bass and striped bass in JST Lake. On average, 750,000 to 1,000,000 striped and hybrid bass have been stocked annually in JST Lake.

The RBR tailrace supports a substantial fishery for striped bass, hybrid bass, and white perch. This area makes up only 2 percent of the surface area of JST Lake, but accounts for 9-11 percent of the total harvest of these species. Fish abundance in the RBR tailrace generally peaks in the summer and is lower in the winter. A commercial fishery for blueback herring exists in the RBR Tailwater. Blueback herring are used by fishermen as bait in both Georgia and South Carolina. Recreational fisherman also net blueback herring in the RBR tailrace and in JST Lake for their personal use as bait.

2.8.4. Aquatic Plants at Hartwell Lake

Aquatic plants have not become abundant in Hartwell Lake. Therefore, no treatment program has been conducted in CY 09. However, there is concern that hydrilla will be moved from J. Strom Thurmond Lake or Keowee Lake into Hartwell Lake. In an effort to identify the spread of hydrilla as early as possible, boat surveys are conducted periodically throughout the summer and fall. The area surrounding a small 4' X 4' patch of hydrilla that was discovered in September 2007 between the Hwy 93 Bridge and Hwy 123 Bridge in Pickens County, SC was surveyed during 2008 and no plants were detected. Hartwell Lake was approximately 20 feet below its normal summer pool and the area where hydrilla was detected in 2007 was exposed for more than one year. Most rangers at the Hartwell Project have been trained to identify and report aquatic plants of concern that would be expected to occur in this area. Additionally, the Lake Hartwell Association membership has agreed to report any aquatic vegetation observed.

If hydrilla is located in Hartwell Lake, it is the intent of the Corps of Engineers to treat all known hydrilla infestations using herbicides to minimize the spread of hydrilla within the impoundment. However, if significant infestations are located before scheduled treatment, treatment areas will be prioritized based on criteria established in accordance with the Aquatic Plant Management plan for U.S. Army Corps of Engineers, Savannah District Water Resources Project, South Carolina and Georgia (APMP). The APMP is available on the Thurmond Project website: http://www.sas.usace.army.mil/lakes/Thurmond/AquaticPlan.pdf.

2.8.5. Aquatic Plants at Richard B. Russell Lake

Hydrilla was first discovered in Richard B. Russell Lake in the McCalla peninsula area in 2002 but has not reoccurred at that location. Approximately two acres of hydrilla were present in Richard B. Russell Lake in the Bond Creek area during the 2008 growing season. Surveys in 2008 also revealed a reduced abundance and distribution of Brazilian elodea in areas where it had been located in previous years. Approximately 10 acres of Brazilian elodea are still present in the Savannah River within 1 to 5 miles downstream of Hartwell Dam. Aquatic plant growth has not reached nuisance levels requiring treatment.

2.8.6. Aquatic Plants at J. Strom Thurmond Lake

The persistent drought from 2006 through 2009 greatly reduced the abundance of hydrilla. By the end of October 2008, the lake was approximately 15.5 ft. below normal summer level. Plant growth varied greatly from area to area. The J. Strom Thurmond Project staff monitor hydrilla growth beginning in May. By mid- to late July, treatment needs are identified with the intent of completing treatments prior to Labor Day. The treatment plans are coordinated with the GADNR, SCDNR, local agencies, and affected outgrantees prior to implementation.

Treatment priorities are established in accordance with the Aquatic Plant Management Plan for U.S. Army Corps of Engineers, Savannah District Water Resources Project, South Carolina and Georgia (APMP). The APMP is available on the Thurmond Project website: http://www.sas.usace.army.mil/lakes/Thurmond/AquaticPlan.pdf. Either Reward with K-TEA or Komeen are applied dependant upon site location, desired level of control, and cost per acre.

Hydrilla adjacent to the following boat ramps and within the following marina basins was treated by the Corps of Engineers in 2008 in order to minimize user impacts:

2.9 TREATMENT AREA	Acres	Herbicide and Application Rate
Amity Boat Ramp	1.0	Komeen – 16 gallons per acre
Cherokee Boat Ramp	1.0	Komeen – 16 gallons per acre
Clarks Hill Park Boat Ramp	1.0	Komeen – 16 gallons per acre
Dordon Creek Boat Ramp	1.0	Komeen – 16 gallons per acre
Lake Spring Boat Ramp	1.5	Komeen – 16 gallons per acre
Leathersville Boat Ramp	0.8	Komeen – 16 gallons per acre
Little River Marina Basin	1.7	Komeen – 16 gallons per acre
Modoc Ramp	0.8	Komeen – 16 gallons per acre
Parksville Boat Ramp	1.0	Komeen – 16 gallons per acre
Petersburg Campground Boat Ramp	0.8	Komeen – 16 gallons per acre
Plum Branch Yacht Club Basin	2.7	Komeen – 16 gallons per acre
Scotts Ferry Boat Ramp	0.8	Komeen – 16 gallons per acre
Tradewinds Marina Boat Ramp	1.1	Komeen – 16 gallons per acre
Raysville Marina	4.4	Komeen – 16 gallons per acre
Winfield Campground Boat Ramp	0.8	Komeen – 16 gallons per acre
Total	19.5	

Adjoining property owners and other agencies may treat hydrilla infestations in accordance with the APMP. In 2008, two permits were issued to adjoining property owners to treat hydrilla around their docks. A total of 6.5 acres was treated. All herbicide applications were made by a licensed applicator using herbicides approved for the treatment of hydrilla.

During early November 2008, District park rangers inspected the shoreline in areas where hydrilla had not been previously found. The low lake level made it possible to locate new plant populations that have become established from 16 to 20 feet below the normal pool elevation. New infestations of hydrilla varied from small patches to well established populations. Significant new infestations of hydrilla were found in the following areas:

Location	County	State
North Side of Benningsfield Creek	McCormick	SC
Hawe Creek Campground to Dorn Boat Ramp	McCormick	SC
Along the Savannah River upstream of Hwy 378 bridge	McCormick	SC
Adjoining and upstream of Hickory Knob Subdivision	McCormick	SC
Little River SC adjoining New Boudreaux Subdivision	McCormick	SC
Along the Savannah River from upstream of Elijah Clark State Part to Murray Creek Peninsula	Lincoln	GA

Hydrilla is present along approximately 7,288 acres of shoreline, including approximately 409 miles of shoreline in Georgia (4,953 ac.) and 193 miles of shoreline in South Carolina (2,336 acres). These estimates are based on the presence of infestations noted since the introduction of hydrilla and the annual survey of areas not previously impacted by hydrilla to determine the presence of additional infestations. The estimate also assumes that once the lake level returns to normal for several growing seasons, hydrilla will become reestablished in all areas of suitable habitat. This represents approximately 10.3 % of the total lake surface at normal summer elevation of 330' msl that may be impacted once the lake returns to normal level.

Hydrilla is present in areas of suitable substrate throughout Little River, GA from the confluence of the Savannah River to upstream of Raysville Campground including most tributaries. Along the Savannah River portion of the lake, hydrilla is present from the dam to Murray Creek Peninsula in Georgia and from the dam to Hickory Knob Subdivision, SC in South Carolina including most tributaries. Hydrilla was found along both sides of Little River, SC from the Savannah River to below the Highway 378 Bridge. Maps showing the known locations of hydrilla infestations are on file at the J. Strom Thurmond Lake Operations Project Manager's Office and are posted on the J. Strom Thurmond Project website.

A large population (approximately 600-acres) of slender pondweed (*Potamogeton pusillus*) was present in the Savannah River headwaters of J. Strom Thurmond Lake (RBR tailwater) in 2008. The abundance of this plant appeared to be in direct response to drought conditions and falling water levels in J. Strom Thurmond Lake. The plant proved to be problematic for pumped storage operations at Richard B. Russell Dam. Large floating mats of the plant were entrained on the pumped storage unit bar screens that are designed to exclude fish from being entrained. Many man-hours were required to physically remove plants from the screens to prevent the restriction of water flow through the pumped storage units. District park rangers conducted intensive surveys during the 2009 growing season. Approximately 82-acres of slender pondweed were treated in August 2009 to prevent a reoccurrence of the problems experienced in 2008.

Approximately 200 water hyacinth plants were found in the Clarks Hill Park area of J. Strom Thurmond Lake during September 2008. The plants were removed by hand from the reservoir and several return survey trips were made to this area, but no additional plants were found. The lower portion of J. Strom Thurmond Lake from Little River, GA to the dam was monitored closely for water hyacinth throughout the 2009 growing season.

2.9.1. Aquatic Plants at New Savannah Bluff Lock and Dam

Aquatic plant populations in the upstream embayment of the New Savannah Bluff Lock and Dam were monitored periodically throughout the 2008 growing season. The following aquatic plants were identified: water hyacinth, elodea, fanwart, pickerelweed, and cattail. For the first time, water hyacinth (a floating invasive species) became problematic at the NSBL&D. By late summer, significant populations of water hyacinth extended upstream approximately 8.5 miles above the lock and dam. In August, plants began floating downstream and accumulating on the upstream buoy line in sufficient quantity that the ramp and courtesy dock were obstructed

(approximately 3 acres). In addition, the accumulation of plants placed excessive weight on the buoy line. Efforts to clear the buoy line of vegetation every 7 to 10 days were not sufficient to keep the boat ramp area usable. On October 30, 2008, the buoy line was temporarily removed. Savannah District does not have the authority to perform aquatic plant management treatments beyond the boundaries of the NSBL&D. Herbicide applications immediately upstream of the NSBL&D would not have reduced the plants' continued impacts to the boat ramp, courtesy dock, and buoy line since the source of the infestation extended well upstream of the area.

2.10. BIOTIC COMMUNITIES IN THE LOWER SAVANNAH RIVER

2.10.1. Fish

Riverine fish habitats in the Savannah River have been highly modified or converted to lacustrine habitat by construction of major dams and reservoirs that inundate the upper half of the River Basin. This large-scale habitat conversion has changed the relative abundance and diversity of fish species from a system dominated by migratory diadromous fish to more localized riverine and lacustrine-dominated fish communities. A comprehensive five-year fishery survey of existing coastal plain habitats concluded that the lower Savannah River supports an abundant, diversified fish community, but has a low to moderately used fishery (Schmitt and Hornsby 1985). Based on numbers and weight collected the most abundant game fish were largemouth bass, chain pickerel, black crappie, yellow perch, redbreast sunfish, bluegill, redear sunfish, warmouth, flier, and pumpkinseed. Important non-game fish include longnose gar, bowfin, white catfish, channel catfish, common carp, spotted sucker, silver redhorse, robust redhorse, striped mullet, and brown bullhead. In numerical terms, the most important forage fish are gizzard shad and a number of minnow species. Diadromous fish inhabiting the lower Savannah River include striped bass, American shad, hickory shad, blueback herring, shortnose sturgeon, Atlantic
sturgeon, and the catadromous American eel. The present-day Savannah River population of striped bass appears to be more riverine in its habitat use patterns than more northern populations that are truly anadromous.

Prior to construction of mainstem Savannah Dams from 1840 to 1984, diadromous fish migrations extended throughout the Piedmont. Historical records document the upstream migration of shad and striped bass to the headwaters of the Savannah River, through the Tugaloo River and up the Tallulah River to Tallulah Falls, Georgia, approximately 384 river miles from the ocean. Sturgeon is known to have migrated well into the Piedmont. A portion of the river was diverted in 1846 at the site of the Augusta Diversion Dam. In 1875, that structure was extended to the entire channel width to create the present Augusta Diversion Dam. That structure restricted inland migration of diadromous species except during high flow periods when the Dam was overtopped. When those conditions occurred, some fish species could continue their upstream migrations. A fish ladder was installed in 1886, but it is presently not considered to be effective in passing fish upstream. Completion of the New Savannah Bluff Lock and Dam (NSBL&D) in 1937 further restricted spawning migrations in many years to below river mile 265, with the exception of high flow periods that occurred during the spawning season. During the late 1950's through the early 1960's, the Corps' Savannah River navigation

project constructed 38 cuts across meander bends that shortened the river by 78 miles. As a result of these cutoffs, the NSBL&D is now located at river mile 187.3. The Stevens Creek Dam, a South Carolina Electric and Gas hydroelectric project, was constructed 0.9 miles upstream of the Augusta Diversion Dam in 1914, blocking all diadromous fish migrations past that point.

Although greatly reduced from former abundance, diadromous fish are an important and increasing component of the River's sport and commercial fisheries. American shad, blueback herring, and lesser numbers of striped bass and sturgeon migrate to the NSBL&D facility, which is the first major obstruction to passage on the river. Some fish have continued to migrate to historical spawning grounds above the facility. Some species pass upstream by swimming through fully-opened dam gates at flows of 16,000 cfs or higher, and by swimming through the navigation lock when it is operated in a manner suitable for fish passage. The NSBL&D restricts passage of sturgeon to periods when high flows overtop the riverbanks during the spawning season. In 2006, The Nature Conservancy the monitored the movement of tagged shortnose sturgeon fish when flows exceeded the height of the dam but stayed within the river banks. TNC could not identify any passage of shortnose sturgeon upstream of the NSBL&D under those flow conditions. Without access to the upstream shoal spawning habitat, gravel bars downstream of the NSBL&D likely represent the only remaining spawning habitat for shortnose sturgeon in the Savannah River. Shortnose sturgeon and other important species have been identified at gravel bars downstream of the NSBL&D (river miles 179-190, 275-278, and 286) during spawning months of February and March (Hall and Lamprecht, 1991, Grabowski and Isely, 2006, and Wrona, unpublished data). Research conducted in 1999-2000 (Collins et al 2002) indicate there has been no increase in recruitment of shortnose sturgeon into the population over the previous 8 years, but that an observed increased number of shortnose in the river was due to the stock enhancement program conducted by SC DNR from 1990-1992.

Presently the lower Savannah River provides extremely important striped bass habitat. Although the majority of historical upstream spawning habitat for striped bass has been inundated by major reservoirs, some remaining rocky rapids habitat exists in the Augusta Shoals from just below NSBL&D up to Stevens Creek Dam. After construction of mainstem dams and prior to initiation of a Tidegate operation in 1977, the primary spawning area for striped bass in the Savannah River system was the tidal fresh water zone approximately 18-25 miles from the river mouth, specifically the Little Back River (McBay 1968; Rees 1974). Salinity changes due to the Tidegate operation (1977-1992) reduced the extent of this tidal freshwater zone. Studies indicated significant declines in numbers of striped bass eggs and larvae in the lower Savannah River system during this period. These declines were related to increased salinity and modified transport patterns caused by the Tidegate and associated hydrologic modifications (Van Den Avyle et al. 1990, Winger and Lasier 1990).

The Little Back River, adjacent to the lower Savannah River, had unique physical characteristics that made it the primary source in the Savannah River System for efficient collection of brood fish for the Georgia statewide propagation and stocking program of striped bass and hybrid bass (white bass x striped bass). It has not served in that capacity since the 1980's. The GADNR adopted a striped bass harvest moratorium in 1988. In the early 1980's, an average of 4,291 kilograms of striped bass was harvested annually by sport fishermen in the Savannah River downstream of the NSBL&D (Schmitt and Hornsby 1985). As a result of increasing numbers of mature striped bass being observed in the estuary, both SC and GA recently opened the fishery for that species in the estuary.

The Corps of Engineers, Georgia Department of Natural Resources, South Carolina Department of Natural Resources, US Fish and Wildlife Service, and the National Oceanic and Atmospheric Administration Fisheries Service are actively coordinating with private sector partners to address enhancement and restoration of diadromous fisheries, wetlands, and other aquatic resources in the Savannah River.

2.10.2. Wetlands

Palustrine forested wetlands dominate the extensive alluvial plain of the Savannah River. The wettest parts of the flood plain, such as swales, sloughs, and back swamps are dominated by bald cypress, water tupelo, and swamp tupelo. Slightly higher areas, which are usually flooded for much of the growing season are often dominated by overcup oak and water hickory. Most of the Savannah River floodplain consists of low relief flats or terraces. These areas are flooded during most of the winter and early spring and one or two months during the growing season. Laurel oak is the dominant species on these flats and green ash, American elm, sweetgum, spruce pine, sugarberry, and swamp palm are often present. Swamp chestnut oak, cherrybark oak, spruce pine, and loblolly pine are found on the highest elevations of the flood plain, which are only flooded infrequently during the growing season.

On the Savannah River downstream of Interstate Highway 95, tidal palustrine emergent wetlands, also known as tidal freshwater marsh, become prevalent. Tidal palustrine emergent wetlands are flooded twice daily by tidal action in the area. These marshes are vegetated with a diverse mixture of plants including giant cutgrass, spikerushes, and up to 58 other plant species (Pearlstine et al. 1990, Applied Technology and Management 1998).

In palustrine emergent wetlands, primary productivity is high, falling in the range of 500 to 2,000 grams/square meter/year (Odum et al. 1984). The quality of primary production is also high. Major primary producers in the salt marsh community are grasses that have little immediate nutritional value to fish and wildlife but support an important detritus-based food web (Teal 1962). In contrast, the fleshy broad-leaf plants characteristic of fresh marshes generally are high in nitrogen and low in fiber content and there is a high incidence of direct grazing or feeding on these plants (Odum et al. 1984).

Freshwater marsh vegetation also contributes to the food web base that supports the area's freshwater fishery. The leaves of the larger macrophytes in this community are used as attachment places by mollusks, insect nymphs, rotifers, hydra, and midge larvae. These are all important fish foods. The submerged littoral zone is vital to the development of freshwater fish,

as well as some marine and estuarine species, as these areas are the principal spawning sites and provide nursery and juvenile habitats.

2.10.3. Wildlife

Wildlife associated with forested wetlands is numerous and diverse. The furbearers are an important component of these wetlands and include beaver, muskrat, mink, otter, bobcat, gray fox, raccoon, and opossum. Deer, turkey, and even black bear in the more isolated areas, use the bottomlands. Palustrine emergent wetlands also provide excellent habitat for furbearers including the mink, beaver, and river otter. Terrestrial species from surrounding areas often utilize the fresh marsh edge for shelter, food, and water. These include raccoon, opossum, rabbit, and bobcat.

The study area is part of the Atlantic Flyway and forested wetlands provide important wintering habitat for many waterfowl species and nesting habitat for wood ducks. Many species of woodpeckers, hawks, and owls use the bottomlands and swamps. Neotropical migratory birds, many of which are decreasing in abundance, depend upon contiguous tracts of forested swamps for breeding and as corridors during migration. Robbins et al. (1989) found that the most area-sensitive bird species required at least 2,800 acres of contiguous forest to be present. The extensive forested wetlands of the Savannah River flood plain provide very valuable habitat for these birds. The American swallow-tailed kite, a state (South Carolina) listed endangered species, can be observed on the study area. Swallow-tailed kites nest in and are closely associated with palustrine wetlands.

Palustrine emergent wetlands also provide habitat for many bird species. Resident, transient, and migrating birds of both terrestrial and aquatic origin utilize food and shelter found in this community. Some species use freshwater marshes for nesting and breeding. Waterfowl feed upon fresh marsh vegetation, mollusks, insects, small crustaceans, and fish found in the fresh marsh community. Wading birds such as the wood stork, great blue heron, little blue heron, green heron, snowy egret, and great egret also heavily utilize the tidal freshwater marsh.

The study area provides excellent habitat for a large number of reptiles and amphibians. Wetland habitats support many kinds of frogs including the bullfrog, bronze frog, southern leopard frog, several species of tree frogs, cricket frogs, and chorus frogs. Turtles found in the wetlands include the river cooter, Florida cooter, pond slider, eastern chicken turtle, snapping turtle, mud turtle, and stinkpot. Snakes found in the wetlands include the red-bellied water snake, banded water snake, brown water snake, eastern mud snake, rainbow snake, and eastern cottonmouth. The American alligator can be observed on streams and ponds of the Coastal Plain study area.

In 2006, the Fish and Wildlife Service conducted a freshwater mussel survey in the Savannah River to determine species composition and distribution of mussels. This study encompassed the portion of the river from the Augusta Shoals region (river mile 203) near the Fall Line downstream to the tidewater region (river mile 22.8) near Savannah. This survey evaluated 39 sites using both shallow water (snorkeling and grubbing) and deep water (SCUBA) survey techniques. A total of 26 freshwater mussel species were identified during the survey efforts. With the exception of sites within the Augusta Shoals area, mussels were generally unevenly

distributed in the surveyed areas, which is reflective of the distribution and quality of microhabitats within a particular river segment. In general mussels were most abundant in the thalweg habitats at the base of the river bank, and rare to absent in the shifting sand dominated runs in the center of the channel.

Atlantic pigtoe (*Fusconaia masoni*) and Savannah liliput (*Toxolasma pullus*) were both observed in the 2006 mussel survey. Both of these species are experiencing range-wide declines. Atlantic pigtoe was found only in the Augusta shoals. This species has not been observed in any other Georgia or South Carolina Rivers in the many years. The population of Savannah liliput upstream of Little Hell boat landing (Allendale County) may be the largest remaining population of this species.

The 2006 discovery of four species not previously known to occur in South Carolina demonstrates the gross lack of knowledge regarding the mussel fauna of the Savannah River. The objective of the 2006 mussel survey was an attempt to estimate species composition and distribution in the Savannah River, but the surveyors only visited a small portion of the available habitat in the river.

Savannah liliput in the Savannah is found primarily in cutoff bends and sloughs. Preliminary observations indicate that much of this habitat is lost or degraded due to loss of connectivity with the main river at flows below 4,000 cfs at Augusta. Even when some water is present, low dissolved oxygen levels are probable during the warmer seasons because of lack of river flows and stagnant conditions in those specific sites.

2.10.4. Endangered Species

Federal Endangered, Threatened, and Candidate species that are likely to occur in the Savannah River Basin Study area are listed in Table 3 (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999). State species are listed in Table 4.

Wetland Habitat

2.10.5. Special Biological Areas

The tidal fresh marsh at the Savannah National Wildlife Refuge (NWR) supports an extremely diverse plant community providing food, cover and nesting habitat for a wide variety of wildlife species. Tidal freshwater marsh is relatively scarce in comparison to coastal brackish and salt marshes. Past harbor modifications, including harbor deepening, have greatly increased salinity levels throughout much of the Savannah NWR and reduced the quantity of tidal freshwater marsh. According to the USFWS, the Savannah NWR contained about 6,000 acres of tidal freshwater marsh when it was established in 1927. By 1997, due to the cumulative impacts of harbor deepening, tidal freshwater marsh had declined to 2,800 acres, a reduction of 53 percent (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999). The freshwater marsh areas had historically been bottomland hardwoods, but were cleared in the 1800's for agricultural purposes, such as the rice culture. The leveled

and diked areas were abandoned when the rice culture was no longer profitable after the Civil War. Those sites partially filled and now support a wide variety of plant and animal species.

Prior to 1977, the Savannah River supported the most important naturally reproducing striped bass population in the State of Georgia, but production of striped bass eggs in the Savannah River estuary declined by about 95 percent. Operation of the Tidegate, in conjunction with the cumulative impacts of harbor deepening, caused a number of impacts. These included increases in salinity and loss of suitable spawning habitat throughout most of Little Back River and the lower Savannah River (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999). The Tidegate restoration project (removing it from operation) was intended to improve most of these conditions. Annual stocking efforts by the GA DNR have been very successful in increasing the number of striped bass in the lower Savannah River, and current population levels approach historic levels. After a 17-year closure, the striped bass fishery was reopened in October 2005.

Table 2: Federal Endangered, Threatened and Candidate Species Likely to Occur in the Savannah River Basin Study Area

SPECIES	SCIENTIFIC NAME	FEDERAL STATUS
MAMMALS		
Indiana Bat	*Myotis sodalis*	E*
West Indian manatee	*Trichechus manatus*	E
BIRDS		
Red cockaded woodpecker	*Picoides borealis*	E
Piping plover	*Charadrius melodus*	T
Wood stork	*Mycteria americana*	E
Kirtland's warbler	*Dendroica kirtlandii*	E
REPTILES		
Eastern indigo snake	*Drymarchon corais couperi*	T
AMPHIBIANS		
Flatwoods salamander	*Ambystoma cingulatum*	T
Fish		
Shortnose sturgeon	*Acipenser brevirostrum*	E
Atlantic sturgeon	*Acipenser oxyrinchus*	C***
PLANTS		
Canby's dropwort	*Oxypolis canbyi*	E
Chaff seed	*Schwalbea americana*	E
Schweinitz's sunflower	*Helianthus schweinitzii*	E
Small whorled pogonia	*Isotria medeoloides*	T
Pondberry	*Lindera melissifolia*	E
Rough leaved loosestrife	*Lysimachia asperulaefolia*	E
False Poison Sumac	*Rhus michauxii*	E
Bunched arrowhead	*Sagittaria fasciculata*	E
White irisette	*Sisyrinchium dichotomum*	E
Dwarf flowered heartleaf	*Hexastylis naniflora*	T
Mountain sweet pitcher plant	*Sarracenia rubra ssp. jonesii*	E
Harperella	*Ptilimnium nodosum*	E

* Endangered ** Threatened *** Candidate

SPECIES	SCIENTIFIC NAME	FEDERAL STATUS
Swamp pink	*Helonias bullata*	T
Smooth coneflower	*Echinacea laevigata*	E
Seabeach amaranth	*Amaranthus pumilus*	T
Persistent trillium	*Trillium persistens*	E
Relict trillium	*Trillium reliquum*	E
Little amphianthus	*Amphianthus pusillus*	T
Miccosukee gooseberry	*Ribes echinellum*	T
Bog asphodel	*Narthecium americanum*	C***

Table 3: Georgia and South Carolina Rare, Threatened and Endangered Species Occurring in Counties Adjacent to the Savannah River

SCIENTIFIC NAME	COMMON NAME	GA STATE STATUS	SC STATE STATUS
Acipenser brevirostrum	Shortnose Sturgeon		FE[1]/SE[2]
Aimophila aestivalis	Bachman's Sparrow	R[3]	
Amblyscirtes reversa	Reversed Roadside Skipper		N3N4
Ambystoma cingulatum	Flatwoods Salamander		FT[4]/SE
Aneides aeneus	Green Salamander	R	
Autochton cellus	Golden-Banded Skipper		N4
Caretta caretta	Loggerhead		FT/ST[5]
Carex biltmoreana	Biltmore Sedge	T	
Carex manhartii	Manhart's Sedge	T	
Carex misera	Wretched Sedge	T	
Ceratiola ericoides	Rosemary	T	
Chamaecyparis thyoides	Atlantic White-Cedar	R	
Charadrius wilsonia	Wilson's Plover	R	
Clemmys guttata	Spotted Turtle	U	
Clemmys guttata	Spotted Turtle		ST
Corynorhinus rafinesquii	Rafinesque's Big-Eared Bat	R	SE
Cymophyllus fraserianus	Fraser's Sedge	T	
Cyprinella callitaenia	Bluestripe Shiner	T[6]	
Cypripedium acaule	Pink Ladyslipper	U[7]	
Cypripedium parviflorum var. Parviflorum	Small-Flowered Yellow Ladyslipper	U	
Cypripedium parviflorum var. Pubescens	Large-Flowered Yellow Ladyslipper	U	
Draba aprica	Open-Ground Whitlow-Grass	E[8]	
Echinacea laevigata	Smooth Coneflower		FE/SE
Elanoides forficatus	Swallow-Tailed Kite	R	
Elliottia racemosa	Georgia Plume	T	

SCIENTIFIC NAME	COMMON NAME	GA STATE STATUS	SC STATE STATUS
Epidendrum conopseum	Green-Fly Orchid	U	
Fusconaia masoni	Atlantic Pigtoe Mussel	E	
Gopherus polyphemus	Gopher Tortoise		SE
Haematopus palliatus	American Oystercatcher	R	
Hydrastis canadensis	Goldenseal	E	
Hymenocallis coronaria	Shoals Spiderlily	E	
Isoetes tegetiformans	Mat-Forming Quillwort	E	
Isotria medeoloides	Small Whorled Pogonia		FT/ST
Lasmigona decorata	Carolina Heelsplitter		FE/SE
Lindera melissifolia	Pondberry		FE/SE
Lindernia saxicola	Rock False Pimpernel	E	
Litsea aestivalis	Pondspice	T	
Lysimachia fraseri	Fraser's Loosestrife	R	
Marshallia ramosa	Pineland Barbara Buttons	R	
Moxostoma robustum	Robust Redhorse	E	
Mycteria americana	Wood Stork		FE/SE
Myotis leibii	Eastern Small-Footed Myotis		ST
Myotis sodalist	Indiana Myotis		FE/SE
Nestronia umbellula	Indian Olive	T	
Notropis hypsilepis	Highscale Shiner	T	
Notropis photogenis	Silver Shiner	E	
Notropis scepticus	Sandbar Shiner	R	
Oxypolis canbyi	Canby's Dropwort	E	
Oxypolis canbyi	Canby's Dropwort		FE/SE
Phenacobius crassilabrum	Fatlips Minnow	E	
Physostegia leptophylla	Tidal Marsh Obedient Plant	T	
Picoides borealis	Red-Cockaded Woodpecker		FE/SE
Plethodon websteri	Webster's Salamander		SE
Pseudobranchus striatus	Dwarf Siren		ST
Ptilimnium nodosum	Harperella		FE/SE
Quercus oglethorpensis	Oglethorpe Oak	T	
Rana capito	Gopher Frog		SE
Ribes echinellum	Miccosukee Gooseberry		FT/ST
Sanguisorba canadensis	Canada Burnet	T	
Sarracenia flava	Yellow Flytrap	U	
Sarracenia minor	Hooded Pitcherplant	U	
Sarracenia purpurea	Purple Pitcherplant	E	
Sarracenia rubra	Sweet Pitcherplant	E	
Schisandra glabra	Bay Starvine	T	
Schwalbea americana	Chaffseed		FE/SE
Scutellaria ocmulgee	Ocmulgee Skullcap	T	
Sedum pusillum	Granite Stonecrop	T	
Senecio millefolium	Blue Ridge Golden Ragwort	T	
Shortia galacifolia	Oconee Bells	E	
Speyeria Diana	Diana		N3
Sterna antillarum	Least Tern		ST
Stewartia malacodendron	Silky Camellia	R	
Stylisma pickeringii var. Pickeringii	Pickering's Morning-Glory	T	

SCIENTIFIC NAME	COMMON NAME	GA STATE STATUS	SC STATE STATUS
Trichechus manatus	Manatee		FE/SE
Trillium persistens	Persistent Trillium		FE/SE
Trillium reliquum	Relict Trillium		FE/SE
Waldsteinia lobata	Piedmont Barren Strawberry	T	
Xerophyllum asphodeloides	Eastern Turkeybeard	R	

Sources: Georgia DNR-EPD and South Carolina DNR

1 FE - Federal Endangered

2 SE - State Endangered (official state list-animals only)

3 R - Rare

4 FT - Federal Threatened

5 ST – State Threatened (official state list-animals only)

6 T - Threatened

7 U - Unusual (thus deserving of special consideration)

8 E – Endangered

2.11. SOCIOECONOMIC ISSUES

2.11.1. Environmental Justice

The concept of environmental justice is based on the premise that no segment of the population should bear a disproportionate share of adverse human health or environmental effects. To address these concerns, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations* was issued. It requires each Federal agency to "make the achievement of environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health and environmental effects on minority and low-income populations." There are no indications that the proposed action or any of the alternatives that were considered would be contrary to the goals of E.O. 12898, or would create disproportionate, adverse human or environmental impacts on minority or low income populations of the surrounding community along the river system.

2.11.2. Protection of Children

The concept of protecting children arises out of a growing body of scientific knowledge, which demonstrates that children may suffer disproportionately from environmental health and safety risks. To address these concerns, Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* was issued. It requires each federal agency to identify and assess environmental health and safety risks that may disproportionately affect children; and, ensures that policies, programs, activities, and standards address disproportionate risk to children that results from environmental health or safety risks. Neither the proposed action nor any of the alternatives that were considered pose any environmental health or safety risks disproportionately to children in the vicinity of the impacted river system.

3.0 DESCRIPTION OF THE PROPOSED ACTION AND OTHER ALTERNATIVES

3.1. ALTERNATIVE FORMULATION

In 2008, the Georgia Department of Natural Resources, Environmental Protection Division (GA DNR-EPD), South Carolina Department of Health and Environmental Control (SC DHEC) and the South Carolina Department of Natural Resources (SC DNR) developed and evaluated alternatives to address the diminishing conservation pools in the Corps' three-lake system on the Savannah River. Their proposal is included as Appendix B to this document. During the summer of 2008, the States and Federal agencies conducted substantial coordination, with various stakeholders included in some of those discussions. The States considered several alternatives and, in October 2008, proposed the Corps temporarily deviate from its Drought Contingency Plan to reduce discharges to 3,100 cfs during the cooler months of October 2008 through February 2009 (Appendix C). After a public and agency review, the Corps implemented that proposal in the months of November 2008 through January 2009. The Corps is proposing a similar flow reduction to 3,100 cfs as Alternative 1 in this document.

The Corps is also considering a further flow reduction to 2,600 cfs as another proposed alternative (Alternative 2). The additional flow reduction would keep more water in the reservoirs, thereby extending the time at which water would be present in the Conservation Pool and Level 4 drought conditions would be reached. Temporary modifications would likely be required to some water intakes to enable withdrawals to continue at these reduced river flows. As with Alternative 1, the flow reduction would occur during the cooler fall and winter months when biological demands are lower.

3.2. ALTERNATIVES ANALYSIS

Alternatives were developed for consideration as part of the planning process and are:

a. No Action Alternative (Continue with the SRBDCP, March 1989 recommending a 3,600 cfs discharge from J. Strom Thurmond Dam during Level 3 drought conditions)
b. Alternative 1: Flow reduced to 3,100 cfs discharge from J. Strom Thurmond Dam during Level 3 drought conditions
c. Alternatives 2: Flow reduced in phases to a final discharge of 2,600 cfs discharge from J. Strom Thurmond Dam during Level 3 drought conditions.

3.2.1. No Action Alternative

This Alternative consists of the Corps taking no action to modify its existing Savannah River Basin Drought Contingency Plan (SBRDCP) with its 2006 modifications. This alternative incorporates the previously-approved deviation request for 3,600 cfs minimum daily flow from Thurmond and 3,600 cfs specified daily average flow once trigger Level 3 is reached. The operating procedures described in that 2006 SRBDCP Update would continue to be implemented and they form the basis upon which comparisons to the other alternatives can be made. Action thresholds were established in the 2006 EA for the SRBDCP Update and are based on pool elevations at Hartwell and Thurmond Lakes. Russell Lake has a relatively small conservation pool, therefore it does not have action thresholds delineated. Due to the nature of pumped storage operation, Russell Lake may vary throughout its five-foot conservation pool.

As described in the 1989 Drought Contingency Plan, the Corps would also monitor salinity levels in the estuary. During “critical water periods” Savannah District would perform roving salinity sampling at several locations in the estuary when requested by the State natural resource agencies to determine and document the extent of salinity intrusion. The Savannah Basin projects have never reached Level 4 in the 16 years that the Plan has been operational.

As a result of mechanical difficulties, all four pumped storage units are presently not available for use at RBR. However, that situation is likely to change. Eighty unit hours of pumping per week is required to support the current hydropower contract. Pumping beyond 80 unit hours up to the maximum allowed by the Richard B. Russell Dam and Lake Project Pumped Storage Environmental Assessment of August 1999 can still occur when economically feasible.

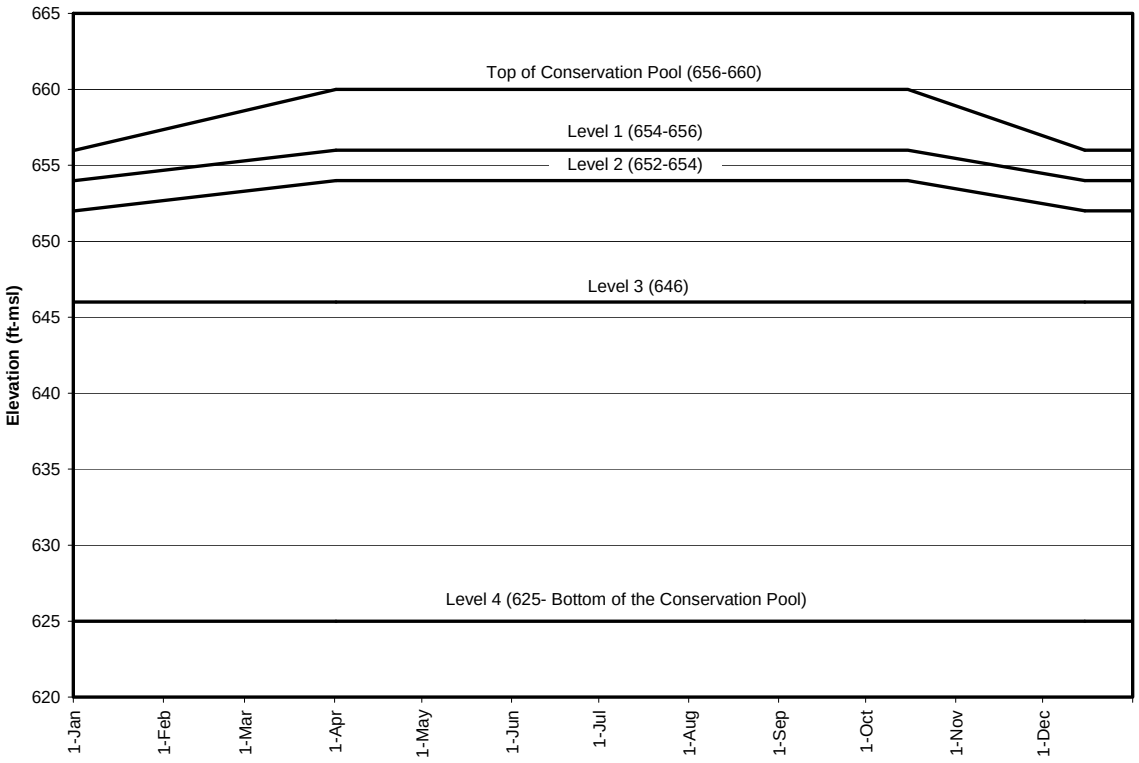
This alternative is considered in detail and is evaluated in regard to all environmental concerns**.**

Table 4: Hartwell Drought Action Levels for the NAA

LEVEL*	1 APR – 15 OCT (feet msl)	15 DEC – 1 JAN** (feet msl)	ACTION
1	656	654	Public safety information. Reduce Thurmond discharge to 4,200 cfs weekly average, reduce Hartwell discharge as appropriate to maintain balanced pools.
2	654	652	Reduce Thurmond discharge to 4,000 cfs weekly average, reduce Hartwell discharge as appropriate to maintain balanced pools.
3	646	646	Reduce Thurmond discharge to 3,800 cfs daily average, reduce Hartwell discharge as appropriate to maintain balanced pools.
4	625	625	Maintain 3,600 cfs as long as possible, thereafter transition to daily average outflow = daily average inflow

Note. A temporary deviation was authorized on October 23, 2007, allowing a minimum daily average release of 3,600 cfs at Thurmond and a specified target of 3,600 cfs at drought Level 3.

Figure 1: Hartwell Drought Action Levels for the No Action Alternative



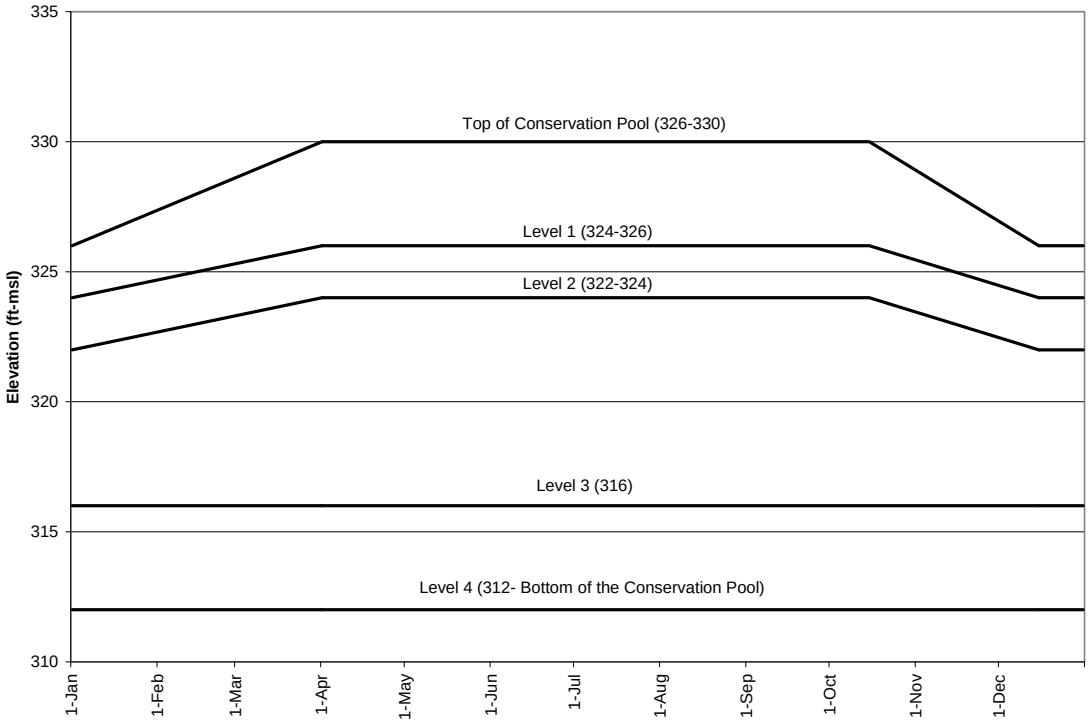
* Level as shown in Figure 1

** Lake elevations for the periods January 1 to April 18 and October 15 to December 1 are linearly interpolated from this data as shown in Figure 1

Table 5: J. Strom Thurmond Drought Action Levels for the No Action Alternative

LEVEL*	1 APR – 15 OCT (FEET MSL)	15 DEC – 1 JAN** (FEET MSL)	ACTION
1	326	324	Public safety information. Reduce Thurmond discharge to 4200 cfs weekly average, reduce Hartwell discharge as appropriate to maintain balanced pools.
2	324	322	Reduce Thurmond discharge to 4000 cfs weekly average, reduce Hartwell discharge as appropriate to maintain balanced pools.
3	316	316	Reduce Thurmond discharge to 3800 cfs daily average, reduce Hartwell discharge as appropriate to maintain balanced pools.
4	312	312	Maintain 3600 cfs as long as possible, thereafter transition to daily average outflow = daily average inflow

Figure 2: Thurmond Drought Action Levels for the No Action Alternative



* Level as shown in Figure 1

** Lake elevations for the periods January 1 to April 1 and October 15 to December 1 are linearly interpolated from this data as shown in Figure 1

3.2.2. Alternative 1

Alternative 1 consists of temporarily modifying the approved Drought Contingency Plan. It is essentially the same as the NAA except the minimum daily average release at Thurmond Dam would be adjusted from 3,600 to 3,100 cubic feet per second (cfs) in the fall/winter when Level 3 drought conditions occur. The Corps would implement this procedure for the duration of the present drought. The reduction would begin in the fall as soon as dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers Depot (#0219897730). The flow reduction would continue until one of the following conditions occurred:

1) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after 1 February.

The first Shortnose sturgeon have recently been observed at the New Savannah Bluff Lock and Dam around 15 February. Shortnose sturgeon are one of the first fish species to spawn in a calendar year. A NOAA Fisheries Spawning Habitat Suitability Index Model (Revised January 2007) identifies water temperature as limiting SNS spawning and incubation when it is <9 degrees C or >12 degrees C. A temperature threshold of 11 degrees C is believed to be appropriate to represent the beginning of the prime SNS spawning period.

The Corps will continue to coordinate with NOAA Fisheries and would extend the flow reduction past mid-February if new information indicates that Shortnose sturgeon spawning would not be measurably adversely affected by continuing the reduced discharges. The Corps would need to obtain separate approval from NOAA Fisheries to extend the flow reduction past the documented arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam.

In response to requests made during the public comment period, the Corps would implement this alternative in phases, with the first phase being a reduction to 3,300 cfs for one week, followed by a further reduction to 3,100 cfs.

The States of Georgia and South Carolina would monitor the results of the proposed flow reduction, should it be implemented. With the cooperation of stakeholders, the States identified specific resources that they will be examining, as well as specific monitoring parameters and general performance targets. The States would coordinate these monitoring efforts with various organizations, which would perform the work. If parameters are found to exceed acceptable levels, the monitoring organization would notify the State, who would review the information, discuss the results with the other State (GA DNR-EPD, SC DHEC and SC DNR), and then recommend to Savannah District appropriate adjustments to Thurmond release levels. The Corps would restore the water flows up to the 3,600 cfs daily average if requested by either the State of Georgia or South Carolina. NOAA-Fisheries would be involved in discussions of potential impacts to spawning of Shortnose sturgeon.

Table 7: Georgia and South Carolina Low Flow Monitoring

Location	Target	Responsible Party
Augusta Canal	Flow < 2,900 cfs	City of Augusta
USGS 021989773 (USACE Dock)	DO > 5.0 mg/L daily average DO > 4.0 mg/L instantaneous Temperature ≤ 90 ºF pH 6-8.5	GA DNR-EPD
USGS 02198840 (I-95 Bridge)	Conductivity < 10,000 µS/cm	GA DNR-EPD
Abercorn Creek	Chloride < 16 ppm	City of Savannah
USGS 02198500 (Clyo)	Flow > 4,500 cfs	SC DHEC
Various	Water level at the intakes	Intake operators
Various	Sturgeon migration	SC DNR and NOAA Fisheries

The values shown above are general performance targets and not strict acceptability criteria. The desired targets would initiate an evaluation of impacts, which could lead to a request to the Corps to restore the discharges from Thurmond Dam to 3,600 cfs. The Corps recognizes that flows at Clyo dropped to less that the target of 4,500 cfs in 2008. However, the States did not identify any water quality problems resulting from that flow level.

