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SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

NORMANDY DAM DROUGHT RESPONSE RELEASE CHANGE

Coffee, Bedford, Marshall, and Maury Counties, Tennessee

LEAD AGENCIES

TENNESSEE VALLEY AUTHORITY
Prepared in partnership with the
TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

COOPERATING AGENCIES

U.S. FISH AND WILDLIFE SERVICE
TENNESSEE WILDLIFE RESOURCES AGENCY

FEBRUARY 2008

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The Proposed Action and Need

Normandy Reservoir is Tennessee Valley Authority's (TVA) largest nonpower tributary storage project and is located on the Duck River in Central Tennessee (Figure 1). The dam is located on the Duck River at Duck River Mile (DRM) 248.6, in Bedford and Coffee counties, Tennessee, about 1.5 miles upstream from the community of Normandy and 8 miles north of Tullahoma, Tennessee. It is 12 miles east of Shelbyville, Tennessee.

Middle Tennessee is experiencing an exceptional drought, and consequently, the pool elevation of Normandy Reservoir is much lower than normal (Figure 2). This reservoir is the source of water for the Duck River Utility Commission (DRUC), which serves the cities of Tullahoma and Manchester. The unusually low reservoir pool increases the pumping and treatment costs for DRUC, as water must be pumped from a lower elevation and from a zone of less desirable water quality. If drought conditions persist and the water level in Normandy Reservoir drops too low, the DRUC intake and pumps could become inoperable and would require emergency modifications to the existing intake or installation of floating pumps to access deeper water. The Bedford County Utility District, Spring Hill, Shelbyville Water System, Lewisburg Water System, and Columbia all obtain their water from the Duck River downstream of Normandy Dam and during much of the year are dependent on releases from the dam.

The State of Tennessee (see letter dated February 1, 2008, in Appendix A) has requested that TVA temporarily reduce the volume of water released from Normandy Dam. Specifically, the Tennessee Department of Environment and Conservation (TDEC) has asked that TVA reduce the flow as measured at Shelbyville (DRM 221.4) from 120 cubic feet per second (cfs) to 80 cfs until May 31, while maintaining a minimum flow of at least 40 cfs from Normandy Dam. A second control point would be established downstream of Shelbyville at the Milltown gauge (DRM 180.2). Total flow at the Milltown gauge would be maintained at no less than 165 cfs (80 cfs minimum flow at Shelbyville with additional local inflow) to ensure water quality and quantity needs are met downstream. The proposed change would conserve water in Normandy Reservoir to help meet the needs of the DRUC and other users of Normandy Reservoir. Furthermore, if the drought persists, the proposed change would better ensure that more water is available in later months to help reduce potential impacts downstream of Normandy Reservoir.

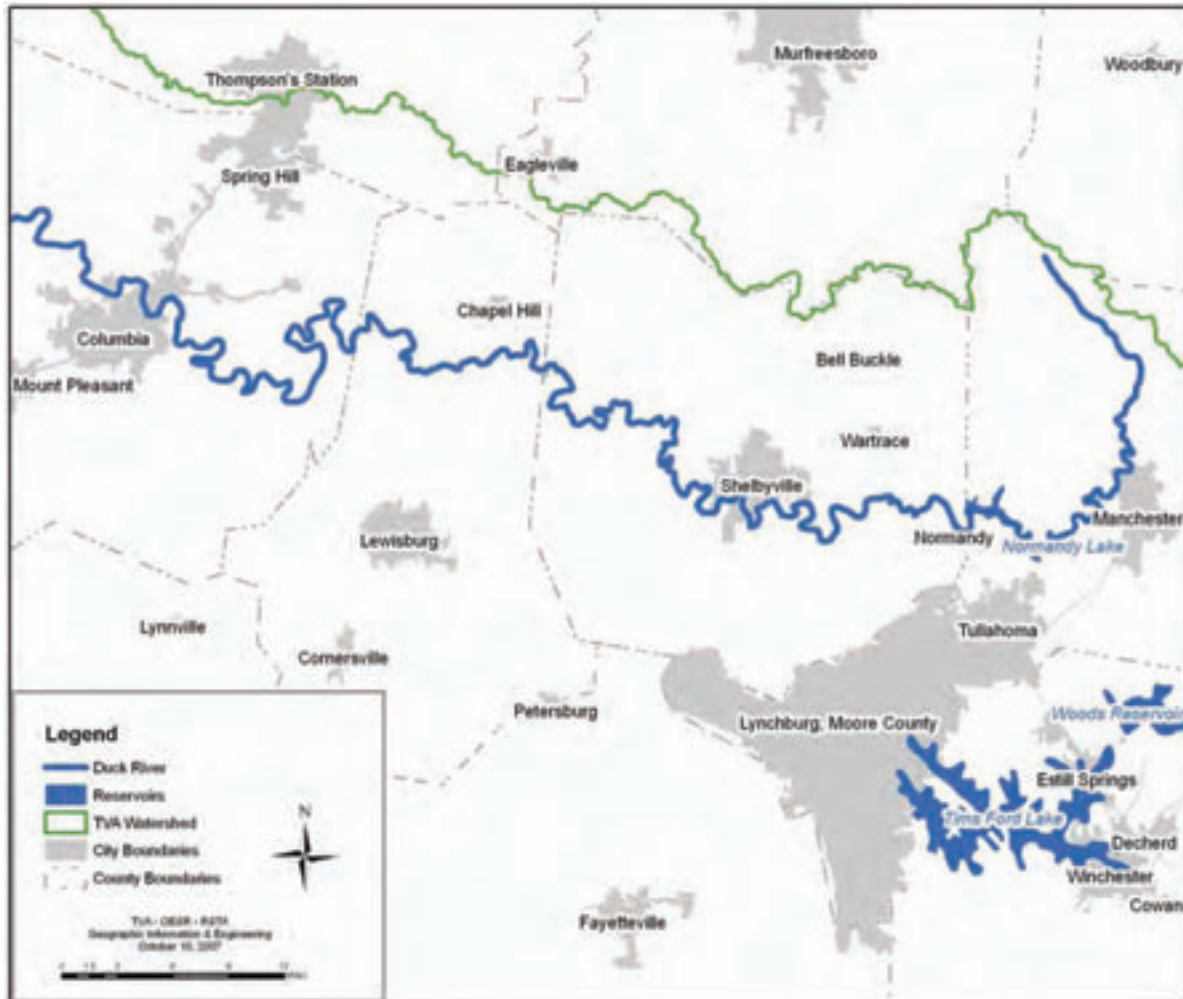


Figure 1. Normandy Reservoir and the Duck River

Historic Background

TVA provides a minimum flow of 40 cfs from Normandy Dam to sustain aquatic habitat in the reach immediately downstream of the dam. In addition, TVA provides flows larger than 40 cfs as required to supplement downstream local inflow in order to maintain seasonally varying minimum flows at Shelbyville, DRM 221.4. The Shelbyville minimum flows are currently 155 cfs for the period June 1 through November 30 and 120 cfs for the period December 1 through May 31. The period of January 2007 through January 2008 is among the driest on record in 118 years. Because of these historic drought conditions across the Tennessee Valley during the past year, TVA has been releasing only enough water to protect aquatic species and to provide adequate water supply and assimilative capacity for the municipal and industrial outfalls downstream. January 2007 through January 2008 release data from Normandy Dam are graphically shown in Figure 3, along with the corresponding flow at Shelbyville, DRM 221.4. The current operating guidelines for water releases from Normandy Dam are outlined in TVA's environmental impact statements (EISs) entitled *Future Water Supply Needs in the Upper Duck River Basin* (TVA 2000) and *Reservoir Operations Study* (TVA 2004).

