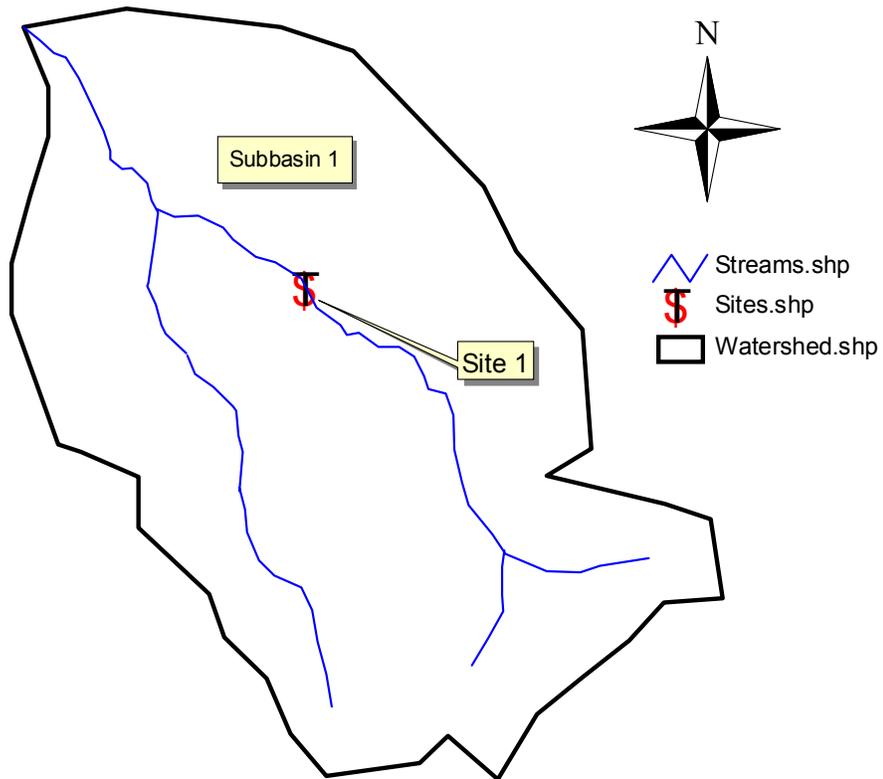


# Cane Branch of Middle Fork (Beaver Creek)

## Total Maximum Daily Load (TMDL) Fact Sheet

<b>Project Name:</b>	Cane Branch of Middle Fork (Beaver Creek)
<b>Location:</b>	McCreary County, Kentucky
<b>Scope/Size:</b>	Cane Branch watershed 1,014 acres (1.58 mi <sup>2</sup> ) Segment Length: River Mile 0.0 to 2.0
<b>Land Type:</b>	forest, agricultural, barren/spoil
<b>Type of Activity:</b>	acid mine drainage (AMD) caused by abandoned mines
<b>Pollutant(s):</b>	H <sup>+</sup> ion mass, sulfuric acid
<b>TMDL Issues:</b>	nonpoint sources
<b>Water Quality Standard/Target:</b>	pH shall not be less than six (6.0) or more than nine (9.0) and shall not fluctuate more than one and zero tenths (1.0) pH unit over a 24-hour period. This standard is found within regulation 401 KAR 5:031.
<b>Data Sources:</b>	Kentucky Pollutant Discharge Elimination System permit historical sampling data, Kentucky Division of Water (KDOW) data collection
<b>Control Measures:</b>	Kentucky nonpoint source TMDL implementation plan, Kentucky Watershed Framework
<b>Summary:</b>	Cane Branch was determined as not supporting the designated uses of primary and secondary contact recreation (swimming and wading) and warm water aquatic habitat (aquatic life). Therefore, the creek was placed on the 1998 and 2002 303(d) lists for Total Maximum Daily Load (TMDL) development. The creek segment is characterized by a depressed pH, the result of AMD from abandoned mining sites. In developing the TMDL for Cane Branch, pH readings were attempted at one location within the watershed. The most recent sampling supports the conclusion that the watershed has unacceptable pH levels.



University of Kentucky Water Sampling Locations on Cane Branch

**TMDL Development:**

TMDLs in grams  $H^+$  ions per day were computed based on the allowable minimum pH value (6.0) for creeks and streams to meet primary and secondary contact recreation (swimming and wading) and aquatic life uses. The TMDL was done for grams of ions (subsequently converted to lbs/day) because the units for pH do not allow for the computation of a quantitatively useful load or reduction amount.

