Exhibit SNC 000018

FONSI for Drought Contingency Plan Update (August 2006)

SNC 000018

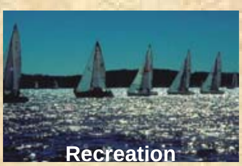
FINAL

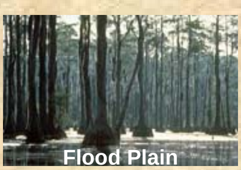
ENVIRONMENTAL ASSESSMENT

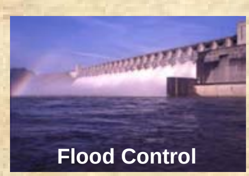
FINDING OF NO SIGNIFICANT IMPACT

DROUGHT CONTINGENCY PLAN UPDATE

SAVANNAH RIVER BASIN







AUGUST 2006

Prepared by:
US Army Corps of Engineers
Mobile/Savannah Planning Center

FINAL
ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

DROUGHT CONTINGENCY PLAN UPDATE
SAVANNAH RIVER BASIN

US ARMY CORPS OF ENGINEERS
SAVANNAH DISTRICT

AUGUST 2006

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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 Update for the Savannah River Basin

1. Description of the Proposed Action

The proposed action, Alternative 2, consists of retaining the major components of the 1989 Savannah River Basin Drought Contingency Plan (SRBDCP) and adding several new features. The minimum daily average release at Thurmond will be adjusted from 3600 cubic feet per second (cfs) to 3800 cfs, and a maximum daily average release of 3800 cfs will be specified in drought level 3. Additionally, the maximum weekly average discharge at J. Strom Thurmond Dam would be 4200 cfs and 4000 cfs for drought levels 1 and 2, respectively. During drought recovery periods, the discharge restrictions at J. Strom Thurmond (JST) Dam will be raised to those of the next higher action level when the pools at Hartwell and JST rise approximately two feet into the new zone. In the SRBDCP, drought level 3 discharge restrictions were not lifted until both Hartwell and Thurmond reach full pool. This change will allow downstream flow to more quickly reflect changing hydrologic conditions during a drought recovery.

Four pumped storage units are also considered available at Richard B. Russell Dam June 1st through September 30th. However, all alternatives include 80-unit hours of pumping per week, which is the amount that 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. Lastly, guide curve drawdown dates at Hartwell and Thurmond would be synchronized for operational consistency.

2. Other Alternatives Considered

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

a. No Action Alternative (Continue with the 1989 Savannah River Basin Drought Contingency Plan (SRBDCP))

b. Alternative 1: Consists of retaining the major components of the 1989 SRBDCP and adding several other features. The discharge restrictions at Thurmond were allowed to transition back to higher flows prior to reaching full pool. A two foot buffer was used to simulate engineering judgment to distinguish a lasting drought recovery from a temporary increase in inflows. The minimum daily average release at Thurmond was adjusted from 3600 cfs to 3800 cfs, and a maximum daily average release of 3800 cfs was specified in drought level 3. Drawdown dates at Hartwell and Thurmond would also be synchronized as listed in Table 7. Action thresholds are shown in Figure 3 and Figure 4.

c. Alternative 3: Includes all components of Alternative 2 (Proposed Action), but the daily average release at Thurmond for Level 3 would be 3600 cfs.

d. Alternatives Considered but Eliminated from Detailed Consideration: Several Project Delivery Team meetings and Stakeholder meetings were held in late 2004 through the spring of 2005 with possible alternatives discussed. At the 4 March 2005 Stakeholders meeting in Evans, Ga. the alternatives were prioritized by the stakeholders in a rating process allowing some alternatives to be eliminated from further consideration. Alternatives eliminated included: increasing the flows when return elevations hit one foot above the elevation triggers, increasing the number of drought triggers for drought management and return from a drought to provide a more gradual transition to 3600 cfs, lowering the minimum drought trigger 3 releases to 3300 or 3000 cfs with 3600 cfs being maintained at the New Savannah Bluff Lock and Dam, adjusting Level 3 elevations at Hartwell from 646 to 648 or 649 and adjusting Level 3 elevations at JST from 316 to 318 or 319.

3. Coordination

Savannah District has 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. Comments received have been addressed in a comment matrix in Appendix D.

4. Conclusion

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 Drought Contingency Plan Update for the Savannah River Basin is not a major Federal action within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. Accordingly, the 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 impact any threatened or endangered species.

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

c. The proposed action would result in no adverse impact to 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 directly affect wetlands, or cause any adverse impacts to wetlands.

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

5. Findings

The proposed action to revise the Drought Contingency Plan for the Savannah River Basin would result in no significant environmental impacts and is the alternative that represents sound natural resource management practices and environmental standards.

15 Sept 06
Date

Mark S Held
Mark S. Held
Colonel, US Army
Commanding

FINAL ENVIRONMENTAL ASSESSMENT

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1. INTRODUCTION

1.1.1. History

From 1986 to 1989, the previous drought of record created severe water shortage conditions over extensive areas of the Southeastern United States. At the three US Army Corps of Engineers' (Corps) impoundments on the Savannah River (Hartwell, Richard B. Russell and J. Strom Thurmond), inflows were the lowest recorded this century.

The severity of the drought created conditions which stressed the traditional management concepts followed in regulating 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. During 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.

In May of 1998, hydrometerologic conditions in the Southeast US transitioned from extremely wet to drier than normal. The unprecedented dry conditions persisted until fall 2002 resulting in a new drought of record for the Savannah River Basin. During this extended drought period, pool elevations declined to an extent that it became apparent conservation measures beyond those included in the SRBDCP were necessary. A series of public meetings pushed for an update of the existing drought plan. The Savannah River Basin Comprehensive Study (SRBC), authorized in the Water Resources Development Act of 1996, became the vehicle for evaluating and implementing changes to the SRBDCP. Phase I efforts of the SRBC focused on delivering these changes.

1.1.2. Requirement for Environmental Documentation

An Environmental Assessment (EA) is prepared in conformance with 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 updates to the SRBDCP.

1.1.3. General Objectives

The objectives of the Proposed Action are:

- ⇨ Savannah River Basin - apply the lessons learned from the new drought of record to improve water supply for as many users as possible and minimize negative impacts to other users adversely affected by such improvements.
- ⇨ Environmental Compliance - comply with all applicable environmental laws, regulations, and policies

1.2. PURPOSE AND NEED

The 1998 to 2002 drought has become the new drought of record for the Savannah River Basin due to its unprecedented duration. The SRBDCP was intended to be a dynamic document which can be changed as new drought periods occur. Items that were mentioned in the Plan that may be cause for changes included: additional experience, further studies of salinity intrusion in Savannah Harbor, changing water supply needs, improvements to water intakes and the uncertain future operational plan at the Savannah River Site. This proposed modification of the SRBDCP is in conjunction with the ongoing Savannah River Basin Comprehensive Study.

1.3. SCOPE

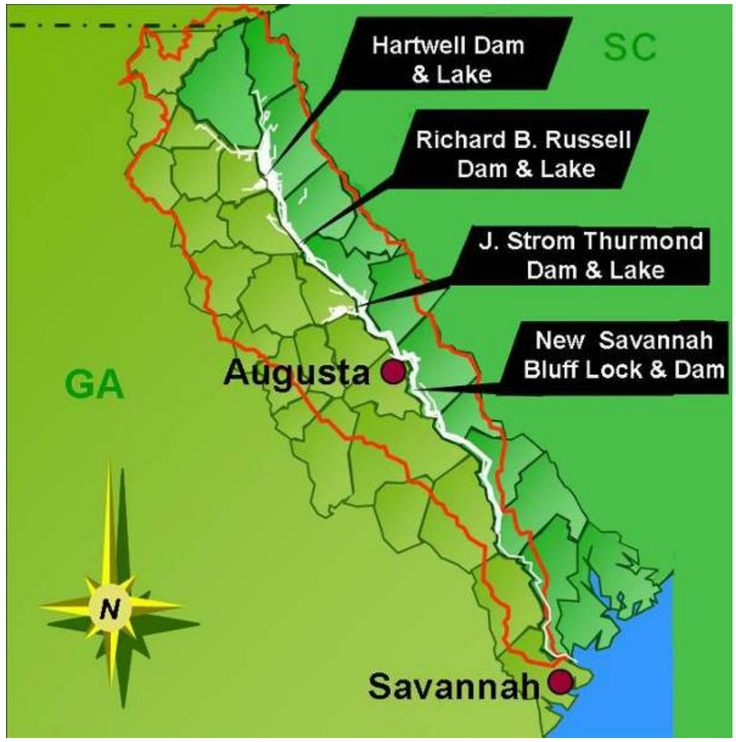
The scope of this EA is limited to assessing the potential environmental and socio-economic effects resulting from implementing the Proposed Action and the alternatives. After the elimination of alternatives that were not considered feasible or effective, the potential environmental impacts associated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

1.4. STUDY METHODOLOGY

Study alternatives were simulated using the HEC-ResSim reservoir operations model developed by the Hydrologic Engineering Center in Davis, California. All simulations ran from October 1, 1997, to September 30, 2003, to cover the new drought of record for the Savannah River Basin. The United States Geologic Survey (USGS) derived unregulated inflow data for the drought period which was used as input in ResSim. Lake levels were still used as a triggering mechanism for action because they are readily understood by the public, are already used by climatologists to define drought, and do not require complex forecast based calculations. Water supply estimates from 2003 were used at appropriate locations in the model. The base condition for the study, or NAA, was initially modeled to provide a baseline from which to evaluate proposed management changes. The base condition follows the existing water release procedures described in the SRBDCP. Pumped storage operation was important to include in the NAA because this feature was not available during the original implementation of the SRBDCP in 1989. Alternatives to the NAA were then modeled to analyze their effect during the period of record drought simulation.

2.0 AFFECTED ENVIRONMENT

2.1. DESCRIPTION OF THE SAVANNAH RIVER BASIN



The Savannah River basin has a surface area of approximately 10,577 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. S. Thurmond (JST) Reservoir) and two large private power reservoirs (Lakes Keowee and Jocassee). Other structures include the New Savannah Bluff Lock and Dam, the Stevens Creek Lock and 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 12 miles downstream of Augusta average discharge is about 10,000 cfs. The range in water year 1998 was about 4,300 cfs to 42,700 cfs. Average discharge at Clyo (Effingham County, Georgia) is 12,040 cfs with a range for water year 1998 of 6,280 cfs to 52,600 cfs (Cooney et al. 1999). 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. RBR Dam and Lake (26,650 acre summer pool) is located 59 miles upstream of Augusta and was filled in 1984. JST Dam and Lake (70,000-acre summer pool) is located 22 miles upstream of Augusta and was filled in 1954.

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, have been 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.

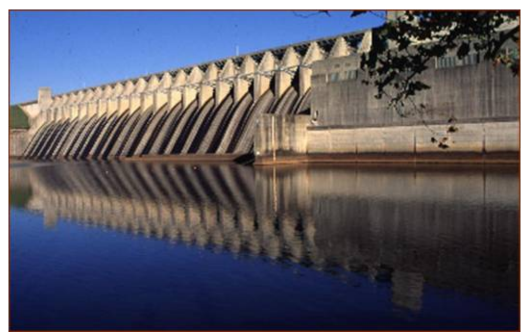

Hartwell Lake and Dam

The existing authorized Savannah Harbor navigation project provides for 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 below the Houlihan Bridge (Highway 17). The terminus of the existing channel for 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)..


R. B. Russell Lake and Dam

2.3. RECREATION

The lakes of the Savannah River Basin provide excellent opportunities for water resources-based recreation. However, in times of drought, when the lake levels of Hartwell and JST Lake drop 6 feet below summer pool, drought information sheets are disseminated to the public instructing them 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. However, adverse impacts become noticeable at designated swimming areas when lake levels drop below 3 feet.


J. S. Thurmond Lake and Dam

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


New Savannah Bluff Lock and Dam

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 resources-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.

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: Hartwell Lake - Unusable Ramps by Lake Level 658 to 652 feet msl

NAME OF BOAT RAMP	LAKE LEVEL RAMP BECOMES UNUSABLE (feet msl)
Sadlers Creek State Park.	658.0
Tugaloo State Lower	658.0
Jacks Landing, SC	658.0
Holders Access, SC	658.0
Lakeshore	658.0
Mountain Bay	658.0
Reed Creek, GA	657.5
Rocky Ford, GA	657.5
Brown Road, SC	657.0
Hurricane Creek, SC	657.0
Seneca Creek, SC	657.0
Walker Creek, GA	657.0
Cove Inlet, SC	656.5

NAME OF BOAT RAMP	LAKE LEVEL RAMP BECOMES UNUSABLE (feet msl)
Durham, SC	655.7
South Union, SC	655.5
Bradberry, GA	655.0
Timberland, SC	654.0
Darwin Wright City Park.	653.0
Tillies, SC	653.0
White City, SC	653.0
Barton Mill, SC	653.0
Port Bass, SC	653.0
Seymour, GA	653.0
Paynes Creek (inner right)	652.6
Paynes Creek (left)	652.6
Big Oak Left Lane (New)	652.5
Tabor, SC	652.5
Townville, SC	652.3
Twelve Mile (new left lane)	652.0
Eighteen Mile Creek	652.0

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.

RBR 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.

JST 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: JST - Unusable Ramps by Lake Level 326 to 317 feet msl

NAME OF BOAT RAMP	LAKE LEVEL RAMP BECOMES UNUSABLE (feet msl)
Wildwood Park (5 ramps)	326.0
Hwy 28 Access Ramp	326.0
Long Cane Creek Ramp	325.7
Catfish Ramp	325.5
Calhoun Falls Ramp	325.0
Broad River Campground	325.0
Double Branches Ramp	324.8
Cherokee Recreation Area (2 lanes)	324.7
Mistletoe State Park (2 lanes)	324.2
Soap Creek Park	324.0
Little River Quarry Ramp	324.0
Scotts Ferry (New Ramp)	323.8
Leroys Ferry Campground	323.6
Clay Hill Campground	323.5
Winfield Subdivision (2 lanes)	323.1
Mt Pleasant Ramp	322.4
Bussey Point	321.0
Chamberlain Ferry Ramp	321.0
Modoc Campground	321.0
Murray Creek Ramp	321.0
Parkway Ramp	321.0
Fishing Creek/Hwy 79 Ramp	320.7
Soap Creek Subdivision	320.0
Scotts Ferry (New Ramp)	318.8
Wildwood Park	318.4
Cherokee Recreation Area (2 lanes)	318.2
Soap Creek Marina	318.0
Raysville Marina	317.6
Soap Creek/Hwy 220 Ramp	317.0

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.

2.3.2. Swimming

Swimming areas are mainly utilized from May through September.

Hartwell Lake

At Hartwell Lake, there are 22 Corps of Engineer's 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.

RBR Lake

At RBR, there are no Corps of Engineer's operated designated swimming areas.

JST Lake

At JST Lake, there are 18 Corps of Engineer's 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.

2.4. WATER SUPPLY

Hartwell Lake

There are 8 water supply users on Hartwell Lake. The highest intake elevation according to the SRBDCP, March 1989, is 638.33 feet msl.

RBR Lake

There are 6 water supply users on RBR. The highest intake elevation according to the SRBDCP, March 1989, is 457.5 feet msl.

JST Lake

There are 8 water supply users on JST Lake. The highest intake elevation according to the SRBDCP, March 1989, is 307 feet msl.

