CHAPTER 2 - ALTERNATIVES

2.1 INTRODUCTION

This chapter describes alternative ways to address the potential for flooding on nonfederal land around Nolichucky Reservoir. Three action alternatives have been evaluated in detail, along with the No Action Alternative. The chapter includes descriptions of each of these alternatives, a comparison of them, and a summary of their potential environmental effects. The last section in this chapter identifies TVA's preferred alternative.

2.2 SELECTION OF ALTERNATIVES

Under NEPA, TVA is required to evaluate a reasonable range of alternatives that would accomplish the project purpose and the alternative of taking no action. TVA reviewed and evaluated all of the suggestions about possible alternatives that had been made by the public, various agencies, and TVA staff during the scoping process. The resulting condensed list of suggestions, presented in Table 1, has been arranged in five broad categories: buying affected land, dredging sediment, modifying the dam, various combinations of these three concepts, and a variety of other ideas. The complete list of suggested alternatives was included in the Scoping Document, issued in March 2000 (TVA 2000a).

All of these suggestions were considered as TVA developed the alternatives to be evaluated in detail as part of the Draft EIS; however, many of them were excluded for various reasons. Some suggestions (such as building new reservoirs, modifying timber harvest practices, or legislative controls on siltation) were considered to be substantially different from the purpose of this project—to resolve flooding problems around the present Nolichucky Reservoir. Other suggestions (such as dredging alone or various ways of reducing runoff and sediment in the upstream part of the watershed) were eliminated as independent alternatives, because by themselves, they would not address all of the potential flooding effects on nonfederal land around the reservoir. Still other suggestions (such as enlarging the size of the reservoir or constructing various types of berms or water diversion channels) were

Table 1. Condensed List of Suggested Ways to Reduce Flooding Effects on Nonfederal Land and Property Around Nolichucky Reservoir

Categories	Alternatives Suggested by Agencies and the Public
Buy Land	• Purchase the affected land. • Acquire the necessary landrights. • Acquire flood rights to the maximum probable flood level.
Dredge Sediment	• Dredge reservoir to increase storage capacity. • Remove silt at same rate as rate of accumulation. • Dredge and market our own sand removal. • Dredge reservoir; permanent commitment to do maintenance dredging. • Seek other dredging operations to remove silt.
Modify Dam	• Remove dam. • Remove dam and restore river corridor. • Remove powerhouse and create wider spillway. • Lower dam - incrementally.
Combinations	• Purchase landrights and dredge. • Make dam higher (to increase storage) and purchase lands. • If dam is removed, must dredge out silt first. • Lower spillway and remove/stabilize sediment subject to flushing. • Purchase land subject to flooding and encourage dredging and sale of sand. • Establish a channel within the accumulated sediment associated with a notch or something in the dam to lower the flood level.
Other	• Ignore the problem; leave everything as it is. • Pay for flood damages. • Floodproof existing homes; no new houses in floodplain. • TVA deed all property to owners and retain only flowage easements. • Reduce flood on TVA property by levees or other engineering. • Evaluate structural and nonstructural (e.g., small watershed) projects to reduce flood and silt levels. • Minimize runoff entering the river. • Stop unregulated clear-cutting. • Build one or more upstream flood control dams. • Build saddle dams, berms, etc., to protect nonfederal land. • Create a diversion channel to handle the flood flow. • Reroute the river - use existing reservoir as a settling basin. • Divert water to retention ponds (levees with controlled release). • Create flow diversion canals to other waterways to handle high-flood-flow situations. • Introduce legislation to control siltation. • Make North Carolina responsible for silt coming out of state.

considered to be unreasonable, because they would be much more complex and substantially more expensive than necessary to address the project purpose.

The four alternatives that were developed during this evaluation process and were discussed in detail in the Draft EIS were Alternative A: No Action (required under NEPA regulations); Alternative B: Acquire the Affected Land or Landrights; Alternative C: Lower the Spillway in the Dam; and Alternative D: Remove Nolichucky Dam. Alternatives C and D would include some sediment removal and/or stabilization work in the reservoir.

During the review of the Draft EIS, a number of commenters indicated that TVA had evaluated all of the appropriate concepts but had not considered them with regard to an additional issue they felt was extremely important. (All substantive comments on the Draft EIS are addressed in Appendix F.) Those commenters encouraged TVA to look at ways to minimize potential flooding on nonfederal land while restoring or, at least, not adversely affecting present recreational use of Nolichucky Reservoir. TVA has carefully reviewed those comments and has evaluated possible variations to Alternative A or B that might address them. The reasons those variations are not evaluated in detail in the Final EIS are presented in Section 2.8. The alternatives that are evaluated in this Final EIS are described in Sections 2.4 through 2.7 and are compared in Section 2.9. The selection of a preferred alternative is presented in Section 2.10.

2.3 FLOODPLAINS AND LANDRIGHTS

Floodplains

Much of the discussion about the alternatives included in this EIS requires an understanding of two subjects that, in this case, are closely related to each other. One of these subjects is the relationship between a river and various parts of its floodplain. Most people recognize that a stream uses more of the valley in which it flows during a flood than it does during dry weather. What many people do not realize, however, is that the part of the valley occupied by a stream during a flood (its floodplain) should be considered at least as much a part of the stream as it is part of the surrounding land.

Engineers identify different parts of a floodplain using terms indicating the probability, or chance, that the area will be occupied by the stream. For example, land likely to be covered by water at least once during an average 10-year period is called the 10-year floodplain. Land within the 10-year floodplain has a 1-in-ten, or 10 percent, chance of being flooded in any given year. Land like this is flooded fairly often, usually is located close to the stream, and most people recognize they should use this land only in ways that would not be bothered by high water.

In contrast, land that is flooded only rarely (for example, on average only once out of every randomly selected 100 years – the 100-year floodplain) can be some distance away from the stream. Because that large a flood occurs so seldom, many people fail to realize that, every so often, the stream should be expected to use that much of the valley. Many cities and counties, including Greeneville and Greene County, have adopted the 100-year flood elevation as the basis for regulations to avoid constructing buildings in flood-prone areas. When dams or other structures are built across or near streams, the planners also often identify the 500-year flood elevation to make sure they understand what land would be affected by the modified stream during these very large and rare flood events.

If all streams were essentially straight and the valleys in which they flowed all were broad and relatively flat, it would be easy to identify which areas would be covered with water during various flood events. Of course, most streams are not straight; most valleys are wide in some places and narrow in others; and, along many streams, dams and other barriers affect where the water will go. The natural and man-made features in a valley and, especially, in the stream all affect flood elevations around them. Narrow gorges, dams, and other large structures in, or close to, a stream can cause higher upstream flood levels and, in some places, lower downstream flood levels than if those barriers were not present.