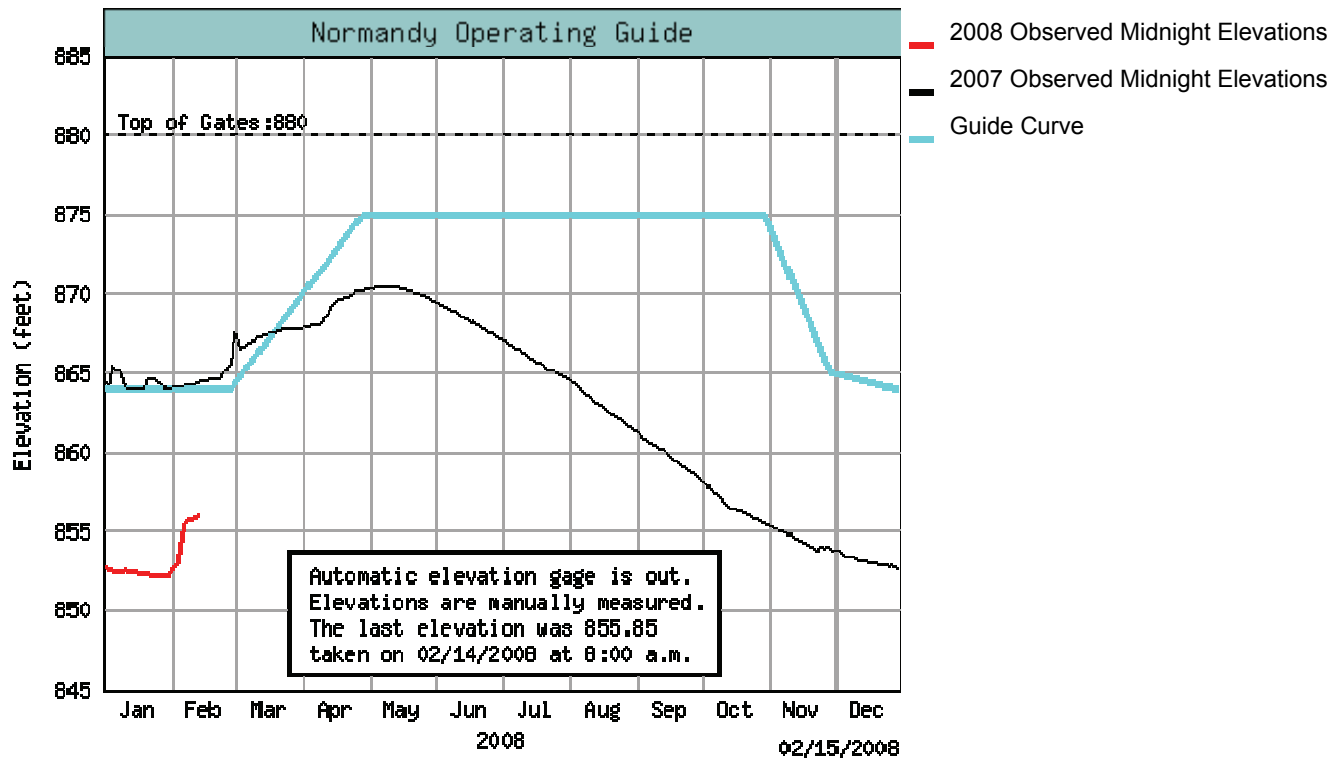


Figure 2. 2007 and Current Reservoir Elevations Compared to Normal Operating Guide

In October 2007, TVA prepared an environmental assessment (EA)—hereafter referred to as the 2007 EA—and issued a finding of no significant impacts to temporarily change the Normandy Dam release schedule by immediately reducing the minimum flow as measured at Shelbyville (DRM 221.4) from 155 cfs to 120 cfs. This change was also requested by TDEC. It implemented the flow reduction a few weeks earlier than normal. This document supplements the 2007 EA. The change in releases assessed in that EA occurred in two increments. The first increment was a reduction from 155 cfs to 140 cfs, where it was maintained for two weeks. After it was determined that this reduction was not having harmful effects on downstream resources, a second reduction from 140 cfs to 120 cfs was implemented. As part of the action, TDEC, TWRA, and USFWS conducted biological and physical habitat monitoring at Lillard Mill to document the change in aquatic habitat, as measured by the wetted area, resulting from the proposed flow reduction. The 2007 EA describes this program in detail, and the newer data included in this SEA and referenced in the February letter from TDEC are a result of that effort.

The 2007 EA concluded that the proposed change in the release schedule would have no or minimal impacts on cultural resources, prime farmland, land use, Wild and Scenic Rivers, streams listed on the Nationwide Rivers Inventory, floodplains and flood risk, wetlands, vegetation, wildlife, and invasive species. In addition, the 2007 EA determined there would be no release of air emissions, wastewater, or solid or hazardous waste. TVA also concluded the proposed change would marginally improve recreation on Normandy Reservoir compared to the No Action Alternative and would not adversely affect recreational usage of the river downstream of the dam. No impacts to terrestrial animals or plants listed as endangered, threatened, or other special status under the *Endangered Species Act* or by the State of Tennessee were anticipated.

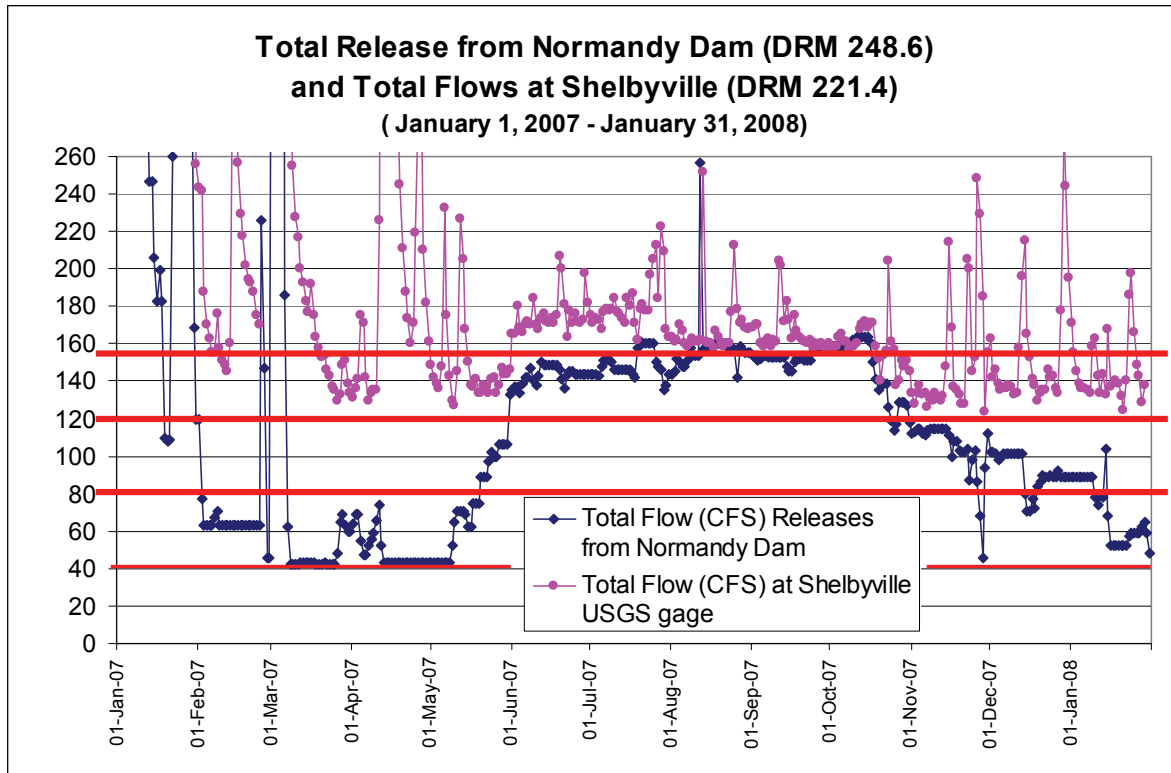


Figure 3. Normandy Dam Releases Compared to Shelbyville Flows

TVA determined that the change proposed last fall did have the potential to affect water quality, endangered and threatened fish and mollusks, and other aquatic life in the Duck River downstream of Normandy Dam for a temporary period. The 2007 EA described these potential impacts and concluded that they would not be significant. In the EA, TVA also concluded that the proposed change would not likely adversely affect federally listed fish or mussel species. This conclusion was based on the implementation of the monitoring program and TVA's commitment to increase flows if monitoring results showed that the release change was adversely affecting aquatic species and/or water quality.

TVA initiated the flow change on October 17, 2007. In the 2007 EA, TVA predicted that water levels in the Normandy Reservoir would fall to 850 feet in elevation by December 1, 2007, with continuing drought. Since then, TVA has carefully managed the discharge from Normandy to meet minimum flows of 120 cfs at Shelbyville and conserve water in Normandy Reservoir. Despite this conservation of water, the Normandy Reservoir level has continued to drop, though not as dramatically as it would have absent careful management. The recorded level for Normandy was 857.9 feet on October 5, 2007. On February 4, 2008, the reservoir level was recorded at 852.95 feet, a drop of approximately 5.0 feet. The mean rainfall for January for Normandy is 5.11 inches based on 1935 through 2007 data. As of February 4, 2008, only 3.04 inches of rainfall has been recorded by the TVA gauge at the Normandy Reservoir Dam for 2008.

The TDEC February 1, 2008, request could result in reservoir elevations approximately 1 foot higher per month than would be the case under the current operating policy guidelines and assuming no rainfall. The State of Tennessee believes the current drought,

especially if it continues through 2008, could prove to be a serious public health and safety issue due to the very large number of residents that depend on Normandy Reservoir and the Duck River as their sole source of water supply. Increasing the amount of water in storage means that more water remains in Normandy Reservoir in later months to help ensure that minimum flows can continue to be made that are beneficial for downstream aquatic life, water supply, and assimilative capacity. In addition, the significant biological resources downstream of Normandy Dam could benefit from water management choices taken now rather than more severe actions that may be required later should the drought continue.

DRUC and other area water systems in the Tennessee Duck River Development Agency that rely on Normandy Reservoir and the Duck River have agreed to implement a water conservation plan. Each utility district has formally adopted the water conservation plan, which includes three stages of alert. Spring Hill voted to join the Tennessee Duck River Development Agency in January 2008 and is in the process of considering the plan. Below are excerpts extracted from the "Drought Water Shortage Management Plan:"

These stages are designed to reduce consumption based on existing conditions of drought. A drought will be declared by the Palmer Drought Severity Index through the National Oceanic and Atmospheric Administration within the U.S. Department of Commerce. Stages of alert are implemented in voluntary and mandatory stages in order to provide all customers with life-sustaining essential potable water. Stages of alert are based on Normandy Reservoir's remaining water storage capacity. When the following water elevations on Normandy are reached, the alerts will be issued: Stage I Alert at elevation 864 feet, Stage II Alert at elevation 850 feet, and Stage III Alert at 844 feet. Stage implementation will be broadcast through all local media, utility web site [link to web site](#) and will be posted at the main office building.

Stage 1 (Moderate Shortage/Drought)

Voluntary reduction

All customers are requested to reduce normal consumption of essential use and domestic use by 10%, and all non-essential use by 15%.

