

## RESULTS/DISCUSSION

Water quality, biological (macroinvertebrate) community, and habitat conditions for each sampling site in 2008 throughout the Middle Susquehanna Subbasin are depicted in Figure 3. Six sites demonstrated the best overall conditions in each category with nonimpaired macroinvertebrates, “higher” water quality, and excellent habitat. Those six sites were ETNK 10.0, LAWR 35.2, SGRR 0.4, STWN 0.1, TUNK 1.8, and TUNK 11.9. Forty sites (43 percent) had “higher” water quality, 45 sites (49 percent) had “middle” water quality, and seven sites (8 percent) had “lower” water quality conditions. Thirty-one sites (34 percent) had nonimpaired, 37 sites (40 percent) had slightly impaired, 20 sites (22 percent) had moderately impaired, and four sites (4 percent) had severely impaired biological conditions. Forty sites (43 percent) had excellent habitat, 45 sites (49 percent) had supporting habitat, six sites (7 percent) had partially supporting habitat, and one (1 percent) had nonsupporting habitat conditions.

The parameters that exceeded levels of concern at the largest number of sites were total sodium (23), alkalinity (20), nitrogen (15), nitrates (14), orthophosphate (11), and phosphorus (10) (Table 3). Sodium and total suspended solids were not sampled at 16 sites due to sampling error; therefore, the number of sites exceeding levels of concern may have been higher. The highest number of levels of concern exceeded at a single site was 11, occurring at the Lackawanna River (LAWR 0.8). Newport Creek (NWPT 0.5) had the second highest number of levels of concern exceeded with ten. The highest or lowest value for each parameter is printed in bold in Table 3. NWPT 0.5 had the highest levels of calcium (138 mg/l), hardness (676 mg/l), iron (22,500 µg/l), magnesium (80.3 mg/l), manganese (4,730 µg/l), sulfate (667 mg/l), acidity (52 mg/l), and conductivity (1,400 µmhos/cm). The highest level of aluminum was on Little Nescopeck Creek (LNSK 0.1) with a value of 4,225 µg/l, and this site had the lowest value of alkalinity at zero mg/l. Catawissa Creek (CATW 33.2) also had high aluminum levels with a value of 3,660 µg/l, and an alkalinity value of zero mg/l. These two sites, LNSK 0.1 and CATW 33.2, had the lowest pH values at 4.5 and 4.0, respectively. Nutrients and sodium were highest at Leggetts Creek with 6.3 mg/l of nitrate, 6.87 mg/l of total nitrogen, 1.998 mg/l of orthophosphate, 2.228 mg/l of total phosphorus, and 84.3 mg/l of sodium. The highest temperature was recorded on Catawissa Creek (CATW 0.5) with a value of 26.9 degrees Celsius, and the highest total suspended solids value was at LNSK 0.1 at 26 mg/l (Table 3).

