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

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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.

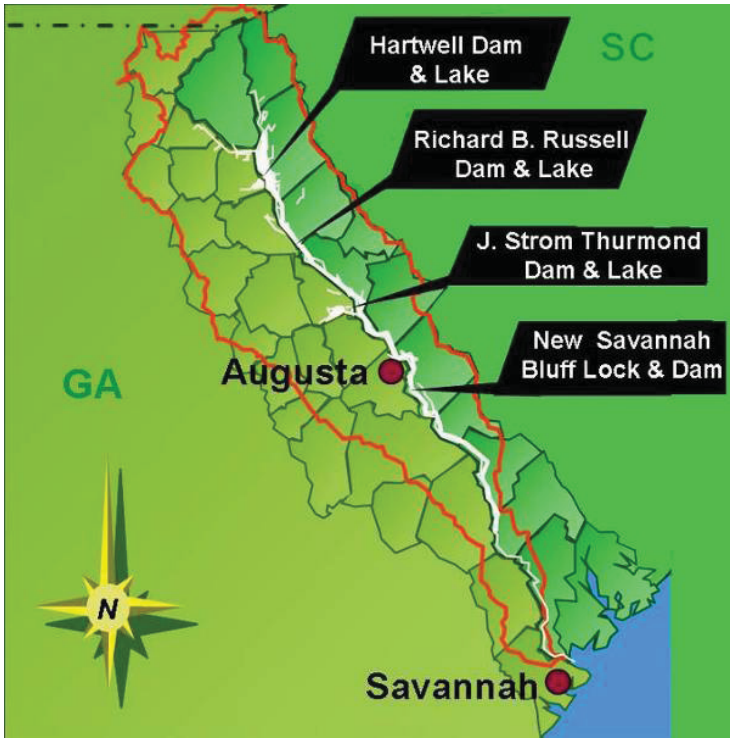
The goal of the alternatives analysis was to identify an operating approach that would allow the conservation storage within the lakes to decline at a slower rate, while still balancing the authorized project purposes of water supply, water quality, fish and wildlife, and hydropower. If such an alternative 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

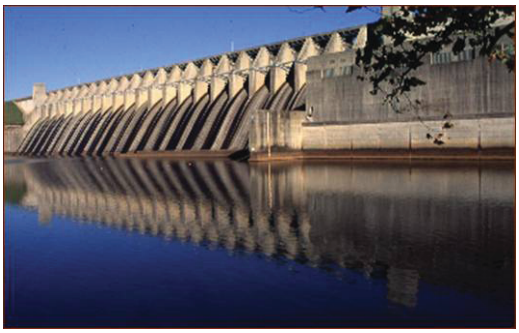
The Corps maintains and operates three large multipurpose projects in the basin. Hartwell Dam and Lake (55,950 acre summer pool) is located 89 miles upstream of Augusta and was filled in 1962. R.B. Russell Dam and Lake (26,650 acre summer pool) is located 59 miles upstream of Augusta and was filled in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

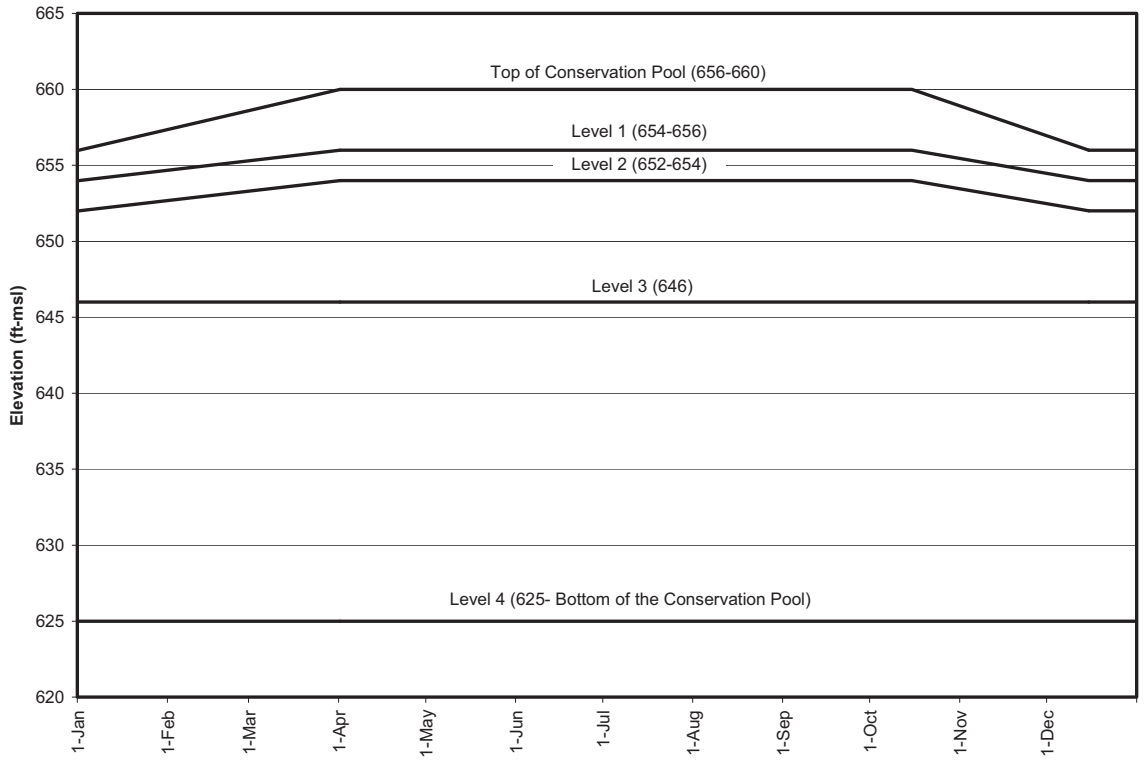
This alternative is considered in detail and is evaluated in regard to all environmental concerns**.**