As part of the work for the Draft EIS, TVA collected appropriate information, including flood elevations not previously available, and developed present flood elevations along the river from Nolichucky Dam (River Mile 46) upstream to beyond where the project would have any effect on the flood

levels (about River Mile 62). In March 2002, after publication of the Draft EIS, TVA arranged for new, more-detailed aerial photography to be taken of the area around Nolichucky Reservoir, in part, to verify or revise the locations of the 100-year and 500-year floodplains around the reservoir. The revised limits of the 100-year and 500-year floodplains along this part of the river are presented on a large-scale land ownership map of the reservoir (Appendix A). Information contained in this appendix was compiled from information contained in TVA land records and from the county tax maps and assessment roll for the year 2000. No surveys were conducted. Maps are for illustrative purposes only. This information has been provided to Greene County for use in floodplain protection.

Landrights

As indicated in Section 1.2, when TVA acquired Nolichucky Dam and Reservoir in 1945, it acquired fee title ownership over approximately 750 acres of land and flowage easements over approximately 300 additional acres. In the mid-1970s, when the purpose of the project was modified to be a waterfowl sanctuary and environmental education area, TVA purchased fee title to approximately 330 acres of previous flowage easement land and fee title to approximately 163 acres of additional land adjacent to the reservoir. By 1980, the Nolichucky Project included 901 acres in fee and approximately 178 acres of flowage easements (TVA 1980).

In another part of the preparations for the Draft EIS, TVA reviewed the federal landrights around Nolichucky Reservoir and used Geographic Information System (GIS) computer mapping and analysis software to compare those results with tax maps obtained from Greene County. Among other features, the GIS software can be used to calculate the total area within many separated pieces of land (tracts) or parts of tracts. The aerial photography of the Nolichucky Reservoir area taken in March 2002 (after the Draft EIS was published) also was used to check and, where necessary, to update the acreage occupied by the reservoir and various ownership categories.

The maps presented in Appendix A show all of the land tracts around Nolichucky Reservoir that include any area within the revised 500-year floodplain. On this 7-panel map, each affected tract is color-coded to indicate

if it is owned by the federal government, if part or all of the tract is covered by a federal easement (typically a flowage easement), or if the land is in private ownership. The revised GIS calculations still indicate the federal government (TVA) owns a total of approximately 1,400 acres of land under and around Nolichucky Reservoir and holds easements over approximately 370 acres of land along this part of the river (Table 2). Together, these federal landrights affect a total of approximately 1,780 acres.

Table 2. Federal Landrights Associated With Nolichucky Reservoir and All Landrights Within the 100-Year and 500-Year Floodplains Around the Reservoir

Ownership Category	Federal Landrights in the Area (Acres)	Acres Within the 100-Year Floodplain	Percent	Acres Within the 500-Year Floodplain	Percent
Nolichucky Reservoir	455.4	455.4	20.9	455.4	17.5
Federal Ownership	950.2	563.3	25.9	607.0	23.3
Federal Easements	371.6	288.2	13.2	298.0	11.4
[All Federal Landrights]	[1777.2]	[1306.9]	[60.0]	[1360.4]	[52.2]
Upstream River Channel	--	157.1	7.2	158.5	6.1
Private Ownership	--	695.8	32.0	1060.4	40.7
Roads	--	16.4	0.8	27.0	1.0
Totals	1777.2	2176.2	100.0	2606.3	100.0

Only part of the federal land is located within the 500-year floodplain around Nolichucky Reservoir. Table 2 also presents the calculated number of acres in several categories within both the revised 100-year and 500-year floodplain areas around the reservoir. As indicated in this table, the revised GIS evaluation indicates the federal government owns the approximately 455 acres of land under Nolichucky Reservoir, approximately 610 acres within the present 500-year floodplain around it, and holds flowage easements over approximately 300 acres within the 500-year floodplain around the reservoir. The difference between the entries in the federal landrights column and the federal entries in the 500-year floodplain column indicates the government

owns 343 acres of land and 74 acres of easements (rights over approximately 417 acres) located outside of the 500-year floodplain around Nolichucky Reservoir. This land includes higher ground adjacent to the dam site, transmission line rights-of-way, and access roads to property along the reservoir.

Overall, the entries in Table 2 indicate the federal landrights under and around the reservoir represent approximately 52 percent of the approximately 2,600 acres within the 500-year floodplain and approximately 60 percent of the nearly 2,100 acres within the 100-year floodplain. Most of the remaining approximately 1,250 acres of land within the revised 500-year floodplain is in private ownership. Privately owned land accounts for about 41 percent of the area within the 500-year floodplain and about 32 percent of the area within the 100-year floodplain. The remaining 7 percent of the 500-year floodplain area is occupied by county roads (approximately 27 acres) and the upstream part of the river channel (about 160 acres). Both the floodplain boundaries and the ownership rights are important background features associated with each of the alternatives evaluated in this EIS.

2.4 ALTERNATIVE A - NO ACTION

Under this alternative, TVA would not take any new actions to address the potential flood impacts on nonfederal lands that could occur because of the presence of Nolichucky Dam and the sediment accumulation in Nolichucky Reservoir. TVA would not acquire any additional landrights or take any action to remove sediment from the reservoir other than to continue to approve sand mining activities as appropriate. TVA would provide information to agencies and individuals regarding the potential flooding effects around the reservoir. Greene County probably would require compliance with applicable local floodplain regulations during any future development of the land around the reservoir. Nolichucky Dam and Powerhouse would continue to be maintained as required by federal dam safety regulations and to preserve their historic value.

Adoption of this alternative would result in little or no change in the floodplain elevations around Nolichucky Reservoir (Appendix A). The federal

government would retain ownership of approximately 1,400 acres of land under and around Nolichucky Reservoir and easements over approximately 370 acres in the area. TVA also would continue the existing agreements with TWRA and other agencies concerning waterfowl management, operation of the environmental education area, and public parks associated with the reservoir. Commercial sand removal operations would continue to exist adjacent to River Miles 49-51 and 62, and TVA would continue to review applications for enlarged or new dredging permits from Nolichucky Reservoir on a case-by-case basis. If this alternative were adopted, TVA would provide floodplain information to landowners and agencies in the area.