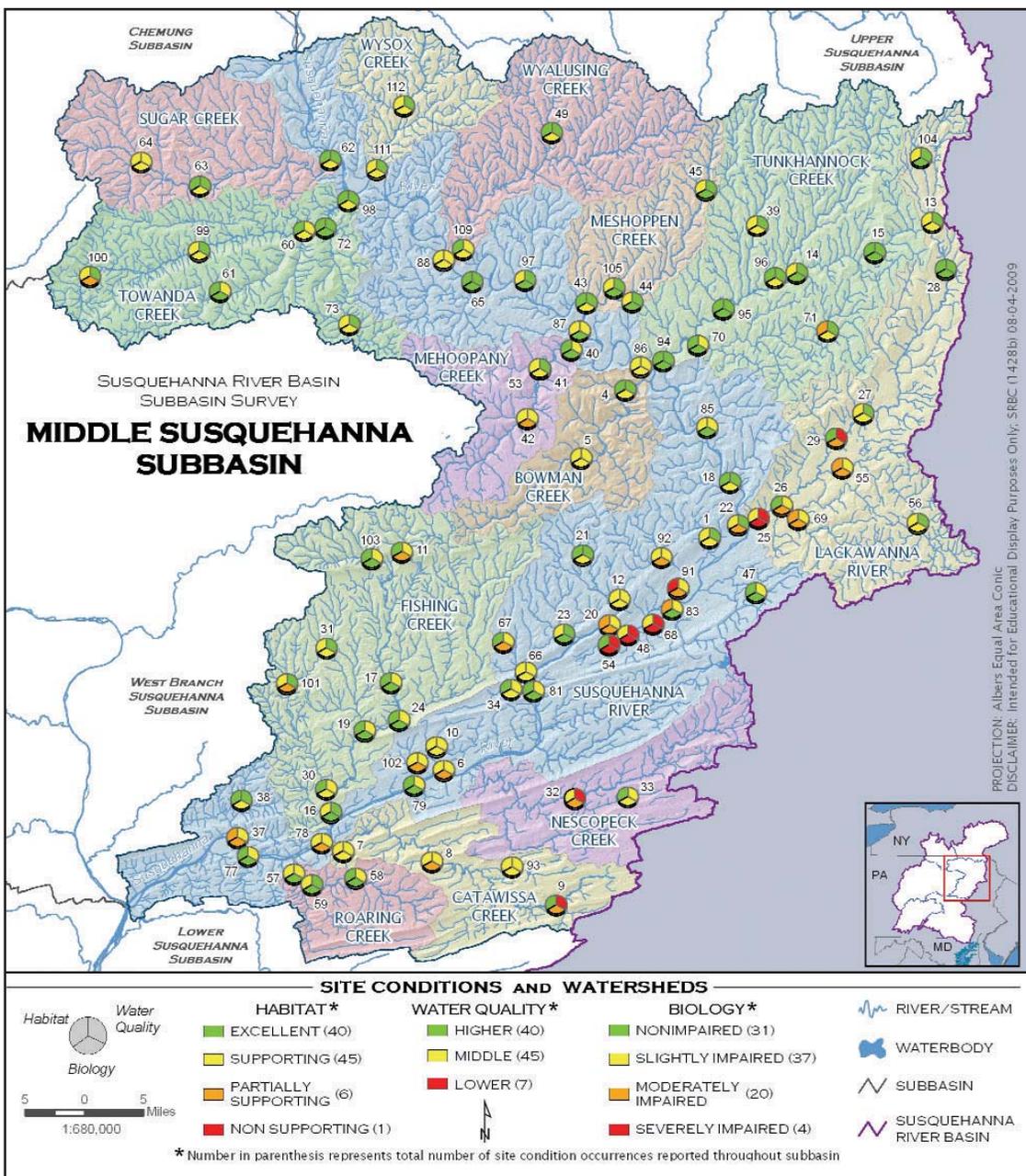


Figure 3. Water Quality, Biological, and Habitat Conditions in the Middle Susquehanna Subbasin in 2008



### Endless Mountain Region Watersheds

The watersheds discussed in this region are located in the northern portion of the Middle Susquehanna Subbasin and include Sugar Creek, Towanda Creek, Wysox Creek, Wyalusing Creek, Sugar Run, Tuscarora Creek, Meshoppen Creek, Mehoopany Creek, Tunkhannock Creek, Bowman Creek, and Gardner Creek. The Endless Mountain Region is mostly in the Northern Appalachian Plateau and Uplands Ecoregion and is characterized by rolling hills of agricultural and forested lands. Urban areas are few and small with the largest town being Towanda, Pa. The stream conditions and habitat in this region are mostly good quality.

This region had five sites with the best overall conditions of nonimpaired biology, “higher” water quality, and excellent habitat. These sites were located in Tunkhannock Creek, Towanda Creek, and Sugar Run Watersheds. Thirty-five sites were sampled in this region and 13 had nonimpaired biological conditions, 26 had “higher” water quality conditions, and 19 had excellent habitat conditions. The sites that had nonimpaired biological conditions were

mostly located in Tunkhannock Creek, Towanda Creek, Sugar Run, Meshoppen Creek, Mehoopany Creek, and Tuscarora Creek Watersheds. The worst biological conditions consisted of two moderately impaired sites located in the headwaters of Mehoopany and Towanda Creeks.

