



PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT



Tennessee Valley Authority Reservoir Operations Study



Record of Decision

May 2004



Lead Agency: Tennessee Valley Authority

**In cooperation with U.S. Army Corps of Engineers
and U.S. Fish and Wildlife Service.**



Billing Code 8120-08 (U)

TENNESSEE VALLEY AUTHORITY

Final Programmatic Environmental Impact Statement–Tennessee Valley Authority Reservoir Operations Study

AGENCY: Tennessee Valley Authority (TVA)

ACTION: Issuance of Record of Decision

SUMMARY: This notice is provided in accordance with the Council on Environmental Quality's regulations (40 Code of Federal Regulation [CFR] Parts 1500 to 1508) and TVA's procedures implementing the National Environmental Policy Act (NEPA). TVA has decided to adopt the Preferred Alternative identified in its Final Programmatic Environmental Impact Statement–Tennessee Valley Authority Reservoir Operations Study. The Final Environmental Impact Statement (FEIS) was made available to the public on February 19, 2004. A Notice of Availability of the FEIS was published in the Federal Register on February 27, 2004. The TVA Board of Directors decided to adopt the Preferred Alternative at its May 19, 2004, public meeting. In adopting the Preferred Alternative, TVA has decided to change the policy that guides the operations of the Tennessee River and reservoir system. Consistent with the operating priorities established by the TVA Act, the change will establish a balance of reservoir system operating objectives to produce a mix of benefits that is more responsive to the values expressed by the public during the Reservoir Operations Study (ROS). This includes enhancing recreational opportunities while avoiding unacceptable effects on flood risk, water quality, and TVA electric power system costs.

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SUPPLEMENTAL INFORMATION: TVA is a multipurpose federal corporation with a mandate to foster the social and economic well-being of the residents of the Tennessee Valley region through the wise use, conservation, and development of its natural resources. In carrying out this mission, TVA conducts a range of programs and activities, including operating the Nation's largest public power system, serving almost nine million people in parts of seven southeastern states, and operating a system of dams and reservoirs with associated facilities—its water control system.

As directed by the TVA Act, TVA manages the Tennessee River and reservoir system as an integrated water control system primarily for the purposes of navigation, flood control, and power production. Consistent with those purposes, TVA operates the system to improve water quality and water supply, and provide recreational opportunities, and a wide range of other public benefits. The water control system has hydroelectric generators and provides the cooling water supply for TVA's coal-fired and nuclear power plants and water supply for other industries located adjacent to the reservoirs. TVA's power system and its management of the integrated water control system are central components of the economic well-being of the Tennessee Valley region.

TVA also manages 11,000 miles of public shoreline to maintain the integrity of the reservoir system. TVA has custody of and manages 293,000 acres of land in the Valley, most of which is along the shorelines of TVA reservoirs. Development and management of these lands and activities are influenced by reservoir levels and river flows.

TVA's reservoir operations policy guides the day-to-day management of the reservoir system. The reservoir operations policy sets the balance of trade-offs among competing uses of the water in the system. It determines the storage and flow of water in the reservoir system in response to rainfall and runoff. It affects the rise and fall of reservoir levels, when changes in reservoir levels occur, and the amount of water flowing through the reservoir system at different times of the year. Because TVA must respond to widely varying conditions in the operation of its reservoir system that are largely beyond TVA's control, its operations policy is basically a guideline and is implemented in a flexible manner.

TVA conducted the ROS to determine whether changes in how it operates the reservoir system would produce greater overall public value for the people of the Tennessee Valley. TVA initiated the study in response to recommendations by public groups, individuals, and other entities while at the same time recognizing that the needs and values of the region and its people change over time. The scope of the study included 35 projects in the Tennessee River and Cumberland River watersheds. The study included a long-range planning horizon to the year 2030. The study area included most of Tennessee and parts of Alabama, Kentucky, Georgia, Mississippi, North Carolina, and Virginia.

On February 25, 2002, TVA published a notice in the Federal Register announcing that it would prepare a programmatic EIS on its reservoir operations policy and inviting comments on its scope and contents. TVA, the U.S. Army Corps of Engineers (USACE), and the U.S. Fish and Wildlife Service (Service) cooperated to prepare the EIS. TVA also established two groups—a 17-member Interagency Team and a 13-member Public Review Group (IAT/PRG)—to ensure that agencies and members of the public were actively and continuously involved throughout the study.