The District expects the following offices to represent their agencies:

Agency	Office	Individual
GA DNR-EPD	Watershed Protection Branch	Jeff Larson, Assistant Branch Chief
SC DNR	Office of Environmental Programs	Bob Perry, Director
SC DHEC	Bureau of Water	David Baize, Assistant Bureau Chief
NOAA Fisheries, Southeast Regional Office	Protected Resources Division	Stephania Bolden, Fishery Biologist

3.2.3. Alternative 2

Alternative 2 consists of temporarily modifying the approved Drought Contingency Plan. It is essentially the same as the Alternative 1 except the minimum daily average release at Thurmond Dam would be adjusted from 3,600 to 2,600 cubic feet per second (cfs) once Level 3 drought conditions are met. It would stay in effect for the duration of the drought. A phased reduction would begin in the fall (mid September) when dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers Depot (#0219897730). The reduction in flow would continue until one of the following conditions occurred:

1) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after 1 February.

In response to requests made during the public comment period in 2008, the Corps would implement this alternative in phases, with the first phase being a reduction to 3,300 cfs for one week, followed by further incremental reductions in discharges from Thurmond Dam until the 2,600 cfs level is reached. This alternative would greatly reduce the decline in conservation storage within the 3-lake system.

3.2.4. Recommended Alternative

The Recommended Action is Alternative 1, the temporary modification of the approved Drought Contingency Plan. The minimum daily average release at Thurmond would be reduced from 3,600 cfs to 3,100 cfs from mid-September, through mid-February when in drought Level 3. The Corps would implement this procedure for the duration of the present drought. The reduction would begin in the fall (mid-September) when dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers Depot (#0219897730). The Corps would restore the discharge to the 3,600 cfs daily average if requested by either the State of Georgia or South Carolina or one of the following conditions occurred:

1) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after 1 February.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC CONSEQUENCES

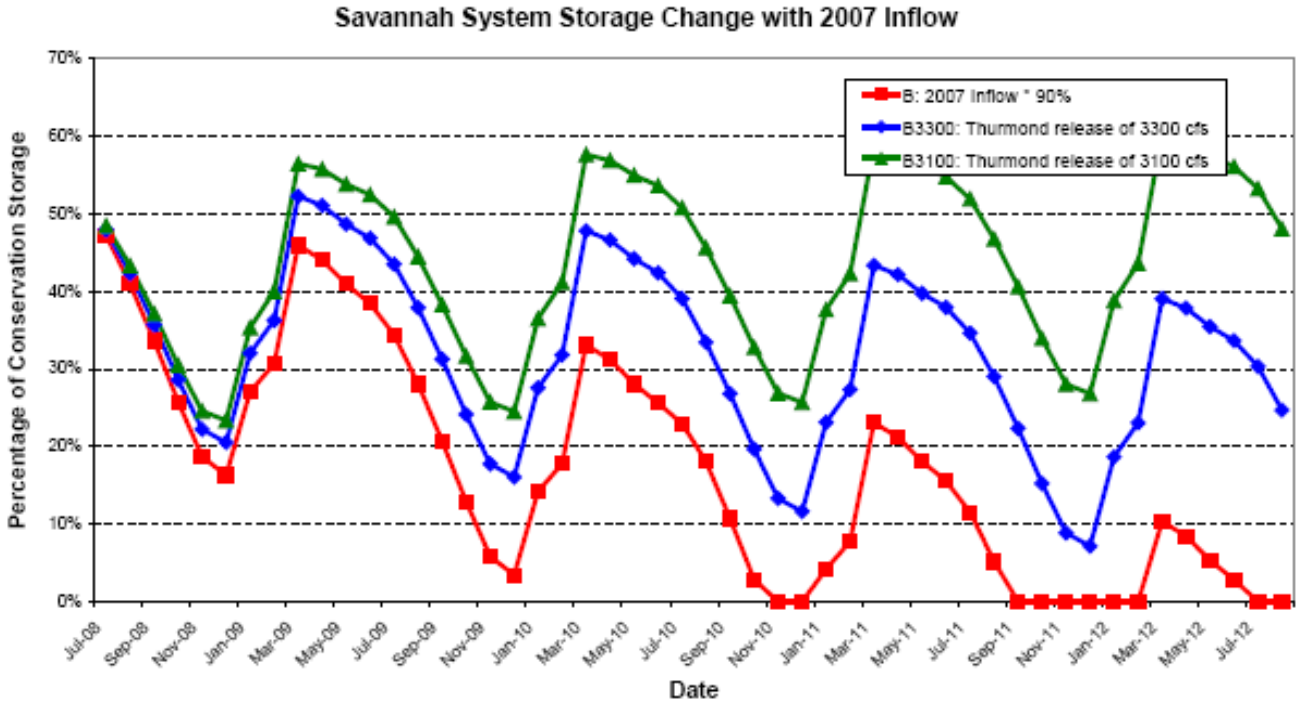
Savannah District does not anticipate any substantial effects to air quality, noise, non-renewable resources, mineral resources, farmland, wetlands, water quality in the lakes, or to fishery resources in the lakes. We do not envision any irretrievable commitments of resources from either alternative. Savannah District believes the proposed action is consistent with both the Georgia and South Carolina Coastal Zone Management Program to the maximum extent practicable.

Flows up to 10,000 to 15,000 cfs remain within the stream channel. Flows discussed in the drought alternatives range between 3,600 and 2,600 cfs, so they would be contained within the stream channels. Fluctuating these flows as discussed in Sections 4.3, 4.4 and 4.5 would appear to produce no measurable impacts on adjacent floodplain wetlands along the river (upstream of the estuary).

4.1. WATER QUANTITY

Reducing discharges from Thurmond Dam during the fall/winter period will not change the total quantity of water in the system, but it would affect the quantity both within the reservoirs and with the downstream river. The purpose of the fall/winter flow reduction is to conserve water within the reservoirs to delay the point at which the conservation pools would be empty (Level 4 drought trigger) and discharges would be reduced to net inflows to the system. Hydraulic modeling was conducted which to show the change in storage capacity within the reservoirs under low inflow conditions and what would occur if discharges from Thurmond Dam were reduced, The figure below shows that more water is retained within the reservoirs as discharges are reduced. The point at which the conservation pools would be depleted is also delayed with greater levels of flow reduction. This modeling did not include the 2,600 cfs flow reduction alternative, but the percentage of conservation storage would be greater under that scenario and the data points would have been above the green line that represents a 3,100 cfs discharge.

Figure 3 – Comparison of Alternatives



4.2. WATER QUALITY

4.2.1 Overview

When discharges are reduced from Thurmond Dam, impacts could occur to downstream water quality. Lower discharges could increase water temperature and reduce the quality of the river downstream of point source discharges. The summer months are the most critical to aquatic resources, so reduced river flows during those months would cause greater adverse impacts.

The State of South Carolina uses the current drought plan Level 3 flow of 3,600 cfs at the Savannah River Augusta gage for the permitting of point source discharges in the Augusta area and this flow is adjusted upward to account for tributary input as one moves down the river (Andrew Wachob, South Carolina DNR). The State of Georgia uses the 7Q10 flow values of 3,800 cfs at the Augusta gage, 4,160 cfs at the Millhaven gage, and 4,710 cfs at the Clyo gage in its point source discharge permit decisions. In the following analysis, the flows of the modeled alternatives were compared to the flows of the modeled No Action Alternative to determine the impacts of temporarily changing the SRBDCP.

The Georgia Department of Natural Resources, Environmental Protection Division (EPD) analyzed the potential effects on water quality from the proposed winter flow reduction. EPD evaluated the potential impacts in both the river and the estuary/harbor area. They concentrated on dissolved oxygen levels, since the States and EPA had previously identified that as a critical water quality parameter in this basin.

For the river portion (Thurmond Dam to Clyo) of the basin, GA DNR-EPD used the RIV1 Model which they use to allocate point source discharges along the river to identify potential problems if the river flow was reduced. For the estuary/harbor portion of the basin (Clyo to ocean), they used the EFDC and WASP Models that had been developed by EPA and used for EPA's TMDL analysis. The States concluded that the modeling indicated that the proposed temporary seasonal reduction of Thurmond release down to 3,100 cfs would not cause water quality problems in the river or the harbor. The following paragraphs contain details of the water quality analyses:

4.1.2 Savannah River downstream of Thurmond Dam

The first model simulation was conducted with 2007 meteorological data, tributary inflows, and Thurmond release data; and 2006 wasteload discharges and water withdrawals. This simulation was developed to identify how well the model was calibrated to observed DO data. Figures 4 and 5 show the observed DO data (red squares) measured in 2007, which never went below 6.5 mg/L and 6.29 mg/L at River Mile (RM) 119 (US Highway 301) and RM 61 (Clyo Gage), respectively, versus the approximate calibration run. It is an approximate calibration run, since the model did not include 2007 discharge and withdrawal data, but rather that of 2006. Despite the approximation of this model run, the results indicate that the model was calibrated relatively well.

Figure 4 - Calibration of Savannah River water quality model at River Mile 119

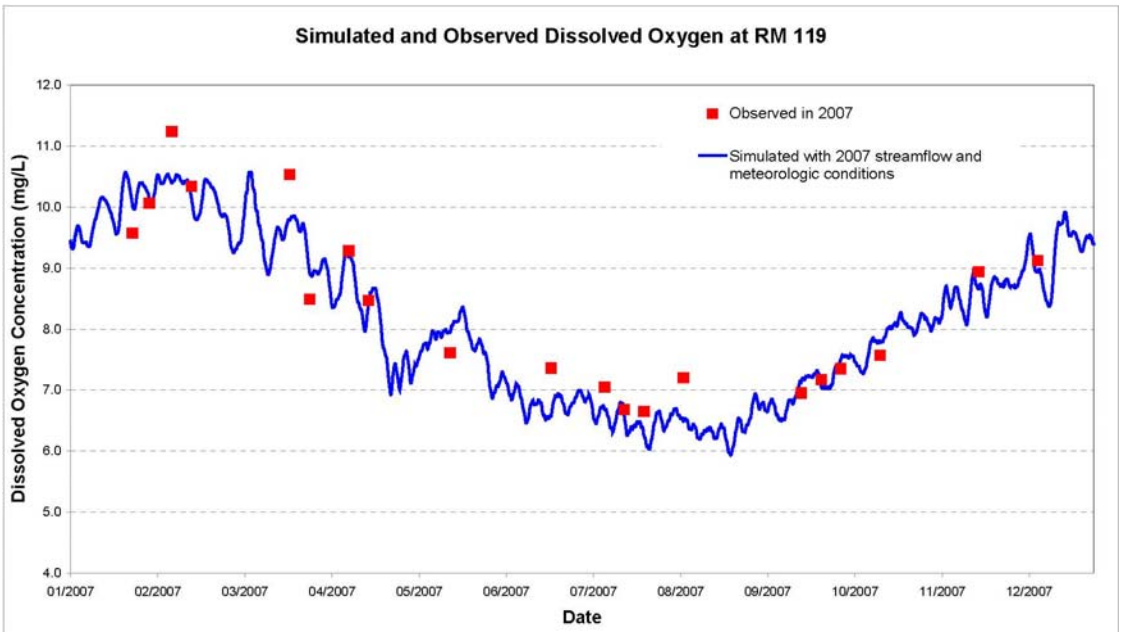
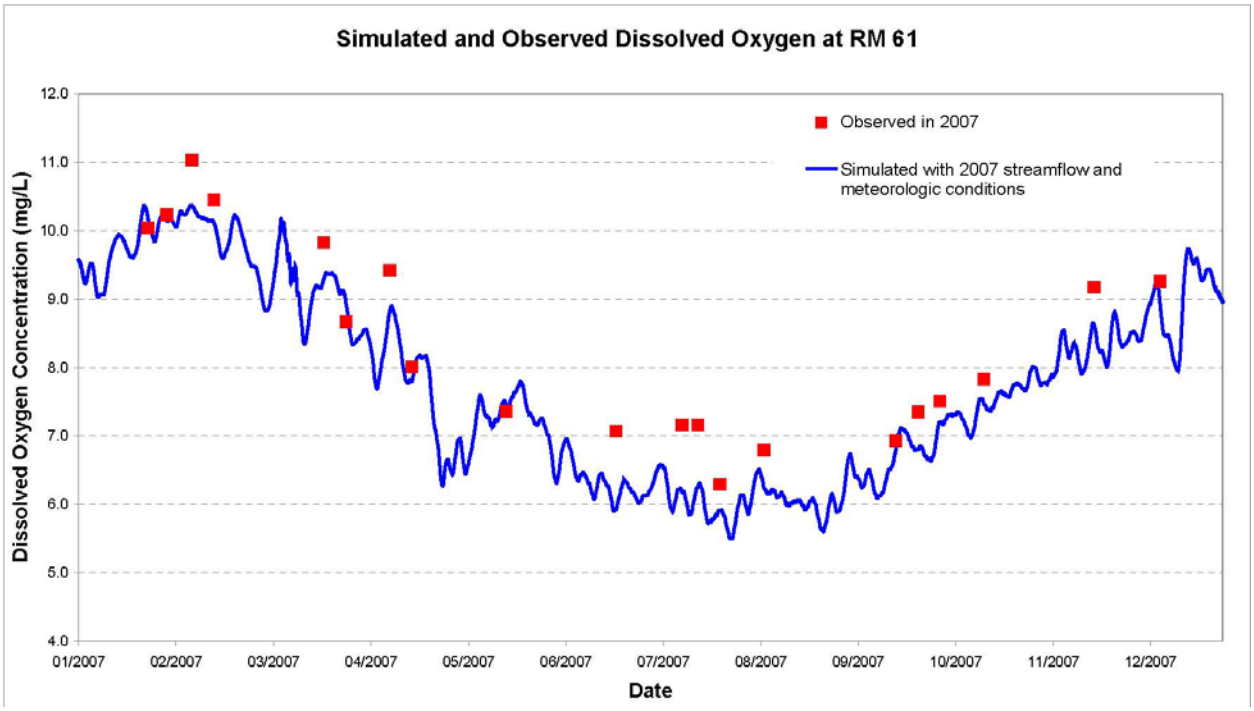


Figure 5 - Calibration of Savannah River water quality model at River Mile 61



GA DNR-EPD conducted additional model simulations using 2007 meteorological data and tributary inflows, and 2006 wasteload discharges and water withdrawals. These model

simulations incorporated varying amounts of discharges from Thurmond Dam (3,600 and 3,100 cfs).

Figures 6 and 7 show the results of the 3,600 cfs simulation (No Action Alternative). Under a Thurmond release of 3,600 cfs, the simulated DO concentrations at RM 119 (US Highway 301) are predicted to be above 5 mg/L throughout the year (Figure 6). Figure 7 shows simulated DO concentration at River Mile 61 (Clyo) under a Thurmond release of 3,600 cfs. Again, the simulated DO concentrations are predicted to be higher than 5 mg/L throughout the year. The riverine water quality model shows that the 5.0 mg/L DO standard would not be breached by a Thurmond release of 3,600 cfs.

GA DNR-EPD did not model conditions with a Thurmond discharge of 2,600 cfs. From the existing model results, it appears that the DO concentrations in the river may dip down below 5.0 mg/L if those flows occurred during the summer months. The low DO levels would rise above the 5.0 mg/L threshold by mid- to late-September.

Figure 6 – Dissolved Oxygen at RM 119

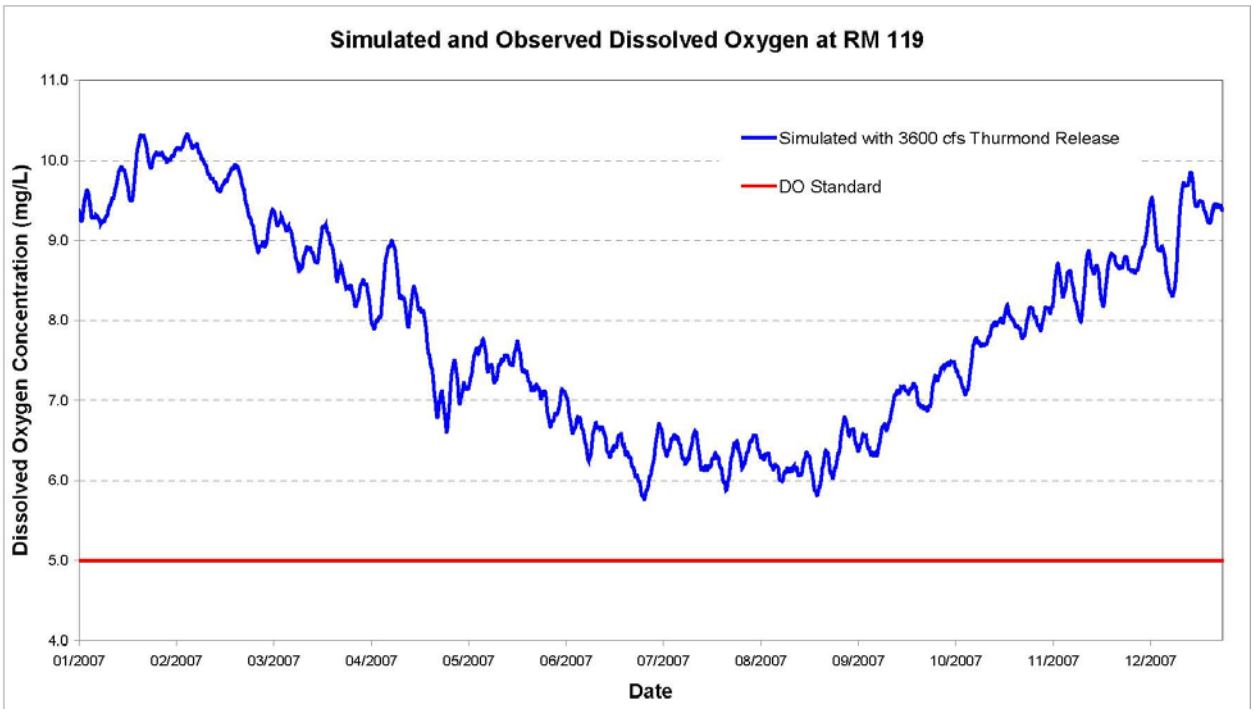
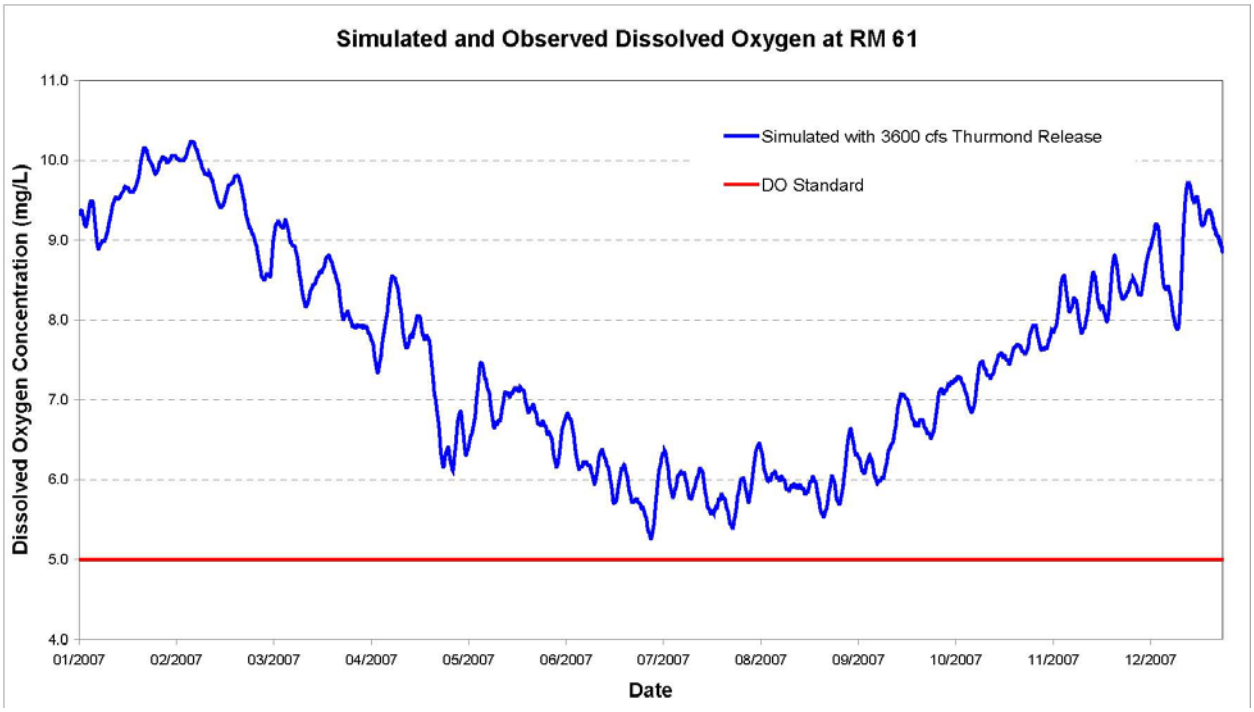


Figure 7 - Dissolved Oxygen at RM 61



Figures 8 and 9 show the simulated DO concentrations at River Mile 119 and River Mile 61 respectively, under a Thurmond release of 3,100 cfs. The model indicates that the DO would remain above the standard of 5 mg/L throughout the year. For the cooler months of October through February, DO concentrations would remain higher than 6.0 mg/L and almost always be higher than 7.0 mg/L at both River Mile 119 and River Mile 61.

Figure 8 – Simulated Dissolved Oxygen at RM 119

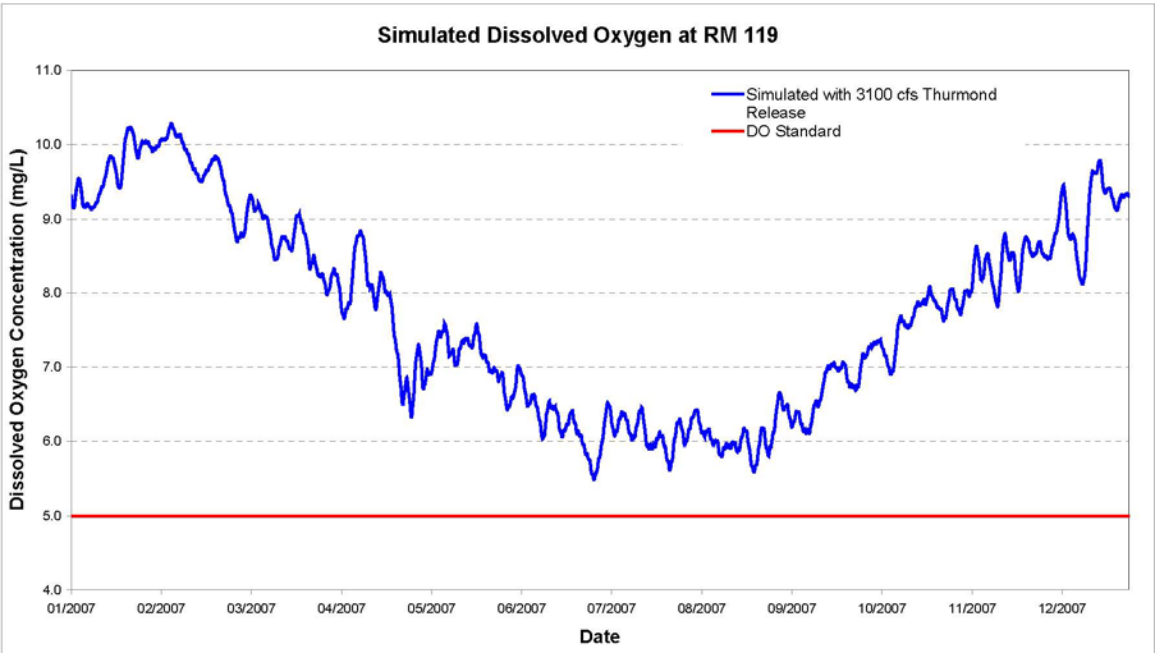
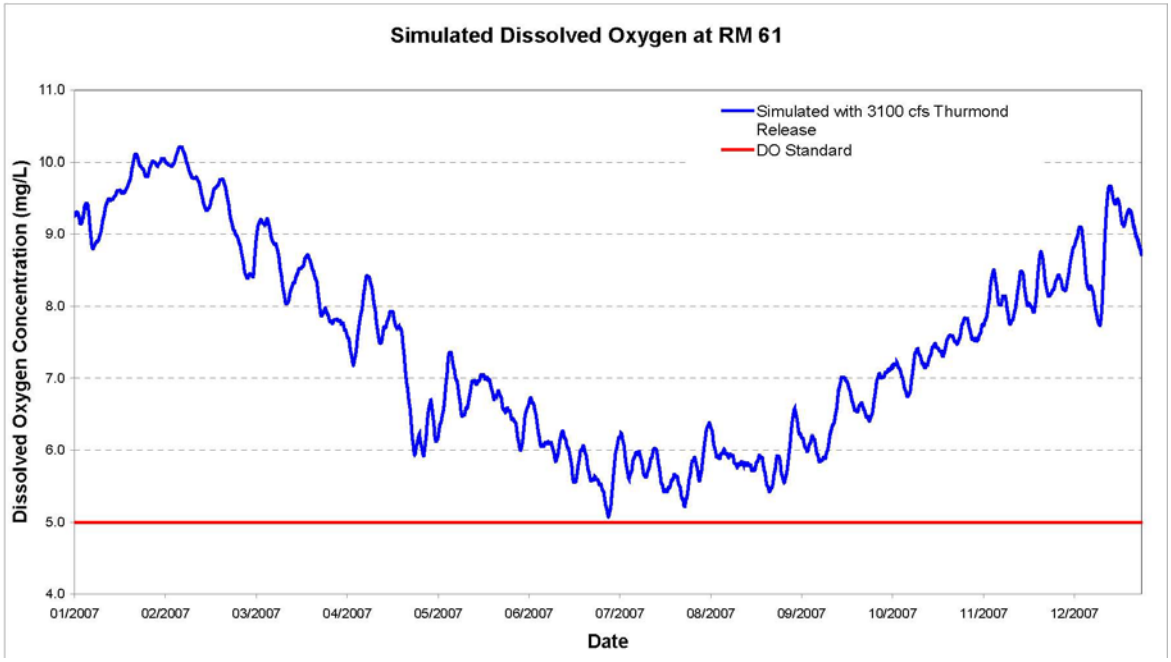


Figure 9 – Simulated Dissolved Oxygen at RM 61



One should note that the water quality model used in this analysis does not contain any modules simulating algal activity in the river. This lack of simulated algal activity means that the model may give overly pessimistic DO concentrations. Algal activity typically increase DO concentrations during the day, while algal respiration and decay of the algal biomass tend to decrease DO at night. It is likely that field data would document higher DO concentrations than the model predicts.

The proposed action includes a continuation of 3,600 cfs release from Thurmond Dam in the months of March through first part of September and a reduced release from Thurmond Dam of 3,100 cfs in the cooler months (mid-September through mid-February). This action would not result in any adverse change in DO concentration in the warmer months.

Although the model was not run for a low flow of 2,600 cfs, examination of the existing modeling indicates that restoration of flows to 3,600 cfs in mid-February would keep DO concentrations in the river above the 5.0 mg/L standard.

GA DNR-EPD indicates that monitoring may occur along the river to identify changes in DO concentration along the lower reaches if the proposed operation is adopted. The Corps proposes to use adaptive management as part of the proposed action. If field observations indicate any problem with DO concentration, GA DNR-EPD or SC DHEC would notify the Corps and Savannah District would then increase flows up to a 3,600 cfs discharge to mitigate the adverse conditions.

Once the 3,100 cfs objective is reached for the preferred alternative, it would be maintained through mid-February or until such time that one of the following conditions occurred:

3) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
4) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C.

In addition, as a result of the water quality monitoring that they are conducting, GA DNR-EPD, SC DHEC or SC DNR may identify a problem and recommend the Corps modify its discharge from Thurmond Dam. If such an event were to occur, the Corps would increase discharges from Thurmond incrementally by 100 cfs/week until the impact is alleviated or 3,600 cfs is reached.

4.1.2 Savannah Harbor

Two potential water quality-related effects in the estuary were evaluated from reduced discharges from Thurmond Dam. These were elevated chloride concentrations at the City of Savannah municipal water intake on Abercorn Creek, and dissolved oxygen concentrations in the Harbor.

The City of Savannah's municipal and industrial water intake is located on Abercorn Creek, upstream of the harbor near river mile 29, approximately two miles from the Savannah River. The City of Savannah is concerned with distributing water with chloride concentrations greater

than roughly 12 milligrams per liter (mg/L) to its industrial customers. Such concentrations have been shown to cause scaling in boilers.

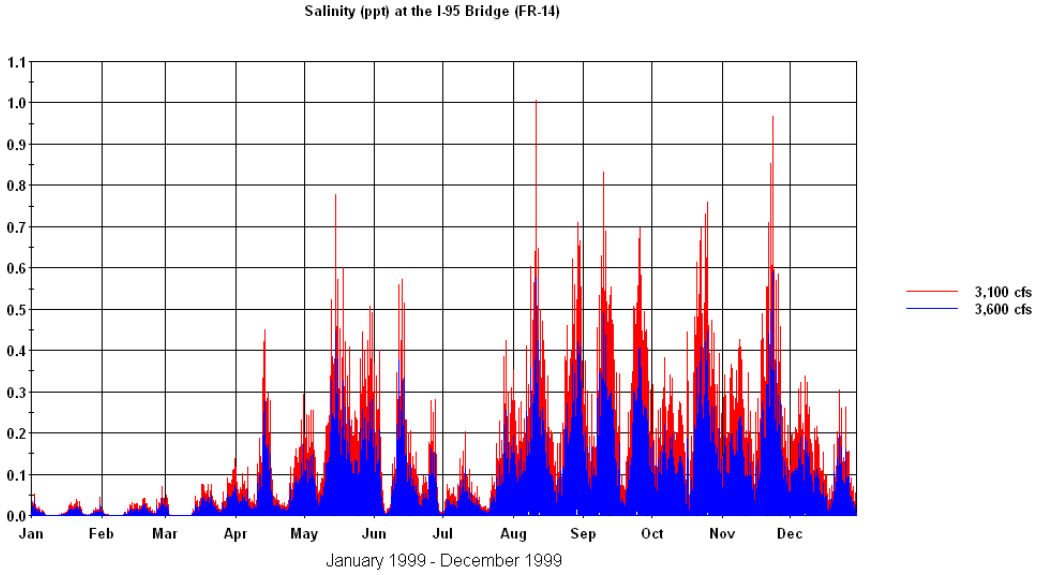
Sources of chloride in Abercorn Creek include upstream inflows from the Savannah River and salinity intrusion from the downstream Savannah Harbor. Studies have shown a good relationship between river flows at the U.S. Geological Survey's Clyo stream gage location and chloride concentrations. Results have shown that the Savannah River contains approximately 10 mg/L of chloride during low flows and 4 mg/L during high flows, when there is greater dilution. Therefore, it is during low flow periods where river chloride concentrations are as high as 10 mg/L when salinity intrusion from downstream can add additional chlorides in the vicinity of the intake and cause the water to exceed the 12 mg/L threshold. Analysis of the historical chloride data collected at the City's intake shows that during drought years the number of samples with chlorides exceeding 12 mg/L ranges from 21 to 58 percent, and concentrations have approached 19 mg/L.

Reducing releases from Thurmond Reservoir, by itself, would not create higher chloride concentrations at the City of Savannah's water withdrawal. Rather, it is the combination of low releases from Thurmond Reservoir, low runoff from the downstream watershed, and high (spring) tides that create a condition for elevated chloride concentrations at the City's withdrawal. With sufficient downstream inflows and normal tidal conditions, chloride levels at the City's intakes should remain unchanged. However, given the sensitivity of the City's intake to chloride concentrations greater than 12 mg/L, the proposed reservoir operation (Alternative 1) combined with low downstream inflows could increase the number and magnitude of chloride concentrations greater than 12 mg/L at the City of Savannah's M&I water withdrawal. The City of Savannah monitors chloride concentrations each day of the water they are withdrawing from Abercorn Creek. If they identify unusual values after implementation of the proposed action, they would notify the Corps and GA DNR-EPD. If the observations by the City of Savannah indicate any problem with chloride concentrations, GA DNR-EPD would recommend an appropriate action to Savannah District, possibly including the resumption of the 3,600 cfs discharge.

As part of the consideration of impacts to chloride levels at the City's intake, GA DNR-EPD used the Savannah Harbor EFDC Model to identify expected changes in salinity levels at the upper end of the harbor. Figure 10 shows the effects on salinity levels at the Interstate 95 Bridge, located at river mile 27.8. The results indicate that salinity should remain below 1 ppm at the I-95 Bridge during the winter months, even with the proposed reduction in discharge to 3,100 cfs.

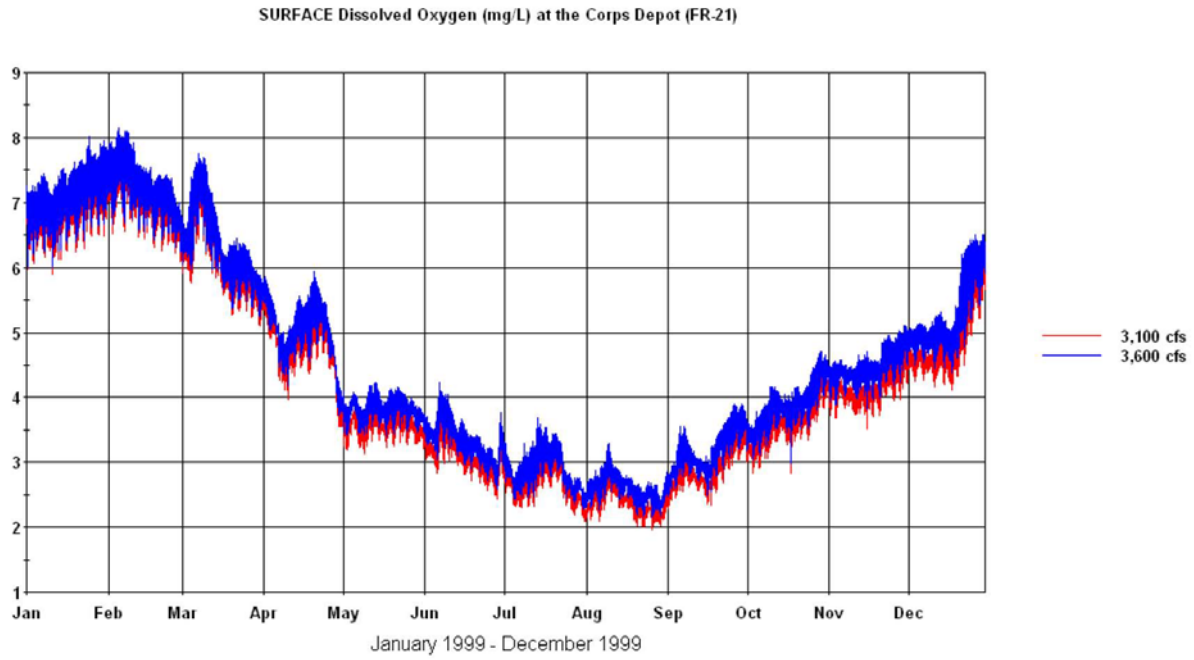
Although the model was not run for a low flow of 2,600 cfs, inspection of existing modeling results indicate that a discharge of 2,600 cfs could result in salinity temporary spiking above 1 ppm for a few days.

Figure 10 – Salinity at I-95 Bridge



GA DNR-EPD evaluated the effect of the proposed Thurmond reservoir operation on dissolved oxygen concentrations in Savannah Harbor using the Savannah Harbor EFDC and WASP Models. The RIV1 Model streamflow and water quality results provided input for the upstream boundary of the harbor models. GA DNR-EPD evaluated model results and the effects on dissolved oxygen concentrations at the USGS monitoring station located at the U.S. Army Corps of Engineers' dock on Hutchinson Island in the harbor. EPD compared the results to the existing coastal fishing classification, whose dissolved oxygen criteria is no less than 3.0 mg/L during June through October, no less than 3.5 mg/L in May and November, and no less than 4.0 mg/L during December through April. The results are shown in Figure 11. GA DNR-EPD concluded that the proposed seasonal reduction of Thurmond releases would not result in substantial adverse impacts to dissolved oxygen levels in the harbor. Therefore, with a flow of 3,100 cfs no substantial effects would be expected to EPA's TMDL for dissolved oxygen in the harbor. With a low flow of 2,600 cfs, the model indicates dissolved oxygen levels could drop below 3.0 mg/L during September and the first half of October. Should that occur, the States could recommend an appropriate action to Savannah District, possibly including the resumption of the 3,600 cfs discharge.

Figure 11 – Simulated Surface Dissolved Oxygen in Savannah Harbor



Once the 3,100 cfs objective is reached for the preferred alternative, it would be maintained through mid-February or until such time that one of the following conditions occurred:

5) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
6) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C.

In addition, as a result of the water quality monitoring that they are conducting, GA DNR-EPD, SC DHEC or SC DNR may identify a problem and recommend the Corps modify its discharge from Thurmond Dam. If such an event were to occur, the Corps would increase discharges from Thurmond incrementally by 100 cfs/week until the impact is alleviated or 3,600 cfs is reached.

4.1.3 Effects on EPA TMDLs

At EPA's request, the Corps reviewed the TMDL's that EPA previously issued for Dissolved Oxygen, Mercury, Fecal Coliform and Lead on the Savannah River.

The potential effects on dissolved oxygen were discussed in the previous section on impacts in the estuary.

The 2000 TMDL for Fecal Coli form indicates that the 23-mile river segment that is impaired is located directly downstream of the City of Augusta's wastewater treatment plant, between the Butler Creek and McBean Creek. The City of Augusta has improved their stormwater conveyance system and separated their stormwater and sanitary sewer systems. Those improvements led to dramatic decreases in fecal coliform loading to the Savannah River. The TMDL evaluated three different river flow conditions. However, the TMDL of 1.37 x 1013 Counts/day was established using the minimum daily average flow of 2,810 cfs. That flow would be exceeded under both the No Action Alternative and Alternative 1, so the TMDL for Fecal Coliform would not be affected by either of those alternatives but may be affected by Alternative 2.

The 1999 TMDL for Lead indicates that the impaired 53-mile river segment is located between Brier Creek and Ebenezer Creek. The TMDL could not identify any sources of lead within the watershed. It stated that the latest sampling did not identify any lead in that segment of the river. The lower river flows with Alternatives 1 and 2 could increase the concentration of lead in the water, if any is still present. Since there is uncertainty in whether lead is still present, the Corps believes that the 5 to 6-month reduction in flow by 500 cfs (14%) referenced in Alternative 1 would not significantly affect the long term ability of the segment to meet the water quality standard of 0.54 ug/l of lead. A 1,000 cfs (28%) reduction in flow proposed by Alternative 2 may impact water quality.

EPA issued a TMDL for Lead in 2000 for the 23-mile segment directly downstream of the City of Augusta's wastewater treatment plant, between the confluence of Butler and McBean Creek. Again, the TMDL could not identify any sources of lead within the watershed. The TMDL assumed that there was a legacy load of lead either in contaminated sediments or nonpoint source runoff. For this river segment, the TMDL used the critical low flow of 2,810 cfs. That flow would be exceeded under both the No Action Alternative and Alternative 1, so the TMDL for Lead in this river segment would not be affected by either alternative that is under consideration. However, a 1,000 cfs (28%) reduction in flow proposed by Alternative 2 may impact water quality.

4.3. BIOTIC COMMUNITIES-LAKES

4.3.1. Largemouth Bass Spawning

Largemouth bass

State natural resource agencies have identified largemouth bass spawning at the three Corps Savannah River lakes as being a priority in water management decisions. The spawning period is defined as beginning when water temperatures reach 65 degrees Fahrenheit and lasts until three weeks after water temperatures reach 70 degrees. The water temperatures are taken each day throughout this period in a sunny cove between 1000 and 1630 hours by submersing a thermometer six inches where the water is approximately three to five feet deep. The spawning period usually starts around the first of April and lasts 4 to 6 weeks (Lake Regulation and Coordination for Fish Management Purposes, South Atlantic Division, US Army Corps of Engineers, March 30, 2001).

Past studies indicate that the 4-week period of April 1-28 is the peak spawning period. Stable lake levels should be provided during this peak spawning period to prevent the stranding of eggs and abandonment of nests. Throughout the spawning season, water levels should not be lowered more than six inches below the highest lake elevation recorded during the operational spawning window. If inflows during the spawning season cause lake levels to rise to flood levels, managers have the authority to lower lake levels more than 6 inches, since flood control takes precedence over fish spawn. Maintaining these stable lake levels may not be possible during drought.

In NAA, Alternative 1 and Alternative 2, stable lake levels would be provided during this peak spawning period as much as possible. The difference between the two alternatives is that the lakes would be somewhat higher if Alternative 2 is implemented, since they would have retained more water during the winter months. Alternative 2 would provide more flexibility to water managers, resulting in a greater potential to manage continued drought flows without adversely impacting the largemouth bass spawning season.

4.3.2 Aquatic Plants

Effects of the NAA

The NAA would have no adverse impacts on aquatic plants (including invasive species, such as hydrilla) as the existing SRBDCP of March 1989 with pumped storage operation would continue to be used.

Effects of Recommended Alternative

The prolonged drought from mid-1998 through the summer of 2002 and the drought that began in 2006 significantly reduced the abundance of aquatic vegetation in JST Lake (including invasive species, such as hydrilla) (Aquatic Plant Management Plan, US Army Corps of Engineers, Savannah District, Calendar Year 2009 Update), which is the only lake of the three with an active aquatic vegetation treatment program. Therefore, the proposed action and the associated small variations in lake levels when compared to the NAA are expected to have no adverse impact on aquatic plants in the lakes. No downstream effects are anticipated to occur

within the main channel. Potential effects to aquatic plants in the shoals, estuary, and flood plain are discussed in the following sections.

As with the proposed action, Alternative 2 would result in small variations in lake levels when compared to the NAA and is expected to have no adverse impact on aquatic plants in the lakes.

4.4. BIOTIC COMMUNITIES-SHOALS


Shoals

Past studies and coordination have listed shad, robust redhorse, Atlantic sturgeon, the shoals spider lily (*Hymenocalis coronaria*) and juvenile out-migration as being high priorities for the Shoals during dry years. The Shoals are defined as the 7.2 kilometer stream segment that is upstream of Augusta and downstream of the Augusta Canal Diversion Dam. High priority fish species benefit from higher flows across the shoals from January to May, since such flows support seasonal spawning and passage. The state-listed endangered Shoals spider lily benefit from higher flows from June to December, as such flows would provide protection from deer grazing. Undefined very high flows could be detrimental to the Shoals spider lily, but these are not expected during times of drought and are not considered here.

The Augusta Shoals area is important year-around habitat for many native riverine species, including the robust readhorse, the shoals spiderlily, and the brother spike. The Augusta Shoals require not only inundation, but also suitable current velocities to allow for survival and reproduction of aquatic organisms. The flow regime in the Augusta Shoals is controlled by flow releases from Thurmond Dam, reregulation of flows at Stevens Creek Dam, and the diversion of water into the Augusta Canal by the City of Augusta at the Augusta Diversion Dam. USGS data indicates that in 2008 when discharges from Thurmond were at 3,600 cfs, the City maintained the canal gates at levels that resulted in an average of 3,150 cfs passing down the Canal and 450 cfs passing over the Shoals. The lower 3,100 cfs discharge that occurred from Thurmond Dam from November 2008 to the end of January 2009 did not appear to adversely impact biotic communities in the Shoals.

Augusta has a pending license application with the Federal Energy Regulatory Commission (FERC) which has not been formally approved by the Augusta-Richmond County Commission, pending resolution of appeals with regard to the Georgia Section 401 water quality certification. A Settlement Agreement concerning the split of water between the Augusta Canal and the Shoals was negotiated as part of the processing of the FERC license. That Agreement has not yet been finalized.

Effects of the NAA

Selection of the NAA and continuing with the existing SRBDCP with coordinated additions would have acceptable effects on these biotic communities.

Effects of Recommended Alternative

In a letter dated October 22, 2008, the City of Augusta notified the Corps that they commit "to the methodology set forth in the proposed Settlement Agreement for determining the Aquatic Base Flow and reserving for the Shoals those amounts set forth in Section 4.3 of the Settlement Agreement for the respective periods and tiers set forth therein." That section contains the following information:

4.3 Agreed Aquatic Base Flows:

	FEB/MAR	APR	MAY 1-15	MAY 16-31	JUNE- JAN
Tier 1 ≥5400	3300	3300	2500	1900	1900
Tier 2 4500-5399	2300	2200	1800	1800	1500
Tier 3 3600-4499	2000	2000	1500	1500	1500
Tier 4 <3600	1800	1800	1500	1500	1500

Although the City is not required to implement the provisions of the yet-to-be finalized Settlement Agreement, it states that it will "use its best efforts to meet the terms for flows as set forth therein, including the higher flows during the month of February as set forth in the respective tiers." If the City fulfills this commitment, the impacts of the proposed flow reduction on biota within the Shoals would be minimal. If the City does not fulfill its commitment, impacts to the Shoal communities would be greater. The Corps believes that a 50/50 split in the 500 cfs flow reduction is probably a good assumption for prediction of future impacts. Under that scenario, the Shoals would experience a 250 cfs reduction in flow from what they presently receive with the 3,600 cfs average daily discharge from Thurmond Dam. This amount of flow reduction is expected to result in minor effects to those biotic communities.

