



# Analysis of Selected Metals in Groundwater and Soil on Byers Island near Sunbury, Northumberland Co., PA

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## Abstract

A group of faculty and students at Bloomsburg University have been sampling the Susquehanna River near the confluence of the West and North Branch for the past several years. During the first round of sampling, elevated concentrations of metals were documented in Susquehanna River water samples collected near Byers Island—a large island in the Susquehanna between Sunbury and Selinsgrove, Northumberland Co., PA. Additional work indicated that the island was the most likely source of these metals, but confirmation in the form of groundwater and soil analyses was lacking. In late summer 2012, soil, groundwater, and surface water samples were collected in and around Byer's Island to identify what could be causing the elevated levels. Due to concerns with nesting bald eagles, the sampling process could not begin until after the nesting season ended on August 1. Travelling by canoe, we collected water and soil samples on Byers Island and adjacent surface water samples. Using a hand auger, 5 wells were installed along the shore of the island; one well was placed above the low-head dam and the subsequent 4 were placed below the dam, three on the east side of the island, where metals level had been elevated, and one on the west side. Soil samples were collected from each well drilled; selected samples were sent to Hawk Mountain Laboratories for further analysis. Surface water samples were also collected at the mouth of Shamokin Creek, and soil samples were collected on the ridge that rises above the east bank of the river, near entrances to the long abandoned Doughty Lead-Zinc Mine. Analyses were run for metals, anions and cations in the lab, as well as alkalinity and acidity using the Hach 8203 and 8201 respectively. The soil samples were all analyzed by X-ray Fluorescence (XRF) in the field. A few minor complications were faced when we went out to sample from our well, especially for the second round of sampling. One well was vandalized before we could sample (OW4) and another was too dry to pump a useful sample from it. Our search found no obvious sources for elevated levels of lead or copper in the Susquehanna River. Field and lab soil analyses, however, as well as groundwater samples from Byer's Island do show moderately elevated levels of manganese.