Stage 2 (Severe Shortage/Drought)

Mandatory restrictions and prohibited activities include:

Restricted:

- a) watering of lawns, flower and/or vegetable gardens, trees, shrubs, etc., are restricted to assigned days of the week and only from 8:00 PM to 6:00 AM: addresses ending in an even number may water on Wednesday, Friday, or Sunday, and addresses ending in an odd number may water on Tuesday, Thursday, or Saturday*
- b) watering of fairways on any golf course and all ball/athletic fields restricted to sprinkling/irrigation to the hours of 12:01 AM to 5:00 AM*
- c) normal scheduled fire hydrant testing is restricted to 50% of the schedule*

Prohibited:

- a) *washing sidewalks, driveways, parking areas, tennis courts, patios, or any other hard surfaces by commercial, industrial or residential customers except for sanitary or safety purposes;*
- b) *filling or re-filling of swimming pools;*
- c) *non-commercial washing of privately owned vehicles, trailers or boats;*
- d) *use of water for dust control or construction compaction; and*
- e) *fire fighting training.*

Stage 3 (Extreme Shortage/Drought)

Mandatory restrictions and prohibited activities include Stage 2 and are amended as follows:

Restricted:

- a) *commercial nurseries and vegetable gardens will be restricted to absolute minimum usage to keep plants alive;*
- b) *watering of golf course tees and greens may only be watered on Monday, Wednesday and Fridays from 12:01 AM to 5:00 AM, and ball fields may only be watered on Tuesday, Thursday, or Saturday from 12:01 AM to 5:00 AM; and*
- c) *water served for drinking purposes at restaurants or other public or non-public eating establishments are restricted to be served only as requested by the patron or customer.*

Strictly Prohibited:

- a) *residential watering of trees, shrubs, lawns, or flower gardens;*
- b) *watering of golf course fairways; and*
- c) *all non state-mandated line flushing by utilities and fire departments.*

The utility districts would conduct enforcement activities. Failure to comply with water restrictions/prohibitions will result in a warning for the first offense, and termination of services for the second offense. Normal reconnect fees will apply. If no one is able to be contacted in person, the notice of violation will be in the form of door hangers and/or by phone if time constraints allow.

Alternatives

This supplemental EA evaluates two alternatives:

Alternative 1 - No Action. Under this alternative, TVA would continue to operate Normandy Dam by releasing enough water to maintain a minimum flow of 120 cfs at Shelbyville through spring 2008 (May 31). Minimum releases from Normandy Dam would be no less than 40 cfs under Alternative 1.

Alternative 2 - Change Normandy Dam Release Schedule. Under this alternative, the proposed action, TVA would change the Normandy Dam release schedule as requested by the State of Tennessee to reduce the minimum flow at Shelbyville from 120 cfs to 80 cfs as soon as possible through May 31. As part of Alternative 2, TDEC, TWRA, The Nature Conservancy, the U.S. Fish and Wildlife Service (USFWS), and TVA would continue to

model, sample, and monitor aquatic habitat and water quality in the affected reach of the Duck River downstream of Normandy Dam, as outlined in the 2007 EA, and adjust flows to protect endangered species, as indicated by monitoring results. A monitoring plan is outlined in Table 1. In addition to the monitoring plan, the following commitments will be placed on dam operations;

- In order to protect listed species and critical habitat present in the Duck River, TVA would manage discharges to maintain no less than 165 cfs as measured at the Milltown gauge located at DRM 180.2 (80 cfs minimum flow at Shelbyville plus additional local inflow). This would protect sensitive species and their habitat downstream of the Milltown gauge. If at any time, the flow measured at the gauge at Milltown is less than 165 cfs, releases from the dam would be increased until the flow at Milltown reaches 165 cfs. Releases from Normandy Dam would be increased to bring flows above 165 cfs within 24 to 48 hours. Analysis of flow data from 1999 - 2008 indicates that it is unlikely that flows below 165 cfs would be seen at Lillard Mill.
- If the measured ammonia concentration at Halls Mill (DRM 202.1) is greater than 0.3 milligrams per liter (mg/L), TVA would increase releases from the dam until ammonia concentrations are less than 0.3 mg/L or until 120 cfs is measured at Shelbyville. These locations are shown in Figure 4. Flow increases would occur within 24 to 48 hours of TDEC's notification to TVA that ammonia levels have been exceeded.

Under this alternative, minimum releases from Normandy Dam would be no less than 40 cfs. After May 31, TVA would return to its normal operating guideline (155 cfs at Shelbyville from June 1 through November 30). TVA is recommending that TDEC and municipal water and wastewater providers complete a long-term water supply plan for the Duck River. Should TDEC and municipal water and wastewater providers prepare a long-term water supply plan for the Duck River, TVA will assist by providing available data and information needed to complete the plan.

Table 1. TDEC Monitoring Plan for Reduced Flows Through May 31, 2008

Monitoring/Sampling Location	Trigger to Initiate Sampling	Constituents Sampled	Trigger to Stop Monitoring	Sampling Frequency
Shelbyville U.S. Geological Survey (USGS) gauge	Immediate monitoring	Flow (in cfs)	Monitoring ends May 31, 2008	Daily
Sample Location 1 - upstream of both Shelbyville Sewage Treatment Plant (STP) outfall and Tyson outfall (DRM 221.2)	One sample during next flow recession at Shelbyville gauge Bimonthly sampling would begin with a reduction of flow (Shelbyville gauge) below 120 cfs	Stevens probe - DO, pH, temperature, and conductivity Grab Sample - BOD, TKN, NH ₃ , NO ₂ -NO ₃ , pH, and chlorine	Flows at Shelbyville gauge exceed 120 cfs	Stevens probe - every 30 minutes - downloaded bimonthly Grab samples - bimonthly
Sample Location 2 - one mile downstream of Tyson Outfall (DRM 219.2)	One sample during next flow recession at Shelbyville gauge Bimonthly sampling would begin with a reduction of flow (Shelbyville gauge) below 120 cfs	Stevens probe - DO, pH, temperature, and conductivity Grab Sample - BOD, TKN, NH ₃ , NO ₂ -NO ₃ , pH, and chlorine	Flows at Shelbyville gauge exceed 120 cfs	Stevens probe - every 30 minutes - downloaded bimonthly Grab samples - bimonthly
Sample Location 3 - Sims Bridge (DRM 216.2)	One sample during next flow recession at Shelbyville gauge Bimonthly sampling would begin with a reduction of flow (Shelbyville gauge) below 120 cfs	Stevens probe - DO, pH, temperature, and conductivity Grab Sample - BOD, TKN, NH ₃ , NO ₂ -NO ₃ , pH, and chlorine	Flows at Shelbyville gauge exceed 120 cfs	Stevens probe - every 30 minutes - downloaded bimonthly Grab samples - bimonthly
Sample Location 4 - Halls Mill (DRM 202.1)	One sample during next flow recession at Shelbyville gauge Bimonthly sampling would begin with a reduction of flow (Shelbyville gauge) below 120 cfs	Stevens probe - DO, pH, temperature, and conductivity Grab Sample - BOD, TKN, NH ₃ , NO ₂ -NO ₃ , pH, and chlorine	Flows at Shelbyville gauge exceed 120 cfs	Stevens probe - every 30 minutes - downloaded bimonthly Grab samples - bimonthly
Sample Location 5 - Lillard Mill (DRM 179.1)	One sample during next flow recession at Shelbyville gauge Bimonthly sampling would begin with a reduction of flow (Shelbyville gauge) below 120 cfs	Stevens probe - DO, pH, temperature, and conductivity Grab Sample - BOD, TKN, NH ₃ , NO ₂ -NO ₃ , pH, and chlorine	Flows at Shelbyville gauge exceed 120 cfs	Stevens probe - every 30 minutes - downloaded bimonthly Grab samples - bimonthly
Milltown gauge station	Immediate monitoring	Flow (in cfs)	Monitoring ends May 31, 2008	Daily
Lillard Mill	Flow at Milltown gauge drops below 165 cfs	Survey to determine if mussels are stranded or near stranding	Flows at Milltown gauge exceed 165 cfs	Daily

Definitions:

Bimonthly means every other week
 BOD = Biochemical oxygen demand
 DO = Dissolved oxygen

NH₃ = Ammonia
 NO₂-NO₃ = Nitrate-Nitrite
 pH = Potential of hydrogen; a measure of acidity