The flow reduction would occur between mid-September and mid-February. The decrease in flows would occur during the fall/winter months, so no impacts to seasonal fish spawning or upstream fish passage are expected. Low flow conditions in the Shoals could harm resident fishes by inhibiting movement, reducing cover, and foraging habitat. The present low flows have caused some fish to leave the Shoals to locations that provide more water depth. Fish are more susceptible to stranding and predation under low flow conditions. Anadromous species, including out-migrating juveniles, are unlikely to be within the Shoals during the time of the proposed flow reduction. The decrease in flows could increase the susceptibility of Shoals spider lily to grazing by deer. Atlantic pigtoe could also be impacted by insufficient water depth, exposure and increased predation. However, it is not anticipated that the reduction of flow from 3,600 to 3,100 cfs would result in significant long term adverse effects to this species.

Once the 3,100 cfs objective is reached for the preferred alternative, it would be maintained through mid-February or until such time that one of the following conditions occurred:

7) arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
8) water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C.

In addition, as a result of the water quality monitoring that they are conducting, GA DNR-EPD, SC DHEC or SC DNR may identify a problem and recommend the Corps modify its discharge from Thurmond Dam. If such an event were to occur, the Corps would increase discharges from Thurmond incrementally by 100 cfs/week until the impact is alleviated or 3,600 cfs is reached.

Effects of Alternative 2

Alternative 2 would have similar effects on biotic communities in the Shoals. The Shoals would experience a 500 cfs reduction in flow from what they presently receive with the 3,600 cfs average daily discharge from Thurmond Dam. That would result in somewhat higher impacts to biotic communities in the Shoals, but the fall/winter is a period of relatively low activity by those communities, so the effects are expected to be minor. The effects would also be temporary.

4.5. BIOTIC COMMUNITIES-FLOODPLAIN


Floodplain

The floodplain reach is defined as beginning downstream of the Augusta Shoals and extending to Ebenezer Landing (approximate river kilometer 65). Seedling establishment is a high priority for the floodplain reach during dry years. The establishment of seedlings is promoted by low flows (3,000 cfs or less was recommended in the 2003 workshop to occur every 10 to 20 years and not last longer than 3 years) between April and October for 3 consecutive years. However, flows up to an estimated 10,000 to 15,000 cfs remain within the stream channel at nearly all locations (15,000 cfs near the Millhaven Gage) and would not be expected to affect the floodplain.

Flows from the No Action Alternative, Alternative 1, and Alternative 2 are expected to remain within the channel banks during the winter months. None of the plans would affect the establishment of seedlings in the floodplain. Therefore, there would be no difference between the alternatives on potential impacts to this resource. A flow reduction to 2,600 cfs as proposed in Alternative 2 would probably provide additional benefits to seedling establishment.

Modeling indicates that river levels will be reduced by approximately 6-inches downstream of Thurmond Dam with a flow of 3,100 cfs. A further reduction would occur with discharges of 2,600 cfs. It is possible that these reductions will have a localized effect to mussel populations and other non-motile species that may be found in shallow sloughs and cutoff bends along the river. Many of these areas would are already separated from the main river as a result of the low flow conditions, and will see no additional impact from the reduction. However, areas still connected by shallow cuts may be affected by the additional flow reduction. These areas

comprise a small percentage of the overall river system. Therefore, impacts to these areas will not result in a significant impact to the river system. The Corps understands that some monitoring is being conducted of those oxbows to identify effects of the proposed flow reduction. No negative effects to the floodplains were reported during the low flow period from November 2008 to the end of January 2009.

No other effects were identified to floodplain communities.

4.6. BIOTIC COMMUNITIES-ESTUARY


Estuary

The report from the April 1-3, 2003 workshop listed freshwater marsh habitat and the salinity gradient as being the high priorities for the estuary reach during dry years. The estuary has been defined as extending from Ebenezer Landing (approximate river kilometer 65) down to the mouth of the river. Historically, river flows of 4,000 to 5,000 cfs and less at the USGS Clyo gage have resulted in a stressed freshwater marsh plant community and an associated upriver shift of the salinity gradient (higher salinity zones). Higher flows throughout the year would provide a healthier freshwater marsh plant community and allow more fish access. The estuary provides habitat for some species of fish for which Management Plans have been prepared by the South Atlantic Fishery Management Council. The managed species that could be affected by the proposed action include oyster, white shrimp, brown shrimp, and red drum. Other habitats that could be affected consist of saltmarsh, brackish marsh, oyster reefs, shell banks, tidal flats and freshwater wetlands.

The Atlantic States Marine Fisheries Commission (ASMFC) has Management Plans for river herrings and American shad, Atlantic sturgeon, and American eel. Shortnose sturgeon are managed under a recovery plan by the National Marine Fishery Service (NMFS). GA DNR-WRD and SC DNR have a Striped Bass Management Plan for the Lower Savannah River. Alewife and hickory shad are other managed species for which Management Plans have not been prepared that commonly occur in the Savannah River or its estuary.

The Savannah National Wildlife Refuge contains both tidal wetlands and managed wetland impoundments. The Refuge was established in the 1927 to provide waterfowl habitat. Since then, it has broadened its mission to the following:

- To provide habitat and sanctuary for migratory birds consistent with the objectives of the Atlantic Flyway.
- To provide habitat and protection for plants and animals whose survival is threatened or endangered.
- To use Refuge property as "a refuge and breeding ground for native birds and wild animals".
- To maintain and enhance the habitats of all other species of indigenous wildlife and fishery resources.

The Refuge manages its impoundments as "managed wetlands". These lands are diked and the habitats within the diked areas are managed for migratory birds, including wintering waterfowl. The USFWS uses prescribed burning and water level control to increase vegetation that provides food for migrating ducks, as well as suppress vegetation that is of less value to waterfowl. According to the USFWS, the moist soil management practices that are used in most of the management units on the Refuge produce the most productive waterfowl habitat. Fresh water is provided to the managed wetlands through a supply canal located off of Little Back River (about river mile 24). On the Savannah NWR, the managed wetlands provide the most heavily used habitat for wintering waterfowl and wading birds. Based on mid-winter waterfowl surveys from 1990-2002, the Refuge provided habitat for 23 percent of the waterfowl in South Carolina.

Freshwater management (salinity < 0.5 ppt) is necessary to maintain maximum waterfowl habitat use of the Refuge's managed wetlands. Studies have concluded that freshwater coastal impoundments in SC produce a greater variety of marsh plants, many of which are desirable waterfowl food, than brackish impoundments. Therefore, continued provision of fresh water at the supply canal is important to the Refuge's ability to maximize its ability to provide quality waterfowl habitats.

Private lands located oceanward of the Refuge also use moist soil management to provide waterfowl habitats within their impoundments. They obtain fresh water to flood those lands from the same supply canal which serves the Savannah NWR.

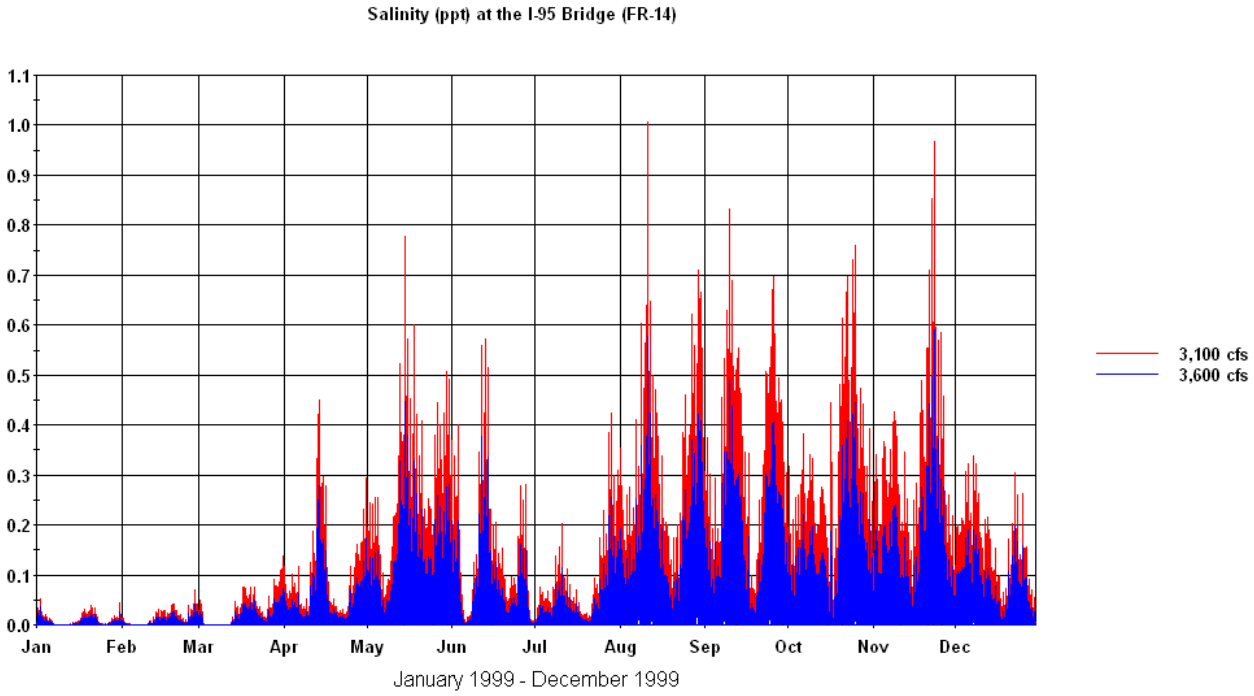
Effects of the NAA

Selection of the NAA and continuing with the existing SRBDCP would have acceptable impacts on these biotic communities for the near term. Since severe drought conditions would be occurring in Level 3, some biotic communities in the estuary would be stressed by higher salinity resulting from additional saltwater intrusion. Long-term impacts are uncertain and recovery of the freshwater communities in the estuary would take a number of years. Should the drought persist, Level 4 of the DCP could adversely affect freshwater communities in this area. Under the NAA conditions, the freshwater / salt water interface is located downstream of the supply canal which feeds the Savannah NWR impoundments. Therefore, the Refuge and the downstream private lands would be able to provide fresh water to their managed impoundments.

Effects of Recommended Alternative

Modeling conducted by GA DNR-EPD suggests that salinity differences of less than 1 ppt would occur at the I-95 Bridge. This is shown in Figure 12 on the following page. That amount is generally within the natural variation seen in the estuary.

Figure 12 – Salinity Modeling at I-95 Bridge

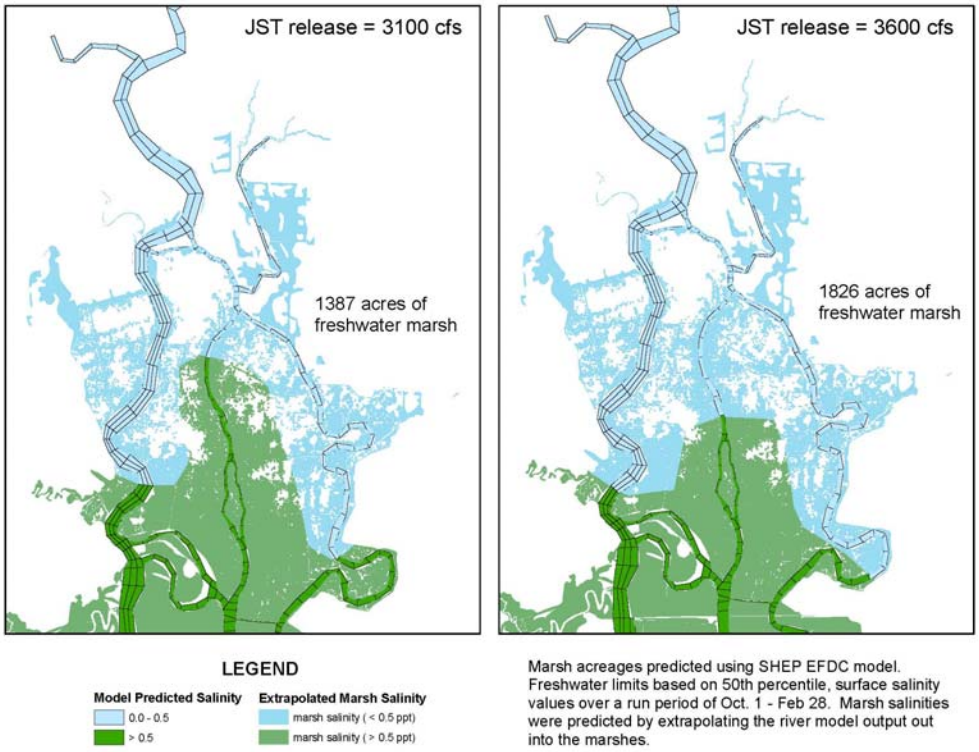


Savannah District used the Savannah Harbor EFDC model to evaluate the potential impact of salinity changes on freshwater wetlands in the estuary. The techniques followed by the District were similar to, but a slight variation from those used to evaluate potential impacts from the proposed Savanna Harbor Expansion Project. In the SH Expansion Project, the natural resource agencies had stated that the location of the 0.5 ppt surface contour across the marsh during the summer growing season was critical to determining the species composition in the estuary. In the present evaluation, the District used the surface salinity levels that would occur during the winter months, since those are the only ones that would change as a result of the proposed Alternatives. With that difference in technique being understood, the analysis indicates that 439 acres of freshwater marsh could undergo temporary adverse effects due to higher salinity as a result of Alternative 1. This is shown in Figure 13 on the following page. The direct effect would be short-term, as salinity levels would be restored in the spring when flows are increased to 3,600 cfs or when normal rainfall and river flows are experienced. It appears that a decrease in flow to 2,600 cfs (Alternative 2) would increase the salinity levels further and substantially expanding the amount of freshwater wetlands subject to salinity increases.

To place the 439 acres in context, the same analysis technique predicts that 4,072 acres of freshwater marsh would exist under average river flows (1997 flows). The results would indicate that the existing drought has already caused the temporary conversion of 2,246 acres (4,072-1,826 acres) of freshwater marsh to brackish marsh. The Corps' previous analyses indicate that a typical, but severe drought (20-year recurrence interval) would have resulted in the existence of 2,208 acres of freshwater marsh. This drought-of-record has allowed salinity to

move further into the estuary than a drought with a 20-year recurrence period, temporarily reducing the acreage of freshwater marsh.

Figure 13 – Surface Salinity Modeling in the Estuary



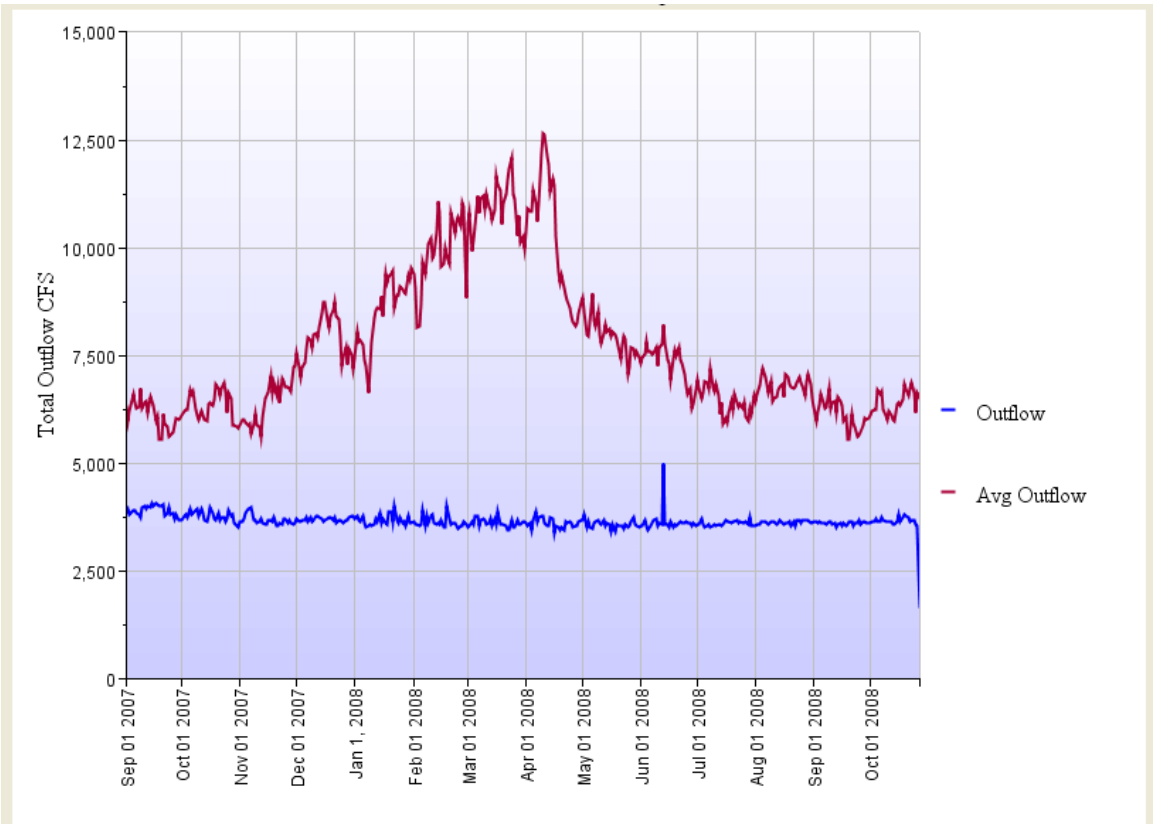
The 439-acre impact likely overstates the changes in marsh vegetation, since the reduced flows and the resulting additional salinity would occur during the winter months, which is not the primary growth season for the plants. Under those conditions, the extent of the conversion of one marsh plant species to another at a site is uncertain.

The District also used the US Geological Survey (USGS) decision support system Model-to-Marsh (M2M) to evaluate the potential impacts to tidal marsh in the estuary. This tool was developed by USGS in cooperation with the Georgia Ports Authority to simulate "the water level and salinity of the rivers and tidal marshes in the vicinity of the Savannah National Wildlife Refuge" (Conrads, 2006). Details of the model development and application can be found in the USGS Scientific Investigations Report 2006–5187 titled "*Simulation of water levels and salinity in the rivers and tidal marshes in the vicinity of the Savannah National Wildlife Refuge, Coastal South Carolina and Georgia*."

The District specified a hydrograph for consideration in the model. The hydrograph was developed based on observed flow data recorded at USGS gage station 02198500 near Clyo, GA for the period from September 1, 2007 through October 27, 2008. Over this time period, releases from Thurmond Dam were targeted at 3,600 cfs. The actual daily average discharge for the

period was 3,672 cfs. Maximums and minimums for the period are 5,018 cfs and 1,688 cfs, respectively. Figure 14 shows a graphical depiction of the actual discharge from the dam (plotted in blue) and long term average discharges (plotted in burgundy).

Figure 14 – J. Strom Thurmond Dam Releases (Actual and Long Term Average)



The average monthly observed freshwater flow data coming into the estuary, determined from USGS gage data (Station 02198500) recorded near Clyo, GA for this period is shown in Table 7 on the following page. This dataset represents freshwater flows during target release from Thurmond Dam of 3,600 cfs. To predict the freshwater flows into the estuary under Alternative 1, 500 cfs was subtracted from the flow data observed under releases of 3,600 cfs. These modifications were made only during the period of October through February. At other times of the year flows near Clyo would be the same as the existing 3,600 cfs releases.

Table 7 – Freshwater Flows near Clyo, GA (USGS 02198500), Observed & Predicted

Year	Month	Average Flow (cfs) (JST = 3,600 cfs)	Predicted Flow (cfs) (JST = 3,100 cfs)*
2007	September	5207	5207
	October	4767	**4267**
	November	4574	**4074**
	December	5161	**4661**
2008	January	6827	**6327**
	February	7009	**6509**
	March	7610	7610
	April	6841	6841
	May	5352	5352
	June	4790	4790
	July	4340	4340
	August	4450	4450
	September	4530	4530
	October	4577	4577

** Flows shown in bold have been modified to predict flows during target releases of 3,100 cfs. All other flows remain unchanged.*

The M2M model was run using each of the datasets outlined in the previous section to determine impacts to the tidal marshes with implementation of the proposed action. Graphical results of the output generated are shown in Figures 15 and 16. The M2M Visualization Tool was used to develop the graphic. Yellow represents tidal marsh with pore water salinities greater than 0.5 ppt and the black and green areas represent tidal marsh pore water salinities less than 0.5 ppt. Other colors represent the river, ponds, uplands, and gaging stations.

Under both the NAA, and Alternative 1, the majority of the marshes have pore water salinities greater than 0.5 ppt. Front and Middle River would have almost no freshwater marshes adjacent to the waterway, while the upper portion of Back River and the area around McCoy Cut have the largest portion of freshwater marsh. Similar conditions would be expected with Alternative 2.

The changes between the figures can be difficult to see due to color schemes, lack of reference objects, and pixel size. Circled on Figure 16 in red are three areas of change that were noted as a result of the model run. The areas that would be impacted appear to be minor.

Figure 15 – Marsh Pore Water Salinity (JST = 3,600)

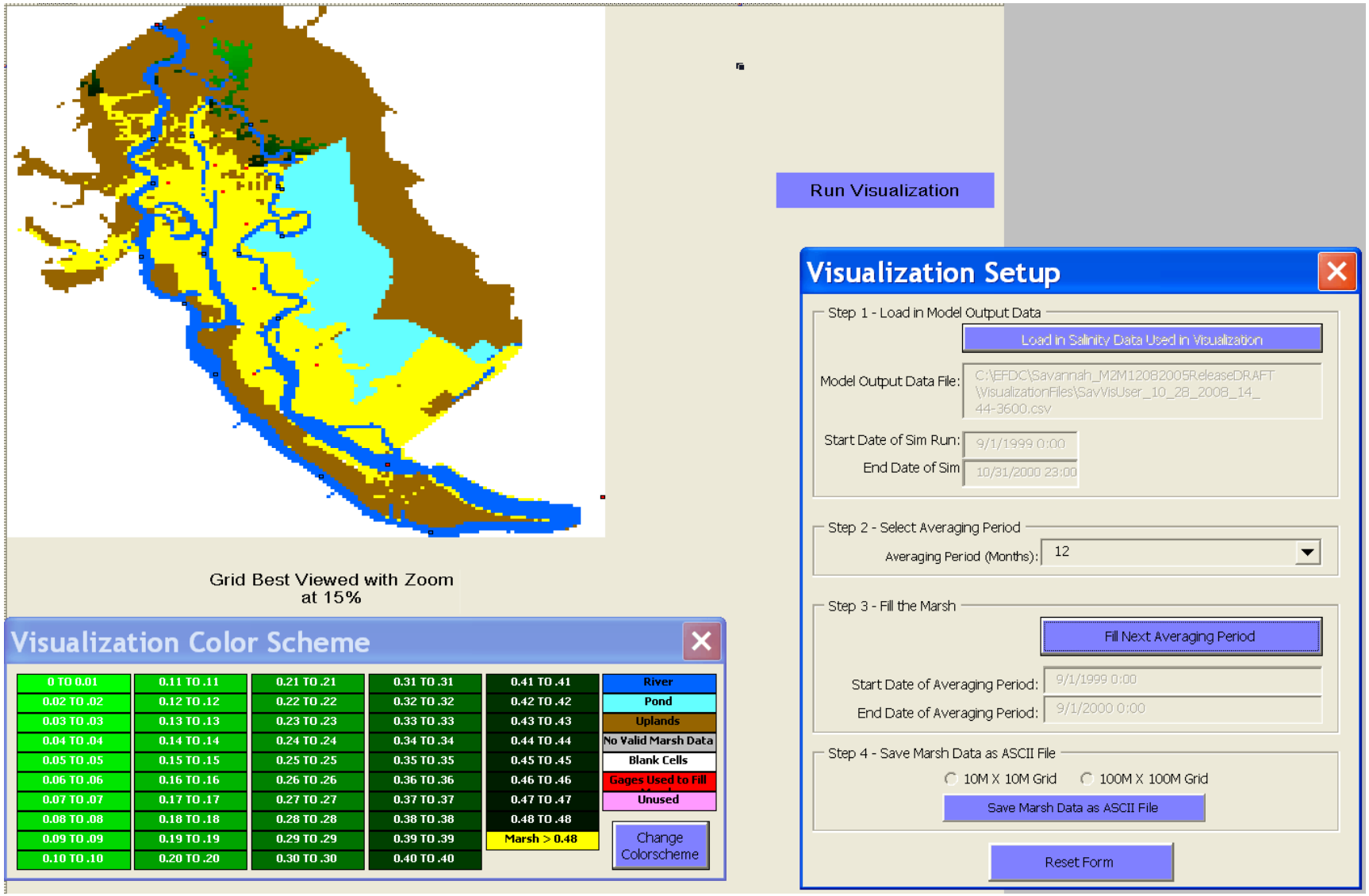
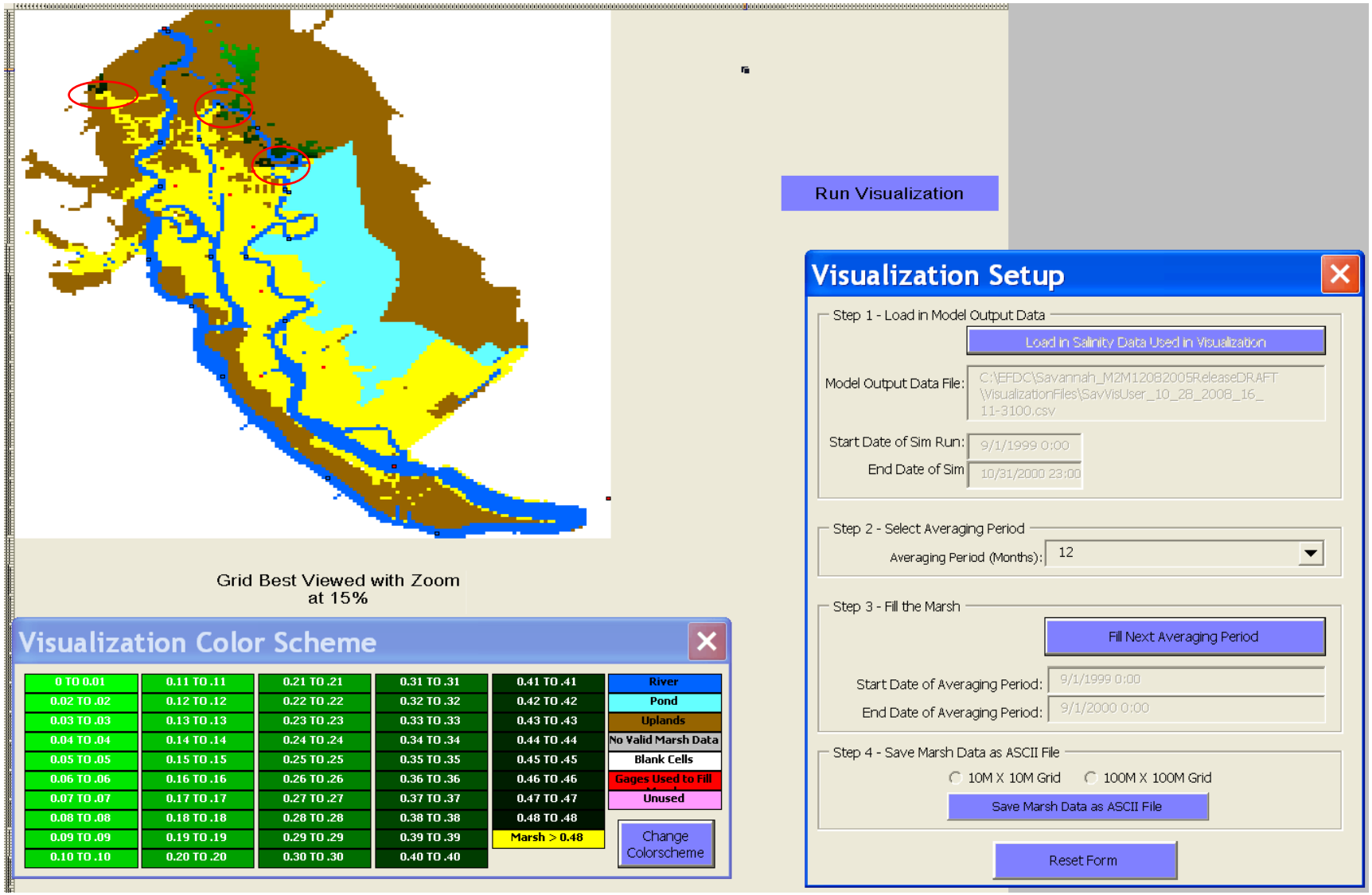


Figure 16 – Marsh Pore Water Salinity (Proposed Action JST = 3,100 October – February)



Summary

In summary, the District used the USGS M2M model to evaluate potential impacts to the tidal marshes adjacent to the estuary under implementation of the proposed flow reduction. The proposed action would limit average releases from J. Strom Thurmond Dam to 3,100 cfs during the fall/winter season (mid-September through mid-February). The M2M model indicates that the Recommended Alternative would have a very small impact on the upper portion of the study area. The existing 3,600 cfs releases from the dam have caused the fresh/salt marsh boundary to move further into the estuary, to the upper portion of the immediate study area. Under the No Action Alternative, most of the freshwater marshes already experience salinity > 0.5 ppt and very little marsh areas could be considered as fresh.

As with any predictive tool, the M2M model has limitations. It is an empirical model and "the reliability of the model is dependent on the quality of the data range of measured conditions used for training or calibrating the model" (Conrads, 2006). USGS used a large dataset to develop the model, covering 4 gaging networks over multiple year periods with flows ranging from 4,320 to 39,600 in the marsh and 4,320 to 52,600 in the river. Considering the quality of the dataset and its large range, the M2M model is considered an appropriate tool to effectively analyze this issue.

Based partially on the increase in salinity occurring over only the fall/winter months (outside the main growing season) and the low impact predicted by the USGS M2M model, Savannah District believes that the proposed flow reduction would not result in substantial or significant impacts to tidal freshwater marshes in the estuary. The District did not run a model scenario for Alternative 2 (discharge of 2,600 cfs), but the impacts to freshwater wetlands in the estuary are expected to be greater than with Alternative 1.

An adaptive management plan is in place to mitigate impacts should any significant increases in salinity are observed.

With Alternative 1, the freshwater / salt water interface would continue to be located downstream of the supply canal which feeds the Savannah NWR impoundments. Therefore, the alternative would not affect the Refuge or private lands' ability to provide fresh water to their managed impoundments.

4.7. THREATENED AND ENDANGERED SPECIES

The robust redhorse, shoals spider lily and the federally-listed shortnose sturgeon, manatee, and wood stork are the only Threatened or Endangered Species that may possibly be affected by small changes in flow.

Robust redhorse

Spider lily

Shortnose sturgeon

Effects of the No Action Alternative

Selection of the NAA and continuing with the existing Drought Contingency Plan would have no effects on threatened and endangered species above those that were previously approved. The NAA provides an average daily minimum flow of 3,600 cfs.

Effects of Recommended Alternative

As discussed earlier, this alternative provides an average daily minimum flow of 3,100 cfs. The decrease in predominant flows would occur during the cooler months of fall and winter, so potential impacts to seasonal fish spawning and fish passage, and impacts from deer grazing shoals spider lily should be minimal. The lower river levels could make shoals spider lily more susceptible to grazing from deer.

Spawning for the robust redhorse typically occurs from April through June. Flows of 3,600 cfs would be restored by that time under Alternative 1. Spawning by Shortnose sturgeon is believed to occur in February and March. Flows of 3,100 cfs during early February may slightly reduce the spawning habitat that is available. In the Congaree River in SC, sturgeon have been found to spawn downstream of gravel bars that are covered by 6 to 15 feet of water (Collins et al. 2003). The roughly 0.5 foot decrease in water depth resulting from the proposed flow reduction could reduce the amount of spawning habitat that shortnose sturgeon find acceptable. However, the small change in water depth compared to the range of depths that sturgeon have found to previously be acceptable indicate that this impact is likely to be minimal and immeasurable.

Anadromous species are unlikely to be within the shoals or upper river areas during the time of the proposed flow reduction; therefore, no adverse effects are anticipated to these species. Staging and foraging areas for these species may see slight alterations in salinities, but modeling indicates those effects would be small, so these highly motile species should easily adapt to these fluctuations.

Changes in river flow, salinity levels, and dissolved oxygen levels that are experienced by shortnose sturgeon and manatee are expected to be minimal and within the variation produced by the tides on a regular basis. The lower river levels could make fish more susceptible to predation from wood stork.

The Corps has determined that the proposed action may affect, but is not likely to adversely affect shortnose sturgeon, manatee, and wood stork. No effects to any other federally listed species were identified.

In a letter addressed to the Corps dated June 4, 2009, the USFWS stated that "based on the information stated so far, the Service does not expect adverse affects to these species (wood stork and manatee) for this new proposed action. However, the letter went on to state that they are concerned about the effects of a proposed flow reduction in the Augusta Shoals and the lower Savannah River. The Service is particularly concerned about effects to the:

- Federally endangered shortnose sturgeon;
- Federal species of concern robust redhorse;
- Striped bass;
- Georgia State Savannah Lilliput;
- Georgia and South Carolina endangered brother spike;
- Georgia threatened Altamaha arcmussel
- Tidal freshwater habitat provided for wetland-dependant migratory birds on the Savannah National Wildlife Refuge

Effects of Alternative 2

The effects on threatened or endangered species from Alternative 2 are expected to be the same as with Alternative 1. The fall/winter months are generally a time of reduced biological activity and the lower flows would have less effect on those species at that time of year.

4.8. ESSENTIAL FISH HABITAT

The proposed flow reductions would alter Essential Fish Habitats in the estuary. Although the reduced flow volume would change velocities, the extent of those changes would be too small to be measurable. The primary noticeable effect would be an increase in salinity at the freshwater/saltwater interface. Salinity would move further into the estuary with the proposed action. This change would be temporary and would disappear when flows are increased in late February. Savannah District believes that these temporary changes to Essential Fish Habitats do not warrant mitigation.

4.9. RECREATION

Recreation experiences diminish on Hartwell and J. Strom Thurmond Lakes as the lake levels drop. Public boat ramps and private docks become unusable as the lakes recedes. In addition, tree stumps and sand bars are exposed in the lakes. For some boaters, continued use of the lakes poses a serious threat to damaging boats and injuring persons. Swimming outside the Corps of Engineers' designated areas increases the potential for swimming fatalities. The expected ½ foot decrease in water depth in the river with Alternative 1 could result in minor adverse impacts to boaters and fishermen using the river.

4.9.1. Boat-Launching Ramps and Private Docks

The NAA will result in further impacts to boat ramps and private docks on the Corps reservoirs as the water continues to recede from the normal pool shoreline. The relative stabilizing effect in the reservoirs resulting from Alternative 1 would increase the duration of use for the currently functioning structures within the conservation pools. Boat ramps along the river could be

impacted by the expected ½ foot decrease in water depth with Alternative 1. This impact is minimized by the winter timing of the proposal, a season when there are fewer users of those facilities. Currently, the boat ramps in the three Corps reservoirs are fully functional and have adequate water levels.

4.9.2. Swimming

Swimming at beach areas usually occurs from May to September. Therefore, the proposed alternatives would occur outside the normal season for swimming activities. Further, Alternatives 1 and 2 are designed to maintain the conservation pools where swimming occurs, thus increasing the time they can be used by the public. The NAA would result in further long-term impacts to the conservation pools and, subsequently, swimming areas.

4.10. WATER SUPPLY

Water shortages during drought are the performance measure used to determine the impacts of the alternatives in comparison to the NAA.

Hartwell Lake

There are eight water supply users with intakes in Hartwell Lake. Two (Anderson County Joint Municipal Water System and the City of Lavonia) currently hold water storage contracts with the US Army Corps of Engineers, Savannah District. Although Hart County Water and Sewer Utility Authority does not have an intake, it does have a water storage contract. Hart County currently uses water from intakes owned by the Cities of Lavonia and Hartwell. The amount of water that they use from these two cities is charged against their water storage contract with the Corps of Engineers. The other six water supply users with intakes have riparian rights (City of Hartwell; Clemson University Musser Fruit Farm; Clemson University; Clemson Golf Course; Point West, Inc. formerly known as J. P. Stevens; and Milliken Company). Clemson University's Musser Fruit Farm intake becomes inoperable at 653 feet msl. Irrigation occurs between the months of June and August. When the intake is inoperable, they use water from the City of Seneca, but only if it is absolutely necessary because of the increased cost. The recommended alternative will increase the amount of water remaining in the conservation pool, resulting in positive effects to the water users in Harwell Lake by increasing the number of days they can withdraw water. The NAA would reduce the water supply available to users of this resource.

Richard B. Russell Lake

There are 6 water supply intakes on RBR Lake. Two (City of Elberton and Santee Cooper) currently hold water storage contracts in RBR Lake with the US Army Corps of Engineers, Savannah District. Three have riparian rights (RBR State Park Golf Course, Mohawk Industries, and Calhoun Falls). One, the City of Abbeville, is in relation to mitigation for RBR construction. The highest intake elevation is 468.8 feet msl. The recommended alternative would increase the amount of water remaining in the conservation pool, resulting in positive effects to the water users in Harwell Lake by increasing the number of days they can withdraw water. The NAA would reduce the water supply available to users of this resource.

J. Strom Thurmond Lake

There are 8 water supply users with intakes on JST Lake. Seven (City of Lincolnton, City of Washington, City of McCormick, City of Thompson, Columbia County, Savannah Lakes POA Monticello Golf Course and Savannah Lakes POA Tara Golf Course) currently hold water storage contracts with the US Army Corps of Engineers, Savannah District. Hickory Knob State Park Golf Course has riparian rights. The City of Lincolnton has three intakes, one each at 321, 314 and 307 feet msl. If the highest intake at 321 feet msl is exposed, then the other two intakes can meet the water needs so that there are no shortages during a drought. This condition is the same for the City of Thompson and Columbia County that have three intakes one each at 320, 312 and 304. The golf courses have intake elevations at 324 feet msl. They experience water shortages with these intakes during drought periods. The recommended alternative will increase the amount of water remaining in the conservation pool, resulting in positive effects to the water users in Harwell Lake by increasing the number of days they can withdraw water. The NAA would reduce the water supply available to users of this resource.

Downstream of J. Strom Thurmond Lake

Water supply users downstream of the JST Lake include the Augusta/Richmond County (Canal and Shoals) and users with intakes in the NSBL&D pool including North Augusta, Mason's Sod, Kimberly Clark, Urquhart Station, PCS Nitrogen, DSM Chemical and General Chemical. Users below NSBL&D include International Paper, the Beaufort-Jasper County Water Supply Authority, Plant Vogtle, the City of Savannah M&I Plant, the Savannah National Wildlife Refuge and many other cities and municipalities. The NAA would not result in any immediate changes for the current water users downstream of the JST Lake. Some users have experienced difficulties using their intakes under the flows associated with discharges of 3,600 cfs.

Water users along the Augusta Canal expressed concern about the recommended alternative. Diversions into the Augusta Canal are managed by the City of Augusta. The City operates three controllable gates to control flow to the Canal. Water in the Canal is used by four entities, as described in the following paragraphs.

Based on current permit information on the City of Augusta intake, the City is allowed to withdraw no more than 45 MGD (about 70 cfs). The City uses that water to operate four turbines for water supply operations. These turbines provide the mechanical energy to drive pumps that lift water from the river for water supply purposes. The City usually uses two of its four turbines units (Units 1 and 4), requiring a flow of 1,364 cfs. This amount is passed through the turbines and returned entirely to the main stem Savannah River (about two thirds of the length of the shoals).

There are three mills on the Augusta Canal located downstream of the City's intake. They are Sibley, King, and Enterprise. All these mills have turbines that are driven by water in the Canal. All return the water used back to the main stem Savannah River downstream of the Shoals. Sibley Mill needs a flow of 1,024 cfs; King Mill needs approximately 880 cfs; and Enterprise Mill needs a flow of approximately 560 cfs. The King Mill is the only operating manufacturing facility. The Sibley Mill has closed and the hydropower units have been operated in the past to generate electrical power which is sold for income. The Enterprise Mill has been converted to commercial and residential use; houses the Interpretative Center for the Augusta Canal National Heritage Area, and uses its allocation of water to generate electrical power for its tenants.

At the current level of Thurmond discharges (3,600 cfs) during Level 3 drought conditions, if there is no incremental flow between the dam and the Canal inlet, 3,600 cfs would flow to the Augusta Diversion Dam. USGS data indicates that in 2008 when discharges from Thurmond were at 3,600 cfs, the City maintained the canal gates at levels that resulted in an average of 3,150 cfs passing down the Canal and 450 cfs passing over the Shoals. After the City's turbines (1,363 cfs), there was roughly 1,787 cfs remaining in the Canal for the mills.

Under the recommended alternative, Thurmond releases would be reduced from 3,600 to 3,100 cfs from mid-September through mid-February. The City indicates that they would likely continue to divert the same amount of water into the Augusta Canal. Therefore, the proposed action is not expected to further affect water supply users on the Canal.

Some water supply users downstream of the NSBL&D indicate they experience difficulties with discharges of 3,600 cfs. However, no users reported major problems when the discharges were reduced to 3,100 cfs from November 2008 to February 2009. All water supply users downstream of the NSBL&D may need to modify their intakes if the drought continues and Level 4 drought conditions are reached. The extent of the environmental and economic impacts resulting from those future modifications is unknown. In general, the owners have yet to determine what actions they would need to take if river flows declined below 3,100 cfs. Some owners submitted comments on Savannah District's 2008 EA. They indicated they would monitor conditions at their individual intakes and seek to implement measures that would allow them to continue to withdraw their allotted amount from the river. That appears to have occurred.

4.11. COASTAL ZONE CONSISTENCY

The proposed reduction of discharges from J. Strom Thurmond Lake would alter flows down the river to the estuary and the coastal zone. The flow reduction would affect salinity and dissolved oxygen levels in the estuary. It could also affect chloride levels at the City of Savannah's municipal and industrial water intake on Abercorn Creek. These potential changes were identified and discussed in Section 4.2 (Water Quality). The potential effects on freshwater vegetation in the estuary were identified and discussed in Section 4.5 (Biotic Communities - Estuary). The potential effects on endangered species were identified and discussed in Section 4.6 (Threatened and Endangered Species).

Recognizing the expected impacts identified and described in other sections of this document, Savannah District believes that the proposed temporary flow reduction is consistent to the maximum extent practicable with the enforceable provisions of both the Georgia and South Carolina Coastal Management Plans.

4.12. HYDROPOWER

A 500 cfs flow reduction from the three Corps dams would result in 13,000 MegaWatt Hours of additional shortage in meeting the contract hydropower generation energy requirement. That additional shortage is approximately 0.1% of the contractual energy requirement for the seasonal flow reduction period.

If sufficient water is available in the Mobile-managed basins, this power could possibly be generated by additional run time of hydropower units on those rivers. If the drought persists, SEPA may have to purchase the additional power on the spot market to meet the additional contract requirements. That would increase SEPA's operating costs. The extent of that increase is not known. No immediate changes to hydropower are expected with the proposed alternative.

4.13. CULTURAL RESOURCES

The Augusta Canal Authority indicates that flows <3,000 cfs would negatively affect the use of the Augusta Canal, a National Historic Landmark and a National Heritage Area, for recreational purposes, as well as operation of the Petersburg Tour Boats.

Savannah District provided the Draft Environmental Assessment to the Georgia and South Carolina State Historic Preservation Officers and eighteen Native American Tribes during the agency and public comment period.

Effects of the No Action Alternative
The NAA would have no additional adverse impacts to historic properties, as the existing SRBDCP of March 1989 would continue to be followed.

Effects of Recommended Alternative
Since the maximum pool levels at all lakes will remain the same and the minimum pool levels would be higher (reducing erosion of submerged archaeological resources), this alternative would produce no additional adverse impacts to historic properties in the lakes. The lower river flows are not expected to expose additional cultural resources, so no adverse effects are expected to historic properties in the river or estuary. Since flows are not expected to change in the Augusta Canal, no effects are anticipated to that resource.

Effects of Alternative 2
As with Alternative 1, this alternative is not expected to adversely impact archaeological resources in the three Corps reservoirs. If river flows are not supplemented by inflows downstream of Thurmond Dam, the 2,600 cfs discharge could negatively affect the use of the Augusta Canal, a National Historic Landmark and a National Heritage Area, for recreational purposes, as well as operation of the Petersburg Tour Boats.

4.14. ENVIRONMENTAL JUSTICE

Effects of the No Action Alternative

The NAA would have no adverse impacts on environmental justice as the existing SRBDCP of March 1989 would continue to be followed.

Effects of Recommended Alternative

This action would have effects along the entire length of the Savannah River Basin. The areas adjacent to the riverbanks and lakes do not support disproportionate concentrations of minority or low-income communities. Minority or low-income populations do not recreate on the river in disproportionate numbers. As a result, this alternative would not result in disproportionately high and adverse human health or environmental impacts on minority or low-income populations in the United States. It, therefore, complies with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations".

Effects of Alternative 2

Alternative 2 is not expected to result in disproportionately high and adverse human health or environmental impacts on minority or low-income populations in the United States, so it complies with Executive Order 12898.