2.5 ALTERNATIVE B - ACQUIRE LANDRIGHTS

Under this alternative, TVA would address the potential flooding effects on nonfederal land by acquiring either fee title or easements with the right to flood all of the nonfederal land within the present 500-year flood boundary around Nolichucky Reservoir (as indicated in Table 2, about 1,060 acres). TVA would decide whether to acquire fee title or a flowage easement on any given tract based on a tract-specific evaluation of the potential flooding effects. Fee simple acquisition would mean that TVA would buy the affected land and all structures built on it and would hold all rights concerning the use of that land. If TVA acquired only a flowage easement, TVA would buy the right to overflow and flood specific parts of the property on an intermittent and temporary basis. The owner could continue to use the easement land in many ways, but would relinquish the right to build structures on the affected property below a specific elevation and would have to receive TVA approval prior to developing the affected land. Nolichucky Dam and Powerhouse would continue to be maintained as required by federal dam safety regulations and to preserve their historic value.

When TVA needs to acquire land or landrights, agency staff members follow a careful and well-documented approach. Specialists research the legal description and ownership status of each tract, while appraisers gather general and specific information about property values in the area. After the preliminary work is done, TVA appraisers contact the property owners for permission to inspect the property and invite them to be present during the

inspection. The appraisers also explain how the property would be affected by the project and how the appraisal process is conducted. Once an appraisal is completed and reviewed for consistency with accepted practices, TVA uses this information to develop an offer for the property. A TVA realty specialist then contacts each property owner to explain the project again, answer questions, and present the offer to purchase specific landrights. If the owner accepts the offer, the conveyance documents are signed and the payment is made. If the owner does not accept the offer and a mutual agreement on the purchase cannot be reached, it may become necessary to have a court decide the amount of compensation for the required property rights.

At the completion of this alternative, no change would occur in the floodplain elevations around Nolichucky Reservoir; however, the federal government would own or have easement rights over all of the approximately 2,450 acres of nonriver channel land within the 500-year floodplain around the reservoir (plus the 417 acres of existing land and easement rights outside of the 500-year floodplain—a combined total of about 2,865 acres). TVA probably would work with TWRA and other agencies to incorporate some or all of the additional fee-owned land into the existing waterfowl management and environmental education areas associated with the reservoir. TVA would also continue to review sand dredging requests on a case-by-case basis. Acquisition of the approximate 1,060 acres of additional land and easement rights could occur within three years and is estimated to cost somewhere between $15 million and $20 million.

2.6 ALTERNATIVE C - LOWER NOLICHUCKY DAM

Under this alternative, TVA would address the potential flooding effects on nonfederal land and property by lowering the spillway part of Nolichucky Dam after removing or stabilizing sediment in the reservoir. The intent of this alternative would be to lower the spillway by approximately 40 feet (to elevation 1,200), just enough to lower the 500-year flood elevation associated with the modified dam to affect only land already in federal ownership or covered by existing flowage easements. Site-specific details of this project would be determined as part of the preconstruction design process; however,

the following paragraphs describe the types of activities that would be included. A general evaluation of the environmental effects associated with this alternative is included in this EIS. If this alternative were adopted, the site-specific environmental effects evaluation would be added in a supplement to this EIS or in an EA.

While the focus of this project would be on lowering the height of the spillway, most of the work would consist of removing or stabilizing the sediment in the reservoir. Early in the project, approximately 1,000 acre-feet (1.6 million cubic yards) of sediment would be removed from the first mile of the river channel just upstream from Nolichucky Dam. The initial dredging of this part of the reservoir and any necessary redredging from this area would create and maintain a settling trap for large sediment particles moving down the river. Additional dredging or in-place stabilization would occur all along the impounded part of the river to remove sediment that has accumulated in the upper 40 feet of the reservoir depth. Also during this work, any necessary modifications would be made to maintain the stability of the approach roads and the four bridges that cross this part of the Nolichucky River. Overall, approximately 8,000-12,000 acre-feet (13-20 million cubic yards) of sediment would be removed or stabilized in place during this project.

The sediment would be removed from the reservoir with suction dredges. Barge-mounted or land-based pumps would be used to suck sediment and water out of the bottom of the reservoir and to push that material through large pipes to nearby upland disposal sites. Federal land along the length of Nolichucky Reservoir outside of the floodplain area substantially affected by a 100-year flood event (the 100-year floodway) would be used for some of these disposal sites. More than likely, other land or landrights owned by willing private entities also would be required. Pumping costs probably would restrict the choice of disposal sites to locations within 3 miles of the dredging sites.

Each disposal site would consist of one or more natural or excavated depressions, associated settling ponds, and maintained drainageway channels. Dredged sediment would be pumped into the deposition sites, fine sediment would be removed from the transport water in the settling ponds,

and the filtered water would be returned to the reservoir or river down the drainageways. Once each disposal site was filled, the sediment deposits would become the property of the landowner. Permanent fill areas would be contoured to match the surrounding land, covered with topsoil, and planted with appropriate native or agricultural vegetation.

Before any work was done on the spillway, a water control structure would be built on the upstream face of Nolichucky Dam. Detailed plans for this structure have not been developed; however, it would include a temporary cofferdam with a deep water control gate that would let water flow into a modified form of the existing spillway gate, a new discharge tunnel through the dam, or the reopened penstocks through the powerhouse. Once it was completed, this control structure could be used to lower the water level in the reservoir far below the present spillway elevation (1,240.9 feet). The control structure would be designed to maintain at least 500 cubic feet per second of flow in the river downstream from the dam. The periodic dredging of the sediment trap would include work to ensure that sediment did not accumulate around the water control gate.

Once most of the sediment had been removed from the reservoir and the water control structure had been built, work would begin on lowering the height of the spillway in the dam. Approximately 75,000 cubic yards of rock from a local quarry would be trucked to the site and used to build an equipment platform all the way across the upstream side of the dam several feet below the present reservoir surface. When the platform was complete, the water level in the reservoir would be lowered to expose this working surface, and impact machinery would be used to break off pieces of the spillway. The pieces of concrete would be deposited in a dewatered work area at the base of the dam, from where they probably would be placed to armor adjacent side slopes of the river valley. Steel, lead, and other recyclable materials would be separated from the removed concrete and sold for reuse. The impact machinery would continue working until the spillway had been lowered about 40 feet (to elevation 1,200). After the spillway was lowered, the water control structure would be used to fill the reservoir pool to the new spillway elevation while maintaining at least 500 cubic feet per second of flow in the river downstream from the dam. The cofferdam,

equipment platform and any other associated materials or structures would be removed from the construction site.