TKN = Total kjeldahl nitrogen

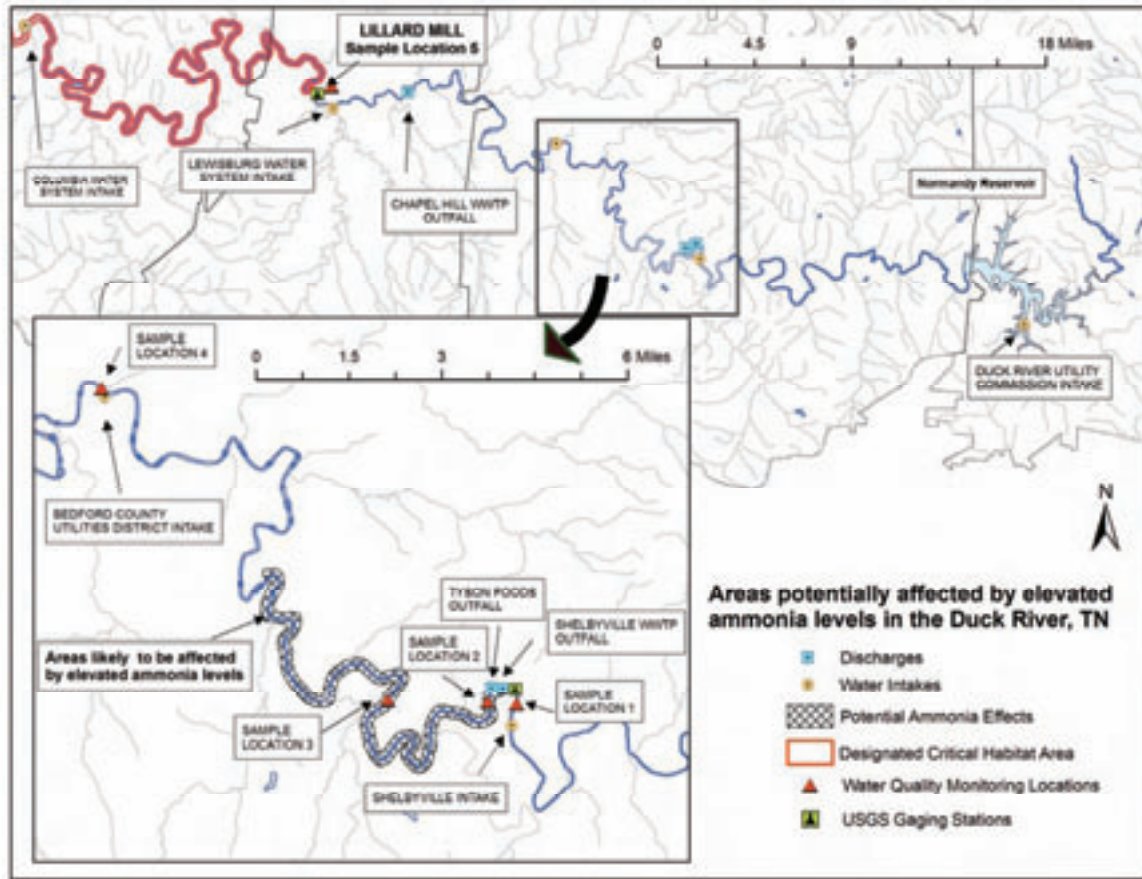


Figure 4. Locations of Sampling Stations, Gauges, and Areas Likely to be Affected by Elevated Ammonia Levels

Affected Environment and Evaluation of Impacts

Site Description

The Duck River is the longest river contained within the borders of Tennessee. Although the river’s supporting watershed is quite large, the karst terrain in the basin impacts the amount of water available for off-stream uses. This is most notable during periods of little precipitation. October 2007 through January 2008 rainfall is 71 percent of normal, and runoff is 41 percent of normal for the entire Tennessee River Basin. The National Weather Service is currently forecasting an easing of drought conditions over the next several months, but the drought is expected to continue over that time frame.

Four wastewater discharges and four water intakes are present between Shelbyville to DRM 70: the Shelbyville Wastewater Treatment Plant (WWTP), Tyson Foods, Chapel Hill WWTP, and the Columbia WWTP. The Lewisburg WWTP discharges into Big Rock Creek, which enters the Duck River in this reach. Bedford County and the cities of Shelbyville, Lewisburg, and Columbia have water supply intakes.

Information presented in the 2007 EA, the Columbia Land Use EIS (TVA 1999), and an EIS addressing water supply needs in the Upper Duck River Basin (TVA 2000) shows that the Duck River supports one of the most species-rich aquatic communities in North America.

Species in the vicinity include six mussels federally listed as endangered: birdwing pearlymussel, Cumberlandian combshell, Cumberland monkeyface, oyster mussel, pale lilliput, and tan riffleshell; one fish federally listed as endangered: pygmy madtom; and three federal candidate mussel species: fluted kidneyshell, slabside pearlymussel, and spectaclecase. The Duck River from DRMs 133 to 179 in Maury and Marshall Counties is federally designated critical habitat for the oyster mussel and the Cumberlandian combshell.

Impacts Evaluated and Consequences

TVA determined the proposed temporary change in discharges from Normandy Dam would have no or minimal impacts to cultural resources, prime farmland, land use, Wild and Scenic Rivers, streams listed on the Nationwide Rivers Inventory, wetlands, floodplains and flood risk, vegetation, wildlife, invasive species, air emissions, wastewater streams, or solid or hazardous waste. These resources are not further addressed in this SEA.

Downstream Water Availability

Stream cross-section data were used to verify that Shelbyville, Lewisburg, and Columbia have weirs to impound water that are sufficient to cover their water supply intakes at the proposed discharge level. This was confirmed in telephone conversations with personnel from these water providers. Although the Bedford County Utility District does not have a weir in front of its intake, the intake is in the middle of a pool in the river channel and is covered with several feet of water. The utility district anticipates no difficulty in obtaining water if the stream flow is reduced. There should be sufficient water to continue to cover downstream municipal water intakes if flows are reduced during this temporary period.

Water Quality and Aquatic Life

TVA currently operates Normandy Dam to provide a minimum release of 40 cfs of water in the Normandy Dam tailrace. This minimum flow ensures that water quality and aquatic habitat in the reach of river between Normandy Dam (DRM 249) to Shelbyville (DRM 221.4) are maintained. No changes to the existing minimum release are proposed, and existing aquatic communities in this reach would be maintained.

The Duck River downstream of Shelbyville could be affected by reductions in available aquatic habitat and reductions in dissolved oxygen (DO) levels. In addition to these potential effects, four wastewater outfalls (and outflow from the Lewisburg WWTP discharge into Big Rock Creek) are present in this reach. There is the potential for impacts related to waste assimilation issues in this reach of the river, particularly from nitrogen compound releases and on DO levels from a biological oxygen demand perspective.

As part of the 2007 EA, TDEC, TWRA, The Nature Conservancy, FW&S, and TVA have jointly implemented an effort to model, sample, and monitor aquatic habitat and water quality in the affected reach of the Duck River downstream of Normandy Dam. Data from this effort were used for the following analyses.

Dissolved Oxygen (DO)

TDEC has modeled the response of DO and nitrogenous biological oxygen demand (NBOD) in the Duck River assuming a flow at Shelbyville of 80 cfs. The modeling runs predict that DO would remain higher than 8 mg/L at all locations with a flow of 80 cfs past

Shelbyville (Figure 5). The simulated DO in Figure 5 is reasonably comparable with the modeling shown in the 2007 EA. The major difference is that the DO concentrations in Figure 5 are higher than shown in that EA. This would be consistent with lower temperature for this time of year. In addition, the DO changes for the various flow rates behave as one would expect with the differences in DO between the 120 cfs simulation and the 100 cfs simulation being less the difference between the 80 cfs and the 60 cfs simulations.

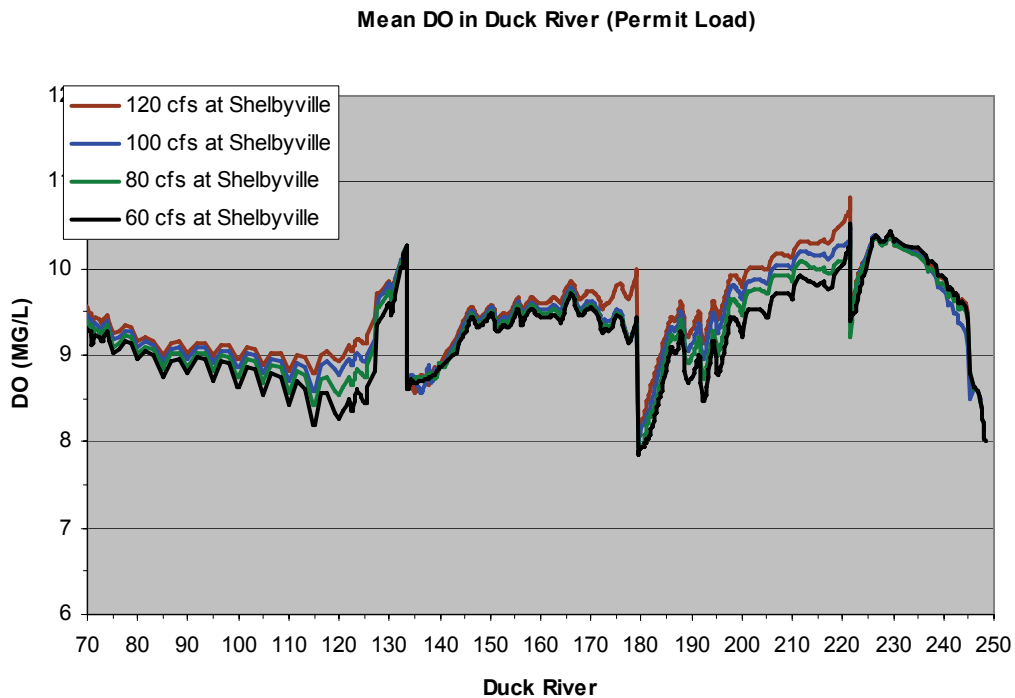


Figure 5. Mean Dissolved Oxygen Concentrations in the Duck River Resulting From Various Flow Requirements at Shelbyville

Ammonia (NH₃)

A reduction of the minimum flow at Shelbyville from 120 cfs to 80 cfs during the remaining winter months and early spring could impact the capacity of Duck River to assimilate the wastewater effluent from the Tyson Foods processing plant and the Shelbyville Wastewater Treatment Plant (WWTP). Ammonia is known to be acutely and chronically toxic to aquatic life at certain concentrations.

