

## Executive Summary

This report addresses the development of the phased benthic TMDL for the Smith River watershed in Virginia. One segment of the Smith River was listed as impaired on Virginia's 1998 303(d) Total Maximum Daily Load (TMDL) Priority List and Report due to violations of the state's aquatic life water quality standards, specifically for the general standard. The segment was also included on subsequent 303(d) Reports on Impaired Waters and 305(b)/303(d) Water Quality Assessment Integrated Reports (VA DEQ, 2004, 2006, 2008).

### Description of the Study Area

The Smith River is located in the south central region of Virginia and is a tributary of the Dan River. The Smith River flows through sections of Henry, Patrick, Franklin and Floyd Counties. The impaired benthic segment of the Smith River (VAW-L54R-01) is 13.75 miles in length, extending from the Martinsville Dam at river mile 26.40 (approximately) downstream to the mouth of Turkeypen Branch. The watershed is approximately 336,926 acres (or 526 square miles) in area.

### Impairment Description

There is only one segment (TMDL Cause Group Code L54R-01-BEN) of Smith River listed as impaired on Virginia's 305(b)/303(d) Water Quality Integrated Report. "*DEQ's General Standard (VR680-21-01.2) is not met for the protection of aquatic life*" and the segment is not "*supporting of the Clean Water Act's Aquatic Life Use Support Goal for the 2002 305(b) report*" (VADEQ, 2004a, 2006, 2008).

The Smith River was listed on Virginia's 303(d) list for not supporting the aquatic life use (TMDL Cause Group Code L54R-01-BEN) based on biological assessments conducted in 1998 at VA DEQ monitoring stations below the Martinsville Dam. The source of the general standard impairment is a mixture of municipal point source and urban nonpoint source runoff. In addition, the Martinsville Dam (hydroelectric plant) is considered a possible cause of the general standard impairment located immediately downstream of the dam. The operation of the Dam causes scouring due to flow releases and dewatering due to periods of low flow, which affect benthic habitat immediately downstream of the dam. The impaired benthic segment of the Smith River (Cause Group Code L54R-01-BEN) is

13.75 miles in length and extends downstream from the Martinsville Dam to the mouth of Turkeypen Branch.

### **Applicable Water Quality Standard**

Water quality standards consist of designated uses for a waterbody and the water quality criteria necessary to support those designated uses. According to Virginia Water Quality Standards (VA DEQ, 2007):

*“water quality standards’ means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.).”*

### **Watershed Characterization and Environmental Monitoring**

The Smith River watershed is approximately 336,926 acres or (526 square miles) in area. The land use characterization for the Smith River TMDL watershed was based on the latest available land cover data from the National Land Cover Dataset, also known as NLCD 2001. Dominant land uses in the watershed are forested lands (76%) and agricultural lands (11%).

Environmental monitoring efforts in the Smith River watershed include benthic macroinvertebrate community sampling and analysis and water quality sampling and analysis. VA DEQ has monitored ambient water quality, macroinvertebrate communities, fish tissue, and sediment chemistry at 19 locations in the Smith River watershed. Of the 19 sites, ten are located within the impaired segment. Water quality data collected between 1993 and 2007 were analyzed for the Smith River TMDL study.

There are 13 individual Virginia Pollutant Discharge Elimination System (VPDES) permitted facilities currently active or under application in the Smith River watershed and 42 general permits currently active within the Smith River Watershed that include industrial stormwater and mining permits.

There is one EPA Superfund site (Doyle Wood Treating Plant) and one Resource Conservation and Recovery Act (RCRA) site (DuPont de Nemours & Co) located in the Smith River watershed. Efforts to clean up Doyle Wood Treating Plant were completed in 1996 and are ongoing at DuPont de Nemours & Co.

## **Stressor Identification**

The primary stressor causing the benthic impairment on the Smith River was identified based on evaluations of candidate stressors that potentially could be impacting the stream. Based on the stressor identification analysis, the most probable stressor to the benthic macroinvertebrate community in the Smith River was identified as total Polycyclic Aromatic Hydrocarbons (PAHs) in sediment. Potential sources of total PAHs in the watershed include non-point sources.

Improvement of the benthic invertebrate community in the Smith River is dependent upon reducing nonpoint source total PAH loading to the stream. These measures should serve to improve benthic habitat and subsequently restore macroinvertebrate communities in the stream. Therefore, a Total PAH TMDL was developed for Smith River.

## **Endpoint Determination**

VA DEQ has not yet adopted a numeric standard for Total PAH. Therefore, a total PAH endpoint was determined based on the Threshold Effect Concentration (TEC) for total PAHs. The TEC identifies the contaminant concentrations below which adverse effects to sediment-dwelling organisms are not expected to occur (MacDonald, et al., 2000).

## **Total PAH Loading Determination**

Total PAH sources within the benthic impaired segment of the Smith River watershed include only non-point sources. Total PAH loads were determined for the impaired watershed in order to quantify the reductions necessary to achieve the designated aquatic life use water quality standard in Smith River. A mass balance model was applied to estimate the existing total PAH concentration in sediment in the benthic impaired segment of the Smith River. Accepted literature values for total PAH were used to estimate the total PAH loads' contribution from runoff (Novotny, 2003). A watershed model, the Generalized Watershed Loading Function (GWLF), was applied to estimate sediment

loads from all the sources in the Smith River watershed. It was assumed that all PAH runoff load adsorbs to sediment, and thus PAH concentrations in sediment loads are equivalent to PAH concentrations in runoff from the watershed.

### TMDL Calculations

Total PAH TMDL allocations for the Smith River impaired watershed were based on the following equation.

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

Where:

TMDL = Total Maximum Daily Load

WLA = Waste Load Allocation

LA = Load Allocation

MOS = Margin of Safety

The MOS will be implicitly incorporated into this TMDL. Implicitly incorporating the MOS requires that allocations meet the Threshold Effect Concentration (TEC) of 1.61 mg/kg.

Wasteload allocation (WLA) for total PAH in sediment was applied to 42 general permitted facilities located in the Smith River watershed. There are no MS4 areas located in the Smith River watershed. To account for future growth an expansion factor of 2 was applied to calculate the WLA. The existing, aggregated allocated total PAH load and the required reduction are shown in **Table E-1**. At this phase of the TMDL, the WLA is aggregated, however, depending on new information during the second phase, WLA may be disaggregated and individual WLAs assigned to the individual facilities.