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Middle Susquehanna Subbasin

A Water Quality and Biological Assessment, July – September 2001

SUSQUEHANNA RIVER BASIN COMMISSION

Table of Contents

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The Susquehanna River Basin Commission (SRBC) monitors and assesses the six major subbasins (Figure 1) of the Susquehanna River Basin on a rotating schedule. SRBC conducted the Year-1 survey of the Middle Susquehanna Subbasin from July to September 2001. This survey included a point-in-time sample and assessment of the water quality, macroinvertebrate community, and habitat. SRBC surveyed the Middle Susquehanna Subbasin previously in 1984 and 1993. Historical data from these surveys as well as all other subbasin surveys are available from SRBC.

Subbasin survey information is used by SRBC staff and others to:

- evaluate the chemical, biological, and habitat conditions of streams in the basin;
- identify major sources of pollution and lengths of stream impacted;
- maintain a database that can be used to document changes in stream quality over time;
- review projects affecting water quality in the basin; and
- identify areas for more intensive study.

D. Gavin

Figure 1. *The Susquehanna River Basin Subbasins.*

SRBC will conduct a detailed Year-2 study of a priority watershed in the Middle Susquehanna Subbasin during 2002 and 2003. The priority watershed will be selected based on results from the Year-1 survey and input from local interests. SRBC will work with area groups to provide additional data to aid in remediation or protection efforts.


G. Hirschel

Susquehanna River near Wilkes-Barre.

Description of the Middle Subbasin

The Middle Susquehanna Subbasin drains an area of approximately 3,700 square miles from Ulster to Sunbury, Pennsylvania, which includes portions of the counties Tioga, Lycoming, Bradford, Sullivan, Susquehanna, Wayne, Lackawanna, Wyoming, Luzerne, Columbia, Montour, Carbon, Schuylkill, and Northumberland. Three different ecoregions are found within this area:

- Northern Appalachian Plateau and Uplands
- North Central Appalachians
- Central Appalachian Ridges and Valleys (Omernick, 1987) (Figure 2).

The Middle Susquehanna Subbasin is a mixture of urban and rural lands that include forest, agriculture, abandoned mines, and cities (Figure 3). The major urban centers in this area are Scranton and Wilkes-Barre, Pa. A section of this subbasin was heavily mined and remnants of the industry, such as coal slag piles, abandoned mines, and abandoned mine drainage (AMD) still impact the water quality of many miles of streams and rivers throughout the Lackawanna and Wyoming Valleys.

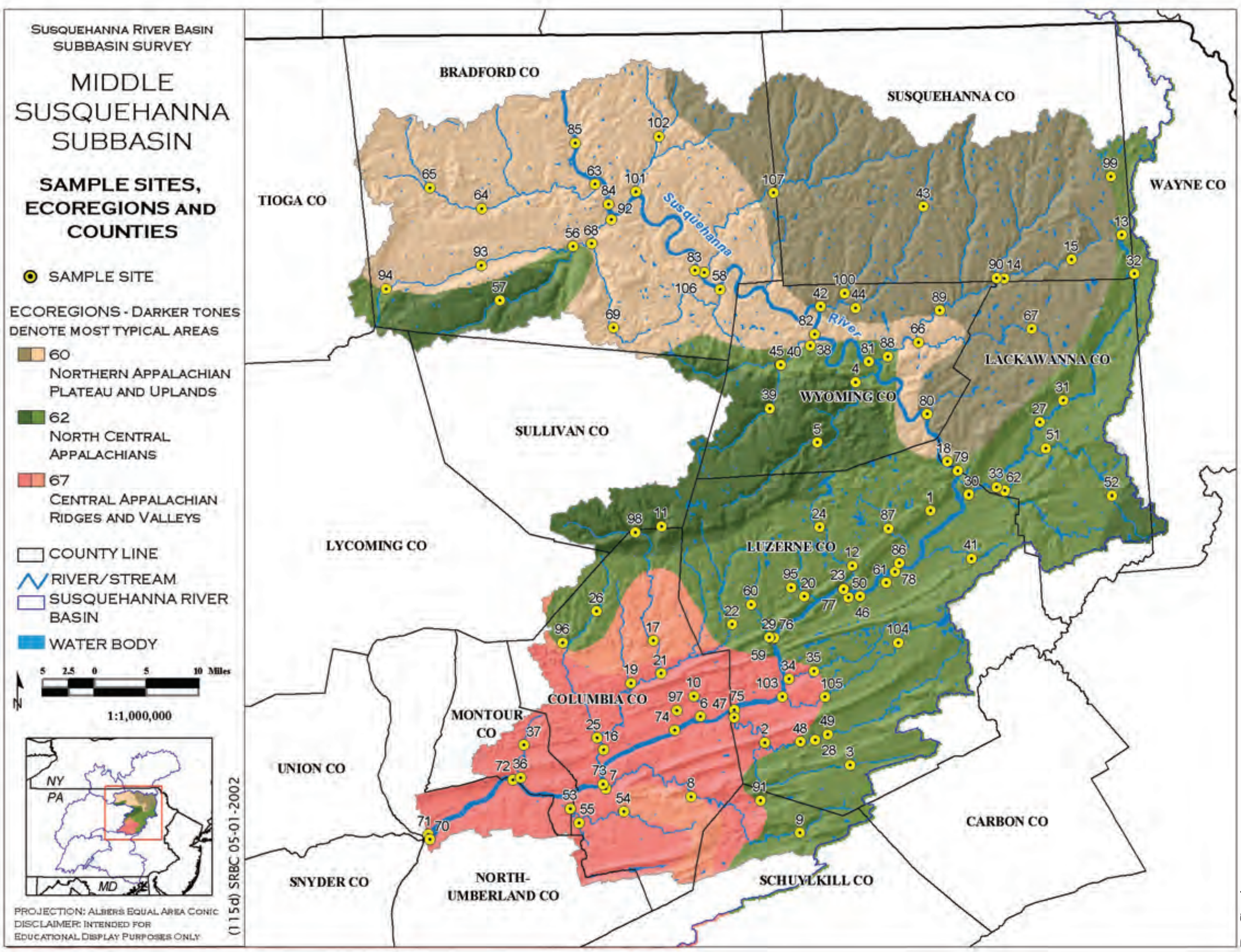

Figure 2. *Ecoregions and Counties in the Middle Susquehanna Subbasin*

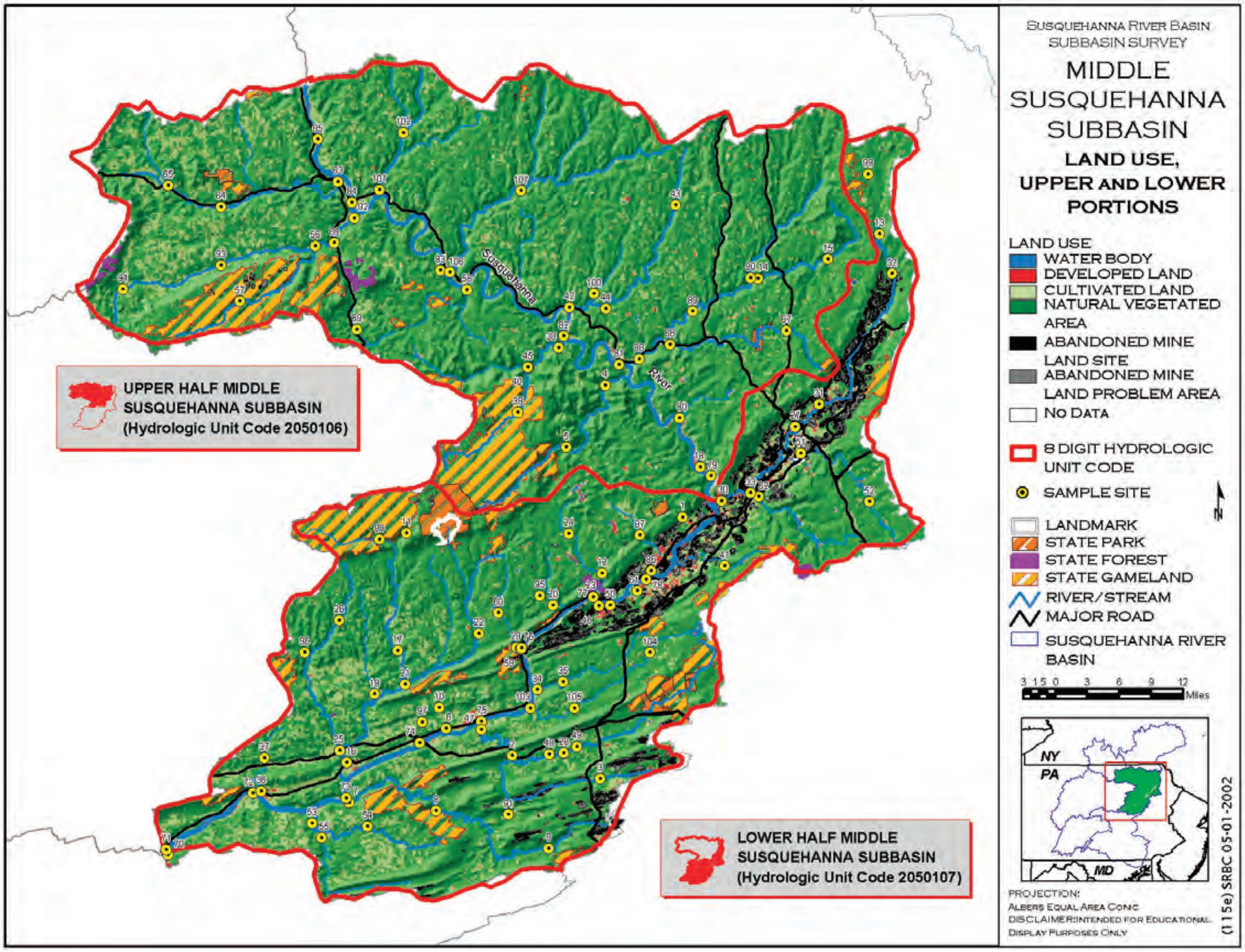

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Figure 3. *Land Use in the Middle Susquehanna Subbasin*

Methods Used in the Subbasin Survey

DATA COLLECTION

During the summer of 2001, SRBC visited 106 sites throughout the Middle Susquehanna Subbasin and took water quality samples at all sites. Appendix A contains a list with the sample site number, the station name (designated by stream mile), a description of the sampling location, the ecoregion, and the drainage size category. Macroinvertebrate samples were taken at all but three sites due to excessive low flow (HNL 0.1), no riffle habitat (SUSQ 125.0A/B), or deep iron precipitates (NPT 0.1). Habitat was rated at all sites where a macroinvertebrate sample was collected and at NPT 0.1.

The sites were sampled once in this Year-1 sampling round in order to provide a point-in-time look at stream characteristics throughout the whole subbasin. Samples were collected using a slightly modified version of the U.S. Environmental Protection Agency's (USEPA's) *Rapid Bioassessment Protocols for Use in Streams and Rivers* (RBP III) (Plafkin and others, 1989). Sampling was performed during the summer, when base flow was sustained primarily by ground water.

