ASSESSMENT OF INTERSTATE STREAMS IN THE SUSQUEHANNA RIVER BASIN

Monitoring Report No. 12
July 1, 1997, to June 30, 1998

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Jennifer L. Rowles
Biologist

Darryl L. Sitlinger
Water Quality Technician

Water Quality and Monitoring Program
Susquehanna River Basin Commission

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SUSQUEHANNA RIVER BASIN COMMISSION

The Susquehanna River Basin Commission was created as an independent agency by a federal-interstate compact* among the states of Maryland, New York, 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 basin water resources among the public and private sectors.

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ABSTRACT

The Susquehanna River Basin Commission (SRBC) used a simple water quality index (WQI) and the U.S. Environmental Protection Agency's (USEPA's) Rapid Bioassessment Protocol III (RBP III) to assess the chemical water quality, biological conditions, and physical habitat of 29 sample sites in the Interstate Streams Water Quality Network from July 1, 1997 to June 30, 1998. Only 34 out of 2,329 parameter observations exceeded water quality standards. Assessment results indicate that approximately 20 percent of the sites supported nonimpaired biological communities. Water quality impacts in the New York-Pennsylvania border streams were mostly from metals, while Pennsylvania-Maryland border sites suffered from high nutrient levels. A Seasonal Kendall Test was performed to determine trends and their magnitude for 1986-1998. Overall, decreasing trends were found for total ammonia, total phosphorus, and total iron. A Pearson Product Moment Correlation was performed on WQI, RBP III score, and physical habitat score. There was a significant ($p<0.05$) positive correlation between biological community and physical habitat for both New York-Pennsylvania and Pennsylvania-Maryland streams. River sites, however, had a significant negative correlation between biological community and WQI score. These relationships, while based on a small number of observations, are presented as subjects to be considered by resource managers, legislators, and local interest groups.

INTRODUCTION

One of the SRBC's functions is to review projects that may have interstate impacts on water resources in the Susquehanna River Basin. SRBC established a monitoring program in 1986 to collect data that were not available from monitoring programs implemented by New York, Pennsylvania, and Maryland. The state agencies do not assess all of the interstate streams and do not produce comparable data needed to determine potential impacts on the water quality of interstate streams. SRBC's ongoing interstate monitoring program is partially funded through a grant from the U.S. Environmental Protection Agency.

The interstate water quality monitoring program includes periodic collection of water and biological samples from, as well as physical habitat assessments of, interstate streams. Water quality data are used to: (1) assess compliance with water quality standards; (2) characterize stream quality and seasonal variations; (3) build a database for assessment of water quality trends; (4) identify streams for reporting to USEPA under Section 305(b) of the Clean Water Act; (5) provide information to signatory states for 303(d) listing and possible Total Maximum Daily Load (TMDL) development; and (6) identify areas for restoration and protection. Biological conditions are assessed using benthic macroinvertebrate populations, which provide an indication of the biological health of a stream and serve as indicators of water quality. Habitat assessments provide information concerning potential stream impairment from erosion and sedimentation, as well as an indication of the stream's ability to support a healthy biological community.

SRBC's interstate monitoring program began in April 1986. For the first five years, results were reported for water years that ran from October to September. In 1991, SRBC changed the reporting periods to correspond with its fiscal year that covers the period from July to June. This report is presented for fiscal year 1998, which covers July 1, 1997, to June 30, 1998.

BASIN GEOGRAPHY

The Susquehanna River Basin is the largest river basin on the Atlantic Coast of the United States, draining 27,510 square miles. The Susquehanna River originates at the outlet of Otsego Lake, Cooperstown, N.Y., and flows 444 miles through New York, Pennsylvania, and Maryland to the Chesapeake Bay at Havre de Grace, Maryland. Eighty-three streams cross state lines in the basin (Table 1). Several streams traverse the state lines at multiple points, contributing to a total of 91 crossings. At 45 of these locations, streams flow from New York into Pennsylvania. Twenty-two reaches cross from Pennsylvania into New York, 15 from Pennsylvania into Maryland, and nine from Maryland into Pennsylvania. Many streams are small, and 32 are unnamed.

METHODS

Field and Laboratory Methods

Sampling frequency

In Water Year 1989, the interstate streams were divided into three groups, according to the degree of water quality impairment, historical water quality impacts, and potential for degradation. These groupings were determined based on historical water quality and land use. To date, these groupings remain consistent and are described below.

Streams with impaired water quality or judged to have a high potential for degradation due to large drainage areas or historical pollution were assigned to Group 1. Originally, water samples were collected from Group 1 stations every other month, except January and February. Sampling was alternated so that streams along the New York-Pennsylvania border were sampled during November, March, May, July, and September, while streams along the Pennsylvania-Maryland border were sampled during October, December, April, June, and August. During fiscal year 1997, water quality sampling of Group 1 streams was reduced to quarterly sampling. During 1998, New York-Pennsylvania streams were sampled July, November, February, and May. Pennsylvania-Maryland stations were sampled August, November, March, and May. Benthic macroinvertebrates were collected, and habitat assessments were performed in Group 1 streams during July and August 1997.

Streams judged to have a moderate potential for impacts were assigned to Group 2. Water quality samples, benthic macroinvertebrate samples, and physical habitat information were obtained from Group 2 stations once a year, preferably during base flow conditions in the summer months. In this sampling period, water chemistry, macroinvertebrate, and physical habitat information were collected during July and August 1997.

Streams judged to have a low potential for impacts were assigned to Group 3. These stations were not sampled but were visually inspected for signs of degradation once a year. New York-Pennsylvania border and Pennsylvania-Maryland border stream stations sampled during fiscal year 1998 are listed in Tables 2 and 3, respectively, and depicted in Figures 1 through 4.

Stream discharge

Stream discharge was measured at all stations unless high streamflows made access impossible. Several stations are located near U.S. Geological Survey (USGS) stream gages. These stations include the following: the Susquehanna River at Windsor, N.Y., Kirkwood, N.Y., Sayre, Pa., Marietta, Pa., and Conowingo, Md.; the Chemung River at Chemung, N.Y.; the Tioga River at Lindley, N.Y.; and the Cowanesque River at

Table 1. Interstate Streams in the Susquehanna River Basin

Stream Name	Monitoring Group*	Flow Direction (from ® to)
Streams Along the New York–Pennsylvania Border		
Apalachin Creek	2	Pa.→ N.Y.
Babcock Run	3	N.Y.→ Pa.
Bentley Creek	2	Pa.→ N.Y.
Bill Hess Creek	3	N.Y.→Pa.
Bird Creek	3	Pa.→N.Y.
Biscuit Hollow	3	N.Y.→Pa.
Briggs Hollow Run	3	N.Y.→Pa.
Bulkley Brook	3	N.Y.→Pa.
Camp Brook	3	N.Y.→Pa.
Cascade Creek	2	N.Y.→Pa.
Cayuta Creek	1	N.Y.→Pa.
Chemung River	1	N.Y.→Pa.→N.Y.→Pa.
Choconut Creek	2	Pa.→ N.Y.
Cook Hollow	3	N.Y.→Pa.
Cowanesque River	1	Pa.→ N.Y.
Deep Hollow Brook	3	N.Y.→Pa.
Denton Creek	3	N.Y.→Pa.
Dry Brook	3	N.Y.→Pa.
Holden Creek	3	N.Y.→Pa.
Little Snake Creek	2	Pa.→ N.Y.
Little Wappasening Creek	3	Pa.→ N.Y.
North Fork Cowanesque River	3	N.Y.→Pa.
Parks Creek	3	Pa.→ N.Y.
Prince Hollow Run	3	N.Y.→Pa.
Red House/Beagle Hollow	3	N.Y.→Pa.
Russell Run	3	N.Y.→Pa.
Sackett Creek	3	Pa.→ N.Y.
Seeley Creek	2	Pa.→ N.Y.
South Creek	2	Pa.→ N.Y.
Snake Creek	2	Pa.→ N.Y.
Strait Creek	3	N.Y.→Pa.
Susquehanna River	1	N.Y.→Pa.→N.Y.→Pa.
Tioga River	1	Pa.→ N.Y.
Troups Creek	1	N.Y.→Pa.
Trowbridge Creek	2	N.Y.→Pa.
Wappasening Creek	2	Pa.→ N.Y.
White Branch	3	N.Y.→Pa.
White Hollow	3	Pa.→ N.Y.
17 Unnamed tributaries	3	N.Y.→Pa.
2 Unnamed tributaries	3	Pa.→ N.Y.
2 Unnamed tributaries	3	Pa.→ N.Y.→Pa.
1 Unnamed tributary	3	N.Y.→Pa.→N.Y.

Table 1. Interstate Streams in the Susquehanna River Basin—Continued

Stream Name	Monitoring Group*	Flow Direction (from→to)
Streams Along the Pennsylvania–Maryland Border		
Big Branch Deer Creek	2	Pa.→Md.
Conowingo Creek	1	Pa.→Md.
Deer Creek	1	Pa.→Md.
Ebaughs Creek	1	Pa.→Md.
Falling Branch Deer Creek	2	Pa.→Md.
Island Branch	3	Pa.→Md.
Long Arm Creek	2	Md.→Pa.
Octoraro Creek	1	Pa.→Md.
Scott Creek	1	Md.→Pa.
South Branch Conewago Creek	2	Md.→Pa.
Susquehanna River	1	Pa.→Md.
6 Unnamed tributaries	3	Md.→Pa.
7 Unnamed tributaries	3	Pa.→Md.

* Group 1 streams are sampled quarterly, Group 2 streams are sampled annually, and Group 3 streams are not sampled.

Table 2. Stream Stations Sampled Along the New York–Pennsylvania Border and Sampling Rationale

Station	Stream and Location	Monitoring Group*	Rationale
CASC 1.6	Cascade Creek Lanesboro, Pa.	2	Monitor for potential water quality impacts
TROW 1.8	Trowbridge Creek, Great Bend, Pa.	2	Monitor for potential water quality impacts
SNAK 2.3	Snake Creek, Brookdale, Pa.	2	Monitor for potential water quality impacts
LSNK 7.6	Little Snake Creek, Brackney, Pa.	2	Monitor for potential water quality impacts
CHOC 9.1	Choconut Creek, Vestal Center, N.Y.	2	Monitor for potential water quality impacts
APAL 6.9	Apalachin Creek, Little Meadows, Pa.	2	Monitor for potential water quality impacts
WAPP 2.6	Wappasening Creek, Nichols, N.Y.	2	Monitor for potential water quality impacts
CAYT 1.7	Cayuta Creek, Waverly, N.Y.	1	Municipal discharge from Waverly, N.Y.
TRUP 4.5	Troups Creek, Austinburg, Pa.	1	High turbidity and moderately impaired macroinvertebrate populations
COWN 2.2	Cowanesque River, Lawrenceville, Pa.	1	Impacts from flood control reservoir
TIOG 10.8	Tioga River, Lindley, N.Y.	1	Pollution from acid mine discharges and impacts from flood control reservoirs
SEEL 10.3	Seeley Creek, Seeley Creek, N.Y.	2	Monitor for potential water quality impacts
SOUT 7.8	South Creek, Fassett, Pa.	2	Monitor for potential water quality impacts
BNTY 0.9	Bentley Creek, Wellsburg, N.Y.	2	Monitor for potential water quality impacts
CHEM 12.0	Chemung River, Chemung, N.Y.	1	Municipal and industrial discharges from Elmira, N.Y.
SUSQ 365.0	Susquehanna River, Windsor, N.Y.	1	Large drainage area (1,882 sq. mi.); municipal discharges from Cooperstown, Sidney, Bainbridge, and Oneonta
SUSQ 340.0	Susquehanna River, Kirkwood, N.Y.	1	Large drainage area (2,232 sq. mi.); historical pollution due to sewage from Lanesboro, Oakland, Susquehanna, Great Bend, and Hallstead
SUSQ 289.1	Susquehanna River, Sayre, Pa.	1	Large drainage area (4,933 sq. mi.); municipal and industrial discharges

* Group 1 streams are sampled quarterly and Group 2 streams are sampled annually

Table 3. Stream Stations Sampled Along the Pennsylvania–Maryland Border and Sampling Rationale

Station	Stream and Location	Monitoring Group*	Rationale
SBCC 20.4	South Branch Conewago Creek, Bandanna, Pa.	2	Monitor for potential water quality impacts
LNGA 2.5	Long Arm Creek, Bandanna, Pa.	2	Monitor for potential water quality impacts
SCTT 3.0	Scott Creek, Delta, Pa.	1	Pollution from untreated sewage
CNWG 4.4	Conowingo Creek, Pleasant Grove, Pa.	1	High nutrient loads and other agricultural runoff; Nonpoint runoff to Chesapeake Bay
OCTO 6.6	Octoraro Creek, Rising Sun, Md.	1	High nutrient loads due to agricultural runoff from New Bridge, Md.; Water quality impacts from Octoraro Lake; Nonpoint runoff to Chesapeake Bay
EBAU 1.5	Ebaughs Creek, Stewartstown, Pa.	1	Municipal discharge from Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay
DEER 44.2	Deer Creek, Gorsuch Mills, Md.	1	Past pollution from Gorsuch Mills, Md., Stewartstown, Pa.; Nonpoint runoff to Chesapeake Bay
BBDC 4.1	Big Branch Deer Creek, Fawn Grove, Pa.	2	Monitor for potential water quality impacts
FBDC 4.1	Falling Branch Deer Creek, Fawn Grove, Pa.	2	Monitor for potential water quality impacts
SUSQ 44.5	Susquehanna River, Marietta, Pa.	1	Bracket hydroelectric dams near the state line
SUSQ 10.0	Susquehanna River, Conowingo, Md.	1	Bracket hydroelectric dams near the state line

* Group 1 streams are sampled quarterly and Group 2 streams are sampled annually

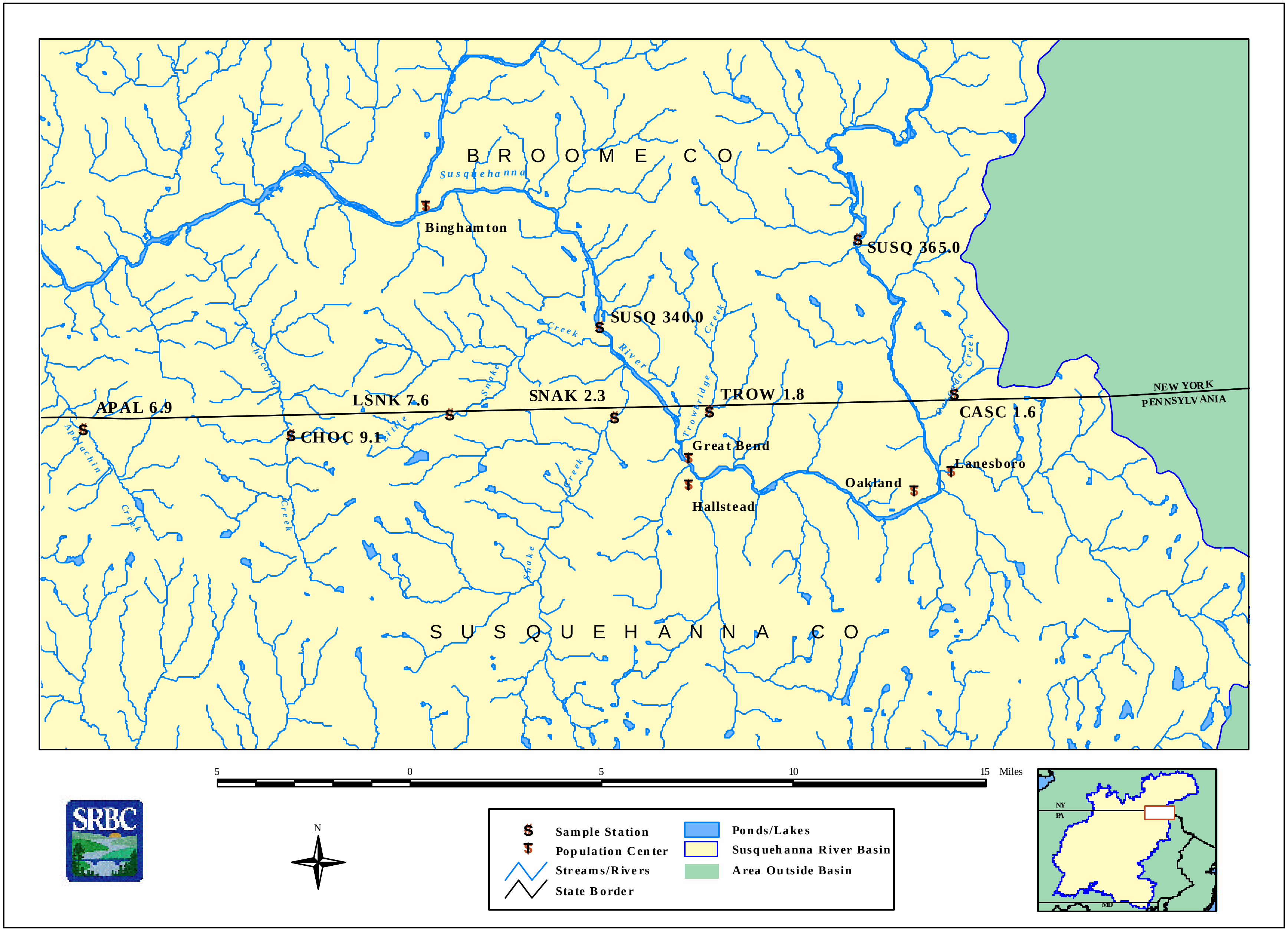

Figure 1. Interstate Streams Along the New York-Pennsylvania Border Between Apalachin Creek and Cascade Creek

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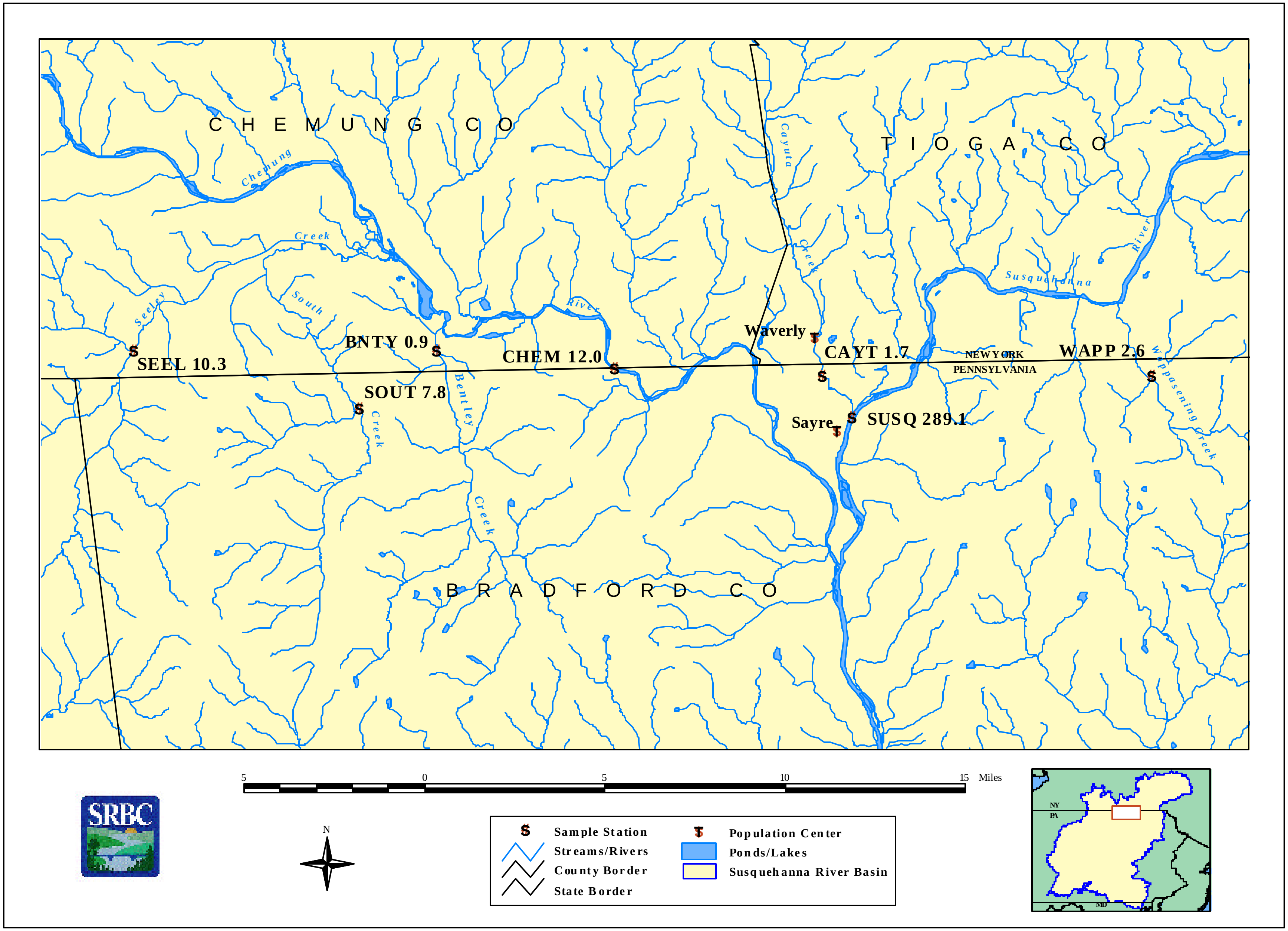

Figure 2. Interstate Streams Along the New York-Pennsylvania Border Between Seeley Creek and Wappasening Creek

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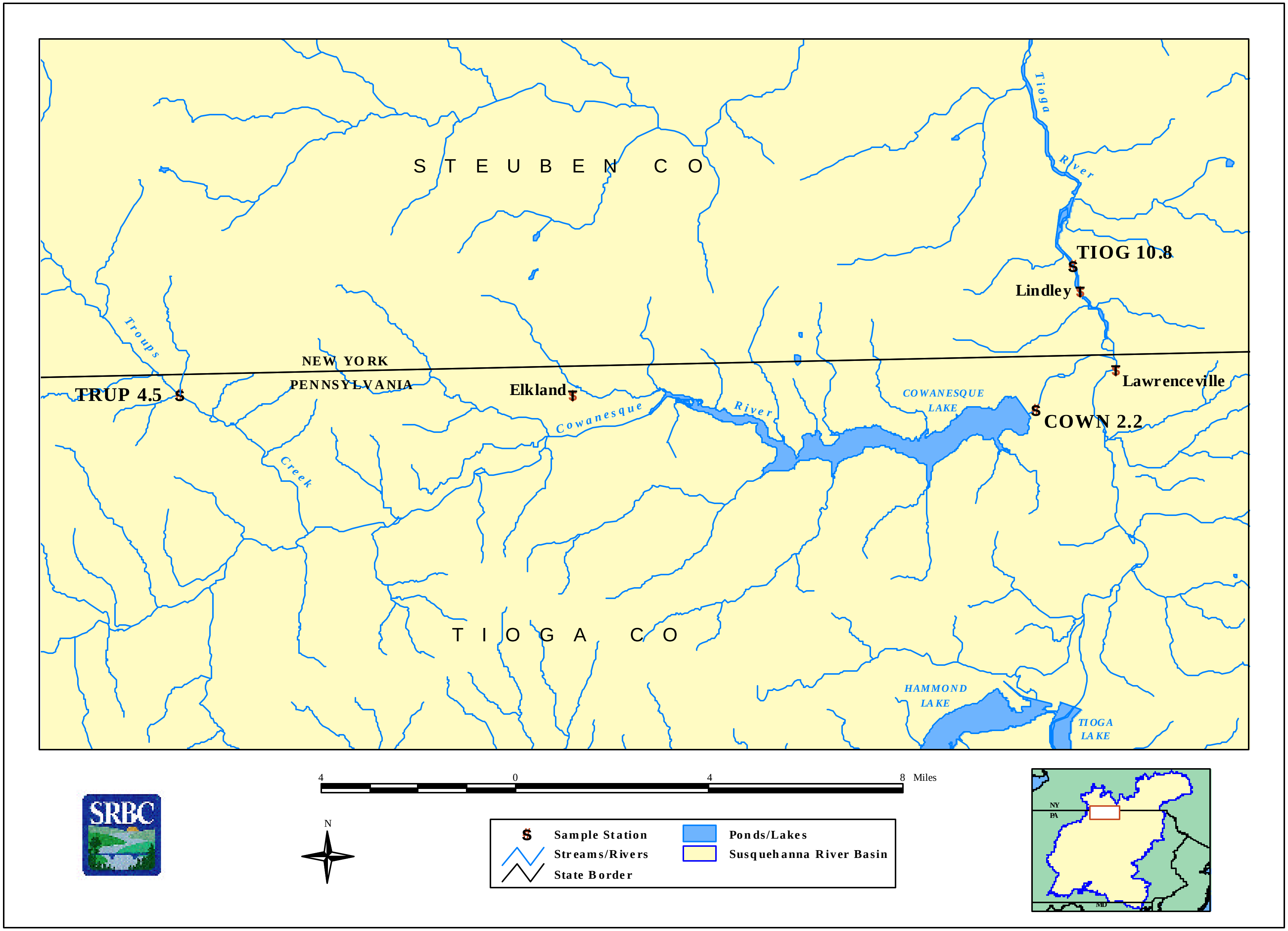

Figure 3. Interstate Streams Along the New York-Pennsylvania Border Between Troups Creek and Tioga River

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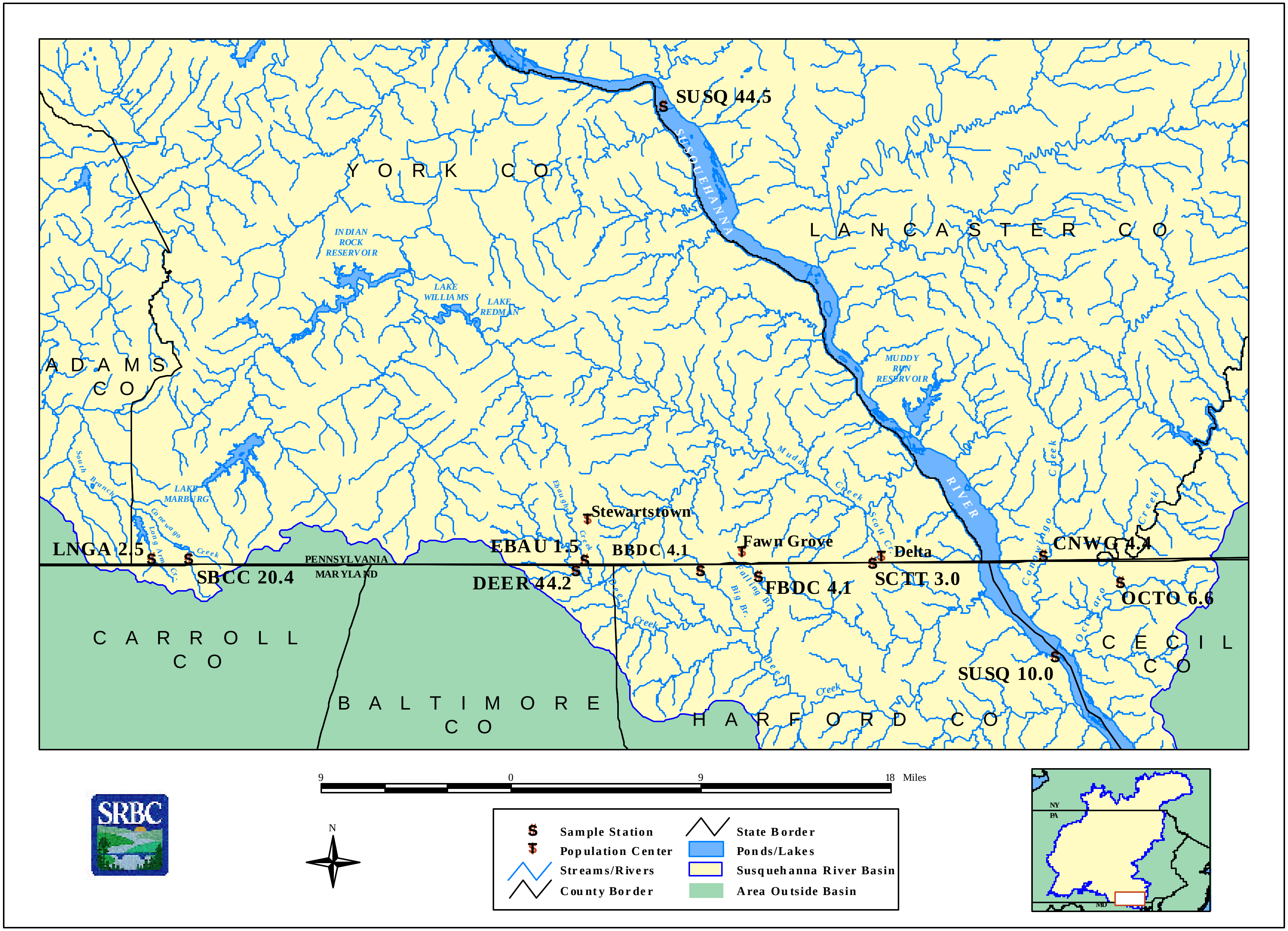

Figure 4. Interstate Sreams Along the Pennsylvania-Maryland Border

Lawrenceville, Pa. Recorded stages from USGS gaging stations and rating curves were used to determine instantaneous discharges in cubic feet per second (cfs). Instantaneous discharges for stations not located near USGS gaging stations were measured at the time of sampling, using standard USGS procedures. Stream discharges are tabulated according to station name and date in Appendix A.

Water samples

Water samples were collected at each of the sites to measure nutrient and metal concentrations. Chemical and physical parameters monitored are listed in Table 4. Water samples were collected using a depth-integrating sampler. Composite samples were obtained by collecting eight depth-integrated samples across the stream channel and combining them in a churn splitter that was previously rinsed with distilled water. Water samples were thoroughly mixed in the churn splitter and collected in 250-ml bottles. One whole water sample and one filtered sample were collected for nutrient analysis. A whole water sample and a filtered sample were collected in acid-rinsed bottles and fixed with concentrated nitric acid (HNO_3) for metal analysis. A cellulose nitrate filter with 0.45-micrometer pore size was used to obtain the filtrate for laboratory analysis. The samples were chilled on ice and were sent to the Pennsylvania Department of Environmental Protection (Pa. DEP), Bureau of Laboratories in Harrisburg, Pa., within 24 hours of collection.

Field chemistry

Temperature, dissolved oxygen, conductivity, pH, alkalinity, and acidity were measured in the field. Dissolved oxygen was measured using a YSI model 55 dissolved oxygen meter. The dissolved oxygen meter was calibrated at the beginning of each day when water samples were collected. A VWR Scientific Model 2052 conductivity meter was used to measure conductivity. A Cole Parmer meter was used to measure pH. The pH meter was calibrated at the beginning of the day and randomly checked throughout the day. Alkalinity was determined by titrating a known sample of water to pH 4.5 with 0.02N sulfuric acid (H_2SO_4). Acidity was measured by titrating a known volume of sample water to pH 8.3 with 0.02N sodium hydroxide ($NaOH$).

Macroinvertebrate and physical habitat sampling

Benthic macroinvertebrates were collected from Group 1 and Group 2 stations between July 21 and August 7, 1997. The benthic macroinvertebrate community was sampled to provide an indication of the biological condition of the stream. Macroinvertebrates are defined as aquatic insects and other invertebrates too large to pass through a No. 30 sieve.

Benthic macroinvertebrate samples were analyzed using field and laboratory methods described in Rapid Bioassessment Protocol for Use in Streams and Rivers by Plafkin and others (1989). Sampling was performed using a 1-meter-square kick screen with size No. 30 mesh. The kick screen was stretched across the current to collect organisms dislodged from riffle/run areas by physical agitation of the stream substrate. Two kick screen samples were collected from a representative riffle/run at each station. The two samples were composited and preserved in isopropyl alcohol for later laboratory analysis.

In the laboratory, composite samples were sorted into 100-organism subsamples using a gridded pan and a random numbers table. The organisms contained in the subsamples were identified to genus (except Chironomidae) and enumerated. Each taxon was assigned an organic pollution tolerance value and a functional feeding category as outlined in Appendix B. A taxa list for each station can be found in Appendix C.

Physical habitat conditions at each station were assessed using a slightly modified version of the habitat assessment procedure outlined by Plafkin and others (1989). Eleven habitat parameters were field-evaluated at each site and used to calculate a site-specific habitat assessment score. Habitat parameters were identified as primary, secondary, or tertiary parameters, based on their contribution to habitat quality. Primary

Table 4. Monitored Parameters

Parameter	STORET Code
Physical	
Discharge	00060
Temperature	00010
Chemical	
Field Analyses	
Conductivity	00095
Dissolved Oxygen	00300
pH	00400
Alkalinity	00410
Acidity	00435
Laboratory Analyses	
Solids, Dissolved	00515
Solids, Total	00500
Ammonia as Nitrogen, Dissolved	00608
Ammonia as Nitrogen, Total	00610
Nitrite as Nitrogen, Dissolved	00613
Nitrite as Nitrogen, Total	00615
Nitrate as Nitrogen, Dissolved	00618
Nitrate as Nitrogen, Total	00620
Phosphorus, Dissolved	00666
Phosphorus, Total	00665
Orthophosphate, Dissolved	00671
Orthophosphate, Total	70507
Organic Carbon, Total	00680
Calcium, Total	00916
Magnesium, Total	00927
Chloride, Total	00940
Sulfate, Total	00945
Iron, Dissolved	01046
Iron, Total	01045
Manganese, Dissolved	01056
Manganese, Total	01055
Aluminum, Dissolved	01106
Aluminum, Total	01105
Turbidity	82079

parameters, stream habitat features that have the greatest direct influence on the structure of aquatic macroinvertebrate communities, were evaluated on a scale of 0 to 20 and included stream bottom substrate and instream cover, embeddedness, and velocity/depth diversity. Secondary parameters included stream channel morphology characteristics, such as pool/riffle ratio, pool quality, riffle/run quality, and channel alteration, and were scored on a scale of 0 to 15. Tertiary parameters, such as streambank erosion, streambank stability, streamside vegetative cover, and riparian buffer zone width, characterized riparian and bank conditions and were scored on a scale of 0 to 10. Criteria used to evaluate habitat parameters are summarized in Table 5.

Data Synthesis Methods

Chemical water quality

Results of laboratory analyses for chemical parameters were compared to New York, Pennsylvania, and Maryland State water quality standards. In addition, a simple WQI was calculated, using procedures established by McMorran and Bollinger (1990). The WQI was used to make comparisons between sampling periods and stations within the same geographical region; therefore, the water quality data were divided into two groups. One group contained stations along the New York-Pennsylvania border, and the other group contained stations along the Pennsylvania-Maryland border. The data in each group were sorted by parameter and ranked by increasing order of magnitude, with several exceptions. Dissolved oxygen and alkalinity were ranked by decreasing order of magnitude, while pH and acidity were not factored into the percentile scores. The rank of each chemical analysis was divided by total number of observations in the group to obtain a percentile. The WQI score was calculated by averaging all percentile ranks for each sample. Water quality index scores range from 1 to 100, and high WQI scores indicate poor water quality. Water quality scores and a list of parameters exceeding standards for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 43.

Reference category designations

Three reference sites were included in this study. These three sites represented the best available conditions, in terms of habitat and biological community, for each of the categories. The Susquehanna River (SUSQ 365.0) at Windsor, N.Y., was used as the reference site for all of the Susquehanna River main stem sampling sites, as well as for Cowanesque River, Chemung River, and Tioga River sites. Sites located on the New York-Pennsylvania border were compared to Snake Creek (SNAK 2.3) at Brookdale, Pa. Snake Creek represented the best biological and habitat conditions in the Northern Appalachian Plateau and Uplands Ecoregion. Big Branch Deer Creek (BBDC 4.1) near Fawn Grove, Pa., served as the reference site for sampling stations located on the Pennsylvania-Maryland border. Big Branch Deer Creek had the best biological and habitat conditions in the Northern Piedmont Ecoregion (Omernik, 1987).

Biological and physical habitat conditions

Benthic macroinvertebrate samples were assessed using procedures described by Plafkin and others (1989). Using this method, we calculated a series of biological indexes for a stream and compared them to a nonimpaired reference station in the same region to determine the degree of impairment. The metrics used in this survey are summarized in Table 6. Metrics 1 and 3 through 8 were taken directly from Plafkin and others (1989). Metric 2 (Shannon Diversity Index) was substituted for the recommended ratio of shredders to total macroinvertebrates, which required specialized sampling protocols.