4.15. PROTECTION OF CHILDREN

Effects of the No Action Alternative

The NAA would have no adverse impacts on the protection of children as the existing SRBDCP of March 1989 would continue to be followed.

Effects of Recommended Alternative

This action would have effects along the entire length of the Savannah River Basin. The areas adjacent to the riverbanks and lakes do not support disproportionate concentrations of children and children do not recreate on the river or lakes in disproportionate numbers. The proposed action would not result in a disproportionate risk or environmental impact to children that result from environmental health or safety risks within the meaning of Executive Order 13045. It therefore complies with Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks".

Effects of Alternative 2

Alternative 2 is not expected to result in a disproportionate risk or environmental impact to children that result from environmental health or safety risks within the meaning of Executive Order 13045, so it complies with Executive Order 13045.

4.16. CUMULATIVE EFFECTS

Council on Environmental Quality regulations (40 CFR 150.7) require an analysis of the cumulative impacts resulting from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these other actions. Cumulative impacts can result from individually minor, but collectively significant, actions. This cumulative impacts section of the EA addresses only the cumulative effects arising from considering the Proposed Action in combination with other ongoing or proposed actions in the Savannah River Basin.

The Savannah River does not function as it originally did, because of various changes. Several dams cross its flow, holding back high spring flows and raising low summer flows. Peaking operations at hydropower plants make the flows irregular during the course of day and week in some areas, rather than being primarily in response to rainfall events and seepage from adjacent wetlands. Numerous withdrawals of water occur, some for municipal use, some for industrial purposes, and others to aid adjacent recreation. The number of users of the river has increased dramatically. The ponded lakes that occur upstream of the dams provide sources for several types of recreation, and those sites are used heavily for those purposes. Fishermen use the free-flowing portions of the river, and their numbers have continued to increase with the overall growth in regional population.

If it were not for the multiple users of the river and lakes as they now exist, there would be little concern about the amount of water flowing in the river during a drought. But the goals and activities of many individuals, organizations, corporations, and government agencies are now affected by the amount of discharged from J. Strom Thurmond Lake to flow down to the ocean. Those users are expected to continue to conduct their activities on the lake and in the river in the future.

Although Savannah District is not aware of any specific plans to substantially increase the use of waters in the Savannah River Basin, we do expect some growth in both the number of users and the amount of water that is desired to be withdrawn from the lakes and river. The District is aware that Georgia Power would like additional water from the Savannah River for the proposed expansion of Plant Vogtle, near Waynesboro, Georgia. That proposed withdrawal may occur at some point in the future, but the present drought is expected to end before that plant could become operational. Therefore, that additional use would not occur within the timeframe that is under consideration in this EA.

The Savannah River is viewed by some located in other river basins as a ready source of clean water for their needs. If the regulating government agencies agree that additional inter-basin transfers can occur, stresses on existing uses along the entire length of the Savannah River basin would increase to some degree.

The proposed flow reduction would come on top of reductions that would be experienced by biological communities along the river and in the estuary as a result of the latest drought. Resources that are stressed by the Level 3 drought releases may be further stressed by the

proposed additional reduction in flow volume over the fall/winter months. These stresses would constitute a cumulative adverse impact of the proposed action. However, if no action is taken and the drought continues to the point that Level 4 conditions and subsequently outflow from Thurmond Lake equals its net inflow, these biological resources would likely experience these same, or greater, stresses. If operations shift to outflows less than 3,600 cfs during the summer months, particularly outflow equals inflow, the stresses on biological communities would be much greater than if they are experienced during the winter months.

In summary, flows in the Savannah River have been substantially modified over time, but the basin still presents a multitude of opportunities for the use and enjoyment of this valuable resource. The number of people desiring to use or benefit from this resource continues to increase. The uses vary seasonally, with lower demands placed on the aquatic ecosystem during the fall/winter months. If the latest drought intensifies or continues in duration, the stress on both the natural ecosystem and human uses of the resources increase. Long term adverse cumulative impacts would result primarily from increases in water usage and an accompanying loss of water from the river basin.

5.0 CONCLUSIONS

This Environmental Assessment considers the potential environmental impacts of the proposed action. The impacts listed for most of the resources in the table below are similar for the NAA and Recommended Alternative. However, the NAA has adverse impacts on conservation pool levels, water usage, recreation, boat-launching ramps and docks at Hartwell and J. Strom Thurmond Lakes, while the Recommended Alternative has positive impacts on these resources. The Recommended Alternative would have minor effects on downstream biological resources. These minor impacts would primarily occur to mussels in cut-off bends and species in the Augusta Shoals area. Temporary adverse impacts would also occur to freshwater wetlands in the estuary. However, failure to implement the Recommended Alternative could result in earlier implementation of Level 4 of the drought contingency plan. Implementation of Level 4 would likely result similar or greater impacts to these biological resources. The Recommended Alternative would provide for a temporary deviation of the Savannah River Basin Drought Contingency Plan of March 1989, as updated in 2006. The conclusion of this Environmental Assessment is that the proposed action – reducing the minimum daily average release at J. Strom Thurmond Dam from 3,600 to 3,100 cubic feet per second while in drought Level 3 during the fall/winter – would result in no significant environmental impacts.

Based on a review of the information contained in this EA, the District determined that a temporary modification to the Savannah River Basin Drought Contingency Plan of March 1989, would not constitute a major Federal action significantly affecting the quality of the human environment within the meaning of Section 102(2)(c) of NEPA. Accordingly, preparation of an Environmental Impact Statement is not required.

Table 8: Impact Summary

RESOURCE	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2
Water Quality	No immediate adverse impact	Modeling by EPD suggests no adverse impacts would occur, but an adaptive management plan has been developed to address any issues, should they occur.	Modeling suggests no adverse impacts would occur, but an adaptive management plan has been developed to address any issues, should they occur.
Biotic Communities-Lakes, Largemouth Bass Spawning, by observing the Pool Elevation Tables	Acceptable impacts, because the existing Drought Contingency Plan would continue to be followed	The objective of this alternative is to maintain the current level of the conservation pool and improve refill capability. Therefore no significant adverse impacts were identified.	The objective of this alternative is to maintain the current level of the conservation pool and improve refill capability. Therefore no significant adverse impacts were identified.
Biotic Communities-Lakes, Aquatic Plants	No adverse impact	No adverse impact	No adverse impact
Biotic Communities-Shoals	Acceptable impacts for the short-term. Could have impacts if drought persists.	Will reduce flows in the Shoals area. This could affect fish movement and mussels. Impacts would be attenuated due to the flow reduction occurring in the cooler months outside of spawning season.	Will reduce flows in the Shoals area. This could affect fish movement and mussels. Impacts would be attenuated due to the flow reduction occurring in the cooler months outside of spawning season.
Biotic Communities-Floodplain (Lower flows recommended here)	Acceptable impacts for the short-term. Could have impacts if the drought persists.	No impact to wetlands identified. Some sloughs and cutoff bends could be impacted by reduced flows. Mussels and other organisms in these areas could see adverse effects. Given the overall project area, these localized occurrences would be minimal.	No impacts to wetlands were identified. Some sloughs and cutoff bends could be impacted by reduced flows. Mussels and other organisms in these areas could see adverse effects. Given the overall project area, these localized occurrences would be minimal.
Biotic Communities-Estuary	Acceptable impacts for the short-term. Could have impacts if the drought persists.	Modeling suggests that salinity increases of less than 1ppt would occur at the I-95 Bridge. This could adversely affect freshwater wetlands. An adaptive management plan is in place should any significant increases in salinity be observed.	Additional salinity increases would occur at the I-95 Bridge. This could adversely affect freshwater wetlands. An adaptive management plan is in place should any significant increases in salinity be observed.

RESOURCE	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2
Threatened and Endangered Species	Acceptable impacts	May affect, but not likely to adversely affect listed T&E species (shortnose sturgeon, manatee, and wood stork).	May affect, but not likely to adversely affect listed T&E species (shortnose sturgeon, manatee, and wood stork).
Recreation, Boat-Launching Ramps and Docks	No immediate adverse impacts	No Adverse Impacts	No Adverse Impacts
Recreation, Swimming	No immediate adverse impacts	No Adverse Impacts	No Adverse Impacts
Water Supply	Will impact water users on impoundments as this alternative will negatively impact the long-term stability of the conservation pools.	Some users in the Augusta Canal may experience a slight reduction in available water during the deviation period, but the effects would be minimal and would be outweighed by the benefits to users within the impoundments and long-term low flow augmentation capability for downstream areas if the drought continues or worsens.	The elevation of the river downstream of Thurmond Dam would decrease. This could adversely affect operation of some water intakes. Benefits would occur to users within the impoundments and the long-term low flow augmentation capability for downstream areas if the drought continues or worsens.
Hydropower	No effect immediately. Persistent drought may induce prolonged shortages.	Total of 13,000 MegaWatt Hours of additional shortage or 0.1 % of contract requirement.	Additional shortage of contract hydropower requirement.
Biological Resources	No immediate effect. Long-term impacts would occur if the drought persists.	No significant impacts identified. An adaptive management plan is in place should any significant impacts be observed.	No significant long term impacts identified. An adaptive management plan is in place should any significant impacts be observed.
Cultural Resources	No additional adverse impacts.	No additional adverse impacts.	Some adverse impacts could result to resources in the Augusta Canal.
Environmental Justice	No adverse impact.	No disproportionately high and adverse impacts.	No disproportionately high and adverse impacts.
Protection of Children	No adverse impact.	No disproportionately high and adverse impacts.	No disproportionately high and adverse impacts.

7.0 RELATIONSHIP OF PROJECT TO FEDERAL AND STATE AUTHORITIES

The following table summarizes the status of the compliance of the proposed action (Recommended Alternative) with applicable Federal and State environmental laws.

Table 9: Summary of Requirements (See Note below)

FEDERAL POLICIES	PROPOSED ACTION
Anadromous Fish Conservation Act, 16 U.S.C. 757, et. seq.	In compliance.
Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et. seq.	In compliance. District's determination of no effect was coordinated with the SHPO in both GA and SC.
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et. seq.	In compliance. Draft EA is being reviewed by EPA.
Clean Water Act, as amended (Federal Water Pollution Control Act) 33 U.S.C. 1251, et. seq.	In compliance. Draft EA is being reviewed by GA, SC, and EPA.
Coastal Zone Management Act, as amended, 16 U.S.C. 1451 et seq.	In compliance. The District's CZM Consistency Determination is being reviewed by both GA and SC.
Endangered Species Act, as amended, 16 U.S.C. 1531, et. seq.	In compliance. The USFWS and NOAA Fisheries are reviewing the District's determination that the project may affect, but no likely to adversely affect shortnose sturgeon, manatee, and wood stork.
Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12, et. seq.	In compliance.
Fish and Wildlife Coordination Act, as amended 16 U.S.C. 661, et. seq.,	In compliance. Draft EA is being coordinated with the GA DNR, SC DNR, USFWS, and NMFS.
Fishery Conservation and Management Act of 1976, Public Law 99-659.	In compliance.
Magnuson-Stevens Act, as amended, Public Law 104-297.	In compliance. Draft EA with its EFH assessment is being coordinated with NOAA Fisheries.
National Historic Preservation Act of 1966, as amended, 16 U. S. C. 470f, et seq.	In compliance. Both GA and SC SHPO are reviewing the District's determination of no effect.
Protection of Wetlands, E.O. 11990	In compliance.
Environmental Justice, E.O. 12898	In compliance.
Protection of Children, E. O. 13045	In compliance.
Invasive Species, E. O. 13112	In compliance.

Note: This District will update this table after comments are received on the Draft EA.

8.0 COORDINATION

Savannah District has coordinated with Federal and state officials from 2006 through 2009 as the drought has continued in the Savannah River Basin. Some of the coordination has included the participation of other stakeholders. The meetings increased the understanding of the drought situation, monitoring which various stakeholders are presently performing, actions that could be taken to better manage the water resources at this time, and identified the resources which could be affected by various alternatives.

A Public Notice of Availability was issued notifying the public of the availability of the Draft EA. This Notice served as the formal advertisement of the proposed temporary deviation to the 1989 Savannah River Drought Contingency Plan, as amended.

A Notice of Availability was published in the following local newspapers to inform the public of the availability of the Draft EA and invite their comments:

- Savannah Morning News
- Augusta Chronicle
- Greenville News
- Anderson Independent

The following natural resource agencies were provided a copy of the Draft EA:

- Georgia Department of Natural Resources, Environmental Protection Division
- Georgia Department of Natural Resources, Wildlife Resources Division
- Georgia Department of Natural Resources, Coastal Resources Division
- Georgia Deputy State Historic Preservation Officer
- Georgia State Clearinghouse

- South Carolina Department of Natural Resources
- South Carolina Department of Health and Environmental Control
- South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management
- South Carolina State Budget and Control Board
- South Carolina Department of Archives and History

- US Environmental Protection Agency, Region 4
- US Fish and Wildlife Service, Field Supervisor
- US Department of Interior, Regional Environmental Officer
- National Marine Fisheries Service, Habitat Protection Division
- National Marine Fisheries Service, Assistant Regional Administrator

A copy of the Draft EA was sent to eighteen representatives of Native American groups that previously lived in the project area to inform them of the proposed action and invite their comments.

The District will accept comments on the proposal by mail, email, and over the telephone. As a result of the various avenues the District used to notify the public of the proposed action, it expects to receive numerous comments. Those would be grouped in the following categories:

Means of Communication	Support the Proposed Action	Do Not Support the Proposed Action	No Direct Comment on the Proposed Action
Telephone			
Mail			
Email			

Note: This District will update this chart after the public has commented on the draft EA.

In their letter dated October 28, 2008 on the 2008 flow reduction, EPA Region 4 expressed concern about potential impacts to downstream biological resources in cutoff bends, the Augusta Shoals, and to freshwater wetlands in the estuary. They also requested that monitoring be performed of the impacts to those resources. EPA requested the Corps evaluate the effect of the proposal of implementation of TMDLs that they had issued for the river for dissolved oxygen, mercury, lead, and fecal coliform. The District has included the results of those evaluations in Section 4.1.3 of this EA.

The Georgia Department of Natural Resources, Coastal Resources Division concurred in the District's determination that the 2008 flow reduction was consistent with the State's Coastal Management Program to the maximum extent practicable.

The South Carolina Department of Department of Health and Environmental Control supported the findings in the 2008 EA. The SC DHEC Office of Ocean and Coastal Resource Management stated that the comments provided by SC DHEC represented their agency comments, including any on consistency with the State's Coastal Management Program.

The Georgia Department of Natural Resources, Environmental Protection Division stated that they thought the Corps' 2008 EA properly presented information supporting a Finding of No Significant Impacts and reiterated their request for the temporary deviation to 3,100 cfs.

The South Carolina Department of Natural Resources concurred with the Corps' 2008 findings and recommendation, and urged implementation of the proposed action beginning November 1, 2008.

NOAA Fisheries stated they concurred with the Corps' 2008 determination that the 2008 fall/winter flow reduction was not likely to adversely affect Federally listed endangered or threatened species under their jurisdiction – shortnose sturgeon if we restored flows by February 1. The Corps agreed to that request.

In correspondence on June 22, 2009, the Georgia Department of Natural Resources, Environmental Protection Division provided the results of their review of the monitoring that was performed during the 2008 fall/winter flow reduction. They identified the organizations that were responsible for the monitoring, the water quality parameters being evaluated, and the targets for those parameters. They stated that "*No problems with(sic) targets were ever reported."* They provided plots of daily river flow, specific conductance, and dissolved oxygen and concluded "*All three of these plots indicate that there was no problem with water quality in the Savannah River system due to the reduced releases from Thurmond. In fact, the period that the releases are reduced could be extended using an adaptive management approach. There could be reduced releases from Thurmond Dam during period when the dissolved oxygen concentration in the Savannah Harbor is greater than 5.0 mg/L and the gage at the Corps Dock could be used to determine this period. Thurmond Dam releases could be increased during fish spawning (i.e., February – March for shortnosed sturgeon, May robust redhorse), but reduced once fishing spawning is over if the dissolved oxygen levels in the Harbor are sufficient (i.e., >5.0 mg/L).*"

In their letter dated June 4, 2009, the US Fish and Wildlife Service concurred in the District's determination that the proposed action is not likely to adversely affect Federally-listed endangered or threatened species under their jurisdiction – wood stork and manatee. The service expressed concern about the effects of a proposed flow reduction in the Augusta Shoals and the lower Savannah River. They are particularly concerned about the effects on the shortnose sturgeon, robust redhorse, striped bass, Savannah Lilliput, brother spike, Altarnaha archmussel, shoals spiderlily, and the tidal freshwater habitat provided for wetland-dependant migratory birds on the Savannah National Wildlife Refuge. The Service recommended that during droughts the flowing river flows should occur:

Recommended Dry Year River Flows (in cfs)

Month	Augusta Shoals	Floodplain	Estuary
September	2,000	5,500	6,000
October	2,000	5,500	6,000
November	2,700	6,200	6,200
December	2,700	6,200	6,200
January	4,000	7,500	8,000
February	4,000	7,500	8,000
March	4,000 + pulse of 12,500-14,500	7,500 + pulse of 16,000-18,000	8,000+ pulse of 16,000-18,000

The Fish and Wildlife Service also recommended that additional monitoring occur to identify the biological effects of various river flows. The Service concluded by stating that "*In light of these concerns, and without additional our critical research needs being addressed, we do not recommend a flow reduction to 3,100 cfs.*"

In their letter dated June 24, 2009, NOAA Fisheries summarized their concerns and recommended studies associated with reduced discharges from Thurmond Dam. NOAA stated

that fish species under its stewardship "are known to spawn in the early spring (February through March); therefore, any flow regime must be thoroughly analyzed to assess its effects on both spawning migration and habitat, particularly for the shortnose sturgeon pursuant to section 7 of the ESA." They identified the shortnose sturgeon spawning period between February 1 and May as being a constraint. They also provided the following recommendations:

a. Corps revisit the guide curve including the conservation depth and full pool levels.
b. Corps revisit the potential to provide fish passage appropriate for sturgeon around NSBL&D.
c. Assessment of the habitat at Augusta Shoals as potential spawning habitat for Shortnose sturgeon.
d. Analysis of hydrologic records (pre-dam) to identify periods of high flow and natural seasonal variability. Correlation of flow regimes to spawning periodicity of anadromous fish inhabiting the Savannah River and required cues; ensure appropriate flow/species.
e. Assessment of habitat suitability/availability under different flow regimes.
f. Assessment of flow regimes on sediment distribution and re-suspension, especially relative to Shortnose sturgeon spawning habitat.
g. A technical (site-specific) Instream Flow Assessment to provide an adequate basis for evaluation of potential effects on sturgeon and other anadromous species spawning habitats.

The Corps has begun some of the studies that NOAA Fisheries recommended, particularly ones designed to identify the extent of suitable Shortnose sturgeon spawning habitat on gravel bars downstream of Augusta. Those studies have not yet been completed, so their results cannot be incorporated into this EA and used in its decision. When the results become available, the Corps will coordinate with NOAA Fisheries to identify whether those spawning areas are substantially adversely impacted by flow reductions and whether the proposed reduced discharge from Thurmond Dam could be extended without adversely impacting Shortnose sturgeon. NOAA Fisheries would need to provide separate approval for that action. If NOAA concurred in such a finding, further coordination with other natural resource agencies or the public would not be required to continue the flow reduction through February.

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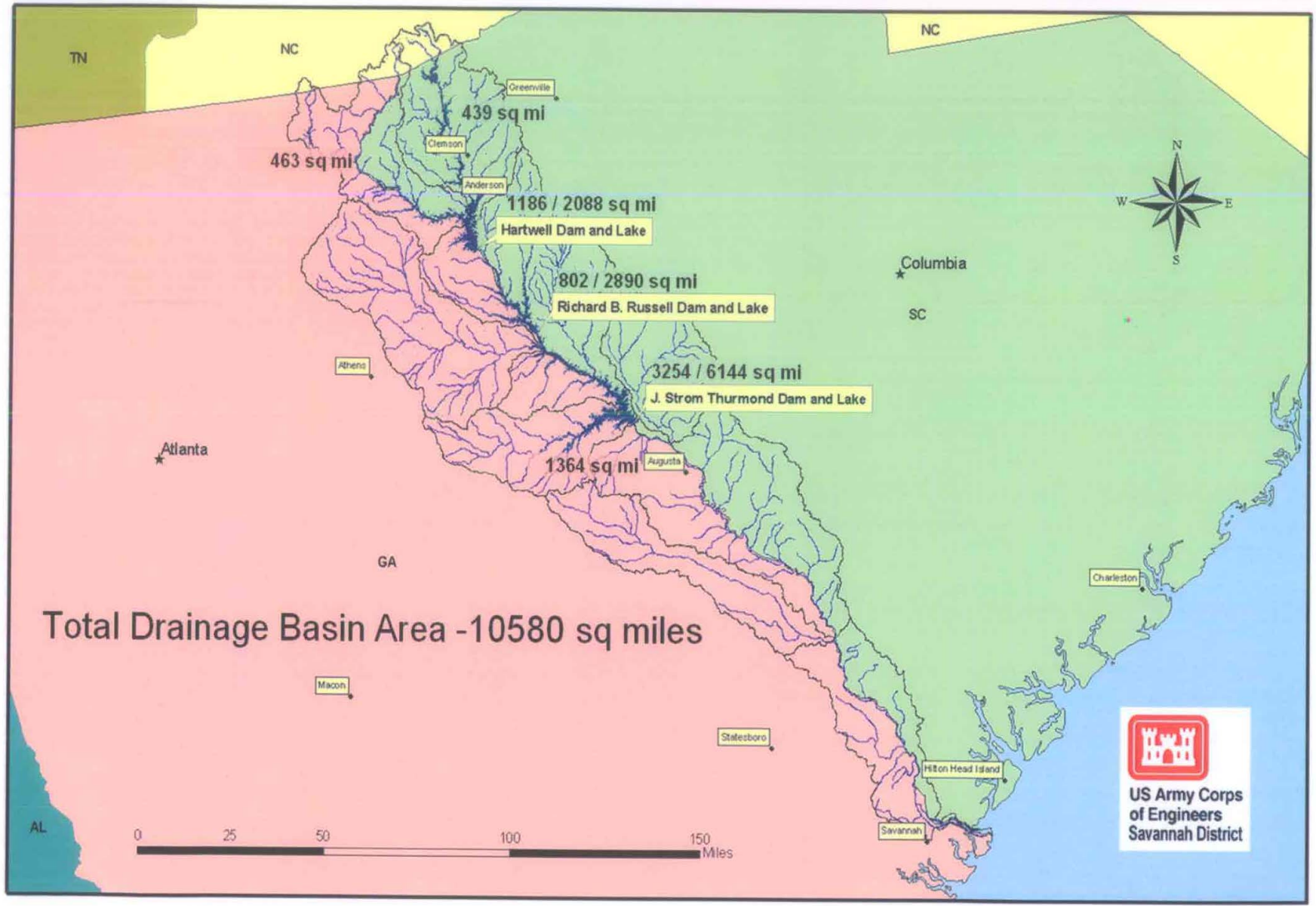
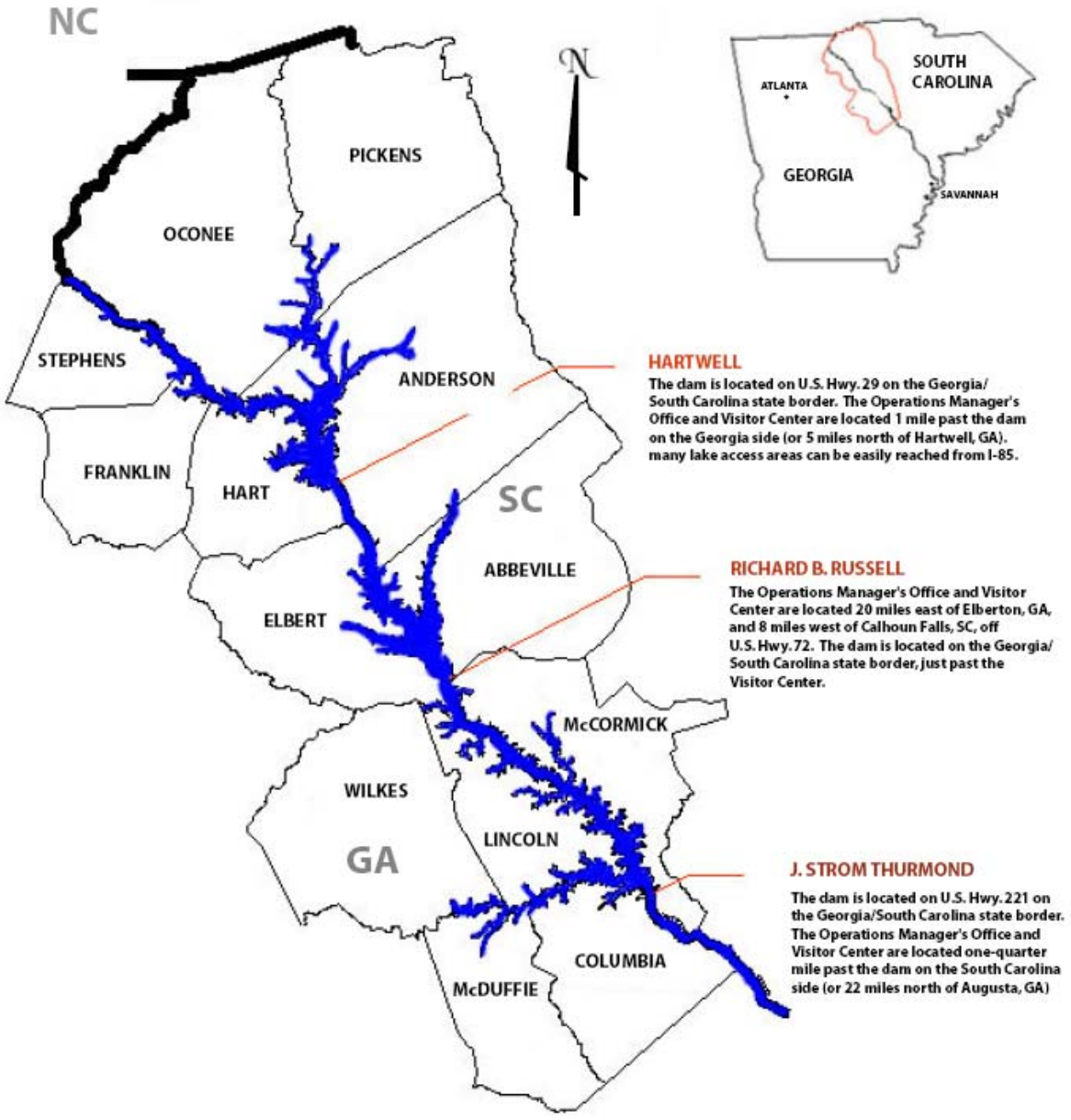
APPENDIX A

SAVANNAH RIVER BASIN MAPS


TN
NC
NC
Greenville
439 sq mi
463 sq mi
Clemson
Anderson
1186 / 2088 sq mi
Hartwell Dam and Lake
802 / 2890 sq mi
Richard B. Russell Dam and Lake
3254 / 6144 sq mi
J. Strom Thurmond Dam and Lake
1364 sq mi
Augusta
Columbia
SC
N
W
E
S
Athens
Atlanta
GA
Total Drainage Basin Area -10580 sq miles
Charleston
Macon
Statesboro
Hilton Head Island
Savannah
AL
0
25
50
100
150
Miles
US Army Corps
of Engineers
Savannah District



HARTWELL

The dam is located on U.S. Hwy. 29 on the Georgia/ South Carolina state border. The Operations Manager's Office and Visitor Center are located 1 mile past the dam on the Georgia side (or 5 miles north of Hartwell, GA). many lake access areas can be easily reached from I-85.

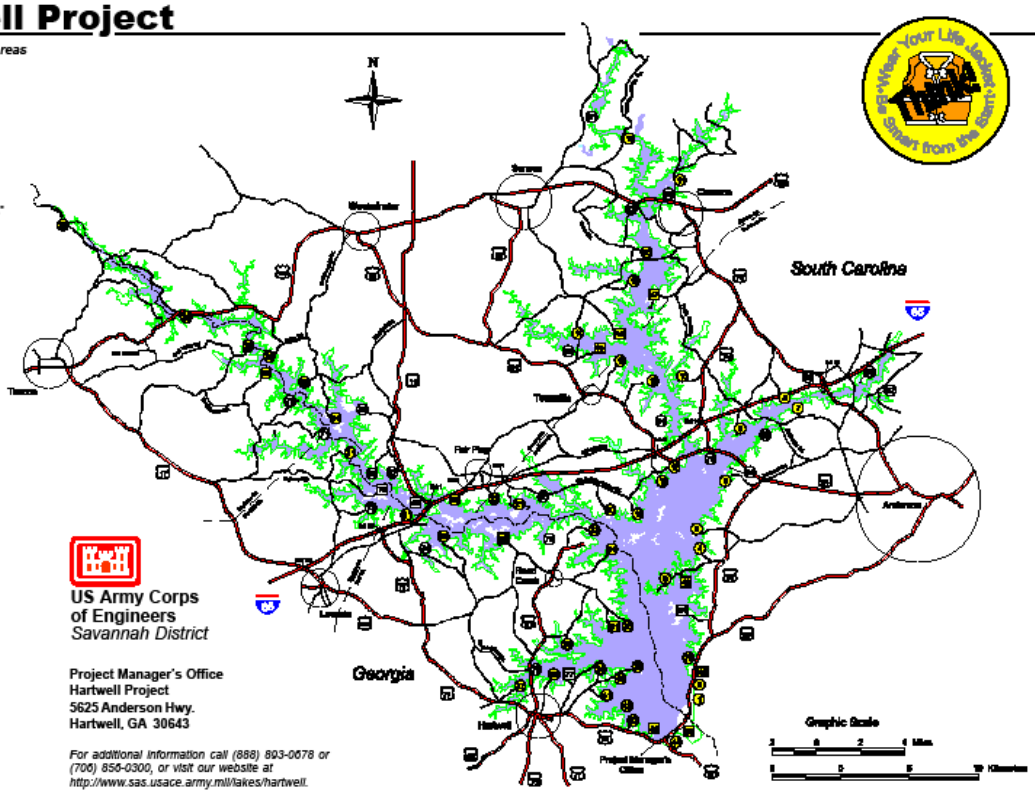
RICHARD B. RUSSELL

The Operations Manager's Office and Visitor Center are located 20 miles east of Elberton, GA, and 8 miles west of Calhoun Falls, SC, off U.S. Hwy. 72. The dam is located on the Georgia/ South Carolina state border, just past the Visitor Center.

J. STROM THURMOND

The dam is located on U.S. Hwy. 221 on the Georgia/South Carolina state border. The Operations Manager's Office and Visitor Center are located one-quarter mile past the dam on the South Carolina side (or 22 miles north of Augusta, GA)

Hartwell Project



Corps Recreation Areas

1 Hartwell Dam
2 Singing Pines
3 Jarrett*
4 Richland Creek
5 River Forks
6 Green Pond
7 Honea Path*
8 Denver
9 Asbury
10 Eighteen Mile Creek*
11 Twelve Mile
12 Lawrence Bridge
13 Martin Creek
14 Friendship
15 Townville
16 Camp Creek
17 Broyles
18 Apple Island*
19 Double Springs
20 Weldon Island
21 Glenn Ferry
22 Durham*
23 Fair Play
24 Choestoea
25 Mullins Ford
26 Tabor*
27 Walker Creek*
28 Stephens County
29 Spring Branch
30 Jenkins Ferry
31 Poplar Springs
32 Rock Springs
33 Mary Ann Branch
34 Crawfords Ferry
35 Carters Ferry*
36 New Prospect
37 Cleveland*
38 Gum Branch
39 Long Point
40 Duncan Branch*
41 Powderbag Creek*
42 Elrod Ferry
43 Hartwell Group
44 Big Oaks
47 Twin Lakes
53 Georgia River

US Army Corps of Engineers
Savannah District

Project Manager's Office
Hartwell Project
5625 Anderson Hwy.
Hartwell, GA 30643

For additional information call (888) 893-0678 or (706) 856-0300, or visit our website at http://www.sas.usace.army.mil/lakes/hartwell.

Corps Campgrounds

45 Crescent Group Can
46 Springfield
47 Twin Lakes
48 Oconee Point
49 Coneross
50 Paynes Creek
51 Milltown
52 Watsadler
53 Georgia River

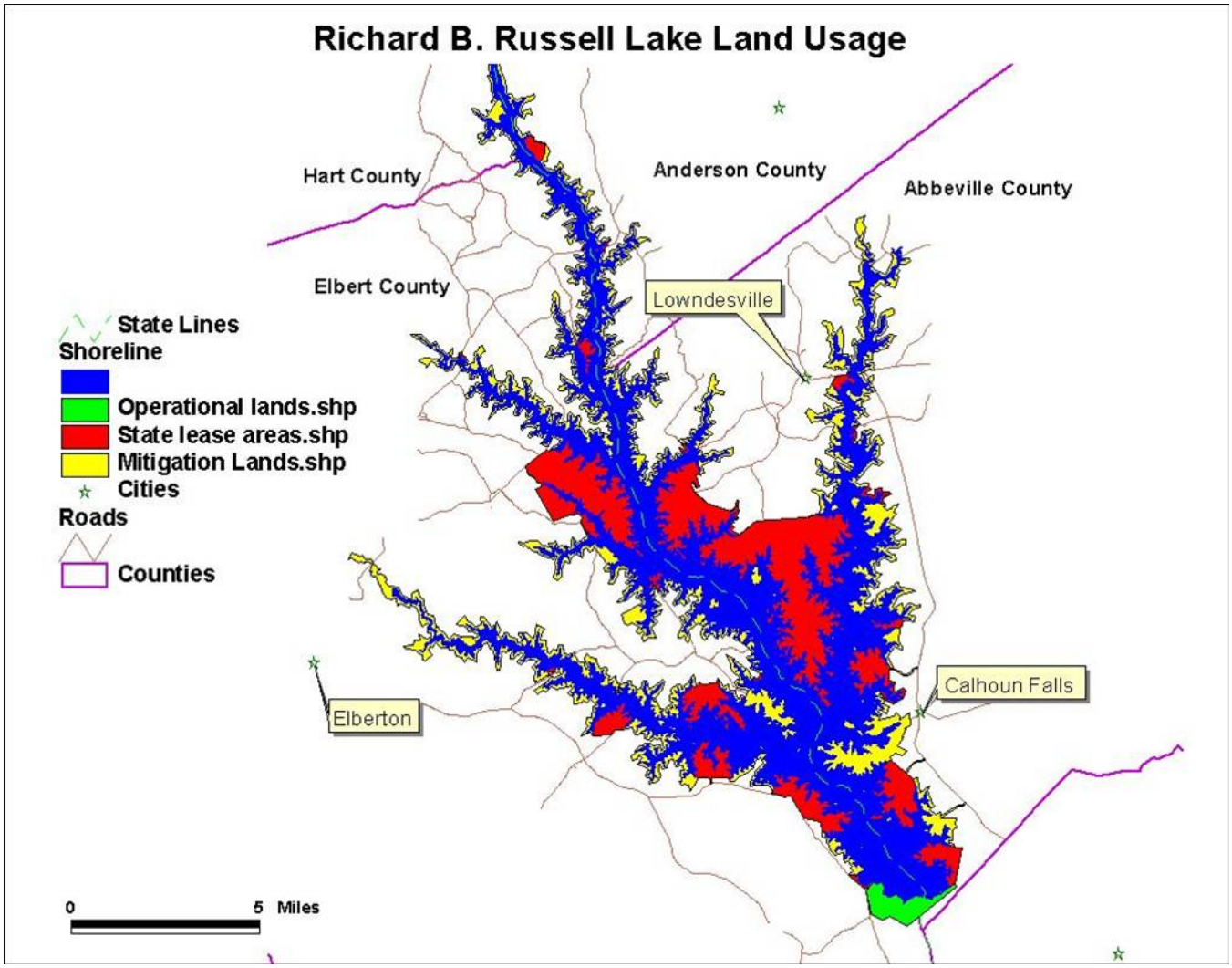
State & Municipal Recreation Areas

54 Sadlers Creek State
55 Jack's Landing*
56 White City*
57 Brown Road*
58 Darwin H. Wright
59 Hurricane Creek*
60 Clemson*
61 Holder's*
62 Seneca Creek*
63 Timberlake*
64 Hoyt-Tilley*
65 Cove Inlet*
66 Lake Hartwell State
67 Barton's Mill*
68 Port Bass*
69 South Union*
70 Bruce Creek*
71 Holcomb*
72 Tugaloo State Park
73 Franklin County*
74 Rocky Ford*
75 Reed Creek*
76 Bradberry*
77 Hart State Park

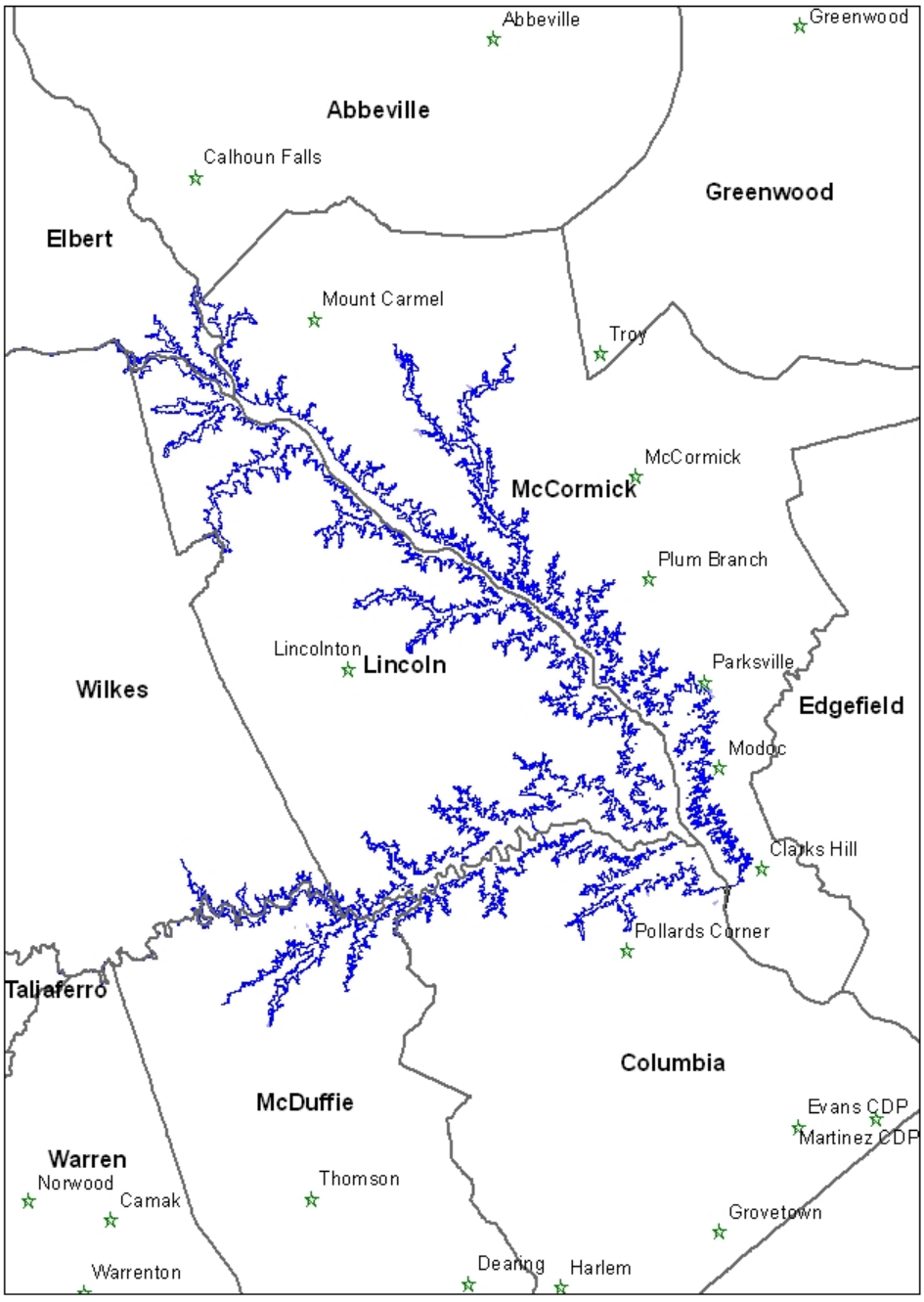
Commercial Marinas

78 Big Water
79 Portman
80 Seneca
81 Harbor Light
82 Hartwell

* Ramp access only


Richard B. Russell Lake Land Usage
Hart County
Anderson County
Abbeville County
Elbert County
Lowndesville
Calhoun Falls
Elberton
State Lines
Shoreline
Operational lands.shp
State lease areas.shp
Mitigation Lands.shp
Cities
Roads
Counties
0
5 Miles

J. STROM THURMOND RESERVOIR



APPENDIX B

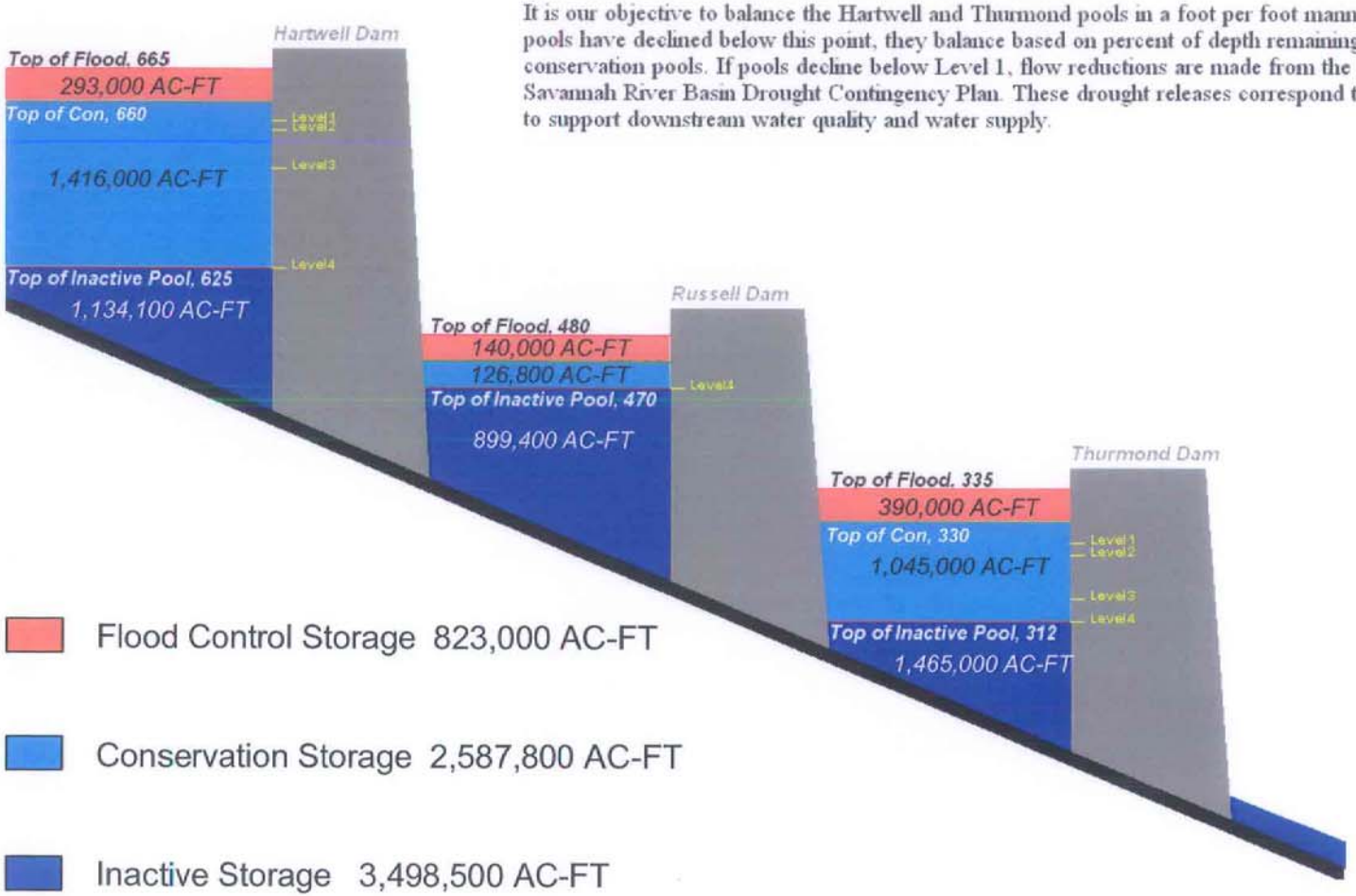
SAVANNAH RIVER SYSTEM
POOL SCHEMATIC

AND

LAKE LEVEL GRAPHS

Savannah River System
Pool Schematic

It is our objective to balance the Hartwell and Thurmond pools in a foot per foot manner for the top 15 feet. Once the pools have declined below this point, they balance based on percent of depth remaining in their respective conservation pools. If pools decline below Level 1, flow reductions are made from the system in accordance to the Savannah River Basin Drought Contingency Plan. These drought releases correspond to the minimum flows needed to support downstream water quality and water supply.