Water Quality

A portion of the water sample was separated for laboratory analysis, and the rest of the sample was used for field analysis. A list of the field and laboratory parameters and their units is found in Table 1. Measurements of flow, water temperature, dissolved oxygen, pH, conductivity, alkalinity, and acidity were taken in the field. Flow was measured using standard United States Geological Survey (USGS) methodology. Temperature was measured with a field thermometer in degrees Celsius. A Cole-Parmer Model 5996 meter was used to measure pH. Dissolved

Field Parameters	
Flow, instantaneous cfs[a]	Conductivity, µmhos/cm[c]
Temperature, °C	Alkalinity, mg/l
pH	Acidity, mg/l
Dissolved Oxygen, mg/l[b]	
Laboratory Analysis	
Specific Conductance, µmhos/cm	Total Sodium, mg/l
pH	Total Potassium, mg/l
Alkalinity, mg/l	Chloride, mg/l
Total Suspended Solids, mg/l	Sulfate - IC, mg/l
Total Nitrogen, mg/l	Total Fluoride, mg/l
Total Ammonia - N, mg/l	Total Copper, µgrams/l[d]
Nitrite - N, mg/l	Total Iron, µgrams/l
Nitrate - N, mg/l	Total Lead, µgrams/l
Total Phosphorus, mg/l	Total Manganese, µgrams/l
Total Organic Carbon, mg/l	Total Nickel, µgrams/l
Total Hardness, mg/l	Total Zinc, µgrams/l
Total Calcium, mg/l	Total Aluminum, µgrams/l
Total Magnesium, mg/l	Total Orthophosphate, mg/l

[a] cfs = cubic feet per second
[b] mg/l = milligram per liter
[c] µmhos/cm = micromhos per centimeter
[d] µgrams/l = micrograms per liter

Table 1. *Water Quality Parameters Sampled in the Middle Susquehanna Subbasin.*

oxygen was measured with a YSI 55 meter, and conductivity was measured with a Cole-Parmer Model 1481 meter. Alkalinity was determined by titration of a known volume of sample water to pH 4.5 with 0.02N H_2SO_4. Acidity was determined by titration of a known volume of sample water to pH 8.3 with 0.02N NaOH.

One 500-ml bottle and two 250-ml bottles of water were collected for laboratory analyses. One of the 250-ml bottles was acidified with nitric acid for metal analysis. The other 250-ml bottle was acidified with sulfuric acid for nutrient analysis. Samples were iced and shipped to the Pa. Department of Environmental Protection, Bureau of Laboratories in Harrisburg, Pennsylvania.

Macroinvertebrates

Benthic macroinvertebrates (organisms that live on the stream bottom, including aquatic insects, crayfish, clams, snails, and worms) were collected using a modified version of RBP III (Plafkin and others, 1989). Two kick screen samples were obtained at each station by disturbing the substrate of representative riffle/run areas and collecting dislodged material with a one-meter-square 600-micron mesh screen. Each sample was preserved in 95 percent denatured ethyl alcohol and returned to SRBC's lab, where the sample was sorted into a subsample of at least 100 organisms. Organisms in the subsample were identified to genus, except for midges and aquatic worms, which were identified to family.

Habitat

Habitat conditions were evaluated using a modified version of RBP III (Plafkin and others, 1989; Barbour and others, 1999). Physical stream characteristics relating to substrate, pool and riffle composition, shape of the channel, conditions of the banks, and the riparian zone were rated on a scale of 0-20, with 20 being optimal. Other observations were noted about weather, substrate material composition, surrounding land use, and any other relevant features in the watershed.

DATA ANALYSIS

Seven reference categories were created for data analysis. The 15 sites on the main stem of the Susquehanna River were grouped into the same reference category in order to compare them to each other and observe how the water quality changes downstream. All the other sites in the Middle Susquehanna Subbasin were divided into reference categories based on ecoregions (Omernick, 1987) and drainage size. The three ecoregions were Ecoregion 60 (Northern Appalachian Plateau and Uplands), Ecoregion 62 (North Central Appalachians), and Ecoregion 67 (Central Appalachian Ridges and Valleys) (Figure 2). All the sites within each ecoregion were divided into small drainage areas (<50 square miles) and medium drainage areas (>50 square miles).

Taxonomic Richness: the total number of taxa in the sample. Number decreases with increasing stress.

Percent Contribution of Dominant Taxa: the percentage of the taxon with the largest number of individuals out of the total number of macroinvertebrates in the sample. Percentage increases with increasing stress.

EPT Index: the total number of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) taxa present in a sample. Number decreases with increasing stress.

Ratio of EPT to Chironomidae: the total number of individuals in the orders Ephemeroptera, Plecoptera, and Trichoptera divided by the number of Chironomidae (midges) in a sample. Ratio decreases with increasing stress.

Shannon-Wiener Diversity Index: a measure of the taxonomic diversity of the community. Index value decreases with increasing stress.

Hilsenhoff Biotic Index: a measure of organic pollution tolerance. Index value increases with increasing stress.

Water quality was assessed by examining 32 water quality parameters, including nutrients, major ions, and metals. For each parameter, all the sites were ranked from lowest value to highest value within each reference category. A percentage of the highest value (representing the worst water quality) was taken for all parameters except dissolved oxygen (the lowest value represented the worst water quality). All the percentages for each parameter were averaged for a Water Quality Index (WQI) score (McMorran and Bollinger, 1990), with the lowest percentages representing better water quality. The difference between WQI values was divided into thirds creating “higher” quality, “middle” quality, and “lower” quality designations. Only 22 out of the 32 parameters were analyzed because temperature, pH (field and lab), alkalinity (field and lab), acidity, calcium, magnesium, potassium, and fluoride could not be ranked for use in the WQI.

Benthic macroinvertebrate samples were analyzed using six metrics: Taxonomic Richness; Percent Contribution of Dominant Taxa; EPT (Ephemeroptera, Plecoptera, Trichoptera) Index; Ratio of EPT to Chironomidae; Shannon-Wiener Diversity Index; and Hilsenhoff Biotic Index.

Reference sites were determined for each reference category, primarily based on the results of the macroinvertebrate metrics and secondarily based on habitat and WQI scores, to represent the best combination of conditions. The metric scores were compared to the reference scores and a biological condition category was assigned based on RBP III methods (Plafkin and others, 1989; Barbour and others, 1999).

The same reference sites were used in the analysis for the habitat scores. The ratings for each habitat condition were totaled and a percentage of the reference site was calculated. The percentages were used to assign a habitat condition category to each site (Plafkin and Barbour and others, 1999).

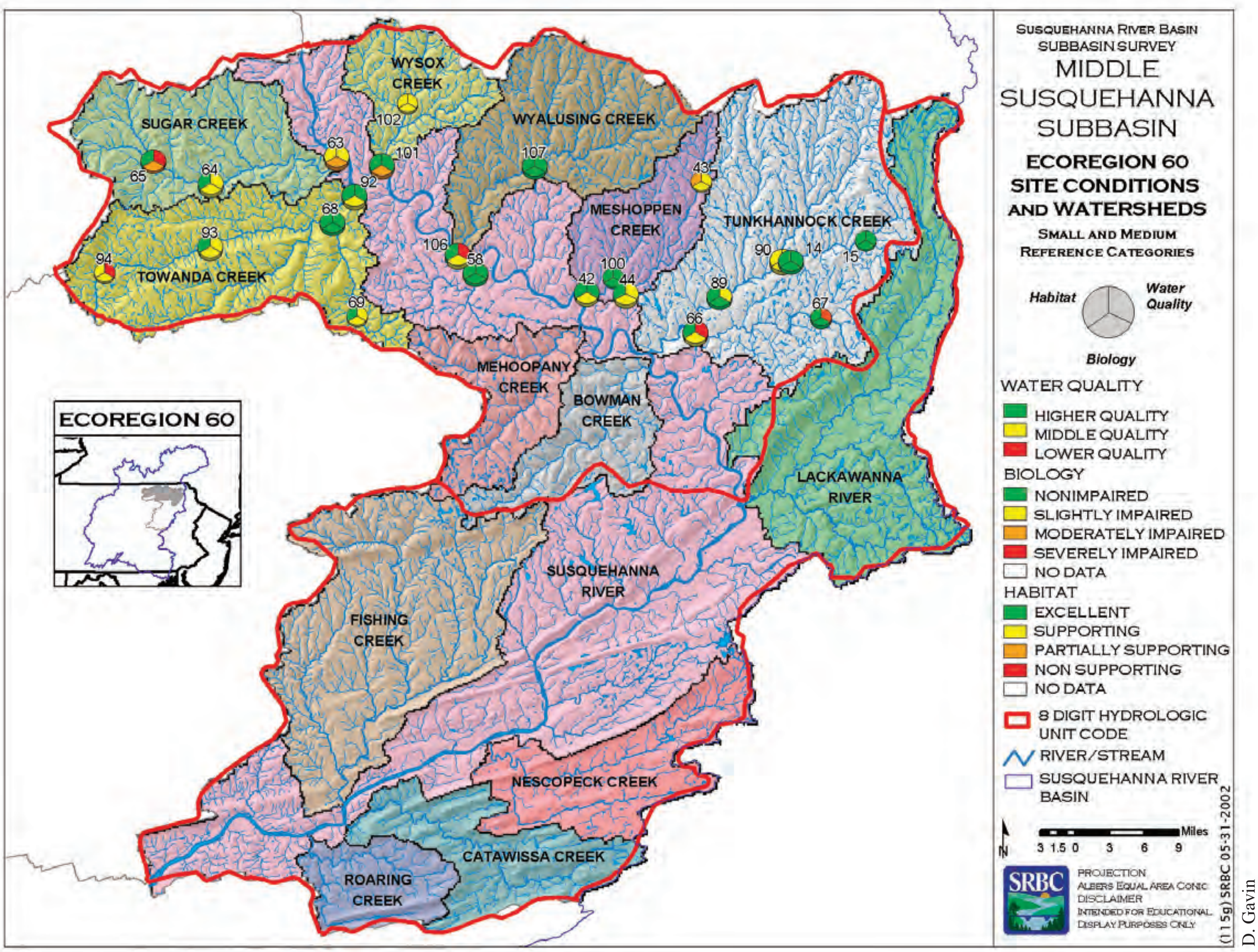

Figure 4. Water Quality, Biological, and Habitat Categories in Ecoregion 60 (small and medium drainage) Sample Sites in the Middle Susquehanna Subbasin.