The 100-organism subsample data were used to generate scores for each of the eight metrics. Each metric score was then converted to a biological condition score, based on the percent similarity of the metric score, relative to the metric score for the reference site. The sum of the biological condition scores constituted the total biological score for the sample site, and total biological scores were used to assign each site to a biological condition category (Table 7). Habitat assessment scores of sample sites were compared

Table 5. Criteria Used to Evaluate Physical Habitat

Habitat Parameter	Excellent	Good	Fair	Poor
1 Bottom Substrate	Greater than 50% cobble, gravel, submerged logs, undercut banks, or other stable habitat. **(16-20)**	30-50% cobble, gravel, or other stable habitat. Adequate habitat. **(11-15)**	10-30% cobble, gravel, or other stable habitat. Habitat availability is less than desirable. **(6-10)**	Less than 10% cobble, gravel, or other stable habitat. Lack of habitat is obvious. **(0-5)**
2 Embeddedness (a)	Larger substrate particles (e.g., gravel, cobble, boulders) are between 0 and 25% surrounded by fine sediment. **(16-20)**	Larger substrate particles (e.g., gravel, cobble, boulders) are between 25 and 50% surrounded by fine sediment. **(11-15)**	Larger substrate particles (e.g., gravel, cobble, boulders) are between 50 and 75% surrounded by fine sediment. **(6-10)**	Larger substrate particles (e.g., gravel, cobble, boulders) are over 75% surrounded by fine sediment. **(0-5)**
3 Velocity/Depth Diversity	Four habitat categories consisting of slow (<1.0 ft/s), deep (>1.5 ft); slow, shallow (<1.5 ft); fast (> 1.0 ft/s), deep; fast, shallow habitats are all present. **(16-20)**	Only three of the four habitat categories are present. **(11-15)**	Only two of the four habitat categories are present. **(6-10)**	Dominated by one velocity/depth category (usually pools). **(0-5)**
4 Pool/Riffle Ratio (or Run/Bend)	Distance between riffles divided by mean wetted width equals 5-7. Stream contains a variety of habitats including deep riffles and pools. **(12-15)**	Distance between riffles divided by mean wetted width equals 7-15. Adequate depth in pools and riffles. **(8-11)**	Distance between riffles divided by mean wetted width equals 15-25. Stream contains occasional riffles. **(4-7)**	Distance between riffles divided by mean wetted width >25. Stream is essentially straight with all flat water or shallow riffle. Poor habitat. **(0-3)**
5 Pool Quality (b)	Pool habitat contains both deep (>1.5 ft) and shallow areas (<1.5 ft) with complex cover and/or depth greater than 5 ft. **(12-15)**	Pool habitat contains both deep (>1.5 ft) and shallow (<1.5 ft) areas with some cover present. **(8-11)**	Pool habitat consists primarily of shallow (<1.5 ft) areas with little cover. **(4-7)**	Pool habitat rare with maximum depth <0.5 ft, or pool habitat absent completely. **(0-3)**
6 Riffle/Run Quality (c)	Riffle/run depth generally >8 in. and consisting of stable substrate materials and a variety of current velocities. **(12-15)**	Riffle/run depth generally 4-8 in. and with a variety of current velocities. **(8-11)**	Riffle/run depth generally 1-4 in.; primarily a single current velocity. **(4-7)**	Riffle/run depth <1 in.; or riffle/run substrates concreted. **(0-3)**
7 Channel Alteration (d)	Little or no enlargement of islands or point bars, and/or no channelization. **(12-15)**	Some new increase in bar formation, mostly from coarse gravel; and/or some channelization present. **(8-11)**	Moderate deposition of new gravel, coarse sand on old and new bars; pools partially filled with silt; and/or embankments on both banks. **(4-7)**	Heavy deposits of fine material, increased bar development; most pools filled with silt; and/or extensive channelization. **(0-3)**

Table 5. Criteria Used to Evaluate Physical Habitat—Continued

Habitat Parameter	Excellent	Good	Fair	Poor
8. Upper and Lower Streambank Erosion (e)	Stable. No evidence of erosion or of bank failure. Side slopes generally <30%. Little potential for future problems. **(9-10)**	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. **(6-8)**	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% in some areas. High erosion potential during extreme high flow. **(3-5)**	Unstable. Many eroded areas. Side slopes >60% common. "Raw" areas frequent along straight sections and bends. **(0-2)**
9. Upper and Lower Streambank Stability (e)	Over 80% of the streambank surface is covered by vegetation or boulders and cobble. **(9-10)**	50-79% of the streambank surface is covered by vegetation, gravel, or larger material. **(6-8)**	25-49% of the streambank surface is covered by vegetation, gravel, or larger material. **(3-5)**	Less than 25% of the streambank surface is covered by vegetation, gravel, or larger material. **(0-2)**
10. Streamside Vegetative Cover *(Both Banks)*	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is shrub. **(9-10)**	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is trees. **(6-8)**	Dominant vegetation that provides stream shading, escape cover, and/or refuge for fish within the bankfull stream channel is forbs and grasses. **(3-5)**	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. **(0-2)**
11. Forested Riparian Buffer Zone Width (f) *(Least Forested Bank)*	Riparian area consists of all three zones of vegetation, Zones 1-3. (See zone descriptions (f). **(9-10)**	Riparian area consists of Zones 1 and 2. **(6-8)**	Riparian area is limited primarily to Zone 1. Zone 2 may be forested but is subject to disturbance (e.g. grazing, intensive forestry practices, roads). **(3-5)**	Riparian area lacks Zone 1 with or without Zones 2 and/or 3. **(0-2)**

(a) Embeddedness — The degree to which the substrate materials that serve as habitat for benthic macroinvertebrates and for fish spawning and egg incubation (predominantly cobble and/or gravel) are surrounded by fine sediment. Embeddedness is evaluated with respect to the suitability of these substrate materials as habitat for macroinvertebrates and fish by providing shelter from the current and predators, and by providing egg deposition and incubation sites.

(b) Pool Quality — Rated based on the variety and spatial complexity of slow- or still-water habitat within the sample segment. It should be noted that even in high- gradient segments, functionally important slow-water habitat may exist in the form of plunge-pools and/or larger eddies. Within a category, higher scores are assigned to segments that have undercut banks, woody debris, or other types of cover for fish.

(c) Riffle/Run Quality — Rated based on the depth, complexity, and functional importance of riffle/run habitat in the segment, with highest scores assigned to segments dominated by deeper riffle/run areas, stable substrates, and a variety of current velocities.

(d) Channel Alteration — A measure of large-scale changes in the shape of the stream channel. Channel alteration includes: concrete channels, artificial embankments, obvious straightening of the natural channel, rip-rap, or other structures, as well as recent sediment bar development. Sediment bars typically form on the inside of bends, below channel constrictions, and where stream gradient decreases. Bars tend to increase in depth and length with continued watershed disturbance. Ratings for this metric are based on the presence of artificial structures as well as the existence, extent, and coarseness of sediment bars, which indicate the degree of flow fluctuations and substrate stability.

(e) Upper and Lower Streambank Erosion and Stability — These parameters include the concurrent assessment of both the upper and lower banks. The upper bank is the land area from the break in the general slope of the surrounding land to the top of the bankfull channel. The lower bank is the intermittently submerged portion of the stream cross section from the top of the bankfull channel to the existing waterline.

(f) Forested Riparian Buffer Zone Width —
Zone 1: a 15 ft wide buffer of essentually undisturbed forest located immediately adjacent to the stream.
Zone 2: a 100-ft-wide buffer of forest, located adjacent to Zone 1, which may be subject to non-intensive forest management practices.
Zone 3: a 20-ft-wide buffer of vegetation, located adjacent to Zone 2, that provides sediment filtering and promotes the formation of sheet flow runoff into Zone 2. Zone 3 may be composed of trees, shrubs, and/or dense grasses and forbs, which are subject to haying and grazing, as of as long as vegetation is maintained in vigorous condition.

Source: Modified from Plafkin and others, 1989.

Table 6. Summary of Metrics Used to Evaluate the Overall Biological Integrity of Stream and River Benthic Macroinvertebrate Communities

Metric	Description
1. Taxonomic Richness (a)	The total number of taxa present in the 100 organism subsample
2. Shannon Diversity Index (b)	A measure of biological community complexity based on the number of equally or nearly equally abundant taxa in the community
3. Hilsenhoff Biotic Index (a)	A measure of the overall pollution tolerance of a benthic macroinvertebrate community
4. EPT Index (a)	The total number of Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa present in the 100 organism subsample
5. Ratio of Scrapers/Filterers (a)	A reflection of the riffle/run community foodbase and an insight into the nature of potential disturbance factors
6. Ratio of EPT/Chironomids (a)	A measure of community balance and indicator of environmental stress
7. Community Loss Index (a)	A measure of loss of benthic taxa between a reference station and the station of comparison
8. Percent Dominant Taxa (a)	A measure of community balance at the lowest positive taxonomic level

Sources (a) Plafkin and others (1989); and
(b) calculated using software developed by Kovach (1993)

Table 7. Summary of Criteria Used to Classify the Biological Conditions of Sample Sites

SAMPLING AND ANALYSIS

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TOTAL BIOLOGICAL SCORE DETERMINATION				
	Biological Condition Scoring Criteria			
Metric	**6**	**4**	**2**	**0**
1. Taxonomic Richness (a)	>80 %	79 – 60 %	59 – 40 %	<40 %
2. Shannon Diversity Index (a)	>75 %	74 – 50 %	49 – 25 %	<25 %
3. Modified Hilsenhoff Biotic Index (b)	>85 %	84 – 70 %	69 – 50 %	<50 %
4. EPT Index (a)	>90 %	89 – 80 %	79 – 70 %	<70 %
5. Ratio Scrapers/Filterers (a,c)	>50 %	49 – 35 %	34 – 20 %	<20 %
6. Ratio EPT/Chironomids (a)	>75 %	74 – 50 %	49 – 25 %	<25 %
7. Community Loss Index (d)	<0.5	0.5 – 1.5	1.5 – 4.0	>4.0
8. Percent Dominant Taxa (e)	<20 %	20 – 30 %	31 – 40 %	>40 %
Total Biological Score (f)				

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BIOASSESSMENT	
Percent Comparability of Study and Reference Site Total Biological Scores (g)	**Biological Condition Category**
>83	Nonimpaired
79 - 54	Slightly Impaired
50 - 21	Moderately Impaired
<17	Severely Impaired

(a) Score is study site value/reference site value X 100.
(b) Score is reference site value/study site value X 100.
(c) Determination of Functional Feeding Group is independent of taxonomic grouping
(d) Range of values obtained. A comparison to the reference station is incorporated in these indices.
(e) Scoring criteria evaluate actual percent contribution, not percent comparability to the reference station.
(f) Total Biological Score = the sum of Biological Condition Scores assigned to each metric.
(g) Values obtained that are intermediate to the indicated ranges will require subjective judgement as to the correct placement into a biological condition category.

to those of reference sites to classify each sample site into a Habitat Condition Category (Table 8).

Trend analysis

A long-term trend has been defined as a steady increase or decrease of a variable over time, as opposed to a change (step trend), which is a sudden difference in water quality associated with an event (Bauer and others, 1984). As the interstate streams data are not useful for analyzing step trends due to large drainage areas and insufficient information about discharges, only long-term trends were included in this study. Trends analysis was performed on all Group 1 streams (see Table 1) for the following parameters: total suspended solids, total ammonia, total nitrogen, total phosphorus, total chloride, total sulfate, total iron, and total aluminum. The period covered for the trends analysis was April 1986 through June 1998.

The nonparametric trend test used in this study was the Seasonal Kendall Test, which is described by Bauer and others (1984) and Smith and others (1982). The Seasonal Kendall Test was used to detect the presence or absence of monotonic trends in the parameters described above. This test is useful for testing trends of quarterly water quality samples with seasonal variability, because seasonality is removed by comparing data points only within the same quarter for all years in the data set. Outliers also do not present a problem, because the test only considers differences in the data points. The Seasonal Kendall Test also can be used with missing and censored data.

Differences in flow also can produce trends in water quality. To adjust the concentrations to compensate for flow, a technique known as Locally Weighted Scatterplot Smoothing (LOWESS), described by Hirsch and others (1991), was used. This technique flow-adjusts the concentrations by using the residual, the result of the actual observation minus the expected observation. The residuals were tested for trends using the Seasonal Kendall Test. Detailed descriptions of the procedures for Seasonal Kendall Test and LOWESS can be found in Trends in Nitrogen, Phosphorus, and Suspended Sediment in the Susquehanna River Basin, 1974-93 (Edwards, 1995).

Table 8. Summary of Criteria Used to Classify the Habitat Conditions of Sample Sites

DETERMINATION OF HABITAT ASSESSMENT SCORES				
	Habitat Parameter Scoring Criteria			
Parameter	**Excellent**	**Good**	**Fair**	**Poor**
Bottom Substrate	20-16	15-11	10-6	5-0
Embeddedness	20-16	15-11	10-6	5-0
Velocity/Depth Diversity	20-16	15-11	10-6	5-0
Pool-Riffle (Run-Bend) Ratio	15-12	11-8	7-4	3-0
Pool Quality	15-12	11-8	7-4	3-0
Riffle/Run Quality	15-12	11-8	7-4	3-0
Channel Alteration	15-12	11-8	7-4	3-0
Upper and Lower Streambank Erosion	10-9	8-6	5-3	2-0
Upper and Lower Streambank Stability	10-9	8-6	5-3	2-0
Streamside Vegetative Cover	10-9	8-6	5-3	2-0
Forested Riparian Buffer Zone Width	10-9	8-6	5-3	2-0
Habitat Assessment Score (a)				

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HABITAT ASSESSMENT	
Percent Comparability of Study and Reference Site Habitat Assessment Scores	**Habitat Condition Category**
>90	Excellent (comparable to reference)
89-75	Supporting
74-60	Partially Supporting
<60	Nonsupporting

(a) Habitat Assessment Score = Sum of Habitat Parameter Scores

RESULTS

Water Quality

During fiscal year 1998, water quality in most interstate streams continued to meet designated use classes and water quality standards (Table 9, Appendix D). The parameter that most frequently exceeded water quality standards was total iron (Table 10, Figure 5). Only 34 out of 2,329 observations exceeded water quality standards.

Biological Communities and Physical Habitat

RBP III biological data for New York-Pennsylvania, Pennsylvania-Maryland, and river sites are summarized in Tables 11 through 13, respectively. A high rapid bioassessment protocol score indicates a low degree of impairment and a healthy macroinvertebrate population. RBP III results for each site can be found in the "Bioassessment of Interstate Streams" section, beginning on page 43.

RBP III physical habitat data for New York-Pennsylvania, Pennsylvania-Maryland, and river sites are presented in Tables 14 through 16, respectively. A high score indicates a high-quality physical habitat. RBP III physical habitat and biological data are summarized in Figures 6 through 8.

New York-Pennsylvania streams

New York-Pennsylvania sampling stations consisted of 12 sites located near or on the New York-Pennsylvania border. The biological communities of two (16.7 %) of these streams were nonimpaired. Four streams were slightly impaired (33.3 %), and six streams were moderately impaired (50 %). Two sites had excellent habitats (16.7 %), and seven sites (58.3 %) had supporting habitats. The remaining three sites (25 %) had partially supporting habitats. There were no sites that had a nonsupporting habitat.

Pennsylvania-Maryland streams

The Pennsylvania-Maryland interstate streams included nine stations located on or near the Pennsylvania-Maryland border. Three of these streams (33.3 %) were designated nonimpaired, using RBP III protocol designations. Of the remaining six sites, five sites (55.5 %) were slightly impaired, while one site (11.1 %) was designated moderately impaired. Five (55.5 %) of the Pennsylvania-Maryland border sites had excellent habitats. One site (11.1 %) had a supporting habitat, two sites (22.2 %) had partially supporting habitats, and one site (11.1 %) had a nonsupporting habitat.

River sites

River sites consisted of seven stations located on the Susquehanna River, Chemung River, Cowanesque River, and Tioga River. One station (SUSQ 10.0) was not sampled for macroinvertebrates due to a lack of riffle habitat at the site. The biological community of one site (14.3 %) was nonimpaired, four sites (57.1 %) were slightly impaired, and one site (14.3 %) was designated moderately impaired. One site (14.3 %) was severely impaired. Four (57.1 %) of the sites had excellent habitats. Of the remaining three sites, one each (14.3 %) had supporting, partially supporting, and nonsupporting habitats.

Trends Analysis

A summary of trend statistics is presented in Table 17. The statistical trends were simplified into trend categories: a highly significant ($p<0.05$) trend that was increasing (INC) or decreasing (DEC); a significant ($p<0.10$) trend that was increasing (inc) or decreasing (dec); or no trend (0). The trend categories are presented for both the concentration and the flow-adjusted concentrations. In Tables 18 and 19, weighted values were assigned for each station, and an average weighted value was calculated to indicate the strength of an overall trend for each variable. Each category was given a value: -2 for DEC, -1 for dec, 0 for 0, +1 for inc, and +2 for INC. An average value was calculated for each parameter.

Table 9. Stream Classifications

Stream	Pa. Classification *	N.Y. Classification *
Apalachin Creek	CWF	D
Bentley Creek	WWF	D
Cascade Creek	CWF	C(T)
Cayuta Creek	WWF	B
Chemung River	WWF	C
Choconut Creek	WWF	C
Cowanesque River	WWF	C
Little Snake Creek	CWF	C
Seeley Creek	CWF	C
Snake Creek	CWF	C
South Creek	TSF	C
Susquehanna River @ Windsor		B
Susquehanna River @ Kirkwood	WWF	
Susquehanna River @ Waverly	WWF	B
Tioga River	WWF	C
Trowbridge Creek	CWF	C
Troups Creek	CWF	D
Wappasening Creek	CWF	C
	Pa. Classification	**Md. Classification ***
Big Branch Deer Creek	CWF	III-P
Conowingo Creek	CWF	I-P
Deer Creek	CWF	III-P
Ebaughs Creek	CWF	III-P
Falling Branch Deer Creek	CWF	IV-P
Long Arm Creek	WWF	I-P
Octoraro Creek	TSF-MF	IV-P
Scott Creek	TSF	
South Branch Conewago Creek	WWF	
Susquehanna River @ Marietta	WWF	
Susquehanna River @ Conowingo		I

* See Appendix D for stream classification descriptions

Table 10. Water Quality Standard Summary

Parameter	Number of Observations	Number Exceeding Standards	Standard
Alkalinity	73	5	Pa. aquatic life
Dissolved Iron	73	2	Pa. aquatic life
Total Iron	74	17	N.Y. health (water source)
	74	1	Pa. aquatic life
Total Manganese	74	5	N.Y. health (water source)
pH	74	2	N.Y. aquatic life
Nitrogen (Nitrate + Nitrite)	73	1	Pa. water supply
Total Dissolved Solids	69	1	N.Y. health (water source)

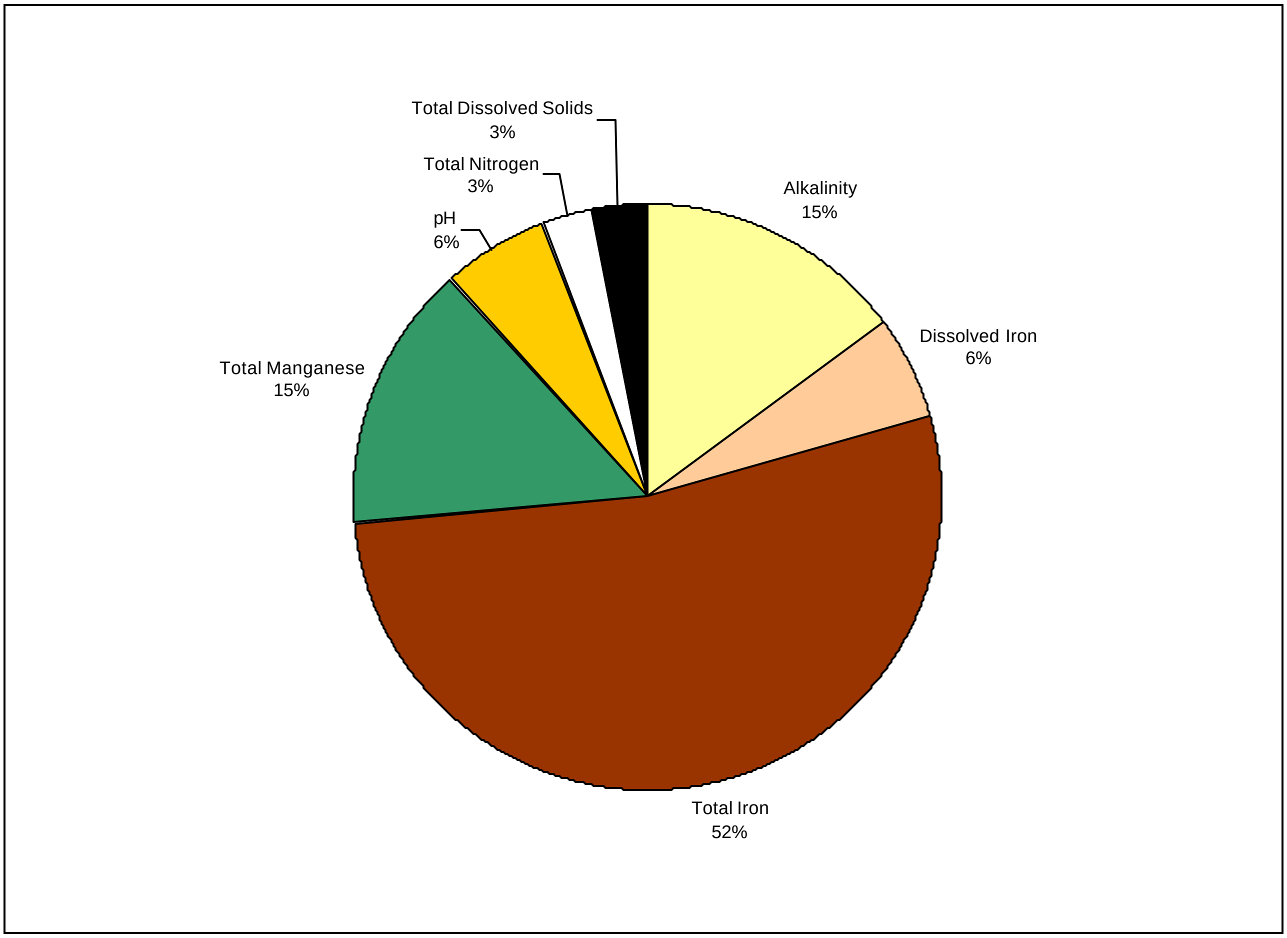


Figure 5.   Parameters Exceeding Water Quality Standards

Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data

	SNAK 2.3	CASC 1.6	SEEL 10.3	APAL 6.9	CHOC 9.1	TROW 1.8
Raw Summary						
Number of Individuals	149	138	107	141	133	123
% Shredders	3.4	1.4	0.0	0.0	3.8	0.0
% Collector-Gatherers	20.8	41.3	66.4	13.5	26.3	52.8
% Filterer-Collectors	64.4	47.1	28.0	68.1	54.9	33.3
% Scrapers	6.7	3.6	1.9	14.2	11.3	12.2
% Predators	4.7	6.5	3.7	4.3	3.8	1.6
Number of EPT Taxa	14	7	6	8	13	10
Number of EPT Individuals	121	71	65	102	106	59
Number of Common Species	19	8	8	10	11	8
Metric Scores						
Taxonomic Richness	19	14	12	14	18	12
Shannon Diversity Index	3.65	2.51	2.37	2.41	3.54	2.46
Modified Hilsenhoff Biotic Index	3.72	4.85	5.05	4.45	4.27	5.50
EPT Index	14	7	6	8	13	10
Ratio Scrapers/Filterers	0.10	0.08	0.07	0.21	0.21	0.37
Ratio EPT/Chironomids	8.64	1.25	1.81	6.38	6.63	1.18
Community Loss Index	0.00	0.79	0.92	0.64	0.44	0.92
Percent Dominant Taxa	18.79	41.30	33.64	54.61	17.29	40.65
Percent of Reference						
Taxonomic Richness	100	73.7	63.2	73.7	94.7	63.2
Shannon Diversity Index	100	68.8	64.9	66.0	97.0	67.4
Hilsenhoff Index	100	76.7	73.7	83.6	87.1	67.6
EPT Index	100	50.0	42.9	57.1	92.9	71.4
Ratio Scrapers/Filterers	100	73.8	64.0	200.0	197.3	351.2
Ratio EPT/Chironomids	100	14.4	20.9	73.8	76.7	13.7
Community Loss Index	0	0.8	0.9	0.6	0.4	0.9
Percent Dominant Taxa	18.8	41.3	33.6	54.6	17.3	40.7
Biological Condition Scores						
Taxonomic Richness	6	4	4	4	6	4
Shannon Diversity Index	6	4	4	4	6	4
Hilsenhoff Index	6	4	4	4	6	2
EPT Index	6	0	0	0	6	2
Ratio Scrapers/Filterers	6	6	6	6	6	6
Ratio EPT/Chironomids	6	0	0	4	6	0
Community Loss Index	6	4	4	4	6	4
Percent Dominant Taxa	6	0	2	0	6	0
Total Biological Score						
Total Biological Score	48	22	24	26	48	22
Biological % of Reference	100	46	50	54	100	46

Table 11. Summary of New York-Pennsylvania Border RBP III Biological Data—Continued

	SOUT 6.9	TRUP 4.5	BNTY 0.9	WAPP 2.6	CAYT 1.7	LSNK 7.6
Raw Summary						
Number of Individuals	124	93	114	151	166	134
% Shredders	1.6	0.0	0.0	0.0	0.0	2.2
% Collector-Gatherers	40.3	48.4	50.9	25.8	45.2	66.4
% Filterer-Collectors	51.6	18.3	45.6	58.9	42.8	18.7
% Scrapers	4.0	12.9	1.8	12.6	9.0	2.2
% Predators	2.4	20.4	1.8	2.6	3.0	10.4
Number of EPT Taxa	8	10	6	8	10	8
Number of EPT Individuals	71	63	56	123	95	38
Number of Common Species	8	9	6	11	10	8
Metric Scores						
Taxonomic Richness	14	12	9	15	16	13
Shannon Diversity Index	2.39	2.88	2.09	3.23	2.89	2.18
Modified Hilsenhoff Biotic Index	5.30	4.62	5.11	4.31	5.05	5.89
EPT Index	8	10	6	8	10	8
Ratio Scrapers/Filterers	0.08	0.71	0.04	0.21	0.2	0.1
Ratio EPT/Chironomids	1.54	3.94	1.00	7.69	1.5	0.5
Community Loss Index	0.79	0.83	1.44	0.53	0.6	0.8
Percent Dominant Taxa	37.10	29.03	49.12	19.21	38.6	61.9
Percent of Reference						
Taxonomic Richness	73.7	63.2	47.4	78.9	84.2	68.4
Shannon Diversity Index	65.5	78.9	57.3	88.5	79.2	59.7
Hilsenhoff Index	70.2	80.4	72.8	86.2	73.6	63.1
EPT Index	57.1	71.4	42.9	57.1	71.4	57.1
Ratio Scrapers/Filterers	75.0	677.6	36.9	204.9	202.8	115.2
Ratio EPT/Chironomids	17.9	45.6	11.6	88.9	17.2	5.3
Community Loss Index	0.8	0.8	1.4	0.5	0.6	0.8
Percent Dominant Taxa	37.1	29.0	49.1	19.2	38.6	61.9
Biological Condition Scores						
Taxonomic Richness	4	4	2	4	6	4
Shannon Diversity Index	4	6	4	6	6	4
Hilsenhoff Index	4	4	4	6	4	2
EPT Index	0	2	0	0	2	0
Ratio Scrapers/Filterers	6	6	4	6	6	6
Ratio EPT/Chironomids	0	2	0	6	0	0
Community Loss Index	4	4	4	4	4	4
Percent Dominant Taxa	2	4	0	6	2	0
Total Biological Score						
Total Biological Score	24	32	18	38	30	20
Biological % of Reference	50	67	38	79	63	42

Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data

	BBDC 4.1	SBCC 20.4	SCTT 3.0	EBAU 1.5	FBDC 4.1
Raw Data Summary					
Number of Individuals	115	112	110	114	93
% Shredders	26.1	29.5	0	1.8	1.1
% Collector-Gatherers	13.0	25.0	90.9	54.4	31.2
% Filterer-Collectors	38.3	16.1	5.5	25.4	49.5
% Scrapers	12.2	21.4	0.9	15.8	10.8
% Predators	10.4	8.0	2.7	2.6	7.5
Number of EPT Taxa	11	9	4	9	10
Number of EPT Individuals	84	66	22	69	57
Number of Common Species	17	7	3	7	9
Metric Scores					
Taxonomic Richness	17	15	7	12	13
Shannon Diversity Index	3.00	3.06	1.19	2.71	2.67
Modified Hilsenhoff Biotic Index	2.22	2.83	6.67	5.04	4.33
EPT Index	11	9	4	9	10
Ratio Scrapers/Filterers	0.32	1.33	0.17	0.62	0.22
Ratio EPT/Chironomids	7.00	3.47	0.26	2.76	2.19
Community Loss Index	0.00	0.67	2.00	0.83	0.62
Percent Dominant Taxa	26.96	29.46	77.27	28.95	34.41
Percent of Reference					
Taxonomic Richness	100	88.2	41.2	70.6	76.5
Shannon Diversity Index	100	102.0	39.7	90.3	89.0
Hilsenhoff Index	100	78.3	33.2	44.0	51.2
EPT Index	100	81.8	36.4	81.8	90.9
Ratio Scrapers/Filterers	100	419.0	52.4	195.1	68.3
Ratio EPT/Chironomids	100	49.6	3.7	39.4	31.3
Community Loss Index	0	0.7	2.0	0.8	0.6
Percent Dominant Taxa	27.0	29.5	77.3	28.9	34.4
Biological Condition Scores					
Taxonomic Richness	6	6	2	4	4
Shannon Diversity Index	6	6	2	6	6
Hilsenhoff Index	6	4	0	0	2
EPT Index	6	4	0	4	6
Ratio Scrapers/Filterers	6	6	6	6	6
Ratio EPT/Chironomids	6	2	0	2	2
Community Loss Index	6	4	2	4	4
Percent Dominant Taxa	4	4	0	4	2
Total Biological Score					
Total Biological Score	46	36	12	30	32
Biological % of Reference	100	78	26	65	70

Table 12. Summary of Pennsylvania-Maryland Border RBP III Biological Data—Continued

	CNWG 4.4	LNGA 2.5	DEER 44.5	OCTO 6.6
Raw Data Summary				
Number of Individuals	111	116	142	120
% Shredders	0	5.2	6.3	2.5
% Collector-Gatherers	11.7	43.1	16.9	20.8
% Filterer-Collectors	30.6	12.9	54.9	68.3
% Scrapers	56.8	27.6	16.9	8.3
% Predators	0.9	11.2	4.9	0
Number of EPT Taxa	9	6	12	10
Number of EPT Individuals	62	38	112	102
Number of Common Species	5	6	8	4
Metric Scores				
Taxonomic Richness	13	12	21	14
Shannon Diversity Index	2.6	2.95	3.66	3.36
Modified Hilsenhoff Biotic Index	4.41	5.34	3.85	4.17
EPT Index	9	6	12	10
Ratio Scrapers/Filterers	1.85	2.13	0.31	0.12
Ratio EPT/Chironomids	6.89	1.19	12.44	9.27
Community Loss Index	0.92	0.92	0.43	0.93
Percent Dominant Taxa	34.23	27.59	18.31	15.00
Percent of Reference				
Taxonomic Richness	76.5	70.6	123.5	82.4
Shannon Diversity Index	86.7	98.3	122.0	112.0
Hilsenhoff Index	50.2	41.6	57.7	53.2
EPT Index	81.8	54.5	109.1	90.9
Ratio Scrapers/Filterers	582.4	670.5	96.7	38.3
Ratio EPT/Chironomids	98.4	17.0	177.8	132.5
Community Loss Index	0.9	0.9	0.4	0.9
Percent Dominant Taxa	34.2	27.6	18.3	15.0
Biological Condition Scores				
Taxonomic Richness	4	4	6	6
Shannon Diversity Index	6	6	6	6
Hilsenhoff Index	2	0	2	2
EPT Index	4	0	6	6
Ratio Scrapers/Filterers	6	6	6	4
Ratio EPT/Chironomids	6	0	6	6
Community Loss Index	4	4	6	4
Percent Dominant Taxa	2	4	6	6
Total Biological Score				
Total Biological Score	34	24	44	40
Biological % of Reference	74	52	96	87

Table 13. Summary of River RBP III Biological Data

	SUSQ 365	SUSQ 340	SUSQ 289.1	SUSQ 44.5
Raw Summary				
Number of Individuals	144	120	151	99
% Shredders	0	0	0	0
% Collector-Gatherers	22.9	44.2	27.2	59.6
% Filterer-Collectors	21.5	0.8	53.6	19.2
% Scrapers	50.0	51.7	18.5	20.2
% Predators	5.6	3.3	0.7	1.0
Number of EPT Taxa	16	9	11	10
Number of EPT Individuals	77	61	112	84
Number of Common Species	22	10	12	9
Metric Scores				
Taxonomic Richness	22	13	14	15
Shannon Diversity Index	3.73	2.89	3.25	2.84
Modified Hilsenhoff Biotic Index	4.33	4.54	4.68	4.92
EPT Index	16	9	11	10
Ratio Scrapers/Filterers	2.32	62.00	0.35	1.05
Ratio EPT/Chironomids	4.81	4.07	5.33	12.00
Community Loss Index	0.00	0.92	0.71	0.87
Percent Dominant Taxa	28.47	29.17	21.85	45.45
Percent of Reference				
Taxonomic Richness	100	59.09	63.64	68.18
Shannon Diversity Index	100	77.48	87.13	76.14
Hilsenhoff Index	100	95.26	92.40	87.95
EPT Index	100	56.25	68.75	62.50
Ratio Scrapers/Filterers	100	2669.44	14.88	45.32
Ratio EPT/Chironomids	100	84.50	110.82	249.35
Community Loss Index	0	0.92	0.71	0.87
Percent Dominant Taxa	28.47	29.17	21.85	45.45
Biological Condition Scores				
Taxonomic Richness	6	2	4	4
Shannon Diversity Index	6	6	6	6
Hilsenhoff Index	6	6	6	6
EPT Index	6	0	0	0
Ratio Scrapers/Filterers	6	6	0	4
Ratio EPT/Chironomids	6	6	6	6
Community Loss Index	6	4	4	4
Percent Dominant Taxa	4	4	4	0
Total Biological Score				
Total Biological Score	46	34	30	30
Percent of Reference	100	74	65	65

Table 13. Summary of River RBP III Biological Data—Continued

	CHEM 12.0	COWN 2.2	TIOG 10.8
Raw Summary			
Number of Individuals	180	118	132
% Shredders	0	1.7	0.0
% Collector-Gatherers	13.9	98.3	22.7
% Filterer-Collectors	75.6	0.0	69.7
% Scrapers	10.6	0.0	6.8
% Predators	0.0	0.0	0.8
Number of EPT Taxa	10	1	11
Number of EPT Individuals	161	2	87
Number of Common Species	9	1	9
Metric Scores			
Taxonomic Richness	12	3	16
Shannon Diversity Index	2.75	0.25	3.07
Modified Hilsenhoff Biotic Index	4.58	7.02	4.80
EPT Index	10	1	11
Ratio Scrapers/Filterers	0.14	0.00	0.10
Ratio EPT/Chironomids	9.47	0.02	3.95
Community Loss Index	1.08	7.00	0.81
Percent Dominant Taxa	42.22	96.61	27.27
Percent of Reference			
Taxonomic Richness	54.55	13.64	72.73
Shannon Diversity Index	73.73	6.70	82.31
Hilsenhoff Index	94.39	61.66	90.22
EPT Index	62.50	6.25	68.75
Ratio Scrapers/Filterers	6.02	0.00	4.21
Ratio EPT/Chironomids	196.79	0.36	82.17
Community Loss Index	1.08	7.00	0.81
Percent Dominant Taxa	42.22	96.61	27.27
Biological Condition Scores			
Taxonomic Richness	2	0	4
Shannon Diversity Index	4	0	6
Hilsenhoff Index	6	2	6
EPT Index	0	0	0
Ratio Scrapers/Filterers	0	0	0
Ratio EPT/Chironomids	6	0	6
Community Loss Index	4	0	4
Percent Dominant Taxa	0	0	4
Total Biological Score			
Total Biological Score	22	2	30
Percent of Reference	48	4	65

Table 14. Summary of New York-Pennsylvania Sites Physical Habitat Data

	SNAK 2.3	CASC 1.6	TROW 1.8	LSNK 7.6	CHOC 9.1	APAL 6.9
Primary Parameters						
Bottom Substrate	17	17	12	15	18	16
Embeddedness	17	14	17	15	15	15
Velocity/Depth Diversity	17	7	9	10	16	16
Secondary Parameters						
Pool/Riffle Ratio	13	6	8	11	13	13
Pool Quality	10	5	6	7	9	11
Riffle/Run Quality	12	5	7	10	11	8
Channel Alteration	11	11	11	9	3	9
Tertiary Parameters						
Streambank Erosion	5	3	5	5	5	5
Streambank Stability	8	5	8	7	9	6
Streamside Vegetative Cover	7	7	5	5	4	9
Riparian Buffer Zone	2	6	2	9	2	2
Total Habitat Score						
Total Habitat Score	119	86	90	103	105	110
Habitat Percent of Reference	100	72	76	87	88	92

	WAPP 2.6	CAYT 1.7	SOUT 6.9	BNTY 0.9	TRUP 4.5	SEEL 10.3
Primary Parameters						
Bottom Substrate	14	9	15	10	17	12
Embeddedness	10	14	16	16	14	12
Velocity/Depth Diversity	17	15	8	11	13	9
Secondary Parameters						
Pool/Riffle Ratio	11	10	6	10	12	9
Pool Quality	10	7	7	7	6	6
Riffle/Run Quality	9	11	7	10	11	8
Channel Alteration	7	9	10	3	9	4
Tertiary Parameters						
Streambank Erosion	3	6	6	2	4	2
Streambank Stability	9	9	6	5	6	4
Streamside Vegetative Cover	2	9	7	7	4	6
Riparian Buffer Zone	5	2	2	4	4	4
Total Habitat Score						
Total Habitat Score	97	101	90	85	100	76
Habitat Percent of Reference	82	85	76	71	84	64

Table 15. Summary of Pennsylvania-Maryland Sites Physical Habitat Data

	BBDC 4.1	LNGA 2.5	SBCC 20.4	DEER 44.5	EBAU 1.5
Primary Parameters					
Bottom Substrate	14	7	7	15	14
Embeddedness	12	8	7	9	14
Velocity/Depth Diversity	14	8	8	19	13
Secondary Parameters					
Pool/Riffle Ratio	10	8	10	13	9
Pool Quality	11	6	6	11	10
Riffle/Run Quality	8	7	6	10	10
Channel Alteration	8	6	12	7	12
Tertiary Parameters					
Streambank Erosion	5	5	7	2	9
Streambank Stability	6	5	7	3	8
Streamside Vegetative Cover	8	4	7	4	5
Riparian Buffer Zone	8	2	9	3	2
Total Habitat Score					
Total Habitat Score	104	66	86	96	106
Habitat Percent of Reference	100	63	83	92	102