During scoping, TVA received over 6,000 individual comments, about 4,200 form letters and petitions signed by more than 5,400 members of the public. In addition, 3,600 residents in the TVA Power Service Area commented as part of a random telephone survey conducted by an independent research firm. TVA staff used this input to identify a broad range of issues and values to be addressed in the ROS. Overall, the public placed a high value on recreation, a healthy environment, production of electricity, and flood control.

Based on issues and values identified during the scoping process, TVA staff along with input from members of the IAT/PRG developed a set of objectives that TVA used to define, evaluate, and compare a range of eight policy alternatives in the DEIS. The eight alternatives were examined in detail through a combination of data collection, statistical analysis, computer modeling, and qualitative assessment. As part of the analysis process, TVA worked with national experts from various disciplines. TVA staff developed advanced technologies for modeling water quality impacts and new analytical tools for modeling flood risk on an unprecedented scale—encompassing 35 dams and reservoirs and 99 years of hydrologic data.

The Notice of Availability of the DEIS was published in the Federal Register on July 3, 2003. During the comment period on the DEIS, TVA received input from almost 7,000 individuals, including form letters and petitions with over 4,500 signatures. Volume II, Appendix F of the FEIS contains responses to the over 3,200 separate comments TVA received during the DEIS review process. Most individuals expressed support for those alternatives in the DEIS that increased reservoir and tailwater recreation opportunities. However, state and federal agencies were concerned about the adverse water quality effects associated with most of the alternatives, particularly those enhancing recreation opportunities. Generally, the agencies preferred that TVA retain its existing operations policy (the No Action Alternative or Base Case). The

Environmental Protection Agency (EPA) suggested the development of a hybrid or blended alternative that would avoid or reduce the environmental impacts associated with the identified action alternatives.

The Department of the Interior, other agencies, and some members of the public strongly encouraged TVA to employ an adaptive management approach to implementing whatever changes might result from ROS. Adaptive management involves monitoring and modifying system operations as appropriate to respond to future conditions, such as changes in water quality. TVA currently practices adaptive management through the flexibility built into its operations policy and extensive monitoring of the reservoir system. TVA will continue to use such adaptive management practices as it implements the Preferred Alternative.

As suggested by EPA, TVA developed an alternative that blends elements of the action alternatives supported by the public while avoiding or reducing associated adverse environmental impacts. Specifically, TVA used a series of simulations to combine and adjust elements of alternatives included in the DEIS that supported increased recreation opportunities, navigation, and other system benefits. Adjustments were made to avoid or reduce adverse impacts to other objectives including flood risk, water quality, power costs, aquatic resources, wetlands, migratory waterfowl and shorebirds, and shoreline erosion. The end result of the blending process is TVA's Preferred Alternative.

The FEIS was released to the public on February 19, 2004, with a request for comment on the Preferred Alternative. The Notice of Availability of the FEIS with 45 days for the public to comment was published in the Federal Register on February 27, 2004.

Comments on the Final EIS

Although not required, TVA provided a 45-day comment period on the FEIS and the Preferred Alternative. To facilitate the review process, TVA distributed approximately 1,200 copies of the FEIS and posted a copy on the official agency internet web site, where comments could be made. In addition, TVA accepted comments by surface or electronic mail, telephone, and facsimile. TVA staff met with and briefed over 1,100 interested stakeholders. Approximately 50 scheduled briefings were conducted for federal, state, and local officials, TVA power distributors, reservoir user groups, and Valley media. TVA continued to meet with its cooperating agencies and with members of the IAT/PRG to brief them on the FEIS and the Preferred Alternative and to receive their input.