Flood Control Storage 823,000 AC-FT

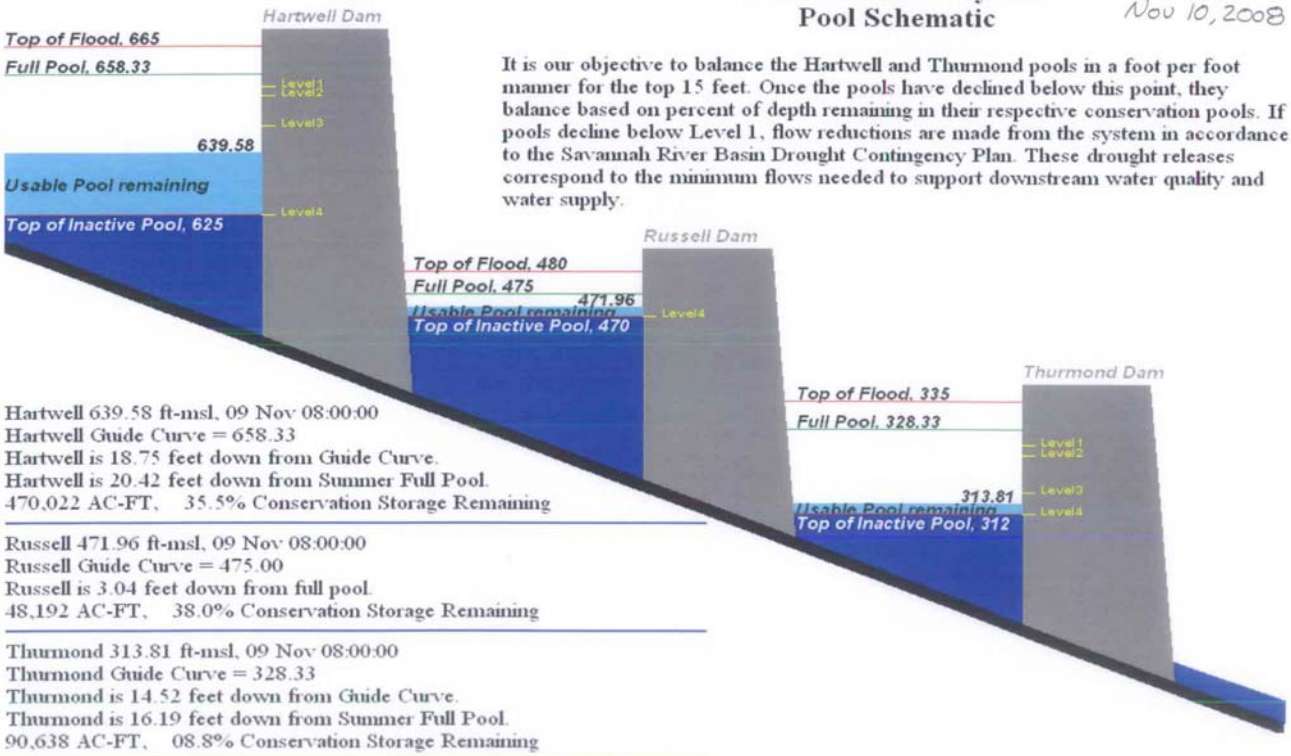
Conservation Storage 2,587,800 AC-FT

Inactive Storage 3,498,500 AC-FT

Savannah River System
Pool Schematic

Nov 10, 2008

It is our objective to balance the Hartwell and Thurmond pools in a foot per foot manner for the top 15 feet. Once the pools have declined below this point, they balance based on percent of depth remaining in their respective conservation pools. If pools decline below Level 1, flow reductions are made from the system in accordance to the Savannah River Basin Drought Contingency Plan. These drought releases correspond to the minimum flows needed to support downstream water quality and water supply.



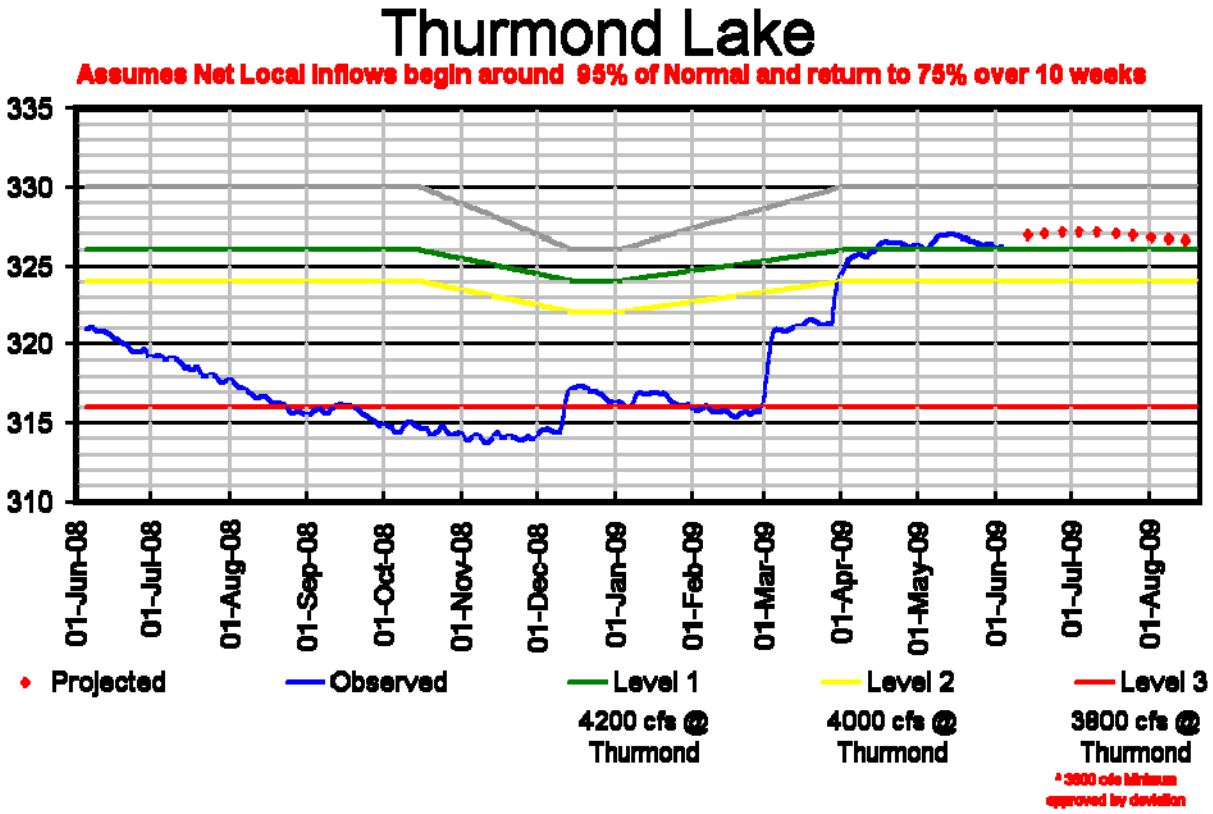
Hartwell 639.58 ft-msl, 09 Nov 08:00:00
Hartwell Guide Curve = 658.33
Hartwell is 18.75 feet down from Guide Curve.
Hartwell is 20.42 feet down from Summer Full Pool.
470,022 AC-FT, 35.5% Conservation Storage Remaining

Russell 471.96 ft-msl, 09 Nov 08:00:00
Russell Guide Curve = 475.00
Russell is 3.04 feet down from full pool.
48,192 AC-FT, 38.0% Conservation Storage Remaining

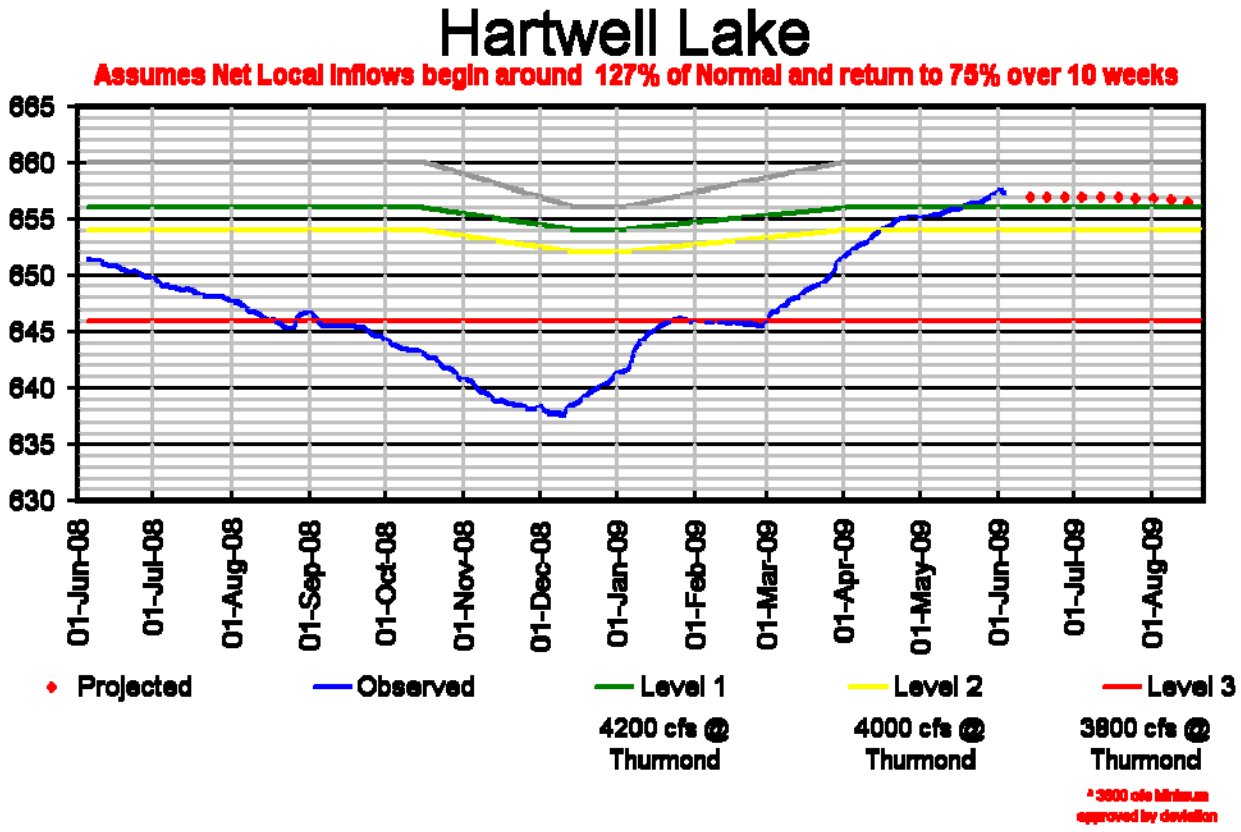
Thurmond 313.81 ft-msl, 09 Nov 08:00:00
Thurmond Guide Curve = 328.33
Thurmond is 14.52 feet down from Guide Curve.
Thurmond is 16.19 feet down from Summer Full Pool.
90,638 AC-FT, 08.8% Conservation Storage Remaining

608,852 AC-FT, 23% Total System Conservation Storage Remaining
3,498,480 AC-FT, 100% Total System Inactive Storage Remaining
4,107,332 AC-FT, 67% Total System Storage Remaining

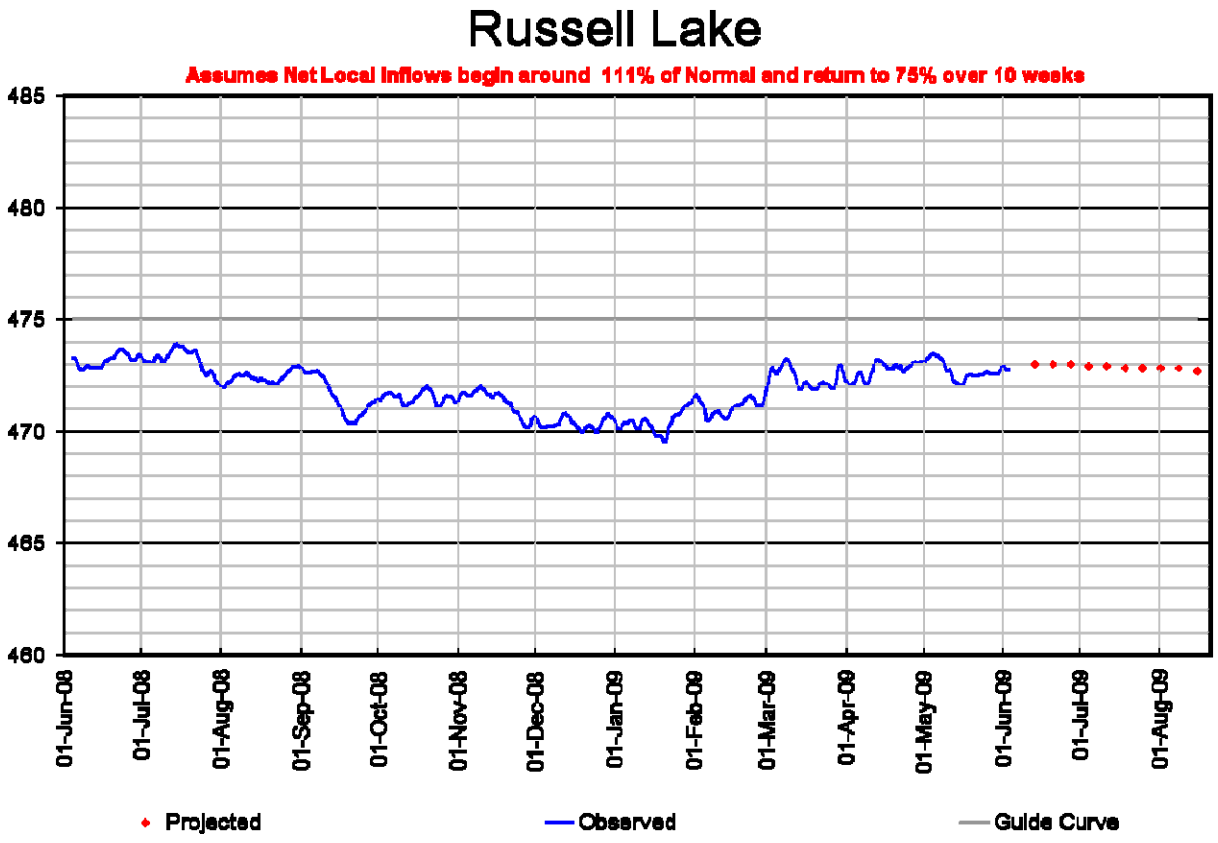
2009
RESERVOIR CONDITIONS
(1 AUGUST 2009)



2009
RESERVOIR CONDITIONS
(1 AUGUST 2009)



2009
RESERVOIR CONDITIONS
(1 AUGUST 2009)



APPENDIX C

2008 AGENCY PROPOSAL

Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts

Georgia Department of Natural Resources, Environmental Protection Division
(Georgia EPD)
South Carolina Department of Health and Environmental Control
(SCDHEC)
South Carolina Department of Natural Resources
(SCDNR)

July 2008

Executive Summary

As the ongoing drought in the southeastern U.S. approaches its third summer, the Savannah River reservoir system operated by the Army Corps of Engineers (hereafter referred to as the Savannah System) is experiencing extreme pressure and difficulties. As of July 23, 2008, the system has only 46% of its conservation storage remaining. Hartwell and Thurmond, the two large storage reservoirs, are approximately 12 feet below normal pool levels. Hartwell has less than 57% of its conservation storage left, and Thurmond has only 28% of its conservation storage remaining.

The recharge season of the year has long gone, and the status of the system is of particular concern to many parties in both Georgia and South Carolina depending on the resources provided by the storage in these reservoirs. Low inflows to the system last year and early this year raised the prospect that the system storage may be exhausted in the near future and a consequent transition to Level 4 operations (only releasing inflow) may be on the horizon.

Based on the Information Paper provided by the Army Corps of Engineers (Corps) and information compiled by other cooperating institutions, Georgia EPD, in coordination with SCDHEC and SCDNR, conducted a thorough analysis of potential operations of the system under a variety of hydrologic conditions. Georgia EPD, SCDHEC, and SCDNR propose that the current operation (i.e. a Thurmond release of 3,600 cfs) be revised to maintaining a 3,600 cfs release from Thurmond Dam in the warmer months of March through September and reducing the release to 3,100 cfs in the cooler months of October to February of next year.

The analysis conducted by Georgia EPD, in coordination with SCDHEC and SCDNR, indicated that such operations would be able to stabilize the system and substantially reduce the speed of decline in system storage. Even under a very pessimistic assumption of inflow (10% worse than the lowest historic inflow) for the next three consecutive years, the proposed operations would be able to prevent the system conservation storage from being depleted. System storage would only approach depletion toward the later part of 2011, with the assumption that worse-than-the-worst hydrology will persist through the years (a highly improbable event).

Our analyses indicate that water users along the river will not be impacted as a result of this revised operation. Also, modeling and field observations indicated that it is unlikely that water quality will be of a concern. Further modeling can be conducted if stakeholders raise additional concerns. In addition, water quality monitoring stations will need to be enhanced at strategic river locations to ensure that there is sufficient real time data available to evaluate and appropriately respond to during modified dam operations.

With respect to intake limiting factors, some of the intakes at the lower reaches may experience little margin in their access to water and thus their functionality. If the lowest incremental flow (recorded in 2007) were to take place again this year, some intakes may not function well in the short period of a few days. However, there are actions that can be taken to mitigate the impact, such as drought-proof engineering measures that will either deepen the bottom elevation at the intake or elevate the surface elevation, or adaptive management measures whereby the facility monitors the river elevation to make sure that sufficient flow takes place when incremental flow is not sufficient. Vulnerable facilities all across the basin will be part of a process that will ensure that proper emergency management measures are incorporated into local planning during this drought emergency.

Background Information

The Savannah River Basin has been experiencing a drought since early 2006. Rainfall and resulting stream flow have been particularly low, causing the reservoirs to drop faster than during previous droughts. If low inflows persist or deteriorate, the current drought could become the new drought-of-record for the basin.

The Corps manages its three impoundments on the Savannah River as a system and uses a Water Control Manual to describe how it will operate those projects. The Drought Contingency Plan is a component of that Manual and was developed (1) to address the effects of the Corps' operation on those impoundments and the downstream portion of the river, and (2) to assist the States of Georgia and South Carolina in drought contingency planning in their water management responsibilities for the Savannah River Basin.

The Corps' 1989 Drought Contingency Plan (DCP) and a 2006 Environmental Assessment (EA) describe activities that would be conducted during four stages of a continuing drought. Those four stages correspond to different lake levels. When the reservoirs reach the Level 1 trigger elevation, the Corps issues a public safety advisory concerning recreational use of the reservoirs. The Corps also reduces discharges from the reservoirs when Levels 1-3 are reached. When Level 4 is reached, the conservation pools are empty. If drought conditions persist after Level 4 is reached, discharges are further reduced to the point where the outflow from the lakes equals the net inflow.

The actions the Corps would take surrounding the Level 4 trigger were never evaluated in

detail when the plan was originally developed or during the 2006 Update. The Reservoir System Simulation modeling conducted to analyze the effects of the various operational scenarios during development of the 1989 DCP and its 2006 EA for the DCP Update always indicated that the lakes would not reach the bottom of conservation pool. This modeling was conducted using inflows that were the drought of record at that time. Sensitivity analyses revealed that the drought would need to extend three additional years to reach Level 4. Therefore, detailed consideration was never given for the best way to operate once that trigger was reached.

It should be noted that when a new drought of record takes place, the Corps' operational objective should always be to avoid ever reaching the bottom of the conservation pool. This requires a constant evaluation of the current operations and the update of the drought of record. If the current drought becomes the drought of record, then additional measures not included in the previous Manual or Drought Contingency Plan should be considered and evaluated to achieve this objective.

Status of System and Issue of Concern

As of 8:00 am July 23, 2008, the federal reservoirs on the Savannah River have 1.19 million acre-feet of conservation storage remaining. This is equivalent to 46% of the system conservation storage. Hartwell has 57% of its conservation storage remaining, while Thurmond has only 28% of its conservation storage available.

The recharge period in 2008 is over at this time, and both Hartwell and Thurmond are roughly 12 feet below their respective normal pool levels. Through the summer months, the evaportranspiration rate will increase, making it all but impossible for the reservoirs to meaningfully gain any storage during this time. This holds true regardless of the prospect of precipitation in the summer, even with the overly optimistic assumption that normal rainfall takes place.

Recent updates from climatologists and meteorologists suggest that it is likely that the current drought will extend into this summer and beyond. If this holds true, it is expected that inflow to the reservoir system will remain low or at least below normal, making it a likely scenario that the Corps will need to use storage to augment releases prescribed by the operation Manual and the Drought Contingency Plan.

If the drought persists or deteriorates, it is not inconceivable that the limited conservation storage will be exhausted, or at least be depleted to an intolerable extent. It is extremely important that all measures be evaluated to prevent the depletion of the Savannah System conservation storage. The following sections of this report document contemplated ways to achieve this.

Principles of Operations

We believe the principles of operating the Savannah System are the following: (1) To the extent possible, the Corps should try all it can to avoid depleting the conservation storage. (2) In order to achieve that, the Corps should take early measures to avoid ever reaching the bottom of the conservation pool. (3) The Corps should more explicitly identify the elevation and flow thresholds below which serious impacts take place at facilities across the basin. (4) If hydrologic conditions are such that an early intervention is unavoidable, then the Corps should identify the flow level below 3,600 cfs that bears the least impact and reduce its release from Thurmond Dam to that level. (5) The water users should identify ways (e.g. local engineering measures) of avoiding or mitigating impacts of such flow reduction and communicate such measures as well as the costs of such measures to the Corps and the States.

Proposed Hydrologic Conditions for Evaluation

On an annual basis, the total amount of inflow to the Savannah System (defined as the Savannah River reservoir system operated by the Army Corps of Engineers) was lowest in 1988, averaging only 3,286 cfs. The second lowest year was 2007, with an average inflow of 3,302 cfs. Based on a long-term average annual inflow of 7,852 cfs, the amounts of inflow in these two years are 42% of normal.

It is thus suggested that the hydrologic conditions of these two years be used to evaluate adverse conditions the system may experience in the rest of 2008 and the next two years. We believe it is a conservative assumption that the on-going drought (which is very close to the drought of record), after impacting for more than two years now, would repeat itself in the next three years. This basically means that after a year of 3,302 cfs inflow, inflow at this level would repeat again and again in each of the next three years.

We also suggest that variations of the 1988 and 2007 hydrology (e.g. 10% reduction in inflow) be used to evaluate potential operations of the Savannah System. We believe it is a very conservative assumption that another round of drought of record with a magnitude of 10% reduction in inflow will repeat itself in 2008, 2009, 2010, and 2011. This gives us the possible but very unlikely hydrologic scenario that after a year of 3,302 cfs inflow, we would have another two to three years in a row with inflow lower than 3,000 cfs (38% of normal).

Baseline Operations under Proposed Hydrologic Conditions

The Corps' current operation calls for a release of 3,600 cfs from Thurmond Dam. This operation's impact on the reservoirs can be assessed with the Corps' spreadsheet tool. Using this tool and the assumed hydrologic conditions, we were able to show how system conservation storage would change as a result of the baseline operation.

Fig. 1 shows the impact of the baseline operation on system conservation storage under recorded 2007 inflow and a variation of this inflow series. Under 2007 hydrology,

system storage will continue to decline to dangerously low levels toward the end of 2008, with only 18% of conservation storage remaining in Hartwell, Russell, and Thurmond. System conservation storage will recover somewhat in early 2009, but start declining again in April 2009 and reach 15% late 2009.

Under the hydrologic scenario with a 10% reduction in inflow, the system will fare even worse. There will be about 16% of system conservation storage left by the end of 2008, and only 3% remaining by the end of 2009. The conservation pool would be virtually empty at this point. The conservation pool will be completely exhausted by November 2010.

Fig. 2 shows the impact of the baseline operation on system conservation storage under another record dry year with a different precipitation pattern, year 1988. Under this hydrology, system conservation storage will see a less dramatic decline in the summer and fall seasons, but also with a less pronounced recovery in the following winter and spring. Overall, there will be a declining trend.

Under the reduced 1988 inflow scenario, system storage will reach 10% by the end of 2009, and be completely exhausted by October 2010.

In order to gauge the potential of devastating consequences, a probability of status analysis was performed for the Savannah River basin. It is assumed that 2007 hydrology is to repeat itself in 2008, and the resulting system storage by December 31, 2008 would be around 16% (see Fig. 1). With this as the starting condition for 2009, and hydrologic conditions from 1954 through 2007 applied to the Savannah system, there is a substantial probability (see Fig. 17) that the system will either be completely empty by the summer of 2009 (2% probability), or that the system will be further depleted toward the end of 2009 (6% probability). The probability of such catastrophe may be small, but it is substantial and its consequences severe.

It is apparent that if the current drought persists at its current intensity or if it intensifies, the baseline operation is not enough to stabilize conservation storage, let alone refilling the system. For the benefit of all stakeholders in the basin, more needs to be done to stop the loss of conservation storage in the middle of this drought.

Critical Flow Requirements

Prior work done by Georgia and South Carolina resource agencies and the federal government provided critical elevations for most withdrawing facilities along the main stem of the Savannah River downstream of Thurmond Dam. This information is provided in Table 1.

Based on rating curves provided by Georgia EPD's Savannah River water quality model, we were able to calculate flow rates that correspond to these minimum elevations. The flow rates are also provided in Table 1.

From this exercise, it is clear to us that the likely controlling flow rates are those at Savannah Electric-Plant McIntosh and Georgia Pacific. The minimum desired flow rate at the intake of Savannah Electric-Plant McIntosh is calculated to be 3,500 cfs. The minimum desired flow at the intake of Georgia Pacific is calculated to be 3,300 cfs. However, since surface elevation in the river at these two facilities is under tidal influence, which may nullify the effects of low stream flow in the river, this tidal influence may help ease the concern that potential reduction in Thurmond release would impact the facilities' intake.

Since flows desired at the locations of the other facilities are much lower than what is needed to sustain water access at these two facilities, we believe these flow rates should serve as the basis for the computation of any potential relief of flow requirement at Thurmond Dam. Another factor to consider is that there exists substantial amount of incremental flow between Thurmond Dam and the intakes of either Savannah Electric-Plant McIntosh or Georgia Pacific. A flow at the locations of these facilities is the result of Thurmond release supplemented by incremental flow between Thurmond and the concerned location.

Recorded Incremental Flow

If the Corps considers potential relief from the 3,600 cfs minimum release requirement from Thurmond, then it is critically important to determine the amount of incremental flow between Thurmond and the locations of the controlling facilities. Since the closest USGS gauge to the two controlling facilities, Savannah Electric-Plant McIntosh and Georgia Pacific, is Savannah River near Clyo, Georgia (02198500), we need to use the incremental flow between Thurmond and the Clyo gauge to estimate the amount of incremental flow. Also, since the Clyo gauge is upstream of these two facilities, the entire amount of incremental between Thurmond Dam and the Clyo gauge can be applied to both facilities.

Using release data from Thurmond (Corps) and gauged stream flow data at the Clyo gauge (USGS), we were able to derive incremental flow between these two locations. For the purpose of smoothing out the impact of routing and travel time, we applied a 7-day moving average for both variables.

As shown in Fig. 3, the magnitude of incremental flow between Thurmond and the Clyo gauge stayed above 500 cfs for most of 2007, with the exception of a few days in November 2007, when it dropped to around 300 cfs. For the previous drought of record, year 1988, the incremental flow between these two locations remained higher than 800 cfs (See Fig. 4). As the U.S. Drought Monitor (Figs. 5 and 6) indicate that the lower Savannah River Basin is in better shape compared to the worst time in last year, when the incremental flow was the lowest in November 2007, and the fact that the coastal area may benefit

from ocean-originated precipitation in the summer and fall, it is reasonable to assume that the incremental flow between Thurmond and Clyo this year will not be at a level worse than in 2007. In other words, it is not unreasonable for us to expect at least 300 cfs to 500 cfs of incremental flow between Thurmond and the Clyo gauge.

Proposed Relief from Thurmond Minimum Flow Requirement

We use the most severe hydrologic conditions suggested earlier in this document to evaluate the contemplated alternative operations of the Savannah System. These conditions are recorded 2007 inflow with a 10% reduction and recorded 1988 inflow with a 10% reduction. A repetition of such conditions, after two years of record-breaking drought, for the next three or four years, in our opinion, provides enough of a challenge to the entire system. Table 2 provides a summary of all the simulations.

Based on the estimated minimum incremental flow of 300 cfs to 500 cfs, we can use a Thurmond release of 3,300 cfs and 3,100 cfs to test the impact to the reservoir system and the downstream river. It is reasonable to assume that at these levels of Thurmond release, the needs of the other stakeholders are met (Table 1).

We first tested a flat release from Thurmond Dam of 3,300 cfs and 3,100 cfs with both hydrologic conditions. Table 2 provides a summary of the hydrologic conditions and alternative operations in the tested scenarios. The resulting reservoir conservation storage change is shown in Figs. 7 and 8.

Under the recorded 2007 hydrology (with a 10% reduction in inflow), a release of 3,300 cfs from Thurmond Dam will not be enough to stabilize the reservoir system. There will be a sharp decline of system conservation storage, resulting in a low system storage at 20% toward the end of 2008. Storage will recover somewhat during the winter and spring period of 2009, but will start to decline again and reach a new low (16%) toward the end of 2009. If hydrologic conditions do not improve dramatically, this downward trend will continue, and the low system storage will keep declining year after year (Fig. 7).

If release at Thurmond Dam is reduced to 3,100 cfs, however, the trend of decline will be stopped. The system storage will still go up and down seasonally, but the declining trend under the 3,300 cfs release will cease to exist.

Under the recorded 1988 hydrology (with a 10% reduction in inflow), the seasonal decline in the summer and fall will be less dramatic than under the 2007 inflow, however, there will be less of a recovery in the following rainy season (Fig. 8). Under a 3,300 cfs Thurmond release, system storage will reach 34% by the end of 2008 and around 24% toward the end of 2009. This moderate reduction in Thurmond release is far from enough to stop the sharp declining trend in system storage.

If release at Thurmond Dam is at 3,100 cfs level, the overall declining trend will still exist. However, the rate of decline of system conservation storage will be much more

moderate compared to the rate of decline under a release of 3,600 cfs (baseline) or 3,300 cfs (Fig. 8).

We understand that a full-scale deviation from the minimum release of 3,600 cfs may require the Corps to go through the NEPA process and to conduct an Environmental Impact Study, which may take years to complete and cause the loss of opportunity to slow the decline of system storage. We also understand that a seasonal deviation (e.g. a reduced release from Thurmond Dam in the cooler seasons) may be easier to achieve, since an Environmental Assessment may suffice in this case.

Thus, we tested an operation scenario where release from Thurmond will be kept at 3,600 cfs for the months of March through September and reduced to 3,100 cfs for the cooler seasons (October through February). The resulting conservation storage percentage (under both 2007 and 1988 inflow with a 10% reduction) is shown in Fig. 9. It can be seen that system conservation storage will remain available at least throughout the next three years. With such adverse hydrologic conditions, system storage will continue to decline, but at a comparatively slow rate.

Under this operation scheme, even if record-breaking drought conditions continue during the next three years, there will be enough conservation storage to support the revised Thurmond release, and the Corps will have enough time to make further revision of its operations in response to persistent or deteriorating conditions.

We make the recommendation that the Corps adopt this operation scheme.

Impacts to Lake and River Water Users

The suggested operation will not be any different from the current baseline operation in the months between March and September, and should not have any impact on water supply intakes throughout the basin during this time period.

In the cooler seasons when Thurmond release is reduced to 3,100 cfs, the most likely impact, based on information in Table 1 and earlier analysis, will be felt by facilities downstream of Thurmond Dam. These facilities include Savannah Electric-Plant McIntosh and Georgia Pacific. Because the proposed operation will not deplete system conservation storage, water users whose intakes are located in the pools of Hartwell, Russell, and Thurmond will not be affected.

Flow at the locations of Georgia Pacific can be determined by Thurmond release with the addition of incremental flow between Thurmond and the Georgia Pacific intake, which is estimated to be around 500 cfs at the driest times, except for a few days, when it may be as low as 300 cfs. This will result in the lower flow at the Georgia Pacific intake to be at 3,600 cfs generally, and at 3,400 cfs at the lowest level. Given that the facility intake will function at flows higher than 3,300 cfs, it is expected that the proposed revision in operation will not have any impact to this facility.

Flow at the intake of Savannah Electric-Plant McIntosh can also be determined similarly. The proposed operation may result in an at-site flow of 3,400 cfs to 3,600 cfs at the intake of Plant McIntosh. Table 1 shows that the intake at Plant McIntosh functions at the minimum flow of 3,500 cfs. So, if the lowest incremental flow (recorded in 2007) were to take place again this year, the intake at this facility may not function well in the short period of a few days when the at-site flow is as low as 3,400 cfs. However, since water surface elevation at this facility's intake is under tidal influence, any impact resulting from reduced Thurmond release may be nullified.

Also, there are measures that can be taken to mitigate the impact. First, drought-proof engineering measures can be taken to either deepen the bottom elevation at the intake or to elevate the water surface elevation. The Corps may be able to help such measures through federal emergency programs. In fact, we encourage all water users in the basin to consider local measures that can make water supply more secure.

Second, adaptive management can be put in place to monitor the elevation at this facility to make sure that sufficient flow takes place when incremental flow is not enough.

There may also be concern from water users along the Augusta Canal. Diversions into the Augusta Canal is managed by the City of Augusta to maintain a minimum of 1500 cfs (1500 cfs May through January and 1800 cfs otherwise) through the shoals. Three electronically controllable gates, operated by the City of Augusta, allow for instantaneous changes of flow to the canal should a management target be approached.

Based on current permit information on the City of Augusta intake, the City is allowed to withdraw no more than 45 MGD (about 70 cfs). The City has four turbines to operate for water supply operations. These turbines are driven by water in the Canal. Then in turn they drive pumps to pump water for water supply purpose. It usually uses two of its four turbines units (Units 1 and 4) with the need of a flow of 1364 cfs. This amount is passed through the turbines and returned entirely to the main stem Savannah River (about two thirds of the length of the shoals).

There are three mills downstream of the City's intake. They are Sibley, King, and Enterprise. All these mills have turbines that are driven by water in the Canal. All return the water used back to the main stem Savannah River downstream of the shoals. Sibley Mill needs a flow of 1024 cfs; King needs approximately 880 cfs; and Enterprise needs a flow of approximately 560 cfs.

At the current level of Thurmond release (3600 cfs), if there is no incremental flow between the dam and the Canal inlet, then 1500 cfs would have to be left to pass the shoals. That leaves only 2100 cfs to go through the Canal. After the City turbines and intake, there would be less than 800 cfs left in the Canal.

Under the proposed release strategy, Thurmond release would be reduced to 3100 cfs from October through February. If the City operates the gates to pass 1500 cfs to the shoals, the amount of water going through the Canal would be 1600 cfs, assuming little

incremental flow. This will be enough to sustain the City's water supply operations. However, after that, there would be less than 300 cfs left to go through the rest of the Canal, and the operations of the mills will be impacted.

We understand that the mills are connected to the power grid and alternative power is available in case their generating capacity is limited.

Impact to Water Quality

To assess the potential impact on water quality of the proposed operation, Georgia EPD, in coordination with SCDHEC and SCDNR, has performed water quality (dissolved oxygen - DO) modeling of both the Savannah River downstream of Thurmond Dam and the Savannah Harbor. The modeling results indicate that the seasonal reduction of Thurmond release would not cause water quality problems in the river or the harbor.

1. Savannah River downstream of Thurmond Dam

The first model simulation has been conducted with 2007 meteorological data, 2007 tributary inflows, 2007 Thurmond release data, and waste load discharges and water withdrawals as recorded in 2006. This run was performed to see how well the model is calibrated to observed DO data. Figs. 10 and 11 show the observed DO data (red squares) measured in 2007, which never went below 6.5 mg/L and 6.29 mg/L at River Mile (RM) 119 and RM 61, respectively, versus the approximate calibration run. It is an approximate calibration run since the model did not include 2007 discharge and withdrawal data, but rather that of 2006. Despite the approximation of this model run, the results indicate that the model has been calibrated relatively well.

Second and third model simulations were conducted with 2007 meteorological data, 2007 tributary inflows, and waste load discharges and water withdrawals as recorded in 2006. However, these model scenarios incorporated Thurmond releases of 3,600 and 3,100 cfs.

Figs. 12 and 13 show the results of the 3,600 cfs simulation. Under a Thurmond release of 3,600 cfs, the simulated DO concentrations at RM 119 were predicted to be above 5 mg/L throughout the year (Fig. 12). Fig. 13 shows simulated DO concentration at River Mile 61 under a Thurmond release of 3,600 cfs. Again, the simulated DO concentrations were predicted to be higher than 5 mg/L throughout the year. The water quality model shows that the 5.0 mg/L DO standard would not be breached by a Thurmond release of 3,600 cfs.

Figs. 14 and 15 show the simulated DO concentrations at River Mile 119 and River Mile 61 respectively, under a Thurmond release of 3,100 cfs. Even though we do not propose a reduction of Thurmond release in the summer time, our model indicated that there would not be a DO problem throughout the year. For the cooler months from October to February, DO concentration would always be higher than 6.0 mg/L and almost always higher than 7.0 mg/L at both River Mile 119 and River Mile 61.

We need to point out that the water quality model used in this analysis does not contain any modules simulating algal activity in the river. This lack of simulated algal activity means that our model tends to give overly pessimistic DO concentrations. It is highly likely that field data will provide higher DO concentrations than the model predicted.

The proposed action includes a continuation of 3,600 cfs release from Thurmond Dam in the months of March through September and a 3,100 cfs reduced release from Thurmond Dam in the cooler seasons (October through February). This action will not result in any adverse change in DO concentration in the warmer months. We suggest that monitoring stations be set up at locations along the river to monitor the change of DO concentration along the lower reaches, if the proposed operation is adopted. We also suggest that adaptive management be used as part of the Corps' operation. If field observation indicate any problem with DO concentration, then prompt actions can be taken to mitigate the adverse conditions.

2. Savannah Harbor

Two water quality related effects of lower Savannah River streamflows resulting from reduced Thurmond Reservoir releases were assessed. These were elevated chloride concentrations at the City of Savannah municipal water intake on Abercorn Creek, and dissolved oxygen concentrations in the Harbor.

The City of Savannah's municipal water intake is located on Abercorn Creek approximately two miles from the Savannah River. The City of Savannah is concerned about distributing water to its customers, particularly industries, when chloride concentrations in Abercorn Creek are greater than 12 milligrams per liter (mg/L). Such concentrations have been shown to cause scaling in boilers.

Sources of chloride in Abercorn Creek are upstream inflows from the Savannah River, and salinity intrusion from the downstream Savannah Harbor estuary. Studies have shown a good relationship between River flows at the U.S. Geological Survey's Clyo, Georgia stream gage location and chloride concentrations. Results have shown that the Savannah River contains approximately 10 mg/L of chloride during low flows, and 4 mg/L during high flows as a result of greater dilution. Therefore, it is during low flow periods where River chloride concentrations are as high as10 mg/L when salinity intrusion from downstream can cause an additional 2-4 mg/L in the vicinity of the intake and exceed the 12 mg/L threshold. Analysis of the historical chloride data collected at the City's intake shows that during drought years the number of samples with chlorides exceeding 12 mg/L ranges from 21 to 58 percent, and concentrations have approached 19 mg/L.

Lowering releases from Thurmond Reservoir, by itself, does not create higher chloride concentrations at the City of Savannah's water withdrawal. Rather, it is the combination of low releases from Thurmond Reservoir and low streamflows from the downstream watershed that create a condition for elevated chloride concentrations at the City's

withdrawal. Therefore, the proposed reservoir operation schedule will not improve conditions for chloride concentrations at the City's intake, and with sufficient downstream inflows these conditions should remain unchanged. However, given the existing sensitivity of the City's intake to chloride concentrations greater than 12 mg/L as shown by the historical exceedances of this threshold, proposed reservoir operation combined with low downstream inflows might increase the number and magnitude of chloride concentrations greater than 12 mg/L at the City of Savannah municipal water withdrawal. Therefore, it is recommended that Savannah River flows at Clyo and chloride concentrations at the City's water intake be monitored closely to assess the effects of reservoir operation.

The effect of the proposed Thurmond reservoir operation on dissolved oxygen concentrations in Savannah Harbor was evaluated using the Savannah Harbor Model. Savannah River Model streamflow and water quality results provided input for the upstream boundary of the Savannah Harbor Model. Model results and the effects on dissolved oxygen concentrations were evaluated at the U.S. Army Corps of Engineers' dock located in the Harbor. The results were compared to the existing coastal fishing classification whose dissolved oxygen criteria is no less than 3.0 mg/L during June through October, no less than 3.5 mg/L in May and November, and no less than 4.0 mg/L during December through April. The results are shown in Figure 16. With respect to Dissolved Oxygen Standards applicable to the Harbor, at the present time, the Savannah Harbor is under a Total Minimum Daily Load for Georgia which indicates 0 assimilative capacity available for the NPDES permitted wastewater treatment system dischargers. The TMDL is based on a 1989 Georgia seasonal Dissolved Oxygen standard which was never approved by the EPA. The GAEPD is in the process of revising the Harbor DO standard which will provide some assimilative capacity for the dischargers, and be similar and consistent with the South Carolina DO standard. Harbor dissolved oxygen monitoring will continue and impact to harbor dissolved oxygen attributable to seasonal dam releases will be evaluated and those operations modified as appropriate.

Other Potential Impacts

Since a seasonal deviation from the 3,600 cfs Thurmond release does not constitute a significant change in operations of the system, we do not foresee any impacts on other aspects and other water users of the Savannah River Basin.

We are willing to work with other resource agencies to address such concerns, if additional stakeholder groups raise concerns. We believe technical tools, such as WASP model and other models exist and are available for use to address salinity, temperature, and other issues.