Downstream of JST Lake

Major water supply users downstream are the Augusta Canal and Shoals. 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. Users below NSBL&D include 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. These water supply users currently require a minimum normal flow from JST of 3,600 cfs to maintain adequate stage for their intakes.

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 will affect 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.

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 no pumped storage operations in April.
- 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 seasonal pumped storage operational restrictions when a Level II drought 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. 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 utilized 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).

RBR Lake utilizes a hypolimnetic DO system that maintains DO concentrations 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.

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 generally fully supported along the main length of the Savannah River. 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. These concerns stemmed from historic methods of disposal of radioactive materials at the Savannah River Site.

Historically, summer discharges from Thurmond Dam have been low in both DO and temperature. Savannah District has replaced six of the seven turbines with a self-aspirating design and replacement is underway on the seventh turbine. This adds oxygen to the discharges increasing their DO levels during the summer months. The District expects to complete installation of a DO injection system within Thurmond Lake in 2007-2009. This system would ensure that waters reaching the dam contain about 3 parts per million (ppm) of DO. With the combination of these two actions, 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.

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 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. The Environmental Protection Agency (EPA) is finalizing a draft Total Maximum Daily Load (TMDL) that was prepared in August of 2004 for the Savannah River from Augusta to the coast for DO.

The State of South Carolina uses the current drought plan Level 3 flow of 3600 cfs (Andrew Wachob, South Carolina DNR) 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, while the State of Georgia uses the 7Q10 values of 3800 cfs at the Augusta gage, 4160 cfs further downstream at the Millhaven gage and 4710 cfs at the Clyo gage (Paul Lamarre, Georgia 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, 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 has the Savannah River in Hart County (which includes the Hartwell tailrace) classified 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 and walleye 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 changes by Savannah District have been implemented to alleviate or minimize this entrainment.

2.8.2. Fishery Resources at RBR Lake

The fishery resources of RBR have been extensively studied. The Savannah District along with the University of Georgia Cooperative Fish and Wildlife Research Unit (GA COOP) began baseline studies of fishery resources in RBR Lake in 1990. These studies included cove rotenone sampling, gill net sampling, electrofishing, and telemetry. The Savannah District has also conducted hydroacoustic surveys of the fishery resources in the RBR tailrace since 1986, and lakewide hydroacoustic surveys of RBR Lake in 1997. The South Carolina DNR has conducted fisherman creel surveys on RBR since 1991. The 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. The Savannah District along with 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 Clemson University Cooperative Fish and Wildlife Research Unit (CU COOP) conducted a commercial creel estimate and a population estimate of blueback herring. The Savannah District has conducted lakewide hydroacoustic surveys of the forage fish populations in 1996 and the 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. The 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 is planned for 2006. 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 will be conducted periodically throughout the summer and fall of 2006. Executive Order 13112-Invasive Species directs federal agencies to take actions, such as preventing the introduction of invasive species and controlling populations of the species in a cost-effective and environmentally sound manner.

2.8.5. Aquatic Plants at RBR Lake

Hydrilla was discovered in Richard B. Russell Lake during the summer of 2002 but has not reoccurred since that time. Approximately 20 acres of Brazilian Elodea (Egeria densa) was present in 2005 with an increase in distribution and abundance from 2004. Boat surveys will be conducted periodically throughout the summer and fall of 2006 to determine plant distribution and abundance. Aquatic plant growth has not reached nuisance levels requiring treatment. Executive Order 13112-Invasive Species directs federal agencies to take actions, such as preventing the introduction of invasive species and controlling populations of the species in a cost-effective and environmentally sound manner.

2.8.6. Aquatic Plants at JST Lake

The Thurmond Project staff monitors the abundance and migration of hydrilla in the reservoir. One of two herbicides are selected and used for control based upon site location, desired level of control, and cost per acre. Changes in the proposed treatment program are coordinated with the GADNR, SCDNR, and affected outgrantees prior to implementation. Hydrilla is present on approximately 5,173 acres near the shoreline, including approximately 318 miles (3,875 acres) of shoreline in Georgia and 107 miles (1,298 acres) of shoreline in South Carolina. The prolonged drought from mid 1998 through the summer of 2002 significantly reduced the abundance of aquatic vegetation in the lake. In 2005, 14.6 acres of Hydrilla adjacent to 10 boat ramps, beaches or marinas was treated with herbicide in order to minimize user impacts (Aquatic Plant Management Plan, US Army Corps of Engineers, Savannah District, Calendar Year 2006 Update). Executive Order 13112-Invasive Species directs federal agencies to take actions, such as preventing the introduction of invasive species and controlling populations of the species in a cost-effective and environmentally sound manner.

2.9. BIOTIC COMMUNITIES IN THE LOWER SAVANNAH RIVER

2.9.1. Fish

Riverine fish habitats in the Savannah River have been highly modified or converted to lacustrine habitat by construction of major dams and reservoirs inundating 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 utilized 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 fishes 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. After 1846 the Augusta Diversion Dam acted as a barrier to inland migration of diadromous species except during high flow periods when the Dam was overtopped, allowing fish to continue unimpeded migrations. Completion of the New Savannah Bluff Lock and Dam (NSBLD) in 1937 further restricted spawning migrations in many years to below river mile 265, with the exception of high flow periods during the spawning season in some years. 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. Therefore, the NSBLD is now located at river mile 187.3.

The Stevens Creek Dam, a South Carolina Electric and Gas hydroelectric project, was constructed upstream of the Augusta Diversion Dam in 1914, blocking all diadromous fish migrations at 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 NSBLD facility which is the first major obstruction to passage on the river. However, some fish have continued to migrate to historical spawning grounds above the facility when flow conditions are suitable. The fish 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.

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 NSBLD up to Stevens Creek Dam. After construction of mainstem dams and prior to initiation of a tide gate 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 tide gate 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 tide gate 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 were harvested annually by sport fishermen in the Savannah River downstream of the NSBLD (Schmitt and Hornsby 1985).

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.

2.9.2. 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, becomes prevalent. Tidal palustrine emergent wetlands are flooded twice daily by tidal action in the study 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 2000 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).

Fresh marsh vegetation also contributes to the food web base that supports the study 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.

2.9.3. 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.

Swallow-tailed kite

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.

Wood stork

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.

Little blue heron

2.9.4. 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

Table 3: 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		
Bald eagle	*Haliaeetus leucocephalus*	T[**]
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
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
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[***]

[*] Endangered
[**] Threatened
[*] Endangered
[**] Threatened
[***] Candidate

Table 4: Georgia and South Carolina Rare, Threatened and Endangered Species Occuring 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	
Epidendrum conopseum	Green-Fly Orchid	U	
Fusconaia masoni	Atlantic Pigtoe Mussel	E	
Gopherus polyphemus	Gopher Tortoise		SE
Haematopus palliatus	American Oystercatcher	R	
Haliaeetus leucocephalus	Bald Eagle		FT/SE
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 sodalis	Indiana Myotis		FE/SE
Nestronia umbellula	Indian Olive	T	
Notropis hypsilepis	Highscale Shiner	T	

SCIENTIFIC NAME	COMMON NAME	GA STATE STATUS	SC STATE STATUS
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	
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 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

2.9.5. 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 our preliminary evaluation, 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).

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. Tide gate operation, 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. Striped bass eggs and larvae were also transported through New Cut and then rapidly downstream to areas with toxic salinity levels (Reconnaissance Planning Aid Report on the Savannah River Basin Study, US Fish and Wildlife Service, July 1999). It was hoped that the tide gate restoration project would improve most of these conditions. Annual stocking efforts by the GADNR 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 once again opened in October 2005.

2.10. SOCIOECONOMIC ISSUES

2.10.1. 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."

2.10.2. 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

3.0 DESCRIPTION OF THE PROPOSED ACTION AND OTHER ALTERNATIVES

3.1. ALTERNATIVE FORMULATION

The objective of the alternative formulation process was to make changes to the existing SRBDCP that focused on conservation of water resources during severe droughts. A District-level Project Delivery Team (PDT) and an Interagency PDT were initially formed to develop a basic set of alternatives for consideration. Ideas were exchanged concerning the make-up of the future alternatives At Stakeholder Meetings (consisting of various user groups) that were held prior to 4 March 2005. At the 4 March 2005 stakeholders meeting a list of these alternatives was presented and the stakeholders divided into groups representing Recreation/Homeowners, Hydropower, Environmental (lakes), Environmental (river) and Water Supply/Water Quality. Each of these groups then rated eleven presented alternatives and the existing Savannah River Basin Drought Contingency Plan of 1989. The meeting resulted in an Alternative Ratings Tally Sheet, Alternative Scores and Suggested Combinations of alternatives. The Project Delivery Team, using the scores and suggested combinations, put together a reasonable set of two alternatives that are evaluated in this document as Alternatives 1 and 2. Alternative 3 was suggested in a later Project Delivery Team meeting as a slight variation of Alternative 2. Subsequent meetings were held to review model output, allowing comparison between the proposed alternatives and the NAA.

3.2. ALTERNATIVES ANALYSIS

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

a. NAA (Continue with the SRBDCP, March 1989)
b. Alternative 1
c. Alternative 2
d. Alternative 3
e. Alternatives Considered But Eliminated From Detailed Consideration

3.2.1. No Action Alternative

This Alternative consists of the Corps taking no action to modify its existing SRBDCP. The operating procedures described in that 1989 Plan would continue to be implemented and forms the basis upon which comparisons to the other alternatives can be made.

Action thresholds were established in the SRBDCP 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 stays near guide curve during drought operations. Thresholds at Hartwell and Thurmond Lakes are shown in Table 5 and Table 6 and Figure 1 and Figure 2. Using this plan, the lakes reached Level 2 in September 1999 and Level 3 in September 2002. In October 2002, J. Strom Thurmond Lake was more than 13 feet below its normal operating pool.

Table 5: Hartwell Action Levels for the NAA

LEVEL*	18 APR – 15 OCT (feet msl)	1 DEC – 1 JAN** (feet msl)	ACTION
1	656	655	Public safety information
2	654	652	Reduce Thurmond discharge to 4500 cfs weekly average, reduce Hartwell discharge as appropriate to maintain balanced pools.
3	646	646	Reduce Thurmond discharge to 3600 cfs daily average, reduce Hartwell discharge as appropriate to maintain balanced pools.
4	625	625	Daily Average Outflow = Daily Average Inflow

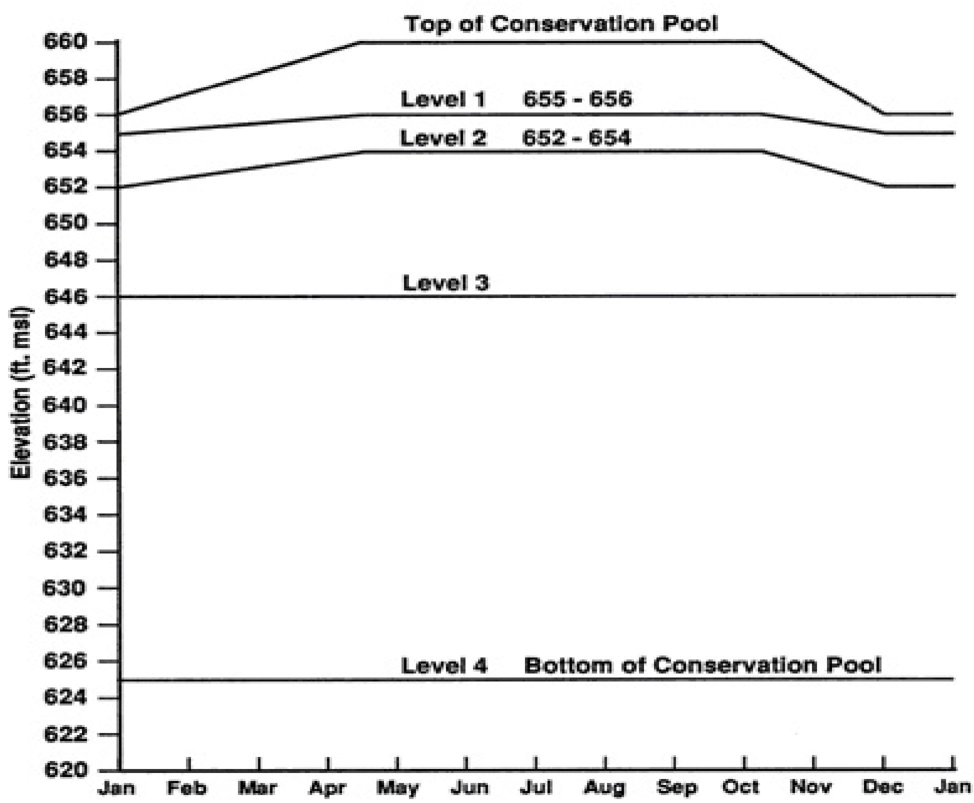


Figure 1: Hartwell Action Levels for the NAA

* 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 6: Thurmond Action Levels for the NAA

LEVEL*	1 MAY – 15 OCT (feet msl)	15 DEC – 1 JAN** (feet msl)	ACTION
1	326	325	Public safety information
2	324	322	Reduce Thurmond discharge to 4500 cfs weekly average.
3	316	316	Reduce Thurmond discharge to 3600 cfs daily average.
4	312	312	Daily Average Outflow = Daily Average Inflow

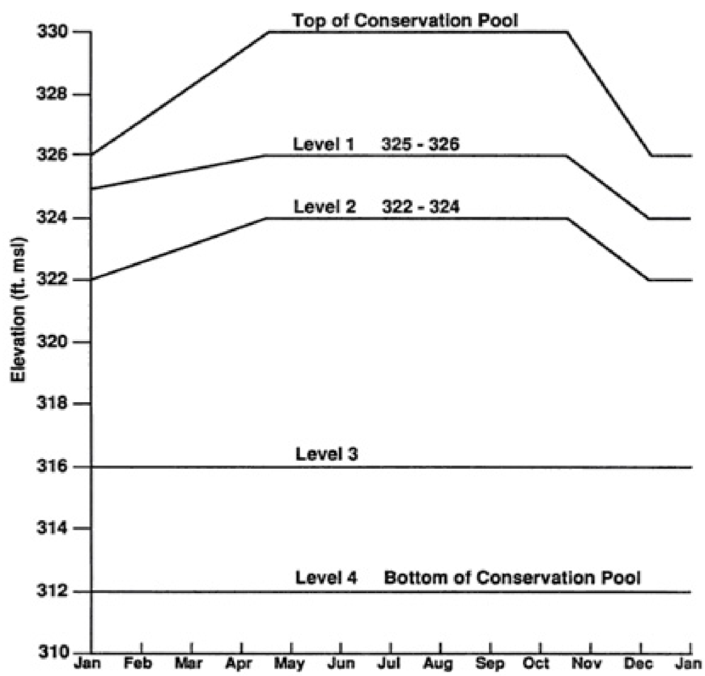


Figure 2: Thurmond Action Level for the NAA

As described in the 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 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.

Four pumped storage units are available at RBR June 1st through September 30th for each alternative. Eighty unit hours of pumping per week is the amount that is required to support the current hydropower contract. Pumping beyond 80 unit hours up to the maximum allowed by the

* Level as shown in Figure 2
** Lake elevations for the periods January 1 t May 1 and October 15 to December 15 are linearly interpolated from this data as shown in Figure 2

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 will be evaluated in regard to all environmental concerns.