	FBDC 4.1	SCTT 3.0	CNWG 4.4	OCTO 6.6
Primary Parameters				
Bottom Substrate	5	4	17	18
Embeddedness	6	4	17	17
Velocity/Depth Diversity	8	3	18	17
Secondary Parameters				
Pool/Riffle Ratio	7	6	13	12
Pool Quality	7	3	13	12
Riffle/Run Quality	7	2	13	13
Channel Alteration	3	2	11	13
Tertiary Parameters				
Streambank Erosion	5	5	6	6
Streambank Stability	6	6	8	8
Streamside Vegetative Cover	7	6	7	7
Riparian Buffer Zone	5	2	9	9
Total Habitat Score				
Total Habitat Score	66	43	132	132
Habitat Percent of Reference	63	41	127	127

Table 16. Summary of River Sites Physical Habitat Data

	SUSQ 365.0	SUSQ 340.0	CHEM 12.0	SUSQ 289.1
Primary Parameters				
Bottom Substrate	18	13	10	16
Embeddedness	16	11	11	17
Velocity/Depth Diversity	17	18	9	17
Secondary Parameters				
Pool/Riffle Ratio	11	5	3	7
Pool Quality	12	12	12	11
Riffle/Run Quality	10	5	10	12
Channel Alteration	9	10	11	11
Tertiary Parameters				
Streambank Erosion	6	7	5	5
Streambank Stability	8	9	8	8
Streamside Vegetative Cover	7	5	5	5
Riparian Buffer Zone	5	2	3	2
Total Habitat Score				
Total Habitat Score	119	97	87	111
Habitat Percent of Reference	100	82	73	93

	TIOG 10.8	COWN 2.2	SUSQ 44.5
Primary Parameters			
Bottom Substrate	17	8	7
Embeddedness	17	9	16
Velocity/Depth Diversity	16	4	17
Secondary Parameters			
Pool/Riffle Ratio	11	3	13
Pool Quality	11	11	13
Riffle/Run Quality	14	4	10
Channel Alteration	12	4	12
Tertiary Parameters			
Streambank Erosion	8	9	6
Streambank Stability	9	8	6
Streamside Vegetative Cover	7	4	7
Riparian Buffer Zone	4	2	2
Total Habitat Score			
Total Habitat Score	126	66	109
Habitat Percent of Reference	106	55	92

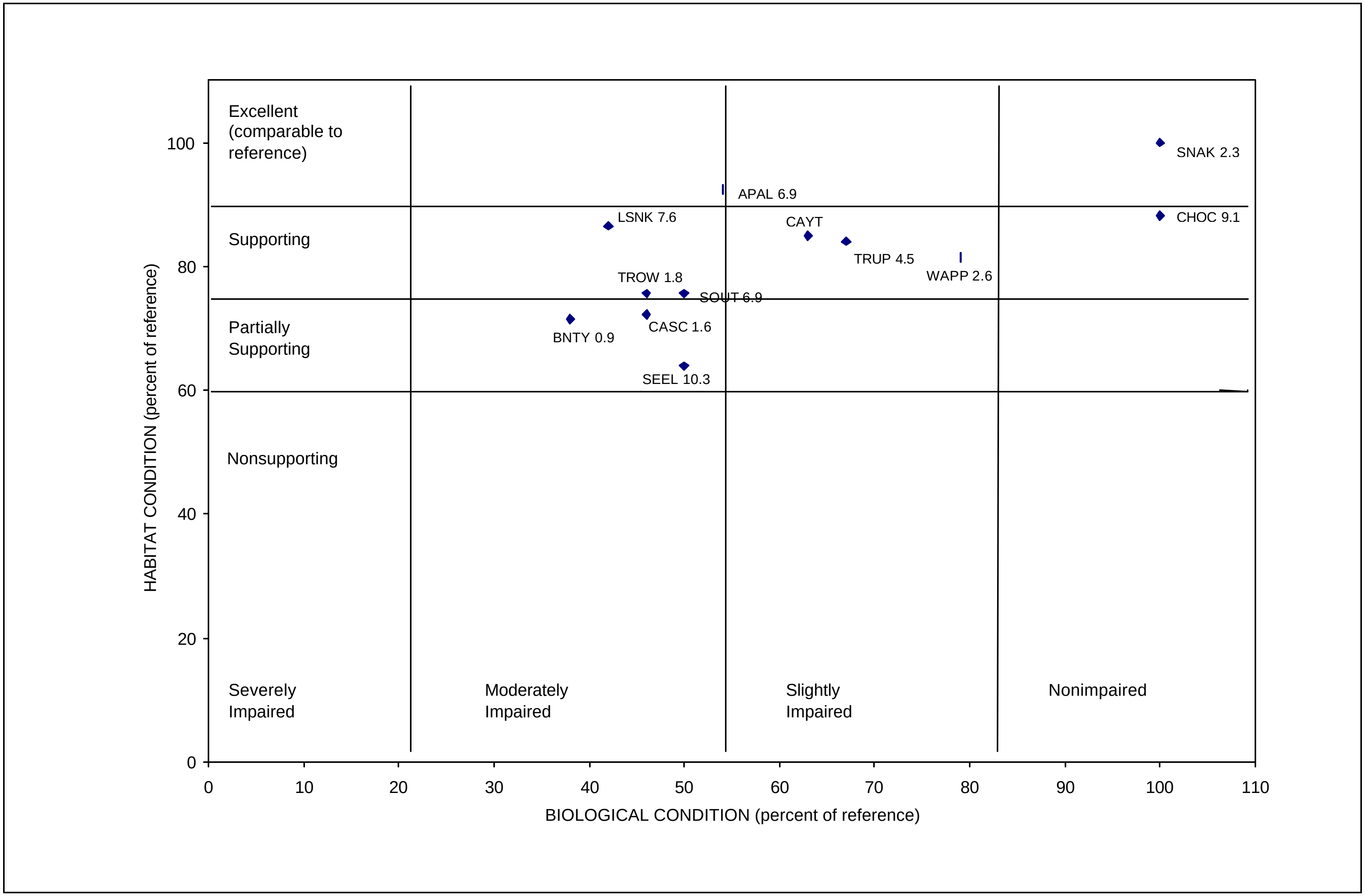


Figure 6. Summary of New York-Pennsylvania Border Streams Habitat and Biological Condition Scores

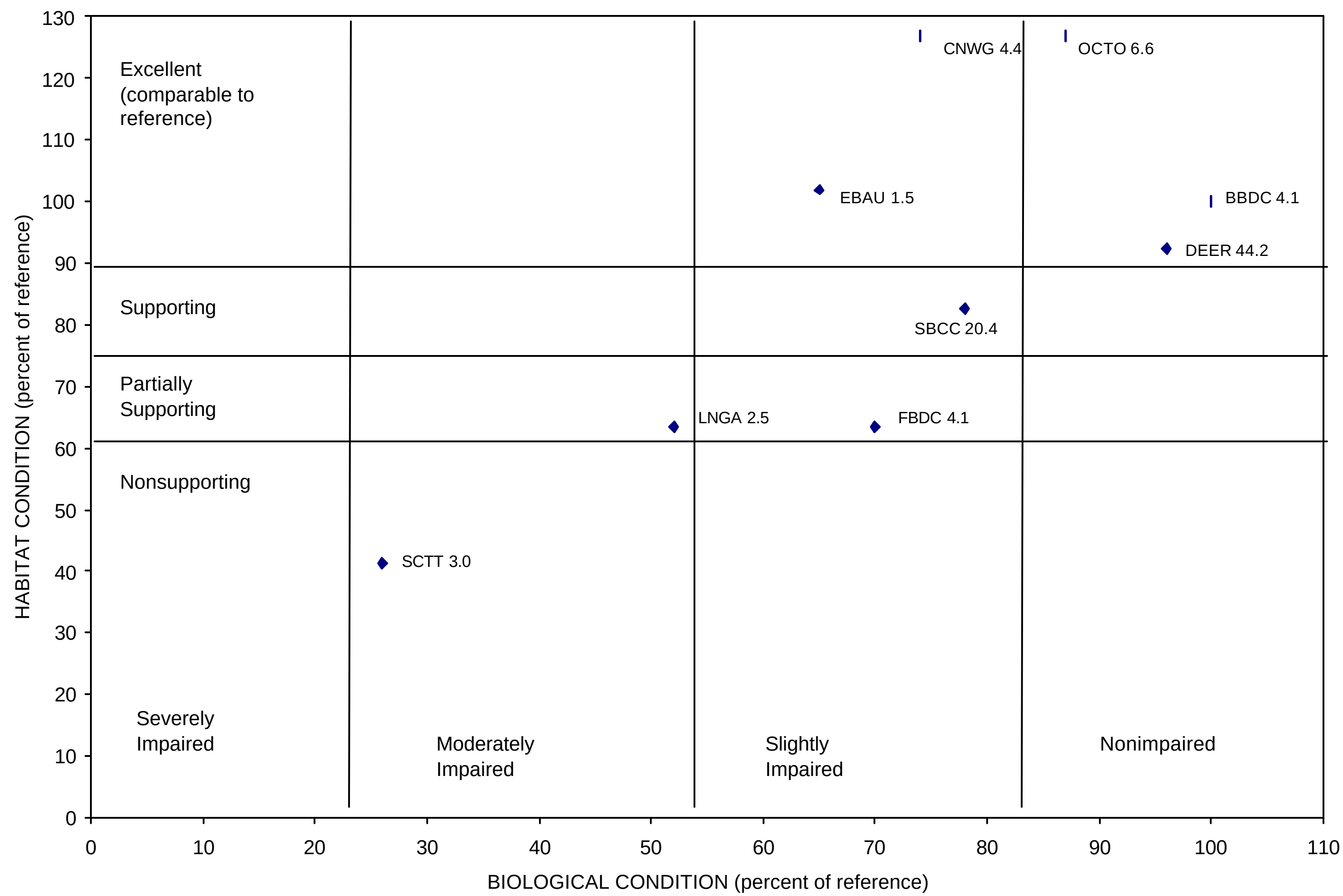


Figure 7. Summary of Pennsylvania-Maryland Border Streams Habitat and Biological Condition Scores

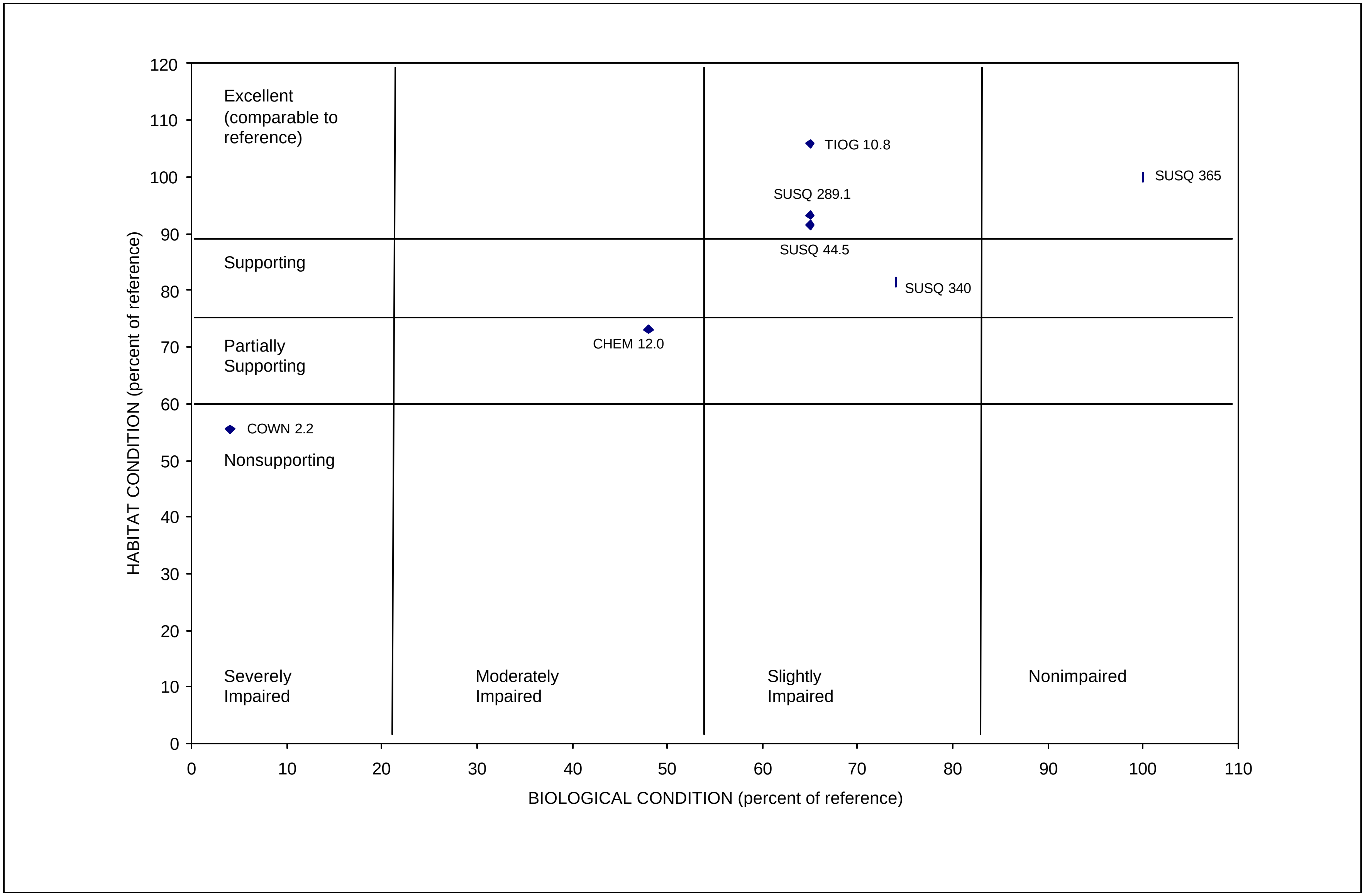


Figure 8.   Summary of River Sites Habitat and Biological Condition Scores

An analysis of "strong decreasing trend" required an average weighted value of less than -1.50. An analysis of "decreasing trend" required an average value between -1.00 and -1.50. An analysis of "no trend" was indicated by a value of -1.00 to +1.00.

Detailed results of the Seasonal Kendall Test are presented in Appendix E, Tables E1-E8. The statistics include the probability (P), slope estimate (b), Kendall's Tau median, and percent slope. The median was calculated from the median of the entire quarterly time series. The percent slope was expressed in percent of the median concentration per year and was calculated by dividing the slope (b) by the median and multiplying by 100. The percent slope identifies those stations for which trend slope (b) is large with respect to the median value.

Total suspended solids

Trend analysis results for total suspended solids are presented in Appendix E, Table E1. Concentration values at the stations showed one decreasing trend at Cayuta Creek, one increasing trend at Cowanesque River, and one strongly increasing trend at Ebaughs Creek (Table 17). Flow-adjusted concentration analysis indicated one decreasing trend at Cayuta Creek, one increasing trend at Troups Creek, and one strongly increasing trend at Ebaughs Creek (Table 17). There was no overall trend, indicated by a weighted value of 0.13 for both concentration values and flow-adjusted concentrations (Tables 18 and 19, respectively).

Total ammonia

Total ammonia trend analysis results are presented in Appendix E, Table E2. Concentration values showed 10 strongly decreasing values at all five Susquehanna River sites, Cayuta Creek, Chemung River, Deer Creek, Ebaughs Creek, and Octoraro Creek and one decreasing value at Tioga River (Table 17). Flow-adjusted concentrations indicated three strongly decreasing values at Susquehanna River sites 44.5, 340, and 365 and two decreasing trends at Susquehanna River site 289.1 and Chemung River (Table 17). There was an overall decreasing trend in concentration with a weighted value of -1.4 (Table 18), but a weighted value of -0.53 indicates that there was no overall trend in flow-adjusted concentrations (Table 19).

Total nitrogen

The results of trend analysis for total nitrogen are presented in Appendix E, Table E3. Concentration values at the Group 1 stations showed four strongly decreasing trends at Susquehanna River sites 289.1, 340, 365, and Cowanesque River, one decreasing site at Cayuta Creek, one increasing site at Scott Creek, and three strongly increasing sites at Conowingo Creek, Deer Creek, and Octoraro Creek (Table 17). Note that increasing trends for total nitrogen were found only in Pennsylvania-Maryland border sites, which are heavily influenced by agriculture. Flow-adjusted concentrations indicated one strongly decreasing trend at Susquehanna River site 340, one decreasing trend at Susquehanna River site 10.0, one increasing trend at Deer Creek, and three strongly increasing trends at Conowingo Creek, Octoraro Creek, and Scott Creek (Table 17). Again, note that increasing trends for total nitrogen were found only in the Pennsylvania-Maryland border sites. Overall, there was no trend in either concentration or flow-adjusted concentrations, with average weighted values of -0.13 and 0.27, respectively (Tables 18 and 19).

Total phosphorus

Trend analysis results for total phosphorus are presented in Appendix E, Table E4. Concentration values showed 10 strongly decreasing trends at all Susquehanna River sites, Chemung River, Deer Creek, Ebaughs Creek, Octoraro Creek, and Scott Creek, and one decreasing trend at Conowingo Creek (Table 17). Flow-adjusted concentrations showed eight strongly decreasing trends at Susquehanna River sites 44.5, 289.1, 340, 365, Chemung River, Deer Creek, Ebaughs Creek, and Scott Creek. Decreasing trends were found at Susquehanna

Table 17. Trend Summary of Selected Parameters for Group 1 Streams, 1986-98

Site	Total Solids		Total Ammonia		Total Nitrogen		Total Phosphorus	
	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC
Cayuta Creek	dec	dec	DEC	O	dec	O	O	dec
Chemung River	O	O	DEC	dec	O	O	DEC	DEC
Conowingo Creek	O	O	O	O	INC	INC	dec	O
Cowanesque River	inc	O	O	O	DEC	O	O	O
Deer Creek	O	O	DEC	O	INC	inc	DEC	DEC
Ebaughs Creek	INC	INC	DEC	O	O	O	DEC	DEC
Octoraro Creek	O	O	DEC	O	INC	INC	DEC	dec
Scott Creek	O	O	O	O	inc	INC	DEC	DEC
Susquehanna River 10.0	O	O	DEC	O	O	dec	DEC	dec
Susquehanna River 44.5	O	O	DEC	DEC	O	O	DEC	DEC
Susquehanna River 289.1	O	O	DEC	dec	DEC	O	DEC	DEC
Susquehanna River 340	O	O	DEC	DEC	DEC	DEC	DEC	DEC
Susquehanna River 365	O	O	DEC	DEC	DEC	O	DEC	DEC
Tioga River	O	O	dec	O	O	O	O	O
Troups Creek	O	inc	O	O	O	O	O	O

Site	Total Chloride		Total Sulfate		Total Iron		Total Aluminum	
	CONC	FAC	CONC	FAC	CONC	FAC	CONC	FAC
Cayuta Creek	O	O	O	O	DEC	O	O	O
Chemung River	O	INC	DEC	DEC	DEC	DEC	O	O
Conowingo Creek	INC	O	O	O	DEC	O	DEC	O
Cowanesque River	O	DEC	DEC	DEC	O	O	inc	O
Deer Creek	O	INC	INC	inc	DEC	DEC	O	O
Ebaughs Creek	INC	INC	O	O	DEC	DEC	O	O
Octoraro Creek	inc	INC	O	O	O	O	O	O
Scott Creek	O	O	DEC	DEC	DEC	DEC	O	O
Susquehanna River 10.0	O	O	O	O	DEC	dec	O	O
Susquehanna River 44.5	O	O	O	DEC	DEC	DEC	O	O
Susquehanna River 289.1	O	dec	O	O	DEC	DEC	dec	DEC
Susquehanna River 340	O	O	O	O	DEC	DEC	O	O
Susquehanna River 365	O	O	O	O	DEC	DEC	O	DEC
Tioga River	dec	DEC	DEC	DEC	O	O	inc	INC
Troups Creek	O	O	DEC	DEC	O	O	O	O

INC Strong, Significant Increasing Trend; Probability < 5 %
inc Significant Increasing Trend; 5 % < Probability < 10 %
O No Significant Trend; Probability > 10%
dec Significant Decreasing Trend; 5 % < Probability < 10 %
DEC Strong, Significant Decreasing Trend; Probability < 5 %
CONC Concentrations
FAC Flow-Adjusted Concentrations

Table 18. Trend Category Counts and Weighted Values of Unadjusted Concentrations for Group 1 Streams

Concentration	Trend Category Count					
	DEC	dec	O	inc	INC	Total
Total Solids	0	1	12	1	1	15
Total Ammonia	10	1	4	0	0	15
Total Nitrogen	4	1	6	1	3	15
Total Phosphorus	10	1	4	0	0	15
Total Chlorides	0	1	11	1	2	15
Total Sulfate	5	0	9	0	1	15
Total Iron	11	0	4	0	0	15
Total Aluminum	1	1	11	2	0	15

Concentration	Weighted Values						
	DEC	dec	O	inc	INC	Sum	Average Value*
Total Solids	0	-1	0	1	2	2	0.13
Total Ammonia	-20	-1	0	0	0	-21	-1.40
Total Nitrogen	-8	-1	0	1	6	-2	-0.13
Total Phosphorus	-20	-1	0	0	0	-21	-1.40
Total Chlorides	0	-1	0	1	4	4	0.27
Total Sulfate	-10	0	0	0	1	-9	-0.60
Total Iron	-22	0	0	0	0	-22	-1.47
Total Aluminum	-2	-1	0	2	0	-1	-0.07

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC =2 each

*Average Value

< - 1.50	Strong Decreasing Trend
-1.5 to -1.00	Decreasing Trend
-1.00 to 1.00	No Trend
1.00 to 1.50	Increasing Trend
>1.50	Strong Increasing Trend

Table 19. Trend Category Counts and Weighted Values of Flow-Adjusted Concentrations for Group 1 Streams

Concentration	Trend Category Count					
	DEC	dec	O	inc	INC	Total
Total Solids	0	1	12	1	1	15
Total Ammonia	3	2	10	0	0	15
Total Nitrogen	1	1	9	1	3	15
Total Phosphorus	8	3	4	0	0	15
Total Chlorides	2	1	8	0	4	15
Total Sulfate	6	0	8	1	0	15
Total Iron	8	1	6	0	0	15
Total Aluminum	2	0	12	0	1	15

Concentration	Weighted Values						
	DEC	dec	O	inc	INC	Sum	Average Value*
Total Solids	0	-1	0	1	2	2	0.13
Total Ammonia	-6	-2	0	0	0	-8	-0.53
Total Nitrogen	-2	-1	0	1	6	4	0.27
Total Phosphorus	-16	-3	0	0	0	-19	-1.27
Total Chlorides	-4	-1	0	0	8	3	0.20
Total Sulfate	-12	0	0	1	0	-11	-0.73
Total Iron	-16	-1	0	0	0	-17	-1.13
Total Aluminum	-4	0	0	0	2	-2	-0.13

DEC = -2 each
dec = -1 each
0 = 0 each
inc = 1 each
INC =2 each

*Average Value

< - 1.50	Strong Decreasing Trend
-1.5 to -1.00	Decreasing Trend
-1.00 to 1.00	No Trend
1.00 to 1.50	Increasing Trend
>1.50	Strong Increasing Trend

River site 10, Cayuta Creek, and Octoraro Creek (Table 17). Overall, there was a decreasing trend in both phosphorus concentrations and flow-adjusted concentrations (average values = -1.40 and -1.27, respectively) (Tables 18 and 19). This decreasing overall trend may have been due to a decrease of phosphates in detergents or to the application of agricultural Best Management Practices (BMPs).

Total chloride

The results of trend analysis for total chloride are presented in Appendix E, Table E5. Concentration values showed one decreasing trend in the Tioga River, one increasing trend at Octoraro Creek, and two strongly increasing trends in Conowingo Creek and Ebaughs Creek (Table 17). Flow-adjusted concentrations indicated two strongly decreasing trends in Cowanesque River and Tioga River, one decreasing trend at Susquehanna River site 289.1, and four strongly increasing trends in Chemung River, Deer Creek, Ebaughs Creek, and Octoraro Creek (Table 17). Overall, there was no trend in either concentration or flow-adjusted concentrations, with average weighted values of 0.27 and 0.20, respectively (Tables 18 and 19).

Total sulfate

Trend analysis results for total sulfate are presented in Appendix E, Table E6. Concentration values at the stations showed five strongly decreasing trends at Chemung River, Cowanesque River, Scott Creek, Tioga River, and Troups Creek and one strongly increasing trend at Deer Creek (Table 17). Six strongly decreasing trends were found at Susquehanna River site 44.5, Chemung River, Cowanesque River, Scott Creek, Tioga River, and Troups Creek, while one increasing trend was found in Deer Creek, indicated by flow-adjusted concentrations (Table 17). There was no overall trend in concentrations or flow-adjusted concentrations, with average weighted values of -0.60 and -0.73 (Tables 18 and 19).

Total iron

Total iron trend analysis results are found in Appendix E, Table E7. Group 1 concentration values showed eleven strongly decreasing trends at all Susquehanna River sites, Cayuta Creek, Chemung River, Conowingo Creek, Deer Creek, Ebaughs Creek, and Scott Creek (Table 17). Flow-adjusted concentrations indicated similar results, with eight strongly decreasing trends at Susquehanna River sites 44.5, 289.1, 340, and 365, Chemung River, Deer Creek, Ebaughs Creek, and Scott Creek and one decreasing trend at Susquehanna River site 10 (Table 17). There was an overall decreasing trend in both concentrations and flow-adjusted concentrations, indicated by values of -1.47 and -1.13, respectively (Tables 18 and 19).

Total aluminum

The results of trend analysis for total aluminum are presented in Appendix E, Table E8. Concentration values at the Group 1 stations showed one strongly decreasing trend at Conowingo Creek, one decreasing trend at Susquehanna River site 289.1, and two increasing trends at Cowanesque River and Tioga River (Table 17). Flow-adjusted concentration values showed two strongly decreasing trends at Susquehanna River sites 289.1 and 365 and one strongly increasing trend at Tioga River. There was no overall trend, indicated by a weighted value of -0.07 for the concentrations and -0.13 for the flow-adjusted concentrations (Tables 18 and 19).

BIOASSESSMENT OF INTERSTATE STREAMS

Abbreviations for water quality standards are provided in Table 20. Summaries of all stations include WQI scores, parameters that exceeded water quality standards, and parameters that exceeded the 90th percentile at each station. RBP III biological and habitat data also are provided, along with graphs depicting historical water quality and biological conditions over the past five years. Fiscal year 1998 WQI scores are indicated by a white bar, and previous WQI scores are indicated by black bars in all WQI graphs.

Table 20. Abbreviations Used in Tables 21 Through 49

Abbreviation	Parameter
ALK	Alkalinity
COND	Conductivity
DAl	Dissolved Aluminum
TAl	Total Aluminum
TCa	Total Calcium
TCl	Total Chloride
DFe	Dissolved Iron
TFe	Total Iron
TN	Total Nitrogen
DN	Dissolved Nitrogen
TMg	Total Magnesium
DMn	Dissolved Manganese
TMn	Total Manganese
DNH3	Dissolved Ammonia
TNH3	Total Ammonia
DNO2	Dissolved Nitrite
TNO2	Total Nitrite
DNO3	Dissolved Nitrate
TNO3	Total Nitrate
DO	Dissolved Oxygen
DP	Dissolved Phosphorus
TP	Total Phosphorus
DPO4	Dissolved Orthophosphate
TPO4	Total Orthophosphate
DS	Dissolved Solids
TS	Total Solids
TSO4	Total Sulfate
TOC	Total Organic Carbon
TURB	Turbidity
WQI	Water Quality Index
RBP	Rapid Bioassessment Protocol

New York-Pennsylvania Border Streams

Cascade Creek

During fiscal year 1998, Cascade Creek at Lanesboro, Pa., (CASC 1.6) showed a moderately impaired macroinvertebrate community. This stream was designated nonimpaired during the 1997 fiscal year.

During the 1998 sampling season, Cascade Creek had a high WQI score for a Group 2 New York-Pennsylvania stream. Water quality standards for total iron and total manganese were exceeded, and water quality analysis indicated that dissolved oxygen (DO) levels were reduced (Table 21). The low DO and poor macroinvertebrate community may be due to low flow conditions during July 1997, which can cause stress on the biological community or to poor habitat conditions at the site.

Trowbridge Creek

Trowbridge Creek at Great Bend, Pa., (TROW 1.8) had a moderately impaired biological community after being designated nonimpaired during fiscal year 1997. Impaired conditions at this site may be due to very low flow conditions at the time of sampling. The location of the site also may contribute to the impaired designation of this site. TROW 1.8 is located directly adjacent to a road, which may lead to an influx of pollutants. Additionally, chemically treated grass clippings were deposited in the stream, as reported by local residents.

Alkalinity exceeded standards for the second consecutive year, with a value of 14 mg/l, and TROW 1.8 had a high WQI score for a Group 2 New York-Pennsylvania stream. However, water quality analysis indicated that no parameters exceeded the 90th percentile (Table 22).

Snake Creek

Snake Creek at Brookdale, Pa., (SNAK 2.3) served as the reference site for New York-Pennsylvania border steams. This site had an excellent biological community and physical habitat, as well as exceptional water quality, with the lowest WQI score of the Group 2 New York-Pennsylvania streams (Table 23). Snake Creek supported many pollution-intolerant taxa, including *Atherix* (Diptera: Athericidae), *Serratella* (Ephemeroptera: Ephemerellidae), *Isonychia* (Ephemeroptera: Isonychiidae), *Nigronia* (Megaloptera: Corydalidae), *Leuctra* (Plecoptera: Leuctridae), *Paragnetina* (Plecoptera: Perlidae), and *Dolophilodes* (Trichoptera: Philopotamidae).

Little Snake Creek

Little Snake Creek at Brackney, Pa. (LSNK 7.6) showed a moderately impaired biological community, after having a nonimpaired biological community during fiscal year 1997. This impairment may be due to low flow conditions at the time of sampling or to rechannelization of the stream, when a new bridge was installed.

Total and dissolved iron exceeded water quality standards during July 1997 (Table 24). Additionally, LSNK 7.6 had one of the highest WQI scores among the annually sampled New York-Pennsylvania streams, with dissolved iron and dissolved manganese exceeding the 90th percentile.

Choconut Creek

During fiscal year 1998, the biological community of Choconut Creek at Vestal Center, N.Y., (CHOC 9.1) was designated nonimpaired, after being designated slightly impaired during fiscal year 1997. CHOC 9.1 had a very diverse macroinvertebrate community and several pollution-intolerant taxa, including *Hexatoma* (Diptera: Tipulidae), *Drunella* (Ephemeroptera: Ephemerellidae), *Serratella*, *Stenonema* (Ephemeroptera: Heptageniidae), *Isonychia*, *Leuctra*, and *Acroneuria* (Plecoptera: Perlidae).

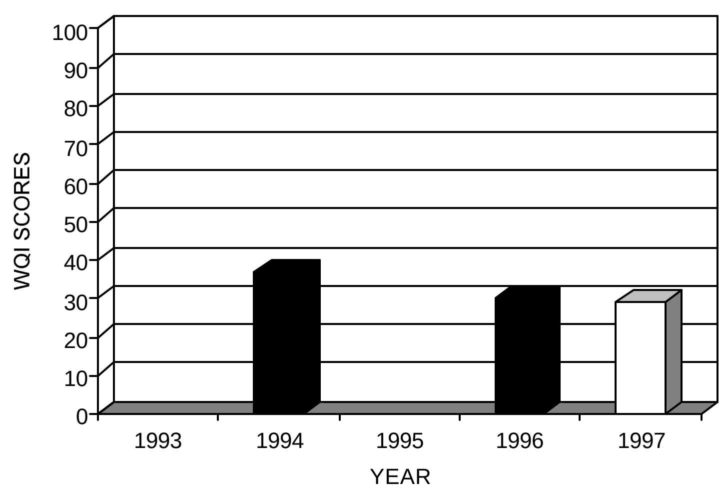
Although total iron exceeded standards during July 1997, water quality analysis indicated that water quality conditions at this site were

Table 21. Water Quality Summary Cascade Creek at Lanesboro, Pa.

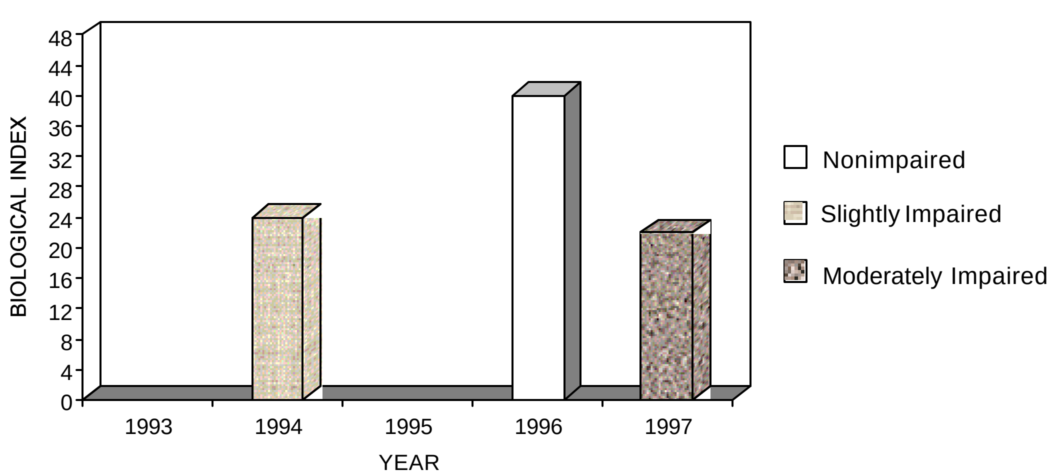
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/21/97	591 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TMn	07/21/97	340 µg/l	300 µg/l	N.Y. health (water source)

Date	WQI	Parameters Exceeding 90th Percentile							
07/21/97	29	DO							

Biological and Habitat Summary	
Number of Taxa	14
Diversity Index	2.51
RBP III Score	22
RBP III Condition	Moderately Impaired
Total Habitat Score	86
Habitat Condition Category	Partially Supporting



Water Quality Index



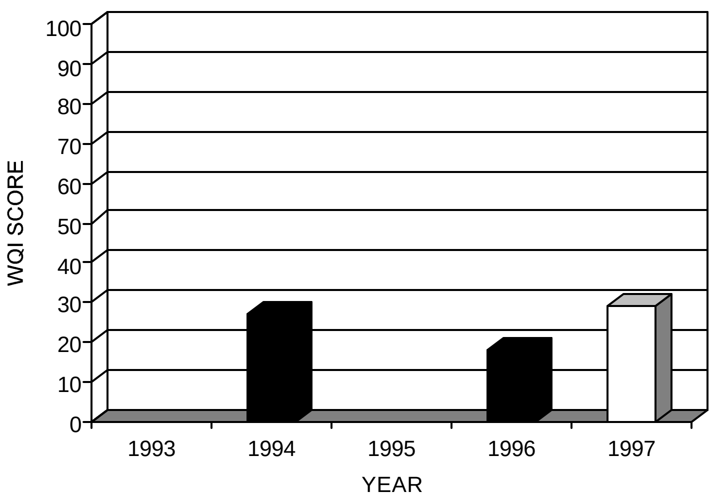
Biological Index

Table 22. Water Quality Summary Trowbridge Creek at Great Bend, Pa.

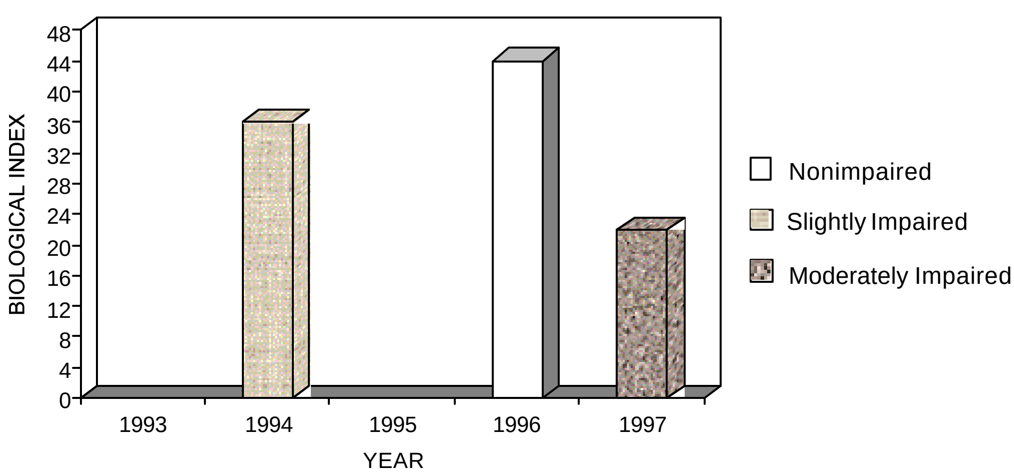
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	07/21/96	14 mg/l	20 mg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile								
07/21/96	29	ALK								

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.46
RBP III Score	22
RBP III Condition	Moderately Impaired
Total Habitat Score	90
Habitat Condition Category	Supporting



Water Quality Index



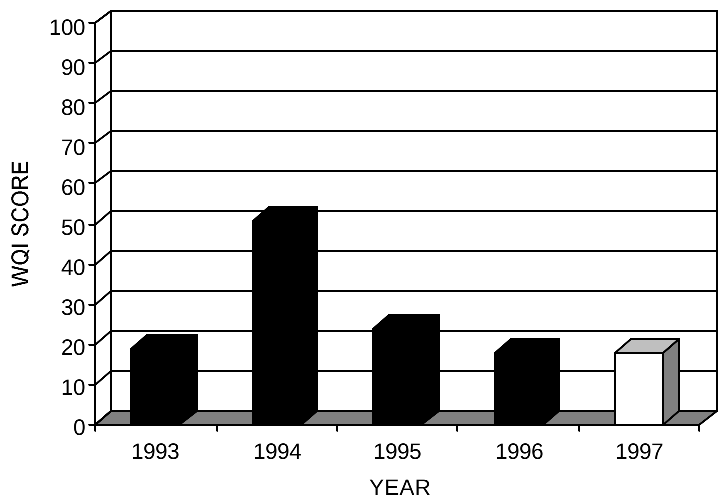
Biological Index

Table 23. Water Quality Summary Snake Creek at Brookdale, Pa.