Table 1. Major facilities along the main stem Savannah River and their tolerance of low elevations and flow rates

FACILITY NAME	INVERT ELEVATION (FT-MSL)	MINIMUM ELEVATION (FT-MSL)	NOTES	CORRESPONDING FLOW TO MIN ELEV. (CFS)
Columbia County			Their withdrawal is upstream from the Stevens Creek Dam.	
Augusta Canal			The necessary flow to support the municipal water withdrawal is 600-800 cfs. There is a deisel back-up pump but it is not capable of providing the full supply requirement. At some flow rate the downstream electric generation will be halted.	~1600 cfs in the Canal + 1000 cfs in shoal
Edgefield County	149.50	149.50	1989 Drought Plan. This value was confirmed by SCDHEC.	
City of Augusta		119.5		
City of North Augusta	106.00	109.00	Minimum elevation value came from the New Savannah Bluff Lock and Dam Project Disposition Report.	1000 cfs at elevation 109 ft
South Carolina Electric and Gas	106.00	105.50	Minimum elevation value came from the New Savannah Bluff Lock and Dam Project Disposition Report.	900 cfs at elevation 106 ft
PCS Nitrogen	97.75	103.90	PCS Nitrogen and DSM Chemical share the same intake structure. A minimum elevation value of 110 came from the New Savannah Bluff Lock and Dam Project Disposition Report. Actual numbers came from a contact with PCS Nitrogen.	1300 cfs at elevation 110 ft
DSM Chemicals	97.75	103.90	PCS Nitrogen and DSM Chemical share the same intake structure. A minimum elevation value of 110 came from the New Savannah Bluff Lock and Dam Project Disposition Report. Actual numbers came from a contact with PCS Nitrogen.	1300 cfs at elevation 110 ft
General Chemical	110.20	111.00	Minimum elevation value came from the New Savannah Bluff Lock and Dam Project Disposition Report.	1800 cfs at elevation 111 ft at DSM Chemical
Kimberly Clark		109.00	Minimum elevation value came from the New Savannah Bluff Lock and Dam Project Disposition Report.	1060 cfs at elevation 109 ft
International Paper	94.00	94.00		2800 cfs at elevation 94 ft
Savannah River Site	79.00	79.00	Latest information indicates that 79 ft is sufficient	3400 cfs at elevation 81 ft, 2300 cfs at elevation 79 ft
Plant Vogtle	70.00	70.00		always met
Savannah Electric-Plant McIntosh	7.50	7.50		3500 cfs at elevation 7.5 ft
Georgia Pacific	-1.00	5.16	Georgia Pacific stated that their minimum operational level is equivalent to a gage height of 2.0 feet at Clyo. Since the gage datum at Clyo is 13.39 feet-msl this results in a minimum elevation at Clyo of 15.39 feet-msl which is equivalent to a Savannah River flow of 3300 cfs. This corresponds to a water surface elevation of 5.16 ft-msl at the Georgia Pacific withdrawal.	3300 cfs per note
City of Savannah		-10.22		
Beaufort-Jasper		-3.0		

Table 2 Simulated hydrologic and operational scenarios

Scenario	A: Recorded 2007 Inflow	B: 2007 Inflow * 90%	C: Recorded 1988 Inflow	D: 1988 Inflow * 90%	B3300: Thurmond release of 3300 cfs	B3100: Thurmond release of 3100 cfs	D3300: Thurmond release of 3300 cfs	D3100: Thurmond release of 3100 cfs	B: 2007 Inflow 3100 Seasonal	D: 1988 Inflow 3100 Seasonal
Hydrology (Inflow to reservoir system)	Recorded 2007 inflow	Recorded 2007 inflow with a 10% reduction	Recorded 1988 inflow	Recorded 1988 inflow with a 10% reduction	Recorded 2007 inflow with a 10% reduction	Recorded 2007 inflow with a 10% reduction	Recorded 1988 inflow with a 10% reduction	Recorded 1988 inflow with a 10% reduction	Recorded 2007 inflow with a 10% reduction	Recorded 1988 inflow with a 10% reduction
Operation	Thurmond release of 3600 cfs	Thurmond release of 3600 cfs	Thurmond release of 3600 cfs	Thurmond release of 3600 cfs	Thurmond release of 3300 cfs	Thurmond release of 3100 cfs	Thurmond release of 3300 cfs	Thurmond release of 3100 cfs	Thurmond release of 3600 cfs in warmer months, and 3100 cfs in cooler months	Thurmond release of 3600 cfs in warmer months, and 3100 cfs in cooler months

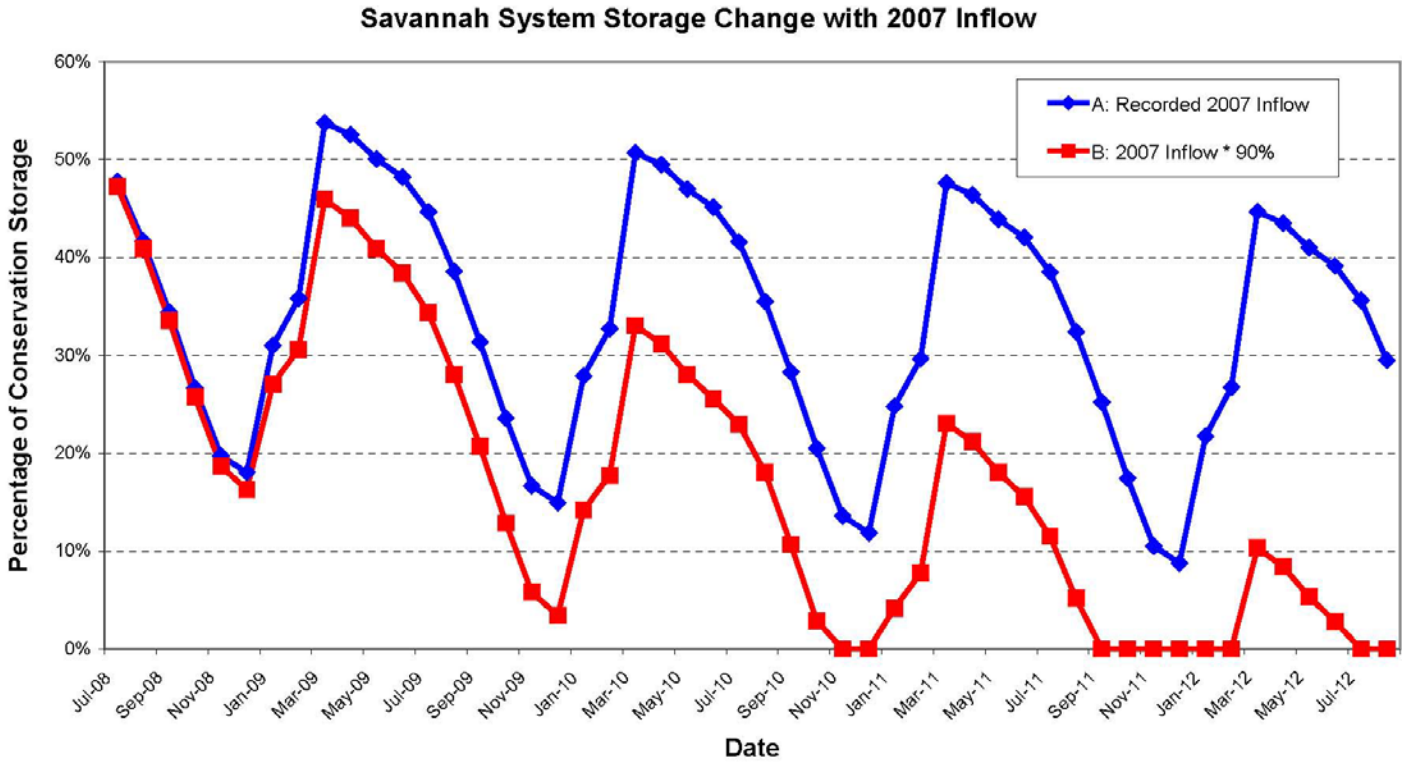


Fig. 1 Change of system conservation storage under 2007 hydrology and variation

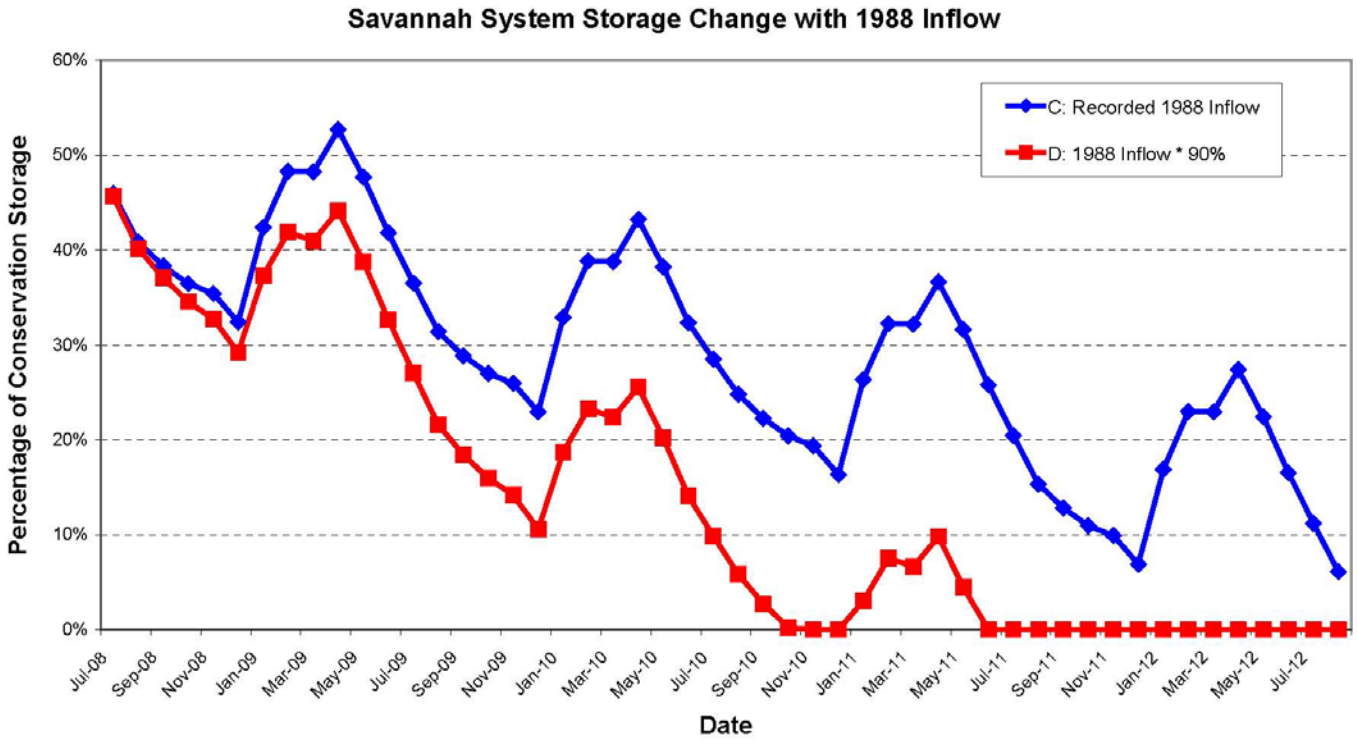
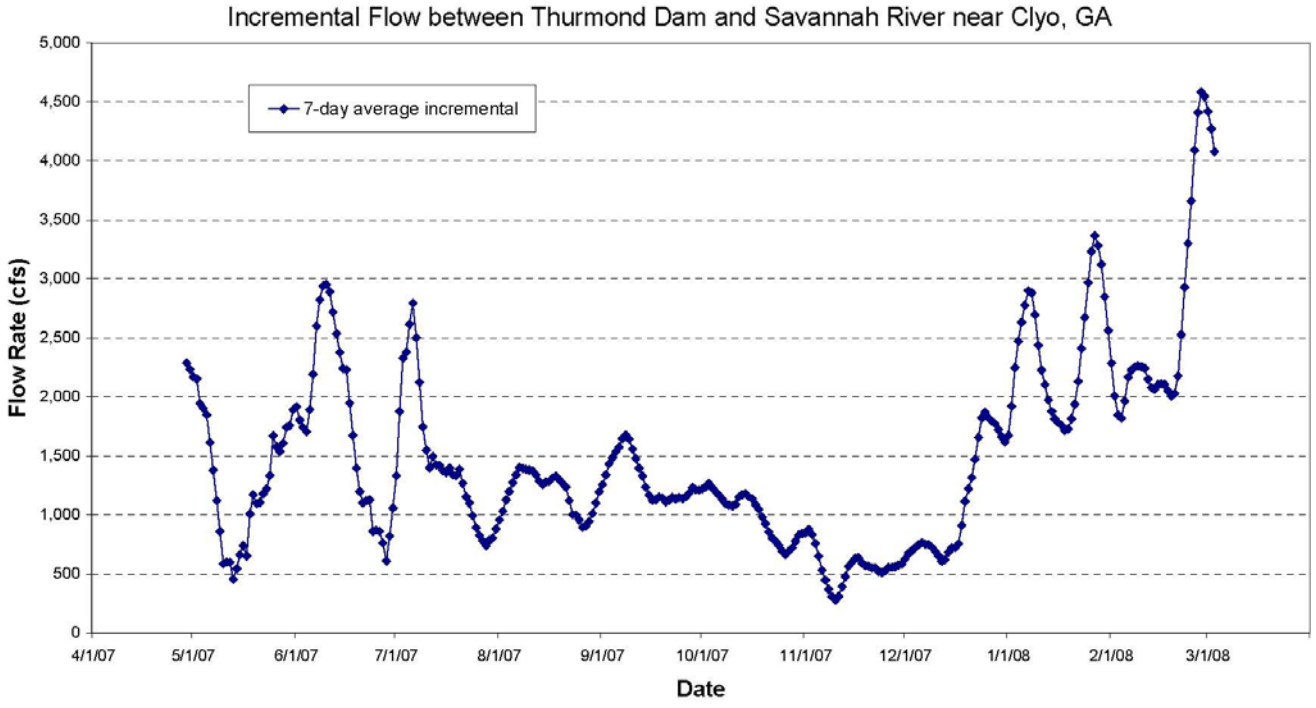


Fig. 2 Change of system conservation storage under 1988 hydrology and variation

Fig. 3 Incremental flow between Thurmond Dam and USGS Clyo gage in 2007-2008 period



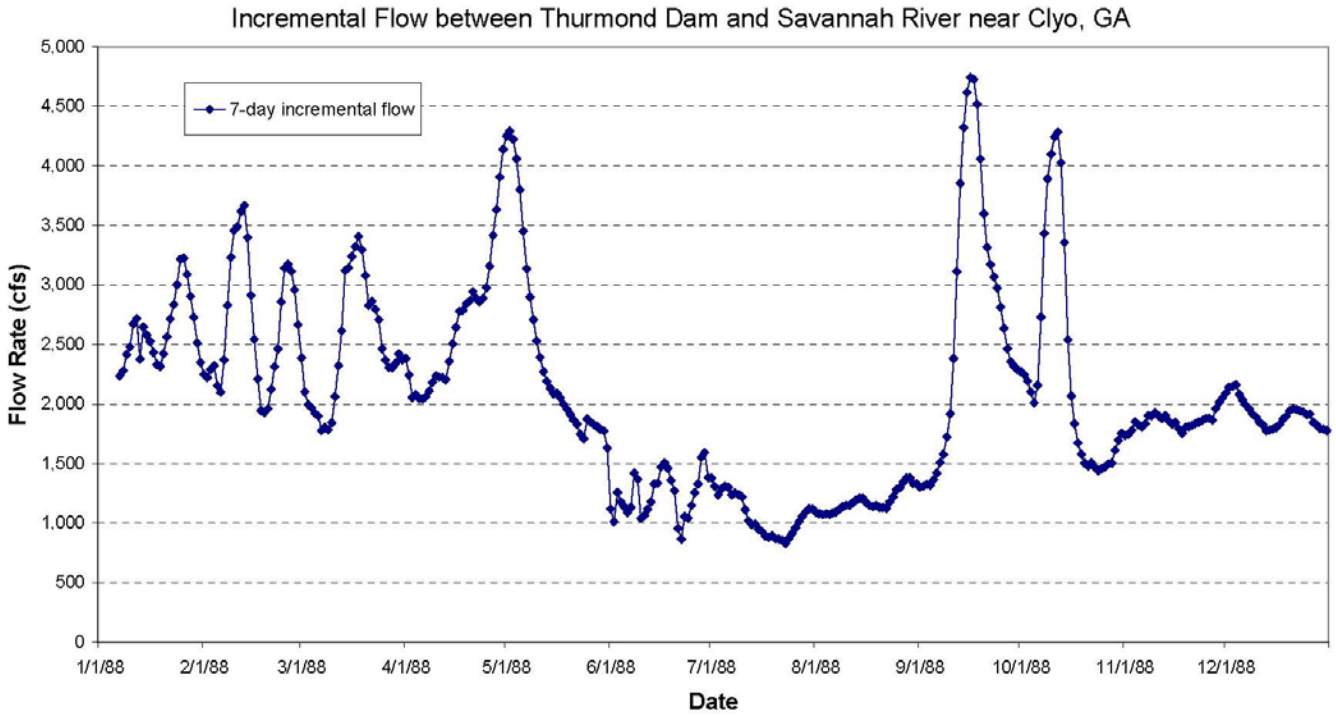


Fig. 4 Incremental flow between Thurmond Dam and the USGS Clyo gage in 1988

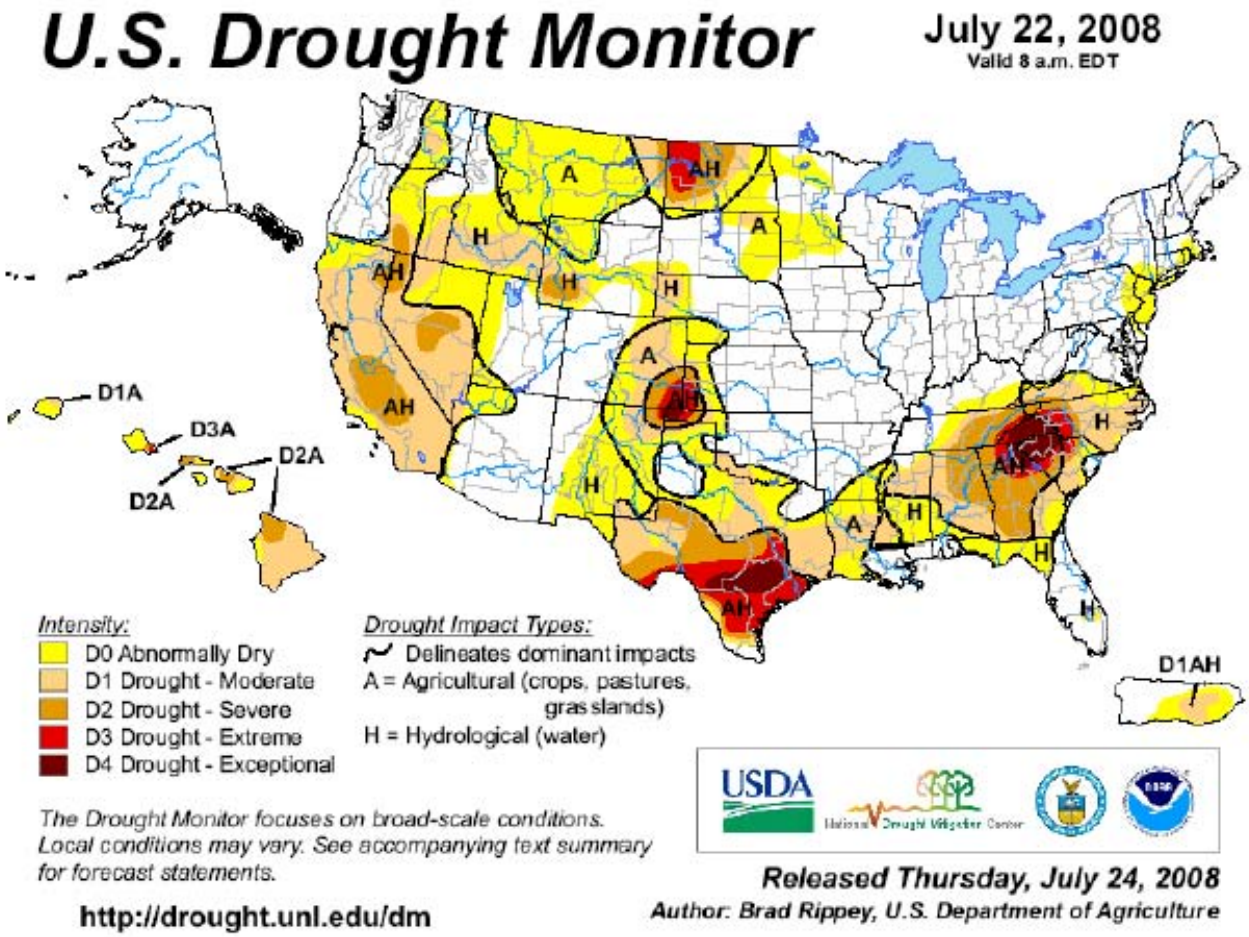


Fig. 5 U.S. Drought Monitor July 2008

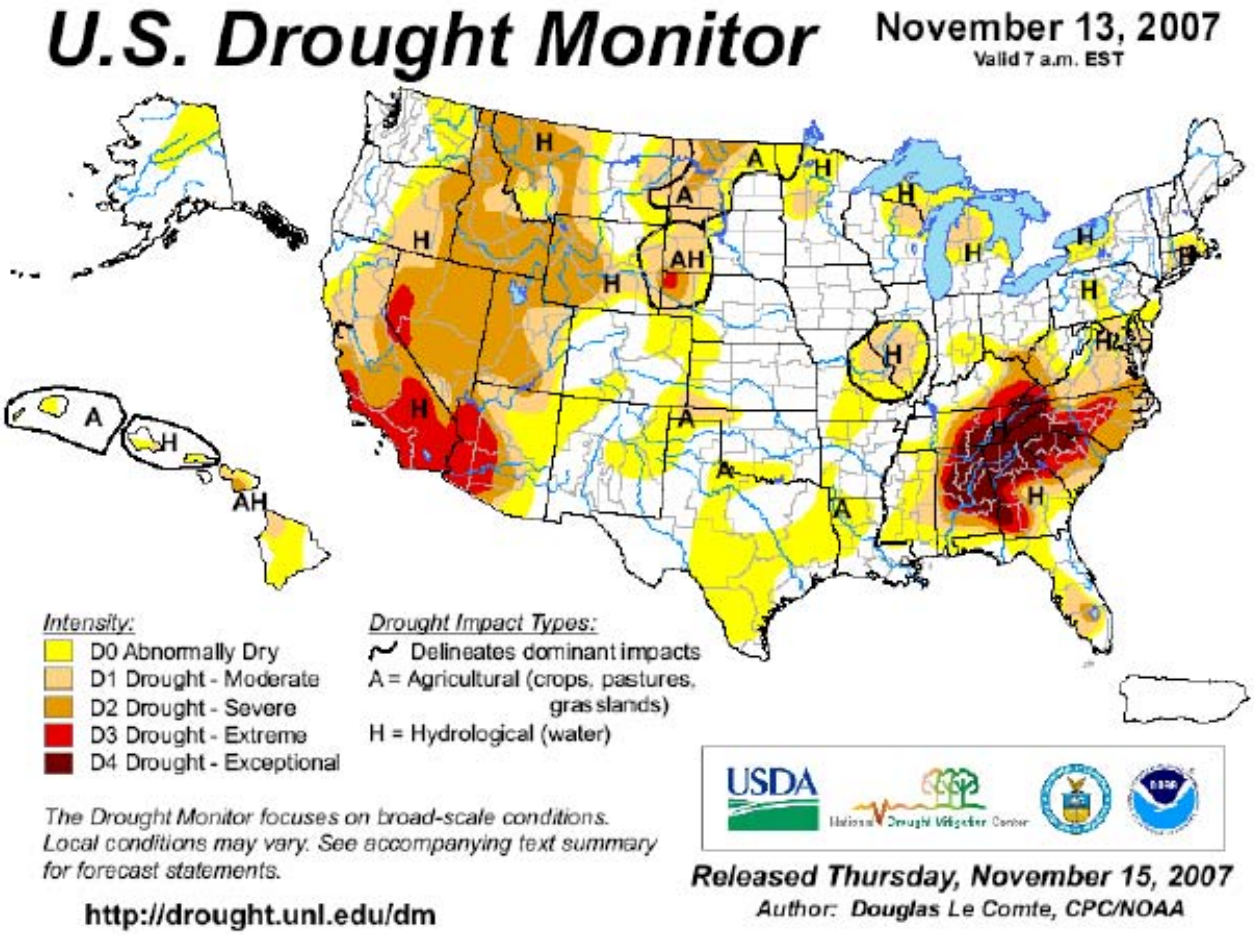
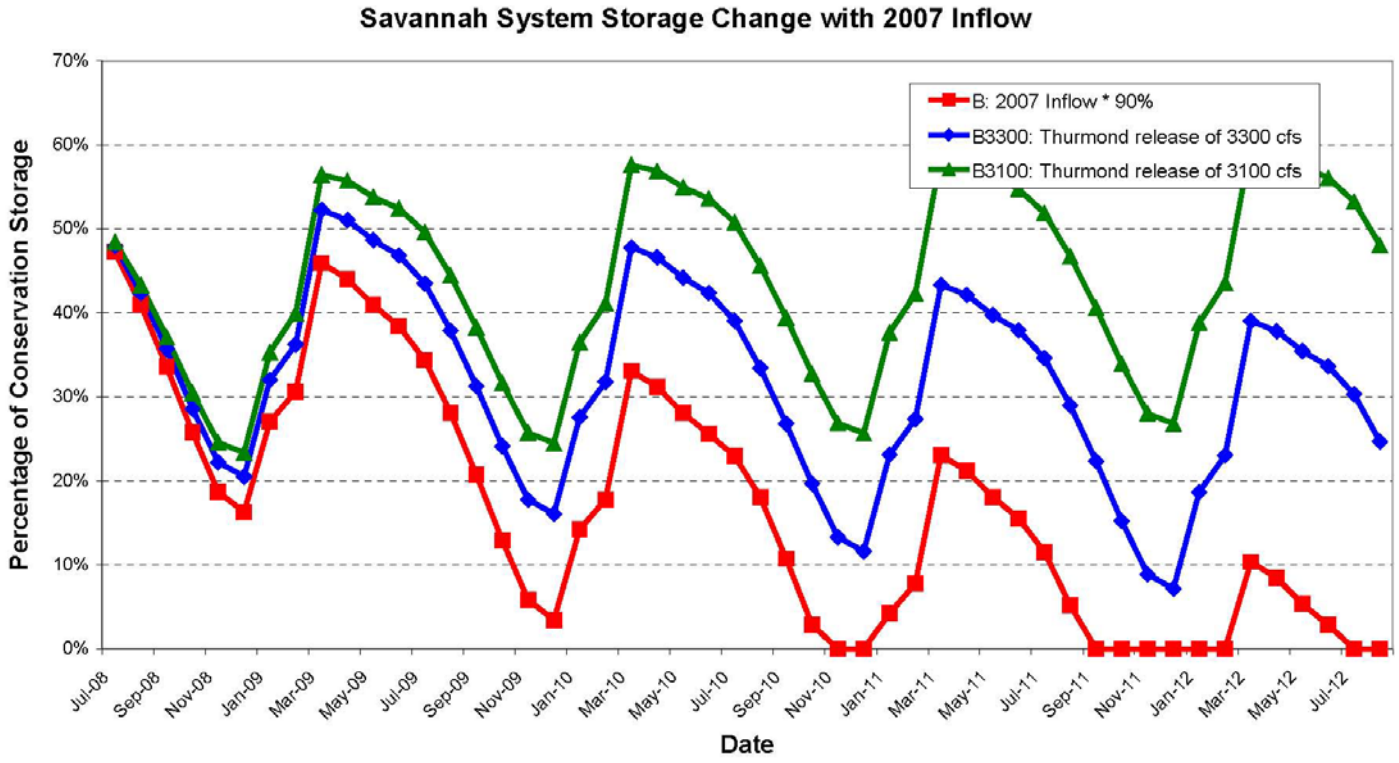


Fig. 6 U.S. Drought Monitor November 2007

Figure 7 Change of system conservation storage with 2007 hydrology and relief release at Thurmond



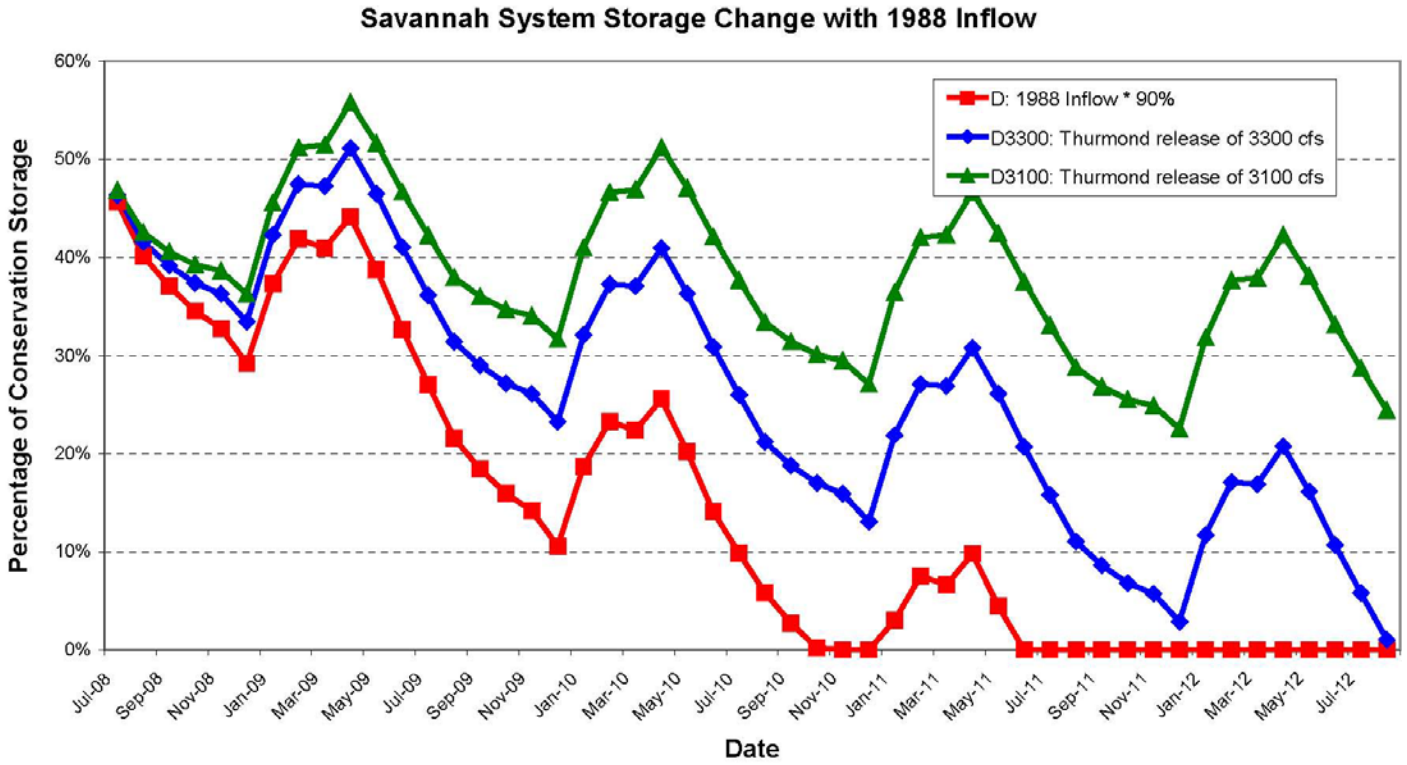


Fig. 8 Change of system conservation storage with 1988 hydrology and relief release at Thurmond

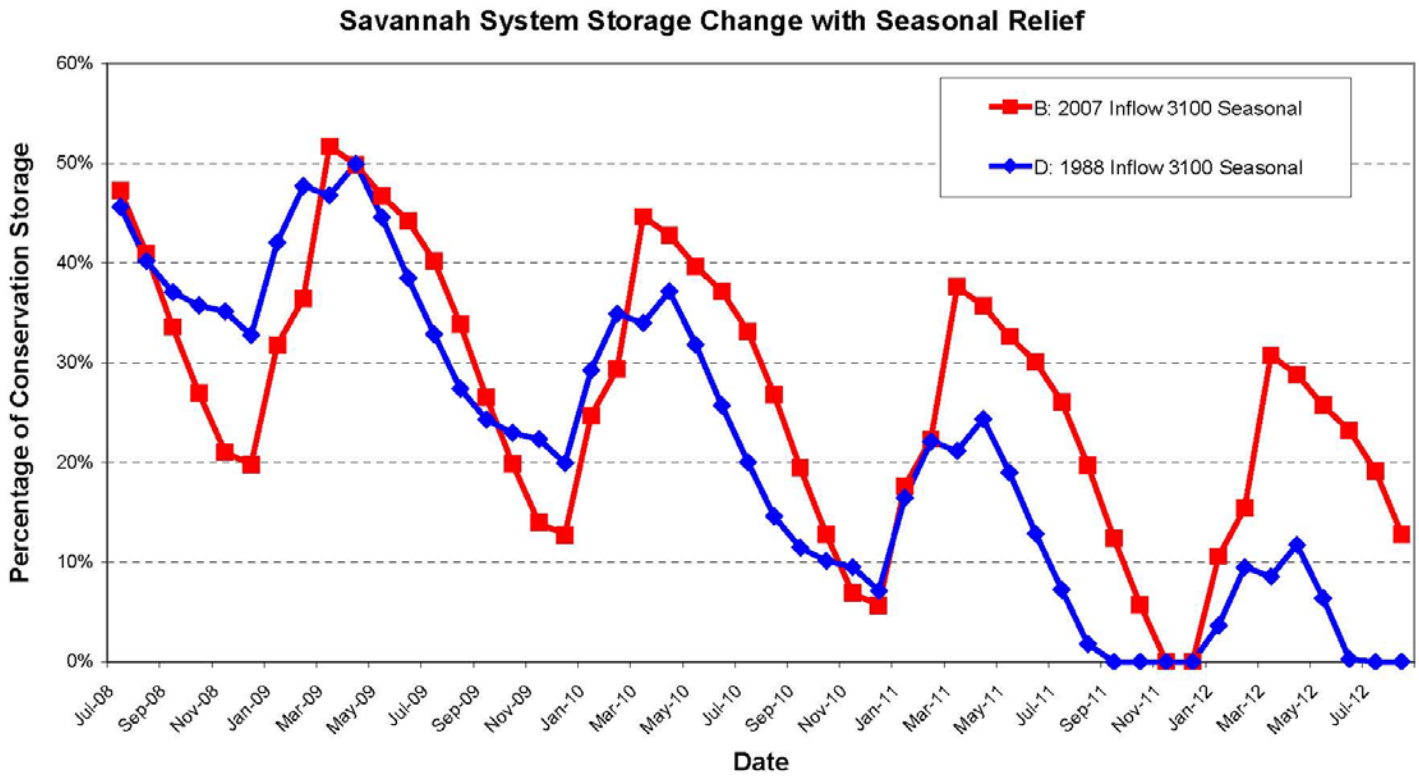


Fig. 9 Reducing Thurmond release to 3,100 cfs only in the cool season results in more stabilized system storage, even with worse-than-record inflow (90% of 2007 and 1998 recorded inflow)

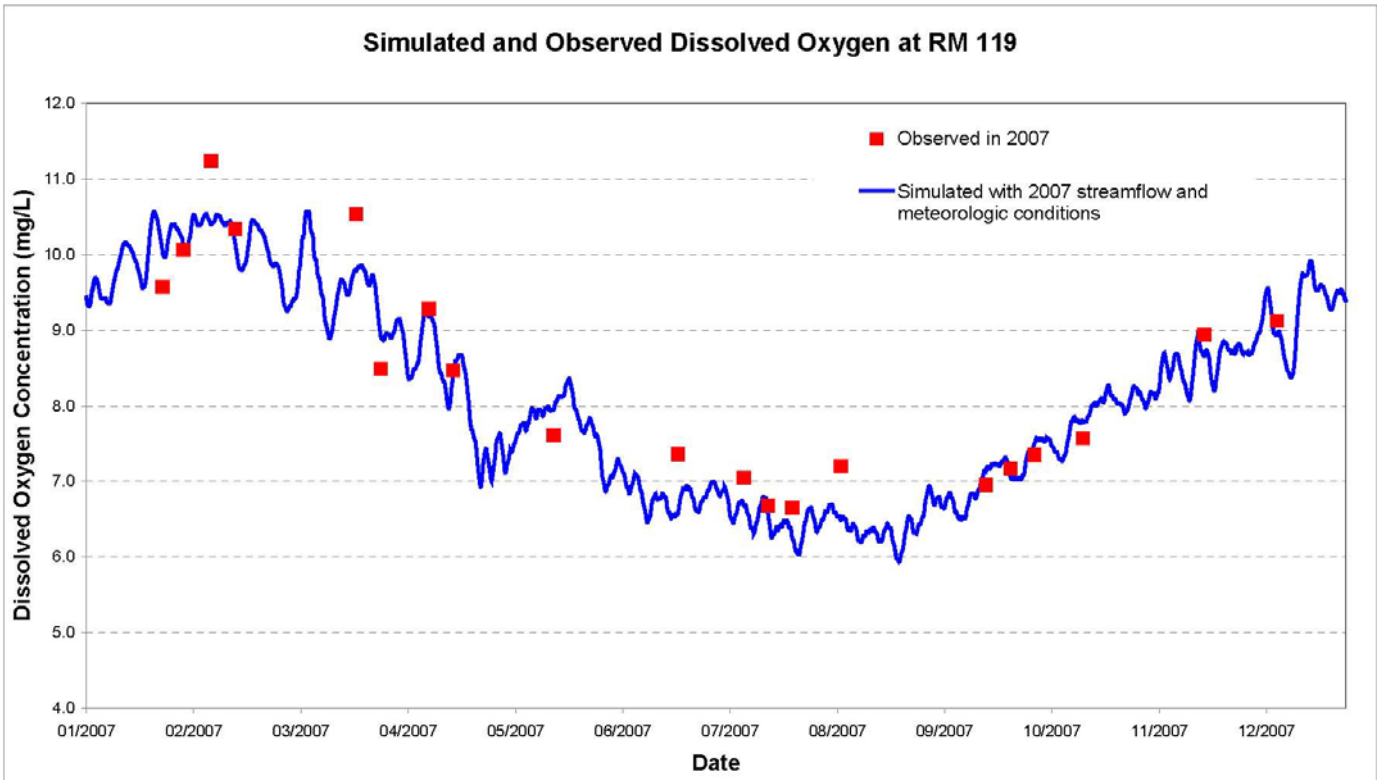
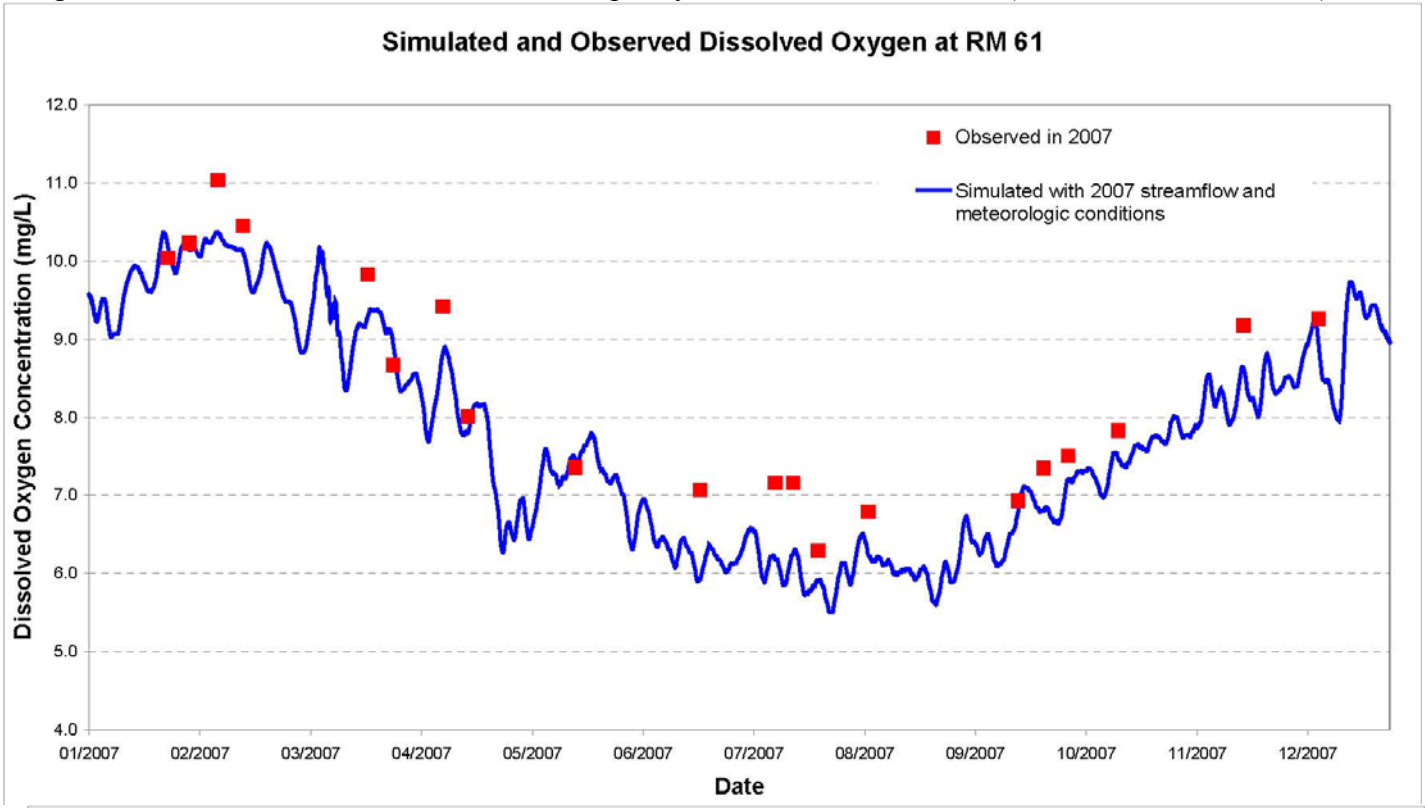


Fig. 10 Calibration of Savannah River water quality model at River Mile 119 (2007 Thurmond release)

Fig. 11 Calibration of Savannah River water quality model at River Mile 61 (2007 Thurmond release)



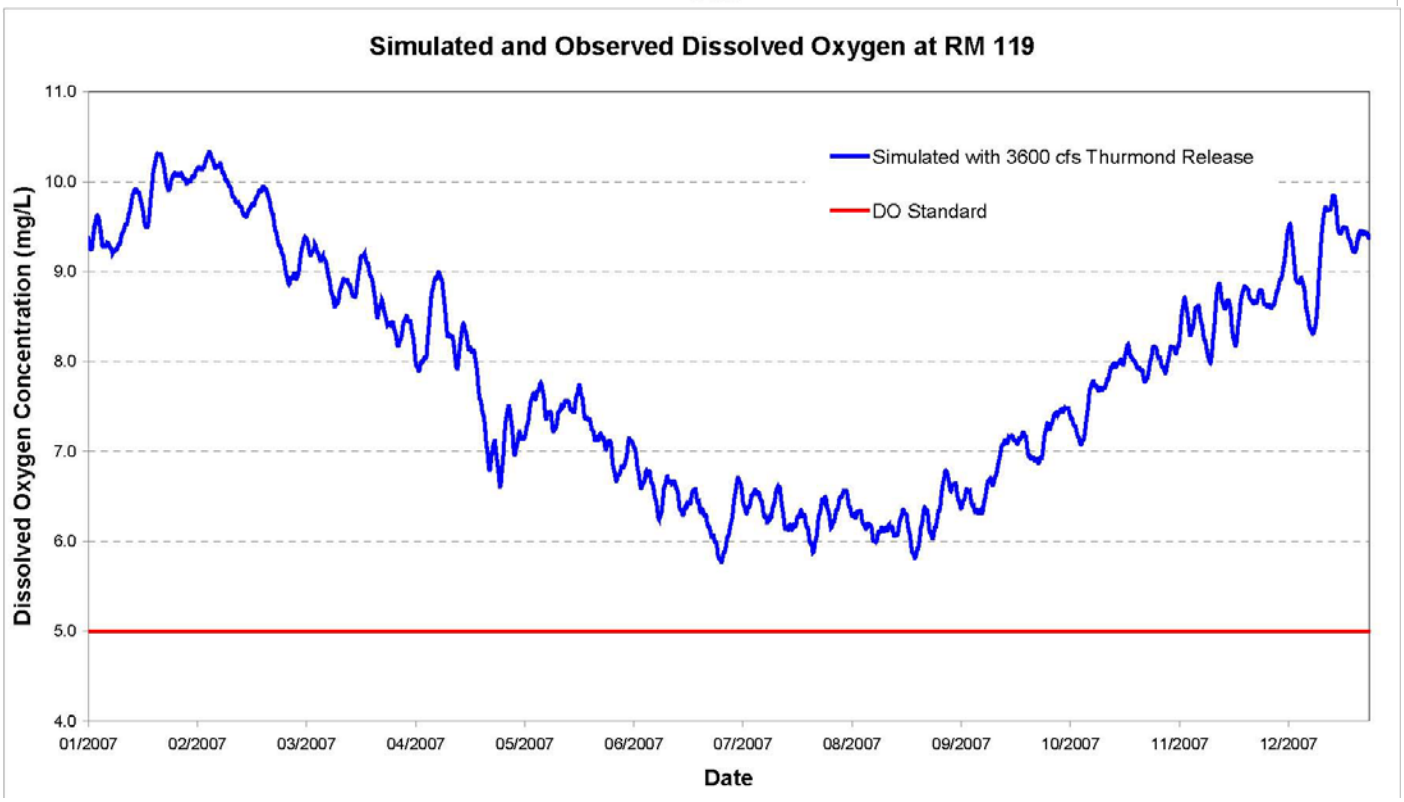


Fig. 12 Dissolved oxygen at RM 119 (with 2007 tributary inflow and meteorological data)

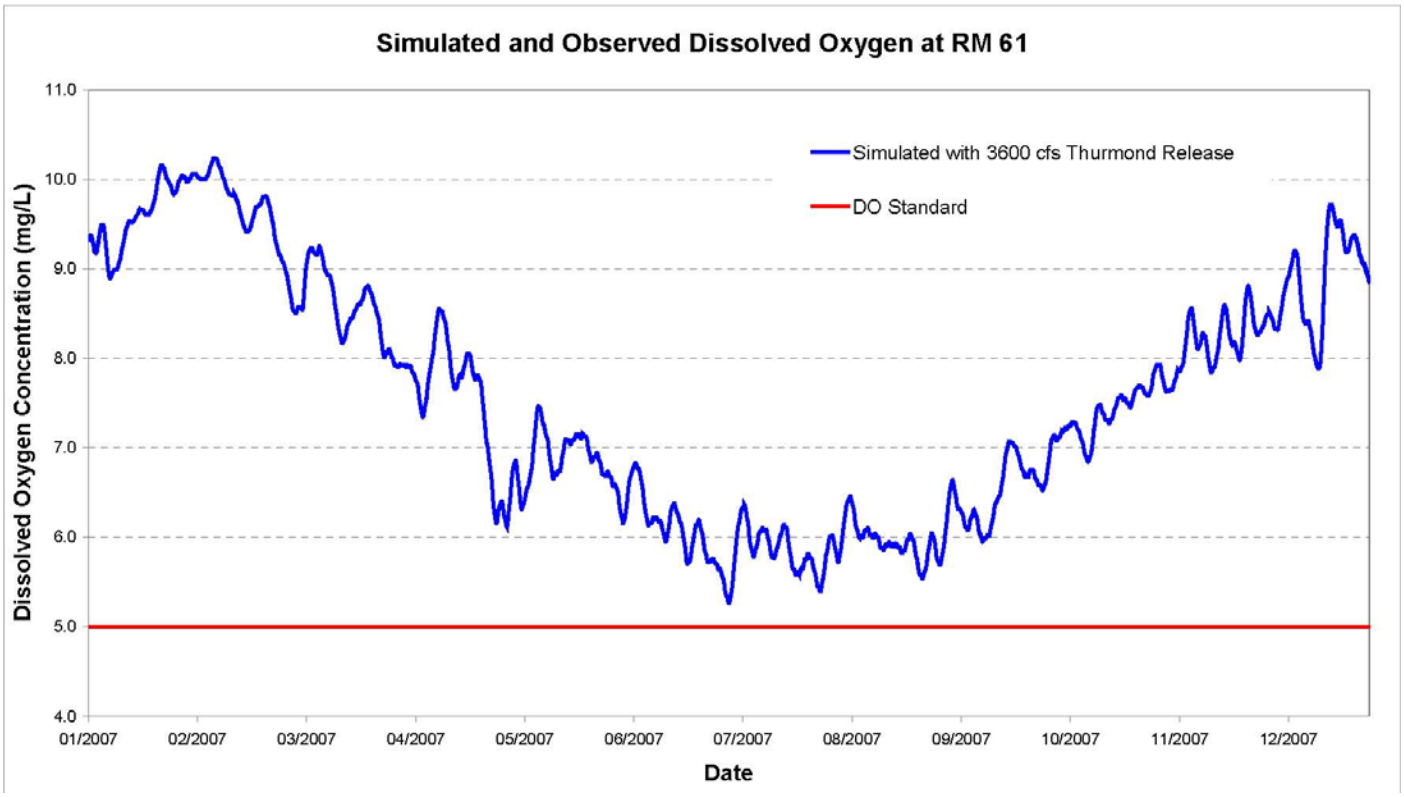


Fig. 13 Dissolved oxygen at RM 61 (with 2007 tributary inflow and meteorological data)