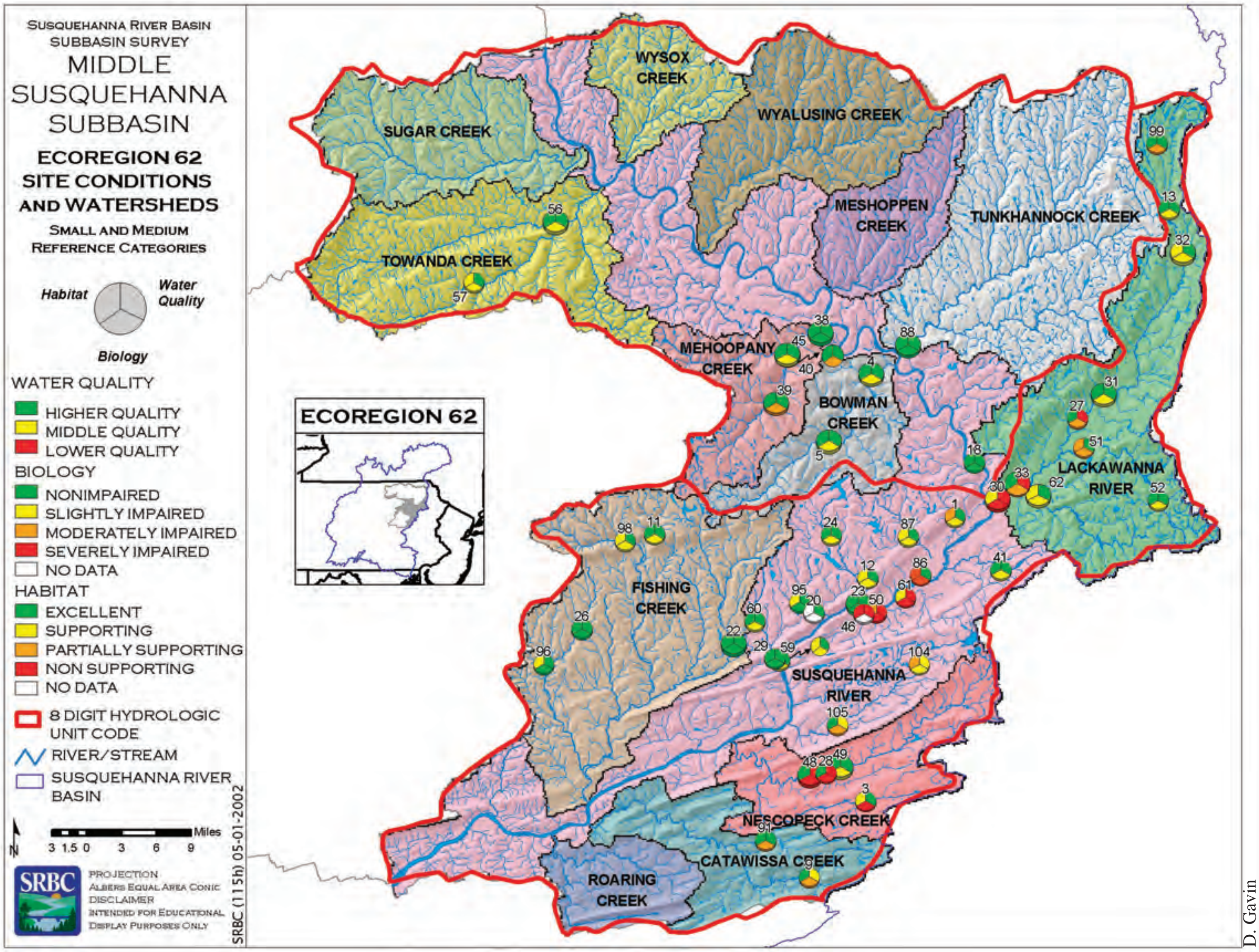

Figure 5. *Water Quality, Biological, and Habitat Categories in Ecoregion 62 (small and medium drainage) Sample Sites in the Middle Susquehanna Subbasin.*

Results/Discussion

The Middle Susquehanna Subbasin was divided into an "Upper Half" and a "Lower Half" based on USGS Hydrologic Unit Code (HUC) 8 (Seaber and others, 1987) in order to differentiate between the major land uses in the Middle Susquehanna Subbasin. Figure 3 shows that abandoned mine lands and urban development had a greater influence on the "Lower Half" of the subbasin. Table 2 lists sites that have extreme values in parameters that are characteristic of AMD or agriculture/wastewater treatment plants. Only values that exceeded limits based on values from Hem (1970), The Commonwealth of Pennsylvania (2002), Gagen and Sharpe (1987), and Baker and Schofield (1982) are listed. Most of the sites in Table 2 were located within the "Lower Half" of the Subbasin. Table 3 lists the same parameters that are characteristic of AMD or agriculture/wastewater treatment plants; however, it contains values for sites that have been designated as Exceptional Value (EV) and High Quality-Cold Water Fishes (HQ-CWF) for comparison to the values in Table 2.

Figures 4 - 7 show the larger watersheds in the subbasin and their relative locations. These figures also show the ratings for water quality, biological condition, and habitat condition relative to the corresponding reference category. Figure 8 (A, B, and C) shows a summary of the ratings for water quality, biological condition, and habitat condition in each reference category. Ecoregion 62 contained most of the severely impaired streams (Figure 8 B), and all of the streams rated nonsupporting in habitat (Figure 8 C). Figures 9 – 12 show the relationships of biological and habitat condition scores at sample sites in each reference category.

SUGAR CREEK WATERSHED (SRC)

There were three sites in the Sugar Creek Watershed, all located on the main stem of Sugar Creek, in Ecoregion 60 size medium reference category. The most upstream site (SRC 25.0) was rated as "lower" in water quality, contained a moderately impaired macroinvertebrate population, and had excellent habitat. SRC 16.4 had "middle" range water quality, a slightly impaired macroinvertebrate population, and excellent habitat. SRC 0.8 contained "middle" water quality, a moderately impaired macroinvertebrate community, and supporting habitat conditions. A municipal sewage treatment plant was upstream of SRC 25.0, which could explain the "lower" water quality at this site. The stream seemed to recover slightly around SRC 16.4, but then degraded at the mouth of the stream where the land use was more influenced by agriculture and industry.

TOWANDA CREEK WATERSHED (TWN)

All the sites within this watershed contained a slightly impaired macroinvertebrate population except STWN 0.1 (South Branch Towanda Creek), which harbored a nonimpaired community. All the sites had either supporting or excellent habitat. TWN 25.0, the most upstream site, was the only site to receive a "lower" water quality rating. TWN 25.0 also is listed on Table 2 for low dissolved oxygen. This sampling site was located in a more commercial and residential area, which could have

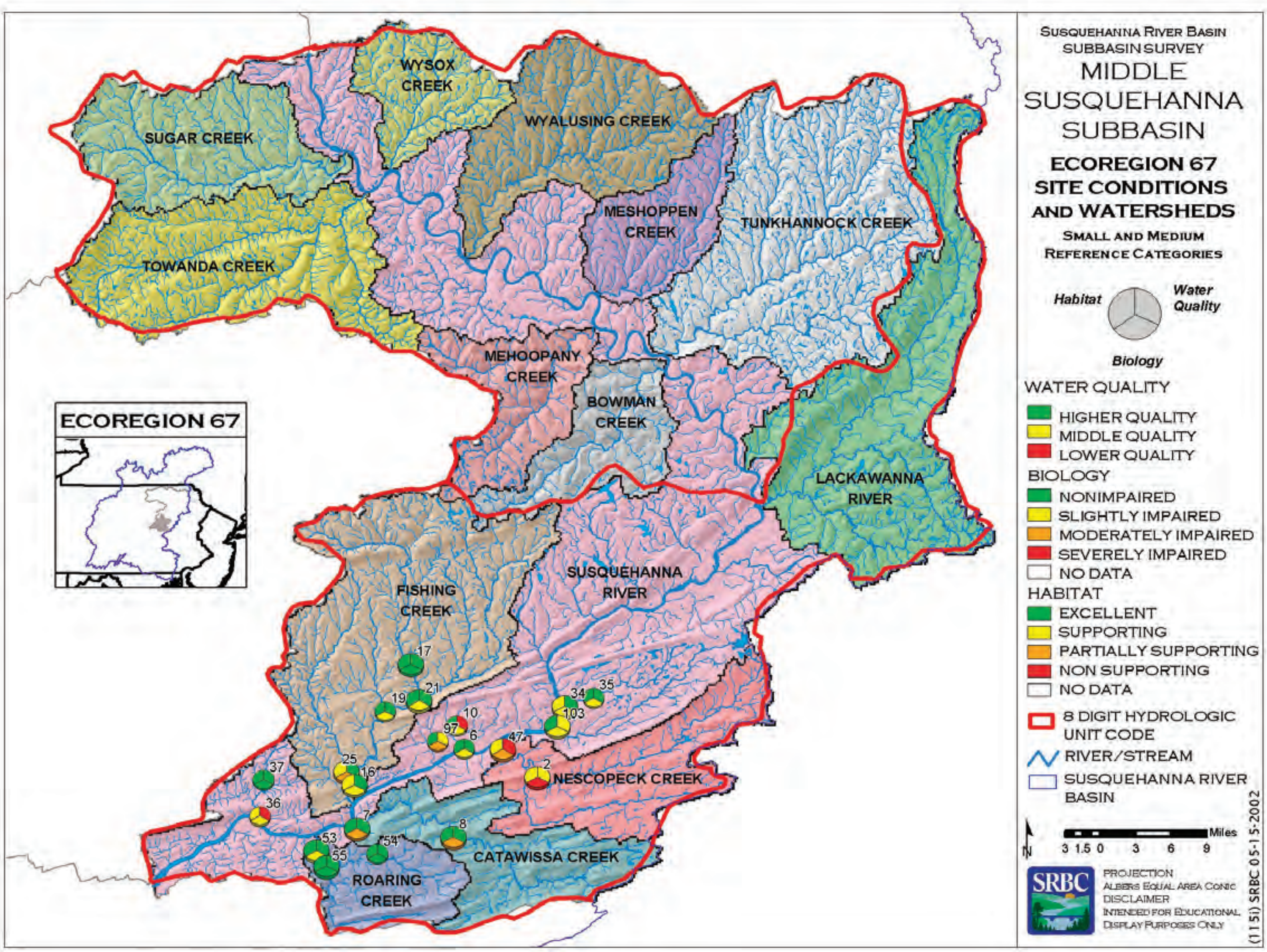

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Figure 6. *Water Quality, Biological, and Habitat Categories in Ecoregion 67 (small and medium drainage) Sample Sites in the Middle Susquehanna Subbasin.*