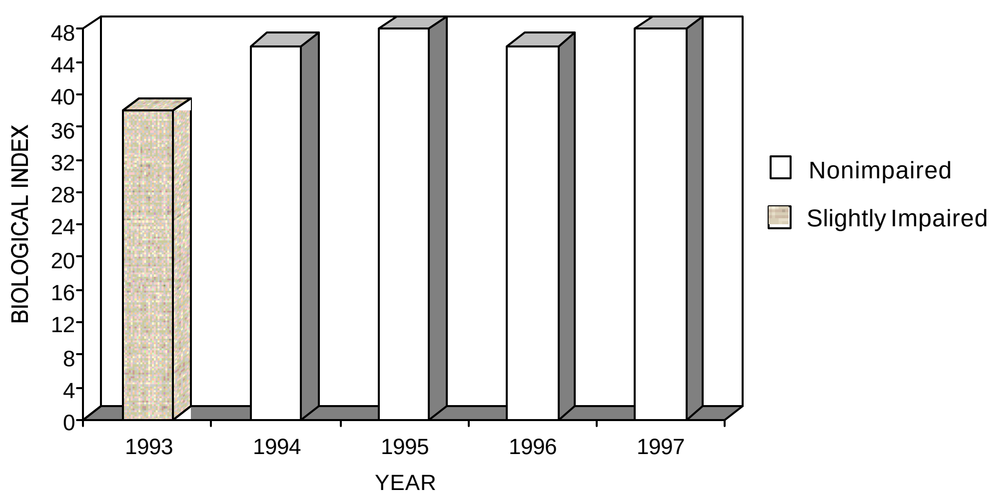
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None	07/22/97			

Date	WQI	Parameters Exceeding 90th Percentile							
07/22/97	18								

Biological and Habitat Summary	
Number of Taxa	19
Diversity Index	3.65
RBP III Score	48
RBP III Condition	Reference
Total Habitat Score	119
Habitat Condition Category	Reference



Water Quality Index



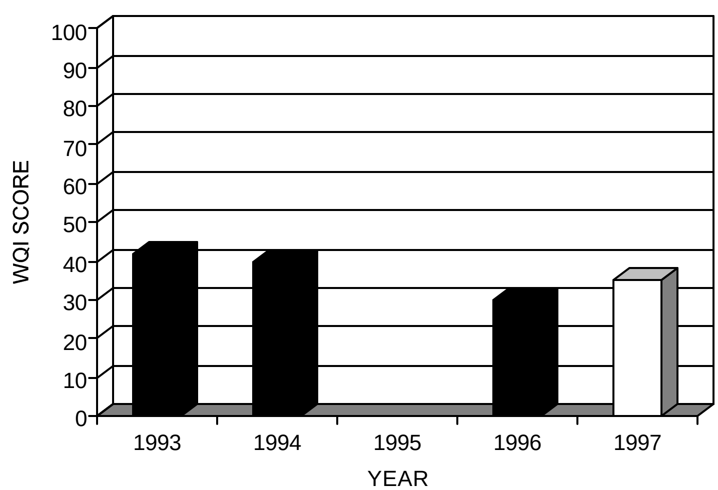
Biological Index

Table 24. Water Quality Summary Little Snake Creek at Brackney, Pa.

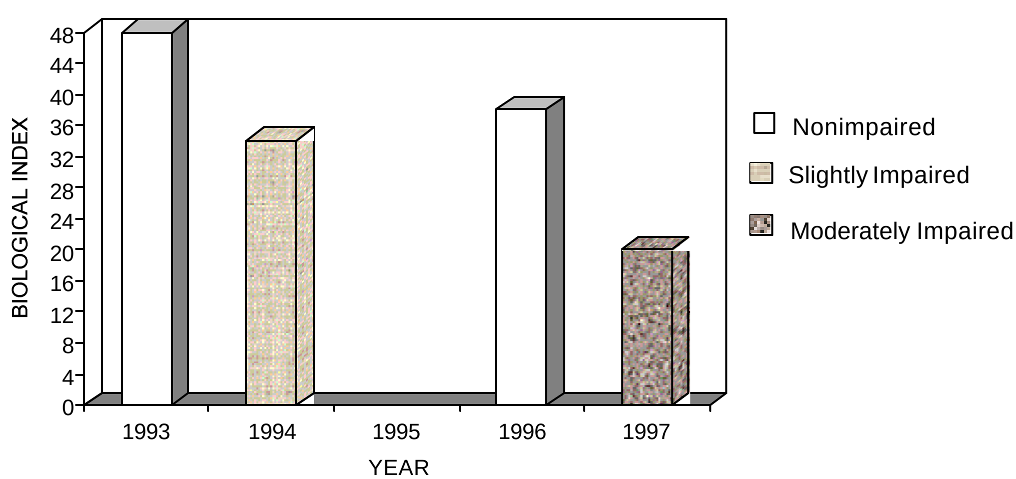
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/22/97	920 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
DFe	07/22/97	426 µg/l	300 µg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile								
07/22/97	35	DFe	DMn							

Biological and Habitat Summary	
Number of Taxa	13
Diversity Index	2.18
RBP III Score	20
RBP III Condition	Moderately Impaired
Total Habitat Score	103
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

comparable to the reference site, with no parameters that exceeded the 90th percentile (Table 25). Previous impairment may have been due to rechannelization as evidenced by large amounts of riprap at the site.

Apalachin Creek

Apalachin Creek at Little Meadows, Pa., (APAL 6.9) showed a slightly impaired biological community during fiscal year 1998, reduced from a nonimpaired designation the previous year. This impairment may have been due to low flow conditions at the time of sampling. Additionally, very little riffle habitat is present at the site due to still-water conditions, which may affect the biological community.

Total iron exceeded water quality standards at the time of sampling. Although no parameters exceeded the 90th percentile, the WQI for Apalachin Creek was elevated for a New York-Pennsylvania Group 2 stream (Table 26).

Wappasening Creek

A slightly impaired biological community was present at Wappasening Creek at Nichols, N.Y., (WAPP 2.6) during fiscal year 1998. WAPP 2.6 had a nonimpaired biological community during the previous year. The RBP III score at this site was 38, which is marginal between a nonimpaired and a slightly impaired biological community. A low EPT index contributed to the slightly impaired condition of this site. Water quality conditions at this site were comparable to the reference site, with no parameters exceeding standards or the 90th percentile (Table 27).

Cayuta Creek

Biological conditions of Cayuta Creek at Waverly, N.Y., (CAYT 1.7) were designated slightly impaired, reduced from nonimpaired conditions the previous year. There were no water quality standards exceeded during fiscal year 1998 at CAYT 1.7. However, water quality analysis indicated that Cayuta Creek contained elevated concentrations of total and dissolved solids, total and dissolved nitrates, dissolved phosphorus, and total and dissolved orthophosphate (Table 28).

Poor water quality conditions may be due to a variety of causes, including wastewater discharges from the Waverly sewage treatment facility, runoff from the city of Waverly, failure of upstream septic systems, or agriculture. More detailed studies would need to be performed in order to determine the cause of impairment. In spite of elevated water quality parameters, CAYT 1.7 contained several pollution-intolerant taxa, including *Antocha* (Diptera: Tipulidae), *Serratella*, *Stenonema*, *Isonychia*, and *Acroneuria*.

Cayuta Creek showed several downward trends for total concentrations. Total solids and total nitrogen showed significant decreasing trends ($0.05<p<0.10$), while a strong, significant decreasing trend ($p<0.05$) was observed for both ammonia and total iron (Table 17). Total solids and total phosphorus also showed significant decreasing trends ($0.05<p<0.10$) when flow-adjusted concentrations were calculated (Table 17).

Troups Creek

Troups Creek at Austinburg, Pa., (TRUP 4.5) had a slightly impaired biological community during July 1997 after nonimpaired conditions existed the previous year. However, several pollution-intolerant taxa did exist in Troups Creek during fiscal year 1998 including *Atherix*, *Stenonema*, *Isonychia*, and *Neoperla* (Plecoptera: Perlidae). Troups Creek also contained a slightly impaired biological community when it was sampled during SRBC's 1997 Chemung Subbasin survey (Traver, 1998).

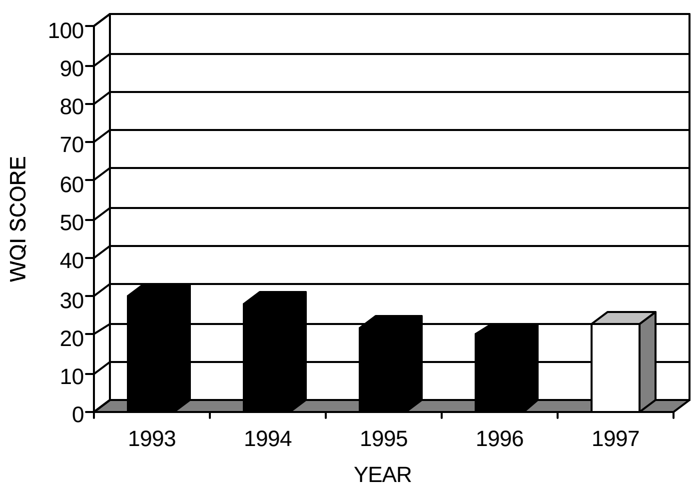
Water quality in Troups Creek was degraded during the sampling period. On two separate occasions, total iron exceeded New York standards. Total manganese and pH also exceeded New York standards during the sampling period. Additional water quality analysis indicated that a variety of parameters exceeded the 90th percentile, including nitrates, ammonia, iron, and phosphorus (Table 29).

Table 25. Water Quality Summary Choconut Creek at Vestal Center, N.Y.

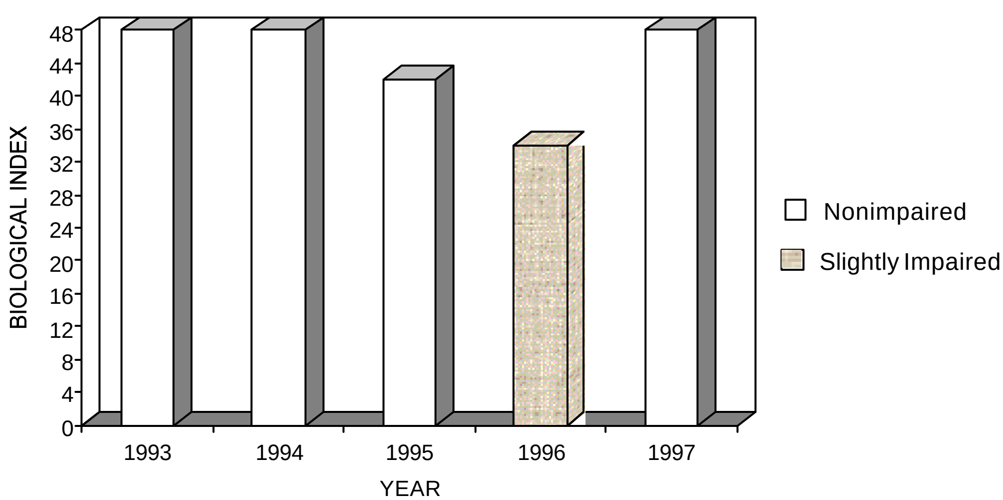
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/22/97	302 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/22/97	23								

Biological and Habitat Summary	
Number of Taxa	18
Diversity Index	3.54
RBP Score	48
RBP Condition	Nonimpaired
Total Habitat Score	105
Habitat Condition Category	Supporting



Water Quality Index



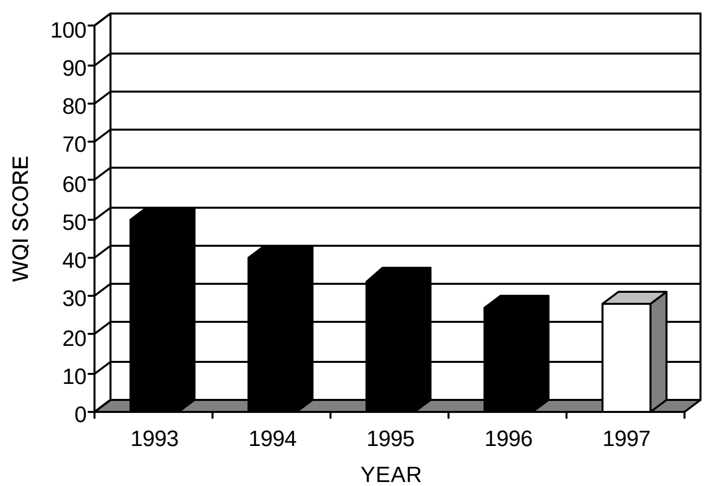
Biological Index

Table 26. Water Quality Summary Apalachin Creek at Little Meadows, Pa.

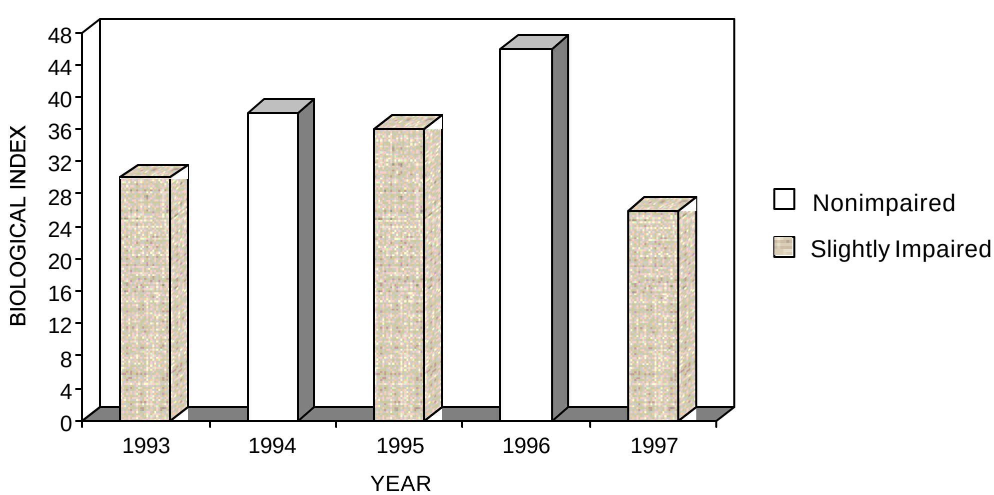
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/22/97	900 μg/l	300 μg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/22/97	28								

Biological and Habitat Summary	
Number of Taxa	14
Diversity Index	2.41
RBP Score	26
RBP Condition	Slightly Impaired
Total Habitat Score	110
Habitat Condition Category	Excellent



Water Quality Index



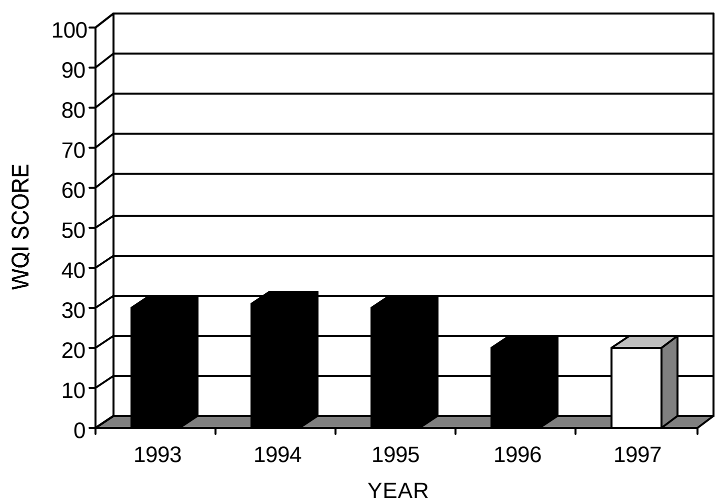
Biological Index

Table 27. Water Quality Summary Wappasening Creek at Nichols, N.Y.

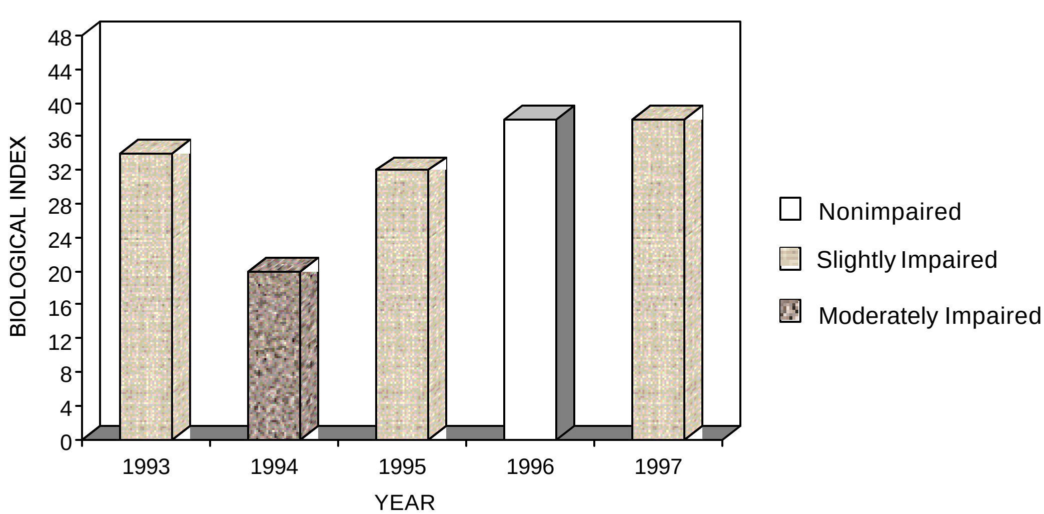
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/23/97	20								

Biological and Habitat Summary	
Number of Taxa	15
Diversity Index	3.23
RBP Score	38
RBP Condition	Slightly Impaired
Total Habitat Score	97
Habitat Condition Category	Supporting



Water Quality Index



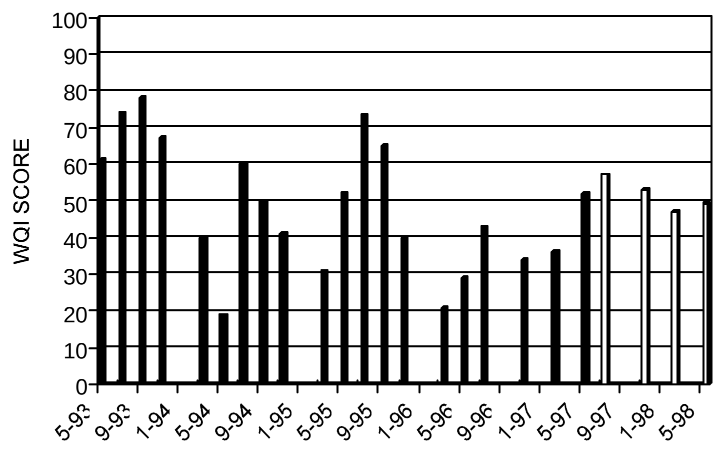
Biological Index

Table 28.   Water Quality Summary Cayuta Creek at Waverly, N.Y.

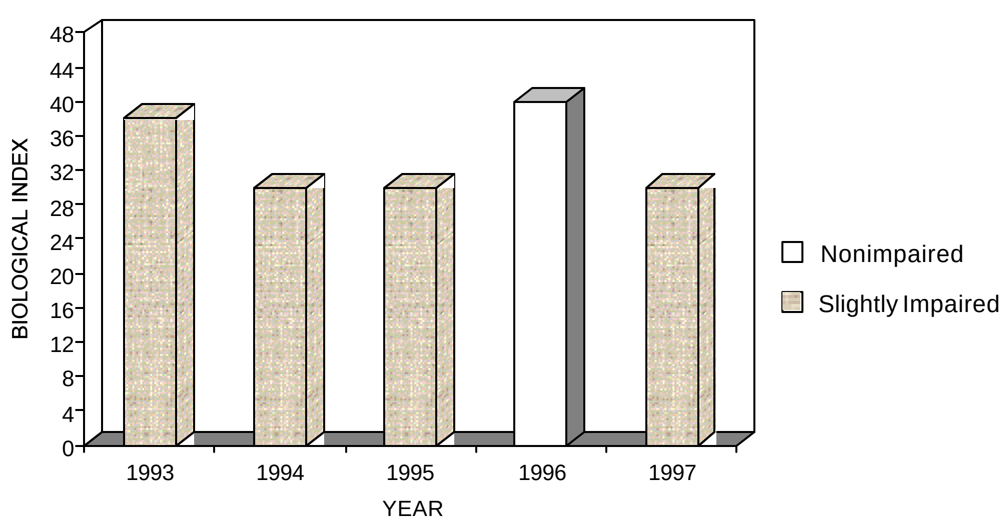
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/23/97	57	COND	TRES	DRES	DNO3	TNO3	DP	DP04	TSO4
		TPO4							
11/11/97	53	DP	DPO4	DFe					
02/17/98	47	DPO4							
05/19/98	49	DP	TCa	TMg					

Biological and Habitat Summary	
Number of Taxa	16
Diversity Index	2.89
RBP Score	30
RBP Condition	Slightly Impaired
Total Habitat Score	101
Habitat Condition Category	Supporting



Water Quality Index



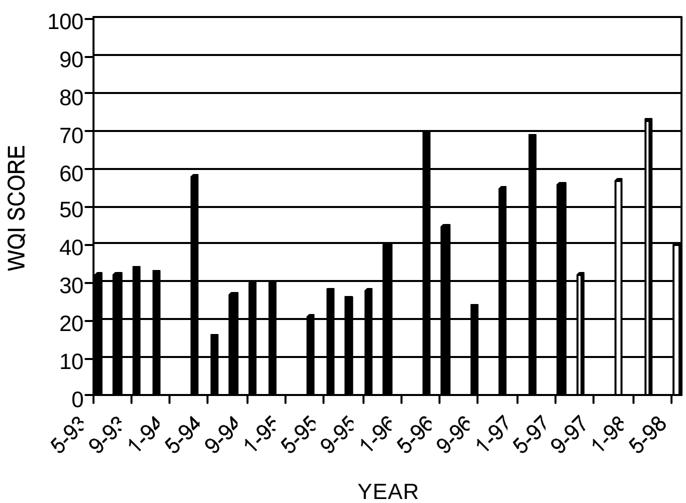
Biological Index

Table 29.   Water Quality Summary Troups Creek at Austinburg, Pa.

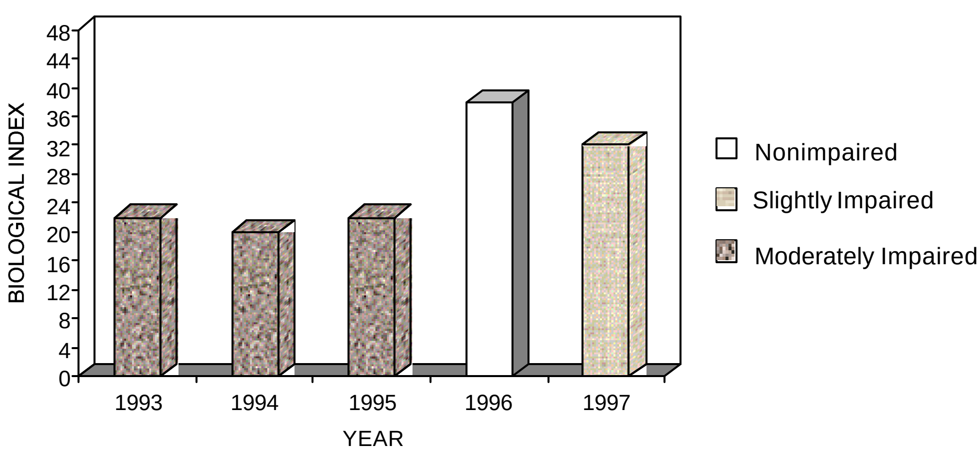
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	11/11/97	509 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	05/21/98	302 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TMn	02/18/98	344 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
pH	07/29/97	8.6	6.5-8.5	N.Y. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/97	32	TCa							
11/11/97	57	DNO3	TNO3	DN	TOC	DFe	TPO4		
02/18/98	73	ALK	DNH3	TNH3	TNO2	TN	TP	DP	DPO4
		TOC	TMg	DFe	TMn	TURB			
05/21/98	40								

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.88
RBP Score	32
RBP Condition	Slightly Impaired
Total Habitat Score	100
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

Troups Creek showed a strong, significant decreasing trend ($p<0.05$) in total sulfate in both concentrations and flow-adjusted concentrations (Table 17). Additionally, there was a significant increasing trend ($0.05<p<0.10$) in solids for flow-adjusted concentrations (Table 17).

Seeley Creek

Seeley Creek at Seeley Creek, N.Y., (SEEL 10.3) contained a moderately impaired biological community and had shown a slightly to moderately impaired biological community for the past 10 years. During the SRBC Chemung Subbasin survey, the biological community at Seeley Creek was designated slightly impaired (Traver, 1998). Water quality analysis showed fair water quality conditions in the stream (Table 30), with no parameters exceeding standards or the 90th percentile. The impaired biological community may have been due to flow-related incidents. During periods of low flow, large amounts of instream substrate were exposed in Seeley Creek. Additionally, rechannelization and removal of the instream habitat may have contributed to impairment at this site, as these activities reduce the habitat quality of the site.

New York State Department of Conservation (NYSDEC) listed Seeley Creek as "threatened" in their publication, The 1998 Chemung River Basin Waterbody Inventory and Priority Waterbodies List (NYSDEC, 1998). According to NYSDEC (1998), the stream is threatened by habitat alteration, streambank erosion, and instability of the stream channel.

South Creek

During fiscal year 1998, South Creek at Fassett, Pa., (SOUT 7.8) showed a moderately impaired biological community. For the previous seven years, a slightly impaired macroinvertebrate community had inhabited the site. A low EPT index and a large number of midges (Diptera: Chironomidae) contributed to the condition of this site. Traver (1998) found nonimpaired biological conditions in South Creek during 1997.

Water quality at SOUT 7.8 was poor for a Group 2 New York-Pennsylvania stream, with elevated dissolved ammonia and total organic carbon. However, no parameters exceeded standards at this site (Table 31). Impairment at SOUT 7.8 may have been due to periodic drying of the streambed or to poor habitat diversity.

Bentley Creek

A moderately impaired biological community existed at Bentley Creek at Wellsburg, N.Y. (BNTY 0.9). A low EPT index and large number of midges contributed to the poor community structure at this site. Impairment may have been due to rechannelization of the stream or to low flow conditions at the time of sampling. SRBC found a nonimpaired biological condition and heavily altered habitat at this site during its 1997 Chemung Subbasin survey (Traver, 1998).

Although no parameters exceeded state standards, total ammonia and total phosphorus exceeded the 90th percentile. Additionally, the WQI was elevated for a Group 2 New York-Pennsylvania stream (Table 32).

Pennsylvania-Maryland Streams

South Branch Conewago Creek

South Branch Conewago Creek near Bandanna, Pa., (SBCC 20.4) contained a slightly impaired biological community, after having served as the Pennsylvania-Maryland reference site for several years. However, several pollution-intolerant taxa inhabited SBCC 20.4, including *Antocha*, *Hexatoma*, *Stenonema*, *Paraleptophlebia* (Ephemeroptera: Leptophlebiidae), *Leuctra*, *Acroneuria*, *Diplectrona* (Trichoptera: Hydropsychidae), and *Dolophilodes*.

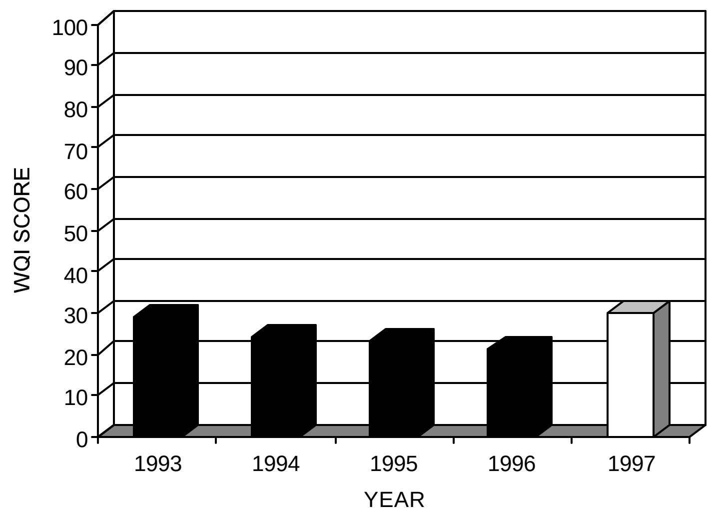
SBCC 20.4 had the lowest WQI score of the Group 1 Pennsylvania-Maryland sites. Although there were no parameters that exceeded standards, total iron and total aluminum exceeded the 90th percentile at this site (Table 33). Low flow conditions at the time of sampling may have affected the biological community and produced a slightly impaired designation.

Table 30. Water Quality Summary Seeley Creek at Seeley Creek, N.Y.

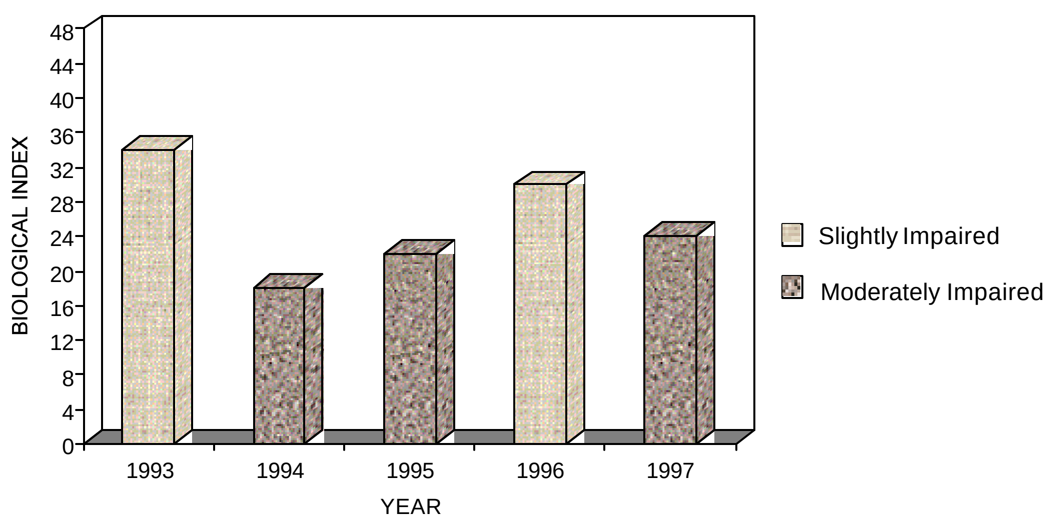
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/30/97	30								

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.37
RBP III Score	24
RBP III Condition	Moderately Impaired
Total Habitat Score	76
Habitat Condition Category	Partially Supporting



Water Quality Index



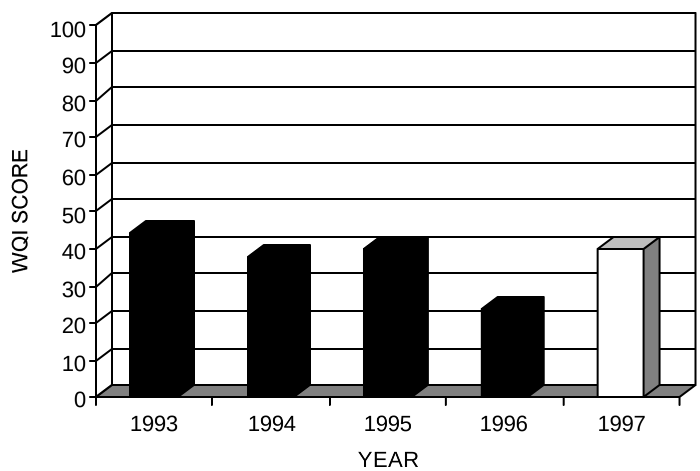
Biological Index

Table 31. Water Quality Summary South Creek at Fassett, Pa.

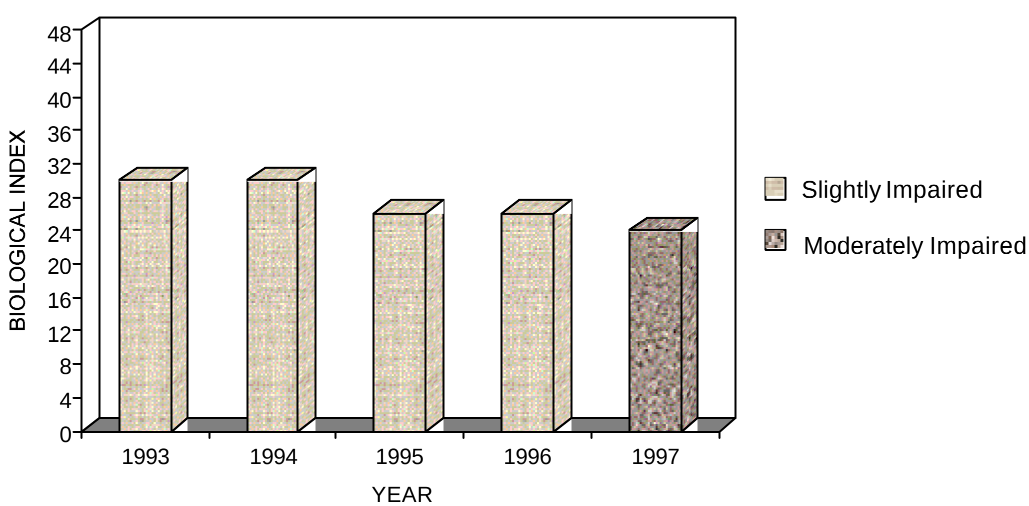
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile								
07/28/97	40	DNH3	TOC							

Biological and Habitat Summary	
Number of Taxa	14
Diversity Index	2.39
RBP III Score	24
RBP III Condition	Moderately Impaired
Total Habitat Score	90
Habitat Condition Category	Supporting



Water Quality Index



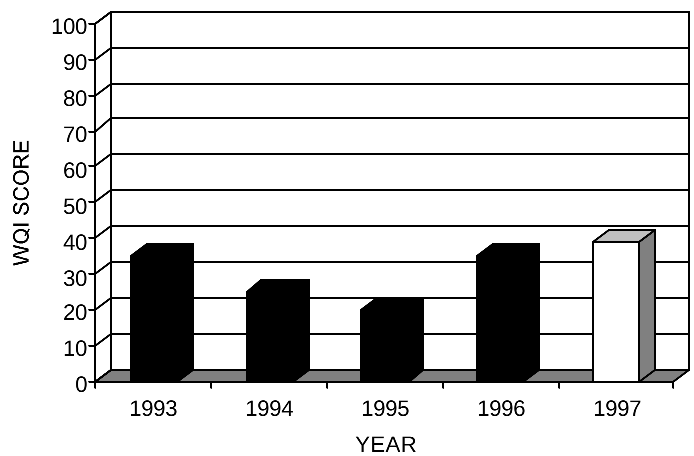
Biological Index

Table 32. Water Quality Summary Bentley Creek at Wellsburg, N.Y.

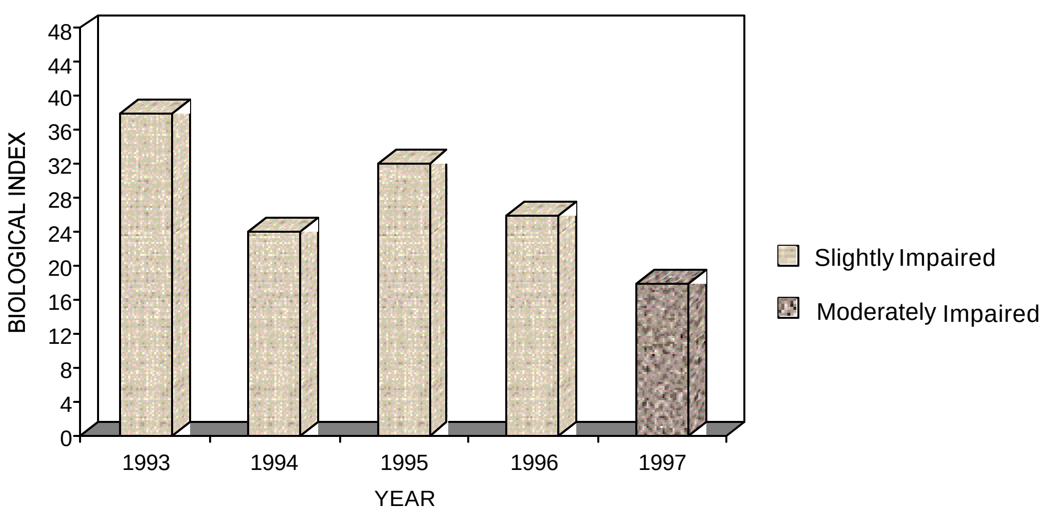
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
None				

Date	WQI	Parameters Exceeding 90th Percentile								
07/28/97	39	TNH3	TP							

Biological and Habitat Summary	
Number of Taxa	9
Diversity Index	2.09
RBP III Score	18
RBP III Condition	Moderately Impaired
Total Habitat Score	85
Habitat Condition Category	Partially Supporting



Water Quality Index



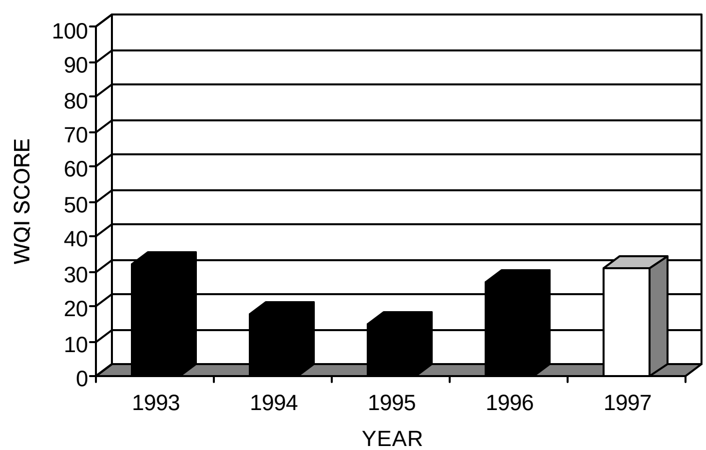
Biological Index

Table 33. Water Quality Summary South Branch Conewago Creek at Bandanna, Pa.