Water quality values that exceeded levels of concern included alkalinity, sodium, total nitrogen, total nitrate, total phosphorus, and total orthophosphate. Alkalinity was low at many sites on Mehoopany, Schrader, and Bowman Creeks and nitrogen and phosphorus levels were elevated on Wyalusing and Sugar Creeks. Wyalusing Creek and South Branch Tunkhannock Creek also had slightly elevated sodium. Most of the sites where sodium and total suspended solids values were not measured due to sampling error were in this region on Towanda, Schrader, Meshoppen, Bowman, and Gardner Creeks. Some of the habitat problems noted at a few sites concerned condition of banks, frequency of riffles, and lack of naturally vegetated riparian areas. One site was rated partially supporting in habitat condition and that site was South Branch Tunkhannock Creek downstream of Route 81.



*Bowman Creek located in Wyoming County.*

## Wyoming Valley (Scranton and Wilkes-Barre) Region Watersheds

The watersheds sampled during this survey that flow into the Wyoming Valley include Lackawanna River, Hicks Creek, Abrahams Creek, Mill Creek, Toby Creek, Solomons Creek, Nanticoke Creek, and Newport Creek. The Wyoming Valley area is located in the North Central Appalachians Ecoregion and is characterized by a legacy of AMD and dense urban development (Figure 2). These urban areas are located in and around Scranton and Wilkes-Barre, Pa.

The best overall conditions in biology, water quality, and habitat in the Wyoming Valley Region were found only at one site in the headwaters of the Lackawanna River (LAWR 35.2). Eighteen sites were sampled in this region and only three of those sites had nonimpaired biological conditions. Two of those sites were in the headwaters of the Lackawanna River and the other one was MILL 6.7. Seven sites had “higher” water quality, and five sites had excellent habitat conditions. Four sites had severely impaired conditions including Lackawanna River at the mouth, Nanticoke Creek, Newport Creek, and Solomons Creek, all of which were impaired by AMD. Five sites had “lower” water quality and six sites had “middle” water quality mostly due to AMD pollutants such as elevated metals and urban pollutants such as elevated nutrients and sodium. Newport Creek had the highest levels of iron, manganese, and sulfates (common pollutants in AMD) while Leggetts Creek, located downstream of a wastewater treatment plant in an urban area, had the highest level of nutrients and sodium (Table 3). Other sites with elevated nutrients and sodium were LAWR 4.2, LAWR 0.8, TOBY 5.1, and TOBY 0.2. Spring Brook and Mill Creek had low levels of alkalinity and elevated sodium. Habitat issues in this region mostly concerned poor condition of banks, lack of naturally vegetated riparian zones, embeddedness, and sediment deposition. The worst habitat conditions were at TOBY 0.2, which had nonsupporting habitat due to a lot of sediment deposition, poor condition of banks, embeddedness, lack of riffles, poor epifaunal substrate, and deficient instream cover habitat.

*“The best overall conditions in biology, water quality, and habitat in the Wyoming Valley Region were found only at one site in the headwaters of the Lackawanna River.”*



*AMD-impacted Solomons Creek.*

## Watersheds from West Nanticoke to Sunbury, Pa.

The watersheds sampled during this survey that enter the Susquehanna River between West Nanticoke and Sunbury, Pa., include Harveys Creek, Hunlock Creek, Shickshinny Creek, Little Nescopeck Creek, Briar Creek, Catawissa Creek, Fishing Creek, Mahoning Creek, and Roaring Creek. This section of the Middle Susquehanna Subbasin is located in the North Central Appalachians Ecoregion and the Central Appalachian Ridges and Valleys Ecoregion. The ridge and valley region is characterized by almost parallel ridges and valleys formed by folding and faulting events. The streams in this area may be influenced by springs and caves. Cultivated agriculture lands are more common in this ridge and valley area (Figure 2). Abandoned mine lands and some urban areas also impact this section from West Nanticoke to Sunbury, Pa.

There were no sites in this section that had the best overall conditions in biology, water quality, and habitat. Of the 30 sites sampled, nine sites had nonimpaired biological conditions, seven sites had “higher” water quality, and 13 sites had excellent habitat conditions. No sites had severely impaired conditions; however, 10 sites had moderately impaired conditions. The sites that had the best biological conditions were located in Fishing Creek, Roaring Creek, and Hunlock Creek Watersheds.