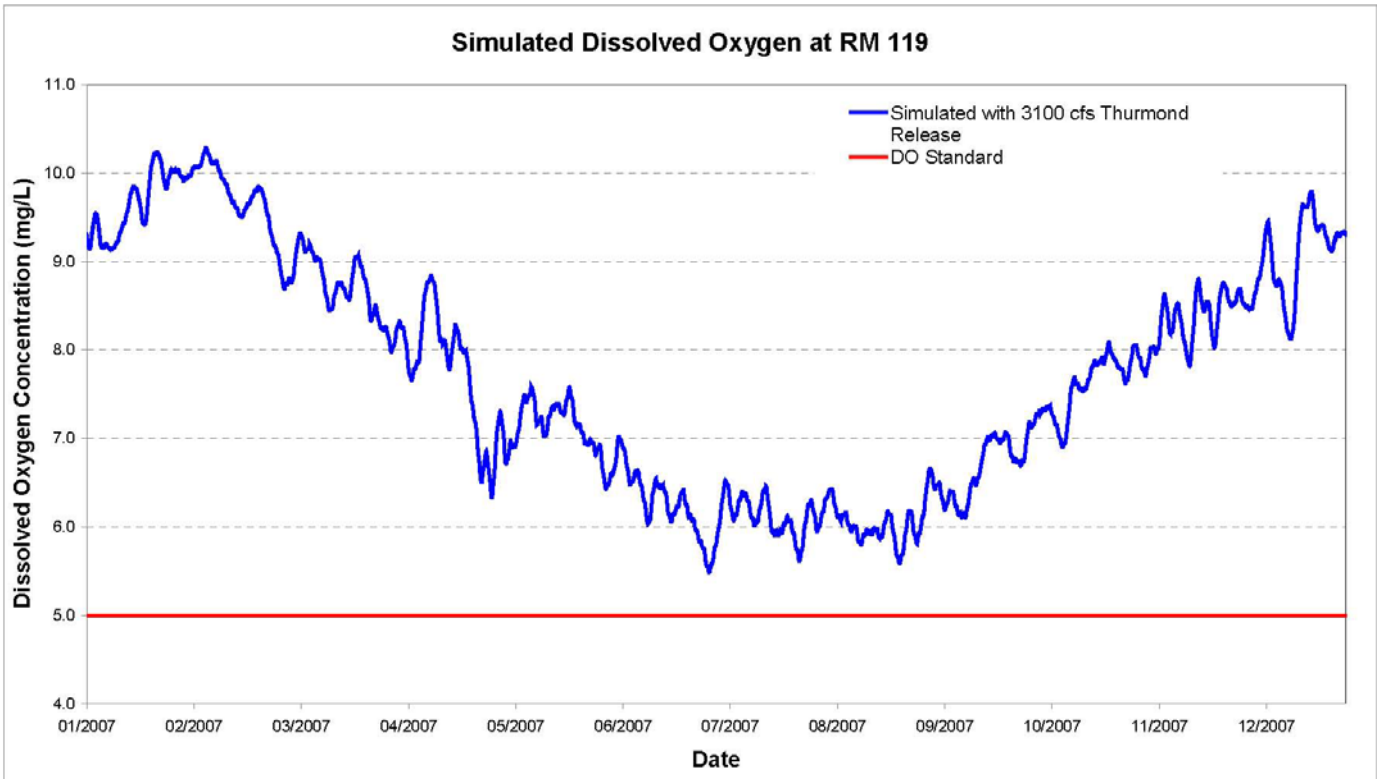


Fig. 14 Simulated dissolved oxygen at RM 119

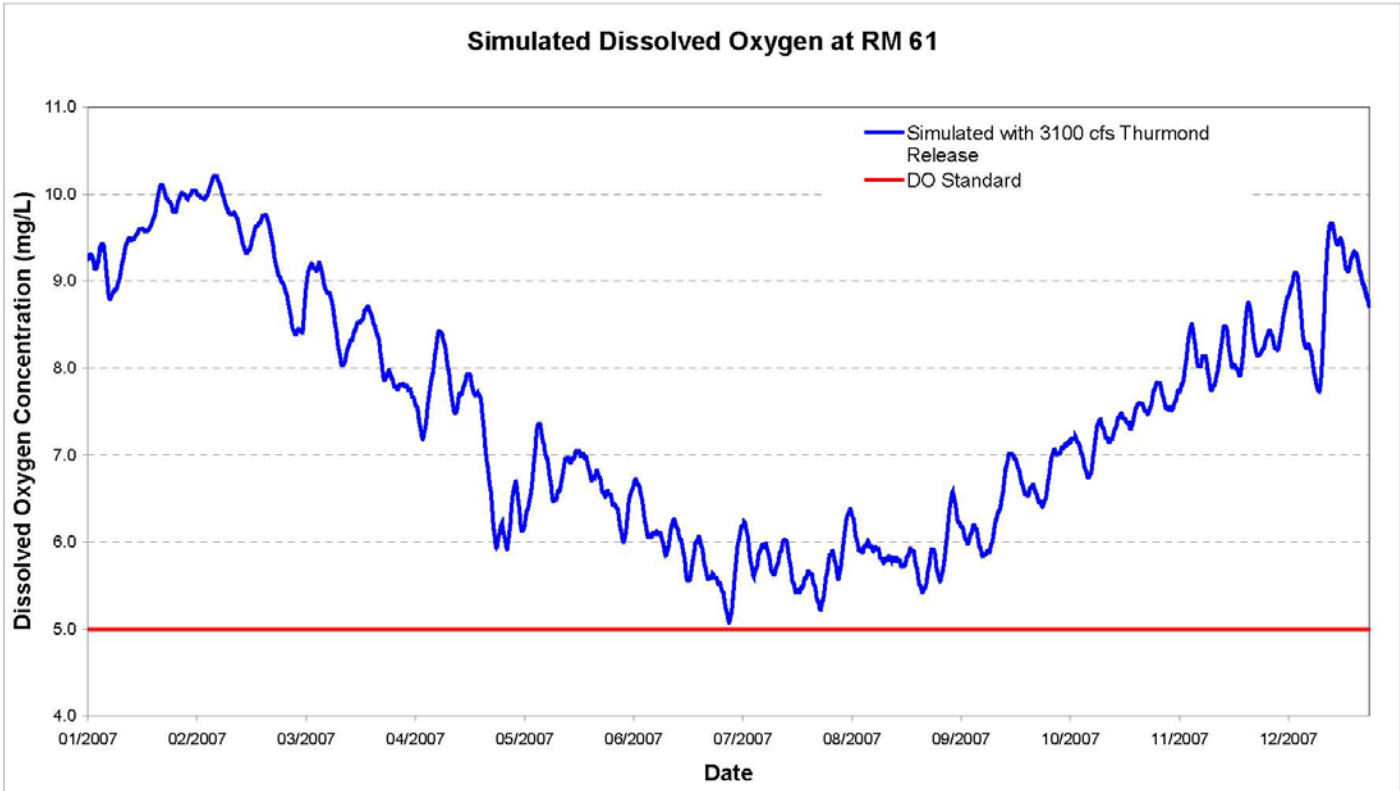


Fig. 15 Simulated dissolved oxygen at RM 61

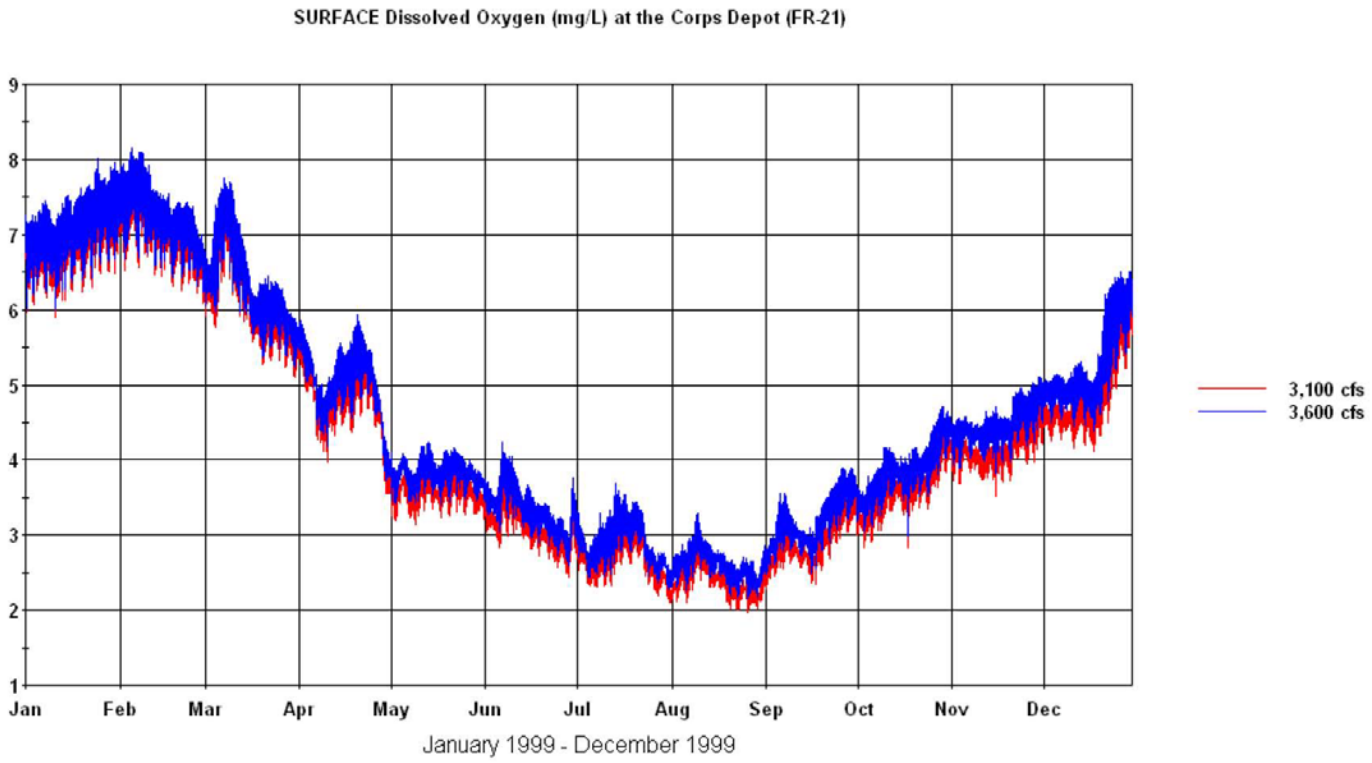
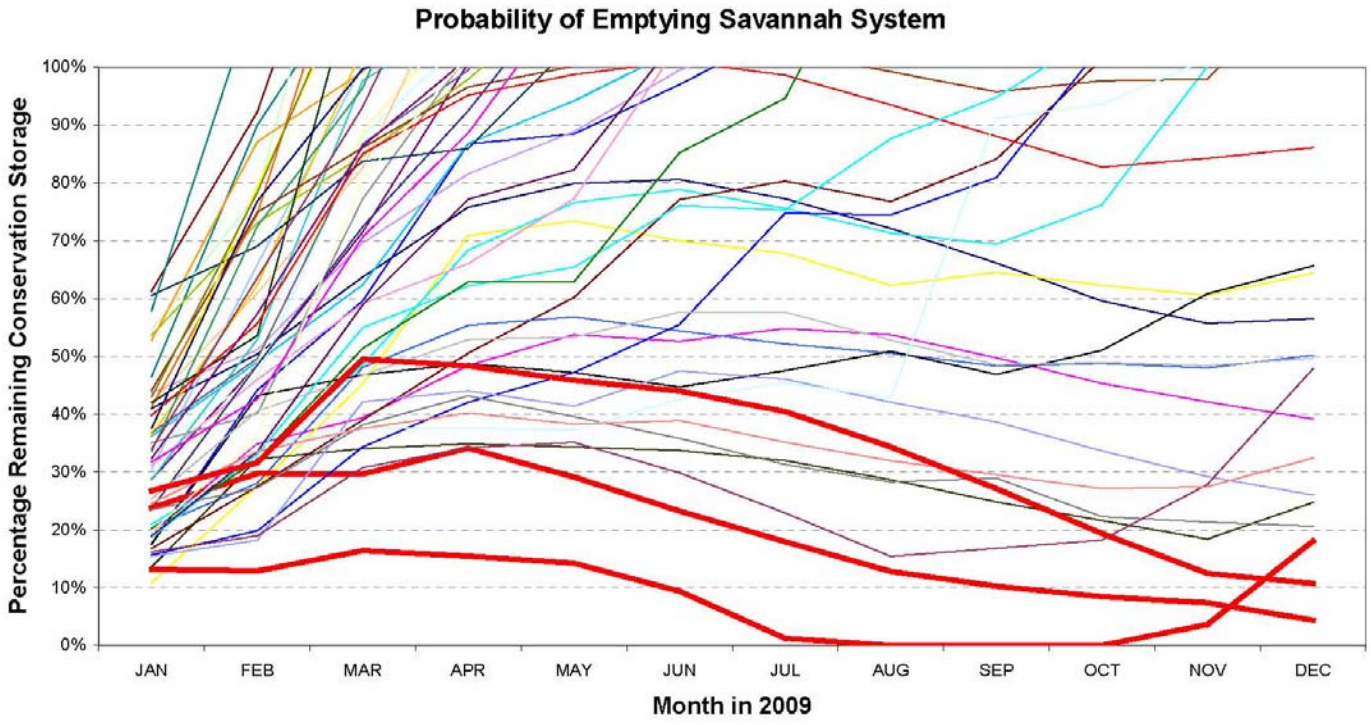


Fig. 16 Simulated surface dissolved oxygen in Savannah harbor

Fig. 17 Probability of refill (emptying) analysis reveals real danger of exhausting system conservation storage



Low Flow (Real Time) Management Plan
for Emergency Drought Response in the Savannah River Basin

A. Purpose/Background

As a result of extreme drought conditions in northeast Georgia, the Georgia Environmental Protection Division (GAEPD), South Carolina Department of Health and Environmental Control (SCDHEC), and South Carolina Department of Natural Resources (SCDNR) are proposing a temporary release reduction at Thurmond Dam from 3600 cfs to 3100 cfs beginning October 1st through the end of February. The Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impact seeks to minimize the depletion of reservoir storage during extreme drought when less than 35% of system conservation remains. Minimizing the depletion of storage will affect both Lake Hartwell and Thurmond Lake. Implementation of the proposed changes should result, at current drought conditions, with the delay of lake level reductions to Level 4 (outflow=inflow) until sometime during the time period of September through November 2011.

This Low Flow (Real Time) Management Plan provides a method for implementing the Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts, and for considering potential upward adjustments to the 3100 cfs (not to exceed 3600 cfs) should a decision be made that significant environmental impacts are occurring. The strategy and plan are not meant to replace the Army Corps of Engineers (ACE) current drought management plan, but instead are to be considered temporary modifications to the plan based on extreme drought conditions in the Savannah River Basin. Both documents were developed with input from multiple stakeholders.

B. Affected Environmental Elements/Low Flow Conditions

- Water quality standards (DO, pH, Temperature)
    - Important for maintaining aquatic biology
- Salt wedge location
    - Important for City of Savannah/BJWSA water supply intakes
    - Important for freshwater habitat maintenance
- Water levels at water intake structures
    - Important for all water users
- Habitat water levels/in-stream flow volumes
    - In shoal habitat within the Central Savannah River Area (CSRA)
      Important for fish spawning and the Rocky Shoals Spider Lily
    - In river bends that could be isolated
      Important for mussel habitat
    - At critical in-stream fish habitat
      Important for determining impact to known fish spawning habitat, especially those species that are endangered

C. Baseline Monitoring Parameters/Low Flow Conditions

- Water quality
  - Continuous sonde data
    - dissolved oxygen
    - pH
    - temperature
    - specific conductance
- Water quantity (Savannah River flow)
  - Continuous discharge measurements
  - Continuous water levels
    - At critical habitat locations
    - At water intake structures

All current monitoring locations within the basin are shown in the Appendix.

D. Management Plan Elements

1. Dams and Diversions (operational strategies for river impoundments and the Augusta Canal System)

a). Storage and Discharge from J. Strom Thurmond Dam

GAEPD, SCDHEC, and SCDNR are proposing a seasonal release from Thurmond Dam constituting 3600 cfs from March through September and 3100 cfs from October through February. Beginning October 1st, discharges from Thurmond Dam would be transitioned down to 3100 cfs over a one-week period. Once the 3100 cfs objective is reached, it would be maintained until 28 February or until such time that 1) a listed monitoring site fails to meet its environmental target and 2) a decision is made by GAEPD, SCDHEC and SCDNR to modify the 3100 cfs. If such an event were to occur, discharges from Thurmond would be incrementally increased by 100 cfs/week until the impact is alleviated or 3600 cfs is reached. It's important to note however that any increase in flow up to and including 3600 cfs during the winter months could result in Level 4 arriving sooner than the currently predicted time period of September through November 2011.

b). Storage and Discharge from Stevens Creek Dam

Stevens Creek Dam attenuates the large, hourly discharge peaks from Thurmond Dam. The Stevens Creek Reservoir will continue to be managed to release as flat a schedule as possible equaling the daily average release at Thurmond Dam plus any local inflows.

c) Discharge between Shoals and Augusta Canal at the Augusta Diversion Dam

Diversions into the Augusta Canal are managed by the City of Augusta to maintain a minimum of 1500 cfs through the Shoals (FERC) from May though January and 1800 cfs in the remaining months. Three electronically controllable gates, operated by the City of Augusta, allow for instantaneous changes of flow to the canal. Based on current permit information on the City of Augusta intake, the City is allowed to withdraw no more than 45 MGD (about 70 cfs). The City has four turbines in its water supply operation. These turbines are driven by canal water, which in turn operates raw water pumps. Usually the City operates Units 1 and 4 to supply water needs at 1364 cfs. This amount is passed through the turbines and returned entirely to the main stem of the Savannah River (discharged into the last third of the shoals).

There are three mills using canal water downstream of the Augusta intake: Sibley, King, and Enterprise. All three mills have turbines used for hydropower generation that are driven by canal water. All water is passed through to the main stem of the Savannah River; in this case downstream of the shoals. Sibley Mill reportedly needs a flow of 1024 cfs, King 880 cfs and Enterprise 560 cfs.

At 3600 cfs (current release from Thurmond), and without consideration of incremental flows (very low), 1500 cfs would have to be provided at the diversion for the shoals (FERC), leaving 2100 cfs for the canal. After the City's turbines and intake, there would be less than 800 cfs remaining for the canal and downstream use. Reportedly, at this time, the mills are still able to operate.

Under the proposed seasonal flow strategy, a 3100 cfs flow would be released from Thurmond Dam from October through February. If the City operates the gates to ensure 1500 cfs through the shoals, the remaining water through the canal would be 1600 cfs (again assuming low incremental flows). While this should be sufficient water for Augusta's water supply needs, the downstream mills would be receiving less than 300 cfs for their hydropower operations.

Reportedly, the mills are connected to the power grid. Discussions will need to occur with the mills to determine their abilities to operate at the 3100 cfs and to use, if necessary, power from the grid during the low flow periods.

d) CSRA pool elevation/discharge over NSBL&D

Discharge from the Lock and Dam would be adjusted to maintain the pool within its current operating limits.

2. Water Management Targets

a). Water quality standards (DO, pH, temperature) within the lower Savannah River Basin (Table 1)

At this time, most of the continuous monitors within the mainstem of the freshwater portion of the river are not Internet accessible. Flow correlations to continuous data can only be established after data has been downloaded and analyzed. However, USGS operates a continuous monitor in the Savannah River at the USACE Dock (021989773). This monitor is located near where the dissolved oxygen concentration is typically the lowest in the Savannah River Basin. If a violation of water quality standards occurs, specifically for DO, pH, and/or temperature, a decision will be made by GAEPD, SCDHEC and SCDNR as to the need to incrementally increase the release from Thurmond Dam by 100 cfs/week until the standard is met or until 3600 cfs is reached..

Table 1. Water quality standards

Waterbody	Dissolved Oxygen	Temperature	pH
Savannah River	5.0 mg/L daily average 4.0 mg/L instantaneous	≤ 90 ºF	6-8.5
[1] South Carolina Regulations 61-68 & 61-69, Water Classifications and Standards			
[2] Georgia DNR EPD Regulations 391-3-6-.03, Water Use Classifications and Water Quality Standards			

b). Saltwater Wedge

The USGS operates a water quality monitor at I-95 near Port Wentworth (02198840). A maximum specific conductivity level of 10,000 microseimens measured at I-95 will be considered a management target for unacceptable migration of the salt-water wedge. Conductivity of 8000 microseimens was measured at I-95 during the 1998-2002 drought, so 10,000 is considered a valid and conservative number. The City of Savannah's intake water quality could be adversely affected by expansion of this wedge. Currently the City collects chloride data in Abercorn Creek. If the City's intake chloride concentrations increase to 16 ppm , then the City of Savannah will be consulted prior to any decision by GAEPA, SCDHEC and SCDNR to release

additional water from Thurmond Dam. Typically the spring tide causes the largest intrusion of salt water upriver. If needed, benefit may come from releasing more water in time to meet the spring tide after which flows could be reduced back to the 3100 cfs.

c). Flows at Clyo/Savannah Harbor

There is a USGS gauge at Clyo (02198500), which also can be used as a management location. If the flows at Clyo are greater than 5000 cfs, there would be no need to increase flow above 3100 cfs from Thurmond Dam regardless of the water quality violations in the Harbor since the reduced flows from Thurmond Dam should not be the cause of the violations. However, if the flow at Clyo is less than 4500 cfs then closer evaluation of the water quality standards is warranted. Should water quality violations be occurring, then a decision will need to be made by GAEPD, SCDHEC and SCDNR regarding incrementally increasing flows from Thurmond Dam by 100 cfs/week until either the water quality standard is met or 3600 cfs is reached. Finally, if the flow at Clyo is between 4500 and 5000 cfs, then an evaluation of the situation to determine if there are unusual circumstances such as higher than normal tides, off shore storms, will be performed to assist in deciding if increase flows from Thurmond are warranted to help solve the problem.

d). Water levels at Permitted Surface Water Intakes

Initial minimum stage requirements have been established for each permitted intake (see Table 2 below). Each permit holder will monitor intake performance. If intakes become impacted and/or unusable due to insufficient river stage, releases from Thurmond Dam will be as required to ensure that the river stage is sufficient to return the intake to service. This is a high priority consideration for protection of public health. Should a problem with an intake arise, consultations with the affected intake operator will also occur to discuss the possibility of employing emergency measures that may be successful in adapting to the lower flows.

Table 2. Intake requirements for entities along the Savannah River.

Facility Name	Invert Elevation	Minimum Elevation Required	Corresponding Flow to Min. Elev (cfs)
Columbia Cty			
Augusta Canal			1600 cfs in canal + 1000 cfs in shoals
Edgefield Cty	149.5	149.5	
City of Augusta		119.5	
City of North Augusta	106	109	1000 cfs at elevation 109 ft
SCE&G	106	105.5	900 cfs at elevation 106 ft
PCS Nitrogen	97.75	103.9	1300 cfs at elevation 110 ft
DSM Chemical	97.75	103.9	1300 cfs at elevation 110 ft
General Chemical	110.2	111	1800 cfs at elevation 111 ft at DSM Chemical
Kimberly Clark		109	1060 cfs at elevation 109 ft
International Paper	94	94	2800 cfs at elevation 94 ft
Savannah River Site	81	81	3400 cfs at elevation 81 ft; 2300 cfs at elevation 79 ft
Plant Vogtle	70	70	always met
Savannah Electric- Plant McIntosh	7.5	7.5	3500 cfs at elevation 7.5 ft
Georgia Pacific	-1	5.16	3300 cfs at elevation 15.39 ft (at Clyo)
City of Savannah		-10.22	
Beaufort-Jasper		+3	

modified from GAEPD, SCDHEC, and SCDNR Draft, *Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts*, July 2008

e). Sturgeon Protection

Sturgeon passage and spawning activity is monitored by SCDNR (fish are tagged and their movement closely observed). SCDNR can determine whether or not fish are successfully navigating toward their spawning habitat. Should problems result in sturgeon migration at lower flows, then a decision will need to be made by GAEPD, SCDHEC and SCDNR on releasing additional water up to the 3600 cfs for the required navigational period.

E. Habitat Water Levels/Instream Flow Volume Considerations

At this point, there is no correlation between discharge at the New Savannah Bluff Lock and Dam (NSBL&D) gauge and water elevation within the shoals. Water depths for fish spawning and habitat have not been established. There is no correlation between discharge and water elevation/depth within the cutoff bends which may affect mussel habitat. There is also no correlation between discharge and water elevation at critical in-stream fish habitat. Discharge measurements should be measured at the habitat site and correlated to a nearby USGS gauge.

The correlation between discharge and critical habitat will require measuring water depth and percent inundation at various discharges at the specific mussel and fish habitat sites. A mesohabitat study showing shoal habitat classifications/areas in response to a range of flows will need to be done. Fish passage monitoring for diadromous fish at the NSBL&D and sampling for juvenile diadromous fish, at least shad and striped bass in the Savannah River from the Augusta Dam downstream to appropriate sampling areas below the NSBL&D will need to be conducted. Juvenile/adult index could then be correlated with river basin flows from year to year. The Southeast National Sciences Academy (SNSA) is working with Augusta State, USFWS, TNC and others to determine these water level targets.

However, developing water level targets for the shoal habitat, the cutoff river bends, and at the critical instream fish habitat cannot be developed within the current time frame for this winter season. Information gathered this fall/winter could be used to develop water level targets that may be used if extreme drought conditions continue in the basin.

F. Monitoring Locations/Communication routes

The following table lists those parties that will be responsible for reporting to GAEPD on specific environmental targets. Upon review of that information, and discussion with SCDHEC and SCDNR, decisions will be made on notifying the ACE of appropriate adjustments to Thurmond release levels.

Table 3

Location	Target	Responsible Party
Shoals	Flow 1500 cfs	City Of Augusta
USGS 021989773	DO 5.0 mg/L daily average DO 4.0 mg/L instantaneous Temperature ≤ 90 ºF pH 6-8.5	GAEPD
USGS 02198840	Conductivity 10,000 µS/cm	GA EPD
Abercorn Creek	Chloride 16 ppm	City of Savannah
USGS 02198500	Flow < 4,500 cfs	SC DHEC
Various	Water level at the intakes	Intake operators
Various	Sturgeon migration	SC DNR

APPENDIX D

2008 AGENCY LOW FLOW

REQUEST LETTERS

Georgia Department of Natural Resources
2 Martin Luther King Jr., Drive, Suite 1152 East Tower, Atlanta, Georgia 30334
Noel Holcomb, Commissioner
Carol A. Couch, Ph.D., Director
Environmental Protection Division
(404) 656-4713

October 1, 2008

Colonel Edward J. Kertis, Jr.
District Commander
U.S. Army Corps of Engineers
Savannah District
100 W. Oglethorpe Ave.
P.O. Box 889
Savannah, Georgia 31402-0889

RE: Savannah River Basin Drought
Request for Modification to the Drought
Contingency Plan Through
The Environmental Assessment Process (EA)

Dear Colonel Kertis:

As you are aware, since the US Army Corps of Engineers (USACE), Savannah District, first declared, in June of 2007, an Action Level 1 release from Thurmond Dam (4200 cfs), the State of Georgia Environmental Protection Division (GA EPD), along with the State of South Carolina, and other Federal, State and local stakeholders, have been routinely discussing and evaluating the drought crisis in the Upper Savannah River Basin via USACE bi-weekly conference calls. These calls have been very helpful and have allowed the participants to fully understand the status of drought in this region, predictions on persistence of the drought, how it might affect those users downstream of Thurmond dam, and how it is affecting the levels of Lakes Hartwell, Russell and Thurmond.

In response to continuing concerns regarding lake levels and predictions on when Action Level 4 (outflow =inflow) might be reached, in December of 2007, the GA EPD organized a Technical Coordination Group (TCG), comprised of Federal and State agencies (see attached list), whose charge was to analyze and evaluate possible alternatives to the existing releases as authorized under the USACE's Drought Contingency Plan. At that time, Thurmond Dam was being operated in accordance with a Modified Action Level 2 (3600 cfs minimum).

Through subsequent TCG meetings, and then just as critically, through breakout meetings involving the States of Georgia and South Carolina, a finalized proposal has been developed on how to extend storage in the lake system through a seasonal release strategy for Thurmond Dam. The attached document entitled Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts (authored by the GA EPD, the South Carolina Department of Health and Environmental Control and the South Carolina Department of Natural Resources) provides the rationale for extending the life of each conservation pool via a seasonal release from Thurmond Dam (3100 cfs from October through February, with a return to a release of 3600 cfs (daily) from March

through September). The other attached document entitled Low Flow (Real Time) Management Plan for Emergency Drought Response in the Savannah River Basin (accomplished with an even broader stakeholder group) provides a program for monitoring appropriate environmental targets with the potential to adjust the 3100 cfs should unacceptable impacts occur to those targets during the October through February time period.

Throughout this process, the USACE has not only been vital in providing predictive information on lake storage levels, but with providing information on how best to expedite implementation of a seasonal strategy using the USACE's Environmental Assessment (EA) process. To that end, I am requesting that the USACE submit to public notice, via its EA process, a strategy for operating the Lake Thurmond project as detailed in the attached documents. Since I consider this an emergency situation and one worthy of reduced EA timelines, I request that the EA process be accomplished, if possible, through a 15 day public notice. The release from Thurmond Dam is now at Action Level 3 (3600 cfs daily), so time is of the essence in initiating the EA process so that the USACE can quickly implement these modifications.

Your continued cooperation in addressing this critical situation is appreciated.

Sincerely,

Carol A. Couch
Director

CC: Mr. Robert W. King, Jr.
Deputy Director
South Carolina Department of Health & Environmental Control-EQC

Mr. D. Breck Carmichael, Jr.
Deputy Director
Wildlife and Freshwater Fisheries Division
South Carolina Department of Natural Resources

ATTACHMENT

D H E C

PROMOTE PROTECT PROSPER

C. Earl Hunter, Commissioner

Promoting and protecting the health of the public and the environment.

~~DE~~
OP

cf: DE
DC
DP
CS
DX

SI 24 Oct 08

October 6, 2008

Colonel Edward J. Kertis, Jr.
District Commander
U.S. Army Corps of Engineers
Savannah District
100 W. Oglethorpe Ave.
PO Box 889
Savannah, Georgia 31402-0889

Re: Savannah River Basin Drought
Request for Modification to the Drought Contingency Plan
Georgia Department of Natural Resources letter dated October 1, 2008

Dear Colonel Kertis:

The referenced letter from the Georgia Department of Resources discussed the background and actions taken to date on this matter, so I will not restate them here. The South Carolina Department of Health and Environmental Control (SCDHEC) supports the proposed temporary changes to Lake Thurmond releases to mitigate drought impacts as outlined in Dr. Couch's letter, and also requests an expedited Environmental Assessment process.

If you have any questions, please let me know.

Sincerely,

Robert W. King, Jr., P.E.
Deputy Commissioner
Environmental Quality Control

CC: Dr. Carol Couch, Director
Georgia Environmental Protection Division

John Frampton, Director
SC Department of Natural Resources

South Carolina Department of
Natural Resources

John E. Frampton
Director

October 10, 2008

Col. Edward J. Kertis, Jr.
District Commander
U.S. Army Corps of Engineers
Savannah District
100 W. Oglethorpe Ave., PO Box 889
Savannah, GA 31402-0889

Dear Colonel Kertis:

As we all are aware, the upper Savannah River basin has experienced a severe drought for the past two and a half years that, despite conservation efforts by the Corps of Engineers, has lowered water levels in Hartwell, Russell, and Thurmond Reservoirs to near record-low levels.

These reservoirs are extremely important to both South Carolina's and Georgia's economies, natural resources, and the health of our citizens. Not only are the reservoirs themselves vital to South Carolina and Georgia, but during this severe drought, releases from the reservoirs are enhancing the flow of the Savannah River, thereby protecting downstream ecosystems, public water supplies, industries, and power plants.

The South Carolina Department of Natural Resources (SCDNR) has worked cooperatively with representatives from the Georgia Environmental Protection Division (GAEPD), the South Carolina Department of Health and Environmental Control (SCDHEC), the U.S. Army Corps of Engineers, and other agencies and stakeholders to develop a proposal to delay the complete depletion of the lakes' conservation pools. Together, the States of South Carolina and Georgia have finalized a proposal to reduce releases from Thurmond Reservoir during the winter months if this severe drought persists. The document entitled *Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts*, coauthored by GAEPD, SCDHEC, and SCDNR, and which has already been presented to you by GAEPD, describes the seasonal flow reduction agreed upon by both States.

Due to the importance of this matter, I am recommending that you implement this flow reduction plan as soon as possible.

Because the proposed release reduction from Thurmond Reservoir cannot be initiated until the Corps of Engineers complete an Environment Assessment, I am urging you to begin the Environment Assessment process immediately, and to make every effort to complete it as quickly as possible, including, if possible, the use of a 15-day public comment period. The opportunity for release reductions for October of this year has already been lost, but quick action by the Corps can allow these reductions to go into effect by November of this year.

Also, I would like to request that your staff work with representatives from both States in planning for the transition into Level 4 drought releases (outflow equals inflow) should this severe drought continue and our efforts to preserve the conservation pools prove unsuccessful.

I appreciate your serious consideration of this proposal.

Sincerely,

John E. Frampton
Director

cc: Michael G. McShane, Chairman, SCDNR Board
Robert W. King, Deputy Commissioner, SCDHEC
Noel Holcombe, Director, GADNR
Carol Couch, Director, GAEPD
Steve de Kozlowski, Interim Deputy Director, SCDNR-LWC
Bob Perry, Director, Office of Environmental Programs, SCDNR

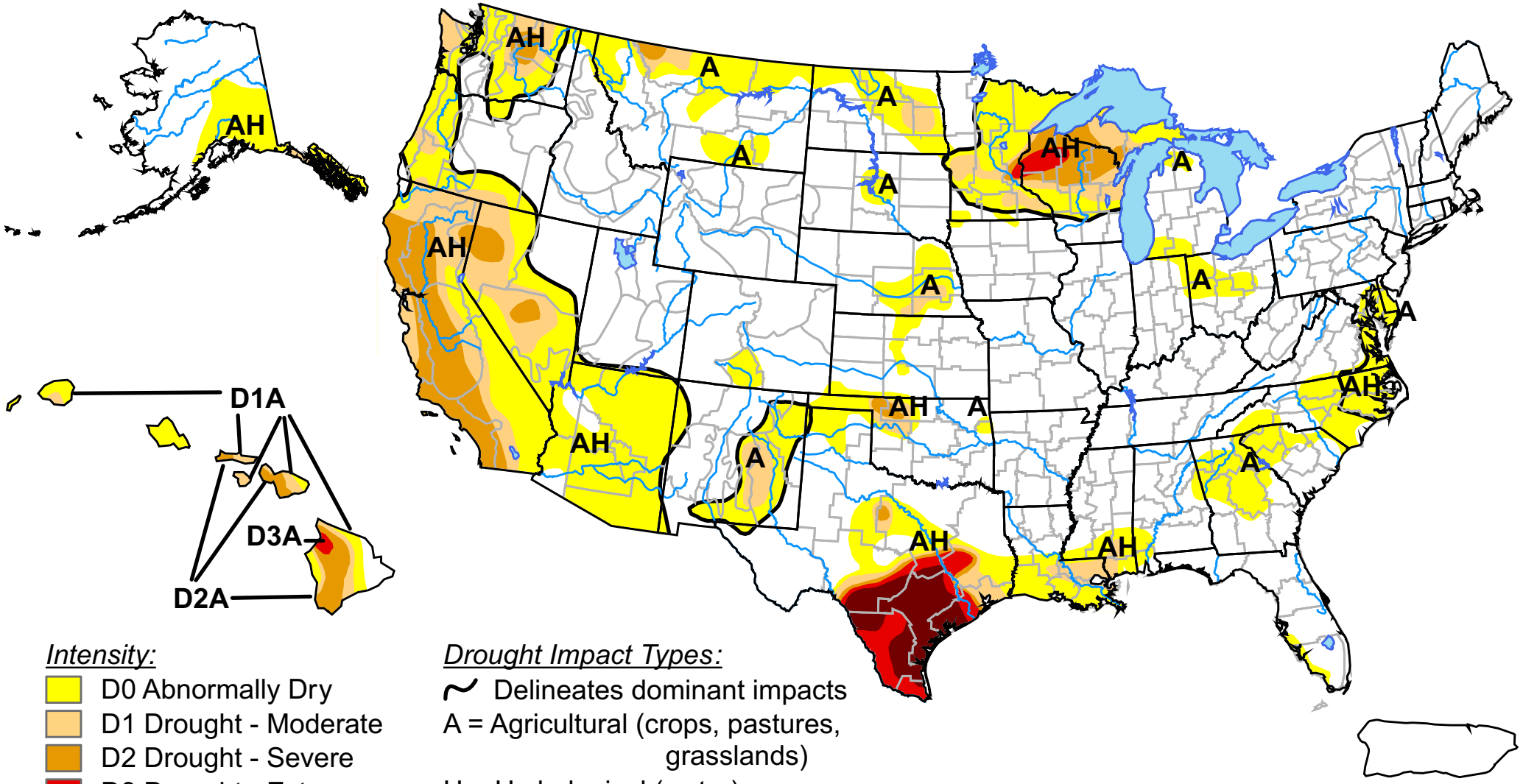
APPENDIX E

US DROUGHT MONITOR MAP

11 AUGUST 2009

U.S. Drought Monitor

August 11, 2009
Valid 8 a.m. EDT



Intensity:
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:
- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

National Drought Mitigation Center

Released Thursday, August 13, 2009

Author: Laura Edwards, Western Regional Climate Center

APPENDIX F

U.S. FISH AND WILDLIFE
FLOW RECOMMENDATION LETTER

JUNE 4, 2009

United States Department of the Interior

Fish and Wildlife Service
105 West Park Drive, Suite D
Athens, Georgia 30606
Phone: (706) 613-9493
Fax: (706) 613-6059

West Georgia Sub-Office
Post Office Box 52560
Fort Benning, Georgia 31995-2560
Phone: (706) 544-6428
Fax: (706) 544-6419

Coastal Sub-Office
4980 Wildlife Drive
Townsend, Georgia 31331
Phone: (912) 832-8739
Fax: (912) 832-8744

JUN 04 2009

Mr. William Bailey (ATTN: PD-E)
Environmental Resources Branch
United States Army Corps of Engineers
100 West Oglethorpe Avenue
Savannah, Georgia 31401-3640

Subject: Savannah River flow recommendations below Thurmond Dam
FWS Log No. 41460-2009-FA-0650

Dear Mr. Bailey:

The U.S. Fish and Wildlife Service (Service) has reviewed your March 16, 2009, email correspondence requesting information on biological and physical flow thresholds in the Savannah River below the United States Army Corps of Engineers (COE) reservoirs. According to your email, this information will be used to evaluate a reduction of the releases below the COE reservoirs during future fall, winter, and spring periods, especially related to fish spawning. The COE recently reduced flows from the J. Strom Thurmond Reservoir (Thurmond) from a daily average flow of 3,600 to 3,100 cubic feet per second (cfs), as measured at Thurmond, from November 2008 to the end of January 2009 in accordance with the Temporary Deviation Drought Contingency Plan for the Savannah River Basin (COE 2008, Ed Betross, GDNR, 2009, personal communication). Per your April 6, 2009, phone conversation with the Service, the COE is now gathering information for the development of an Environmental Assessment (EA) in relation to extending this flow reduction period. We submit the following comments under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*) and as technical assistance under the Fish and Wildlife Coordination Act (FWCA)(48 Stat. 401, as amended; 16 U.S.C. § 661 *et seq.*).

Endangered Species Act

On October 27, 2008, the Service concurred with your determination that the COE's reduction of flows from 3600 cfs to 3100 cfs from November 1, 2008 to February 28, 2009 was not likely to adversely affect federally-listed or proposed endangered and threatened species under our jurisdiction, including the wood stork (*Mycteria americana*) and manatee (*Trichechus manatus*). Based on the information provided thus far, the Service does not expect adverse affects to these

species for this new proposed action. The shortnose sturgeon (*Acipenser brevirostrum*) is federally endangered under the purview of the National Oceanic and Atmospheric Administration (NOAA) Fisheries for the ESA.

Fish and Wildlife Coordination Act

We are concerned about the effects of a proposed flow reduction in the Augusta Shoals and the lower Savannah River. The Service is particularly concerned about effects to the:

- federally endangered shortnose sturgeon;
- Federal species of concern robust redhorse (*Moxostoma robustum*). The robust redhorse, although not federally-listed, is the subject of a pre-listing recovery approach by the Robust Redhorse Conservation Committee (RRCC). The COE, along with the Service, is a member of the RRCC. The RRCC is a voluntary stakeholder partnership charged with the overall responsibility for directing the recovery of the robust redhorse. As a member, the Service has included comments about potential impacts to robust redhorse.
- striped bass (*Morone saxatilis*);
- Georgia State threatened Savannah lilliput (*Toxolasma pullus*). Additionally, Savannah lilliput is undergoing a status review to determine the need to be elevated to a Federal candidate species;
- Georgia and South Carolina State endangered brother spike (*Elliptio fraterna*);
- Georgia State threatened Altamaha arcmussel (*Alasmidonta arcula*);
- Georgia State threatened shoals spiderlily (*Hymenocallis coronaria*); and
- tidal freshwater habitat provided for wetland-dependant migratory birds on the Savannah National Wildlife Refuge.

The Service provided flow recommendations for the Savannah River below the COE reservoirs in our 2003 Draft FWCA Report to the COE. Those recommendations were divided by dry, average, and wet years and were developed to benefit the entire ecosystem downstream of the COE reservoirs. We recommend the COE review this document when developing their EA. The flows for the Augusta Shoals do not include the diverted flows into the Augusta Canal; therefore those diverted flows would need to be added to the Augusta Shoals flows listed below to generate the upstream flow releases. The recommendations for **dry** years are as follows:

Month	Augusta Shoals (cfs)	Savannah River-Floodplain (cfs)	Savannah River-Estuary (cfs)
January	4000	7500	8000
February	4000	7500	8000
March	4000 (pulse of 12500-14500)	7500 (pulse of 16000-18000)	8000 (pulse of 16000-18000)
April	4000 (pulse of 12500-14500)	7500 (pulse of 16000-18000)	8000 (pulse of 16000-18000)
May	2700	6200	6200

June	2700	6200	6200
July	2700	6200	6200
August	2000	5500	6000
September	2000	5500	6000
October	2000	5500	6000
November	2700	6200	6200
December	2700	6200	6200

Additionally, the Service's Draft FWCA Report recommended the COE address critical research needs for informed management of the lower Savannah River that were developed at the Savannah River Ecosystem Flow Workshop in April 2003 (Attachment A). Since the 2003 Ecosystem Flows Workshop and the Service's Draft FWCA Report, there has been little monitoring and research to refine these flow recommendations.

A summary of the monitoring and research that has been accomplished is compiled in Wrona et al. (2007). Additionally, the Southeastern Natural Sciences Academy sent you a summary of monitoring information that may be helpful to the development of your EA (Oscar Flite, Southeastern Natural Sciences Academy, 2009, pers. comm.). Other pertinent post-2003 FWCA Report research is as follows:

• Ongoing negotiations for the Federal Energy Regulatory Commission (FERC) relicensing of the Augusta Canal project involve flows that are based on levels equal to or greater than 3600 cfs at Thurmond Dam. Due to ongoing canal maintenance, the Augusta Canal is currently not operational and nearly all discharge released from Thurmond Dam currently flows into the Augusta Shoals. Using the pre-dam discharge dataset, 3100 cfs in the Augusta Shoals is expected to occur approximately every 1.5-2 years, on average. From an ecological perspective, the discharge in the Augusta Shoals without the water diversion is likely to occur within the natural range of variation. Shoal-inhabiting organisms are unlikely to be adversely affected, assuming water quality is unimpaired. However, once the Augusta Canal is operational, and depending upon how much water is provided to the Augusta Shoals by the City of Augusta, the discharge in the Augusta Shoals may not be within the natural range of variation and adverse impacts to aquatic populations may occur.

• Shortnose sturgeon are now known to spawn on gravel bars in the Savannah River downstream of the New Savannah Bluff Lock and Dam (NSBLD) as early as mid-February (Ed Eudaly, USFWS, October 27, 2008, written correspondence to Bill Bailey, COE).