During the FEIS review process, TVA received comments from almost 2,000 individuals, 4 federal agencies, and 10 state agencies. The comments included over 500 form letters and petitions signed by more than 800 individuals. Most of the comments were similar to those TVA received on the DEIS, except for those comments specifically on the Preferred Alternative. In general, the public and agencies supported the Preferred Alternative and viewed it as a substantial improvement over the Base Case. However, about 800 individuals expressed concerns regarding the delayed fill component on the upper mainstem projects, especially Watts Bar and Fort Loudoun/Tellico, and the potential adverse recreation and economic impact this could have on marina operators on these reservoirs. Concerns were also expressed about the lack of changes in the operations of Tims Ford and Kentucky Reservoirs.

The delayed fill component of the Preferred Alternative was included to enhance flood risk protection at locations on the mainstem reservoirs, including Chattanooga. Although there is some uncertainty in this regard, TVA expects the delayed fill to have minimal effects on the recreation opportunities (dock accessibility) on the upper

mainstem reservoirs and fish spawning. Impacts to fish spawning would be minimized because much of the prime nesting habitat would be covered during the first week of April when half the summer pool is filled and before spawning begins. Additionally, starting on April 8, a slow fill into the remainder of the shallows may benefit the growth and survival of both fry and young-of-year fish. TVA's analysis of median reservoir levels projected under the Preferred Alternative indicate that boat ramps, commercial marinas, and most private docks will be functional from April 15 through the period of slowed fill. Assuming average rainfall and runoff, water levels would be within the summer operating zone by the first week of May. More importantly, TVA's adaptive management approach to implementing the Preferred Alternative will enable the agency to determine if unacceptable or unexpected adverse impacts result on these reservoirs and to adjust operations appropriately. No changes were made on Tims Ford and Kentucky reservoirs to avoid unacceptable impacts on flood risk, wetlands, and wildfowl. None of the comments on the FEIS identified material weaknesses in TVA's analyses.

Alternatives Considered

TVA considered eight reservoir operations policy alternatives in the DEIS: **Base Case** (the No Action Alternative), **Reservoir Recreation A**, **Reservoir Recreation B**, **Tailwater Recreation**, **Tailwater Habitat**, **Summer Hydropower**, **Equalized Summer/Winter Flood Risk**, and **Commercial Navigation**. A ninth alternative, the Preferred Alternative was addressed in the FEIS. Each policy alternative establishes a balance of reservoir system operating objectives. Except for the Base Case, each alternative would change, to various degrees, reservoir levels and flow releases and their seasonal timing to produce a different mix of benefits. Under all of the alternatives, including the Preferred Alternative, TVA would continue to use water stored in the

reservoirs to preserve the reliability of the TVA power system during Power System Alerts or other critical power system situations.

As required by NEPA, TVA used the **Base Case Alternative** to document the existing reservoir operations policy and to serve as a baseline against which the action alternatives are compared. Under the Base Case, TVA would continue to operate its integrated water control system in accordance with the existing balance of operating objectives, reservoir levels and water release guidelines, and project commitments and constraints.

The Base Case also involves a number of other actions that would occur regardless of changes in the reservoir operations policy. These actions include: existing water-use patterns, taking into account increasing water supply demand in the future (through 2030), modernization and automation of TVA's hydro plants, operation of Browns Ferry Nuclear Plant Unit 1 and continued operation and uprate of Units 2 and 3, and operation of the Tennessee–Tombigbee Waterway at full capacity.

TVA considered three alternatives (**Reservoir Recreation A, Reservoir Recreation B, and Tailwater Recreation**) designed primarily to shift the balance of operating objectives to enhance recreation opportunities while maintaining other system benefits. These alternatives would extend summer pools and limit water releases between June 1 and Labor Day, provide higher winter pools, and modify winter operating ranges of mainstem reservoirs to allow a one-foot fluctuation. Under the Tailwater Recreation Alternative, an increase in tailwater flows at five additional projects would have priority over reservoir levels to support tailwater-related recreation activities.

The **Tailwater Habitat Alternative** was designed primarily to improve conditions in tailwater aquatic habitats. Under this alternative, TVA would release water to try to mimic natural variations in runoff through the year. Tailwater habitat would also be

improved by decreasing the rate of river fluctuations associated with rapid changes in the number of turbines operated.

Two alternatives (**Summer Hydropower and Equalized Summer/Winter Flood Risk**) were designed to increase summer hydropower production and reduce summer flood risk, respectively. These alternatives would generally reduce summer pool levels and increase winter pool levels, establish weekly average water releases during summer, and modify winter operating ranges of mainstem reservoirs to allow a one-foot fluctuation.