During all phases of this project, appropriate best management practices would be used to minimize construction and sedimentation effects on the river and the surrounding area. The dredging and disposal facilities would be constructed and used by TVA staff or contractors in compliance with all applicable federal and state dam safety, water pollution control, and other pertinent laws and regulations. Any commercial reprocessing of the sand and other materials in the disposal sites would be conducted in compliance with all applicable federal, state and local laws and regulations. Appropriate measures would be taken to minimize erosion on areas where sediment would be removed or deposited, to stabilize those areas as quickly as possible, and to establish vegetation on them soon after they were stabilized. Erosion control measures to be used during this part of the project would likely include building appropriate grade-control structures and lateral dikes, using erosion-control fabric, placing riprap, and installing native material (e.g., root wad, cedar tree, etc.) revetments. Revegetation measures to be used along the smaller reservoir and disturbed upland areas would likely include bioengineering techniques, various types of specific seeding measures, and tree planting.

At the conclusion of this project, Nolichucky Reservoir would have an area of about 160 acres instead of the present 455 acres and would still contain a large amount of sediment (7,000–11,000 acre-feet [10 to 17 million cubic yards]). TVA would develop revised flood elevations for this part of the Nolichucky River and would make that information available to appropriate agencies in Greeneville and Greene County. Figure 4 shows how the size of this reservoir and the associated 500-year floodplain might differ from present conditions. The federal government would continue to own approximately 1,780 acres of land and flowage easement rights under and around this smaller reservoir. In cooperation with appropriate state and local agencies, TVA would determine how the federal land and easements would be used, probably as parts of modified versions of the existing wildlife management and environmental education areas. Nolichucky Dam and Powerhouse would

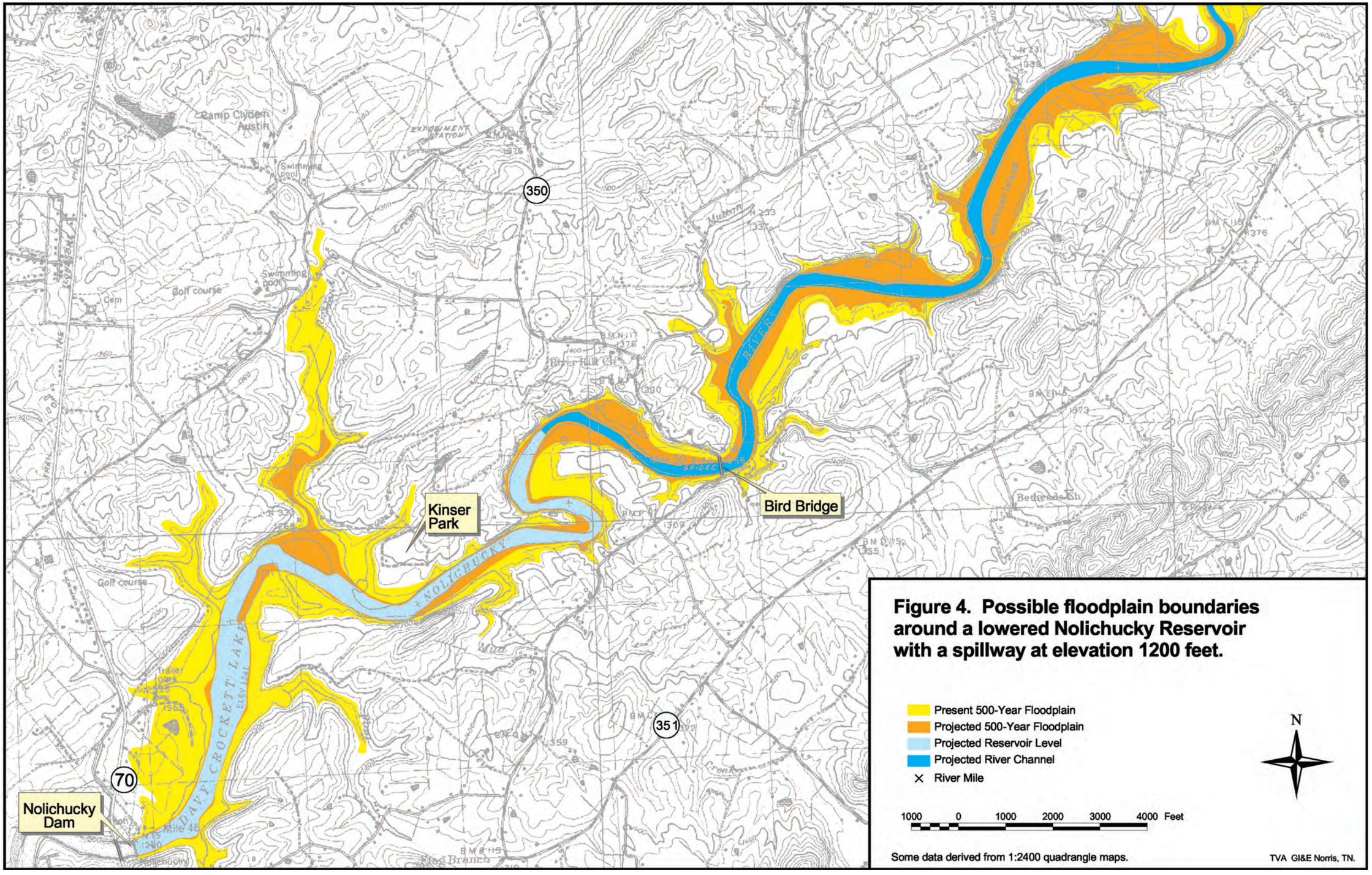

Figure 4. Possible floodplain boundaries around a lowered Nolichucky Reservoir with a spillway at elevation 1200 feet.

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continue to be maintained as appropriate under federal dam safety regulations and to preserve their historic value.

All together, the sediment removal, lowering of the dam, and stabilization work would take between 5 and 10 years to complete and would cost between $45 million and $70 million. This project would require a variety of work crews, which at any one time might involve as many as 50 people. Most of this time and effort would be involved in sediment removal and stabilization.

2.7 ALTERNATIVE D - REMOVE NOLICHUCKY DAM

This alternative addresses the flooding effects of Nolichucky Dam and Reservoir on the adjacent nonfederal lands using the same general approach described under Alternative C—lowering the 500-year flood elevation by lowering the dam and removing or stabilizing the accumulated sediment. Under this alternative, however, TVA would completely remove all visible components of Nolichucky Dam and Powerhouse from the river valley. The general types and sequence of activities included in this alternative would be the same as those described under Alternative C; however, some specific differences would occur associated with removing the remainder of the dam, the powerhouse, and more of the accumulated sediment. The following general description highlights the differences between this alternative and Alternative C. If this alternative were adopted, site-specific details of the project would be determined as part of the preconstruction design process, and the site-specific environmental effects would be added in a supplement to this EIS or in an EA.