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



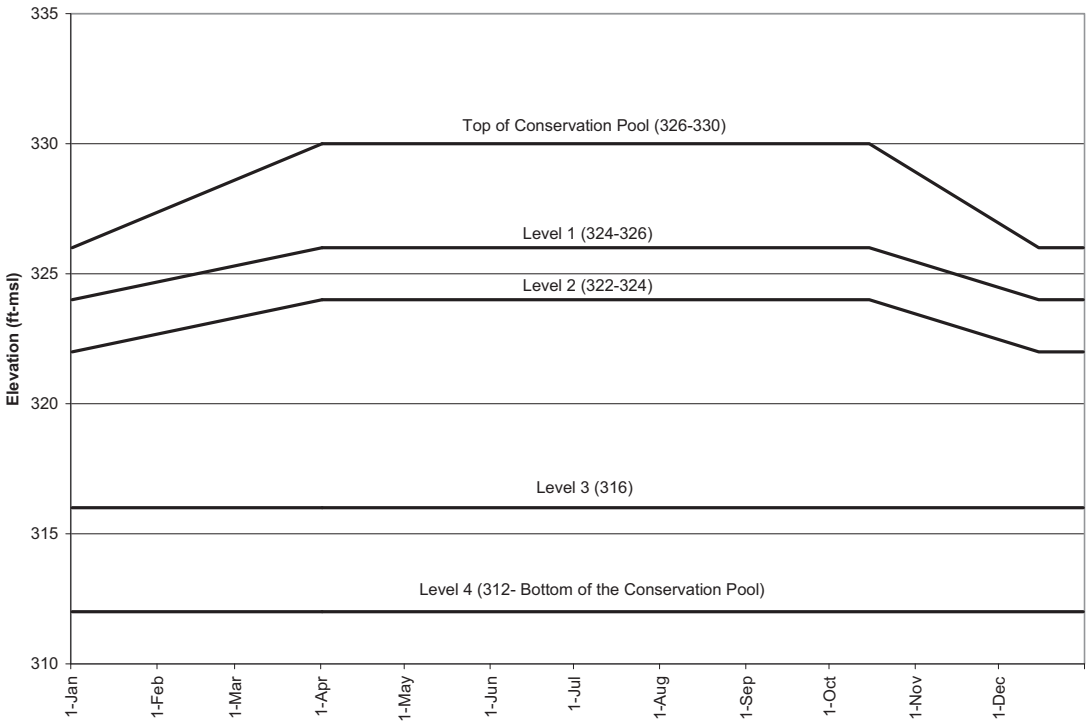
* Level as shown in Figure 1

** 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

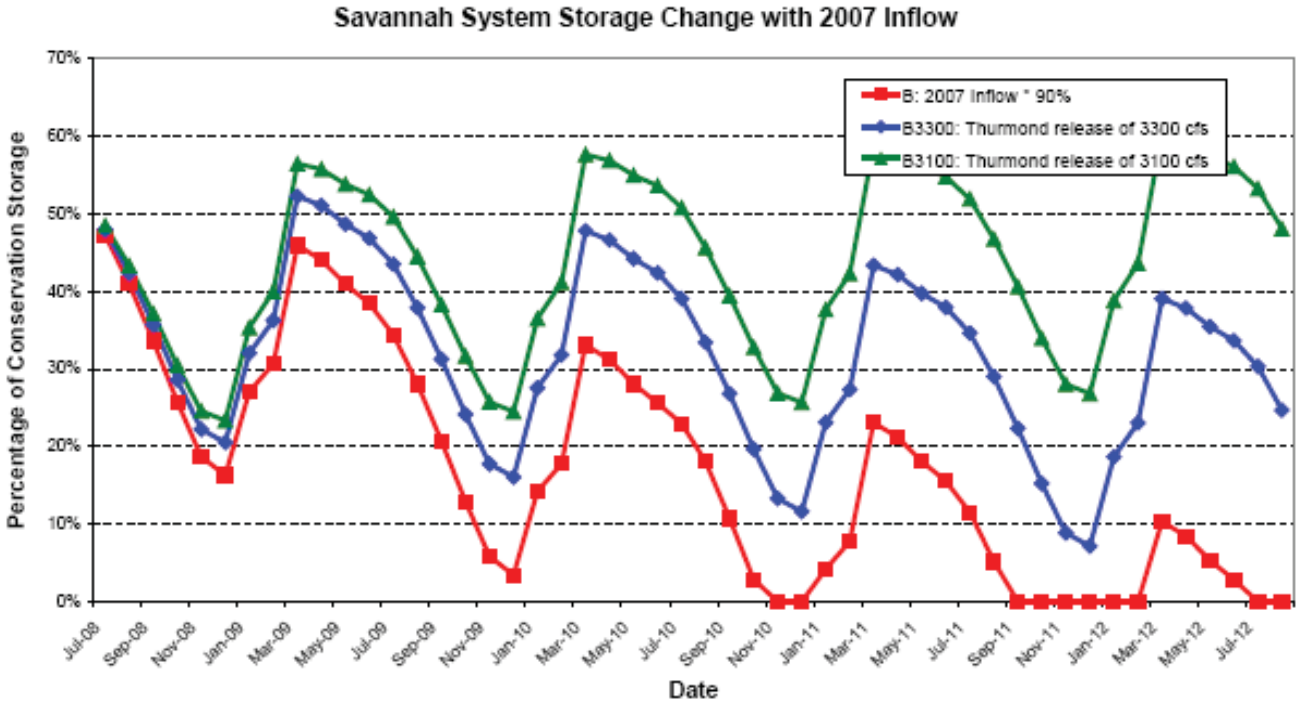
Savannah District does not anticipate any substantial effects to air quality, noise, non-renewable resources, mineral resources, farmland, wetlands, water quality in the lakes, or to fishery resources in the lakes. We do not envision any irretrievable commitments of resources from either alternative. 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