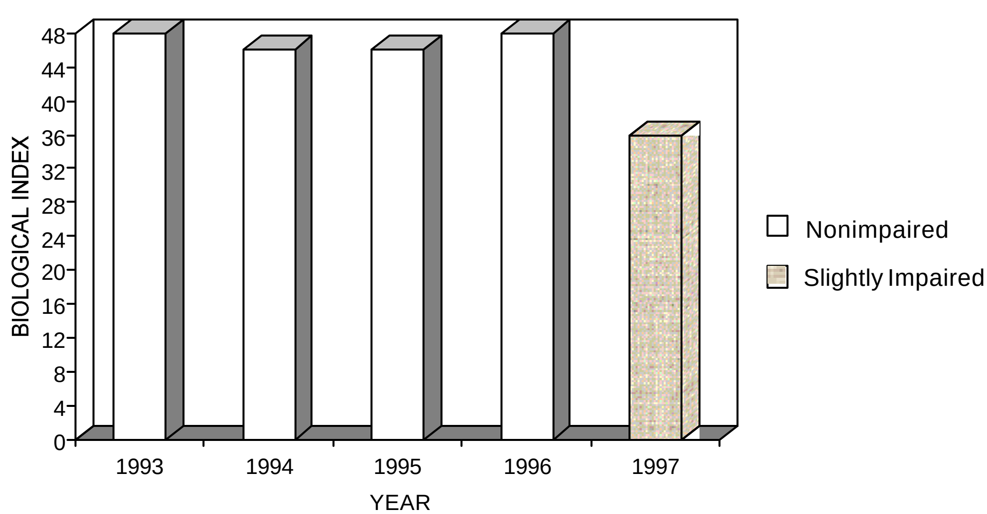
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile								
08/04/97	31	TFe	TAl							

Biological and Habitat Summary	
Number of Taxa	15
Diversity Index	3.06
RBP III Score	36
RBP III Condition	Slightly Impaired
Total Habitat Score	86
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

Long Arm Creek

For the third consecutive year, Long Arm Creek at Bandanna, Pa., (LNGA 2.5) had a slightly impaired biological community. This designation is due to a small number of EPT individuals in the sample, a large number of midges, and a high Hilsenhoff Biotic Index. LNGA 2.5 was located adjacent to agricultural activities, which may have been the source of impairment at this site. Livestock in the stream reduced the habitat quality at this site, which may have affected the biological community.

Long Arm Creek showed elevated nitrogen values, as did most of the streams in this region. Overall, the water quality in this stream was fair for a Pennsylvania-Maryland Group 2 stream (Table 34). Although no water quality standards were exceeded, turbidity exceeded the 90th percentile at this site.

Scott Creek

For the ninth consecutive year, Scott Creek at Delta, Pa., (SCTT 3.0) had a moderately to severely impaired biological community. During the 1998 sampling season, Scott Creek had a moderately impaired macroinvertebrate community, with the lowest taxonomic richness (7), lowest diversity index (1.19), highest Hilsenhoff Biotic Index (6.67), lowest EPT index (4), and the highest percent dominant taxa (77.3) of all streams in the region. Habitat at this site also was extremely poor.

In January 1998, a fuel spill occurred on Scott Creek in Cardiff, Md. Four to five thousand gallons of home heating fuel spilled into Scott Creek when an attempt was made to steal the fuel. The spill also resulted in a fish kill.

Although no state standards were exceeded, water quality analysis indicated that Scott Creek had elevated ammonia, phosphorus, solids, iron, and manganese, and reduced dissolved oxygen (Table 35). This site also had the highest average WQI score (61) of the streams in this region. Raw sewage from the Cardiff-Delta area continued to degrade water quality and the biological community of Scott Creek. However, a treatment plant has been constructed to serve the area and reduce the impacts of sewage on the stream.

Scott Creek had a mixture of increasing and decreasing trends. Using unadjusted concentration values, total nitrogen showed a significant increasing trend, while total phosphorus, total sulfate, and total iron showed a strong, significant decreasing trend. When concentrations were flow-adjusted, total nitrogen showed a strong, significant increasing trend, while total phosphorus, total sulfate, and total iron showed a strong, significant decreasing trend (Table 17).

Conowingo Creek

Conowingo Creek at Pleasant Grove, Pa., (CNWG 4.4) had a slightly impaired biological community for the second consecutive year. The designation was influenced by the large number of *Stenelmis* (Coleoptera: Elmidae) and *Ceratopsyche* (Trichoptera: Hydropsychidae) in the sample, which increased the Hilsenhoff Biotic Index and the Percent Dominant Taxa Index. Habitat at this site was excellent.

Total nitrogen values exceeded Pennsylvania standards in November 1997 and were high year-round. Additional water quality analysis indicated that magnesium, nitrates, and nitrites were elevated (Table 36). As agriculture is the area's prevalent land use, it appears that the stream was enriched by agricultural runoff.

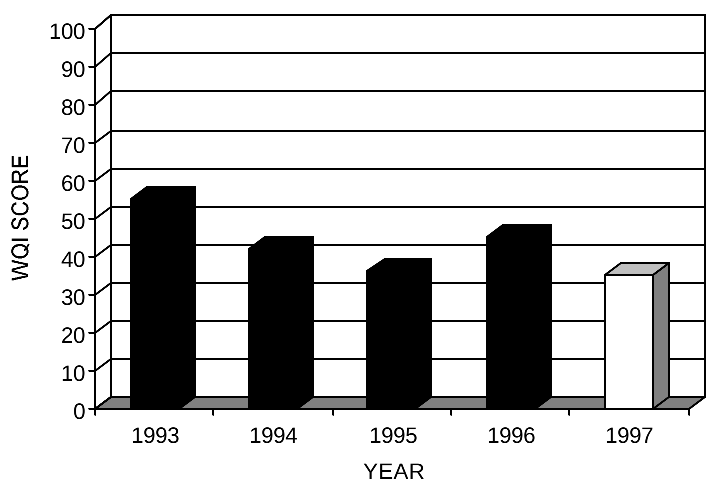
Conowingo Creek had a variety of upward and downward trends. Strong, significant increasing trends occurred for total nitrogen in both unadjusted and flow-adjusted concentrations and in total chloride for unadjusted concentrations. A significant decreasing trend occurred in total phosphorus for unadjusted concentrations, while strong, significant decreasing trends were found for total iron and total aluminum for unadjusted concentrations (Table 17).

Table 34. Water Quality Summary Long Arm Creek at Bandanna, Pa.

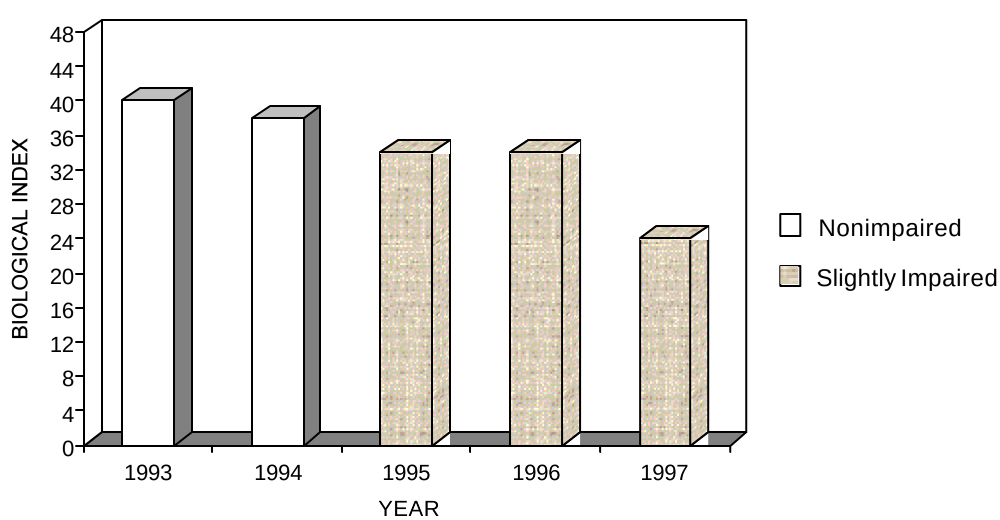
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/31/97	35	TURB							

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.95
RBP III Score	24
RBP III Condition	Slightly Impaired
Total Habitat Score	66
Habitat Condition Category	Partially Supporting



Water Quality Index



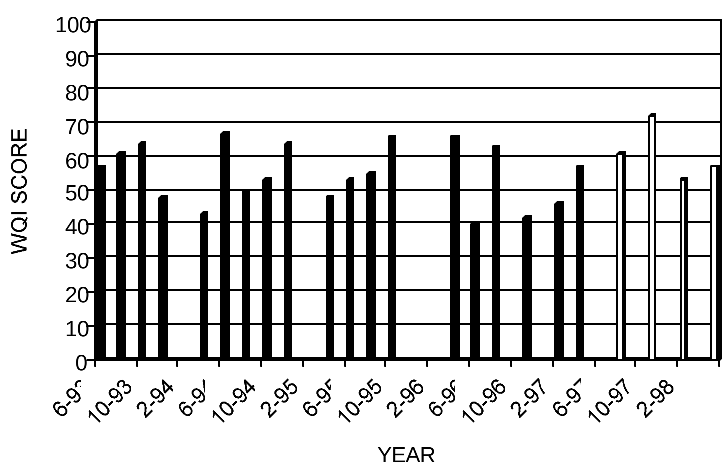
Biological Index

Table 35. Water Quality Summary Scott Creek at Delta, Pa.

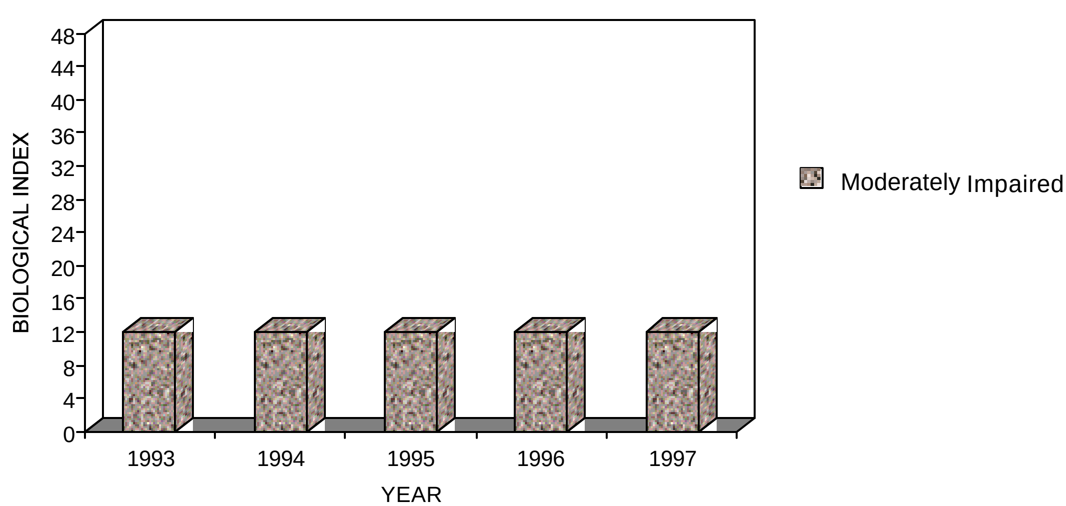
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/97	61	DNH3	TNH3	TP	DP	DPO4	TMg	TCl	TMn
		TPO4							
11/13/97	72	DO	COND	TRES	DRES	DNH3	TNH3	DNO2	TNO2
		DP	DPO4	TCa	TMg	TSO4	DFe	DMn	TPO4
03/11/98	53	DO	DNH3	TNH3	DPO4	DFe			
05/26/98	57	ALK	DNH3	TNH3	DP	DPO4	DFe	TPO4	

Biological and Habitat Summary	
Number of Taxa	7
Diversity Index	1.19
RBP III Score	12
RBP III Condition	Moderately Impaired
Total Habitat Score	43
Habitat Condition Category	Nonsupporting



Water Quality Index



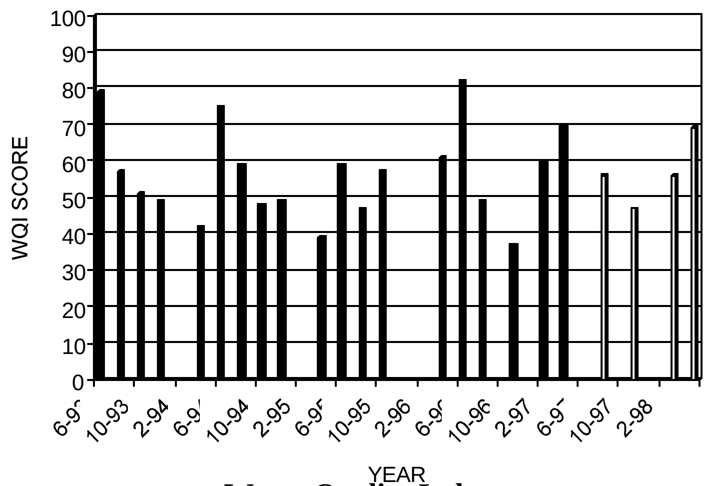
Biological Index

Table 36.   Water Quality Summary Conowingo Creek at Pleasant Grove, Pa.

Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TN	11/14/97	10.51 mg/l	10 mg/l	Pa. water supply

Date	WQI	Parameters Exceeding 90th Percentile							
08/06/97	56	DNO3	TNO3	TN	DN	TMg			
11/14/97	47	DNO3	TNO3	TN	DN				
03/13/98	56	DNO3	TNO3	TN	DN	TMg			
05/27/98	69	DNO2	TNO2	DNO3	TNO3	TN	DN	TMg	TFe

Biological and Habitat Summary	
Number of Taxa	13
Diversity Index	2.60
RBP III Score	34
RBP III Condition	Slightly Impaired
Total Habitat Score	132
Habitat Condition Category	Excellent



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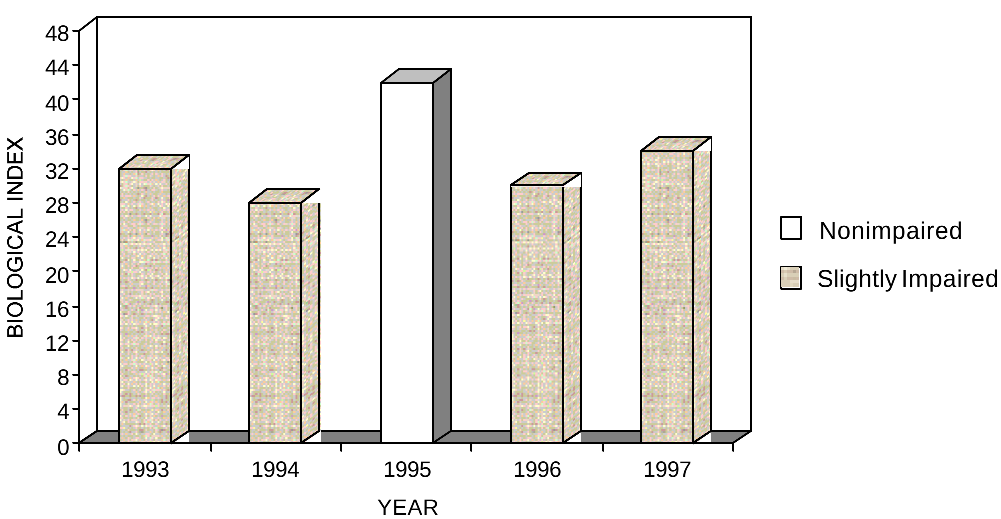


Biological Index

Octoraro Creek

Octoraro Creek at Rising Sun, Md., (OCTO 6.6) had a nonimpaired biological community during the 1997 sampling season. The habitat at this site was excellent. However, water quality was degraded. Although no Pennsylvania or Maryland standards were exceeded, water quality analysis indicated that the water quality of Octoraro Creek was poor. Ammonia, nitrites, phosphorus, and magnesium were elevated (Table 37).

Octoraro Creek had the highest individual score (76) of the Group 1 streams in this region. High WQI scores may have been due to agricultural activities in the watershed or to the impoundment at Octoraro Lake.

Several increasing and decreasing trends were found at OCTO 6.6. Strong, significant increasing trends occurred for both unadjusted total nitrogen and flow-adjusted total nitrogen. While a significant increasing trend occurred for unadjusted concentrations of total chloride, a strongly significant increasing trend occurred for flow-adjusted total chloride. A significant decreasing trend was found for flow-adjusted total phosphorus, and strong, significant decreasing trends occurred in unadjusted total ammonia and total phosphorus (Table 17).

Ebaughs Creek

For the ninth year, Ebaughs Creek at Stewartstown, Pa., (EBAU 1.5) had a slightly to moderately impaired biological community. Although the physical habitat at this site was considered excellent during the 1998 fiscal year, the biological community was designated slightly impaired.

On two separate occasions, alkalinity exceeded Pennsylvania standards for aquatic life. Additionally, Ebaughs Creek appeared to have elevated concentrations of dissolved and total solids, calcium, and chloride (Table 38). The relatively high WQI and low RBP III scores suggested that wastewater discharges may have affected the water quality and the biological community at this site.

Ebaughs Creek had a mixture of upward and downward water quality trends. Strong, significant increasing trends occurred for both unadjusted and flow-adjusted concentrations of total solids and total chloride. Strong, significant decreasing trends were found for both unadjusted and flow-adjusted concentrations of total phosphorus and total iron and for unadjusted ammonia (Table 17).

Deer Creek

For the second consecutive year, Deer Creek at Gorsuch Mills, Md., (DEER 44.2) had a nonimpaired biological community. Previous impairment may have been due to habitat conditions at the sampling site, which was located adjacent to agricultural activities. Deer Creek had the lowest average WQI score (39) and the lowest individual WQI score (37) of Group 1 streams in this region. Water quality at this stream was good (Table 39), although nitrate levels were somewhat elevated, as they were in most streams in this area. Deer Creek harbored a very diverse macro-invertebrate community including pollution-intolerant taxa such as *Atherix*, *Antocha*, *Serratella*, *Epeorus* (Ephemeroptera: Heptageniidae), *Stenonema*, *Isonychia*, *Nigronia*, *Leuctra*, *Acroneuria*, and *Paragnetina*.

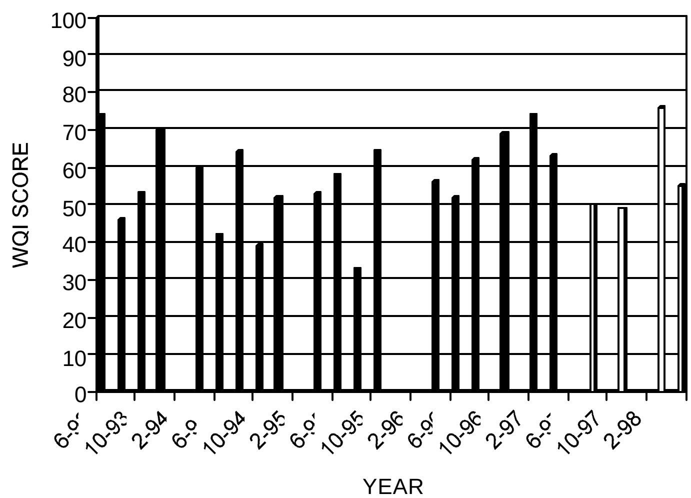
Deer Creek also showed a mixture of increasing and decreasing trends for the period 1986 through 1998. Strong, significant upward trends were found for unadjusted concentrations of total nitrogen and total sulfate, as well as flow-adjusted total chloride. Significant increasing trends occurred for flow-adjusted concentrations of total nitrogen and total sulfate. Strong, significant decreasing trends were found for unadjusted concentrations of ammonia and both unadjusted and flow-adjusted concentrations of total phosphorus and total iron (Table 17).

Table 37. Water Quality Summary Octoraro Creek at Rising Sun, Md.

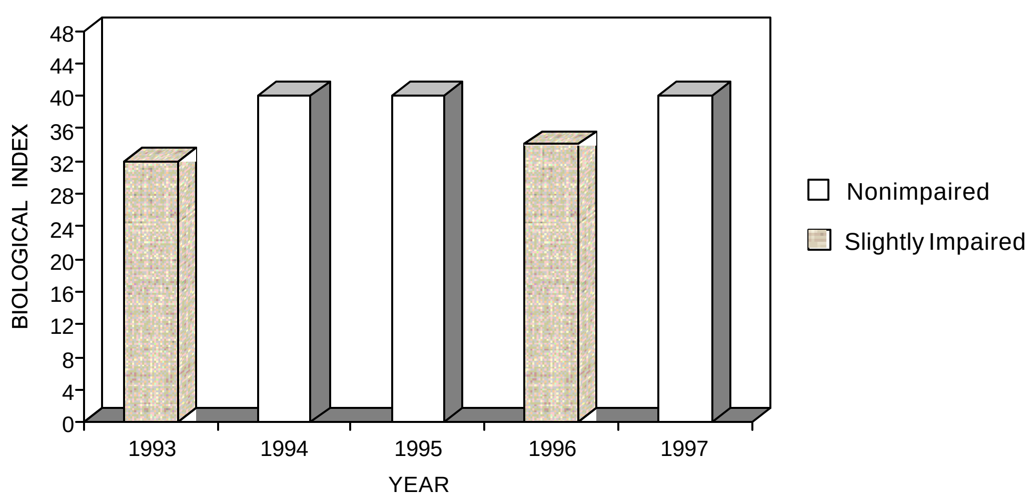
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/07/97	50	TAl	TURB						
11/14/97	49	TFe							
03/13/98	76	DNH3	TNH3	DNO2	TNO2	DN	TP	DP	TOC
		TMg	TPO4						
05/27/98	55	TP	TOC	TMg					

Biological and Habitat Summary	
Number of Taxa	14
Diversity Index	3.36
RBP III Score	40
RBP III Condition	Nonimpaired
Total Habitat Score	132
Habitat Condition Category	Excellent



Water Quality Index



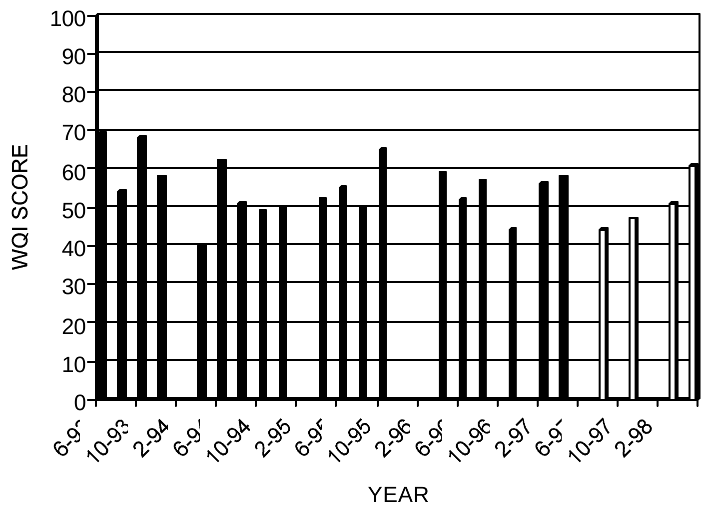
Biological Index

Table 38.   Water Quality Summary Ebaughs Creek at Stewartstown, Pa.

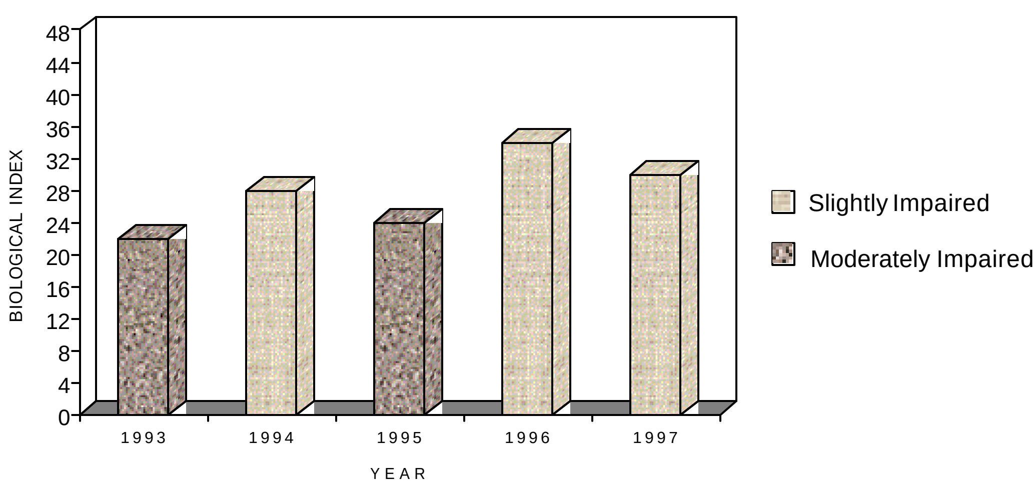
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	11/13/97	18 mg/l	20 mg/l	Pa. aquatic life
ALK	03/11/97	16 mg/l	20 mg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
08/04/97	44	DP	TPO4						
11/13/97	47	ALK	COND	TRES	DRES	TCa	TCl		
03/11/98	51	DO	COND	ALK	TRES	DRES	TCa	TCl	
05/26/98	61	COND	ALK	TRES	DRES	TCa	TCl		

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.71
RBP Score	30
RBP Condition	Slightly Impaired
Total Habitat Score	106
Habitat Condition Category	Excellent



Water Quality Index



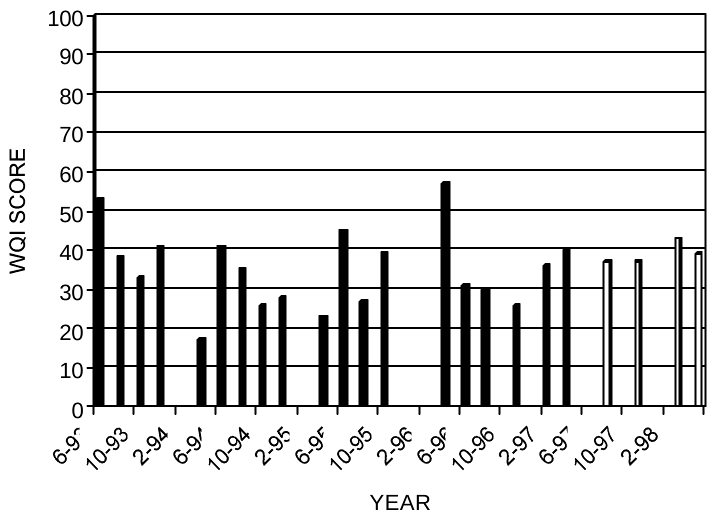
Biological Index

Table 39. Water Quality Summary Deer Creek at Gorsuch Mills, Md.

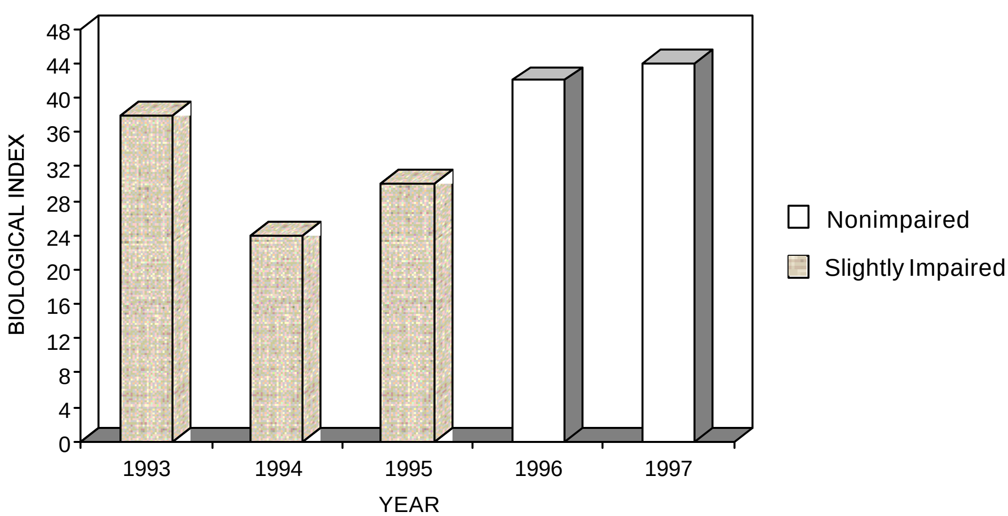
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/04/97	37	TAl							
11/13/97	37								
03/11/98	43								
05/26/98	39								

Biological and Habitat Summary	
Number of Taxa	21
Diversity Index	3.66
RBP Score	44
RBP Condition	Nonimpaired
Total Habitat Score	96
Habitat Condition Category	Excellent



Water Quality Index



Biological Index

Big Branch Deer Creek

Big Branch Deer Creek at Fawn Grove, Pa., (BBDC 4.1) served as the reference site for the Pennsylvania-Maryland border streams during the 1997 sampling season. This site had the best biological community of the Pennsylvania-Maryland streams. A large number of organic pollution-intolerant taxa inhabited the stream, including *Boyeria*, (Odonata: Aeshnidae), *Leuctra*, *Acroneuria*, *Agnetina* (Plecoptera: Perlidae), *Eccoptura* (Plecoptera: Perlidae), *Paragnetina*, *Dolophilodes*, and *Rhyacophila* (Trichoptera: Rhyacophilidae). Alkalinity exceeded Pennsylvania standards during August 1997; however, overall water quality was good in Big Branch Deer Creek (Table 40).

Falling Branch Deer Creek

The biological community of Falling Branch Deer Creek at Fawn Grove, Pa., (FBDC 4.1) was designated slightly impaired. This impairment may have been due to poor habitat at the site, low flow conditions, runoff from cropland adjacent to the site, and the large amount of agricultural activity in the area.

Alkalinity and dissolved iron exceeded Pennsylvania standards for aquatic life during August 1997. Although nitrogen was elevated, overall water quality appeared to be fair (Table 41).

River Sites

Susquehanna River at Windsor, N.Y.

Susquehanna River at Windsor, N.Y., (SUSQ 365.0) served as the reference site for the Susquehanna, Chemung, Cowanesque, and Tioga River sites. This site contained the best macroinvertebrate community of the river sites. Organic pollution-intolerant taxa included *Serratella*, *Leucrocuta* (Ephemeroptera: Heptageniidae), *Stenonema*, *Isonychia*, *Ephoron* (Ephemeroptera: Polymitarcyidae), *Leuctra*, and *Acroneuria*.

Water quality data showed that no state standards were exceeded. However, nitrates, nitrogen, and calcium were elevated at this site (Table 42).

Several strong, significant decreasing trends occurred at SUSQ 365.0. These downward trends included both unadjusted and flow-adjusted concentrations of total ammonia, total phosphorus, and total iron. Strong, significant decreasing trends also occurred for unadjusted total nitrogen and flow-adjusted total aluminum (Table 17).

Susquehanna River at Kirkwood, N.Y.

Slightly impaired conditions existed at Susquehanna River at Kirkwood, N.Y., (SUSQ 340.0) for the fourth time in five years. Impairment may have been due to the lack of suitable riffle habitat at this site. A low taxonomic richness and low EPT index, as compared to the reference site, contributed to the slightly impaired designation for SUSQ 340.0.

Total iron and total dissolved solids exceeded standards during the 1998 fiscal year. However, this site had the lowest average WQI score (44) and the lowest individual WQI score (26) of all sites in this category (Table 43).

Only strongly significant downward trends occurred at SUSQ 340.0. Strong, significant decreasing trends were found in both unadjusted and flow-adjusted concentrations of total ammonia, total nitrogen, total phosphorus, and total iron (Table 17).

Susquehanna River at Sayre, Pa.

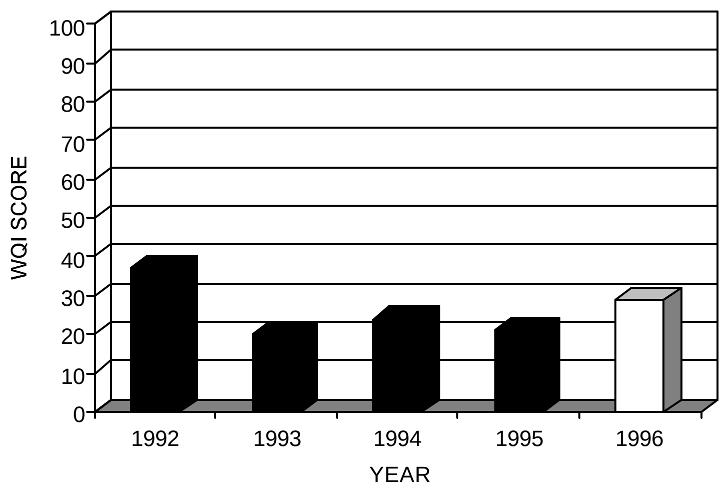
The Susquehanna River at Sayre, Pa., (SUSQ 289.1) had a slightly impaired biological community, after being nonimpaired for the previous two years. A low EPT index contributed to the slightly impaired designation of this site. Habitat conditions were considered excellent.

Table 40. Water Quality Summary Big Branch Deer Creek at Fawn Grove, Pa.

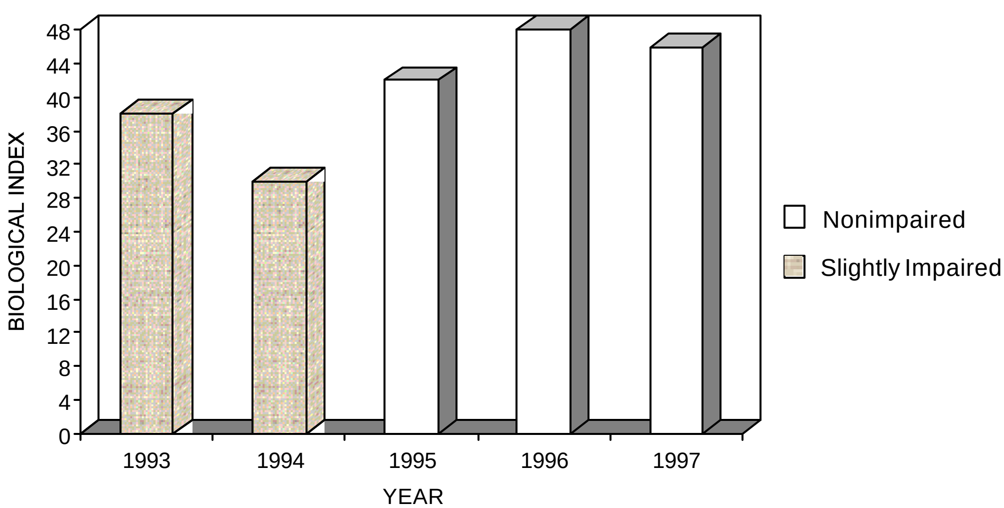
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	08/05/97	18 mg/l	20 mg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/96	35								

Biological and Habitat Summary	
Number of Taxa	17
Diversity Index	3.00
RBP Score	46
RBP Condition	Reference
Total Habitat Score	104
Habitat Condition Category	Reference



Water Quality Index



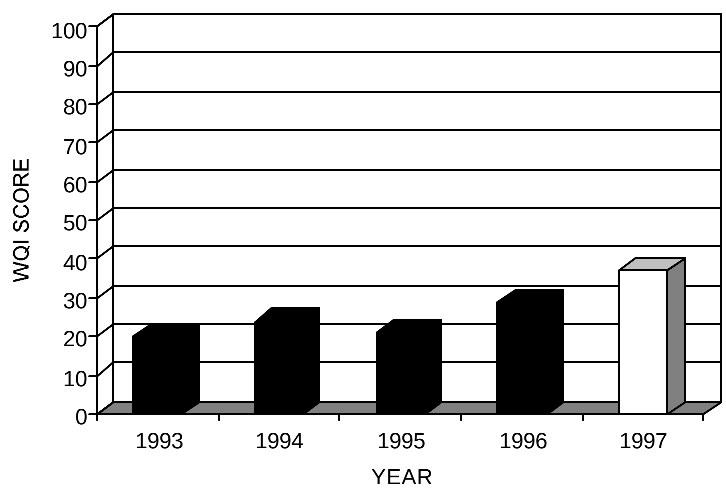
Biological Index

Table 41. Water Quality Summary Falling Branch Deer Creek at Fawn Grove, Pa.