As under Alternative C, an early part of this project would be the removal of most of the sediment in the first mile or so of the river channel just upstream from Nolichucky Dam. This material would be removed using suction dredges and deposited on TVA or private land within 3 miles of the dredging sites as described under Alternative C. The only difference for this alternative would be a possible increase of up to 1,800 acre-feet (3 million cubic yards) in the volume of sediment to be removed from this sediment trap. Additional dredging would occur when required to remove sediment that had moved

downstream into this trap, for example, after major flood events or after the water level in the reservoir had been lowered.

An additional activity in this project would be the removal of the Nolichucky Powerhouse. Both the dam and powerhouse would be documented in accordance with NHPA requirements, all remaining equipment in these structures would be removed and preserved or recycled, and the powerhouse building would be demolished. All appropriate measures would be taken to identify and properly handle asbestos and any other potentially hazardous materials in the building. Reasonable efforts would be made to find uses for the brick and other materials that would be available, then all remaining debris would be transported to one or more appropriate landfill sites in the area.

The water control structure would be built on the upstream face of the dam and used to lower the reservoir pool level as described under Alternative C; however, the bottom elevation of this structure might be lower than it would have been under Alternative C. Construction and use of the rock-filled equipment platform would be as described under Alternative C; however, the impact machinery would be used to remove the full width of the dam instead of just the spillway. In addition, the working platform and the water level in the reservoir would have to be lowered at least once to allow the impact machinery to reach parts of the dam closer to the riverbed. Near the end of the dam removal work, all of the working platform, the control structure, and components of the dam higher than the riverbed would be removed. The final work at the dam site would consist of establishing natural-looking streambed and banks along that part of the river channel.

Throughout the construction period, suction dredges and earthmoving equipment would be used to move sand and other fine sediment out of the remainder of the former river channel. As described under Alternative C, this sediment would be placed or stabilized in a number of controlled dewatering and storage sites located on federal and private land outside of the 100-year floodway. Also as described under Alternative C, any necessary modifications would be made to maintain the stability of the approach roads and the four bridges that cross this part of the Nolichucky River. Whenever

possible, level floodplains would be constructed along the new river channel. These areas would function to trap some sediment moving down the river and could partially compensate for the loss of sediment storage in the present reservoir pool. The final shape of the excavated or filled areas would be designed to minimize any risk of slope failure. All of these new and stabilized deposits would be contoured to match or establish a natural landscape and would be planted with native or agricultural vegetation.

As described under Alternative C, appropriate best management practices would be used during each of these activities to minimize erosion and sedimentation effects in the reservoir, in any receiving stream, and in the river downstream from the dam site. The dredging and disposal work would be conducted in compliance with all applicable laws and regulations, and appropriate erosion and stabilization measures would be used to minimize impacts related to the land disturbance activities.

At the conclusion of this project, the federal government would own approximately 1,780 acres of land and flowage easements along an unimpounded reach of the Nolichucky River. TVA would develop revised flood elevations for this river reach and would make that information available to appropriate agencies in Greeneville and Greene County. In cooperation with appropriate state and local agencies, TVA would determine how the federal land and easements would be used, probably as parts of modified versions of the existing wildlife management, environmental education, and public park areas.

All together, removing the dam and powerhouse and the sediment removal or stabilization work would be completed in approximately 10 to 12 years and would cost between $90 million and $150 million. This project would result in relocating or stabilizing between 15,000 and 19,000 acre-feet (24 to 30 million cubic yards) of sediment and would require work crews ranging up to 70 persons in size.

2.8 ALTERNATIVES NOT EVALUATED IN DETAIL

Several other suggestions for resolving the potential flooding effects around Nolichucky Reservoir might appear to be possible alternatives; however, they have not been evaluated in detail as part of this EIS. The reasons these suggestions have not been evaluated further are presented in the following paragraphs.

Remove Nolichucky Dam and Powerhouse With No Dredging

If Nolichucky Dam is causing upstream flooding problems on nonfederal land and, especially, if the dam is no longer associated with a usable power production facility, it would seem logical to evaluate simply removing the dam and letting the river deal with the accumulated sediment. TVA has seriously considered this concept; however, the evaluation indicated that removing the dam without dealing with the accumulated sediment is not a reasonable alternative. Preliminary evaluations conducted for several resource areas indicate that taking the dam out and allowing the 19,000 acre-feet (30.6 million cubic yards) of accumulated sediment to migrate downstream would result in a wide variety of adverse effects both in the Nolichucky River itself and across much of its floodplain. Initial calculations indicate that large amounts of sediment would be deposited in the river a short distance downstream from Nolichucky Dam and would not disperse for many years. Until most of this sediment moved all the way downstream into Douglas Reservoir, it would continue to cause some flood effects on nonfederal land upstream from Nolichucky Dam. In addition, this sediment would cause flood effects on large areas of nonfederal land all along the 46 miles of river downstream from the dam. In addition, this sediment would cause flood effects on large areas of nonfederal land along the 46 miles of river downstream from the dam. The mass of sediment moving down the river also would smother areas where bottom-dwelling plants and animals occur, virtually eliminate most fish habitat in the river, substantially modify many terrestrial habitats in the river corridor, severely degrade wetlands and the extensive agricultural lands in the river floodplain, and disrupt much of the local agricultural economy. Because of these severe adverse effects, there was no reason to complete a detailed evaluation of removing the dam without also including the removal or stabilization of the accumulated sediment as in Alternative D.

Dredge Sediment Out of the Reservoir

If the accumulation of sediment in the reservoir is causing the flooding on nonfederal land and property, dredging or allowing other entities to dredge, the sediment out of the water would seem to be a logical alternative that should be evaluated. In fact, however, the accumulation of sediment in Nolichucky Reservoir is only serving to make an old problem somewhat worse. The results of recent evaluations indicate that even if all 19,000 acre-feet of sediment were removed from the reservoir pool, the 500-year flood elevation upstream from Nolichucky Dam (at its present elevation of 1,240.9 feet) would still affect some private land over which TVA does not have flowage easements. In addition, to maintain those lower flood levels, sediment would have to be dredged out of the reservoir on a continuing basis. Removing the existing sediment would not resolve all of the flooding on nonfederal land but could be the start of a long-term, continuing maintenance commitment. TVA concluded that such a dredging program was not a stand-alone solution to the flooding effects on nonfederal land and property around Nolichucky Reservoir.