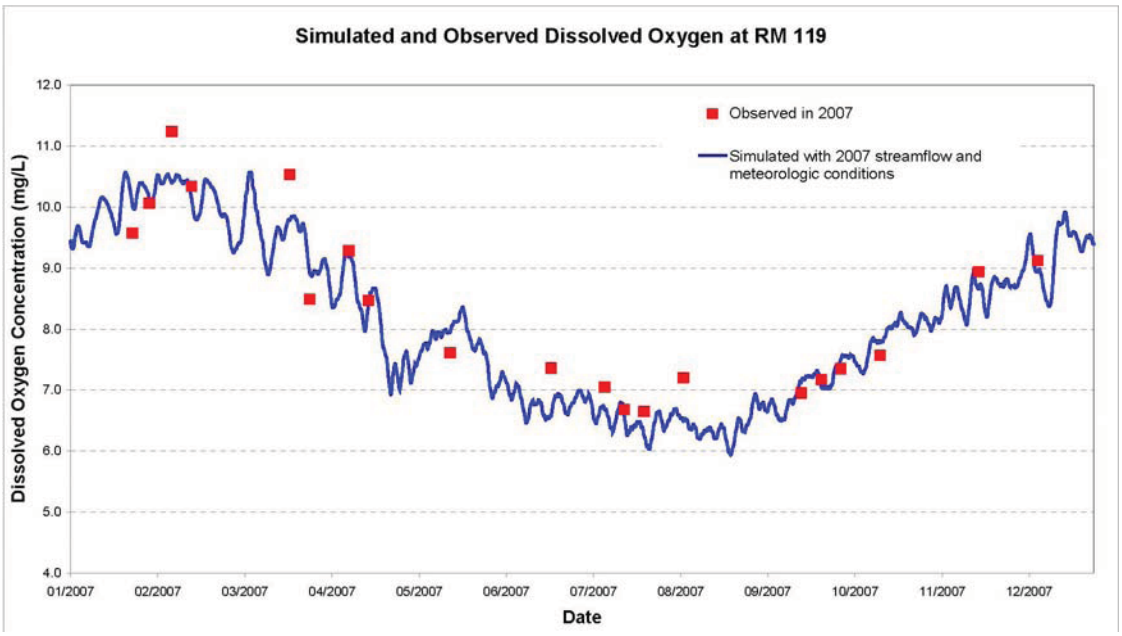
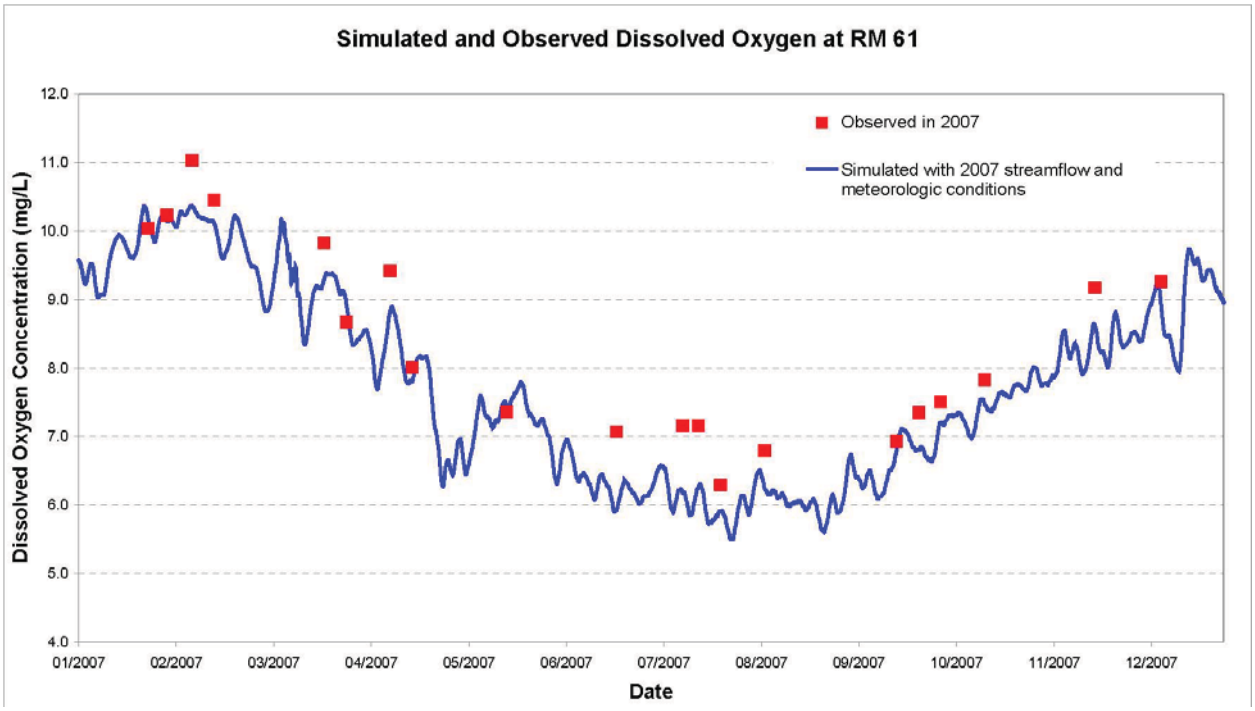