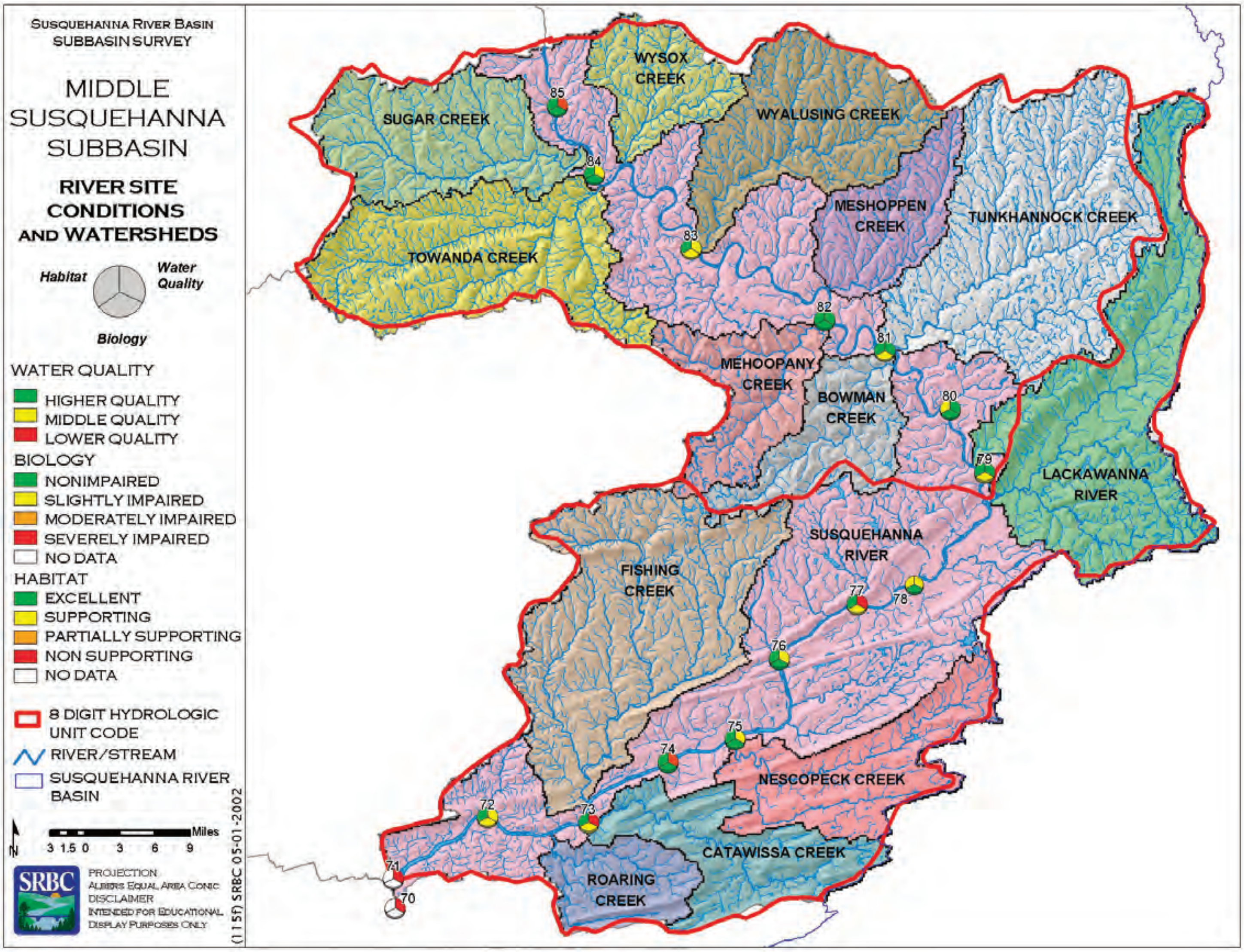

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Figure 7. Water Quality, Biological, and Habitat Categories at River Sample Sites in the Middle Susquehanna Subbasin.

attributed to the "lower" water quality rating. TWN 16.9 was rated "middle" water quality, and is listed on Table 2 for dissolved oxygen below 4.0 mg/l. This site was located in an agricultural area. Both sites on Schrader Creek were rated "higher" water quality. Schrader Creek is designated as EV and HQ-CWF (Table 3); however, it also is listed on Table 2 for dissolved oxygen below 4.0 mg/l. Also, the land use map (Figure 3) indicates that there are abandoned mine lands in the Schrader Creek Watershed. STWN 10.0 was rated "middle" quality and is listed on Table 2 for high total organic carbon. The two remaining sites (STWN 0.1 and TWN 0.1) in this watershed were located in forested areas, and had "higher" water quality ratings.

WYSOX CREEK WATERSHED (WSX)

WSX 6.6 contained "middle" water quality, a slightly impaired macroinvertebrate population, and supporting habitat. WSX 0.2 was rated "higher" in water quality, and excellent in habitat, but had a moderately impaired macroinvertebrate population, possibly due to a scarcity of riffle areas.

WYALUSING CREEK WATERSHED (WYL)

The two sampling sites in this watershed are both within Ecoregion 60. The more upstream site, WYL 16.2, had a "higher" water quality rating, a nonimpaired biological community, and excellent habitat. Downstream at WYL 0.4, the water quality was "lower," and the macroinvertebrate population was slightly impaired, although the habitat was excellent. WYL 0.4, located near the borough of Wyalusing, was visibly impacted by human activities. WYL 16.2 is listed on Table 2 for low dissolved oxygen, and WYL 0.4 is listed for high total nitrogen.

MESHOPPEN CREEK WATERSHED (MSH)

This watershed contained the reference site for Ecoregion 60 small drainage areas on West Branch Meshoppen Creek (WMSH 0.5). The two sites upstream of West Branch Meshoppen Creek (MSH 12.0 and MSH

5.3) had "middle" range water quality, slightly impaired biological communities, and partially supporting and excellent habitats, respectively. MSH 12.0 was influenced by beaver dams and was located in an apple orchard. The site downstream of those land influences, MSH 5.3, is listed on Table 2 for high total organic carbon (4.5 mg/l). WMSH 0.5, which was heavily forested, had "higher" water quality, nonimpaired biological conditions, and excellent habitat. The site at the mouth of Meshoppen Creek (MSH 0.1), also had "higher" water quality and excellent habitat conditions; however, the biological condition was slightly impaired.

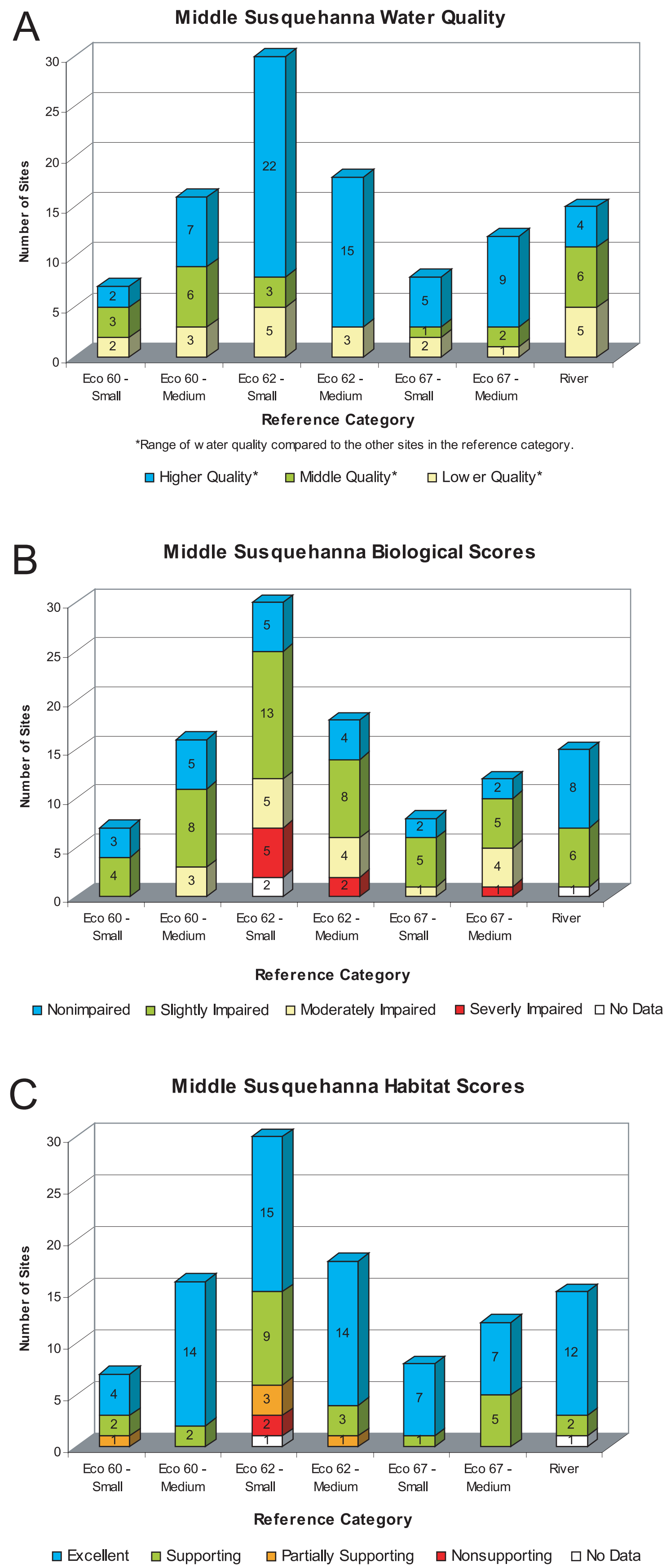
MEHOOPANY CREEK WATERSHED (MHO)

All the sites in this watershed were in the reference category Ecoregion 62 medium drainage size and were mostly forested. The water quality at all of the sites was rated "higher" quality and the habitat was excellent. The two upstream sites, MHO 15.0 and MHO 6.5, were both moderately impaired in biological condition, although MHO 15.0 was a HQ-CWF (Table 3). These sites scored poorly in EPT, EPT/Chironomidae, dominant taxa, and Hilsenhoff metrics. North Branch Mehoopany Creek (NMH 0.1) contained a better macroinvertebrate community, which was rated only slightly impaired. The site below North Branch Mehoopany Creek (MHO 0.1), at the mouth of Mehoopany Creek, had a nonimpaired biological community. MHO 0.1 was used as the reference site for biological condition and habitat in the Ecoregion 62 medium drainage size reference category. Our samples indicated that this watershed was healthy.

TUNKHANNOCK CREEK WATERSHED (TNK)

This watershed had two sampling sites located on both the East Branch and the South Branch Tunkhannock Creek, in addition to three sites on the main branch. The water quality at East Branch Tunkhannock Creek was "higher" than the South Branch, even though iron concentrations were elevated at ETNK 0.1 (Table 2). Both sites on the East Branch had "higher" water quality, excellent habitat, and nonimpaired macroinvertebrate communities. The site above the East Branch (TNK 20.0) had a "middle" water quality rating, supporting habitat, and a slightly impaired macroinvertebrate population. Below the confluence of the East Branch, Tunkhannock Creek

Figure 8. Summary of Water Quality, Biological, and Habitat Characteristics.



(TNK 11.3) still had a "middle" water quality rating, but the habitat was excellent, and the macroinvertebrate population was nonimpaired, similar to the East Branch. The South Branch also had excellent habitat, but the water quality was "lower" and the macroinvertebrate population at STNK 0.1 was slightly impaired. The site near the mouth of Tunkhannock Creek (TNK 0.3) contains a "higher" water quality, a nonimpaired biological community, and excellent habitat. Overall, this watershed was healthy.

BOWMANS CREEK WATERSHED (BOW)

The main branch of Bowmans Creek is designated as a HQ-CWF (Table 3), and this watershed appeared to be healthy. Both sites had "higher" water quality, slightly impaired macroinvertebrate communities, and excellent habitat.

