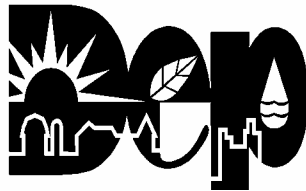


# **EAST BRANCH WHITE CLAY CREEK WATERSHED TMDL Chester County**

For Pesticides Affected Segments



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February 27, 2007

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## **INTRODUCTION**

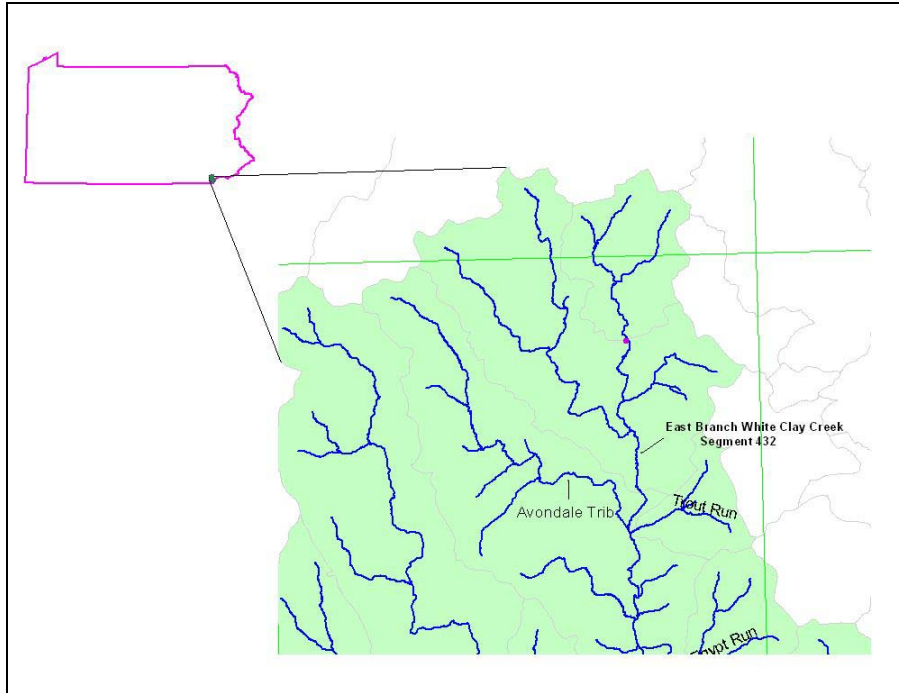
East Branch White Clay Creek (Segment ID: 432) was included on Pennsylvania's 1996 303(d) List of Impaired Waters for aquatic life use impairments due to pesticides. Pennsylvania collected data at ten stations in a 1997 survey, including one on Segment 432, to identify possible sources of degradation found by White Clay Watershed Association (WCWA). DDT was found to be the only pesticide exceeding water column criteria. This document will address DDT in East Branch White Clay Creek above the Avondale Tributary (Segment ID 446).

## **BACKGROUND**

In the 1950s and 1960s, agricultural producers used pesticides that were chemically and environmentally different from the current use pesticides. DDT has a decades long half-lives rather than most of today's environmental half-lives of days or weeks. Today's competitive market of pesticide manufacturing is also encouraging production for more "natural" and "environmentally friendly" pesticides. In essence, effects of legacy pesticides are much different and require different evaluations than the current use pesticides. Even after 25 years of little or no use, DDT metabolites are being found that are degraded metabolites of the parent compound. DDT contamination has been linked to problems with the reproduction rates of certain avian species such as eagles and pelicans. The eggs from these and other species were weakened due to contamination and reproduction was severely impacted. The use of DDT was prohibited in the United States in 1973 and production has ceased.

The most likely source of pesticides in the East Branch White Clay Creek basin in the vicinity of the Borough of Avondale is the mushroom industry. Mushroom growing facilities are located to the northwest, north and east of Avondale, and within the eastern half of the Borough itself. In addition, spent mushroom compost has been spread on much of the surrounding terrain throughout the watershed. A mushroom growing cycle takes approximately 10 to 15 weeks to complete. At the end of each cycle, old compost must be disposed of and new compost created. Each new batch of compost must be sanitized. Historically, pesticides had been used as part of the sanitation process; now most compost is steam pasteurized. Pesticides also had been used to control flies, and bacteria and fungi that attacked the mushroom spawn. Although pesticide use by the mushroom industry has decreased greatly in recent years, persistent organochloride compounds have leached from old spent compost that had been spread in the past.

A 0.2 mile portion of East Branch White Clay Creek, Segment 432 just upstream of the confluence with the Avondale Tributary and Trout Run, was included on the 1996 303(d) List of Impaired Waters as impaired by pesticides. Samples taken at the WQN site included periodic excursions for various pesticides in the early 1990s leading to its 303(d) listing. Despite the mushroom industry's reduction in pesticide usage, the White Clay Watershed Association documented a depressed aquatic community leading to a PADEP survey of the watershed in 1997. The results of chemical sampling for over thirty different pesticides turned up one exceedence, a DDT concentration of 0.015 ug/l.



## TMDL DEVELOPMENT

25 Pa. Code §16.102 contains Pennsylvania’s criteria for 4,4-DDT. The Criteria Continuous Concentration (CCC) is for the protection of Fish and Aquatic Life Uses for which the design flow condition is  $Q_{7-10}$  (25 Pa. Code §96.4). Additionally, Chapter 16 specifies a Human Health Criterion to be evaluated at the Harmonic Mean Flow. However, all criteria are concentration-based, thus the allowable load will vary with flow. The TMDL will be presented as an allowable load at both  $Q_{7-10}$  (Fish and Aquatic Life) and Harmonic Mean Flow (Non-threshold Human Health) and the most stringent will be set as the TMDL.