Following a review of the public comments on the Draft EIS, TVA also explored the possibility of including some form of public- or commercial-funded sediment removal from Nolichucky Reservoir as a component of either Alternative A or B. Dredging sediment from the reservoir could reopen some areas to flat-water recreation; however, removing those deposits also could eliminate part or all of the extensive, high-quality wetlands that have developed around Nolichucky Reservoir. Those wetlands support and enhance the present management focus of the project as a waterfowl sanctuary and environmental education center. Conducting or promoting extensive dredging of sediment from the reservoir could involve spending large amounts of money essentially to exchange one type of recreational benefit for another while having little effect on the potential for flooding private land and property. At the end of this review, TVA concluded that conducting or promoting extensive dredging of sediment from Nolichucky Reservoir would not solve the flooding effects on nonfederal land and property and could degrade present uses of the project. However, under Alternative A, TVA would continue to review and accept, as appropriate, proposals to mine (dredge) accumulated sediment from private companies. Depending on the

number of approved proposals, this would address in part the problems associated with the accumulated sediment.

Divert the Floodwater Around the Reservoir

Several ideas included in Table 1 suggest finding ways to divert floodwater around Nolichucky Reservoir without affecting the present pool level and adjacent private land. These suggestions include rerouting the river or constructing diversion canals to move floodwater around the reservoir. These ideas, however, do not take into account the extremely large volume of water that would be involved during a major flood event. The flow in the river at Nolichucky Dam would be approximately 158,000 cubic feet per second during a 500-year flood event. If the pipe, tunnel, or canal system became blocked or was not large enough to handle all of the flow, the water would back up and flood land not now in federal ownership. Based on this analysis, TVA determined that construction of a diversion system was not a workable or reasonable way to address the flooding effects around Nolichucky Reservoir.

2.9 COMPARISON OF ALTERNATIVES

Table 3 presents a brief summary of the concepts and components involved in each of the four alternatives evaluated in detail. The abbreviated entries in this table are derived from the information presented in Sections 2.4 through 2.7.

The following paragraphs and the entries in Table 4 present a summary of the potential effects of the alternatives on the full range of environmental resources. All of the information in these summaries is derived from the discussions presented in Chapter 4.

Table 3. Summary Comparison of the Four Alternatives Being Evaluated in Detail

Components	A: No Action	B: Acquire Landrights	C: Lower Nolichucky Dam	D: Remove Nolichucky Dam
Basic Concept	TVA would take no action to reduce potential flooding risks on nonfederal land and property	TVA would acquire title or flowage easements on all land within the 500-year floodplain around Nolichucky Reservoir	TVA would lower the spillway enough so that Nolichucky Dam would not affect flood levels on private land	TVA would remove all of the dam and powerhouse from the river valley
Resulting Federal Landrights	Approximately 1,780 acres in fee and flowage easements (no change)	Approximately 2,865 acres in fee and/or flowage easements (an addition of about 1,060 acres)	Approximately 1,780 acres in fee and flowage easements (no change)	Approximately 1,780 acres in fee and flowage easements (no change)
Sediment Storage Areas	None required	None required	To hold up to 12,000 acre-feet of sediment	To hold up to 19,000 acre-feet of sediment
Potential for Flooding on Nonfederal Land	Approximately 1,060 acres of private land within the 500-year floodplain (no change)	None; all land or landrights within the 500-year floodplain would be under federal control	None related to the presence of the dam and remaining sediment	None related to the remaining components of the Nolichucky Project
Effect on Nolichucky Dam and Powerhouse	No change	No change	Spillway would be lowered to elevation 1,200; powerhouse and rest of dam would not be affected	All visible signs of dam and powerhouse would be removed from the river valley
Effect on Nolichucky Reservoir and Wildlife Management Area	No change	Some management changes might occur on the larger area around the reservoir	Reservoir would be about 160 acres in size; management area might be refocused on other uses	Reservoir would be eliminated; management area might be refocused on other uses
Estimated Time to Complete	Not applicable	3 years	5-10 years	10-12 years
Estimated Additional Cost	None	$15 million to $20 million	$45 million to $70 million	$90 million to $150 million

Table 4. Summary of the Potential Environmental Effects of the Four Alternatives Being Evaluated in Detail.

Resource Areas	A: No Action	B: Acquire Landrights	C: Lower Nolichucky Dam	D: Remove Nolichucky Dam
Climate, Geology, and Soils (Section 4.2)	No effects	Potential increased long-term protection of soils due to public ownership	Some soils disturbed around reservoir; insignificant effects on soils downstream	Some soils disturbed around reservoir; insignificant effects on soils downstream
Groundwater (Section 4.3)	No effects	No effects	Local water table could drop 40 feet near dam; mitigation identified	Local water table could drop 70 feet near dam; mitigation identified
Surface Water and Sedimentation (Section 4.4)	No changes in water quality or existing sedimentation trends	Local water quality might improve; no change in existing sedimentation trends	Increased downstream turbidity during construction period; insignificant post-construction increases in downstream sedimentation	Increased downstream turbidity during construction period; significant changes in downstream riverbed composition after dam removal
Aquatic Life (Section 4.5)	No change in present conditions, communities, or long-term trends	Possible minor improvement in present conditions and communities; no change in long-term trends	Insignificant effects during construction period and in downstream reach afterward; beneficial long-term effects in upstream half of present reservoir	Insignificant effects during construction period; beneficial long-term effects in former reservoir area; significant adverse effects downstream for many years after dam removal
Wetlands (Section 4.6)	No change in present communities and long-term trends	Potential benefits due to public ownership; no change in long-term trends	Approximately 320 acres of existing wetlands would be eliminated; at least partial mitigation identified	Approximately 320 acres of existing wetlands would be eliminated; at least partial mitigation identified
Floodplains and Flood Risk (Section 4.7)	No change in flood elevations or potential to flood nonfederal land and property	No change in flood elevations; expanded federal rights would avoid project-related effects on private land and property within the 500-year floodplain	Flood elevations upstream from dam would be lower; no private property would be affected by project-related flooding	Flood elevations upstream from dam would be lower; no private property would be affected by project-related flooding
Terrestrial Life (Section 4.8)	No change in present communities or long-term trends	Potential benefits due to more land in public ownership; no change in long-term trends	Significant adverse effects on species now using the reservoir and wetlands; insignificant effects downstream	Significant adverse effects on species now using the reservoir and wetlands; insignificant effects downstream

Table 4 (Continued)