Figure 5 - Calibration of Savannah River water quality model at River Mile 61



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

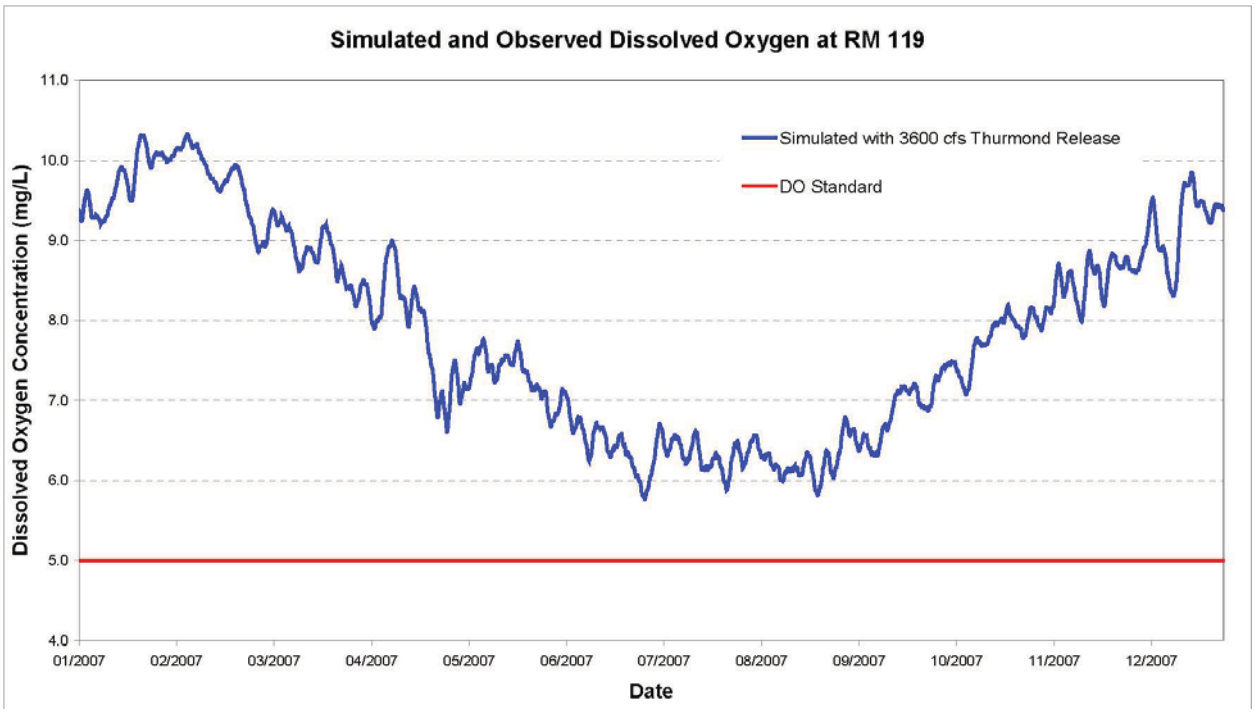
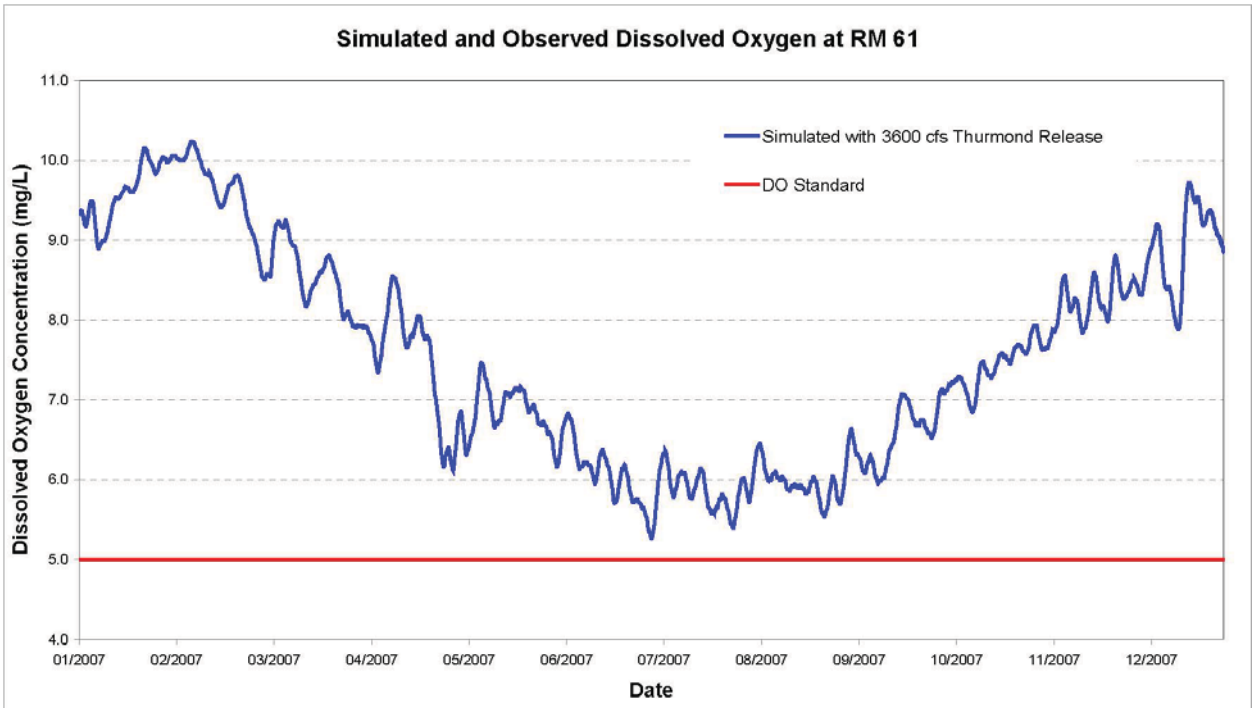