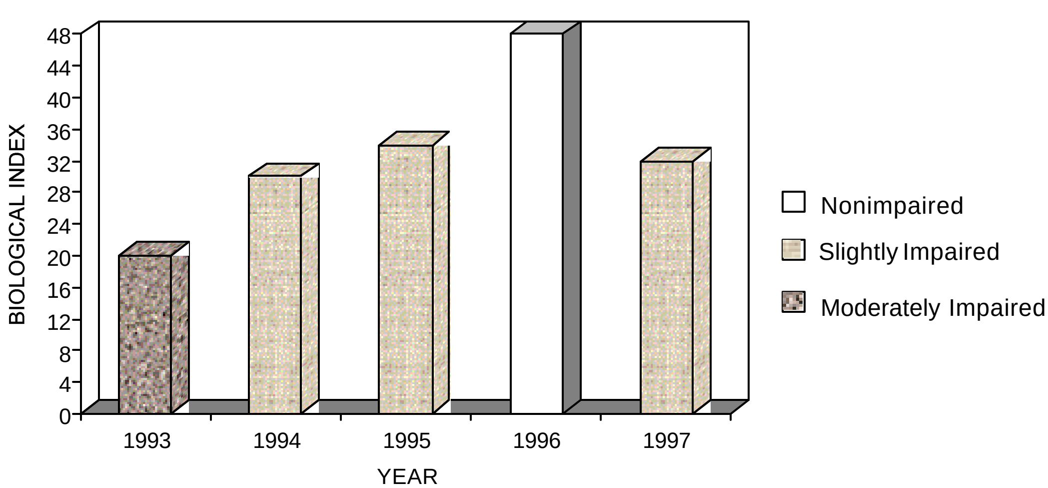
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
ALK	08/05/97	16 mg/l	20 mg/l	Pa. aquatic life
DFe	08/05/97	356 µg/l	300 µg/l	Pa. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
08/05/97	37	ALK	DFe						

Biological and Habitat Summary	
Number of Taxa	13
Diversity Index	2.67
RBP Score	32
RBP Condition	Slightly Impaired
Total Habitat Score	66
Habitat Condition Category	Partially Supporting



Water Quality Index



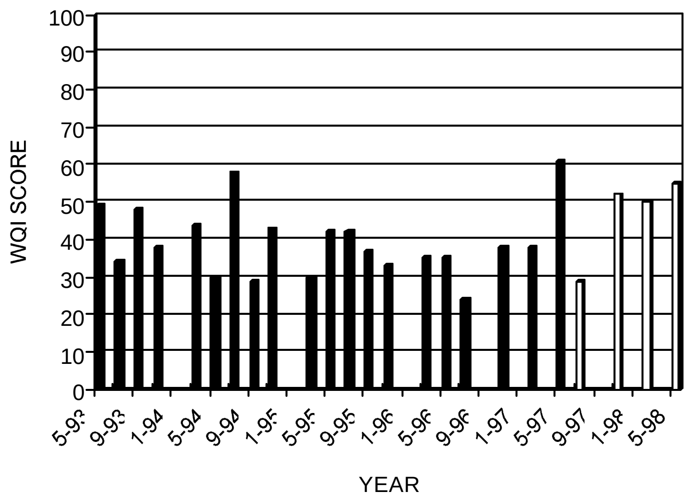
Biological Index

Table 42. Water Quality Summary Susquehanna River at Windsor, N.Y.

Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/21/97	29	DO							
11/10/97	52	TCa	TSO4						
02/16/98	50	DNO3	TNO3	TN	DN	TCa			
05/19/98	55	DO	TNO2	DNO3	TNO3	TN	DN		

Biological and Habitat Summary	
Number of Taxa	22
Diversity Index	3.73
RBP Score	46
RBP Condition	Reference
Total Habitat Score	119
Habitat Condition Category	Reference



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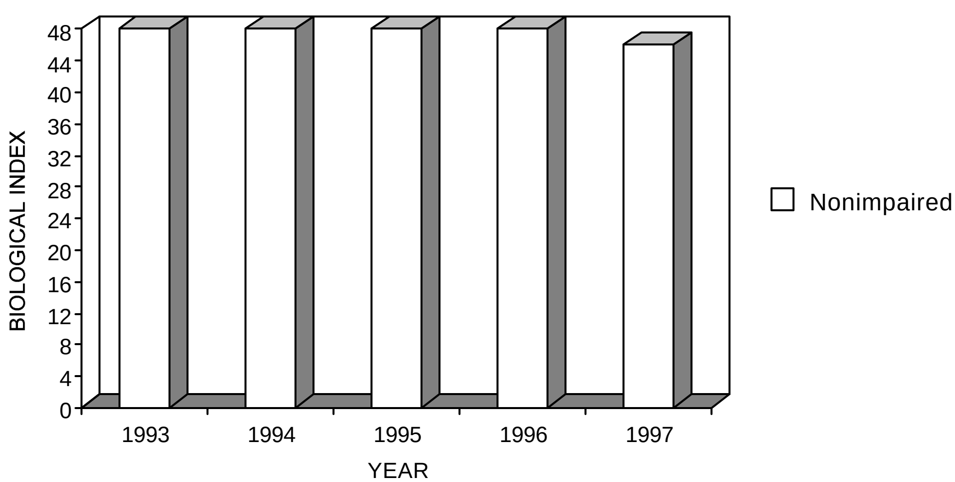


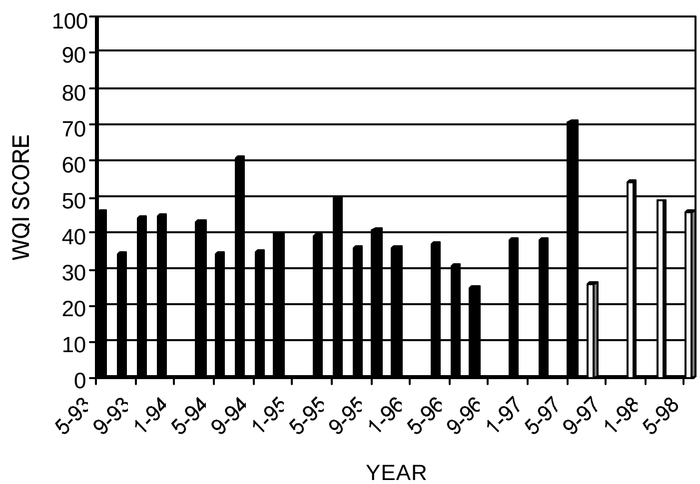
Biological Index

Table 43.   Water Quality Summary Susquehanna River at Kirkwood, N.Y.

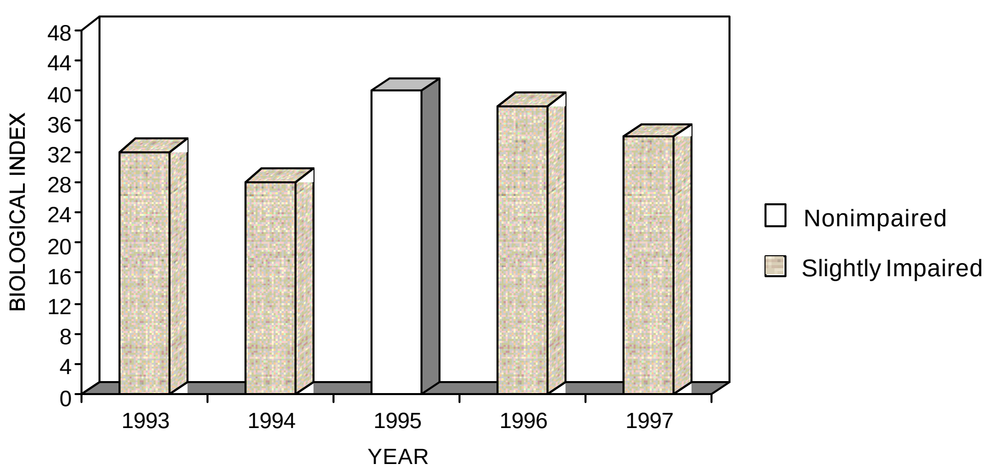
Parameters Exceeding Standards				
Parameter	Date	Value	Standard	State
TFe	02/16/98	940 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TDS	11/10/97	3,184 mg/l	500 mg/l	N.Y. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/21/97	26								
11/10/97	54	TRES	DRES						
02/16/98	49								
05/19/98	46	DO							

Biological and Habitat Summary	
Number of Taxa	13
Diversity Index	2.89
RBP Score	34
RBP Condition	Slightly Impaired
Total Habitat Score	97
Habitat Condition Category	Supporting



Water Quality Index



Biological Index

Although no state water quality standards were exceeded, additional water quality analysis indicated that water quality was fair at this site. Ammonia, nitrites, nitrates, and total nitrogen were elevated at this site (Table 44).

As at all Susquehanna River mainstem sites, only decreasing trends were found at SUSQ 289.1. Strong, significant decreasing trends were found in unadjusted and flow-adjusted concentrations of total phosphorus and total iron. Strong, significant downward trends also were found for unadjusted concentrations of total ammonia and flow-adjusted concentrations of total aluminum. Significant downward trends occurred for unadjusted total aluminum and flow-adjusted total ammonia and total chloride (Table 17).

Cowanesque River

Severely impaired biological conditions existed on the Cowanesque River at Lawrenceville, Pa., (COWN 2.2). Moderately to severely impaired conditions have existed at this site for the past six years of sampling. In the past, increased phytoplankton production in the Cowanesque Reservoir may have caused a shift in the macroinvertebrate community, resulting in a biological population dominated by filter-feeding organisms. Additionally, the bottom discharge dam depressed dissolved oxygen levels in the Cowanesque River downstream of the outflow. Impaired conditions also may be affected by very poor habitat conditions at this site. The Cowanesque River also had very poor water quality at this site, which may affect the biological community. The site was heavily dominated (97 %) by pollution-tolerant Chironomidae. This site had the fewest number of taxa (3), the lowest diversity index (0.25), the highest Hilsenhoff Biotic Index (7.02), the lowest EPT index (1), and the lowest overall RBP III score (2) of the sites in this region. SRBC's 1997 Chemung Subbasin survey also found severely impaired biological conditions near this site (Traver, 1998).

The Cowanesque River had the highest average WQI score (63), and the highest individual WQI score (74), of the river sites. Total iron concentrations exceeded New York standards four times and Pennsylvania standards once during the sampling period. The New York standard for total manganese also was exceeded during July 1997. Water quality analysis indicated elevated concentrations of nitrites, aluminum, manganese, iron, and total phosphates (Table 45).

A mixture of upward and downward trends occurred in the Cowanesque River during 1986 through 1998. Significant increasing trends were found for unadjusted concentrations of total solids and total aluminum. Strong, significant decreasing trends were found for both unadjusted and flow-adjusted concentrations of total sulfate, unadjusted concentrations of total nitrogen, and flow-adjusted concentrations of total chloride (Table 17).

Tioga River

The Tioga River at Lindley, N.Y., (TIOG 10.8) had a slightly impaired biological community. A low EPT index reduced the biological score at this site. Habitat, however, was excellent. Traver (1998) also found a slightly impaired biological community and excellent habitat conditions at this site. Total iron exceeded New York water quality standards four times during the survey. Total manganese exceeded New York standards twice during the sampling period. Additional water quality analysis indicated that several parameters were elevated, including nitrogen, ammonia, sulfate, iron, and manganese (Table 46).

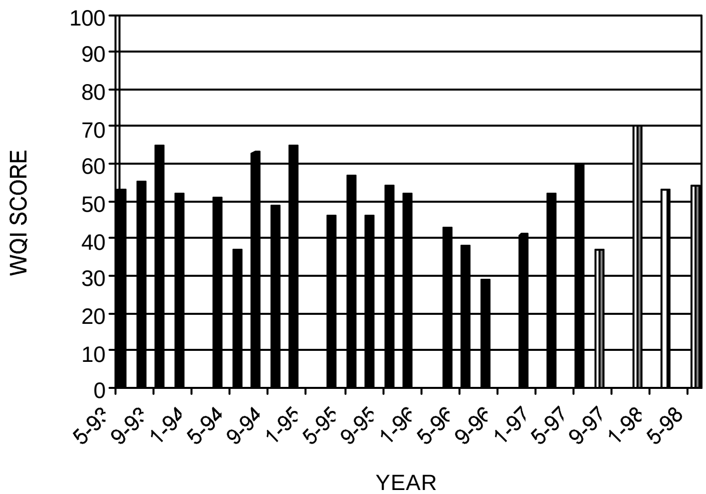
Poor water quality at this site may have been due to acid mine drainage in the headwaters of the Tioga River. The Tioga-Hammond Reservoir, located upstream of TIOG 10.8, alleviated some of the effects of acid mine drainage by buffering the outflow of Tioga Lake with alkaline waters stored in Hammond Lake. However, the effects of the acid mine drainage were still observed downstream.

Table 44. Water Quality Summary Susquehanna River at Sayre, Pa.

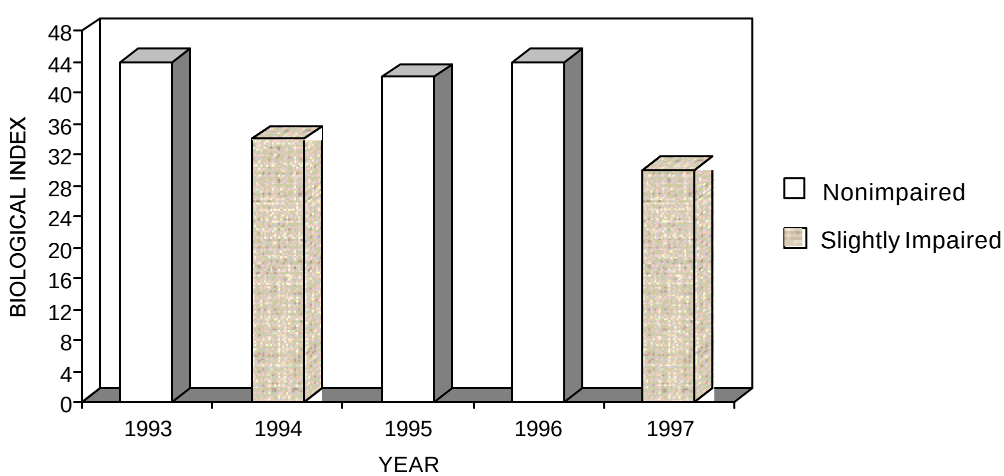
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
07/23/97	37	DNH3	DNO3	TNO3	TN	DN			
11/10/97	70	DO	DNO2	TNO2	DNO3	TNO3	TN	DN	COND
		TP	DP	TCa	TMg	TCl			
02/16/98	53	DNH3	DNO3	TNO3	TN	DN			
05/19/98	54	TNH3							

Biological and Habitat Summary	
Number of Taxa	14
Diversity Index	3.25
RBP Score	30
RBP Condition	Slightly Impaired
Total Habitat Score	111
Habitat Condition Category	Excellent



Water Quality Index



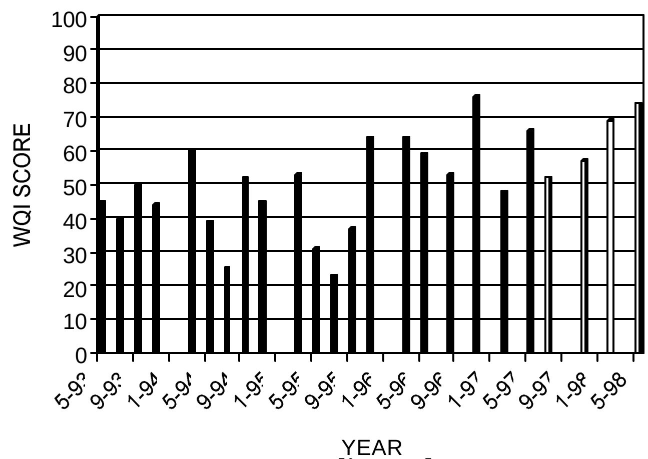
Biological Index

Table 45. Water Quality Summary Cowanesque River at Lawrenceville, Pa.

Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/29/97	1,440 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	11/11/97	1,210 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	02/17/98	1,480 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	05/20/98	1,520 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	05/20/98	1,520 µg/l	1,500 µg/l	Pa. aquatic life
TMn	07/29/97	523 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	**WQI**	**Parameters Exceeding 90th Percentile**							
07/29/97	52	TNO2	TN	DN	TFe	TMn	DMn	TURB	
11/11/97	57	DO	TOC	TMg	TFe	TAl	TPO4	TURB	
02/17/98	69	DO	DNH3	TN	DN	TFe	TAl	TPO4	
05/20/98	74	TNH3	TNO2	TP	DPO4	TOC	TFe	TAl	TPO4
		TURB							

Biological and Habitat Summary	
Number of Taxa	3
Diversity Index	0.25
RBP Score	2
RBP Condition	Severely Impaired
Total Habitat Score	66
Habitat Condition Category	Nonsupporting



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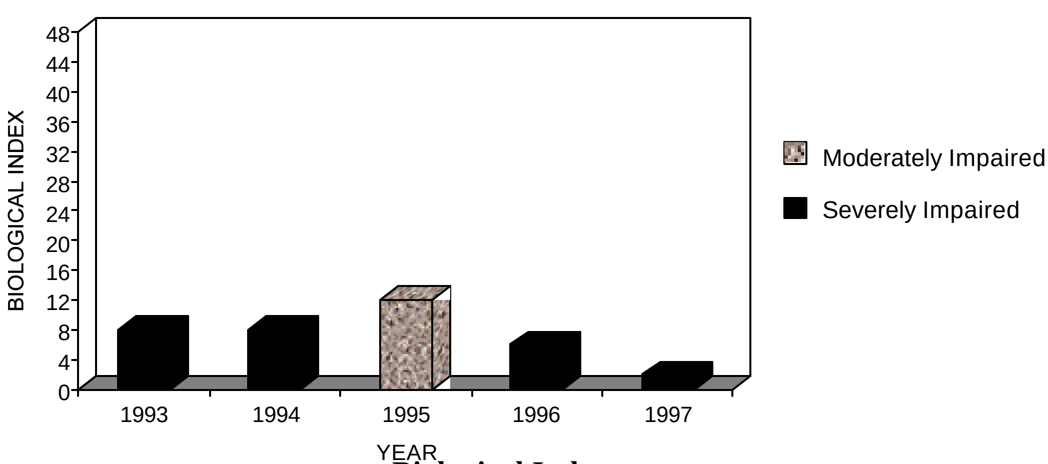


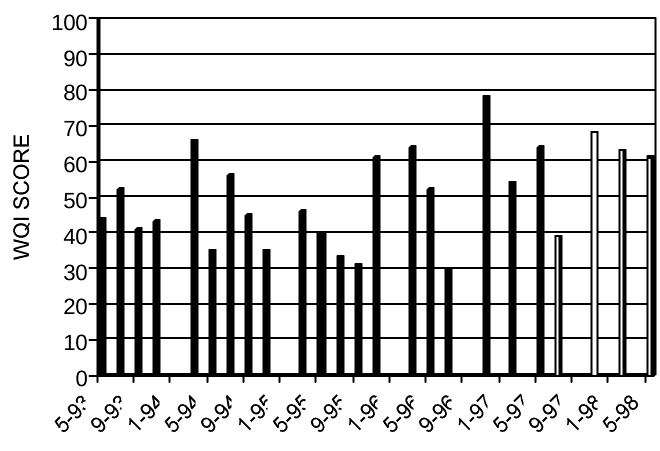
Biological Index

Table 46. Water Quality Summary Tioga River at Lindley, N.Y.

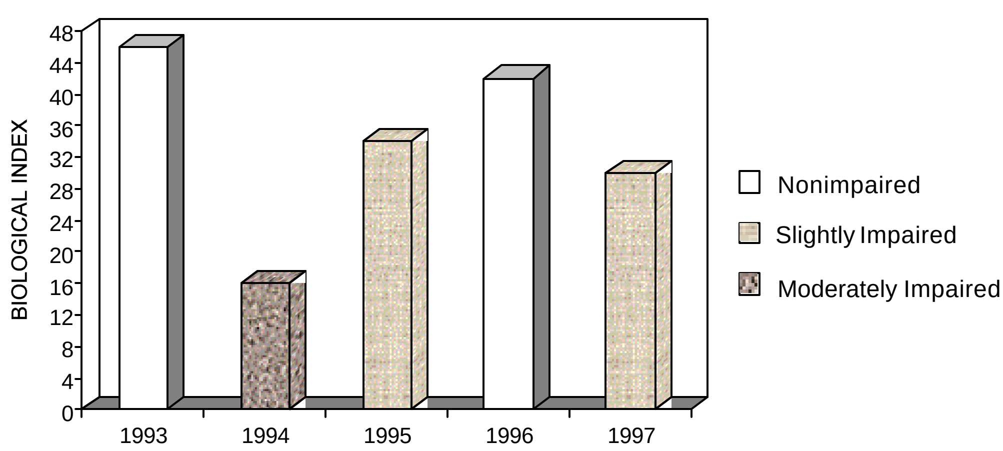
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	07/29/97	351 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	11/11/97	998 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	02/17/98	784 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TFe	05/20/98	730 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TMn	07/29/97	407 µg/l	300 µg/l	N.Y. health (water source) and aquatic life
TMn	02/17/98	345 µg/l	300 µg/l	N.Y. health (water source) and aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/29/97	39	DO	TN	DN					
11/11/97	68	ALK	DNH3	TNH3	TMg	TSO4	TMn	DMn	
02/17/98	63	DO	TSO4	TMn	DMn				
05/20/98	61	DO	ALK	DFe	TMn	DMn			

Biological and Habitat Summary	
Number of Taxa	16
Diversity Index	3.07
RBP III Score	30
RBP III Condition	Slightly Impaired
Total Habitat Score	126
Habitat Condition Category	Excellent



Water Quality Index



Biological Index

A strong, significant increasing trend occurred at TIOG 10.8 for flow-adjusted concentrations of total aluminum, while a significant upward trend was found for unadjusted concentrations. Significant decreasing trends occurred for unadjusted concentrations of total ammonia and total chloride. Strong, significant decreasing trends were found for both unadjusted and flow-adjusted concentrations of total sulfate and flow-adjusted concentrations of total chloride (Table 17).

Chemung River

A moderately impaired biological community existed in the Chemung River at Chemung, N.Y., (CHEM 12.0). No macroinvertebrate data had been collected the previous sampling season. A low EPT index and a large number of hydropsychid caddisflies contributed to the poor biological conditions at the site. The physical habitat at the site was somewhat degraded, and very little riffle habitat was found at CHEM 12.0.

Total iron exceeded New York standards twice during the sampling period, and pH exceeded standards once. Additional water quality analysis indicated that solids, magnesium, nitrates, and chloride were elevated at this site (Table 47).

Total chloride showed a strong, significant increasing trend. All other parameters decreased over the period involved. A significant decreasing trend for flow-adjusted concentrations of total ammonia was found, while strong, significant decreasing trends occurred for both unadjusted and flow-adjusted concentrations of total phosphorus, total sulfate, and total iron and for unadjusted concentrations of total ammonia (Table 17).

Susquehanna River at Marietta, Pa.

The Susquehanna River at Marietta, Pa., (SUSQ 44.5) had a slightly impaired biological community for the second consecutive year. There were various reasons for a slightly impaired designation, including lack of suitable riffle habitat and distance from the reference site. Although the habitat at this site was considered excellent, the substrate at SUSQ 44.5 is largely bedrock, and little riffle habitat exists.

No state standards were exceeded during this period. However, water quality analysis indicated that manganese, aluminum, sulfate, and iron levels were elevated at this station (Table 48).

Only strong, significant decreasing trends were found at this site. Strong, significant downward trends occurred for both unadjusted and flow-adjusted concentrations in total ammonia, total phosphorus, and total iron. A strong, significant downward trend also was found for flow-adjusted concentrations of total sulfate (Table 17).

Susquehanna River at Conowingo, Md.

No macroinvertebrate sampling was performed in the Susquehanna River at Conowingo, Md., (SUSQ 10.0) due to deep waters and a lack of riffle habitat. None of the state water quality standards were exceeded at SUSQ 10.0; however, analysis indicated that solids, manganese, ammonia, and nitrates were elevated. Dissolved oxygen also was depressed in this area during much of the year (Table 49). The Conowingo Dam impoundment, located directly upstream from the sampling site, may have affected the water quality at this site.

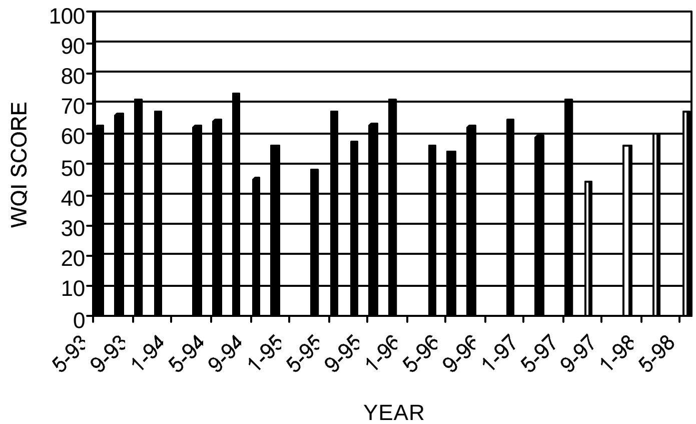
As at all Susquehanna River main stem sites, only downward trends were observed at SUSQ 10.0. Significant downward trends were found for flow-adjusted concentrations of total nitrogen, total phosphorus, and total iron. Strong, significant decreasing trends occurred in unadjusted concentrations of total ammonia, total phosphorus, and total iron (Table 17).

Table 47. Water Quality Summary Chemung River at Chemung, N.Y.

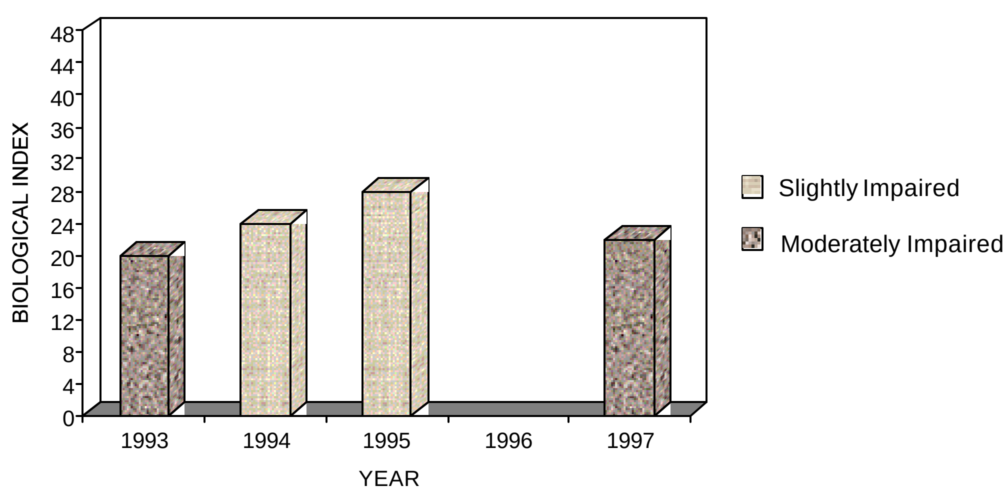
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
TFe	11/11/97	349 μg/l	300 μg/l	N.Y. health (water source) and aquatic life
TFe	05/20/98	543 μg/l	300 μg/l	N.Y. health (water source) and aquatic life
pH	07/23/97	8.65	6.5 - 8.5	N.Y. aquatic life

Date	WQI	Parameters Exceeding 90th Percentile							
07/23/97	44	COND	TRES	DRES	TMg	TCl			
11/11/97	56	DO	TP	TMg					
02/17/98	60	COND	TRES	DRES	DNO3	TNO3	DN	TCl	TSO4
05/20/98	67	DO	COND	TRES	DRES	TN	TCa	TMg	TCl

Biological and Habitat Summary	
Number of Taxa	12
Diversity Index	2.75
RBP Score	22
RBP Condition	Moderately Impaired
Total Habitat Score	87
Habitat Condition Category	Partially Supporting



Water Quality Index



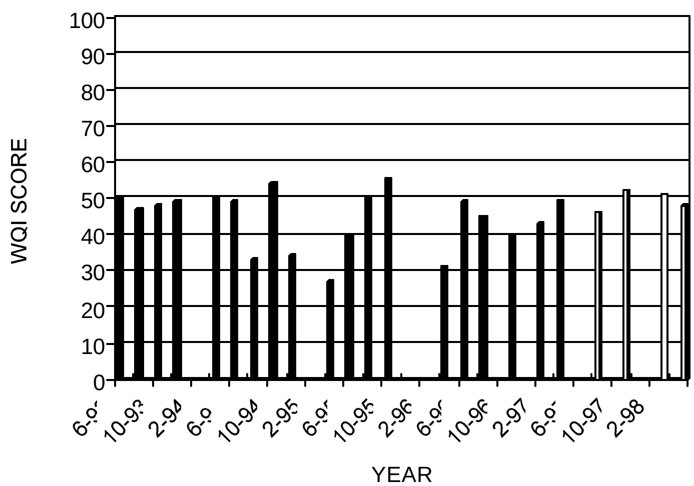
Biological Index

Table 48.   Water Quality Summary Susquehanna River at Marietta, Pa.

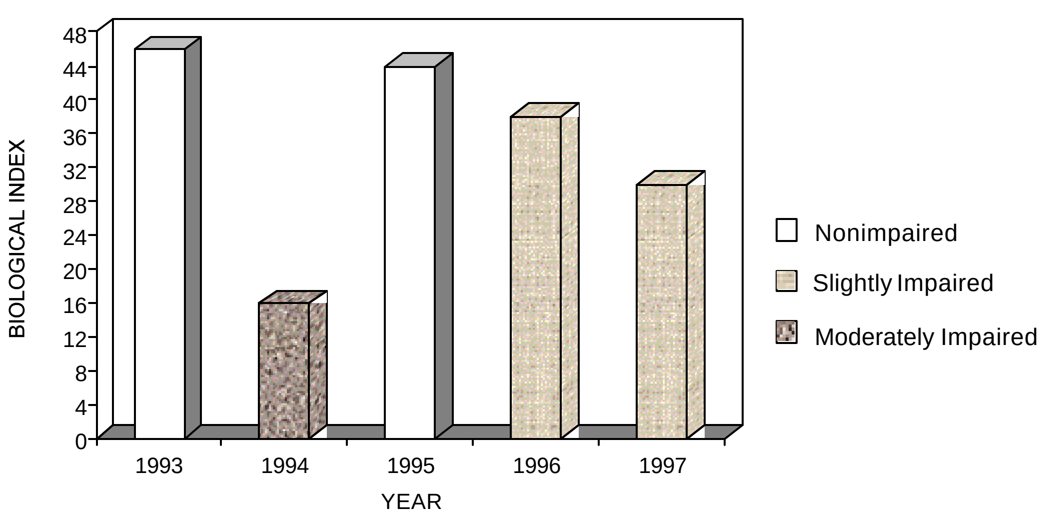
Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90th Percentile							
08/07/97	46	COND	TRES	TOC	TCa	TSO4			
11/10/97	52	TP	TOC	TMn	TAl				
03/07/98	51	DNO2	TSO4	TMn	DMn				
05/28/98	48	TSO4	TFe						

Biological and Habitat Summary	
Number of Taxa	15
Diversity Index	2.84
RBP Score	30
RBP Condition	Slightly Impaired
Total Habitat Score	109
Habitat Condition Category	Excellent



Water Quality Index

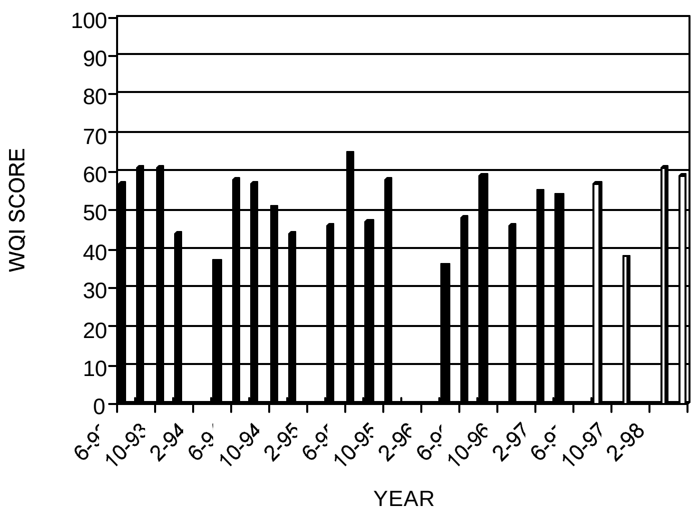


Biological Index

Table 49. Water Quality Summary Susquehanna River at Conowingo, Md.

Parameters Exceeding Standards				
Parameter	**Date**	**Value**	**Standard**	**State**
None				

Date	WQI	Parameters Exceeding 90[th] Percentile							
08/06/97	57	DO	COND	TRES	DRES	DNO2	TNO2	TCa	TMn
11/13/97	38	TSO4	TURB						
03/11/98	61	DO	TFe	TMn	DMn	TAl	TPO4	TURB	
05/27/98	59	DO	DNH3	TNH3	TMn	DMn	TURB		



Water Quality Index

MANAGEMENT IMPLICATIONS

To establish water quality trends and understand biological conditions, long-term studies of this nature are critical. Unfortunately, short-term monitoring studies are too often the rule, due to time and monetary constraints. However, to effectively manage the resources, officials and local interest groups must have a true picture of ecological dynamics and possible problem areas, which can only be obtained through long-term studies such as this one.

Several management implications can be extracted from the chemical water quality, macroinvertebrate community, and physical habitat data collected from sampling areas. A Pearson Product Moment Correlation was performed for each reference category for average WQI score, RBP III score, and physical habitat score. Statistically significant relationships ($p<0.05$) observed among the chemical characteristics, the biological communities, and physical habitats of the interstate streams are described below. These observations, although based on a small sample size, are presented as possible subject areas for future research and as issues to be considered by aquatic resource managers, legislators, and local interest gorups.

New York-Pennsylvania Sites

The sites in this reference category show a large degree of variability in water quality. Overall, there was no significant correlation between RBP III score and water chemistry (WQI score) for the 12 New York-Pennsylvania border sites. However, there was a significant positive ($p<0.05$) correlation between habitat score and biological score, indicating that as habitat quality increased, so did the quality of the macroinvertebrate community. Impairment of many New York-Pennsylvania border sites may have been due to poor physical habitat, especially unstable stream substrate, the removal of instream habitat by rechannelization, and the removal of gravel for building and paving materials. Disturbance of instream habitat often reduces the abundance of macroinvertebrates and the species diversity of the area, resulting in an impairment designation.

Pennsylvania-Maryland Sites

There was no significant correlation between water chemistry and biological score for the nine Pennsylvania-Maryland border sites. However, a significant positive correlation existed between the RBP III score and the physical habitat score. This indicates that an improvement in habitat produces an improvement in the biological community.

The area around the Pennsylvania-Maryland border is largely agricultural. Heavy agricultural activities without proper best management practices result in streambank erosion and sedimentation, contributing to poor instream habitat quality. Additionally, nutrient enrichment encourages excessive plant growth, which can depress dissolved oxygen levels during decomposition.

River Sites

For the seven river sites, there was a significant negative correlation between average WQI and RBP III scores, indicating that as WQI increased, the quality of the macroinvertebrate community decreased. There was no significant correlation between the physical habitat and total biological scores for the river sites. Thus, it appears that water quality may be a limiting factor for the biological communities of the river sites.

CONCLUSIONS

Six (21.4 %) of the 28 interstate macroinvertebrate sampling sites contained nonimpaired biological communities. Biological conditions at another 13 sites (46.4 %) were slightly impaired, while eight sites (28.6 %) were moderately impaired. Only one site (3.6 %), Cowanesque River, was designated severely impaired. One site (SUSQ 10.0) was not sampled using RBP III techniques and, thus, was not averaged into the final scores. Eleven sites

(39.3 %) had excellent habitats. Nine of the sites (32.1 %) had supporting habitats, and six sites (21.4 %) had partially supporting habitats. Only two sites (7.1 %) had nonsupporting habitats: Scott Creek and Cowanesque River.

Overall, interstate streams seemed to be achieving their designated uses, and only 34 observations (1 %) of water chemistry parameters exceeded state standards. The standard for total iron was the one most commonly exceeded. These findings corresponded with those in past reporting periods and indicated that elevated iron concentrations may have been a natural condition of the streams in the basin.

Of the New York-Pennsylvania border streams, the biological communities of two (16.7 %) of these streams were nonimpaired. Four sites (33.3 %) in the New York-Pennsylvania reference category were slightly impaired, and six streams (50 %) were moderately impaired. Two sites had excellent habitat (16.7 %), and seven sites (58.3 %) had supporting habitat. The remaining three sites (25 %) had partially supporting habitat. High metal concentrations appeared to be the largest source of water quality degradation in this region. WQI score and biological score were not correlated; however, physical habitat score and biological score were correlated. Rechannelization of the streambed and removal of instream habitat may have resulted in poor conditions for macroinvertebrate colonization.

Nonimpaired biological conditions existed at three (33.3 %) of the nine Pennsylvania-Maryland interstate streams. Of the remaining six sites, five sites (55.5 %) were slightly impaired, while one site (11.1 %) was designated moderately impaired. Five (55.5 %) of the Pennsylvania-Maryland border sites had excellent habitat. One site (11.1 %) had supporting habitat, two sites (22.2 %) had partially supporting habitat, and one site (11.1 %) had nonsupporting habitat. Elevated nutrient levels, possibly due to agricultural runoff, appeared to affect the water quality of the streams in this region. Physical habitat and RBP III scores were significantly correlated for the Pennsylvania-Maryland border sites. Streambank erosion and sedimentation were a problem in the instream habitat for this region.

River sites consisted of seven sites located on the Susquehanna, Chemung, Cowanesque, and Tioga Rivers. One station (SUSQ 10.0) was not sampled for macroinvertebrates due to a lack of riffle habitat at the site. The biological community of one site (14.3 %) was nonimpaired, four sites (57.1 %) were slightly impaired, and one site each (14.3 % each) was designed moderately and severely impaired. Four (57.1 %) of the sites had excellent habitat. Of the remaining sites, one each (14.3 % each) had supporting, partially supporting, and nonsupporting habitat. Water Quality Index and RBP III scores were significantly correlated for the river sites, indicating that, as WQI increased, the quality of the macroinvertebrate community decreased.

The Seasonal Kendall nonparametric test for trend was applied to observed concentration and flow-adjusted concentration. Trends were detected ($p<0.10$) for several parameters at individual stations. For each parameter, an overall weighted value was calculated to indicate the strength of the trend in the Susquehanna River Basin over the period 1986 through 1998. Table 50 provides a summary of detected trends and overall direction.

Significant overall weighted trends were found in total phosphorus and total iron. Decreasing trends in total iron were found at many of the river stations. Most trends detected were decreasing, indicating an improvement in water quality. However, increasing trends were detected, including total nitrogen at the Pennsylvania-Maryland stations.

The current and historical data contained in this report provide a database that enables SRBC staff and others to better manage water quality, water quantity, and biological resources of interstate streams in the Susquehanna River Basin. The data can be used by SRBC's member states and local interest groups to gain a better understanding of water quality in upstream and downstream areas outside of their jurisdiction. Information in this report also can serve as a starting point for more detailed assessments and remediation efforts that may be planned on these streams.