In recognition of the inherent difficulties associated with imposition of a “no-exceedance” pH criteria on potentially intermittent streams, the KDOW has decided to use the lowest one year average discharge of the most recent 10-year flow record as the flow basis for setting the appropriate TMDL and associated loading reduction. Previous pH TMDLs have used a 3-year recurrence interval of the average flow as the critical flow. However, this flow resulted in a target discharge that frequently was

significantly greater than any of the observed flows for the sites as collected over several years. Thus use of a 3-year flow would require an extrapolation of the observed ion vs. flow model, well beyond the upper limit of the observed data. The selection of the 10-year frequency was based on a consideration of water quality standards (WQSs) (i.e. 7Q10). However, since many of these streams have a 7Q10 of zero, a greater duration was needed. The consensus of the KDOW was to use the 1-year duration. The use of an average annual flow as the basis for determining the TMDL also provides a convenient mechanism for determining the total annual load, the total annual reduction that would be derived from an annual summation of both the daily TMDLs, and the associated daily load reductions for the critical year using the actual historical daily flows.

**TMDL for Cane Branch:** To develop a TMDL for Cane Branch, a cumulative TMDL was obtained for the downstream extent of the impaired portion of the watershed. The TMDL and associated load reduction are shown below.

TMDL and Associated Load Reduction

Watershed (mi <sup>2</sup> )	Critical flow (cfs)	TMDL for a pH of 6.0 (lbs/day)	Predicted load (lbs/day)	Load reduction needed (lbs/day)
1.58	1.92	0.0104	0.2330	0.2226

**Permitting in the Cane Branch Watershed**

**New Permits:** New permits (except for new reminging permits) for discharges to streams could be allowed anywhere in the Cane Branch Watershed, contingent upon the end-of-pipe pH permit limits in the range of 6.35 to 9.0 standard units. WQSs state that for meeting the designated uses of aquatic life and swimming, the pH value should not be less than 6.0, nor greater than 9.0. This range of 6.0 to 9.0 for pH is generally the value assigned for end-of-pipe effluent limits. However, because a stream impairment exists (low pH), new discharges should not cause or contribute to an existing impairment. Application of agricultural limestone on mine sites results in highly buffered water leaving the site. A buffered solution with nearly equal bicarbonate and carbonic acid components will have a pH of 6.35 (Carew,

personal communication, 2004). Discharge of this buffered solution will use up free hydrogen ions in the receiving stream, thus it should not cause or contribute to an existing low pH impairment. New permits having an effluent limit pH of 6.35 to 9.0 would not be assigned a hydrogen ion load as part of a WLA. There are no active permits in the Cane Branch Watershed that would contribute to the pH impairment.

**Remining Permits:**

Remining permits may be approved on a case-by-case basis where streams are impaired because of low pH from abandoned mines. Permit approval is contingent on reclamation of the site after mining activities are completed. Existing water quality conditions must be maintained or improved during the course of remining. The permittee is required to monitor in-stream conditions during remining to make sure that current water quality conditions are maintained or improved. Reclamation of the site is the ultimate goal, but WQSs (pH of 6.0 to 9.0 standard units) may not necessarily be met in the interim if the Commonwealth issues a variance to the discharger. In instances where the Commonwealth issues a variance for a remining activity consistent with this regulation, hydrogen ion loads from this remining activity are allowed to exceed the waste load allocation (WLA). The variance allows an exception to the applicable WQS as well as the TMDL. Remining therefore constitutes a means whereby a previously disturbed and unreclaimed area can be reclaimed. The authority for remining is defined in Section 301(p) of the Federal Clean Water Act; Chapter 33, Section 1331(p) of the U.S. Code – Annotated (the Rahall Amendment to the Federal Clean Water Act); and the Kentucky Administrative Regulations (401 KAR 5:029 and 5:040).

The remediation of the remining site will result in a reduction of the nonpoint source ion load of the subbasin where the remining is done. When remining is completed, the remediation should result in a reduction in the load allocation. Follow-up, in-stream monitoring will need to be done at the subbasin outfall to determine the effect of reclamation activities following remining on the overall ion load coming from the subbasin.

**General KPDES Permit**

**for Coal Mine Discharges:** This permit covers all new and existing discharges associated with coal mine runoff. This permit does not authorize discharges that (1) are subject to an existing individual KPDES permit or application, (2) are subject to a promulgated storm water effluent guidelines or standard, (3) the Director has determined to be or may reasonably be expected to be contributed to a violation of a water of a WQS or to the impairment of a 303(d) listed water, or (4) are into a surface water that has been classified as an Exceptional or Outstanding or National Resource Water. A signed copy of a Notice of Intent (NOI) form must be submitted to the Kentucky Division of Water (KPDES Branch) when the initial application is filed with the Division of Mine Permits. However, coverage under this general permit may be denied and submittal of an application for an individual KPDES permit may be required based on a review of the NOI and/or other information.