• Robust redhorse in the Savannah River are known to initiate upstream spawning migrations in March when water temperatures are 10-12 degrees Celsius and spawn from May to mid-June at several gravel bars below NSBLD. The upper gravel bar is located at river kilometer (rkm) 299.4 and the lower gravel bar at rkm 283.7. Individuals were observed on the gravel bars in 2004 and

2005 when water temperatures were 16.6-21.8 degrees Celsius. They were observed in spawning areas with a mean depth of 0.74 meters [± 0.017 standard error (SE)], mean velocity of 0.24 meters/second (± 0.014 SE), mean slope of 0.07 (± 0.003 SE), mean substrate particle size of 14.3 millimeters (± 0.272 SE), and modal substrate size of 32.0 millimeters. Depth and velocity at the gravel bars varied with discharge at the NSBLD. Robust redhorse on the upper gravel bar were found consistently in the same areas regardless of water level. The spawning areas at the upper gravel bar remained underwater and flow was maintained under all observed levels of discharge, ranging from approximately 3000 to over 30,000 cfs, as measured at the United States Geological Survey (USGS) gage 02197000 (Savannah River at Augusta, Georgia). However, on the lower gravel bar, robust redhorse initiated spawning on the Georgia side of the bar and expanded spawning activity to the center and South Carolina edge as spawning intensity increased. Redd sites on the center and South Carolina edge of the bar were exposed and degraded by fluctuating water levels during the period of observation (T. Grabowski, 2006, Ph.D dissertation). Flow levels at 3600 cfs already limit the amount of available gravel bar spawning habitat, and flow reductions to 3100 cfs would be expected to exacerbate this loss (T. Grabowski, 2009, pers. comm.).

• The Nature Conservancy (TNC) has also collected some information regarding levels of discharge and correlations to exposure of the gravel bars mentioned above. Flow data should be correlated to gravel bar exposure by examining the data collected by Tim Grabowski and TNC.

• A portion of the robust redhorse population is also present above the NSBLD in the Augusta Shoals. Unlike their counterparts below the NSBLD, it appears these individuals do not make extensive migrations and remain in the Augusta Shoals year-round (T. Grabowski, 2006, Ph.D dissertation).

• As noted in your October 2008 Draft EA (COE 2008), a freshwater mussel survey of the Savannah River from the Augusta Shoals downstream to the tidewater region near Savannah (river mile 22.8) totaling thirty-nine individual survey sites was conducted in 2006 (The Catena Group 2007). Rare species detected include the State listed Altamaha arcmussel, the brother spike, and the Savannah lilliput. The brother spike was found in the Augusta Shoals and the mainstem Savannah River, and the Altamaha arcmussel and the Savannah lilliput were found within cut-off bends of the Savannah River.

• As we stated in our October 27, 2008, letter, the Savannah National Wildlife Refuge (NWR) provides habitat for an average 23% of South Carolina's waterfowl, based on mid-winter waterfowl surveys from 1990-2002. Freshwater (salinity less than 0.5 parts per thousand) is necessary to maintain maximum waterfowl use and provide essential habitat for wetland-dependent migratory birds on the Savannah NWR. Additionally, Savannah NWR has the legal mandate of providing freshwater to several adjacent landowners for agricultural and wildlife management purposes (Chuck Hayes, Savannah NWR, wildlife biologist, 2009, pers. comm.). Studies have concluded that freshwater coastal impoundments in South Carolina produce a

greater variety of marsh plants, many of which are desirable waterfowl food, than brackish impoundments.

• The recommended flow for "dry" years from the 2003 Draft FWCA report is set at a range of 6,000 - 6,200 cfs for the critical period for the Savannah NWR of August – December as measured at USGS gage 02198500 (Savannah River near Clyo, Georgia). The Service has reviewed the most readily available USGS salinity data (October 2006 - present) at USGS gage 021989784 (Little Back River above Lucknow Canal, near Limehouse, South Carolina), the entrance to the Freshwater Diversion Canal. Savannah NWR is already experiencing salinity spikes during these critical months ranging from > 0.5 - 3.2 parts per thousand (ppt), when flow at Clyo during these periods is much less than the lower recommended range of 6,000 cfs. It appears the salinity spikes are occurring with higher tides on a lunar cycle. Savannah NWR relies on high tides to fill the Freshwater Diversion Canal; thus, the impoundments are being inundated with saline water. These small increases in salinity on a repetitive cycle can have deleterious cumulative effects on the vegetation that Savannah NWR is managing to provide high-quality habitat for migrant birds. Further reducing flow in an already stressed environment could potentially have more severe and prolonged negative effects on the Savannah NWR.

• During our May 11, 2009, meeting, the effects of a flow reduction to salinity levels as they relate to blue crab (*Callinectes sapidus*) parasite issues was briefly discussed. The EA should examine this potential impact.

Conclusion

The Augusta Shoals area is important year-round habitat for many native riverine species, including the robust redhorse, the shoals spiderlily, and the brother spike. The Augusta Shoals require not only inundation, but also suitable current velocities to allow for survival and reproduction of aquatic organisms. We are unclear as to 1) the amount of flow that would be provided to the Augusta Shoals by the City of Augusta, and 2) if the agreed-upon flows to the Augusta Shoals would be implemented in full without a binding agreement involving the City of Augusta.

The gravel bars downstream of NSBLD serve as critically important spring spawning habitat for a multitude of riverine species, including the shortnose sturgeon and the robust redhorse. Gravel deposits are extremely rare in the main channel of the lower Savannah River (T. Grabowski, 2006, Ph.D dissertation). Suitable depths and velocities at these gravel bars need to be present to inundate, but also protect the suitability of, spawning habitat. Additionally, natural springtime flows need to be present to cue migratory fishes to initiate their upstream migrations.

Reduced flows have caused backwater and oxbow habitat to transition into sediment-laden areas colonized with vegetation. Backwaters and oxbows are habitat for many native freshwater mussels and the only known habitat for the Altamaha arcmussel and Savannah lilliput in the

Savannah River. Preliminary observations indicate a loss of connectivity occurs between these habitats and the main river at flows below 4,000 cfs (COE 2008).

Savannah NWR is already experiencing unsuitable salinity levels during the COE's current releases. The harbor is currently approximately twice its historic depth and Savannah NWR is unfortunately already experiencing salinity levels higher than ever anticipated at the northern intake of the Diversion Canal during these critical periods. The Service is concerned that a future reduction in flow will exacerbate the salinity conditions at Savannah NWR during their critical period of August-December. Cumulative impacts to salinity levels, including climate change and the proposed Savannah Harbor deepening, should also be considered.

We are aware of very little additional research and monitoring for informed management of the Savannah River since the Ecosystem Flows Workshop and the Service's Draft FWCA Report. If future seasonal flow reductions are deemed necessary for maintenance of water in the reservoirs during drought, the COE should initiate some of the recommended studies to better anticipate flow needs for all downstream resources.

In light of these concerns, and without our critical research needs addressed, we do not recommend a flow reduction to 3,100 cfs. Both the long duration and timing of the protracted period would be of concern. Additionally, if implemented in 2009, the proposed reduction would be in addition to the recent long-term, low-flow conditions, which could exacerbate environmentally stressful conditions and amplify otherwise negligible biological impacts. We appreciate the opportunity to comment during the planning stages of this project. If you have any questions, please contact staff biologists Lora Zimmerman (Charleston Field Office) at (843) 727-4707 ext. 226 or Alice Lawrence (Athens Field Office) at (706) 613-9493 ext. 222.

Sincerely,

Sandra S. Tucker
Field Supervisor
Georgia Ecological Services

Jane Griess
Project Leader
Savannah Coastal Complex

cc: Lora Zimmerman, USFWS, Charleston, SC
Amanda Hill, USFWS, Charleston, SC
Russell Webb, USFWS, Savannah, GA
Chuck Hayes, USFWS, Savannah, GA
Stephania Bolden, NOAA Fisheries, St. Petersburg, FL
Prescott Brownell, NOAA Fisheries, Charleston, SC
Ed Betross, GDNR, Thomson, GA

Oscar Flite, Southeastern Natural Sciences Academy, Augusta, GA
Amanda Meadows, TNC, Savannah, GA

References

Entrix. 2002. Savannah River Instream Flow Study, Augusta Canal Hydropower Project (FERC No. 11810), prepared for the City of Augusta and ZEL Engineers, Inc. September 2002.

Grabowski, Tim. 2006. Reproductive ecology and seasonal migrations of robust redhorse (*Moxostoma robustum*) in the Savannah River, Georgia and South Carolina. A dissertation presented to the graduate school of Clemson University. May 2006. 73 pp.

The Catena Group. 2007. Freshwater mussel surveys, the Savannah River from Augusta to Savannah: South Carolina and Georgia. Prepared for: International Paper and the U.S. Fish and Wildlife Service, Hillsboro, North Carolina, December 17, 2007. 42 pp.

United States Army Corps of Engineers. 2008. Draft Environmental Assessment and Finding of No Significant Impact, Temporary deviation drought contingency plan, Savannah River Basin, Savannah District, October 2008. 65 pp.

Wrona, A. D. Wear, J. Ward, R. Sharitz, J. Rosenzweig, J.P. Richardson, D. Peterson, S. Leach, L. Lee, C. R. Jackson, J. Gordon, M. Freeman, O. Flite, G. Edison, M. Davis, and D. Batzer. 2007. Restoring ecological flows to the lower Savannah River: A collaborative scientific approach to adaptive management. Proceedings of the 2007 Georgia Water Resources Conference, March 27-29, 2007, University of Georgia. 12 pp.

Attachment A

Critical Research Needs Developed at the Savannah River Ecosystem Flow Workshop
April 2003

Shoals

- Real time streamflow gauging in shoals along with temperature: allows for the development of a streamflow-temperature model
- Fish, plant, invertebrate distribution and composition (and movement tied to flows over time)
- Physical dynamics during low and high flow extremes: informs sediment transport and deposition study
- Spiderlily flow needs
- Robust redhorse spawning habitat
- Atlantic sturgeon spawning and passage information along with shortnose sturgeon passage data in relation to flow
- Striped bass passage and thermal requirements as well as egg drift requirements for movement past New Savannah Bluff Lock and Dam

Floodplain

- Cross-sectional and/or spatial topography at fine resolution
- Vegetation community distributions
- In-channel survey of physical structure (woody debris, sand and gravel bars, etc)
- Location of gravel patches below New Savannah Bluff Lock and Dam and flow-habitat relationships
- Oxbows & sloughs – at what flows will water be exchanged with river, and how do these exchanges affect water quality
- Duration of inundation in floodplain after flood events
- Modify existing USGS streamgauges to include temperature, turbidity, dissolved oxygen
- Revisit COE cut-off bend study

Estuary

- Relate flow at Clyo to salinity distribution in estuary
- Fish community distributions, inter-tidal marsh conditions during high flow periods (similar to what has been done for drought period)
- Relate salinity conditions to inter-tidal/floodable habitat
- How does flow affect spawning and recruitment success for estuary-dependent (including diadromous) fish species
- Relationship between flow and dissolved oxygen
- Analyze fish community data with a focus on flow impacts

APPENDIX G

NOAA FISHERIES

FLOW RECOMMENDATION LETTER

JUNE 24, 2009

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5317; FAX (727) 824-5300
http://sero.nmfs.noaa.gov/

June 24, 2009 F/SER4:PB/pw

(sent via electronic mail)

Colonel Edward J. Kertis
Commander, Savannah District
U.S. Army Corps of Engineers
100 W. Oglethorpe Avenue
Savannah, Georgia 31401-3640

Attention: Jeffrey Morris

Dear Col. Kertis:

NOAA's National Marine Fisheries Service (NMFS) reviewed your letter, dated June 4, 2009, requesting information on the impacts to fishery resources and habitats from the reduced outflows from the J. Strom Thurmond (JST) Dam during the 2006-2009 drought of record in the Savannah River Basin.

During the drought, NMFS participated in frequent meetings with your staff, state and federal resource agencies, local governments, and non-governmental organizations concerning the water resource issues presented by the drought. Our concerns regarding potential effects of reduced water flows on marine and migratory diadromous fish were presented and discussed during the meetings.

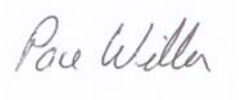
Public trust resources potentially affected by altered Savannah River instream flow conditions include migratory diadromous species such as striped bass, American shad, blueback herring, Atlantic and shortnose sturgeon, and American eel. Shortnose sturgeon is listed as endangered under the Endangered Species Act and present in the Savannah River downstream of Augusta Diversion Dam and Savannah Bluff Lock & Dam as well as the Savannah River estuary. Riverine and estuarine habitats downstream from the JST Dam provide spawning and maturation habitat for those migratory species. Aquatic habitats and fishery resources of the Savannah River estuary are also potentially affected by altered JST outflow conditions, in combination with potential effects of the Savannah Harbor Expansion Project.

Attached is a summary of concerns and recommended studies we provided by email to Mr. Bill Bailey of your staff following the interagency meeting on May 11, 2009, at the Phinizy Swamp Nature Park Conference Center. That meeting provided for helpful interagency discussions of potential impacts from flow reductions and the information that would be within future assessments.

We hope this information is helpful. Related correspondence should be directed to the attention of Mr. Prescott Brownell at our Atlantic Branch office, 219 Fort Johnson Road, Charleston, South Carolina, 29412. He may be reached by telephone at (843) 953-7204, or by e-mail at Prescott.Brownell@noaa.gov. For information specific to the endangered shortnose sturgeon, correspondence should be directed to Dr.

Stephania Bolden, Protected Resources Division, at the letterhead address, by telephone at (727) 824-5312, or by e-mail at Stephania.Bolden@noaa.gov.

Sincerely,



/ for

Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:

CESAS, Jeffrey.S.Morris@usace.army.mil
CESAS, William.G.Bailey@usace.army.mil
FWS, Lora_Zimmerman@fws.gov
SCDHEC, TURNERLE@dhec.sc.gov
SCDNR, PerryB@dnr.sc.gov
flite@naturalsciencesacademy.org
F/SER3, Stephania.Bolden@noaa.gov

Response to COE: Savannah River: Low Flow/Drought
NOAA National Marine Fisheries Service
May 22, 2009

Unanticipated record drought conditions and critical water flow issues experienced in 1998-2009, particularly since 2005, have reduced reservoir storage capacity, and limited flexibility in regulating water flow in the Savannah River Basin. Strong concerns have been expressed by residents in the upper Savannah Basin regarding reduced water levels in the reservoirs, and potential effects on municipal water supply intakes, marina operations, and recreational water access.

A temporary reduction in the specified drought management plan occurred in early 2009; flow was reduced from 3,600 cfs to 3,100 cfs. It is anticipated that a flow reduction may again be requested by the U.S. Army Corps of Engineers (COE) in the future.

Reduction of minimum drought flows may affect both anadromous fish spawning and recruitment potential in the Savannah River. Species under NMFS stewardship that would likely be affected by reduced flow include American shad, blueback herring striped bass, Atlantic sturgeon, and shortnose sturgeon. The shortnose sturgeon is an endangered species listed under the Endangered Species Act (ESA); the Atlantic sturgeon is a candidate for listing. All of these fish are known to spawn in the early spring (February through March); therefore, any flow regime must be thoroughly analyzed to assess its effects on both spawning migration and habitat, particularly for the shortnose sturgeon pursuant to section 7 of the ESA.

Recently The Nature Conservancy (TNC) organized a meeting to discuss the biological and ecological flow requirements for the Savannah River during extreme low flow/drought conditions. Participants included TNC, NMFS, COE, USFWS, SCDNR, GADNR, GADDR, UGA, SCDHEC, and SCDNR. At the meeting conclusion, the COE requested that each agency submit a list of constraints, concerns and recommendations. The following is a summary from NMFS:

1. Constraint: shortnose sturgeon spawning period between February 1 and May. Shortnose sturgeon utilize the gravel bar just below New Savannah Bluff Lock and dam during the spawning season; all habitat upstream of this location is not accessible due to lack of fish passage. Assurances that any reduction in flow from the current flow regime of 3,600 cfs would not affect shortnose sturgeon or its limited spawning habitat.
2. Concerns:
    a. Little information exists on how flow rates impact the availability of spawning habitat in terms of water depth, substrate availability, migratory cues, larval dispersal, etc.
    b. Limited flow gauges on the river provide insufficient data to determine downstream effects of regulated flow.
    c. The guide curve regulating flow and reservoir depth in the upper Savannah River has greatly reduced the seasonal variability in water flow.
    d. The conservation level and full pool depths may not be appropriate and have not been recently analyzed and were designated about 50 years ago.

e. A deviation in flow from the 3,600 cfs to 3,100 cfs translates into 0.6 ft per month in reservoir elevation.

3. Recommendations:
    a. COE revisit the guide curve including the conservation depth and full pool levels.
    b. COE revisit the potential to provide fish passage appropriate for sturgeon around NSBLD.
    c. Assessment of the habitat at Augusta Shoals as potential spawning habitat for shortnose sturgeon.
    d. Analysis of hydrologic records (pre-dam) to identify periods of high flow and natural seasonal variability. Correlation of flow regimes to spawning periodicity of anadromous fish inhabiting the Savannah River and required cues; ensure appropriate flow/species (see Kynard 1997 for shortnose sturgeon).
    e. Assessment of habitat suitability/availability under different flow regimes.
    f. Assessment of flow regimes on sediment distribution and re-suspension, especially relative to shortnose sturgeon spawning habitat.
    g. A technical (site specific) instream flow assessment to provide an adequate basis for evaluation of potential effects on sturgeon and other anadromous species spawning habitats. Details are provided in Appendix A. (Attached).

Appendix A. Instream Flow Study

Prior ecological instream flow studies on the upper Savannah were not designed to assess extreme drought flow conditions in the Thurmond and Stevens Creek tailwater reaches, the Augusta Shoals, the riverine habitat reach below Savannah Bluff Lock & Dam, and the lower Savannah River.

An instream flow would provide a sound technical basis for evaluation of alterative drought flows, and potential effects on aquatic species, important habitats and water quality. Site-specific studies may be focused on specific reaches where prior studies did not fully address the potential effects of extreme drought flows on important species life cycle needs.

The study approach should include the following key study elements:

- Establish an interagency instream flow study team
- Review prior instream flow studies conducted in the upper Savannah River
- Determine the appropriate study area(s) where additional assessment is needed
- Identify key aquatic species or guilds potentially affected
- Identify key habitat suitability criteria for each species
- Select instream flow study methodologies (IHA + species/habitat field study)
- Develop draft and final study plans

Key evaluation species to be considered

- Shortnose sturgeon
- Atlantic sturgeon
- American shad, hickory shad, river herring
- Striped bass (Inland spawning stock model)

Key habitat considerations to be evaluated:

- Anadromous species spawning habitats, maturation habitats (areal extent, suitability, accessibility)
- Effects of flows on fish movements to and from spawning habitats
- Effects of flows on fish passage and facility operations (existing and planned)

Instream flow methodologies to consider

- IFIM/PHABSIM
- HEC-EFM
- MESOHABSIM (may be best suited for sturgeon habitat characterization and assessment of instream flows)
- IHA (In combination with a technical instream flow assessment)

APPENDIX H

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

SUMMARY OF FINDINGS ON
2008
3,100 CFS DISCHARGE

JUNE 22, 2009

Proposed Changes to Lake Thurmond Releases to Mitigate Drought Impacts

During the ongoing drought in the southeastern U.S., the Savannah River reservoir system operated by the Army Corps of Engineers (ACE) experienced extreme pressure and difficulties. In the summer of 2008, based on the Information Paper provided by the Army Corps of Engineers (Corps) and information compiled by other cooperating institutions, Georgia EPD, in coordination with South Carolina Department of Health and Environmental Control (SCDHEC) and South Carolina Department of Natural Resources (SCDNR), conducted a thorough analysis of potential operations of the system under a variety of hydrologic conditions. At that time, Georgia EPD, SCDHEC, and SCDNR propose that the operation (i.e. a Thurmond release of 3,600 cfs) be revised to maintain a 3,600 cfs release from Thurmond Dam in the warmer months of March through September and reducing the release to 3,100 cfs in the cooler months of October to February. The analysis indicated that this reduction would stabilize the system and substantially reduce the speed of decline in system storage. In addition, the analysis showed that the water users along the river would not be impacted as a result of this revised operation and modeling and field observations indicated that it was unlikely that water quality would be of a concern. The Army Corps of Engineers implemented the reduced flow from Thurmond Dam to 3,100 cfs from November 2008 through January 2009. The period of reduced releases was shortened due to shortnosed sturgeon spawning.

It was suggested several real time monitoring stations be examined to reviewed changes in flow, dissolved oxygen concentrations, and conductivity measurements in the lower reaches of the Savannah River as a result of the reduced releases from Thurmond Dam. It was suggested that adaptive management be used as part of the Corps' operation. If field observation indicate any problem with DO concentration and conductivity levels, then prompt actions can be taken to mitigate the adverse conditions.

The following table lists those parties that were responsible for reporting on specific environmental targets. Upon review of that information, and discussion with SCDHEC and SCDNR, decisions were to be made on notifying the ACE of appropriate adjustments to Thurmond release levels. No problems will targets were ever reported.

Location	**Target**	**Responsible Party**
Shoals	Flow 1500 cfs	City Of Augusta
USGS 021989773	DO 5.0 mg/L daily average DO 4.0 mg/L instantaneous Temperature ≤ 90 ºF pH 6-8.5	GAEPD
USGS 02198840	Conductivity 10,000 µS/cm	GA EPD
Abercorn Creek	Chloride 16 ppm	City of Savannah
USGS 02198500	Flow < 4,500 cfs	SC DHEC
Various	Water level at the intakes	Intake operators
Various	Sturgeon migration	SC DNR

A plot of the flow measured in the Savannah River near Clyo, Georgia that includes the period of reduced releases from Thurmond is shown in Figure 1.

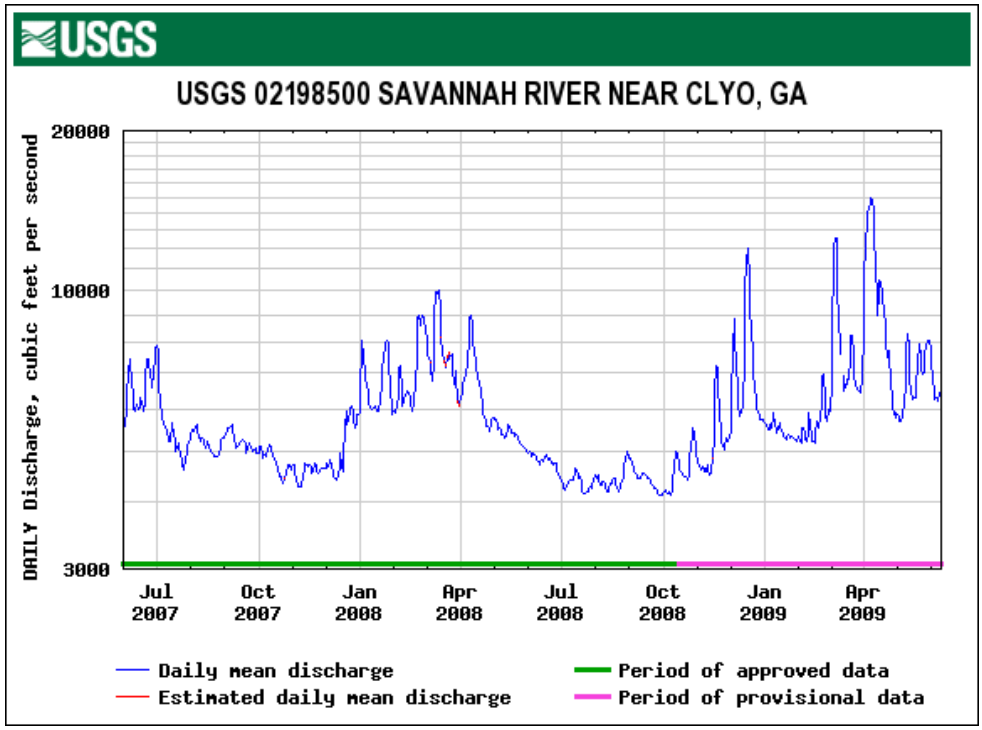


Figure 1. Flow at Savannah River Flow near Clyo, Georgia

A plot of the conductivity measured in the Savannah River near Port Wentworth, Georgia that includes the period of reduced releases from Thurmond is shown in Figure 2.

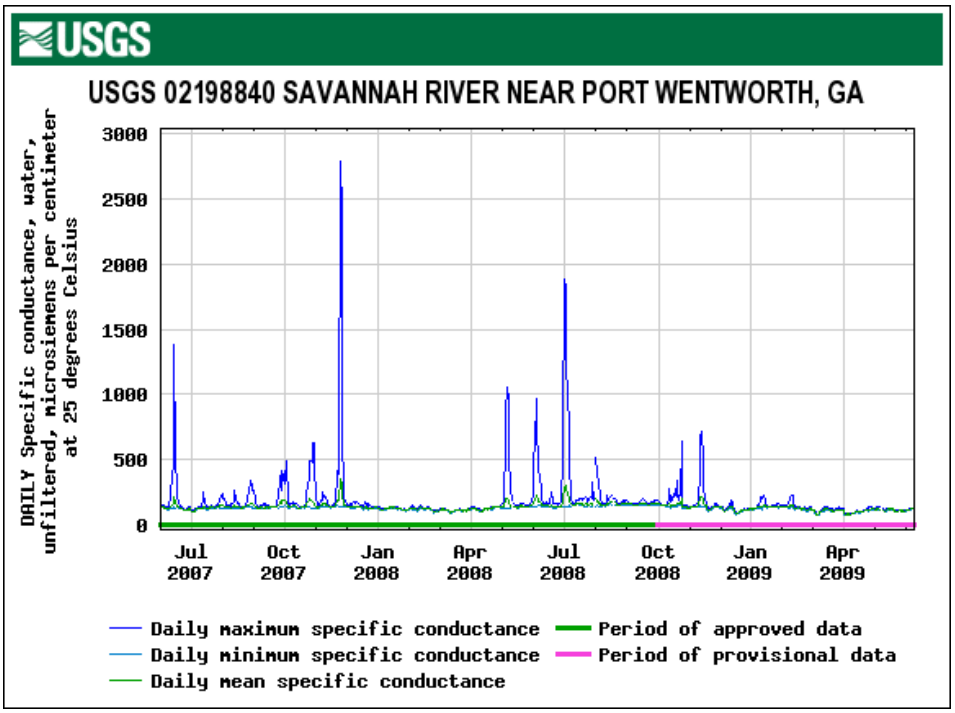


Figure 2. Conductivity in Savannah River near Port Wentworth, Georgia

A plot of the dissolved oxygen measured in the Savannah Harbor at the Corps Dock that includes the period of reduced releases from Thurmond is shown in Figure 3.

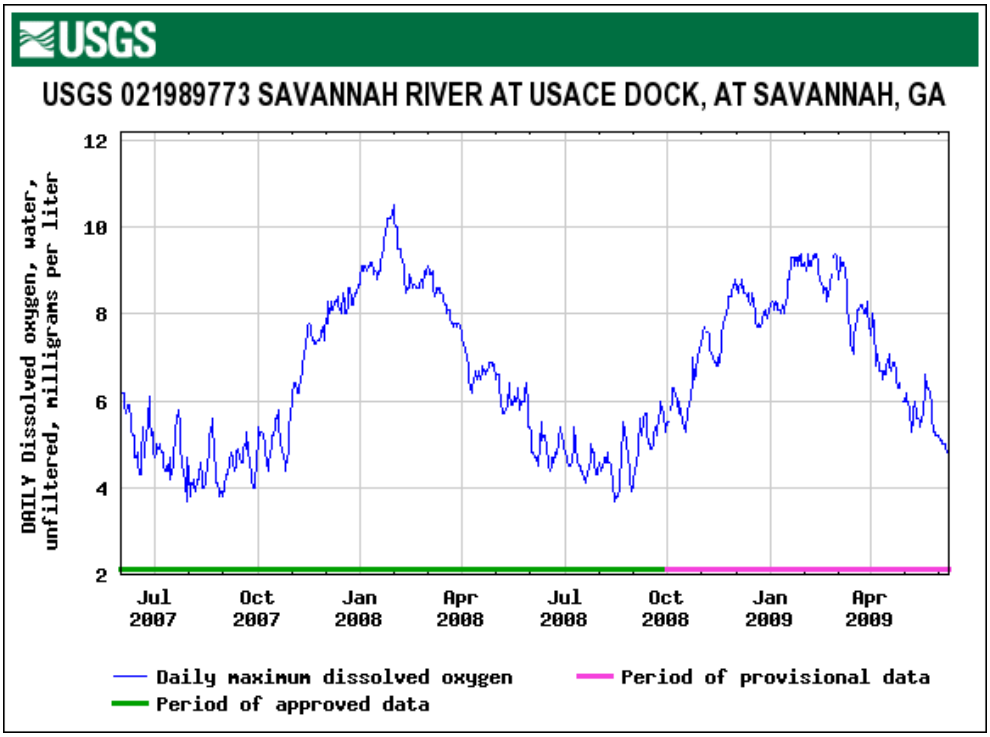


Figure 3. Dissolved Oxygen Savannah River at the Corps Dock

All three of these plots indicate that there was no problem with water quality in the Savannah River system due to the reduced releases from Thurmond. In fact, the period that the releases are reduced could be extended using an adaptive management approach. There could be reduced releases from Thurmond Dam during period when the dissolved oxygen concentration in the Savannah Harbor is greater than 5.0 mg/L and the gage at the Corps Dock could be used to determine this period. Thurmond Dam releases could be increased during fish spawning (i.e., February – March for shortnosed sturgeon, May robust redhorse), but reduced once fishing spawning is over if the dissolved oxygen levels in the Harbor are sufficient (i.e., >5.0 mg/L).

APPENDIX I

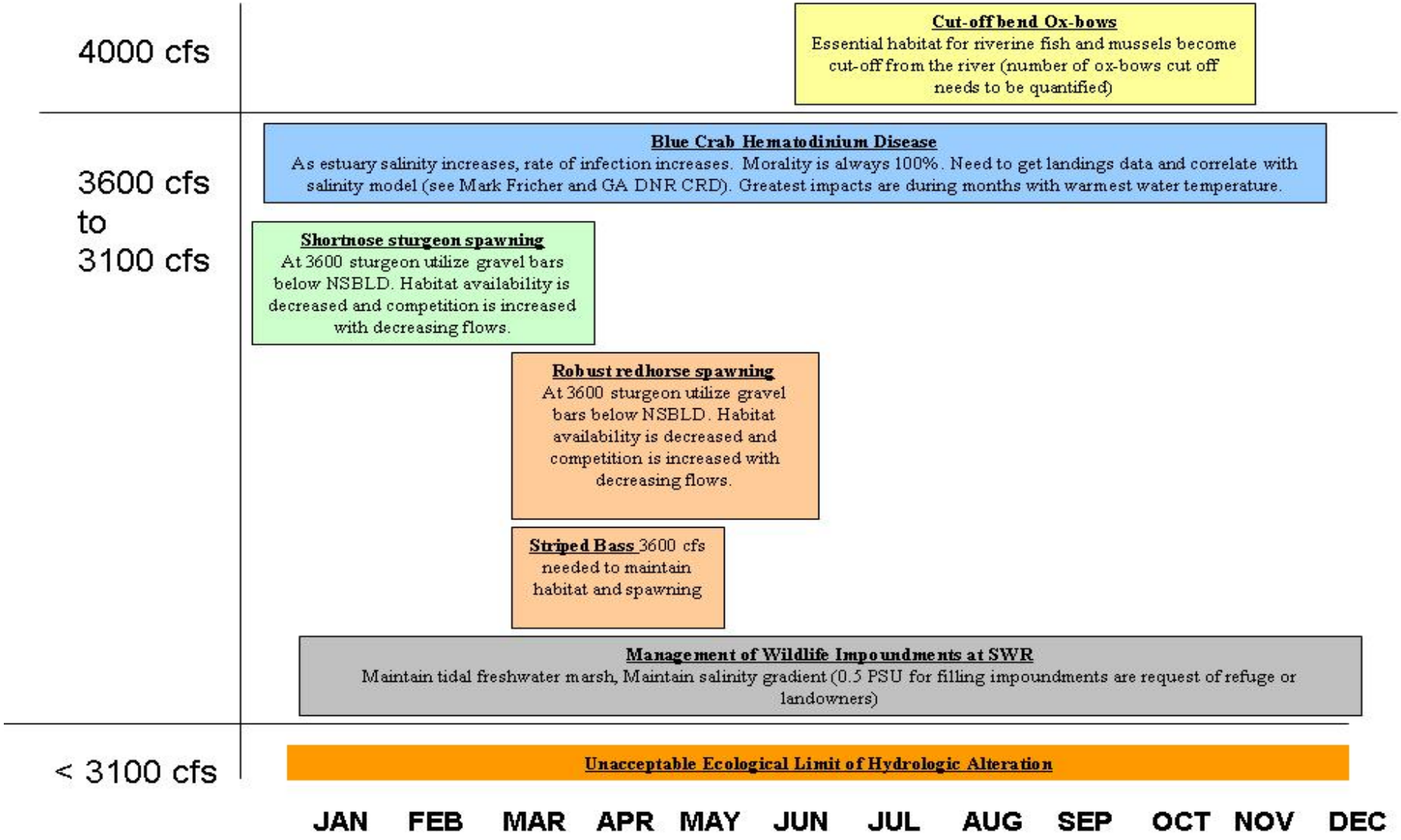
RECOMMENDATIONS FROM 2003 ECOSYSTEM FLOW WORKSHOP

FOR SAVANNAH RIVER

DOWNSTREAM OF THURMOND DAM

Ecosystem Flow Recommendations

Savannah River, below Thurmond Dam (Extreme Low Flows)



APPENDIX J

LIST OF PREPARERS

LIST OF PREPARERS

Mike Malsom Biologist	USACE Planning – Environmental 8 years USACE
Howard Ladner Biologist	USACE Planning - Environmental 7 years USACE
William Bailey Physical Scientist	USACE Planning 28 years USACE
Stan Simpson Water Manager	USACE Engineering - Water Management 26 years USACE
Jason Ward Water Manager	USACE Engineering - Water Management 7 years USACE

APPENDIX K

PUBLIC NOTICE

Mobile/Savannah
Planning Center

Draft

JOINT PUBLIC NOTICE
US Army Corps of Engineers, Savannah District,
and the
Georgia Department of Natural Resources, Coastal Resources Division,
and the
South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

TO WHOM IT MAY CONCERN:

SUBJECT: Notice of Availability of a Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for a temporary deviation to the US Army Corps of Engineers' Savannah River Basin Drought Contingency Plan on the Savannah River in Georgia and South Carolina, in response to the continued drought conditions.

Notice of the following is hereby given:

a. Pursuant to the National Environmental Policy Act of 1969, notice is hereby given that the US Army Corps of Engineers, Savannah District proposes a temporary deviation to the March 1989 Savannah River Basin Drought Contingency Plan, as revised.

b. The Savannah District announces the availability to the public of a Draft EA and Draft FONSI concerning the action. Copies of the Draft EA and unsigned FONSI can be obtained from the following website: www.sas.usace.army.mil, by emailing Mr. William Bailey at following address: william.g.bailey@usace.army.mil.

c. Written statements regarding the Draft EA and FONSI for the proposed action will be received at the Savannah District Office until

12 O'CLOCK NOON, OCTOBER xx, 2009

from those interested in the activity and whose interests may be affected by the proposed action.

PROJECT DESCRIPTION: The proposed action is a temporary revision to the US Army Corps of Engineers (Corps) 1989 Savannah River Basin Drought Contingency Plan. The revision would be a reduction in the minimum daily average discharge from the J. Strom Thurmond reservoir from 3,600 to 3,100 cubic feet per second (cfs) during the fall/winter months for the duration of the present drought. The reduction would

begin in the fall (mid-September) when dissolved oxygen levels in the harbor exceed Water Quality standards as measured at the USGS gage at the Corps of Engineers' Depot (#0219897730). The reduction in flow would continue until one of the following conditions occurred:

1. arrival of the first Shortnose sturgeon at the New Savannah Bluff Lock and Dam, or
2. water temperature at USGS gage at the NSBL&D (#02197000) reaches 11 degrees C after 1 February.

This change would preserve water in the Corps reservoirs and delay the time at which those reservoirs would reach the bottom of their conservation storage. The Corps would restore the discharges from the Thurmond reservoir up to the present 3,600 cfs per day daily average if requested by either the State of Georgia or South Carolina.

The US Army Corps of Engineers operates its three multi-purpose projects on the Savannah River (Hartwell, Richard B. Russell, and J. Strom Thurmond) as a three-lake system. The most recent drought has reduced the volume of conservation storage in those three lakes. As a result of declines in the conservation storage and concerns that Level 4 drought conditions may be reached if the drought continues, Savannah District is considering reducing discharges from the Thurmond Reservoir during the fall/winter months when the projects are in a Level 3 drought condition. Alternatives considered included the following:

(A) No Action,

(B) Reducing discharges during the fall/winter months from 3,600 to 3,100 cubic feet per second (cfs) (Alternative 1), and

(C) Reducing discharges during the fall/winter months from 3,600 to 2,600 cfs (Alternative 2).

The tentatively recommended plan is Alternative 1.

AUTHORIZATION REQUIRED FROM THE STATE OF GEORGIA:

Coastal Zone Consistency: Savannah District has evaluated the proposed project and believes it is consistent with the Georgia Coastal Zone Management Program to the maximum extent practicable. The District will submit its evaluation to the Georgia Department of Natural Resources, Coastal Resources Division in Brunswick, Georgia, who administers that program. The State will review the proposed action and determine whether it concurs that the proposed project is consistent with the State's Coastal Zone Management Program to the maximum extent practicable. Any person who desires to comment or object to Georgia Coastal Zone Management Consistency Certification must do so in writing within 10 days of the date of this notice to the Federal Consistency Coordinator, Georgia Department of Natural Resources, Coastal Resources Division, Suite 300, One Conservation Way, Brunswick, Georgia 31520-8687 and state the reasons or basis for the objections.

AUTHORIZATION REQUIRED FROM THE STATE OF SOUTH CAROLINA:

Coastal Zone Consistency: Savannah District has evaluated the proposed project and believes it is consistent with the South Carolina Coastal Zone Management Program to the maximum extent practicable. The District will submit its evaluation to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management in Charleston, South Carolina, who administers that program. The State will review the proposed action and determine whether it concurs that the proposed project is consistent with the State's Coastal Zone Management Program to the maximum extent practicable. Any person who desires to comment or object to South Carolina Coastal Zone Management Consistency Certification must do so in writing within 10 days of the date of this notice to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management; 1362 McMillan Avenue; Suite 400, Charleston, South Carolina 29405 and state the reasons or basis for the objections.

DEPARTMENT OF THE ARMY EVALUATION:

Environmental Assessment: Savannah District has prepared a Draft EA and found that an Environmental Impact Statement will not be required for this action. The Draft EA is being coordinated concurrently with this Notice to Federal and State natural resource agencies for review and comment. No wetlands would be filled, but riparian wetlands could be temporarily impacted by reduced river flows. No discharge of dredge or fill material into waters of the US is included in the proposed action, so no evaluation is required under Section 404 of the Clean Water Act.

Threatened and Endangered Species: The District reviewed the most recent information on Federally-listed endangered or threatened species and determined that the proposed action may effect, but is not likely to affect shortnose sturgeon, manatee, and wood stork. This proposed action is being coordinated with the US Fish and Wildlife Service and the National Marine Fisheries Service under Section 7 of the Endangered Species Act.

Cultural Resources: In accordance with the National Historic Preservation Act (P.L. 89-655, as amended) and 36 CFR, Part 800, Savannah District has evaluated the proposed action's potential effect upon historic properties. The District has determined the proposed action will have no adverse effect upon historic properties and has initiated consultation with the Georgia and South Carolina State Historic Preservation Officers and eighteen Native American Tribes.

Essential Fish Habitat: Savannah District evaluated the proposal's potential effects on Essential Fish Habitat. The project's effects would be of relatively short duration. As a result, the District believes the proposed action would not produce long term effects on these valuable coastal habitats that warrant mitigation. The District is

coordinating the proposed action with the National Marine Fisheries Service under the Magnuson-Stevens Fishery Conservation and Management Act.

Coastal Zone Consistency: Savannah District evaluated compliance of the proposed action with both the Georgia and South Carolina Coastal Management Programs (CMP). The District believes that the proposed action is consistent with the CMPs to the maximum extent practicable. The District will submit the EA to the Georgia Department of Natural Resources, Coastal Resources Division in Brunswick, Georgia and to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management in Charleston, South Carolina.

Public Interest Review: The decision whether to proceed with the project as proposed will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both the protection and use of important resources. The benefits which reasonably may be expected to accrue from the proposal will be balanced against its reasonably foreseeable detriments. All factors that may be relevant to the proposal will be considered, including the cumulative effects thereof. Among these are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife, flood hazards, flood plains, land use, navigation, shoreline erosion/accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, consideration of property ownership, environmental justice, and, in general, the needs and welfare of the people.

Consideration of Public Comments: The US Army Corps of Engineers is soliciting comments from the public; Federal, State, and local agencies and officials; Native American Tribes; and other interested parties in order to consider and evaluate the impacts of the proposed activity. Any comments received will be considered by the US Army Corps of Engineers in its deliberations on this action. To make this decision, comments are used to assess impacts to endangered species, wetlands, historic properties, water quality, general environmental effects, socioeconomic effects, and the other public interest factors listed above. Comments are used in the preparation of the Environmental Assessment pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

Comment Period: Anyone wishing to comment to the Corps on this proposed action should submit comments no later than the end of the comment period shown in this notice, in writing, to the US Army Corps of Engineers, Savannah District, Mobile/Savannah Planning Center, ATTN: Mr. William Bailey, Post Office Box 889, Savannah, Georgia 31402-0889, by FAX to 912-652-5787, or by emailing the comments to the following address: william.g.bailey@usace.army.mil.

Any person who desires to comment or object to Georgia Coastal Zone Management Consistency Certification must do so in writing to the Georgia Department of Natural Resources, Coastal Resources Division, Federal Consistency Coordinator, Suite 300, One Conservation Way, Brunswick, Georgia 31520-8687.

Any person who desires to comment or object to South Carolina Coastal Zone Management Consistency Certification must do so in writing to the South Carolina Department of Health and Environmental Control, Office of Ocean and Coastal Resource Management; 1362 McMillan Avenue; Suite 400, Charleston, South Carolina 29405.

ATTACHMENT D

RAS 9-125

Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Southern Nuclear Operating Company

Docket Number: 52-011-ESP;
ASLBP No. 07-850-01-ESP-01-BD01

Location: Augusta, Georgia

Date: Monday, March 23, 2009

Work Order No.: NRC-2728 Pages M-1662-M-1914

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TEMPLATE = SECY-032

D503

these periods. And I submit that although we see in there recently you have several drought periods, that there isn't necessarily a strong trend into those lower flow periods.

JUDGE TRIKOUROS: It just appears that when there's persistent rainfall in the 35-inch range. I'm sorry. Can you hear me now?

MR. VAIL: Yes.

JUDGE TRIKOUROS: When rainfall is in the 35 inch range, that's kind of a low rainfall for this area it looks like and over the last -- from about 2000 to today it's been hanging in that 35 inch range for fairly long periods of time. It's hard to tell with this chart really how it correlates to the dam flow because, yes, it is counterintuitive. But you didn't see a trend here either. In other words, rainfall trend did not concern you in doing these evaluations. You looked at that and you feel --

MR. VAIL: Yes, we clearly acknowledge that we had two relatively recent drought periods. The 2000 drought and the one that we're currently in were significant droughts. But we don't see those as necessarily being indicative of long term trend.

JUDGE TRIKOUROS: Thank you.

MR. VAIL: So the next slide, slide 16.

These are my conclusions and then I'll be handing it over to Dr. Kincaid. We acknowledge that the wet cooling towers will reduce the flow whenever they do consumptively use water. So we will have a reduction in flow.

The consumptive water use of the plants is nearly constant. It doesn't vary seasonally significantly. It's basically a constant consumptive loss rate. So the fraction of reduction --

JUDGE JACKSON: Your microphone.

MR. VAIL: I just heard myself. Wow, that's scary.

The fractional reduction in flow will increase as the upstream flow decreases. There's not any real mystery in that and that the consumptive water uses between Thurmond Dam and the Vogtle site are more than offset by the flows that we are picking up between Thurmond Dam and the Vogtle site.

And that we believe that the 3800 cfs was appropriate for the NEPA analysis, although we did include values at 3000 and 2000. And the staff at this point has no reason to believe that the ongoing drought is representative of a persistent trend into the future and that we believe that our conclusions of the water cumulative impacts being small is

appropriate.

JUDGE JACKSON: So after having looked at this for a long time and evaluated it you would say that the long-term impact according to your best guess right now, your best estimate, would be on the order of perhaps three to four percent of the river flow. Is that --

MR. VAIL: That's correct.

JUDGE JACKSON: Okay. Thanks.

(Off the record comments.)

DR. KINCAID: We'll move onto the groundwater segment. Slide 17 please. My name is Dr. Charles Kincaid. I have a Ph.D. from Utah State University in Engineering and I've been working at the Pacific Northwest National Laboratory in the area of surface water, actually in the area of soil physics and groundwater, for the better part of 29 years.

The topics I'll touch on are four. One is on groundwater resource use and then there will be three on quality aspects. One of those is on tritium and the groundwater aquifer, the Savannah River Site groundwater plumes and saltwater intrusion and then I'll have a slide again on just concluding remarks. Next slide please.

On slide 18, I have some summary remarks