Table 50. Summary of Overall Direction of Trends

Parameter	Detected Trends				Overall Direction of Concentration Trend	Overall Direction of Flow-Adjusted Concentration Trend
	Concentration		Flow-Adjusted Concentration			
	+	-	+	-		
Total Suspended Solids	2	1	2	1	None	None
Total Ammonia	0	11	0	5	Decreasing	None
Total Nitrogen	4	5	4	2	None	None
Total Phosphorus	0	11	0	11	Decreasing	Decreasing
Total Chloride	3	1	4	3	None	None
Total Sulfate	1	5	1	6	None	None
Total Iron	0	11	0	9	Decreasing	Decreasing
Total Aluminum	2	2	1	2	None	None

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Appendix A

Water Quality Data for Interstate Streams Crossing the New York-Pennsylvania and Pennsylvania-Maryland Borders

Table A1. *Water Quality Data for New York-Pennsylvania Border Streams*

Parameter	Units	APAL 6.9	BNTY 0.9	CASC 1.6	CAYT 1.7	CAYT 1.7	CAYT 1.7	CAYT 1.7
Date	yyyymmdd	19970722	19970728	19970721	19970723	19971111	19980217	19980519
Time	hhmm	1415	1340	1240	1355	800	930	1610
Discharge	cfs	0.61	2.36	NA	24.52	NA	154.69	51.3
Temp	degree C	22.6	22	16.2	20.8	5.9	2.6	17.9
Conductance	µmhos/cm	97	232	98	362	199	204	235
Dissolved Oxygen	mg/l	7.13	8.68	6.44	9.44	8		9.41
pH		7.15	8.35	6.5	8.5	7.65	7.35	7.5
Alkalinity	mg/l	28	90	30	112	58	58	80
Acidity	mg/l	4	0	12	0	6	4	6
Solids, Total	mg/l	104	170	76	270	142	136	4
Solids, Dissolved	mg/l	76	94	64	270	118	114	4
Ammonia, Total	mg/l	0.07	0.15	0.05	<0.02	0.1	<0.02	0.07
Ammonia, Dissolved	mg/l	<0.02	0.04	0.05	<0.02	0.1	<0.02	<0.02
Nitrite, Total	mg/l	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01
Nitrate, Total	mg/l	0.19	0.13	0.1	0.89	0.4	0.51	0.33
Nitrate, Dissolved	mg/l	0.15	0.13	0.08	0.89	0.4	0.51	0.33
Nitrogen, Total	mg/l	0.55	2	0.37	1.36	0.8	0.91	0.79
Nitrogen, Dissolved	mg/l	0.4	1.81	0.37	1.28	0.8	0.89	0.71
Phosphorus, Total	mg/l	0.03	0.15			0.03	0.034	0.03
Phosphorus, Dissolved	mg/l	0.011	0.003	0.012	0.15	0.019	0.032	0.021
Orthophosphate, Total	mg/l	0.009	0.156	0.015	0.188	0.017	0.034	0.012
Orthophosphate, Dissolved	mg/l	0.006	0.002	0.01	0.177	0.013	0.034	0.012
Organic Carbon, Total	mg/l	2	2.2	2	2.5	3.3	2.1	2.8
Calcium	mg/l	8.58	29.3	9.49	35.4	21.5	21	29.7
Magnesium	mg/l	2.59	5.79	2.73	7.99	4.35	4.43	5.83
Chloride	mg/l	6	13	7	34	16	19	19
Sulfate	mg/l	<10	13	<10	47	20	20	<10
Turbidity	ntu	8.4	<1	2.2	1.6	3.8	1.9	2
Iron, Total	µg/l	900	25	591	107	244	128	196
Iron, Dissolved	µg/l	167	13	139	13	102	68	51
Manganese, Total	µg/l	181	<10	340	13	38	11	10
Manganese, Dissolved	µg/l	96	<10	135	<10	<10	<10	<10
Aluminum, Total	µg/l	430	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams—Continued

Parameter	Units	CHEM 12.0	CHEM 12.0	CHEM 12.0	CHEM 12.0	CHOC 9.1	COWN 2.2	COWN 2.2
Date	yyyymmdd	19970723	19971111	19980217	19980520	19970722	19970729	19971111
Time	hhmm	1615	845	1030	835	1220	850	1130
Discharge	cfs	443	3,240	2,110	3,150	3.54	26	498
Temp	degree C	24.6	6.8	2.2	19	20.9	14.5	8.8
Conductance	µmhos/cm	396	228	262	275	108	159	208
Dissolved Oxygen	mg/l	8.66	7.65	9.17	8.3	7.85	8.44	7.7
pH		8.65	7.6	7.6	7.6	7.2	7.55	7.7
Alkalinity	mg/l	120	60	76	74	24	52	64
Acidity	mg/l	0	8	6	4	4	4	6
Solids, Total	mg/l	286	208	180	174	86	160	196
Solids, Dissolved	mg/l	282	176	170	174	78	118	166
Ammonia, Total	mg/l	0.02	0.05	0.03	0.05	0.03	0.05	0.07
Ammonia, Dissolved	mg/l	<0.02	0.05	0.03	<0.02	<0.02	0.03	0.07
Nitrite, Total	mg/l	0.01	0.01	0.01	0.01	<0.01	0.05	0.02
Nitrite, Dissolved	mg/l	0.01	0.01	0.01	0.01	<0.01	0.01	<0.01
Nitrate, Total	mg/l	0.35	0.38	0.79	0.57	0.25	0.44	0.19
Nitrate, Dissolved	mg/l	0.35	0.38	0.79	0.55	0.22	0.44	0.19
Nitrogen, Total	mg/l	1.12	0.95	1.25	1.05	0.51	2.24	0.69
Nitrogen, Dissolved	mg/l	0.71	0.83	1.25	0.89	0.47	2.23	0.65
Phosphorus, Total	mg/l		0.04	0.024	0.03		0.03	0.03
Phosphorus, Dissolved	mg/l	0.027	0.016	0.024	0.018	0.011	0.006	0.011
Orthophosphate, Total	mg/l	0.023	0.018	0.033	0.026	0.006	0.007	0.025
Orthophosphate, Dissolved	mg/l	0.015	0.01	0.023	0.013	0.006	0.002	0.006
Organic Carbon, Total	mg/l	3.4	3.7	2.4	3.4	1.9	3.3	4.2
Calcium	mg/l	41.7	25	24.4	30.6	8.26	17.8	22.7
Magnesium	mg/l	10.1	5.19	5.89	6.25	2.66	3.87	4.67
Chloride	mg/l	42	18	26	30	10	8	16
Sulfate	mg/l	33	27	23	<10	<10	18	21
Turbidity	ntu	5.3	16.8	<4.5	5.4	2.1	34	29
Iron, Total	µg/l	145	349	207	543	302	1,440	1,210
Iron, Dissolved	µg/l	25	44	46	41	123	20	53
Manganese, Total	µg/l	97	93	71	53	59	523	74
Manganese, Dissolved	µg/l	<10	14	61	15	43	185	23
Aluminum, Total	µg/l	<200	276	234	336	<200	1590	1380
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. ***Water Quality Data for New York-Pennsylvania Border Streams—Continued***

Parameter	Units	COWN 2.2	COWN 2.2	LSNK 7.6	SEEL 10.3	SNAK 2.3	SOUT 7.8	SUSQ 365.0
Date	yyyymmdd	19980217	19980520	19970722	19970730	19970722	19970728	19970721
Time	hhmm	1400	1350	1025	1155	845	1605	1055
Discharge	cfs	437	213	1.17	3.28	5.16	3.97	244
Temp	degree C	3.3	13.4	19.5	18.7	18.2	24.1	22.6
Conductance	µmhos/cm	160	118	157	303	103	168	212
Dissolved Oxygen	mg/l	8.81	9.74	7.61	6.86	8.13	7.47	6.47
pH		7.15	7.1	7.15	8	7.05	7.7	8.1
Alkalinity	mg/l	42	44	40	134	24	62	74
Acidity	mg/l	4	8	6	2	4	2	2
Solids, Total	mg/l	134	112	136	138	76	148	162
Solids, Dissolved	mg/l	110	92	128	118	68	132	158
Ammonia, Total	mg/l	0.06	0.08	0.06	<0.02	0.05	0.07	0.11
Ammonia, Dissolved	mg/l	0.06	0.05	<0.02	<0.02	<0.02	0.07	<0.02
Nitrite, Total	mg/l	0.03	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite, Dissolved	mg/l	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate, Total	mg/l	0.76	0.33	0.09	0.27	0.13	0.11	0.06
Nitrate, Dissolved	mg/l	0.76	0.33	0.06	0.26	0.11	0.11	<0.04
Nitrogen, Total	mg/l	1.39	0.93	0.51	1.88	0.41	1.99	0.59
Nitrogen, Dissolved	mg/l	1.31	0.87	0.44	1.85	0.35	1.99	0.31
Phosphorus, Total	mg/l	0.03	0.04	0.02	<0.02	<0.02	0.03	0.04
Phosphorus, Dissolved	mg/l	0.019	0.017	0.012	0.008	0.01	0.008	0.016
Orthophosphate, Total	mg/l	0.042	0.049	0.008	0.009	0.011	0.004	
Orthophosphate, Dissolved	mg/l	0.018	0.017	0.006	0.003	0.006	0.004	0.014
Organic Carbon, Total	mg/l	3.5	5.1	3.6	1.2	1.5	4.7	2.7
Calcium	mg/l	21.5	16	14.2	33.6	7.77	19.6	35.4
Magnesium	mg/l	4.06	3.51	3.27	6.31	2.49	3.67	3.75
Chloride	mg/l	11	4	20	11	9	13	14
Sulfate	mg/l	18	<10	<10	23	<10	13	12
Turbidity	ntu	27	22	3.5	<1	1.2	<1	2.1
Iron, Total	µg/l	1,480	1,520	920	115	66	274	167
Iron, Dissolved	µg/l	105	98	426	<20	<20	51	17
Manganese, Total	µg/l	104	171	248	16	<10	79	55
Manganese, Dissolved	µg/l	73	87	198	16	<10	41	<10
Aluminum, Total	µg/l	1,700	1,130	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<135	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams—Continued

Parameter	Units	SUSQ 365.0	SUSQ 365.0	SUSQ 365.0	SUSQ 340.0	SUSQ 340.0	SUSQ 340.0	SUSQ 340.0
Date	yyyymmdd	19971110	19980216	19980519	19970721	19971110	19980216	19980519
Time	hhmm	1135	1115	1205	1625	1300	1245	1035
Discharge	cfs	1,170	2,263	2,708	341	1,160	2,650	2,840
Temp	degree C	7.7	0.7	19.7	24.2	7.1	1	19
Conductance	µmhos/cm	238	169	164	200	208	150	155
Dissolved Oxygen	mg/l	7.85	10.28	8.36	7.78	7.84	9.96	8.49
pH		7.35	7.35	7.35	8.5	7.35	7.4	7.4
Alkalinity	mg/l	72	54	66	68	68	46	56
Acidity	mg/l	6	4	6	0	6	6	8
Solids, Total	mg/l	152	120	96	158	3190	94	108
Solids, Dissolved	mg/l	136	100	86	154	3184	84	12
Ammonia, Total	mg/l	<0.02	0.02	0.04	0.09	<0.02	0.03	0.07
Ammonia, Dissolved	mg/l	<0.02	0.02	<0.02	<0.02	<0.02	0.03	<0.02
Nitrite, Total	mg/l	0.01	<0.01	0.02	<0.01	0.01	<0.01	0.01
Nitrite, Dissolved	mg/l	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
Nitrate, Total	mg/l	0.54	0.86	0.76	<0.04	0.47	0.71	0.42
Nitrate, Dissolved	mg/l	0.54	0.86	0.76	<0.04	0.47	0.7	0.42
Nitrogen, Total	mg/l	1.05	1.37	1.16	0.51	1.04	1.2	0.89
Nitrogen, Dissolved	mg/l	1.01	1.37	1.16	0.36	1.04	1.2	0.89
Phosphorus, Total	mg/l	0.03	0.02	0.02	0.03	0.02	0.02	0.02
Phosphorus, Dissolved	mg/l	0.017	0.017	0.014	0.012	0.014	0.017	0.012
Orthophosphate, Total	mg/l	0.013	0.018	0.014	0.013	0.013	0.018	0.012
Orthophosphate, Dissolved	mg/l	0.006	0.018	0.013	0.011	0.011	0.014	0.006
Organic Carbon, Total	mg/l	2.7	2.6	2.8	2.5	2.6	2.5	2.9
Calcium	mg/l	30.4	28.8	26	32.2	26	25.6	22.5
Magnesium	mg/l	3.61	2.72	2.46	3.22	3.49	2.71	2.55
Chloride	mg/l	18	12	10	14	16	12	11
Sulfate	mg/l	31	20	<10	12	24	15	<10
Turbidity	µtu	6.5	3.3	3.4	2.1	4.2	4	2.3
Iron, Total	µg/l	289	252	224	148	179	940	223
Iron, Dissolved	µg/l	87	89	38	<20	54	71	38
Manganese, Total	µg/l	78	21	28	45	30	59	38
Manganese, Dissolved	µg/l	78	16	10	13	<10	16	23
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	603	202
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams—Continued

Parameter	Units	SUSQ 289.1	SUSQ 289.1	SUSQ 289.1	SUSQ 289.1	TIOG 10.8	TIOG 10.8	TIOG 10.8
Date	yyyymmdd	19970723	19971110	19980216	19980519	19970729	19971111	19980217
Time	hhmm	1145	1530	1505	1420	1145	1030	1245
Discharge	cfs	920	3,700	7,150	7,090	84.61	1,550	917.1
Temp	degree C	23.9	7.7	1.5	20.8	20.9	7.1	3.4
Conductance	µmhos/cm	319	282	182	192	199	181	158
Dissolved Oxygen	mg/l	6.92	7.41	10.1	9.03	6.39	7.87	8.66
pH		8.15	7.5	7.3	7.75	7.5	7.2	6.8
Alkalinity	mg/l	102	86	50	64	46	34	36
Acidity	mg/l	2	8	4	4	4	6	2
Solids, Total	mg/l	232	214	128	156	156	234	138
Solids, Dissolved	mg/l	212	202	108	114	132	202	110
Ammonia, Total	mg/l	0.04	0.16	0.06	0.08	0.07	0.18	0.05
Ammonia, Dissolved	mg/l	<0.02	0.15	0.06	<0.02	<0.02	0.18	0.05
Nitrite, Total	mg/l	0.01	0.03	<0.01	0.01	0.01	0.02	0.01
Nitrite, Dissolved	mg/l	0.01	0.02	<0.01	0.01	0.01	0.01	<0.01
Nitrate, Total	mg/l	0.41	0.65	0.86	0.48	0.41	0.3	0.67
Nitrate, Dissolved	mg/l	0.41	0.65	0.85	0.48	0.4	0.3	0.65
Nitrogen, Total	mg/l	0.97	1.4	1.43	1.03	2.19	0.8	1.23
Nitrogen, Dissolved	mg/l	0.83	1.23	1.31	0.89	2.12	0.8	1.09
Phosphorus, Total	mg/l	0.04	0.04	0.02	0.03	0.03	0.03	0.02
Phosphorus, Dissolved	mg/l	0.021	0.018	0.018	0.013	0.005	0.011	0.018
Orthophosphate, Total	mg/l	0.015	0.02	0.018	0.014	0.004	0.014	0.028
Orthophosphate, Dissolved	mg/l	0.012	0.011	0.012	0.009	0.002	0.007	0.014
Organic Carbon, Total	mg/l	3	3.3	2.5	3.1	2.4	3.4	2.9
Calcium	mg/l	34.4	29.6	21.9	26.8	22.5	19.3	8.38
Magnesium	mg/l	6.38	5.11	3.56	3.27	5.02	4.67	4.58
Chloride	mg/l	32	27	17	14	9	10	11
Sulfate	mg/l	21	24	15	<10	35	32	24
Turbidity	ntu	2.7	5.9	3.5	2.4	8.9	22	16
Iron, Total	µg/l	59	169	208	155	351	998	784
Iron, Dissolved	µg/l	12	34	73	26	19	47	105
Manganese, Total	µg/l	25	37	20	27	144	407	345
Manganese, Dissolved	µg/l	<10	<10	14	<10	63	275	281
Aluminum, Total	µg/l	<200	<200	<200	<200	294	1060	728
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A1. Water Quality Data for New York-Pennsylvania Border Streams—Continued

Parameter	Units	TIOG 10.8	TROW 1.8	TRUP 4.5	TRUP 4.5	TRUP 4.5	TRUP 4.5	WAPP 2.6
Date	yyyymmdd	19980520	19970721	19970729	19971111	19980218	19980521	19970723
Time	hhmm	1240	1410	1420	1330	830	840	930
Discharge	cfs	775.5	NA	10.63	87.55	NA	26.32	3.14
Temp	degree C	15.2	18.5	20.9	6.6	1.1	18	20.2
Conductance	µmhos/cm	124	86	281	189	126	182	122
Dissolved Oxygen	mg/l	8.48	8.85	7.82	8.54	9.18	9.4	7.37
pH		6.85	7.1	8.6	8.1	7.2	8.1	7.25
Alkalinity	mg/l	32	14	110	58	32	74	32
Acidity	mg/l	6	4	0	2	4	2	4
Solids, Total	mg/l	102	116	170	168	110	114	94
Solids, Dissolved	mg/l	72	80	156	140	88	114	86
Ammonia, Total	mg/l	0.03	0.08	0.04	0.1	0.09	<0.02	<0.02
Ammonia, Dissolved	mg/l	<0.02	0.06	<0.02	0.1	0.06	<0.02	<0.02
Nitrite, Total	mg/l	0.01	<0.01	<0.01	0.01	0.05	<0.01	<0.01
Nitrite, Dissolved	mg/l	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate, Total	mg/l	0.37	0.36	<0.04	0.71	0.5	0.09	0.31
Nitrate, Dissolved	mg/l	0.33	0.36	<0.04	0.71	0.5	0.08	0.29
Nitrogen, Total	mg/l	0.84	0.84	1.76	1.23	1.4	0.48	0.57
Nitrogen, Dissolved	mg/l	0.72	0.68	1.72	1.23	1.2	0.45	0.52
Phosphorus, Total	mg/l	0.02	0.03	<0.02	0.02	0.22	0.02	<0.02
Phosphorus, Dissolved	mg/l	0.013	0.011	0.006	0.012	0.04	0.011	0.011
Orthophosphate, Total	mg/l	0.02		0.002	0.023		0.014	0.007
Orthophosphate, Dissolved	mg/l	0.01	0.011	0.002	0.003	0.037	0.008	0.006
Organic Carbon, Total	mg/l	3.5	1.6	2.9	4.2	6.7	3.3	1.7
Calcium	mg/l	15.1	6.03	58.8	20.5	6.97	24.9	9.68
Magnesium	mg/l	3.8	2.09	7.02	4.39	7.02	5.61	3.04
Chloride	mg/l	4	7	18	13	16	7	9
Sulfate	mg/l	18	<10	20	18	<10	<10	<10
Turbidity	ntu	12.3	3.7	1.6	15.9	56	6.5	1.4
Iron, Total	µg/l	730	133	87	509	138	302	75
Iron, Dissolved	µg/l	142	<20	<20	106	138	<20	<10
Manganese, Total	µg/l	233	30	<10	14	344	12	12
Manganese, Dissolved	µg/l	182	<10	<10	<10	20	12	<10
Aluminum, Total	µg/l	561	<200	<200	500	<200	259	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams

Parameter	Units	BBDC 4.1	CNWG 4.4	CNWG 4.4	CNWG 4.4	CNWG 4.4	DEER 44.2	DEER 44.2
Date	yyyymmdd	19970805	19970806	19971114	19980313	19980527	19970804	19971113
Time	hhmm	1015	1415	930	1040	1215	1150	1030
Discharge	cfs	1.25	5.52	31.55	NA	21.94	6.41	8.06
Temp	degree C	16.2	20.2	5.4	2.6	18.1	20.9	4.8
Conductance	µmhos/cm	116	215	219	204	220		185
Dissolved Oxygen	mg/l	7.91	7.8	7.91	8.39	8.42	7.37	9.42
pH		6.9	7.1	7.3	7.05	7.1	7.6	7.4
Alkalinity	mg/l	18	32	26	32	32	24	26
Acidity	mg/l	8	2	4	4	4	4	4
Solids, Total	mg/l	98	192	112	102	152	144	120
Solids, Dissolved	mg/l	84	160	112	96	142	124	120
Ammonia, Total	mg/l	<0.02	0.04	0.05	0.06	0.06	0.02	0.06
Ammonia, Dissolved	mg/l	<0.02	<0.02	0.05	0.06	0.02	<0.02	<0.02
Nitrite, Total	mg/l	0.01	0.02	0.01	0.01	0.04	0.02	<0.01
Nitrite, Dissolved	mg/l	<0.01	0.02	0.01	0.01	0.04	0.02	<0.01
Nitrate, Total	mg/l	5.24	7.46	10.5	7.64	9.12	4.27	6.56
Nitrate, Dissolved	mg/l	5.24	7.46	9.03	7.64	9.1	4.27	6.34
Nitrogen, Total	mg/l	7.13	12.9	12.3	10.2	9.78	4.85	7.09
Nitrogen, Dissolved	mg/l	6.9	11.3	12.3	8.56	9.62	4.8	6.96
Phosphorus, Total	mg/l	0.02	0.03	0.04	0.02	0.04	<0.02	<0.02
Phosphorus, Dissolved	mg/l	0.011	0.015	0.025	0.018	0.018	0.004	0.01
Orthophosphate, Total	mg/l	0.01	0.021	0.044	0.016	0.015	0.005	0.01
Orthophosphate, Dissolved	mg/l	0.01	0.011	0.011	0.005	0.014	0.004	0.008
Organic Carbon, Total	mg/l	<1	2	2.2	1.6	2.7	1.2	3.2
Calcium	mg/l	8.57	18.7	17.6	17.2	18.2	15.8	17.6
Magnesium	mg/l	5.24	12.5	9.57	9.53	8.97	5.94	5.61
Chloride	mg/l	9	16	17	16	17	20	21
Sulfate	mg/l	<10	<10	16	17	19	<10	25
Turbidity	ntu	1.3	5.4	2.6	<1	5	1.4	1.04
Iron, Total	µg/l	339	398	397	251	287	411	86
Iron, Dissolved	µg/l	<20	41	38	47	<20	23	60
Manganese, Total	µg/l	29	52	45	42	42	24	25
Manganese, Dissolved	µg/l	<10	32	30	37	24	12	25
Aluminum, Total	µg/l	261	213	269	238	234	332	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	DEER 44.2	DEER 44.2	EBAU 1.5	EBAU 1.5	EBAU 1.5	EBAU 1.5	FBDC 4.1
Date	yyyymmdd	19980311	19980526	19970804	19971113	19980311	19980526	19970805
Time	hhmm	940	925	1345	1115	1030	1055	1235
Discharge	cfs	NA	20.64	2.53	3.26	NA	10.87	1.19
Temp	degree C	4.3	15.8	19.9	6.2	4.7	14.9	16.5
Conductance	µmhos/cm	157	169		311	282	374	102
Dissolved Oxygen	mg/l	8.36	9.06	7.13	9.42	7.88	8.83	7.6
pH		7.2	7.1	7.15	7.15	7	7.05	6.75
Alkalinity	mg/l	22	32	28	18	16	28	16
Acidity	mg/l	4	6	6	4	2	8	6
Solids, Total	mg/l	100	106	142	228	150	272	
Solids, Dissolved	mg/l	87	106		228	132	272	
Ammonia, Total	mg/l	0.03	<0.02	<0.02	<0.02	<0.02	0.05	0.07
Ammonia, Dissolved	mg/l	0.03	<0.02	<0.02	<0.02	<0.02	<0.02	0.05
Nitrite, Total	mg/l	0.01	0.01	0.01	<0.01	0.01	0.02	0.01
Nitrite, Dissolved	mg/l	<0.01	0.01	0.01	<0.01	0.01	0.02	<0.01
Nitrate, Total	mg/l	4.69	5.47	5.32	7.82	5.19	5.57	4.75
Nitrate, Dissolved	mg/l	4.52	5.3	5.27	7.3	5.16	5.57	4.72
Nitrogen, Total	mg/l	5.8	5.69	7.4	8.89	8.06	5.92	6.57
Nitrogen, Dissolved	mg/l	5.8	5.74	7.4	8.72	7.53	5.8	6.57
Phosphorus, Total	mg/l	<0.02	0.02	0.05	0.02	<0.02	0.02	<0.02
Phosphorus, Dissolved	mg/l	0.011	0.011	0.036	0.016	0.01	0.015	0.007
Orthophosphate, Total	mg/l	0.011	0.014	0.05	0.024	0.01	0.015	0.006
Orthophosphate, Dissolved	mg/l	0.011	0.008	0.04	0.01	0.007	0.014	0.005
Organic Carbon, Total	mg/l	1.3	1.3	1.2	1.4	1.2	1.5	1.1
Calcium	mg/l	14.1	15.2	13.1	26.8	24	30.7	6.69
Magnesium	mg/l	5.11	5.62	5.6	4.57	5.07	5.22	4.03
Chloride	mg/l	16	17	16	59	54	76	9
Sulfate	mg/l	13	<10	<10	14	<10	<10	<10
Turbidity	ntu	<1	1.54	1.1	<1	1.98	2.1	1
Iron, Total	µg/l	412	95	145	110	152	148	356
Iron, Dissolved	µg/l	37	<20	45	63	30	42	356
Manganese, Total	µg/l	31	20	18	30	31	32	11
Manganese, Dissolved	µg/l	23	13	12	29	22	23	<10
Aluminum, Total	µg/l	<200	<200	<200	<200	<200	<200	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	LNGA 2.5	OCTO 6.6	OCTO 6.6	OCTO 6.6	OCTO 6.6	SBCC 20.4	SCTT 3.0
Date	yyyymmdd	19970731	19970806	19971114	19980313	19980527	19970804	19970805
Time	hhmm	1010	1205	900	915	1035	910	1445
Discharge	cfs	0.62	43.29	51.01	226.5	177.4	0.5	NA
Temp	degree C	16.8	21.7	5.8	4	20.1	18.4	19.5
Conductance	µmhos/cm	108	221	235	217	216		303
Dissolved Oxygen	mg/l	8.25	8.37	8.23	8.14	8.46	7.36	6.94
pH		7.05	8.1	7.65	7.45	7.5	7	7.3
Alkalinity	mg/l	22	40	34	48	44	32	64
Acidity	mg/l	4	2	4	4	6	6	8
Solids, Total	mg/l	104	188	138	122	160		164
Solids, Dissolved	mg/l	90	176	138	118	154		158
Ammonia, Total	mg/l	0.02	<0.02	0.17	0.11	<0.02	0.04	0.15
Ammonia, Dissolved	mg/l	0.02	<0.02	0.17	0.11	<0.02	<0.02	0.08
Nitrite, Total	mg/l	0.01	0.02	0.01	0.03	0.03	0.01	0.02
Nitrite, Dissolved	mg/l	<0.01	0.02	0.01	0.02	0.03	0.01	0.02
Nitrate, Total	mg/l	2.93	5.04	7.51	5.18	5.63	1.23	1.46
Nitrate, Dissolved	mg/l	2.93	4.98	7.37	5.04	5.26	1.23	1.46
Nitrogen, Total	mg/l	6.14	8.04	8.08	8.89	6.41	1.53	1.85
Nitrogen, Dissolved	mg/l	6.06	7.12	8.08	8.89	6.22	1.44	1.79
Phosphorus, Total	mg/l	0.03	0.03	0.02	0.05	0.05	0.02	0.06
Phosphorus, Dissolved	mg/l	0.012	0.014	0.019	0.034	0.012	0.005	0.04
Orthophosphate, Total	mg/l	0.017	0.018	0.022	0.047	0.024	0.003	0.053
Orthophosphate, Dissolved	mg/l	0.012	0.014	0.008	0.007	0.006	0.003	0.048
Organic Carbon, Total	mg/l	1.8	2.6	2.6	3.6	3.9	1.3	1.6
Calcium	mg/l	7.88	18.8	20.4	20.2	20.8	9.87	23
Magnesium	mg/l	4.11	8.64	13.5	9.78	8.69	2.76	12.3
Chloride	mg/l	7	16	16	15	14	5	42
Sulfate	mg/l	14	17	23	21	21	<10	13
Turbidity	ntu	6	6.5	1.5	1.12	4.5	3.4	3.6
Iron, Total	µg/l	183	426	20,400	618	132	615	216
Iron, Dissolved	µg/l	34	16	41	66	<20	85	83
Manganese, Total	µg/l	15	40	19	79	54	41	63
Manganese, Dissolved	µg/l	14	<10	12	48	<10	10	52
Aluminum, Total	µg/l	<200	364	<200	628	<200	362	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	SCTT 3.0	SCTT 3.0	SCTT 3.0	SUSQ 10.0	SUSQ 10.0	SUSQ 10.0	SUSQ 10.0
Date	yyyymmdd	19971113	19980311	19980526	19970806	19971113	19980311	19980527
Time	hhmm	1230	1140	1310	950	1330	1245	930
Discharge	cfs	0.31	NA	1.301	4,910	76,300	150,000	9,160
Temp	degree C	8	5.7	15.1	27.9	9.2	7.5	23
Conductance	µmhos/cm	325	188	178	328	188	170	211
Dissolved Oxygen	mg/l	7.03	7.61	8.72	5.5	8.43	7.49	7.86
pH		7.05	6.8	7.05	7.65	7.3	7.1	7.55
Alkalinity	mg/l	44	24	28	68	24	30	48
Acidity	mg/l	6	4	4	4	4	4	4
Solids, Total	mg/l	234	78	114	262	122		144
Solids, Dissolved	mg/l	234	78	108	256	122		144
Ammonia, Total	mg/l	0.28	0.11	0.07	0.09	0.05	0.06	0.07
Ammonia, Dissolved	mg/l	0.28	0.11	0.07	0.07	0.05	0.05	0.07
Nitrite, Total	mg/l	0.05	0.01	0.03	0.06	0.01	0.01	0.02
Nitrite, Dissolved	mg/l	0.05	0.01	0.02	0.05	<0.01	0.01	0.01
Nitrate, Total	mg/l	4.54	2.02	2.08	0.81	1.24	1.38	1.13
Nitrate, Dissolved	mg/l	4.41	2.02	2.02	0.81	1.24	1.29	1.13
Nitrogen, Total	mg/l	5.61	2.31	2.52	1.52	1.72	1.71	1.84
Nitrogen, Dissolved	mg/l	5.49	2.31	2.47	1.4	1.72	1.52	1.68
Phosphorus, Total	mg/l	0.07	0.02	0.04	0.02	0.04	0.04	0.03
Phosphorus, Dissolved	mg/l	0.04	0.016	0.029	0.012	0.015	0.015	0.017
Orthophosphate, Total	mg/l	0.095	0.018	0.038	0.018	0.017	0.043	0.02
Orthophosphate, Dissolved	mg/l	0.042	0.016	0.025	0.01	0.01	0.009	0.017
Organic Carbon, Total	mg/l	2.4	2.5	1.6	2.5	3.4	2.6	3.1
Calcium	mg/l	27.4	12.2	10.1	32.9	21.8	18.7	22.7
Magnesium	mg/l	15.7	7.22	5.46	9.95	6	5.15	5.93
Chloride	mg/l	35	24	26	23	9	10	12
Sulfate	mg/l	31	17	<10	45	32	24	33
Turbidity	ntu	1.8	1.82	1.75	4.9	16.1	23	6.3
Iron, Total	µg/l	383	170	174	237	1,080	1,230	207
Iron, Dissolved	µg/l	105	91	58	110	41	64	<20
Manganese, Total	µg/l	170	58	29	86	83	113	157
Manganese, Dissolved	µg/l	81	58	22	11	18	69	49
Aluminum, Total	µg/l	<200	<200	<200	<200	652	1,020	<200
Aluminum, Dissolved	µg/l	<200	<200	<200	<200	<200	<200	<200

Table A2. Water Quality Data for Pennsylvania-Maryland Border Streams—Continued

Parameter	Units	SUSQ 44.5	SUSQ 44.5	SUSQ 44.5	SUSQ 44.5
Date	yyyymmdd	19970807	19971110	19980307	19980528
Time	hhmm	1030	1425	1140	1330
Discharge	cfs	5,360	90,800	91,400	22,100
Temp	degree C	24.3	11	9.6	
Conductance	µmhos/cm	357	199	171	244
Dissolved Oxygen	mg/l	7.68			
pH		8.2	6.8	7.3	8.5
Alkalinity	mg/l	62		32	56
Acidity	mg/l	2		0	0
Solids, Total	mg/l	274		124	178
Solids, Dissolved	mg/l	211		96	174
Ammonia, Total	mg/l	0.03	0.03	0.04	0.02
Ammonia, Dissolved	mg/l	0.03		0.04	<0.02
Nitrite, Total	mg/l	0.01		0.02	0.01
Nitrite, Dissolved	mg/l	0.01		0.02	<0.01
Nitrate, Total	mg/l	0.71	1.15	1.03	0.99
Nitrate, Dissolved	mg/l	0.71		1.03	0.95
Nitrogen, Total	mg/l	1.19	2.09	1.27	
Nitrogen, Dissolved	mg/l	1.11		1.05	
Phosphorus, Total	mg/l	0.02	0.17	0.02	0.03
Phosphorus, Dissolved	mg/l	0.01		0.011	0.017
Orthophosphate, Total	mg/l	0.016		0.016	0.018
Orthophosphate, Dissolved	mg/l	0.009	0.013	0.011	0.015
Organic Carbon, Total	mg/l	3.1	5	2.1	3
Calcium	mg/l	36	17.8	17.2	27
Magnesium	mg/l	11	4.42	4.46	7.8
Chloride	mg/l	27	10	10	13
Sulfate	mg/l	62	21	50	51
Turbidity	ntu	2.6		<1	2.5
Iron, Total	µg/l	133	5540	848	304
Iron, Dissolved	µg/l	32		52	<20
Manganese, Total	µg/l	56	405	106	65.8
Manganese, Dissolved	µg/l	25		65.3	3.1
Aluminum, Total	µg/l	<200	2,235	307	152
Aluminum, Dissolved	µg/l	<200		35.8	43.9

APPENDIX B

ORGANIC POLLUTION–TOLERANCE AND FUNCTIONAL FEEDING GROUP DESIGNATIONS OF BENTHIC MACROINVERTEBRATE TAXA

Order	Family	Genus	Organic Pollution Tolerance Value	Functional Feeding Group Designation
Coleoptera	Elmidae	*Optioservus*	4	SC
		Stenelmis	5	SC
	Gyrinidae	*Dineutus*	4	P
	Psephenidae	*Psephenus*	4	SC
		Ectopria	5	SC
	Ptilodactylidae	*Anchytarsus*	5	SH
Diptera	Athericidae	*Atherix*	2	P
	Chironomidae	Chironomidae	7	CG
	Empididae	*Hemerodromia*	6	P
	Simuliidae	*Simulium*	6	FC
	Tabanidae	*Chrysops*	7	P
	Tipulidae	*Antocha*	3	CG
		Dicranota	3	P
		Hexatoma	2	P
Ephemeroptera	Baetidae	*Acentrella*	4	CG
		Baetis	6	CG
		Callibaetis	9	CG
		Heterocloeon	2	SC
	Caenidae	*Caenis*	7	CG
	Ephemerellidae	*Drunella*	1	SC
		Ephemerella	1	SC
		Serratella	2	SC
	Heptageniidae	*Epeorus*	0	CG
		Heptagenia	4	SC
		Leucrocuta	1	SC
		Stenacron	4	SC
		Stenonema	3	SC
	Isonychiidae	*Isonychia*	2	FC
	Leptophlebiidae	*Paraleptophlebia*	1	CG
	Polymitarcyidae	*Ephoron*	2	CG
	Potamanthidae	*Anthopotamus*	4	CG
	Tricorythidae	*Tricorythodes*	4	CG
Hemiptera	Veliidae	*Rhagovelia*	8	P
Lepidoptera	Pyralidae	*Petrophila*	5	SC
Megaloptera	Corydalidae	*Corydalus*	4	P
		Nigronia	2	P
	Sialidae	*Sialis*	4	P
Odonata	Aeshnidae	*Boyeria*	2	P
	Coenagrionidae	*Argia*	6	P
	Gomphidae	*Gomphus*	5	P
		Lanthus	5	P
		Stylogomphus albistylus	4	P
Plecoptera	Leuctridae	*Leuctra*	0	SH
	Perlidae	*Acroneuria*	0	P
		Agnetina	2	P
		Eccoptura	2	P
		Neoperla	3	P
		Paragnetina	1	P

Order	Family	Genus	Organic Pollution Tolerance Value	Functional Feeding Group Designation
Trichoptera	Brachycentridae	*Brachycentrus*	1	FC
	Hydropsychidae	*Ceratopsyche*	4	FC
		Cheumatopsyche	5	FC
		Diplectrona	0	FC
		Hydropsyche	4	FC
		Macrostemum	3	FC
		Potamyia	5	FC
	Hydroptilidae	*Hydroptila*	6	SC
		Ochrotrichia	6	SC
	Lepidostomatidae	*Lepidostoma*	1	SH
	Leptoceridae	*Ceraclea*	3	CG
	Philopotamidae	*Chimarra*	4	FC
		Dolophilodes	0	FC
	Polycentropodidae	*Polycentropus*	6	FC
	Rhyacophilidae	*Rhyacophila*	1	P
Amphipoda	Gammaridae	*Gammarus*	6	SH
Isopoda	Asellidae	*Caecidotea*	6	SH