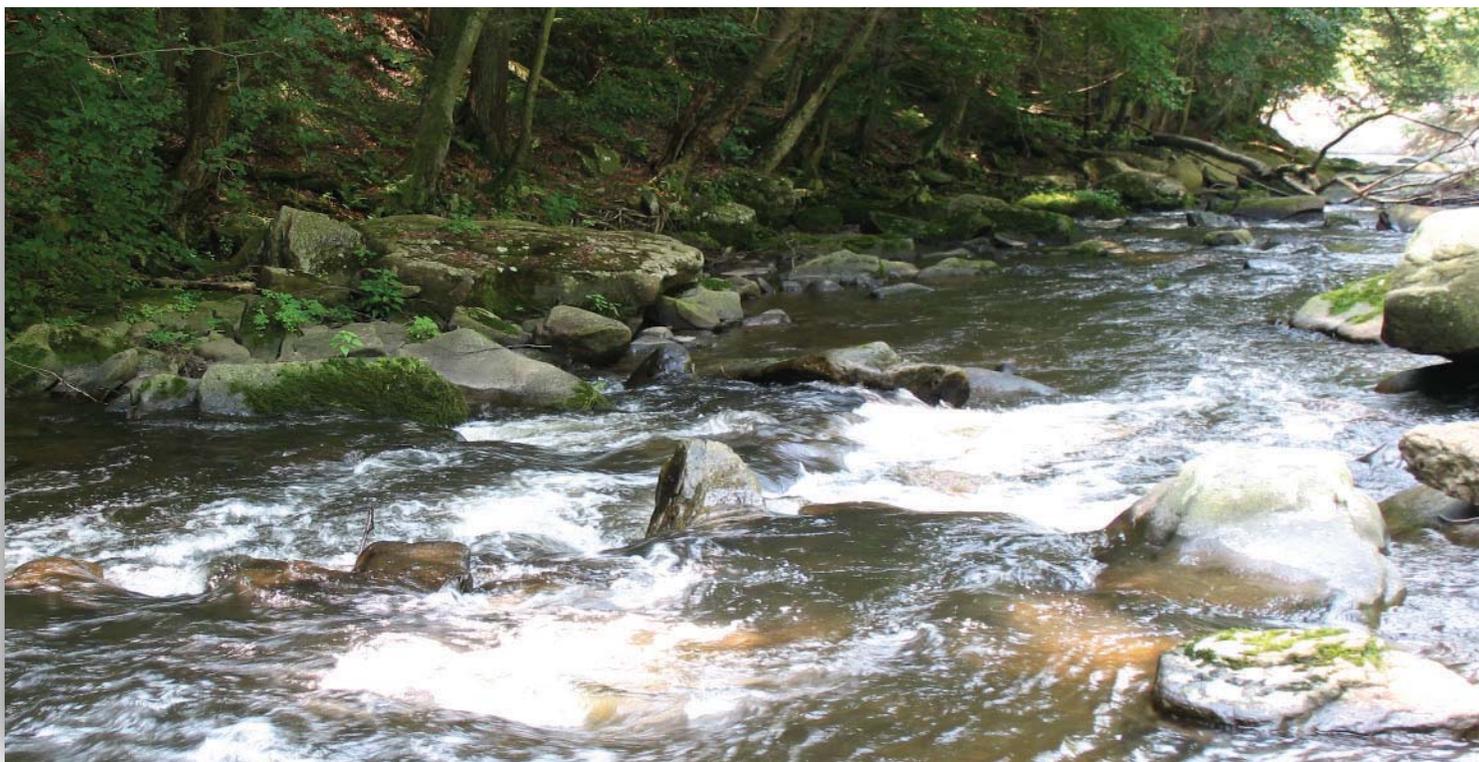
Twenty-three sites exceeded water quality levels of concern. Many of the sites had low alkalinity, such as East Branch Fishing Creek, West Branch Fishing Creek, Fishing Creek, Huntingdon Creek (Fishing Creek Watershed), Shickshinny Creek, Little Shickshinny Creek, Little Nescopeck Creek, and Catawissa Creek. Little Nescopeck and Catawissa Creeks also displayed impacts of AMD with high metals, particularly aluminum. LNSK 0.1 had the highest aluminum value in the survey (Table 3). High nutrient conditions were found on numerous streams such as Harveys Creek, East Fork Harveys Creek, Mahoning Creek, Briar Creek, West Branch Briar Creek, East Branch Briar Creek, Green Creek (Fishing Creek Watershed), Roaring Creek, and Tomhicken Creek (Catawissa Creek). No sites had nonsupporting habitat and only two sites had partially supporting habitat (HARV 0.1 and MAHO 1.4). Most of the habitat issues included poor condition of banks, lack of naturally vegetated riparian zones, channel alteration, infrequent riffles, low channel flow, and lack of diversity in velocity and depth.