TDEC has modeled the response of DO and NBOD in the Duck River during a flow at Shelbyville of 80 cfs (dividing the model output for NBOD by 4.33 yields ammonia in mg/L; 4.33 was the ratio used in the model). The model run assumed concentrations of 40 mg/L of ammonia in the Tyson discharge (monthly average concentration allowed under permit) and 7 mg/L of ammonia in the Shelbyville WWTP discharge (conservative assumption based on review of similar WWTPs). Average monthly ammonia concentrations for the Tyson discharge were 27.5 mg/L in November 2007 and 36.5 mg/L in December 2007. No ammonia concentration data were collected for the Shelbyville discharge, but a review of

data for similar treatment plants suggests that the discharge concentration would be less than 1 mg/L on average. The discharge flows were based on reported average dry weather flows and were 1.3 millions of gallons per day (MGD) for Tyson and 2.6 MGD for Shelbyville.

The modeling predicts in-stream ammonia concentrations at about 1.29 mg/L immediately downstream of Tyson (5.6 mg/L of NBOD on Figure 6 divided by the ratio of 4.33) and decreasing steadily with increasing distance downstream (Figure 6). The ammonia concentration pattern with river mile, as simulated by NBOD and shown in Figure 6, is consistent with the 2007 EA with the initial spike in ammonia levels due to the Tyson Foods and Shelbyville discharge followed by the decrease to background concentrations.

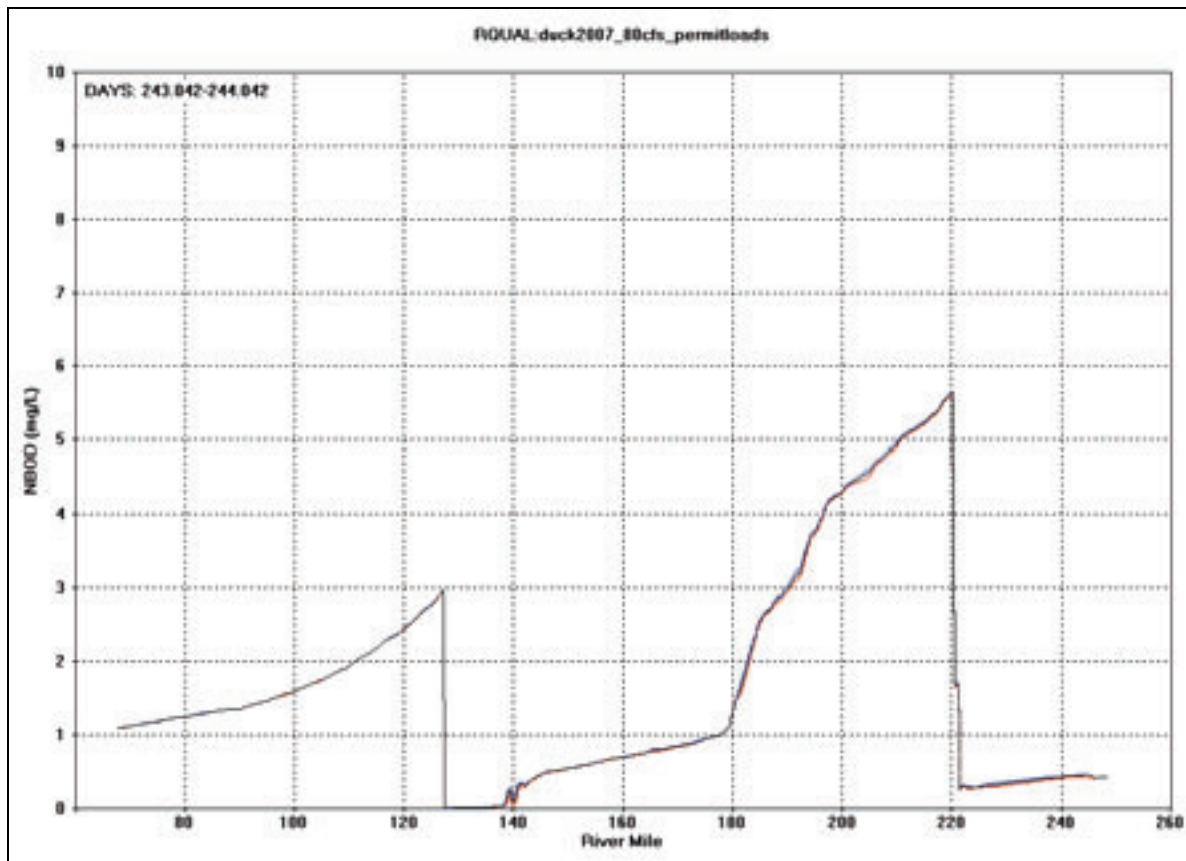


Figure 6. Predicted Nitrogenous Biological Oxygen Demand Levels in the Duck River Downstream of Shelbyville

TDEC's modeling predicts that ammonia concentrations would be less than (<) 0.3 mg/L (1.2 mg/L NBOD from Figure 6 divided by the ratio of 4.33) at DRM 180, which is 40 miles downstream from the Tyson discharge. The model is limited in the ability to take into account additional stream inflows so it is only modeling a flow of 80 cfs for the entire 180 mile stream reach. This model is very conservative in its estimates of in-stream ammonia levels, and was used primarily to identify areas that could potentially be affected by elevated ammonia levels, and identify appropriate monitoring points. Data collected from Duck River in October and November 2007 indicated that ammonia is assimilated perhaps more rapidly in the river than the model predicts. Ammonia concentrations measured about

4 miles below the Tyson discharge were less than 20 percent of the concentrations measured immediately below the discharge. Therefore ammonia concentrations of <0.3 mg/L should be observed in less than 40 miles downstream of the outfalls at a flow of 80 cfs (see Figure 4). Higher flows would result in more dilution of the ammonia plume, assimilation would be quicker, and the potential to affect aquatic life would be reduced further.

The ammonia levels predicted by TDEC modeling are below the current U.S. Environmental Protection Agency (USEPA) criteria for protection of aquatic organisms. No long-term adverse effects to common aquatic organisms or fisheries resources are expected to occur in the reach of river downstream of Shelbyville, except possibly to mollusks.

Mollusks

Recent research indicates that freshwater mussels could be negatively affected by ammonia concentrations that are much lower than the current USEPA criteria (Wang et al. 2007). Several more common species of mussels and two federal candidate mussels (fluted kidneyshell and slabside pearl mussel) are known to be present within the Duck River between DRMs 221 and 211. None of the federally listed mussels present in the Duck River have been recently reported from areas that could be affected by elevated ammonia concentrations (Ahlstedt et al. 2004).

The ammonia concentrations predicted by TDEC modeling would be at levels that could cause chronic, sublethal adverse effects on freshwater mussels, based on this recent research. The effects likely include inhibition of growth and reproduction and physiological stress. Cooler winter and spring temperatures would moderate these effects to some degree.

Threatened and Endangered Aquatic Species

One of the primary potential impacts to listed aquatic species would be from increases in ammonia concentrations downstream of Shelbyville. Recent surveys have not found any federally listed mussels in the vicinity of Shelbyville or within 30 miles downstream of Shelbyville. The first records for federally listed mussels are in the vicinity of Lillard Mill (DRM 179), 32 miles downstream of the area that could be affected by increased ammonia concentrations.

Two federal candidate species are known from the Duck River in the vicinity of Shelbyville and downstream to Lillard Mill: fluted kidneyshell and slabside pearl mussel. Ahlstedt et al. (2004) considered the fluted kidneyshell to be extirpated from the Duck River during their 2002 surveys but commented that it would be a good candidate for reintroduction. A recent Duck River record of fluted kidneyshell results from a reintroduction effort by TWRA (Don Hubbs). Individuals collected from the Clinch River were stocked at DRM 221.4, upstream of the Shelbyville and Tyson outfall. Ahlstedt et al. (2004) characterized the slabside pearl mussel as common in the Duck River, making up 3 percent of the number of mussels collected in their 2002 effort and most abundant in the downstream reaches of the river. Only one individual is known from within the 20-mile reach of the Duck River downstream of the WWTP outfalls at Shelbyville. Therefore, although individuals of both these federal candidate species could experience sublethal effects due to increased ammonia concentrations in the reach of the Duck River downstream of Shelbyville, it is unlikely that any (or many) fluted kidneyshells would have migrated downstream since

October 2004 to be affected by elevated ammonia concentrations. The slabside pearlymussel is documented by Ahlstedt 2004. A slabside pearlymussel population is apparently not robust in this area, as indicated by a single individual located at DRM 208, 12 miles downstream of the Shelbyville outfalls. Any sublethal ammonia impacts would not adversely affect the slabside pearlymussel population, which was described as abundant in downstream reaches. No federally listed species are known from this reach. Cooler winter and spring temperatures would moderate these effects to some degree. The requirement to increase flows if bimonthly (occurring every other week) monitoring indicates ammonia concentrations at the chronic level of impact (0.3 mg/L or above as measured at DRM 202.1 - Halls Mill) would further ensure protection of federally listed species.

Lillard Mill

Lillard Mill (DRM 179.0) represents the upstream limit of distribution for the listed mussel species present in the Duck River. Because so many listed species are found at this site, potential impacts to in-stream habitat resulting from flow reductions at Shelbyville are a concern. On October 31, 2007, and November 9, 2007, personnel with TDEC, TWRA, and USFWS surveyed habitat as it relates to river stage (elevation) and measured stream discharge at Lillard Mill. U.S. Geological Survey (USGS) gauge data were compared with the survey data and were found to be consistent (Table 2). Mussels were observed within an inch of the water surface on November 9, 2007 (at a flow of 156 cfs), and would have been stranded if water levels dropped further.