Figure 7 - Dissolved Oxygen at RM 61



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

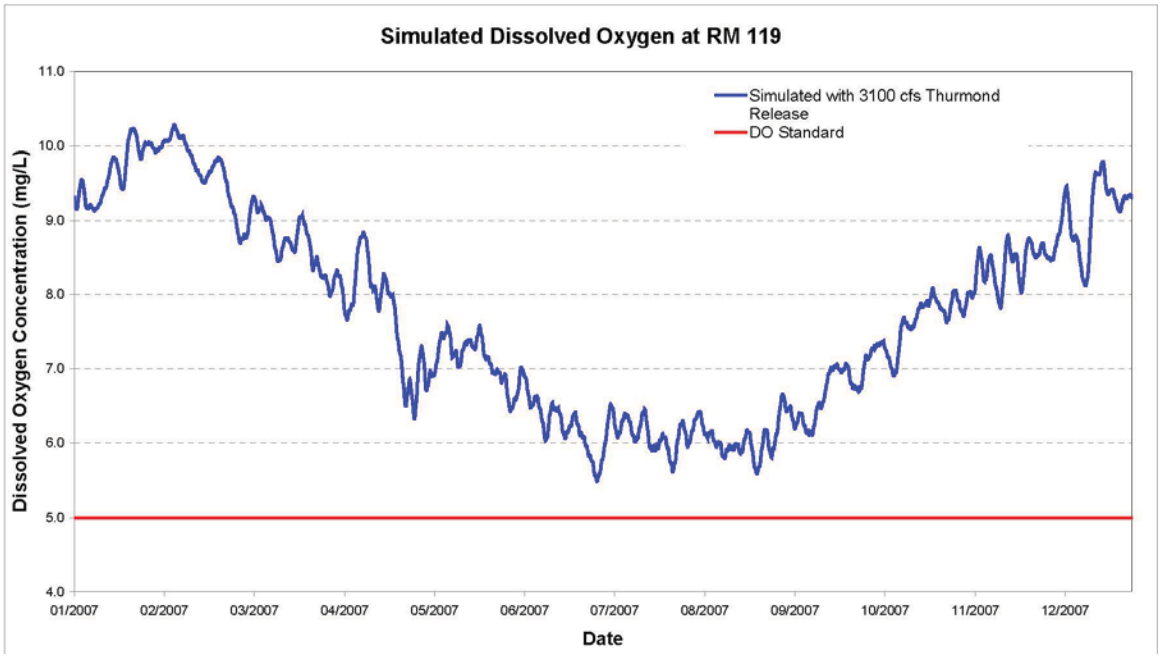
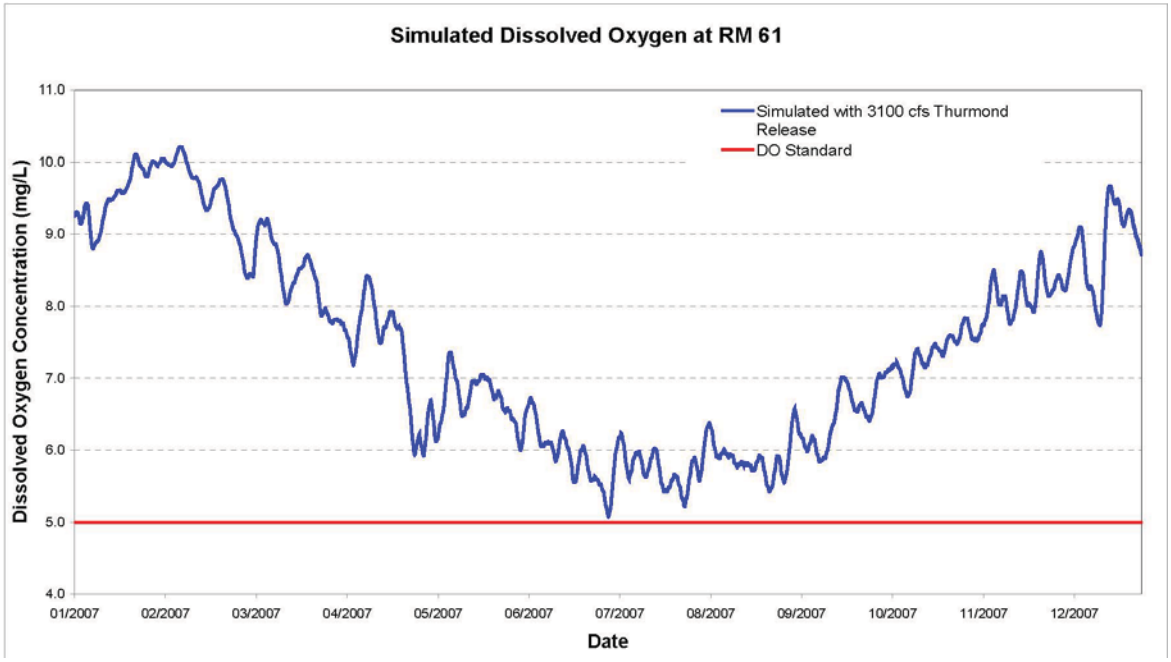


Figure 9 – Simulated Dissolved Oxygen at RM 61



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.

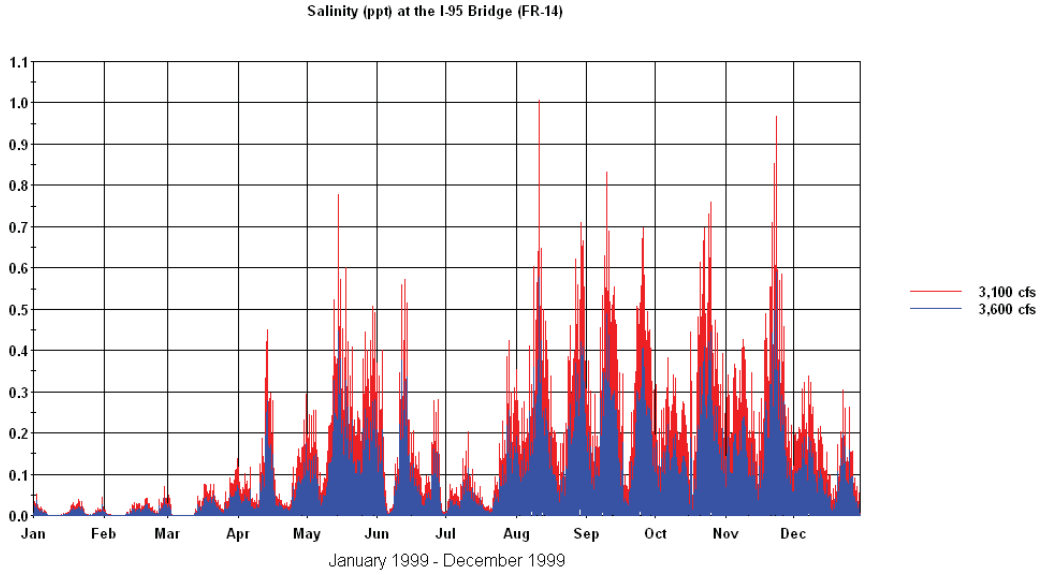
Sources of chloride in Abercorn Creek include upstream inflows from the Savannah River and salinity intrusion from the downstream Savannah Harbor. Studies have shown a good relationship between river flows at the U.S. Geological Survey's Clyo stream gage location and chloride concentrations. Results 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.

