Conclusions

In general, the sites sampled during the 2011 survey of the Lower Susquehanna Subbasin had satisfactory results, but problems persist throughout many areas. The majority of sites sampled had either nonimpaired or slightly impaired macroinvertebrate communities as well as excellent or supporting habitat. Nearly all sites had at least one water quality parameter exceed a level of concern. Less than 30 percent of the sites sampled had nonimpaired biological conditions, and less than 5 percent of the sites had higher water quality ratings. Less than 50 percent of the habitat assessments were excellent, suggesting more effort is needed to physically protect streams.

The largest cause of impairment appeared to be from nutrients, primarily nitrate and total nitrogen, which may have originated from excess fertilization of agricultural fields and residential lawns, uncontrolled barnyard runoff, livestock directly accessing streams, increased loads from point sources, leaking septic tanks, outdated sewage treatment plants, or combined sewer overflows. Combined sewer overflows occur in some older towns where the infrastructure was developed to channel stormwater runoff from the streets into the wastewater treatment plants. When these systems receive too much water, as occurs during a storm, they are unable to process and treat the waste, resulting in raw sewage discharge to the streams.

Another significant source of pollution appeared to be urbanization. Sodium levels were high in numerous streams, and habitat assessments indicated problems with channelized streams, eroded banks, and litter. In areas where most of the land is paved or developed, there is no place for precipitation to be absorbed in the ground, which leads to runoff. Problems that result from this runoff are higher water temperatures from the hot pavement, higher velocity and volume of water over shorter time periods, and higher concentrations of pollutants being washed off the pavement. Elevated sodium levels were found in streams that drain York, Lancaster, Hershey, and the greater Harrisburg area.

AMD in this subbasin was minimal and was concentrated mostly in a small northeastern section of the subbasin. Only a few sites showed possible effects due to AMD, and those effects were very slight for most of those sites. Restoration efforts by watershed groups and local government may have helped these watersheds.

In the past several years, SRBC has continued its focus on stormwater remediation support within targeted watersheds within the Lower Susquehanna Subbasin. In 2010, SRBC completed a four-year stormwater management demonstration

Sherman Creek, Perry County, Pa.

project using Paxton Creek in urbanized Dauphin County, Pa., as a model watershed in conjunction with the Paxton Creek Watershed and Project Education Association. More information on this project can be found at www.srbc.net/programs/paxton/index.asp. SRBC is currently in the early stages of collecting data to develop the TMDL for the urbanized Cedar Run Watershed in Cumberland County, Pa.

SRBC is also currently conducting long-term monitoring in the Conestoga River Watershed for the purpose of developing a TMDL in the future and is in the middle of developing the Octoraro Creek TMDL. In addition, SRBC has collected annual biological samples and annual and/or seasonal water chemistry since the 1980s along 11 sites located in the Lower Susquehanna Subbasin as part of its Interstate Water Quality Network (www.srbc.net/interstate_streams/).

Some of the highest quality watersheds within the Lower Susquehanna River Subbasin were Sherman, Powell, and Clarks Creeks. Some watersheds that also rated well overall were Muddy, Deer, Penns, Middle, North and West Branch Mahantango, Chiques, and Pequea Creeks and some portions of the Conestoga River. Although these watersheds contained a large amount of agricultural land and did have higher nutrient levels, they did not have heavy urban influence. Naturally vegetated buffers serve to protect the stream and provide necessary habitat to the aquatic insects and fish.

Some of the most degraded watersheds were Wiconisco, Conodoguinet, Swatara, Mahanoy, Codorus, Shamokin, and Paxton Creeks. Shamokin, Mahanoy, and Wiconisco Creeks were impacted by AMD, Paxton Creek by urban development, and the Swatara, Codorus, and Conodoguinet by a mix of agriculture and urban development. Portions of both the Conodoguinet and Yellow Breeches Watersheds appeared to be influenced by limestone geology. The sampling in this survey was a one-time event at sites that were chosen for ease of access, so replicate and more representative sampling along more segments in watersheds would be needed to truly identify and isolate problems in these watersheds.

Efforts should be made to restore the most degraded watersheds and protect the higher quality ones within this subbasin. Agricultural best management practices can be used to limit the impacts associated with farming operations. Information on these practices and other conservation methods can be obtained from county conservation district offices (www.pacd.org). Grant opportunities to alleviate AMD impacts and more information on remediation technologies also are available in county conservation district offices and from the Eastern Pennsylvania Coalition for Abandoned Mine Reclamation (www.orangewaternetwork.org). Urban stormwater problems can be minimized with low impact development and by allowing for groundwater recharge areas. More information on urban pollution remediation can be obtained from the Center for Watershed Protection through its Urban Subwatershed Restoration Manual series (www.cwp.org) and from the PADEP's Pennsylvania Stormwater Best Management Practices Manual (PADEP, 2006).

The Lower Susquehanna Subbasin Survey Year-2 assessment is being conducted in the three reservoirs along the last 45 miles of the Susquehanna River: Lake Aldred, Lake Clarke, and Conowingo Pond. This Year-2 study will focus on the Lower Susquehanna mainstem as a single hydrologic system and will involve the collection of water chemistry and biological data. Data collection began in April 2012 and is expected to go into November 2012, and a final report will be available in late 2013. More information on this project is available from SRBC.

Collecting macroinvertebrate samples along Rattling Creek, Dauphin County, Pa.