**Antidegradation Policy:** Kentucky’s Antidegradation Policy was approved by EPA on April 12, 2005. For impaired waters, general permit coverage will not be allowed for one or more of the pollutants commonly associated with coal mining (i.e., sedimentation, solids, pH, metals, alkalinity of acidity). The individual permit process remains the same except new conditions may apply if a Total Maximum Daily Load (TMDL) has been developed and approved.

**Distribution of Load:** Because there were no point source discharges active during the study period, the existing hydrogen ion load for the watershed was defined entirely as a nonpoint source load. Because new permits (pH 6.35 to 9.0) would not cause or contribute to the existing impairment and remaining permits would be exempt from the TMDL requirements, no load has been provided for the WLA category.

Wasteload and Load Allocation for the Cane Branch Watershed

Watershed (mi <sup>2</sup> )	Incremental Critical Flow Rate (cfs)	TMDL for pH = 6.0 (lbs/day)	Wasteload Allocation* (lbs/day)	Load Allocation (lbs/day)
1.58	1.92	0.0104	0.00	0.0104

\*pH limits for new discharges must be between 6.35 and 9.0

**Implementation/  
Remediation Strategy:**

Remediation of pH-impaired streams as a result of current mining operations is the responsibility of the mine operator. The Kentucky Division of Field Services of the Kentucky Department of Surface Mining Reclamation and Enforcement is responsible for enforcing the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The Kentucky Division of Abandoned Mine Lands (DAML) is charged with performing reclamation to address the impacts from pre-law and bond forfeiture mine sites in accordance with priorities established in SMCRA. SMCRA sets environmental problems as third in priority in the list of abandoned mine land (AML) problem types.

Prior to initiating reclamation activities to improve water quality, a watershed plan should be developed in order to more precisely identify past mine site operations in the watershed. For example, the watershed plan should include a detailed overview of past mine operations, including the location of the mine, the permit number, the type of mining and the status of the mine (e.g. active, bond forfeited, bond released, illegal “wildcat” mining, etc.). Refining historic landuses in the watershed, with a particular focus on mine site operations, will assist with identifying the most appropriate funding source(s) as well as the best management practices needed for remediating the pH impacts.

In addition to historic mine operation inventory, the watershed plan should identify (1) point and nonpoint source controls needed to attain and maintain WQSs, (2) who will be responsible for implementation of controls and measures, (3) an estimate of the load reductions to be achieved, (4) threats to other waters, (5) an estimate of the implementation costs and identify financing sources, (6) a monitoring plan and adaptive implementation process and (7) a public participation process. The watershed plan should consider non-traditional opportunities and strive for the most cost-effective long-term solutions for restoring the water quality of Cane Branch.

Practical application of pH TMDLs, especially for AMLs, will normally involve a phased implementation approach with associated monitoring in order to insure that the implemented measures are having the desired effect. That has been the strategy pursued thus far with regard to

watersheds in Kentucky. Typical remediation strategies have involved channel restoration, re-vegetation, and the use of agricultural limestone. On sites where applicable, and funding allows, passive treatment systems have been used to treat AMD including open limestone channels, vertical flow systems, limestone dosing, and constructed wetlands.

There are currently no ongoing remediation activities for the Cane Branch watershed. However, reclamation activities have occurred at other locations within the State where water quality is affected by AMD. Examples of reclamation projects addressing AMD in the Upper Cumberland River watershed are summarized below.

Reclamation Projects Addressing AMD in the Upper Cumberland

<b>Watershed</b>	<b>Project Name</b>	<b>Cost</b>
Back Creek	Pruden-Fonde Reclamation Project	\$840,000
Rock Creek	Rock Creek AMD Abatement Projects	\$1,300,000

For 2000, the total federal Kentucky AML budget allocation was approximately \$17 million. However, the bulk of these funds were used to support Priority 1 (extreme danger of adverse effects to public health, safety, welfare, and property) and Priority 2 (adverse effects to public health, safety, and welfare) projects. Of the total annual federal budget allocation, AML receives only approximately \$700,000 in Appalachian Clean Streams Initiative funds, which are targeted for Priority 3 environmental problems. Based on the cost of current remediation efforts, it would appear that a significant increase in federal funding to the AML program, as well as rearrangement of priorities as established in SMCRA, would be required in order for the AML program to play a significant part in meeting the TMDL implementation requirement associated with pH impaired streams in the state of Kentucky.