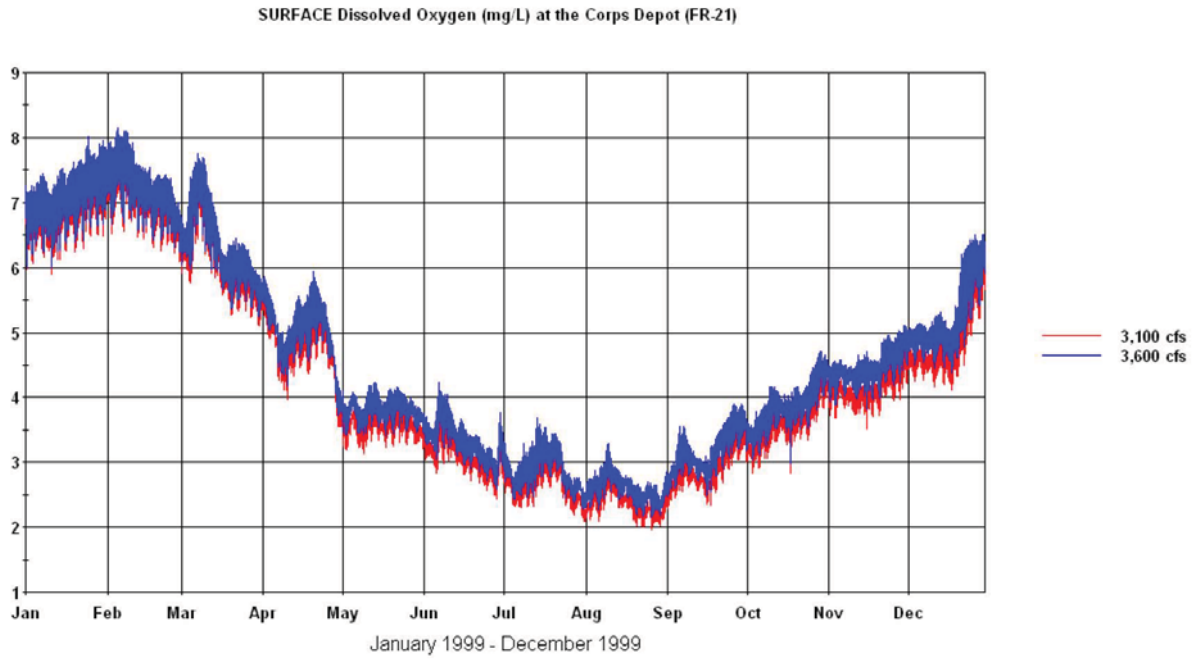
Although the model was not run for a low flow of 2,600 cfs, inspection of existing modeling results indicate that a discharge of 2,600 cfs could result in salinity temporary spiking above 1 ppm for a few days.

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.