Lower Half of the Middle Susquehanna Subbasin

LACKAWANNA RIVER WATERSHED (LWR)

This watershed was fairly healthy at the upstream sites. In fact, the East Branch Lackawanna River is designated as a HQ-CWF (Table 3). It was degraded downstream, however, due to abandoned mine land and urban influences (Figure 3). The East and West Branch Lackawanna River sites had "higher" water quality, excellent habitat, and slightly and moderately impaired macroinvertebrate populations, respectively. Despite signs of AMD starting to appear downstream on Lackawanna River at LWR 36.0 and LWR 15.0, these two sites on the main branch remained fairly healthy with "higher" water quality ratings, slightly impaired macroinvertebrate communities, and supporting and excellent habitats, respectively. Leggetts Creek (LGT 0.1) entered the Lackawanna River with "lower" water quality and a moderately impaired macroinvertebrate population. LGT 0.1 was located below joint sewage and wastewater treatment plants and is listed in Table 2 for high total nitrogen, high phosphorus, high total organic carbon, and high chloride. Roaring Brook also entered the Lackawanna River downstream of Leggetts Creek, but with "higher" water quality and slightly to moderately impaired macroinvertebrate populations despite strong urban influence. LWR 4.0 was characterized by "lower" water quality and a moderately impaired macroinvertebrate community. High total nitrogen was evident at this site (Table 2), and the stream sediments and water smelled of chlorine at the time of the sampling. Although a tributary to the main branch, Spring Brook (SPR 0.1), influenced the Lackawanna River with "higher" water quality and a slightly impaired macroinvertebrate population, the site at the mouth of the Lackawanna River (LWR 0.3) had "lower" water quality, severely impaired biological conditions, and supporting habitat. This site is listed in Table 2 for high iron and manganese (both indicators of AMD), and had yellow boy ($FeOH_2$) on the streambed.

SOLOMONS CREEK (SOL 0.9), NANTICOKE CREEK (NTK 0.4), and NEWPORT CREEK (NPT 0.1)

These streams were strongly impacted by AMD and urban influences (Figure 3). All the sites had "lower" water quality ratings and SOL 0.9 and NTK 0.4 had severely impaired macroinvertebrate communities. NPT 0.1 was not sampled for macroinvertebrates because

Nescopeck Creek outfall severly impacted by acid mine drainage.
(Left) Robert Hughes of EPCAMR helps remove litter during Streamside Cleanup 2001.

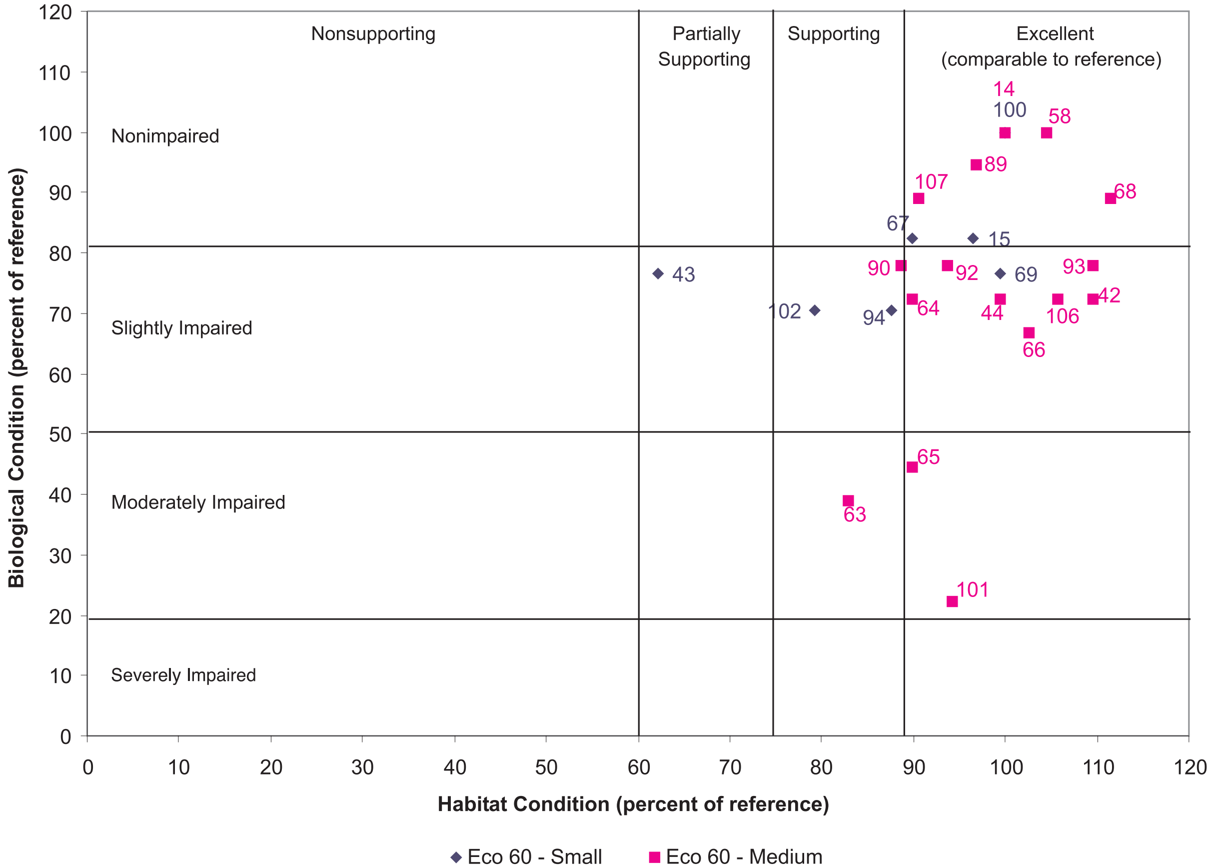


Figure 9. Biological and Habitat Condition Scores at Ecoregion 60 Small and Medium Reference Category Sample Sites in the Middle Susquehanna Subbasin.

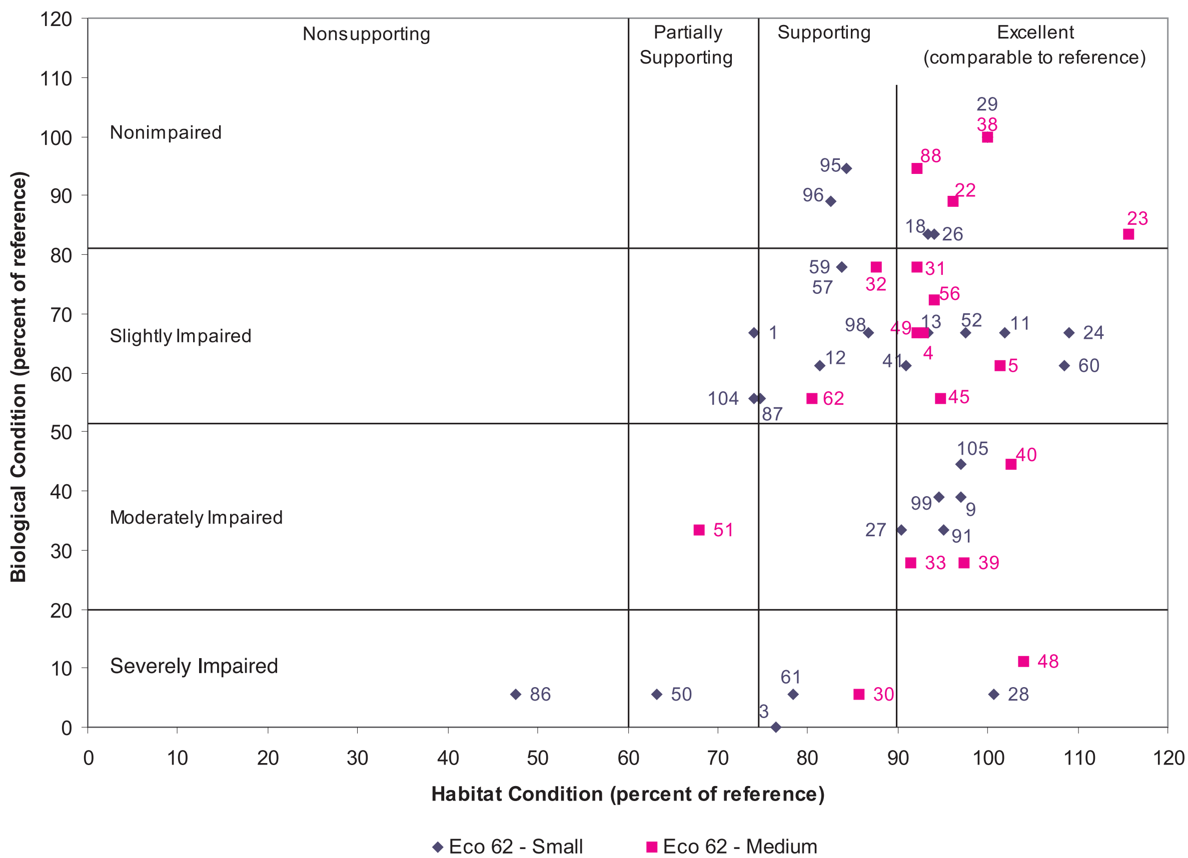


Figure 10. Biological and Habitat Condition Scores at Ecoregion 62 Small and Medium Reference Category Sample Sites in the Middle Susquehanna Subbasin.

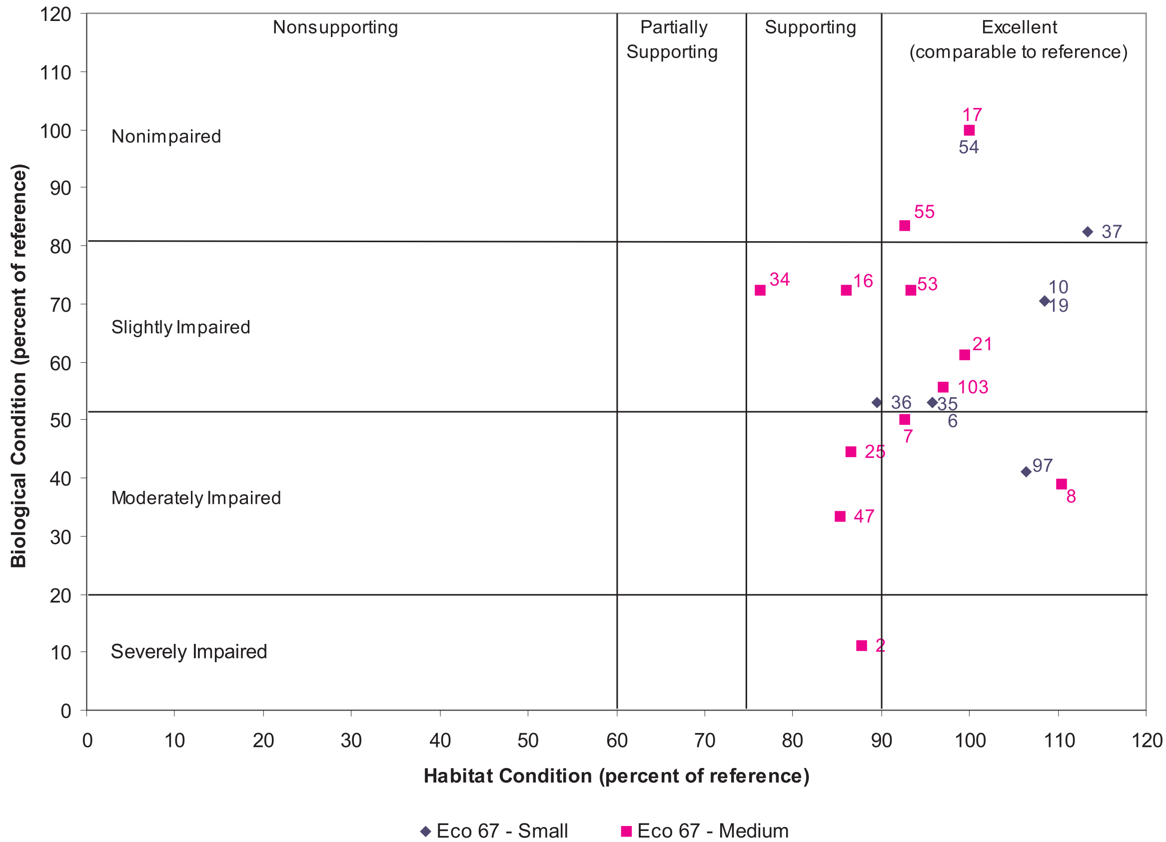


Figure 11. *Biological and Habitat Condition Scores at Ecoregion 67 Small and Medium Reference Category Sample Sites in the Middle Susquehanna Subbasin.*