3.2.2. Alternative 1

Alternative 1 consists of retaining the major components of the 1989 SRBDCP and adding several other features. The minimum daily average release at Thurmond was adjusted from 3600 cubic feet per second (cfs) to 3800 cfs, and a maximum daily average release of 3800 cfs was specified in drought level 3. During drought recovery periods, the discharge restrictions at J. Strom Thurmond (JST) Dam were raised to those of the next higher action level when the pools at Hartwell and JST rise approximately two feet into the new zone. In the NAA, drought level 3 discharge restrictions were not lifted until both Hartwell and Thurmond reach full pool. This change allowed downstream flow to more quickly reflect changing hydrologic conditions during a drought recovery. Drawdown dates at Hartwell and Thurmond were also synchronized as listed in Table 7. Action thresholds are shown in Figure 3 and Figure 4.

Table 7: Hartwell and Thurmond Action Levels for Alternative 1

LEVEL	1 APR – 15 OCT (feet msl)	15 DEC – 1 JAN (feet msl)	ACTION
1	656 and 326	654 and 324	Public safety information
2	654 and 324	652 and 322	Reduce Thurmond discharge to 4500 cfs weekly average.
3	646 and 316	646 and 316	Reduce Thurmond discharge to 3800 cfs daily average.
4	625 and 312	625 and 312	Daily Average Outflow = Daily Average Inflow

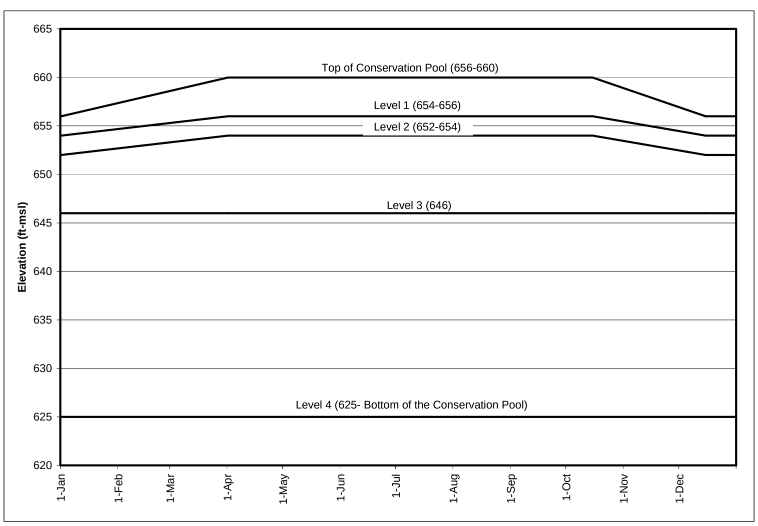


Figure 3: Hartwell Action Levels for Alternatives 1, 2 and 3

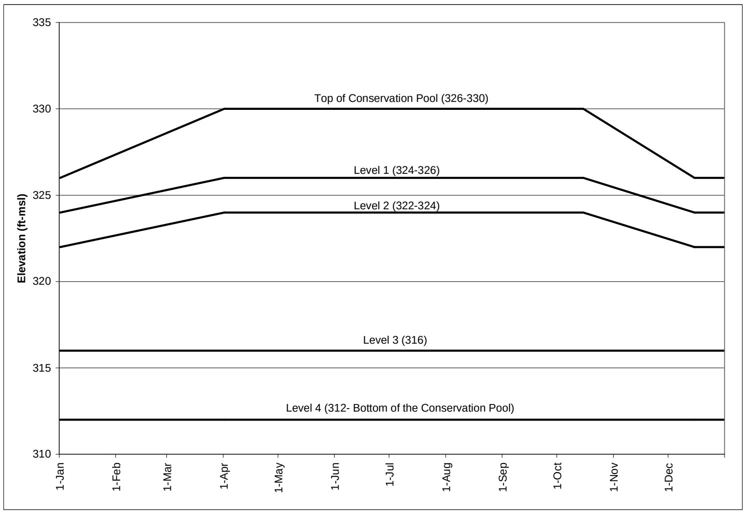


Figure 4: Thurmond Action Levels for Alternatives 1, 2 and 3

3.2.3. Alternative 2

Alternative 2 includes all components of Alternative 1. Additionally, the maximum weekly average discharge at J. Strom Thurmond would be 4200 cfs and 4000 cfs for drought levels 1 and 2, respectively.

Table 8: Hartwell and Thurmond Action Levels for Alternative 2

LEVEL	1 APR – 15 OCT (feet msl)	15 DEC – 1 JAN (feet msl)	ACTION
1	656 and 326	654 and 324	Reduce Thurmond discharge to 4200 cfs weekly average.
2	654 and 324	652 and 322	Reduce Thurmond discharge to 4000 cfs.
3	646 and 316	646 and 316	Reduce Thurmond discharge to 3800 cfs daily average.
4	625 and 312	625 and 312	Daily Average Outflow = Daily Average Inflow

3.2.4. Alternative 3

Alternative 3 includes all components of Alternative 2, but the daily average release at Thurmond for Level 3 would be 3600 cfs.

3.2.5. Alternatives Considered But Eliminated From Detailed Consideration

Several Project Delivery Team meetings and Stakeholder meetings were held in late 2004 through the spring of 2005 with possible alternatives discussed. At the 4 March 2005 Stakeholders meeting in Evans, Ga. the alternatives were prioritized by the stakeholders in a rating process allowing some alternatives to be eliminated from further consideration. Alternatives eliminated included: increasing the flows when return elevations hit one foot above the elevation triggers, increasing the number of drought triggers for drought management and return from a drought to provide a more gradual transition to 3600 cfs, lowering the minimum drought trigger 3 releases to 3300 or 3000 cfs with 3600 cfs being maintained at the New Savannah Bluff Lock and Dam, adjusting Level 3 elevations at Hartwell from 646 to 648 or 649 and adjusting Level 3 elevations at JST from 316 to 318 or 319.

3.2.6. Selected Alternative

The Proposed Action is Alternative 2. It consists of retaining the major components of the 1989 SRBDCP and adding several other features. The discharge restrictions at Thurmond would be allowed to transition back to higher flows prior to reaching full pool. A two foot buffer would be used to simulate engineering judgment to distinguish a lasting drought recovery from a temporary increase in inflows. The minimum daily average release at Thurmond would be adjusted from 3600 cfs to 3800 cfs, and a specified daily average release of 3800 cfs would be included in drought level 3. Additionally, the maximum weekly average discharge at J. Strom Thurmond would be 4200 cfs and 4000 cfs for drought levels 1 and 2, respectively. HEC-ResSim pool plots are included in Appendix F.

4.0 ENVIRONMENTAL AND SOCIOECONOMIC 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 fish. We do not envision any irretrievable commitments of resources from either alternative. Savannah District believes the proposed project is consistent with the Coastal Zone Management Program to the maximum extent practicable.

Flows up to 10,000-15,000 cfs, as discussed in Section 4.4, are expected to remain within the stream channel. Flows discussed in the drought alternatives range between 3600 and 4500 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 produce no measurable impacts on wetlands

Alternatives 1, 2 and 3 were each compared to the NAA in this section. For Sections 4.1 thru 4.6, this was conducted primarily by comparing Downstream Hydrographs (example can be found on page 30), comparing Pool Elevation Tables (example can be found on Pages 34, Figure 6) and by employing the Ecosystems Function Model (EFM), in conjunction with information from the 1-3 April, 2003, Scientific Stakeholders Workshop. The Workshop included approximately 48 attendees and the organizations represented included the University of Georgia, the South Carolina Department of Natural Resources, the US Army Corps of Engineers, the US Geological Survey, the US Fish and Wildlife Service, the Environmental Protection Agency, The Nature Conservancy, the Southeastern Natural Sciences Academy, the National Marine Fisheries Service and the South Carolina Coastal Conservation League. An example of the EFM can be found on pages 38-39.

4.1. WATER QUALITY

When discharges are reduced from Thurmond Dam, impacts occur to downstream water quality. Reduced discharges result in increases in water temperature and a reduction in the quality of the river downstream of point source discharges. Increasing the low flows that are associated with drought conditions would enhance water quality. The summer months are the most critical to aquatic resources, so reduced flow rates during those months would cause greater adverse impacts.

The State of South Carolina uses the current drought plan Level 3 flow of 3600 cfs (Andrew Wachob, South Carolina DNR) 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, while the State of Georgia uses the 7Q10 flow values of 3800 cfs at the Augusta gage, 4160 cfs at the Millhaven gage and 4710 cfs at the Clyo gage. In the following analysis, however, the flows of the modeled alternatives were not compared to these values. They were compared to the flows of the modeled NAA to determine the impacts of changing the existing SRBDCP.

Downstream hydrographs that were generated by ResSim modeling were used here and in other portions of Section 4.0 to compare Alternatives 1, 2 or 3 to the NAA. The following example is a two year portion of the overall hydrograph that covers approximately five years. It compares Alternative 1 to the NAA and shows a modeled 200 cfs increase in predominant flows for Alternative 1. Predominant flows are those that are present for much of the drought of record on a modeled alternatives downstream hydrograph. As mention earlier, flow increases during drought enhance water quality. Similar comparisons follow in this Water Quality section.

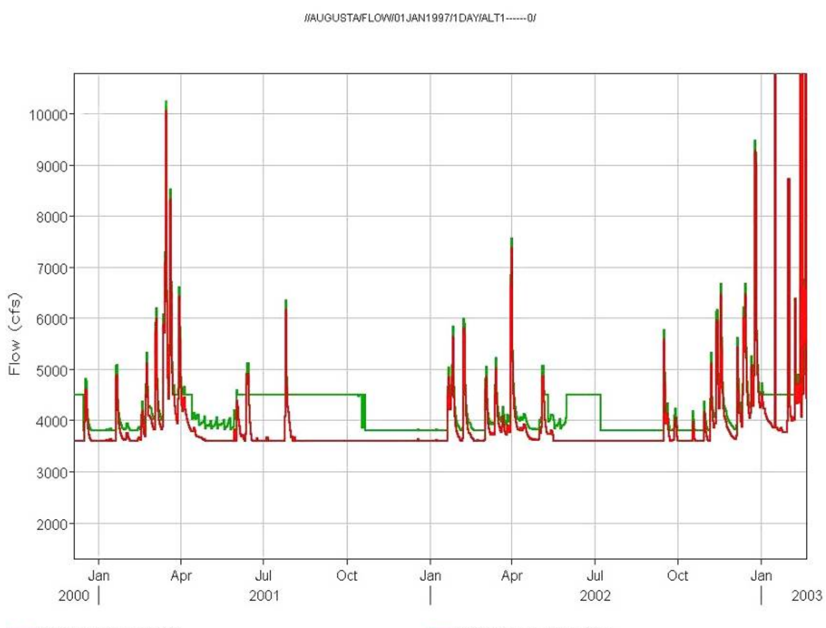


Figure 5: Example of Downstream Hydrographs

Effects of the NAA

The NAA would have no adverse impacts on water quality, as the existing SRBDCP of March 1989 with coordinated additions would continue to be used.

Effects of Alternative 1

Augusta Gage
This alternative would have a minor positive impact on water quality in the Augusta area. The downstream hydrograph of this alternative provides flows that are primarily above 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200 cfs increase in predominant flows is spread across the calendar years, so overall water quality would be enhanced.

Millhaven Gage
This alternative would have a minor positive impact on water quality in the Millhaven area. The downstream hydrograph of this alternative and the NAA provides flows that greatly exceed 6000 cfs from September 1997 to June 1998. The flows of this and the NAA vary little between June 1998 and November 2000 and are 50-900 cfs higher than the NAA between December 2000 and September 2003. The 50-900 cfs increase in flows for the long period from December 2000 to September 2003 would enhance overall water quality.

Clyo Gage
This alternative would have a minor positive impact on water quality in the Clyo area. The downstream hydrograph of this alternative and the NAA provide flows that greatly exceed 6000 cfs from September 1997 to September 1998. From October 1998 to November 2000 there is little variation between the flows of this alternative and the NAA and from December 2000 to December 2002 this alternatives flows are 200-1000 cfs higher. The flows again greatly exceed 6000 cfs from January 2003 to August 2003 for this and the NAA. The 200-1000 cfs increase in flows for the long period from December 2000 to December 2002 would enhance overall water quality.

Effects of Alternative 2

Augusta Gage
This alternative would have a minor positive impact on water quality in the Augusta area. The downstream hydrograph of this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant flows is spread across the calendar years, so overall water quality would be enhanced.

Millhaven Gage
This alternative would have a minor positive impact on water quality in the Millhaven area. The downstream hydrograph of this alternative and the NAA provides flows that greatly exceed

6000 cfs from September 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are 50-1000 cfs less than those of the NAA, from March 1999 to August 1999 there is little variation, from September 1999 to October 1999 this alternatives flows are 300-1300 cfs lower, from November 1999 to April 2000 there is again little variation, from May 2000 to June 2000 this alternatives flows are 200-1200 cfs higher, from July 2000 to November 2000 the flows are 50-700 cfs lower and this alternatives flows are 50-400 cfs higher between December 2000 and February 2003. This alternative and the NAA provide flows that greatly exceed 6000 cfs from March 2003 to August 2003. The 50-400 cfs increase in flows for the long period from December 2000 to February 2003 would enhance overall water quality.

Clyo Gage
This alternative would have a minor positive impact on water quality in the Clyo area. The downstream hydrograph of this alternative and the NAA provide flows that greatly exceed 6000 cfs from December 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are 200-1500 cfs less than those of the NAA, from March 1999 to July 1999 there is little variation, from August 1999 to October 1999 (see Appendix G for several hydrographs associated with downstream flows) this alternatives flows are 50-1500 cfs lower, from November 1999 to April 2000 there is again little variation, from May 2000 to June 2000 this alternatives flows are 200-4000 cfs higher, from July 2000 to November 2000 the flows are 300-500 cfs less and from December 2000 to February 2003 this alternatives flows are 50-500 cfs higher. The flows again greatly exceed 6000 cfs from March 2003 to August 2003 for this and the NAA. The 50-500 cfs increase in flows for the long period from December 2000 to February 2003 would enhance overall water quality.

Effects of Alternative 3

Augusta Gage
This alternative would have a minor positive impact on water quality in the Augusta area. The downstream hydrograph of this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant flows is spread across the calendar years, so overall water quality would be enhanced.

Millhaven Gage
This alternative would have a minor positive impact on water quality in the Millhaven area. For October 1997 there is little variation between this alternative's flows and those of the NAA. The hydrographs of both alternatives provide flows that greatly exceed 6000 cfs from November 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are 50-1000 cfs less than those of the NAA, from March 1999 to August 1999 there is little variation, from September 1999 to October 1999 this alternatives flows are 300- 1300 cfs lower, from November 1999 to April 2000 there is again little variation, from May 2000 to June 2000 this alternatives flows are 200-1200 cfs higher, from July 2000 to December 2000 the flows are 50-700 cfs lower and this alternatives flows are 50-400 cfs higher between January 2001 and February 2003. This alternative and the NAA provide flows that greatly exceed 6000 cfs from

March 2003 to August 2003. The 50-400 cfs increase in flows for the long period from January 2001 to February 2003 would enhance overall water quality.

Clyo Gage
This alternative would have a minor positive impact on water quality in the Clyo area. For October 1997 there is little variation between this alternative's flows and those of the NAA. The hydrographs of both alternatives provide flows that greatly exceed 6000 cfs from November 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are predominantly 200-1500 cfs less than those of the NAA, from March 1999 to August 1999 there is little variation, from September 1999 to October 1999 this alternatives flows are 50-1500 cfs lower, from November 1999 to March 2000 there is again little variation, from April 2000 to June 2000 this alternatives flows are 200-4000 cfs higher, from July 2000 to November 2000 the flows are 300-500 cfs less and from December 2000 to January 2003 this alternatives flows are 50-500 cfs higher. The flows again greatly exceed 6000 cfs from February 2003 to August 2003 for this and the NAA. The 50-500 cfs increase in flows for the long period from December 2000 to January 2003 would enhance overall water quality.