The **Commercial Navigation** alternative was designed to increase the reliability and reduce the cost of commercial navigation by increasing the depth of the main channel in order to accommodate heavier barges. This alternative would raise the winter flood guides on mainstem reservoirs by two feet, modify their winter operating range to allow a one-foot fluctuation, and increase minimum flows at several key projects with major navigation locks.

The **Preferred Alternative** was designed to provide increased recreation opportunities while avoiding or reducing adverse impacts on other operating objectives and resource areas. Under the Preferred Alternative, TVA will no longer target specific summer pool elevations. Instead, TVA intends to manage the *flow* of water through the system to meet operating objectives. TVA will use weekly average system flow requirements to limit the drawdown of 10 tributary reservoirs (Blue Ridge, Chatuge, Cherokee, Douglas, Fontana, Nottely, Hiwassee, Norris, South Holston, and Watauga) June 1 through Labor Day to increase recreation opportunities. For four mainstem reservoirs (Chickamauga, Guntersville, Wheeler, and Pickwick), summer operating zones will be maintained through Labor Day. For Watts Bar Reservoir, the summer operating zone will be maintained through November 1. Great Falls Reservoir will be filled on a schedule to achieve summer pool elevation by Memorial Day.

Weekly average system minimum flow requirements from June 1 through Labor Day, measured at Chickamauga Dam, will be determined by the volume of water in storage at the 10 tributary reservoirs compared to the total storage available. A system minimum operating guide (MOG), which is a seasonal system storage guide curve as opposed to the project storage guide curve under existing operations, will be used to define the combined storage volume for those 10 tributary reservoirs. If the volume of water in storage is above the system MOG, the weekly average system minimum flow requirement will be increased each week from 14,000 cfs the first week of June to 25,000 cfs the last week of July. Beginning August 1 and continuing through Labor Day, the weekly average flow requirement will be 29,000 cfs. If the volume of water in storage is below the system MOG curve, only 13,000 cfs weekly average minimum flows will be released from Chickamauga Dam between June 1 and July 31, and only 25,000 cfs weekly average minimum flows will be released from August 1 through Labor Day.

TVA has established reservoir balancing guides for each tributary storage reservoir to ensure that water releases for downstream system needs will be withdrawn more equitably from tributary reservoirs. The balancing guide is a seasonal reservoir pool elevation that defines the relative drawdown at each tributary reservoir when water must be released to meet downstream flow requirements. Under this operating principle, water would be drawn from each tributary reservoir so that the elevation of each reservoir is similar relative to its position between the flood guide and the balancing guide. Balancing pool elevations will be accomplished to the extent practicable, depending on hydrology and power system economic and reliability considerations. To reduce impacts to power cost, TVA will ensure minimal hydropower capacity at each tributary reservoir by generating up to a volume of water equivalent of 17 hours of use per week at best turbine efficiency from July 1 through Labor Day.

Based on the results of the flood risk analysis, TVA has decided to raise winter flood guides and winter operating ranges on Blue Ridge, Boone, Chatuge, Cherokee, Douglas, Fontana, Hiwassee, Norris, Nottely, South Holston, and Watauga. Additionally to better protect against the risk of flooding for all main river projects (with the most benefits realized at Chattanooga), TVA will slow the filling of the three upper mainstem projects (Fort Loudoun/Tellico, Watts Bar, and Chickamauga) to reach the summer operating zone by early May. In addition, minimum winter pool elevation would be raised by 0.5 feet at Wheeler to better ensure minimum navigable channel depth.