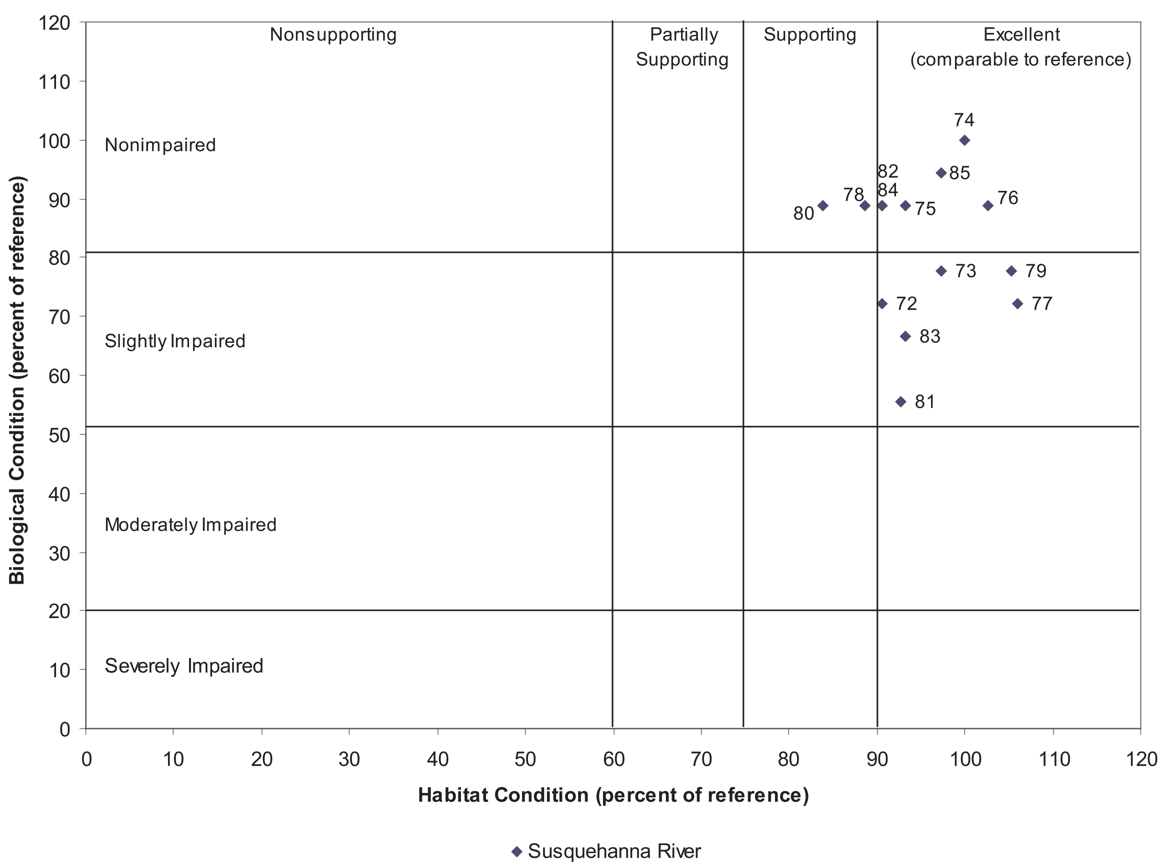


Figure 12. *Biological and Habitat Condition Scores at Susquehanna River Reference Category Sample Sites in the Middle Susquehanna Subbasin.*

the depth of iron deposits made entering the stream hazardous. All three sites were covered with a coating of yellow boy, and some of them smelled of sulfide. A sewage treatment smell, possibly from a local sanitary authority pumping station located adjacent to the site, was detected at NTK 0.4. All sites are listed in Table 2 for AMD characteristics.

NESCOPECK CREEK WATERSHED (NSK)

Most of the sites in this watershed had severely impaired macroinvertebrate populations, although the habitat ratings were excellent or supporting throughout the watershed. The upstream site in this watershed (NSK 13.9) was healthy with "higher" water quality and a slightly impaired macroinvertebrate population. Little Nescopeck Creek (LNSK 0.1), which had "lower" water quality and a severely impaired biological condition, joined Nescopeck Creek and degraded the stream causing "lower" water quality and a severely impacted macroinvertebrate population below the confluence (NSK 13.2). LNSK 0.1 and NSK 13.2 are listed in Table 2 for AMD characteristics. Black Creek also influenced the water quality in Nescopeck Creek Watershed. The macroinvertebrate population was severely impacted at both sites on Black Creek, even though the water quality was rated "higher" and "middle" quality. Black Creek was affected by aluminum (Table 2). At the downstream site in this watershed (NSK 0.7), the water quality remained "lower," and the site is listed in Table 2 for AMD characteristics. However, the macroinvertebrate population recovered slightly and received a moderately impaired rating.

FISHING CREEK WATERSHED (FSH)

All the sites in this watershed had "higher" water quality and nonimpaired or slightly impaired macroinvertebrate populations, except the site at the mouth of Little Fishing Creek (LFSH 0.1), which was rated moderately impaired. LFSH 0.1 also is listed on Table 2 for high total organic carbon. All habitat ratings in the Fishing Creek Watershed were excellent or supporting. Many areas of this watershed are designated HQ-CWF (Table 3). FSH 15.6 served as a reference site for Ecoregion 67 medium drainage size category.

CATAWISSA CREEK WATERSHED (CAT)

This watershed is affected by AMD. Even though the habitat was rated as excellent at all sites, the macroinvertebrate population was moderately impaired at all sites in this watershed, possibly due to very high aluminum concentrations (Table 2). CAT 25.0 also is listed in Table 2 for high manganese and low pH values.

ROARING CREEK WATERSHED (RRC)

The upstream site on Roaring Creek (RRC 10.7) was used as a reference site for the Ecoregion 67 small drainage size category. The macroinvertebrate population was nonimpaired at RRC 10.7 and SBRC 0.5, and was rated slightly impaired at RRC 1.1. The habitat at all sites was excellent.

SUSQUEHANNA RIVER SITES (SUSQ)

Water quality, macroinvertebrates, and habitat received the best quality ratings, for Susquehanna River sites, in the upper portion of the Middle Susquehanna Subbasin from below the Meshoppen Creek Watershed to upstream of the Lackawanna River Watershed (Figure 7). SUSQ 230, located below the confluence of Meshoppen Creek, was the only river site to have "higher" water quality, a nonimpaired macroinvertebrate community, and excellent habitat. The sites in the lower portion of the Middle Susquehanna Subbasin had either "middle" or "lower" water quality, although the macroinvertebrate populations were not largely impaired. The river site below Solomons, Nanticoke, and Newport Creeks, SUSQ 181, appeared to be impacted by the poor quality of the streams above it. SUSQ 181 had a "lower" water quality rating and a slightly impaired macroinvertebrate community. SUSQ 146.2 had the same ratings as SUSQ 181. This site was located below the borough of Berwick and the town of Bloomsburg.

G. Hirschel

Susquehanna River near Wilkes-Barre.

Table 2. Middle Susquehanna Subbasin Sites with Extreme Values in Parameters Characteristic of Abandoned Mine Drainage (AMD) or Agriculture/Wastewater Treatment Plants.

	pH		AMD				AGRICULTURE/WASTE WATER TREATMENT PLANT				
Sites	Field pH (<5.0)[a]	Lab pH (<5.0)[a]	Iron (>1,500 ug/l)[a]	Manganese (>1,000 ug/l)[a]	Aluminum (>200 ug/l)[b]	Sulfate (>250 mg/l)[a]	D.O. (<4.0mg/l)[a]	Nitrogen T (>5.0 mg/l)[a]	Phosphorus T (>1.0 mg/l)[a]	T. Org. Carbon (>4.0 mg/l)[a]	Chloride (>150mg/l)[a]
BLK 0.10	4.5	4.9			913						
CAT 0.20					254						
CAT 13.0	4.15	4.8			880						
CAT 25.0	3.4	4		2,060	5,850						
EBRR 4.7			5,370		221						
EFSH 0.50					220						
ETNK 0.10			1,610								
LFSH 0.10										4.1	
LGT 0.10								13.52	2.78	5	179
LNSK 0.10	4	4.5	1,820	4,880	9,960						
LWR 0.30			4,890	1,510							
LWR 4.0								5.92			
MSH 5.30										4.5	
NPT 0.10			57,500	5,230		827					
NSK 0.70	4.15	4.8		2,820	4,025						
NSK 13.2	4	4.6		3,810	7,450	306					
NTK 0.40			6,830	3,480	361	325					
SCH 0.2							3.8				
SHK 4.5							3.93				
SOL 0.90			38,100	3,870							
SUSQ 125.0					250					4.2	
SUSQ 254.0										4.2	
STWN 10.0										4.7	
TOM 1.0					284						
TWN 16.9							3.93				
TWN 25.0							3.8				
WLWR 0.10										4.7	
WWP 6.4								7.04	1.47		
WWP 12.0								7.36	1.69		
WYL 0.4								5.5			
WYL 16.2							3.92				

[a]Values based on Hem (1970) and The Commonwealth of Pennsylvania (2002). [b]Gagen and Sharpe (1987) and Baker and Schofield (1982).