Resource Areas	A: No Action	B: Acquire Landrights	C: Lower Nolichucky Dam	D: Remove Nolichucky Dam
Endangered and Threatened Species (Section 4.9)	No change in present communities or long-term trends	Some possible benefits due to public ownership; no change in long-term trends	Potential significant adverse construction effects on endangered aquatic species; commitments to minimize them; insignificant post-construction effects	Potential significant adverse construction effects on endangered aquatic species; commitments to minimize them; significant adverse post-construction effects on some listed aquatic species
Land Use (Section 4.10)	No change in present trends; flooding potential continues on 1,060 acres of private land	1,060 acres would be acquired in fee or easement from private owners; some uses of this land would require TVA approval	Private land around the reservoir would no longer be affected by project-related flooding	Private land along the river would no longer be affected by project-related flooding
Visual/Recreation/ Managed Areas (Section 4. 11)	No change in present status or long-term trends	Enlarged federal lands could enhance recreation and management areas	Disruptions during the construction period; part of area would become riverlike; recreation and management activities would change	Disruptions during the construction period; large river setting would be restored; river likely to become the focus of recreation and management activities
Cultural Resources (Section 4.12)	Continued potential flooding effects on eligible structures	Continued potential flooding effects on eligible structures	Flooding effects eliminated on eligible structures; some buried sites could be exposed	Flooding effects eliminated on eligible structures; Nolichucky Dam and Powerhouse would be removed; more buried sites could be exposed
Socioeconomics (Section 4.13)	No change in status of local population or economy	Possible minor benefits to local economy due to enhanced recreation opportunities	Economic benefits during the construction period; possible minor long-term population and economic benefits	Economic benefits during the construction period; possible minor long-term population and economic benefits
Environmental Justice (Section 4.14)	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population	No disproportionate effects on any segment of the population

Alternative A – No Action

Adoption of the No Action Alternative (Alternative A) would mean that TVA would not do anything on the ground to address the potential flooding effects on nonfederal land and property around Nolichucky Reservoir. TVA already has provided updated flood level information to Greene County officials, and all proposed development within the 100-year floodplain would continue to be subject to local floodplain regulations (Section 4.7). Present environmental conditions and ongoing trends would continue both in the water (Sections 4.4, 4.5, and 4.9) and on the land surrounding the reservoir (Sections 4.2, 4.3, 4.6, 4.8, 4.9, 4.10, and 4.11). Present flood elevations upstream from Nolichucky Dam would not be affected by this alternative and approximately 1,060 acres of land not in federal ownership or covered by flowage easements would continue to be located within the 500-year floodplain affected by the dam (Sections 4.7 and 4.10). Approximately 72 privately owned structures occur within this 500-year floodplain (Section 4.10), 19 of which may be eligible for listing on the National Register of Historic Places (NRHP) (Section 4.12). This alternative would not have any effect on the present population or economic conditions in the area adjacent to Nolichucky Reservoir (Sections 4.13 and 4.14).

Alternative B - Acquire Landrights

If the Acquire Landrights Alternative (Alternative B) were adopted, present flood elevations around Nolichucky Reservoir would not be affected (Section 4.7), but TVA would acquire either fee title or flowage easements over approximately 1,060 acres of privately owned land within the 500-year floodplain upstream from the dam. Most of the new land acquired in fee probably would be added to the existing wildlife management area, presently managed by the TWRA (Sections 4.10 and 4.11). Uses of the land within this floodplain area would be controlled to minimize the potential for flooding effects (Section 4.10), and all structures on this land, including potentially eligible historic structures, probably would be floodproofed, relocated to higher ground, or removed (Sections 4.7 and 4.12).

Environmental conditions and ongoing trends in the water and on the land surrounding the reservoir would not be adversely affected and, in fact, public ownership or control over the entire floodplain area could lead to improved

terrestrial habitat conditions, more resource protection, and increased recreation potential (Sections 4.2, 4.3, 4.4, 4.5, 4.6, 4.8, 4.9, 4.10, and 4.11). If increased recreation use did occur, this alternative could result in modest positive effects on economic conditions in the area surrounding Nolichucky Reservoir (Section 4.13).

Alternative C - Lower Nolichucky Dam

Adoption of the Lower Nolichucky Dam Alternative (Alternative C) would lead to a number of changes in, around, and downstream from Nolichucky Reservoir. While the site-specific effects of this alternative would be evaluated in a supplement to this EIS or in an EA that would be prepared following completion of the detailed design work (if this alternative were adopted), the general types and likely significance of these effects have been identified in this analysis. Lowering the spillway and removing sediment from the reservoir would reduce flood elevations to the point that the 500-year floodplain associated with Nolichucky Dam would not affect private land and property (Sections 4.7 and 4.10); however, some presently buried archaeological and historic sites might be exposed as sediment was relocated out of the reservoir pool (Section 4.11). All federal land around the reservoir would remain in public ownership and would continue to be used for wildlife management, environmental education, and public parks, while private land no longer in flood-prone areas would be available for other uses (Section 4.10).

Lowering the pool level by 40 feet would lower the groundwater level adjacent to the reservoir, in some places enough that nearby well performance could be adversely affected (Section 4.3). Lowering the reservoir pool level also would drain approximately 320 acres of high-quality wetlands around and in the reservoir (Section 4.6), which would adversely modify the habitats of a variety of plants and animals that typically occur only in wetlands (Section 4.8). Lowering the spillway and disturbing the sediment in Nolichucky Reservoir could result in some increased sedimentation in the river downstream from Nolichucky Dam during the construction period; however, the inclusion of sediment control measures and monitoring requirements would result in only insignificant effects on downstream water quality and aquatic life (Sections 4.4 and 4.5). Adoption of this alternative might still

result in significant adverse construction effects on one or more silt-intolerant protected aquatic species living only where the dam presently protects them from excessive sedimentation (Section 4.9). Recreation and resource management opportunities in the area would be different from present uses around the reservoir and probably would shift to focus more on river-related activities (Section 4.11). The local economy would receive a short-term benefit from the construction activities included in this alternative and a possible minor long-term benefit if recreation use did increase in the area (Section 4.13).

Alternative D - Remove Nolichucky Dam

The general types and likely significance of the environmental effects of the Remove Nolichucky Dam Alternative (Alternative D) have been identified in this analysis. If this alternative were adopted, site-specific effects of this work would be evaluated in a supplement to this EIS or in an EA that would be prepared following completion of the detailed design studies. Adoption of this alternative would result in the removal of all visible components of Nolichucky Dam from the valley and the restoration of a free-flowing river through this area. The resulting 500-year flood elevation would be well within the existing federal landrights in the area (Section 4.7). All federal land around the reservoir would remain in public ownership and would continue to be used for wildlife management, environmental education, and public parks (Section 4.10). Some presently buried archaeological and historic sites might be exposed as sediment was relocated out of the full length of the reservoir pool (Section 4.11).