Based on input from affected stakeholders, TVA will formally schedule water releases to increase tailwater recreational opportunities below Apalachia, Norris, Ocoee #1, South Holston, and Watauga/Wilbur. With variation in the amounts of flow and days of release, water releases will be provided from Apalachia, May 1 through October 31; from Norris, May 1 through October 31; from Ocoee #1 on Tuesdays and Wednesdays from June 1 through August 31; from South Holston April 1 through October 31; and from Watauga for recreation flows below Wilbur Memorial Day through October 31. This will allow people recreating on these tailwaters and recreation service providers to better plan their activities. The specified flows with the Preferred Alternative will be met depending on the volume of water in the upstream reservoirs. TVA will provide continuous minimum flows in the area between the Apalachia Dam and downstream powerhouse from June 1 through November 1 to enhance aquatic habitat. TVA will also provide continuous minimum flows up to 25,000 cfs at Kentucky, as needed, to maintain a minimum tailwater elevation of 301 for navigation.

Basis for Decision

The TVA Board has decided to adopt the Preferred Alternative. This alternative will establish a balance of reservoir system operating objectives that is more responsive

to values expressed by the public during the ROS while remaining consistent with the operating priorities established by the TVA Act. It also reduces or avoids the unacceptable environmental impacts associated with most of the other action alternatives.

The Preferred Alternative will provide greater value for reservoir and tailwater recreation users, increase revenue for recreation service providers, enhance the scenic beauty of the reservoirs, and result in some benefits to commercial navigation and aquatic habitat. It will provide more equitable pool levels among tributary reservoirs. It avoids and reduces impacts to the primary system operating objectives of flood control, navigation, and power generation associated with the other action alternatives.

Based on computer simulations, the Preferred Alternative is not expected to increase flood damage associated with flood events up to a 500-year magnitude at any critical location within the Tennessee Valley, including Chattanooga. Rather, with the slowed filling of the three upper mainstem reservoirs, flood risk protection should be increased for locations on all of TVA's mainstem reservoirs, including Chattanooga. The Preferred Alternative will increase the minimum depth of the Tennessee River navigation channel at two important locations and will maintain power system reliability while lessening impacts on the delivered cost of power compared to other alternatives. Additionally, the Preferred Alternative will lessen impacts on reservoir water quality, as well as shoreline erosion and its associated adverse effects on cultural resources and some shoreline habitats compared to Reservoir Recreation Alternative A, Reservoir Recreation Alternative B, the Tailwater Recreation Alternative, and the Tailwater Habitat Alternative. To the extent practicable, impacts on wetlands, water quality, and aquatic resources will be mitigated thereby reducing the potential for long-term cumulative impacts. TVA will maintain tailwater minimum flows and dissolved oxygen (DO) targets

established by the Lake Improvement Plan to help reduce the risk of adverse water quality impacts.

Responding to flood control, wetland, and wildlife concerns expressed by USACE, the Service, state agencies, and some members of the public, no changes in seasonal water levels on Kentucky Reservoir and Tims Ford were included in the Preferred Alternative. Current operating conditions will be retained for these reservoirs.

In strictly economic terms, the overall public value of the Preferred Alternative will be similar to the Base Case, which represents TVA's current operations policy. Revenues from recreation of approximately \$9 million and shipper savings of approximately \$2.5 million will be largely offset by the increase in power costs of approximately \$14 million annually. Additionally, the Preferred Alternative is expected to reduce flood damages along mainstem reservoirs, including such locations as Chattanooga and South Pittsburg, Tennessee, and Decatur, Alabama (e.g., for the last two major flood events in early May 1984 and 2003, flood damages would have been reduced in the Chattanooga area by a total of \$12 million to \$15 million, respectively). Further, TVA will make a capital investment of about \$17 million over three years to address DO issues with an annual operation and maintenance cost of about \$800,000. TVA will also spend over \$500,000 annually in monitoring mosquito breeding habitat, shoreline erosion, water quality, aquatic resource, threatened and endangered species, and changes in certain wetland types; and based on monitoring results, could provide additional funding to address resource improvement opportunities.

TVA closely coordinated the formulation of the Preferred Alternative with USACE and the Service. USACE concurs that the Preferred Alternative addresses its primary concerns with flood control, water quality, and environmental conditions on the lower Tennessee, Cumberland, Ohio, and Mississippi Rivers and satisfies their concerns about Section 404 and navigation on the Tennessee River. USACE and TVA cooperated to

conduct additional analyses for high-flow periods and increased navigation problems during low-flow periods for areas downstream from Kentucky Reservoir along the lower Ohio and Mississippi River. Both agencies concluded that the Preferred Alternative will not adversely impact the risk of flooding during high-flow periods and that under the Preferred Alternative there are potential benefits to navigation on the lower river during extreme low water periods. As a result of these analyses, USACE recommended a more rigorous management of flood control storage at Kentucky and Barkley reservoirs and that TVA closely adhere to the reservoir guide curves at these reservoirs to ensure their continued effective operation over a wide range of flow conditions. TVA is committed to continuing the close cooperative relationship with USACE in managing low-flow and emergency situations that may arise on the lower Ohio and Mississippi rivers.