Table 2. Milltown Gauge Readings Compared to Measured In-Stream Flows at Lillard Mill

Date	Milltown Gauge Reading (average daily discharge)	Measured Flow at Lillard Mill
October 31, 2007	167 cfs	164 cfs
November 9, 2007	162 cfs	156 cfs

The survey data, gauge data, and observations of mussels at the site are the basis for TDEC's recommendation that the releases from Normandy ensure that the flow at the Milltown gauge be maintained at no less than 165 cfs. TVA would monitor flows on a daily basis to maintain appropriate flows at Lillard Mill. Because no mussels were observed to be exposed at a flow of 162 cfs (as measured at the Milltown gauge) setting a minimum flow of 165 cfs at the Milltown gauge would protect mussels from stranding. If flow falls below 165 cfs, TVA would increase releases from Normandy Dam to raise the flow to 165 cfs or greater. Flow is not likely to drop below this level, however, if it does, TVA can augment flows within 24 to 48 hours. If at any time during the period described in this SEA flows drop below 165 cfs at Milltown, TVA, TWRA, and USFWS would perform biological and physical habitat monitoring at Lillard Mill with the assistance of TDEC and The Nature Conservancy.

Impacts to listed mussels would not occur unless flows fell below 162 cfs. Freshwater mussels employ various methods to avoid exposure when water levels fall including burrowing deeper into the substrates or lateral movement to wet areas, and can tolerate short periods (several days) of drying by tightly closing their valves to conserve moisture.

A review of the USGS gauge data for the past two months (provisional data) indicates that flows in the Upper Duck River watershed tributaries have recovered such that the stranding

of mussels is not likely at Lillard Mill, or at any point downstream of Lillard Mill, provided a minimum flow of 165 cfs is maintained at Lillard Mill.

Water Quality Monitoring

Because of the concerns about impacts to the mussels, TDEC proposes to monitor the water quality below Shelbyville in two phases. The first phase of monitoring would begin immediately under present conditions while a minimum of 120 cfs is maintained at Shelbyville. The second phase would be conducted when the minimum flow at Shelbyville is 80 cfs and would employ the same methods (described below).

Ammonia monitoring would occur at three stations in the vicinity of Shelbyville, a station at DRM 202.1 (Halls Mill), and at Lillard Mill (DRM 179.1) (Figure 2). The three stations in the vicinity of Shelbyville would be located upstream of Shelbyville (DRM 221.3), downstream of both the Shelbyville WWTP outfall and the Tyson outfall (DRM 220.2), and at Sims Bridge (216.2). The USFWS and TWRA have requested Whole Effluent Toxicity (WET) testing for potentially problematic outfalls. TDEC will require additional WET testing by permit holders as conditions warrant.

Monitoring would begin with the deployment of four meters (“Stevens probes”) and the collection of grab samples by TDEC staff. The Stevens probes would be programmed to record DO, pH, temperature, and conductivity at half-hour intervals, and the meters would be serviced and the data retrieved every two weeks. Bimonthly grab samples would be collected and analyzed for BOD, TKN, NH₃, NO₂-NO₃, pH, and chlorine at the five locations listed in Table 1. A grab sample would also be collected from the outfall of Tyson Foods and the Shelbyville WWTP outfall prior to any reduction in flow at Shelbyville. The outfall samples would be analyzed for the same parameters as the in-stream samples.

The locations downstream of the Tyson and Shelbyville WWTP outfalls for the deployment of the Stevens probes and the collection of in-stream grab samples would be at the point below which effluent is mixed with the river flow and where the maximum impacts are predicted by modeling. The monitoring station at Halls Mill (DRM 202.1) would be established to identify the presence of elevated in-stream ammonia levels before these levels would be observed in areas occupied by listed mussels. Halls Mill is located some 25 miles upstream of Lillard Mill. In-stream grab samples would also be collected at Lillard Mill to verify that ammonia does not reach harmful levels where listed mussels are present.

TDEC would monitor water quality as outlined in the monitoring plan and report results to TVA, USFWS and TWRA on a bimonthly basis. In the event that the monitoring results show ammonia levels equal to or greater than 0.3 mg/L at the Halls Mill station TVA would increase flows as appropriate up to the normal operating guide level (120 cfs at Shelbyville). Because grab samples would be collected bimonthly, mussels downstream of Halls Mill would be exposed to elevated ammonia levels for no more than 14 days. This amount of time is of a shorter duration than is considered chronic exposure.

Because the proposed action would only be implemented in February-May 2008, and normal operations would resume in June 2008, no long-term adverse effects on aquatic habitat or species are anticipated. Local inflows below Normandy Dam are beginning to recharge, and this should also help ameliorate the effect of temporarily reducing discharges from the dam.

In light of the above, TVA has determined that all mussel species, including threatened and endangered species, would not likely be adversely affected by temporarily reducing the discharge from Normandy Dam such that 80 cfs would be maintained at Shelbyville, provided that the minimum instantaneous flow at the dam is not less than 40 cfs and the flow at the Milltown gauge is maintained at no less than 165 cfs. This would help preserve more water for use later in the summer if the drought persists and help offset potential impacts on sensitive downstream resources, including listed species that could otherwise occur because of drought-induced low flows.

Because neither water quality nor quantity would be adversely affected in the portion of the Duck River designated as critical habitat for the oyster mussel and Cumberlandian combshell (DRMs 133-179), this action would not result in the adverse modification of this designated critical habitat. USFWS concurred with this determination on February 15, 2008. See Appendix A.

Recreation

The Duck River with reduced flows, as cited, would continue with sufficient mean depth, velocity, and surface area to provide recreation opportunities at similar levels as are currently available. This area below Normandy Dam has a variety of game fish species that would continue to be available, and anglers would adapt to the necessary lures, methods, bag limits, and seasons to catch these fish. Local fishing outfitters would transition to providing guide services for the game fish as available. Flow conditions would support paddle sports and float-related recreation, with canoe outfitters and local canoe and kayak enthusiasts still consulting TVA's release schedule to understand which release conditions provide for safe and adequate water levels for river use. Holding more water in the reservoir also would help ameliorate the impacts of drought conditions on water-based reservoir recreation opportunities like motor boating, jet skiing, swimming, and fishing.

Commitments

1. TVA would monitor flows at the Shelbyville and Milltown gauges daily. From the date of initiation through May 31, 2008, flows measured at Shelbyville and the Milltown gauge will be maintained at no less than 80 cfs and no less than 165 cfs, respectively.
2. Instantaneous flow at Normandy Dam shall be not less than 40 cfs.
3. TDEC will continue to monitor and sample water quality as discussed above during the period of changed flows and would provide monitoring data to TVA, USFWS, and TWRA bimonthly and coordinate additional monitoring as appropriate.
4. In the event that monitoring and sampling results show that reduced flow is adversely affecting in-stream habitat and/or water quality in excess of the effects predicted here, TVA would increase flows as appropriate up to the normal operating guide level after coordinating with TDEC, USFWS, and TWRA.
5. Should TDEC and municipal water and wastewater providers prepare a long-term water supply plan for the Duck River, TVA will assist by providing available data and information needed to complete the plan.
6. If at any time during the period described in this SEA flows drop below 165 cfs at Milltown, TVA, TWRA, and USFWS would perform biological and physical habitat monitoring at Lillard Mill with the assistance of TDEC and The Nature Conservancy.

TVA Preparers

John T. Baxter, Aquatic Biologist Endangered Species
Chuck Bohac, Water Supply Specialist
Jerry Fouse, Recreation Specialist
Michael McCall, Water Quality Specialist
Dave Robinson, Senior NEPA Specialist
Helen Rucker, Manager, NEPA Services
Peggy Shute, Manager, Heritage Services
Bruce Yeager, Program Manager, NEPA Policy

TDEC Preparers

Paul E. Davis, Director, Water Pollution Control
Ming Chen Shiao, Environmental Specialist III
Tim Wilder, Environmental Field Office Manager

TWRA Contributors

David McKinney, Chief of Ecological Services

USFWS Contributors

Steven Alexander, Biologist
Lee Barclay, Field Supervisor

Literature Cited

Ahlstedt, S. A., J. R. Powell, R. S. Butler, M. T. Fagg, D. W. Hubbs, S. F. Novak, S. R. Palmer, and P. D. Johnson. 2004. *Historical and Current Examination of Freshwater Mussels (Bivalvia: Margaritiferidae, Unionidae) in the Duck River Basin Tennessee*. Final report submitted to satisfy the requirements of Tennessee Wildlife Resources Agency Contract FA-02-14725-00, November 2004.

Tennessee Valley Authority. 1999. *Use of Lands Acquired for the Columbia Dam Component of the Duck River Project Final Environmental Impact Statement*. Knoxville, Tennessee.

———. 2000. *Future Water Supply Needs in the Upper Duck River Basin Final Environmental Impact Statement*. Knoxville, Tennessee.

———. 2004. *Reservoir Operations Study Final Environmental Impact Statement*. Prepared in cooperation with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. Knoxville, Tennessee.

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and M. C. Barnhart. 2007. "Chronic Toxicity of Copper and Ammonia to Juvenile Freshwater Mussels (Unionidae)." *Environmental Toxicology and Chemistry* 26(10):2048-2056.

APPENDIX A - CORRESPONDENCE

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STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE, TENNESSEE 37243-0435

JAMES H. FYKE
COMMISSIONER

PHIL BREDESEN
GOVERNOR

February 1, 2008

Ms. Bridgette K. Ellis
Senior Vice-President
Office of Environment and Research
Tennessee Valley Authority
400 W. Summit Hill Drive
Knoxville, TN 37902

Re: Normandy Reservoir Flow Release

Dear Ms. Ellis:

We appreciate TVA's action this past October to temporarily decrease the minimum flow in Duck River at Shelbyville from 155 cubic feet per second (cfs) to 120 cfs. We now find it necessary to again recommend a temporary adjustment to minimum flow in order to address risks presented by the continuing drought. We request an 80 cfs minimum instantaneous flow as measured at Shelbyville until May 31, 2008.