Eliminating the reservoir would lower the groundwater level adjacent to the reservoir, in places enough that nearby well performance could be adversely affected (Section 4.3). Approximately 320 acres of wetlands upstream from the dam would be drained (Section 4.6), which would adversely modify the habitats of a variety of plants and animals typically found only in wetlands (Section 4.8). The land disturbance activities associated with this project would include sedimentation control measures and monitoring requirements that would result in insignificant effects on surface water quality, sedimentation, and aquatic life in the Nolichucky River during the construction period (Sections 4.4 and 4.5). Following the complete removal of the dam,

however, the riverbed downstream from the dam site would be blanketed with sand and other coarse sediment, which would have immediate and significant adverse effects on some aquatic species (Sections 4.4 and 4.5). Freshwater mussels and other uncommon bottom-dwelling species, including two species federally listed as endangered, might be extirpated from the river (Sections 4.5 and 4.9). Once the dam was removed, recreation activities in the former reservoir area could expand to include tubing, float fishing, and possibly as good or better canoeing potential as exists now along the first 10 miles upstream or downstream from the reservoir (Section 4.11). The net impact of this alternative on the local economy and employment probably would be positive, especially over the long term (Section 4.13).

Comparison

The adoption of Alternative A or B would result in very similar effects on the environment; however, Alternative B would address the potential flooding effects on nonfederal land and property, while Alternative A would not. Alternative B would involve the acquisition of fee title or flowage easement rights over approximately 1,060 acres of private land within the present 500-year flood elevation upstream from Nolichucky Dam. Alternative A would not affect the ownership of this land; however, homes, historic structures, and other property located on that land would continue to be subject to risk of flooding.

The adoption of Alternative C or D also would result in similar environmental effects; however, those effects would be very different from what would occur under Alternative A or B. Both C and D would involve modifications to the dam that would reduce the flood elevations around the reservoir and avoid the project-related flooding effects on private land and property, including homes and historic structures. Results of this general evaluation indicate that both of these projects also could drain about 320 acres of significant wetlands, lower groundwater levels in wells close to the reservoir, expose some buried archaeological or historic sites, and cause adverse effects on aquatic life in the river downstream from Nolichucky Dam. Largely because it would involve the complete removal of Nolichucky Dam, Alternative D would likely result in more extensive adverse effects on the downstream part of the river and aquatic life than Alternative C. Once the dam was removed,

Alternative D would result in significant changes in the downstream river substrate, which could eliminate some types of bottom-dwelling animals, including two mussel species federally listed as endangered. Alternative D also would reconnect the upstream and downstream parts of the river and refocus local recreation activities on the free-flowing river. Both of these alternatives would include a variety of ways to avoid, minimize, or mitigate the potential adverse effects; however, some of those effects (such as the loss of the wetlands and elimination of endangered aquatic species) would be extremely difficult to mitigate completely.

The estimated costs of implementing these alternatives are none for Alternative A, between $15 million and $20 million for Alternative B, between $45 million and $70 million for Alternative C, and between $90 million and $150 million for Alternative D (Table 3). Alternative A would take little or no time to complete, while Alternative B could be completed in 3 years, Alternative C could take 5-10 years, and Alternative D could take between 10-12 years. The construction activities associated with both Alternatives C and D would provide some short-term economic benefit to the local area. All of the action alternatives (Alternatives B, C, and D) might result in some long-term economic benefits; however, the extent of those potential benefits would depend on decisions that would be made by many individuals and governmental agencies.

2.10 PREFERRED ALTERNATIVE

TVA did not identify a preferred alternative in the Draft EIS, in part to encourage a wider review of all the possible alternatives. As a result of their review of the Draft EIS, members of the public and representatives from interested agencies provided a number of comments indicating how they thought TVA should address the potential flooding problems around Nolichucky Reservoir. As indicated in Appendix F, each alternative received some support and some criticism. Several members of the public also provided comments indicating they were more interested in maintaining or restoring recreational uses of Nolichucky Reservoir than resolving the potential flooding problems.

The fact that each of the four approaches to resolving the potential flooding problems (no action, buy land, dredge sediment, and modify dam) received some support indicates that each approach has some basic merit. No Action would leave Nolichucky Reservoir—and the recreation opportunities it now supports—intact but would not address the potential flooding problems. Public control over all of the land within the floodplain around the reservoir (Alternative B) would minimize or avoid the flooding effects on private land and property and increase recreation potential on public lands, but would not reduce the amount of sediment in the reservoir. Modifying or removing Nolichucky Dam accompanied by stabilizing or removing the accumulated sediment (Alternatives C and D) would eliminate the dam-related flooding impacts but also would partially or fully eliminate the reservoir, destroy the wetland habitats that exist around it, and possibly or probably lead to adverse effects on the downstream part of the river.

Based on the analyses done for this EIS and public comments, TVA has identified Alternative B (Acquire Landrights) as the environmentally preferable alternative. This would accomplish the project purpose and would not involve any adverse impacts on the surrounding natural and human environment, while enhancing protection of some resources. Alternative A, No Action, would also not result in adverse environmental impacts, nor would it enhance protection of some resources as would Alternative B. Hence, Alternative A is not the environmentally preferable alternative. Each of the other alternatives, C and D, would result in various adverse environmental effects (e.g., varying wetlands losses and downstream impacts).

While Alternative B would resolve the potential flooding impacts on adjacent private land and property around Nolichucky Reservoir by purchasing appropriate land or landrights, this would cost an estimated $15 million to $20 million. It also would do nothing to change the risk of flooding to any of the acquired land or landrights. In addition, Alternative B would not restore recreational benefits that once existed at Nolichucky, which have been lost due to the accumulation of sediment. Alternatives C and D also would resolve the potential flooding impacts; however, both of these alternatives would cost more than Alternative B, could or would have adverse effects on the environment, and would partially or fully eliminate Nolichucky Reservoir.

Under Alternative A, TVA would provide information to help agencies and individuals recognize the potential for flooding impacts and would maintain present recreational uses on Nolichucky Reservoir. This alternative would not include any additional cost and would not cause any additional environmental impacts. Adoption of this alternative would result in little or no change in the floodplain elevations around the reservoir (see Appendix E), and existing federal land and landrights would be retained. Under this alternative, TVA also would continue the existing agreements to allow waterfowl management and operation of the environmental education area and public parks in the area. Nolichucky Dam and Powerhouse would continue to be maintained as required by federal dam safety regulations and to preserve their historic value. After considering all of the information and evaluation included in this EIS and the public comments on the Draft EIS, TVA has decided that Alternative A (No Action) is the agency preferred alternative.