APPENDIX C

MACROINVERTEBRATE DATA FOR INTERSTATE STREAMS CROSSING THE NEW YORK-PENNSYLVANIA AND PENNSYLVANIA-MARYLAND BORDERS

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams

Order	Family	Genus	SNAK 2.3	CASC 1.6	SEEL 10.3	APAL 6.9
Coleoptera	Elmidae	Optioservus	5	1		1
		Stenelmis	4	3	1	11
	Gyrinidae	Dineutus				
	Psephenidae	Psephenus			1	6
		Ectopria				
	Ptilodactylidae	Anchytarsus		1		
Diptera	Athericidae	Atherix	4		2	3
	Chironomidae	Chironomidae	14	57	36	16
	Empididae	Hemerodromia				
	Simuliidae	Simulium				
	Tabanidae	Chrysops				
	Tipulidae	Antocha				
		Dicranota			1	
		Hexatoma			1	2
Ephemeroptera	Baetidae	Acentrella	1			
		Baetis	11			1
		Callibaetis				
		Heterocloeon				
	Caenidae	Caenis	3		2	2
	Ephemerellidae	Drunella				
		Ephemerella				
		Serratella	1			
	Heptageniidae	Epeorus				
		Heptagenia				
		Leucrocuta				
		Stenacron				
		Stenonema		1		2
	Isonychiidae	Isonychia	14	29		
	Leptophlebiidae	Paraleptophlebia			1	
	Polymitarcyidae	Ephoron				
	Potamanthidae	Anthopotamus	1			
	Tricorythidae	Tricorythodes	1		32	
Hemiptera	Veliidae	Rhagovelia		2		
Lepidoptera	Pyralidae	Petrophila				
Megaloptera	Corydalidae	Corydalus				
		Nigronia	1			
	Sialidae	Sialis				
Odonata	Aeshnidae	Boyeria		1		
	Coenagrionidae	Argia				
	Gomphidae	Gomphus				
		Lanthus				
		Stylogomphus albistylus		2		
Plecoptera	Leuctridae	Leuctra	5	1		
	Perlidae	Acroneuria		4		1
		Agnetina				
		Eccoptura				
		Neoperla				
		Paragnetina	2			
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche	28		22	3
		Cheumatopsyche	11	15	7	12

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Order	Family	Genus	SNAK 2.3	CASC 1.6	SEEL 10.3	APAL 6.9
Trichoptera	Hydropsychidae	Diplectrona				
		Hydropsyche	8	1	1	4
		Macrostemum				
		Potamyia				
	Hydroptilidae	Hydroptila				
		Ochrotrichia				
	Lepidostomatidae	Lepidostoma				
	Leptoceridae	Ceraclea				
	Philopotamidae	Chimarra	19	20		77
		Dolophilodes	16			
	Polycentropodidae	Polycentropus				
	Rhyacophilidae	Rhyacophila				
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Order	Family	Genus	CHOC 9.1	TROW 1.6	SOUT 6.9	TRUP 4.5
Coleoptera	Elmidae	Optioservus			1	
		Stenelmis	7	14	1	
	Gyrinidae	Dineutus				
	Psephenidae	Psephenus			2	
		Ectopria				
	Ptilodactylidae	Anchytarsus				
Diptera	Athericidae	Atherix				14
	Chironomidae	Chironomidae	16	50	46	16
	Empididae	Hemerodromia	1		2	
	Simuliidae	Simulium				
	Tabanidae	Chrysops				
	Tipulidae	Antocha				
		Dicranota				
		Hexatoma	2			
Ephemeroptera	Baetidae	Acentrella		2		
		Baetis	6	12	3	27
		Callibaetis				
		Heterocloeon				
	Caenidae	Caenis	13			1
	Ephemerellidae	Drunella	1			
		Ephemerella				
		Serratella	1			
	Heptageniidae	Epeorus		1		
		Heptagenia	3			1
		Leucrocuta				
		Stenacron				
		Stenonema	3	1	1	11
	Isonychiidae	Isonychia	23			2
	Leptophlebiidae	Paraleptophlebia				
	Polymitarcyidae	Ephoron				
	Potamanthidae	Anthopotamus				
	Tricorythidae	Tricorythodes				1
Hemiptera	Veliidae	Rhagovelia				
Lepidoptera	Pyralidae	Petrophila				
Megaloptera	Corydalidae	Corydalus				
		Nigronia				
	Sialidae	Sialis	1		1	
Odonata	Aeshnidae	Boyeria				
	Coenagrionidae	Argia				
	Gomphidae	Gomphus				
		Lanthus				
		Stylogomphus albistylus				
Plecoptera	Leuctridae	Leuctra	5		1	
	Perlidae	Acroneuria	1			
		Agnetina		1		
		Eccoptura				
		Neoperla		1		5
		Paragnetina				
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche	19	29		11
		Cheumatopsyche	10	9	21	1

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Order	Family	Genus	CHOC 9.1	TROW 1.6	SOUT 6.9	TRUP 4.5
Trichoptera	Hydropsychidae	Diplectrona				
		Hydropsyche	3	2	5	3
		Macrostemum				
		Potamyia				
	Hydroptilidae	Hydroptila				
		Ochrotrichia				
	Lepidostomatidae	Lepidostoma			1	
	Leptoceridae	Ceraclea			1	
	Philopotamidae	Chimarra	18		38	
		Dolophilodes		1		
	Polycentropodidae	Polycentropus				
	Rhyacophilidae	Rhyacophila				
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Order	Family	Genus	BNTY 0.9	WAPP 2.6	CAYT 1.7	LSNK 7.6
Coleoptera	Elmidae	Optioservus		1	2	
		Stenelmis		1	1	
	Gyrinidae	Dineutus				
	Psephenidae	Psephenus		5	1	1
		Ectopria				
	Ptilodactylidae	Anchytarsus				
Diptera	Athericidae	Atherix		3		
	Chironomidae	Chironomidae	56	16	64	83
	Empididae	Hemerodromia			2	9
	Simuliidae	Simulium		1		
	Tabanidae	Chrysops				
	Tipulidae	Antocha			1	
		Dicranota				
		Hexatoma		1		1
Ephemeroptera	Baetidae	Acentrella		3		
		Baetis	2	20	9	6
		Callibaetis				
		Heterocloeon				
	Caenidae	Caenis			1	
	Ephemerellidae	Drunella				
		Ephemerella				
		Serratella		1	3	
	Heptageniidae	Epeorus				
		Heptagenia			5	
		Leucrocuta				
		Stenacron				
		Stenonema	2	11	3	2
	Isonychiidae	Isonychia	26	20	15	5
	Leptophlebiidae	Paraleptophlebia				
	Polymitarcyidae	Ephoron				
	Potamanthidae	Anthopotamus				
	Tricorythidae	Tricorythodes				
Hemiptera	Veliidae	Rhagovelia	1			
Lepidoptera	Pyralidae	Petrophila				
Megaloptera	Corydalidae	Corydalus				
		Nigronia				2
	Sialidae	Sialis				
Odonata	Aeshnidae	Boyeria				
	Coenagrionidae	Argia				
	Gomphidae	Gomphus				
		Lanthus	1			
		Stylogomphus albistylus				
Plecoptera	Leuctridae	Leuctra				3
	Perlidae	Acroneuria			3	2
		Agnetina				
		Eccoptura				
		Neoperla				
		Paragnetina				
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche	17	29	22	5
		Cheumatopsyche	3	17	9	12

Table C1. Macroinvertebrate Data for New York-Pennsylvania Border Streams—Continued

Order	Family	Genus	BNTY 0.9	WAPP 2.6	CAYT 1.7	LSNK 7.6
Trichoptera	Hydropsychidae	Diplectrona				
		Hydropsyche	6			3
		Macrostemum				
		Potamyia				
	Hydroptilidae	Hydroptila				
		Ochrotrichia				
	Lepidostomatidae	Lepidostoma				
	Leptoceridae	Ceraclea				
	Philopotamidae	Chimarra		22	25	
		Dolophilodes				
	Polycentropodidae	Polycentropus				
	Rhyacophilidae	Rhyacophila				
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams

Order	Family	Genus	SBCC 20.4	SCTT 3.0	EBAU 1.5	BBDC 4.1
Coleoptera	Elmidae	Optioservus	21		16	1
		Stenelmis				13
	Gyrinidae	Dineutus				
	Psephenidae	Psephenus				
		Ectopria				
	Ptilodactylidae	Anchytarsus				1
Diptera	Athericidae	Atherix				
	Chironomidae	Chironomidae	19	85	25	12
	Empididae	Hemerodromia	2	2		
	Simuliidae	Simulium				
	Tabanidae	Chrysops	1			
	Tipulidae	Antocha	1		4	
		Dicranota				
		Hexatoma	2			
Ephemeroptera	Baetidae	Acentrella				
		Baetis	7	15	33	2
		Callibaetis				1
		Heterocloeon				
	Caenidae	Caenis				
	Ephemerellidae	Drunella				
		Ephemerella				
		Serratella				
	Heptageniidae	Epeorus				
		Heptagenia				
		Leucrocuta				
		Stenacron				
		Stenonema	3	1	2	
	Isonychiidae	Isonychia				
	Leptophlebiidae	Paraleptophlebia	1			
	Polymitarcyidae	Ephoron				
	Potamanthidae	Anthopotamus				
	Tricorythidae	Tricorythodes				
Hemiptera	Veliidae	Rhagovelia		1		
Lepidoptera	Pyralidae	Petrophila				
Megaloptera	Corydalidae	Corydalus				
		Nigronia				
	Sialidae	Sialis				
Odonata	Aeshnidae	Boyeria				1
	Coenagrionidae	Argia				
	Gomphidae	Gomphus				3
		Lanthus				
		Stylogomphus albistylus				
Plecoptera	Leuctridae	Leuctra	33		2	29
	Perlidae	Acroneuria	4		2	1
		Agnetina				1
		Eccoptura				3
		Neoperla				
		Paragnetina			1	1
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche		4	5	12
		Cheumatopsyche		2	1	

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued

Order	Family	Genus	SBCC 20.4	SCTT 3.0	EBAU 1.5	BBDC 4.1
Trichoptera	Hydropsychidae	Diplectrona	8			1
		Hydropsyche	4		22	
		Macrostemum				
		Potamyia				
	Hydroptilidae	Hydroptila				
		Ochrotrichia				
	Lepidostomatidae	Lepidostoma				
	Leptoceridae	Ceraclea				
	Philopotamidae	Chimarra				
		Dolophilodes	5			31
	Polycentropodidae	Polycentropus	1		1	
	Rhyacophilidae	Rhyacophila				2
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued

Order	Family	Genus	FBDC 4.1	CNWG 4.4	LNGA 2.5	DEER 44.5
Coleoptera	Elmidae	Optioservus		1	24	2
		Stenelmis	9	38	4	6
	Gyrinidae	Dineutus				
	Psephenidae	Psephenus				3
		Ectopria				1
	Ptilodactylidae	Anchytarsus			3	
Diptera	Athericidae	Atherix				1
	Chironomidae	Chironomidae	26	9	32	9
	Empididae	Hemerodromia	1		13	2
	Simuliidae	Simulium			2	
	Tabanidae	Chrysops				
	Tipulidae	Antocha				4
		Dicranota				
		Hexatoma				
Ephemeroptera	Baetidae	Acentrella				1
		Baetis		3	18	9
		Callibaetis	2			
		Heterocloeon				
	Caenidae	Caenis				
	Ephemerellidae	Drunella				
		Ephemerella		1		
		Serratella			2	1
	Heptageniidae	Epeorus				1
		Heptagenia		1		
		Leucrocuta				
		Stenacron		1		
		Stenonema	1	21	2	11
	Isonychiidae	Isonychia				17
	Leptophlebiidae	Paraleptophlebia				
	Polymitarcyidae	Ephoron				
	Potamanthidae	Anthopotamus				
	Tricorythidae	Tricorythodes		1		
Hemiptera	Veliidae	Rhagovelia				
Lepidoptera	Pyralidae	Petrophila				
Megaloptera	Corydalidae	Corydalus		1		
		Nigronia				2
	Sialidae	Sialis				
Odonata	Aeshnidae	Boyeria				
	Coenagrionidae	Argia				
	Gomphidae	Gomphus				
		Lanthus				
		Stylogomphus albistylus				
Plecoptera	Leuctridae	Leuctra	1		3	9
	Perlidae	Acroneuria				1
		Agnetina	1			
		Eccoptura	5			
		Neoperla				
		Paragnetina				1
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche	32	25		22
		Cheumatopsyche	1		4	26

Table C2. ***Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued***

Order	Family	Genus	FBDC 4.1	CNWG 4.4	LNGA 2.5	DEER 44.5
Trichoptera	Hydropsychidae	Diplectrona	7			
		Hydropsyche		8	9	13
		Macrostemum		1		
		Potamyia				
	Hydroptilidae	Hydroptila				
		Ochrotrichia	1			
	Lepidostomatidae	Lepidostoma				
	Leptoceridae	Ceraclea				
	Philopotamidae	Chimarra				
		Dolophilodes	6			
	Polycentropodidae	Polycentropus				
	Rhyacophilidae	Rhyacophila				
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C2. Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued

Order	Family	Genus	OCTO 6.6
Coleoptera	Elmidae	Optioservus	
		Stenelmis	4
	Gyrinidae	Dineutus	
	Psephenidae	Psephenus	
		Ectopria	
	Ptilodactylidae	Anchytarsus	
Diptera	Athericidae	Atherix	
	Chironomidae	Chironomidae	11
	Empididae	Hemerodromia	
	Simuliidae	Simulium	
	Tabanidae	Chrysops	
	Tipulidae	Antocha	1
		Dicranota	
		Hexatoma	
Ephemeroptera	Baetidae	Acentrella	
		Baetis	13
		Callibaetis	
		Heterocloeon	
	Caenidae	Caenis	
	Ephemerellidae	Drunella	
		Ephemerella	2
		Serratella	
	Heptageniidae	Epeorus	
		Heptagenia	
		Leucrocuta	
		Stenacron	
		Stenonema	4
	Isonychiidae	Isonychia	
	Leptophlebiidae	Paraleptophlebia	
	Polymitarcyidae	Ephoron	
	Potamanthidae	Anthopotamus	
	Tricorythidae	Tricorythodes	
Hemiptera	Veliidae	Rhagovelia	
Lepidoptera	Pyralidae	Petrophila	
Megaloptera	Corydalidae	Corydalus	
		Nigronia	
	Sialidae	Sialis	
Odonata	Aeshnidae	Boyeria	
	Coenagrionidae	Argia	
	Gomphidae	Gomphus	
		Lanthus	
		Stylogomphus albistylus	
Plecoptera	Leuctridae	Leuctra	
	Perlidae	Acroneuria	
		Agnetina	
		Eccoptura	
		Neoperla	
		Paragnetina	
Trichoptera	Brachycentridae	Brachycentrus	10
	Hydropsychidae	Ceratopsyche	17
		Cheumatopsyche	15

Table C2. ***Macroinvertebrate Data for Pennsylvania-Maryland Border Streams—Continued***

Order	Family	Genus	OCTO 6.6
Trichoptera	Hydropsychidae	Diplectrona	
		Hydropsyche	4
		Macrostemum	18
		Potamyia	
	Hydroptilidae	Hydroptila	
		Ochrotrichia	
	Lepidostomatidae	Lepidostoma	1
	Leptoceridae	Ceraclea	
	Philopotamidae	Chimarra	18
		Dolophilodes	
	Polycentropodidae	Polycentropus	
	Rhyacophilidae	Rhyacophila	
Amphipoda	Gammaridae	Gammarus	2
Isopoda	Asellidae	Caecidotea	

Table C3. Macroinvertebrate Data for River Sites

Order	Family	Genus	SUSQ 365	SUSQ 340	SUSQ 289.1	SUSQ 44.5
Coleoptera	Elmidae	Optioservus	4	8	1	2
		Stenelmis	41	35	17	4
	Gyrinidae	Dineutus	1	1		
	Psephenidae	Psephenus	4			
		Ectopria				
	Ptilodactylidae	Anchytarsus				
Diptera	Athericidae	Atherix				
	Chironomidae	Chironomidae	16	15	21	7
	Empididae	Hemerodromia				
	Simuliidae	Simulium	1			
	Tabanidae	Chrysops				
	Tipulidae	Antocha				
		Dicranota				
		Hexatoma				
Ephemeroptera	Baetidae	Acentrella				3
		Baetis	8	4	20	45
		Callibaetis				
		Heterocloeon				
	Caenidae	Caenis				
	Ephemerellidae	Drunella				
		Ephemerella				
		Serratella	1		6	
	Heptageniidae	Epeorus				
		Heptagenia	8	5		
		Leucrocuta	3			
		Stenacron		1		
		Stenonema	10	13	2	13
	Isonychiidae	Isonychia	8		4	4
	Leptophlebiidae	Paraleptophlebia				
	Polymitarcyidae	Ephoron	4	3		
	Potamanthidae	Anthopotamus	3	29		2
	Tricorythidae	Tricorythodes		2		2
Hemiptera	Veliidae	Rhagovelia				
Lepidoptera	Pyralidae	Petrophila				1
Megaloptera	Corydalidae	Corydalus				
		Nigronia				
	Sialidae	Sialis				
Odonata	Aeshnidae	Boyeria				
	Coenagrionidae	Argia				1
	Gomphidae	Gomphus				
		Lanthus				
		Stylogomphus albistylus				
Plecoptera	Leuctridae	Leuctra				
	Perlidae	Acroneuria	4		1	
		Agnetina	3			
		Eccoptura				
		Neoperla		3		
		Paragnetina				
Trichoptera	Brachycentridae	Brachycentrus				
	Hydropsychidae	Ceratopsyche	5		4	
		Cheumatopsyche	3		18	1

Table C3. Macroinvertebrate Data for River Sites—Continued

Order	Family	Genus	SUSQ 365	SUSQ 340	SUSQ 289.1	SUSQ 44.5
Trichoptera	Hydropsychidae	Diplectrona				
		Hydropsyche			9	2
		Macrostemum	4	1	13	7
		Potamyia	2			
	Hydroptilidae	Hydroptila	1		2	
		Ochrotrichia				
	Lepidostomatidae	Lepidostoma				
	Leptoceridae	Ceraclea				
	Philopotamidae	Chimarra	10		33	5
		Dolophilodes				
	Polycentropodidae	Polycentropus				
	Rhyacophilidae	Rhyacophila				
Amphipoda	Gammaridae	Gammarus				
Isopoda	Asellidae	Caecidotea				

Table C3. Macroinvertebrate Data for River Sites—Continued

Order	Family	Genus	CHEM 12.0	COWN 2.2	TIOG 10.8
Coleoptera	Elmidae	Optioservus			
		Stenelmis	2		1
	Gyrinidae	Dineutus			
	Psephenidae	Psephenus			
		Ectopria			
	Ptilodactylidae	Anchytarsus			
Diptera	Athericidae	Atherix			
	Chironomidae	Chironomidae	17	114	22
	Empididae	Hemerodromia			
	Simuliidae	Simulium			19
	Tabanidae	Chrysops			
	Tipulidae	Antocha			2
		Dicranota			
		Hexatoma			
Ephemeroptera	Baetidae	Acentrella			2
		Baetis	7		3
		Callibaetis			
		Heterocloeon			1
	Caenidae	Caenis	1	2	1
	Ephemerellidae	Drunella			
		Ephemerella			
		Serratella	7		
	Heptageniidae	Epeorus			
		Heptagenia			
		Leucrocuta			
		Stenacron			
		Stenonema	10		7
	Isonychiidae	Isonychia	8		9
	Leptophlebiidae	Paraleptophlebia			
	Polymitarcyidae	Ephoron			
	Potamanthidae	Anthopotamus			
	Tricorythidae	Tricorythodes			
Hemiptera	Veliidae	Rhagovelia			
Lepidoptera	Pyralidae	Petrophila			
Megaloptera	Corydalidae	Corydalus			1
		Nigronia			
	Sialidae	Sialis			
Odonata	Aeshnidae	Boyeria			
	Coenagrionidae	Argia			
	Gomphidae	Gomphus			
		Lanthus			
		Stylogomphus albistylus			
Plecoptera	Leuctridae	Leuctra			
	Perlidae	Acroneuria			
		Agnetina			
		Eccoptura			
		Neoperla			
		Paragnetina			
Trichoptera	Brachycentridae	Brachycentrus			
	Hydropsychidae	Ceratopsyche	20		36
		Cheumatopsyche	76		21

Table C3. Macroinvertebrate Data for River Sites—Continued

Order	Family	Genus	CHEM 12.0	COWN 2.2	TIOG 10.8
		Diplectrona			
		Hydropsyche	11		2
		Macrostemum	1		1
		Potamyia			
	Hydroptilidae	Hydroptila			
		Ochrotrichia			
	Lepidostomatidae	Lepidostoma			
	Leptoceridae	Ceraclea			
	Philopotamidae	Chimarra	20		4
		Dolophilodes			
	Polycentropodidae	Polycentropus			
	Rhyacophilidae	Rhyacophila			
Amphipoda	Gammaridae	Gammarus			
Isopoda	Asellidae	Caecidotea		2	

APPENDIX D

WATER CLASSIFICATION AND BEST USAGE RELATIONSHIPS

New York:

The New York State water quality classifications are summarized from Water Quality Regulations for Surface Waters and Groundwaters, 6NYCRR Parts 700-705, effective September 1, 1991, New York State Department of Environmental Conservation, Division of Water, Albany, New York. Only classifications that are used in this report will be described in this section. The classes are as follows:

Class B: The best usage of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

Class C: The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

Class D: The best usage of these waters is fishing. Due to such natural conditions as intermittence of flow, water conditions not conducive to propagation of game fishery, or streambed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

(T): Suffix added to classes where trout survival is an additional best use to the use classification.

Pennsylvania:

The Pennsylvania state water quality classifications are summarized from Water Quality Standards of the Department's Rules and Regulations, 25 Pa. Code, Chapter 93.3-5, effective August 1989, Pennsylvania Department of Environmental Resources, Division of Water Quality, Harrisburg, Pennsylvania. All surface waters must meet protected water uses for aquatic life (warm water fishes), water supply (potable, industrial, livestock, and wildlife), and recreation (boating, fishing, water contact sports, and aesthetics). Only classifications that are used in this report will be described in this section. The use classifications are as follows:

CWF - Cold Water Fishes: Maintenance and/or propagation of fish species including the family Salmonidae and additional flora and fauna, which are indigenous to a cold water habitat.

WWF – Warm Water Fishes: Maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

TSF – Trout Stocked Fishery: Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat.

MF – Migratory Fishes: Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes that ascend to flowing waters to complete their life cycle. The MF designation is in addition to other designations when appropriate.

Maryland:

The Maryland State water quality classifications are summarized from Water Quality Regulations for Designated Uses, COMAR 26.08.02, Effective November 1, 1993, Maryland Department of the Environment, Annapolis, Maryland. All surface waters must protect public health or welfare; enhance the quality of water; protect aquatic resources; and serve the purposes of the Federal Act. Only classifications that are used in this report will be described in this section. The designated use classifications are as follows:

I-P – Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply: This use designation includes waters that are suitable for water contact sports; play and leisure time activities where individuals may come in direct contact with surface water; fishing; the growth and propagation of fish (other than trout), other aquatic life, and wild life; and industrial supply. The P designation indicates that the water source may be used as a public water supply.

III-P – Natural Trout Waters and Public Water Supply: This use designation includes waters that have the potential for or are suitable for the growth and propagation of trout, and capable of supporting self-sustaining trout populations and their food organisms. The P designation indicates that the water use may be used as a public water supply

IV-P – Recreational Trout Waters and Public Water Supply: This use designation includes cold or warm waters that have the potential for or are capable of holding or supporting adult trout for put-and-take fishing; and managed as a special fishery by periodic stocking and seasonal catching. The P designation indicates that the waters may be used as a public water supply.

Appendix E

Statistical Trend Results by Parameter

Table E1. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Suspended Solids

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.050	-8.10	-0.231	-4.71	172	0.098	-4.89	-0.237	82.8
Chemung River	0.747	-0.341	-0.028	-0.166	206	0.709	0.494	0.045	-21.7
Conowingo Creek	0.717	0.804	0.059	0.496	162	0.322	1.78	0.124	NA
Cowanesque River	0.069	3.07	0.264	2.45	125	0.624	1.18	0.093	-30.1
Deer Creek	0.687	-0.731	-0.039	-0.537	136	0.414	1.65	0.108	-58.4
Ebaughs Creek	0.002	12.68	0.378	6.47	196	0.004	9.63	0.355	-33.4
Octoraro Creek	0.264	-2.00	-0.127	-1.15	174	0.628	-0.698	-0.136	-38.5
Scott Creek	0.164	-4.78	-0.189	-2.42	198	0.842	0.728	0.031	NA
Susquehanna River 10.0	0.196	-5.15	-0.167	-2.86	180	0.142	-2.43	-0.224	23.7
Susquehanna River 44.5	0.839	2.36	0.002	1.23	192	0.684	-2.44	-0.120	68.0
Susquehanna River 289.1	0.170	-1.52	-0.169	-1.01	150	0.185	-1.62	-0.158	48.6
Susquehanna River 340	0.677	-0.620	-0.041	-0.500	124	0.836	-0.200	-0.013	NA
Susquehanna River 365	0.133	-2.00	-0.182	-1.59	126	0.449	-1.26	-0.153	72.3
Tioga River	0.334	-1.34	-0.098	-0.924	144	0.464	0.917	0.083	-28.1
Troups Creek	0.132	1.99	0.192	1.20	166	0.098	5.06	0.231	NA

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E2. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Ammonia

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.004	-0.002	-0.303	-5.56	0.03	0.414	-0.001	-0.136	24.1
Chemung River	0.036	-0.003	-0.232	-6.54	0.05	0.093	-0.003	-0.189	NA
Conowingo Creek	0.310	-0.001	-0.119	-2.85	0.05	0.547	-0.001	-0.07	27.7
Cowanesque River	0.564	-0.002	-0.053	-2.77	0.06	0.112	-0.004	-0.246	88.1
Deer Creek	0.040	-0.002	-0.222	-4.19	0.04	0.559	-0.001	-0.073	30.4
Ebaughs Creek	0.007	-0.004	-0.291	-8.01	0.05	0.259	-0.001	-0.136	20
Octoraro Creek	0.015	-0.004	-0.269	-10.3	0.04	0.225	-0.001	-0.102	26.8
Scott Creek	0.228	-0.010	-0.163	-8.31	0.12	0.842	-0.001	-0.033	7.4
Susquehanna River 10.0	0.035	-0.003	-0.234	-3.42	0.08	0.711	-0.001	-0.053	69.2
Susquehanna River 44.5	0.006	-0.003	-0.340	-8.30	0.04	<0.001	-0.003	-0.442	93.9
Susquehanna River 289.1	0.009	-0.003	-0.287	-6.69	0.05	0.058	-0.002	-0.215	NA
Susquehanna River 340	0.011	-0.001	-0.265	-3.63	0.04	0.018	-0.002	-0.265	32.4
Susquehanna River 365	<0.001	-0.002	-0.433	-8.32	0.03	0.019	-0.002	-0.293	68.1
Tioga River	0.053	-0.002	-0.200	-4.15	0.06	0.204	-0.002	-0.161	NA
Troups Creek	0.262	0.000	0.149	0.000	0.02	0.535	0.001	0.114	NA

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E3. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Nitrogen

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.069	-0.027	-0.205	-4.65	0.576	0.164	-0.027	-0.178	4.77
Chemung River	0.303	-0.012	-0.124	-1.55	0.752	0.758	-0.004	-0.038	-20.5
Conowingo Creek	<0.001	0.192	0.379	2.64	7.26	<0.001	0.191	0.493	NA
Cowanesque River	0.044	-0.018	-0.283	-3.65	0.502	0.221	-0.012	-0.218	NA
Deer Creek	0.031	0.077	0.246	1.66	4.66	0.094	0.049	0.200	NA
Ebaughs Creek	0.675	0.005	0.058	0.077	5.81	0.907	0.003	0.018	18.8
Octoraro Creek	0.006	0.158	0.314	3.00	5.27	0.013	0.089	0.308	NA
Scott Creek	0.064	0.082	0.253	3.92	2.09	0.036	0.079	0.272	-42.9
Susquehanna River 10.0	0.888	-0.003	-0.008	-0.232	1.24	0.096	-0.025	-0.217	68.6
Susquehanna River 44.5	1.00	0.001	-0.029	0.062	0.912	0.937	0.000	-0.033	9.16
Susquehanna River 289.1	0.002	-0.023	-0.345	-3.31	0.702	0.104	-0.015	-0.179	NA
Susquehanna River 340	<0.001	-0.017	-0.367	-3.09	0.538	0.004	-0.017	-0.318	NA
Susquehanna River 365	0.022	-0.017	-0.259	-2.71	0.614	0.748	-0.003	-0.062	-17.3
Tioga River	0.245	-0.006	-0.118	-1.07	0.528	0.259	-0.010	-0.135	NA
Troups Creek	0.840	0.000	-0.028	0.000	0.202	0.756	-0.006	-0.021	34.6

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E4. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Phosphorus

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.164	-0.027	-0.178	NA	0.006	0.053	-0.005	-0.253	NA
Chemung River	0.013	-0.003	-0.268	-4.82	0.070	0.034	-0.002	-0.250	81.6
Conowingo Creek	0.060	-0.004	-0.216	-4.76	0.080	0.315	-0.002	-0.119	NA
Cowanesque River	0.626	0.000	-0.057	0.000	0.035	0.112	-0.002	-0.244	86.1
Deer Creek	<0.001	-0.003	-0.425	-7.24	0.035	0.039	-0.001	-0.245	61.8
Ebaughs Creek	<0.001	-0.003	-0.416	-8.33	0.040	0.003	-0.004	-0.355	NA
Octoraro Creek	0.017	-0.005	-0.278	-5.25	0.090	0.084	-0.004	-0.250	NA
Scott Creek	<0.001	-0.016	-0.556	-17.4	0.090	0.040	-0.007	-0.253	NA
Susquehanna River 10.0	0.002	-0.002	-0.351	-4.99	0.050	0.071	-0.002	-0.244	NA
Susquehanna River 44.5	0.034	-0.003	-0.251	-5.59	0.060	0.033	-0.004	-0.296	NA
Susquehanna River 289.1	<0.001	-0.003	-0.428	-6.69	0.050	<0.001	-0.003	-0.374	NA
Susquehanna River 340	<0.001	-0.003	-0.436	-7.51	0.040	<0.001	-0.003	-0.371	NA
Susquehanna River 365	<0.001	-0.002	-0.425	-6.24	0.040	0.004	-0.003	-0.379	NA
Tioga River	0.120	-0.001	-0.166	-2.57	0.033	0.203	-0.001	-0.150	-66.1
Troups Creek	0.274	0.000	-0.115	0.000	0.030	0.325	-0.001	-0.059	NA

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E5. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Chloride

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.287	-0.570	-0.121	-2.92	19.5	0.195	-0.65	-0.161	NA
Chemung River	0.206	0.786	0.142	3.02	26	0.004	0.772	0.318	NA
Conowingo Creek	0.038	0.050	0.203	0.313	16	0.244	0.091	0.131	56.3
Cowanesque River	0.154	-0.254	-0.133	-2.55	10	0.010	-0.37	-0.315	NA
Deer Creek	0.156	0.117	0.152	0.732	16	0.032	0.148	0.255	-85.9
Ebaughs Creek	<0.001	6.28	0.514	16.3	38.5	<0.001	5.68	0.464	NA
Octoraro Creek	0.088	0.000	0.178	0.000	14	0.009	0.186	0.337	NA
Scott Creek	0.852	0.000	0.026	0.000	32	1.00	-0.076	-0.006	26.9
Susquehanna River 10.0	0.392	-0.198	-0.093	-1.32	15	0.781	-0.120	-0.033	33.8
Susquehanna River 44.5	0.633	-0.125	-0.033	-0.892	14	0.207	-0.138	-0.112	67.1
Susquehanna River 289.1	0.204	0.376	0.141	2.69	14	0.068	0.215	0.199	-42.8
Susquehanna River 340	0.624	0.000	0.057	0.000	9	0.945	0.007	0.011	-4.02
Susquehanna River 365	0.552	0.000	0.084	0.000	9.5	0.435	-0.100	-0.072	90.3
Tioga River	0.056	-0.155	-0.203	-1.72	9	0.020	-0.204	-0.259	NA
Troups Creek	0.800	0.000	-0.049	0.000	12	0.756	-0.047	-0.049	-29.3

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E6. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Sulfate

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.195	-0.65	-0.161	NA	0.505	0.270	-0.522	-0.139	-89.2
Chemung River	0.021	-0.854	-0.260	-2.75	31	0.015	-0.715	-0.273	97.2
Conowingo Creek	0.738	0.000	-0.059	0.000	16	0.445	-0.326	-0.094	NA
Cowanesque River	<0.001	-1.33	-0.461	-5.78	23	<0.001	-1.49	-0.490	NA
Deer Creek	0.021	0.000	0.228	0.000	10	0.080	0.717	0.209	NA
Ebaughs Creek	0.140	0.000	0.145	0.000	10	0.129	0.294	0.182	NA
Octoraro Creek	0.635	-0.099	-0.066	-0.473	21	0.305	-0.187	-0.103	NA
Scott Creek	0.018	-1.23	-0.296	-5.13	24	0.036	-1.03	-0.286	NA
Susquehanna River 10.0	0.157	-0.673	-0.158	-1.68	40	0.926	0.081	0.028	8.46
Susquehanna River 44.5	0.286	-1.50	-0.129	-3.26	46	0.006	-1.64	-0.317	NA
Susquehanna River 289.1	0.664	-0.222	-0.056	-1.17	19	0.618	-0.120	-0.065	30
Susquehanna River 340	0.427	0.262	0.091	1.46	18	0.758	0.124	0.038	NA
Susquehanna River 365	0.837	0.099	0.039	0.567	17.5	0.491	-0.338	-0.065	46.2
Tioga River	<0.001	-2.36	-0.455	-5.76	41	<0.001	-1.79	-0.491	NA
Troups Creek	<0.001	-1.56	-0.463	-6.8	23	0.003	-1.20	-0.414	NA

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E7. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Iron

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.026	-26.0	-0.250	-13.0	201	1.00	0.289	-0.036	-1.24
Chemung River	0.009	-32.3	-0.279	-10.9	296	0.022	-47.6	-0.258	51.2
Conowingo Creek	<0.001	-59.8	-0.388	-12.9	462	0.117	-17.4	-0.193	NA
Cowanesque River	0.179	42.6	0.214	19.5	219	0.392	44.8	0.129	-22.2
Deer Creek	<0.001	-64.7	-0.487	-18.0	360	0.032	-26.4	-0.255	NA
Ebaughs Creek	<0.001	-61.1	-0.451	-16.5	369.5	0.002	-28.8	-0.373	NA
Octoraro Creek	0.160	-33.8	-0.154	-7.57	447	0.375	-15.5	-0.107	NA
Scott Creek	<0.001	-79.24	-0.453	-19.5	407	0.046	-60.8	-0.247	NA
Susquehanna River 10.0	0.022	-50.4	-0.270	-8.99	561	0.096	-55.5	-0.233	71.8
Susquehanna River 44.5	0.009	-77.2	-0.357	-8.57	900	0.009	-67.5	-0.367	NA
Susquehanna River 289.1	<0.001	-59.3	-0.447	-21.0	282	<0.001	-55.9	-0.372	88.2
Susquehanna River 340	0.003	-40.3	-0.333	-11.6	348	0.043	-47.2	-0.227	61.5
Susquehanna River 365	0.004	-38.7	-0.320	-13.6	284.5	0.048	-14.9	-0.286	NA
Tioga River	0.765	-4.10	-0.027	-1.30	315	0.724	12.5	0.044	-38.7
Troups Creek	0.484	6.52	0.119	2.95	221	0.352	-15.1	-0.057	35.3

P - Trend Probability
Strong Significant Trend: P < 0.05
Significant Trend: 0.05 < P < 0.10
No Significant Trend: P > 0.10

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available

Table E8. Trend Statistics in Concentrations and Flow-Adjusted Concentrations for Total Aluminum

Station	Concentrations					Flow-Adjusted Concentrations			
	P	b	Tau Test	% Slope	Median	P	b	Tau Test	% Slope
Cayuta Creek	0.402	-0.788	-0.095	-0.670	117.5	0.472	-4.22	-0.128	NA
Chemung River	0.615	1.21	0.065	0.516	234	0.656	5.14	0.053	-67.4
Conowingo Creek	0.028	-17.4	-0.255	-5.80	300	0.278	-19.9	-0.140	NA
Cowanesque River	0.074	83.0	0.255	32.2	258	0.221	72.5	0.183	NA
Deer Creek	0.154	-0.751	-0.154	-0.529	142	0.613	-2.88	-0.064	NA
Ebaughs Creek	0.280	-0.751	-0.114	-0.494	152	0.460	-5.37	-0.091	83.2
Octoraro Creek	0.598	-4.65	-0.056	-1.72	271	0.176	-19.0	-0.171	-42.3
Scott Creek	0.380	0.000	-0.117	0.000	75	0.194	-10.5	-0.156	NA
Susquehanna River 10.0	0.972	0.000	-0.017	0.000	289	0.309	-11.3	-0.139	NA
Susquehanna River 44.5	0.286	-12.0	-0.142	-3.35	359	0.693	-5.60	-0.079	33.2
Susquehanna River 289.1	0.065	-11.4	-0.196	-5.99	190	0.015	-10.9	-0.257	95.3
Susquehanna River 340	0.836	0.000	-0.027	0.000	188	0.472	-3.01	-0.083	11
Susquehanna River 365	0.166	-1.25	-0.142	-0.825	151	0.005	-16.8	-0.321	NA
Tioga River	0.069	25.8	0.210	10.4	249	0.005	21.9	0.317	-55.3
Troups Creek	0.798	0.000	0.049	0.000	227	1.00	-2.19	0.044	5.57

P - Trend Probability
Strong Significant Trend: $P < 0.05$
Significant Trend: $0.05 < P < 0.10$
No Significant Trend: $P > 0.10$

b - Slope or trend direction (+ or -)
% Slope - Percent change of median concentration per year
Median - Median concentration for time period indicated
NA - Not available