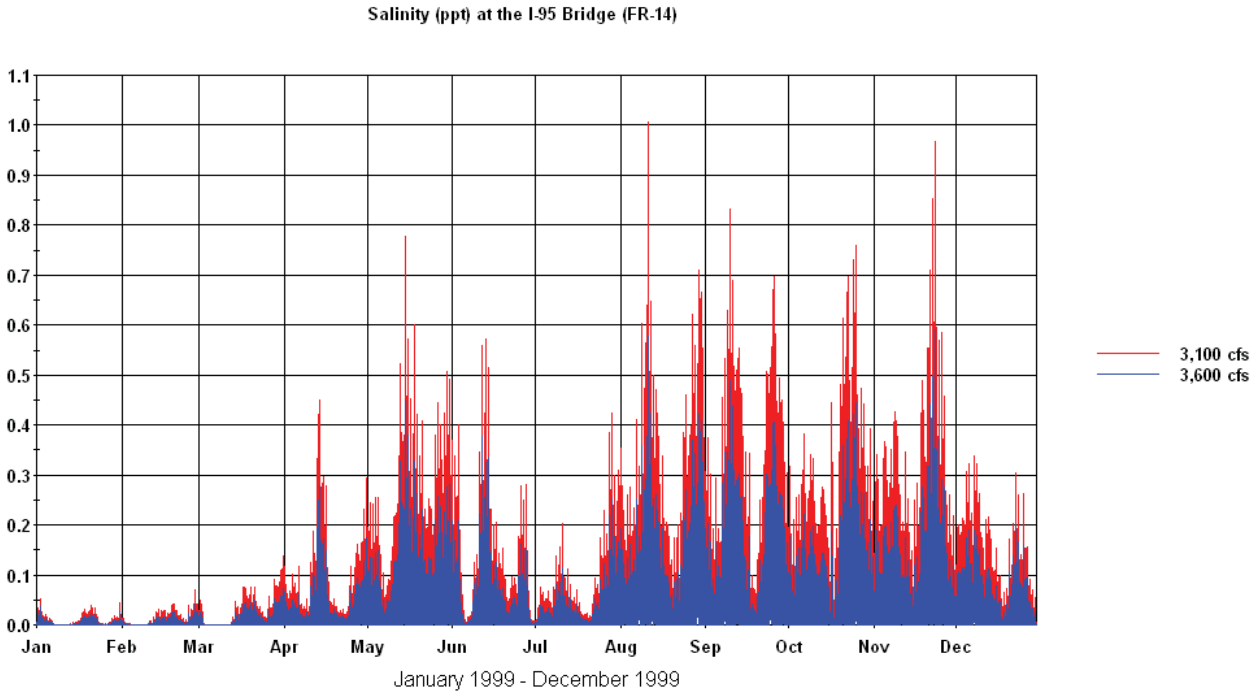
Effects of the NAA

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

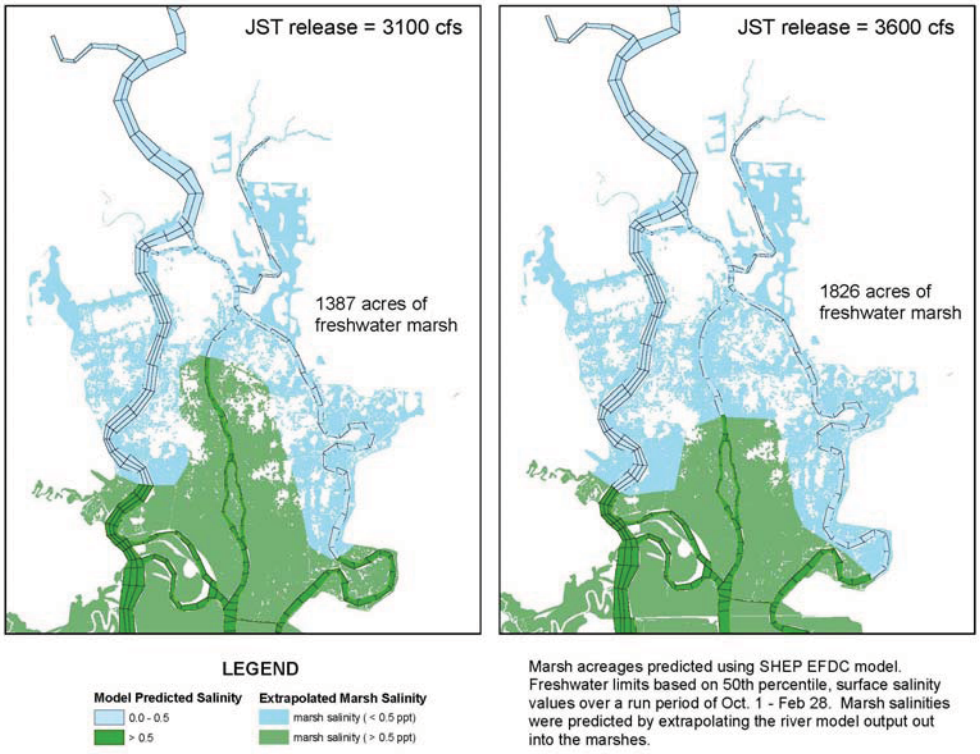


Savannah District used the Savannah Harbor EFDC model to evaluate the potential impact of salinity changes on freshwater wetlands in the estuary. The techniques followed by the District were similar to, but a slight variation from those used to evaluate potential impacts from the proposed Savanna Harbor 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



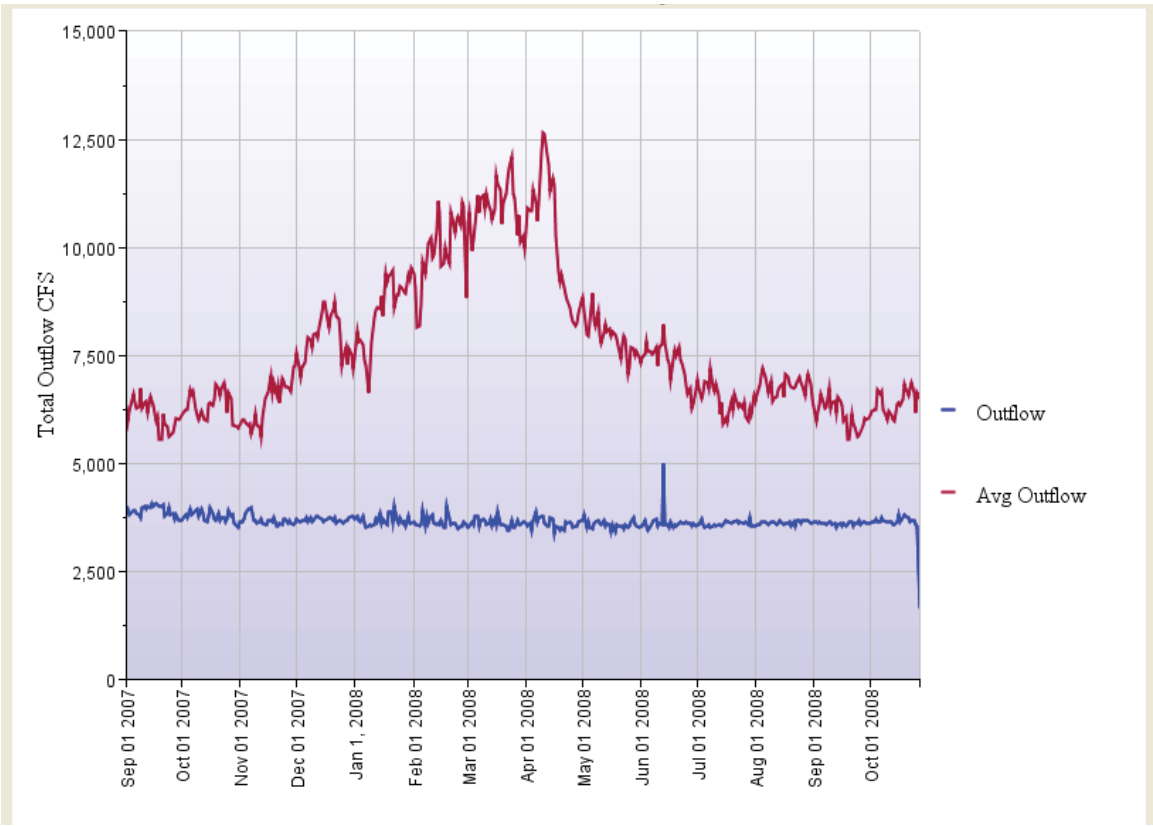
The 439-acre impact likely overstates the changes in marsh vegetation, since the reduced flows and the resulting additional salinity would occur during the winter months, which is not the primary growth season for the plants. Under those conditions, the extent of the conversion of one marsh plant species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