4.2. Biotic Communities-Lakes

4.2.1. 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, 30 Mar 2001).

The 4-week period of April 1-28 was used in the HEC-ResSim model applications. 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.

Pool Elevation Tables that were generated by HEC-ResSim modeling were used in this Section to compare Alternatives 1, 2 or 3 to the NAA. The adjacent example reveals that the modeled pool elevations show a 0.64-foot maximum drop that would occur from 12 April to 17 April 1998 for Hartwell Lake. The paragraph contains this occurrence of 0.64 feet that exceeds six inches.

There are seventy-two tables that were used similarly in this Biotic Communities-Lakes section. It should be noted that this model does not operate the lakes and the existing manual lake operation is more adaptive in maintaining the stable spawning pools.

Ordinate Units Type	Date / Time		HARTWELL-POOL ELEV BASE_DCP--0 ft INST-VAL
191	01 Apr 98	24:00	659.34
192	02 Apr 98	24:00	659.38
193	03 Apr 98	24:00	659.41
194	04 Apr 98	24:00	659.45
195	05 Apr 98	24:00	659.64
196	06 Apr 98	24:00	659.79
197	07 Apr 98	24:00	659.73
198	08 Apr 98	24:00	659.66
199	09 Apr 98	24:00	659.96
200	10 Apr 98	24:00	660.32
201	11 Apr 98	24:00	660.47
202	12 Apr 98	24:00	660.63
203	13 Apr 98	24:00	660.5
204	14 Apr 98	24:00	660.36
205	15 Apr 98	24:00	660.24
206	16 Apr 98	24:00	660.05
207	17 Apr 98	24:00	659.99
208	18 Apr 98	24:00	660.4
209	19 Apr 98	24:00	660.66
210	20 Apr 98	24:00	660.81
211	21 Apr 98	24:00	660.91
212	22 Apr 98	24:00	660.98
213	23 Apr 98	24:00	661.03
214	24 Apr 98	24:00	661.14
215	25 Apr 98	24:00	661.29
216	26 Apr 98	24:00	661.3
217	27 Apr 98	24:00	661.06
218	28 Apr 98	24:00	660.82

Figure 6: Example of Pool Elevation Tables

Effects of the NAA (By observing the Pool Elevation tables)

Hartwell Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.64, 0.26, 0.22, 0.29, 0.23 and 0.28 feet.

RBR Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.67, 0.01, 0.07, 1.07, 0.01 and 0.01 feet.

JST Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.41, 0.14, 0.16, 0.32, 0.13 and 0.28 feet.

Review of the above model-generated pool elevation reductions show that the 6-inch maximum lowering for April 1-28 would be exceeded 1 year at Hartwell Lake, 2 years at RBR Lake and 0 years at JST Lake during the 6-year period of analysis. The approved SRBDCP has been found to be an acceptable plan based on its impacts on biotic communities in the lakes.

Effects of Alternative 1 (By observing the Pool Elevation tables)

Hartwell Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 2.13, 0.26, 0.25, 0.37, 0.25 and 0.02 feet.

RBR Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.01, 0.01, 0.82, 0.01, 0.07 and 0.01 feet.

JST Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.42, 0.14, 0.18, 0.34, 0.17 and 0.13 feet.

Review of the above model-generated pool elevation reductions shows that the 6-inch maximum lowering for April 1-28 would be exceeded 1 year at Hartwell Lake, 1 year at RBR Lake and 0 years at JST Lake during the 6-year period of analysis. This alternative would have no adverse impact, as 2 total exceedances were observed and 3 were observed previously for the NAA. The exceedances do not primarily occur at one lake.

Effects of Alternative 2 (By observing the Pool Elevation tables)

Hartwell Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 2.13, 0.26, 0.15, 0.56, 0.27 and 0.49 feet.

RBR Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.01, 0.01, 0.66, 0.62, 0.01 and 0.40 feet.

JST Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.42, 0.14, 0.90, 0.27, 0.15 and 0.20 feet.

Review of the above model-generated pool elevation reductions shows that the 6-inch maximum lowering for April 1-28 would be exceeded 2 years at Hartwell Lake, 2 years at RBR Lake and 1 year at JST Lake during the 6-year period of analysis. This alternative would have a minor adverse impact, as 5 total exceedances were observed and 3 were observed for the NAA. The exceedances do not primarily occur at one lake.

Effects of Alternative 3 (By observing the Pool Elevation tables)

Hartwell Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 2.13, 0.26, 0.15, 0.56, 0.27 and 0.45 feet.

RBR Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.01, 0.01, 0.66, 0.62, 0.01 and 0.19 feet.

JST Lake
The maximum lowering of the pool elevations between April 1-28 for the drought of record years 1998 to 2003 would respectively be 0.42, 0.14, 0.90, 0.27, 0.15 and 0.26 feet.

Review of the above model-generated pool elevation reductions shows that the 6-inch maximum lowering for April 1-28 would be exceeded 2 years at Hartwell Lake, 2 years at RBR Lake and 1 year at JST Lake during the 6-year period of analysis. This alternative would have a minor adverse impact, as 5 total exceedances were observed and 3 were observed for the NAA. The exceedances do not primarily occur at one lake.

4.2.2. 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 Alternative 1
The prolonged drought from mid 1998 through the summer of 2002 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 2006 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.

Effects of Alternative 2
This alternative would produce small variations in lake levels when compared to the NAA as with Alternative 1, so this action is expected to have no adverse impact on aquatic plants (including invasive species, such as hydrilla) in the lakes.

Effects of Alternative 3
This alternative would produce small variations in lake levels when compared to the NAA as with Alternative 1, so this action is expected to have no adverse impact on aquatic plants (including invasive species, such as hydrilla) in the lakes.

4.3. BIOTIC COMMUNITIES-SHOALS

Shoals

The final report from the Scientific Stakeholders Workshop of 1-3 April 2003 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. The high priority fish species would benefit from higher flows across the shoals from January to May that would provide seasonal spawning and passage. The endangered shoals spider lily would benefit from higher flows from June to December that would provide protection from deer grazing. Undefined very high flows could be detrimental to the spider lily, but these are not expected during times of drought and are not considered here. Higher flows in November and December would also enhance out-migration of juvenile fish.

Effects of the NAA

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

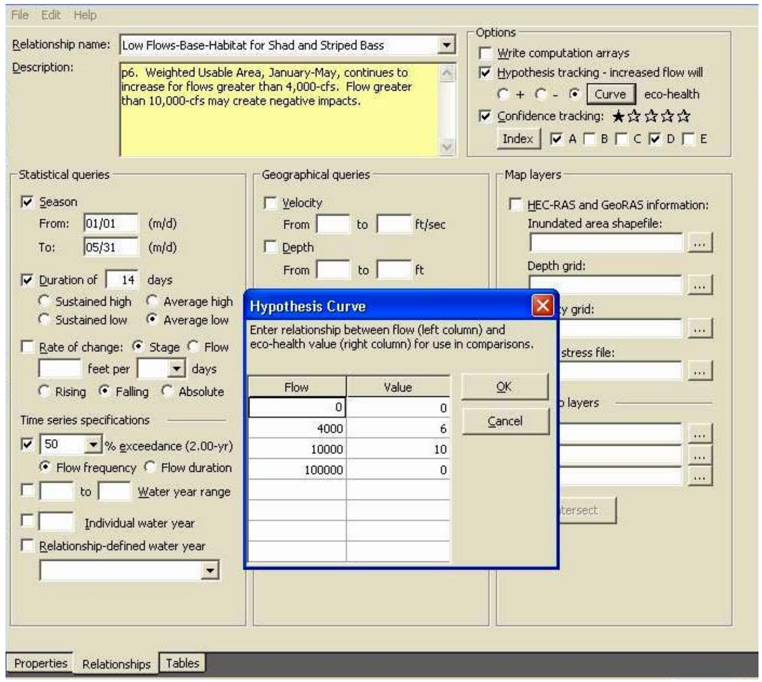
Effects of Alternative 1 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the NAA)

This alternative would have a minor positive impact on these biotic communities. As discussed earlier in the Water Quality section, this alternative provides flows that are primarily above 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200 cfs increase in predominant flows is spread across the January to May, June to December and November to December time frames, so seasonal fish spawning, fish passage, shoals spider lily protection from deer grazing and juvenile out-migration would be enhanced.

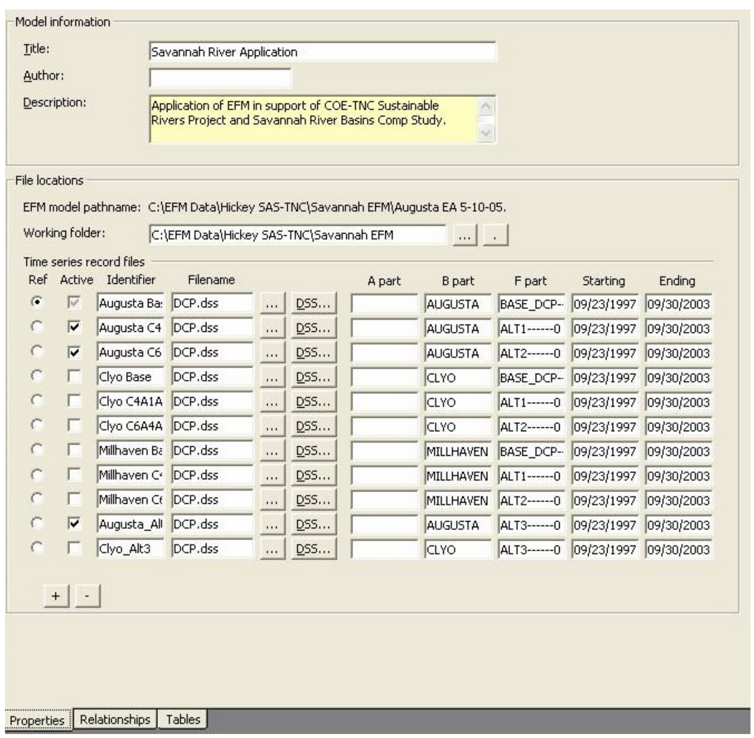
Effects of Alternative 1 (By employing the Ecosystems Function Model (EFM) in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

The EFM (established by the US Army Corps of Engineers Hydrologic Engineering Center (HEC)) was used to compare Alternatives 1, 2 and 3 to the NAA. Recommendations from the 2003 Scientific Stakeholders Workshop, including seasonal and eco-health curve data, were used to establish flow/habitat relationships (see Example 1) for several resources in the EFM. HEC-ResSim files were loaded into the model and are shown listed in Example 2. Output from the model consists of the average flow for each alternative in the specified season and whether a positive or negative impact would result for the particular resource when the flow in the alternatives is compared to the flow in the NAA (see Example 3).

Example 1



Example 2



Example 3

Evaluated at: 11/03/2005 08:36

Summary

		Augusta Base		Augusta C4A1A25A-0			Augusta C6A4A1A25A0			Augusta_Alt3		
Relationship	Conf.	Stage, ft	Flow, cfs	Chg.	Stage, ft	Flow, cfs	Chg.	Stage, ft	Flow, cfs	Chg.	Stage, ft	Flow, cfs
Low Flows-Base-Habitat for Shad and Striped Bass	*	3641.5	3,642	Pos	3846.9	3,847	Pos	3907.2	3,907	Pos	3907.5	3,907

Four flow/habitat relationships were analyzed for the shoals area.

Habitat for Shad and Striped Bass (7500 cfs recommended in the workshop):
The output for this model run was 3847 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Shoals Spider Lily in June and July (6200 cfs recommended in the workshop):
The output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Shoals Spider Lily from August to October (5500 cfs recommended in the workshop):
The output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Shoals Spider Lily in November and December (6200 cfs recommended in the workshop):
The output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Effects of Alternative 2 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the NAA)

This alternative would have a minor positive impact on these biotic communities. As discussed earlier, this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant minimums is spread across the January to May, June to December and November to December time frames, so seasonal fish spawning, fish passage, shoals spider lily protection from deer grazing and juvenile out-migration would be enhanced.

Effects of Alternative 2 (By employing the EFM in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

Four flow/habitat relationships were analyzed for the shoals area.

Habitat for Shad and Striped Bass (7500 cfs recommended in the workshop):
The output for this model run was 3907 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Shoals Spider Lily in June and July (6200 cfs recommended in the workshop):
The output for this model run was 3856 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Shoals Spider Lily from August to October (5500 cfs recommended in the workshop):
The output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Shoals Spider Lily in November and December (6200 cfs recommended in the workshop):
The output for this model run was 4000 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Effects of Alternative 3 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the NAA)

This alternative would have a minor positive impact on these biotic communities. As discussed earlier, this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gage, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant minimums is spread across the January to May, June to December and November to December time frames, so seasonal fish spawning, fish passage, shoals spider lily protection from deer grazing and juvenile out-migration would be enhanced.

Effects of Alternative 3 (By employing the EFM in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

Four flow/habitat relationships were analyzed for the shoals area.

Habitat for Shad and Striped Bass (7500 cfs recommended in the workshop):
The output for this model run was 3907 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

Shoals Spider Lily in June and July (6200 cfs recommended in the workshop):
The output for this model run was 3856 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

Shoals Spider Lily from August to October (5500 cfs recommended in the workshop):
The output for this model run was 3600 cfs. This is the same as the output of the NAA model run, so Alternative 3 would produce no impact on the resource.

Shoals Spider Lily in November and December (6200 cfs recommended in the workshop):
The output for this model run was 4000 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

4.4. 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). The report from the April 1-3, 2003 workshop listed seedling establishment as being the high priority for the floodplain reach during dry years. The establishment of seedlings is promoted by low flows (3000 cfs or less was recommended in the 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 (15,000 cfs near the Millhaven Gage is discussed in this Section) are expected to remain within the stream channel at nearly all locations and are not expected to affect the floodplain. The 2003 workshop recommendations and the estimated 15,000 cfs stream channel capacity at Millhaven are considered below. Graphical and tabular information is available for April to October for the years 1998-2002.

Effects of the NAA

Selection of the NAA and continuing with the existing SRBDCP with coordinated additions would have no adverse impact on this biotic community.

Effects of Alternative 1 (By comparing the alternatives Millhaven gage Downstream Hydrograph to that of the NAA)

For 2003 Workshop recommendations:
Selection of this alternative would have a minor adverse impact on this biotic community, but reducing flows to the levels recommended above would produce adverse impacts for other Savannah River resources. Action Level 4, as discussed in Section 2.1.1, would be required to produce flows as low as 3000 cfs in the floodplain. The downstream hydrograph of this alternative and the NAA provides flows that greatly exceed 6000 cfs from September 1997 to June 1998. The flows of this and the NAA vary little between June 1998 and November 2000 and are 50-900 cfs higher than the NAA between December 2000 and September 2003. The higher flows produced by this alternative are expected to produce a minor adverse impact, because they are increases above the recommended 3000 cfs. It should be noted that achieving flows of 3000 cfs for the desired three separate seasons would likely result in a violation of state water quality standards.

Considering stream channel capacity:
The physical characteristics of the Savannah River stream channel limit the floodplain overbank benefit to flows exceeding 15,000 cfs near the Millhaven Gage. The modeled flows produced by this alternative rarely exceed bankfull capacity for the period of July 1998 to January 2003, so no adverse impact would result. Additional flood control storage in the reservoir system may be required to eliminate periods when flows exceed channel capacity between April and October during a three year period for seedling establishment during normal to wet years.