### TMDL – Human Health

$$\begin{aligned} \text{TMDL (human health)} &= (\text{Harmonic Mean Flow}) * (\text{HH Criterion}) * \text{Conversion factor} \\ &= (5.82 \text{ mgd}) * (0.00000059 \text{ mg/l}) * (8.34) \\ &= 2.86 \times 10^{-5} \text{ lbs/day} \end{aligned}$$

### TMDL – Chronic

Flow data spanning from August 1996 to the present was collected from a downstream fixed Water Quality Network (WQN) station to estimate the  $Q_{7-10}$  for White Clay Creek. WQN 149 is 7.6 miles downstream of Segment 432, therefore, an area weighted flow was calculated to represent  $Q_{7-10}$ . The area weighted design flow for Segment 432 is 1.166 mgd. The TMDL for DDT in White Clay Creek Segment 432 required to meet the Fish and Aquatic Life criterion is represented by the following equation:

$$\begin{aligned} \text{TMDL (chronic)} &= (Q_{7-10}) * (\text{CCC}) * \text{Conversion factor} \\ &= (1.17 \text{ mgd}) * (0.000001 \text{ mg/l}) * 8.34 \end{aligned}$$

$$= 9.76 \times 10^{-6} \text{ lbs/day}$$

The allowable load calculated for the CCC is the more stringent of the two and will be established as the allowable daily load. Due to the fact that production and use of DDT has ceased and there are no point sources of DDT, the entire allowable load will be given as a Load Allocation (LA). The calculation of the allowable load based on the chronic criterion provides an implicit Margin of Safety. Therefore, the entire TMDL is:

$$\text{TMDL} = \text{LA} + \text{WLA} + \text{MOS}$$

$$\text{TMDL} = 9.76 \times 10^{-6} \text{ lbs/day} + 0 + 0$$

### Current Load

$$\text{Current Load} = (Q_{7-10}) * (\text{In-stream concentration}) * \text{Conversion factor}$$

$$\text{Current Load} = (1.17 \text{ mgd}) * (0.000015 \text{ mg/l}) * 8.34$$

$$\text{Current Load} = 1.46 \times 10^{-4} \text{ lbs/day}$$

Current Load (lbs/day)	TMDL (lbs/day)	LA(lbs/day)	WLA(lbs/day)	MOS (lbs/day)	% Reduction
$1.46 \times 10^{-4}$	$9.76 \times 10^{-6}$	$9.76 \times 10^{-6}$	0	Implicit	93.3

### Reasonable Assurance and Other Relevant Information

The goal of this TMDL is to reduce pesticide (DDT) concentrations in the impaired segments of East Branch White Clay Creek to meet the water quality objectives for pesticides in this waterbody. Attainment of these targets and allocations are expected to result in attainment of the narrative objectives for pesticides, and, hence, protect the freshwater habitat and wildlife habitat beneficial uses in this watershed and in the case of DDT, indirectly protect human health.

Reductions in surface water loads of these pesticides will be achieved through application controls and other BMPs designed to reduce the transport of pesticides to surface waters.

The source of DDT in these basins was from historic applications to mushroom spawns for the control of insects and sanitization of mushroom compost. Because of their past heavy and widespread use, strong affinities for sorption to sediment organic matter and tissue, and slow rates of decomposition, DDT and/or their degradation products frequently remain at elevated levels in the environment for many years after widespread use has ended (Smith et al. 1988). Bans on the use of DDT have resulted in a slow but steady decline in environmental residues (Smith et al., 1988). Continuing decreases in the environmental levels of these pesticides is expected via degradation and metabolism of the contaminants and burial of contaminated sediment through natural sedimentation. This is the preferred mechanism for removal of these

pesticides from the environment. The use of steam pasteurization instead of pesticide application to mushroom compost also helps to reduce pesticide levels. Alternative approaches primarily reserved for heavily contaminated sites due to point source discharges and major spills include removal of contaminated sediments by dredging and eradication of contaminated fish communities and restocking. Removal of contaminated sediments results in habitat disturbance and destruction.

Because of the limited amount of data to support the 1996 303(d) Listing for impairments due to pesticides in the East Branch White Clay Creek Watershed, additional data collection is anticipated.

The data will be analyzed to determine if the TMDL has resulted in attainment of the appropriate water quality standards or numeric targets for freshwater or needs some adjustment to bring the impaired segment(s) in the East Branch White Clay Creek Watershed into attainment.

The Hy Tech Compost and Mushroom Farm has been a cooperator with the Chester County Conservation District since the early 1980's. Located right next to the Avondale Sewage Treatment Plant and a tributary to the White Clay Creek, this fresh compost and mushroom growing operation installed wharf runoff controls, 2 recycle runoff water storage with monitoring wells, aerators to minimize odors, and other runoff BMP's. Hy Tech has also installed state of the art machinery to more efficiently aerate and hydrate raw materials used to make fresh mushroom compost. The machinery enables Hy Tech to shorten the composting timeframe and have a more consistent compost mix. The Needham Family and Hy Tech managers have been early supporters of the Chester County Conservation District's efforts to secure funding for the PL83-566 Land Treatment Program for the Red and White Clay Creeks watersheds.

## **References**

Smith, J.A., P.J. Witkowski, and T.V. Fusillo. 1988. Manmade Organic Compounds in the Surface Waters of the United States – A Review of Current Understanding. U.S. Geological Survey Circular 1007.