As you well know, Normandy Reservoir was intended to provide water resource benefits including recreation, flood protection, water supply and water quality. It was expected to provide at least 165 cfs at Shelbyville (Duck River Mile 221.4) so that downstream users could meet their needs of water supply and water quality. Following the drought of 1980 and 1981, TDEC concurred with TVA's decision to reduce the instantaneous minimum flow at Shelbyville from 155 cfs to 80 cfs during the winter and spring months (December through May). Then in 1991, in response to a request made by the City of Shelbyville, TVA raised that minimum to 120 cfs at Shelbyville for the winter and early spring months. (Tennessee Valley Authority, 2000, *Future Water Supply Needs in the Upper Duck River Basin* Final Programmatic EIS)

In the Environmental Assessment produced last fall, TVA predicted that with continuing drought, water levels in Normandy Reservoir would fall to the 850 foot level by December 1, 2007. Since then, TVA has carefully managed the discharge from Normandy to satisfy minimum flows and conserve water. On many days since November, releases from Normandy were well below 120 cfs, and often less than 80 cfs (Figure 1). Despite this conservation of water, the reservoir has continued to drop, though not as dramatically as it would have otherwise. Rainfall recorded by the TVA

gage at Normandy Dam for the month of December was 1.63 inches, and as of the 27th, only 1.30 inches of rain was recorded for the month of January. With the continuing drought, the lake has dropped an additional 5.8 feet from 857.9 on October 5, 2007 to 852.1 on January 31, 2008.

TDEC believes that the most prudent course of action is to temporarily adjust the operating guidelines for minimum instantaneous flow at Shelbyville (Duck River Mile 221.4), so that the minimum instantaneous flow at that point is no less than 80 cfs. This temporary adjustment would be in effect until May 31, 2008.

Stage and Discharge

A review of the USGS gage data for the past two months indicate that flows in the Upper Duck River watershed tributaries have recovered such that the stranding of mussels is not likely at Lillard's Mill, or at any point downstream of Lillard's Mill, with a reduction to minimum flow of 80 cfs at Shelbyville. For example, at the end of a period of flow recession on January 21 and 22, 2008, flow at Shelbyville was recorded around 121 cfs. The low flow recorded at Lillard's Mill (USGS gage 03599240 Duck River above Milltown, TN) on the 22nd, was exactly three times greater, or 363 cfs.

On October 31, 2007 and November 9, 2007, personnel with TDEC, TWRA and USFWS surveyed the stage and measured the discharge at Lillard's Mill. The discharge measured on these dates was 164 and 156 cfs, respectively. Mussels were observed within an inch of the water surface on November 9th. USGS gage data is consistent with our survey. Data recorded at the Milltown gage (Lillard's Mill) is 167 cfs average daily discharge on October 31st and 162 cfs average daily discharge on November 9th. The survey, gage data and observations of mussels at the site are the basis for our expectation that a flow at the Milltown gage of 165 cfs or higher will protect mussels.

TDEC proposes to monitor the USGS gage at Milltown during periods of flow recession. When flows recorded at the gage are less than 180 cfs, WPC staff from the Columbia Field Office will visit Lillard's Mill to determine whether mussels are in jeopardy of being stranded. TDEC will consult with TWRA, USFWS, and TVA should these conditions be reached.

Water Quality

We also considered the extent to which a reduction of the minimum flow at Shelbyville from 120 cfs to 80 cfs during the remaining winter months and early spring could impact the capacity of Duck River to assimilate the wastewater effluent from the Tyson processing plant and the Shelbyville Sewage Treatment Plant (STP). TDEC has modeled the response of Dissolved Oxygen (DO) and Nitrogenous Biological Oxygen Demand (NBOD) in the Duck River during a flow at Shelbyville of 80 cfs (dividing the model output for NBOD by the 4.33 model ratio to get ammonia in mg/L.) We used

Ms. Bridgette Ellis
February 1, 2008
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conservative assumptions of 40 mg/L ammonia in the Tyson discharge, and 7 mg/L ammonia for the STP. On these assumptions, DO remain at or above 8 mg/L in the Duck with a flow of 80 cfs past Shelbyville (Figure 2). The modeling predicts instream NBOD of 5.7 mg/L (or NH₃ at about 1.3 mg/L) immediately downstream of Tyson, and decreasing from there (Figure 3).

Monitoring will begin immediately with the deployment of 3 meters (Stevens probes) and collection of grab samples. The Stevens probes will be programmed to record DO, pH, temperature and conductivity at half-hour intervals and the meters will be serviced and data retrieved every two weeks. Grab samples will be collected and analyzed for BOD, TKN, NH₃, NO₂-NO₃ and chlorine. A grab sample will also be collected from the outfall of the STP and analyzed for the same parameters as the in-stream samples.

The locations downstream of the Tyson and STP outfalls for the deployment of the Stevens Probes and the collection of instream grab samples will be selected based on modeling. Instream grab samples will also be collected at Lillard's Mill. Water quality monitoring data collected by TDEC will be reported as it becomes available to Lee Barclay, USFWS, Dave McKinney, TWRA and Peggy Shute, TVA.

Your time and consideration in this matter is greatly appreciated.

Sincerely,



Paul L. Sloan
Deputy Commissioner

PLS:PED:cm

Enclosure

Cc: Lee A. Barclay, Field Supervisor, U.S. Fish and Wildlife Service
David McKinney, TWRA, Division of Environmental Services
Doug Murphy, Executive Director, Duck River Agency