Effects of Alternative 2 (By comparing the alternatives Millhaven gage Downstream Hydrograph to that of the NAA)

For 2003 Workshop Recommendations
Selection of this alternative would have a minor adverse impact on this biotic community, but reducing flows to the levels recommended above would produce adverse impacts for other Savannah River resources. Action Level 4, as discussed in Section 2.1.1, would be required to produce flows as low as 3000 cfs in the floodplain. The downstream hydrograph of this alternative and the NAA provides flows that greatly exceed 6000 cfs from September 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are 50-1000 cfs less than those of the NAA, from March 1999 to August 1999 there is little variation, from September 1999 to October 1999 this alternatives flows are 300- 1300 cfs lower, from November 1999 to April 2000 there is again little variation, from May 2000 to June 2000 this alternatives flows are 200-1200 cfs higher, from July 2000 to November 2000 the flows are 50-700 cfs lower and this alternatives flows are 50-400 cfs higher between December 2000 and February 2003. This alternative and the NAA provide flows that greatly exceed 6000 cfs from March 2003 to August 2003. The higher flows produced by this alternative are expected to produce a minor adverse impact, because they are increases above the recommended 3000 cfs. It should be noted that achieving flows of 3000 cfs for the desired three separate seasons would likely result in a violation of state water quality standards.

Considering Stream Channel Capacity
The physical characteristics of the Savannah River stream channel limit the floodplain overbank benefit to flows exceeding 15,000 cfs near the Millhaven Gage. The modeled flows produced by this alternative rarely exceed bankfull capacity for the period of July 1998 to January 2003, so no adverse impact would result. Additional flood control storage in the reservoir system may be required to eliminate periods when flows exceed channel capacity between April and October during a three year period for seedling establishment during normal to wet years.

Effects of Alternative 3 (By comparing the alternatives Millhaven gage Downstream Hydrograph to that of the NAA)

For 2003 Workshop Recommendations
The Downstream Hydrograph for this alternative is very similar to that of Alternative 2 above, so selection of this alternative would also have a minor adverse impact on this biotic community.

Considering Stream Channel Capacity
The Downstream Hydrograph for this alternative is very similar to that of Alternative 2 above, so no adverse impact would result.

4.5. BIOTIC COMMUNITIES-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

Estuary

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). GADNR and SCDNR have a Striped Bass Management Plan for the Lower Savannah River. Other managed species, for which Management Plans have not been prepared, that commonly occur in the Savannah River or its estuary include Alewife and Hickory shad.

Lower flows are not projected by the model runs of the final or detailed alternatives, so no substantial effects on coastal zone resources or chloride intrusion are expected.

Effects of the NAA

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

Effects of Alternative 1 (By comparing the alternatives Clyo gage Downstream Hydrograph to that of the NAA)

The downstream hydrographs of this alternative and the NAA provide flows that greatly exceed 6000 cfs from September 1997 to September 1998. From October 1998 to November 2000 there is little variation between the flows of this alternative and the NAA and from December 2000 to December 2003 this alternatives flows are 200-1000 cfs higher. The flows again greatly exceed 6000 cfs from January 2003 to August 2003 for this and the NAA. This alternative would have a minor positive impact on this biotic community due to the higher flows produced.

Effects of Alternative 1 (By employing the EFM in conjunction with estuary information from the 1-3 April 2003 Scientific Stakeholders Workshop)

Three flow/habitat relationships were analyzed for the estuary area.

Instantaneous maintenance of tidal freshwater marsh (5000 cfs recommended in the workshop): The output for this model run was 4272 cfs. This is greater than the output of 3990 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Spring seasonal maintenance of tidal freshwater marsh (8000 cfs recommended in the workshop):

The output for this model run was 4941 cfs. This is greater than the output of 4816 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Summer and fall seasonal maintenance of tidal freshwater marsh (6000 cfs recommended in the workshop):
The output for this model run was 4649 cfs. This is greater than the output of 4358 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Effects of Alternative 2 (By comparing the alternatives Clyo gage Downstream Hydrograph to that of the NAA)

The downstream hydrograph of this alternative and the NAA provides flows that greatly exceed 6000 cfs from December 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are 200-1500 cfs less than those of the NAA, from March 1999 to July 1999 there is little variation, from August 1999 to October 1999 (see Appendix G for several hydrographs associated with downstream flows) this alternatives flows are 50-1500 cfs lower, from November 1999 to April 2000 there is again little variation, from May 2000 to June 2000 this alternatives flows are 200-4000 cfs higher, from July 2000 to November 2000 the flows are 300-500 cfs less and from December 2000 to February 2003 this alternatives flows are 50-500 cfs higher. The flows again greatly exceed 6000 cfs from March 2003 to August 2003 for this and the NAA. This alternative would have a minor positive impact on this biotic community due to the higher flows produced.

Effects of Alternative 2 (By employing the EFM in conjunction with estuary information from the 1-3 April 2003 Scientific Stakeholders Workshop)

Three flow/habitat relationships were analyzed for the estuary area.

Instantaneous maintenance of tidal freshwater marsh (5000 cfs recommended in the workshop):
The output for this model run was 4357 cfs. This is greater than the output of 3990 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Spring seasonal maintenance of tidal freshwater marsh (8000 cfs recommended in the workshop):
The output for this model run was 4928 cfs. This is greater than the output of 4816 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Summer and Fall seasonal maintenance of tidal freshwater marsh (6000 cfs recommended in the workshop):
The output for this model run was 4476 cfs. This is greater than the output of 4358 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Effects of Alternative 3 (By comparing the alternatives Clyo gage Downstream Hydrograph to that of the NAA)

For October 1997 there is little variation between this alternative's flows and those of the NAA. The hydrographs of both alternatives provide flows that greatly exceed 6000 cfs from November 1997 to September 1998. From October 1998 to February 1999 this alternatives flows are predominantly 200-1500 cfs less than those of the NAA, from March 1999 to August 1999 there is little variation, from September 1999 to October 1999 this alternatives flows are 50-1500 cfs lower, from November 1999 to March 2000 there is again little variation, from April 2000 to June 2000 this alternatives flows are 200-4000 cfs higher, from July 2000 to November 2000 the flows are 300-500 cfs less and from December 2000 to January 2003 this alternatives flows are 50-500 cfs higher. The flows again greatly exceed 6000 cfs from February 2003 to August 2003 for this and the NAA. This alternative would have a minor positive impact on this biotic community due to the higher flows produced.

Effects of Alternative 3 (By employing the EFM in conjunction with estuary information from the 1-3 April 2003 Scientific Stakeholders Workshop)

Three flow/habitat relationships were analyzed for the estuary area.

Instantaneous maintenance of tidal freshwater marsh (5000 cfs recommended in the workshop): The output for this model run was 4350 cfs. This is greater than the output of 3990 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

Spring seasonal maintenance of tidal freshwater marsh (8000 cfs recommended in the workshop):
The output for this model run was 4929 cfs. This is greater than the output of 4816 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

Summer and Fall seasonal maintenance of tidal freshwater marsh (6000 cfs recommended in the workshop):
The output for this model run was 4476 cfs. This is greater than the output of 4358 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

4.6. THREATENED AND ENDANGERED SPECIES

The Robust redhorse, Shoals Spider lily and the federally-listed Shortnose sturgeon are the only Threatened or Endangered Species that would possibly be impacted by small changes in flow. The possible impacts would result from overall decreases in flow in the Augusta area during fish spawning and the Augusta shoals area during the deer grazing periods.

Robust redhorse

Spider lily

Shortnose sturgeon

Effects of the NAA

Selection of the NAA and continuing with the existing Drought Contingency Plan with coordinated additions would have acceptable impacts on any threatened and endangered species. The NAA provides flows primarily above 3600 cfs.

Effects of Alternative 1 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the NAA)

As discussed earlier, this alternative provides flows that are primarily above 3800 cfs at the Augusta gauge, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200 cfs increase in predominant flows is spread across the calendar years. This would enhance spawning for the fish species and provide more protection to the Spider lily from deer grazing, so a minor positive impact would result.

Effects of Alternative 1 (By employing the EFM in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

As discussed earlier in Section 4.5, for the Habitat for Shad and Striped Bass, the output for this model run was 3847 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on Robust redhorse and Shortnose sturgeon.

As discussed earlier in Section 4.5, for the Shoals Spider Lily in June and July, the output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

As discussed earlier in Section 4.5, for the Shoals Spider Lily from August to October, the output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

As discussed earlier in Section 4.5, for the Shoals Spider Lily in November and December, the output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 1 would produce a minor positive impact on the resource.

Effects of Alternative 2 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the No Action Alternative)

As discussed earlier, this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gauge, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant flows is spread across the calendar years. This would enhance spawning for the fish species and provide more protection to the Spider lily from deer grazing, so a minor positive impact would result.

Effects of Alternative 2 (By employing the EFM in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

As discussed earlier in Section 4.5, for the Habitat for Shad and Striped Bass, the output for this model run was 3907 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on Robust redhorse and Shortnose sturgeon.

As discussed earlier in Section 4.5, for the Shoals Spider Lily in June and July, the output for this model run was 3856 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

As discussed earlier in Section 4.5, for the Shoals Spider Lily from August to October, the output for this model run was 3800 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

As discussed earlier in Section 4.5, for the Shoals Spider Lily in November and December, the output for this model run was 4000 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 2 would produce a minor positive impact on the resource.

Effects of Alternative 3 (By comparing the alternatives Augusta gage Downstream Hydrograph to that of the NAA)

As discussed earlier, this alternative provides flows that are primarily above 4000 cfs with occasional drops to 3800 cfs at the Augusta gauge, while the NAA provides flows primarily above 3600 cfs. These flow trends occurred between 23 September 1997 and 30 September 2003. The 200-400 cfs increase in predominant flows is spread across the calendar years. This would enhance spawning for the fish species and provide more protection to the Spider lily from deer grazing, so a minor positive impact would result.

Effects of Alternative 3 (By employing the EFM in conjunction with Augusta Shoals information from the 1-3 April 2003 Scientific Stakeholders Workshop)

As discussed earlier in Section 4.5, for the Habitat for Shad and Striped Bass, the output for this model run was 3907 cfs. This is greater than the output of 3642 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on Robust redhorse and Shortnose sturgeon.

As discussed earlier in Section 4.5, for the Shoals Spider Lily in June and July, the output for this model run was 3856 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

As discussed earlier in Section 4.5, for the Shoals Spider Lily from August to October, the output for this model run was 3600 cfs. This is the same as the output of the NAA model run, so Alternative 3 would produce no adverse impact on the resource.

As discussed earlier in 4.5, for the Shoals Spider Lily in November and December, the output for this model run was 4000 cfs. This is greater than the output of 3600 cfs for the NAA model run, so Alternative 3 would produce a minor positive impact on the resource.

4.7. RECREATION

As evident in past droughts, recreation experiences diminish on Hartwell and J. Strom Thurmond Lakes. Some public boat ramps and private docks are out of the water as the lake level 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. For swimmers, swimming outside the Corps of Engineers' operated designated areas increases the potential for swimming fatalities.

4.7.1. Boat-Launching Ramps and Private Docks

Hartwell Lake

An examination of the number of days water surface elevations are at and below each lake level over the period of record of drought for each alternative provides a macro view of impacts on recreation relative to the No Action Alternative (Table 7).

Table 9: Hartwell Lake: Days At and Below Lake Level by Alternative

Lake Level (feet msl)	658	657	656	655	654	653	652	651
NAA	1556	1485	1402	1286	1159	1053	867	623
Alt 1	1557	1491	1343	1275	1161	1051	924	805
Alt 2	1557	1464	1336	1264	1145	875	657	540
Alt 3	1557	1464	1334	1263	1142	877	655	539

Lake Level (feet msl)	650	649	648	647	646	645	644	643	642	641
NAA	502	393	284	173	49	0	0	0	0	0
Alt 1	690	634	566	459	316	234	161	102	61	18
Alt 2	444	335	174	91	0	0	0	0	0	0
Alt 3	442	331	173	82	0	0	0	0	0	0

At and below lake level 658 feet msl, some boat-launching ramps become unusable. Table 9 shows that there is little change between Alternatives 1, 2, and 3 and the NAA in the number of days at and below each lake level from 658 through 654 feet msl. Starting at and below lake level 653, there is a consistently measurable change in the number of days at and below each lake level between Alternative 2 and 3 and the NAA. For example, when the lake level is at and below 653 feet msl, Alternative 2 provides an additional 178 days of recreation for 6 boat ramps while Alternative 1 provides two less days of recreation than the NAA. Changes become consistently measurable for Alternative 1 at and below lake level 652.

The following table shows the number of unusable and useable public boat-launching ramps by lake level in one-foot increments. Table 11 is a comparison of the NAA and Alternative 1 including the difference in the number of days at and below each lake level and the number of public boat-launching ramps adversely impacted.

Table 10: Hartwell Lake: Number of Unusable and Useable Ramps by Lake Level

At And Below Lake Level (feet msl)	Additional Ramps Unusable By 1-Foot Drop In Lake	Total Ramps Unusable By 1-Foot Drop In Lake Level	Useable Ramps By 1-Foot Drop In Lake Level
659	0	0	95
658	6	6	89
657	6	12	83
656	1	13	82
655	3	16	79
654	1	17	78
653	6	23	72
652	7	30	65
651	9	39	56
650	5	44	51
649	3	47	48
648	1	48	47
647	1	49	46
646	0	49	46
645	1	50	45
644	0	50	45
643	3	53	42
642	0	53	42
641	0	53	42

Effects of the NAA

The NAA's minimum lake level elevation during the modeled drought of record is estimated at 645.6 feet msl. Therefore, 46 boat-launching ramps (48 percent) would be useable at the worst period of drought under the NAA.

Currently, there are an estimated 10,500 private boat docks in Hartwell Lake. The SRBDCP, March 1989, approximated 5,400 private docks. It was roughly estimated that about 50 percent of these private docks were unusable at 652 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 newer developments are located in shallow coves. Hence, at and below 652 feet msl more than 50 percent of these private docks would likely be unusable for 867 days.

Effects of Alternative 1

Alternative 1's minimum lake level elevation is estimated at 640.01 feet msl. Therefore, 42 (44 percent) boat-launching ramps would be useable at the worst period of drought under Alternative 1. According to a survey conducted by Lake Hartwell Association in 2003, most of the people surveyed (80 percent) considered boating and water sports safe when lake levels are above 652 feet msl. In 2002, when lake levels were below 652 feet msl all year, the survey reveals an estimated 63 percent drop in the number of boating trips taken from non-drought years. This number corresponds to the estimated 61 percent drop in visits according to the Zapata report. Therefore, one may conclude, based on these reports, that once lake levels drop at and below 652 feet msl approximately 37 to 39 percent of all boating trips conducted in non-drought years would be impacted. As shown in Table 11, above 652 feet msl, there are minor differences in the number of days between the NAA and Alternative 1 at and below each lake level. At and below 652 feet msl there are more measurable negative differences between the NAA and Alternative 1 in the number of days at and below each lake level. However, by the time lake levels are at and below 652 feet msl, it is estimated that 61 to 63 percent of the all boating trips conducted in non-drought years have been displaced. Therefore, Alternative 1 is considered to have minor adverse impacts on the number of boating trips beginning at and below lake level 652 feet msl.

