



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
NASHVILLE ENVIRONMENTAL FIELD OFFICE
537 BRICK CHURCH PARK DRIVE
NASHVILLE, TENNESSEE 37243-1550

March 27, 1996

Mr. Joe Cathey
Chief of Planning
U.S. Army Corps of Engineers
PO Box 1070
Nashville, TN 37202

RE: Low flow in the Duck River near Columbia
Maury County

Dear Mr. Cathey:

In October 1995, Larry Richardson of the U.S. Army Corps of Engineers requested that the Division of Water Pollution Control evaluate the threshold low-flow condition in the Duck River near Columbia at which the waterbody supports designated uses. The Division has determined that to ensure this section of the Duck River supports recreational use and protects habitat for fish and aquatic life, streamflow should be maintained such that the daily flow at river mile 132.8 does not fall below 100 cubic feet per second (cfs).

The river's assimilative capacity for wastewater discharges is currently estimated based on a low flow of 130 cfs at river mile 132.8. If streamflow in the Duck River during low flow periods decreases from the current regime (as a result of changes in water withdrawals or flow regulation), the river's assimilative capacity would decrease and therefore the permit limits for the Columbia Wastewater Treatment Plant effluent would require revision.

The instream flow criterion of 100 cfs is based on the rationale that in order to support recreational use and protect habitat for fish and aquatic life, streamflow during critical low flow periods should be maintained close to the level expected under 'natural' (without flow regulation or water withdrawals) conditions. At this level, the waterbody would provide the same recreational opportunities and habitat for fish and aquatic life as expected under natural conditions. Natural low-flow conditions were estimated using statistical analysis of streamflow record for the gage at river mile 132.8 (U.S. Geological Survey Water-Resources Investigation Report 95-4293; results summarized in the attached table). Because this gage is located between the point of withdrawal for Columbia's water supply and the point of treated wastewater discharge, these estimates slightly underestimate natural streamflow in the Duck River in the vicinity of Columbia. The period April 1961-March 1976 was used for the analysis, because this period represents no regulation by either the Columbia hydroelectric plant (stopped in 1961) or Normandy Dam (started in 1976).

The results of the low-flow analysis can be interpreted as follows: under natural conditions, the streamflow in the Duck River at river mile 132.8 falls to 86 cfs, as a daily average, once

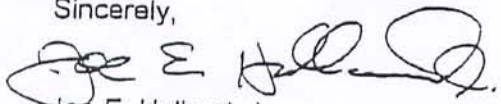
every two years (1Q2 = 86 cfs). A sustained flow of 86 cfs for a period of several consecutive days, however, occurs less frequently than once every 2 years. For example, an average flow of 86 cfs over a period of five days occurs only once every five years (5Q5 \approx 86 cfs). The Division is concerned that because of regulation of the Duck River by upstream impoundment, a low flow condition may be maintained for several consecutive days or weeks. The Division has therefore selected a sustained flow value as the instream flow criterion: the value for 14Q2, 99 cfs, is the level that the 14-day average streamflow falls to about once every two years under natural conditions. (The value 99 cfs is rounded up to 100 cfs for the criterion.)

The Division intends that this criterion be applied to the 1-day average streamflow. It is noted that applying a criterion that is based on the estimate of the 14-day average flow to the 1-day average flow is a conservative approach to ensuring that the Duck River supports designated uses during low flow periods. This approach should compensate for the problem of slightly underestimating natural streamflow at river mile 132.8 as a result of upstream water withdrawal.

In the event of a severe drought condition in the Duck River basin, the need for an exception to the 100 cfs flow criterion would be considered by this Division.

If you have any questions about this information, please call me or Anne Hoos at 226-6918.

Sincerely,



Joe E. Holland, Jr
Manager, Nashville Environmental Field Office
Division of Water Pollution Control

Enclosure

cc: Paul Davis, WPC
Steve Parks, Duck River Development Agency
Larry Richardson, U.S. Army Corps of Engineers
Dan Ferry, Tennessee Valley Authority
Hal Mattraw, U.S. Geological Survey

Natural Hydrologic Regime of the Duck River at Columbia
 River Mile 132.8 (Station 03599500)

The statistical analysis is from the U.S. Geological Survey Water-Resources Investigations Report 95-4293, by George S. Outlaw and Jess D. Weaver. The period April 1961-March 1976 was used in the analysis, because this period represents no regulation by either the powerplant upstream (stopped in 1961) or Normandy Dam (started in 1976).

Because this gage is located between the point of withdrawal and the point of treated wastewater discharge, these estimates slightly underestimate natural streamflow in the Duck River in the vicinity of Columbia.

Low-flow characteristic	Streamflow, in cfs	Low-flow characteristic	Streamflow, in cfs
1Q20	65	3Q20	69
1Q10	68	3Q10	71
1Q5	72	3Q5	75
1Q2	86	3Q2	88

Low-flow characteristic	Streamflow, in cfs	Low-flow characteristic	Streamflow, in cfs
7Q20	71	14Q20	77
7Q10	74	14Q10	79
7Q5	78	14Q5	84
7Q2	92	14Q2	99

Explanation of terminology for low-flow characteristics
 "AQB":

- A is the averaging period, using units of days,
- Q is the commonly used symbol for streamflow, and
- B is the recurrence interval, using units of years.

The 1Q2 is therefore the lowest 1-day average flow that occurs an average of once every two years.