Table 3. Values of Exceptional Value (EV)[a] and High Quality-Cold Water Fishes (HQ-CWF)[b] Middle Susquehanna Subbasin Sites based on Abandoned Mine Drainage (AMD), and Agriculture/Wastewater Treatment Plant Characteristics.

		pH		AMD				AGRICULTURE/WASTE WATER TREATMENT PLANT				
Sites	Designation	Field pH	Lab pH	Iron ug/l	Manganese ug/l	Aluminum ug/l	Sulfate mg/l	D.O. mg/l	Nitrogen T mg/l	Phosphorus T mg/l	T. Org. Carbon mg/l	Chloride mg/l
SCH 12.0	EV	6.85	5.8	31	<10	73.3	5.6	4.12	0.22	<0.01	1.2	<1
SCH 0.2	HQ-CWF	7.1	5.9	22	<10	69.5	17.9	3.8	0.13	<0.01	1.3	<1
MHO 15.0	HQ-CWF	5.65	5.7	80	22	129	4.3	4.45	0.26	<0.01	3	1
BOW 12.5	HQ-CWF	7.05	6.3	81	31	37.6	5.6	4.67	0.37	0.01	1.5	<1
BOW 0.1	HQ-CWF	7.3	6.5	20	<10	20.3	7.2	4.84	0.53	0.01	1.4	7
ELWR 0.1	HQ-CWF	7.15	6.8	201	36	38.1	6.5	6.5	0.38	0.02	2.6	6
RRB 10.0	HQ-CWF	7.15	6.7	84	25	27.6	7.1	6.65	0.54	0.02	2.4	15
SPR 0.1	HQ-CWF	7.2	6.6	23	<10	15.2	9.9	7.5	0.4	0.03	1.2	25
LSHK 0.1	HQ-CWF	7.05	6.7	282	34	82.2	5.2	4.93	0.62	0.02	3.5	5
WFSH 0.5	HQ-CWF	6.7	5.9	<20	<10	26.9	5.3	6.65	0.53	<0.01	1.2	<1
EFSH 0.5	HQ-CWF	6.3	5.3	40	45	220	6.4	8.3	0.62	<0.01	3.3	<1
LFSH 10.0	HQ-CWF	7.2	6.5	132	12	45.5	3.6	5.96	0.67	0.02	2.2	6
SBRC 0.5	HQ-CWF	6.95	6.5	95	11	34.4	8.7	8.43	0.75	0.07	2	9

[a] *Strongest special protection designated use for surface water that meets specific water chemistry and biological qualifiers (The Commonwealth of Pennsylvania, 2002)*

[b] *Special protection designated use for surface water that meets specific water chemistry and biological qualifiers (The Commonwealth of Pennsylvania, 2002)*

Conclusions

The watersheds in the upper portion of the Middle Susquehanna Subbasin appeared to be healthier than the ones in the lower portion. Assessments of Towanda Creek, Meshoppen Creek, Mehoopany Creek, Tunkhannock Creek, and Bowmans Creek indicated healthy watersheds. There were no watersheds in the upper portion that would be characterized as extremely degraded. In the lower portion of the Middle Susquehanna Subbasin, only some of the smaller watersheds and the Fishing Creek and Roaring Creek Watersheds are considered healthy. The Lackawanna River, Solomons Creek, Nanticoke Creek, Newport Creek, Nescopeck Creek, and Catawissa Creek were all degraded, mostly by abandoned mine lands and urban influence (Figure 3). The primary source of severe impairment in the Middle Susquehanna Subbasin was AMD. Urban influence was another source of impairment, while agricultural impairment was not significant in this subbasin.

The results of this report were similar to those found in the 1993 Middle Subbasin Survey (Water Quality & Monitoring Programs Division, 1997). It was difficult to directly compare these results since the present survey included more sampling points than the 1993 survey. However, two of the sampling sites in this report that were used as reference sites (RRC 10.7 and FSH 15.6) also were used as reference sites in the 1993 survey. Three of the reference sites in this report were not sampling sites in 1993. For the most part, the watersheds that were categorized as healthy in this report also scored well in the previous survey. The watersheds that were severely degraded also were severely degraded in 1993.

A second year of more intensive sampling will be conducted in the Middle Susquehanna Subbasin starting in the fall of 2002. SRBC will focus on a smaller watershed within the Middle Susquehanna Subbasin based on the survey results and input from watershed organizations and local government entities. The data collected will be provided to these local groups to support protection or remediation efforts in the watershed.

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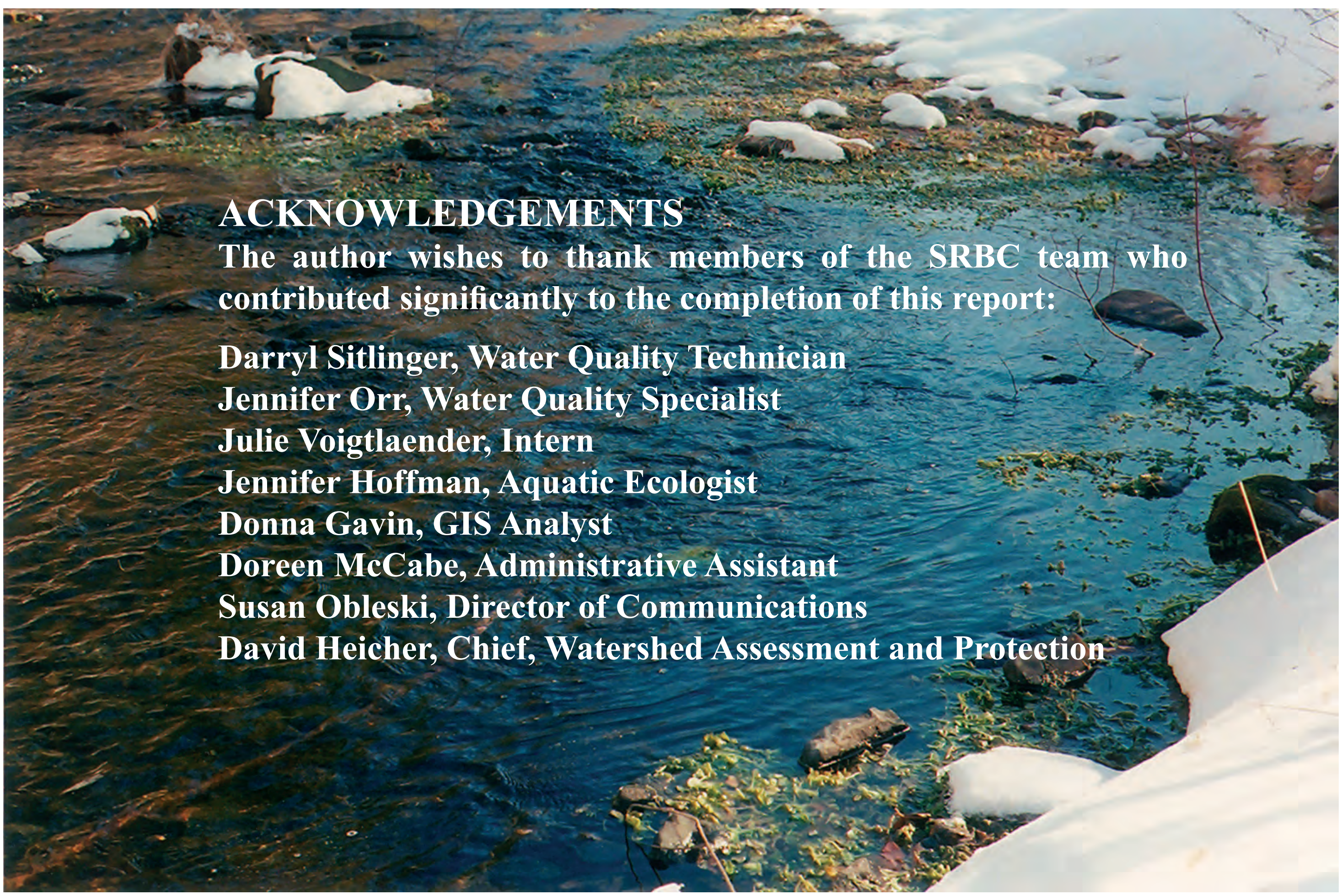
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Roaring Brook, Lackawanna County

APPENDIX

Sample Site #	Station	Location Description	Ecoregion	Drainage Size Category
1	ABRA 0.1	Abrahams Creek at abandoned mine road above W. Wyoming	62	SMALL
2	BLK 0.1	Black Creek above bridge on SR 3016 upstream of confluence with Nescopeck Creek	67	MEDIUM
3	BLK 9.3	Black Creek upstream of bridge on SR 93 outside of City of Hazleton	62	SMALL
4	BOW 0.1	Bowmans Creek downstream of SR 3003 Bridge above Tunkhannock	62	MEDIUM
5	BOW 12.5	Bowmans Creek upstream of Market Street Bridge in Noxen	62	MEDIUM
6	BRR 0.4	Briar Creek downstream Rt. 11 bridge	67	SMALL
7	CAT 0.2	Catawissa Creek adjacent to park area near old railroad bridge piers	67	MEDIUM
8	CAT 13.0	Catawissa Creek upstream T367 bridge	67	MEDIUM
9	CAT 25.0	Catawissa Creek upstream T 818 bridge	62	SMALL
10	EBRR 4.7	East Branch Briar Creek along road above lake - SR 1014	67	SMALL
11	EFSH 0.5	East Fishing Creek above bridge near Jamison City at gamelands	62	SMALL
12	EHRV 0.1	East Fork Harveys Creek upstream Rt. 29 bridge	62	SMALL
13	ELWR 0.1	East Branch Lackawanna River upstream of bridge on SR 171 upstream of Stillwater Lake	62	SMALL
14	ETNK 0.1	East Branch Tunkhannock Creek downstream Rt. 407 bridge	60	MEDIUM
15	ETNK 10.0	East Branch Tunkhannock Creek upstream of bridge on SR 2014, approx. 250 feet	60	SMALL
16	FSH 1.5	Fishing Creek downstream of Creek Road bridge at Bloomsburg (Red Rock Bridge)	67	MEDIUM
17	FSH 15.6	Fishing Creek upstream Rt. 487 bridge	67	MEDIUM
18	GARD 0.1	Gardner Creek above SR 3005 bridge	62	SMALL
19	GREN 0.5	Green Creek 1/2 mile upstream of bridge on SR 4020	67	SMALL
20	HNL 0.1	Hunlock Creek approximately 2-3 miles upstream behind Hunlock Fire Station	62	SMALL
21	HNT 0.2	Huntingdon Creek above covered bridge at Park	67	MEDIUM
22	HNT 5.0	Huntingdon Creek at 157 bridge downstream of Huntingdon Mills	62	MEDIUM
23	HRV 0.1	Harveys Creek downstream of Rt. 11 bridge and railroad bridge	62	MEDIUM
24	HRV 6.8	Harveys Creek adjacent Rt. 118 below LR 802	62	SMALL
25	LFSH 0.1	Little Fishing Creek 100 feet above confluence	67	MEDIUM
26	LFSH 10.0	Little Fishing Creek upstream Alden Hill Road covered bridge	62	SMALL
27	LGT 0.1	Leggetts Creek along Rt. 11, above bridge, downstream of South Abington/Clarks Summit Joint STP & WTP, approximately 1/2 mile	62	SMALL
28	LNSK 0.1	Little Nescopeck Creek approximately 0.1 mile upstream from confluence with Nescopeck Creek	62	SMALL
29	LSHK 0.1	Little Shickshinny Creek near mouth upstream of old bridge piers (stone walls)	62	SMALL
30	LWR 0.3	Lackawanna River upstream of bridge on SR 2033 near town of Duryea above discharge/trib confluence upstream of bridge on left bank	62	MEDIUM
31	LWR 15.0	Lackawanna River at end of Olyphant St. in Olyphant Court in borough of Olyphant	62	MEDIUM
32	LWR 36.0	Lackawanna River approximately 200 feet upstream of bridge on SR 247 near Forest City Borough Limits	62	MEDIUM
33	LWR 4.0	Lackawanna River 250 feet upstream of bridge between Lawrenceville & Moosic; at Moosic Road Bridge	62	MEDIUM
34	LWWP 0.1	Little Wapwallopen Creek upstream route 239 bridge	67	MEDIUM
35	LWWP 6.7	Little Wapwallopen Creek upstream T392 bridge	67	SMALL
36	MAH 0.8	Mahoning Creek above Rt. 11 bridge	67	SMALL
37	MAH 5.0	Mahoning Creek upstream of bridge near Creek Rd. (Rt. 642 bridge)	67	SMALL
38	MHO 0.1	Mehoopany Creek upstream of bridge on SR 87 near mouth	62	MEDIUM
39	MHO 15.0	Mehoopany Creek upstream of Kasson Brook	62	MEDIUM
40	MHO 6.5	Mehoopany Creek above confluence with West Branch @ 87 bridge	62	MEDIUM