## Susquehanna River Mainstem

The Susquehanna River meanders through the Middle Susquehanna Subbasin from Towanda to Sunbury, Pa., and passes through the Northern Appalachian Plateau and Uplands, North Central Appalachians, and Central Appalachian Ridges and Valleys ecoregions. No sites sampled on the Susquehanna River during this 2008 subbasin survey had overall best biological, water quality, and habitat conditions. Of the nine sites sampled on the river, six sites had nonimpaired conditions; however, no sites had “higher” water quality. All the sites had “middle” water quality. Most of the habitat conditions were supporting or excellent.

The six nonimpaired sites were SUSQ 138 (just upstream of Danville), SUSQ 155.9 (Mifflinville), SUSQ 172.8 (upstream of Shickshinny), SUSQ 187.5 (Wilkes-Barre), SUSQ 209.1 (West Falls), and SUSQ 231.8 (North Mehoopany). None of the

river sites had severely impaired conditions, but one of them had moderately impaired conditions. This site was located in Bloomsburg, Pa. (SUSQ 146.4). All the sites on the river exceeded the sodium level of concern of 20 mg/l. The highest sodium level was 33.8 mg/l at the site located upstream of Shickshinny, Pa. Two river sites also had elevated total phosphorus and orthophosphate. Those sites were located at Mifflinville and Bloomsburg, Pa. The habitat was rated excellent at three of the nonimpaired sites in Danville, Mifflinville, and north of Shickshinny, Pa. There were no sites with nonsupporting habitat and only one site had partially supporting habitat. This site was located in Wilkes-Barre, Pa., and scored low in the habitat assessment on sediment deposition, channel alteration, channel sinuosity, condition of banks, vegetative protective cover, and riparian vegetative zone width.



*Hunlock Creek located in Luzerne County.*

## Comparison of 2008 and 2001 Data

A comparison of the current 2008 data and historical 2001 data showed mostly similar conditions. The results for the biological, water quality, and habitat conditions in the 2001 Middle Susquehanna Subbasin Survey (LeFevre, 2002) are depicted in Figure 4. There were 106 sites sampled during the 2001 survey; however, two sites (HNT 5.0 and UNTA 0.1) were removed from the list for 2008 and are not included in this report. The methods from 2001 to 2008 were very similar except for the water quality analysis methods. Therefore, the water quality analysis was repeated using current methods for the 2001 data in order to compare it to the 2008 data.

A comparison of Figures 3 and 4 indicates that the conditions in 2001 and 2008 have remained relatively the same

with mostly green colors (nonimpaired, “higher”, and excellent conditions) located in the northern portion and mostly red colors (severely impaired, “lower”, and nonsupporting conditions) located in the Wyoming Valley (eastern) portion of the subbasin. Figures 5 and 6 show similar percent composition of biological conditions in 2001 and 2008. In 2001, 27 percent of the sites had nonimpaired, 48 percent had slightly impaired, 17 percent had moderately impaired, and 8 percent had severely impaired conditions (Figure 5). In 2008, 34 percent had nonimpaired, 40 percent had slightly impaired, 22 percent had moderately impaired, and 4 percent had severely impaired conditions (Figure 6). Four sites had the best overall conditions for biology, water quality, and habitat in both 2001 and 2008.