## Background Information and Objectives



Transporting equipment over the low-head dam

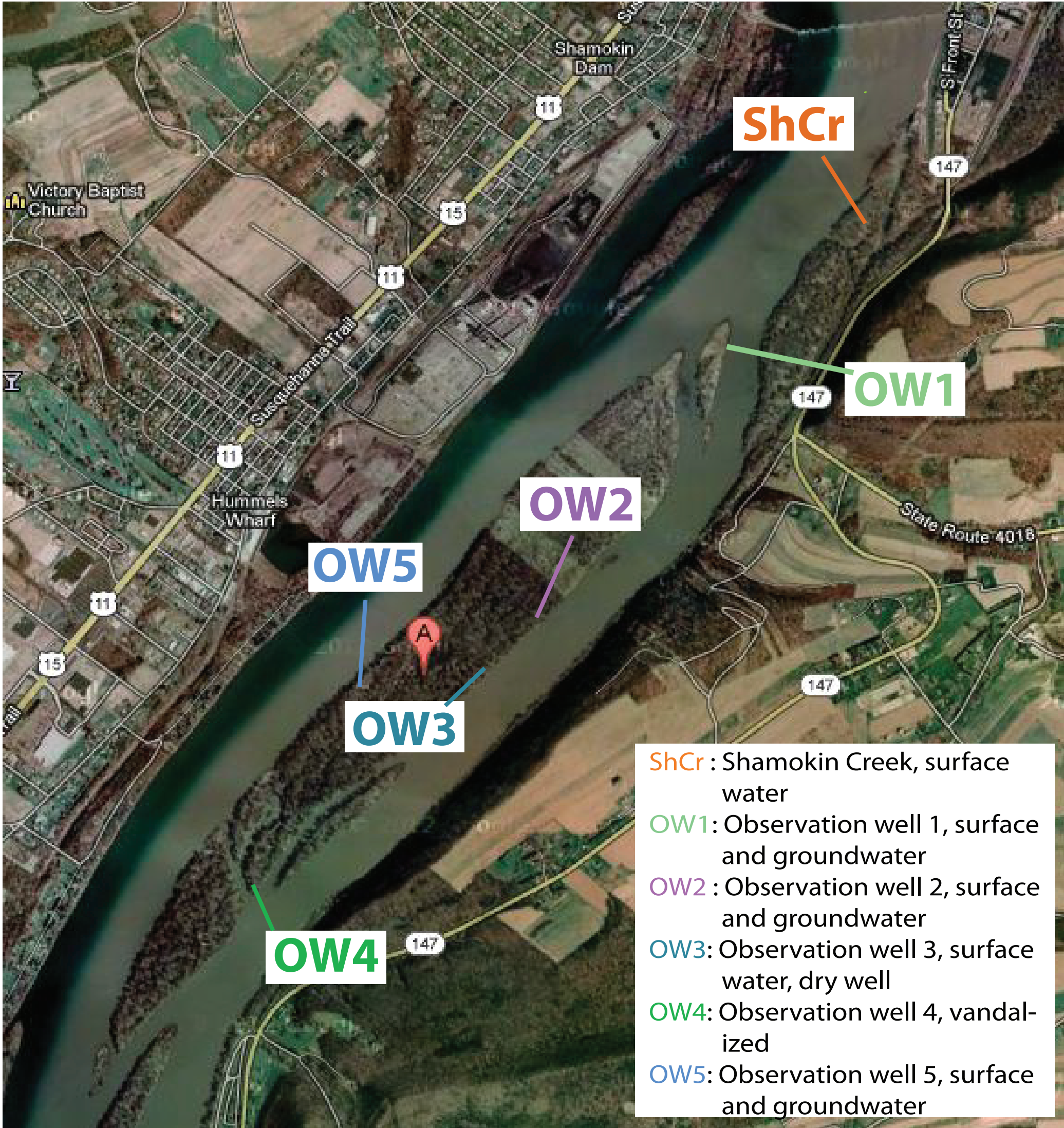
The Susquehanna River Heartland Coalition for Environmental Studies has, for the past several years, funded collection and analysis of water from the Susquehanna River to determine levels of dissolved constituents and help establish a baseline against which surface water affected by hydraulic fracturing or flowback water may be identified. Drs. Christopher Hallen and Cynthia Venn of Bloomsburg University, along with several undergraduate summer research students, have conducted this sampling in the North Branch, West Branch, and Main Stem Susquehanna since summer 2009. During their first round of sampling, elevated concentrations of metals including lead, manganese, and copper were documented (Eyerly et al., 2010) in Susquehanna River water samples collected near Byers Island—a large island in the Susquehanna between Sunbury and Selinsgrove, Northumberland Co., PA. Additional work indicated that the island is the most likely source of these metals, but confirmation in the form of groundwater and soil analyses was lacking (Kaldon et al., 2010, Ochal et al., 2011, Reed et al., 2012). A variety of potential sources of metals were evaluated for this study. In the initial survey, lead levels were highest along the east bank of the Susquehanna river south of its confluence with Shamokin Creek. Aerial photos going back to the 1930s suggest that input from Shamokin creek may stay relatively unmixed near the east bank of the river along the length of the island. Recent analyses of fish in Shamokin Creek (Cravotta and Kirby, 2004), however, did not detect elevated lead levels. A literature review turned up documentation of an old (mid-late 1800s) lead-zinc mine on the east side of the river, across from Byer's Island (Rogerson, 1976). Exploration of the ridge revealed several locations that may be related to mining, and soil samples were collected and screened for metals using a handheld ThermoScientific Niton XL2 Series handheld X-ray Fluorescence instrument.

## Soil Conditions



Silt bank at OW3 (source of high manganese?).

The soil type found on Byer's Island as described in the Soil Survey of Northumberland County Pennsylvania is Uf, or Udi-fluvents and coal overwash (Eckenrode, 1985). Uf soils are generally deep, have a slope of 0-3 percent and are excessively drained to moderately well drained. There are 20 to 40 inches of black, sand/silt size coal particles overlying 1 to 6 inches of silt or sandy loam. The substratum is composed of loam or sandy loam and descends to a depth of 60 inches or more. Uf soils have a moderate to rapid permeability but the available water capacity is moderate to low. Historical records (Brainerd et al., 1798) indicate the island was part of a large native american settlement and aerial photos indicated that the north half of the island was used as farm land at least through the late 1930s. Shallow soil in the farmed area was analyzed in the field with XRF. On the banks of the island, a three-layer stratigraphy was observed, a steep, silt bank underlain by a 6-12-inch dark clay-rich layer, followed by more silty sand underlain by a poorly sorted mix of sand and rounded gravel to cobbles.



## Soil Samples