APPENDIX

Sample Site #	Station	Location Description	Ecoregion	Drainage Size Category
41	MILL 0.1	Mill Creek approximately 1/4 mile downstream from powerline crossing	62	SMALL
42	MSH 0.1	Meshoppen Creek near mouth upstream of bedrock gorge (recreational area)	60	MEDIUM
43	MSH 12.0	Meshoppen Creek upstream SR 2024 bridge	60	SMALL
44	MSH 5.3	Meshoppen Creek upstream of SR 4019 bridge	60	MEDIUM
45	NMH 0.1	North Branch Mehoopany Creek upstream of confluence with Mehoopany Creek; 1/4 mile downstream of bridge on SR 3001	62	MEDIUM
46	NPT 0.1	Newport Creek below confluence with large deep mine discharge approx. 1/10 mile upstream from mouth	62	SMALL
47	NSK 0.7	Nescopeck Creek upstream Rt. 339 bridge, downstream SR 4092 bridge	67	MEDIUM
48	NSK 13.2	Nescopeck Creek upstream of bridge on TR 338	62	MEDIUM
49	NSK 13.9	Nescopeck Creek upstream 1/8 mile from TR 342 (Walp Road) bridge, upstream of confluence with Little Nescopeck Creek	62	MEDIUM
50	NTK 0.4	Nanticoke Creek upstream of San Souci Expressway bridge outside town of Nanticoke upstream of Wyoming Valley Sanitary Authority #18 building (WVSA)	62	SMALL
51	RRB 0.1	Roaring Brook upstream Ash Street Bridge in Scranton	62	MEDIUM
52	RRB 10.0	Roaring Brook upstream of bridge on SR 2005 and upstream of confluence of Roaring Brook and Bear Brook	62	SMALL
53	RRC 1.1	Roaring Creek along T 313 above cabins (houses)	67	MEDIUM
54	RRC 10.7	Roaring Creek upstream Rt. 42 bridge at Queen City	67	SMALL
55	SBRC 0.5	South Branch Roaring Creek downstream T369 bridge	67	MEDIUM
56	SCH 0.2	Schrader Creek at bridge at Powell	62	MEDIUM
57	SCH 12.0	Schrader Creek at old Railroad Grade at Laquin	62	SMALL
58	SGRR 0.3	Sugar Run upstream of SR 2002 bridge	60	MEDIUM
59	SHK 0.1	Shickshinny Creek downstream of town of Shickshinny, upstream of confluence with Susquehanna River, downstream of channelized section	62	SMALL
60	SHK 4.5	Shickshinny Creek downstream of SR 4007 bridge	62	SMALL
61	SOL 0.9	Solomons Creek about 1/8 mile downstream of Breaker Road bridge below City of Wilkes-Barre	62	SMALL
62	SPR 0.1	Spring Brook about 1/8 mile upstream of Rt. 502 bridge, downstream of Rt. 9 bridge	62	MEDIUM
63	SRC 0.8	Sugar Creek upstream of old Railroad bridge	60	MEDIUM
64	SRC 16.4	Sugar Creek downstream bridge SR3019 at West Burlington	60	MEDIUM
65	SRC 25.0	Sugar Creek upstream of Rt. 6 bridge below Troy	60	MEDIUM
66	STNK 1.0	South Branch Tunkhannock Creek at old bridge abutment along Rt. 6 below Bardwell	60	MEDIUM
67	STNK 10.0	South Branch Tunkhannock Creek downstream of bridge on SR 4003 downstream of Rt. 81 bridge crossing	60	SMALL
68	STWN 0.1	South Branch Towanda Creek near mouth	60	MEDIUM
69	STWN 10.0	South Branch Towanda Creek upstream bridge at Monroe Township Building above New Albany	60	SMALL
70	SUSQ 125.0 A	Susquehanna River from Rt. 147 bridge between Northumberland and Packers Island*	67	RIVER
71	SUSQ 125.0 B	Susquehanna River from Rt. 147 bridge between Packers Island and Sunbury*	67	RIVER
72	SUSQ 136	Susquehanna River approximately 1/2 mile downstream of Rt. 54 bridge between Danville and Riverside upstream of Mahoning Creek confluence and upstream of Merck Plant	67	RIVER
73	SUSQ 146.2	Susquehanna River immediately upstream of Rt. 42 bridge near Catawissa upstream of confluence with Catawissa Creek	67	RIVER
74	SUSQ 156	Susquehanna River 1/3 mile downstream from U.S. Route 80 bridge downstream of Mifflinville (Lime Ridge)	67	RIVER
75	SUSQ 163	Susquehanna River 1/2 mile upstream of new Rt. 93 bridge between Berwick and Nescopeck (downstream of Berwick steam and electric)	67	RIVER

APPENDIX

Sample Site #	Station	Location Description	Ecoregion	Drainage Size Category
76	SUSQ 171	Susquehanna River upstream of confluence with Shickshinny Creek, 1/4 mile upstream of Rt. 239 bridge (left hand side of Bellis Island)	62	RIVER
77	SUSQ 181	Susquehanna River 1/10 mile upstream of Harveys Creek near West Nanticoke	62	RIVER
78	SUSQ 190	Susquehanna River 1/2 mile upstream from SR 2005 Carey Ave. bridge between Larksville and Iona in leveed section and upstream of construction for bridge (300 yards downstream from upper tip of grassy island)	62	RIVER
79	SUSQ 198	Susquehanna River approximately 200 yards downstream of highest powerline crossing, green water tank, near Village of Stanton Station	62	RIVER
80	SUSQ 207	Susquehanna River approximately 3/4 mile downstream of Rt. 92 bridge adjacent to campground on right bank	60	RIVER
81	SUSQ 219	Susquehanna River upstream Rt. 29 bridge	62	RIVER
82	SUSQ 230	Susquehanna River downstream Rt. 87 bridge approximately 1 mile	60	RIVER
83	SUSQ 254	Susquehanna River adjacent to island at Wyalusing	60	RIVER
84	SUSQ 271	Susquehanna River upstream Rt. 6 bridge at Towanda	60	RIVER
85	SUSQ 280	Susquehanna River upstream of Ulster	60	RIVER
86	TBY 0.2	Toby Creek upstream of Rt. 11 bridge at Edwardsville	62	SMALL
87	TBY 6.7	Toby Creek upstream of Carveton Road	62	SMALL
88	TNK 0.3	Tunkhannock Creek downstream of 1st Rt. 6 bridge	62	MEDIUM
89	TNK 11.3	Tunkhannock Creek 1/4 mile downstream SR 1029 bridge	60	MEDIUM
90	TNK 20.0	Tunkhannock Creek upstream Rt 374 bridge	60	MEDIUM
91	TOM 1.0	Tomhicken Creek upstream T 796 bridge, Croll Road	62	SMALL
92	TWN 0.1	Towanda Creek downstream of bridge at airport	60	MEDIUM
93	TWN 16.9	Towanda Creek at closed bridge at Woodruff Corners	60	MEDIUM
94	TWN 25.0	Towanda Creek upstream of Rt. 154 Bridge at Canton	60	SMALL
95	UNTA 0.1	Unnamed Tribtary to Hemlock Creek upstream of funeral home between 1st and 2nd bridges above mouth of trib.	62	SMALL
96	WBRN 0.1	West Branch Little Fishing Creek above bridge near covered bridge on Rt. 442	62	SMALL
97	WBRR 2.4	West Branch Briar Creek at Fowlersville Bridge	67	SMALL
98	WFSH 0.5	West Branch Fishing Creek above upper bridge	62	SMALL
99	WLWR 0.1	West Branch Lackawanna River upstream of bridge on SR 2046 near village of Burnwood	62	SMALL
100	WMSH 0.5	West Branch Meshoppen Creek upstream of T 502 bridge	60	SMALL
101	WSX 0.2	Wysox Creek above Rt. 6 Bridge at Wysox	60	MEDIUM
102	WSX 6.6	Wysox Creek at Water Street Bridge in Rome	60	SMALL
103	WWP 0.1	Wapwallopen Creek approximately 60 meters downstream of Rt. 239 bridge near mouth (upstream of washed out bridge and railroad bridge)	67	MEDIUM
104	WWP 12.0	Wapwallopen Creek below SR 2042 bridge	62	SMALL
105	WWP 6.4	Wapwallopen Creek upstream of T392 bridge	62	SMALL
106	WYL 0.4	Wyalusing Creek downstream of Rt 6 bridge	60	MEDIUM
107	WYL 16.2	Wyalusing Creek take T 875 to SR 1075 Bridge (downstream)	60	MEDIUM

* SUSQ 125.0 A and 125.0 B are two different locations, but put together as a composite sample.

S. Lefevre

West Branch Fishing Creek, Columbia County.

In 1972, the Susquehanna River Basin Commission was created as an independent agency by a federal-interstate compact among the states of Maryland, New York, and Commonwealth of Pennsylvania, and the federal government. In creating the Commission, the Congress and state legislatures formally recognized the water resources of the Susquehanna River Basin as a regional asset vested with local, state, and national interests for which all the parties share responsibility. As the single federal-interstate water resources agency with basinwide authority, the Commission's goal is to coordinate the planning, conservation, management, utilization, development and control of the basin's water resources among the public and private sectors.

For More Information

For more information on a particular stream or more details on the methods used in this survey contact Susan R. LeFevre, (717) 238-0426 ext. 104, email: slefevre@srbc.net. For additional copies of this subbasin survey, contact the Susquehanna River Basin Commission, 1721 N. Front Street, Harrisburg, PA 17102-2391, (717) 238-0423, fax: (717) 238-2436, email: srbc@srbc.net. For raw data from this survey or more information concerning the Commission, visit our website: www.srbc.net.