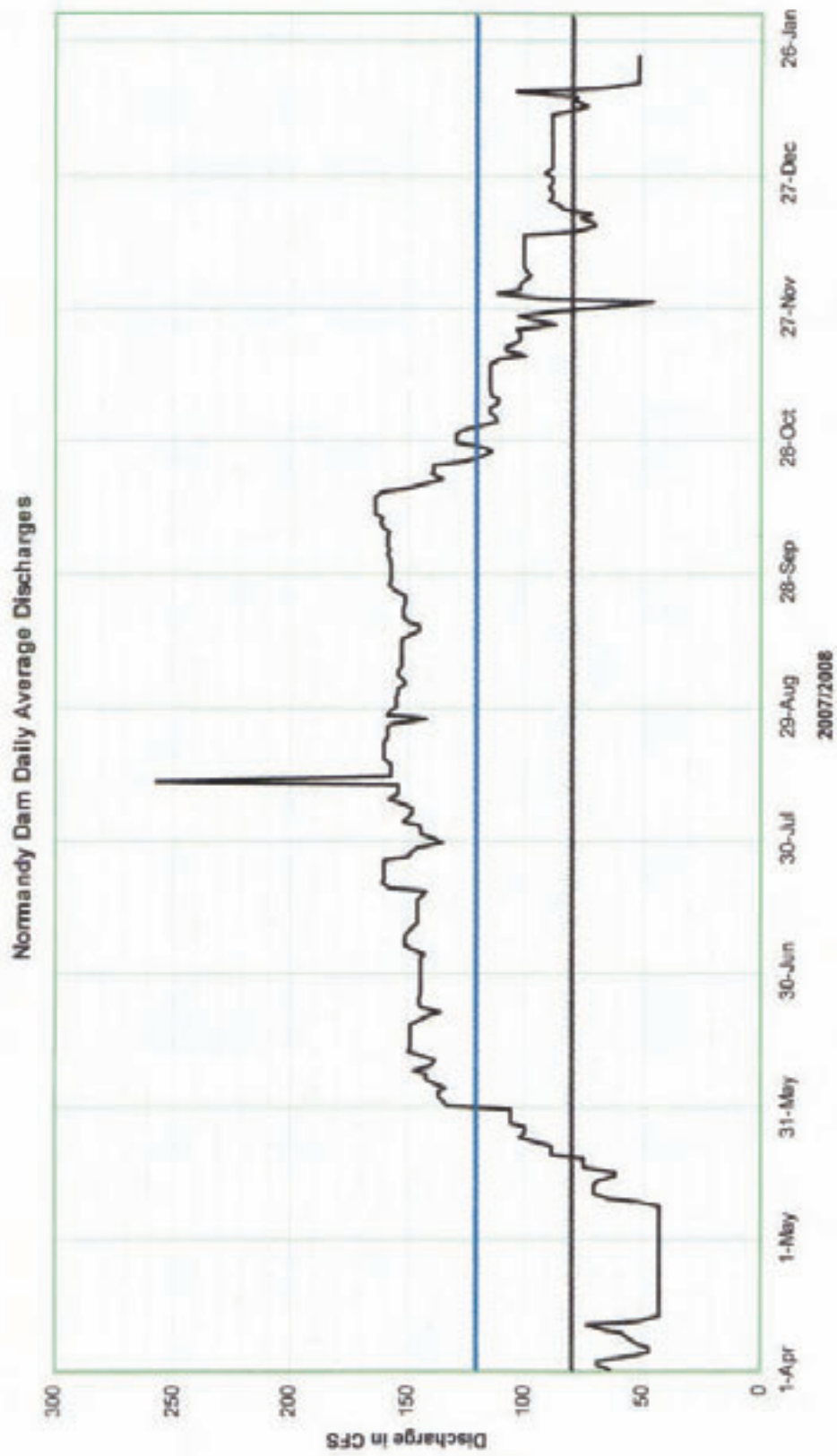


Figure 1

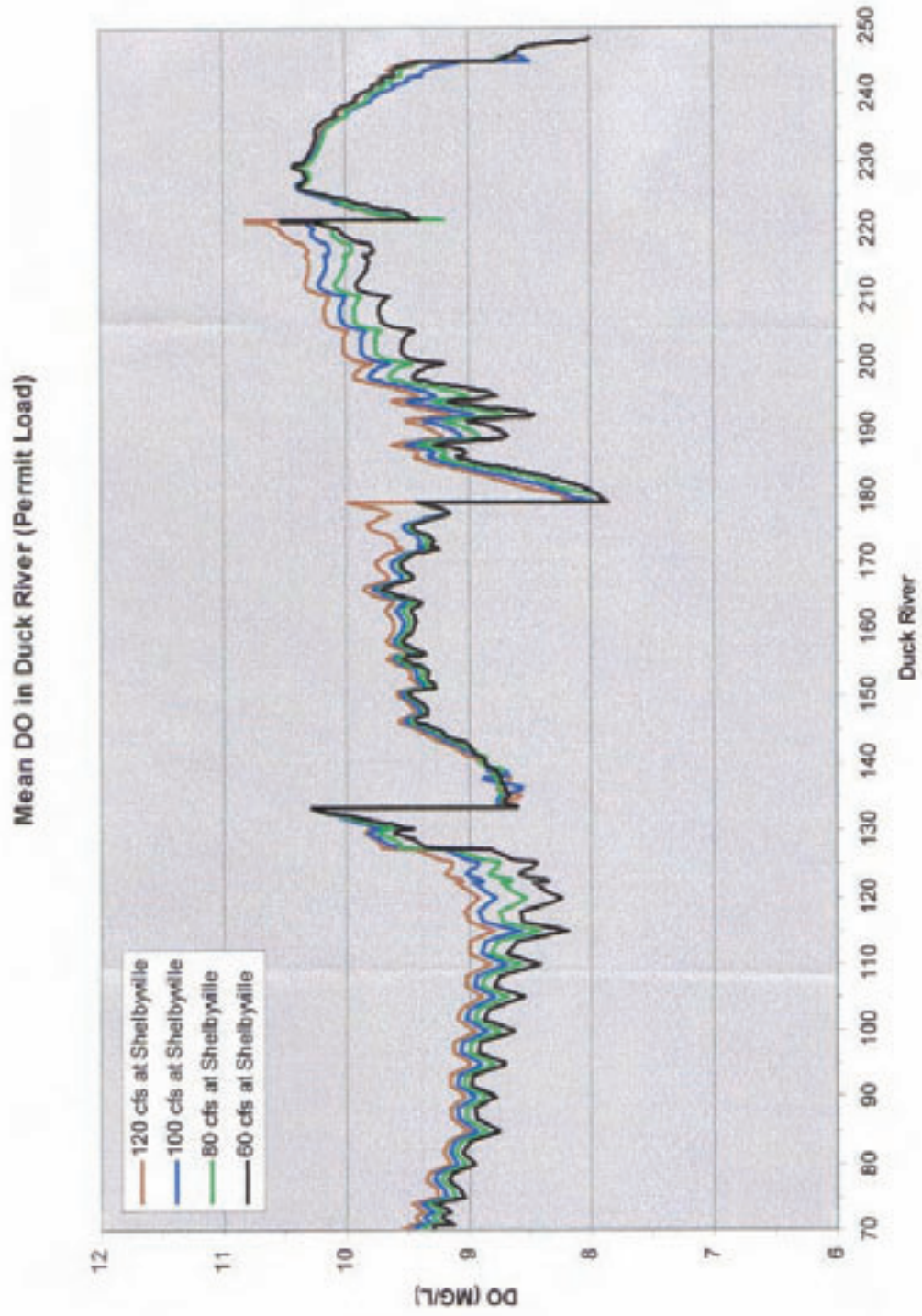


Figure 2.

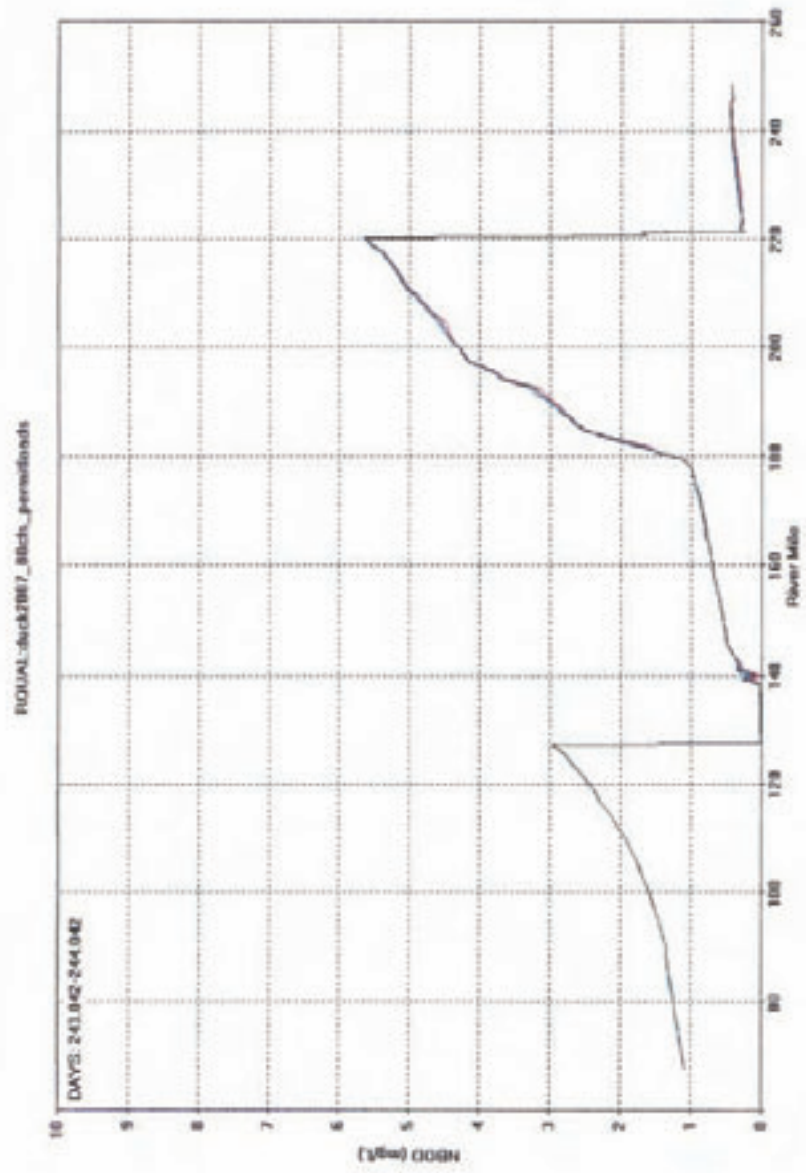


Figure 3



United States Department of the Interior

FISH AND WILDLIFE SERVICE
446 Neal Street
Cookeville, TN 38501

February 15, 2008

Ms. Peggy W. Shute
Manager, Heritage Resources
Tennessee Valley Authority
400 West Summit Hill Drive
Knoxville, Tennessee 37902-1499

Dear Ms. Shute:

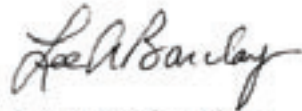
U. S. Fish and Wildlife Service personnel have reviewed the February 2008 Supplemental Environmental Assessment for the proposal by the Tennessee Department of Environment and Conservation (TDEC) to have the Tennessee Valley Authority (TVA) temporarily operate Normandy Reservoir releases such that the minimum instantaneous flow at Shelbyville is 80 cubic feet per second (cfs). The reduction in flows to 80 cfs would be in place until May 31, 2008, and is necessitated by the ongoing extreme drought conditions being experienced throughout much of the Southeastern United States.

The original Environmental Assessment was prepared in October 2007 in support of the TDEC request to reduce the minimum instantaneous flow at Shelbyville from 155 cfs to 120 cfs during the October-November 2007 time period. This original EA evaluated the potential adverse effects of the proposed flow reduction on six federally listed mussels and one federally listed fish species: birdwing pearl mussel, Cumberlandian combshell, Cumberland monkeyface, oyster mussel, pale lilliput, tan riffleshell, and pygmy madtom. Based on this analysis, TVA concluded that the proposed action was not likely to adversely affect these federally listed species, and we concurred with this finding.

The current Supplemental Environmental Assessment evaluates the potential adverse effects of the proposed reduction of minimum instantaneous flows from 120 cfs to 80 cfs at Shelbyville on these same federally listed species. New data and modeling runs are evaluated in the SEA and, together with commitments made by the cooperating agencies (TDEC, TWRA, and USFWS), result in a finding of "not likely to adversely affect federally listed species" by the TVA. Based on our careful evaluation of the data and the commitments made and memorialized in the SEA, we concur with TVA's "not likely to adversely affect" finding.

Thank you for the opportunity to partner with TVA, TDEC, and TWRA on this important project evaluation. The way in which this project has been handled should serve as a model for future projects and activities of mutual interest. We look forward to working with you in the interest of present and future generations of Americans and the natural resources that we all value.

Sincerely,

A handwritten signature in black ink that reads "Lee A. Barclay". The signature is written in a cursive style with a large, prominent initial "L".

Lee A. Barclay, Ph.D.
Field Supervisor