Table 11: Hartwell Lake: Days At and Below Lake Level - Comparison of NAA and Alternative 1 Including Number of Boat-Launching Ramps Impacted by 1 Foot Increment

Lake Level (feet msl)	658	657	656	655	654	653	652	651
NAA	1556	1485	1402	1286	1156	1053	867	623
Alt 1	1557	1491	1343	1275	1158	1051	924	805
Difference	-1	-6	59	11	-2	2	-57	-182
# of Ramps Out	6	6	1	3	1	6	7	9

Lake Level (feet msl)	650	649	648	647	646	645	644	643	642	641
NAA	502	393	284	173	49	0	0	0	0	0
Alt 1	690	634	566	459	316	234	161	102	61	18
Difference	-188	-241	-282	-282	-267	-234	-161	-102	-61	-18
# of Ramps Out	5	3	1	1	0	1	0	3	0	0

Since there is very little difference in the number of days between the NAA and Alternative 1 above lake level 652, Alternative 1 is considered to have minor adverse impacts on private docks at Hartwell Lake relative to the NAA.

Effects of Alternative 2

The minimum lake level for Alternative 2 is 646.04 feet msl. Therefore, 46 (48 percent) public boat-launching ramps would be useable at the worst period of the drought. At each lake level there are more days available to use the boat-launching ramps than the NAA. Hence, Alternative 2 has a positive impact on boat-launching ramps at Hartwell Lake.

Table 12: Hartwell Lake: Days At and Below Lake Level – Comparison of NAA and Alternative 2 Including Number of Boat-Launching Ramps Impacted by 1 Foot Increment

Lake Level (feet msl)	**658**	**657**	**656**	**655**	**654**	**653**	**652**	**651**
NAA	1556	1485	1402	1286	1159	1053	867	623
Alt 2	1557	1464	1336	1264	1145	875	657	540
Difference	-1	21	66	22	14	178	210	83
# of Ramps Out	6	6	1	3	1	6	7	9

Lake Level (feet msl)	**650**	**649**	**648**	**647**	**646**	**645**	**644**	**643**	**642**	**641**
NAA	502	393	284	173	49	0	0	0	0	0
Alt 2	444	335	174	91	0	0	0	0	0	0
Difference	58	58	110	82	49	0	0	0	0	0
# of Ramps Out	5	3	1	1	0	1	0	3	0	0

At every lake level there are more days available to use private docks. Therefore, Alternative 2 has positive impacts on private docks at Hartwell Lake relative to the NAA.

Effects of Alternative 3
The minimum lake level for Alternative 3 is 646.04 feet msl. Therefore, 46 (48 percent) boat-launching ramps would be useable at the worst period of the drought. At each lake level there are more days available to use the boat-launching ramps than the NAA. Hence, Alternative 3 has a positive impact on boat-launching ramps at Hartwell Lake.

Table 13: Hartwell Lake: Days At and Below Lake Level – Comparison of NAA and Alternative 3 Including Number of Boat-Launching Ramps Impacted by 1 Foot Increment

Lake Level (feet msl)	**658**	**657**	**656**	**655**	**654**	**653**	**652**	**651**
NAA	1556	1485	1402	1286	1159	1053	867	623
Alt 3	1557	1464	1334	1263	1142	877	655	539
Difference	-1	21	68	23	17	176	212	84
# of Ramps Out	6	6	1	3	1	6	7	9

Lake Level (feet msl)	**650**	**649**	**648**	**647**	**646**	**645**	**644**	**643**	**642**	**641**
NAA	502	393	284	173	49	0	0	0	0	0
Alt 3	442	331	173	82	0	0	0	0	0	0
Difference	60	62	111	91	49	0	0	0	0	0
# of Ramps Out	5	3	1	1	0	1	0	3	0	0

At every lake level there are more days available to use private docks than the NAA. Therefore, Alternative 3 has positive impacts on private docks at Hartwell Lake relative to the NAA.

RBR Lake
The minimum lake level for the NAA is 473.74 feet msl; Alternative 1 is 473.72 feet msl; and Alternative 2 and 3 are 471.22 feet msl. Lake level would have to be at 466 feet msl and lower

to have adverse impacts on the boat-launching ramps in the RBR Lake. Therefore, for all the alternatives, there are no adverse impacts on public boat-launching ramps in RBR Lake.

There are no private docks on the RBR Lake.

JST Lake
An examination of the numbers of days at and below each lake level for each alternative provides a macro view of the impacts on recreation of each alternative relative to the NAA (Table 14).

Table 14: JST Lake: Days At and Below Lake Level by Alternative

Lake Level (feet msl)	328	327	326	325	324	323	322	321
NAA	1557	1467	1371	1240	1119	1014	860	637
Alt 1	1583	1522	1427	1277	1130	1037	915	808
Alt 2	1513	1405	1226	1008	914	754	654	566
Alt 3	1512	1402	1223	992	913	754	653	560

Lake Level (feet msl)	320	319	318	317	316	315	314	313	312	311
NAA	496	385	236	57	0	0	0	0	0	0
Alt 1	688	631	559	385	273	159	13	0	0	0
Alt 2	413	224	127	65	3	0	0	0	0	0
Alt 3	409	222	126	50	3	0	0	0	0	0

Table 14 shows that there is little change between the alternatives and the NAA in the number of days at for lake levels at and below 328 and at and below 327 feet msl. Starting at and below lake level 326 feet msl, there is a measurable change in the number of days at and below each specific lake level between Alternative 2 and 3 and the NAA. As shown in Table 15, at and below lake level 326 feet msl, boat-launching ramps start to become unusable. For example, when the lake level is at and below 326 feet msl, Alternative 2 (Table 17) provides an additional 145 days of recreation for 1 boat ramp while Alternative 1 (Table 16) provides 56 less days of recreation than the NAA. Changes become consistently measurable for Alternative 1 at and below lake level 323.

There are 84 public boat-launching ramps and marinas located on JST Lake. Above lake elevation 326 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 15: Number of Unusable and Useable Ramps by Lake Level

At and Below Lake Level (feet msl)	Additional Ramps Unusable by 1-Foot Drop in Lake	Total Ramps Unusable By 1-Foot Drop in Lake	Useable Ramps by 1-Foot Drop in Lake
327	0	0	84
326	1	1	83
325	4	5	79
324	7	12	72
323	5	17	67
322	1	18	66
321	5	23	61
320	2	25	59
319	0	25	59
318	6	31	53
317	2	33	51
316	6	39	45
315	7	46	38
314	19	65	19

Effects of the NAA

The NAA's minimum lake level during the modeled drought of record is estimated at 316.39 feet msl. Therefore, 51 public boat-launching ramps (61 percent) would be useable at the worst period of drought under the NAA. At and below lake level 326 feet msl, boat-launching ramps start to become unusable. At and below lake level 326 feet msl, 1 boat-launching ramp is unusable for 1,371 days. At and below lake level 325 feet msl, 4 additional boat-launching ramps become unusable for 1,240 days. At and below lake level 324 feet msl, 7 additional boat launching ramps become unusable for 1,119 days. The total number of unusable boat-launching ramps continues to increase to 33 at and below 317 feet msl.

Currently, there are approximately 1,851 private boat docks on the JST Lake. This is a 25 percent increase from the March 1989 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.

Effects of Alternative 1

Alternative 1's minimum lake level elevation is estimated at 313.73 feet msl. Therefore, 36 of all public boat-launching ramps (42 percent) would be useable at the worst period of drought under Alternative 1. At and below lake level 326 feet msl, 1 boat-launching ramp is unusable for 1,427 days for Alternative 1 versus 1,371 days for the NAA. Alternative 1 is unusable for 56 days more than the NAA representing a 4 percent change at and below lake level 326 feet msl. At and below lake level 325 feet msl, 4 additional boat-launching ramps become unusable for 1,277 days. Alternative 1 is unusable for 37 days more than the NAA at and below lake level 325 feet msl. At and below lake level 324 feet msl, 7 additional boat-launching ramps become unusable for 1,130 days. Alternative 1 is unusable for 11 days more than the NAA at and below lake level 324 feet msl. Alternative 1 is unusable for 24 and 55 days more than the NAA at and below lake level 323 and 322 feet msl, respectively. Above 322 feet msl, there are minor changes in number of days while at and below 322 feet msl there are more measurable negative changes in the number of days boat ramps are available. However, by the time lake levels are at and below 322 feet msl, it is estimated that 61 to 63 percent of the visits have been displaced. Therefore, Alternative 1 is considered to have minor adverse impacts on boating access at JST Lake.

Table 16: JST Lake: Days At and Below Lake Level – Comparison of NAA and Alternative 1 Including Number of Boat-Launching Ramps Impacted by 1-Foot Increment

Lake Level (feet msl)	**328**	**327**	**326**	**325**	**324**	**323**	**322**	**321**
NAA	1557	1467	1371	1240	1119	1014	860	637
Alt 1	1583	1522	1427	1277	1130	1037	915	808
Difference	-26	-55	-56	-37	-11	-23	-55	-171
# of Ramps Out	0	0	1	4	7	5	1	5

Lake Level (feet msl)	**320**	**319**	**318**	**317**	**316**	**315**	**314**	**313**	**312**	**311**
NAA	496	385	236	57	0	0	0	0	0	0
Alt 1	688	631	559	385	273	159	13	0	0	0
Difference	-192	-246	-323	-328	-273	-159	-13	0	0	0
# of Ramps Out	2	0	6	2	6	7	19	0	0	0

At and below lake level 322 feet msl, 50 percent of the private docks would be unusable for 55 days more than the NAA. In addition, the NAA lake levels do not drop below 317 feet msl whereas Alternative 1 drops to 313.73 feet msl. Therefore, additional docks will be adversely impacted under Alternative 1. Hence, Alternative 1 has minor adverse impacts on private docks at JST Lake relative to the NAA.

Effects of Alternative 2

The minimum lake level for Alternative 2 is 315.64 feet msl. Therefore, 42 boat-launching ramps would be useable (61 percent) at the worst period of drought for Alternative 2. At and below lake level 326 feet msl, 1 boat-launching ramp is unusable for 1,226 days for Alternative 2 versus 1,371 days for the NAA. Alternative 2 is useable for 145 days more than the NAA at and below lake level 326 feet msl. At and below lake level 325 feet msl, 4 additional boat-launching ramps become unusable for 1,008 days. Alternative 2 is useable for 232 days more than the NAA at and below lake level 325 feet msl. At and below lake level 324 feet msl, 7 additional boat-launching ramps become unusable for 914 days. Alternative 2 is useable for 205 days more than the NAA at and below lake level 324 feet msl. Alternative 2 is useable for 260 and 206 days more than the NAA at and below lake levels 323 and 322 feet msl, respectively. Alternative 2 is considered to have a positive impact on boat-launching ramps at JST Lake since there is a measurably consistent increase in the number of days that boat-launching ramps are available especially above lake level 322 feet msl from the NAA.

Table 17: JST Lake: Days At and Below Lake Level – Comparison of NAA and Alternative 2 Including Number of Boat-Launching Ramps Impacted by 1-Foot Increment

Lake Level (feet msl)	328	327	326	325	324	323	322	321
NAA	1557	1467	1371	1240	1119	1014	860	637
Alt 2	1513	1405	1226	1008	914	754	654	566
Difference	44	62	145	232	205	260	206	71
# of Ramps Out	0	0	1	4	7	5	1	5

Lake Level (feet msl)	320	319	318	317	316	315	314	313	312	311
NAA	496	385	236	57	0	0	0	0	0	0
Alt 2	413	224	127	65	3	0	0	0	0	0
Difference	83	161	109	-8	-3	0	0	0	0	0
# of Ramps Out	2	0	6	2	6	7	19	0	0	0

Above lake level 322 feet msl, there is a measurable increase in the number of days that private docks are available compared to the NAA. Therefore, Alternative 2 is considered to have positive impacts on private docks at JST Lake relative to the NAA.

Effects of Alternative 3

The minimum lake level for Alternative 3 is 315.64 feet msl. Therefore, 42 boat-launching ramps would be useable (61 percent) at the worst period of drought for Alternative 3. At and below lake level 326 feet msl, 1 boat-launching ramp is unusable for 1,223 days for Alternative 3 versus 1,371 days for the NAA. Alternative 3 is useable for 148 days more than for the NAA at and below lake level 326 feet msl. At and below lake level 325 feet msl, 4 additional boat-launching ramps become unusable for 992 days. Alternative 3 is useable for 248 days more than the NAA at and below lake level 325 feet msl. At and below lake level 324 feet msl, 7 additional boat-launching ramps become unusable for 913 days. Alternative 3 is useable for 206 days more than the NAA at and below lake level 324 feet msl. Alternative 3 is useable for 260 and 206 days more than the NAA at and below lake levels 323 and 322 feet msl, respectively. Alternative 3 is considered to have a positive impact on boat-launching ramps at JST Lake since there is a measurably consistent increase in the number of days that boat-launching ramps are available especially above lake level 322 feet msl from the NAA.

Above lake level 322 feet msl, there is a measurable increase in the number of days that private docks are available compared to the NAA. Therefore, Alternative 3 is considered to have positive impacts on private docks at JST Lake relative to the NAA.

Table 18: JST Lake: Days At and Below Lake Level – Comparison of NAA and Alternative 3 Including Number of Boat-Launching Ramps Impacted by 1-Foot Increment

Lake Level (feet msl)	328	327	326	325	324	323	322	321
NAA	1557	1467	1371	1240	1119	1014	860	637
Alt 3	1512	1402	1223	992	913	754	653	560
Difference	45	65	148	248	206	260	207	77
# of Ramps Out	0	0	1	4	7	5	1	5

Lake Level (feet msl)	320	319	318	317	316	315	314	313	312	311
NAA	496	385	236	57	0	0	0	0	0	0
Alt 3	409	222	126	50	3	0	0	0	0	0
Difference	87	163	110	7	-3	0	0	0	0	0
# of Ramps Out	2	0	6	2	6	7	19	0	0	0

4.7.2. Swimming

Swimming at beach areas usually occurs from May-September. Therefore, it is important to identify the differences between the NAA and Alternatives 1, 2 and 3 during this period of time. Also, designated swimming areas are considered useable by lake managers with greater than 3 feet of water. Hence, only a change in the number of swimming days available greater than lake level 657 feet msl at Hartwell and 327 feet msl at JST would constitute an impact on swimming.

Hartwell Lake
At Hartwell Lake, there are 22 Corps of Engineer's operated swimming beach areas located within 13 recreation areas. At and below lake level 654 feet msl, all designated swimming areas are completely dry. Designated swimming areas are useable with greater than 3 feet of water. Hence, a change in the number of swimming days available greater than lake level 657 from the NAA would constitute an impact on swimming.

Effects of the NAA
Designated swimming areas are completely dry 1,159 days at and below 654 feet msl during the modeled drought of record. Designated swimming areas are above 3 feet of water for 177 days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003.

Effects of Alternative 1
Designated swimming areas are above 3 feet of water for 177 days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. Therefore, Alternative 1 provides no adverse impact on swimming days available.

Effects of Alternative 2
Designated swimming areas are above 3 feet of water for 204 days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. This

constitutes a 15 percent increase in the number of swimming days compared to the NAA. Therefore, Alternative 2 provides a minor positive impact on swimming days available.

Effects of Alternative 3

Designated swimming areas are above 3 feet of water for 204 days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. This constitutes a 15 percent increase in the number of swimming days compared to the NAA. Therefore, Alternative 3 provides a minor positive impact on swimming days available.