The Service agreed with TVA's determination that implementation of the Preferred Alternative will not jeopardize the continued existence of any listed threatened and endangered species. The Service issued a Biological Opinion which identified two reasonable and prudent measures, with terms and conditions that TVA must take to minimize the impacts of incidental take of the snail darter (a fish) and pink mucket (a mussel) that might otherwise result from the Preferred Alternative. As requested by the Service, TVA has entered into discussion with the Service over possible effects to endangered and threatened species associated with those components of TVA's reservoir operations that are not being changed through implementation of the Preferred Alternative.

In cooperation with the State Historic Preservation Officers (SHPO) of Alabama, Georgia, Mississippi, North Carolina, Tennessee, and Virginia, and the Eastern Band of Cherokee Indians, TVA developed a Programmatic Agreement that addresses the identification and protection or mitigation of historic resources that could be affected by

adoption of the Preferred Alternative. Kentucky SHPO concurs with TVA's opinion that there will be no effect on historic properties in Kentucky under the Preferred Alternative. This fulfills TVA's responsibilities under the National Historic Preservation Act.

Environmentally Preferable Alternative

In general, the extent of potential environmental effects of the reservoir operations policy alternatives is related to the amount and timing of water held in storage and flow through the system. TVA has concluded that the Commercial Navigation Alternative, with its minor changes in water availability limited primarily to mainstem reservoirs, has slightly better environmental consequences than the Base Case and Preferred Alternative and is the environmentally preferable alternative. The Commercial Navigation Alternative would not have any adverse effects on protected species and would result in slightly beneficial effects for critical habitats of some protected species. It would provide beneficial effects on greenhouse gas emissions, aquatic resources, summer water temperature, mainstem water levels, and increased stability of wetland habitats. However, the Commercial Navigation Alternative would result in slightly adverse impacts on wetland plant communities, terrestrial ecology (use of mud flats and some bottomland hardwood wetlands), recreation spending, and private site access. It also would incrementally increase flood risk at key locations and would do little to enhance recreation opportunities.

Impacts of the Base Case and Preferred Alternative, with the added mitigation measures, would be basically the same as those for the Commercial Navigation Alternative except for flood risk as noted above. The Preferred Alternative was formulated purposefully to reduce or avoid the adverse impacts associated with all of the other action alternatives, especially the substantially adverse impacts related to flood

damages, water quality, power costs, aquatic resources, wetlands, and migratory waterfowl and shorebirds.

The Commercial Navigation Alternative was not selected as TVA's preferred alternative primarily because it would increase flood risk and would produce little or no changes in recreation opportunities and other system benefits except for reduced cost for waterborne transportation. As such, it is not as responsive to expressed public values as TVA's Preferred Alternative.

Potential Mitigation Measures

All identified practicable means to mitigate potential environmental impacts associated with this decision will be implemented. Primarily, TVA has chosen to do this in the way the Preferred Alternative was formulated, as discussed above. However, TVA was unable to avoid all potential impacts. In particular, implementation of the Preferred Alternative could result in slightly adverse to adverse impacts on certain wetland types and locations, water quality and aquatic resources in some reservoirs, and other resource areas. In some cases, the extent of the impacts may vary from year to year—depending on the reservoir, annual rainfall and runoff conditions, and other factors. TVA will use a mix of monitoring and adaptive response as a component of its programmatic approach to mitigating these impacts.