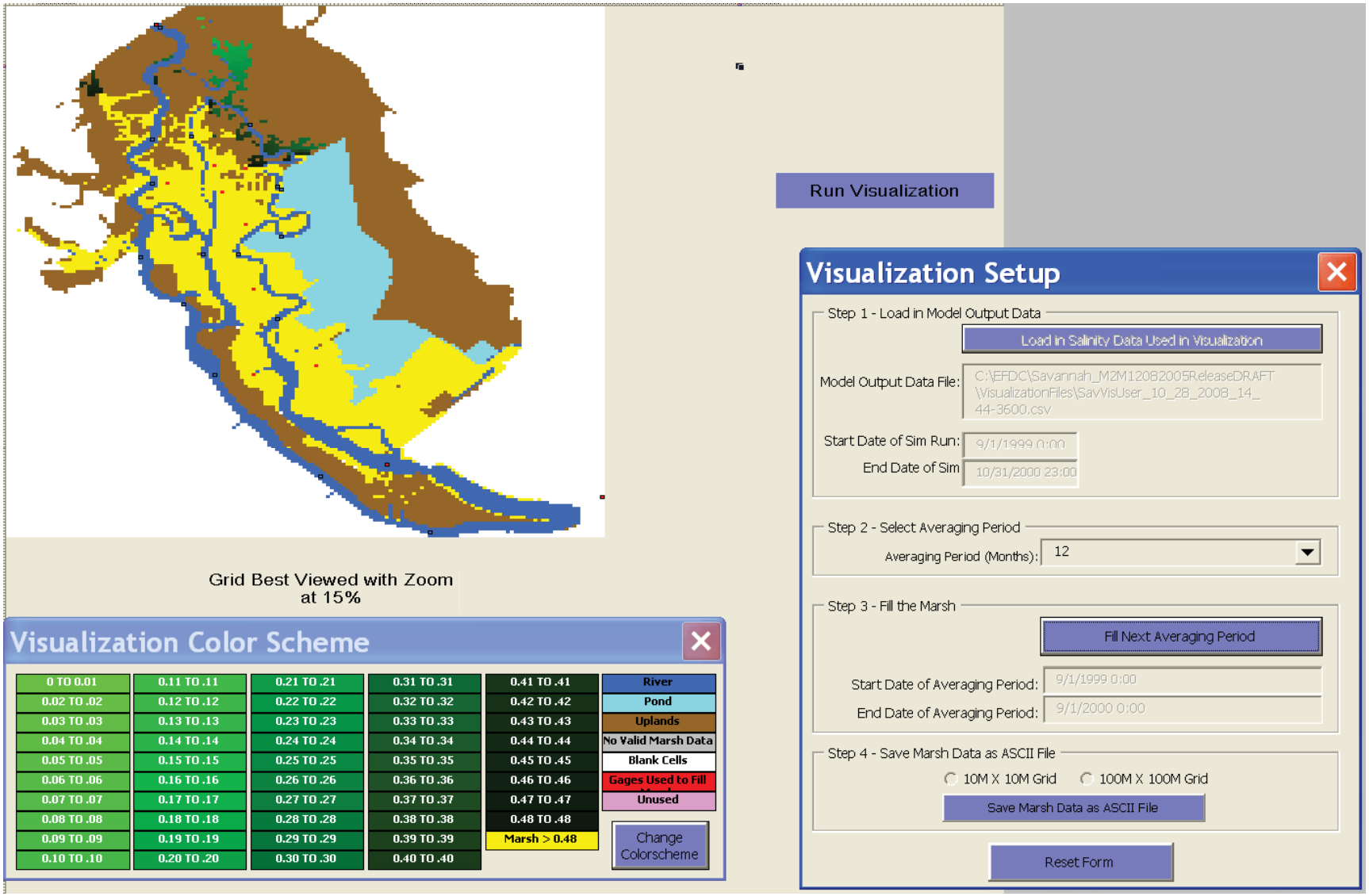
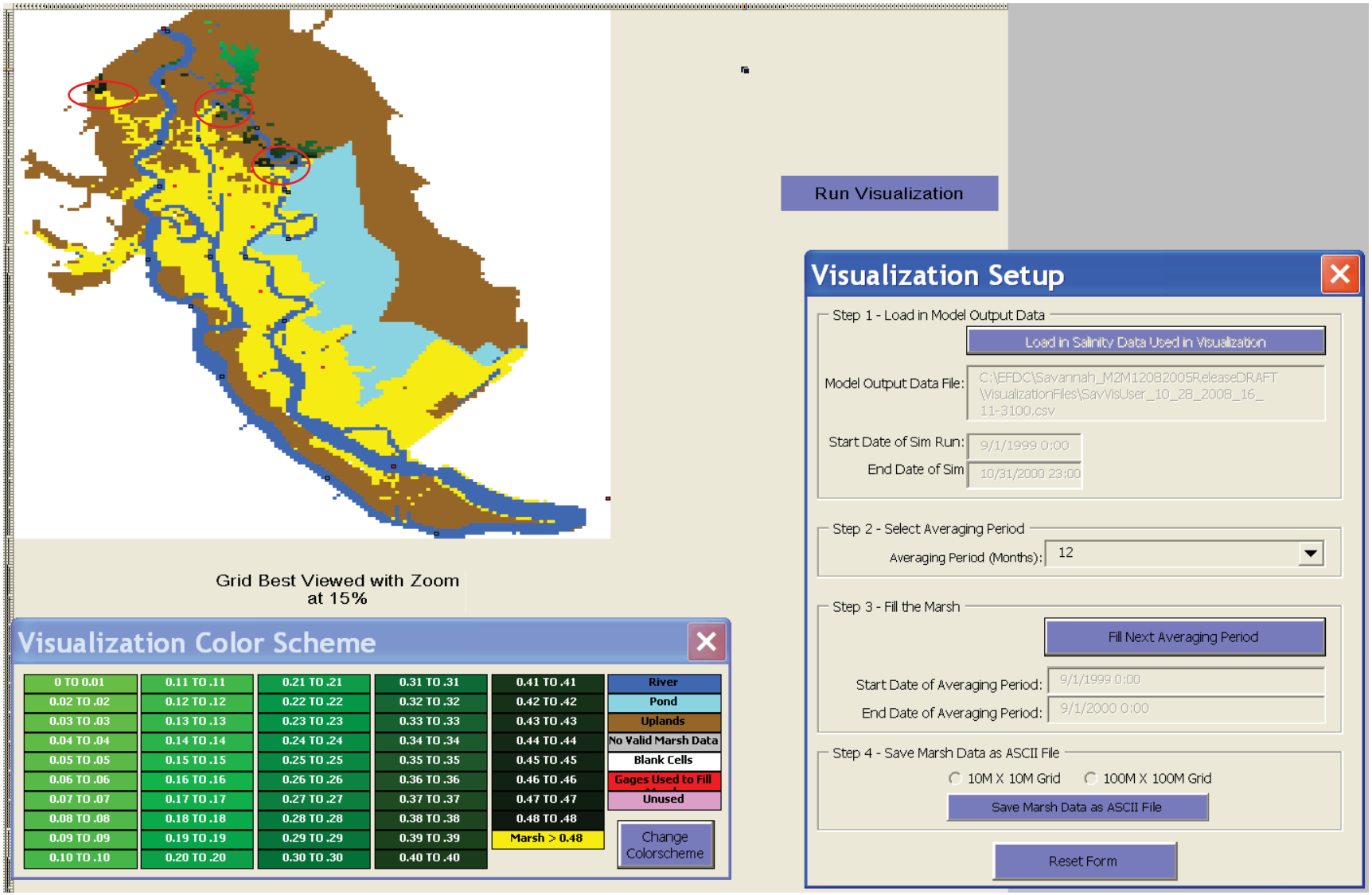


Figure 16 – Marsh Pore Water Salinity (Proposed Action JST = 3,100 October – February)



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.

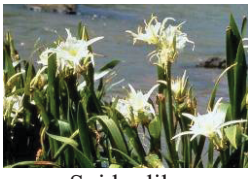
An adaptive management plan is in place to mitigate impacts should any significant increases in salinity are observed.

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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