RBR Lake

At RBR, there are no Corps of Engineer's operated designated swimming beach areas.

JST Lake

At JST Lake, there are 18 swimming beach areas. At and below lake level 324 feet msl, the designated swimming beaches become completely dry. Designated swimming areas are useable with greater than 3 feet of water. Hence, only a change in the number of swimming days available above lake level 327 from the NAA would constitute an impact on swimming.

Effects of the NAA

Designated swimming areas are completely dry 1,119 days at and below lake level 324 feet msl during the modeled drought of record. There are 171 total days usable for swimming above lake level 327 or above 3 feet of water in the designated swimming area between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003.

Effects of Alternative 1

Designated swimming areas are above 3 feet of water for 171 total days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. Since the swimming days available are the same for Alternative 1 and the NAA, Alternative 1 provides no adverse impact on swimming days available.

Effects of Alternative 2

Designated swimming areas are above 3 feet of water for 176 total days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. This is a 3 percent increase in the number of swimming days available from the NAA to Alternative 2. Therefore, Alternative 2 provides relatively no adverse impacts on swimming days available.

Effects of Alternative 3

Designated swimming areas are above 3 feet of water for 176 total days between the months of May and September with a drought of record like the one from 1 July 1998 to 22 March 2003. This is a 3 percent increase in the number of swimming days available from the NAA to Alternative 3. Therefore, Alternative 3 provides relatively no adverse impacts on swimming days available.

4.8. 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, 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. Alternative 1 provides an additional 9 days of lake level above 653 feet msl during the modeled drought from June through August while Alternatives 2 and 3 provide an additional 83 days of lake levels above 653 feet msl. Therefore, the Clemson University's Musser Fruit Farm intake would experience no adverse impact with Alternative 1, but may have a minor positive impact with Alternatives 2 or 3. The next highest intake at elevation 638 feet msl is used by Clemson University for heating and cooling. This intake is 8 feet below the lowest water level modeled (645.49 feet msl) for the No Action Alternative. It is 9 feet below the lowest water level modeled (646.02 feet msl) for Alternatives 2 and 3. It is 2 feet below the lowest water level (640.05 feet msl) for Alternative 1. Therefore, there would be no adverse impacts to water supply users with intakes in Hartwell Lake for the alternatives in comparison to the NAA. The table below summarizes who has intakes in Hartwell Lake, the elevation at which the intake becomes inoperable and the impact of each alternative.

Table 19: Hartwell Lake Water Supply Intake Summary

Hartwell Lake Intakes	Intake Inoperable (feet msl)	NAA Lowest Lake Level (645.59 feet msl)	Alternative 1 Lowest Lake Level (640.05 feet msl)	Alternatives 2 & 3 Lowest Lake Level (646.04 feet msl)
Clemson University Agriculture	653	Above	Above	Above
Clemson University	638	Below	Below	Below
City of Lavonia	636	Below	Below	Below
Clemson Golf Course	633	Below	Below	Below
City of Hartwell	620	Below	Below	Below
Anderson County Joint Municipal Water System	615	Below	Below	Below
Milliken Company	611	Below	Below	Below
J.P. Stevens	610	Below	Below	Below

RBR 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. This is about 5 feet below the lowest water level during the modeled drought of record for the NAA and alternative 1 and over two feet below the lowest water level of the modeled drought for Alternatives 2 and 3. Therefore, there would be no adverse impacts to water supply users in RBR Lake for all the alternatives in comparison to the NAA.

Table 20: RBR Water Supply Intake Summary

RBR Lake Intakes	Intake Inoperable (feet msl)	NAA Lowest Lake Level (473.74 feet msl)	Alternative 1 Lowest Lake Level (473.72 feet msl)	Alternatives 2 & 3 Lowest Lake Level (471.22 feet msl)
RBR State Park Golf Course	468.8	Below	Below	Below
City of Elberton	465	Below	Below	Below
Santee Cooper (John S. Rainey)	460.5	Below	Below	Below
City of Abbeville	457.5	Below	Below	Below
Calhoun Falls	457	Below	Below	Below
Mohawk Industries	464.75 459.75 454.75	Below Below Below	Below Below Below	Below Below Below

JST 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. As shown in Table 14, page 52, the number of days that the lake level is at and below 324 feet msl for the NAA is 1119. Alternative 1 differs by only 11 more days while alternatives 2 and 3 differ by 205 and 206 less days, respectively. Therefore, there would be no adverse impacts on water supply in the JST Lake for alternative 1 and a minor positive impact on the intakes used for the golf courses for alternatives 2 and 3 in comparison to the NAA.

Table 21: JST Lake Water Supply Intake Summary

JST Lake Intakes	Intake Inoperable (feet msl)	NAA Lowest Lake Level (feet msl 316.39)	Alternative 1 Lowest Lake Level (313.73 feet msl)	Alternatives 2 & 3 Lowest Lake Level (315.6 feet msl)
Savannah Lakes POA Monticello Golf Course	324	Above	Above	Above
Savannah Lakes POA Tara Golf Course	324	Above	Above	Above
Hickory Knob State Park Golf Course	324	Above	Above	Above
City of Lincolnton	321	Above	Above	Above
	314	Below	Above	Below
	307	Below	Below	Below
City of Thompson/McDuffie County	320	Above	Above	Above
	312	Below	Below	Below
	304	Below	Below	Below
Columbia County	320	Above	Above	Above
	312	Below	Below	Below
	304	Below	Below	Below
City of Washington	307	Below	Below	Below
City of McCormick	300	Below	Below	Below

Downstream of JST 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 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.

Users downstream of JST Lake require a minimum normal flow from JST of 3,600 cfs to maintain adequate stage for their intakes. All the alternatives and the NAA provide such minimum flows. Therefore, there is no adverse impact on these intakes. However, flow requirements for the Augusta Canal and shoals exceed 5,000 cfs and many of the water years of drought do not provide such flows. Augusta, Georgia, Utilities Department projected average water needs (in cfs) from 2005 out to 2035 in ten-year increments for the Augusta Canal for the summer, winter and spring periods. Minimum water needs during periods of drought for the Augusta shoals were estimated at 1500 cfs in the summer and winter and 2000 cfs in the spring. In the following table, the Augusta Canal and shoals water needs are combined.

Table 22: Projected Average Flows Required for Augusta Canal and Shoals

YEAR	SUMMER 1 Jun - 30 Nov	WINTER 1 Dec - 29 Feb	SPRING 1 Mar – 31 May
2005	5,261 cfs	5,067 cfs	5,685 cfs
2015	5,503 cfs	5,268 cfs	5,912 cfs
2025	5,796 cfs	5,512 cfs	6,186 cfs
2035	5,853 cfs	5,807 cfs	6,346 cfs

Effects of the NAA

The difference between the projected Augusta Canal and shoals water needs and the NAA JST average flows (cfs) determine the impact on projected water needs for the Augusta Canal and shoals in the NAA. Analyzing the NAA JST average flows for the summer period over the modeled drought of record against the Augusta Canal and shoals water demands indicates that 2005 Augusta Canal and shoals water demands are met in the first two water years. However, there would be a shortage or unmet demands in summer flows during the third (4,658 cfs), fourth (3,808 cfs) and fifth (3,804 cfs) water years of the modeled drought in relation to the Augusta/Richmond County's projected average water demands for year 2005 (5,261 cfs). Measuring the modeled drought of record against the projected Augusta Canal and shoals water demands of 5,503 cfs in 2015, 5,796 cfs in 2025 and 5,853 cfs in 2035 indicates unmet demands in the NAA during the second, third, fourth and fifth water years of the modeled drought of record.

Analyzing the average flow for the winter period over the modeled drought of record indicates that Augusta Canal and shoals water flows are unmet in the second, third, fourth and fifth water years of the modeled drought of record for years 2005, 2015 and 2025. In 2035, unmet demands for the Augusta Canal and shoals are expected for all five water years.

Analyzing the average flow for the spring period over the modeled drought of record indicates that there would be a shortage in spring flows for the Augusta Canal and shoals during the first four water years of drought, but not the last, for the years 2005, 2015, 2025 and 2035.

Table 23: NAA JST Average Annual Flows by Water Year

	WY 1 (cfs)	WY 2 (cfs)	WY 3 (cfs)	WY 4 (cfs)	WY 5 (cfs)
Summer	5,982	5,502	4,658	3,808	3,804
Winter	5,551	4,997	3,642	3,684	4,472
Spring	4,134	4,264	3,687	3,659	9,969

Effects of Alternative 1

To determine the impact of each alternative, JST flows for each alternative were compared to the Augusta Canal and shoals water demands in years 2005, 2015, 2025 and 2035 to determine whether demands were met or unmet for that alternative. Then, the outcome (met or unmet demand) of the alternative was compared with the outcome of the NAA to determine if the impact of the alternative is positive, negative or not significant. If Augusta Canal and shoals water needs are met by the alternative but unmet by the NAA, then the impact is positive. If Augusta Canal and shoals water needs are unmet by the alternative but met by the NAA, then the impact is negative. If outcome is the same for the alternative and the NAA, then there is no significant adverse impact.

Analyzing Alternative 1 JST average flows for the summer period over the modeled drought of record against the Augusta Canal and shoals water demands indicates that 2005 Augusta Canal and shoals water demands are met in the first two water years. However, there would be a shortage or unmet demands in summer flows during the third (4,712 cfs), fourth (4,498 cfs) and fifth (4,147 cfs) water years of the modeled drought in relation to the Augusta Canal and shoals projected average water demands for year 2005 (5,261 cfs). Measuring the modeled drought of record against the projected Augusta Canal and shoals water demands of 5,503 cfs in 2015, 5,796 cfs in 2025 and 5,853 cfs in 2035 indicates unmet demands in the NAA during the second, third, fourth and fifth water years of the modeled drought of record. Since the outcome is the same between Alternative 1 and the NAA, there is no significant adverse impact.

Analyzing the average flow for the winter period over the modeled drought of record indicates that Augusta Canal and shoals water flows are unmet in the second, third, fourth and fifth water years of the modeled drought of record for years 2005, 2015 and 2025. In 2035, unmet demands for the Augusta Canal and shoals are expected for all five water years. Since the outcome is the same between Alternative 1 and the NAA, there is no significant adverse impact.

Analyzing the average flow for the spring period over the modeled drought of record indicates that there would be a shortage in spring flows for the Augusta Canal and shoals during all five water years of drought for the projected water demands in years 2005, 2015, 2025 and 2035. Unlike the NAA, the fifth water year of drought there would be unmet demands on the Augusta Canal and shoals. Therefore, Alternative 1 has a minor adverse impact on the Augusta Canal and shoals relative to the NAA.

Table 24: Alternative 1 JST Average Annual Flows by Water Year

	WY 1 (cfs)	WY 2 (cfs)	WY 3 (cfs)	WY 4 (cfs)	WY 5 (cfs)
Summer	5,982	5,461	4,712	4,498	4,147
Winter	5,556	4,351	3,951	3,885	3,946
Spring	4,190	4,525	3,990	3,908	5,594

Effects of Alternative 2

Comparing Alternative 2 JST average flows for the summer period over the modeled drought of record against the Augusta Canal and shoals water demands indicates that Augusta Canal and shoals water demands are met in the first water year of drought for the projected water demands in years 2005, 2015, 2025 and 2035. However, there would be a shortage or unmet demands in summer flows during the second (5,094), third (4,327 cfs), fourth (4,187 cfs) and fifth (4,117 cfs) water years of the modeled drought in relation to the Augusta Canal and shoals projected average water demands for years 2005, 2015, 2025 and 2035. Since the outcome is the same between Alternative 2 and the NAA with the exception of unmet demands in water year two in the year 2005 for Alternative 2, there is no significant adverse impact.

Analyzing the average flow for the winter period over the modeled drought of record indicates that Augusta Canal and shoals water flows are unmet in the second, third, fourth and fifth water years of the modeled drought of record for years 2005, 2015 and 2025. In 2035, unmet demands for the Augusta Canal and shoals are expected for all five water years. Since the outcome is the same between Alternative 2 and the NAA, there is no significant adverse impact.

Analyzing the average flow for the spring period over the modeled drought of record indicates that there would be a shortage in spring flows for the Augusta Canal and shoals during the first four water years of drought for the projected water demands in years 2005, 2015, 2025 and 2035. Since the outcome is the same between Alternative 2 and the NAA, there is no significant adverse impact.

Table 25: Alternative 2 JST Average Annual Flows by Water Year

	WY 1 (cfs)	**WY 2 (cfs)**	**WY 3 (cfs)**	**WY 4 (cfs)**	**WY 5 (cfs)**
Summer	5,880	5,094	4,327	4,187	4,117
Winter	5,700	3,960	3,981	4,038	3,810
Spring	4,192	4,964	3,938	3,911	11,457

Effects of Alternative 3

Comparing Alternative 3 JST average flows for the summer period over the modeled drought of record against the Augusta Canal and shoals water demands indicates that Augusta Canal and shoals water demands are met in the first water year of drought for the projected water demands in years 2005, 2015, 2025 and 2035. However, there would be a shortage or unmet demands in summer flows during the second (5,094), third (4,327 cfs), fourth (4,187 cfs) and fifth (4,140 cfs) water years of the modeled drought in relation to the Augusta Canal and shoals projected average water demands for years 2005, 2015, 2025 and 2035. Since the outcome is the same between Alternative 3 and the NAA with the exception of unmet demands in water year two in the year 2005 for Alternative 3, there is no significant adverse impact.

Analyzing the average flow for the winter period over the modeled drought of record indicates that Augusta Canal and shoals water flows are unmet in the second, third, fourth and fifth water years of the modeled drought of record for years 2005, 2015 and 2025. In 2035, unmet demands for the Augusta Canal and shoals are expected for all five water years. Since the outcome is the same between Alternative 3 and the NAA, there is no significant adverse impact.

Analyzing the average flow for the spring period over the modeled drought of record indicates that there would be a shortage in spring flows for the Augusta Canal and shoals during the first four water years of drought for the projected water demands in years 2005, 2015, 2025 and 2035. Since the outcome is the same between Alternative 3 and the NAA, there is no significant adverse impact.

Table 26: Alternative 3 JST Average Annual Flows by Water Year

	WY 1 (cfs)	WY 2 (cfs)	WY 3 (cfs)	WY 4 (cfs)	WY 5 (cfs)
Summer	5,880	5,094	4,327	4,187	4,040
Winter	5,700	3,959	3,981	4,038	3,810
Spring	4,192	4,964	3,938	3,911	11,661

In summary, for the summer period, there is no difference in terms of outcome between Alternative 1 and the NAA and a minor adverse change between Alternatives 2 and 3 and the NAA in the second water year of 2005. For the winter period, there is no significant adverse difference between the alternatives and the NAA. For the spring period, there is no significant adverse difference between Alternatives 2 and 3 and the NAA and a minor adverse impact between Alternative 1 and the NAA in the fifth water year.

Table 27 on page 65, shows a summary of met/unmet water demands for the Augusta Canal and shoals during drought periods for the NAA and all the alternatives.