TVA will continue its existing monitoring activities under its Reservoir Release Improvement and Vital Signs Reservoir Ecological Health Monitoring Programs to look for water quality and ecological changes. Additional DO and temperature sampling will be conducted at selected tailwater locations as determined by Vital Signs monitoring. A Wetlands Monitoring Program will be established to determine whether shifts of wetland plant communities occur as a result of extended water levels. TVA commits to conducting wetland monitoring activities on a 3- to 5-year basis for 15 years to establish

effects. If substantial shifts of wetland plant communities occur, TVA will take appropriate action to mitigate adverse effects.

TVA also will extend the existing Vector Monitoring Program to identify any increase in the number of days that reservoir mosquito breeding habitat exists due to the extended time the mainstem reservoirs are held up. If the number of days of reservoir mosquito breeding habitat increases, TVA will extend the duration of reservoir level fluctuations on Chickamauga, Guntersville, Pickwick, and Wheeler for mosquito control. If extending the duration of the fluctuations does not offset the increase in reservoir mosquitoes, TVA will investigate other mitigation methods.

Based on results of DO monitoring, TVA will upgrade aeration equipment and operations at appropriate locations as necessary to continue to meet the DO target levels established by the 1991 Lake Improvement Plan. This could include increased oxygenation, upgrading existing equipment, or installing additional equipment. Such measures will be initiated and completed within 1 year after implementation at Watts Bar and within 3 years at other locations where established targets are not being met. The estimated cost of these changes is \$17 million over three years with an annual operation and maintenance cost of \$800,000. TVA will share information about the enhanced aeration efforts with interested agencies and will continue monitoring to determine whether efforts are successful. If DO targets cannot be maintained, TVA will investigate additional mitigation approaches with interested agencies. TVA will also spend over \$500,000 annually on other measures to reduce or avoid potential environmental and cultural resource impacts associated with the Preferred Alternative.

TVA will continue monitoring sensitive cultural resource sites along the reservoir shoreline to determine if the rate of shoreline erosion increases, affecting those sites. If the rate of erosion increases and affects those sites, TVA will increase its stabilization efforts to protect sensitive cultural resources. Further, TVA will ensure that the

measures identified in its programmatic agreement with State Historic Preservation Officers for the states of Alabama, Georgia, Mississippi, North Carolina, Tennessee and Virginia, and the Eastern Band of Cherokee Indians will be implemented in accordance with the stipulations of that agreement.

TVA will implement the reasonable and prudent measures, including the terms and conditions, identified in the Service's Biological Opinion to minimize the impacts of incidental take of the snail darter and pink mucket. Relative to the population of the endangered green pitcher plant on Chatuge Reservoir that could be affected by changes in reservoir levels, TVA will work with the Service, the landowner, and other interested agencies to conduct a hydrologic study to determine what effects, if any, implementation of the Preferred Alternative will have on the plants and their habitat. The study and results will be completed within 1 year after implementation. TVA will monitor on an annual basis the status of green pitcher plant populations around Chatuge Reservoir and share data with interested agencies. If results of the study and monitoring indicate that changes resulting from implementation of the Preferred Alternative are likely to adversely affect the green pitcher plant, TVA will take appropriate action to avoid or mitigate those adverse effects.

Additionally, the results of the ROS indicate that there is a need for TVA and state and other federal agencies to work together in a more cooperative manner to develop a Drought Management Plan for the Tennessee River system and to determine habitat requirements and opportunities for potential enhancements for shorebirds and important sports fish. TVA will work with state and other federal agencies to develop a Drought Management Plan within a reasonable period of time. This plan will be implemented during extreme drought conditions when TVA must suspend normal reservoir operating guidelines. Efforts to determine habitat requirements and potential enhancements for shorebirds and important sports fish will include better identification of

information gaps, cataloguing federal and state programs that address these habitats and species, sharing data with other interested agencies, and investigating actions that could be taken to enhance these habitats and species.

Implementation of Policy Guidelines

TVA will begin implementing the described changes to TVA's reservoir operations policy on the date of release of this Record of Decision. TVA will use these guidelines to make determinations of changes in pool levels and flows through the system during normal operations. Operations of the reservoir system during a power supply alert will depend on the level of alert. Water stored in the reservoir system will be released as needed to preserve the integrity and stability of the TVA Power System.



Kathryn J. Jackson
Executive Vice President
River System Operations & Environment

May 19, 2004
Date