Table 27: Augusta Canal and Shoals Met/Unmet Water Demands during Drought Periods

SUMMER PERIOD

	No Action Alternative				Alternative 1				Alternative 2				Alternative 3			
Water Year	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**
1	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met	Met
2	Met	Unmet	Unmet	Unmet	Met	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
3	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
4	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
5	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet

WINTER PERIOD

	No Action Alternative				Alternative 1				Alternative 2				Alternative 3			
Water Year	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**
1	Met	Met	Met	Unmet	Met	Met	Met	Unmet	Met	Met	Met	Unmet	Met	Met	Met	Unmet
2	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
3	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
4	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
5	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet

SPRING PERIOD

	No Action Alternative				Alternative 1				Alternative 2				Alternative 3			
Water Year	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**	**2005**	**2015**	**2025**	**2035**
1	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
2	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
3	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
4	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet	Unmet
5	Met	Met	Met	Met	Unmet	Unmet	Unmet	Unmet	Met	Met	Met	Met	Met	Met	Met	Met

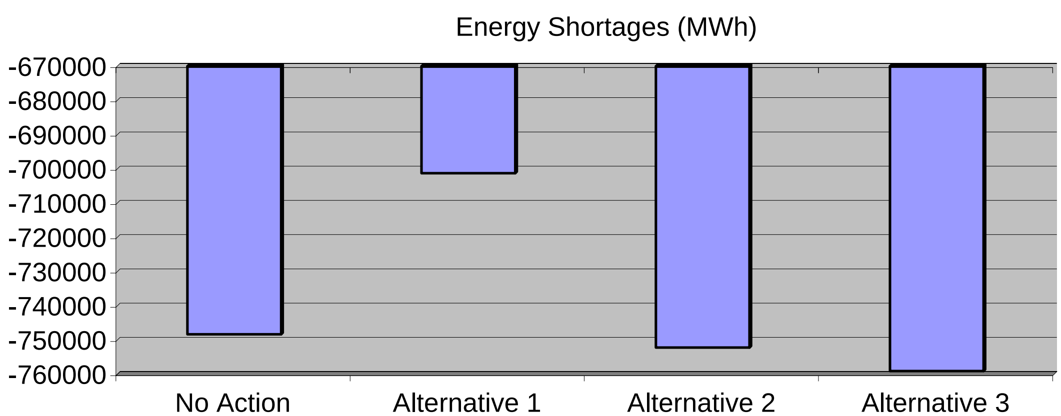
4.9. HYDROPOWER

Effects of NAA
The NAA output indicates that during the drought of record there were 139 shortages accounting for a total shortage of 748,302 MWh.

Effects of Alternative 1
Alternative 1 output indicates that during the drought of record there were 144 shortages accounting for a total shortage of 701,211 MWh. This implies a reduction in shortages of 47,091 MWh. This represents a 6.3 percent reduction in shortage from the NAA to Alternative 1. Therefore, Alternative 1 provides a positive impact in terms of fewer shortages for hydropower.

Effects of Alternative 2
The results for Alternative 2 indicate that during the drought of record there were 138 shortages accounting for a total shortage of 749,468 MWh. This implies an increase in shortages of 1,165 MWh. This represents a 0.156 percent increase in shortages of MWh from the NAA to Alternative 2. Therefore, Alternative 2 provides no meaningful adverse impact in terms of increased shortages.

Effects of Alternative 3
The results for Alternative 3 indicate that during the drought of record there were 137 shortages accounting for a total shortage of 759,002 MWh. This implies an increase in shortages of 10,700 MWh. This represents a 1.43 percent increase in shortages of MWh from the NAA to Alternative 3. Therefore, Alternative 3 provides a minor adverse impact in terms of increased shortages.



4.10. CULTURAL RESOURCES

Tribal consultation with 19 Native American tribes has occurred and a letter indicating concurrence with no adverse impacts has been received from the Alabama-Quassarte Tribal Town. A letter from the Catawba Indian Nation did not mention adverse impacts, but did mention they are opposed to illegal artifact hunting at times of low water.

Effects of the No Action Alternative
The NAA would have no additional adverse impacts to cultural resources as the existing SRBDCP of March 1989 with pumped storage operation would continue to be used.

Effects of Alternative 1
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), Alternative 1 would have no additional adverse impacts to cultural resources.

Effects of Alternative 2
This would have the same effect on pool levels as Alternative 1, so this action would have no additional adverse impacts to cultural resources.

Effects of Alternative 3
This would have the same effect on pool levels as Alternative 1, so this action would have no additional adverse impacts to cultural resources.

4.11. ENVIRONMENTAL JUSTICE

Effects of the NAA
The NAA would have no adverse impacts on environmental justice as the existing SRBDCP of March 1989 with pumped storage operation would continue to be used.

Effects of Alternative 1
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
This alternative would have the same effect along the river as Alternative 1, so this action would not result in disproportionately high and adverse human health or environmental impacts on minority or low-income populations in the United States.

Effects of Alternative 3
This alternative would have the same effect along the river as Alternative 1, so this action would not result in disproportionately high and adverse human health or environmental impacts on minority or low-income populations in the United States.

4.12. PROTECTION OF CHILDREN

Effects of the NAA
The NAA would have no adverse impacts on the protection of children as the existing SRBDCP of March 1989 with pumped storage operation would continue to be used.

Effects of Alternative 1
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
As with Alternative 1, 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, so this action would not result in a disproportionate risk or environmental impact to children.

Effects of Alternative 3
As with Alternative 1, 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, so this action would not result in a disproportionate risk or environmental impact to children.

4.13. 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. Primarily, 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 water in J. Strom Thurmond Lake and the amount that is discharged 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. We recognize that the Savannah River is viewed by some located in other river basins as a ready source of clean water for their needs. If/when 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 will increase to some degree.

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 winter months. As a drought intensifies or continues in duration, the stress on both the natural ecosystem and human uses of the resources increase. Impacts would result primarily from increases in water usage and not from relatively small changes in the allocation of water considered in the Proposed Action or any of the detailed alternatives, so no adverse cumulative impacts would be expected. Cumulative impacts could result from a more comprehensive plan with larger changes in the allocation of water.

5.0 CONCLUSION

This Environmental Assessment considers the potential environmental impacts of the proposed project. The impacts listed for most of the resources in Table 28 below are similar for the three alternatives. However, Alternative 1 has a minor adverse impact on recreation, boat-launching ramps and docks at Hartwell and J. Strom Thurmond Lakes, while Alternative 2 has positive impacts on these resources. Alternative 3 has a minor adverse impact on hydropower, while Alternative 2 has no adverse impact. Therefore Alternative 2 is the preferred alternative. The Proposed Action (Alternative 2) would update the Savannah River Basin Drought Contingency Plan of March 1989. The conclusion of this Environmental Assessment is that the proposed action would result in no significant environmental impact.

Based on a review of the information contained in this EA, the District determined that update of 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 28: Comparison of Effects of the No Action Alternative, Alternatives 1, 2 and 3

RESOURCE	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Water Quality	No adverse impact	Minor positive impact for the Augusta, Millhaven and Clyo gaging stations	Minor positive impact for the Augusta, Millhaven and Clyo gaging stations	Minor positive impact for the Augusta, Millhaven and Clyo gaging stations
Biotic Communities-Lakes, Largemouth Bass Spawning, by observing the Pool Elevation Tables	Acceptable impacts, because the existing Drought Contingency Plan would be used, 3 violations of the 6" April 1-28 pool lowering rule were observed.	No adverse impact, 2 violations of the 6" April 1-28 pool lowering rule were observed.	Minor adverse impact, 5 violations of the 6" April 1-28 pool lowering rule were observed.	Minor adverse impact, 5 violations of the 6" April 1-28 pool lowering rule were observed.
Biotic Communities-Lakes, Aquatic Plants	No adverse impact	No adverse impact	No adverse impact	No adverse impact
Biotic Communities-Shoals	Acceptable impacts			
-by downstream hydrographs		Minor positive impact as flows consistently 200 cfs higher than those of the No Action Alternative.	Minor positive impact as flows consistently 200-400 cfs higher than those of the No Action Alternative.	Minor positive impact as flows consistently 200-400 cfs higher than those of the No Action Alternative.
-by EFM		Minor positive impacts for each of the four model runs.	Minor positive impacts for each of the four model runs.	Minor positive impacts for three model runs and no impact for the fourth.
Biotic Communities-Floodplain (Lower flows recommended here)	No adverse impact			

Table 28: Comparison of Effects of the No Action Alternative, Alternatives 1, 2 and 3 (continued)

RESOURCE	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
For 2003 Workshop recommendation -by downstream hydrographs		Minor adverse impact as flows are often 200-900 cfs higher than the No Action Alternative. Reducing flows to the levels recommended in the Scientific Stakeholders Workshop of April 2003 would produce adverse impacts for other Savannah River resources.	Minor adverse impact as flows are often 100-1000 cfs higher than the No Action Alternative. Reducing flows to the levels recommended in the Scientific Stakeholders Workshop of April 2003 would produce adverse impacts for other Savannah River resources.	The Dowmstream Hydrograph is very similar to that of Alternative 2 at left, so a minor adverse impact would result.
For 10,000 stream cfs channel capacity -by downstream hydrographs		No adverse impact as flows are rarely above 9000 cfs during the drought. Coordination of Thurmond releases would be required to achieve seedling establishment.	No adverse impact as flows are rarely above 9000 cfs during the drought. Coordination of Thurmond releases would be required to achieve seedling establishment.	The Dowmstream Hydrograph is very similar to that of Alternative 2 at left, so no adverse impact would result.
Biotic Communities-Estuary	Acceptable impacts			
-by downstream hydrographs		Minor positive impact as flows are 200-1000 cfs higher than the No Action Alternative for December 2000 through November 2002.	Minor positive impact as flows are higher for longer than those of the No Action Alternative.	Minor positive impact as flows are higher for longer than those of the No Action Alternative.
-by EFM		Minor positive impacts	Minor positive impacts	Minor positive impacts
Threatened and Endangered Species	Acceptable impacts		.	
-by downstream hydrographs		Minor positive impact with a predominant 200 cfs flow increase.	Minor positive impact with a predominant 200-400 cfs flow increase	Minor positive impact with a predominant 200-400 cfs flow increase.

Table 28: Comparison of Effects of the No Action Alternative, Alternatives 1, 2 and 3 (continued)

RESOURCE	NO ACTION ALTERNATIVE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
-by EFM		Minor positive impacts.	Minor positive impacts.	Minor positive impacts for three model runs and no adverse impact for the fourth.
Recreation, Boat-Launching Ramps and Docks		Hartwell: Minor Adverse RBR: No Adverse JST: Minor Adverse	Hartwell: Positive RBR: No Adverse JST: Positive	Hartwell: Positive RBR: No Adverse JST: Positive
Recreation, Swimming		Hartwell: No Adverse RBR: Not Applicable JST: No Adverse	Hartwell: Minor Positive RBR: Not Applicable JST: No Adverse	Hartwell: Minor Positive RBR: Not Applicable JST: No Adverse
Water Supply		Hartwell: No Adverse RBR: No Adverse JST: No Adverse Below JST: No adverse in summer and winter, but minor adverse in spring	Hartwell: No Adverse RBR: No Adverse JST: Minor Positive Below JST: No Adverse in winter and spring, but minor adverse in summer	Hartwell: No Adverse RBR: No Adverse JST: Minor Positive Below JST: No Adverse in winter and spring, but minor adverse in summer
Hydropower		Positive	No Adverse	Minor Adverse
Cultural Resources	No additional adverse impacts	No additional adverse impacts	No additional adverse impacts	No additional adverse impacts
Environmental Justice	No adverse impact	No disproportionately high and adverse impacts.	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.	No disproportionately high and adverse impacts.

Table 29: Comparison of Pool Elevations and Actions Taken for the NAA, Alternatives 1, 2 and 3

BREAK POINT ELEVATIONS				
	NO ACTION ALTERNATIVE		ALTERNATIVES 1-3	
Level	**Hartwell 18 Apr-15 Oct Thurmond 01 May-15 Oct**	**Hartwell 01 Dec-01 Jan Thurmond 15 Dec- 01 Jan**	**Hartwell 01Apr -15 Oct Thurmond 01Apr -15 Oct**	**Hartwell 15 Dec-01 Jan Thurmond 15 Dec- 01 Jan**
1	656 & 326	655 & 325	656 & 326	654 & 324
2	654 & 324	652 & 322	654 & 324	652 & 322
3	646 & 316	646 & 316	646 & 316	646 & 316
4	625 & 312	625 & 312	625 & 312	625 & 312

ACTIONS TAKEN AT TRIGGER LEVELS				
Level	**NAA**	**ALTERNATIVE 1**	**ALTERNATIVE 2**	**ALTERNATIVE 3**
1	Safety Advisory	Safety Advisory	Max Weekly Average 4200 cfs at JST	Max Weekly Average 4200 cfs at JST
2	Max Weekly Average 4500 cfs at JST	Max Weekly Average 4500 cfs at JST	Max Weekly Average 4000 cfs at JST	Max Weekly Average 4000 cfs at JST
3	Specified Daily Flow 3600 cfs at JST	Specified Daily Flow 3800 cfs at JST.	Specified Daily Flow 3800 cfs at JST	Specified Daily Flow 3600 cfs at JST
Above Level 4	Minimum Daily Average Flow 3600 cfs	Minimum Daily Average Flow 3600 cfs at JST	Minimum Daily Average Flow 3800 cfs at JST	Minimum Daily Average Flow 3800 cfs at JST (except LV3)
4	Daily Average Outflow = Daily Average Inflow	Daily Average Outflow = Daily Average Inflow	Daily Average Outflow = Daily Average Inflow	Daily Average Outflow = Daily Average Inflow

6.0 RELATIONSHIP OF PROJECT TO FEDERAL AND STATE AUTHORITIES

The following table summarizes the status of the compliance of the proposed action (Alternative 2) with applicable Federal and State environmental laws.

Table 30: Relationship of Plans to Environmental Requirements

FEDERAL POLICIES	PROPOSED ACTION
Anadromous Fish Conservation Act, 16 U.S.C. 757, et. seq.	In compliance. Draft EA has been coordinated with NMFS.
Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et. seq.	In compliance. District's determination of no effect has been 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 has been coordinated with EPA.
Clean Water Act, as amended (Federal Water Pollution Control Act) 33 U.S.C. 1251, et. seq.	In compliance. District has coordinated Draft EA with both GA and SC.
Coastal Zone Management Act, as amended, 16 U.S.C. 1451 et seq.	In compliance, has been coordinated with both GA and SC. No comments were received from either.
Endangered Species Act, as amended, 16 U.S.C. 1531, et. seq.	In compliance. District's determination of no effect has been coordinated with the USFWS and NMFS.
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 has been coordinated with the GA and SC DNR, as well as the 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. District has coordinated determination with NMFS.
National Historic Preservation Act of 1966, as amended, 16 U. S. C. 470f, et seq.	In compliance. District's determination of no effect has been coordinated with the SHPO in both GA and SC.
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.

7.0 COORDINATION

Savannah District has coordinated with Federal and state officials on a regular basis during the course of the Savannah River Basin Comprehensive Study that includes this proposed change in the Savannah River Basin Drought Contingency Plan of 1989. This coordination was enhanced by the meeting of the Scientific Stakeholders Workshop of 1-3 April 2003 where recommended Savannah River flows were discussed for the Augusta shoals, floodplain and estuary. The coordination has continued with several stakeholder meetings in the Augusta area. The meetings have aided the Corps as it attempts to balance the various needs that include hydropower, recreation, water supply, water quality and wildlife management.

A Public Notice of Availability was issued on May 30, 2006, notifying the public of the availability of the Draft EA. This Notice served as the formal advertisement of the update. Agencies, individuals and organizations that have expressed an interest in the update were furnished a copy of the EA. Comments regarding the Draft EA and FONSI for the proposed action were received at the Savannah District Office until 12 o'clock noon, July 3, 2006.

8.0 LITERATURE CONSULTED

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